

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION**

REDWOOD TECHNOLOGIES, LLC,

Plaintiff,

v.

LUMEN TECHNOLOGIES, INC.,

Defendant.

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§ **JURY TRIAL DEMANDED**
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§ **C.A. NO. 6:22-cv-628**
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PLAINTIFF’S COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Redwood Technologies, LLC (“Redwood”) files this Complaint against Defendant Lumen Technologies, Inc. for infringement of U.S. Patent No. 7,460,485 (the “485 patent”), U.S. Patent No. 8,005,165 (the “165 patent”), U.S. Patent No. 9,628,300 (the “300 patent”), U.S. Patent No. 10,075,272 (the “272 patent”), and U.S. Patent No. 10,341,071 (the “071 patent”), collectively, the “Asserted Patents.”

THE PARTIES

1. Redwood Technologies, LLC is a Texas limited liability company, with a principal place of business at 812 West McDermott Dr. #1038, Allen, TX 75013.
2. On information and belief, Lumen Technologies, Inc. (f/k/a CenturyLink, Inc. and d/b/a Lumen, CenturyLink, and Quantum Fiber), collectively (“Lumen” or “Defendant”), is a corporation organized under the laws of Louisiana, with a regular and established place of business located at 84 W. Ave. E, Copperas Cove, TX 76522.
3. Prior to the filing of the Complaint, Redwood sent a letter received by Lumen on November 8, 2021, where Redwood attempted to engage Lumen and/or its agents in licensing discussions related to the Asserted Patents for reasonable and non-discriminatory terms for a

license to be taken in the absence of litigation. Lumen ignored Redwood's request to engage in licensing discussions. Indeed, Lumen has known about the Asserted Patents since at least November 8, 2021, when Lumen received notice of its infringement of these patents via the letter sent by Redwood and a list of relevant patents, including the Asserted Patents. Furthermore, Redwood sent a follow-up letter received by Lumen on January 7, 2022.

4. Prior to the filing of the Complaint, Redwood sent another letter received by Lumen on May 17, 2022, where Redwood again attempted to engage Lumen and/or its agents in licensing discussions related to the Asserted Patents for reasonable and non-discriminatory terms for a license to be taken in the absence of litigation. Lumen again ignored Redwood's request to engage in licensing discussions. Indeed, Lumen has known about each of the Asserted Patents since at least May 17, 2022, when Lumen received another notice of its infringement of the Asserted Patents via the letter sent by Redwood.

5. Lumen's past and continuing making, using, selling, offering for sale, leasing, and/or importation, and/or inducing its subsidiaries, affiliates, retail partners, and customers in the making, using, selling, offering for sale, and/or importing the accused Wi-Fi compliant devices throughout the United States i) willfully infringe each of the Asserted Patents and ii) impermissibly take the significant benefits of Redwood's patented technologies without fair compensation to Redwood.

6. Lumen is engaged in making, using, selling, offering for sale, leasing, and/or importing, and/or induces its subsidiaries, affiliates, retail partners, and customers in the making, using, selling, offering for sale, and/or importing throughout the United States, including within this District, products, such as access points, accused of infringement.

JURISDICTION AND VENUE

7. This action arises under the patent laws of the United States, namely 35 U.S.C. §§ 271, 281, and 284-285, among others.

8. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

9. This Court has personal jurisdiction over Lumen in accordance with due process and/or the Texas Long Arm Statute because, among other things, Lumen does business in this State by, among other things, maintaining offices in this District, including maintaining its office located at 84 W. Ave. E, Copperas Cove, TX 76522 and “recruit[ing] Texas residents, directly or through an intermediary located in this state, for employment inside or outside this state.” TEX. CIV. PRAC. & REM. CODE § 17.042(3):

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<https://jobs.lumen.com/global/en>.

10. Further, this Court has personal jurisdiction over Lumen because it has engaged, and continues to engage, in continuous, systematic, and substantial activities within this State, including the substantial marketing and sale of products and services within this State and this District. Indeed, this Court has personal jurisdiction over Lumen because it has committed acts giving rise to Redwood's claims for patent infringement within and directed to this District, has derived substantial revenue from its goods and services provided to individuals in this State and this District, and maintains regular and established places of business in this District, including at least its facilities in Copperas Cove.

11. Relative to patent infringement, Lumen has committed and continues to commit acts in violation of 35 U.S.C. § 271, and has made, used, marketed, distributed, offered for sale, leased, imported, and/or sold infringing products in this State, including in this District, and otherwise engaged in infringing conduct within and directed at, or from, this District. Such products have been and continue to be offered for sale, distributed to, sold, and used in this District, and the infringing conduct has caused, and continues to cause, injury to Redwood, including injury suffered within this District. These are purposeful acts and transactions in this State and this District such that Lumen reasonably should know and expect that it could be haled into this Court because of such activities.

12. In addition, Lumen has knowingly induced and continues to knowingly induce infringement within this District by advertising, marketing, offering for sale, leasing, and/or selling devices pre-loaded with infringing functionality within this District, to consumers, customers, manufacturers, distributors, resellers, partners, and/or end users, and providing instructions, user

manuals, advertising, and/or marketing materials which facilitate, direct or encourage the use of infringing functionality with knowledge thereof.

13. Venue is proper in this District under 28 U.S.C. §§ 1391 and 1400(b) because Lumen has regular and established places of business in this District and has committed acts of infringement in this District. Lumen's regular and established places of business in this District include, at least, its facilities in Copperas Cove.

14. With respect to the '165 patent, the '300 patent, the '272 patent, and the '071 patent, the Accused Products are devices that include, but are not limited, to devices that support IEEE 802.11n and/or IEEE 802.11ac and/or IEEE 802.11ax (e.g., Actiontec C1000A, Actiontec C1900A, Actiontec C2000A, Actiontec C2300A, Actiontec C3000A, Actiontec PK5000, Actiontec PK5001A, Actiontec Q1000, Adtran C424G, Axon C4000BG, Axon C4000LG, Axon C4000XG, Calix C844G, Westell 7500, Zyxel C1000Z, Zyxel C1100Z, Zyxel C2100Z, Zyxel C3000Z, Zyxel C3510XZ, Zyxel C4000BZ, Zyxel C4000LZ, Zyxel FR1000Z, Zyxel PK5000Z, Zyxel PK5001Z, Zyxel Q1000Z, Plume Superpod, and Plume Superpod w WiFi 6), as well as, their components, and processes related to the same. With respect to the '485 patent, the Accused Products are devices that include, but are not limited, to devices that support Wi-Fi Multimedia ("WMM") (e.g., Actiontec C1000A, Actiontec C1900A, Actiontec C2000A, Actiontec C2300A, Actiontec C3000A, Actiontec PK5000, Actiontec PK5001A, Actiontec Q1000, Calix C844G, Zyxel C1000Z, Zyxel C1100Z, Zyxel C2100Z, Zyxel C3000Z, Zyxel C3510XZ, Zyxel C4000BZ, Zyxel C4000LZ, Zyxel FR1000Z, Zyxel PK5000Z, Zyxel PK5001Z, Plume Superpod, and Plume Superpod w WiFi 6), as well as, their components, and processes related to the same.

COUNT I

(INFRINGEMENT OF U.S. PATENT NO. 7,460,485)

15. Plaintiff incorporates paragraphs 1 through 14 herein by reference.

16. Redwood is the assignee of the '485 patent, entitled "Methods for Performing Medium Dedication in Order to Ensure the Quality of Service for Delivering Real-Time Data Across Wireless Network," with ownership of all substantial rights in the '485 patent, including the right to exclude others and to enforce, sue, and recover damages for past and future infringements.

17. The '485 patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code. The '485 patent issued from U.S. Patent Application No. 10/654,901.

18. Lumen has and continues to directly and/or indirectly infringe (by inducing infringement) one or more claims of the '485 patent in this judicial district and elsewhere in Texas and the United States.

19. Lumen and/or its agents directly infringe the '485 patent via 35 U.S.C. § 271(a) by using and/or testing the Accused Products, their components and processes, and/or products containing the same that incorporate the fundamental technologies covered by the '485 patent. For example, Lumen installs, services, and/or maintains the Accused Products leased, sold, and/or provided to its customers. Indeed, Lumen owns and controls many of the Accused Products it provides to its customers. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf ("Except for Equipment purchased by you under the terms of this Agreement, or other equipment purchased by you, CenturyLink owns the Equipment regardless of who installed the Equipment."). Lumen provides Internet service to the Accused Products, such that Lumen causes the Accused Products to perform the Wi-Fi functionality recited by the asserted claims of the '485 patent. Lumen further directs and controls the Accused Products to perform in an infringing manner by providing the

requisite Internet service that results in the Accused Product becoming a product that performs Wi-Fi functionality in an infringing manner. *See, e.g.*, <https://www.lumen.com/content/quantumfiber/support/internet/360wifi/faqs.html> (“The Quantum Fiber modem by itself does not have wireless capability ... The modem will deliver internet over a wired Ethernet connection, but it is not a WiFi device by itself.”). Lumen further controls the performance of the claimed method steps of the Accused Products by conditioning receipt of warranty benefits on the customer’s agreement not to modify the Accused Products. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“This Limited Warranty does not cover defects due to defacement, misuse, abuse, neglect, improper use, improper electrical voltages or current, repairs by others, alterations, modifications, accidents, fire, flood, vandalism, acts of God or the elements.”).

20. For example, Lumen infringes claim 1 of the ’485 patent via the Accused Products. The Accused Products perform a method for guaranteeing a quality of service (QoS) in delivering real-time data across a transmission medium. *See, e.g.*, Section 4.3.10 of IEEE 802.11 2016 and Section 1.0 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

21. The Accused Products each specify a traffic requirement for a traffic stream in accordance with a generic first specification. For example, the Accused Products utilize the traffic specification (“TSPEC”) element, which is a traffic requirement for a traffic stream based on QoS parameters for a particular STA. *See, e.g.*, Section 9.4.2.30 of IEEE 802.11 2016 and Figure 14 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

22. The Accused Products each transform the specified traffic requirement in accordance with a generic second specification based on the specified traffic requirement, an overhead requirement for the traffic stream and a condition of the transmission medium. For

example, the STA sends the TSPEC to the access point, where the access point transforms the TSPEC into medium time. *See, e.g.*, Section 3.5.2 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0. Medium Time is a traffic stream requirement utilized by the Accused Products which takes into consideration elements from the TSPEC, overhead requirements, and expected error performance on the medium. *See, e.g.*, Section K.4.1 of IEEE 802.11 2016 and A.3 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

23. The Accused Products each adjust the generic second specification based on feedback obtained from monitoring the condition of the transmission medium. For example, the Accused Products adjust the medium time with the receipt of each new TSPEC. *See, e.g.*, Sections 3.5.1 and 3.5.3 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

24. The Accused Products each aggregate a plurality of specifications for a plurality of traffic streams into a single specification to reduce resources required to maintain and process the plurality of specifications and overhead incurred in medium dedication. For example, the Accused Products aggregate the mean data rate and burst size for a plurality of traffic streams to generate a single token bucket specification, which allows the Accused Products to manage the STA's admitted flows more effectively. *See, e.g., See, e.g.*, Section 3.5.1 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

25. The Accused Products each generate a medium dedication schedule according to the single specification. For example, the Accused Products generate a medium dedication schedule using the token bucket specification as its schedule parameter. *See, e.g.*, Sections 3.5.2 and 3.5.3 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

26. The Accused Products each perform medium dedication in accordance with the medium dedication schedule to coordinate transmission of the plurality of traffic streams. For

example, the Accused Products perform the medium dedication according to the schedule to coordinate transmission between a plurality of STAs with admitted traffic streams. *See, e.g.*, Section 3.5.2 of the Wi-Fi Multimedia Technical Specification, Version 1.2.0.

27. The technology discussion above and the exemplary Accused Products provide context for Plaintiff's infringement allegations.

28. At a minimum, Lumen has known of the '485 patent at least as early as the filing date of the complaint. In addition, Lumen has known about the '485 patent since at least November 8, 2021, when Lumen received notice of its infringement via a letter. Redwood sent another letter, which referenced the prior notice letter, that was received by Lumen on January 7, 2022. Furthermore, Lumen has known about the '485 patent since at least May 17, 2022, when Lumen received notice of its infringement via another letter.

29. On information and belief, since at least the above-mentioned date when Lumen was on notice of its infringement, Lumen has actively induced, under U.S.C. § 271(b), its distributors, customers, subsidiaries, importers, and/or consumers that use and/or test the Accused Products comprising all of the limitations of one or more claims of the '485 patent to directly infringe one or more claims of the '485 patent by using and/or testing the '485 Accused Products. Since at least the notice provided on the above-mentioned date, Lumen does so with knowledge, or with willful blindness of the fact, that the induced acts constitute infringement of the '485 patent. Lumen intends to cause, and has taken affirmative steps to induce infringement by its distributors, importers, customers, subsidiaries, and/or consumers by at least, *inter alia*, creating advertisements that promote the infringing use of the Accused Products, creating and/or maintaining established distribution channels for the Accused Products into and within the United States, manufacturing the Accused Products in conformity with U.S. laws and regulations, distributing or making

available instructions or manuals for these products, testing and certifying features related to infringing features in the Accused Products, and/or providing technical support, replacement parts, or services for these products to these recipients in the United States.

30. On information and belief, despite having knowledge of the '485 patent and knowledge that it is directly and/or indirectly infringing one or more claims of the '485 patent, Lumen has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Lumen's infringing activities relative to the '485 patent have been, and continue to be, willful, wanton, malicious, in bad-faith, deliberate, consciously wrongful, flagrant, characteristic of a pirate, and an egregious case of misconduct beyond typical infringement such that Plaintiff is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the amount found or assessed.

31. Redwood has been damaged as a result of Lumen's infringing conduct described in this Count. Lumen is, thus, liable to Redwood in an amount that adequately compensates Redwood for Lumen's infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

COUNT II

(INFRINGEMENT OF U.S. PATENT NO. 8,005,165)

32. Plaintiff incorporates paragraphs 1 through 31 herein by reference.

33. Redwood is the assignee of the '165 patent, entitled "MIMO-OFDM Transmission Device, MIMO-OFDM Transmission Method, Reception Apparatus and Reception Method," with ownership of all substantial rights in the '165 patent, including the right to exclude others and to enforce, sue, and recover damages for past and future infringements.

34. The '165 patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code. The '165 patent issued from U.S. Patent Application No. 12/840,024.

35. Lumen has and continues to directly and/or indirectly infringe (by inducing infringement) one or more claims of the '165 patent in this judicial district and elsewhere in Texas and the United States.

36. Lumen and/or its agents directly infringe the '165 patent via 35 U.S.C. § 271(a) by using and/or testing the Accused Products, their components and processes, and/or products containing the same that incorporate the fundamental technologies covered by the '165 patent. For example, Lumen installs, services, and/or maintains the Accused Products leased, sold, and/or provided to its customers. Indeed, Lumen owns and controls many of the Accused Products it provides to its customers. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“Except for Equipment purchased by you under the terms of this Agreement, or other equipment purchased by you, CenturyLink owns the Equipment regardless of who installed the Equipment.”). Lumen provides Internet service to the Accused Products, such that Lumen causes the Accused Products to perform the Wi-Fi functionality recited by the asserted claims of the '165 patent. Lumen further directs and controls the Accused Products to perform in an infringing manner by providing the requisite Internet service that results in the Accused Product becoming a product that performs Wi-Fi functionality in an infringing manner. *See, e.g.,* <https://www.lumen.com/content/quantumfiber/support/internet/360wifi/faqs.html> (“The Quantum Fiber modem by itself does not have wireless capability ... The modem will deliver internet over a wired Ethernet connection, but it is not a WiFi device by itself.”). Lumen further

controls the performance of the claimed method steps of the Accused Products by conditioning receipt of warranty benefits on the customer's agreement not to modify the Accused Products. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“This Limited Warranty does not cover defects due to defacement, misuse, abuse, neglect, improper use, improper electrical voltages or current, repairs by others, alterations, modifications, accidents, fire, flood, vandalism, acts of God or the elements.”).

37. For example, Lumen infringes claim 7 of the '165 patent via the Accused Products. The Accused Products perform a MIMO-OFDM transmission method. *See, e.g.*, Sections 19.1.1 and 19.1.2 of IEEE 802.11 2016.

38. The Accused Products each form a plurality of OFDM signals, where each of the plurality of OFDM signals comprise several pilot carriers, the several pilot carriers being located on identical carrier positions among the plurality of OFDM signals, such that orthogonal pilot sequences are assigned to identical time slots of pilot carriers on an identical carrier position among the plurality of OFDM signals, and an identical pilot sequence is assigned to at least two of the plurality of OFDM signals. For example, each of the Accused Products form a plurality of HT-mixed format PPDUS to transmit as OFDM signals, where the stream parser divides the plurality of signals into spatial streams, such that each stream comprises a plurality of OFDM signals. *See, e.g.*, Section 19.3.3 of IEEE 802.11 2016. Each of the plurality of OFDM signals comprise four pilot carriers inserted in carrier positions -21, -7, 7, and 21. *See, e.g.*, Section 19.3.11.10 of IEEE 802.11 2016. The pilot sequences corresponding to different spatial streams are orthogonal and assigned to identical time slots of pilot carrier on an identical position among the plurality of OFDM signals. *See, e.g.*, Section 19.3.11.10 and Table 19-19 of IEEE 802.11 2016. The Accused

Products assign an identical pilot sequence to each OFDM symbol corresponding to a particular spatial stream. *See, e.g.*, Section 19.3.11.10 and Table 19-19 of IEEE 802.11 2016.

39. The Accused Products each transmit the plurality of OFDM signals over an identical frequency band at an identical time. For example, transmissions from each antenna are simultaneous and use the same channel having a particular width (e.g., 20 MHz). *See, e.g.*, Section 19.3.15.1 and Tables 19-28, 19-29, and 19-30 of IEEE 802.11 2016.

40. The technology discussion above and the exemplary Accused Products provide context for Plaintiff's infringement allegations.

41. At a minimum, Lumen has known of the '165 patent at least as early as the filing date of the complaint. In addition, Lumen has known about the '165 patent since at least November 8, 2021, when Lumen received notice of its infringement via a letter. Redwood sent another letter, which referenced the prior notice letter, that was received by Lumen on January 7, 2022. Furthermore, Lumen has known about the '165 patent since at least May 17, 2022, when Lumen received notice of its infringement via another letter.

42. On information and belief, since at least the above-mentioned date when Lumen was on notice of its infringement, Lumen has actively induced, under U.S.C. § 271(b), its distributors, customers, subsidiaries, importers, and/or consumers that use and/or test the Accused Products comprising all of the limitations of one or more claims of the '165 patent to directly infringe one or more claims of the '165 patent by using and/or testing the '165 Accused Products. Since at least the notice provided on the above-mentioned date, Lumen does so with knowledge, or with willful blindness of the fact, that the induced acts constitute infringement of the '165 patent. Lumen intends to cause, and has taken affirmative steps to induce infringement by its distributors, importers, customers, subsidiaries, and/or consumers by at least, inter alia, creating advertisements

that promote the infringing use of the Accused Products, creating and/or maintaining established distribution channels for the Accused Products into and within the United States, manufacturing the Accused Products in conformity with U.S. laws and regulations, distributing or making available instructions or manuals for these products, testing and certifying features related to infringing features in the Accused Products, and/or providing technical support, replacement parts, or services for these products to these recipients in the United States.

43. On information and belief, despite having knowledge of the '165 patent and knowledge that it is directly and/or indirectly infringing one or more claims of the '165 patent, Lumen has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Lumen's infringing activities relative to the '165 patent have been, and continue to be, willful, wanton, malicious, in bad-faith, deliberate, consciously wrongful, flagrant, characteristic of a pirate, and an egregious case of misconduct beyond typical infringement such that Plaintiff is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the amount found or assessed.

44. Redwood has been damaged as a result of Lumen's infringing conduct described in this Count. Lumen is, thus, liable to Redwood in an amount that adequately compensates Redwood for Lumen's infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

COUNT III

(INFRINGEMENT OF U.S. PATENT NO. 9,628,300)

45. Plaintiff incorporates paragraphs 1 through 44 herein by reference.

46. Redwood is the assignee of the '300 patent, entitled "Method and Signal Generating Apparatus for Generating Modulation Signals" with ownership of all substantial

rights in the '300 patent, including the right to exclude others and to enforce, sue, and recover damages for past and future infringements.

47. The '300 patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code. The '300 patent issued from U.S. Patent Application No. 14/591,346.

48. Lumen has and continues to directly and/or indirectly infringe (by inducing infringement) one or more claims of the '300 patent in this judicial district and elsewhere in Texas and the United States.

49. Lumen and/or its agents directly infringe the '300 patent via 35 U.S.C. § 271(a) by using and/or testing the Accused Products, their components and processes, and/or products containing the same that incorporate the fundamental technologies covered by the '300 patent. For example, Lumen installs, services, and/or maintains the Accused Products leased, sold, and/or provided to its customers. Indeed, Lumen owns and controls many of the Accused Products it provides to its customers. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“Except for Equipment purchased by you under the terms of this Agreement, or other equipment purchased by you, CenturyLink owns the Equipment regardless of who installed the Equipment.”). Lumen provides Internet service to the Accused Products, such that Lumen causes the Accused Products to perform the Wi-Fi functionality recited by the asserted claims of the '300 patent. Lumen further directs and controls the Accused Products to perform in an infringing manner by providing the requisite Internet service that results in the Accused Product becoming a product that performs Wi-Fi functionality in an infringing manner. *See, e.g.,* <https://www.lumen.com/content/quantumfiber/support/internet/360wifi/faqs.html> (“The

Quantum Fiber modem by itself does not have wireless capability ... The modem will deliver internet over a wired Ethernet connection, but it is not a WiFi device by itself.”). Lumen further controls the performance of the claimed method steps of the Accused Products by conditioning receipt of warranty benefits on the customer’s agreement not to modify the Accused Products. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“This Limited Warranty does not cover defects due to defacement, misuse, abuse, neglect, improper use, improper electrical voltages or current, repairs by others, alterations, modifications, accidents, fire, flood, vandalism, acts of God or the elements.”).

50. For example, Lumen infringes claim 1 of the ’300 patent via the Accused Products. Each of the Accused Products perform a method of transmitting modulation signals. *See, e.g.*, Sections 19.1.1 and 19.1.2 of IEEE 802.11 2016.

51. The Accused Products each generate a plurality of modulation signals each of which is to be transmitted from a different one of a plurality of antennas. For example, each of the Accused Products generate modulation signals (e.g., HT-mixed format PPDU) which are to be transmitted from a plurality of antennas. *See, e.g.*, Section 9.3.3 of IEEE 802.11 2016. Each modulation signal includes a pilot symbol sequence and/or a pilot subcarrier including a plurality of pilot symbols used for demodulation. For example, each OFDM symbol within a modulation signal includes a pilot symbol sequence, in a 20 MHz transmission, of four pilot symbols located at carrier positions -21, -7, 7, and 21, or a pilot symbol sequence, in a 40 MHz transmission, of six pilot symbols, where the pilot symbols are used for demodulation for detecting frequency offsets and phase noise. *See, e.g.*, Sections 17.3.5.9, 19.3.11.10, and Equation 19-54 of IEEE 802.11 2016.

52. Each of the Accused Products insert each of the pilot symbol sequences and/or pilot subcarriers at a same temporal point in each modulation signal. For example, each of the

modulation signals is comprised of pilot symbol sequences that include at least four pilot symbols inserted in, for example, carrier positions -21, -7, 7, and 21, such that each modulation signal and respective pilot symbol sequence are inserted and transmitted simultaneously in time. *See, e.g.*, Section 19.3.11.10 of IEEE 802.11 2016. The pilot symbol sequences and/or pilot subcarriers are orthogonal to each other, where each pilot symbol has a non-zero amplitude. For example, the pilot sequences corresponding to different spatial streams are orthogonal to each other and have zero mutual correlation. *See, e.g.*, Table 19-19 of IEEE 802.11 2016. A quantity of the plurality of pilot symbols in each pilot symbol sequence and/or pilot subcarrier are greater than a quantity of the plurality of modulation signals to be transmitted. As previously discussed, each pilot symbol sequence contains at least four pilot symbols in a 20 MHz transmission and at least six pilot symbols in a 40 MHz transmission, such that these quantities are greater than a respective number of modulation signals to be transmitted by the Accused Device. *See, e.g.*, Sections 19.1.1, 19.3.11.10 and Equation 19-54 of IEEE 802.11 2016.

53. Each of the Accused Products transmit in an identical frequency band the plurality of modulation signals, each including different transmission data and one of the pilot symbol sequences and/or pilot subcarriers, from the plurality of antennas. For example, each of the modulation signals is transmitted using a channel (e.g., a 20 MHz channel or a 40 MHz channel) from at least two antennas, such that each of the modulation signals include different transmission data. *See, e.g.*, Section 19.3.15.1, Tables 19-28, 19-29, and 19-30, and Figure 17-13 of IEEE 802.11 2016.

54. As previously discussed, each of the plurality of modulation signals contains one of the pilot symbol sequences and/or pilot subcarriers. *See, e.g.*, Section 19.3.11.10 of IEEE 802.11 2016.

55. The technology discussion above and the exemplary Accused Products provide context for Plaintiff's infringement allegations.

56. At a minimum, Lumen has known of the '300 patent at least as early as the filing date of the complaint. In addition, Lumen has known about the '300 patent since at least November 8, 2021, when Lumen received notice of its infringement via a letter and a list of relevant patents. Redwood sent another letter, which referenced the prior notice letter, that was received by Lumen on January 7, 2022. Furthermore, Lumen has known about the '300 patent since at least May 17, 2022, when Lumen received notice of its infringement via another letter.

57. On information and belief, since at least the above-mentioned date when Lumen was on notice of its infringement, Lumen has actively induced, under U.S.C. § 271(b), its distributors, customers, subsidiaries, importers, and/or consumers that use and/or test the Accused Products comprising all of the limitations of one or more claims of the '300 patent to directly infringe one or more claims of the '300 patent by using and/or testing the Accused Products. Since at least the notice provided on the above-mentioned date, Lumen does so with knowledge, or with willful blindness of the fact, that the induced acts constitute infringement of the '300 patent. Lumen intends to cause, and has taken affirmative steps to induce infringement by its distributors, importers, customers, subsidiaries, and/or consumers by at least, inter alia, creating advertisements that promote the infringing use of the Accused Products, creating and/or maintaining established distribution channels for the Accused Products into and within the United States, manufacturing the Accused Products in conformity with U.S. laws and regulations, distributing or making available instructions or manuals for these products, testing and certifying features related to infringing features in the Accused Products, and/or providing technical support, replacement parts, or services for these products to these recipients in the United States.

58. On information and belief, despite having knowledge of the '300 patent and knowledge that it is directly and/or indirectly infringing one or more claims of the '300 patent, Lumen has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Lumen's infringing activities relative to the '300 patent have been, and continue to be, willful, wanton, malicious, in bad-faith, deliberate, consciously wrongful, flagrant, characteristic of a pirate, and an egregious case of misconduct beyond typical infringement such that Plaintiff is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the amount found or assessed.

59. Redwood has been damaged as a result of Lumen's infringing conduct described in this Count. Lumen is, thus, liable to Redwood in an amount that adequately compensates Redwood for Lumen's infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

COUNT IV

(INFRINGEMENT OF U.S. PATENT NO. 10,075,272)

60. Plaintiff incorporates paragraphs 1 through 59 herein by reference.

61. Redwood is the assignee of the '272 patent, entitled "Transmission Signal Generation Apparatus, Transmission Signal Generation Method, Reception Signal Apparatus, and Reception Signal Method," with ownership of all substantial rights in the '272 patent, including the right to exclude others and to enforce, sue, and recover damages for past and future infringements.

62. The '272 patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code. The '272 patent issued from U.S. Patent Application No. 15/811,954.

63. Lumen has and continues to directly and/or indirectly infringe (by inducing infringement) one or more claims of the '272 patent in this judicial district and elsewhere in Texas and the United States.

64. Lumen directly infringes the '272 patent via 35 U.S.C. § 271(a) by making, using, offering for sale, selling, and/or importing the Accused Products, their components and processes, and/or products containing the same that incorporate the fundamental technologies covered by the '272 patent. As to Lumen using and/or testing the Accused Products, Lumen installs, services, and/or maintains the Accused Products leased, sold, and/or provided to its customers. Indeed, Lumen owns and controls many of the Accused Products it provides to its customers. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“Except for Equipment purchased by you under the terms of this Agreement, or other equipment purchased by you, CenturyLink owns the Equipment regardless of who installed the Equipment.”). Lumen provides Internet service to the Accused Products, such that Lumen causes the Accused Products to perform the Wi-Fi functionality recited by the asserted claims of the '272 patent. Lumen further directs and controls the Accused Products to perform in an infringing manner by providing the requisite Internet service that results in the Accused Product becoming a product that performs Wi-Fi functionality in an infringing manner. *See, e.g.*, <https://www.lumen.com/content/quantumfiber/support/internet/360wifi/faqs.html> (“The Quantum Fiber modem by itself does not have wireless capability ... The modem will deliver internet over a wired Ethernet connection, but it is not a WiFi device by itself.”). Lumen further controls the performance of the claimed method steps of the Accused Products by conditioning receipt of warranty benefits on the customer’s agreement not to modify the Accused Products. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf

(“This Limited Warranty does not cover defects due to defacement, misuse, abuse, neglect, improper use, improper electrical voltages or current, repairs by others, alterations, modifications, accidents, fire, flood, vandalism, acts of God or the elements.”).

65. For example, Lumen infringes claim 1 of the '272 patent via the Accused Products. The Accused Products comprise a transmission apparatus comprising electronic circuitry. *See, e.g.*, Sections 19.1.1, 19.3.3 of IEEE 802.11 2016.

66. The Accused Products each comprise electronic circuitry to map a first stream of input data to first complex symbols in serial format. For example, each of the Accused Products comprises a constellation mapper configured to map a sequence of bits points on a constellation diagram, represented by complex numbers. *See, e.g.*, Section 17.3.2.2 of IEEE 802.11 2016.

67. The Accused Products each comprise electronic circuitry to convert the first complex symbols in serial format into first complex symbols in parallel format. For example, each of the Accused Products are configured to insert the complex numbers into subcarriers associated with one OFDM symbol, such that information in each subcarrier is transmitted in parallel as part of the full OFDM symbol. *See, e.g.*, Section 17.3.2.2, I.1.6.3, and Table I-20 of IEEE 802.11 2016.

68. The Accused Products each comprise electronic circuitry to perform an inverse Fourier transform on the first complex symbols in parallel format to form a first Orthogonal Frequency Division Multiplexed (OFDM) signals associated with multiple subcarriers. For example, each of the Accused Products comprise inverse Fourier transform sections configured to convert the plurality of symbols to OFDM time domain blocks for transmission. *See, e.g.*, Section 17.3.2.2 of IEEE 802.11 2016.

69. The Accused Products each comprise electronic circuitry to transmit the first OFDM signals via a first antenna over the multiple subcarriers in a same frequency band over a same time

period that includes a same set of time slots. For example, each of the Accused Products comprise electronic circuitry to transmit the first OFDM symbols via a first antenna, where each OFDM symbol is a time slot, such that transmissions occur within a same time period (e.g., the 3.2 μ s DFT period) and in the same channel (e.g., a 20 MHz channel). *See, e.g.*, Sections 17.3.2.2, 17.3.5.9, 19.3.15.1, 19.3.21, 19.3.6, Figure 17.1, Equation 19-90, and Table 19-19 of IEEE 802.11 2016.

70. The Accused Products each comprise electronic circuitry to transmit first pilot information via a first antenna on a first one of a plurality of pilot subcarriers during the same set of time slots. For example, each of the Accused Products comprise electronic circuitry configured to transmit, for example, a first pilot value of 1 via a first antenna on a first pilot subcarrier of a plurality of pilot subcarriers within an OFDM symbol. *See, e.g.*, Section 17.3.5.9 and Table 19-19 of IEEE 802.11 2016.

71. The Accused Products each comprise electronic circuitry to transmit second pilot information via a first antenna on a second one of a plurality of pilot subcarriers during the same set of time slots, where the second pilot information is different from the first pilot information. For example, each of the Accused Products comprise circuitry configured to transmit, for example, a second pilot value of -1 via a first antenna on a second pilot subcarrier of a plurality of pilot subcarriers within the OFDM symbol. *See, e.g.*, Section 17.3.5.9 and Table 19-19 of IEEE 802.11 2016.

72. The Accused Products each comprise electronic circuitry to map a second stream of input data to first complex symbols in serial format. For example, each of the Accused Products comprises a constellation mapper configured to map a sequence of bits to points on a constellation diagram, represented by complex numbers. *See, e.g.*, Section 17.3.2.2 of IEEE 802.11 2016.

73. The Accused Products each comprise electronic circuitry to convert the second complex symbols in serial format into second complex symbols in parallel format. For example, each of the Accused Products are configured to insert the second complex numbers into subcarriers associated with one OFDM symbol, such that information in each subcarrier is transmitted in parallel as part of the full OFDM symbol. *See, e.g.*, Section 17.3.2.2, I.1.6.3, and Table I-20 of IEEE 802.11 2016.

74. The Accused Products each comprise electronic circuitry to perform an inverse Fourier transform on the second complex symbols in parallel format to form second OFDM signals associated with multiple subcarriers. For example, each of the Accused Products comprise inverse Fourier transform sections configured to convert the plurality of symbols to OFDM time domain blocks for transmission. *See, e.g.*, Section 17.3.2.2 of IEEE 802.11 2016.

75. The Accused Products each comprise electronic circuitry to transmit the second OFDM signals via a second antenna over the multiple subcarriers in the same frequency band over a same time period that includes a same set of time slots. For example, each of the Accused Products comprise electronic circuitry to transmit the second OFDM symbols via a second antenna, where each OFDM symbol is a time slot, such that transmissions occur within a same time period (e.g., the 3.2 μ s DFT period) and in the same channel (e.g., a 20 MHz channel). *See, e.g.*, Sections 17.3.2.2, 17.3.5.9, 19.3.15.1, 19.3.21, 19.3.6, Figure 17.1, Equation 19-90, and Table 19-19 of IEEE 802.11 2016.

76. The Accused Products each comprise electronic circuitry to transmit first pilot information via the second antenna on the second pilot subcarrier during the same set of time slots. For example, each of the Accused Products comprise electronic circuitry configured to transmit,

for example, a first pilot value of 1 via a second antenna on the second pilot subcarrier during the same set of time slots. *See, e.g.*, Section 17.3.5.9 and Table 19-19 of IEEE 802.11 2016.

77. The Accused Products each comprise electronic circuitry to transmit the second pilot information on one of the plurality of subcarriers during the same set of time slots. For example, each of the Accused Products comprise electronic circuitry configured to transmit, for example, the second pilot value of -1 on a subcarrier within an OFDM symbol that can be transmitted at the same time as the first OFDM symbol. *See, e.g.*, Section 17.3.5.9 and Table 19-19 of IEEE 802.11 2016.

78. The technology discussion above and the exemplary Accused Products provide context for Plaintiff's infringement allegations.

79. At a minimum, Lumen has known of the '272 patent at least as early as the filing date of the complaint. In addition, Lumen has known about the '272 patent since at least November 8, 2021, when Lumen received notice of its infringement via a letter and a list of relevant patents. Redwood sent another letter, which referenced the prior notice letter, that was received by Lumen on January 7, 2022. Furthermore, Lumen has known about the '272 patent since at least May 17, 2022, when Lumen received notice of its infringement via another letter.

80. On information and belief, since at least the above-mentioned date when Lumen was on notice of its infringement, Lumen has actively induced, under U.S.C. § 271(b), its distributors, customers, subsidiaries, importers, and/or consumers that import, use, purchase, offer to sell, or sell the Accused Products comprising all of the limitations of one or more claims of the '272 patent to directly infringe one or more claims of the '272 patent by using, offering for sale, selling, and/or importing the '272 Accused Products. Since at least the notice provided on the above-mentioned date, Lumen does so with knowledge, or with willful blindness of the fact, that

the induced acts constitute infringement of the '272 patent. Lumen intends to cause, and has taken affirmative steps to induce infringement by its distributors, importers, customers, subsidiaries, and/or consumers by at least, inter alia, creating advertisements that promote the infringing use of the Accused Products, creating and/or maintaining established distribution channels for the Accused Products into and within the United States, manufacturing the Accused Products in conformity with U.S. laws and regulations, distributing or making available instructions or manuals for these products to recipients and prospective buyers, testing and certifying features related to infringing features in the Accused Products, and/or providing technical support, replacement parts, or services for these products to these recipients in the United States.

81. On information and belief, despite having knowledge of the '272 patent and knowledge that it is directly and/or indirectly infringing one or more claims of the '272 patent, Lumen has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Lumen's infringing activities relative to the '272 patent have been, and continue to be, willful, wanton, malicious, in bad-faith, deliberate, consciously wrongful, flagrant, characteristic of a pirate, and an egregious case of misconduct beyond typical infringement such that Plaintiff is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the amount found or assessed.

82. Redwood has been damaged as a result of Lumen's infringing conduct described in this Count. Lumen is, thus, liable to Redwood in an amount that adequately compensates Redwood for Lumen's infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

COUNT V

(INFRINGEMENT OF U.S. PATENT NO. 10,341,071)

83. Plaintiff incorporates paragraphs 1 through 82 herein by reference.

84. Redwood is the assignee of the '071 patent, entitled "Radio Transmission Apparatus and Methods," with ownership of all substantial rights in the '071 patent, including the right to exclude others and to enforce, sue, and recover damages for past and future infringements.

85. The '071 patent is valid, enforceable, and was duly issued in full compliance with Title 35 of the United States Code. The '071 patent issued from U.S. Patent Application No. 15/494,666.

86. Lumen has and continues to directly and/or indirectly infringe (by inducing infringement) one or more claims of the '071 patent in this judicial district and elsewhere in Texas and the United States.

87. Lumen directly infringes the '071 patent via 35 U.S.C. § 271(a) by making, using, offering for sale, selling, and/or importing the Accused Products, their components and processes, and/or products containing the same that incorporate the fundamental technologies covered by the '071 patent. As to Lumen using and/or testing the Accused Products, Lumen installs, services, and/or maintains the Accused Products leased, sold, and/or provided to its customers. Indeed, Lumen owns and controls many of the Accused Products it provides to its customers. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf ("Except for Equipment purchased by you under the terms of this Agreement, or other equipment purchased by you, CenturyLink owns the Equipment regardless of who installed the Equipment."). Lumen provides Internet service to the Accused Products, such that Lumen causes the Accused Products to perform the Wi-Fi functionality recited by the asserted claims of the '071 patent. Lumen further directs and controls the Accused Products to perform in an infringing manner by providing the requisite Internet service that results in the Accused Product becoming a product that performs

Wi-Fi functionality in an infringing manner. *See, e.g.*, <https://www.lumen.com/content/quantumfiber/support/internet/360wifi/faqs.html> (“The Quantum Fiber modem by itself does not have wireless capability ... The modem will deliver internet over a wired Ethernet connection, but it is not a WiFi device by itself.”). Lumen further controls the performance of the claimed method steps of the Accused Products by conditioning receipt of warranty benefits on the customer’s agreement not to modify the Accused Products. *See, e.g.* https://www.centurylink.com/legal/docs/HSI_Subscriber_Agreement_LCTL_ENG.pdf (“This Limited Warranty does not cover defects due to defacement, misuse, abuse, neglect, improper use, improper electrical voltages or current, repairs by others, alterations, modifications, accidents, fire, flood, vandalism, acts of God or the elements.”).

88. For example, Lumen infringes claim 1 of the ’071 patent via the Accused Products. The Accused Products each comprise a radio transmission apparatus comprising a first antenna and a second antenna. *See, e.g.*, Figure 19-2 of IEEE 802.11 2016.

89. The Accused Products each comprise circuitry configured to generate a single modulation signal or a plurality of modulation signals based on the estimated communications channel condition information. For example, each of the Accused Products comprise circuitry configured to generate a single modulation signal or a plurality of modulation signals based on information associated with a channel quality assessment and selection of an appropriate modulation and coding scheme (MCS) value. *See, e.g.*, Sections 19.3.13.4 and 19.3.5 of IEEE 802.11 2016.

90. The Accused Products each comprise circuitry configured to transmit, based on information associated with an estimated communication channel condition, the single modulation signal from the first antenna or transmit the plurality of modulation signals, which include different

information from each other over an identical frequency band from the first antenna and the second antenna at an identical temporal point. For example, the Accused Products each comprise circuitry configured to transmit the single modulation signal or a plurality of modulation signals based on the MCS value. *See, e.g.*, Sections 19.3.13.4 and 19.3.5 of IEEE 802.11 2016. When a plurality of modulation signals are transmitted, each of the modulation signals represent a respective spatial stream, where each spatial stream includes distinct information from each other. *See, e.g.*, Section 19.3.5 of IEEE 802.11 2016. The plurality of modulation signals from each antenna are transmitted simultaneously using the same channel (e.g., a 20 MHz channel). *See, e.g.*, Section 19.3.15.1 and Tables 19-28, 19-29, and 19-30 of IEEE 802.11 2016.

91. The single modulation signal and the plurality of modulation signals contain parameter information indicating a number of modulation signals transmitted at the same time. For example, the single modulation signal and the plurality of modulation signals for HT transmissions contain an HT-SIG, which contains an MCS indicating a number of modulations to multiplex and transmit at the same time. *See, e.g.*, 19.3.9.4.3 and 19.3.5 of IEEE 802.11 2016.

92. The technology discussion above and the exemplary Accused Products provide context for Plaintiff's infringement allegations.

93. At a minimum, Lumen has known of the '071 patent at least as early as the filing date of the complaint. In addition, Lumen has known about the '071 patent since at least November 8, 2021, when Lumen received notice of its infringement via a letter and a list of relevant patents. Redwood sent another letter, which referenced the prior notice letter, that was received by Lumen on January 7, 2022. Furthermore, Lumen has known about the '071 patent since at least May 17, 2022, when Lumen received notice of its infringement via another letter.

94. On information and belief, since at least the above-mentioned date when Lumen was on notice of its infringement, Lumen has actively induced, under U.S.C. § 271(b), its distributors, customers, subsidiaries, importers, and/or consumers that import, use, purchase, offer to sell, or sell the Accused Products comprising all of the limitations of one or more claims of the '071 patent to directly infringe one or more claims of the '071 patent by using, offering for sale, selling, and/or importing the '071 Accused Products. Since at least the notice provided on the above-mentioned date, Lumen does so with knowledge, or with willful blindness of the fact, that the induced acts constitute infringement of the '071 patent. Lumen intends to cause, and has taken affirmative steps to induce infringement by its distributors, importers, customers, subsidiaries, and/or consumers by at least, inter alia, creating advertisements that promote the infringing use of the Accused Products, creating and/or maintaining established distribution channels for the Accused Products into and within the United States, manufacturing the Accused Products in conformity with U.S. laws and regulations, distributing or making available instructions or manuals for these products to recipients and prospective buyers, testing and certifying features related to infringing features in the Accused Products, and/or providing technical support, replacement parts, or services for these products to these recipients in the United States.

95. On information and belief, despite having knowledge of the '071 patent and knowledge that it is directly and/or indirectly infringing one or more claims of the '071 patent, Lumen has nevertheless continued its infringing conduct and disregarded an objectively high likelihood of infringement. Lumen's infringing activities relative to the '071 patent have been, and continue to be, willful, wanton, malicious, in bad-faith, deliberate, consciously wrongful, flagrant, characteristic of a pirate, and an egregious case of misconduct beyond typical infringement such

that Plaintiff is entitled under 35 U.S.C. § 284 to enhanced damages up to three times the amount found or assessed.

96. Redwood has been damaged as a result of Lumen's infringing conduct described in this Count. Lumen is, thus, liable to Redwood in an amount that adequately compensates Redwood for Lumen's infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

CONCLUSION

97. Plaintiff Redwood is entitled to recover from Lumen the damages sustained by Plaintiff as a result of Lumen's wrongful acts, and willful infringement, in an amount subject to proof at trial, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court.

98. Plaintiff has incurred and will incur attorneys' fees, costs, and expenses in the prosecution of this action. The circumstances of this dispute may give rise to an exceptional case within the meaning of 35 U.S.C. § 285, and Plaintiff is entitled to recover its reasonable and necessary attorneys' fees, costs, and expenses.

JURY DEMAND

99. Plaintiff hereby requests a trial by jury pursuant to Rule 38 of the Federal Rules of Civil Procedure.

PRAYER FOR RELIEF

100. Plaintiff respectfully requests that the Court find in its favor and against Lumen, and that the Court grant Plaintiff the following relief:

1. A judgment that Lumen has infringed the Asserted Patents as alleged herein, directly and/or indirectly by way of inducing infringement of such patents;

2. A judgment for an accounting of all damages sustained by Plaintiff as a result of the acts of infringement by Lumen;
3. A judgment and order requiring Lumen to pay Plaintiff damages under 35 U.S.C. § 284, including up to treble damages as provided by 35 U.S.C. § 284, and any royalties determined to be appropriate;
4. A judgment and order requiring Lumen to pay Plaintiff pre-judgment and post-judgment interest on the damages awarded;
5. A judgment and order finding this to be an exceptional case and requiring Lumen to pay the costs of this action (including all disbursements) and attorneys' fees as provided by 35 U.S.C. § 285; and
6. Such other and further relief as the Court deems just and equitable.

Dated: June 16, 2022

Respectfully submitted,

/s/ Patrick J. Conroy

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