

**IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF ILLINOIS  
EASTERN DIVISION**

THETA IP, LLC,

Plaintiff,

v.

MOTOROLA MOBILITY LLC;  
LENOVO (UNITED STATES) INC.; and  
LENOVO GROUP LTD.,

Defendants.

Civil Action No.: 1:22-cv-3441

**JURY TRIAL DEMANDED**

**THETA IP'S COMPLAINT FOR PATENT INFRINGEMENT**

Plaintiff Theta IP, LLC ("Plaintiff" or "Theta"), through its attorneys, for its Complaint against Motorola Mobility LLC, Lenovo (United States) Inc., and Lenovo Group Ltd. (collectively, "Lenovo," "Motorola," or "Defendants"), demands a trial by jury and alleges as follows:

**FACTUAL INTRODUCTION**

1. This case is about Lenovo's infringement of ground-breaking patents directed to reducing the power consumed by the receiver in cellular phones and other types of mobile devices. Infringement of Theta's patents enables Lenovo to realize significant product cost and size savings by utilizing smaller, less expensive batteries in their cellular phones and tablets without compromising performance, and to compete effectively with regard to the battery life of its cell phones and mobile devices.

2. Cell phone ownership and usage skyrocketed in the last fifteen years as the cell phone became ubiquitous. New classes of mobile devices, along with the omnipresent cell phone, have been introduced on a yearly product cycle. Cell phones in particular have evolved from simple mobile phones to smart phones that might more aptly be called "Mobile Internet

Appliances.” For simplicity, the terms cellular phone, cell phone, mobile phone, and smart phone are used interchangeably herein. Mobile devices have rapidly evolved to support a wide array of data-hungry applications that increase the demand for battery power in a market where consumers demand increased battery life along with expanded functionality. In parallel with consumer demand for increased functionality, the demand for larger screens has increased power demands. Advances in battery and screen technology alone have been inadequate to meet consumer demand for increased battery life along with expanded functionality. The ever-present need to stay online and connected imposes ever-increasing demands for a battery life that is sufficient to satiate consumer expectations. At the same time, competing consumer demands for lighter, smaller, or thinner devices place limits on commercially viable battery size and weight. From the cell phone maker’s perspective, a phone’s battery comprises a substantial portion of the overall bill of material cost, so any need for a larger battery increases the cost of the finished goods. In addition, a smaller battery results in slimmer design form factor, and less weight, both with substantial influence on the overall competitiveness and market success of the product. Thus, decreasing a mobile phone’s power consumption to maximize battery life is an imperative goal for engineers that design mobile devices.

3. Because the cell phone receiver must always be on to receive a cellular call, the cellular phone receiver consumes a significant portion of a phone’s battery life. The lower the quality of an incoming signal, the more battery power is consumed. As a user moves farther away from a cellular tower, the signal level decreases and is often further degraded by interference from physical objects or other radio signals. Noise is also introduced from a variety of sources. Within a cellular device, a series of components operate in concert to amplify the signals received from the antenna and filter out the unwanted noise and interference. Achieving

adequate performance with widely varying signal quality has always been a major challenge for cell phone makers.

4. Prior to the inventions of the Asserted Patents, cellular radio designers focused mostly on making sure the cell phone would operate in the “worst-case” scenario. The “worst-case” occurs when the desired signal strength is low, and interference and noise are high. Because conditions are not always “worst case,” a cell phone designed to focus on this worst-case scenario consumes more power than is necessary for the actual operating conditions. Battery life was wasted by addressing conditions that were not always present.

5. Professor Yannis Tsividis is a renowned researcher and educator, widely recognized as a pioneer in integrated circuit design, circuits for signal processing, and adaptive-power circuits. Currently a professor of electrical engineering at Columbia University in New York, he previously worked at Motorola Semiconductor and AT&T Bell Laboratories, and taught at the University of California, Berkeley, the National Technical University of Athens, the Massachusetts Institute of Technology, and the University of Paris. A large part of his academic and industry pursuits focused on delivering power-optimized solutions; in his words: “I have felt for a long time that, although it is necessary to dissipate power when you are doing something useful in circuits such as filters, dissipating such power when the signal does not demand it is a crime.” Yannis Tsividis, *Exploring and Explaining Circuits*, IEEE SOLID-STATE CIRCUITS MAG., Fall 2014, at 27.

6. Prof. Tsividis is a Life Fellow of the Institute of Electrical and Electronics Engineers (IEEE)—a distinction reserved for select members of the IEEE whose extraordinary accomplishments are deemed fitting of this prestigious recognition. He is also the recipient of numerous awards from Columbia University and the IEEE. The IEEE Solid State Circuits

Magazine dedicated its Fall 2014 issue to recognizing Prof. Tsividis as a “Path-Breaking Researcher and Educator.” In that issue, his colleague at Columbia University honored Prof. Tsividis’s quest to innovate: “He is genuinely interested in the research of others, stimulates the development of new ideas, and always strives to find the original source of ideas. But, like no other, he is able to identify new directions, even if it means going against what is considered common sense.” Peter Kinget, *Guest Editorial: A Born Educator and Researcher*, IEEE SOLID-STATE CIRCUITS MAG., Fall 2014, at 13. Prof. Kinget is currently the Chairman of the Electrical Engineering Department at Columbia University. Last year, the United States National Academy of Engineering elected Prof. Tsividis as a member for his contributions to analog and mixed-signal integrated circuit technology and engineering education, one of the highest professional honors awarded to an engineer.

7. Professor Tsividis co-founded Theta, along with Yannis Papananos, a Professor at the National Technical University of Athens. Prof. Tsividis maintained a position as a technical consultant throughout the life of Theta, during which time he helped the company design more power-efficient radio transceiver integrated circuits for use in the design of mobile devices of several kinds. In 2001, while working on Theta-related projects, Prof. Tsividis invented novel and path-breaking solutions that allowed for dynamic adjustment of components within the radio’s signal path to optimize power consumption based upon the signal strength of the desired signal(s) and interferer signal(s), which are claimed in the Asserted Patents. His inventions allow significant reduction in power consumption relative to the worst-case scenario (in which radios were designed or are required to operate). By optimizing the power of the radio circuitry in this way, mobile device makers could achieve improved battery life, or reduce the size and weight of the battery or the device, or both—depending on the marketing or design requirements.

8. Prof. Tsividis's inventions received significant academic and industry acclaim. Indeed, the need to optimize power was critical to achieving product designs that satisfied consumers' demand for devices that were "always connected," portable, and could operate for long periods of time without recharging. Prof. Tsividis has frequently been invited to present his research at academic and industry conferences, events, and training sessions. His inventions on dynamically controlling the power dissipation of mobile devices are now the subject of six issued United States Patents that are assigned to Theta, three of which are asserted in this action.

9. Lenovo makes, imports, uses, offers, and sells in the United States various cellular smartphones under both the Motorola and Lenovo brand names, as well as various cellular connected tablets under the Lenovo brand. As described in further detail herein, these constitute the Accused Products.

10. As described in further detail herein, Lenovo utilizes this patented technology in all of its most recent cell phone and tablet models. Indeed, Lenovo appears to include radios that employ these patented power-saving designs and methods across the entirety of its mobile phone and cellular-enabled tablet lineup offered in the United States. And Lenovo does so knowing not only of Prof. Tsividis's inventions, but also its unlawful practice of them.

11. By the nature of the Accused Products' design and configuration, Prof. Tsividis's claimed methods (which are asserted in this matter) are necessarily practiced each and every time that an accused Lenovo device is powered on or used. Indeed, Lenovo includes the infringing hardware and/or software configuration in each Accused Product, intending that the device carry out the claimed methods each and every time the device is powered on or used no matter the circumstances. Because the methods claimed in the Asserted Patents are so instrumental to the operation of the Accused Products, Lenovo does not provide any mechanism through which an

end-user could disable the accused functionality, and does not otherwise permit an end-user to use an Accused Product in a manner that avoids practicing the methods claimed in the Asserted Patents.

12. Lenovo recognizes significant financial benefit, competitive advantage, and market positioning value from its unauthorized practice of the Theta's patented inventions. By using Prof. Tsvidis's power optimization strategies, Lenovo can market and sell mobile devices, including its many cell phones and tablets, that continue to function for longer periods of time between recharges, without having to increase the capacity of the battery embedded in its devices. Lenovo, therefore, is able to offer smaller, sleeker devices than it could without using Theta's patented improvements—and it enjoys significant savings in the device's bill of material and hence manufacturing costs in the process.

#### **NATURE OF THE ACTION**

13. This is an action for infringement of U.S. Patent No. 7,010,330 (“the ’330 Patent”), U.S. Patent No. 10,129,825 (“the ’825 Patent”), and U.S. Patent No. 10,524,202 (“the ’202 Patent”) (collectively, the “Asserted Patents”).

#### **THE PARTIES**

14. Theta is a limited liability company organized under the laws of Delaware, with its principal place of business at 710 Inglenook Court, Coppell, Texas 75019.

15. Theta is the true and correct owner of the Asserted Patents and holds all rights necessary to bring this action.

16. On information and belief, Defendant Motorola Mobility LLC is indirectly a wholly owned subsidiary of Lenovo Group Ltd. and is a Delaware limited liability company with its principal office located in this District at 222 W. Merchandise Mart Plaza, Suite 1800,

Chicago, Illinois 60654. Motorola Mobility LLC has a regular and established place of business in this District.

17. On information and belief, Defendant Lenovo (United States) Inc. is a wholly owned subsidiary of Lenovo Group Ltd. and is a corporation organized under the laws of the State of Delaware, with its principal place of business at 1009 Think Place, Building One, Morrisville, North Carolina 27560. Defendant Lenovo (United States) Inc. maintains offices and hires engineers and other employees to work in Chicago, Illinois. Defendant Lenovo (United States) Inc. has a regular and established place of business in this District.

18. On information and belief, Defendant Lenovo Group Ltd. is organized under the laws of the People's Republic of China, with its key operations center at Lenovo HQ East, Building 1, No. 10 Courtyard Xibeiwang East Road, Haidian District, Beijing 100094 and with a registered office at 23<sup>rd</sup> Floor, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong S.A.R. of China.

19. Joinder is proper under 35 U.S.C. § 299. The allegations of infringement contained herein are asserted against the Defendants jointly, severally, or in the alternative, arise, at least in part, out of the same series of transactions or occurrences relating to Defendants' manufacture, use, sale, offer for sale, and importation of the same Accused Products. On information and belief, Defendants are part of the same corporate family of companies, and the infringement allegations arise, at least in part, from Defendants' collective activities with respect to Defendants' Accused Products. Questions of fact common to Defendants will arise in the action, including questions relating to the structure and operation of the Accused Products and Defendants' infringing acts.

**JURISDICTION AND VENUE**

20. This action arises under the patent laws of the United States, Title 35 of the United States Code. Subject matter jurisdiction is proper in this Court pursuant to 28 U.S.C. §§ 1331 and 1338(a).

21. Venue is proper in this District under 28 U.S.C. §§ 1391(c) and 1400(b).

22. Lenovo is subject to this Court's specific and general personal jurisdiction pursuant to due process, due at least to its substantial business in this forum, including: (i) at least a portion of the infringements alleged herein; (ii) purposefully and voluntarily placing one or more infringing products into the stream of commerce with the expectation that they will be purchased by consumers in this forum; and (iii) 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 Illinois and in this District.

23. Lenovo has transacted business in this District and has committed acts of patent infringement in this District. Additionally, Lenovo is registered to do business in the State of Illinois, has offices and facilities in the State of Illinois and this District, actively posts job listings for positions in Illinois, and actively directs its activities to customers located in the State of Illinois and this District.

24. Jurisdiction over Lenovo in this matter is also proper inasmuch as Lenovo has voluntarily submitted itself to the jurisdiction of the courts by commencing litigations within the State of Illinois, by registering with the Illinois Secretary of State's Office to do business in the State of Illinois, and by appointing a registered agent.

25. Lenovo personnel (including its employees and agents) directly infringe each Patent-in-Suit when Lenovo personnel design, test, demonstrate, or use the Accused Products



within the United States, including (but not limited to) at Lenovo facilities within Illinois and this District.

26. Venue is proper in this District pursuant to 28 U.S.C. § 1400(b) because, among other things, Lenovo has a regular and established place of business in this District.

27. Lenovo also owns and operates online stores for Lenovo and Motorola Mobility products, through which it sells substantial volumes of products, including infringing products, in Illinois and within this District. Lenovo also provides Accused Products to distributors and resellers in Illinois and within this District. Through its online presence, and through numerous distributors and resellers (both online and brick-and-mortar), Lenovo directly and indirectly extracts significant revenues from Illinois and this District.

28. Lenovo has committed tortious acts within Illinois and this District, and the causes of action set forth in this Complaint arise from those acts. Lenovo develops, manufactures, distributes, tests, markets, and sells mobile telephone and computing products that infringe the Asserted Patents, which are, and have been, offered for sale, sold (directly or through Defendants' online store and distribution network), purchased, and used in Illinois and within this District. Defendants, directly or through their distribution network, also place infringing products within the stream of commerce, with the knowledge and/or understanding that such infringing products will be sold and/or used in Illinois and in this District.

29. Venue is also proper as to a foreign defendant in any district. 28 U.S.C. § 1391(c)(3); *In re HTC Corp.*, 889 F.3d 1349 (Fed. Cir. 2018). Defendant Lenovo Group Ltd. is a foreign corporation organized under the laws of China, with a principal place of business in China.

## **FACTUAL ALLEGATIONS**

### **The Patented Inventions**

30. Prof. Yannis Tsividis is a founder, consultant and shareholder of Theta; he invented the improvements that are described and claimed in the '330, '825, and '202 Patents while working on projects for Theta. At the time, Theta was developing high performance wireless networking equipment for mobile devices. The Asserted Patents describe and claim systems and methods for reducing power dissipation in the receivers of battery powered mobile devices by varying the operational characteristics of components in the receiver signal path based upon the operating conditions in accordance with the claims.

31. Prof. Tsividis is a pioneer in the integrated circuits and systems field and is widely recognized for his contributions to the advancement of electrical engineering. Prof. Tsividis is the Edwin Howard Professor of Electrical Engineering at Columbia University. In addition to his selection as a Life Fellow of the IEEE, he received numerous awards and distinctions throughout his career, including the Golden Jubilee Medal from the IEEE Circuits and Systems Society in 2000, the IEEE Undergraduate Teaching Award in 2005, and the IEEE Gustav Robert Kirchhoff Award in 2007. Prof. Tsividis is the recipient of the 1984 IEEE W.R.G. Baker Prize Award for the best IEEE publication, the 1986 European Solid-State Circuits Conference Best Paper Award, and the 1998 and 2008 IEEE Circuits and Systems Society Guillemin-Cauer Best Paper Awards. He is also the co-recipient of the 1987 IEEE Circuits and Systems Society Darlington Best Paper Award and the 2003 IEEE International Solid-State Circuits Conference L. Winner Outstanding Paper Award. In 2019, Prof. Tsividis was elected a member of the National Academy of Engineering (NAE), one of the highest professional honors awarded to an engineer, citing his “contributions to analog and mixed-signal integrated

circuit technology and engineering education.” See <https://www.nae.edu/204145/Professor-Yannis-Tsividis>.

32. Prof. Tsividis continues to receive recognition for the detailed teachings described and claimed in the Asserted Patents. By way of example, the IEEE Solid-State Circuits Magazine recently featured Prof. Tsividis and his explanation of related subject matter in its Fall 2018 issue, based on a presentation given at the Forum on Energy Efficient Analog Design, IEEE Solid-State Circuits Conference 2018. See Yannis Tsividis, *Signal-to-Noise Ratio, Dynamic Range, and Power Dissipation*, IEEE SOLID-STATE CIRCUITS MAG., Fall 2018, at 60. As discussed above, the Fall 2014 issue of the same trade publication featured Prof. Tsividis on the cover of a special edition dedicated to the recognition of his role as a “Path-Breaking Researcher and Educator.” That issue featured his many contributions to solid-state circuits and systems education, metal-oxide semiconductor (MOS) modeling, and analog and integrated circuit (IC) design. Indeed, the detailed teachings and the inventions claimed in the Asserted Patents (and their predecessor patents) became fundamental to radio receiver design.

33. Theta IP is the owner by assignment of each of the Asserted Patents, each of which is presumed valid and enforceable.

34. The Theta/Tsividis family of patents that includes the Asserted Patents has been cited by United States Patent and Trademark Office examiners and applicants on numerous occasions, including in patent applications filed by Samsung, Qualcomm, Broadcom, Ericsson, Intel, Texas Instruments, and others.

35. In the years leading up to the claimed inventions, wireless connectivity was gaining in popularity. Increasingly, laptops were fitted with wireless networking cards. Mobile phone adoption was also on the rise, as was prevalence of cellular data. A downside of this

connectivity was a corresponding drain on battery life, especially for mobile devices; the power consumed by a wireless transmitter and receiver reduces the usefulness of a device and sends a user on a hunt to recharge—or requires a larger battery to achieve the same battery life that would be achieved absent the wireless capabilities.

36. As the specifications of the Asserted Patents explain, one reason why this power drain was high is that electronic circuits are typically designed to function properly under worst-case operating conditions. For a wireless transceiver (a combined receiver and transmitter), the worst-case condition occurs when the reception of the desired signal is low, while other transceivers, nearby electronic equipment, or other factors generate interfering signals and spurious noise. This worst-case condition is typically accompanied by a worst-case power consumption owing to the need for increased amplifier gain and bias and impedance scaling to achieve and maintain adequate connectivity.

37. But a wireless transceiver does not always operate in these worst-case conditions. For example, a base station, router, or access point may be nearby such that the received signal is strong. Also, there may be no interfering signals, or the interfering signals may be relatively weak. In these situations, receiver bias currents can be reduced below what is necessary for the worst-case condition. If this is done appropriately, power dissipation is reduced while signal-to-noise ratio is appropriately managed, and battery life is increased. Contrary to designing to, and always operating for, the “worst case,” the Asserted Patents describe and claim methods that adapt to a better-than-worst-case condition, thus reducing circuit currents and therefore power dissipation and battery drain accordingly.

38. Prof. Tsividis’s inventions use bias current control and varying impedance, gain, and other dynamic changes (separately or in combination) to reduce power dissipation when

conditions are better than a worst case. For example, bias currents are reduced in response to a need for reduced signal handling capability and impedances are varied/controlled thus reducing required drive and other bias currents in response to a strong received signal or varying gain and/or impedances in response to a received signal in the presence of no or weak interfering signals.

39. The Asserted Patents claim various implementations of Prof. Tsividis's inventions. By way of example, the Asserted Patents teach that circuitry may be used to determine the signal strength of the desired signal and an interferer signal. That information about the desired signal and interferer signal is used to adjust the operating characteristics of the components in the receiver's signal path—for example, the amplifier(s), mixer(s), and/or filter(s)—relative to a worst-case condition. By varying a bias current and/or an impedance, power dissipation is lowered relative to a worst-case condition. The specification describes that operating parameters, including bias current, impedance, and gain, are dynamically changed, either separately or in combination, to reduce power dissipation in response to better-than-worst case conditions.

40. The specification provides appropriate teachings to allow a person of ordinary skill in the art to practice the inventions in exemplary battery-powered mobile devices. Detailed figures and narrative descriptions explain the roles of the dynamic range and noise floors for particular operating conditions, and the effects that changes to biasing, gain, and impedances (as examples) will have on the operating characteristics of a receiver, as well as their attendant impact on power consumption. Indeed, the claims and specification provide appropriate direction to allow an ordinarily skilled artisan to implement the claimed inventions without extensive experimentation.

41. An essential aspect of effective power management includes understanding when, how, and where energy is used in a device—in other words, how much energy does each component (or sub-system) consume, and under what circumstances. For example, a typical mobile phone is most often in a standby mode, where it is not in active use but must maintain contact with cellular towers so that it is prepared to receive an incoming call. In this state, the cellular radio subsystem (including its transceiver and related components) is most pronounced in its relative power consumption as compared with other components (e.g., the application processor, graphics, LCD, RAM, etc., none of which is in active use). While the phone is in active use, other subsystems may then consume more energy, but the cellular components continue to demand a significant share of the phone’s available battery power. Optimizing power consumption of the phone’s cellular receiver, therefore, offers a significant improvement in a mobile device’s power consumption and attendant battery life across a wide array of usage scenarios.

42. The inventions described and claimed in the Asserted Patents provide important advances in mobile wireless communications, by offering novel solutions that allow for a significant reduction in the power consumed by wireless receivers by responding to the conditions experienced by the device. By determining the signal levels of desired and interferer signals, it is possible to tune the operational characteristics of the components within a receiver’s signal path to optimize the receiver’s power consumption—with an attendant improvement to battery life.

### **The Asserted Patents**

43. Theta is the assignee and owner of all rights to enforce U.S. Patent No. 7,010,330, entitled “Power Dissipation Reduction in Wireless Transceivers,” and has full rights to sue and

recover damages from all past, present, and future infringements of the '330 Patent. The United States Patent and Trademark Office duly and legally issued the '330 Patent on March 7, 2006. Yannis Tsvidis is the sole inventor of the inventions claimed in the '330 Patent. A true and correct copy of the '330 Patent is attached as **Exhibit A**.

44. The '330 Patent describes and claims methods for improving battery life in a wireless device by reducing the receiver's power dissipation by dynamically varying the impedance, bias current, or gain of one or more components in the receiver signal path based upon determined signal strengths. The '330 Patent describes, for example, making gain adjustments and scaling impedance in circuits in portions of a received signal path, based on determination of signal strength. These dynamic adjustments save power and provide valuable improvement to battery life in varying real-world conditions.

45. Theta is the assignee and owner of all right to enforce U.S. Patent No. 10,129,825, entitled "Power Dissipation Reduction in Wireless Transceivers," and has full rights to sue and recover damages from all past, present and future infringements of the '825 Patent. The United States Patent and Trademark Office duly and legally issued the '825 Patent on November 13, 2018. Yannis Tsvidis is the sole inventor of the inventions claimed in the '825 Patent. A true and correct copy of the '825 Patent is attached as **Exhibit B**.

46. The '825 Patent describes and claims methods for improving battery life in a wireless device by reducing the receiver's power dissipation by dynamically changing the bias current, impedance, and/or gain of one or more components in the receiver signal when operating conditions are better than a worst-case power dissipation condition (i.e., when the signal strength of the desired signal is low and the signal strength of the interferer signal is high). The '825

Patent describes various operating scenarios and associated adjustments in bias current, impedance, and/or gain to reduce power dissipation and save power.

47. Theta is the assignee and owner of all right to enforce U.S. Patent No. 10,524,202, entitled “Power Dissipation Reduction in Wireless Transceivers,” and has full rights to sue and recover damages from all past, present and future infringements of the ’202 Patent. The United States Patent and Trademark Office duly and legally issued the ’202 Patent on December 31, 2019. Yannis Tsvividis is the sole inventor of the inventions claimed in the ’202 Patent. A true and correct copy of the ’202 Patent is attached as **Exhibit C**.

48. The ’202 Patent describes and claims methods for reducing power dissipation in wireless transceivers for operating conditions that vary between best-case and worst-case scenarios. The signal strengths of the desired and interferer signals are determined and compared. In response to the comparison, the gain, impedance, and/or bias current of one or more components in the receiver signal path is dynamically adjusted to reduce power consumption from the battery. The ’202 Patent additionally describes and claims dynamically adjusting operating parameters based on changes in interferer or desired signal strength.

49. The Asserted Patents each claim priority to two Provisional U.S. Patent Applications filed on March 31, 2003 bearing Application Nos. 60/451,229 and 60/451,230. The disclosures in these Provisional Applications fully support the disclosures and claims of the Asserted Patents.

50. The applications for the ’330 and ’825 Patents were published, and the file wrappers made available for public access, on March 16, 2006 and July 21, 2016 respectively.

51. The inventions taught and claimed in the Asserted Patents solved the problems described in their specifications and in this Complaint in unconventional ways that improved the



functioning and performance of systems and methods of operating wireless receivers to reduce power consumption and improve battery life as compared to traditional approaches.

### **Lenovo's Knowledge of Infringement**

52. In 2007, Motorola was contacted by Theta about the possibility of licensing Theta's technology and patents. In 2008, discussions between Theta and Motorola occurred. On information and belief, Lenovo learned of at least the '330 Patent and its infringement of its claims, or was willfully blind to the possibility that it infringed the Asserted Patents.

53. Additionally, Lenovo became aware of the issued Asserted Patents and its infringement of them through service of the Complaint in this action.

### **Lenovo's Infringing Products**

54. Lenovo entered the smartphone market around 2010. In 2014, Lenovo acquired Motorola Mobility from Google in order to increase its market share in the United States. Today, Lenovo is the third largest smartphone company in the United States. In addition to mobile phones, Lenovo also offers an array of tablet devices that are also equipped with cellular communications capabilities.

55. Because battery life is so important, as part of its marketing efforts, Lenovo frequently touts the battery life of its mobile products. Lenovo advertises, for example, "[a]ll-day battery" and the ability to "[g]o a full day without recharging your razr." *See, e.g.*, <https://www.motorola.com/us/smartphones-razr-gen-2/p?skuId=464>; *see also* <https://www.motorola.com/us/smartphones-motorola-edge-gen-2/p?skuId=631> ("Go two days on a single charge"). Lenovo understands and appreciates that offering products that can deliver superior battery life is instrumental to the success of its products. Additionally, Lenovo

frequently refreshes its product lines to offer additional features and improved functionality over the prior generation.

56. Lenovo makes, uses, sells, offers to sell, and/or imports into the United States a number of devices that are equipped with cellular communications capabilities and power-saving technologies that infringe the Asserted Patents, including at least the following product families branded under the Motorola or “Moto” name: the Moto G Family phones (including, without limitation, Moto G Power (2021), Moto G Stylus (2022), Moto G Stylus 5G, Moto G Stylus (2021), Moto G Stylus 5G (2022), Moto G Pure, Moto G 100, Moto G Play, Moto G Stylus (2020), Moto G Fast, Moto G Power (2022), Moto G Power (2020)); the Motorola Edge Family (including, without limitation, Edge, Edge (2021), Edge (2020), Edge Plus, Edge 5G, Edge Plus (2022)); the Motorola One Family (including, without limitation, One, One 5G, One 5G Ace, One Fusion Plus, One Action, One Hyper, One Zoom); the Moto X4; the Moto E Family; the Moto Z Family; and the RAZR Family (including, without limitation, Razr, Razr (2020), Razr (2nd Gen)); as well as the following Lenovo branded series smartphones to the extent sold or offered in the United States: S Series; K Series; Legion Series; P Series; Z Series; VIBE Series; A Series; and the Tab Series products with cellular capabilities. The Accused Products in this case include at least these products.

57. One of Lenovo’s popular currently sold phones is the RAZR, depicted below:



58. In its marketing materials offering the RAZR for sale, including on its website, Lenovo advertises that with the RAZR phones you can “Go a full day without recharging your razr,” and touts “All-day battery.” <https://www.lenovo.com/us/en/p/phones/motorola-smartphones/motorola-razr/motorola-razr/len311m0001>. Lenovo makes these claims based on tests performed across mixed use profiles (including usage and standby times) under optimal network conditions. *See e.g.:*

<b>Power</b>	<ul style="list-style-type: none"> <li>• 2800mAh Battery</li> <li>• 15W TurboPower™ Charging</li> <li>• All-day battery</li> </ul> <p style="font-size: small; margin-top: 10px;">All battery life claims are approximate and based on the median user tested across a mixed use profile (which includes both usage and standby time) under optimal network conditions. Actual battery performance will vary and depends on many factors including signal strength, network and device settings, temperature, battery condition, and usage patterns.</p>
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59. Motorola makes similar claims for its other phones, based on similar battery use testing. For example, the Moto One 5g Ace is advertised as supporting over two days of battery life based on the same testing scenarios:

**Over 2 days of battery life<sup>2</sup>**

<sup>2</sup> All battery life claims are approximate and based on the median user tested across a mixed use profile (which includes both usage and standby time) under optimal network conditions. Actual battery performance will vary and depends on many factors including signal strength, network and device settings, temperature, battery condition, and usage pattern.

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

60. Each of these battery life claims is accompanied by a disclaimer instructing consumers that power consumption, and corresponding battery life, vary based on, e.g., signal strength and network setting:

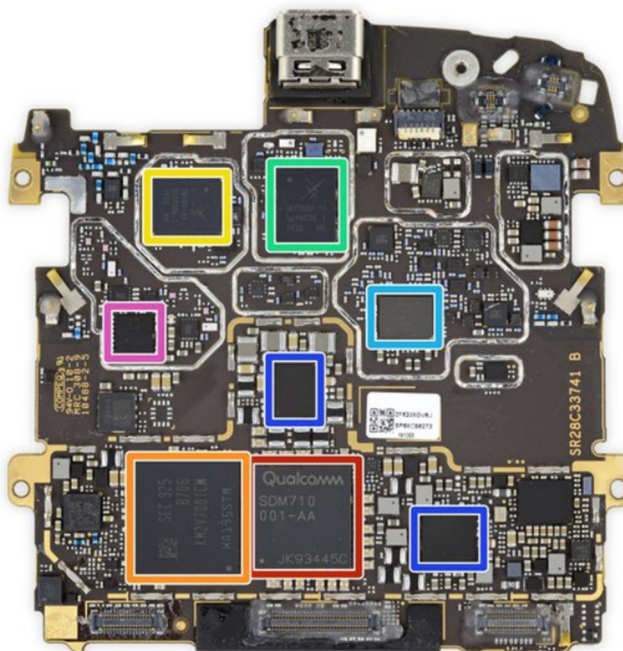
All battery life claims are approximate and based on the median user tested across a mixed use profile (which includes both usage and standby time) under optimal network conditions. Actual battery

performance will vary and depends on many factors including signal strength, network and device settings, temperature, battery condition, and usage patterns.

See, e.g., <https://www.motorola.com/us/smartphones-motorola-edge-gen-2/p?skuId=631>.

61. On information and belief, power consumption and corresponding battery life varies with, e.g., signal strength because the Accused Products employ the dynamic power dissipation technology claimed in the Asserted Patents.

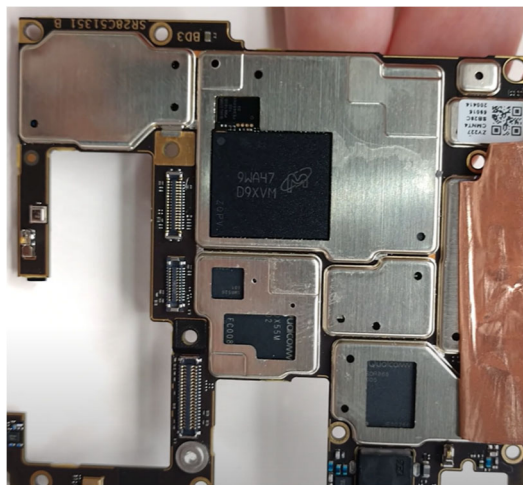
62. Each of the Accused Products includes one or more cellular receiver signal paths, including RF Front End and transceiver components used in infringing the Asserted Patents. By way of example, the RAZR includes a Qualcomm SDR660 transceiver (light blue highlight below), and Skyworks SKY78185-11 Low Band (yellow highlight) and SKY78187-11 High Band (green highlight) RF Front End components in the receive signal path:



See <https://www.ifixit.com/Teardown/Motorola+Razr+Teardown/130414#s255765>.

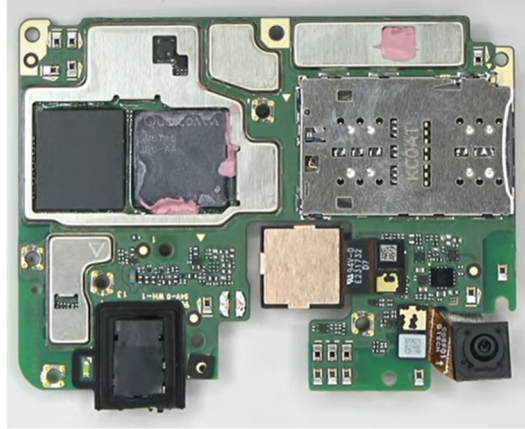
63. By way of further example: the Motorola Edge Plus includes a Qualcomm Snapdragon 865 5G Mobile Platform with a SDR865 transceiver. See

<https://www.qualcomm.com/snapdragon/device-finder/motorola-edge-plus>. The Qualcomm SDR865 transceiver and SDX55M modem components of the Edge Plus can be seen below:



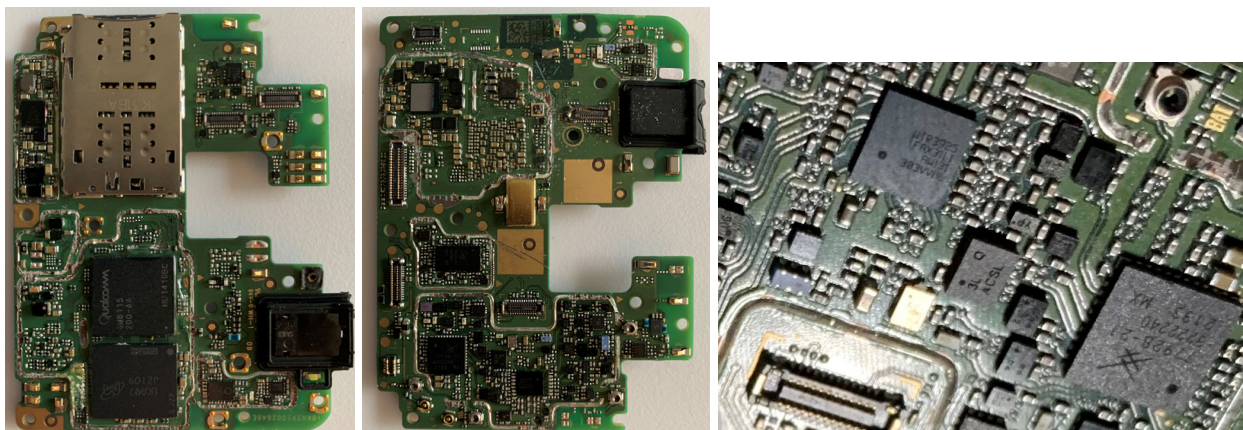
See <https://youtu.be/TLdzV7gw0fA?t=399>.

64. By way of further example: the Motorola One 5G includes a Qualcomm Snapdragon 765 5G Mobile Platform with a SDR865 transceiver (<https://www.qualcomm.com/snapdragon/device-finder/motorola-one-5g>); the Motorola Edge includes a Qualcomm Snapdragon 778G 5G Mobile Platform (<https://www.qualcomm.com/snapdragon/device-finder/motorola-edge>); and the Moto G100 includes a Qualcomm Snapdragon 870 5G Mobile Platform (<https://www.qualcomm.com/snapdragon/device-finder/moto-g100>); and the Moto G Power (2021) also includes a Qualcomm Snapdragon Mobile Platform processor:















See <https://youtu.be/infAv2uU9NA?t=156>.

65. Disassembly of a Moto G Power (2021) smartphone reveals that it includes: the Qualcomm SM6115 Application Processor / Baseband Modem chip (part of the Snapdragon 662 Mobile Platform); the Qualcomm WTR3925 transceiver; and RF Front End components including the Skyworks 77928-21 and 77643-61 front end modules:



66. By way of further example: Qualcomm features several more Motorola products on its website as including Qualcomm Snapdragon mobile platforms:

 POWERED BY SNAPDRAGON 870 5G MOBILE PLATFORM. <b>moto g100</b>	 FEATURING A SNAPDRAGON 632 MOBILE PLATFORM. <b>moto g<sup>7</sup> play</b>	 FEATURING A SNAPDRAGON 632 MOBILE PLATFORM. <b>Moto g<sup>7</sup></b>
 FEATURING A SNAPDRAGON 435 MOBILE PLATFORM. <b>moto e<sup>5</sup> plus</b>	 FEATURING A SNAPDRAGON 427 MOBILE PLATFORM. <b>moto g<sup>6</sup> play</b>	 FEATURING A SNAPDRAGON 636 MOBILE PLATFORM. <b>moto z<sup>3</sup> play</b>
 FEATURING A SNAPDRAGON 835 MOBILE PLATFORM. <b>Motorola Moto z3</b>	 FEATURING A SNAPDRAGON 630 MOBILE PLATFORM. <b>moto x<sup>4</sup></b>	 FEATURING A SNAPDRAGON 430 MOBILE PLATFORM. <b>moto g<sup>8</sup></b>
 FEATURING A SNAPDRAGON 430 MOBILE PLATFORM. <b>moto g<sup>6</sup></b>	 FEATURING A SNAPDRAGON 835 MOBILE PLATFORM. <b>Motorola Moto Z Force (2nd gen)</b>	 FEATURING A SNAPDRAGON 820 MOBILE PLATFORM. <b>Moto Z Force Droid</b>

See, e.g., <https://www.qualcomm.com/snapdragon/device-finder/motorola-edge-plus>. On information and belief, each of the Accused Products includes—as an element or complementary

component of at least the Snapdragon mobile platform—associated Qualcomm modem(s), wireless transceiver(s), and various RF front end components with infringing power-saving technology.

67. Qualcomm also advertises its Mobile Platform solutions and their components with heavy emphasis on their power-saving features—including as implemented in Motorola smartphones. *See, e.g.*, <https://www.qualcomm.com/snapdragon/device-finder/smartphones/moto-g7-power>; <https://www.qualcomm.com/news/releases/2017/05/08/qualcomm-snapdragon-660-and-630-mobile-platforms-drive-advanced-photography>; <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/qualcomm-rf-front-end-infographic.pdf>; [https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/prod\\_brief\\_qcom\\_x65.pdf](https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/prod_brief_qcom_x65.pdf).

68. Lenovo’s Accused Products benefit in power-saving performance and increased selling price from including the infringing technology in components from Qualcomm and other manufacturers. *See, e.g.*, <https://www.qualcomm.com/products/technology/modems/rf>; *linking to*: <https://www.qualcomm.com/snapdragon/device-finder/motorola-edge-plus>; *linking to*: <https://www.motorola.com/us/smartphones-motorola-edge-plus/p> (“go for multiple days on a single charge” and “All battery life claims are approximate and based on the median user tested across a mixed use profile (which includes both usage and standby time) under optimal network conditions. Actual battery performance will vary and depends on many factors including signal strength, network and device settings, temperature, battery condition, and usage patterns”).

69. To the extent that additional Lenovo products incorporate or include transceiver and or RF Front End components that operate in a manner that is not colorably different from



these Accused Products described herein, then such additional Lenovo products are also “Accused Products.”

70. To the extent that additional Lenovo products include power-saving functionality that operates in a manner that is not colorably different than described herein, even if delivered without the use of particular components or component manufacturers mentioned herein, then such additional Lenovo products are also “Accused Products.”

71. As explained herein, and as will be further described in infringement contentions in this case, the Accused Products practice one or more claims of the Asserted Patents. Lenovo is not authorized or licensed to practice Theta’s claimed inventions, nor are any of Lenovo’s component suppliers, vendors, customers, or end-users. As discussed in further detail below, Lenovo’s infringement is knowing and willful.

**FIRST COUNT (INFRINGEMENT OF U.S. PATENT NO. 7,010,330)**

72. Theta incorporates by reference the allegations set forth in the paragraphs above as though fully set forth herein.

73. Lenovo makes, uses, sells, and/or offers to sell in the United States, and/or imports into the United States products that directly infringe the ’330 Patent each and every time they are powered on and used as intended (i.e., to connect to cellular wireless networks) by an end-user, including the Accused Products identified herein. Making, using, selling, offering, and importing of the Accused Products infringes at least claim 23 of the ’330 Patent, as detailed herein.

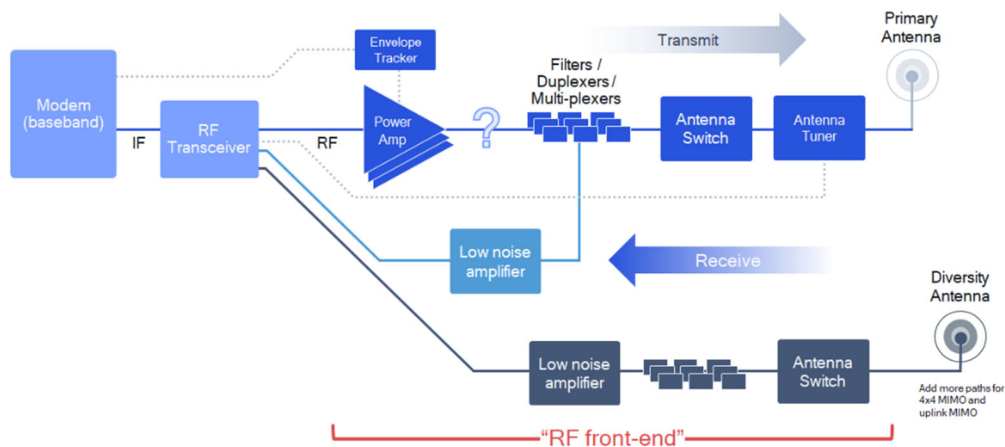
74. On information and belief, the Accused Products employ power-saving techniques that dynamically adjust impedance of components in the receiver signal path in

response to determined desired and interferer signal strengths in accordance with the '330 Patent claims.

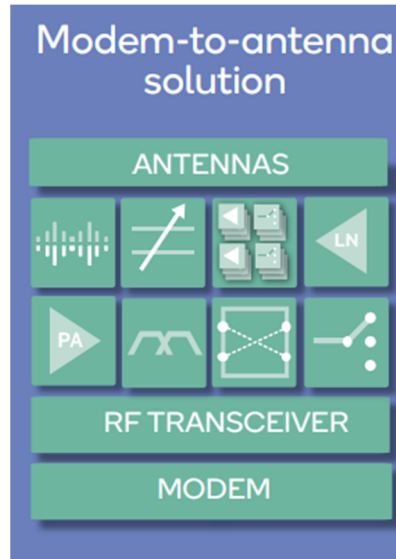
75. The Accused Products infringe at least claim 23 of the '330 Patent. Each Accused Product includes wireless transceiver circuitry necessary for the device to offer cellular calling and/or cellular data capabilities. The transceiver circuitry includes a receiver signal path.

76. The Accused Products receive wireless signals, including both a desired signal(s) (i.e., a signal that carries the voice or data of interest) and interferer signal(s). These signals are received by the transceiver circuitry via an input from an antenna in the Accused Product.

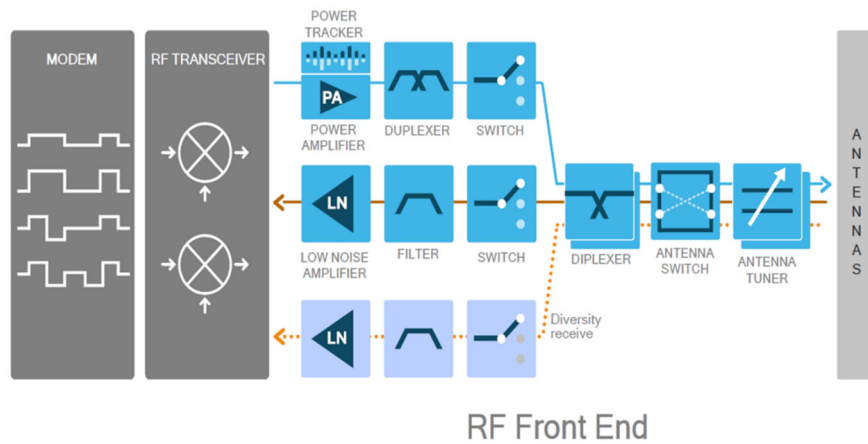
77. The wireless transceivers in the Accused Products include at least one signal path comprised of a plurality of circuits, including a low-noise amplifier, a mixer, and a low-pass filter. By way of example, as discussed above, many Lenovo Accused Products use Qualcomm mobile RF components in their receive signal paths. Qualcomm provides high-level depictions of representative signal paths of its Snapdragon 4G and 5G mobile platforms as used in the Accused Products by Lenovo—indicating that the components include such features:



See, e.g., <https://developer.qualcomm.com/blog/5g-modems-rf-and-antennas-getting-mmwave-data-device>.



See also <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/qualcomm-rf-front-end-infographic.pdf>.




See also <https://www.forbes.com/sites/tiriasresearch/2017/02/22/qualcomm-adds-complete-rf-portfolio-paves-way-to-5g/>.

78. On information and belief, RF Transceiver components from Qualcomm used by Lenovo in the Accused Products have internal signal paths comprising a low-noise amplifier, with an output coupled to a mixer, with an output coupled to a low-pass filter.

79. The Accused Products also include circuitry coupled to the signal path for determining signal strength. By way of example, the desired signal strength is displayed in

iconic form as the “bar” indicator on each Accused Product and can also be accessed via service screen and administrative functions:

2. Navigate: **Settings**  **About phone**.
3. Tap **SIM Status**.
4. Obtain the following Received Signal Strength Indicator (RSSI) info from the customer:
  - Signal strength  
→ For more info, refer to [My Verizon Diagnostics Network Values for Signal Strength](#). The RSSI definitions shouldn't be shared with the customer.
  - Mobile voice network type  
→ LTE
  - Mobile data network type
    - LTE
    - 5G

*See, e.g.*, <https://www.verizon.com/support/knowledge-base-239835/> (illustrating how to view received signal strength RSSI via the user interface of a Motorola Edge 5G phone).

80. The Accused Products also includes circuitry coupled to the signal path for determining the signal strength of the interferer signal. By way of example, multiple patents of Qualcomm—filed after and citing to Prof. Tsividis’ inventions—discuss jammer detection circuitry. *See, e.g.*, U.S. Patent No. 8,781,426 at 3:44–59, 9:50–61 (“For example, the bias current may be increased when jammers are detected or decreased when jammers are not detected. The bias current may also be adjusted by different amounts depending on the jammer strength.”). “Jammer” refers to an interferer signal or signals. On information and belief, Qualcomm includes jammer detection circuitry in components used by Lenovo in the Accused Products. The jammer detection feature in the Accused Products determines the jammer signal strength levels.

81. The Accused Products also dynamically adjust impedance of circuit components in the signal path, including to reduce a switching current, in response to the signal strength measurements described herein.

82. For example, on information and belief, RF Transceiver components from Qualcomm used by Lenovo in the Accused Products have programmable “gain states” which effect variable bias currents and/or impedances in the circuits. *See, e.g.*, U.S. Patent No. 8,521,198, “Dynamic LNA Switch Points Based on Channel Conditions,” at 8:58–60 (“The jammer indicators from all jammer detectors may be used to select the switch points, gain, and/or bias of the LNA”).

83. By way of further example, a page from the WTR3925 transceiver datasheet, available online, confirms that the device has programmable gain modes to control, e.g., the LNA performance and power consumption at different desired signal strengths and jammer signal strengths:

Table 3-8 UMTS Rx performance specifications (cont.)



Parameter	Comments	Min	Typ	Max	Unit
Survivable input level (LNA off)		–	–	+23	dBm
Input VSWR (in-band)	50 $\Omega$ single-ended, external match	–	–	2.1	–
LO to RF leakage (in-band)	All gain modes, at LNA input	–	–	-60	dBm
Residual sideband level (uncal)	Due to amplitude and phase imbalance	–	-35	-28	dBc
DC offset at I/Q outputs <sup>1</sup>		-100	–	100	mV
Single-ended I/Q load capacitance <sup>2</sup>	Each BBI and BBQ pin	–	–	12	pF
<b>Gain mode G0</b>					
Voltage conversion gain		49	53	57	dBV/V
Noise figure <sup>3</sup>	Small signal, single sideband	–	2.3	3.0	dB
Input IP3 <sup>4</sup> (ACS)					dBm
Ref 99/HSDPA/HSPA/HSPA+	S = -90 dBm, J1 = J2 = -44 dBm	-22	-10	–	dBm
DC-HSPA+/3G-HSPA+	S = -90 dBm, J1 = J2 = -47 dBm	-22	-10	–	dBm
Input IP3 <sup>5</sup> (triple beat)	S = -90, J = -55; TX1 = TX2 = -33 dBm	-7	-1	–	dBm
Input IP2 <sup>6</sup>	S = -90 dBm, TX1 = TX2 = -30 dBm	–	54	–	dBm
<b>Gain mode G1</b>					
Voltage conversion gain		40	44	48	dBV/V
Noise figure <sup>3</sup>	Small signal, single sideband	–	3.5	4.5	dB
Input IP3 <sup>4</sup> (ACS)	S = -90 dBm, J1 = J2 = -47 dBm	-12	-10	–	dBm
Input IP3 <sup>5</sup> (triple beat)	S = -90, J = -55; TX1 = TX2 = -33 dBm	-7	-1	–	dBm
<b>Gain mode G2</b>					
Voltage conversion gain		22	26	30	dBV/V
Noise figure <sup>3</sup>	Small signal, single sideband	–	16	19	dB
<b>Gain mode G3</b>					
Voltage conversion gain		13	17	21	dBV/V
Noise figure <sup>3</sup>	Small signal, single sideband	–	26	29	dB

Ref: 80-NH379-1

84. Qualcomm has previously marketed infringing receiver technology under the name “IntelliCiever.” On information and belief, while Qualcomm no longer advertises using the IntelliCiever term, the same or materially similar technology has been utilized in subsequent generations of Qualcomm’s transceiver and RF Front End components, including those used by

Lenovo in the Accused Products. Qualcomm’s IntelliCiver Data Review presentation identifies the variable gain states and their effect on current consumption:

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### Current Consumption (mA)

Cell, PRx Only	High Lin	Mid Lin	Low Lin	delta
Idle	25.5	13.0	14.5	11.0
G0	61.1	43.0	30.4	30.7
G1	55.3	37.1	30.0	25.3
G2	51.0	32.9	27.4	23.8
G3	51.0	32.9	27.4	23.8
G4	51.0	32.9	27.4	23.8

- Limited sample size and early data
- G0 = highest gain
- G4 = lowest gain
- PCS addressed in commercial samples



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See “IntelliCiver Data Review” documents attached to U.S. Provisional Application No. 60/800,484 filed on May 15, 2006, *available at* <https://portal.uspto.gov/pair/PublicPair>.

85. Qualcomm’s IntelliCiver, and successor technology, determines interferer levels in a received signal and adjusts the current consumption of components within the receiver signal path, including the amplifiers, filters, and mixers based on the operational characteristic encountered by the receiver, to optimize power dissipation:

Ciccarelli, Strain (intecent) 05/11/05

### Architecture Summary

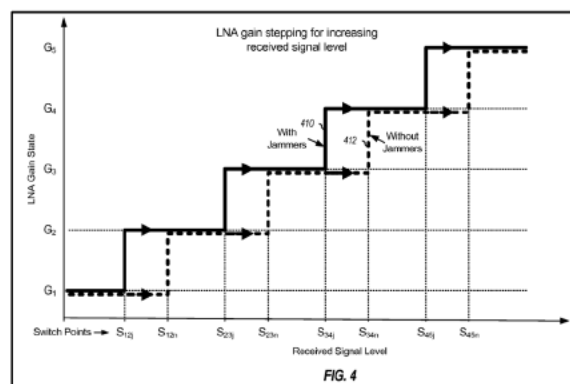
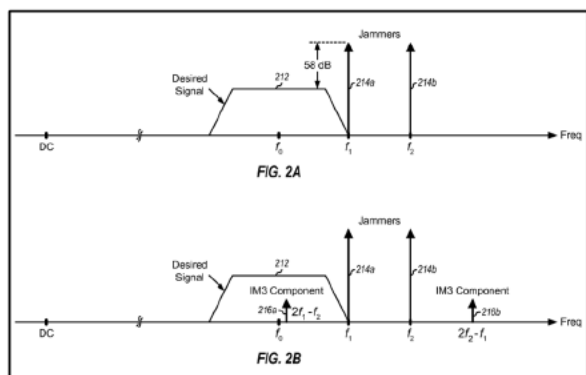
- When jammers are below a threshold, reduce current of these blocks:
  - LNA, mixer
    - X-mod
  - VCO
    - Reciprocal mixing
  - Baseband, analog  $g_m C$  filters
    - $\frac{1}{2}$  the  $g_m$ , 4x the capacitance  $\Rightarrow$  same pulse shaping
- Two jammer detectors
  - Poor man’s FFT
  - Differentiate between close-in and far-out jammers

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*Id.*

86. In the Accused Products, the bias current of one or more of the plurality of circuits in the receiver signal path is adjusted based upon the determined desired signal strength and interferer signal strength. *See, e.g.*, U.S. Patent No. 8,521,198 at 9:17–19 (“A bias selector 542 receives the jammer indicator and/or the received signal level and generates a bias control for LNA 120.”). For example, on information and belief, measured changes in the determined desired signal strength and/or interferer signal strength cause adjustments to the gain state (or gain mode) of the system.



*See, e.g., id.* at 3:56–4:59, Figs. 2A, 2B, 4.

87. On information and belief, in the Accused Products, the impedance of one or more of the plurality of circuits in the receiver signal path is also adjusted—based upon the change in gain state caused by measured changes in the determined desired signal strength and/or interferer signal strength—according to claim 23 of the '330 Patent.

88. Lenovo directly infringes the apparatus claims of the '330 Patent by making, using, selling, offering for sale, and/or importing the Accused Products.

89. Each and every time an Accused Product is powered on and used as intended, the Accused Product is configured to and does operate according to the claims of the '330 Patent, and practices the method(s) claimed in the '330 Patent, constituting direct infringement by its user(s). By way of example, such users include Lenovo’s customers, as well as Lenovo

personnel acting within the scope of their employment with Lenovo, including by testing and using the Accused Products in the United States.

90. Lenovo has injured Theta and is liable to Theta for directly infringing one or more claims of the '330 Patent, including, without limitation, claim 23 pursuant to 35 U.S.C. § 271(a).

91. Lenovo also infringes the '330 Patent under 35 U.S.C. § 271(b) & (c).

92. Lenovo knowingly encourages and intends to induce infringement of the '330 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including, but not limited to, the Accused Products, with knowledge of the '330 Patent and with knowledge and specific intention that such products will be used by its customers and personnel, and that such use will necessarily result in infringement of the '330 Patent. Lenovo had actual knowledge of the '330 Patent and that its actions would lead to infringement, and/or Lenovo had knowledge of the foregoing by way of willful blindness to the existence of the '330 Patent and to the fact that its actions would lead to infringement.

93. Lenovo also contributes to the infringement of the '330 Patent. Lenovo makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including, but not limited to, the '330 Accused Products, with knowledge of the '330 Patent, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '330 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use. Lenovo had actual knowledge of the '330 Patent, and that its products constitute a material part of the invention and are especially made or adapted for use in infringing the invention, and that the products are not staple articles or commodities of commerce capable of substantial non-infringing use, and/or Lenovo had knowledge of the foregoing by way of willful blindness to the



existence of the '330 Patent, to the fact that its products constitute a material part of the invention and are especially made or adapted for use in infringing the invention, and to the fact that the products are not staple articles or commodities of commerce capable of substantial non-infringing use.

94. Lenovo has had knowledge of the infringing nature of its activities, including that any use of the Accused Products as intended would directly infringe the devices and methods claimed in the '330 Patent, and nevertheless continued, and continues its infringing activities with respect to the '330 Patent.

95. Lenovo intended that its customers and personnel infringe the asserted claims because practice of the asserted claims was necessary in order to achieve the battery life touted in Lenovo's promotional materials. Indeed, Lenovo touted the advantages of the battery life and physical characteristics (e.g., weight, size, and availability of larger screens) that could not be achieved in the advertised form factors but for the implementation of Prof. Tsividis' claimed methods.

96. As described herein, the claims of the '330 Patent are necessarily infringed when the Accused Products are powered on and used as intended. No mechanism is provided to prevent a user from practicing the claims, and users are barred by license from disabling or altering the relevant functionality of the Accused Products. Thus, there are no substantial non-infringing uses of the Accused Products.

97. Lenovo's infringement of the '330 Patent has been and continues to be deliberate and willful, and therefore, this is an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284–285. On information and belief, Lenovo had knowledge of the issued '330 Patent prior to the filing of this Complaint, including by way of

willful blindness. And Lenovo had actual knowledge of the '330 Patent at least with the filing of this Complaint. After acquiring that knowledge, Lenovo infringed the '330 Patent, and in doing so, it knew, or should have known, that its conduct amounted to infringement of the '330 Patent.

98. As a result of Lenovo's infringement of the '330 Patent, Theta has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Lenovo's infringement, but in no event less than a reasonable royalty with interest and costs.

**SECOND COUNT (INFRINGEMENT OF U.S. PATENT NO. 10,129,825)**

99. Theta incorporates by reference the allegations set forth in the paragraphs above as though fully set forth herein.

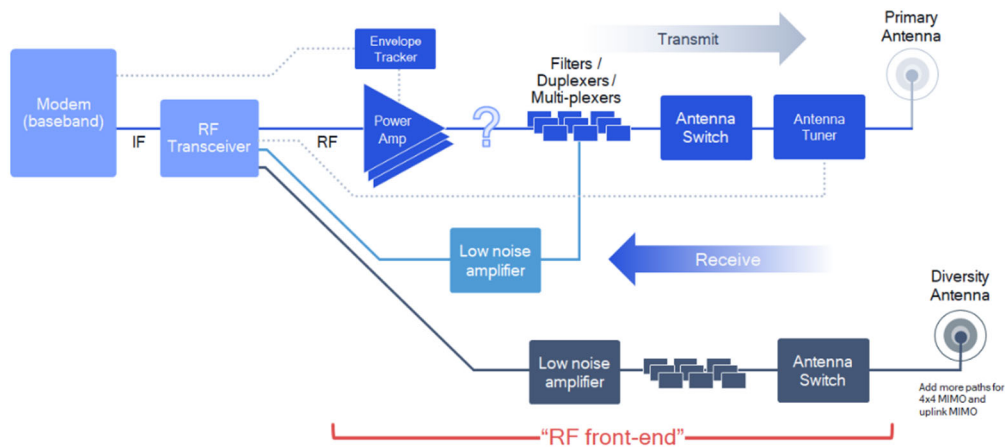
100. Lenovo makes, uses, sells, and/or offers to sell in the United States, and/or imports into the United States products that directly infringe the '825 Patent each and every time they are powered on and used as intended (i.e., to connect to cellular wireless networks) by an end-user, including the Accused Products identified herein. Use of the Accused Products infringes at least claim 3 of the '825 Patent.

101. On information and belief, the Accused Products employ power-saving techniques that dynamically adjust bias current and/or impedance of components in the receiver signal path in response to determined desired and interferer signal strengths in accordance with the '825 Patent claims, including through techniques employed in transceiver, modem, and RF Front End components of the Accused Products.

102. The Accused Products infringe at least claim 3 of the '825 Patent. Each Accused Product is a battery powered portable wireless device. Each includes wireless transceiver circuitry necessary for the device to offer cellular calling and/or cellular data capabilities. The transceiver circuitry includes a receiver signal path.

103. The Accused Products receive wireless signals, including both a desired signal(s) (i.e., a signal that carries the voice or data of interest) and interferer signal(s). These signals are received by the transceiver circuitry via an input from an antenna in the Accused Products.

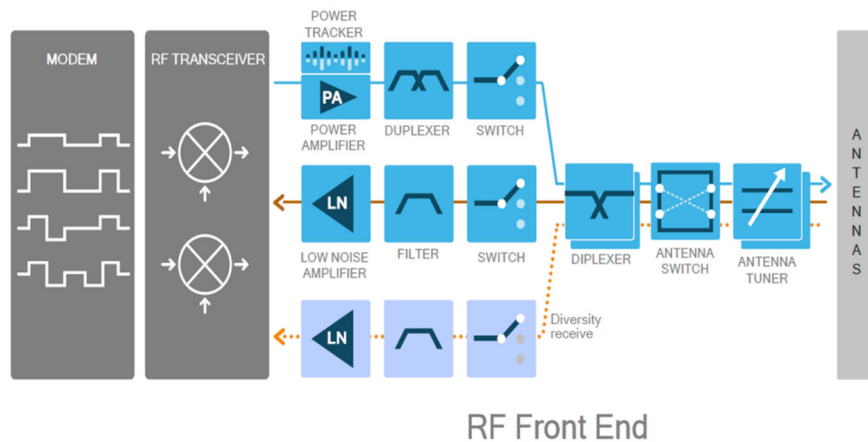
104. The wireless transceivers in the Accused Products include at least one signal path comprised of a plurality of circuits, including an amplifier, a filter, and a mixer. By way of example, as discussed above, many Lenovo Accused Products use Qualcomm mobile RF components in their receive signal paths. Qualcomm provides high-level depictions of representative signal paths of its Snapdragon 4G and 5G mobile platforms as used in the Accused Products by Lenovo—indicating that the components include such features:



See, e.g., <https://developer.qualcomm.com/blog/5g-modems-rf-and-antennas-getting-mmwave-data-device>.




See also <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/qualcomm-rf-front-end-infographic.pdf>.



See also <https://www.forbes.com/sites/tiriasresearch/2017/02/22/qualcomm-adds-complete-rf-portfolio-paves-way-to-5g/>.

105. The Accused Products also include circuitry for determining the desired signal strength. By way of example, the desired signal strength is displayed in iconic form as the “bar” indicator on each Accused Product and can also be accessed via service screen and administrative functions:

2. Navigate: **Settings**  **About phone**.
3. Tap **SIM Status**.
4. Obtain the following Received Signal Strength Indicator (RSSI) info from the customer:
  - Signal strength
    - For more info, refer to [My Verizon Diagnostics Network Values for Signal Strength](#). The RSSI definitions shouldn't be shared with the customer.
  - Mobile voice network type
    - LTE
  - Mobile data network type
    - LTE
    - 5G

*See, e.g.*, <https://www.verizon.com/support/knowledge-base-239835/> (illustrating how to view received signal strength RSSI via the user interface of a Motorola Edge 5G phone).

106. The Accused Products also includes circuitry for determining the signal strength of the interferer signal. By way of example, multiple patents of Qualcomm—filed after and citing to Prof. Tsvidis’ inventions—discuss jammer detection circuitry. *See, e.g.*, U.S. Patent No. 8,781,426 at 3:44–59, 9:50–61 (“For example, the bias current may be increased when jammers are detected or decreased when jammers are not detected. The bias current may also be adjusted by different amounts depending on the jammer strength.”). “Jammer” refers to an interferer signal or signals. On information and belief, Qualcomm includes jammer detection circuitry in components used by Lenovo in the Accused Products. The jammer detection feature in the Accused Products determines the jammer signal strength levels in order to optimize power consumption.

107. Consistent with exemplary claim 3 of the ’825 Patent, a worst-case power dissipation condition occurs when the signal strength of the desired signal is low, and the signal strength of the interferer signal is high in relation to it. In such case in the Accused Products, it is necessary to amplify the received signal to a stage where the desired signal is detectible using a gain stage. Such amplification will also amplify the interferer (jammer) signal necessitating,

for example, high bias currents to achieve sufficient linearity and dynamic range. Adjustments may also be required to reduce gain in order to stay within the maximum signal strength that the device can receive in a particular signal condition.

108. The receivers in the Accused Products achieve a reduction in power dissipation by dynamically altering the bias currents and/or impedances of the components in the signal receive path. For example, on information and belief, the transceiver and RF Front End amplifier components used by Lenovo in the Accused Products have programmable “gain states” which effect variable bias currents and/or impedances in the circuits. *See, e.g.*, U.S. Patent No. 8,521,198, “Dynamic LNA Switch Points Based on Channel Conditions,” at 8:58–60 (“The jammer indicators from all jammer detectors may be used to select the switch points, gain, and/or bias of the LNA”).

109. By way of further example, on information and belief, RF Front End Components from Qualcomm, Skyworks, and other manufacturers used by Lenovo in the Accused Products have programmable “gain states” which effect variable current and power dissipation in their low noise amplifier (LNA) elements. For example, a Skyworks datasheet, available online, confirms that the various front end modules containing LNAs that are marketed by Skyworks employ software programmable registers to control the LNA gain state and bias, effecting the current and power dissipation in their amplifier components:

**SKYWORKS**

**PRELIMINARY DATA SHEET**  
**SKY53735-21: LB / LMB / MB / HB and 4x4 MIMO Diversity Receive Module**

**Applications**

- Antenna cable loss compensation circuit
- 2G, 3G, 4G, 5G multiband cellular handsets (5G NR, LTE, WCDMA, GSM, EDGE, and GPRS)
- Embedded data cards

**Features**

- Reversible FEM with the following integrated filter bands:
  - B0 (800 to 960 MHz)
  - B0S1819 (850 to 904 MHz)
  - B1 (1800 to 1920 MHz)
  - B3 (1800 to 1920 MHz)
  - B3S2 (1800 to 1920 MHz)
  - B4 (2010 to 2025 MHz)
  - B4S1 (2110 to 2205 MHz)
  - B4S2 (2300 to 2400 MHz)
  - B4S3 (2400 to 2600 MHz)
  - B7 (2670 to 2690 MHz)
- Auxiliary LNA ports:
  - LNA\_AuxN\_MB1\_644 (1800 to 2020 MHz)
  - LNA\_AuxN\_MB1\_645 (2200 to 2700 MHz)
  - LNA\_AuxN\_MB2 (2200 to 2700 MHz)
  - LNA\_AuxN\_MB1 (1400 to 2020 MHz)
  - LNA\_AuxN\_MB2 (1400 to 2020 MHz)
  - LNA\_AuxN\_MB1\_671 (1800 to 1920 MHz)
  - LNA\_AuxN\_MB2\_671 (1800 to 1920 MHz)
  - LNA\_AuxN\_MB1\_672 (1800 to 1920 MHz)
  - LNA\_AuxN\_MB2\_672 (1800 to 1920 MHz)
- Integrated MPR RFTE interface
  - Standard size 42 x 42 x 2.3 mm, non-42-lead package
  - Lead (Pb) free and RoHS-compliant
  - EMI/RFI 100% TC per JEDEC J-STD-020

**Description**

The SKY53735-21 is a low-band (LB)/mid-band (MB)/mid-band (MB)/high-band (HB) diversity receiver module to be used in cellular mobile devices. The device supports cellular diversity receiver functions and is scalable to support 4x4 MIMO original and existing band requirements.

The diversity module supports all key 2, and 3 carrier aggregation band combinations.

High performance, multi-gain mode LNAs are integrated enabling compatibility to next generation 5G-mmWave (E)E implementations.

The SKY53735-21 is compatible with 3GPP GSM, WCDMA, LTE, LTE-A and 5G standards and includes filters for the following carrier bands: B0, B0S1819, B1, B3, B3S2, B4, B4S1, B4S2, B4S3, B7, B4S1\_671, and B7.

Figure 1 shows the functional block diagram for the SKY53735-21, and the pinout is shown in Figure 2. Signal pin assignments and functional pin descriptions are described in Table 1.

Skyworks Solutions, Inc. • Phone (781) 376-3000 • Fax (781) 376-3100 • info@skyworks.com • www.skyworks.com  
 202207 • Skyworks Proprietary Information • Product and Patent Information Subject to Change Without Notice • January 7, 2022

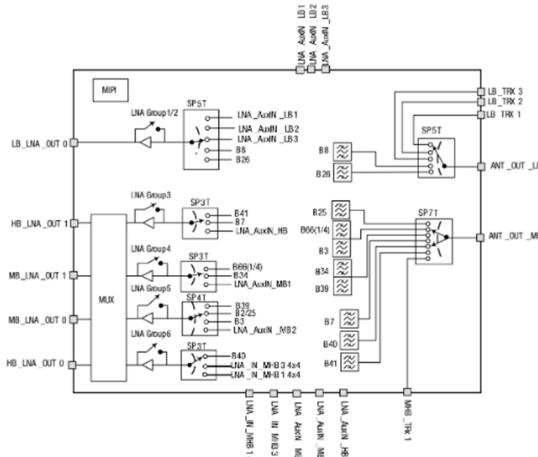


Figure 1. SKY53735-21 Functional Block Diagram

Block	Symbol	LNA Group	Gain/Bias	Control Bits	Register Address		Options
					Gain	Bias	Description
LNA Power Control Block	0x0E	LNA Group1	Gain	5:3	000	LNA Gain Control (Gain setting options selected in bit [0] of Register 0x15)	0x00 G7 (highest gain)
							0x01 G6
							0x02 G5
							0x03 G4
							0x04 G3
							0x05 G2
							0x06 G1
		LNA Group1	Bias	2:0	000	LNA Bias Control	0x00 bias0 (lowest bias)
							0x01 bias1
							0x02 bias2
							0x03 bias3
							0x04 bias4
							0x05 bias5
							0x06 bias6
0x07 bias7 (highest bias)							

Table 10. B41 RF Performance

Parameter	Symbol	Gain State	Mode 0			Mode 1			Unit
			Min	Typ	Max	Min	Typ	Max	
Frequency	B41	mode0 = [G7, G6, G5, G4, G3, G2, G1, G0] mode1 = [G7, G6, G5, G4, G3, G2, G1]	2496		2690	2496		2690	MHz
LNA current	IDD	G7		9.6		9.6			mA
		G6		5.1		5.1			
		G5		4.2		2.9			
		G4		2.9		2.5			
		G3		2.9		1.4			
		G2		2.9		0.3			
		G1		1.5		0.3			
G0		0.3		NA					

110. Qualcomm has previously marketed infringing receiver technology under the name “IntelliCiever.” On information and belief, while Qualcomm no longer advertises using the IntelliCiever term, the same or materially similar technology has been utilized in subsequent generations of Qualcomm’s transceiver and RF Front End components, including those used by Lenovo in the Accused Products. Qualcomm’s IntelliCiever Data Review presentation identifies the variable gain states and their effect on current consumption:

Current Consumption (mA)

Cell, PRx Only	High Lin	Mid Lin	Low Lin	delta
Idle	25.5	13.0	14.5	11.0
G0	61.1	43.0	30.4	30.7
G1	55.3	37.1	30.0	25.3
G2	51.0	32.9	27.4	23.8
G3	51.0	32.9	27.4	23.8
G4	51.0	32.9	27.4	23.8

- Limited sample size and early data
- G0 = highest gain
- G4 = lowest gain
- PCS addressed in commercial samples

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See “IntelliCeiver Data Review” documents attached to U.S. Provisional Application No. 60/800,484 filed on May 15, 2006, available at <https://portal.uspto.gov/pair/PublicPair>.

111. Qualcomm’s IntelliCeiver, and successor technology, determines interferer levels in a received signal and adjusts the current consumption of components within the receiver signal path, including the amplifiers, filters, and mixers based on the operational characteristic encountered by the receiver, to optimize power dissipation:

Architecture Summary

- When jammers are below a threshold, reduce current of these blocks:
  - LNA, mixer
    - X-mod
  - VCO
    - Reciprocal mixing
  - Baseband, analog  $g_m C$  filters
    - $\frac{1}{2}$  the  $g_m$ , 4x the capacitance  $\Rightarrow$  same pulse shaping
- Two jammer detectors
  - Poor man’s FFT
  - Differentiate between close-in and far-out jammers

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*Id.*

112. By way of further example, on information and belief, transceiver components from Qualcomm used by Lenovo in the Accused Products have programmable “gain states” which effect variable current and power dissipation in their low noise amplifier (LNA) elements.



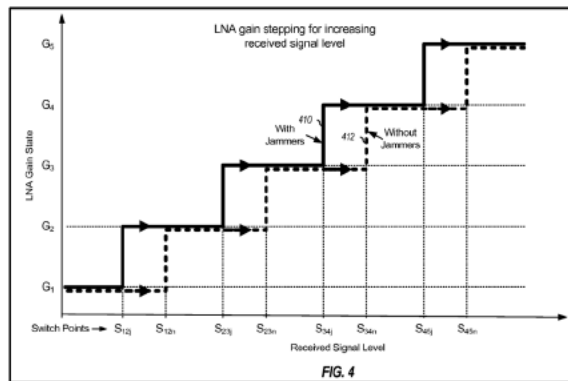
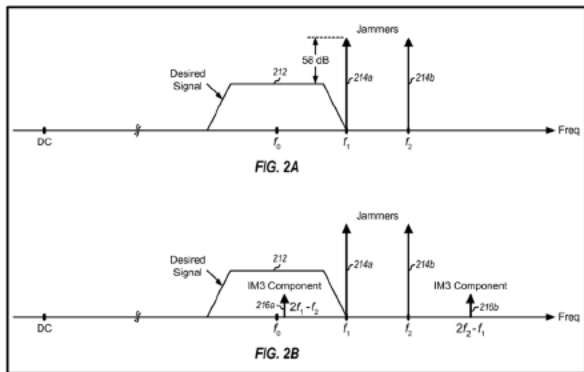
For example, a page from the WTR3925 transceiver datasheet, available online, confirms that the device has programmable gain modes to control, e.g., the LNA performance and power consumption at different desired signal strengths and jammer signal strengths:

Table 3-8 UMTS Rx performance specifications (cont.)

Parameter	Comments	Min	Typ	Max	Unit	
Survivable input level (LNA off)		-	-	+23	dBm	
Input VSWR (in-band)	50 $\Omega$ single-ended, external match	-	-	2.1	-	
LO to RF leakage (in-band)	All gain modes, at LNA input	-	-	-60	dBm	
Residual sideband level (uncal)	Due to amplitude and phase imbalance	-	-35	-28	dBc	
DC offset at I/Q outputs <sup>1</sup>		-100	-	100	mV	
Single-ended I/Q load capacitance <sup>2</sup>	Each BBI and BBQ pin	-	-	12	pF	
<b>Gain mode G0</b>						
Voltage conversion gain		49	53	57	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	2.3	3.0	dB	
Input IP3 <sup>4</sup> (ACS)	Rel 99/HSDPA/HSPA/HSPA+ DC-HSPA+/3C-HSPA+	S = -90 dBm, J1 = J2 = -44 dBm S = -90 dBm, J1 = J2 = -47 dBm	-22 -22	-10 -10	- -	dBm dBm
Input IP3 <sup>5</sup> (triple beat)		S = -90, J = -55, TX1 = TX2 = -33 dBm	-7	-1	-	dBm
Input IP2 <sup>6</sup>		S = -90 dBm, TX1 = TX2 = -30 dBm	-	54	-	dBm
<b>Gain mode G1</b>						
Voltage conversion gain		40	44	48	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	3.5	4.5	dB	
Input IP3 <sup>4</sup> (ACS)		S = -90 dBm, J1 = J2 = -47 dBm	-12	-10	-	dBm
Input IP3 <sup>5</sup> (triple beat)		S = -90, J = -55, TX1 = TX2 = -33 dBm	-7	-1	-	dBm
<b>Gain mode G2</b>						
Voltage conversion gain		22	26	30	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	16	19	dB	
<b>Gain mode G3</b>						
Voltage conversion gain		13	17	21	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	26	29	dB	

Ref: 80-NH379-1

113. In the Accused Products, the bias current of one or more of the plurality of circuits in the receiver signal path is adjusted based upon the determined desired signal strength and interferer signal strength. *See, e.g.,* U.S. Patent No. 8,521,198 at 9:17–19 (“A bias selector 542 receives the jammer indicator and/or the received signal level and generates a bias control for LNA 120.”). For example, on information and belief, when the interferer signal is high and the signal strength of the desired signal is low, as measured in the Accused Products, and the desired signal is larger than in a worst-case power dissipation condition, the bias current(s) of one or more of the circuits in the receiver signal path of the wireless transceiver are changed compared to the worst-case power dissipation condition, thereby saving power (e.g., the gain is changed from a G0 state to a G1 state, or G1 to G2 state, etc.).



See, e.g., *id.* at 3:56-4:59, Figs. 2A, 2B, 4.

114. On information and belief, in the Accused Products, the impedance of one or more of the plurality of circuits in the receiver signal path is also adjusted based upon the determined desired signal strength and interferer signal strength, according to the additional elements of claim 8 of the '825 Patent.

115. Each and every time an Accused Product is powered on and used as intended, the Accused Product practices the method(s) claimed in the '825 Patent, constituting direct infringement by its user(s). By way of example, such users include Lenovo's customers, as well as Lenovo personnel acting within the scope of their employment with Lenovo, including by testing and using the Accused Products in the United States.

116. Lenovo has injured Theta and is liable to Theta for directly infringing one or more claims of the '824 Patent, including, without limitation, claim 3 pursuant to 35 U.S.C. § 271(a).

117. Lenovo also infringes the '825 Patent under 35 U.S.C. § 271(b) & (c).

118. Lenovo knowingly encourages and intends to induce infringement of the '825 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including, but not limited to, the Accused Products, with knowledge of the '825 Patent and with knowledge and specific intention that such products will be used by its customers and personnel, and that such use will necessarily result in infringement

of the '825 Patent. Lenovo had actual knowledge of the '825 Patent and that its actions would lead to infringement by end-users, and/or Lenovo had knowledge of the foregoing by way of willful blindness to the existence of the '825 Patent and to the fact that its actions would lead to infringement by end-users.

119. Lenovo also contributes to the infringement of the '825 Patent. Lenovo makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the Accused Products, with knowledge of the '825 Patent, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '825 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use. Lenovo had actual knowledge of the '825 Patent, and that its products constitute a material part of the invention and are especially made or adapted for use in infringing the invention, and that the products are not staple articles or commodities of commerce capable of substantial non-infringing use, and/or Lenovo had knowledge of the foregoing by way of willful blindness to the existence of the '825 Patent, to the fact that its products constitute a material part of the invention and are especially made or adapted for use in infringing the invention, and to the fact that the products are not staple articles or commodities of commerce capable of substantial non-infringing use.

120. Lenovo has had knowledge of the infringing nature of its activities, including that any use of the Accused Products as intended would directly infringe the methods claimed in the '825 Patent, and nevertheless continued, and continues its infringing activities with respect to the '825 Patent.

121. Lenovo intended that its customers and personnel infringe the asserted claims because practice of the asserted claims was necessary in order to achieve the battery life touted in Lenovo's promotional materials. Indeed, Lenovo touts the advantages of the battery life and physical characteristics (e.g., weight, size, and availability of larger screens) that could not be achieved in the advertised form factors but for the implementation of Prof. Tsvidis' claimed methods.

122. As described herein, the claimed methods are necessarily practiced when the Accused Products are powered on and used as intended. No mechanism is provided to prevent a user from practicing the claimed methods, and users are barred by license from disabling or altering the relevant functionality of the Accused Products. Thus, there are no substantial non-infringing uses of the Accused Products.

123. Lenovo's infringement of the '825 Patent has been and continues to be deliberate and willful, and therefore, this is an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284–285. On information and belief, Lenovo had knowledge of the issued '825 Patent prior to the filing of this Complaint, including by way of willful blindness. And Lenovo had actual knowledge of the '825 Patent at least with the filing of this Complaint. After acquiring that knowledge Lenovo infringed the '825 Patent, and in doing so, it knew, or should have known, that its conduct amounted to infringement of the '825 Patent.

124. As a result of Lenovo's infringement of the '825 Patent, Theta has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Lenovo's infringement, but in no event less than a reasonable royalty with interest and costs.

**THIRD COUNT (INFRINGEMENT OF U.S. PATENT NO. 10,524,202)**

125. Theta incorporates by reference the allegations set forth in the paragraphs above as though fully set forth herein.

126. Lenovo makes, uses, sells, and/or offers to sell in the United States, and/or imports into the United States products that directly infringe the '202 Patent each and every time they are powered on and used as intended (i.e., to connect to cellular wireless networks) by an end-user, including the Accused Products identified herein. Use of the Accused Products infringes at least claim 7 of the '202 Patent.

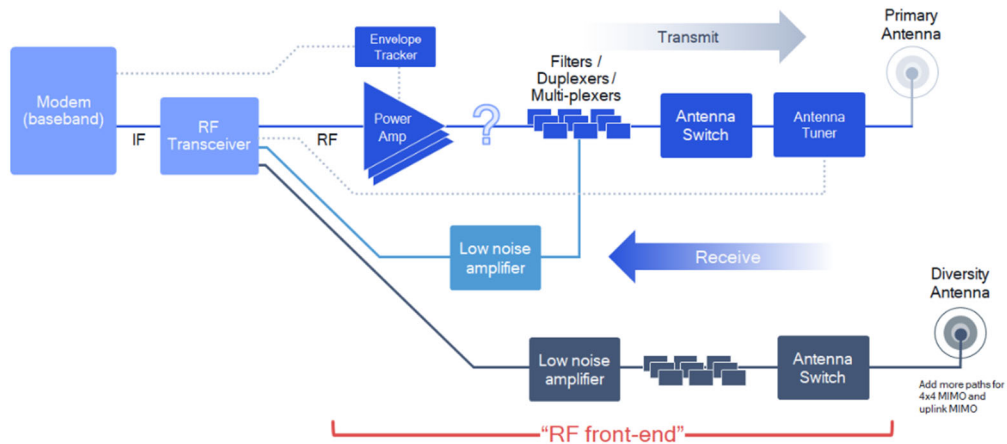
127. On information and belief, the Accused Products employ power-saving techniques that dynamically adjust gain, bias, and/or impedance of components in the receiver signal path in response to determined desired and interferer signal strengths, thereby controlling power dissipation, in accordance with the '202 Patent claims, including through techniques employed in transceiver, modem, and RF Front End components of the Accused Products.

128. The Accused Products infringe at least claim 7 of the '202 Patent. Each Accused Product is a battery powered portable wireless device. Each includes wireless transceiver circuitry necessary for the device to offer cellular calling and/or cellular data capabilities. The transceiver circuitry includes a receiver signal path.

129. The Accused Products receive wireless signals, including both a desired signal(s) (i.e., a signal that carries the voice or data of interest) and interferer signal(s). These signals are received by the transceiver circuitry via an input from an antenna in the Accused Product.

130. The wireless transceivers in the Accused Products include at least one signal path comprised of a plurality of circuits, including an amplifier, a filter, and a mixer. By way of example, as discussed above many Lenovo Accused Products use Qualcomm mobile RF

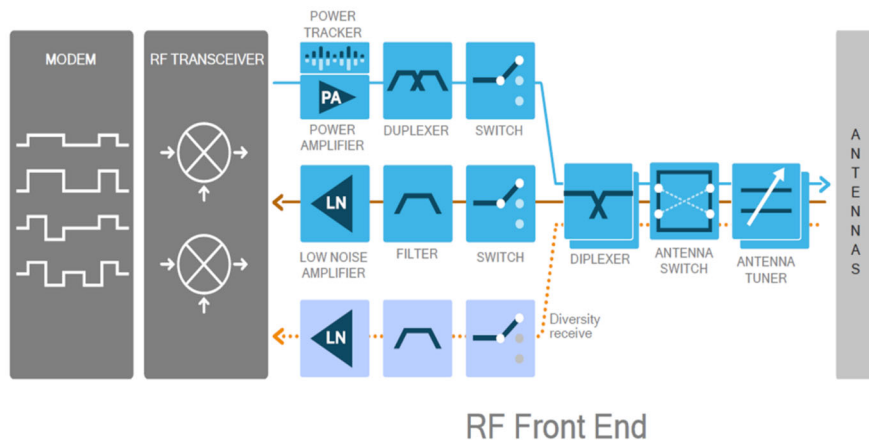
components in their receive signal paths. Qualcomm provides high-level depictions of representative signal paths of its Snapdragon 4G and 5G mobile platforms as used in the Accused Products by Lenovo—indicating that the components include such features:



See, e.g., <https://developer.qualcomm.com/blog/5g-modems-rf-and-antennas-getting-mmwave-data-device>.




See also <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/qualcomm-rf-front-end-infographic.pdf>.



See also <https://www.forbes.com/sites/tiriasresearch/2017/02/22/qualcomm-adds-complete-rf-portfolio-paves-way-to-5g/>.

131. Consistent with exemplary claim 7 of the '202 Patent, the Accused Products operate between a worst-case condition when the signal strength of the desired signal is low, and the signal strength of the interferer signal is high in relation to it, and a best-case condition when the signal strength of the desired signal is high, and the signal strength of the interferer signal is low in relation to it. For example, as discussed herein, the Accused Products operate across ranges of signal conditions utilizing multiple dynamically configurable gain states, which are switched between based on signal conditions and which effect the gain, bias, and/or impedance of circuit components such as, e.g., low noise amplifiers.

132. The Accused Products also include circuitry for determining the desired signal strength. By way of example, the desired signal strength is displayed in iconic form as the “bar” indicator on each Accused Product and can also be accessed via service screen and administrative functions:

2. Navigate: **Settings**  **About phone**.
3. Tap **SIM Status**.
4. Obtain the following Received Signal Strength Indicator (RSSI) info from the customer:
  - Signal strength
    - For more info, refer to [My Verizon Diagnostics Network Values for Signal Strength](#). The RSSI definitions shouldn't be shared with the customer.
  - Mobile voice network type
    - LTE
  - Mobile data network type
    - LTE
    - 5G

*See, e.g.*, <https://www.verizon.com/support/knowledge-base-239835/> (illustrating how to view received signal strength RSSI via the user interface of a Motorola Edge 5G phone).

133. The Accused Products also includes circuitry for determining the signal strength of the interferer signal. By way of example, multiple patents of Qualcomm—filed after and citing to Prof. Tsvidis’ inventions—discuss jammer detection circuitry. *See, e.g.*, U.S. Patent No. 8,781,426 at 3:44–59, 9:50–61 (“For example, the bias current may be increased when jammers are detected or decreased when jammers are not detected. The bias current may also be adjusted by different amounts depending on the jammer strength.”). “Jammer” refers to an interferer signal or signals. On information and belief, Qualcomm includes jammer detection circuitry in components used by Lenovo in the Accused Products. The jammer detection feature in the Accused Products determines the jammer signal strength levels in order to optimize power consumption.

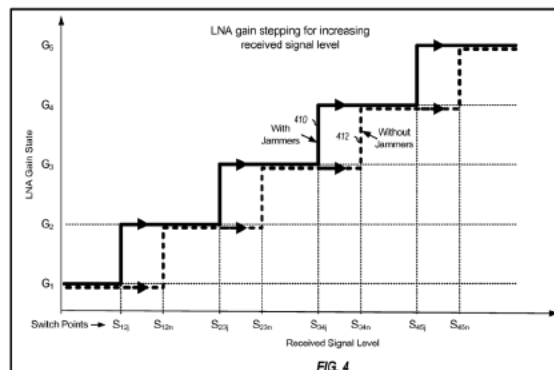
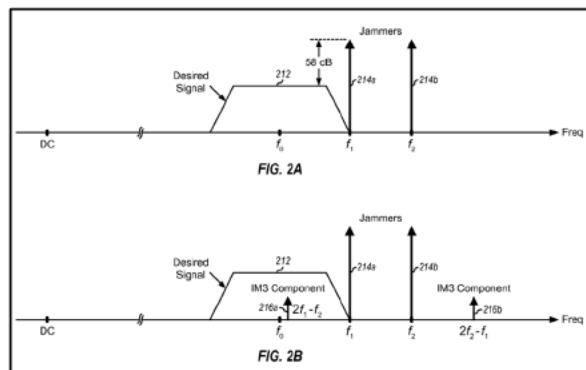
134. The Accused Products compare the strength of the desired signal to the strength of the interferer signal. For example, on information and belief Lenovo’s Accused Products using Qualcomm Mobile Platform components implement infringing comparisons:

A comparator (Comp) 520 compares the filtered signal against a jammer threshold,  $V_{th}$ , and provides a jammer indicator signal. The jammer threshold,  $V_{th}$ , may be programmed by the digital processor



150 to different levels based on the current gain state of the receiver, or channel conditions, or received signal strength.

See, e.g., U.S. Patent No. 8,521,198 at 8:30–35.



See also *id.* at Figs 2A, 2B, 4.

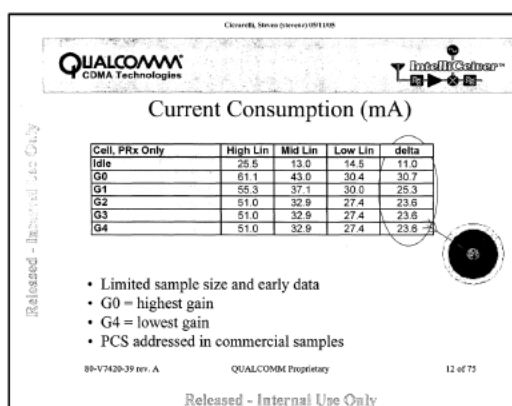
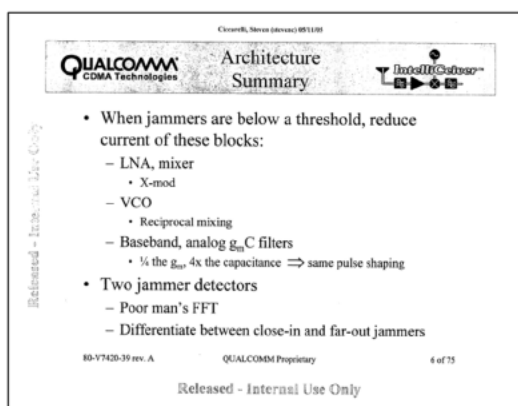
135. The Accused Products achieve control of power dissipation by dynamically altering the gain, bias currents, and/or impedances of the components in the receiver signal path based on the signal strength comparison. For example, on information and belief the transceiver and RF Front End amplifier components used by Lenovo in the Accused Products have programmable “gain states” which effect variable bias currents and/or impedances in the circuits. See, e.g., U.S. Patent No. 8,521,198, “Dynamic LNA Switch Points Based on Channel Conditions,” at 8:58–60 (“The jammer indicators from all jammer detectors may be used to select the switch points, gain, and/or bias of the LNA”).

136. By way of further example, on information and belief, RF Front End Components from Qualcomm, Skyworks, and other manufacturers used by Lenovo in the Accused Products have programmable “gain states” which effect variable current and power dissipation in their low noise amplifier (LNA) elements. For example, a Skyworks datasheet, available online, confirms that the various front end modules containing LNAs that are marketed by Skyworks employ software programmable registers to control the LNA gain state and bias, effecting the current and power dissipation in their amplifier components:

Table 10. B41 RF Performance

Parameter	Symbol	Gain State	Mode 0			Mode 1			Unit
			Min	Typ	Max	Min	Typ	Max	
Frequency	B41	mode0 = [G7,G6,G5,G4,G3,G2,G1,G0] mode1 = [G7,G6,G5,G4,G3,G2,G1]	2496		2690	2496		2690	Mhz
LNA current	IDD	G7		9.6			9.6		mA
		G6		5.1			5.1		
		G5		4.2			2.9		
		G4		2.9			2.5		
		G3		2.9			1.4		
		G2		2.9			0.3		
		G1		1.5			0.3		
		G0		0.3			NA		

137. Qualcomm has previously marketed infringing receiver technology under the name “IntelliCeiver.” On information and belief, while Qualcomm no longer advertises using the IntelliCeiver term, the same or materially similar technology has been utilized in subsequent generations of Qualcomm’s transceiver and RF Front End components, including those used by Lenovo in the Accused Products. Qualcomm’s “IntelliCeiver Data Review” presentation identifies the variable gain states and their effect on current consumption. Qualcomm’s IntelliCeiver, and successor technology, determines interferer levels in a received signal and adjusts the current consumption of components within the receiver signal path, including the amplifiers, filters, and mixers based on the operational characteristic encountered by the receiver, to optimize power dissipation:



138. By way of further example, on information and belief, transceiver components from Qualcomm used by Lenovo in the Accused Products have programmable “gain states” which effect variable current and power dissipation in their low noise amplifier (LNA) elements.

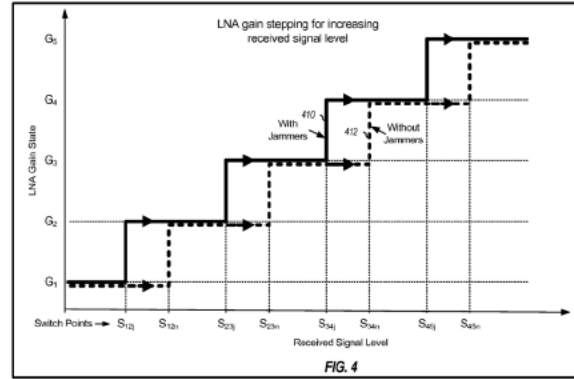
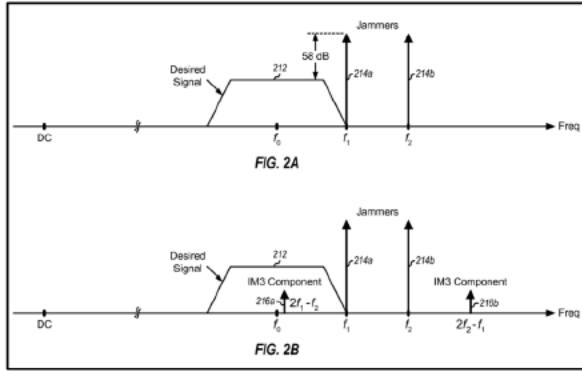
For example, a page from the WTR3925 transceiver datasheet, available online, confirms that the device has programmable gain modes to control, e.g., the LNA performance and power consumption at different desired signal strengths and jammer signal strengths:

Table 3-8 UMTS Rx performance specifications (cont.)

Parameter	Comments	Min	Typ	Max	Unit	
Survivable input level (LNA off)		-	-	+23	dBm	
Input VSWR (in-band)	50 $\Omega$ single-ended, external match	-	-	2.1	-	
LO to RF leakage (in-band)	All gain modes, at LNA input	-	-	-60	dBm	
Residual sideband level (uncal)	Due to amplitude and phase imbalance	-	-35	-28	dBc	
DC offset at I/Q outputs <sup>1</sup>		-100	-	100	mV	
Single-ended I/Q load capacitance <sup>2</sup>	Each BBI and BBQ pin	-	-	12	pF	
<b>Gain mode G0</b>						
Voltage conversion gain		49	53	57	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	2.3	3.0	dB	
Input IP3 <sup>4</sup> (ACS)	Rel 99/HSDPA/HSPA/HSPA+ DC-HSPA+/3C-HSPA+	S = -90 dBm, J1 = J2 = -44 dBm S = -90 dBm, J1 = J2 = -47 dBm	-22 -22	-10 -10	- -	dBm dBm
Input IP3 <sup>5</sup> (triple beat)		S = -90, J = -55, TX1 = TX2 = -33 dBm	-7	-1	-	dBm
Input IP2 <sup>6</sup>		S = -90 dBm, TX1 = TX2 = -30 dBm	-	54	-	dBm
<b>Gain mode G1</b>						
Voltage conversion gain		40	44	48	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	3.5	4.5	dB	
Input IP3 <sup>4</sup> (ACS)		S = -90 dBm, J1 = J2 = -47 dBm	-12	-10	-	dBm
Input IP3 <sup>5</sup> (triple beat)		S = -90, J = -55, TX1 = TX2 = -33 dBm	-7	-1	-	dBm
<b>Gain mode G2</b>						
Voltage conversion gain		22	26	30	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	16	19	dB	
<b>Gain mode G3</b>						
Voltage conversion gain		13	17	21	dBV/V	
Noise figure <sup>3</sup>	Small signal, single sideband	-	26	29	dB	

Ref: 80-NH379-1

139. In the Accused Products, the gain, bias current, and/or impedance of one or more of the plurality of circuits in the receiver signal path is adjusted based upon the determined desired signal strength and interferer signal strength comparison. *See, e.g.*, U.S. Patent No. 8,521,198 at 9:17–19 (“A bias selector 542 receives the jammer indicator and/or the received signal level and generates a bias control for LNA 120.”). For example, on information and belief, when the signal conditions improve to be better than in a worst-case condition, the gain state of one or more of the circuits in the receiver signal path of the wireless transceiver are changed compared to the worst-case power dissipation condition, thereby controlling power dissipation (*e.g.*, the gain is changed from a G0 state to a G1 state, or G1 to G2 state, etc.).



See, e.g., *id.* at Figs. 2A, 2B, 4.

140. Each and every time an Accused Product is powered on and used as intended, the Accused Product practices the method(s) claimed in the '202 Patent, constituting direct infringement by its user(s). By way of example, such users include Lenovo's customers, as well as Lenovo personnel acting within the scope of their employment with Lenovo, including by testing and using the Accused Products in the United States.

141. Lenovo has injured Theta and is liable to Theta for directly infringing one or more claims of the '202 Patent, including, without limitation, claim 7 pursuant to 35 U.S.C. § 271(a).

142. Lenovo also infringes the '202 Patent under 35 U.S.C. § 271(b) & (c).

143. Lenovo knowingly encourages and intends to induce infringement of the '202 Patent by making, using, offering for sale, and/or selling products in the United States, and/or importing them into the United States, including, but not limited to, the Accused Products, with knowledge of the '202 Patent and with knowledge and specific intention that such products will be used by its customers and personnel, and that such use will necessarily result in infringement of the '202 Patent. Lenovo had actual knowledge of the '202 Patent and that its actions would lead to infringement by end-users, and/or Lenovo had knowledge of the foregoing by way of willful blindness to the existence of the '202 Patent and to the fact that its actions would lead to infringement by end-users.

144. Lenovo also contributes to the infringement of the '202 Patent. Lenovo makes, uses, sells, and/or offers to sell products in the United States, and/or imports them into the United States, including but not limited to the Accused Products, with knowledge of the '202 Patent, knowing that those products constitute a material part of the claimed invention, that they are especially made or adapted for use in infringing the '202 Patent, and that they are not staple articles or commodities of commerce capable of substantial non-infringing use. Lenovo had actual knowledge of the '202 Patent, and that its products constitute a material part of the invention and are especially made or adapted for use in infringing the invention, and that the products are not staple articles or commodities of commerce capable of substantial non-infringing use, and/or Lenovo had knowledge of the foregoing by way of willful blindness to the existence of the '202 Patent, to the fact that its products constitute a material part of the invention and are especially made or adapted for use in infringing the invention, and to the fact that the products are not staple articles or commodities of commerce capable of substantial non-infringing use.

145. Lenovo has had knowledge of the infringing nature of its activities, including that any use of the Accused Products as intended would directly infringe the methods claimed in the '202 Patent, and nevertheless continued, and continues its infringing activities with respect to the '202 Patent.

146. Lenovo intended that its customers and personnel infringe the asserted claims because practice of the asserted claims was necessary in order to achieve the battery life touted in Lenovo's promotional materials. Indeed, Lenovo touted the advantages of the battery life and physical characteristics (e.g., weight, size, and availability of larger screens) that could not be

achieved in the advertised form factors but for the implementation of Prof. Tsividis' claimed methods.

147. As described herein, the claimed methods are necessarily practiced when the Accused Products are powered on and used as intended. No mechanism is provided to prevent a user from practicing the claimed methods, and users are barred by license from disabling or altering the relevant functionality of the Accused Products. Thus, there are no substantial non-infringing uses of the Accused Products.

148. Lenovo's infringement of the '202 Patent has been and continues to be deliberate and willful, and therefore, this is an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284–285. On information and belief, Lenovo had knowledge of the issued '202 Patent prior to the filing of this Complaint, including by way of willful blindness. And Lenovo had actual knowledge of the '202 Patent at least with the filing of this Complaint. After acquiring that knowledge Lenovo infringed the '202 Patent, and in doing so, it knew, or should have known, that its conduct amounted to infringement of the '202 Patent.

149. As a result of Lenovo's infringement of the '202 Patent, Theta has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Lenovo's infringement, but in no event less than a reasonable royalty with interest and costs.

#### **PRAYER FOR RELIEF**

WHEREFORE, Theta prays for judgment and seeks relief against Lenovo as follows:

- A. For judgment that Lenovo has infringed and/or continues to infringe one or more claims of the Asserted Patents, directly, and/or indirectly by way of inducement or contributory infringement;

- B. For a preliminary and permanent injunction against Lenovo, its respective officers, agents, servants, employees, attorneys, parent and subsidiary corporations, assigns and successors in interest, and those persons in active concert or participation with them, enjoining them from infringement, inducement of infringement, and contributory infringement of the Asserted Patents, including, but not limited to, an injunction against making, using, selling, and/or offering for sale within the United States, and importing into the United States, any products and/or services that infringe the Asserted Patents;
- C. For judgment awarding Theta damages adequate to compensate it for Lenovo's infringement of the Asserted Patents, including all pre-judgment and post-judgment interest;
- D. For judgment that Lenovo has willfully infringed and continues to willfully infringe one or more claims of the Asserted Patents;
- E. For judgment that Lenovo has infringed in bad faith and continues to infringe one or more claims of the Asserted Patents in bad faith;
- F. For judgment awarding enhanced damages pursuant to 35 U.S.C. § 284;
- G. For judgment awarding pre-issuance damages pursuant to 35 U.S.C. § 154(d);
- H. For judgment imposing a mandatory future royalty payable on each and every product or service sold by Lenovo in the future that is found to infringe the Asserted Patents and on all future products and services which are not colorably different from products found to infringe;
- I. For judgment awarding attorneys' fees pursuant to 35 U.S.C. § 285 or otherwise permitted by law;

- J. For judgment awarding costs of suit; and
- K. For judgment awarding Theta such other and further relief as the Court may deem just and proper.

**DEMAND FOR JURY TRIAL**

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Theta hereby demands a trial by jury of this action.



Dated: June 30, 2022

Respectfully submitted,

*/s/ Nicole E. Kopinski*

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