UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TOT POWER CONTROL, S.L.

        Plaintiff,

    v.

APPLE, INC.

        Defendant.

C.A. No. 21-cv-1302-MN

JURY TRIAL DEMANDED

AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff TOT Power Control, S.L. ("TOT" or "Plaintiff") for its Amended Complaint for Patent Infringement against Defendant Apple, Inc. ("Apple" or "Defendant") alleges as follows:

INTRODUCTION

1.   TOT is an intellectual property and technology licensing company. TOT's patent portfolio is based on technology conceived, developed, and patented by its President, Alvaro Medrano, along with four colleagues. Mr. Medrano has a Master of Science in Electrical Engineering from the Universidad Politecnica, but it was during his graduate studies in Astronautics and Space Engineering at Cranfield University, where he specialized in satellite attitude control, that he first thought to apply certain control engineering principles to mobile communications.

1

Mr. Medrano and his colleagues developed the patented power control solutions from concepts in control theory that had not previously been applied in the context of telecommunications. TOT was founded to develop and license these superior methods of and devices for managing how power is used to respond to decreases and increases in the ratio of radio signal to interference ("SIR"). This technology is protected in the United States by the patents identified below and at issue in this case (collectively, the "TOT Patents").

2.   Apple infringes the TOT Patents by making, using, offering for sale, and/or importing products throughout the United States, including within this District. Apple's infringement is based on the power control processes practiced by the transceivers that Apple's mobile devices employ to access and operate over the cellular networks operated by United States carriers, including Verizon Wireless, AT&T, T-Mobile, and Sprint.

3.   Apple has infringed and continues to infringe the TOT Patents. Apple and its suppliers of transceivers have thus far refused to license the TOT Patents and, instead, have continued to make, use, sell, offer to sell, and/or import TOT's patented intellectual property within the United States without TOT's permission.

THE PARTIES

4.   Plaintiff TOT is a limited liability company organized and existing under the laws of Spain with its principal place of business at C/ Gobelas 17, 1st Floor, Urb. La Florida 28023 Madrid, Spain. In 2012, TOT incorporated TOT Power Control, Inc. ("TOT DE") in Delaware for the purpose of licensing the TOT Patents in the United States and receiving royalties therefrom. However, TOT later had to let TOT DE's charter lapse as its business prospects evaporated once the mobile transceiver companies that supply Defendant Apple and other smartphone manufacturers adopted TOT's patented technology without authorization or license.

5.   Defendant Apple is a California corporation with its principal place of business at 1 Infinite Loop, Cupertino, California 95014. Apple is a publicly traded company that may be served through its registered agent for service, CT Corporation Trust Company, 1209 Orange Street, Wilmington, Delaware 19801.

JURISDICTION AND VENUE

6.   This Court has jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331 and 1338(a) at least because this action arises under the patent laws of the United States, including 35 U.S.C. § 271 *et seq*.

7.   This Court has both general and specific jurisdiction over Apple because Apple has committed acts within this District giving rise to this action and

has established minimum contacts with this forum such that the exercise of

jurisdiction over Apple would not offend traditional notions of fair play and

substantial justice. Among other things:

(a) Apple has employees and operates a retail store at 125 Christiana

Mall, Newark, DE 19702. *See* https://www.apple.com/retail/christianamall/ (last

accessed Aug. 30, 2021); https://www.christianamall.com/en/directory/apple-

8718.html (last accessed July 13, 2022). Defendant Apple's retail store at 125

Christiana Mall sells and offers for sale products and services that infringe the

TOT Patents. On information and belief, the Apple retail store at 125 Christiana

Mall sells more infringing products than any other Apple retail store in the United States. *See*

Alan Farnham and Mark Mooney, Apple's (AAPL) Delaware Store Claims Title for Selling

Most iPhones, ABC NEWS (Nov. 12, 2013, 6:14 AM), https://abcnews.go.com/Business/

applesdelaware-store-claims-title-selling-iphones/story?id=20650009 (last accessed July 13,

2022).

(b) Apple, directly and through subsidiaries and intermediaries (including

distributors, retailers, franchisees, and others), has regularly committed and continues to commit

acts of patent infringement in this District, by, among other things, making, using, testing,

selling, licensing, importing and/or offering for sale/license products and services that infringe

the TOT Patents. *See, e.g.,* https://locate.apple.com/sales/ (last accessed July 13, 2022).

8.   Venue is properly laid in this judicial district pursuant to 28 U.S.C.

§§1391(b) and (c) and 1400(b). Apple has a physical presence in this District and

has committed acts of infringement in this District by, among other things, selling and offering for sale in this District (and elsewhere) infringing products made, used, developed, tested, and otherwise practiced by Apple. Venue is further proper based on facts alleged in the preceding paragraphs which TOT incorporates by reference as if fully set forth herein.

THE PATENTS-IN-SUIT

A. U.S. Patent No. 7,532,865

9.   U.S. Patent No. 7,532,865 (the '865 Patent), entitled "Outer Loop Power Control Method and Device for Wireless Communications Systems," was duly and properly issued by the United States Patent and Trademark Office ("USPTO") on May 12, 2009. A true and correct copy of the '865 Patent is attached hereto as **Exhibit A.**

10.   TOT is the assignee of the '865 Patent; owns all right, title and interest in the '865 Patent; and holds the right to sue and recover damages for infringement thereof, including past infringement.

11.   TOT does not itself manufacture or sell products that practice the technology protected by the '865 Patent nor has it licensed others to do so. As a result, the marking requirements of 35 U.S.C. § 287(a) are inapplicable.

B. U.S. Patent No. 7,496,376

12.   U.S. Patent No. 7,496,376 (the '376 Patent), entitled "Outer Loop

Power Control Method and Apparatus for Wireless Communications Systems,"

was duly and properly issued by the USPTO on February 24, 2009. A true and

correct copy of the '376 Patent is attached hereto as **Exhibit B.**

13.   TOT is the assignee of the '376 Patent; owns all right, title and

interest in the '376 Patent; and holds the right to sue and recover damages for

infringement thereof, including for past infringement.

14.   TOT does not itself manufacture or sell products that practice the

technology protected by the '376 Patent nor has it licensed others to do so. As a

result, the marking requirements of 35 U.S.C. § 287(a) are inapplicable.

BACKGROUND FOR THE INVENTIONS

15.   Wideband CDMA ("WCDMA") is the physical layer implementation

of the 3rd Generation Partnership Project ("3GPP") Universal Mobile Telephone

Service ("UMTS") cellular standard. Code Division Multiple Access ("CDMA")

is a radio access method used by various wireless communication technologies that

allows multiple channels to be carried on a single physical radio channel.

CDMA2000 is 3G technology that evolved from IS-95 CDMA compliant systems.

In all respects relevant hereto, CDMA2000 and WCDMA standards share the same

fundamental technologies, including channelization codes, and are referred to

collectively herein as "3G CDMA."

6

16.   In 3G CDMA, a single radio frequency ("RF") channel is utilized to transmit voice calls and data between multiple mobile devices (such as mobile phones, tablets, or watches which are generally referred to as end-user devices ("UE"), and a base transmission station ("Node B") operated by a cellular carrier. Each UE is assigned a code that is transmitted in an RF channel along with the codes for other UEs. Some of the codes are close to, but not perfectly, orthogonal (*i.e.,* non-correlated). The imperfect orthogonal positioning results in a certain degree of interference between codes in the same RF channel.

17.   Power control is a critical aspect of 3G CDMA systems because it is used, *inter alia*, to ameliorate interference within the uplink signals (*i.e.,* UE transmitting to the Node B) and the downlink signals (*i.e.,* the Node B transmitting to UE) exchanged between the UE and the Node B. Power control is especially necessary to address the problem of near-far intracell interference. This interference results from the differing transmission power requirements of UEs near to and UEs far from the carrier's Node B. The varying distances require individualized power levels to maintain the level of call quality required by the signal propagation conditions.

18.   Power control for ongoing transmissions within a cellular system is accomplished through a closed loop as specified in the 3GPP UMTS standard. The closed loop is comprised of two intermeshed processes—inner loop and outer loop

7

power controls. As a general overview, the inner loop adjusts the transmission power control ("TPC") command based on an SIR_{target} level provided by the outer loop. This intermeshed process allows the cellular system to continuously adjust call quality.

A. Inner Loop

19.   The 3GPP UMTS closed loop standard applies to both downlink and uplink transmissions between the UE and Node B. A downlink transmission originates with the Node B and is sent to the UE. An uplink transmission is the converse—it is sent by the UE to the Node B.

20.   In power control for a downlink, a signal-to-interference ratio target (SIR_{target}) is set in the UE as it receives the signal. Per the 3GPP UMTS standard, the SIR is measured in the inner loop and then compared to the SIR_{target}. The SIR measurement is dictated by § 5.2.2 of ETSI TS 25.215, Physical layer - Measurements (FDD):

5.2.2   SIR

Definition	Type 1: Signal to Interference Ratio, is defined as: (RSCP/ISCP)×SF. The measurement shall be performed on the DPCCH of a Radio Link Set. In compressed mode the SIR shall not be measured in the transmission gap. The reference point for the SIR measurements shall be the Rx antenna connector. If the radio link set contains more than one radio link, the reported value shall be the linear summation of the SIR from each radio link of the radio link set. If Rx diversity is used in the Node B for a cell, the SIR for a radio link shall be the linear summation of the SIR from each Rx antenna for that radio link. When cell portions are defined in the cell, the SIR measurement shall be possible in each cell portion. where: RSCP = Received Signal Code Power, unbiased measurement of the received power on one code. ISCP = Interference Signal Code Power, the interference on the received signal. SF=The spreading factor used on the DPCCH. Type 2: Signal to Interference Ratio, is defined as: (RSCP/ISCP)×SF. The measurement shall be performed on the PRACH control part. The reference point for the SIR measurements shall be the Rx antenna connector. When cell portions are defined in the cell, the SIR measurement shall be possible in each cell portion. where: RSCP = Received Signal Code Power, unbiased measurement of the received power on the code. ISCP = Interference Signal Code Power, the interference on the received signal. SF=The spreading factor used on the control part of the PRACH.

See https://www.etsi.org/deliver/etsi_ts/125200_125299/125215/11.00.00_ 60/ts_125215v110000p.pdf_ (last accessed July 12, 2022).

21.   In the downlink, if the measured SIR is below the SIR_{target}, the inner loop of the UE directs the device to send a TPC command to the carrier Node B to increase the transmission power. If the measured SIR is above the SIR_{target}, the inner loop of the UE directs the device to send a TPC command to the carrier Node B to decrease the transmission power. In Annex B.2. of the standard document TS 125.214, and from § 5.2.2. of the standard document TS 125.215, it is described that a mobile terminal should estimate the received SIR to operate the inner loop.

9

B.2   Example of implementation in the UE

The downlink inner-loop power control adjusts the network transmit power in order to keep the received downlink SIR at a given SIR target, SIR_{target}. A higher layer outer loop adjusts SIR_{target} independently for each connection.

The UE should estimate the received downlink DPCCH/DPDCH power of the connection to be power controlled. Simultaneously, the UE should estimate the received interference and calculate the signal-to-interference ratio, SIR_{est}. SIR_{est} can be calculated as RSCP/ISCP, where RSCP refers to the received signal code power on one code and ISCP refers to the non-orthogonal interference signal code power of the received signal on one code. Note that due to the specific SIR target offsets described in [5] that can be applied during compressed frames, the spreading factor shall not be considered in the calculation of SIR_{est}.

The obtained SIR estimate SIR_{est} is then used by the UE to generate TPC commands according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is "0", requesting a transmit power decrease, while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is "1", requesting a transmit power increase.

When the UE is in soft handover, the UE should estimate SIR_{est} from the downlink signals of all cells in the active set.

22.   The uplink works similarly. SIR measurements are made at the carrier's Node B and are compared in the inner loop to the SIR_{target} which then directs the Node B to send a TPC power control command to the UE. The inner loop power control is dictated in § 5.1.2.2.1 of ETSI TS 25.214, Physical layer procedures (FDD):

5.1.2.2   Ordinary transmit power control

5.1.2.2.1   General

For each activated uplink frequency, the uplink inner-loop power control adjusts the UE transmit power in order to keep the received uplink signal-to-interference ratio (SIR) on that frequency at a given SIR target, SIR_{target}.

The cells in the active set should estimate signal-to-interference ratio SIR_{est} of the received uplink DPCH. The cells in the active set should then generate TPC commands and transmit the commands once per slot according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is "0", while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is "1". When UL_DTX_Active is TRUE (see section 6C), a TPC command is not required to be transmitted in any downlink slot starting during an uplink DPCCH slot which is in an uplink DPCCH transmission gap as defined in subclause 6C.2, in which case it is not known to be present.

See https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/11.03.00_60/ts_125214v110300p.pdf (last visited July 12, 2022).

10

B. **Outer Loop**

23.   In addition to inner loop requirements, the 3GPP UMTS standard also defines outer loop power control for maintaining the "long-term quality control of the radio channel."[1] through adjustments to the SIR_{target} value. From § 14.9.1 of the document TS 125.331, the creation of the SIR_{target} results from the following example embodiment in normal mode:

14.9s   Downlink power control

14.9.1   Generalities

This function is implemented in the UE in order to set the SIR target value on each CCTrCH used for the downlink power control. This SIR value shall be adjusted according to an autonomous function in the UE in order to achieve the same measured quality as the quality target set by UTRAN. The quality target is set as the transport channel BLER value for each transport channel as signalled by UTRAN.

When transport channel BLER is used the UE shall run a quality target control loop such that the quality requirement is met for each transport channel, which has been assigned a BLER target.

The UE shall set the SIR target when the physical channel has been set up or reconfigured. It shall not increase the SIR target value before the power control has converged on the current value. The UE may estimate whether the power control has converged on the current value, by comparing the averaged measured SIR to the SIR target value.

24.   Furthermore, TS 125.401 states in § 7.2.4.8.2:

7.2.4.8.2   DL Outer Loop Power Control

The DL Outer Loop Power Control sets the target quality value for the DL inner loop power control. It receives input from quality estimates of the transport channel, measured in the UE. The DL outer loop power control is mainly used for a long-term quality control of the radio channel.

This function is located mainly in the UE, but some control parameters are set by the UTRAN.

The SRNC, regularly (or under some algorithms), sends the target down link power range based on the measurement report from UE.

---

[1] ETSI TS 25.401, § 7.2.4.8.1 at 23, UTRAN overall description; https://www.etsi.org/deliver/etsi_ts/125400_125499/125401/04.02.00_60/ts_125401v040200p.pdf (last accessed July 12, 2022).

25.   The quality requirement mentioned in § 14.9.1 of TS 125.331 refers to the SIR (required) in a specific radio environment in order to maintain a specific Block Error Rate ("BLER") (target). The same applies to clause 7.2.4.8.2 of TS 125.401, which refers to the target quality value, *i.e.,* the value required or determined for the corresponding radio link. To maintain the BLER set by the network for a particular channel, the example embodiment sets an SIR_{target} that maintains the required Quality of Service (*i.e.*, is close to the SIR in normal operation).

26.   However, unlike the inner loop, the 3GPP UMTS standard does not define the specifics of the outer loop power control algorithm. As a general overview, the outer loop's purpose is to adjust the SIR_{target} to account for the changing radio conditions that a UE might encounter over the course of a call. For example, call quality is adversely affected when the UE enters a tunnel or elevator, there is significant weather interference with the RF signal, or there are rapid changes in the speed of the UE. These kinds of conditions will require a higher SIR_{target} (and hence a more powerful radio signal) than would otherwise be the case. Telecommunications standards do not specify how these SIR_{target} should be adjusted to achieve optimal efficiency.

27.   The early universal approach to the adjustment of SIR_{target} values in the outer loop was based on block/frame errors indicated by Cyclic Redundancy

Check ("CRC") errors. When a CRC error is detected, the SIR_{target} was increased by a number of decibels. For each successive block/frame without a CRC error, the SIR_{target} value was decreased by a percentage corresponding to the BLER percentage that the system is configured for. This process of adjusting the SIR_{target} value is illustrated in the first figure below, with an exemplary BLER of 1%. The second figure below shows the rate at which the SIR_{target} value is decreased for BLER values ranging from 10% to 0.1%. Different values for the maximum tolerated value for BLER can be set for different types of traffic, allowing, for example, real-time interactive data traffic to maintain lower transmission error rates than non-real-time video downloading operations.

28.   As part of the outer loop power control mechanism implemented in mobile devices, adjustments to the SIR_{target} are made based on block/frame errors indicated by CRC errors. When a CRC error is detected, the SIR_{target} is increased by a number of decibels. For each successive block/frame without a CRC error, the SIR_{target} is decreased by a percentage corresponding the BLER percentage that the system is configured for. The process of modifying the SIR_{target} is illustrated below, with an exemplary BLER of 1%.
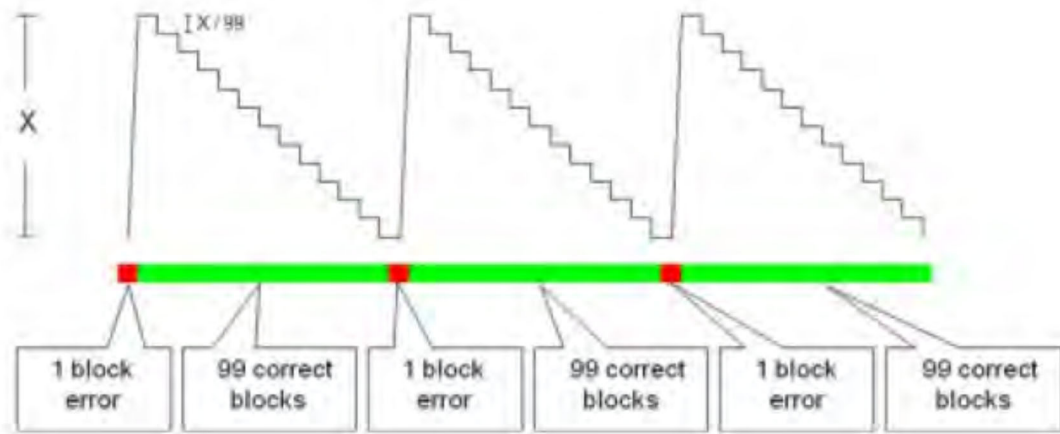
29.   The convergence rate of the BLER is slow and potentially wastes significant potential code capacity within a RF channel. A more precise manner of adjusting the SIR$_{target}$ is required. In the Qualcomm mobile transceivers incorporated into Apple devices and in Apple's own Intel transceivers, a component is added to the SIR$_{target}$ determination that accounts for the propagation of the channel for each code.

14
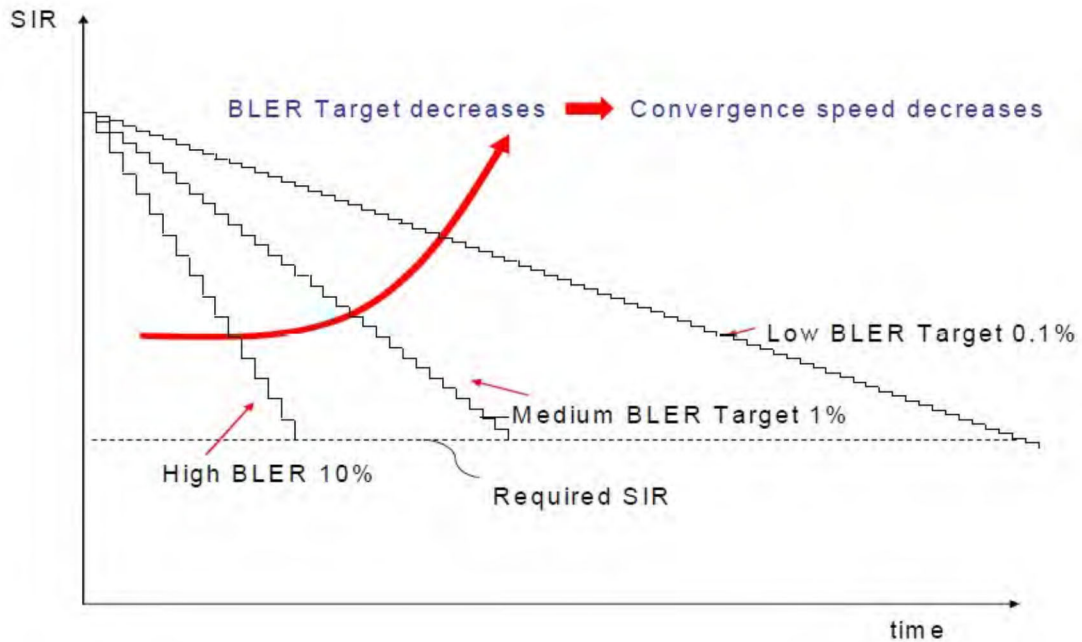
30.   Under normal conditions, the convergence rate of the SIR_{target} value based on the CRC and BLER diminishes performance of the UE and the cell network whenever there is a resumption of favorable channel conditions, such as coming out of a tunnel or elevator. The conventional BLER method of power control slows the power adaptation of the transmitter between the UE and carrier's Node B, thereby degrading call quality. The BLER method of power control also impacts potential capacity within an RF channel by permitting excess power levels on each channel in various circumstances thus servicing fewer end-users in each cell. To keep their networks operating through these wasted resources, the carriers are forced to add expensive additional network capacity.

THE PATENTED SOLUTIONS

31.   The TOT Patents are directed at better management of the SIR_{target} values so that power, and consequently wireless channel capacity, is not wasted and call quality is maintained. This is achieved by the techniques taught and claimed in the '376 Patent, which is directed at a more precise manner of adjusting the SIR_{target} in the outer loop under a variety of dynamic channel conditions; and in the '865 Patent which is directed at managing control power during the unwinding phase.

32.   The '865 Patent describes and claims a technique to solve the problem of convergence of the SIR_{target} value when the exit from a "wind-up"

condition has started, *i.e.,* when the unwinding process has started. The technique

of the '865 Patent matches the SIR*target* value at wind-up exit to a value close to

the SIR*target* value before the wind-up began. By doing so, the unwinding time of

the SIR*target* value is drastically shortened and interference in the system is

reduced. The immediate effect is that the outer loop power control quickly

returns to a normal mode of operation when the wind-up conditions pass. The

solution of the '865 Patent thus provides for increased system capacity and

improved wireless connections *(e.g.,* reduction in dropped calls).

33.   The '376 Patent describes and claims an outer loop power control

apparatus to address the problems that are associated with a certain type of fading

in the wireless channel. Fading is a change in the received level of signal even

when the distance between the UE and carrier Node B does not change. Channel

fading can occur as the result of a variety of conditions, *e.g.,* multipath

propagation, referred to as multipath-induced fading, weather (particularly rain),

or shadowing from obstacles affecting the wave propagation (this is sometimes

referred to as shadow fading). Channel fading can result in either constructive or

destructive interference, amplifying or attenuating the signal power seen at the

receiver. The '376 Patent enables better reaction to change in signal propagation

conditions by (i) measuring the amount of fading within the channel and (ii)

accounting for that fading as part of the outer loop power control. As alleged

16

above, conventional channel quality control methods relied on the measured BLER which operate more slowly than an optimally designed system.

34.   The '376 Patent describes and claims a technique to determine SIR_{target} values based on the collection of SIR_{Rec} values. These SIR_{Rec} values are used to calculate the short-term historical conditions in the channel (which will affect the received signal as judged by the SIR at the receiver). Based on the historical conditions, one or more fading margin(s) can be calculated. A weighting function is then used to map the fading margins to a SIR_{target} value, taking into account prior SIR_{target} values. This approach allows the SIR_{target} value to vary with channel conditions and reduce the amount of data errors that occur because of the channel conditions. This, in turn, reduces the amount of power that is wasted when using conventional power control techniques based on measurements of data errors.

35.   Together, the TOT Patents describe and claim techniques for better management of the SIR_{target} values so that power, and consequently wireless channel capacity, are not wasted and call quality is maintained. By utilizing mobile transceivers that employ TOT's patented technology, Apple has been able to sell mobile products that produce superior call quality.

36.   The claims in the TOT Patents are not directed to abstract ideas and do not merely attempt to limit a method of organizing human activity or an idea

17

itself to a particular technological environment. The claimed technologies are expressly directed to the structure and operation of wireless communication networks, which are not abstract methods or abstract ideas. The apparatus and methods claimed in the TOT Patents exist only in a concrete and tangible form, and the claimed inventions cannot be accomplished through pen-and-paper or the human mind. As alleged above, the claimed apparatus and methods provided a technical solution to an existing technical problem. Accordingly, the claims of the TOT Patents are not directed to an abstract idea.

37.   When viewed as a whole, the claims of the TOT Patents are not merely a recitation of well-understood, routine, or conventional technologies or components. The claimed inventions were not well-known, routine, or conventional at the time of the inventions, and they represent specific improvements over the prior art and existing systems and methods. The claimed inventions were not known in the prior art at the time of the invention, let alone well-known, routine, or conventional.

ATTEMPTS TO LICENSE

38.   As alleged *supra*, the USPTO issued the TOT Patents in the first half of 2009. TOT thereafter engaged in extensive discussions with Qualcomm and Intel (the then primary manufacturers of mobile transceivers) about licensing the TOT Patents. These discussions, which were conducted pursuant to Non-

Disclosure Agreements, covered all aspects of how to utilize TOT's patented technology. Ultimately, neither Qualcomm nor Intel licensed the technology. They instead misappropriated it.

39.   Upon information and belief, Apple has incorporated into its phones and certain tablets the following Qualcomm mobile transceivers that practice or have practiced the technology protected by one or both of the TOT Patents:

MDM9625M (X5)

MDM9635M (X7)

MDM9645M (X12)

MDM9655M (X16)

SDR865/SDX55M (X55)

SDX60M (X60)

SDX57M (X57)

The parties have not yet conducted discovery and that process may reveal additional models of Qualcomm mobile transceivers that infringe the TOT Patents.

40.   Upon information and belief, the following Intel mobile transceivers practice or have practiced the TOT technology protected by one or both of the TOT Patents.

XMM7360

XMM7480

XMM 7560

XMM 7660

The parties have not yet conducted discovery and that process may reveal additional models of Intel mobile transceivers that infringe the TOT Patents.

COUNT I

(Infringement of the '865 Patent)

41.   TOT repeats and realleges paragraphs 1 through 40 as though the same were set forth herein.

42.   As alleged above, TOT is the assignee and lawful owner of all right, title and interest in and to the '865 Patent.

43.   The '865 Patent is valid and enforceable.

44.   On information and belief and pursuant to 35 U.S.C. § 271(a), Apple has directly infringed and continues to infringe one or more claims of the '865 Patent, including but not limited to independent Claims 1 (method) and 5 (device), pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents.

45.   By way of a non-exclusive example of infringement, Claim 1 of the '865 Patent describes a method for managing control power during a condition known as wind-up which is prevalent in communications systems based in CDMA technology.

46.   Upon information and belief, Apple has directly infringed and continues to directly infringe the '865 Patent's independent method claim by using—including through testing and demonstrations—the Apple Accused Products (as defined *infra* in Paragraph 48 and attached as **Exhibit C**) which employ the Qualcomm and Intel mobile transceivers identified *supra* in Paragraphs 39 and 40 or, upon information and belief, mobile transceivers designed and fabricated by Apple itself based on technology that it acquired in August 2019 from Intel.

47.   The transceivers identified above that Apple has used and continues to use in the Apple Accused Products practice each limitation of Claim 1 of the '865 Patent, specifically:

(a)   Claim 1 requires "*estimating a desired signal to interference ratio received (SIR$_{rec}$) based on a data signal (107, 108) received from a base station (102, 103) or mobile station (104).*" The Qualcomm mobile transceivers incorporated in the Apple Accused Products practice this step by complying with the standards described *supra* in Paragraphs 19-31, particularly Paragraph 21.

(b)   Claim 1 of the '865 Patent further requires "*setting a desired signal to interference ratio target (SIR$_{target}$) that is close to a signal to interference ratio required (SIR$_{rec}$) during the normal mode of the outer loop.*" The Qualcomm mobile transceivers incorporated in the Apple Accused Products practice this step

by complying with the standards described *supra* in Paragraphs 19-31.

More specifically, § 7.2.4.8 of TS 25.401 (UTRAN Overall Description),

and § 5.1.2.2.1 of TS 25.214, Physical layer procedures (FDD) respectively dictate:

7.2.4.8   RF power control

This group of functions controls the level of the transmitted power in order to minimise interference and keep the quality of the connections. It consist of the following functions: UL Outer Loop Power Control, DL Outer Loop Power Control, UL Inner Loop Power Control, DL Inner Loop Power Control, UL Open Loop Power Control and DL Open Loop Power Control.

7.2.4.8.1   UL Outer Loop Power Control

The UL Outer Loop Power Control located in the SRNC [TDD – except for uplink shared channels where it is located in the CRNC] sets the target quality value for the UL Inner Loop Power Control which is located in Node B for FDD and 1.28 Mcps TDD and is located in the UE for 3.84 Mcps TDD. It receives input from quality estimates of the transport channel. The UL outer loop power control is mainly used for a long-term quality control of the radio channel.

In FDD and 1.28 Mcps TDD this function is located in the UTRAN, in 3.84 Mcps TDD the function is performed in UTRAN and the target quality value is sent to the UE by the SRNC or the CRNC, respectively.

In FDD and 1.28 Mcps TDD, if the connection involves both a SRNS and a DRNS the function UL Outer Loop Power Control (located in the SRNC [1.28 Mcps TDD – or in the CRNC, respectively]) sets the target quality for the UL Inner Loop Power Control function (located in Node B).

7.2.4.8.2   DL Outer Loop Power Control

The DL Outer Loop Power Control sets the target quality value for the DL inner loop power control. It receives input from quality estimates of the transport channel, measured in the UE. The DL outer loop power control is mainly used for a long-term quality control of the radio channel.

This function is located mainly in the UE, but some control parameters are set by the UTRAN.

The SRNC, regularly (or under some algorithms), sends the target down link power range based on the measurement report from UE.

5.1.2.2   Ordinary transmit power control

5.1.2.2.1   General

For each activated uplink frequency, the uplink inner-loop power control adjusts the UE transmit power in order to keep the received uplink signal-to-interference ratio (SIR) on that frequency at a given SIR target, SIR_{target}.

The cells in the active set should estimate signal-to-interference ratio SIR_{est} of the received uplink DPCH. The cells in the active set should then generate TPC commands and transmit the commands once per slot or once per slot cycle if Algorithm 3 is configured according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is "0", while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is "1". When UL_DTX_Active is TRUE (see clause 6C) or DL_DCH_FET_Config is configured, a TPC command is not required to be transmitted in any downlink slot starting during an uplink DPCCH slot which is in an uplink DPCCH transmission gap as defined in subclause 6C.2, in which case it is not known to be present. When DL_DCH_FET_Config is configured, a TPC command is also required to be transmitted on the first slot of a downlink radio frame, when the corresponding uplink radio frame is transmitted after a transmission gap.

22

(c)   Claim 1 further requires "*detecting a start (402) of the outer loop windup.*" That the mobile transceivers incorporated into the Apple Accused Products practice this step is demonstrated by the testing Plaintiff has done of representative Apple Accused Products. When the tested device received a significant increase in interference, it initially tried to fulfill the required BLER. Despite receiving more block errors than expected and requesting increases in transmitting power, the requested increases failed to rectify the excessive errors.   . This indicates that the tested device detected entry into a wind-up condition.

(d)   Claim 1 further requires "*setting a specific desired signal to interference ratio target (SIR$_{target}$) during the outer loop wind-up.*" That the mobile transceivers incorporated in the Apple Accused Products practice this step is demonstrated by testing Plaintiff has done of representative Apple Accused Products. After the tested device detected the wind-up, it established a SIR$_{target}$ for the duration of the wind-up. The tested device did not request an increase in the received signal transmission power, although it still was experiencing BLERs above those necessary to meet the quality criterion.

(e)   Claim 1 further requires "*detecting a start (403) of the outer loop unwinding.*" That the mobile transceivers incorporated in the Apple Accused Products practice this step is demonstrated by testing Plaintiff has done of

representative Apple Accused Products. The UE needs to detect the end of the wind-up to keep operating outer loop power control and maintain the $BLER_{target}$. The tested device was subjected to removal of the increased interference. . The tested device reacted to the start of the outer loop unwinding by requesting that the simulated base station reduce its signal transmission power.   This shows that the algorithm in the tested device detected the drop of the BLER which marks the beginning of the outer loop unwinding.

(f)   Claim 1 lastly requires "*wherein the desired signal to interference ratio target (*SIR_{target}*) is modified at the start (403) of the outer loop unwinding, to match it to the outer loop power control in normal mode just prior to the start of the outer loop wind up.*" That the mobile transceivers incorporated in the Apple Accused Products practice this step is demonstrated by the testing that Plaintiff has done of representative Apple Accused Products. The testing showed that after detection of the outer loop unwinding (*see* above), the tested device immediately dropped the SIR_{target} to a value that was in the range of the values measured before the start of the wind-up phase. This indicates that the SIR_{target} was modified according to the invention.

48.   As another non-exclusive example of infringement, Claim 5 of the '865 Patent describes a device that practices the method of Claim 1. Upon information and belief, Apple has directly infringed and continues to directly

infringe Claim 5 by, among other things, making, using, selling, offering to sell, and/or importing into the United States without authorization the mobile products identified in **Exhibit C**. The parties have not yet conducted discovery and that process may reveal additional Apple products that infringe the '865 Patent.

49.   Each Apple Accused Product practices the limitations of Claim 5 of the '865 Patent, specifically:

(a)   Claim 5 requires "*at least one programable electronic device, the programable device capable of performing the [following] steps….*" The Qualcomm mobile transceivers incorporated into the Apple Accused Products include at least one programmable electronic device operable to perform various steps based on a data signal received from a base station or from a mobile station. For example, Apple's mobile devices are comprised of multiple processors that manage cellular transmit/receive functionality and the accompanying the inner loop power control and outer loop power control processes. These processors include a combination of general-purpose microprocessors and/or digital signal processors, and application specific integrated circuits (ASIC, *e.g.,* standard cell or gate array) and/or field programmable gate array devices.

(b)   The programmable electronic devices incorporated into the Apple Accused Products are capable of performing the remaining limitations of Claim 5 as described *supra* in Paragraph 47.

50.   As a direct and proximate result of Apple's infringement, TOT has sustained and is entitled to recover damages from Apple for its infringing activity during the period that begins on September 14, 2015 and continues through trial.

51.   Apple's infringement of the '865 Patent has been knowing, deliberate, and willful since at least August 2019 when Apple acquired Intel's mobile transceiver business. In addition, Apple continued to infringe the '865 Patent even after being served with the initial Complaint in this action on September 15, 2021.

COUNT II

(Infringement of the '376 Patent)

52.   TOT repeats and realleges paragraphs 1 through 51 as though the same were set forth herein.

53.   As alleged above, TOT is the original and sole assignee and lawful owner of all right, title, and interest in and to the '376 Patent.

54.   The '376 Patent is valid and enforceable.

55.   On information and belief and pursuant to 35 U.S.C. § 271(a), Apple has directly infringed and continues to infringe one or more claims of the '376 Patent, including but not limited to independent Claims 1 (method) and 6 (apparatus) pursuant to 35 U.S.C. § 271(a), literally or under the doctrine of equivalents.

56.   By way of a non-exclusive example of infringement, independent Claim 1 of the '376 Patent describes a method of more precisely adjusting the SIR_{target} in the outer loop under a variety of dynamic channel conditions. Upon information and belief, Apple has directly infringed and continues to infringe Claim 1 by using (including through testing and demonstrations) the mobile transceivers incorporated in the Apple Accused Products.

57.   The mobile transceivers that Apple has used and continues to use in the Apple Accused Products, practice the limitations of Claim 1, specifically:

(a)   Claim 1 requires "*establishing a target block error rate ($BLER_{target}$).*" The mobile transceivers incorporated into the Apple Accused Products, practice this step by following applicable standards, including: 3GPP TS 25.331 §14.9.1. According to TS 25.215 v.12.2.0 (06/2016), in Chapter 5.1 dealing with "UE measurement abilities": "Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC of each transport block associated with the measured transport channel after RL combination."

(b)   Claim 1 further requires "*calculating an estimate (701) of a desired signal to interference ratio (SIR_{rec}).*" The mobile transceivers incorporated in the Apple Accused Products practice this step by following applicable standard B.2, the text of which is quoted *supra* in Paragraph 22.

(c)   Claim 1 further requires "*calculating . . . some fading parameters in a channel (706) which characterize the data signal (107, 108) received.*" The mobile transceivers incorporated in the Apple Accused Products practice this step by following applicable standards including, § 5.2.2. of the standard document TS 125.215, SIR, the text of which is quoted *supra*. The standard requires the performance of the following steps:

- First, the mobile device measures the received SIR [SIR_{rec}] at sampling points (for example, for 1500 Hz inner loop power control frequency, at each 2/3 ms time slot) pursuant to standard 3GPP UMTS requirements. This measurement is already required pursuant to the standards described in Paragraphs 19-31, above, for inner loop power control.

- Second, at each sampling point, the SIR_{target} value is subtracted from the measured received SIR [SIR_{rec}] to generate an SIR_{error} value. The mobile device collects the SIR_{error} values over a certain time period (*e.g.*, 300-1000ms) that constitutes a window for making fading margin determinations.

- Third, the data set of collected SIR_{error} values is sorted, typically from minimum to maximum. This creates a histogram (or probability density function) for the SIR_{error} values in the time period of the

28

window for making fading margin determinations. An exemplary histogram (or probability density function) is shown in the figure below. The shape of the histogram (or probability density function) will vary for different propagation channels.
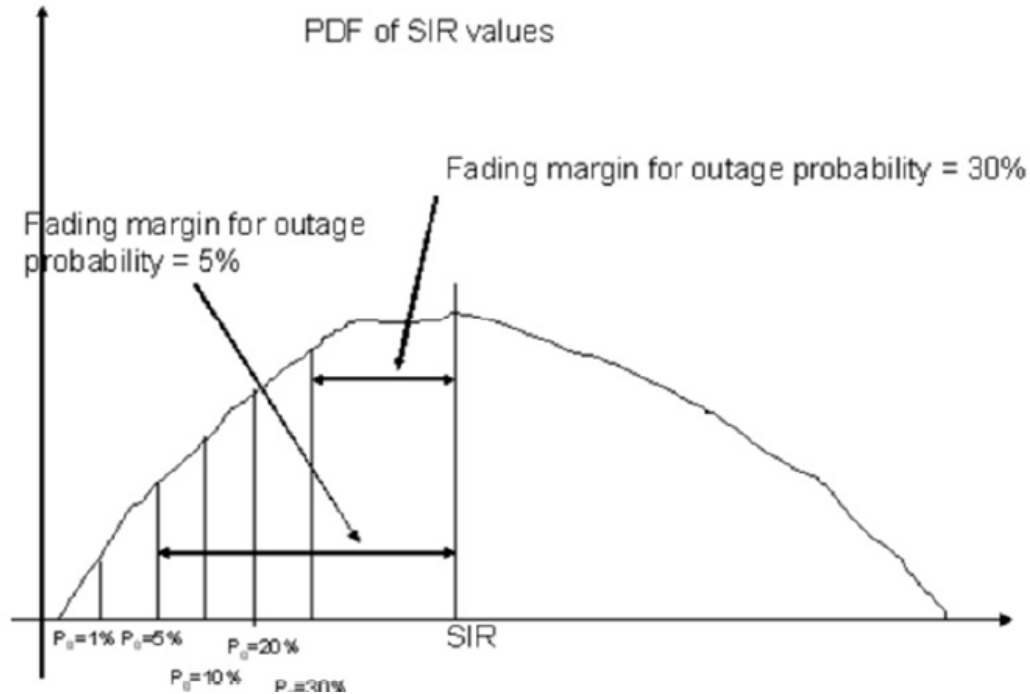
- As described further below, the collection of SIR_{rec} values when compared to the temporally commensurate SIR_{target} values are used in the mobile devices to estimate channel fading. Channel fading can occur as the result of a variety of conditions, *e.g.,* multipath propagation, referred to as multipath-induced fading, weather (particularly rain), or shadowing from obstacles affecting the wave propagation, sometimes referred to as

29

shadow fading. This can result in either constructive or destructive interference, amplifying or attenuating the signal power seen at the receiver.

(d)   Claim 1 further requires "*estimating some fading margins (M1, M2, . . . , MN) associated with some outage probabilities (po1, po2, . . . , poN) and with the fading parameters in the channel (706).*" The mobile transceivers in the Apple Accused Products identify a certain value, relative to the SIR_{target}, below which the signal quality is poor. This is shown by Patent Application US 13/424665—entitled "Outage Based Outer Loop Power Control For Wireless Communications Systems" —that Qualcomm filed on March 20, 2012 (long after the TOT patents had issued). Upon information and belief, this patent application shows how Qualcomm's mobile transceivers practice this step of Claim 1.
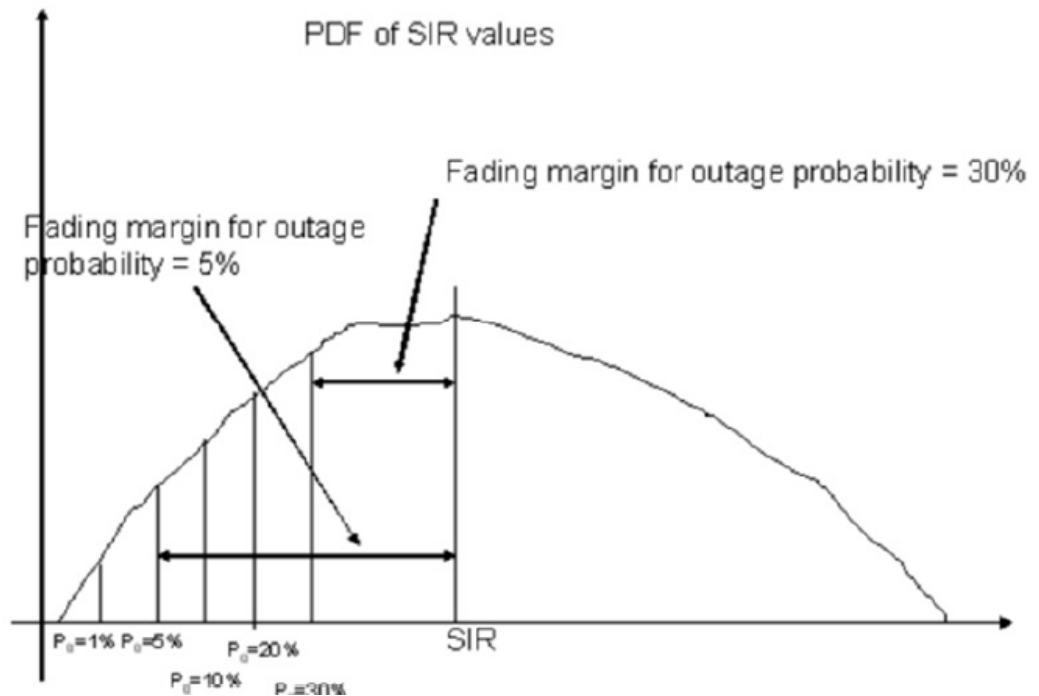
- First, the mobile transceiver calculates a SIR_{rec} and of some fading parameters which can be used to characterize the received channel as one or more fading margins, including by calculating the number of outage slots. In this regard, the Qualcomm Patent Application states:

    > [0083] Additionally, an outer loop power control function can be performed, which as noted above, improves the performance of the power control. For example, referring back to FIG. 6, for each frame, the number of outage slots (i.e., slots with

SIRE less than SIR outage threshold, in 620).
These outage slots can be counted.

- Second, the mobile transceiver measures the received SIR
  [SIR_{rec}] at sampling points (for example, for 1500 Hz inner
  loop power control frequency, at each 2/3 ms time slot)
  pursuant to standard 3GPP UMTS requirements. This
  measurement is done in the mobile transceiver since it is
  already required for inner loop power control.

- Third, at each sampling point, the SIR_{target} value is subtracted
  from the measured received SIR [SIR_{target},] to generate an
  SIR_{error} value. The mobile transceiver collects the SIR_{error}
  values over a certain time period (*e.g.*, 300-1000ms) that
  constitutes a window for making fading margin determinations.

- Fourth, the data set of collected SIR_{error} values is sorted,
  typically from minimum to maximum. This creates a histogram
  (or probability density function) for the SIR_{error} values in the
  time period of the window for making fading margin
  determinations. An exemplary histogram (or probability
  density function) is shown in the figure below. The shape of the
  histogram (or probability density function) will vary for

31

different propagation channels. The mobile transceivers use an

outage probability representative of the number of time periods

(*e.g.*, slots) in which the received signal is below that identified

value over the total number of time periods.

As shown in this figure, the mobile transceivers incorporated in the Apple Accused

Products calculate one or more outage probabilities as a percentage of the total sum

of the SIR$_{error}$ values (under the curve, from minimum to maximum). Each outage

probability can be calculated by maintaining the total sum of the SIR$_{error}$ values in

the histogram and then summing the SIR$_{error}$ values from minimum upward until a

percentage of the total sum is reached (*e.g.*, as shown in the figure, outage

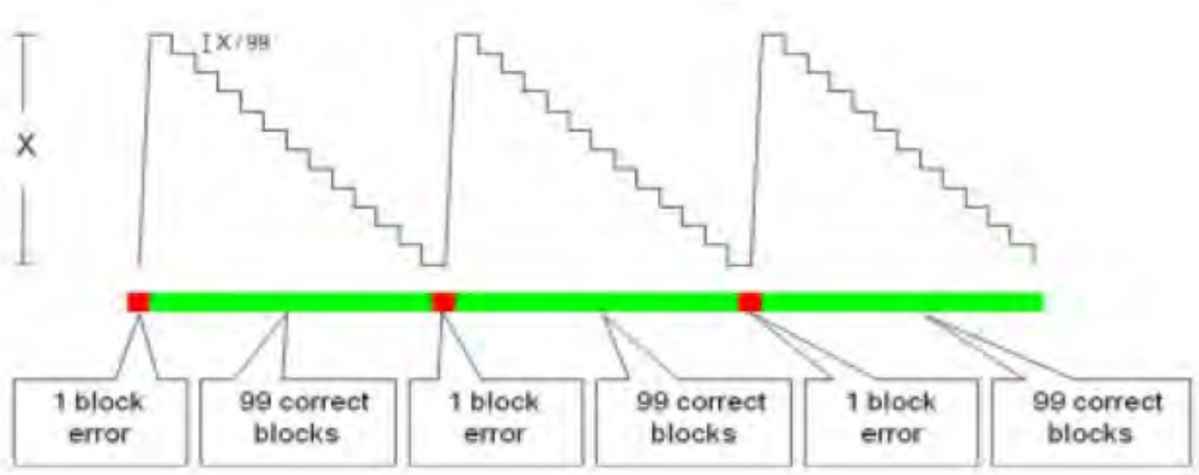probabilities of 1%, 5%, 10%, 20%, and 30%). The Qualcomm mobile

transceivers use the last SIR_{error} value for each outage probability and subtract either from the middle SIR_{error} value or the SIR_{error} value for outage probability of 50% to calculate the one or more fading margins for the one or more outage probabilities. A single outage probability*, e.g.,* of 15%, that is used to generate a single fading margin, would suffice for practical implementation purposes. The one or more fading margins may then map to a SIR_{outage} value through a linear weighting function that takes into account the initial SIR_{target} value and recent effect of the one or more fading margins on the SIR_{target} value. In Qualcomm's patent application, the inventors state:

> [0010] Accordingly, an embodiment can include a method for closed loop power control of a signal having slots. The method can include detecting valid slots based on a given validity criterion; classifying the valid slots outage slots if an estimated signal quality does not exceed an outage signal quality; accumulating, over an outer loop duration spanning a plurality of the slots, a total valid slot count and a total outage slot count; comparing the total outage slot count to a preset ratio of the total valid slot count; and updating a target signal quality based on the comparison.

(e)   Claim 1 also requires "*indicating a status of the data blocks (707) based on the checking of a Cyclic Redundancy Code (CRC) and establishing a target desired signal to interference ratio (SIR_{target}) for the outer loop, based on said status of the data blocks (707).*" The mobile transceivers incorporated in the Apple Accused Products practice this step by following applicable standards including 5.1.6, the text of which is quoted below:

33

• 5.1.6 → Transport·channel·BLER¶

| Definition | Estimation·of·the·transport·channel·block·error·rate·(BLER).·The·BLER·estimation·shall·be·based· on·evaluating·the·CRC·of·each·transport·block·associated·with·the·measured·transport·channel· after·RL·combination.·The·BLER·shall·be·computed·over·the·measurement·period·as·the·ratio· between·the·number·of·received·transport·blocks·resulting·in·a·CRC·error·and·the·number·of· received·transport·blocks.¶

When·either·TFCI·or·guided·detection·is·used,·the·measurement·"Transport·channel·BLER"·may· only·be·requested·for·a·transport·channel·when·the·associated·CRC·size·is·non·zero·and·at·least· one·transport·format·in·the·associated·transport·format·set·includes·at·least·one·transport·block.¶

When·neither·TFCI·nor·guided·detection·is·used,·the·measurement·"Transport·channel·BLER"· may·only·be·requested·for·a·transport·channel·when·the·associated·CRC·size·is·non·zero·and·all· transport·formats·in·the·associated·transport·format·set·include·at·least·one·transport·block.·¶

The·measurement·"Transport·channel·BLER"·does·not··apply·to·transport·channels·mapped·on· a·P-CCPCH·and·a·S-CCPCH.·The·UE·shall·be·able·to·perform·the·measurement·"Transport· channel·BLER"·on·any·transport·channel·configured·such·that·the·measurement·"Transport· channel·BLER"·can·be·requested·as·defined·in·this·section. |
| Applicable·for | CELL_DCH·intra |

¶

(f)   Claim 1 lastly requires "*establishing a target desired signal to interference ratio (SIR_{target}) for the outer loop, based on . . . the fading margins (M_1, M_2, ..., M_N) and the target block error ($BLER_{target}$) of the outer loop, by means of a dynamic adjusting function which performs a mapping between a quality criterion based on the outage probabilities (p_{o1}, p_{o2}, . . . , p_{oN}) and the quality criterion based on the target block error rate ($BLER_{target}$), so that the power is*

34

adapted to the propagation conditions of the data signal (107, 108)." The mobile

transceivers incorporated in the Apple Accused Products adjust the SIR$_{target}$

dynamically using the outage based outer loop power control. This is shown by the

Qualcomm patent application which states, in pertinent part:

> [0084] If the actual outage ratio is greater than a preset target outage ratio (e.g., in the range of 6%-20% of the valid slots), as determined in 630, which means the channel condition is bad, the SIRT can be increased by X dB, in 634. On the other hand, if the outage ratio is less than or equal to the preset target outage ratio, SIRT is decreased by X dB, in 632, since the channel condition is good. The step size can be adjusted within a range of values (e. g., X<1 dB). For example, in one aspect X can be 0.2 dB to keep the power change reasonable. Accordingly, for this example, if the outage ratio is larger than the target outage ratio, SIRT can be multiplied by 1.0471 . On the other hand, the SIR$_{target}$ can be multiplied by 0.9550 if the outage ratio is lower than the target outage point.

> [0085] Additionally, it will be appreciated that a windowing or threshold function may be provided in relationship to the adjustment of the Target Signal Quality (SIRT) based on the comparison in 630. For example, there could be a first outage ratio for an increase and a second outage ratio for a decrease, and any comparison that fell between those ratios Would result in no change in the SIRT.

> [0088] One simulated example of the performance improvement is shown in Table 1 for case 4 channel (see, 3GPP TS 25.101, 2010) with -ldB Geometry. With the inner loop power control (ILPC) only, the converged BER is much higher than the target BER. This can lead to test failure on targets. However, with outage-based OLPC, the BER is pulled down to the desirable range. Furthermore, there is enough margin to pass various performance tests. Therefore, through dynamically changing the SIRT, OLPC helps the UE to converge to the UL TPC BER target.

58.   As another non-exclusive example of infringement, Claim 6 of the

'376 Patent describes an apparatus that practices the method of Claim 1. Upon information and belief, Apple has directly infringed and continues to directly infringe Claim 6 by, among other things, making, using, selling, offering to sell, and/or importing into the United States without authorization the Apple Accused Products.

59.   Each accused product practices the limitations of Claim 6 of the '376 Patent, specifically:

(a)   Claim 6 requires "*at least one programmable electronic device the programmable electronic device operable to, based on a data signal received from a base station or from a mobile station, perform the steps of.*" The mobile transceivers incorporated into the Apple Accused Products include at least one programmable electronic device operable to perform various steps based on a data signal received from a base station or from a mobile station. For example, Defendant's mobile devices are comprised of multiple processors that manage at least WCDMA cellular transmit and receive functionality and the accompanying the inner loop power control and outer loop power control processes. These processors include a combination of general-purpose microprocessors and/or digital signal processors, and application specific integrated circuits (ASIC, *e.g.*, standard cell or gate array) and/or field programmable gate array devices.

(b)   The Apple Accused Products (which include programmable

electronic devices) are capable of performing the remaining limitations of Claim 6 as described *supra* in Paragraph 57 (a)-(f).

60.   As a direct and proximate result of Apple's infringement, TOT has sustained and is entitled to recover damages from Apple for its infringing activity during the period that begins on September 14, 2015 and continues through trial.

61.   Apple's infringement of the '376 Patent has been knowing, deliberate, and willful since at least August 2019 when Apple acquired Intel's mobile transceiver business. In addition, Apple continued to infringe the '376 Patent even after being served with the initial Complaint in this action on September 15, 2021.

PRAYER FOR RELIEF

WHEREFORE, TOT prays for the following relief:

a.   A judgment in favor of TOT that Defendant Apple has infringed and is infringing, either literally and/or under the doctrine of equivalents, U.S. Patent No. 7,532,865;

b.   A judgment in favor of TOT that Defendant Apple has infringed and is infringing, either literally and/or under the doctrine of equivalents, U.S. Patent No. 7,496,376;

c.   An Order permanently enjoining Defendant Apple, its respective officers, agents, employees, and those acting in privity with them, from further direct and/or indirect infringement of U.S. Patent No. 7,532,865;

d.   An Order permanently enjoining Defendant Apple, its respective officers, agents, employees, and those acting in privity with them, from further direct and/or indirect infringement of U.S. Patent No. 7,496,376;

e.   An award of damages to TOT arising out of Defendant Apple's infringement of U.S. Patent No. 7,532,865, including supplemental damages for any continuing post-verdict infringement up until entry of the final judgment, with an accounting, as needed, and enhanced damages pursuant to 35 U.S.C. § 284, together with prejudgment and post-judgment interest, in an amount according to proof;

f.   An award of damages to TOT arising out of Defendant Apple's infringement of U.S. Patent No. 7,496.376, including supplemental damages for any continuing post-verdict infringement up until entry of the final judgment, with an accounting, as needed, and enhanced damages pursuant to 35 U.S.C. § 284, together with prejudgment and post-judgment interest, in an amount according to proof;

g.   An award of an ongoing royalty for Defendant Apple's post-judgment infringement of U.S. Patent No. 7,532,865 in an amount according to proof in the event that a permanent injunction preventing future acts of infringement is not granted;

h.   An award of an ongoing royalty for Defendant Apple's post-judgment infringement of U.S. Patent No. 7,496,376 in an amount according to proof in the event that a permanent injunction preventing future acts of

38

infringement is not granted;

i.   A declaration that Defendant Apple's post September 15, 2021 infringement of U.S. Patent No. 7,532,865 was willful and an award of enhanced damages pursuant to 35 U.S.C. § 284;

j.   A declaration that Defendant Apple's post September 15, 2021 infringement of U.S. Patent No. 7,496,376 was willful and an award of enhanced damages pursuant to 35 U.S.C. § 284;

k.   An award of attorneys' fees pursuant to 35 U.S.C. § 285 or as otherwise permitted by law; and

l.   Granting TOT its costs and such further relief as the Court may deem just and proper.

DEMAND FOR JURY TRIAL

TOT demands a trial by jury of any and all issues so triable.

Dated: July 13, 2022   Respectfully submitted,

                                        FARNAN LLP

                                        /s/ Michael J. Farnan
                                        Brian E. Farnan (#4089)
                                        Michael J. Farnan (#5165)
                                        919 North Market Street
                                        12th Floor
                                        Wilmington, DE 19801
                                        (302) 777-0300 (Telephone)
                                        (302) 777-0301 (Facsimile)
                                        bfarnan@farnanlaw.com

mfarnan@farnanlaw.com

Walter D. Kelley, Jr. (admitted *pro hac vice*)
Brian A. Ratner (admitted *pro hac vice*)
Tara L. Zurawski (admitted *pro hac vice*)
HAUSFELD LLP
888 16th Street, NW
Suite 300
Washington, DC 20006
Tel: (202) 540-7157
Fax: (202 540-7201
wkelley@hausfeld.com
bratner@hausfeld.com
tzurawski@hausfeld.com

Bruce J. Wecker (admitted *pro hac vice*)
HAUSFELD LLP
600 Montgomery Street
Suite 3200
San Francisco, CA 94111
Tel: (415) 633-1907
bwecker@hausfeld.com

Attorneys for Plaintiff TOT Power Control, S.L.

40