IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
(AUSTIN DIVISION)

BELL NORTHERN RESEARCH, LLC, Plaintiff, v. NXP SEMICONDUCTORS, N.V.; NXP, B.V.; and NXP USA, INC., Defendants.	**Civil Action No. 1:23-cv-633** **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Bell Northern Research, LLC ("BNR" or "Plaintiff"), for its Complaint against Defendants NXP Semiconductors, N.V.; NXP, B.V.; and NXP USA, Inc. (collectively, "NXP" or "Defendants"), alleges the following:

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq*.

THE PARTIES

2. Plaintiff BNR is a limited liability company organized under the laws of the State of Delaware with a place of business at 401 North Michigan Avenue, Chicago, Illinois 60611.

3. BNR is informed and believes Defendant NXP N.V. has its principal place of business and headquarters at 60 High Tech Campus, Eindhoven, Netherlands, 5656 AG. BNR is informed and believes that Defendant NXP N.V. imports, sells for importation, and/or sells after importation into the United States products that are made using the patented systems and methods ("Accused Products"), including at least the NXP 88W8997 2.4/5 GHz Dual-Band 2x2

Wi-Fi 5 (802.11ac) + Bluetooth 5.3 system-on-chip ("NXP Exemplary Accused Product"), either directly or by directing the co-defendant NXP entities to do so.

4. BNR is informed and believes Defendant NXP B.V. has its principal place of business and headquarters at 60 High Tech Campus, Eindhoven, Netherlands, 5656 AG. Defendant NXP B.V. is a subsidiary of or otherwise controlled by Defendant NXP N.V. BNR is informed and believes that Defendant NXP N.V. imports, sells for importation, and/or sells after importation the Accused Products, including the NXP Exemplary Accused Product, in the United States, either directly or by directing other co-defendant NXP entities to do so.

5. BNR is informed and believes Defendant NXP USA, Inc. has its principal place of business and headquarters at 6501 William Cannon Drive West, Austin, TX 78735. BNR is informed and believes Defendant NXP USA is a subsidiary of or otherwise controlled by Defendant NXP N.V. and/or NXP B.V. as to the sale for importation, importation, and/or sale after importation into the United States of the Accused Products, including the NXP Exemplary Accused Product. BNR is informed and believes that Defendant NXP USA imports, sells for importation, and/or sells after importation into the United States the Accused Products, including the NXP Exemplary Accused Product, either directly or by directing other co-defendant NXP entities to do so.

JURISDICTION AND VENUE

6. This is an action for patent infringement arising under the Patent Laws of the United States, Title 35 of the United States Code.

7. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

8. Venue is proper in this judicial district under 28 U.S.C. § 1400(b).

9. Upon information and belief, Defendant NXP Semiconductors, N.V. is not a resident in the United States and may be sued in any judicial district. Defendant NXP

Semiconductors has a place of business located at 60 High Tech Campus, Eindhoven, Netherlands, 5656 AG. Defendant NXP Semiconductors has committed acts of infringement in this District.

10. Upon information and belief, Defendant NXP B.V. is not a resident in the United States and may be sued in any judicial district. Defendant NXP B.V. has a place of business located at 60 High Tech Campus, Eindhoven, Netherlands, 5656 AG. Defendant NXP B.V. has committed acts of infringement in this District.

11. Upon information and belief, s Defendant NXP USA, Inc. has its principal place of business and headquarters at 6501 William Cannon Drive West, Austin, TX 78735. Defendant NXP USA, Inc. has committed acts of infringement within this district.

12. Upon information and belief, Defendants are subject to this Court's general and specific personal jurisdiction, because the Defendants have sufficient minimum contacts within the State of Texas and this District, pursuant to due process and/or the Texas Long Arm Statute, because the Defendants purposefully availed itself of the privileges of conducting business in the State of Texas and in this District, because the Defendants regularly conduct and solicits business within the State of Texas and within this District, and because Plaintiff's causes of action arise directly from the Defendants' business contacts and other activities in the State of Texas and this District.

BACKGROUND

13. The Asserted Patents come from a rich pedigree dating back to the late 19th century. This is when Bell Labs sprang to life from the combined efforts of AT&T and Western Electric. Bell Labs is one of America's greatest technology incubators, and paved the way for many technological advances we know and use today, including the transistor, several kinds of

lasers, the UNIX operating system, and computer languages such as C++. In total, Bell Labs received nine Nobel Prizes for its work over the years.

14. Eventually the Bell system broke up and spawned several new companies. They included telecommunications powerhouses Lucent and Agere Systems. Lucent was absorbed by Nokia, while Agere Systems was acquired by LSI, then Avago, and ultimately renamed Broadcom. The Bell system also spun off Northern Electric which led to the creation of a research lab known as BNR. This lab grew to host thousands of engineers in offices around the globe. One of those was an 800,000-square-foot campus in Richardson, Texas.

15. Collectively, these companies spurred a digital revolution in telecommunications, starting with the first digital telephone switch in 1975. They continued to push the industry to new heights in the late-80s, when BNR announced the desire to create a global fiber optic network (called "FiberWorld"). Its goal was to give users easy, reliable, and fast access to a variety of multimedia services. To realize this vision, Bell Labs and subsequent innovators made numerous breakthroughs in laser, integrated circuit, photodetector, amplifier, and waveguide designs. These advancements led to the modern fiber optic systems we use today.

16. This work naturally evolved to include cellular telecommunications as well. On May 6, 1992, BNR VP George Brody—along with executives from Bell Cellular and Northern Electric—made the first Canada-US digital cellular call. It stretched from Toronto, Ontario to Fort Worth, Texas.

17. Eventually, Nortel Networks absorbed BNR. Although Nortel was ultimately unsuccessful in its bid to supply digital telecommunications and networking solutions to the market, some Bell Labs and Nortel alumni decided to reenergize BNR in 2017. Today it is the successor in interest to many of the key telecommunications technologies.

18. The BNR Patent portfolio comprises hundreds of patents that reflect important developments in telecommunications that were invented and refined by leading technology research companies, including Agere, LSI, and Broadcom. These include U.S. Patent Nos. RE 48,629, 8,416,862, and 7,564,914 (collectively, these patents comprise the "Asserted Patents").

19. Portions of the BNR portfolio are presently licensed and/or were previously licensed to leading technology companies.

20. BNR brings this action to put a stop to the Defendants' unauthorized and unlicensed use of the Asserted Patents.

U.S. PATENT NO. RE 48,629

21. Jason Alexander Trachewsky and Rajendra T. Moorti are the inventors of U.S. Patent No. RE 48,629 (the '629 patent). A true and correct copy of the '629 patent is attached as Exhibit A.

22. The '629 patent resulted from the pioneering efforts of Messrs. Trachewsky and Moorti (hereinafter "the Inventors") in the general area of wireless communication systems and more particularly to long training sequences of minimum peak-to-average power ratio which may be used in legacy systems. At the time of these pioneering efforts, conventionally implemented technology did not sufficiently address the problem of different wireless devices compliant with different standards or different versions of the same standard while enabling backward compatibility with legacy devices that avoids collisions. For example, in the 802.11a and 802.11g standards, each data packet starts with a preamble which includes a short training sequence followed by a long training sequence. The short and long training sequences are used for synchronization between the sender and the receiver. The long training sequence of 802.11a and 802.11g is defined such that each of sub-carriers -26 to +26, except for the subcarrier 0 which is set to 0, has one binary phase shift keying constellation point, either +1 or -1.

23. There existed a need to create a long training sequence of minimum peak-to-average ratio that uses more sub-carriers without interfering with adjacent channels.

24. For example, the Inventors developed a wireless communications device, comprising: a signal generator that generates an extended long training sequence; and an Inverse

Sub-carrier	*−28*	*−27*	*−26*	*−25*	*−24*	*−23*	*−22*
Encoding	*+1*	*+1*	*+1*	*+1*	*−1*	*−1*	*+1*
Sub-carrier	*−14*	*−13*	*−12*	*−11*	*−10*	*−9*	*−8*
Encoding	*+1*	*+1*	*+1*	*−1*	*−1*	*+1*	*+1*
Sub-carrier	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Encoding	*+1*	*−1*	*−1*	*+1*	*+1*	*−1*	*+1*
Sub-carrier	*15*	*16*	*17*	*18*	*19*	*20*	*21*
Encoding	*+1*	*+1*	*−1*	*−1*	*+1*	*−1*	*+1*
Sub-carrier	*−21*	*−20*	*−19*	*−18*	*−17*	*−16*	*−15*
Encoding	*+1*	*−1*	*+1*	*−1*	*+1*	*+1*	*+1*
Sub-carrier	*−7*	*−6*	*−5*	*−4*	*−3*	*−2*	*−1*
Encoding	*−1*	*+1*	*−1*	*+1*	*+1*	*+1*	*+1*
Sub-carrier	*8*	*9*	*10*	*11*	*12*	*13*	*14*
Encoding	*−1*	*+1*	*−1*	*−1*	*−1*	*−1*	*−1*
Sub-carrier	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Encoding	*−1*	*+1*	*+1*	*+1*	*+1*	*−1*	*−1.*

Fourier Transformer operatively coupled to the signal generator, wherein the Inverse Fourier Transformer processes the extended long training sequence from the signal generator and provides an optimal extended long training sequence with a minimal peak-to-average ratio, and wherein at least the optimal extended long training sequence is carried by a greater number of subcarriers than a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme, wherein the optimal extended long training sequence is carried by exactly 56 active sub-carriers, and wherein the optimal extended long training sequence is represented by encodings for indexed sub-carriers -28 to +28, excluding indexed sub-carrier 0 which is set to zero, as follows:

25. One advantage of the patented invention is that it provides an expanded long training sequence of minimum peak-to-average power ratio thereby decreasing power back-off. (*See* ’629 patent at 4:15-17.)

26. Another advantage of the invention is that expanded long training sequence may be used by 802.11a and 802.11g devices for estimating the channel impulse response and by a receiver for estimating the carrier frequency offset between the transmitter clock and receiver clock. (*See* '629 patent at 4:17-21.)

U.S. PATENT NO. 8,416,862

27. Carlos Aldana and Joonsuk Kim are the inventors of U.S. Patent No 8,416,862 ("the '862 patent"). A true and correct copy of the '862 patent is attached as Exhibit B.

28. The '862 patent resulted from the pioneering efforts of Messrs. Aldana and Kim (hereinafter "the Inventors") in the area of wireless communications systems using beamforming. These efforts resulted in the development of a method and system for the efficient feedback of channel information in a closed loop beamforming wireless communication system.

29. At the time of these pioneering efforts, the most widely implemented technology used to address reduced beam forming feedback information for wireless communications was to reduce the size of the feedback. For instance, in a 2x2 MIMO wireless communication, the feedback needs four elements that are all complex Cartesian coordinate values V11 V12;V21 V22. In general, Vik=aik+j*bik, where aik and bik are values between -1, 1. Thus, with 1 bit express per each element for each of the real and imaginary components, aik and bik can be either -1/2 or +1/2, which requires 4x2x1=8 bits per tone. With 4 bit expressions per each element of V(f) in an orthogonal frequency division multiplexing (OFDM) 2x2 MIMO wireless communication, the number of bits required is 1728 per tone (e.g., 42*54*4=1728, 4 elements per tone, 2 bits for real and imaginary components per tone, 54 data tones per frame, and 4 bits per element), which requires overhead for a packet exchange that is too large for practical applications.

30. The Inventors conceived of the invention claimed in the ’862 patent as a way to reduce beam forming feedback information for wireless communications.

31. For example, the Inventors developed a method for feeding back transmitter beamforming information from a receiving wireless communication device to a transmitting wireless communication device, the method comprising: the receiving wireless communication device receiving a preamble sequence from the transmitting wireless device; the receiving wireless device estimating a channel response based upon the preamble sequence; the receiving wireless device determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U); the receiving wireless device decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information; and the receiving wireless device wirelessly sending the transmitter beamforming information to the transmitting wireless device.

32. One advantage of the patented invention is a reduction of beamforming feedback information for wireless communications. (*See* ’862 patent at 3:49-51.)

U.S. PATENT NO. 7,564,914

33. Christopher J. Hansen, Carlos H. Aldana, and Joonsuk Kim are the inventors of U.S. Patent No. 7,564,914 (“the ’914 patent”). A true and correct copy of the ’914 patent is attached as Exhibit C.

34. The ’914 patent resulted from the pioneering efforts of Messrs. Hansen, Aldana, and Kim (hereinafter “the Inventors”) in the general area of wireless networking.

35. For example, the Inventors developed a method for communicating information in a communication system, the method comprising: transmitting data via a plurality of radio frequency (RF) channels utilizing a plurality of transmitting antennas; receiving feedback information via at least one of said plurality of RF channels; modifying a transmission mode

based on said feedback information; receiving said feedback information comprising channel estimates based on transmission characteristics of said transmitted data via at least one of said plurality of transmitting antennas; and deriving said feedback information from mathematical matrix decomposition of said channel estimates.

36. One advantage of the ’914 patent is the more precise estimation of channel characteristics. (*See* ’914 patent at 18:12-15.)

37. Another advantage of the patented invention is that it minimizes the quantity of feedback information and in turn reduces overhead. (*See* ’914 patent at 18:35-39.)

38. Further advantages include higher information transfer rates, and more effective beamforming on transmitted signals. (*See* ’914 patent at 18:40-45.)

DEFENDANTS’ ACTIVITIES

39. NXP makes, uses, sells, imports and/or provides or caused to be used wireless communications devices, such as the NXP 88W8997 2.4/5 GHz Dual-Band 2x2 Wi-Fi 5 (802.11ac) + Bluetooth 5.3 system-on-chip (the NXP Exemplary Accused Product), and other Accused Products including (but not limited to) the NXP 88Q9098, 88Q9098S, 88W8801, 88W8887, 88W8897, 88W8897P, 88W8964, 88W8977, 88W8987, 88W8987S, 88W9054, 88W9098, AW690, CW641, IW416, IW612, and IW620 products.

COUNT I – INFRINGEMENT OF U.S. PATENT NO. RE 48,629

40. The allegations set forth in the foregoing paragraphs 1 through 86 are incorporated into this First Claim for Relief.

41. On July 6, 2021, the ’629 patent was duly and legally reissued by the United States Patent and Trademark Office under the title “Backward-compatible Long Training Sequences for Wireless Communication Networks.”

42. BNR is the assignee and owner of the right, title and interest in and to the '629 patent, including the right to assert all causes of action arising under the Patent and the right to any remedies for infringement of it.

43. Upon information and belief, the Defendants have and continues to directly infringe one or more claims of the '629 patent, including at least claim 1, making, using, selling, importing and/or providing and causing to be used the Accused Instrumentalities that operate according to the 802.11n standard, such as NXP 88W8997 devices, which operate using the 802.11ac standard that is backward-compatible with the 802.11n standard. A chart showing exemplary infringement of the '629 patent by NXP's 88W8997 device is provided in Exhibit D to this Complaint.

44. The 802.11n standard was introduced on or about October 2009, and provides a definition for a High Throughput Long Training Field ("HT-LTF"). The first part of the HT-LTF "consists of one, two, or four HT-LTFs that are necessary for demodulation of the HT-Data portion of the PPDU" (i.e., Protocol Data Unit). The 802.11n standard provides a specific HT-LTF sequence that is transmitted in the case of 20 MHz operation. (*See* 802.11-2016 at 19.3.9.4.6 or 802.11-2009 at 20.3.9.4.6.)

45. Upon information and belief after a reasonable investigation, at least the Accused Instrumentalities infringe the '629 patent. The Accused Instrumentalities are wireless communication devices that include a signal generator that generates an extended long training sequence. For instance, the NXP 88W8997 is 802.11n compliant because it is 802.11ac compliant, and, therefore, uses a specific HT-LTF sequence that is transmitted in the case of 20 MHz operation. (*See* 802.11-2016 at 19.3.9.4.6 or 802.11-2009 at 20.3.9.4.6; *see, e.g.*, Ex. D.) This corresponds to the long training sequence with minimum peak-to-average power ratio

described in the '629 patent. (*See id.*) Devices operating in accordance with the 802.11n standard (known as "wireless stations" or "STAs") must be able to generate the HT-LTF described.

46. The Accused Instrumentalities include an Inverse Fourier Transformer operatively coupled to the signal generator. For instance, the NXP 88W8997 is 802.11n compliant and, therefore, uses an encoding process that requires a reverse Fourier transformer. (*See* 802.11-2016 and 19.3.4(b) or 802.11-2009 at 20.3.4(b); *see, e.g.*, Ex. D.)

47. The Accused Instrumentalities include an Inverse Fourier Transformer (as explained above) that processes the extended long training sequence from the signal generator and provides an optimal extended long training sequence with a minimal peak-to-average ratio. For instance, the NXP 88W8997 is 802.11n compliant and, therefore, processes the HT-LTF training sequence from the signal generator. (*See* 802.11-2016 at Figure 19-9 and 19.3.9.4.6; *see, e.g.*, Ex. D.) The NXP 88W8997 also provides an optimal HT-LTF training sequence with a minimal peak-to-average ratio. (*See* 802.11-2016 at 19.3.9.4.6 at Equation 19-23; *see, e.g.*, Ex. D.)

48. The Accused Instrumentalities also include an optimal extended long training sequence that is carried by a greater number of subcarriers than a standard wireless networking configuration for an OFDM scheme. For instance, the NXP 88W8997 is 802.11n compliant and, therefore, includes an optimal HT-LTF training sequence that is carried by a greater number of subcarriers than is standard for an OFDM scheme. (*See* 802.11-2016 at 19.3.9.4.6 at Equation 19-23 and additional subcarriers noted therein as compared to L-LT; *see, e.g.*, Ex. D)

49. The Accused Instrumentalities also include an optimal extended long training sequence that is carried by exactly 56 active subcarriers. For instance, the NXP 88W8997 is

802.11n compliant and, therefore, includes an optimal HT-LTF training sequence that is carried by 56 active subcarriers. (*See* 802.11-2016 at 19.3.9.4.6; *see, e.g.*, Ex. D.)

50. The Accused Instrumentalities also include an optimal extended long training sequence (as explained above) that is represented by encodings for indexed subcarriers -28 to +28, excluding indexed subcarrier 0 which is set to zero, as follows:

Sub-carrier	*−28*	*−27*	*−26*	*−25*	*−24*	*−23*	*−22*
Encoding	*+1*	*+1*	*+1*	*+1*	*−1*	*−1*	*+1*
Sub-carrier	*−14*	*−13*	*−12*	*−11*	*−10*	*−9*	*−8*
Encoding	*+1*	*+1*	*+1*	*−1*	*−1*	*+1*	*+1*
Sub-carrier	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Encoding	*+1*	*−1*	*−1*	*+1*	*+1*	*−1*	*+1*
Sub-carrier	*15*	*16*	*17*	*18*	*19*	*20*	*21*
Encoding	*+1*	*+1*	*−1*	*−1*	*+1*	*−1*	*+1*
Sub-carrier	*−21*	*−20*	*−19*	*−18*	*−17*	*−16*	*−15*
Encoding	*+1*	*−1*	*+1*	*−1*	*+1*	*+1*	*+1*
Sub-carrier	*−7*	*−6*	*−5*	*−4*	*−3*	*−2*	*−1*
Encoding	*−1*	*+1*	*−1*	*+1*	*+1*	*+1*	*+1*
Sub-carrier	*8*	*9*	*10*	*11*	*12*	*13*	*14*
Encoding	*−1*	*+1*	*−1*	*−1*	*−1*	*−1*	*−1*
Sub-carrier	*22*	*23*	*24*	*25*	*26*	*27*	*28*
Encoding	*−1*	*+1*	*+1*	*+1*	*+1*	*−1*	*−1.*

51. For instance, the NXP 88W8997 is 802.11n compliant, and therefore includes an optimal HT-LTF training sequence that is represented by encodings for indexed subcarriers -28 to +28, excluding indexed subcarrier 0 according to the chart above. (*See* 19.3.9.4.6 at Equation 19-23; *see, e.g.*, Ex. D.)

52. Defendants have infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claim one claim of the ’629 patent, *e.g.*, claim 1, in violation of 35 U.S.C. §§ 271, *et seq*., directly or indirectly, by making, using, offering for sale, selling, offering for lease, leasing in the United States, and/or importing into the United States without authority or license, the Accused Instrumentalities.

53. Upon information and belief, NXP has been aware of the ’629 patent and its infringement thereof at least as early as January 21, 2022, when BNR sent a notice letter to NXP.

54. Upon information and belief, since the Defendants have had knowledge of the ’629 patent, NXP has induced and continues to induce others to infringe at least claim 1 of the ’629

patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including but not limited to NXP's partners, clients, customers, and end users whose use of the Accused Instrumentalities constitutes direct infringement of at least claim 1 of the '629 patent.

55. In particular, NXP's actions that aid and abet others such as its partners, customers, clients, and end users to infringe include advertising and distributing the Accused Instrumentalities and providing instruction materials, training, and services regarding the Accused Instrumentalities. On information and belief, NXP has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because NXP has had actual knowledge of the '629 patent and knowledge that its acts were inducing infringement of the '629 patent since at least the date NXP received notice that such activities infringed the '629 patent.

56. Upon information and belief, the Defendants have engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because the Defendants have had actual knowledge of the '629 patent and that its acts were inducing infringement of the '629 patent since NXP has had knowledge of the '629 patent.

57. NXP's infringement of the '629 patent is willful and deliberate, entitling BNR to enhanced damages and attorneys' fees.

58. NXP's infringement of the '629 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

59. BNR is entitled to recover from NXP all damages that BNR has sustained as a result of Defendants' infringement of the '629 patent, including without limitation and/or not less than a reasonable royalty.

COUNT II – INFRINGEMENT OF U.S. PATENT NO. 8,416,862

60. The allegations set forth in the foregoing paragraphs 1 through 86 are incorporated into this Second Claim for Relief.

61. On April 9, 2013, the ’862 patent was duly and legally issued by the United States Patent and Trademark Office under the title “Efficient Feedback of Channel Information in a Closed Loop Beamforming Wireless Communications System.”

62. BNR is the assignee and owner of the right, title and interest in and to the ’862 patent, including the right to assert all causes of action arising under the patent and the right to any remedies for infringement of it.

63. Upon information and belief, NXP has and continues to directly or indirectly infringe one or more claims of the ’862 patent, *e.g.*, claim 1, by selling, offering to sell, making, using, and/or providing and causing to be used Accused Instrumentalities that operate according to the 802.11ac standard, such as NXP 88W8997 devices. A chart showing exemplary infringement of the ’862 patent by the NXP 88W8997 is attached as Exhibit E.

64. The 802.11ac standard was introduced on or about December 2013, and provides a definition and standardization for channel sounding for beamforming for Multiple Input Multiple Output (“MIMO”) RF radio links, including how a receiving wireless device communicates channel sounding to a base station. Beamforming requires the use of a steering matrix that improves the reception to the beamformee. The 802.11ac standard provides a specific way to compress the beamforming feedback matrix by the beamformee, and how to determine and decompose the estimated transmitter beamforming unitary matrix and compressed into angles for efficient transmission to the beamformer, which generates a next steering matrix. (*See* 802.11-2016 at 19.3.12.1.)

65. Upon information and belief after a reasonable investigation, at least the Accused Instrumentalities infringe the ’862 patent that provide a method for feeding back transmitter beamforming information from a receiving wireless communication device to a transmitting wireless communication device. For instance, the NXP 88W8997 is 802.11ac compliant and therefore provides a compressed beamforming feedback matrix to a beamformer. (*See, e.g.*, 802.11-2016 at 19.3.12.1; Ex. E.)

66. The Accused Instrumentalities, for example, receive a preamble sequence from a transmitting wireless device. For instance, the NXP 88W8997 is an 802.11ac compliant receiver and, therefore, receives a PHY preamble with HT-LTFs from a beamformer. (*See, e.g.*, 802.11-2016 at 19.3.13.1; Ex. E.)

67. The Accused Instrumentalities include estimating a channel response based upon the preamble sequence. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device and, therefore, estimates a channel response as a result of receiving the HT-LTF’s which are part of the PHY preamble. (*See, e.g.*, 802.11-2016 at 19.3.13.1; Ex. E.)

68. The Accused Instrumentalities include determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U). For instance, the NXP 88W8997 is an 802.11ac compliant wireless device, and therefore calculates a beamforming unitary matrix V based on a singular value decomposition of the channel response H=UDV*, where D is a diagonal matrix and U is a receiver unitary matrix. (*See, e.g.*, 802.11-2016 at 19.3.12.3.6; Ex. E.)

69. The Accused Instrumentalities include decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device and, therefore, determines

beamforming feedback matrices and compresses those into the form of angles. (*See, e.g.*, 802.11-2016 at 19.3.12.3.6; Ex. E.)

70. The Accused Instrumentalities include wirelessly sending the transmitter beamforming information to the transmitting wireless device. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device and, therefore, wirelessly sends the compressed beamformed matrices to the beamformer. (*See, e.g.*, 802.11-2016 at 19.3.12.3.6; Ex. E.)

71. NXP has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least one claim of the '862 patent, e.g. claim 1, in violation of 35 U.S.C. §§ 271, *et seq.*, directly and/or indirectly, by making, using, offering for sale, selling, offering for lease, leasing in the United States, and/or importing into the United States without authority or license, the Accused Instrumentalities.

72. Upon information and belief NXP has been aware of the '862 patent and its infringement thereof at least as early as January 21, 2022 upon the receipt of a notice letter from BNR.

73. Upon information and belief, since NXP has had knowledge of the '862 patent, NXP has induced and continues to induce others to infringe at least claim 1 of the '862 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including but not limited to NXP's partners, clients, customers, and end users across the country and in this District, whose use of the Accused Instrumentalities constitutes direct infringement of at least one claim of the '862 patent.

74. In particular, NXP's actions that aid and abet others such as its partners, customers, clients, and end users to infringe include advertising and distributing the Accused Instrumentalities and providing instruction materials, training, and services regarding the

Accused Instrumentalities. On information and belief, NXP has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because NXP has had actual knowledge of the ’862 patent and knowledge that its acts were inducing infringement of the ’862 patent since at least the date NXP received notice that such activities infringed the ’862 patent.

75. Upon information and belief, NXP has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because NXP has had actual knowledge of the ’862 patent and that its acts were inducing infringement of the ’862 patent since NXP has had knowledge of the ’862 patent.

76. NXP’s infringement of the ’862 patent is willful and deliberate, entitling BNR to enhanced damages and attorneys’ fees.

77. NXP’s infringement of the ’862 patent is exceptional and entitles BNR to attorneys’ fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

78. BNR is entitled to recover from NXP all damages that BNR has sustained as a result of NXP’s infringement of the ’862 patent, including without limitation and/or not less than a reasonable royalty.

79. Plaintiff has been harmed by NXP’s infringing activities.

COUNT III – INFRINGEMENT OF U.S. PATENT NO. 7,564,914

80. The allegations set forth in the foregoing paragraphs 1 through 86 are incorporated into this Fifth Claim for Relief.

81. On July 21, 2009, the ’914 patent was duly and legally issued by the United States Patent and Trademark Office under the title “Method and System for Frame Formats for MIMO Channel Measurement Exchange.”

82. BNR is the assignee and owner of the right, title and interest in and to the '914 patent, including the right to assert all causes of action arising under the patent and the right to any remedies for infringement of it.

83. Upon information and belief, the Defendants have and continues to directly infringe one or more claims of the '914 patent, including at least claim 13, by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities that operate according to the 802.11ac standard, including the Accused Instrumentalities. A chart showing exemplary infringement of the'914 patent by the NXP 88W8997 is attached as Exhibit F.

84. The 802.11ac standard provides for a "compressed beamforming feedback matrix" and specifies that "[i]n compressed beamforming feedback matrix, the beamformee shall remove the space-time stream CSD in Table 19-10 from the measured channel before computing a set of matrices for feedback to the beamformer." (*See* 802.11-2016 at 19.3.12.3.6.) Furthermore, "[t]he beamforming feedback matrices, V(k), found by the beamformee are compressed in the form of angles, which are sent to the beamformer." (*Id.*) Devices implementing the beamforming standardization according to 802.11ac standard must be capable of providing compressed beamforming feedback matrices as set forth above.

85. On information and belief after a reasonable investigation, the Accused Instrumentalities infringe the '914 patent that provide a method for receiving data via a plurality of radio frequency (RF) channels utilizing a plurality of receiving antennas. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device that transmits data via a plurality of radio frequency (RF) channels utilizing a plurality of transmitting antennas. *See* Ex. F.

86. The Accused Instrumentalities transmit feedback information via at least one of the plurality of RF channels. For instance, the NXP 88W8997 is an 802.11ac compliant wireless

device that transmits feedback information via at least one of the plurality of RF channels. *See* Ex. F.

87. The Accused Instrumentalities request modification of a transmission mode based on the feedback information in transmitted response messages. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device that modifies a transmission mode based on the feedback information. *See* Ex. F.

88. The Accused Instrumentalities transmit, via at least one of the plurality of receiving antennas, the feedback information comprising channel estimates based on transmission characteristics of the received data. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device that transmits, via at least one of the plurality of receiving antennas, the feedback information comprising channel estimates based on transmission characteristics of the received data *See* Ex. F.

89. The Accused Instrumentalities derive the feedback information from mathematical matrix decomposition of channel estimates. For instance, the NXP 88W8997 is an 802.11ac compliant wireless device that derives the feedback information from mathematical matrix decomposition of channel estimates. *See* Ex. F.

90. NXP has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least one claim of the ’914 patent, *e.g.*, claim 13, in violation of 35 U.S.C. §§ 271, *et seq.*, directly or indirectly, by making, using, offering for sale, selling, offering for lease, leasing in the United States, and/or importing into the United States without authority or license, the Accused Instrumentalities.

91. On information and belief, these Accused Instrumentalities are used marketed, provided to, and/or used by or for NXP's partners, clients, customers and end users across the country and in this District.

92. Upon information and belief, NXP has been aware of the '914 patent and its infringement thereof at least as early as January 21, 2022 upon the receipt of a notice letter from BNR.

93. Upon information and belief, since NXP has had knowledge of the '914 patent, NXP has induced and continues to induce others to infringe at least claim 13 of the '914 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including but not limited to NXP's partners, customers, clients, and end users, whose use of the Accused Instrumentalities constitutes direct infringement of at least claim 13 of the '914 patent.

94. In particular, NXP's actions that aid and abet others such as its partners, customers, clients, and end users to infringe include advertising and distributing the Accused Instrumentalities and providing instruction materials, training, and services regarding the Accused Instrumentalities. On information and belief, NXP has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because NXP has had actual knowledge of the '914 patent and knowledge that its acts were inducing infringement of the '914 patent since at least the date NXP received notice that such activities infringed the '914 patent.

95. Upon information and belief, NXP has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because NXP has had

actual knowledge of the ’914 patent and that its acts were inducing infringement of the ’914 patent since NXP has had knowledge of the ’914 patent.

96. NXP’s infringement of the ’914 patent is exceptional and entitles BNR to attorneys’ fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

97. BNR is entitled to recover from NXP all damages that BNR has sustained as a result of NXP’s infringement of the ’914 patent, including without limitation and/or not less than a reasonable royalty.

98. Plaintiff has been harmed by NXP’s infringing activities.

JURY DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, BNR demands a trial by jury on all issues triable as such.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff BNR demands judgment for itself and against the Defendant as follows:

A. An adjudication that each Defendants have infringed U.S. Patent Nos. RE 48,629, 8,416,862, and 7,564,914;

B. An award of damages to be paid by Defendants adequate to compensate BNR for Defendants’ past infringement of U.S. Patent Nos. RE 48,629, 8,416,862, and 7,564,914, and any continuing or future infringement through the date such judgment is entered, including interest, costs, expenses, and an accounting of all infringing acts including, but not limited to, those acts not presented at trial;

C. Enhanced damages for willful infringement;

D. A declaration that this case is exceptional under 35 U.S.C. § 285, and an award of BNR’s reasonable attorneys’ fees; and

E. An award to BNR of such further relief at law or in equity as the Court deems just and proper.

Dated: June 2, 2023

Respectfully submitted,

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