

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,

Petitioner,

v.

INTELLECTUAL VENTURES II LLC,

Patent Owner.

Case No. IPR2025-00219

U.S. Patent No. 9,706,500

**DECLARATION OF DR. GARY LOMP IN SUPPORT OF
PATENT OWNER'S RESPONSE**

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I, Dr. Gary Lomp, do hereby declare:

I. INTRODUCTION

1. I am making this declaration at the request of Intellectual Ventures II, LLC (“Intellectual Ventures”) in the matter of the *Inter Partes* Review (“IPR”) proceedings before the United States Patent and Trademark Office (“USPTO”) of U.S. Patent No. 9,706,500 (“the ‘500 Patent”) to provide expert technical opinions with respect to the ‘500 Patent.

2. I am being compensated for my work in this matter at my standard hourly rate of \$450 for such consulting services. My compensation in no way depends on the outcome of this case, and I have no financial interest in the outcome.

3. In preparing this Declaration, I considered the following materials, the subject matter of which are all within the scope of my education and professional experience:

- The ‘500 Patent, Ex. 1001;
- The Petition for *Inter Partes* Review of U.S. Patent No. 9,706,500 (“Pet.”);
- the Declaration of Dr. Kotzin;
- U.S. Patent No. 6,334,047 (Ex. 1009)(“Andersson”);
- U.S. Patent Appln. Pub. No. 2004/0190485 (Ex. 1005)(“Khan”);
- U.S. Patent Appln. Pub. No. 2001/0036238 (Ex. 1010)(“Baker”); and
- U.S. Patent No. 6,600,772 (Ex. 1004)(“Zeira”).

- Harri Holma & Antti Toskala, WCDMA for UMTS: Radio Access for Third Generation Mobile Communications (2d ed. 2002)(Ex. 1012)

II. PROFESSIONAL BACKGROUND

4. Based on my qualifications, education, knowledge, expertise, experience, and work background, I believe I am qualified to offer opinions relating to the technology described in the ‘500 Patent. Exhibit 2002 is a copy of my current *curriculum vitae* (“CV”), detailing my education and experience. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter.

5. I am currently an Adjunct Professor in Wireless Communications at the NYU Tandon School of Engineering and President of TekTaktiks, a research and expert consulting company. My job duties include directing and performing research in, and technical evaluation of, advanced communication system design, especially new cellular technologies. I have over 45 years of experience in the field of wireless telecommunications, including advanced military communications systems, commercial satellite, WiFi and cellular systems research and development. I have over 20 years of experience in providing expert services in the field of wireless telecommunications. I hold Ph.D., Master’s and Bachelor’s degrees in Electrical Engineering, all from the Polytechnic Institute of New York (now part of NYU Tandon School of Engineering).

6. I am a named inventor on over 100 issued U.S. Patents in the field of wireless telecommunications. Most of these patents pertain to wireless communication, including communication system architecture, communication system signal processing and communication system protocols.

7. In addition to my technical experience in the field of wireless communications systems, I have been a principal and executive in multiple wireless technology corporations. In the late 1980s and early 1990s, I was Vice President and Chief Scientist at SCS Mobilecom, a wireless company that developed new technology based on spread spectrum technologies and advanced signal processing (DSP) techniques. Following the acquisition of SCS Mobilecom by InterDigital Communications, Corporation in 1992, I held various leadership roles at InterDigital, including General Manager of the Wireless Products Business Unit and Executive Vice President and Chief Technology Officer, where I helped develop 2G and 3G technologies. After InterDigital, I served in leadership positions at several wireless startups, including Symbol Technologies (where I led the Wide Area Wireless technology division), LayerOne Wireless Technologies Inc. (where I served as CEO) and incNetworks (where I served as CTO). I am also the Founder and President of The TekTacktics Group, Inc. a private company that has provided expert services and telecommunications consulting in the Telecommunications industry for the past 15 years.

8. In terms of commercial research and development (R&D) experience, I have worked extensively on the design and optimization of radio frequency (RF) communications systems for enhanced capacity and service coverage. A further object of my work has been to realize systems that are “converged” or are ingredients in a converged network concept. Convergence means the technical integration of heterogeneous services (such as voice, data, and multimedia) and heterogeneous radio technologies (macrocellular, microcellular, WiFi, cordless phone) into a seamless operating unit. This work requires cross functional design in which the respective heterogeneous technologies are made to interoperate.

9. During this career activity, I have had first-hand knowledge and exposure to numerous discussions, and debates in support of the advancement of new wireless technologies and paradigms. These new technologies addressed various air interface methods, including orthogonal frequency division multiplexing (OFDM) and Orthogonal Frequency Division Multiple Access (OFDMA), a closely related method of utilizing the OFDM format to provide shared access. My current research includes the presently evolving 5G cellular concept, which incorporates, among other things, MIMO-OFDM/OFDMA processing. As outlined above, my involvement in wireless R&D has also drawn me to fundamental system architecture issues and philosophies including the functional portioning of the overall wireless network. I have had the benefit of collaboration and debate with numerous top tier innovators,

from many industry-leading organizations in the field. In particular, I have detailed knowledge and recollection of the atmosphere surrounding the ongoing wireless technology revolution that began in the late 1980s and continues to the present day, including the period surrounding the present invention, and also including attempts by interested parties across the globe to promulgate and protect preferred ideas and intellectual property.

10. With respect to the technologies relevant to the '500 Patent, my experience includes over 20 years of research and development in the area of CDMA cellular telephone technology and systems, beginning at the very start of the commercialization of previously classified spread spectrum techniques, with which I had also a decade of prior experience. During that period of my career I had roles ranging from Senior Member of Technical Staff and Senior Principal Engineer to Chief Scientist and Chief Technology Officer heading a team of over 100 engineers in the development of the earliest WCDMA prototypes. I am a named inventor on 7 US Patents pertaining specifically to power control techniques in wireless systems, as well as many additional patents that cover all aspects of CDMA and post-CDMA wireless technology and systems. In addition to direct application to power control in cellular systems, in which numerous challenges and tradeoff analyses are required (as exemplified by the scope and depth of research and invention of concern in the current matter), I also had the benefit (earlier in my career) of 2 years of intensive study and

optimization of Delta Modulation for voice digitization, a project for which I was recognized for creating “the best 16 kilobit per second voice coder yet to be heard”. Many of the core issues that occur in power control of a wireless transmission over a randomly and often drastically varying radio channel are found in the application of delta modulation to voice encoding. An example is the well-known problem of choosing a step size and optimally varying the step size in order to cope with the dichotomous nature of the quantity being controlled (received radio frequency power level) or tracked (voice). In both applications, as dissimilar as they seem, the quantity of interest undergoes changes from near quiescence to rapid variation with large swings of level that challenge any algorithm attempting to stabilize or track said quantity.

11. To place the experience I have in the context of innovation and invention, I have been involved throughout my career in the evolution of many other basic radio communication technologies since their inception, such as MIMO, Multiuser Detection, and FEC coding advances, such as Turbo and LDPC, and soft output decoders such as the Soft Output Viterbi Algorithm (SOVA). A significant portion of the engineering design work I have performed has entailed the introduction of new techniques to provide capabilities that had not existed previously, such as a recently deployed novel baseband processor capable of robust demodulation and combining of signal components received on two antennas,

respectively, at very low signal to noise ratios. Most recently, I have designed an advanced form of OFDM in which the impairments due to channel dispersion are mitigated in both the time domain (as in conventional OFDM) and the frequency domain (which is an Achilles heel of OFDM). This achievement is the result of many years of perseverance culminating in the discovery of a mathematical tool of broad applicability (*to wit*, Simultaneous Approximate Singular Value Decomposition). Previously, a similar tenacity-fueled accomplishment produced the first and only complete closed-form theory of equalization of offset modulation formats (e.g. O-QPSK) in multipath channels, again a result of a persistent creative attack on the problem. In a word, I am well versed and well aware of the nuances of innovation and the toils of invention.

12. My CV contains further details on my education, experience, publications, and other qualifications to render an expert opinion in this case, Ex. 2006.

III. RELEVANT LEGAL STANDARDS

13. I have been asked to provide my opinion as to whether certain claims of the '500 Patent are obvious over US Patent No. 6,334,047 to Andersson et al. (hereinafter "Andersson") and U.S. Patent Appln. Pub. No. 2004/0190485 to Khan (hereinafter "Khan") in one combination and Andersson, Khan and U.S. Patent Appln. Pub. No. 2001/0036238 to Baker et al. (hereinafter "Baker") in another combination.

In addition, I have been asked to review whether the claims are allegedly obvious over U.S. Patent No. 6,600,772 to Zeira et al. (U.S. Patent Appln. Pub. No. 6,600,772) and Khan and U.S. Patent No. 6,529,741 to Tong et al. (hereinafter “Tong”) in one combination and Zeira, Baker, Khan and Tong in another combination.

14. The opinions I am expressing in this report involve the application of my knowledge and experience to the evaluation of certain references with respect to the ‘500 patent. My formal knowledge of patent law is no different than that of any lay person. Therefore, I have requested the attorneys from Volpe Koenig, who represent Intellectual Ventures, to provide me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patent validity to my analysis.

15. I understand that an IPR is a proceeding before the USPTO for evaluating the patentability of an issued patent’s claims based on prior-art patents and printed publications.

16. I understand that the claims of a patent are reviewed from the point of view of a hypothetical person of ordinary skill in the art (“POSITA”) at the time of the filing of the patent. The “art” is the field of technology to which a patent relates.

17. I understand that in determining whether a patent claim is anticipated or obvious in view of the prior art, the Patent Office must apply the *Phillips* standard to construe the claims.

18. I understand that, in this proceeding, Petitioners have the burden of proving that the challenged claims of the '500 Patent are unpatentable by a preponderance of the evidence. I understand that "preponderance of the evidence" means that a fact or conclusion is more likely true than not true.

19. I understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can "anticipate" the claim. Second, the prior art can render the claim "obvious" to a POSITA. I understand that for an invention claimed in a patent to be patentable, it must not be anticipated and must not be obvious based on what was known before the invention was made. For purposes of this Declaration only, I have applied the definition of a POSITA proposed in the Petition.

20. I understand that a patent claim may be invalid as "anticipated" under 35 U.S.C. § 102 if each and every limitation of the claim as construed by the court is found, either expressly or inherently, in a single prior art reference, such as a publication or patent, that predates the claimed subject matter. I also understand that a patent claim may be invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter claimed and the prior art are such that the claimed subject matter as a whole would have been obvious to a POSITA at the time the invention was made. I also understand that several factual inquiries underlie a determination of obviousness. These inquiries include (1) the scope and content of the prior art, (2) the

level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness (i.e., “secondary considerations”).

21. I also understand that, when a party alleges obviousness based on a combination of references, that party should identify a reason why a POSITA would have been motivated to combine the asserted references in the manner recited in the claims and to explain why a POSITA would have had a reasonable expectation of success in making such combinations.

22. I understand that an obviousness analysis permits the application of “common sense” in examining whether a claimed invention would have been obvious to a POSITA. For example, I understand that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. And I understand a party asserting obviousness should still provide a specific motivation to combine the references as recited in the claims and explain why one would have reasonably expected to succeed in doing so.

23. I understand that one indicator of non-obviousness is when a prior art reference leads in a different direction or discourages that combination, recommends steps that would not likely lead to the patent’s result, or otherwise indicates that a seemingly inoperative device would be produced.

IV. SPECIFICATION OF ‘500 PATENT

A. Overview

24. U.S. Patent No. 9,706,500, titled “Power Control in a Wireless Network” and assigned to Intellectual Ventures II LLC, discloses an innovative hybrid power control architecture designed to improve uplink power control performance in wireless communication systems, with particular applicability to CDMA-based technologies such as UTRA TDD. Ex. 1001, 1:23-26, 13:2-8.

25. The patent addresses fundamental limitations of conventional power control schemes—namely, open-loop and closed-loop approaches—which have long been used to manage uplink transmit power in mobile networks. Ex. 1001, 2:12-51, 6:1-8:25. Open-loop power control schemes enable user equipment (UE) to estimate path loss based on the received strength of a known downlink beacon. Ex. 1001, 2:16-27. While this method offers rapid responsiveness to short-term variations in the channel (e.g., fast fading), it fails to account for interference seen at the base station and assumes a symmetry between uplink and downlink channels that may not exist in real-world conditions. Ex. 1001, 2:25-27, 7:51-64.

26. In contrast, closed-loop power control schemes operate by having the network monitor uplink signal quality—typically measured in terms of signal-to-noise-and-interference ratio (SNIR)—and issue binary transmit power control (TPC) commands (e.g., ± 1 dB) to incrementally adjust the UE's transmit power. Ex. 1001,

2:28-36, 7:22-38. These schemes offer precise adjustment capabilities that reflect actual interference conditions at the receiver but suffer from delayed convergence in dynamic environments, where many sequential commands are required to effect significant power changes. Ex. 1001, 2:36-43, 7:65-8:16.

27. The invention disclosed in the '500 Patent proposes a hybrid control mechanism that intelligently combines open-loop estimation with closed-loop feedback. Ex. 1001, 2:44-51, 8:17-24. In the open-loop component, the UE determines uplink path loss by measuring a downlink beacon signal transmitted at a known power level and calculating a "partial power" based on the measured path loss. Ex. 1001, 8:52-67. In parallel, the closed-loop component allows the network to measure uplink SNIR, compare it against a dynamically updated SNIR target (managed by an outer loop using observed error metrics such as block error rate), and transmit TPC commands to the UE. Ex. 1001, 10:21-31. The UE accumulates the TPC commands over a frame. Ex. 1001, 9:21-27, 10:21-28. In the combined closed-open-loop method, the UE determines its transmit power by essentially integrating the accumulated TPC commands with the calculated partial power for the current frame and adding in "adjustment factors." Ex. 1001, 9:21-35, 10:21-31.

28. An advancement of the patented invention is the use of multi-level TPC commands in the closed-loop feedback. Ex. 1001, 9:9-10. Traditional systems utilize binary (up/down) TPC instructions with fixed step sizes, typically ± 1 dB. Ex. 1001,

7:67-8:3. This binary limitation restricts responsiveness in fast-changing environments. The patented system, by contrast, allows the network to transmit TPC commands that represent a range of predefined adjustment magnitudes—enabling larger or more nuanced transmit power changes in a single command. Ex. 1001, 7:65-8:9. This substantially improves convergence speed and controls granularity, particularly under fast fading or sudden path loss conditions.

29. Another important enhancement disclosed in the ‘500 Patent is the integration of TPC commands with uplink resource allocation data on a single channel, improving signaling efficiency and reducing latency. 12:65-13:8. This design ensures that the UE receives consistent, timely control instructions, which is essential in environments where rapid adaptation to changing interference or fading conditions is required.

30. The ‘500 Patent further introduces an accumulation mechanism within the UE, wherein the device maintains a running total of TPC commands over an entire frame. Once per frame, the UE integrates the total of the TPC commands with the results of a partial power calculation to determine an adjusted uplink transmit power level for UE transmissions. Ex. 1001, 9:21-39, 10:21-28. In the ‘500 Patent, this functionality can be both enabled and disabled using a “new parameter” that “instructs the UE to enable or disable the setting of uplink transmit power level based on both the path loss estimation and the TPC commands.” Ex. 1001, 13:17-20. Accumulation

can be disabled, for example, “when a UE passes a threshold value indicative of mobile speed.” Ex. 1001, 11:58-62.

31. In sum, the ‘500 Patent discloses a robust and adaptive uplink power control methodology that overcomes the respective shortcomings of open- and closed-loop control schemes. Ex. 1001, 2:44-51, 8:25-32. By integrating fast, beacon-based path loss estimation with fine-grained, multi-level feedback control—and further optimizing command delivery via a unified signaling channel—the invention provides a significant improvement in managing uplink SNIR, reducing interference, and enhancing overall system performance, particularly in mobile and interference-prone wireless environments. Ex. 1001, 2:22-25, 9:-10, 21-32, 12:65-13:9. Additionally, the ‘500 Patent teaches that TPC command accumulation can be enabled or disabled, for example based on the UE speed, which may reduce the amount of processing and signaling required by both the UE and the base station in the event that the UE is traveling either slow enough, such that fast channel fading is not an issue, or fast enough, such that fast channel fading is a concern. Ex. 1001, 13:17-19, 11:58-62.

B. Terminology

1. Fading and Fast Fading

32. In the context of wireless communications, and specifically’500 Patent, the term “fading” refers to the fluctuation in the strength of a radio signal as it propagates through the environment from the transmitter (such as user equipment, or

UE) to the receiver (typically a base station), or vice versa. Ex. 1001, 4:34-44. These fluctuations are primarily the result of the signal taking multiple paths through the environment due to reflection, diffraction, and scattering caused by obstacles such as buildings, vehicles, trees, and terrain. *Id.* As the various versions of the signal travel different paths, they arrive at the receiver at slightly different times and with different phases. Depending on how these signal components align when they arrive, they can interfere either constructively—resulting in a stronger signal—or destructively—weakening or even canceling the signal. This interference pattern causes the amplitude, phase, and sometimes the frequency of the received signal to vary, a phenomenon referred to as fading.

33. Fading can be broadly categorized into several types, but in the context of this patent, the most relevant form is fast fading, also known as small-scale fading. Fast fading refers to rapid changes in signal strength that occur over very short time intervals (often milliseconds or less) or small physical distances, typically due to user mobility or dynamic changes in the propagation environment. *Id.* This contrasts with slow fading (also called shadowing), which occurs more gradually and is caused by large-scale obstructions like buildings blocking the line-of-sight path. Fading can also be classified as flat fading, where the entire signal bandwidth is affected equally, or frequency-selective fading, where only portions of the bandwidth are impacted depending on the multipath delay spread.

34. The patent focuses on the challenges that fast fading poses for power control in uplink transmissions. Ex. 1001, 7:65-8:3. Because the channel conditions can change rapidly due to user movement or environmental shifts, the transmit power must be adapted quickly to maintain an acceptable signal-to-noise-and-interference ratio (SNIR) at the receiver. Ex. 1001, 7:42-45, 8:4-8. This is particularly difficult for closed-loop power control schemes, which depend on the network measuring the uplink SNIR and sending transmit power control (TPC) commands back to the UE—typically in fixed increments such as 1 dB. *Id.* Since these adjustments are limited in size and subject to transmission delay, closed-loop control often cannot respond fast enough to compensate for deep fades or sudden increases in path loss. In contrast, open-loop power control—which allows the UE to estimate the path loss independently based on beacon signals transmitted at known power levels from the base station—can react more quickly to fast fading, since it does not rely on delayed network feedback. *Id.*

2. Accumulation of TPC Commands

35. “Accumulation” of TPC command increments is fundamental to closed loop power control. The underlying concept, common to all closed-loop power control schemes, is known as “Delta Modulation.” Delta Modulation was developed in 1952. Ex. 2010. It was presented as a simple method of analog-to-digital conversion with a serial output. The primary application was encoding voice.

36. The analogy between voice encoding and power control is as follows: The input voice represents the quantity that is to be matched by the accumulated delta-modulation increments. *Id.* at 450-451. Here the accumulator is equivalent to an integrator. The encoder compares the input voice level (amplitude) to the current (encoder local) integrator output. If it is larger the integrator receives an “up” increment (a predefined step). *Id.* Conversely, if it is smaller the integrator receives a “down” increment at its input. In some cases, if the difference is negligible, the integrator may receive “no change” increment at its input. In this way, the integrator is always within 1 step of matching the voice level – assuming the update is frequent enough and the step size is large enough. This aspect will be addressed further in what follows.

37. The input increments to the local integrator may obviously be mapped to information bits. These bits are transmitted to the remote end of a communication link, where they are fed into another integrator. Assuming no bit errors, the remote integrator will match the local integrator, and the voice is thereby reproduced at the remote location. Errors in transmission can, of course, cause problems, as they, too, accumulate. This may be solved, for example, by employing a “leaky integrator” in both the local encoder loop and the remote reconstruction loop.

38. The use of delta modulation for voice communication is incidental to the basic tracking loop functionality. The entire power control analogy (except for errors,

which can again be handled by utilizing a leaky integrator in the UE) can be found in the local encoder.

39. It soon became evident that DM was limited by two factors: the coarseness of the quantization if the step size is too large and the inability to follow (“failure to follow” distortion) large changes in amplitude if the step size is too small (known as slope overload).

40. In a radio channel, the fading and interference environment causes radio signal levels to vary in a manner very similar to a random voice signal’s amplitude variations. There is a small variation during a voice sound (called a phoneme) that creates the sound (which may have buzz, hiss, or tone quality), and a superimposed larger, phoneme-by-phoneme, or syllable-by-syllable, variation in voice intensity. The latter may be compared to slow fading or shadowing of a radio signal as a mobile device moves.

41. Since a single step size cannot meet all conditions at low update rates, new approaches were invented. There is long history and large literature of Adaptive Delta Modulation (ADM) in which the step size is allowed to vary. A very successful method was known as “Continuously Variable Slope Delta-Modulation”, or CVSD. In CVSD the step value is stored in an auxiliary integrator (accumulator register or an analog integrator, as was well known in the time frame of the 70’s and later). If the encoder produced consecutive commands of the same polarity (say 3 or 4 in a row), a

“coincidence detector” would generate a pulse that fed the step size integrator, causing the step size to increase. If the step size integrator is leaky, the step size will naturally relax back to a smaller level if coincidences (which are slope overload indications) subside.

42. Not all of the speech-encoding aspects of ADM are relevant to radio signal power control, but they could well be mimicked. The fundamental principle is the use of stepped adjustments that need to be able to respond to two kinds of change (slow and rapid) of level of the quantity being tracked. Importantly, in both applications it is desirable to keep the required update rate low to conserve signal communication bandwidth.

43. As used in the patent, “TPC command accumulation” refers to the process by which user equipment (UE) tracks and sums the history of transmit power control (TPC) commands received from the network as part of a closed-loop power control scheme by “adding a TPC command value to an integrator” each time a TPC command is received. In such a system, the base station continuously monitors the signal-to-noise-and-interference ratio (SNIR) of the uplink transmission from the UE and compares it to a predefined SNIR target. If the measured SNIR is too low or too high, the network sends a TPC command instructing the UE to increase or decrease its transmit power—typically by a small, fixed step size, such as ± 1 dB. Rather than adjusting the transmit power immediately and independently in response to each TPC

command, the UE keeps a running tally of all the "up" and "down" commands. This process of summing these incremental adjustments over time is what the patent refers to as accumulation. In the context of the '500 Patent specification, TPC commands are accumulated by adding corresponding values to an integrator each time a TPC command is received, although the power the UE transmits at may be updated at longer intervals (such as once per frame). Ex. 1001, 7:34-38, 10:11-15, 9:27-33, Figures 3 and 4.

44. Accumulation is particularly valuable because it enables the UE to determine the net power adjustment required, especially when many small commands are issued in rapid succession. It helps smooth out the power control process by avoiding constant back-and-forth swings in transmit power, which could occur if each TPC command were acted upon in isolation. Additionally, accumulation provides a measure of resilience against noise and temporary fluctuations in SNIR, as it prevents the UE from overreacting to transient conditions. In the hybrid power control scheme described in the patent, accumulation also plays a key role in supporting multi-level TPC commands—where the magnitude of the final power adjustment is derived from the total number of steps accumulated over a period of time.

45. A helpful analogy for understanding accumulation is to think of a thermostat controlling the temperature in a room. Suppose the thermostat detects that the room is slightly too cold and sends a signal to turn up the heat by one degree. If

the room remains cold, the thermostat keeps sending more “turn up” signals. Instead of reacting to each individual signal by tapping the thermostat every time, you could simply count the number of “heat up” signals and then raise the temperature by the total amount all at once. This is the idea behind accumulation: tracking a series of small, incremental instructions to inform a more stable and controlled adjustment in transmit power. By using accumulation, the system balances responsiveness with stability, enabling more precise and efficient power control in dynamic wireless environments.

46. In the context of the ‘500 Patent, an “accumulator”/“integrator” is a functional component within the user equipment (UE) that stores and tracks the history of transmit power control (TPC) commands received from the network—specifically, from the base station (Node-B). Ex. 1001, 3:31-35, 7:7-21, 9:21-38. It plays a key role in the closed-loop power control mechanism and is particularly important in the combined open-loop and closed-loop scheme described in the ‘500 patent.

47. In closed-loop power control, the base station periodically sends TPC commands to the UE, instructing it to increase or decrease its transmit power—typically by a fixed amount. Ex. 1001, 6:58-61. These instructions are meant to adjust the UE’s transmit power so that the SNIR at the base station aligns with a predefined SNIR target. *Id.* In the combined closed-open-loop scheme, the TPC

commands are accumulated over a frame and then integrated with the partial power calculated based on pathloss, as indicated by $P_{TX}(k)$, although integration can occur less than every frame period (e.g., every time a new TPC command is received), or less frequently (e.g., only when a new power level is received from the network). Ex. 1001, 9:21-33.

3. Channel

48. In the context of the ‘500 Patent, the term “channel” refers to the communication path over which radio signals are transmitted between a network entity, such as a base station, and a UE, such as a mobile phone or other wireless device. A wireless channel can be thought of as the radio link between the transmitter and receiver. In the ‘500 Patent, channels are discussed in the context of both the uplink (from UE to base station) and the downlink (from base station to UE). Ex. 1001, 1:28-34, 1:53-56, 4:24-31. Further, the ‘500 Patent specifically discloses, for the combined open-closed loop scheme, “a new physical channel on downlink [that] may be used to carry fast allocation and scheduling information to a user” Ex. 1001, 12:65-13:1. This channel may also be used to carry TPC commands. Ex. 1001, 13:3-7. Alternatively, instead of a new channel, “the combined scheme may be applied to existing channel types (dedicated or shared uplink physical channels) for UTRA TDD as well as to other TDD systems.” Ex. 1001, 13:5-8.

4. ‘On a Single Physical Channel’

49. In my opinion, the term “on a single physical channel” refers to the same physical channel instance addressed to the UE for the relevant uplink transmission. It does not merely mean that the information appears somewhere within the same system but on different codes or in different time slots. The ‘500 Patent specification confirms this usage: it expressly describes a single downlink physical channel carrying both fast allocation/scheduling information and transmit-power-control (TPC) feedback to the UE. EX1001, 12:65–13:5. Based on this, it is my opinion that “physical channel” in the claims refers to the specific L1 bearer, defined by code and timing, addressed to the UE, and not a collection of different covers or slot fields shared among users.

C. Accumulation in combined open- and closed-loop power control scheme

50. In a combined open- and closed-loop uplink power control scheme, the user equipment (UE) accumulates transmit power control (TPC) commands using the following expression:

$$\sum_{k-K}^k TPC^i, \quad (\text{Equation 1})$$

where k represents the current frame, K is the first frame after accumulation is reset (or the first frame in general), and i denotes the current time slot. See, e.g., Ex. 1001, 9:21-23, 10:21-31.

51. The full transmit power equation for the combined scheme, which incorporates the TPC accumulation shown above (Equation 1, highlighted in red), is given by:

$$P_{Tx}(k) = P_{open}(k) + step \cdot \sum_{k-K}^k TPC^i + \gamma_{SF} + \beta_{TFC} \quad (\text{Equation 2})$$

Ex. 1001, 9:21-38.

52. The transmit power $P_{Tx}(k)$ may be updated every frame period, each time a new TPC command is received (i.e., once per slot, ii), or only when either a TPC command or a new power level is received from the network. See Ex. 1001, 9:27-33. In other words, when the system is configured to operate in the combined open-closed-loop scheme (as indicated by a corresponding parameter—see sub-heading 1 *supra*), the UE accumulates TPC commands received in each slot either once per slot or over one or more frames. Ex. 1001, 9:21-38.

53. As described in the specification, “[t]he UE accumulates 420 the TPC commands and uses the accumulated TPC commands in part to set 436 the transmit power level for future uplink transmissions 400.” Ex. 1001, 10:12-15. The resulting transmit power level $P_{Tx}(k)$ may then be used to set the uplink power of transmitted user data. See Ex. 1001, 10:31-33;. This process is illustrated in FIGURE 4 of the ‘500 Patent, a block diagram in which the relevant components cited above are highlighted in red below for ease of reference.

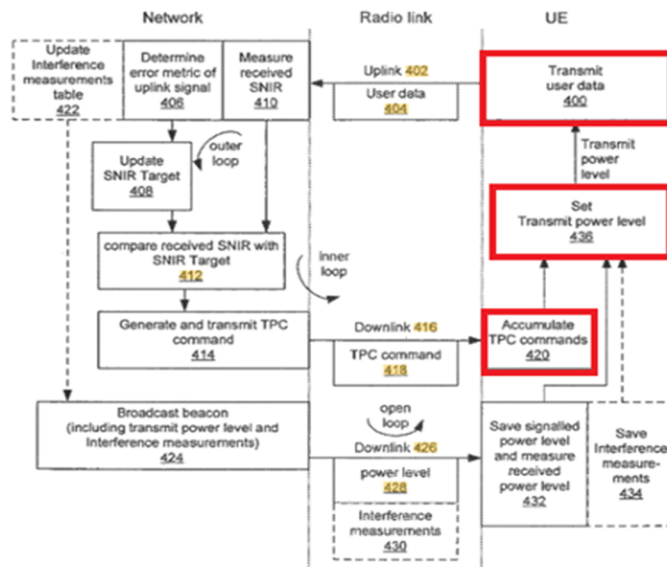


FIGURE 4

54. Regarding Open Loop control, it can be stated that in the case of perfect channel reciprocity, there is no need for closed loop control. For, with reciprocity, knowledge of the received power and the transmitted power in one direction (the downlink, for example), determines exactly the uplink path loss and therefore the required power to transmit to produce the desired received signal power (or SNR).

55. In my opinion, there are two problems with the open loop method. First, perfect reciprocity is not guaranteed, especially if there are distinct uplink and downlink radio frequencies. Even in TDD, when the frequencies are the same, there is a small time difference between transmissions, so that conditions may not be the same in the uplink transmission interval as they were in the reference downlink interval. Second, other factors, especially external or other users' signals interference, can be different in the two link directions. Open loop control does not measure this

passively (i.e., by simply measuring received signal level in one direction). A means of informing the transmitter of the need to overcome interference is required. Over the air closed loop can handle this. Local closed loop requires “side information” to handle the asymmetry in the two link directions.

56. One may regard closed loop control as a means of correcting for the inaccuracy of open loop control. This is a beneficial point of view. The overall variation of signal level in a wireless system can be 100 dB. That is, ten orders of magnitude. If open loop control can eliminate 80 dB of that variation, then closed loop control can be applied to handle the remaining 20 dB of variation. Moreover, the open loop control may be adjusted such that the residual variation (say 20 dB) may have a smaller rate of change than the uncompensated variation.

V. Other Technical Concepts and Terminology

57. The Zeira and Andersson references are based on certain underlying technology, which is, in my opinion, important to understand when reading these references. Below, I explain some important underlying concepts and terminology for the underlying technologies of these Patents that I believe are important in applying them correctly to the Claims of the ‘500 Patent.

A. DPCCH

58. A Dedicated Physical Control Channel (DPCCH) was defined in the cited Andersson reference. EX1009, 9:12-24, FIG. 5. FIG. 5 of Andersson is

reproduced below. The DPCCH shown in FIG. 5 and described in Andersson “is divided into 72 frames corresponding to a 720 msec recycle time period.” *Id.* at 9:14-15. Each frame is divided into 16 times slots, each 0.625 msec long. *Id.* at 9:16-18. The channel carries a pilot field, a TPC command field, a power control flag and other bits. *Id.* at 9:16-22. This information was included in each frame. *Id.*

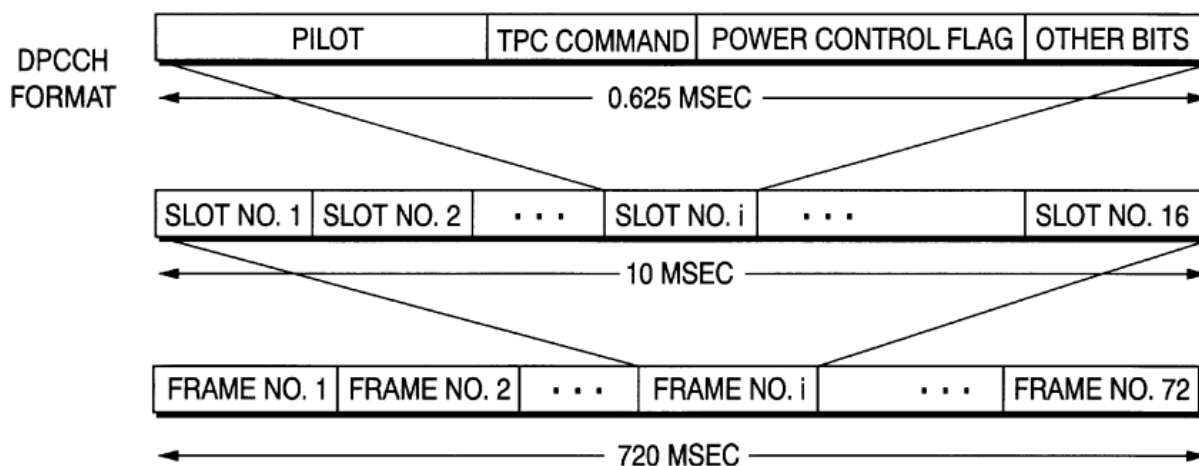


Fig. 5

59. In 3GPP TS 25.211 Release 99, the DPCCH was defined as *an uplink channel* in WCDMA/UMTS that was transmitted continuously by the UE to the Node B. EX2014 at § 5.2.1. Figure 1 of 3GPP TS 25.211 V 3.10.0 is reproduced below for purposes of this discussion. As shown, the DPCCH carried essential control information needed to maintain the radio link, specifically, pilot bits (for channel estimation), the Transport Format Combination Indicator (TFCI), Feedback Information (FBI), and TPC commands. *Id.* These fields were transmitted in fixed

locations in every slot, ensuring that the Node B could track channel quality, adjust transmit power in real time, and decode the user's data correctly. *Id.*

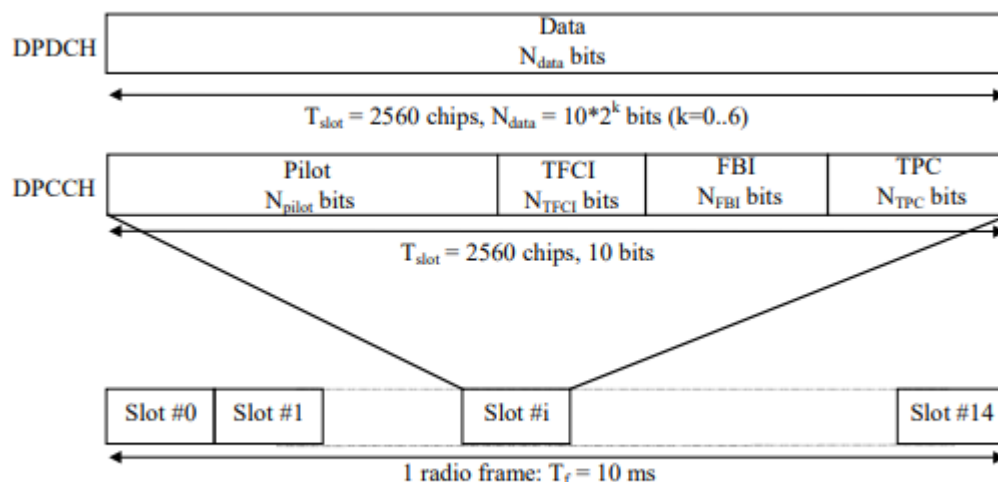


Figure 1: Frame structure for uplink DPDCH/DPCCH

B. Dedicated Physical Channel (DPCH)

60. While the DPCCH was exclusively an uplink channel, Andersson himself contemplated TPC commands sent in both the uplink and downlink directions. EX1009, 6:24-30, 7:6-12. With respect to the DPCCH specifically, Andersson stated: “This type of transmit power control message may be sent in the uplink direction and downlink direction of the dedicated physical control channel.” *Id.* at 9:22-24. In my opinion, this makes sense because Andersson was filed just a few months prior to close date for 3GPP standardization of the DPCCH in Release 99. Accordingly, a POSITA reading Andersson and interested in implementation details for downlink TPC commands related to the DPCCH, would have looked to 3GPP TS 25.211 Release 99 and would have found the corresponding downlink channel, the Downlink

Dedicated Physical Channel (DPCH), which was used to transmit TPC commands in the downlink, similar to the DPCCH in the uplink.

61. In 3GPP TS 25.211 Release 99, the DPCH, shown, for example, in FIG. 9 (reproduced below), was defined as a downlink channel in WCDMA/UMTS that carried both user data and control information. EX2014 at § 5.3.2. The DPCH consisted of two parts multiplexed together: the Dedicated Physical Data Channel (DPDCH) **and the DPCCH fields**. *Id.* (“The downlink DPCH can thus be seen as a time multiplex of a downlink DPDCH and a downlink DPCCH, compare subclause 5.2.1.”). As shown in FIG. 9 below, each 0.667 msec slot of the DPCH frame structure contained data bits in the DPDCH portion, while the DPCCH portion carried fixed control fields consisting of pilot bits (for channel estimation), the TFCI, FBI, and TPC commands. *Id.* at § 5.3.2, FIG. 9. These control fields were transmitted in fixed positions in every slot, ensuring that the UE could estimate the channel, identify the active transport format, support transmit diversity, and adjust its uplink transmit power as commanded by the Node B.

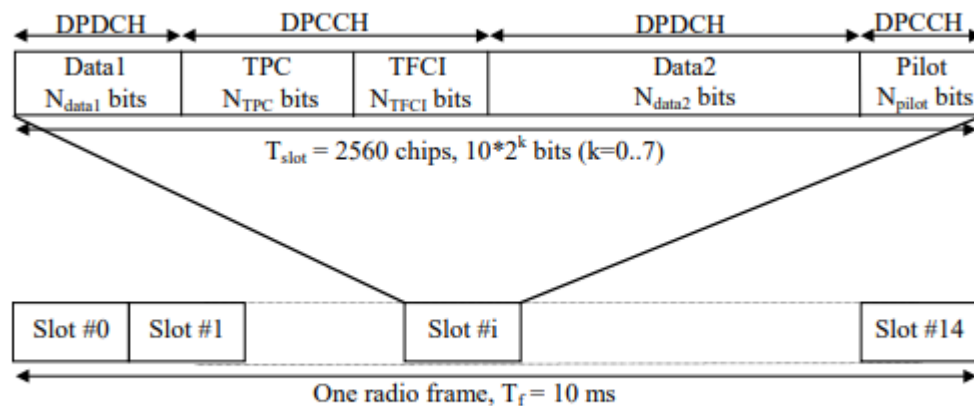


Figure 9: Frame structure for downlink DPCH

C. 3GPP Release 99 RRC Uplink Transport Channel Configuration/Re-configuration

62. It is my understanding that, in Release 99 RRC, when a UE needed to start or change a data session, the RNC (via RRC signaling) would configure or reconfigure the transport channels assigned to that UE, for example, setting a fixed bit rate, coding scheme, or mapping to dedicated channels or common channels. EX2015 at § 8.6 (defining the Transport Channel Reconfiguration procedure used by the RNC to modify a UE's transport channel characteristics). This was done through RRC procedures such as Transport Channel Reconfiguration, not by sending rapid per-TTI grants, as in Khan. Once the RRC reconfiguration was complete, the UE used the assigned channel parameters until the RNC later changed them again. *Id.* (procedure initiated by UTRAN to reconfigure transport channels as part of resource management). In other words, the RNC/RRC model was “slow scheduling”: the network assigned relatively static resources to the UE for some

duration, and those resources did not change every 2 msec or depend on instantaneous channel conditions. This is fundamentally different from fast scheduling, where the Node B dynamically selects users and coding/modulation every TTI and informs the UE.

63. In my opinion, EX2015 would have been applicable to both UMTS/FDD (WCDMA), the underlying technology in the Andersson reference, and UMTS/TDD, the underlying technology in the Zeira reference. While not specifically stated in the standard documents themselves, UMTS/TDD and UMTS/FDD used the same Layer 3 (RRC) technical specification at least during the relevant time period. Petitioner's EX2012, titled WCDMA for UMTS, which Petitioner uses to map dedicated to physical channels in Zeira, in fact ties this all together. Andersson is based on UMTS FDD mode (also referred to as WCDMA), while Zeira is based on UMTS TDD mode, yet Petitioner used a WCDMA text book to explain the mapping of dedicated to physical channels in Zeira. § 7.3.2 of that book explains that scheduling, at the least to extent it would allegedly have been obvious to send it on Zeira's dedicated channel, is actually sent by the RNC, and not the base station that sends TPCs, "as part of the reconfiguration function of the RRC layer." *See* EX2012, § 7.3.2. Further, Petitioner maps Zeira's dedicated channel to the DPCH, the same channel disclosed in the 3GPP TS 25.211 Release 99 specification discussed in § V.B. *infra*.

VI. CHALLENGED CLAIMS OF THE ‘500 PATENT

64. Petitioner challenges independent Claims 11 and 17, and dependent claims 12-16 and 18-22 of the ‘500 Patent. Independent Claims 11 and 12 are representative, and recite:

11. A user equipment (UE) comprising:

a transmitter;

a receiver; and

a processor operatively coupled to the transmitter and the receiver;
and

the processor and the receiver are configured to receive, on a single physical channel, an allocation of an uplink resource and a multi-level TPC command;

wherein the processor is further configured to determine a transmission power level based on a value of the multi-level TPC command out of a plurality of potential values for the multi-level TPC command;

wherein the plurality of potential values for the multi-level TPC command includes at least two values up or at least two values down;
and

wherein the processor is configured to have the transmitter transmit an uplink signal on the allocated uplink resource at the determined transmission power level.

12. The UE of claim 11, the processor is further configured to receive an indication as to whether accumulation of TPC commands is enabled.

VII. A PERSON HAVING ORDINARY SKILL IN THE ART

65. For purposes of the institution decision only, I do not contest the definition of a person of ordinary skill in the art (“POSITA”) proposed in the Petition. Petition, 15. I reserve the right to contest Petitioner’s proposed definition of a POSITA if a trial is instituted.

VIII. PRIOR ART RELIED ON IN PETITION

66. In Ground 1, Petitioner challenges independent claims 11 and 17, and certain dependent claims, as allegedly obvious over US Patent No. 6,334,047 to Andersson et al. (hereinafter “Andersson”) and U.S. Patent Appln. Pub. No. 2004/0190485 to Khan (hereinafter “Khan”). In Ground 2, Petitioner challenges dependent claim 12, and certain other dependent claims, as allegedly obvious over Andersson, Khan, and U.S. Patent Appln. Pub. No. 2001/0036238 to Baker et al. (hereinafter “Baker”). In Ground 4, Petitioner challenges independent claims 11 and 17, and certain dependent claims, as allegedly obvious over U.S. Patent No. 6,600,772 to Zeira et al. (U.S. Patent Appln. Pub. No. 6,600,772), Khan and U.S. Patent No. 6,529,741 to Tong et al. (hereinafter “Tong”). In Ground 5, Petitioner challenges dependent claim 12, and certain other dependent claims, as obvious over Zeira, Khan, Tong, and Baker. The remainder of the grounds address dependent claims only. Independent claims 1 and 6, and dependent claims 2-5 and 7-10 are not challenged.

A. Andersson

67. Andersson describes a technique for enabling fast and efficient adaptation of transmit power control in wireless systems. The reference is particularly focused on varying the step size and type of power control scheme used based on changing radio conditions, while minimizing signaling overhead. Ex. 1009, 10:27–31. This is achieved by “transmitting a single bit value with the transmit power control command,” which I understand to refer to a power control indicator (PCI) that signals which of multiple predefined power control behaviors the UE should follow. Ex. 1009, 10:27–31. From a wireless systems perspective, this approach enables the network to signal a “very fast power control type adjustment” to the UE “without much increase in overhead,” which is important in environments where fast fading or rapid mobility demand quick adaptation. Ex. 1009, 10:31–39

1. Power Control Routine

68. Andersson sets forth a power control routine that may be implemented by a wireless network. This routine is illustrated in the flow chart of FIG. 4 (reproduced below with relevant steps highlighted in red), which outlines how the network computes and sends power control instructions to the UE. Specifically, as shown in block 206, the network transmits a “transmit power control command” to the UE instructing it “to either raise, lower, or make no change to the transceiver’s current transmit power level.” Ex. 1009, 9:4–6.

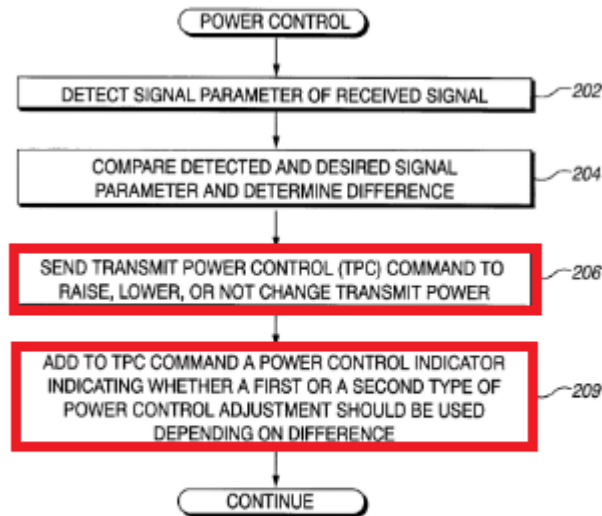


Fig. 4

69. In block 209, a power control indicator is added to this TPC command. This indicator, which “in its simplest form, may be a single flag bit,” tells the UE whether it should apply a first or second type of power control adjustment. Ex. 1009, 9:6–11. In other words, Andersson discloses that, for uplink power control, the UE receives both: (1) a TPC bit indicating whether to raise, lower, or maintain power, and (2) a power control indicator bit instructing whether to use one of multiple power control schemes, which may be as simple as using a small or large step size (e.g., 1 dB or 8 db), or using the same step size in each slot or varying step sizes per slot. Ex. 1009, 9:45-50, 10:41-59.

2. Dedicated Physical Control Channel (DPCCH)

70. Andersson also describes the transmission format used to deliver the TPC and power control indicator bits to the UE. These values are transmitted on the

Dedicated Physical Control Channel (DPCCH), a channel uniquely assigned to an individual UE. Ex. 1009, 9:12–16. In my experience, such a dedicated channel enables the network to issue frequent, per-UE-specific commands, including fast power control signaling without delay or contention.

71. As a general matter, regarding dedicated channels, etc., it is well-known in the art, at least as far back as 2G Digital Cellular, and even in Analog Cellular, to use separate channels, both at the Physical Layer (PHY) and Higher Layers (e.g., Logical Channels such as RLC Link Control Layer, RRC, etc.) to support signaling and control transmission between individual users (UE's) and the Access Network (dedicated channels), on the one hand, and between the Access Network and multiple UE's (shared channels) on the other hand. In the first case, only the intended UE demodulates and decodes (or transmits) the signal. In the second case, an entire set of UEs (possibly all) can demodulate a shared channel transmitted from the base station or transmit to a base station using a shared channel. In the dedicated case, frequency, time, and code resources are allocated to a single UE, preventing other UE's from receiving the dedicated channel. In the shared case, additional methods, namely multiplexing methods, must be added to organize the shared channel usage into non-interfering parts. The relevant aspect of the dichotomy is that only single UE's can receive a DCH signal. When a dedicated channel is used to transmit information to the UE, that information is packaged into a data payload carried within the physical

"container" of a well-defined discrete transmission. Thus, two time slots are not a single discrete transmission; they comprise two such transmissions, even when intended/transmitted for a single UE. Another distinguishing characteristic of a dedicated channel is that it is allocated for a specific user and is deallocated when that user no longer requires it. In more picturesque language, the channel is "nailed up" during the time it is allocated to the user, and the resources are unavailable to other users. Note, however, that two dedicated channels may be assigned to the same user, at least in principle. They may carry different information at different times and have frequencies (recurrence rates, not radio frequencies) of transmission. It is also logically possible to opportunistically, or conditionally, based on user operational state, utilize a dedicated channel to convey signaling information to a user when such information is ready for transmission. Such opportunistic use of a dedicated channel may decrease the need for the user to access shared resources (channels that are shared and that, therefore, have variable demand and load). Such use of a dedicated channel does not change the nature of the channel from "dedicated" to some other type.

72. The format of the DPCCH is illustrated in FIG. 5 of Andersson (reproduced below). As shown, the DPCCH is divided into 72 frames spanning 720 ms, with each 10 mS frame consisting of 16 time slots of 0.625 mS duration. Each time slot includes a pilot field, a TPC field (increase, decrease, or maintain), a power control indicator, and other bits. Ex. 1009, 9:16–22. Andersson does not define the

“other bits” nor does even hint at what those bits could be. It is important to note that Andersson also teaches a common channel over which the base station transmits “common signaling.” Ex. 1009, 8:10.

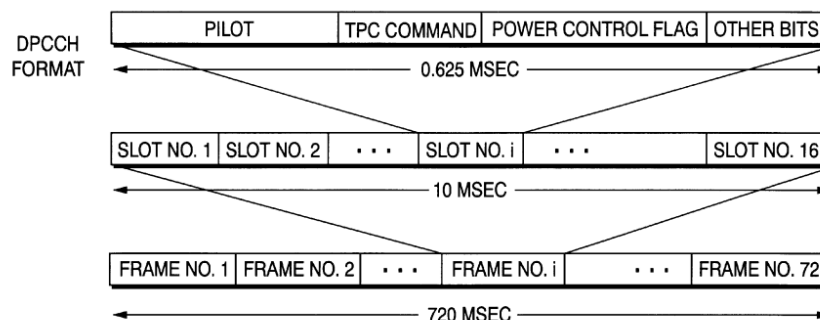


Fig. 5

B. Baker

73. Baker is directed to uplink power control in a wireless communication system, specifically within a UMTS framework, utilizing two-state Transmit Power Control (TPC) commands that are transmitted once per timeslot. See Baker, ¶ 21. In addition to the TPC command bit itself, the system behavior is governed by two parameters: the Power Control Algorithm (PCA) and the uplink Transmit Power Control step size (ΔTPC). These parameters define the power control step size applied by the user equipment (UE), enabling three effective step size configurations. *Id.*

74. Table 1 below summarizes the relevant combinations of PCA, TPC command, and ΔTPC , as well as the resulting transmit power adjustment at the UE. When PCA is set to 1, ΔTPC may be either 1 dB or 2 dB. Under these conditions, a

received TPC command of 0 causes the UE to reduce its transmit power by ΔTPC dB, while a command of 1 causes the UE to increase its transmit power by the same amount. See Baker, ¶ 22.

TABLE 1

PCA	TPC Command	ΔTPC	UE Action
1	0	1 or 2	Reduce Transmit Power by ΔTPC
	1	1 or 2	Increase Transmit Power by ΔTPC
2	0	1	Combine TPCs in groups of 5. If all 5 TPCS are 1, increase transmit power by ΔTPC ; if all 5 TPCs are 0, decrease transmit power by ΔTPC ; otherwise, do not change Transmit Power.

75. When PCA is set to 2, ΔTPC is fixed at 1 dB. In this case, the UE does not respond to individual TPC commands. Instead, it evaluates the commands in groups of five. If all five commands are equal to 1, the UE increases its transmit power by ΔTPC dB; if all five commands are 0, the UE decreases its power by ΔTPC dB; otherwise, no adjustment is made. See Baker, ¶ 23.

76. While Baker does not explicitly disclose the use of an accumulator, it is evident that the described logic enables the accumulation of power adjustments over

time. Depending on the sequence of received TPC commands and the selected PCA and Δ TPC parameters, the effective net adjustment to transmit power may be +1, -1, +2, -2, or 0 dB. These outcomes reflect behavior consistent with an accumulation process, even though that term is not expressly used in the reference.

C. Khan

77. Khan is directed to mechanisms for delivering control information—such as scheduling grants—for reverse link (i.e., uplink) packet access in a wireless communication system. See Ex. 1005, ¶ 11. Unlike systems such as described by Andersson, which rely on dedicated control channels (such as the Dedicated Physical Control Channel, or DPCCH) to transmit Power Control (TPC) commands to user equipment (UE), Khan focuses on architectures that leverage shared control channels to perform this function.

78. Khan explains that legacy voice-based systems traditionally used dedicated links between a base station and individual wireless units. See Ex. 1005, ¶ 4. However, as wireless networks evolved to accommodate bursty and delay-tolerant data traffic—such as Internet applications—resource management in the uplink has become a significant design consideration. In this context, Khan observes that dedicated links may no longer be necessary, and that both uplink and downlink control channels can instead be shared among multiple UEs. See Ex. 1005, ¶ 5. Under this model, UEs contend for access to shared resources, with base stations managing

uplink scheduling based on system-wide constraints, including received signal power and inter-cell interference. *Id.*

79. Khan identifies a specific problem that arises in time-multiplexed systems supporting reverse link packet access. In such systems, the forward link (FL) may use a time-slot structure that makes it difficult to allocate persistent or code-multiplexed channels for control signaling. See Ex. 1005, ¶¶ 11, 43. Consequently, Khan proposes mechanisms to transmit control information—including scheduling grants and TPC bits—over shared channels that align with the slot-based nature of the system. See Ex. 1005, ¶ 43.

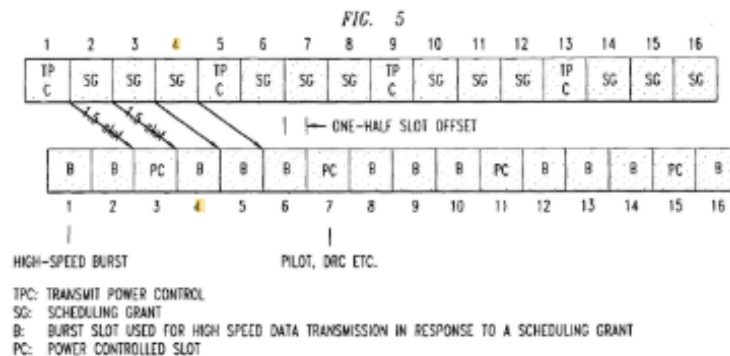
80. Khan is based on the CDMA2000 HRPD specification. EX1005, ¶43. Khan is premised on an understanding that “a code-multiplexed scheduling grant channel, in some cases, may not be used in the CDMA2000 HRPD. *Id.* The detailed description of Khan therefore presents two exemplary embodiments for delivering such control information to UEs, one of which uses a time-multiplexed slot structure:

- Using Orthogonal Walsh Covers (Ex. 1005, ¶¶ 45–47):

In this approach, each active UE is assigned a unique MAC index. These MAC indices are transmitted in bursts of 64 chips and can convey up to 6 bits of control information. To simultaneously support scheduling grants and TPC bits, orthogonal Walsh codes are used to separate the information streams. In practical terms, this embodiment treats TPC and scheduling grant information

as being transmitted over separate physical channels. See Ex. 1005, ¶¶ 37–41, 47.

- Using a TDD Channel Structure (Ex. 1005, ¶ 47 and FIG. 5):
In this embodiment, the forward link uses a time-division multiplexed structure where control information is distributed across different timeslots. For example, as illustrated in FIG. 5, TPC bits are transmitted in slots 1, 5, 9, and 13, whereas scheduling grants are sent in the intervening slots. In this manner, although both types of control information are sent over the same shared physical channel, they are separated in time rather than by code. The UE responds by transmitting in designated slots that are tied to its received scheduling grant. See Ex. 1005, FIG. 5.



81. Thus, Khan distinguishes itself by enabling TPC and scheduling control over shared media, rather than relying on dedicated physical control channels. This design allows for scalable and efficient use of limited radio resources, particularly in environments characterized by dynamic user activity and asymmetric data demands.

D. Zeira

82. Zeira describes combined open loop and closed loop power control in a wireless TDD (Time Division Duplex) communication network. *See* Ex. 1004, FIG. 4; 3:25–26. The combined closed/open loop power controller 108 resides in a "transmitting station" 52, which can be either a user equipment (UE) or a network-side entity, such as a base station. Ex. 1004, FIG. 1004, 3:22-39.

83. Zeira's power control mechanism determines the transmit power level based on both closed loop and open loop control components. Specifically, a transmit power calculation device (element 116) within the controller 108 sets the transmit power level of the transmitting station adjusting target power control to account for a closed loop power control factor, $G(n)$, and a weighted open loop power control factor αL , using Equation 4 in Zeira (referred to herein as Equation 3):

$$P_{TS} = P_0 + G(n) + \alpha L \quad (\text{Equation 3})$$

84. Here, P_0 is the target received power at the base station, which may be derived from the desired SIR and interference level. Ex. 1004, 6:5-6. $G(n)$ is the closed loop power control factor, defined by the recursive relation (Equation 6 in Zeira, referred to herein as Equation 4):

$$G(n) = G(n - 1) + b_{TPC} \Delta_{TPC} \quad (\text{Equation 4})$$

85. In this equation, $G(n-1)$ represents the previous closed loop power control factor, b_{TPC} , is a binary power control command sent from the base station

(either +1 or -1), and ΔTPC is the power step size, typically 1 dB. Ex. 1004, 6:21–27. Accordingly, each power control command either increases or decreases the accumulated closed loop term by ΔTPC . Zeira states that b_{TPC} is transmitted by the network to the UE over a dedicated channel. See Ex. 1004, 4:27–30.

86. The term L in Equation 3 represents the estimated pathloss, which is calculated at the UE based on measurements of a received downlink signal and the known or signaled transmit power of that signal. Ex. 1004, 5:18-36. The weight α is a scalar quality factor applied to the pathloss estimate and reflects the system's confidence in the accuracy of the open loop component. Zeira describes α as a measure of pathloss quality and notes that it is determined by the UE. Ex. 1004, 6:32–33.

87. Zeira also contemplates scenarios where the network operator may choose to rely solely on closed loop control. To achieve solely open loop power control, α may be set to zero. See Ex. 1004, 7:18–22. In Zeira, α is typically determined by the transmitting station (i.e., the station whose transmit power is being controlled or the UE in the alleged combination), and the specification does not explain how the network can set α to zero in this limited circumstance. Ex. 1004, 6:32-33.

88. With respect to the transmission of control information, Zeira, like Andersson, relies on dedicated control channels. Zeira explicitly states that the closed loop power control command b_{TPC} is typically transmitted via a dedicated channel

established between the receiving station and the transmitting station. See Zeira, 4:27–30; 7:28–30. Thus, each UE is assigned a dedicated control channel for receiving power control commands from the base station, consistent with legacy UMTS architectures that prioritize link-specific reliability and latency. See Section A.2. *supra*.

89. In sum, Zeira teaches a flexible power control mechanism that dynamically combines open and closed loop elements, with the ability to fall back to closed loop-only operation as needed. However, the transmission of power control information remains tied to dedicated channels, like Andersson, distinguishing Zeira from later systems that leverage shared channels for improved scalability and efficiency.

IX. GROUND 1 FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD OF SUCCESS ON THE MERITS

A. The Petition’s Proposed Combination of Andersson and Khan Fails to Disclose or Suggest Key Claim Limitations

90. In Ground 1, Petitioner asserts that Claims 11, 15-17, and 21-22 are obvious under 35 U.S.C. § 103 over Andersson in view of Khan. In my opinion, the asserted ground is deficient for several technical reasons.

91. Petitioner has failed to establish a sound technical motivation to combine Andersson with Khan. The two references operate on fundamentally different control architectures, and integrating their teachings would require a

substantial reengineering of Andersson’s system—far beyond what is permissible under obviousness jurisprudence.

1. There Was No Motivation to Combine Andersson and Khan to Arrive at “receiv[ing], on a single physical channel, an allocation of an uplink resource and a multi-level transmit power control (TPC) command,” as Required by Claim 11

92. Petitioner contends that POSITA would have been motivated to send both the TPC commands described in Andersson and the uplink scheduling grants described in Khan over Andersson’s dedicated physical control channel (DPCCH). Petition at 28 (citing *KSR*, 550 U.S. at 417). Petitioner frames this as “the predictable use of prior art elements according to their established functions,” arguing that such a combination would “improve Andersson in the same way.” *Id.*

93. According to Petitioner, Andersson teaches a UE receiving TPC commands from the Node B on a downlink channel and also transmitting uplink data to that Node B. From this, Petitioner reasons that a POSITA would naturally turn to Khan, “which discloses such signaling techniques used by a base station for allocating uplink resources in a spread-spectrum communications system that similarly transmits TPC commands,” and graft Khan’s scheduling grant onto Andersson’s DPCCH “other bits.” *Id.* (emphasis in original).

94. This framing seems superficially attractive: if a Node B already transmits TPC bits to the UE, why not also send an allocation of an uplink resource on the same downlink channel? The shortcomings of this reasoning, however, are

just as plain. First, Petitioner presumes that fast, per-TTI scheduling was the mechanism used in WCDMA, which was not the case. Second, Petitioner assumes that such “scheduling” signaling would come from the Node B, rather than the RNC. Both assumptions are contrary to how the system actually operated.

95. Even setting aside Andersson’s own disclosures and the WCDMA framework in which it sits, a POSITA would not have been motivated to adopt Khan in the manner Petitioner suggests. Andersson and Khan employ fundamentally different multiplexing structures, such that overlaying Khan’s time-shared control slots into Andersson’s continuous DPCCH stream would not “improve” Andersson in the same way or yield predictable results. Instead, it would require substantial redesign of Andersson’s channels—precisely the type of hindsight-driven reconstruction that *KSR* cautions against.

96. Finally, Petitioner points to four supposed “advantages” of its proposed combination: (1) support for more active wireless units, (2) reduced complexity, (3) lower latency, and (4) the view that “allocation of an uplink resource is control information” that “naturally belongs” on Andersson’s DPCCH. Petition 21. Each of these asserted benefits collapses under scrutiny. They depend on mischaracterizations of both Andersson and Khan, disregard the fundamental architectural differences between WCDMA and CDMA2000 HRPD, and in fact

illustrate why a skilled artisan would have avoided, rather than pursued, such a combination.

a. In Andersson, Dedicated Uplink Channels Were Semi-Statically Configured Through RRC Signaling

97. Petitioner assumes that uplink transmissions in Andersson necessarily imply fast, per-TTI scheduling via downlink grants. That assumption is incorrect. At the time, WCDMA (UMTS/FDD), the context for Andersson, did not employ per-TTI downlink scheduling grants for uplink transmissions. Instead, dedicated uplink transport channels were semi-statically configured by RRC signaling. *Id.* RRC initially established the channel and only reconfigured it upon changes in service needs, such as modified QoS requirements, handover or cell reselection, or initiation of new radio bearers. Andersson itself confirms this, noting that “Radio network controllers (RNCs) 12 and 14 control various radio network functions including for example radio access bearer setup, diversity handover, etc.” EX1009, 7:3–10. Thus, Petitioner’s premise, that Andersson’s uplink transmissions implied fast per-TTI scheduling grants, is inconsistent with both Andersson and contemporaneous WCDMA standards, as Andersson teaches and the specifications confirm.

b. RRC Signaling Was Provided by the RNC, Not the Node B

98. Petitioner further presumes that Andersson’s Node B would deliver scheduling information directly to the UE. This is also incorrect. Under WCDMA

standards, the RRC signaling that configured uplink channels was the responsibility of the RNC, not the Node B. Andersson reflects this division of labor: RRC in the RNC handled scheduling/configuration, while the Node B managed fast power control. Petitioner's suggestion that Andersson's Node B would have originated "scheduling grants" conflates roles and misstates the standard architecture.

c. Andersson and Khan Employ Incompatible Channel Multiplexing Structures

99. Khan belongs to a different technological family, CDMA2000 HRPD. In Khan, the forward link is organized into time-division slots where TPC, scheduling grants, and HARQ information are multiplexed into distinct fields within a single slot. Ex.1005, Fig. 5; ¶¶ [0045]–[0047]. Andersson, by contrast, describes a DPCCH in which each 0.625 msec slot carries a fixed set of control bits (TPC, TFCI, FBI, pilot) repeated in every slot, without time-multiplexed grants. Ex. 1009, 9:12–22, Fig. 5. These structures are not compatible.

100. It is my understanding that under *KSR*, prior art must be combined "in the same way" to achieve predictable results, and that is what Petitioner alleges regarding the proposed combination of Andersson and Khan. That is not the case here. In WCDMA, the DPCCH and DPCH are continuous, fixed-format streams. Khan, by contrast, is expressly organized to carve scheduling grants into time-multiplexed slots. Ex.1005, ¶¶ [0043]–[0047]. A POSITA would not have expected predictable results from merging these two paradigms. TPC commands demand per-

slot, highly reliable delivery to preserve closed-loop stability, whereas scheduling is bursty and less time-critical. Attempting to multiplex the two would either disrupt TPC's critical feedback or constrain scheduling flexibility, undermining both. A skilled artisan would have recognized that this was not a predictable or natural design choice but a hindsight reconstruction that would require redesign of Andersson's physical channels.

101. WCDMA and CDMA2000 HRPD, though both "CDMA" systems, developed under different standards bodies with fundamentally different architectures. In WCDMA (Andersson), RRC in the RNC managed scheduling, while the Node B provided continuous fast power control on the DPCCH. HRPD, by contrast, centralized scheduling in the base station and multiplexed grants and TPC together at the slot level. Ex.1005, ¶¶ [0043]–[0047]. These two approaches were not interchangeable. A POSITA in 2004 would have looked to 3GPP's WCDMA standards, not HRPD, because adopting HRPD's slot-centric architecture would have required moving scheduling to the Node B and redesigning the channel structure, fundamental departures from WCDMA, not predictable improvements.

102. Finally, more broadly, TPC and scheduling have historically addressed different concerns. TPC is only relevant once resources are already assigned. By contrast, scheduling determines when and what resources to assign. Conflating the two functions assumes a context in which both must be signaled together, which is

not how the prior art operated. That context is introduced by the ‘500 Patent itself, not by Andersson or Khan. Id.

2. Alleged Benefits of Petitioner’s Proposed Combination

103. Petitioner also claims four benefits from sending both TPC and uplink scheduling on Andersson’s DPCCH: (1) more active wireless units, (2) reduced complexity, (3) lower latency, and (4) allocation of an uplink resource is control information that “naturally belonging” on the DPCCH. Each claim misreads the references, ignores architectural differences between WCDMA and HRPD, and ultimately illustrates why a skilled artisan would have avoided, not pursued, such a design.

a. Larger Number of Active Wireless Units

104. Andersson’s DPCCH delivers TPC bits every slot to every active user, ensuring stable closed-loop control. Khan’s multiplexed scheme, by contrast, was tailored to HRPD, where scheduling dominates and TPC update rates can be reduced. Ex.1005, ¶¶ [0043]–[0047]. Grafting Khan onto Andersson would not allow more users—it would deprive them of reliable power control, destabilizing the loop that Andersson sought to protect.

b. Reduced Complexity

105. Andersson minimized overhead by embedding a single control bit alongside TPC, avoiding more complex per-slot signaling. Khan multiplexes diverse

control information (TPC, grants, IDs, HARQ) into shared slot fields. Combining the two would require additional logic to parse mixed controls, coordinate power updates with grants, and reconcile timing—greater complexity, not less.

c. Reduced Latency

106. Andersson already delivered 0.625 msec inner-loop updates, the fastest possible cycle in UMTS. Khan’s structure reduces TPC frequency by sharing slot space with other controls. That does not improve latency; it undermines it.

d. Scheduling Information Belongs in a Control Channel

107. WCDMA refutes this notion. Uplink configuration was handled at Layer 3 via RRC, not dynamically multiplexed at Layer 1. A POSITA would have known that scheduling did not “naturally belong” on Andersson’s DPCCH, which was reserved for fast power control.

B. Independent Claim 11 Is Not Obvious Over the Alleged Combination of Andersson and Khan

108. For the reasons discussed above—including the incompatibility of the channel structures in Andersson and Khan, and the lack of a reasonable expectation of success—Claim 11 is not rendered obvious by the proposed combination of Andersson, and Khan. Each reference addresses a distinct control signaling framework, and their integration would require substantial modifications not suggested by the cited art.

C. Independent Claim 17 Is Not Obvious Over Andersson and Khan for at Least the Same Reasons as Claim 1

109. Although Claim 17 is not identical to Claim 11, it recites similar features and is subject to the same core limitations—most notably, those concerning the receipt of scheduling and power control information on a single channel. For the same technical reasons that Claim 11 is not obvious over the combination of Andersson, and Khan, Claim 17 likewise is not obvious over this combination.

D. Dependent Claims 15, 16, 21 and 22 Are Not Obvious Over Andersson and Khan for at Least the Same Reasons as Their Respective Base Claims

110. Claims 15 and 16 depend from Claim 11, and Claims 21 and 22 depend from Claim 17. Because both independent Claims 11 and 17 are not rendered obvious by the alleged combination of Andersson and Khan, as explained above, the same conclusion applies to each of these dependent claims. Accordingly, Claims 15, 16, 21 and 22 are not obvious over the alleged combination for at least the same reasons as their respective base claims.

X. GROUND 2 FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD OF SUCCESS ON THE MERITS

A. The Petition's Proposed Combination of Andersson, Khan, and Baker Fails to Disclose or Suggest Key Claim 1 Limitations

111. In Ground 2, Petitioner asserts that Claims 12-13 and 18-19 are obvious under 35 U.S.C. § 103 based on a purported combination of Andersson, Khan, and Baker. In my opinion, the asserted ground is deficient for several technical reasons.

112. Andersson, either alone or in combination with Baker, does not disclose, or suggest, any indication sent to a user equipment (UE) that accumulation of transmit power control (TPC) commands is enabled.

1. Andersson and Baker, Alone or in Combination, Fail to Disclose or Suggest “an Indication as to Whether Accumulation of TPC Commands is Enabled,” as Recited in Claims 12 and 18

113. Petitioner argues that Andersson discloses a UE that “receives, from a network device, an indication as to whether TPC command accumulation is enabled.” Petition, 41-42. The basis for this assertion is the “power control indicator” disclosed in Andersson at 9:6–11, which Petitioner characterizes as an indication that a particular type of power control adjustment is enabled.

114. This interpretation is technically incorrect. In Andersson, the TPC command causes the UE to increase, decrease, or maintain its transmit power. While the concept of “accumulation” is not expressly described, to the extent that the TPC commands are integrated with the transmit power response to successive TPC commands, the effect is similar to accumulation. That said, this accumulation behavior—whether implicit or not—is always enabled in Andersson’s system. There is no disclosure or suggestion that the network ever disables accumulation or sends an indication to enable it.

115. The power control indicator bit in Andersson merely modulates the magnitude of the TPC adjustment—for example, specifying whether the adjustment

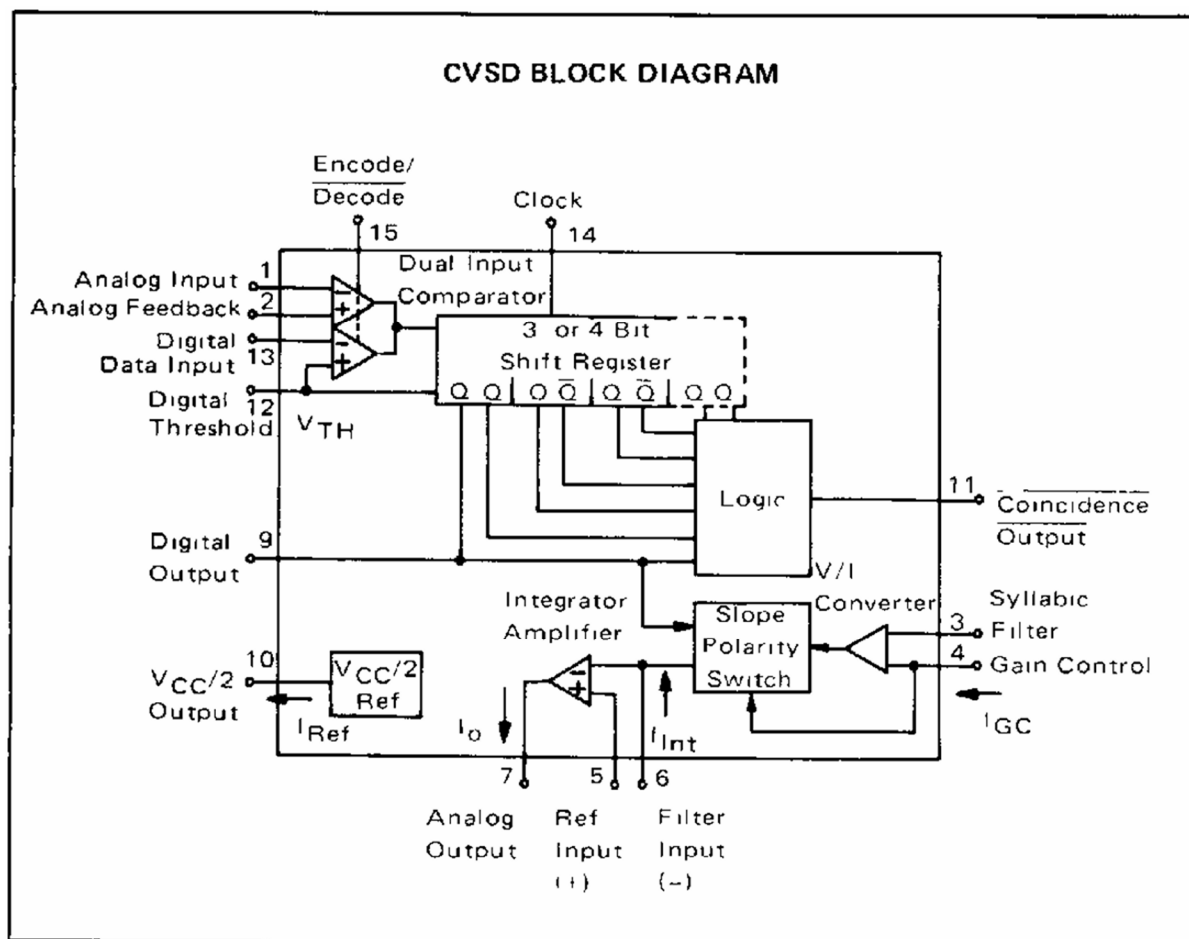
is 1 dB or 8 dB. See Ex. 1009, 9:45–50. In other embodiments, the power control indicator varies the adjustment based on slot number. *See id.*, 10:40–58. In all cases, the TPC command continues to effect a power change – the magnitude of the change may vary, but the TPC is always applied.

116. Thus, the power control indicator does not serve as an enable/disable flag for accumulation. Rather, it modifies how the accumulation (i.e., the integration of power adjustments over time) is performed. Therefore, Petitioner’s characterization of this indicator as an “indication that TPC accumulation is enabled” is inaccurate.

117. Petitioner also posits that, since TPC accumulation was a “well-known type of power control adjustment” prior to the ‘500 patent, Andersson’s indication must include that functionality. Petition, Paper 42. However, this interpretation is inconsistent with the actual disclosure. In Andersson, there is no indication that the power control indicator disables the TPC command or bypasses integration with the accumulated transmit power level. On the contrary, if the goal were to transmit a null adjustment, that could be achieved simply by sending a TPC command indicating no change. Ex. 1004, 45-48. There is no reason to use the indicator for that purpose. See Ex. 1009, 9:4–6.

118. From a purely technical perspective, it is my opinion that Andersson’s power control indicator is distinct from the power control bit and merely informs how the latter is to be applied. It is not providing any other information. It is superfluous

in the role, since the ability to turn off adjustments is subsumed in the TPC command (viz, zero change to power). Moreover, as explained *infra* in the context of adaptive delta modulation, there is no need to provide explicit step size adjustment because the need for such adjustment is inherent in the bit stream. It can be inferred from the observation of an imbalance in the up-down adjustments. Such imbalance, measured on a running basis, is sometimes referred to as the "charge" carried by the bit stream. When a delta modulation process is tracking, the "charge" is near zero. When it starts to fall behind (failure to follow) the charge accumulates. Measuring this charge obviates the need for a separate bit. POSITA would regard Andersson's indicator to be an indicator of a separate aspect of the algorithm. Andersson appears to leave that aspect to the imagination. Data sheets for the Motorola part MC3417 and MC3418 go back to at least the 90's. Ex. 2011 and Ex. 2012. These chips implemented the algorithm I outlined in the earlier discussion. Using the technique known and used by this chip would obviate the need for Andersson's Indicator. A replica of the data sheet is shown below. Ex 2011, page (2-)101.



The relevant excerpt from the Exhibit is shown below.

CIRCUIT DESCRIPTION

The continuously variable slope delta modulator (CVSD) is a simple alternative to more complex conventional conversion techniques in systems requiring digital communication of analog signals. The human voice is analog, but digital transmission of any signal over great distance is attractive. Signal/noise ratios do not vary with distance in digital transmission and multiplexing, switching and repeating hardware is more economical and easier to design. However, instrumentation A to D converters do not meet the communications requirements. The CVSD A to D is well suited to the requirements of digital communications and is an economically efficient means of digitizing analog inputs for transmission.

The Delta Modulator

The innermost control loop of a CVSD converter is a simple delta modulator. A block diagram CVSD Encoder is shown in Figure 11. A delta modulator consists of a comparator in the forward path and an integrator in the feedback path of a simple control loop. The inputs to the comparator are the input analog signal and the integrator output. The comparator output reflects the

sign of the difference between the input voltage and the integrator output. That sign bit is the digital output and also controls the direction of ramp in the integrator. The comparator is normally clocked so as to produce a synchronous and band limited digital bit stream.

If the clocked serial bit stream is transmitted, received, and delivered to a similar integrator at a remote point, the remote integrator output is a copy of the transmitting control loop integrator output. To the extent that the integrator at the transmitting location tracks the input signal, the remote receiver reproduces the input signal. Low pass filtering at the receiver output will eliminate most of the quantizing noise, if the clock rate of the bit stream is an octave or more above the bandwidth of the input signal. Voice bandwidth is 4 kHz and clock rates from 8 k and up are possible. Thus the delta modulator digitizes and transmits the analog input to a remote receiver. The serial, unframed nature of the data is ideal for communications networks. With no input at the transmitter, a continuous one zero alternation is transmitted. If the two integrators are made leaky, then during any loss of contact the receiver output decays to

CIRCUIT DESCRIPTION (continued)

zero and receive restart begins without framing when the receiver reacquires. Similarly a delta modulator is tolerant of sporadic bit errors. Figure 12 shows the delta modulator waveforms while Figure 13 shows the corresponding CVSD decoder block diagram.

The Companding Algorithm

The fundamental advantages of the delta modulator are its simplicity and the serial format of its output. Its limitations are its ability to accurately convert the input within a limited digital bit rate. The analog input must be band limited and amplitude limited. The frequency limitations are governed by the nyquist rate while the amplitude capabilities are set by the gain of the integrator.

The frequency limits are bounded on the upper end; that is, for any input bandwidth there exists a clock frequency larger than that bandwidth which will transmit the signal with a specific noise level. However, the amplitude limits are bounded on both upper and lower ends. For a signal level, one specific gain will achieve an optimum noise level. Unfortunately, the basic delta modulator has a small dynamic range over which the noise level is constant.

The continuously variable slope circuitry provides increased dynamic range by adjusting the gain of the integrator. For a given clock frequency and input bandwidth the additional circuitry increases the delta modulator's dynamic range. External to the basic delta modulator is an algorithm which monitors the past few outputs of the delta modulator in a simple shift register. The register is 3 or 4 bits long depending on the application. The accepted CVSD algorithm simply monitors the contents of the shift register and indicates

if it contains all 1s or 0s. This condition is called coincidence. When it occurs, it indicates that the gain of the integrator is too small. The coincidence output charges a single pole low pass filter. The voltage output of this syllabic filter controls the integrator gain through a pulse amplitude modulator whose other input is the sign bit or up/down control.

The simplicity of the all ones, all zeros algorithm should not be taken lightly. Many other control algorithms using the shift register have been tried. The key to the accepted algorithm is that it provides a measure of the average power or level of the input signal. Other techniques provide more instantaneous information about the shape of the input curve. The purpose of the algorithm is to control the gain of the integrator and to increase the dynamic range. Thus a measure of the average input level is what is needed.

The algorithm is repeated in the receiver and thus the level data is recovered in the receiver. Because the algorithm only operates on the past serial data, it changes the nature of the bit stream without changing the channel bit rate.

The effect of the algorithm is to compand the input signal. If a CVSD encoder is played into a basic delta modulator, the output of the delta modulator will reflect the shape of the input signal but all of the output will be at an equal level. Thus the algorithm at the output is needed to restore the level variations. The bit stream in the channel is as if it were from a standard delta modulator with a constant level input.

The delta modulator encoder with the CVSD algorithm provides an efficient method for digitizing a voice input in a manner which is especially convenient for digital communications requirements.

119. Petitioner's alternative argument—that the use of TPC accumulation as a power control adjustment would have been obvious in light of Baker—also fails.

120. Baker discloses a "Power Control Algorithm" (PCA) parameter that governs how TPCs are interpreted over time. See Ex. 1010, ¶¶ 21–23. If PCA = 1, the UE adjusts power in every slot based on the TPC command and a ΔTPC value of 1 or 2 dB. If PCA = 2, the UE combines TPC commands over groups of five slots and only adjusts power when all five commands are identical. Even in this mode, TPC

commands are still being integrated, albeit over a longer time interval. The adjustment to the UE's transmit power is simply deferred, not disabled. *See id.*

121. There is no teaching in Baker that accumulation can be turned off or that the accumulator can be reset. Indeed, Baker does not describe an accumulator explicitly at all. However, it is apparent from the described behavior that the UE's transmit power is always updated based on a function of one or more prior TPC commands—i.e., accumulation is always implied to be “enabled.” At most, when no change is required, the adjustment is zero, but this is not the same as disabling accumulation. A disabled accumulator would involve suspending integration and potentially resetting or freezing the internal state. Neither scenario is described or even suggested in Baker.

122. Furthermore, Baker's framework does not contemplate sending a network-side indication to the UE that accumulation is enabled. There is no disclosure of a signaling mechanism for such an enable/disable control, and no behavior in Baker is predicated on enabling or disabling accumulation.

123. Finally, the assumption made in the Petition—that the use of grouped TPC commands when $PCA = 2$ implies that accumulation is disabled—is technically incorrect. The UE still modifies its transmit power based on the collective effect of five TPC commands. This is accumulation over a longer window, not its absence. This

is entirely consistent with the ‘500 patent, which contemplates accumulation on a per-slot or per-frame basis. See Ex. 1001, 9:27-42.

124. From a technical perspective, given the fact that the quantity being tracked and controlled (received signal power) exhibits varying rates of change, from quiescent to rapidly fading, it is natural to consider signaling of adjustments scheduled at a minimal rate necessary. A most adaptive system might only signal an adjustment when the magnitude of the deviation from the setpoint exceeds a threshold. But in order to take advantage of a reduced rate when such is appropriate, it is necessary to coordinate the transmission and reception entities to expect adjustments only as needed. Otherwise, in non-adjustment instances, it would still be necessary to indicate “no adjustment” which spoils the savings in transmission resources. Of course, it is possible in such “quiet conditions” to reduce the step size, which would increase the accuracy of the approximation of the quiescent level. However, that is less important in wireless systems, where transmission capacity is paramount, than reducing transmission rate. The next best thing is to approximate this minimal adjustment arrangement with a less frequent adjustment timing, for example, every 5 frames instead of every frame. This, in turn, entails detecting that the conditions permit the reduced rate, and restoring the higher rate when conditions revert to higher dynamic conditions.

125. Accumulating TPC commands over longer intervals, such as every 5 slots, as disclosed by Baker, or every frame, as disclosed by the ‘500 Patent, is a natural way to conserve transmission capacity when adjustment frequency can be lowered or raised according to the variation of the quantity being tracked. *See* Ex. 2013 at 4.2.1. It was well known, at the time of filing of the application for the ‘500 Patent, to schedule signaling of various periodic repetition intervals.

126. Both Andersson and Baker are completely silent on the concept of disabling accumulation. There is no support in either reference for the notion that accumulation can be toggled on or off via signaling, let alone that such an indication is sent from the network to the UE. Accordingly, there is no disclosure—either express or implied—of “an indication that TPC accumulation is enabled,” as required by Claim 1 of the challenged patent.

127. In summary, while both references may assume or imply that accumulation occurs as part of TPC-based uplink power control, neither reference supports the idea of disabling or re-enabling accumulation or transmitting an indication to the UE regarding its state. The Petition’s attempt to construct such a teaching from Andersson and Baker is unsupported by the references themselves and rests on flawed technical assumptions.

2. Dependent Claims 12-13 and 18-19 are Not Obvious Over the Alleged Combination of Andersson, Khan and Baker

128. For the reasons discussed above, Claims 12 and 18 are not rendered obvious by the proposed combination of Andersson, Khan, and Baker. Claims 13 and 19 depend from claims 12 and 18, respectively, and are not obvious over the proposed combination of Andersson, Kahn and Baker for at least reasons as their base claims.

XI. Ground 3 – Claims 14 and 20 Are Not Obvious Over Andersson, Khan, and Dick Under 35 U.S.C. § 103

129. Claim 14 depends from Claim 11, and Claim 10 depends from Claim 17. As discussed, Claims 11 and 17 are not obvious over the combination of Andersson and Khan. The additional reference, Dick, does not cure the fundamental deficiencies in the combination of these references. Dick does not resolve the incompatibility between the dedicated and shared control channel architectures discussed above. Accordingly, Claims 14 and 20 are also not obvious over the combination of Andersson, Baker, Khan, and Dick.

XII. Ground 4 – Claims 11, 15-17, 21 and 22 Are Not Obvious Over Zeira, Khan, and Tong Under 35 U.S.C. § 103

130. The Petition asserts that Claims 11, 15-17, 21 and 22 are rendered obvious under 35 U.S.C. § 103 based on an alleged combination of Zeira, Khan, and Tong. In my expert opinion, this assertion is deficient because the Petition fails to establish an adequate motivation to combine Zeira and Khan – the proposed

combination would require a substantial reengineering of Zeira's system architecture, which is not supported by any teaching in the prior art.

A. There Was No Motivation to Combine Zeira and Khan to Arrive At A UE "Receiv[ing], On a Single Physical Channel, An Allocation of an Uplink Resource and a Multi-Level Transmit Power Control (TPC) Command "

131. Petitioner asserts that a POSITA would have chosen to convey both the TPC command disclosed in Zeira and the uplink scheduling grant disclosed in Khan over Zeira's dedicated channel, claiming this would "improve Zeira in the same way" and require only the "predictable use of prior art elements according to their established function." Petition at 59-60 (citing *KSR*, 550 U.S. at 417). Petitioner's logic is: Zeira teaches receipt of TPC commands from a base station/Node B and uplink transmissions to the base station/Node B "in the appropriate codes of the assigned resource units." From there, Petitioner contends a POSITA would look to Khan, "which discloses signaling techniques used by a base station to allocate uplink resources in a spread-spectrum system that also transmits TPC commands," and graft Khan's scheduling grants onto Zeira's dedicated channel (characterizing Zeira's references to "assigned resource units" as implying a base-station scheduling function for uplink transmissions). *Id.*

132. At first blush, the theory sounds simple: if the UE already receives TPC from the Node B on a downlink control path, why not deliver the uplink scheduling grant over that same path? The defects are equally simple. First, it presupposes that

fast, per-TTI scheduling was the mechanism to “schedule” uplink in the UMTS/TDD system of Zeira. Second, it assumes that any such “scheduling” would be signaled by the Node B. Third, it equates “resource grants” with dynamic, per-TTI grants. All three premises are incorrect.

133. Even if one set aside Zeira’s own context, a POSITA would not have adopted Khan in the manner Petitioner suggests because **Zeira and Khan employ fundamentally different multiplexing schemes**. Any attempt to combine Zeira’s continuous, slot-by-slot TPC operation with Khan’s time-multiplexed, grant-bearing slots would not “improve Zeira in the same way” or produce predictable results; it would require substantial redesign of Zeira’s channels and control flow. A skilled person, therefore, would not have applied Khan to Zeira as proposed.

134. Finally, Petitioner touts four supposed “advantages” of transmitting both TPC and uplink scheduling over Zeira’s dedicated channel: (1) more active users, (2) less complexity, (3) lower latency, and (4) the idea that scheduling “naturally belongs” on the dedicated control channel. Each claim rests on misreadings of Zeira and Khan, ignores foundational architectural differences between **UTRA/TDD** and **CDMA2000 HRPD**, and in fact underscores why a POSITA would have avoided, not pursued, Petitioner’s combination.

1. In Zeira, and Its Underlying Technology, the UE's Dedicated Uplink Transport Channel Was Semi-Statically Configured Using RRC Signaling

135. Petitioner assumes that uplink transmission in Zeira, as well as “assigned resource units,” necessarily implies fast, per-TTI downlink grants. That is wrong. In the relevant period, UMTS/TDD, the technology context for Zeira, did not employ per-TTI downlink grants to schedule uplink; instead, RRC signaling semi-statically established and, when needed, reconfigured the UE's uplink transport channel. Reconfiguration occurred upon changed conditions (e.g., QoS/rate, mobility, or activation of new radio bearers). Petitioner's premise that Zeira's uplink transmissions imply per-TTI scheduling grants conflicts with how UMTS operated, as confirmed by the UMTS/TDD specifications.

2. The RRC Signaling That Configured the UE's Dedicated Uplink Transport Channel Was an RNC Function

136. Petitioner further assumes the base station/Node B in Zeira would send the supposed scheduling information to the UE. That is incorrect. In Zeira's UMTS/TDD setting, RRC configuration signaling was issued by the RNC, not the Node B. Zeira's architecture separates roles: the RNC provides the configuration (“scheduling” in Petitioner's parlance) while the Node B receives the UE's uplink transmissions and handles fast power control. Petitioner's suggestion that Zeira's “scheduling grants” and uplink transmissions would originate from the same network element contradicts both Zeira's context and the standards.

3. Zeira's Reference to "Assigned Resource Units" Does Not Imply a Khan-Style Scheduling Function

137. A POSITA would read Zeira's "assigned resource units" as the **time-slot + spreading-code** allocations used for transmission, not as a dynamic, per-TTI grant carrying identity, rate, and HARQ fields as in Khan. *See* Ex.1004, 4:31–39; cf. Ex.1005, ¶¶13–15. Petitioner's attempt to treat "assigned resource units" as an invitation to replace UMTS/TDD's RRC-based configuration with HRPD-style fast grants finds no support in Zeira and misunderstands the technology. Because UMTS/TDD used RRC to set up and adjust uplink transport channels, Zeira's mention of assigned resource units does not motivate a POSITA to adopt Khan's fast grant mechanism. Petitioner's motivation-to-combine theory therefore fails, and Ground 3 should be rejected.

4. Zeira and Khan Employ Fundamentally Incompatible Channel Multiplexing Structures

138. Khan is from CDMA2000 HRPD, where the forward link slot time-multiplexes TPC, scheduling grants, rate indication, and HARQ fields in distinct portions of the same slot. Ex.1005, Fig. 5; ¶¶[0045]–[0047]. Zeira, by contrast, addresses UTRA-TDD in which a dedicated channel carries continuous L1 TPC every frame/slot to preserve closed-loop power control; scheduling and channel configuration are handled separately by Layer-3 RRC procedures (e.g., Transport Channel Reconfiguration and Physical Channel Reconfiguration in TS 25.331).

139. It is my understanding that under *KSR*, the art must be combined “in the same way” to yield predictable results, and that is what Petitioner argues. Here, Zeira’s dedicated control is a continuous, slot-by-slot TPC stream, while resource configuration occurs via slower RRC messages; Khan’s HRPD slots, by design, embed fast grants alongside TPC. Ex.1005, ¶¶[0043]–[0047]. A POSITA would not view those mechanisms as operating “in the same way,” nor expect predictable results from merging them. TPC requires uninterrupted, highly reliable delivery each slot to maintain closed-loop stability, whereas grant signaling is bursty and follows a different cadence. Interleaving the two on Zeira’s dedicated channel would either impair TPC timing/reliability or constrain grant flexibility, degrading both. A skilled artisan would recognize that Petitioner’s proposal is a hindsight reconstruction that would demand re-architecting the UTRA-TDD stack.

5. Alleged Benefits of Petitioner’s Proposed Combination Fail For the Same Reasons as Ground 1

140. Petitioner repeats four “benefits” of sending TPC and uplink scheduling over Zeira’s dedicated channel: (1) more active users, (2) reduced complexity, (3) reduced latency, and (4) the notion that a POSITA would view scheduling as “control information” that “naturally belongs” on Zeira’s dedicated channel. Each claim misreads the references, ignores core differences between UMTS/TDD (Zeira) and HRPD (Khan), and ultimately shows why a POSITA would have avoided the

combination. Importing HRPD-style multiplexing into Zeira would compromise power-control stability, increase implementation burden, and degrade performance.

a. Larger Number of Active Wireless Units

141. Zeira ensures regular, slot-by-slot TPC updates on a dedicated channel within the TDD frame structure to keep the loop stable. Khan's multiplexed grants are tailored to HRPD, where scheduling drives decisions and TPC frequency can be reduced. Ex.1005, ¶¶[0043]–[0047]. Importing that approach into Zeira would not increase capacity; it would erode the reliability of TPC that Zeira relies on, destabilizing the loop and defeating Zeira's purpose.

b. Reduced Complexity

142. Zeira's contribution is a stable hybrid power-control algorithm that weights open- and closed-loop inputs, predicated on simple, continuous TPC feedback on a dedicated channel. Khan multiplexes heterogeneous control (grants, IDs, HARQ, TPC) inside shared slot fields. Overlaying Khan onto Zeira forces new parsing/control logic in both UE and Node B, coordination between weighted power adjustments and grant bursts, and resolution of timing conflicts—more complexity, not less.

c. Reduced Latency

143. Zeira already provides frame-by-frame closed-loop updates (~100 Hz) by design for UMTS/TDD. Khan's slot multiplexing shares the same space among

TPC, grants, and HARQ (see Fig. 5), reducing the effective frequency or regularity of TPC bits. Ex.1005, Fig. 5. That doesn't reduce latency; it risks delaying or thinning TPC updates, degrading responsiveness.

d. A POSITA Would Understand that Scheduling Information and Control Information Would Naturally Belong Within a Control Channel

144. UMTS TDD contradicts this premise. In Zeira's context, uplink configuration is an L3 RRC function (e.g., Transport/Physical Channel Reconfiguration in TS 25.331), not a dynamic L1 grant multiplexed with TPC. A POSITA would not equate uplink "scheduling information" with Zeira's L1 dedicated TPC channel, because the architecture assigns configuration to RRC. Scheduling did not "naturally belong" on Zeira's dedicated channel.

B. Independent Claim 11 Is Not Obvious Over the Alleged Combination of Zeira, Khan, and Tong

145. For the reasons set forth above, Claim 1 is not rendered obvious by the proposed combination of Zeira, Khan. As discussed, none of these references supports receiving scheduling and power control information on a single physical channel.

C. Independent Claim 17 Is Not Obvious Over Zeira and Khan, and Tong for at Least the Same Reasons as Claim 11

146. Although Claim 17 differs in form from Claim 11, it recites similar limitations, including those directed to receiving scheduling information and power

control information. For at least the same reasons set forth above with respect to Claim 11, Claim 17 is not obvious over the combination of Zeira, Khan, and Tong.

D. Dependent Claims 15-16 and 21-22 Are Not Obvious Over Zeira and Khan for at Least the Same Reasons as Base Claims 11 and 17

147. Claims 15-16 depend from Claim 11, and Claims 21-22 depend from Claim 17. As established above, both Claim 11 and Claim 17 are not obvious over the alleged combination of Zeira and Khan. Because the dependent claims necessarily incorporate the limitations of their respective base claims, and because none of the additional references provide any teaching or suggestion that overcomes the deficiencies in the combination, Claims 15-16 and 21-22 likewise are not obvious over the same alleged combination.

XIII. Ground 5 – Claims 12-13 and 18-19 Are Not Obvious Over Zeira, Khan, Tong, and Baker under 35 U.S.C. § 103

148. The Petition asserts that Claims 12-13 and 18-19 are rendered obvious under 35 U.S.C. § 103 based on an alleged combination of Zeira, Khan, Baker and Tong. In my expert opinion, Andersson, either alone or in combination with Baker, does not disclose, or suggest, any indication sent to a user equipment (UE) that accumulation of transmit power control (TPC) commands is enabled.

A. Zeira and Baker, Alone or in Combination, Fail to Disclose or Suggest “The Processor is Configured to Cause: “The UE Receiv[ing] an Indication as to Whether Accumulation of TPC Commands is Enabled,” as Required by Claims 12 and 18

149. The Petition argues that Zeira teaches a UE configured to receive “an indication as to whether accumulation of TPC commands is enabled.” Petition, 66-67. More specifically, it contends that the “weighting factor α ” disclosed in Zeira is the claimed “indication.” *Id.* In my opinion, this interpretation is technically incorrect.

150. Zeira discloses a combined open-loop and closed-loop power control scheme in which the UE’s uplink transmit power is determined according to the equation:

$$P_{TS}: P_{TS} = P_0 + G(n) + \alpha L$$

151. In this equation, P_0 represents the baseline power level at which the network wishes to receive UE transmission, $G(n)$ is a closed loop control factor that is updated based on the previous closed loop control factor, $G(n - 1)$ and a step size ΔTPC . αL is the weighted open-loop control factor, where α is the weighting factor, typically determined by the transmitting device whose power level is being controlled (the UE according to the assertions in the petition), applied to the pathloss estimate L .

152. The Petition refers to $G(n)$ as representing “TPC command accumulation.” Petition, 55:16-56:2. While Zeira does not explicitly use the term “accumulation,” it is clear that $G(n)$ builds upon previously received TPC commands and is thus always active—regardless of the value of α .

153. Zeira does describe that, under certain network configurations, the operator may choose to use only closed-loop control by setting $\alpha = 0$. See Ex. 1004, 7:18–22. In that case, the αL term is effectively removed from the equation, and power control relies solely on $G(n)$:

$$G(n) = G(n - 1) + b_{TPC}\Delta_{TPC}$$

154. However, this does not indicate that $G(n)$ (i.e., the TPC command accumulation logic) is selectively enabled or disabled. In all configurations described in Zeira, $G(n)$ is always present and active. The choice to enable or disable αL affects only the open-loop contribution to the total power output—not the closed-loop accumulation.

155. It is my opinion, in fact, that *enabling* accumulation, and weight L by zero, are entirely different concepts. Weighting L by zero does not affect accumulation (a closed loop process) in any way. Similarly, enabling accumulation does not affect the weight factor applied to L .

156. It is further my opinion that a POSITA would not have to read into the situation data that is not there: If L is weighted to zero, accumulation must be active because, otherwise, there is no power control at all. And conversely, if accumulation is disabled, the weight of L must be positive. But these are only two cases out of four that can be resolved by the weighting of L or the enabling of accumulation. It is still necessary to indicate that both nonzero weight and enabled accumulation are in effect,

when it is. Thus, the nonzero weight of L and the enabling of accumulation are not logically equivalent.

157. In my opinion, Zeira does not, in any event, disclose, or even imply, any method by which the UE would be informed that the weighting factor α has been set to zero. The passage relied upon by Petitioner states only that “the network operator may desire to use solely open-loop or closed-loop power control.” Ex. 1004, 7:16–22. It does not explain any mechanism by which that choice would be conveyed to the UE. This is particularly significant because α is defined in Zeira as a dynamic weighting factor computed locally at the UE itself. Nothing in Zeira identifies the UE as receiving an instruction from the Node-B to force α to zero.

158. It is my opinion that this omission is critical. Zeira’s teaching centers on the combined use of open-loop and closed-loop control, with α functioning as the key parameter that determines the balance between them. A decision by a network operator to eliminate one mode entirely from that calculation would undermine the fundamental operation that Zeira describes. Even if an operator were to adopt such a policy, Zeira provides no disclosure of how that decision would be implemented. The reference does not explain why an operator would do so, and certainly does not describe incorporating functionality into the Node-B to dynamically control α . In fact, such an approach would be improbable, because it would require retrofitting the Node-B with capabilities that Zeira never envisions. The far more plausible

explanation, in my opinion, is that if an operator wished to mandate exclusive use of one power-control method, it would do so by policy—for example, through SIM card configuration—rather than by dynamically signaling it to the UE.

159. Accordingly, Zeira does not teach, suggest, or imply any mechanism by which a network device sends an indication to the UE that TPC command accumulation is enabled. Instead, TPC-based closed-loop control is always applied by default, and there is no concept of disabling it via signaling.

B. Zeira in Combination With Baker Still Fails to Disclose the Claimed Feature

160. In the alternative, the Petition contends that even if Zeira does not expressly describe the UE receiving α from the network, such signaling “was well known and conventional,” and therefore obvious to a POSITA. Petition, Paper 58, 69. The Petition then cites Baker for disclosures related to relating to adjustable power control parameters. *See* Petition, 69-71.

161. However, neither Zeira nor Baker discloses or suggests that TPC accumulation can be disabled or that a network-sent indication to enable TPC accumulation exists. As discussed earlier, Baker likewise does not describe any scenario in which TPC command accumulation is disabled. While Baker does show that power control behavior varies based on the PCA parameter (e.g., per-slot vs. grouped over five slots), TPC commands are always applied in some form, and accumulation is always implicitly enabled.

162. Moreover, Baker provides no guidance on communicating an “enablement” indication from the network to the UE with respect to accumulation functionality. It therefore cannot cure the deficiencies in Zeira.

163. In sum, neither Zeira alone or in combination with Baker discloses or suggests the claim limitation requiring that a UE “receive an indication as to whether accumulation of TPC commands is enabled.” In both references, accumulation is always assumed to be active, and no mechanism is described for enabling or disabling it via signaling. The Petition’s attempt to rely on general knowledge or conclusory expert statements is insufficient to support a finding of obviousness under 35 U.S.C. § 103.

C. Claims 12-13 and 18-19 are Not Obvious, Under 35 U.S.C. § 103, Over the Alleged Combination of Zeira, Khan, Tong and Baker

164. Claims 12 and 18 are, therefore, not obvious under 35 U.S.C. § 103 over the proposed combination of Zeira, Khan, Tong and Baker for the reasons set forth above. Claims 13 and 19 depend from claims 12 and 18, respectively, and are, therefore, also not obvious over the proposed combination of Zeira, Khan, Tong and Baker for at least the same reasons as their base claims.

XIV. Ground 6 - Claims 14 and 20 Are Not Obvious Over Zeira, Khan, Tong, and Dick Under 35 U.S.C. § 103

165. Claim 14 depends from Claim 11, and Claim 20 depends from Claim 17. As discussed above, neither Claim 11 nor Claim 17 is obvious over Zeira, Khan, and

Tong. The additional reference, Dick, does not cure the deficiencies of that combination. Dick does not disclose or suggest any feature that would compensate for the absence of an indication enabling TPC accumulation. Accordingly, Claims 14 and 20 are not obvious over the combination of Zeira, Khan, Tong, and Dick.

XV. CONCLUSION

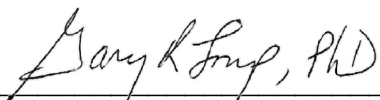
166. Based on my review of the cited prior art and the claim limitations of U.S. Patent No. 9,706,500, it is my professional opinion that none of the grounds asserted in the Petition establishes a reasonable likelihood that the challenged claims are unpatentable under 35 U.S.C. § 103. Specifically, the prior art combinations relied upon in Grounds 1, 2, 3, 4, 5 and 6 fail to disclose or suggest key limitations of independent Claims 11 and 17, and dependent Claims 12 and 18, including (1) an indication as to whether accumulation of TPC commands is enabled, and (2) the receipt of an allocation of an uplink resource and a multi-level TPC command on a single physical channel. Moreover, the Petition's proposed combinations would require substantial architectural redesigns of the cited systems, are not supported by the references themselves, and rest on flawed technical assumptions and conclusory expert opinions.

167. Accordingly, it is my opinion that Claims 11-22 of the '500 Patent are not obvious over the cited references and that the Petition fails to demonstrate a reasonable likelihood of prevailing on any asserted ground.

XVI. DECLARATION

I, Dr. Gary Lomp, declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: September 22, 2025

By: 
Dr. Gary Lomp