UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

GODO KAISHA IP BRIDGE 1, Plaintiff, v. NOKIA CORPORATION, NOKIA SOLUTIONS AND NETWORKS OY, and NOKIA OF AMERICA CORPORATION, Defendants.	)	Civil Action No. **COMPLAINT FOR PATENT INFRINGEMENT** **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Godo Kaisha IP Bridge 1 ("IP Bridge") hereby files this Complaint for Patent Infringement against Nokia Corporation ("Nokia Corp."), Nokia Solutions and Networks Oy ("NSN Oy"), and Nokia of America Corporation ("Nokia USA") (collectively, "Nokia").

NATURE OF ACTION

1. This is a civil action for infringement under the patent laws of the United States of America, 35 U.S.C. § 1 *et seq.*

2. IP Bridge is the owner of all rights, title, and interest in U.S. Patent Nos. 7,372,909; 8,787,275; 9,769,820; 8,085,724; 8,077,594; 8,385,239; 8,526,546; and 9,137,000 (collectively, the "Asserted Patents").

PARTIES

3. Plaintiff IP Bridge is a Japanese entity with its principal place of business located at c/o Sakura Sogo Jimusho, 1-11 Kanda Jimbocho, Chiyoda-ku, Tokyo, 101-0051 Japan. IP Bridge owns the Asserted Patents.

4. On information and belief, Defendant Nokia Corporation is a corporation organized and existing under the laws of Finland with its principal place of business at Karakaari 7, 02610 Espoo, Finland. On information and belief, Nokia Corporation acquired Alcatel-Lucent, with the closing of the deal on or around November 2, 2016.

5. On information and belief, Defendant Nokia Solutions and Networks Oy is a corporation organized and existing under the laws of Finland with its principal place of business at Karaportti 3, 02610 Espoo, Finland. Nokia Solutions and Networks Oy is a wholly owned subsidiary of Nokia Corporation.

6. On information and belief, Defendant Nokia of America Corporation is a Delaware corporation with its principal place of business at 600 Mountain Avenue, Murray Hill, New Jersey 07974. Nokia Corporation of America is an indirect wholly owned subsidiary of Nokia Solutions and Networks Oy and Nokia Corporation.

7. On information and belief, Nokia of America Corporation is the surviving legal entity of several acquisitions, mergers, and/or corporate changes of name, including from Nokia's acquisition of Alcatel-Lucent. For example, on information and belief, effective August 8, 2013, Nokia Siemens Networks US LLC was renamed Nokia Solutions and Networks US LLC. Effective November 30, 2017, Nokia Solutions and Networks Holdings USA, Inc. merged into Nokia Solutions and Networks US LLC. Furthermore, effective January 1, 2018, Nokia Solutions and Networks US LLC merged into Alcatel-Lucent USA Inc., which was renamed Nokia of America Corporation.

JURISDICTION AND VENUE

8. This is a civil action for infringement under the patent laws of the United States of America, 35 U.S.C. § 1 *et seq*. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

9. This Court has personal jurisdiction over Nokia Corp., NSN Oy, and Nokia USA because, directly or through intermediaries, they have committed acts within Texas giving rise to this action and/or have established minimum contacts with Texas such that the exercise of jurisdiction would not offend traditional notions of fair play and substantial justice.

10. Nokia Corp., NSN Oy, and/or Nokia USA operate the website www.nokia.com, which is accessible to and directed toward citizens of the State of Texas and this judicial district.

11. During the infringing time period, Nokia Corp., NSN Oy, and/or Nokia USA have placed one or more infringing products into the stream of commerce via an established distribution channel with the knowledge and/or understanding that such products were being offered for sale, and/or sold to customers, and/or utilized in this judicial district. Nokia Corp., NSN Oy, and/or Nokia USA also have contracted with various entities to perform certain services and/or deliver products in Texas, including in this judicial district. For example, Nokia Corp., NSN Oy, and/or Nokia USA have contracted and partnered with telecommunications companies, including at least all major nationwide carriers—Sprint/T-Mobile, Verizon, and Dallas-based AT&T—and internet service provider Nextlink Internet (based in nearby Parker County, Texas), to provide 4G LTE and 5G infrastructure products for delivery in this judicial district. *See, e.g.*, https://www.fiercewireless.com/wireless/t-mobile-picks-ericsson-nsn-as-its-lte-vendors (identifying Nokia as one of T-Mobile's primary infrastructure vendors for its LTE network); https://www.wraltechwire.com/2010/02/10/att-picks-ericsson-alcatel-lucent-for-4g-network/ (identifying Nokia and Alcatel-Lucent (which later was acquired by Nokia) as suppliers of AT&T's LTE infrastructure equipment); https://www.nokia.com/about-us/news/releases/2020/01/09/nokia-highlights-momentum-with-63-commercial-5g-deals/ (AT&T, Sprint, T-Mobile, Verizon); https://www.nokia.com/about-

us/news/releases/2020/10/14/nokia-and-nextlink-internet-bring-5g-ready-wireless-internet-to-rural-americans/; *see also* https://www.nokia.com/about-us/news/releases/2019/10/02/nokia-celebrates-twelve-months-of-5g-achievements/ (celebrating a year of "5G 'firsts'" that started with "the first over-the-air, end-to-end data transmission on a commercial 3GPP 5G New Radio network in partnership with Verizon"); https://www.t-mobile.com/news/legacy-sprint/sprint-unveils-5g-ready-massive-mimo-markets ("With Nokia's 5G-ready massive MIMO radios, Sprint will build high capacity for its customers.").

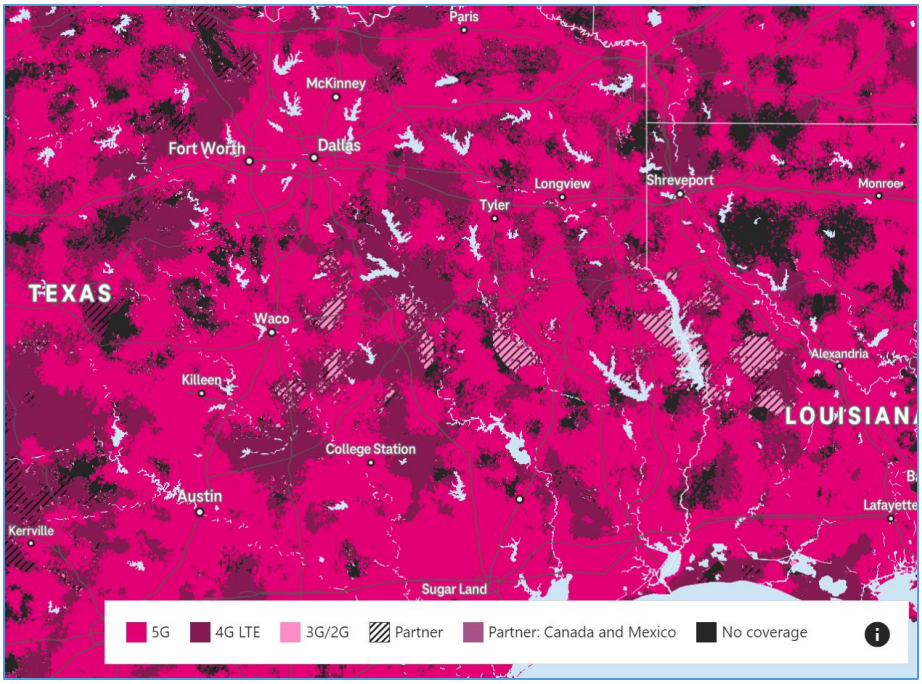
12. For example, Nokia Corp., NSN Oy, and/or Nokia USA were selected in 2012 as one of T-Mobile's "primary infrastructure vendors for its [then-]forthcoming LTE network." *See, e.g.*, https://www.fiercewireless.com/wireless/t-mobile-picks-ericsson-nsn-as-its-lte-vendors. Nokia in 2014 extended its "long-term relationship with T-Mobile under a new contract to help the operator continue the expansion of its fastest nationwide 4G LTE network," including in this judicial district. *See, e.g.*, https://www.nokia.com/about-us/news/releases/2014/10/01/t-mobile-extends-partnership-with-nokia-networks-to-support-further-expansion-of-its-4g-lte-network/; https://www.fiercewireless.com/wireless/t-mobile-will-work-nokia-networks-to-launch-lte-carrier-aggregation. According to the announcement, Nokia "has deployed 4x2 and 4x4 MIMO-capable radio technology in its LTE base stations" since 2012, and "T-Mobile's LTE solution is comprised of [Nokia's] best-in-class Flexi Multiradio10 Base Station." *See, e.g., id.*

13. In addition, in an announcement in July 2018, Nokia Corp., NSN Oy, and/or Nokia USA were selected by T-Mobile to accelerate the deployment of the carrier's nationwide 5G network, including in this judicial district. *See, e.g.*, https://www.nokia.com/about-us/news/releases/2018/07/30/t-mobile-and-nokia-ink-35-billion-multi-year-5g-network-

agreement/. The announcement celebrated the multi-year, $3.5 billion contract as "Nokia's largest 5G agreement globally" that "provide[s] T-Mobile with [Nokia's] complete end-to-end 5G technology." *See, e.g., id.* "As part of the agreement [in 2018], Nokia will help build T-Mobile's nationwide 5G network with 600 MHz and 28 GHz millimeter wave 5G capabilities compliant with 3GPP 5G New Radio (NR) standards." *See, e.g., id.*

14. Nokia and T-Mobile also collaborated "to bring T-Mobile's first commercial hardware based 5G 28 GHz cell on air," and then successfully completed "the nation's first bi-directional over-the-air 5G data session on a 3GPP-compliant 5G New Radio (NR) system." *See, e.g.,* https://www.nokia.com/about-us/news/releases/2018/01/03/nokia-t-mobile-us-and-intel-collaborate-to-bring-t-mobiles-first-commercial-hardware-based-5g-28-ghz-cell-on-air/; https://www.nokia.com/about-us/news/releases/2018/06/07/nokia-and-t-mobile-achieve-nations-first-3gpp-compliant-bi-directional-5g-new-radio-data-transmission/. In early 2021, Nokia Corp., NSN Oy, and/or Nokia USA recently "announced a continuation of its long standing T-Mobile partnership with a five-year deal" for 5G infrastructure products. *See, e.g.,* https://www.nokia.com/about-us/news/releases/2021/01/14/nokia-supports-t-mobile-5g-evolution-with-five-year-expansion-deal/.

15. T-Mobile offers 4G LTE and 5G coverage in this judicial district and the State of Texas (*see* https://www.t-mobile.com/coverage/coverage-map):

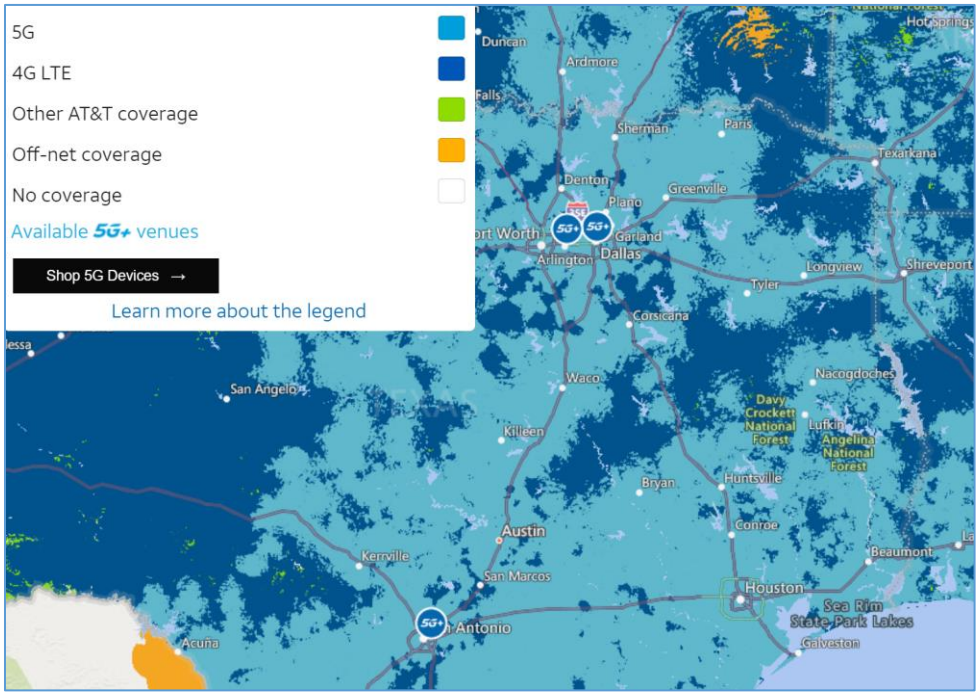


16. Upon information and belief, Nokia LTE and 5G products are deployed to provide these T-Mobile services in this judicial district.

17. As another example, in February 2010, Alcatel-Lucent, which was later acquired by Nokia, was selected by AT&T to provide LTE cell-tower equipment and "to build out [AT&T's] LTE network." *See, e.g.*, https://www.wraltechwire.com/2010/02/10/att-picks-ericsson-alcatel-lucent-for-4g-network/; https://www.rcrwireless.com/20100210/carriers/at-t-picks-ericsson-alcatel-lucent-for-lte-rollout. In early 2021, Nokia announced a five-year contract with AT&T, under which "Nokia's C-Band RAN technology will interwork with existing Nokia LTE RAN equipment [already] deployed by AT&T" "to support both indoor and outdoor 5G coverage." *See, e.g.*, https://www.nokia.com/about-us/news/releases/2021/03/18/nokia-supports-5g-for-att-customers-with-five-year-c-band-deal/. According to the announcement, the "[d]eal features Nokia's massive MIMO antenna solutions, macro remote radio heads and next generation AirScale baseband equipment." *See, e.g., id.*

18. In addition, Nokia Corp., NSN Oy, and/or Nokia USA were selected as a supplier when Dallas-based AT&T "started deploying 3GPP Release 15 compliant equipment in a handful of [its] early 5G cities," including Waco, Houston, and nearby Dallas. *See, e.g.*, https://about.att.com/story/2018/5g_cities_2018_2019.html. Furthermore, Nokia Corp., NSN Oy, and/or Nokia USA, in collaboration with AT&T, are launching a "5G Innovation Studio" in Plano, Texas, to "provid[e] a space where customers can explore and try out tech using advanced network capabilities." *See, e.g.*, https://www.fiercewireless.com/5g/at-t-launches-5g-innovation-studio-ericsson-nokia.

19. AT&T offers 4G LTE and 5G coverage in this judicial district and the State of Texas (*see* https://www.att.com/maps/wireless-coverage.html):

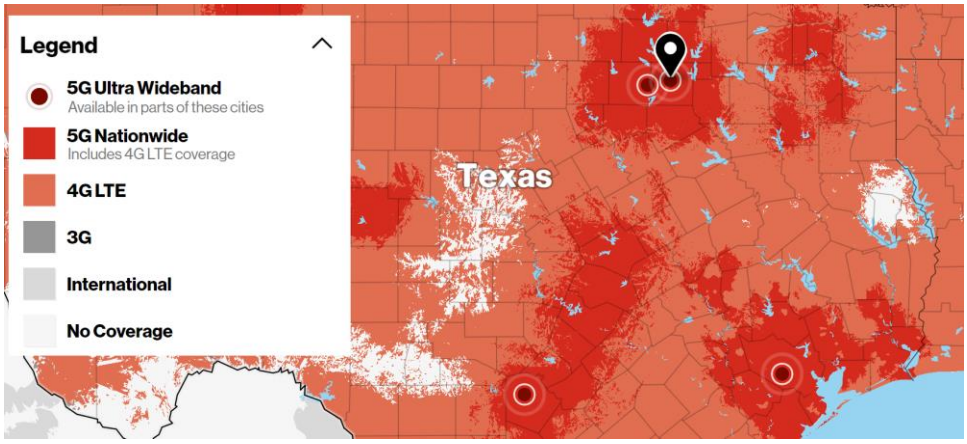


20. Upon information and belief, Nokia LTE and 5G products are deployed to provide these AT&T services in this judicial district.

21. Nokia Corp., NSN Oy, and/or Nokia USA have also contracted with Verizon wireless for infrastructure equipment. For example, "Verizon's network historically has been . . .

half Nokia gear." *See, e.g.*, https://www.fiercewireless.com/financial/samsung-scores-6b-network-deal-verizon. As another example, Alcatel-Lucent, which was later acquired by Nokia, was "one of the key vendors of CDMA and LTE infrastructure for Verizon Wireless." *See, e.g.*, https://www.verizon.com/about/news/vzw/2010/01/pr2010-01-06f. In 2013, Verizon announced it would use Alcatel-Lucent's "LTE small cell products" to enhance the coverage of its LTE network, and Alcatel-Lucent was a "primary radio access network (RAN) vendor[] for Verizon's LTE network." *See, e.g.*, https://www.fiercewireless.com/wireless/verizon-taps-alcatel-lucent-ericsson-for-lte-small-cells. In 2018, Nokia Corp., NSN Oy, and/or Nokia USA collaborated to reach "record-breaking speeds on [Verizon's] 4G LTE [network]" using "Nokia's AirScale base station." *See, e.g.*, https://www.verizon.com/about/news/verizon-nokia-and-qualcomm-use-lte-advanced-technology-six-carrier-aggregation-reach-145-gbps.

22. Verizon offers 4G LTE and 5G coverage in this judicial district and the State of Texas (*see* https://www.verizon.com/coverage-map/):



23. Upon information and belief, Nokia LTE and 5G products are deployed to provide these Verizon services in this judicial district.

24. Nokia Corp., NSN Oy, and/or Nokia USA have also partnered with Netlink Internet to "bring 5G-ready wireless internet to . . . people living in rural and underserved

regions in the Central United States." *See, e.g.*, https://www.nokia.com/about-us/news/releases/2020/10/14/nokia-and-nextlink-internet-bring-5g-ready-wireless-internet-to-rural-americans/. According to the announcement, "Nokia is deploying a CBRS 4G LTE network" using "Nokia['s] AirScale 4G LTE RAN," "thereby enabling Nextlink to build its 5G-ready network." *See, e.g., id.*

25. Nextlink Internet offers internet coverage in this judicial district, including in at least Cooke, Denton, Grayson, Collin, Fannin, Lamar, Hopkins, and Van Zandt Counties (*see* https://nextlinkinternet.com/sign-up/?lang=en):

26. Upon information and belief, Nextlink provides these services in this judicial district using, at least in part, Nokia Corp.'s, NSN Oy's, and/or Nokia USA's LTE and 5G products.

27. Nokia Corp., NSN Oy, and/or Nokia USA have availed themselves and/or participated in litigation in courts within the State of Texas and this judicial district. For example, Nokia USA recently intervened in lawsuits in this district against its customers AT&T,

Sprint, and Verizon. *See, e.g.*, *IPCom Gmbh & Co. v. AT&T Inc.*, No. 2:20-cv-00322-JRG (E.D. Tex. filed Oct. 1, 2020) (lead) (involving AT&T and Verizon); *Sol IP, LLC v. AT&T Mobility LLC*, No. 2:18-cv-00526-RWS-RSP (E.D. Tex. filed Dec. 3, 2018) (lead) (involving AT&T, Sprint, and Verizon). Nokia Corp., NSN Oy, and/or Nokia USA have also asserted patents in the State of Texas and this judicial district. *See, e.g.*, *Nokia Sols. and Network US LLC v. Huawei Techs. Co.*, No. 2:16-cv-00753-JRG (E.D. Tex. filed July 11, 2016).

28. This Court further has personal jurisdiction over Nokia USA because it maintains a significant physical presence in this judicial district, including an office at 2525 Highway 121, Lewisville, Texas 75056 and a data center at 601 Data Drive, Plano, Texas 75075. *See, e.g.*, https://www.nokia.com/about-us/company/worldwide-presence/north-america/; https://www.nokia.com/contact-us/offices/#north-america. During the infringing time period, Nokia USA has operated the Plano facility as a "NokiaEDU Training Center," to deliver "a top-quality learning experience" to their customers. *See, e.g.*, https://learningstore.nokia.com/locations/files/US-Plano.pdf. The training facility is "equipped with state-of-the-art technology, amenities and helpful staff." *See, e.g.*, *id.*

29. Nokia USA maintains additional offices throughout Texas, including its U.S. headquarters in Dallas and an office in Austin. *See, e.g.*, https://www.nokia.com/about-us/company/worldwide-presence/north-america/; https://www.nokia.com/contact-us/offices/#north-america. In addition, job openings at Nokia's Dallas and Austin locations are posted on its website (www.nokia.com), and Nokia operates an additional NokiaEDU Training Center in Dallas. *See, e.g.*, https://careers.nokia.com/jobs/search/27419584; https://learningstore.nokia.com/locations/files/US-Dallas.pdf.

30. Because this Court has personal jurisdiction over Nokia Corp. and NSN Oy—both foreign corporations—venue is proper pursuant to 28 U.S.C. § 1391(c).

31. For the reasons set forth above, venue is proper for Nokia USA under 28 U.S.C. § 1400(b).

IP BRIDGE'S PATENTS

32. United States Patent No. 7,372,909 ("the '909 Patent"), titled "Radio Transmitting Apparatus, Radio Receiving Apparatus and Method Therefor," was duly and lawfully issued on May 13, 2008. IP Bridge is the owner of all right, title, and interest in the '909 Patent, including the right to sue for past infringement. A true and correct copy of the '909 Patent is attached hereto as Exhibit 1.

33. The claims of the '909 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

34. Rather, the '909 Patent addresses problems and shortcomings in the field of mobile communications, and multicarrier communications in an orthogonal frequency-division multiplexing (OFDM) scheme in particular, and claims novel and inventive technological solutions to such problems and shortcomings. For example, the '909 Patent describes limitations in the prior art multicarrier communications methods and systems in which the subcarriers of the data channel have a different center frequency than the subcarriers of the control channel. '909 Patent at 1:32-35. As described in the '909 Patent, a transmitter up-converts the transmitted signal by multiplying it by a "local signal"—"a signal whose frequency is set to the center frequency of a transmit frequency band on the transmitter side." '909 Patent at 1:40-43. On the receiving end, the received signal is multiplied by a local signal to down-convert it. '909 Patent at 1:43-46. When the center frequencies of the data channel and the control channel are

different, as in the prior art, a receiving apparatus would need to use one local signal frequency for down-converting the subcarriers of the control channel, then switch the local signal frequency to receive the data channel. As the '909 Patent explains, this switching was not stable and prevented speeding up switching, and thus reception, of the multicarrier signal. '909 Patent, 1:52-57.

35. The technology recited in the claims of the '909 Patent specifies how to implement a multicarrier communications scheme that allows switching between the control channel and data channel at high speed—a result that creates efficiencies and overrides the routine and conventional practice of transmitting control and data channels with different center frequencies. For example, instead of the conventional approach of a base station transmitting subcarriers of a data channel and subcarriers of a control channel such that the data channel subcarriers have a different center frequency than the control channel subcarriers, the '909 Patent provides a specific way for transmitting data channel subcarriers and control channel subcarriers with a single, common center frequency.

> Since the local frequency does not need to be changed, switching from the control channel 34 to the data channel 33 in receiving can be speeded up. Moreover, by dealing with the control channel 34 and the data channel 33 by changing the sampling rate of one analog-digital conversion section 45, the circuit configuration can be further reduced compared with the case of providing respective analog-digital conversion sections for the control channel 34 and the data channel 33.

'909 Patent at 4:23-31.

36. The claims of the '909 Patent addresses technical problems arising out of the field of multicarrier communications. For example, the '909 Patent explains how, in the art at the time of the invention, Phased Locked Loop circuits for generating the local signal was not stable

in changing the local signal's frequency, resulting in delays in transmission and reception speeds. '909 Patent at 1:52-57.

37. The '909 Patent solves this technological problem through the technological solution of assigning control channel subcarriers and data channel subcarriers so that the control channel subcarriers and data channel subcarriers have a common center frequency along a frequency axis.

38. On July 16, 2009, Panasonic Corporation (the original assignee of the '909 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the '909 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the declaration are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

39. United States Patent No. 8,787,275 ("the '275 Patent"), titled "Wireless Communication Base Station Equipment, Wireless Communications Terminal Device and Search Space Setting Method," was duly and lawfully issued on July 22, 2014. IP Bridge is the owner of all right, title, and interest in the '275 Patent, including the right to sue for past infringement. A true and correct copy of the '275 Patent is attached hereto as Exhibit 2.

40. The claims of the '275 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

41. Rather, the '275 Patent addresses problems and shortcomings in the field of mobile communications, and communicating control information in the orthogonal frequency-division multiple access (OFDMA) in particular, and claims novel and inventive technological

solutions to such problems and shortcomings. For example, the '275 Patent describes limitations in the prior art LTE specification characterized by downlink OFDMA and uplink single carrier frequency division multiple access (SC-FDMA) communication schemes in which a radio communication terminal must blindly decode a physical downlink control channel (PDCCH) received from a base station. '275 Patent at 1:14-34, 1:40-44. As described in the '275 Patent, the PDCCH contains control information that indicates resource allocation of downlink data and uplink data to each terminal. The PDCCH directed to a terminal occupies a resource made up of continuous Control Channel Element units (CCEs) within a larger set of CCEs referred to as the terminal's "search space." '275 Patent at 1:26-34, 1:45-50. To obtain control information relevant to the terminal, the terminal blindly decodes the scrambled CRC bits in the PDCCH and detects a PDCCH directed to the terminal. The search space limits the CCE area subject to blind decoding for each terminal. '275 Patent at 1:35-44. But when a terminal is allocated multiple component bands for transmission, and a single search space is used to address communications with a terminal across multiple component bands, there are limitations on how much data can be successfully transmitted to the device across the component bands. '275 Patent at 4:21-39.

42. The technology recited in the claims of the '275 Patent specifies a method of setting a plurality of search spaces for a plurality of component bands—a result that creates efficiencies and overrides the routine and conventional practice of setting a single search space for the control information for a plurality of component bands. For example, instead of the conventional approach of limiting a terminal to a single search space for all control information for communications across all component bands (or component carriers), the '275 Patent discloses a base station that allocates multiple PDCCH signals relating to separate component

bands (or component carriers) for each terminal in search spaces that are located close to each other.

> In the present setting method, allocation section 105 sets different search spaces for every plurality of component bands so that the search spaces of the plurality of component bands set in each terminal neighbor each other.

'275 Patent at 10:56-59; *see also id.* at 6:30-36. Because the search spaces for the different component bands neighbor each other, the amount of searching the receiving terminal needs to perform is minimized, thereby minimizing power consumption by the terminal.

43. The claims of the '275 Patent address technical problems arising out of the field of OFDMA communications. For example, the '275 Patent explains how, in the art at the time of the invention, when multiple component bands are available to carry information, using a single search space for all component bands for a given terminal limits the amount of control information that can be sent to the terminal, potentially limiting how much data can be communicated with the terminal.

44. The '275 Patent solves this technological problem through the technological solution of defining separate search spaces for a plurality of component bands:

> Thus, in the downlink component band of each component band set in terminal 200, it is possible to perform CCE allocation in each downlink component band without being limited by CCE allocation of other different component bands set in terminal 200. This allows base station 100 to reduce the possibility that a PDCCH signal not being allocated to CCEs may limit data transmission.

'275 Patent at 12:31-38.

45. On August 6, 2013, Panasonic Corporation (the original assignee of the '275 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the application that led to the '275 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the

declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

46. In addition, on October 15, 2020, IP Bridge submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying a foreign counterpart of the '275 Patent, as an intellectual property right (IPR) owned by IP Bridge. In the declaration, IP Bridge declared that, to the extent the IPRs identified in the declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the 5G standard, IP Bridge is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

47. United States Patent No. 9,769,820 ("the '820 Patent"), titled "Method and Device for Setting a Control Channel and a Data Channel in a Wireless Communication System," was duly and lawfully issued on September 19, 2017. IP Bridge is the owner of all right, title, and interest in the '820 Patent, including the right to sue for past infringement. A true and correct copy of the '820 Patent is attached hereto as Exhibit 8.

48. The claims of the '820 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

49. Rather, the '820 Patent addresses problems and shortcomings in the field of mobile communications, and multicarrier communications in an orthogonal frequency-division multiplexing (OFDM) scheme in particular, and claims novel and inventive technological solutions to such problems and shortcomings. For example, the '820 Patent describes limitations

in the prior art multicarrier communications methods and systems in which the size of the traditional Physical Downlink Control Channel (PDCCH) is insufficient to send control information to a large number of pieces of user equipment (UE) served by the same base station (BS), necessitating use of an enhanced control channel (E-PDCCH). '820 Patent at 15:13-39. The PDCCH is limited to a maximum of three ODFM symbols in the first slot of a downlink subframe, with the rest of the symbols in a subframe assigned as a data region to which data channels are assigned. '820 Patent at 6:32-40. As described in the '820 Patent, the E-PDCCH can be configured within the existing Physical Downlink Shared Channel (PDSCH) region in place of a data channel in order to resolve interference in the conventional PDCCH. '820 Patent at 15:40-56. Sending information about the starting position of the E-PDCCH in the PDSCH in addition to existing control information increases undesirable signal overhead, which requires more transmission resources to be used for control signaling such that there is less data that can be transmitted.

50. The technology recited in the claims of the '820 Patent specifies how to implement a multicarrier communications scheme that allows for the use of an E-PDCCH—a result that creates efficiencies and overrides the routine and conventional approach of sending all control data over a conventional PDCCH only. For example, instead of the conventional approach of a base station always sending all control information over a traditional PDCCH, the '820 Patent provides an efficient way to identify to a terminal the start position (in particular, the location of a first symbol) for an E-PDCCH region by reusing a Control Format Indicator (CFI) that needs to be transmitted regardless of whether an E-PDCCH is transmitted.

> The UE sets a next OFDM symbol in a PDCCH region, indicated by the CFI value, as the start symbol of an E-PDCCH region (S102). That is, the UE receives a CFI value through an existing PCFICH, checks the size of a PDCCH in a time domain, and sets a next first

> OFDM symbol of the PDCCH as the start symbol of an E-PDCCH. In other words, the first example is a method of setting the start symbol of an E-PDCCH using an existing PCFICH (or CFI). In accordance with the first example, there is an advantage in that UE can be aware of the start symbol of an E-PDCCH region even without additional signaling in addition to signaling in an existing LTE system.

'820 Patent at 15:62-16-6.

51. The claims of the '820 Patent address technical problems arising out of the field of multicarrier communications. For example, the '820 Patent explains how, in the art at the time of the invention, E-PDCCH implementations were being considered which would use the existing PDSCH data channels to relieve interference in the existing PDCCH region. '820 Patent at 15:18-44. No conventional method for communicating the location of the E-PDCCH within the PDSCH to the UE then existed, and always explicitly transmitting that information to each UE would have produced significant signal overhead.

52. The '820 Patent solves this technological problem through the technological solution of assigning the start symbol of the E-PDCCH as the symbol after the end of the PDCCH by using the PDCCH length information already transmitted in the CFI, unless a signal is sent indicating otherwise.

53. On November 13, 2016, LG Electronics (the original assignee of the '820 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying a foreign counterpart to the '820 Patent as an intellectual property right (IPR) owned by LG. In the declaration, LG declared that, to the extent the IPRs identified in the declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the LTE standard, LG is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

54. United States Patent No. 8,085,724 ("the '724 Patent"), titled "Sequence Report Method and Sequence Report Device," was duly and lawfully issued on December 27, 2011. IP Bridge is the owner of all right, title, and interest in the '724 Patent, including the right to sue for past infringement. A true and correct copy of the '724 Patent is attached hereto as Exhibit 3.

55. The claims of the '724 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

56. Rather, the '724 Patent addresses problems and shortcomings in the field of cellular communications, and more specifically the signaling and allocation of sequences and cyclic shifts for generation of preambles used to initiate communications between wireless devices and base stations across a random access channel in cellular communications systems. For example, the '724 Patent describes limitations in the prior art cellular communications methods and systems in which the "broadcast channel signaling amount (number of bits) increases" as the number of available preambles within a cell increases. '724 Patent at 2:43-58. As the '724 Patent explains, "in the case of a cell with a large cell radius it is necessary to report a maximum of 64 ZC sequences" thereby requiring more signaling information. *Id.* The '724 Patent further explains that certain sequences used to generate preambles may be limited in their application to certain cyclic shifts and certain cell sizes based on properties of the sequences. For example, the '724 Patent explains that because an erroneous "correlation value peak occurs at timing that is wrong in a + direction or – direction" for certain sequences, those sequences should not be cyclically shifted greater than the amount that would lead to the erroneous correlative peak. '724 Patent at 17:62-18:5. The '724 Patent also recognized that because the cyclic shift of a sequence should "be greater than round trip

propagation delay" within a cell, certain cyclic shifts are suited for certain cell sizes. '724 Patent at 13:28-35. Accordingly, the '724 Patent disclosed correlating certain sequences with certain cyclic shifts for use with certain cell sizes.

57. The technology recited in the claims of the '724 Patent specifies how to "provide a sequence report method and sequence report apparatus that reduce a signaling amount" for a sequence allocated to a cell by a base station in a manner that correlates sequences with cyclic shifts for suitable applications (e.g., certain cell sizes)—a result that creates efficiencies and overrides the routine and conventional approach of separately signaling each sequence. '724 Patent at 2:55-59, 13:28-35, 17:62-18:5. For example, instead of the conventional approach of transmitting separate information about each possible sequence that may be used in the random access procedure, the '724 Patent uses the transmission of a single index by correlating "indexes having consecutive numbers to a plurality of different code sequences" that are used by mobile devices to generate random access preambles. '724 Patent at 2:62-3:5. The code sequences are further correlated with cyclic shifts, for example, as illustrated in Fig. 23 of the '724 Patent, which are used to generate preambles from the code sequences and cyclic shifts. '724 Patent at 19:22-25. The correlation of code sequences with cyclic shifts accounts for maximum applicable cyclic shifts limited by erroneous "correlation value peaks." '724 Patent at 18:5-12. The '724 Patent's mapping of consecutive indices to code sequences facilitates a mapping arrangement in which code sequences with similar properties (e.g., maximum cyclic shift) are grouped together. '724 Patent at 19:46-56.

58. The claims of the '724 Patent address technical problems arising out of the field of signaling and allocation of sequences, and generation of preambles from such sequences. For example, the '724 Patent explains how, in the art at the time of the invention, signaling a large

number of preambles could require a large number of bits, consuming valuable bandwidth, and using inappropriate cyclic shifts to generate preambles from certain sequences could lead to errors. '724 Patent at 2:62-3:5, 13:28-35, 17:62-18:5.

59. The '724 Patent solves this technological problem through the technological solution of correlating consecutive indices to code sequences and cyclic shifts that account for certain properties of the code sequences and sizes of cells, such that only a single code sequence needs to be identified by the base station to allow a terminal to determine all assigned code sequences while ensuring the assigned code sequence have desirable properties. '724 Patent at 18:22-28; 19:1-7.

60. On October 25, 2010, Panasonic Corporation (the original assignee of the '724 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the '724 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the declaration are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

61. In addition, on October 15, 2020, IP Bridge submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying a foreign counterpart to the '724 Patent, as an intellectual property right (IPR) owned by IP Bridge. In the declaration, IP Bridge declared that, to the extent the IPRs identified in the declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the 5G standard, IP Bridge is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

62. United States Patent No. 8,077,594 ("the '594 Patent"), titled "Radio Communication Base Station Device and Correlation Setting Method," was duly and lawfully issued on December 13, 2011. IP Bridge is the owner of all right, title, and interest in the '594 Patent, including the right to sue for past infringement. A true and correct copy of the '594 Patent is attached hereto as Exhibit 4.

63. The claims of the '594 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

64. Rather, the '594 Patent addresses problems and shortcomings in the field of cellular communications, and the transmitting of random access preambles and reference signal information from terminals to base stations in particular, and claims novel and inventive technological solutions to such problems and shortcomings. For example, the '594 Patent describes limitations in the prior art cellular communication systems in which "communication resources available for data transmission decrease" as "the number of mobile stations within the cell increases." '594 Patent at 2:27-38. As described in the '594 Patent, in a "conventional technique of performing transmission by assigning the [sounding reference signal] to the first [long block] in a subframe," "the first [long block] … is more frequently used to transmit the SRS as the number of mobile stations in a cell increases." *Id.* "The efficiency of communication resources available for data transmission decrease, and, as a result, the data transmission efficiency is reduced." *Id.*

65. The technology recited in the claims of the '594 Patent specifies how to implement a cellular communication system to provide additional resources for transmitting reference signals (e.g., concurrently with random access preambles) and to reduce interference

between the transmission of a preamble and a reference signal—a result that creates efficiencies and overrides the routine and conventional practice of transmitting reference signals. For example, instead of the conventional approach of sending the reference signal in a first long block of a subframe when the cyclic prefix of a random access preamble is simultaneously transmitted, the '594 Patent sends the reference signal in a portion of a subframe during which the random access preamble is not transmitted. The inventors of the '594 Patent recognized that because a first device transmitting a random access preamble does not transmit anything during a guard time that immediately follows the preamble, a second device could send a reference signal during that guard time without interference between the random access preamble transmitted by the first device and the reference signal transmitted by the second device. '594 Patent at 1:50-54; 12:41-51, 13:14-23. By sending the reference symbol in a guard time of a subframe in which the random access preamble is transmitted, the '594 Patent provides a specific way for transmitting reference signals.

> Therefore, by increasing the rate at which the preamble and SRS transmission time fields match each other as the system bandwidth decreases, it is possible to provide greater effect of reducing SRS communication resources.

'594 Patent at 12:41-51.

66. The claims of the '594 Patent address technical problems arising out of the field of cellular communication systems. For example, the '594 Patent explains how, in the art at the time of the invention, a reference signal is transmitted in a long block at the beginning of a subframe, which could result in a decrease in data transmission efficiency. '594 Patent at 2:28-38.

67. The '594 Patent solves this technological problem through the technological solution of arranging a transmission of a sounding reference signal from a first device that is

mapped to the position of a guard time immediately following a random access preamble transmitted from a second device, during which guard time nothing is transmitted from the second device.

68. On October 25, 2010, Panasonic Corporation (the original assignee of the ’594 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the parent application of the ’594 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

69. United States Patent No. 8,385,239 (“the ’239 Patent”), titled “Control Channel Signalling for Triggering the Independent Transmission of a Channel Quality Indicator,” was duly and lawfully issued on February 26, 2013. IP Bridge is the owner of all right, title, and interest in the ’239 Patent, including the right to sue for past infringement. A true and correct copy of the ’239 Patent is attached hereto as Exhibit 5.

70. The claims of the ’239 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

71. Rather, the ’239 Patent addresses problems and shortcomings in the field of cellular communications, and sending of channel quality information (CQI) as feedback in particular, and claims novel and inventive technological solutions to such problems and shortcomings. For example, the ’239 Patent describes limitations in the prior art cellular

communication systems where CQI was sent either in an aperiodic or periodic manner from a terminal to a base station. '239 Patent at 8:43-44. When communicating aperiodic reports of CQI, a terminal concurrently sent the report with data if the terminal's data buffer was not empty. '239 Patent at 6:52-7:18. The '239 Patent further described the existing signaling parameters that were used to communicate CQI from a terminal to a base station. '239 Patent at 8:39-54.

72. The technology recited in the claims of the '239 Patent specifies how to improve upon the existing methods by defining a "control signaling scheme" within the existing signaling framework, which would allow a base station to request a terminal to send a CQI report without data under certain conditions in order to "improve control on the content and error resilience of the aperiodic CQI report"—a result that creates efficiencies and overrides the routine and conventional practice of always requesting aperiodic CQI reports with data. '239 Patent at 9:30-37. For example, instead of the conventional approach of a base station requesting only either periodic CQI reports without data or aperiodic reports with data, the '239 Patent provides a specific way for a base station to signal to a terminal to transmit an aperiodic report without data (e.g., during poor and/or rapidly changing channel conditions). '239 Patent at 14:49-56. As the '239 Patent explains, a "main advantage of the invention relies in that the overall structure and content of the MCS/TBS table is preserved for [] Uplink and Downlink." '239 Patent at 14:38-40.

73. The claims of the '239 Patent addresses technical problems arising out of the field of cellular communications systems and channel quality feedback. For example, the '239 Patent explains how, in the art at the time of the invention, CQI was either communicated without data in a periodic report or with data in an aperiodic report. '239 Patent at 6:38-7:18, 8:39-44. When

channel conditions were poor, base stations were less likely to properly receive a transmission of an aperiodic CQI report together with data. Without the CQI report, the base station's ability to maintain the communication link between the base station and terminal could degraded.

74. The '239 Patent solves this technological problem through the technological solution of using specific signaling parameters within an existing signaling framework in order to signal the transmission of an aperiodic CQI report without data, without adding signaling overhead in the base station control signaling, which leaves more communication resources available for other transmissions.

75. On October 25, 2010, Panasonic Corporation (the original assignee of the '239 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the '239 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the declaration are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

76. United States Patent No. 8,526,546 ("the '546 Patent"), titled "Radio Transmission Device and Radio Transmission Method," was duly and lawfully issued on September 3, 2013. IP Bridge is the owner of all right, title, and interest in the '546 Patent, including the right to sue for past infringement. A true and correct copy of the '546 Patent is attached hereto as Exhibit 6.

77. The claims of the '546 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

78. Rather, the '546 Patent addresses problems and shortcomings in the field of cellular communications systems, and the concurrent transmission of different types of slot structures in particular, and claims novel and inventive technological solutions to such problems and shortcomings. For example, the '546 Patent describes limitations in the prior art communication methods and systems which relied upon using cyclically shifted ZC sequences to multiplex and de-multiplex signals transmitted using different slot structures (e.g., an ACK/NACK and CQI). '546 Patent at 3:23-39. As described in the '546 Patent, non-ideal communication environments (e.g., with delays on channels) may break "orthogonality of cyclic shift sequences" and result in a "CQI signal [] interfered from an ACK/NACK signal." '546 Patent at 3:40-50.

79. The technology recited in the claims of the '546 Patent improve "receiving performance when a delay [] occurs on a channel, when transmission timing lags occur or when residual interference occurs between different cyclic shift amounts of ZC sequences"—a result that creates efficiencies and overrides the routine and conventional practice of relying upon cyclically shifted ZC sequences to separate different structured transmissions. '546 Patent at 4:34-38. For example, instead of the conventional approach of using orthogonal covering codes to differentiate only ACK/NACK signals from each other, which could result in interference between the ACK/NACK signals and CQI signals transmitted using a different slot structure, the '546 Patent provides a specific way for applying certain additional orthogonal Walsh codes to the ACK/NACK signals while setting certain reference signal symbols in the CQI signals to be opposite phase in order to reduce interference between the ACK/NACK signals and the CQI signals in transmissions by terminals.

> This is because correlation processing used to receive a CQI+NACK signal inverts the phases of the second symbol and sixth symbol of

> a signal spread using the Walsh sequence and the phases cancel each other, so that it is possible to reduce interference from the ACK/NACK signal to RSs of the CQI+NACK signal.

'546 Patent at 14:50-55. This approach of using different structured transmissions also overrides the other conventional approach of transmitting both CQI and ACK/NACK using the same structure of transmission for both, thus providing more flexibility in transmissions than existing methods.

80. The claims of the '546 Patent address technical problems arising out of the field of cellular communication systems. For example, the '546 Patent explains how, in the art at the time of the invention, non-ideal channel conditions could cause loss of orthogonality of ZC sequences leading to interference between signals of different slot structures. '546 Patent at 3:40-50.

81. The '546 Patent solves this technological problem through the technological solution of assigning opposite phases to the reference signals of a CQI signal that reduces interference with ACK/NACK signals transmitted with a Walsh code having the same phase in the symbol positions corresponding to the reference signals of the CQI signal. '546 Patent at 14:50-55.

82. On June 6, 2013, Panasonic Corporation (the original assignee of the '546 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the '546 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the declaration are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

83. United States Patent No. 9,137,000 ("the '000 Patent"), titled "Base Station Apparatus and Method for Controlling Channel Quality Indicator Transmission," was duly and

lawfully issued on September 15, 2015. IP Bridge is the owner of all right, title, and interest in the '000 Patent, including the right to sue for past infringement. A true and correct copy of the '000 Patent is attached hereto as Exhibit 7.

84. The claims of the '000 Patent are not directed to basic tools of scientific and technological work, fundamental economic practices, or the use of an abstract mathematical formula.

85. Rather, the '000 Patent addresses problems and shortcomings in the field of mobile communications, and subcarrier allocations in a wireless communication apparatus in particular, where data is allocated to a plurality of subcarriers using, for example, orthogonal frequency-division multiplexing (OFDM). '000 Patent at 1:8-12. For example, the '000 Patent describes limitations in the prior art channel quality indicator (CQI) methods and systems in which, to carry out scheduling and adaptive modulation for every subcarrier block, the terminal apparatus must report the CQI of every subcarrier to the base station apparatus, requiring the transmission of an enormous amount of control information. '000 Patent at 1:62-66; *see also id.* at 22-48. As a result, the transmission rate fell. '000 Patent at 1:65-2:1. In addition, the amount of processing required at the terminal apparatus to measure reception quality and generate the CQI, and at the base station apparatus to carry out processing for scheduling and adaptive modulation for every subcarrier, consumed significant power. '000 Patent at 2:1-10.

86. The technology recited in the claims of the '000 Patent specifies how to implement a CQI transmission scheme that reduces the amount of CQI information calculated and generated by the terminal apparatus, transmitted from the terminal apparatus to the base station apparatus, and used by the base station apparatus for optimal Modulation and Coding Scheme (MCS)—a result that creates efficiencies and overrides the routine and conventional

practice of transmitting CQI information for all subcarriers. For example, instead of the conventional approach of a base station apparatus transmitting control information requesting the terminal apparatus to send a CQI for all subcarriers, the '000 Patent provides a specific way for requesting CQI for groups of subcarriers or a single subcarrier by requesting one CQI for all subcarrier blocks within the communication frequency band instead of multiple CQIs for multiple subcarrier blocks within the communication frequency band. *See, e.g.*, '000 Patent, 7:25-41, 11:18-34.

87. The claims of the '000 Patent address technical problems arising out of the field of mobile communications. For example, the '000 Patent explains how, in the art at the time of the invention, carrying out scheduling and adaptive modulation for every subcarrier block to report the CQI required an enormous amount of control information sent from the terminal apparatus to the base station apparatus, reducing the transmission rate and increasing power consumption. '000 Patent at 1:62-2:10.

88. The '000 Patent solves this technological problem through the technological solution of the base station apparatus determining whether to request either one CQI for each subcarrier block within the communication frequency band or one CQI for all subcarrier blocks within the communication frequency band.

89. On July 16, 2009, Panasonic Corporation (the original assignee of the '000 Patent) submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying the parent application of the '909 Patent as an intellectual property right (IPR) owned by Panasonic. In the declaration, Panasonic declared that, to the extent the IPRs identified in the declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the LTE standard, Panasonic is prepared to grant an irrevocable license to

the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

90. In addition, on October 15, 2020, IP Bridge submitted an IPR Information Statement and Licensing Declaration to ETSI, identifying a continuation application of the '000 Patent, as an intellectual property right (IPR) owned by IP Bridge. In the declaration, IP Bridge declared that, to the extent the IPRs identified in the declaration (which includes family members of the patents explicitly identified) are or become, and remain essential to the 5G standard, IP Bridge is prepared to grant an irrevocable license to the IPRs on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

NOKIA'S INFRINGING PRODUCTS AND ACTIVITIES

91. On information and belief, Nokia makes, uses, sells, and/or offers to sell in the United States, and/or imports into the United States numerous products compliant with the 4G LTE standard ("LTE Products"). These products include LTE base stations (e.g., eNodeBs, eNBs). On information and belief, Nokia's LTE base stations include Nokia's AirScale Base Stations, which comply with the 3GPP 4G LTE standard. *See, e.g.*, https://onestore.nokia.com/asset/200026?_ga=2.15668277.22983469.1621276730-599134674.1617295711&_gac=1.254824058.1619024593.CjwKCAjwmv-DBhAMEiwA7xYrd5IySQrykKqtBspGKGNVNfWvgn5OrNLoTqJUlDUpyBPZEXKHtiwSshoCnZQQAvD_BwE ("AirScale Base Stations support all radio technologies (2G, 3G, 4G and 5G)").

92. On information and belief, Nokia makes, uses, sells, and/or offers to sell in the United States, and/or imports into the United States numerous products compliant with the 5G standard ("5G Products"). These products include 5G base stations (e.g., gNodeBs, gNBs). On information and belief, Nokia's 5G base stations include Nokia's AirScale Base Stations, which

comply with the 3GPP 5G standard. *See, e.g.*, https://www.nokia.com/about-us/news/releases/2018/02/07/nokia-and-qualcomm-complete-key-foundation-tests-of-5g-new-radio-network-and-devices/ ("Nokia and Qualcomm complete key foundation tests of 5G New Radio network and devices"; "[s]uccessful interoperability and over-the-air-testing compliant with the 5G New Radio (NR)"; Nokia and Qualcomm . . . have successfully completed interoperability testing in the 3.5Ghz and 28Ghz spectrum compliant with the 3GPP 5G NR Release 15 standard"); *see also* https://www.qualcomm.com/news/releases/2018/02/07/nokia-and-qualcomm-complete-key-foundation-tests-5g-new-radio-network-and; https://www.nokia.com/about-us/news/releases/2018/12/03/qualcomm-and-nokia-complete-5g-nr-mmwave-and-sub-6-ghz-over-the-air-ota-interoperability-test-calls-in-preparation-for-commercial-5g-deployments-in-early-2019/.

FIRST CAUSE OF ACTION
(Infringement of U.S. Patent No. 7,372,909)

93. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

94. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '909 Patent, including but not limited to Nokia's LTE Products (the "'909 Accused Products"). Nokia's '909 Accused Products infringe one or more claims of the '909 Patent, including without limitation, claim 5 of the '909 Patent.

95. As an example, the '909 Accused Products practice a "method for transmitting an OFDM multicarrier signal comprising a first plurality of subcarriers and a second plurality of subcarriers." '909 Patent, claim 5. For example, the OFDM multicarrier signal of the '909 Accused Products comprises PDSCH subcarrier signals and PBCH subcarrier signals. *See, e.g.*,

3GPP TS 36.211 v8.9.0 at §§ 1, 6.3.5, 6.4, 6.6.4. The '909 Accused Products practice the method further comprising "assigning a data channel to the first plurality of subcarriers and a control channel to the second plurality of subcarriers." '909 Patent, claim 5. For example, the '909 Accused Products map the PDSCH and PBCH to resource elements. The PDSCH signal is mapped to resource elements (*k*,*l*) in increasing order of first the index *k* over the assigned physical resource blocks and then the index *l*. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 6.3.5. The PBCH is mapped to resource elements (*k*,*l*) in increasing order of first the index *k*, then the index *l* in slot 1 in subframe 0 according to defined resource element indices. *See, e.g.*, *id.* at § 6.6.4.

96. The '909 Accused Products practice the method further comprising "assigning … the second plurality of subcarriers [such that the second plurality of subcarriers] are located between the first plurality of subcarriers on a frequency axis and the center frequency of the data channel and the center frequency of the control channel are common." '909 Patent, claim 5. For example, the resource element indices of the PBCH are defined to place the PBCH immediately around the center frequency. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 6.6.4. Moreover, the PDSCH is mapped to resource elements such that the PBCH is located between the PDSCH subcarriers. *See, e.g., id.* at §§ 6.3.5, 6.4, 6.6.4.

97. The '909 Accused Products practice the method further comprising "up-converting the multicarrier signal to a carrier frequency; and … transmitting the up-converted multicarrier signal." '909 Patent, claim 5. For example, "[m]odulation and upconversion to the carrier frequency of the complex-valued OFDM baseband signal for each antenna port is shown in Figure 6.13-1," and the up-converted multicarrier signal is transmitted over antennae by the '909 Accused Products. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 6.13.

98. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '909 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the '909 Patent, including without limitation claim 5, pursuant to 35 U.S.C. § 271(a).

99. Nokia also infringes the '909 Patent under 35 U.S.C. § 271(b) & (c).

100. Nokia knew of IP Bridge's patent portfolio before the filing of this action and was alerted by IP Bridge's February 29, 2016 identification of the '909 Patent as part of IP Bridge's portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the '909 Patent or was willfully blind to the '909 Patent. Also, Nokia has had knowledge of the '909 Patent at least by virtue of the filing of this Complaint.

101. Nokia knowingly encourages and intends to induce infringement of the '909 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '909 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '909 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

102. Nokia also contributes to the infringement of the '909 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '909 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for

use in infringing the '909 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

103. Nokia's infringement of the '909 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

104. As a result of Nokia's infringement of the '909 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

105. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

SECOND CAUSE OF ACTION
(Infringement of U.S. Patent No. 8,787,275)

106. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

107. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '275 Patent, including but not limited to Nokia's LTE Products and 5G Products (the "'275 Accused Products"). Nokia's '275 Accused Products infringe one or more claims of the '275 Patent, including without limitation, claim 13 of the '275 Patent.

108. As an example, the '275 Accused Products "assign[] a downlink control channel for a terminal, for which one or multiple component carriers (CC(s)) are configured, to a control channel element (CCE) in a first search space comprised of a plurality of CCEs." '275 Patent, claim 13. For example, the '275 Accused Products assign the PDCCH for a user equipment

(UE) to one or more CCEs in a control region of a base station serving cell consisting of $N_{CCE,k}$ CCEs. *See, e.g.*, 3GPP TS 36.211 v10.7.0 at § 6.1.1; 3GPP TS 36.213 v10.13.0 at § 9.1.1; 3GPP TS 38.213 v15.7.0 at § 10.1 3GPP TS 38.211 v15.7.0 at § 7.1. The CCEs to which the PDCCH is assigned are located in a first search space that is assigned to the UE. *See, e.g., id.*

109. Moreover, "the downlink control channel includes resource assignment information indicating a resource allocated to the terminal in a component carrier n (CC_n) out of the configured CC(s)." '275 Patent, claim 13. For example, the PDDCH contains a carrier indicator and a resource block assignment for the UE. *See, e.g.*, 3GPP TS 36.212 v10.9.0 at § 4.2; 5.3.3.1.2; 3GPP TS 36.213 v10.13.0 at § 9.1.1; 3GPP TS 38.213 v15.7.0 at § 4.2, 7.3.1; 3GPP TS 38.213 v15.7.0 at § 10.1.

110. The '275 Accused Products further "transmit[] the downlink control channel to the terminal in the CCE, wherein the first search space, in which the downlink control channel including the resource assignment information indicating the resource allocated in the CC is assigned, is comprised of the plurality of CCEs depending on the value of n." '275 Patent, claim 13. For example, the Accused '275 Products transmit the PDDCH to the UE on one or more consecutive CCEs and carries carrier indication and scheduling assignment information. *See, e.g.*, 3GPP TS 36.211 v10.7.0 at § 6.8.1; 3GPP TS 36.211 v10.7.0 at § 6.8.1; 3GPP TS 36.213 v10.13.0 at § 9.1; 3GPP TS 38.211 v15.7.0 at § 7.3.2; 3GPP TS 38.213 v15.7.0 at § 10.1. Within the search space monitored by the UE, the PDCCH includes carrier indication information in which corresponding CCEs are based on the carrier indication field value, n_{CI}. *See, e.g.*, 3GPP TS 36.213 v10.13.0 at § 9.1.1; 3GPP TS 38.213 v15.7.0 at § 10.1.

111. The '275 Accused Products further transmit the CCEs such that "a CCE number that defines an end position of the first search space for the CC_n and a CCE number that defines a

start position of a second search space for a component carrier n+1 (CC_{n+1}) are consecutive, the second search space being different from the first search space." '275 Patent, claim 13. For example, the corresponding CCE positions of a UE's search space for the component carrier n_{CI} is defined as a continuous set of CCEs, while the search space for the next component carrier (n_{CI} + 1) starts at the next CCE immediately after the last CCE of the search space for the previous component carrier, such that the first CCE for the search space for the $n+1^{th}$ component carrier is sequential to the last CCE number for the search space for the n^{th} component carrier. *See, e.g.*, 3GPP TS 36.213 v10.13.0 at § 9.1.1; 3GPP TS 38.213 v15.7.0 at § 10.1.

112. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '275 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the '275 Patent, including without limitation claim 13, pursuant to 35 U.S.C. § 271(a).

113. Nokia also infringes the '275 Patent under 35 U.S.C. § 271(b) & (c).

114. Nokia knew of IP Bridge's patent portfolio before the filing of this action and was alerted by IP Bridge's August 2, 2017 identification of the '275 Patent as part of IP Bridge's portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the '275 Patent or was willfully blind to the '275 Patent. Also, Nokia has had knowledge of the '275 Patent at least by virtue of the filing of this Complaint.

115. Nokia knowingly encourages and intends to induce infringement of the '275 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '275 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers

in a network that infringes the '275 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G and 5G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

116. Nokia also contributes to the infringement of the '275 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '275 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '275 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

117. Nokia's infringement of the '275 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

118. As a result of Nokia's infringement of the '275 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

119. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

THIRD CAUSE OF ACTION
(Infringement of U.S. Patent No. 9,769,820)

120. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

121. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one

or more of the inventions covered by the '820 Patent, including but not limited to Nokia's LTE Products (the "'820 Accused Products"). Nokia's '820 Accused Products infringe one or more claims of the '820 Patent, including without limitation, claim 1 of the '820 Patent.

122. As an example, the '820 Accused Products "transmit[] a Physical Downlink Shared Channel (PDSCH) to a user equipment (UE); and transmit[] an Enhanced Physical Downlink Control Channel (EPDCCH) to the UE." '820 Patent, claim 1. For example, the '820 Accused Products comply with the LTE standard, which provides for transmission by base stations of PDCCH and EPDCCH. *See, e.g.*, 3GPP TS 36.213 v12.10.0 at § 7.1.

123. In the '820 Accused Products, "if position information informing of a starting orthogonal frequency division multiplexing (OFDM) symbol of the EPDCCH is configured to the UE through a radio resource control (RRC) message, the starting OFDM symbol for the EPDCCH corresponds to the position information within the RRC message." '820 Patent, claim 1. For example, the *EPDCCH-Config* field "startSymbol" of an RRC message indicates this position. *See, e.g.*, 3GPP TS 36.331 v12.10.0 at § 6.3.2.

124. Further, in the '820 Accused Products, "if the position information is not configured to the UE through the RRC message, the starting OFDM symbol for the EPDCCH is an OFDM signal next to a physical downlink control channel (PDCCH) region checked through a physical control format indicator channel (PCFICH)." '820 Patent, claim 1. For example, the position of the starting symbol is set as the symbol immediately following the PDCCH region according to the CFI value sent over the PCFICH. *See, e.g.*, 3GPP TS 36.213 v 12.10.0 at § 9.1.4.1.

125. Further, in the '820 Accused Products, "if the PDSCH is assigned by the EPDCCH in a same serving cell, a starting OFDM symbol for the PDSCH and a starting OFDM

symbol for the EPDCCH are the same." '820 Patent, claim 1. For example, the starting symbol of both the PDSCH and EPDCCH are either both set by the "startSymbol" parameter of the RRC message, or both start at the symbol immediately following the PDCCH region according to the CFI value sent over the PCFICH. *See, e.g.*, 3GPP TS 36.331 v12.10.0 at § 6.3.2; 3GPP TS 36.213 v 12.10.0 at §§ 7.1.6.4, 9.1.4.1.

126. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '820 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the '820 Patent, including without limitation claim 1, pursuant to 35 U.S.C. § 271(a).

127. Nokia also infringes the '820 Patent under 35 U.S.C. § 271(b) & (c).

128. Nokia has had knowledge of the '820 Patent at least by virtue of the filing of this Complaint.

129. Nokia knowingly encourages and intends to induce infringement of the '820 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '820 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '820 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

130. Nokia also contributes to the infringement of the '820 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United

States, including but not limited to the '820 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '820 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

131. Nokia's infringement of the '820 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

132. As a result of Nokia's infringement of the '820 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

133. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

FOURTH CAUSE OF ACTION
(Infringement of U.S. Patent No. 8,085,724)

134. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

135. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '724 Patent, including but not limited to Nokia's LTE Products and 5G Products (the "'724 Accused Products"). Nokia's '724 Accused Products infringe one or more claims of the '724 Patent, including without limitation, claim 18 of the '724 Patent.

136. As an example, the '724 Accused Products "allocat[e] at least one of sequences." '724 Patent, claim 18. For example, the '724 Accused Products "configures the set

of preamble sequences the UE is allowed to use" or provides the PRACH preamble configuration to the UE. *See, e.g.*, 3GPP TS 36.300 v8.9.0 at §§ 10.1.5.1-10.1.5.2; 3GPP TS 38.300 v15.6.0 at § 5.3.4. The '724 Accused Products "allocat[e] at least one of sequences with consecutive indices among a plurality of sequences." '724 Patent, claim 18. For example, the '724 Products each implement a mapping of consecutive logical indexes to root sequences. *See, e.g.*, 3GPP TS 36.211v8.9.0 at Table 5.7.2-4, § 5.7.2; 3GPP TS 38.211 v15.6.0 at Table 6.3.3.1-3, § 6.3.3.1. In the '724 Accused Products, upon information and belief, the plurality of sequences "are indexed by the indices having consecutive numbers in order of generally increasing to a maximum value and then decreasing from the maximum value, a required cyclic shift amount according to a sequence number." '724 Patent, claim 18. For example, the root sequences are indexed according to generally increasing cyclic shift amounts to a maximum required cyclic shift amount, and then decreasing cyclic shift amounts from the maximum cyclic shift amount. *See, e.g.*, 3GPP TS 36.211v8.9.0 at Tables 5.7.2-2 and 5.7.2-4, § 5.7.2; U.S. Patent No. 8,451,787 at Fig. 2; 3GPP TS 38.211 v15.6.0 at Tables 6.3.3.1-3, 6.3.3.1-5 and 6.3.3.1-6, § 6.3.3.1. The '724 Accused Products "report[] the index of the allocated sequence." '724 Patent, claim 18. For example, the '724 Accused Products "configures the set of preamble sequences the UE is allowed to use" and send to the UE an indication of the first root sequence for the UE to use. *See, e.g.*, 3GPP TS 36.300 v8.9.0 at §§ 10.1.5.1-10.1.5.2; 3GPP TS 36.211 v8.9.0 at § 5.7.2; 3GPP TS 38.300 v15.6.0 at § 5.3.4.

137. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '724 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or

more claims of the '724 Patent, including without limitation claim 18, pursuant to 35 U.S.C. § 271(a).

138. Nokia also infringes the '724 Patent under 35 U.S.C. § 271(b) & (c).

139. Nokia knew of IP Bridge's patent portfolio before the filing of this action and was alerted by IP Bridge's February 29, 2016 identification of the '724 Patent as part of IP Bridge's portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the '724 Patent or was willfully blind to the '724 Patent. Also, Nokia has had knowledge of the '724 Patent at least by virtue of the filing of this Complaint.

140. Nokia knowingly encourages and intends to induce infringement of the '724 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '724 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '724 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G and 5G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

141. Nokia also contributes to the infringement of the '724 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '724 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '724 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

142. Nokia's infringement of the '724 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

143. As a result of Nokia's infringement of the '724 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

144. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

FIFTH CAUSE OF ACTION
(Infringement of U.S. Patent No. 8,077,594)

145. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

146. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '594 Patent, including but not limited to Nokia's LTE Products (the "'594 Accused Products"). Nokia's '594 Accused Products infringe one or more claims of the '594 Patent, including without limitation, claim 13 of the '594 Patent.

147. As an example, the '594 Accused Products "receiv[e] a Sounding Reference Signal (SRS) mapped to a position of a guard time in a subframe, in which a random access preamble is transmitted." '594 Patent, claim 13. For example, a random access burst consists of a cyclic prefix, a preamble, and a guard time, where the guard time is sent at the end of the subframe. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 5.2.5. Moreover, an SRS is sent during the last symbol of the subframe, where the guard time is located. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 5.5.3.2.

148. In the '594 Accused Products, "the guard time during which nothing is transmitted [is] added to the last of the random access preamble, and a cyclic prefix [is] added to the beginning of the random access preamble." '594 Patent, claim 13. For example, "nothing is transmitted" by the device transmitting the preamble during the guard time following the preamble. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 5.2.5. Moreover, the random access preamble includes a cyclic prefix before the preamble sequence. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at Figure 5.7.1, § 5.7.1.

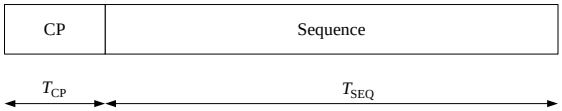


Figure 5.7.1-1: Random access preamble format.

149. The '594 Accused Products further "demodulat[e] the received SRS." '594 Patent, claim 13. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 5.5.3.3. In the '594 Accused Products a "random access preamble is a preamble sequence selected from a set of preamble sequences." '594 Patent, claim 13. For example, the '594 Accused Products select a preamble from a number of preambles allocated in each cell. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at § 5.5.3.3.

150. In the '594 Accused Products, "the guard time is of a given length." '594 Patent, claim 13. For example, in the '594 Accused Products, the guard time follows the preamble sequence up to the remainder of a subframe, where the cyclic prefix, preamble sequence and subframe are of given lengths, and thus the guard time is the difference between the length of the subframe and the combined length of the cyclic prefix and the preamble. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at Figure 5.7.1-1, §§ 4.1, 5.7.1.

151. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '594 Accused

Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the '594 Patent, including without limitation claim 13, pursuant to 35 U.S.C. § 271(a).

152. Nokia also infringes the '594 Patent under 35 U.S.C. § 271(b) & (c).

153. Nokia knew of IP Bridge's patent portfolio before the filing of this action and was alerted by IP Bridge's February 29, 2016 identification of the '594 Patent as part of IP Bridge's portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the '594 Patent or was willfully blind to the '594 Patent. Also, Nokia has had knowledge of the '594 Patent at least by virtue of the filing of this Complaint.

154. Nokia knowingly encourages and intends to induce infringement of the '594 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '594 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '594 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

155. Nokia also contributes to the infringement of the '594 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '594 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '594 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

156. Nokia's infringement of the '594 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

157. As a result of Nokia's infringement of the '594 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

158. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

SIXTH CAUSE OF ACTION
(Infringement of U.S. Patent No. 8,385,239)

159. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

160. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '239 Patent, including but not limited to Nokia's LTE Products (the "'239 Accused Products"). Nokia's '239 Accused Products infringe one or more claims of the '239 Patent, including without limitation, claim 14 of the '239 Patent.

161. As an example, the '239 Accused Products are "base stations." '239 Patent, claim 14; *see, e.g.*, 3GPP TS 36.300 v8.10.0 at § 4 (eNB).

162. The '239 Accused Products include "a transmitter configured to transmit a control channel signal to a mobile terminal." '239 Patent, claim 14. For example, the transmitter is configured to transmit a PDCCH with DCI format 0 to a mobile terminal. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 8; 3GPP TS 36.212 v8.8.0 at § 4.2.

163. In the transmitter of the '239 Accused Products, "the control channel signal comprises a Modulation and Coding Scheme (MCS) Index, information on resource blocks used for a transmission from the mobile terminal to the base station, and a channel quality indicator trigger." '239 Patent, claim 14. For example, the '239 Accused Products transmit a "Modulation and coding scheme," "Resource block assignment" and a "CQI request." *See, e.g.*, 3GPP TS 36.212 v8.8.0 at §§ 5.3.3, 5.3.3.1.1.

164. The control channel signal transmitted by the transmitter of the '239 Accused Products further "trigger[s] a transmission of an aperiodic channel quality indicator report from the mobile station to the base station." '239 Patent, claim 14. For example, the control channel signal triggers the mobile station to perform "aperiodic CQI" reporting using the PUSCH. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 7.2.1.

165. The '239 Accused Products include "a receiver configured to receive from the mobile terminal the aperiodic channel quality indicator report when the channel quality indicator trigger is set." '239 Patent, claim 14. For example, the receiver receives aperiodic CQI reporting performed by the UE using the PUSCH in response to the CQI Request. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 7.2.1.

166. In the '239 Accused Products, the "aperiodic channel quality indicator report is not multiplexed with data transmitted by the mobile terminal via an Uplink Shared Channel (UL-SCH) in case when the control channel signal indicates a determined value of the MCS Index and also indicates a number of resource blocks that is smaller than or equal to a determined number of resource blocks." '239 Patent, claim 14. For example, when the "CQI Request" trigger is set, "there is no transport block for the UL-SCH and only the control information feedback for the current PUSCH reporting mode is transmitted" when the modulation and coding

scheme index is set to 29, and when the number of resource blocks is less than or equal to 4. *See, e.g.,* 3GPP TS 36.213 v8.8.0 at §§ 8.6, 8.6.2.

167. In the '239 Accused Products, the "aperiodic channel quality indicator report is multiplexed with data transmitted by the mobile terminal via the UL-SCH in case (a) when the control channel signal does not indicate the determined value of the MSC index, or in case (b) when the control channel does not indicate a number of resource blocks that is smaller than or equal to the determined number of resource blocks." '239 Patent, claim 14. For example, when the "CQI Request" trigger is set and (1) when the modulation and coding scheme index is not set to 29, or (2) when the number of resource blocks is not less than or equal to 4, a transport block containing data for the UL-SCH is not precluded, and the CQI report is transmitted with the uplink data. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at §§ 8.6, 8.6.2; 3GPP TS 36.300 v8.10.0 § 11.5; 3GPP TS 36.212 § 5.2.2, Figure 5.2.2-1.

168. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '239 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the '239 Patent, including without limitation claim 1, pursuant to 35 U.S.C. § 271(a).

169. Nokia also infringes the '239 Patent under 35 U.S.C. § 271(b) & (c).

170. Nokia knew of IP Bridge's patent portfolio before the filing of this action and was alerted by IP Bridge's February 29, 2016 identification of the '239 Patent as part of IP Bridge's portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the '239 Patent or was willfully blind to the '239 Patent. Also, Nokia has had knowledge of the '239 Patent at least by virtue of the filing of this Complaint.

171. Nokia knowingly encourages and intends to induce infringement of the '239 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '239 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '239 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

172. Nokia also contributes to the infringement of the '239 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '239 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '239 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

173. Nokia's infringement of the '239 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

174. As a result of Nokia's infringement of the '239 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

175. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

SEVENTH CAUSE OF ACTION
(Infringement of U.S. Patent No. 8,526,546)

176. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

177. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '546 Patent, including but not limited to Nokia's LTE Products (the "'546 Accused Products"). Nokia's '546 Accused Products infringe one or more claims of the '546 Patent, including without limitation, claim 6 of the '546 Patent.

178. As an example, the '546 Accused Products "receiv[e] an acknowledgement or non-acknowledgement (ACK/NACK) signal that is spread with an orthogonal sequence, which is selected from a plurality of orthogonal sequences." '546 Patent, claim 6. For example, the '546 Accused Products receive a HARQ-ACK that is "block-wise spread with the orthogonal sequence," such as a Walsh code, where there are multiple Walsh codes that can be used. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 10.1; 3GPP TS 36.211 v8.9.0 at § 5.4.1.

179. The '546 Accused Products use "a plurality of orthogonal sequences including more orthogonal sequences that render two values respectively corresponding to 2nd symbol and 6th symbol of an ACK/NACK signal transmission slot in phase, than orthogonal sequence(s) that render said two values in opposite phases from each other." '546 Patent, claim 6. For example, the '546 Accused Products include the plurality of orthogonal sequences shown in Table 5.4.1-2 below. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 10.1; 3GPP TS 36.211 v8.9.0 at §§ 5.4.1, 5.5.2.2, and Tables 5.4.1-2 and 5.5.2.2.2-1. The 2nd and 3rd positions of the orthogonal sequences correspond to the 2nd and 6th positions of the ACK/NACK signal transmission. *See, e.g., id.*

Table 5.4.1-2: Orthogonal sequences $\left[w(0) \quad \cdots \quad w(N_{SF}^{PUCCH}-1)\right]$ for $N_{SF}^{PUCCH}=4$.

Sequence index $n_{oc}(n_s)$	Orthogonal sequences $\left[w(0) \quad \cdots \quad w(N_{SF}^{PUCCH}-1)\right]$
0	$[+1 \quad +1 \quad +1 \quad +1]$
1	$[+1 \quad -1 \quad +1 \quad -1]$
2	$[+1 \quad -1 \quad -1 \quad +1]$

180. In the '546 Accused Products, "each of the plurality of orthogonal sequences [has] a sequence length of 4 corresponding to 1st, 2nd, 6th and 7th symbols of 7 symbols included in the ACK/NACK signal transmission slot." '546 Patent, claim 6. For example, in the '546 Accused Products, reference signal symbols are located at the 3rd, 4th and 5th symbol positions (positions 2, 3, and 4 of positions 0-6) within an ACK/NACK transmission, whereas the data symbols are located in the 1st, 2nd, 6th and 7th symbol positions (positions 0, 1, 5, and 6 of positions 0-6), as indicated by Table 5.5.2.2.2-1 of TS 36.211 v8.9.0. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 10.1; 3GPP TS 36.211 v8.9.0 at §§ 5.4.1, 5.5.2.2, and Tables 5.4.1-2 and 5.5.2.2.2-1.

Table 5.5.2.2.2-1: Demodulation reference signal location for different PUCCH formats

PUCCH format	Set of values for l	
	Normal cyclic prefix	Extended cyclic prefix
1, 1a, 1b	2, 3, 4	2, 3
2	1, 5	3
2a, 2b	1, 5	N/A

181. The '546 Accused Products receive the "spread ACK/NACK signal being arranged in the 1st, 2nd, 6th and 7th symbols of the ACK/NACK signal transmission slot and first reference signals (1st RS) being arranged in 3rd, 4th and 5th symbols of the ACK/NACK signal transmission slot." '546 Patent, claim 6. For example, as discussed above, in the '546 Accused Products, reference signal symbols are located at the 3rd, 4th and 5th symbol positions (positions 2, 3, and 4 of positions 0-6) within an ACK/NACK transmission, whereas the data

symbols are located in the 1st, 2nd, 6th and 7th symbol positions (positions 0, 1, 5, and 6 of positions 0-6), as indicated by Table 5.5.2.2.2-1 of TS 36.211 v8.9.0. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 10.1; 3GPP TS 36.211 v8.9.0 at § 5.4.1.

182. The '546 Accused Products further "despread[] the ACK/NACK signal with said orthogonal sequence." '546 Patent, claim 6. For example, the '546 Accused Products use the orthogonal sequence used to spread the ACK/NACK signal to despread the ACK/NACK signal. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at §§ 5.1.1, 5.5.2.2, 5.6, Table 5.5.2.2.2-1.

183. The '546 Accused Products "receiv[e] CQI signals arranged in 1st, 3rd, 4th, 5th and 7th symbols of a CQI signals transmission slot." '546 Patent, claim 6. For example, in the '546 Accused Products, reference signal symbols are located at the 2nd and 6th symbol positions (positions 1 and 5 of positions 0-6) within a CQI transmission, whereas the data symbols are located in the 1st, 3rd, 4th, 5th, and 7th symbol positions (positions 0, 2-4, and 6 of positions 0-6), as indicated by Table 5.5.2.2.2-1 of TS 36.211 v8.9.0. *See, e.g.*, 3GPP TS 36.213 v8.8.0 at § 10.1; 3GPP TS 36.212 v8.8.0 at §§ 5.2.3.3-5.2.3.4, 5.4.2-5.4.3, Table 5.5.2.2.2-1.

Table 5.5.2.2.2-1: Demodulation reference signal location for different PUCCH formats

PUCCH format	Set of values for l	
	Normal cyclic prefix	Extended cyclic prefix
1, 1a, 1b	2, 3, 4	2, 3
2	1, 5	3
2a, 2b	1, 5	N/A

184. The '546 Accused Products "receiv[e] two second reference signals (2nd RS), which are produced by multiplying two reference signal sequences with values having opposite phases from each other and which are arranged in 2nd and 6th symbols of the CQI signals transmission slot." '546 Patent, claim 6. For example, the Accused Products set the reference signals of a CQI signal to opposite phase according to Table 5.4.2-1 of TS 36.211 v8.9.0. *See,*

e.g., 3GPP TS 36.213 v8.8.0 at § 10.1; 3GPP TS 36.212 v8.8.0 at § 5.2.3.4; 3GPP TS 36.211 v8.9.0 at § 5.4.2, Table 5.4.2-1.

Table 5.4.2-1: Modulation symbol $d(10)$ for PUCCH formats 2a and 2b.

PUCCH format	$b(20),...,b(M_{\text{bit}}-1)$	$d(10)$
2a	0	1
	1	−1
2b	00	1
	01	$-j$
	10	j
	11	−1

185. The ’546 Accused Products further “demodulat[e] the CQI signals arranged in the CQI signals transmission slot.” ’546 Patent, claim 6. For example, the ’546 Accused Products are base stations (eNBs) that demodulate signals received from user equipment over various channels, including the PUCCH carrying the CQI reports. *See, e.g.*, 3GPP TS 36.211 v8.9.0 at §§ 5.1.1, 5.1.2, 5.6; 3GPP TS 36.300 v. 8.13.0 at § 5.

186. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the ’546 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the ’546 Patent, including without limitation claim 6, pursuant to 35 U.S.C. § 271(a).

187. Nokia also infringes the ’546 Patent under 35 U.S.C. § 271(b) & (c).

188. Nokia knew of IP Bridge’s patent portfolio before the filing of this action and was alerted by IP Bridge’s February 29, 2016 identification of the ’546 Patent as part of IP Bridge’s portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the ’546 Patent or was willfully blind to the ’546 Patent. Also, Nokia has had knowledge of the ’546 Patent at least by virtue of the filing of this Complaint.

189. Nokia knowingly encourages and intends to induce infringement of the '546 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '546 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '546 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

190. Nokia also contributes to the infringement of the '546 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '546 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '546 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

191. Nokia's infringement of the '546 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

192. As a result of Nokia's infringement of the '546 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

193. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

EIGHTH CAUSE OF ACTION
(Infringement of U.S. Patent No. 9,137,000)

194. IP Bridge realleges and incorporates by reference the allegations set forth in the foregoing paragraphs of its Complaint.

195. Nokia makes, uses (including through testing), sells, and/or offers to sell in the United States, and/or imports into the United States, products that incorporate or make use of one or more of the inventions covered by the '000 Patent, including but not limited to Nokia's LTE Products and 5G Products (the "'000 Accused Products"). Nokia's '000 Accused Products infringe one or more claims of the '000 Patent, including without limitation, claim 1 of the '000 Patent.

196. As an example, the '000 Accused Products "transmit[] control information indicating whether a mobile station is to transmit one channel quality indicator (CQI) for each subcarrier block within a communication frequency band or one CQI for all subcarrier blocks within the communication frequency band instead of multiple CQIs for multiple subcarrier blocks within the communication frequency band." '000 Patent, claim 1. For example, the '000 Accused Products send control information indicating the CQI that the mobile stations report and the sizes and formats of the CQI reports. *See, e.g.*, 3GPP TS 36.300 v10.12.0 at § 11.5; 3GPP TS 38.214 v15.7.0 at § 5.2.1.4; 3GPP TS 38.331 v15.7.0 at § 6.3.2. The control information transmitted by the '000 Accused Products specifies a wideband type or multi-band type of CQI reporting, where the wideband type provides channel quality information (CQI) of the entire system bandwidth of the cell and the multi-band type provides CQI of some subset of the system bandwidth of a cell. *See, e.g.*, 3GPP TS 36.300 v10.12.0 at § 11.5; 3GPP TS 38.214 v15.7.0 at § 5.2.1.4. Further, for the subband CQI transmission scheme, a subband CQI reports the channel quality in a particular part or parts of the bandwidth of that serving cell. *See, e.g.*, 3GPP TS

36.213 v10.13.0 at § 7.2.2; 3GPP TS 38.214 v15.7.0 at § 5.2.1.4. The CQI-ReportConfig is used to specify the CQI reporting configuration, including in the cqi-FormatIndicatorPeriodic field. *See, e.g.*, 3GPP TS 36.331 v10.22.0 at § 6.3.2; 3GPP TS 38.331 v15.7.0 at § 6.3.2 ("CSI-ReportConfig information element").

197. The '000 Accused Products further "receiv[e] one CQI for each subcarrier block within the communication frequency band or one CQI for all subcarrier blocks within the communication frequency band from the mobile station according to the control information." '000 Patent, claim 1. For example, the base station will receive from a mobile station either the wideband type or multi-band type CQI based on the CQI-ReportConfig control information. *See, e.g.*, 3GPP TS 36.300 v10.12.0 at § 11.5; 3GPP TS 36.213 v10.13.0 at § 7.2.1; 3GPP TS 36.331 v10.22.0 at § 6.3.2; 3GPP TS 38.214 v15.7.0 at § 5.2.1.4; 3GPP TS 38.331 v15.7.0 at § 6.3.2 ("CSI-ReportConfig information element").

198. By making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '000 Accused Products, Nokia has injured IP Bridge and is liable to IP Bridge for directly infringing one or more claims of the '000 Patent, including without limitation claim 1, pursuant to 35 U.S.C. § 271(a).

199. Nokia also infringes the '000 Patent under 35 U.S.C. § 271(b) & (c).

200. Nokia knew of IP Bridge's patent portfolio before the filing of this action and was alerted by IP Bridge's August 2, 2017 identification of the '000 Patent as part of IP Bridge's portfolio that included a set of patents essential to the LTE standard. Upon information and belief, Nokia knew of the '000 Patent or was willfully blind to the '000 Patent. Also, Nokia has had knowledge of the '000 Patent at least by virtue of the filing of this Complaint.

201. Nokia knowingly encourages and intends to induce infringement of the '000 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including but not limited to the '000 Accused Products, with knowledge and specific intention that such products will be used by Nokia or its customers in a network that infringes the '000 Patent. For example, Nokia expressly advertises that its portfolio of products "provides efficient and scalable mobile network coverage and capacity" for 4G and 5G where "nationwide coverage" is required. *See, e.g.*, https://www.nokia.com/networks/portfolio/radio-access-networks-ran/.

202. Nokia also contributes to the infringement of the '000 Patent. Nokia makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the '000 Accused Products, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '000 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use.

203. Nokia's infringement of the '000 Patent has been and continues to be deliberate and willful, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

204. As a result of Nokia's infringement of the '000 Patent, IP Bridge has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Nokia's infringement, but in no event less than a reasonable royalty with interest and costs.

205. On information and belief, Nokia's infringement in violation of the federal patent laws will continue to injure IP Bridge unless otherwise enjoined by this Court.

DEMAND FOR JURY TRIAL

IP Bridge hereby demands a trial by jury of all issues so triable in this action.

PRAYER FOR RELIEF

IP Bridge respectfully requests this Court grant relief as follows:

A. Judgment that Defendants have infringed one or more claims of each of the Asserted Patents in this litigation pursuant to 35 U.S.C. §§ 271(a), 271(b), and/or 271(c), and that Defendants are liable for damages caused by such infringement;

B. Judgment requiring Defendants to make an accounting of damages resulting from Defendants' infringement of the Asserted Patents;

C. Judgment awarding IP Bridge its damages resulting from Defendants' infringement of the Asserted Patents, and increasing such damages pursuant to 35 U.S.C. § 284 because of the willful and deliberate nature of Defendants' conduct;

D. A judicial determination of the conditions for future infringement such as an ongoing royalty;

E. Judgment requiring Defendants to pay IP Bridge's costs and expenses, along with pre-judgment and post-judgment interest, for Defendants' infringement of each of the Asserted Patents;

F. An order that this case is "exceptional" pursuant to 35 U.S.C. § 285, entitling IP Bridge to an award of its reasonable and necessary attorneys' fees, expenses, and costs, and pre-judgment interest thereon; and

G. Grant to IP Bridge such other and further relief as the Court deems just and proper.

Dated: June 11, 2021

/s/ *Melissa R. Smith*

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