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

BELL NORTHERN RESEARCH, LLC Plaintiff, v. LENOVO GROUP LTD., LENOVO (UNITED STATES), INC. AND MOTOROLA MOBILITY, LLC, Defendants.	**Civil Action No. 6:21-cv-847** **JURY TRIAL DEMANDED**

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Bell Northern Research, LLC ("BNR" or "Plaintiff"), for its First Amended Complaint against Defendants Lenovo Group Ltd., Lenovo (United States), Inc. and Motorola Mobility, LLC, (collectively referred to herein as "Lenovo" or "Defendant"), 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. Upon information and belief, Lenovo is a corporation organized under the laws of Hong Kong with a place of business at 23rd Floor, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong. Upon information and belief, Lenovo sells, offers to sell, and/or

uses products and services throughout the United States, including in this judicial district, and introduces Accused Instrumentalities and services into the stream of commerce knowing that they would be sold and/or used in this judicial district and elsewhere in the United States.

4. Upon information and belief, Lenovo (United States), Inc. is a Delaware corporation with its principal place of business located at 1009 Think Place, Morrisville, NC 27560. Upon information and belief, Lenovo (United States), Inc. is authorized to do business in Texas where it can be served with process through its registered agent CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201-3136.

5. Upon information and belief, Motorola Mobility, LLC is a Delaware corporation with its principal place of business located at 600 North US Highway 45, Libertyville, IL 60048. Upon information and belief, Motorola Mobility, LLC is authorized to do business in Texas where it can be served with process through its registered agent CT Corporation System, 1999 Bryan Street, Suite 900, Dallas, Texas 75201-3136.

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). Venue is also convenient in this District. This is at least true because of this District's close ties to this case–including the technology, relevant witnesses, and sources of proof–and its ability to quickly and efficiently move this case to resolution. Further, this District has familiarity with at least some of the BNR Patents. First, several of the patents (*i.e.*, the '129 and '930 patents) were involved in a recent lawsuit filed in this District. (*See Bell Northern Research, LLC v. Samsung Elecs. Co.,*

Ltd., No. 6:20-cv-326-ADA, ECF No. 1 (W.D. Tex. Apr. 24, 2020.) Second, several of the patents (*i.e.*, the '554, '889, '629, '862, '450, '129, '930, and '435 patents) are involved in another pending lawsuit, also filed in this District. *See Bell Northern Research, LLC v. Apple Inc.*, No. 6:21-cv-833, ECF No. 1 (W.D. Tex. Aug. 11, 2021.)

9. Venue is proper as to Lenovo Group Ltd. in this judicial district under 28 U.S.C. §1391(c)(3). On information and belief, Lenovo Group Ltd. is not resident in the United States and may be sued in any judicial district.

10. This Court has personal jurisdiction over the Lenovo Group Ltd. under the laws of the State of Texas, due at least to its substantial business in Texas and in this judicial district, directly or through intermediaries, including: (i) at least a portion of the infringements alleged herein; and (ii) regularly doing or soliciting business, engaging in other persistent courses of conduct and/or deriving substantial revenue from goods and services provided to individuals in the State of Texas.

11. This Court has personal jurisdiction over Motorola Mobility, LLC under the laws of the State of Texas, due at least to its substantial business in Texas and in this judicial district, directly or through intermediaries, including: (i) at least a portion of the infringements alleged herein; and (ii) regularly doing or soliciting business, engaging in other persistent courses of conduct and/or deriving substantial revenue from goods and services provided to individuals in the State of Texas.

12. Venue is also proper in this district because Motorola Mobility, LLC has a regular and established place of business in Austin, Texas, in this district. (*See* https://www.zippia.com /motorola-mobility-careers-31988/salary/.) In addition, on information and belief, Motorola Mobility, LLC has regular and established service centers in Austin, Waco, and San Antonio

Texas, in this district. On information and belief, these service centers are dedicated to providing certified service and technical support of Lenovo products, including the Accused Instrumentalities.

13. This Court has personal jurisdiction over Lenovo (United States), Inc. under the laws of the State of Texas, due at least to its substantial business in Texas and in this judicial district, directly or through intermediaries, including: (i) at least a portion of the infringements alleged herein; and (ii) regularly doing or soliciting business, engaging in other persistent courses of conduct and/or deriving substantial revenue from goods and services provided to individuals in the State of Texas. Venue is also proper in this district because Lenovo (United States), Inc. has a regular and established place of business in this district. For example Lenovo (United States), Inc. has facilities located in this judicial district, as evidenced by its job offers for project managers, engineers, and directors for to work in Austin Texas, in this judicial district. (*See* https://jobs.lenovo.com/en_US/careers/SearchJobs/?6911=488&6911_format=2573& listFilterMode=1&jobRecordsPerPage=10&; https://www.linkedin.com/jobs/search/? currentJobId=2622998574&keywords=lenovo&location=austin%20texas%20metropolitan%20area; https://lensa.com/services-hybrid-bdm-public-sector-west- jobs/austin/jd/145cda7 d3b0d65cc1d09cf95c5445ed4.) In addition, Lenovo (United States), Inc. has regular and established service centers in Austin, Waco, and San Antonio, Texas. On information and belief, these service centers are dedicated to providing certified service and technical support of Lenovo products, including the Accused Instrumentalities. (*See* https://www.service-center-locator.com/lenovo/texas/lenovo-austin-texas.htm; https://www.service-center-locator.com/lenovo/texas/lenovo-san-antonia-texas.htm.)

BACKGROUND

14. 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.

15. 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.

16. 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-80's, 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 lead to the modern fiber optic systems we use today.

17. 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.

18. 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.

19. 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. 8,204,554, 7,319,889, RE 48,629, 8,416,862, 7,957,450, 6,941,156, 6,696,941, 6,963,129, 6,858,930, 7,039,435, 7,564,914 (collectively, these patents comprise the "Asserted Patents").

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

21. BNR brings this action to put a stop to Lenovo's unauthorized and unlicensed use of the Asserted Patents.

U.S. Patent No. 8,204,554

22. Norman Goris and Wolfgang Scheit are the inventors of U.S. Patent No. 8,204,554 ("the '554 patent"). A true and correct copy of the '554 patent is attached as Exhibit A.

23. The '554 patent resulted from the pioneering efforts of Messrs. Goris and Scheit (hereinafter "the Inventors") in the area of mobile devices. These efforts resulted in the development of a system of power reducer controls to control the power consumption of a mobile station display use with a mobile device and a method of operation thereof in the early

2000s. At the time of these pioneering efforts, the most widely implemented technology used to increase stand-by time as well as the talk-time of a mobile device was to increase the capacity of the battery. The drawback of increasing the capacity of the battery is that as the capacity of the battery increases, so too does its size, weight, and cost. The Inventors conceived of the invention claimed in the '554 patent as a way of prolonging the use of a mobile device without increasing the capacity of the battery.

24. For example, the Inventors developed a mobile station, comprising: a display; a proximity sensor adapted to generate a signal indicative of the existence of a first condition, the first condition being that an external object is proximate; and a microprocessor adapted to: (a) determine, without using the proximity sensor, the existence of a second condition independent and different from the first condition, the second condition being that a user of the mobile station has performed an action to initiate an outgoing call or to answer an incoming call; (b) in response to a determination in step (a) that the second condition exists, activate the proximity sensor; (c) receive the signal from the activated proximity sensor; and (d) reduce power to the display if the signal from the activated proximity sensor indicates that the first condition exists.

25. One advantage of the claimed '554 invention over the prior art is to reduce the power consumption of a cell phone display when the display is not needed. (*See* '554 patent at 1:40-52.) This increases available battery power that results in increased stand-by and/or talk time. (*See* '554 patent at 1:50-55.)

U.S. Patent No. 7,319,889

26. Norman Goris and Wolfgang Scheit are the inventors of U.S. Patent No. 7,319,889 ("the '889 patent"). A true and correct copy of the '899 patent is attached as Exhibit B.

27. The ’889 patent resulted from the pioneering efforts of Messrs. Goris and Scheit (hereinafter “the Inventors”) in the area of mobile devices. These efforts resulted in the development of a system of power reducer controls to control the power consumption of a mobile station display use with a mobile device and a method of operation thereof in the early 2000s. At the time of these pioneering efforts, the most widely implemented technology used to increase stand-by time as well as the talk-time of a mobile device was to increase the capacity of the battery. The drawback of increasing the capacity of the battery is that as the capacity of the battery increases, so too does its size, weight, and cost. The Inventors conceived of the invention claimed in the ’889 patent as a way of prolonging the use of a mobile device without increasing the capacity of the battery.

28. For example, the Inventors developed a mobile station, comprising: a display; a proximity sensor adapted to generate a signal indicative of proximity of an external object; and a microprocessor adapted to: (a) determine whether a telephone call is active; (b) receive the signal from the proximity sensor; and (c) reduce power to the display if (i) the microprocessor determines that a telephone call is active and (ii) the signal indicates the proximity of the external object; wherein: the telephone call is a wireless telephone call; the microprocessor reduces power to the display while the signal indicates the proximity of the external object only if the microprocessor determines that the wireless telephone call is active; and the proximity sensor begins detecting whether an external object is proximate substantially concurrently with the mobile station initiating an outgoing wireless telephone call or receiving an incoming wireless telephone call.

29. One advantage of the claimed ’889 invention over the prior art is to reduce the power consumption of the display of a cell phone when the display is not needed. (*See* ’889

patent at 1:40-52.) This increases available battery power that results in increased stand-by and/or talk time. (*See* '554 patent at 1:50-55.)

U.S. Patent No. RE 48,629

30. 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 C.

31. 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.

32. 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.

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

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.*

34. 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.)

35. 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

36. 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 D.

37. 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.

38. 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.

39. The Inventors conceived of the invention claimed in the '862 patent as a way to reduce beamforming feedback information for wireless communications.

40. 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.

41. One advantage of the patented invention is a reduction of beam forming feedback information for wireless communications. (*See* '862 patent at 3:49-51.)

U.S. Patent No. 7,957,450

42. Christopher J. Hansen, Carlos H. Aldana, and Joonsuk Kim are the inventors of U.S. Patent No. 7,957,450 ("the '450 patent"). A true and correct copy of the '450 patent is attached as Exhibit E.

43. The '450 patent resulted from the pioneering efforts of Messrs. Hansen, Aldana, and Kim (hereinafter "the Inventors") in the general area of wireless networking.

44. For example, the Inventors developed a method for communication, the method comprising: computing a plurality of channel estimate matrices based on signals received by a mobile terminal from a base station, via one or more downlink RF channels, wherein said plurality of channel estimate matrices comprise coefficients derived from performing a singular value matrix decomposition (SVD) on said received signals; and transmitting said coefficients as feedback information to said base station, via one or more uplink RF channels.

45. As another example, the Inventors developed a system for communication, the system comprising: one or more circuits of a mobile terminal that are operable to compute a

plurality of channel estimate matrices based on signals received by said mobile terminal from a base station, via one or more downlink RF channels, wherein said plurality of channel estimate matrices comprise coefficients derived from performing a singular value matrix decomposition (SVD) on said received signals; and said one or more circuits are operable to transmit said coefficients as feedback information to said base station, via one or more uplink RF channels.

46. One advantage of the ’450 patent is the more precise estimation of channel characteristics. (*See* ’450 patent at 18:1-5.)

47. Another advantage of the patented invention is that it minimizes the quantity of feedback information and in turn reduces overhead. (*See* ’450 patent at 18:25-30.)

48. Further advantages include higher information transfer rates, and more effective beamforming on transmitted signals. (*See* ’450 patent at 18:30-35.)

U.S. Patent No. 6,941,156

49. Philip D. Mooney is the inventor of U.S. Patent No. 6,941,156 (“the ’156 patent”). A true and correct copy of the ’156 patent is attached as Exhibit F.

50. The ’156 patent resulted from the pioneering efforts of Mr. Mooney (hereinafter “the Inventor”) in the area of cell phone communication. These efforts resulted in the development of a method and apparatus for the automatic handoff for wireless piconet multimode cell phones. At the time of these pioneering efforts, the most widely implemented technology used to address the problem of switching between a first type RF communication mode and a second type RF communication mode at a multimode cell phone required manual switching between the two modes. In that type of system, the user must first terminate any existing telephone call, and then manually switch the mode of the multimode cell phone.

51. The Inventor conceived of the invention claimed in the '156 patent as a way to improve multimode cell phones.

52. For example, the Inventor developed a multimode cell phone, comprising: a cell phone functionality; and an RF communication functionality separate from said cell phone functionality, a module to establish simultaneous communication paths from said multimode cell phone using both said cell phone functionality and said RF communication functionality; and an automatic switch over module, in communication with both said cell phone functionality and said RF communication functionality, operable to switch a communication path established on one of said cell phone functionality and said RF communication functionality, with another communication path later established on the other of said cell phone functionality and said RF communication functionality.

53. One advantage of the '156 patented invention is that it provides an automatic switch over between two modes of a multimode cell phone. (*See* '156 patent at 1:51-2:4.)

54. Another advantage of the patented invention is that it provides a smooth switch over between two modes of a multimode cell phone. (*See* '156 patent at Abstract; 1:46-49.)

55. Another advantage of the patented invention is that it provides interaction between separate modes of operation of a multimode cell phone. (*See* '156 patent at 1:46-49.)

U.S. Patent No. 6,696,941

56. Thomas W. Baker is the inventor of U.S. Patent No. 6,696,941 ("the '941 patent"). A true and correct copy of the '941 patent is attached as Exhibit G.

57. The '941 patent resulted from the pioneering efforts of Mr. Baker (hereinafter "the Inventor") in the area of smart phone technology. These efforts resulted in the development of an apparatus relating to a theft alarm in a mobile device in the early 2000s. At the time of

these pioneering efforts, conventionally implemented technology used to address the problem of deterring theft and assisting in locating the mobile phone was to add a lock/unlock personal identification number (PIN) to lock and unlock the device. In that type of system, the device becomes disabled until a lock/unlock PIN is entered that matches a pre-stored lock unlock PIN in memory of the mobile phone. In that type of system, locking a mobile phone prevents further use, but does not assist a user in finding their mobile phone, nor does it deter a thief from hiding the phone on their person.

58. The Inventor conceived of the invention claimed in the '941 patent as a way to discourage theft of a mobile phone, or if stolen, assist the owner in locating their stolen mobile phone.

59. For example, the Inventor developed a method of remotely triggering an alarm within a mobile wireless device, said method comprising: receiving an alarm trigger signal from a service provider to said mobile wireless device based on user authorization; triggering a sensory output from said mobile wireless device based on receipt of said alarm trigger signal from said service provider; and preventing a current holder of said mobile wireless device from stopping said sensory output unless an alarm PIN is manually entered by said holder into said mobile wireless device.

60. One advantage of the '941 patented invention is that it deters theft of a mobile phone. (*See* '941 patent at 1:6-10.)

61. Another advantage of the patented invention is that it assists in locating a mobile phone. (*See id.*)

U.S. Patent No. 6,963,129

62. Thomas Evans, Stan Mihelcic, Leah M. Miller, Kumar Nagarajan, and Edwin M. Fulcher are the inventors of U.S. Patent No. 6,963,129 ("the '129 patent"). A true and correct copy of the '129 patent is attached as Exhibit H.

63. The '129 patent resulted from the pioneering efforts of Messrs. Evans, Mihelcic, Nagarajan, and Fulcher and Ms. Miller (hereinafter "the Inventors") in the area of heat spreader and package design. The Inventors conceived of the invention claimed in the '129 patent as a way to implement better heat transfer mechanisms in relation to semiconductor packages. For example, the Inventors developed a heat spreader assembly, comprising: a single, unibody heat spreader configured to extend across substantially the entire first surface of at least two spaced integrated circuits opposite a second surface of the integrated circuits having a bonding pad; adhesive placed between the heat spreader and the first surface for securing the heat spreader to the first surface of the integrated circuits at a spaced distance above at least one passive device arranged in the area between the spaced integrated circuits; and a second heat spreader interposed between the heat spreader and only of the at least two spaced integrated circuits.

64. Among the advantages of the '129 patented invention is that it provides for heat spreader assemblies having improved thermal characteristics. (*See* '129 patent at 2:23-26.)

U.S. Patent No. 6,858,930

65. Leah M. Miller and Kishor Desal are the inventors of U.S. Patent No. 6,858,930 ("the '930 patent"). A true and correct copy of the '930 patent is attached as Exhibit I.

66. The '930 patent resulted from the pioneering efforts of Ms. Miller and Mr. Kishor (hereinafter "the Inventors") in the area of heat spreader and semiconductor package design.

67. The Inventors conceived of the invention claimed in the ’930 patent as a way to address the problems of heat production and package flexibility that constrain certain aspects of semiconductor package design.

68. For example, the Inventors developed a semiconductor package, compromising: a package substrate having a first side and an opposing second side, the first side for receiving package electrical connections; integrated circuits each having a first side and an opposing second side, the first side of each of the integrated circuits electrically connected and structurally connected to the second side of the package substrate, heat spreaders each having a first side and an opposing second side, the first side of each of the heat spreaders disposed adjacent the second side of the integrated circuits, where one each of the heat spreaders is associated with one each of the integrated circuits, a single stiffener having a first side and an opposing second side, the stiffener covering all of the integrated circuits and heat spreaders, the first side of the stiffener disposed adjacent the second side of the heat spreaders, and discrete components electrically connected to the second side of the package substrate and coplanar with the integrated circuits.

69. One advantage of the ’930 patented invention is that it provides adequate heat dissipation for a semiconductor package. (*See* ’930 patent at 1:58-60.)

70. Another advantage of the ’930 patented invention is that it provides structural support for a semiconductor package. (*See id*.)

U.S. Patent No. 7,039,435

71. Richard I. McDowell and Phillip D. Mooney are the inventors of U.S. Patent No. 7,039,435 (“the ’435 patent”). A true and correct copy of the ’435 patent is attached as Exhibit J.

72. The ’435 patent resulted from the pioneering efforts of Messrs. MacDowell and Mooney (hereinafter “the Inventors”) in the area of mobile telecommunication devices. These efforts resulted in the development of a proximity regulation system for use with a portable cell

phone and a method of operation thereof. At the time of these pioneering efforts, one attempt to reduce the transmit power level of a portable cell phone when located near a human body was to permanently reduce the power of the transmitter in cell phones or to use cell phones with a base, such as in an automobile. However, it is a drawback to permanently reduce the power of the transmitter in cell phones because this also reduces the quality of service. It is also a drawback to use a base, as it does not allow the flexibility demanded by users of a portable cell phone. The Inventors conceived of the invention claimed in the '435 patent as a way to reduce the transmit power level of a portable cell phone when located near a human body.

73. For example, the Inventors developed a portable cell phone, comprising: a power circuit that provides a network adjusted transmit power level as a function of a position to a communications tower; and a proximity regulation system, including: a location sensing subsystem that determines a location of said portable cell phone proximate a user; and a power governing subsystem, coupled to said location sensing subsystem, that determines a proximity transmit power level of said portable cell phone based on said location and determines a transmit power level for said portable cell phone based on said network adjusted transmit power level and said proximity transmit power level.

74. One advantage of the '435 patented invention is that it automatically reduces the transmit power level of a portable cell phone when located near a human body. (*See* '435 patent at 1:63-65.)

75. Another advantage of the '435 patented invention is that it does not require a permanent reduction of the power of the transmitter in cell phones. (*See* '435 patent at 1:52-53.)

76. Another advantage of the patented invention is that it does not require the use of a cell phone with a base. (*See* '435 patent at 1:56-57.)

77. 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 L.

78. The '914 patent resulted from the pioneering efforts of Messrs. Hansen, Aldana, and Kim (hereinafter "the Inventors") in the general area of wireless networking.

79. 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.

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

81. 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.)

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

DEFENDANTS' ACTIVITIES

83. Defendant is a consumer electronics and telecommunications company.

84. Defendant designs, develops, manufactures, and sells smartphones and laptop computers. Defendant's smart phones include Moto E smart phones, such as Moto E5 and Moto E5 Play smart phones, Moto G smart phones, such as Moto G7 Power and Moto G Stylus smart

phones, Moto Z smart phones, such as Moto Z, Moto Z3, Moto Z3 Droid, Moto Z4 and Moto Z Force Droid smart phones. Defendant's laptop computers include IdeaPad laptop computers, such as IdeaPad S740 laptop computers, Legion laptop computers, such as Legion 5i laptop computers, and ThinkPad l laptop computers, such as ThinkPad X1 Extreme laptop computers (collectively "Accused Instrumentalities").

COUNT I– INFRINGEMENT OF U.S. PATENT NO. 8,204,554

85. The allegations set forth in the foregoing paragraphs 1 through 84 are incorporated into this First Claim for Relief.

86. On June 19, 2012, the '554 patent was duly and legally issued by the United States Patent and Trademark Office under the title "System and Method for Conserving Battery Power in a Mobile Station."

87. BNR is the assignee and owner of the right, title and interest in and to the '554 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

88. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '554 patent, including at least one or more of claims 1, 2, 4-9, and 11-14, by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities that include a proximity sensor. The proximity sensor in Lenovo's instrumentalities, including one or more Moto E smart phones, such as Moto E5 and E5 Play smart phones, and Moto Z smart phones, such as Moto Z, Moto Z3 and Moto Z Force Droid smart phones (the "'554 Accused Instrumentalities"), detects when a mobile device user (i) is on a call and (ii) has his or her mobile device positioned proximal to their face, ear, or cheek. When these conditions are detected, the display screen on the mobile device goes dark, which results in

battery power savings and prevents the user from accidently selecting buttons on the screen during an ongoing call.

89. On information and belief and after a reasonable investigation, the '554 Accused Instrumentalities infringe the '554 patent. The '554 Accused Instrumentalities are mobile stations that include a display. For instance, the Moto E5 is a mobile device that includes a display.

90. The '554 Accused Instrumentalities also include a proximity sensor adapted to generate a signal indicative of the existence of a first condition, the first condition being that an external object is proximate. For instance, the Moto E5 includes a proximity sensor that is adapted to generate a signal indicating whether one's face, ear or cheek is proximate. (*See, e.g.*, https://download.lenovo.com /Motorola/Manuals/129818/3604261/moto%20e5_UG_en-GB_SSC8C29132B.pdf.)

91. The '554 Accused Instrumentalities also include a microprocessor that is adapted to determine, without using the proximity sensor, the existence of a second condition independent and different from the first condition, the second condition being that a user of the mobile station has performed an action to initiate an outgoing call or to answer an incoming call. For instance, the Moto E5 has a microprocessor that is adapted to determine whether a user has performed an action to initiate or receive a call. (*See, e.g.*, https://download.lenovo.com /Motorola/Manuals/129818/3604261/moto%20e5_UG_en-GB_SSC8C29132B.pdf.)

92. The '554 Accused Instrumentalities' microprocessor is adapted to activate the proximity sensor in response to a determination that the second condition exists. For instance, the Moto E5's microprocessor is adapted to activate the proximity sensor if the user has

performed an action to initiate/receive a call. (*See, e.g.*, https://download.lenovo.com /Motorola/Manuals/129818/3604261/moto%20e5_UG_en-GB_SSC8C29132B.pdf.)

93. The '554 Accused Instrumentalities' microprocessor is adapted to receive the signal from the proximity sensor. For instance, the Moto E5's microprocessor is adapted to receive a signal from the proximity sensor. (*See, e.g.*, https://download.lenovo.com /Motorola/Manuals/129818/3604261/moto%20e5_UG_en-GB_SSC8C29132B.pdf.)

94. The '554 Accused Instrumentalities' microprocessor is adapted to reduce power to the display if the signal from the proximity sensor indicates that the first condition exists. For instance, the Moto E5's microprocessor is adapted to reduce power to the display if the signal from the proximity sensor indicates that the Moto E5 is proximate to the user's face, ear, or cheek. (*See, e.g.*, https://download.lenovo.com/Motorola/Manuals/129818/3604261 /moto%20e5_UG_en-GB_SSC8C29132B.pdf.)

95. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1, 2, 4-9, and 11-14 of the '554 patent 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 '554 Accused Instrumentalities.

96. On information and belief, Lenovo has had knowledge of the '554 patent, at least since receiving a notice letter from BNR dated December 1, 2017.

97. Upon information and belief, since Lenovo had knowledge of the '554 patent, Lenovo has induced and continues to induce others to infringe at least claims 1, 2, 4-9, and 11-14 of the '554 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

Lenovo's partners and customers, whose use of the '554 Accused Instrumentalities constitutes direct infringement of at least claims 1, 2, 4-9, and 11-14 of the '554 patent.

98. In particular, Lenovo's actions that aid and abet others such as their partners and customers to infringe include distributing the '554 Accused Instrumentalities and providing materials and/or services related to the '554 Accused Instrumentalities. On information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '554 patent and that its acts were inducing infringement of the '554 patent since Lenovo has had knowledge of the '554 patent.

99. In particular, after the December 1, 2017 notice letter, the parties engaged in follow up discussions to the notice letter.

100. Lenovo's infringement of the '554 patent is willful and deliberate, entitling BNR to enhanced damages and attorneys' fees.

101. Lenovo's infringement of the '554 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

102. BNR has been damaged by Lenovo's infringement of the '554 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

103. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '554 patent, including without limitation and/or not less than a reasonable royalty.

COUNT II– INFRINGEMENT OF U.S. PATENT NO. 7,319,889

104. The allegations set forth in the foregoing paragraphs 1 through 103 are incorporated into this Second Claim for Relief.

105. On January 15, 2008 the '889 patent was duly and legally issued by the United States Patent and Trademark Office under title "System and Method for Conserving Battery Power in a Mobile Station."

106. BNR is the assignee and owner of the right, title and interest in and to the '889 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

107. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '889 patent, including at least claims 1, 2, 4-6, 8, 9 and 11 of the '889 patent by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities that include a proximity sensor. The proximity sensor on Lenovo's instrumentalities, including one or more Moto E smart phones, such as Moto E5 and E5 Play smart phones, and Moto Z smart phones, such as Moto Z, Moto Z3 and Moto Z Force Droid smart phones (the "'889 Accused Instrumentalities"), detects when a mobile device user (i) is on a call and (ii) has his or her mobile device positioned proximal to their face, ear, or cheek. When these conditions are detected, the display screen on the mobile device goes dark, which results in battery power savings and prevents the user from accidently selecting buttons on the screen during an ongoing call.

108. On information and belief and after a reasonable investigation, the '889 Accused Instrumentalities infringe the '889 patent. The '889 Accused Instrumentalities are mobile stations that include a display. For instance, the Moto E5 is a mobile device that includes a

display. (*See, e.g.*, https://download.lenovo.com/Motorola/Manuals/129818/3604261/moto%20e5_UG_en-GB_SSC8C29132B.pdf.)

109. The '889 Accused Instrumentalities also include a proximity sensor adapted to generate a signal indicative of proximity of an external object. For instance, the Moto E5 includes a proximity sensor that detects the presence of one's face, ear, or cheek. (*See, e.g.*, https://download.lenovo.com/Motorola/Manuals/129818/3604261/moto %20e5_UG_en-GB_SSC8C29132B.pdf.)

110. The '889 Accused Instrumentalities also include a microprocessor that is adapted to determine whether a telephone call is active, to receive the signal from the proximity sensor, and reduce power to the display if (i) the microprocessor determines that a telephone call is active and (ii) the signal indicates the proximity of the external object. For instance, the Moto E5 determines whether a user has pressed the call answer button to initiate an active call, once the call button is pressed and the mobile device is moved closer to the head, the Moto E5's display goes dark indicating that a signal has been received from the proximity sensor, after a user presses the call button to initiate a wireless telephone call and moves the mobile device closer to his or her head, the display on the Moto E5 goes dark, indicating that the display has reduced power. (*See, e.g.*, https://download.lenovo.com/Motorola/Manuals/129818/3604261 /moto %20e5_UG_en-GB_SSC8C29132B.pdf.)

111. The '889 Accused Instrumentalities' proximity sensor begins detecting whether an external object is proximate substantially concurrently with the mobile station initiating an outgoing wireless telephone call or receiving an incoming wireless telephone call. For instance, the Moto E5's proximity sensor will detect whether an external object is proximate substantially concurrently with initiation of an outgoing call or reception of an incoming call. (*See, e.g.*,

https://download.lenovo.com/Motorola/Manuals/129818/3604261/moto %20e5_UG_en-GB_SSC8C29132B.pdf.)

112. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1, 2, 4-6, 8, 9 and 11 of the '889 patent 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 '889 Accused Instrumentalities.

113. On information and belief, Lenovo has had knowledge of the '889 patent, at least since receiving a notice letter from BNR dated December 1, 2017.

114. Upon information and belief, since Lenovo had knowledge of the '889 patent, Lenovo has induced and continues to induce others to infringe at least claim 1 of the '156 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 Lenovo's partners and customers, whose use of the '889 Accused Instrumentalities constitutes direct infringement of at least claims at least claims 1, 2, 4-6, 8, 9 and 11 of the '889 patent.

115. In particular, Lenovo's actions that aid and abet others such as their partners and customers to infringe include distributing the '889 Instrumentalities and providing materials and/or services related to the '889 Accused Instrumentalities. On information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '889 patent and that its acts were inducing infringement of the '889 patent since Lenovo has had knowledge of the '889 patent.

116. In particular, after the December 1, 2017 notice letter, the parties engaged in follow up discussions to the notice letter, including a meeting in Chicago, Illinois on January 25, 2018.

117. Lenovo's infringement of the '889 patent is willful and deliberate, entitling BNR to enhanced damages and attorneys' fees.

118. Lenovo's infringement of the '889 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

119. BNR has been damaged by Lenovo's infringement of the '889 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

120. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '889 patent, including without limitation and/or not less than a reasonable royalty.

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

121. The allegations set forth in the foregoing paragraphs 1 through 120 are incorporated into this Third Claim for Relief.

122. 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."

123. 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 said Patent and the right to any remedies for infringement of it.

124. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the ’629 patent, including at least claim 1, by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities that operate according to the 802.11n standard, including its Motorola One smart phones, such as Motorola One 5G Ace smart phones (the “’629 Accused Instrumentalities”).

125. 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.

126. On information and belief after a reasonable investigation, the ’629 Accused Instrumentalities infringe the ’629 patent. The ’629 Accused Instrumentalities are mobile stations that include a signal generator that generates an extended long training sequence. For instance, the Motorola One 5G Ace is 802.11n 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).) 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.

127. The ’629 Accused Instrumentalities include an Inverse Fourier Transformer operatively coupled to the signal generator. For instance, the Motorola One 5G Ace 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).)

128. The '629 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 Motorola One 5G Ace 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).) The Motorola One 5G Ace 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).)

129. The '629 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 Motorola One 5G Ace 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).)

130. The ’629 Accused Instrumentalities also include an optimal extended long training sequence that is carried by exactly 56 active subcarriers. For instance, the Motorola One 5G Ace 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).)

131. The ’629 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.*

132. For instance, the Motorola One 5G Ace 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.,* https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537 (specifying 802.11n connectivity).)

133. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claim 1 of the ’629 patent 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 '629 Accused Instrumentalities.

134. Lenovo has been, and currently is, an active inducer of infringement of one or more claims of the '629 patent under 35 U.S.C. § 271(b). On information and belief, one or more of the '629 Accused Instrumentalities directly infringe (by induced infringement) at least claim 1 of the '629 patent, literally and/or under the doctrine of equivalents.

135. Lenovo intentionally encourages and aids at least its users to directly infringe the '629 patent.

136. Lenovo provides the '629 Accused Instrumentalities and instructions to its users such that they will use the '629 Accused Instrumentalities in a directly infringing manner. Lenovo markets the '629 Accused Instrumentalities to its users and provides instructions to its users on how to use the functionality of the '629 patent on its website and elsewhere. (*See, e.g.*, https://motorola-global-portal.custhelp.com/app/answers/prod_answer_detail/a_id/156861.)

137. Lenovo users directly infringe by using the '629 Accused Instrumentalities in their intended manner. Lenovo induces such infringement by providing the '629 Accused Instrumentalities and instructions to enable and facilitate infringement. On information and belief, Lenovo specifically intends that its actions will result in infringement of the '629 patent or has taken deliberate actions to avoid learning of infringement.

138. Lenovo's infringement is knowing, egregious, consciously wrongful, and willful.

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

140. Lenovo'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.

141. BNR has been damaged by Lenovo's infringement of the '629 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

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

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

143. The allegations set forth in the foregoing paragraphs 1 through 142 are incorporated into this Fourth Claim for Relief.

144. 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."

145. 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 said patent and the right to any remedies for infringement of it.

146. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '862 patent, including at least claims 1 and 9-12, 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 one or more Moto G smart phones, such as Moto G Stylus smart phones, and one or more Moto Z smart phones, such as Moto Z3 and Moto Z Force Droid, smart phones (the "'862 Accused Instrumentalities").

147. 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.)

148. On information and belief after a reasonable investigation, the '862 Accused Instrumentalities infringe the '862 patent. The '862 Accused Instrumentalities provide a method for feeding back transmitter beamforming information from a receiving wireless communication device to a transmitting wireless communication device. For instance, the Moto Z Force Droid 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; https://www.gsmarena.com/motorol a_moto_z_force-8093.php; https://www.devicespecifications.com/en/model/1f303c85.)

149. The '862 Accused Instrumentalities, for example, receive a preamble sequence from a transmitting wireless device. For instance, the Moto Z Force Droid 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; https://www.gsmarena.com/motorola_moto_z_force-8093.php; https://www.device specifications.com/en/model/1f303c85.)

150. The '862 Accused Instrumentalities include estimating a channel response based upon the preamble sequence. For instance, the Moto Z Force Droid 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;

https://www.gsmarena.com/motorola _moto_z_force-8093.php; https://www.device specifications.com/en/model/1f303c85.)

151. The '862 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 Moto Z Force Droid Z 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; https://www.gsmarena .com/motorola _moto_z_force-8093.php; https://www.device specifications.com/en/model/1f303c85.)

152. The '862 Accused Instrumentalities include decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information. For instance, the Moto Z Force Droid 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; https://www.gsmarena.com/motorola _moto_z_force-8093.php; https://www.device specifications.com/en/model/1f303c85.)

153. The '862 Accused Instrumentalities include wirelessly sending the transmitter beamforming information to the transmitting wireless device. For instance, the Moto Z Force Droid 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; https://www.gsmarena.com/motorola _moto_z_force-8093.php; https://www.device specifications.com/en/model/1f303c85.)

154. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1 and 9-12, of the '862 patent 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 '862 Accused Instrumentalities.

155. On information and belief, Lenovo has had knowledge of the '862 patent, at least since receiving a notice letter from BNR dated December 1, 2017.

156. Upon information and belief, since Lenovo had knowledge of the '862 patent, Lenovo has induced and continues to induce others to infringe at least claims 1 and 9-12 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 Lenovo's partners and customers, whose use of the '862 Accused Instrumentalities constitutes direct infringement of at least claims 1 and 9-12 of the '862 patent.

157. In particular, Lenovo's actions that aid and abet others such as their partners and customers to infringe include distributing the '862 Instrumentalities and providing materials and/or services related to the '862 Accused Instrumentalities. On information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '862 patent and that its acts were inducing infringement of the '862 patent since Lenovo has had knowledge of the '862 patent.

158. In particular, after the December 1, 2017 notice letter, the parties engaged in follow up discussions to the notice letter, including a meeting in Chicago, Illinois on January 25, 2018.

159. Lenovo'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.

160. BNR has been damaged by Lenovo's infringement of the '862 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

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

COUNT V– INFRINGEMENT OF U.S. PATENT NO. 7,957,450

162. The allegations set forth in the foregoing paragraphs 1 through 161 are incorporated into this Fifth Claim for Relief.

163. On January 7, 2011, the '450 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."

164. BNR is the assignee and owner of the right, title and interest in and to the '450 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

165. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '450 patent, including at least claims 1 and 11, 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 one or more Moto Z smart phones, such as Moto Z3 smart phones (the "'450 Accused Instrumentalities").

166. 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, e.g.,* 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.

167. On information and belief after a reasonable investigation, the '450 Accused Instrumentalities infringe the '450 patent. The '450 Accused Instrumentalities provide a system for communication having one or more circuits of a mobile terminal that are operable to compute a plurality of channel estimate matrices based on signals received by said mobile terminal from a base station, via one or more downlink RF channels, wherein said plurality of channel estimate matrices comprise coefficients derived from performing a singular value matrix decomposition (SVD) on said received signals and that is 802.11ac compliant. For instance, the Moto Z3 is an 802.11ac compliant wireless device and has one or more circuits of a mobile terminal that are operable to compute a plurality of channel estimate matrices based on signals received by said mobile terminal from a base station, via one or more downlink RF channels, wherein said plurality of channel estimate matrices comprise coefficients derived from performing a singular value matrix decomposition (SVD) on said received signals. (*See, e.g.*, https://www.gsmarena.com/motorola_moto_z3-9283.php; https://www.devicespecifications.com/en/model/dd9d4bd7.)

168. The ‘450 Accused Instrumentalities include one or more circuits operable to transmit the coefficients as feedback information to the base station, via one or more uplink RF channels. For instance, the Moto Z3 smart phone is an 802.11ac compliant wireless device and, therefore, includes one or more circuits operable to transmit the coefficients as feedback information to the base station, via one or more uplink RF channels. (*See, e.g.*, https://www.gsmarena.com/motorola_moto_z3-9283.php; https://www.devicespecifications.com /en/model/dd9d4bd7.)

169. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1 and 11 of the ’450 patent 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 ’450 Accused Instrumentalities.

170. On information and belief, Lenovo has had knowledge of the ’450 patent, at least since receiving a notice letter from BNR dated January 15, 2019.

171. Upon information and belief, since Lenovo had knowledge of the ’450 patent, Lenovo has induced and continues to induce others to infringe at least claims 1 and 11 of the ’450 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 Lenovo’s partners and customers, whose use of the ‘450 Accused Instrumentalities constitutes direct infringement of at least claims 1 and 11 of the ’450 patent.

172. In particular, Lenovo’s actions that aid and abet others such as their partners and customers to infringe include distributing the ‘450 Accused Instrumentalities and providing materials and/or services related to the ‘450 Accused Instrumentalities. On information and

belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '450 patent and that its acts were inducing infringement of the '450 patent since Lenovo has had knowledge of the '450 patent.

173. In particular, after the January 15, 2019 notice letter, the parties engaged in follow up discussions to the notice letter.

174. Lenovo's infringement of the '450 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

175. BNR has been damaged by Lenovo's infringement of the '450 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

176. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '450 patent, including without limitation and/or not less than a reasonable royalty.

COUNT VI– INFRINGEMENT OF U.S. PATENT NO. 6,941,156

177. The allegations set forth in the foregoing paragraphs 1 through 176 are incorporated into this Sixth Claim for Relief.

178. On September 6, 2005, the '156 patent was duly and legally issued by the United States Patent and Trademark Office under the title "Automatic Handoff for Wireless Piconet Multi Mode Cell Phone."

179. BNR is the assignee and owner of the right, title and interest in and to the '156 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

180. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '156 patent, including at least claims 1 and 4 of the '156 patent by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities for transferring a communication link between two different modes of a multimode cellphone. The instrumentalities, including one or more Moto Z smart phones, such as Moto Z3 smart phones (the "'156 Accused Instrumentalities") which include both an RF radio for cellular communications and a separate RF radio for connection to WiFi networks. Further, those smart phones are designed and able to operate simultaneous communication paths at different frequencies and automatically switch over communication from either the cellular communication or the WiFi functionality to the other.

181. On information and belief and after a reasonable investigation, the '156 Accused Instrumentalities infringe the '156 patent. The '156 Accused Instrumentalities are multimode cell phones that include a cell phone functionality and an RF communication functionality separate from said cell phone functionality. For instance, the Moto Z3 is a multimode cell phone that include a cell phone functionality and an RF communication functionality separate from said cell phone functionality. (*See* Exhibit K at 6.)

182. The '156 Accused Instrumentalities also include an automatic switch over module, in communication with both said cell phone functionality and said RF communication functionality, operable to switch a communication path established on the other of said cell phone functionality and said RF communication functionality. For instance, the Moto Z3 includes an automatic switch over module, in communication with both said cell phone functionality and said RF communication functionality, operable to switch a communication path

established on the other of said cell phone functionality and said RF communication functionality. (*See* Exhibit K at 6.)

183. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1 and 4 of the '156 patent 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 '156 Accused Instrumentalities.

184. On information and belief, Lenovo has had knowledge of the '156 patent, at least since receiving a notice letter from BNR dated December 1, 2017.

185. Upon information and belief, since Lenovo had knowledge of the '156 patent, Lenovo has induced and continues to induce others to infringe at least claim of the '156 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 Lenovo's partners and customers, whose use of the '156 Accused Instrumentalities constitutes direct infringement of at least claims 1 and 4 of the '156 patent.

186. In particular, Lenovo's actions that aid and abet others such as their partners and customers to infringe include distributing the '156 Accused Instrumentalities and providing materials and/or services related to the '156 Accused Instrumentalities. On information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '156 patent and that its acts were inducing infringement of the '156 patent since Lenovo has had knowledge of the '156 patent.

187. In particular, after the December 1, 2017 notice letter, the parties engaged in follow up discussions to the notice letter.

188. Lenovo's infringement of the '156 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

189. BNR has been damaged by Lenovo's infringement of the '156 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

190. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '156 patent, including without limitation and/or not less than a reasonable royalty.

COUNT VII– INFRINGEMENT OF U.S. PATENT NO. 6,696,941

191. The allegations set forth in the foregoing paragraphs 1 through 190 are incorporated into this Seventh Claim for Relief.

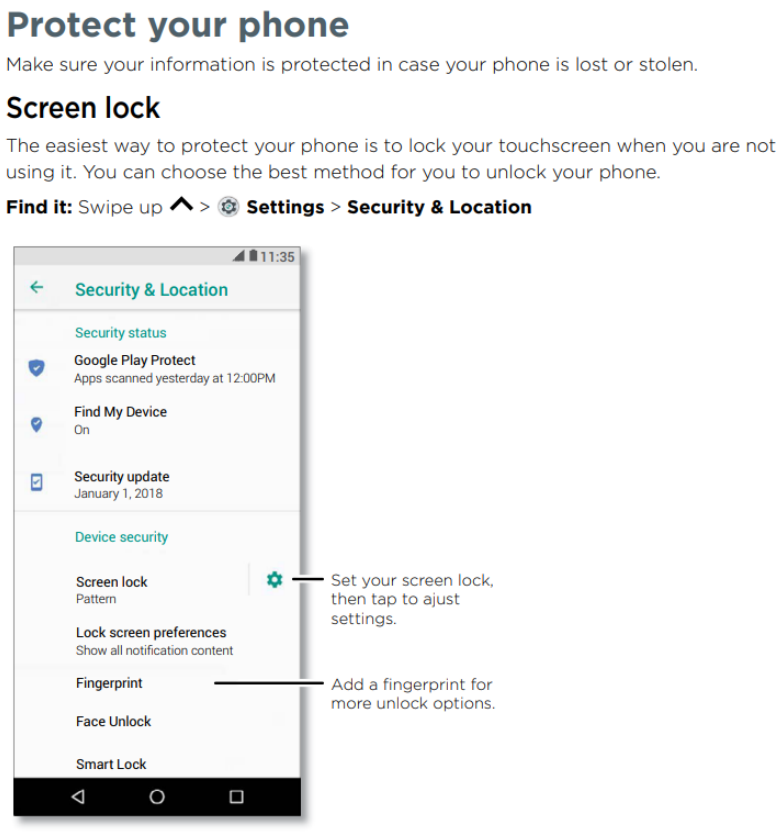
192. On February 24, 2004, the '941 patent was duly and legally issued by the United States Patent and Trademark Office under the title "Theft Alarm in Mobile Device."

193. BNR is the assignee and owner of the right, title and interest in and to the '941 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

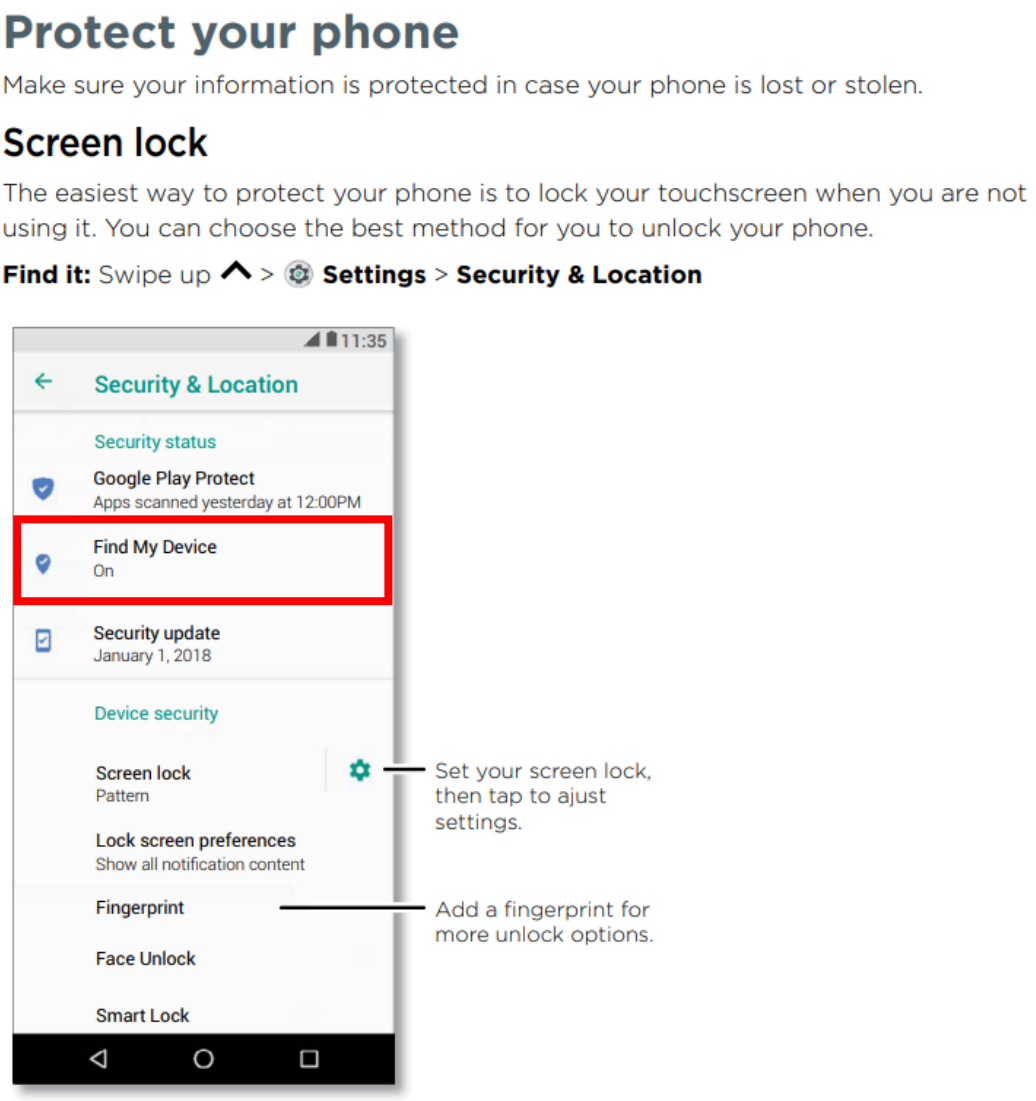
194. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '941 patent, including at least claims 1, 10 and 12-15 of the '941 patent by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities for remotely triggering an alarm within a mobile phone. The instrumentalities, including one or more Moto Z smart phones, such as Moto Z3 smart phones (the "'941 Accused

Instrumentalities"), have an alarm capable of being remotely triggered by a remote trigger detection element which responds to an alarm personal identification number (PIN) entered by a remote user to produce an alarm signal that triggers a display within the mobile phone.

195. On information and belief and after a reasonable investigation, the '941 Accused Instrumentalities infringe the '941 patent. The '941 Accused Instrumentalities comprise a remotely triggering means for an alarm within a mobile wireless device. For instance, the Moto Z3 is a mobile wireless device having a remotely triggering means for an alarm, as shown below, to "[m]ake sure your information is protected in case your phone is lost or stolen." (*See e.g.*, https://motorola-global-portal.custhelp.com/ci/fattach/get/3902132/1540217053 /redirect/1/filename/moto%20Z3.Verizon.NA.UG.en-US.SSC8C30377-B_web.pdf.)

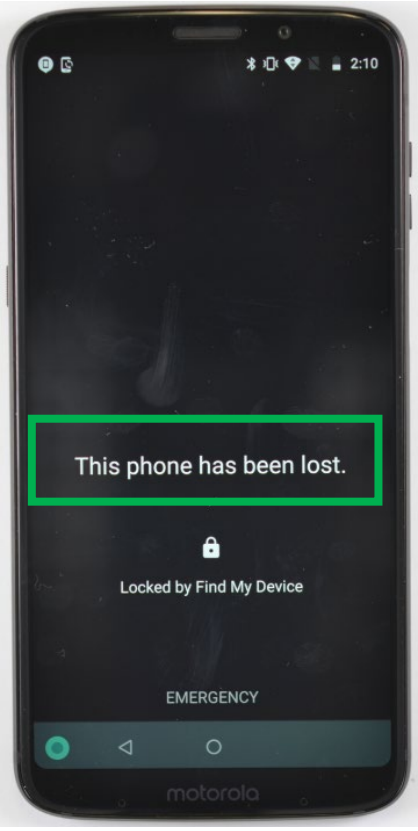


196. The '941 Accused Instrumentalities also include a means for receiving an alarm trigger signal from a service provider to said mobile wireless device based on user authorization. For instance, the Moto Z3 includes an antenna for receiving an alarm trigger signal from a service provider based on user authorization (outlined in red), as shown below. (*See e.g.*, https://motorola-global-portal.custhelp.com/ci/fattach/get/3902132/1540217053/redirect/1.NA.UG.en-US.SSC8C30377-B_web.pdf.)

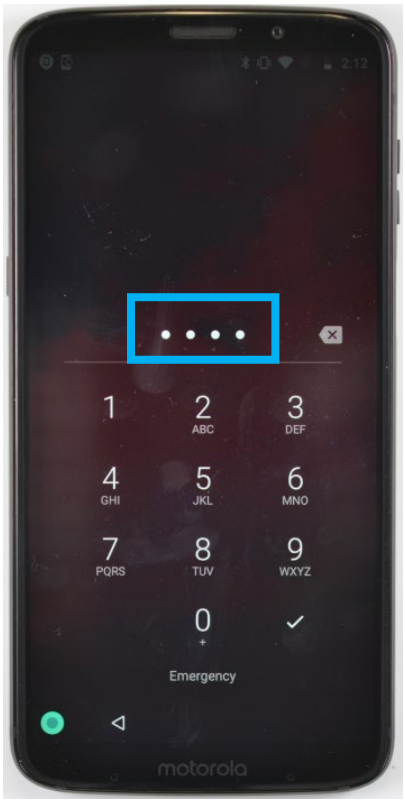


197. The '941 Accused Instrumentalities also include means for triggering a sensory output based on receipt of said alarm trigger signal from said service provider. For instance, the

Moto Z3 includes means for triggering a sensory output (outlined in green) based on receipt of said alarm trigger signal from said service provider, as shown below. (*See e.g.*, https://motorola-global-portal.custhelp.com/ci/fattach/get/3902132/1540217053/redirect /1.NA.UG.en-US.SSC8C30377-B_web.pdf.)



198. The '941 Accused Instrumentalities also include means for preventing a current holder of said mobile wireless device from stopping said sensory output unless an alarm PIN is manually entered by said holder into said mobile wireless device. For instance, the Moto Z3 includes means for preventing a current holder of said mobile wireless device from stopping said sensory output unless an alarm PIN (outlined in blue) is manually entered by said holder into said mobile wireless device. (*See e.g.*, https://motorola-global-portal.custhelp.com /ci/fattach/get/3902132 /1540217053/redirect/1 .NA.UG.en-US.SSC8C30377-B_web.pdf.)



199. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1, 10 and 12-15 of the '941 patent 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 '941 Accused Instrumentalities.

200. On information and belief, Lenovo has had knowledge of the '941 patent, at least since receiving a notice letter from BNR dated January 15, 2019.

201. Upon information and belief, since Lenovo had knowledge of the '941 patent, Lenovo has induced and continues to induce others to infringe at least claims 1, 10 and 12-15 of the '941 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

Lenovo's partners and customers, whose use of the Accused Instrumentalities constitutes direct infringement of at least claims 1, 10 and 12-15 of the '941 patent.

202. In particular, Lenovo's actions that aid and abet others such as their partners and customers to infringe include distributing the '941 Accused Instrumentalities and providing materials and/or services related to the '941 Accused Instrumentalities. On information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '941 patent and that its acts were inducing infringement of the '941 patent since Lenovo has had knowledge of the '941 patent.

203. In particular, after the January 15, 2019 notice letter, the parties engaged in follow up discussions to the notice letter, including a meeting in Chicago, Illinois on January 25, 2018.

204. Lenovo's infringement of the '941 Patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

205. BNR has been damaged by Lenovo's infringement of the '941 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

206. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '941 patent, including without limitation and/or not less than a reasonable royalty.

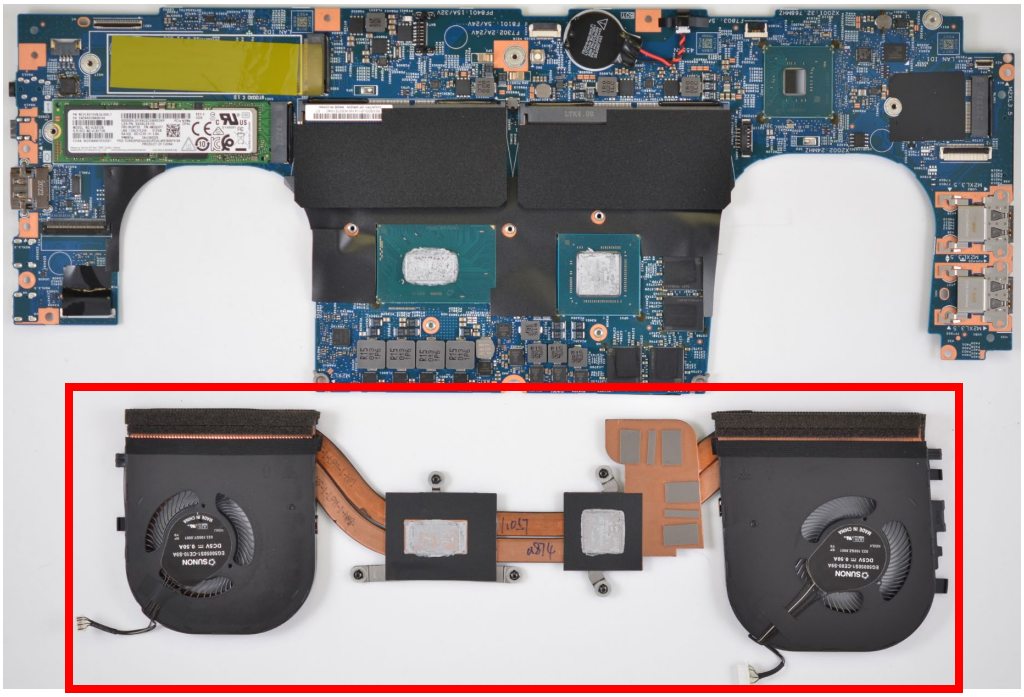
COUNT VIII – INFRINGEMENT OF U.S. PATENT NO. 6,963,129

207. The allegations set forth in the foregoing paragraphs 1 through 206 are incorporated into this Eighth Claim for Relief.

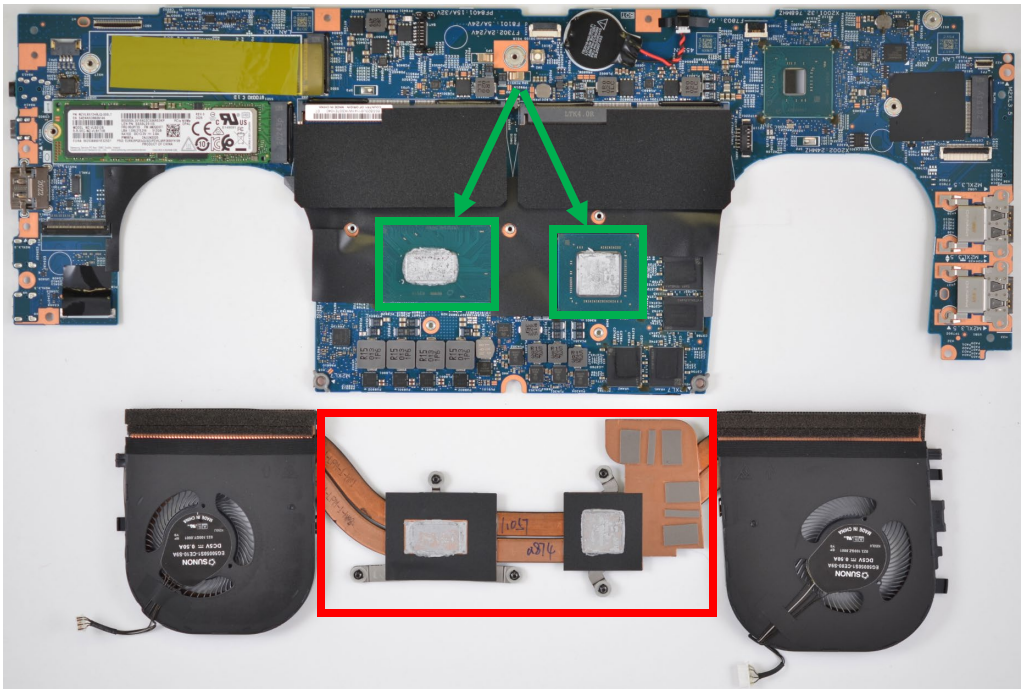
208. On November 8, 2005, the ’129 patent was duly and legally issued by the United States Patent and Trademark Office under the title “Multi-chip Package Having a Contiguous Heat Spreader Assembly.”

209. BNR is the assignee and owner of the right, title and interest in and to the ’129 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

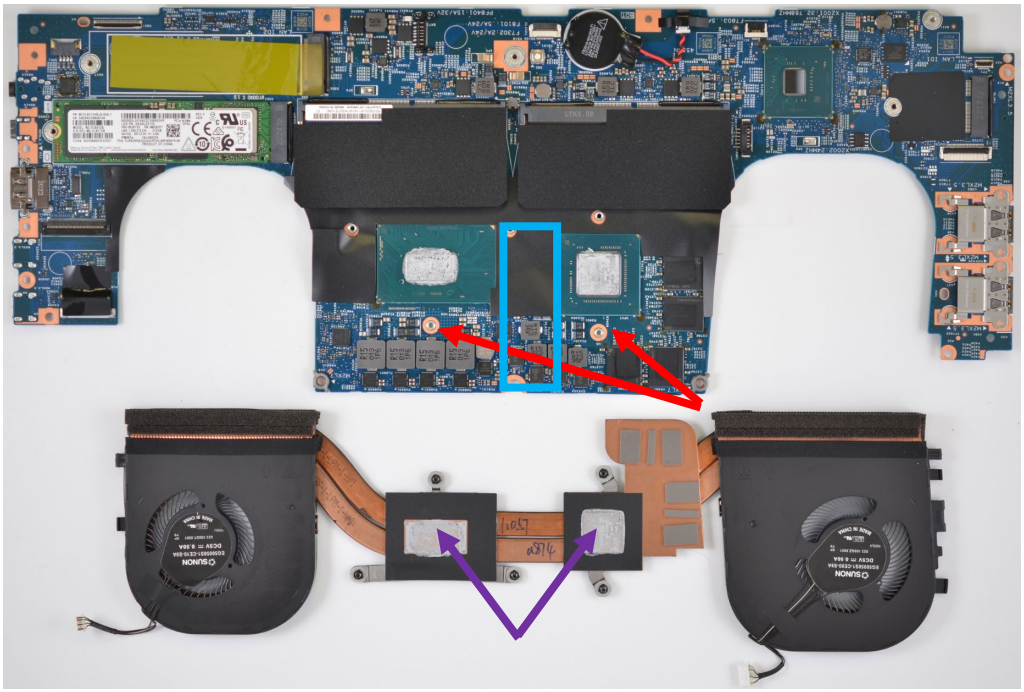
210. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the ’129 patent, including at least claims 1 and 2, by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities that include a heat spreader assembly. Lenovo’s instrumentalities, including one or more Moto E smart phones, such as Moto E5 and Moto E5 Play smart phones, one or more Moto G smart phones, such as Moto G7 Power and Moto G Stylus smart phones, and one or more Moto Z smart phones, such as Moto Z, Moto Z3, Moto Z4 smart phones, as well as IdeaPad S740, Legion 5i and ThinkPad X1 Extreme laptop computers (the “’129 Accused Instrumentalities”) include a heat spreader assembly. For instance, the exemplary ThinkPad X1 Extreme laptop contains a heat spreader assembly (outlined in red), as shown below.



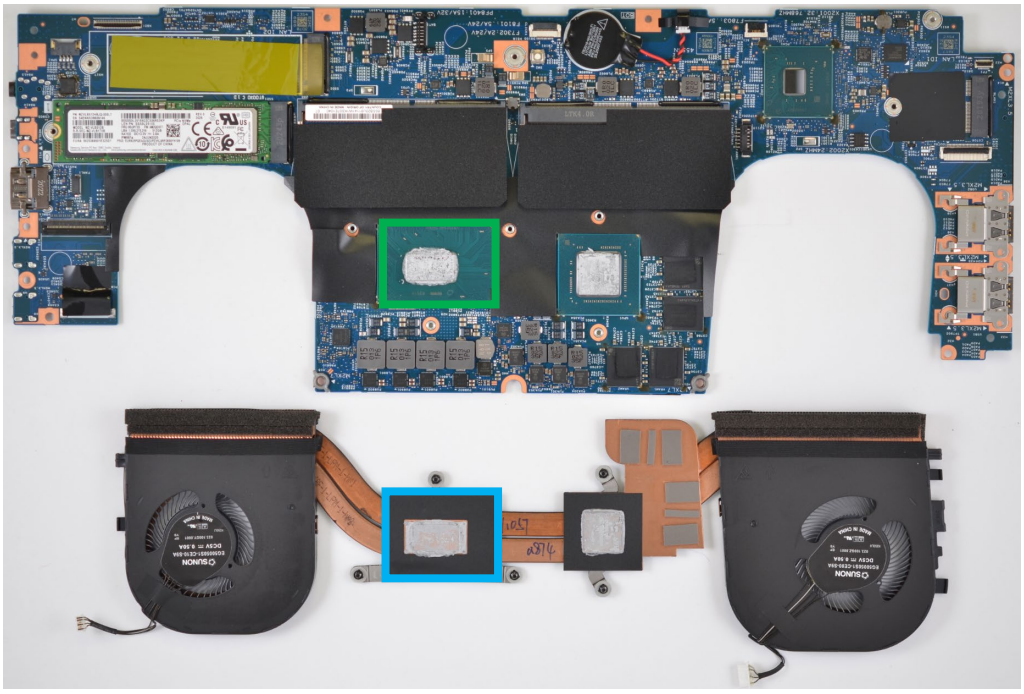
211. The ’129 Accused Instrumentalities’ heat spreader assembly includes a single, unibody heat spreader configured to extend across substantially the entire first surface of at least two spaced chips opposite a second surface of the chips having a bonding pad. For instance, the ThinkPad X1 Extreme contains a heat spreader assembly that includes a single, unibody heat spreader (outlined in red) configured to extend across substantially the entire first surface of at least two spaced chips (indicated by green arrows) opposite a second surface of the chips having a bonding pad (outlined in green), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys/PDF/ThinkPad/ThinkPad_X1_Extreme_Gen_3/ThinkPad_X1_Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)



212. The ’129 Accused Instrumentalities’ heat spreader assembly also includes adhesive placed between the heat spreader and the first surface for securing the heat spreader to the first surface of the chips at a spaced distance above at least one passive device arranged in the area between the spaced chips. For instance, the ThinkPad X1 Extreme’s heat spreader assembly includes adhesive placed between the heat spreader and the first surface for securing the heat spreader to the first surface of the chips (indicated by purple arrows) at a spaced distance above at least (indicated by red arrows) one passive device arranged in the area between the spaced chips (outlined in blue), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys/PDF /ThinkPad/ThinkPad_X1_ Extreme_Gen_3/ThinkPad _X1_Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)



213. The '129 Accused Instrumentalities' heat spreader assembly also includes a second heat spreader interposed between the heat spreader and only one of the at least two spaced chips. For instance, the ThinkPad X1 Extreme's heat spreader assembly includes a second heat spreader interposed between the heat spreader (outlined in blue) and only one of the at least two spaced chips (outlined in green), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys /PDF/ThinkPad/ThinkPad_X1_Extreme_Gen_3/ThinkPad_X1_Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)



214. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1 and 2 of the '129 patent 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 '129 Accused Instrumentalities.

215. Lenovo's infringement is knowing, egregious, consciously wrongful, and willful. Lenovo has had knowledge of the '129 patent, at least since receiving a notice letter from BNR dated May 22, 2020. Despite receiving this letter, Lenovo continued to infringe the '129 patent by continuing to make, use, sell, and/or offer to sell the '129 Accused Instrumentalities in the United States.

216. Lenovo's infringement of the '129 patent is willful and deliberate, entitling BNR to enhanced damages and attorneys' fees.

217. Lenovo's infringement of the '129 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

218. BNR has been damaged by Lenovo's infringement of the '129 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

219. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '129 patent, including without limitation and/or not less than a reasonable royalty.

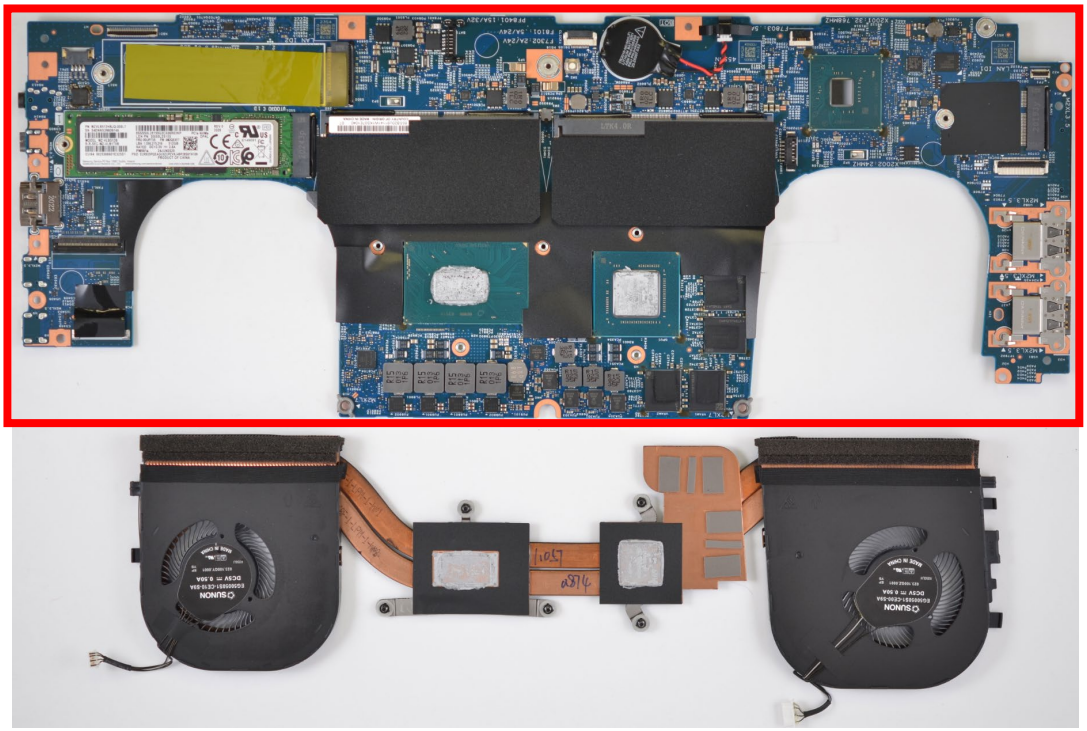
COUNT IX – INFRINGEMENT OF U.S. PATENT NO. 6,858,930

220. The allegations set forth in the foregoing paragraphs 1 through 219 are incorporated into this Ninth Claim for Relief.

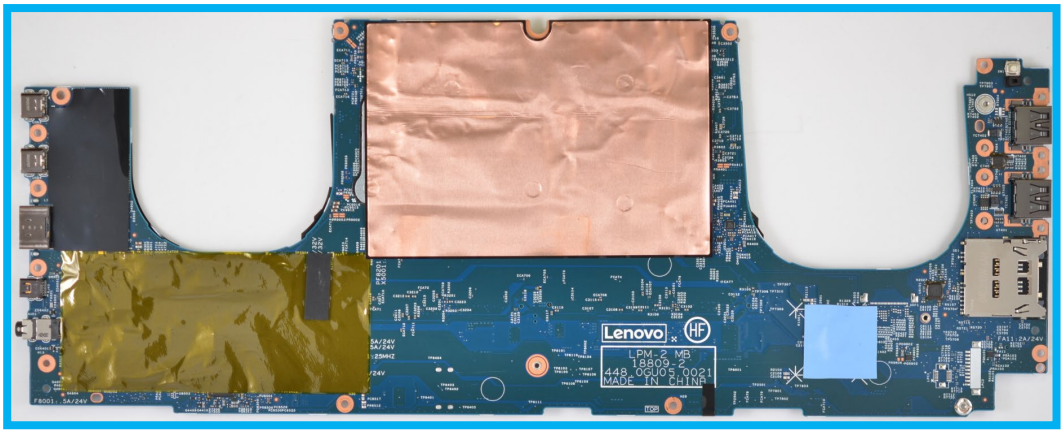
221. On February 22, 2005, the '930 patent was duly and legally issued by the United States Patent and Trademark Office under the title "Multi Chip Module."

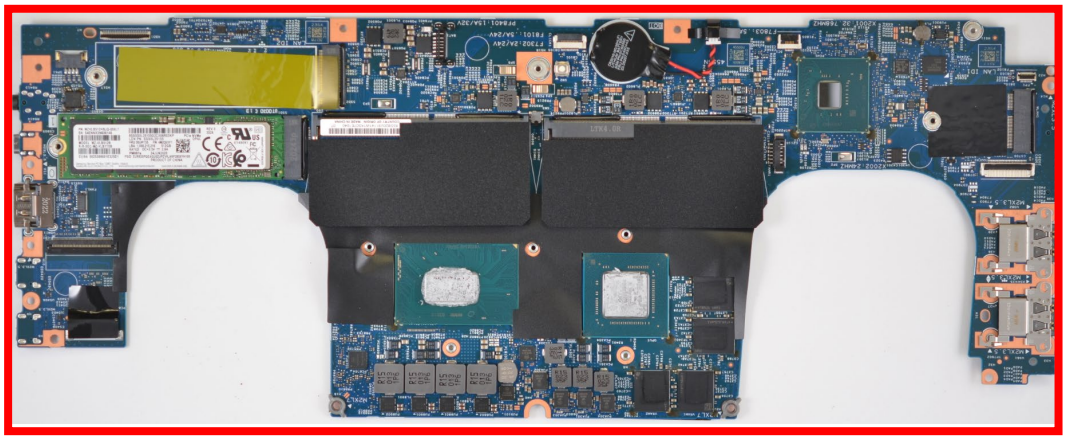
222. BNR is the assignee and owner of the right, title and interest in and to the '930 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

223. Upon information and belief, Lenovo has and continues to directly infringe one or more claims of the '930 patent, including at least claims 1 and 2 by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities having a semiconductor package, including one or more Moto E smart phones, such as Moto E5 and Moto E5 Play smart phones, one or more Moto G smart phones, such as Moto G7 Power and Moto G Stylus smart phones, and one or more Moto Z smart phones, such as Moto Z, Moto Z3, Moto Z4 and Moto Z Force Droid smart phones, as well as, IdeaPad S740, Legion 5i and ThinkPad X1 Extreme laptop computers (the "'930 Accused Instrumentalities"). For instance, the ThinkPad X1 Extreme includes a semiconductor package (outlined in red), as shown below.

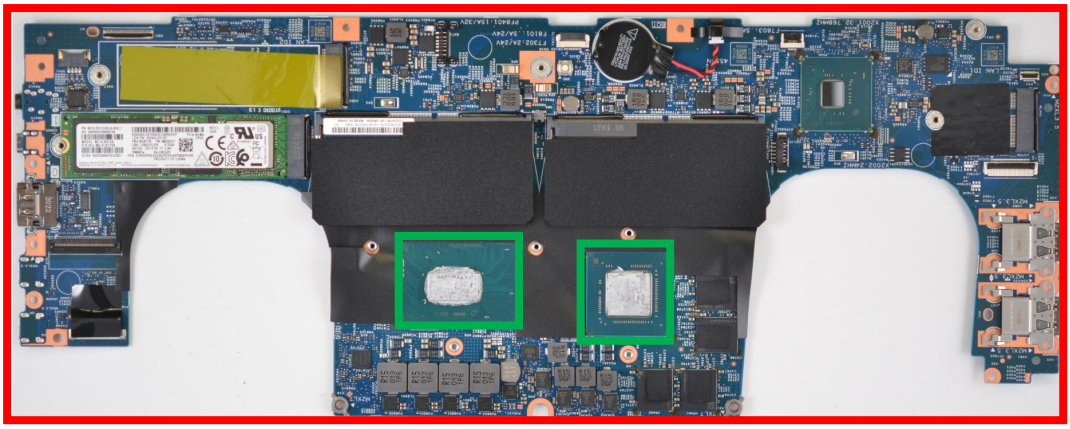


224. The ’930 Accused Instrumentalities include a package substrate having a first side and an opposing second side, the first side for receiving package electrical connections. For instance, the ThinkPad X1 Extreme includes a package substrate having a first side (outlined in blue) and an opposing second side (outlined in red), the first side for receiving package electrical connections, as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys/PDF /ThinkPad/ThinkPad _X1_Extreme_ Gen_3/ThinkPad_X1_Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)

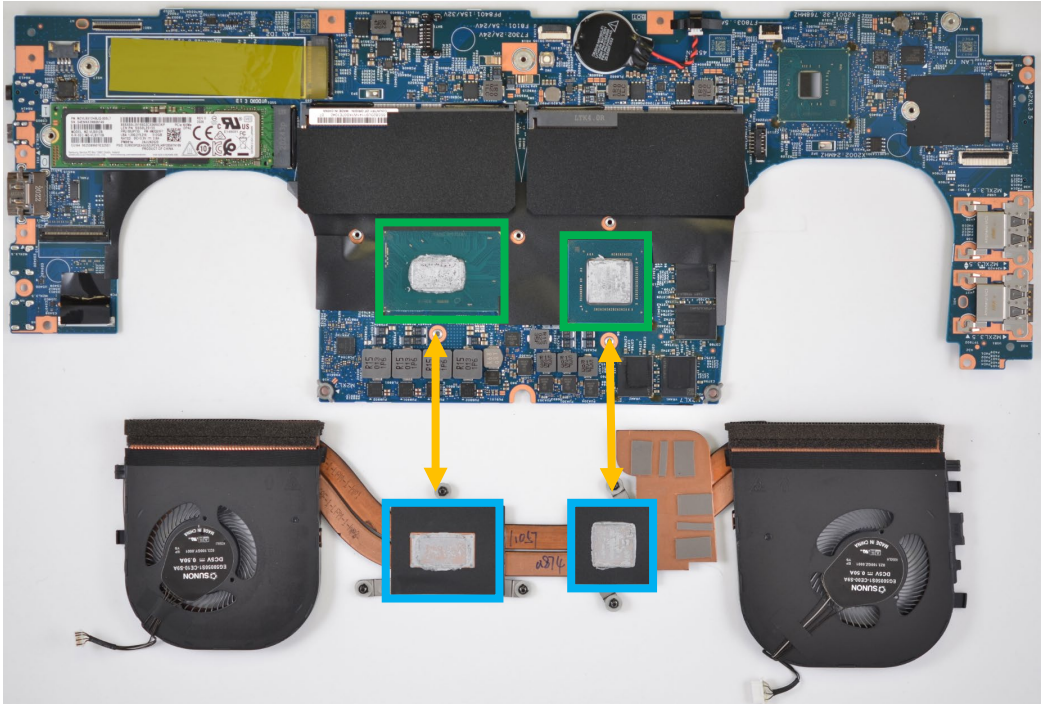




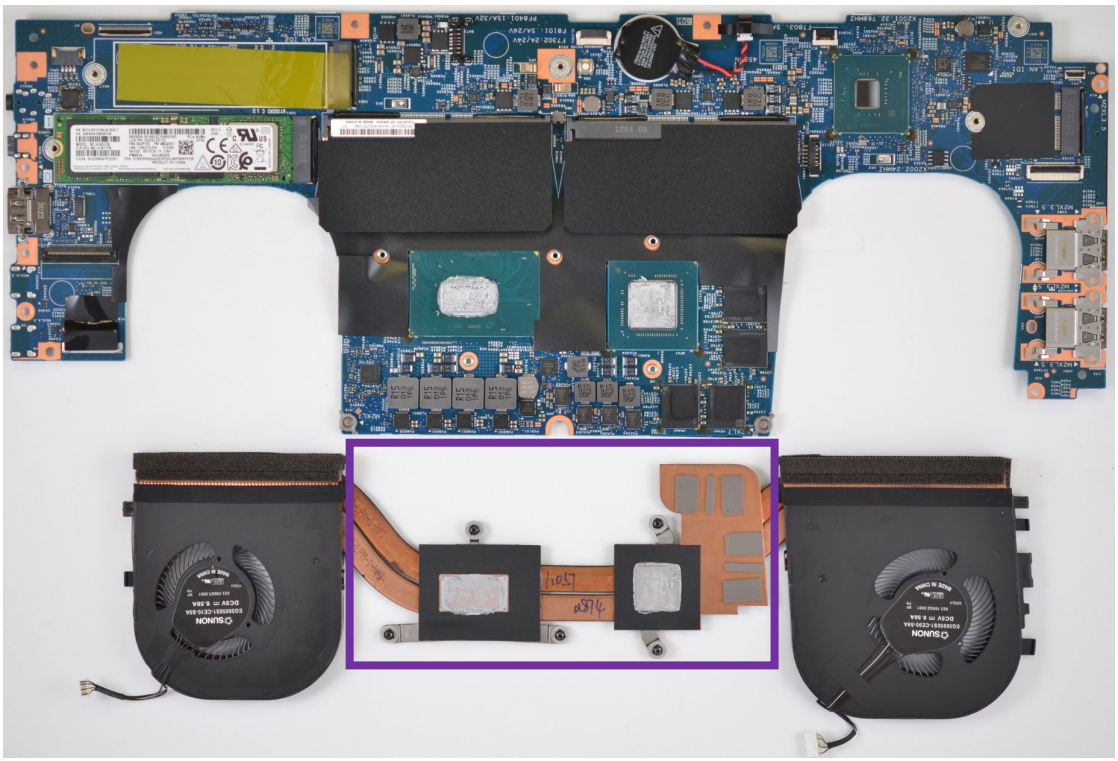
225. The ’930 Accused Instrumentalities also include chips each having a first side and an opposing second side, the first side of each of the chips electrically connected and structurally connected to the second side of the package substrate. For instance, the ThinkPad X1 Extreme includes chips (outlined in green) each having a first side and an opposing second side, the first side of each of the chips electrically connected and structurally connected to the second side of the package substrate (outlined in red), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys/PDF/ThinkPad/ThinkPad_X1_Extreme_Gen_3/ThinkPad_X1_Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)

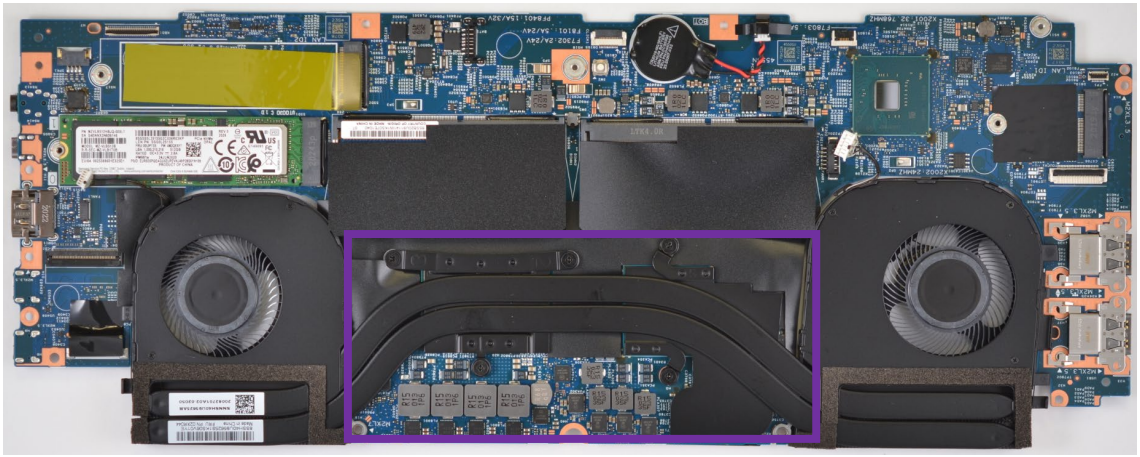


226. The ’930 Accused Instrumentalities also include heat spreaders each having a first side and an opposing second side, the first side of each of the heat spreaders disposed adjacent the second side of the chips, where one each of the heat spreaders is associated with one each of the chips. For instance, the ThinkPad X1 Extreme includes heat spreaders (outlined in blue) each having a first side and an opposing second side, the first side of each of the heat spreaders disposed adjacent the second side of the chips (outlined in green), where one each of the heat spreaders is associated with one each of the chips (indicated by orange arrows), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys /PDF/ ThinkPad/ThinkPad_X1_Extreme _Gen_3/ThinkPad _X1_Extreme_ Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)



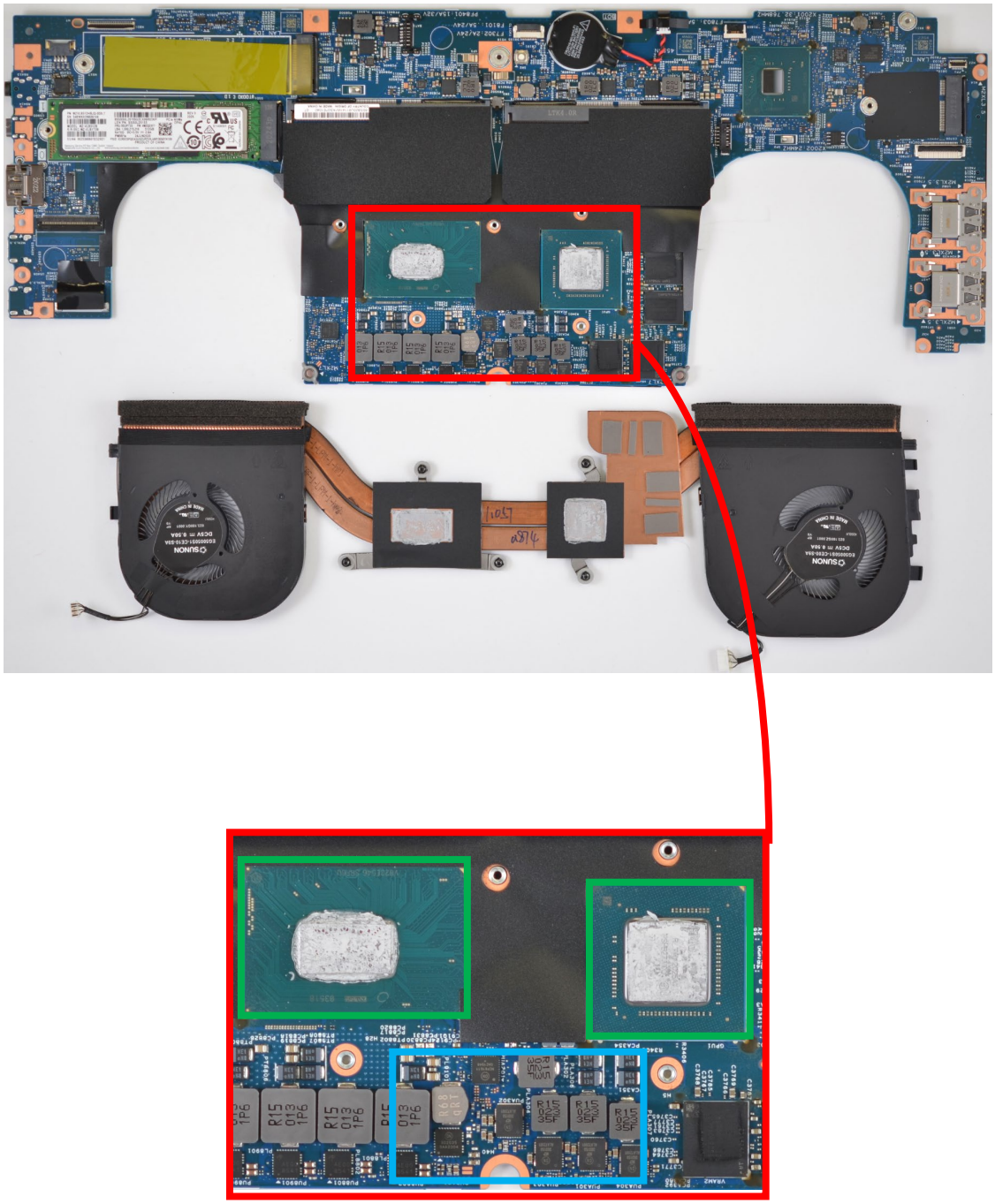
227. The ’930 Accused Instrumentalities also include a single stiffener having a first side and an opposing second side, the stiffener covering all of the chips and heat spreaders, the first side of the stiffener disposed adjacent the second side of the heat spreaders. For instance, the ThinkPad X1 Extreme includes a single stiffener having a first side and an opposing second side, the stiffener covering all of the chips and heat spreaders, the first side of the stiffener disposed adjacent the second side of the heat spreaders (outlined in purple), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys/PDF/ThinkPad /ThinkPad_X1_Extreme_Gen_3/ ThinkPad_X1 _Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)





228. The ’930 Accused Instrumentalities also include discrete components electrically connected to the second side of the package substrate and coplanar with the chips. For instance, the ThinkPad X1 Extreme includes discrete components electrically connected (outlined in blue) to the second side of the package substrate and coplanar with the chips (outlined in green), as shown below. (*See, e.g.*, https://psref.lenovo.com/syspool/Sys/PDF/ThinkPad/ThinkPad_X1_

Extreme_Gen_3/ ThinkPad_X1_ Extreme_Gen_3_Spec.pdf (identifying the technical specifications, including chip components, for the ThinkPad X1 Extreme).)



229. On information and belief, Lenovo has had knowledge of the '930 patent, at least since receiving a notice letter from BNR dated May 22, 2020.

230. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1 and 2 of the ’930 patent 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 ’930 Accused Instrumentalities.

231. Upon information and belief, since Lenovo had knowledge of the ’930 patent, Lenovo has induced and continues to induce others to infringe the ’930 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 Lenovo’s partners and customers, whose use of the ‘930 Accused Instrumentalities constitutes direct infringement.

232. In particular, Lenovo’s actions that aid and abet others such as their partners and customers to infringe include distributing the ‘930 Accused Instrumentalities and providing materials and/or services related to the ‘930 Accused Instrumentalities. On information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the ’930 patent and that its acts were inducing infringement of the ’930 patent since Lenovo has had knowledge of the ’930 patent.

233. In particular, after the May 22, 2020 notice letter, the parties engaged in follow up discussions to the notice Lenovo’s infringement of the ’930 patent is willful and deliberate, entitling BNR to enhanced damages and attorneys’ fees.

234. Lenovo’s infringement of the ’930 patent is exceptional and entitles BNR to attorneys’ fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

235. BNR has been damaged by Lenovo's infringement of the '930 Patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

236. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '930 patent, including without limitation and/or not less than a reasonable royalty.

COUNT X– INFRINGEMENT OF U.S. PATENT NO. 7,039,435

237. The allegations set forth in the foregoing paragraphs 1 through 236 are incorporated into this Tenth Claim for Relief.

238. On May 2, 2006, the '435 patent was duly and legally issued by the United States Patent and Trademark Office under the title "Proximity Regulation System for Use with a Portable Cell Phone and a Method of Operation Thereof."

239. BNR is the assignee and owner of the right, title and interest in and to the '435 patent, including the right to assert all causes of action arising under said patent and the right to any remedies for infringement of it.

240. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '435 patent, including at least claim 1 of the '435 patent by selling, offering to sell, making, using, and/or providing and causing to be used instrumentalities having proximity regulation systems , including Moto Z smart phones, such as the Moto Z3 smart phones (the "'435 Accused Instrumentalities"), having systems to detect the location of the mobile device proximate to the user and adjusts the transmit power level of the mobile device based on its location proximate to the user.

241. On information and belief after a reasonable investigation, the '435 Accused Instrumentalities infringe the '435 patent. The '435 Accused Instrumentalities include a power circuit that provides a network adjusted transmit power level as a function of a position to a communications tower. For instance, the Moto Z3 includes a power circuit that provides a network adjusted transmit power level as a function of a position to a communications tower (*e.g.*, the circuitry coupled to the antenna). The claimed power signal is part of the Long-Term Evolution ("LTE") standard, which is utilized by the Moto Z3.

242. More specifically, section 5.1.1 of the LTE standard addresses the "UE behaviour" and states:

> If the UE transmits PUSCH without a simultaneous PUCCH for the serving cell c, then the UE transmit power $P_{\mathrm{PUSCH},c}(i)$ for PUSCH transmission in subframe i for the serving cell c is given by
>
> $$P_{\mathrm{PUSCH},c}(i) = \min\begin{Bmatrix} P_{\mathrm{CMAX},c}(i), \\ 10\log_{10}(M_{\mathrm{PUSCH},c}(i)) + P_{\mathrm{O\_PUSCH},c}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\mathrm{TF},c}(i) + f_c(i) \end{Bmatrix} \text{ [dBm]}$$

(*See* https://www.etsi.org/deliver/etsi_ts/136200_136299/136213/10.04.00_ 60/ts_136213v100 400p.pdf at 5.1.1.)

243. The '435 Accused Instrumentalities have a proximity regulation system, including: a location sensing subsystem that determines a location of said portable cell phone proximate a user; and a power governing subsystem, coupled to said location sensing subsystem that determines a proximity transmit power level of said portable cell phone based on said location and determines a transmit power level for said portable cell phone based on said network adjusted transmit power level and said proximity transmit power level. As part of its submissions to the Federal Communications Commission ("FCC"), Lenovo disclosed test results from Specific Absorption Rate ("SAR") Testing. Those test results indicate that the '435

Accused Instrumentalities have a location sensing subsystem that determines the location of a mobile device proximate to the user. (*See* Exhibit K at 8, 10.)

244. The '435 Accused Instrumentalities also have a proximity regulation system, including: a location sensing subsystem that determines a location of said portable cell phone proximate a user; and a power governing subsystem, coupled to said location sensing subsystem that determines a proximity transmit power level of said portable cell phone based on said location and determines a transmit power level for said portable cell phone based on said network adjusted transmit power level and said proximity transmit power level. The SAR test results confirm that the '435 Accused Instrumentalities have a location sensing subsystem and a power governing subsystem, the latter of which determines a transmit power level based on a proximity transmit power level determined by the location of the mobile phone proximate to a user and the network adjusted transmit power level. For instance, the SAR test results to the Moto Z3 include the following table, which indicates that power is adjusted based on proximity. (*See* Exhibit K at 12, 13.)

245. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least one or more claims (*e.g.*, claim 1) of the '435 patent 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 '435 Accused Instrumentalities.

246. Lenovo's infringement is knowing, egregious, consciously wrongful, and willful. Lenovo has had knowledge of the '435 patent, at least since receiving a notice letter from BNR dated January 15, 2019. Despite receiving this letter, Lenovo continued to infringe the '435

patent by continuing to make, use, sell, and/or offer to sell the '435 Accused Instrumentalities in the United States.

247. Lenovo's infringement of the '435 patent is exceptional and entitles BNR to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

248. BNR has been damaged by Lenovo's infringement of the '435 patent and will continue to be damaged unless BNR is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

249. BNR is entitled to recover from Lenovo all damages that BNR has sustained as a result of Lenovo's infringement of the '435 Patent, including without limitation and/or not less than a reasonable royalty.

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

250. The allegations set forth in the foregoing paragraphs 1 through 249 are incorporated into this Eleventh Claim for Relief.

251. 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."

252. 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.

253. Upon information and belief, Lenovo has and continues to directly or indirectly infringe one or more claims of the '914 patent, including at least claims 1 and 25, 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 one or more Moto G smart phones, such as Moto G Stylus smart phones, and one or more Moto Z smart phones, such as Moto Z3 and Moto Z Force Droid smart phones, and Motorola One 5G Ace smart phones (the "'914 Accused Instrumentalities").

254. 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.

255. On information and belief after a reasonable investigation, the Accused Instrumentalities infringe the '914 patent. The '914 Accused Instrumentalities provide a method for transmitting data via a plurality of radio frequency (RF) channels utilizing a plurality of transmitting antennas. For instance, the Motorola One 5G Ace 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, e.g.*, https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537.)

256. The '914 Accused Instrumentalities receive feedback information via at least one of the plurality of RF channels. For instance, the Motorola One 5G Ace is an 802.11ac compliant wireless device that receives feedback information via at least one of the plurality of RF

channels. (*See, e.g.*, https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537.)

257. The '914 Accused Instrumentalities modify a transmission mode based on the feedback information. For instance, the Motorola One 5G Ace is an 802.11ac compliant wireless device that modifies a transmission mode based on the feedback information. (*See, e.g.*, https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537.)

258. The '914 Accused Instrumentalities receive the feedback information comprising channel estimates based on transmission characteristics of the transmitted data via at least one of the plurality of transmitting antennas. For instance, the Motorola One 5G Ace is an 802.11ac compliant wireless device that receives the feedback information comprising channel estimates based on transmission characteristics of the transmitted data via at least one of the plurality of transmitting antennas; and deriving the feedback information from mathematical matrix decomposition of channel estimates. (*See, e.g.*, https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537.)

259. The '914 Accused Instrumentalities derive the feedback information from mathematical matrix decomposition of channel estimates. For instance, the Motorola One 5G Ace is an 802.11ac compliant wireless device that derives the feedback information from mathematical matrix decomposition of channel estimates. (*See, e.g.*, https://www.motorola.com/us/smartphones-motorola-one-5g-ace/p?skuId=537.)

260. Lenovo has infringed and is infringing, individually and/or jointly, either literally or under the doctrine of equivalents, at least claims 1 and 25 of the '914 patent 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 '914 Accused Instrumentalities.

261. Lenovo knew or should have known of the '914 patent but was willfully blind to the existence of the patent. Lenovo has had actual knowledge of the '914 patent since at least as early as the filing and service of this Complaint.

262. Upon information and belief, since Lenovo had knowledge of the '914 patent, Lenovo has induced and continues to induce others to infringe at least claims 1 and 25 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 Lenovo 's partners and customers, whose use of the '914 Accused Instrumentalities constitutes direct infringement of at least claims 1 and 25 of the '914 patent.

263. In particular, Lenovo's actions that aid and abet others such as their partners and customers to infringe include marketing the '914 Accused Instrumentalities to its customers, distributing the '914 Accused Instrumentalities and providing materials and/or services to users of the '914 Accused Instrumentalities, including providing instructions to users on how to use the functionality of the '914 patent on its website and elsewhere. (*See, e.g.,* https://www.motorola -support.com/us-en/?page=device/motorola/one-5g-ace.)

264. Upon information and belief, Lenovo has engaged in such actions with specific intent to cause infringement or with willful blindness to the resulting infringement because Lenovo has had actual knowledge of the '914 patent and that its acts were inducing infringement of the '914 patent since Lenovo has had knowledge of the '914 patent.

265. Lenovo'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.

266. BNR has been damaged by Lenovo's infringement of the '914 patent and will continue to be damaged unless Lenovo is enjoined by this Court. BNR has suffered and continues to suffer irreparable injury for which there is no adequate remedy at law. The balance of hardships favors BNR, and public interest is not disserved by an injunction.

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

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 Lenovo as follows:

A. An adjudication that the Lenovo has infringed U.S. Patent Nos. 8,204,554, 7,319,889, RE 48,629, 8,416,862, 7,957,450, 6,941,156, 6,696,941, 6,963,129, 6,858,930, 7,039,435, 7,564,914;

B. An award of damages to be paid by Lenovo adequate to compensate BNR for Lenovo's past infringement of U.S. Patent Nos. 8,204,554, 7,319,889, RE 48,629, 8,416,862, 7,957,450, 6,941,156, 6,696,941, 6,963,129, 6,858,930, 7,039,435, 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. A permanent injunction prohibiting Defendants and their officers, directors, employees, agents, consultants, contractors, suppliers, distributors, all affiliated entities, and all others acting in privity with Defendants, from committing further acts of infringement;

D. Enhanced damages for willful infringement;

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

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

Dated: October 22, 2021

DEVLIN LAW FIRM LLC

/s/ Timothy Devlin

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