

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ERICSSON INC.  
Petitioner,

v.

KONINKLIJKE KPN N.V.  
Patent Owner.

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Case IPR2023-00526  
U.S. Patent 9,210,590

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**DECLARATION OF DR. ZYGMUNT J. HAAS,  
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW  
OF U.S. PATENT NO. 9,210,590**

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**EXHIBIT LIST<sup>1</sup>**

| <b>Exhibit No.<sup>2</sup></b> | <b>Description</b>                                                                                                                |
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| <b>1001</b>                    | U.S. Patent No. 9,210,590 to Jorgueskie al. (“the ’590 Patent”)                                                                   |
| <b>1002</b>                    | Prosecution File History for the ’590 Patent                                                                                      |
| <b>1003</b>                    | Declaration of Dr. Zygmunt J. Haas                                                                                                |
| <b>1004</b>                    | U.S. Patent Pub. No. US2012/0094661 to Frenger (“Frenger”)                                                                        |
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| <b>1007</b>                    | Furht, “Long Term Evolution: 3GPP LTE Radio and Cellular Technology” (April 2009) (“Furht”)                                       |
| <b>1008</b>                    | 3GPP TS 24.301 V8.5.0 (2010-03) (“24.301”)                                                                                        |
| <b>1009</b>                    | Declaration of Craig Bishop                                                                                                       |
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| <b>1011</b>                    | Curriculum Vitae of Dr. Zygmunt Haas                                                                                              |
| <b>1012</b>                    | H. Xie, S. Tabbane and D. J. Goodman, “Dynamic location area management and performance analysis,” Proc. IEEE VTC’93, pp. 536-539 |
| <b>1013</b>                    | WO2010/093296 to Frenger                                                                                                          |

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<sup>1</sup> The Exhibit List was provided by counsel

<sup>2</sup> Citations to patents are made by column and line cite; citations to patent publications are made by paragraph number; citations to Exhibit 1002 is made with reference to the Bates-stamped pagination; citations to other exhibits are made to the page number of the document itself.

I, Zygmunt J. Haas, do hereby declare as follows:

**I. INTRODUCTION**

1. I am making this declaration at the request of Petitioner Ericsson, Inc. in the *Inter Partes* Review of U.S. Patent No. 9,210,590 (“the ’590 Patent”).

2. I am being compensated for my work in this matter at my current standard hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this investigation. My compensation is not contingent on the outcome of this matter or on the specifics of my testimony.

3. I have been asked to provide my opinions regarding whether claims 1-20 (“the Challenged Claims”) of the ’590 Patent are patentable as they would or would not have been obvious to a person having ordinary skill in the art (“POSITA”) at the time of the invention, in light of the prior art. My conclusion and opinion of my work on this project is that the challenged claims would have been obvious to a POSITA.

4. In the preparation of this declaration, I have studied the documents listed in the List of Exhibits and Appendices.

5. In forming the opinions expressed below, I have considered:  
the documents listed in the Exhibit List above;

the relevant legal standards, including the standard for obviousness, and any additional authoritative documents as cited in the body of this declaration, all as provided to me by counsel; and

my own knowledge and experience based upon my work in the field of networking as described below.

6. Unless otherwise noted, all emphasis in any quoted material has been added.

## **II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE**

7. My complete qualifications and professional experience are described in my *Curriculum Vitae*, a copy of which I was told by counsel is attached as Exhibit 1011. The following is a brief summary of my relevant qualifications and professional experience.

8. I am a Professor and Distinguished Chair in Computer Science at the University of Texas in Dallas. I am also Professor Emeritus at the School of Electrical and Computer Engineering at Cornell University. In addition, I have provided technical consulting services in intellectual property matters, during which I have written expert reports and provided deposition and trial testimony involving, among others, wireless communication technologies.

9. My academic credentials include a Bachelor of Science Degree in Electrical Engineering, *summa cum laude*, from Technion (IIT), Israel, in 1979 and

a Master of Science Degree in Electrical Engineering, *summa cum laude*, from Tel Aviv University, Israel, in 1985. I subsequently authored the thesis titled “Packet Switching in Fiber-Optic Networks” as part of earning my Ph.D. in Electrical Engineering from Stanford University in 1988.

10. I am being compensated at my current consulting rate, with reimbursement for actual expenses, for my work related to this Petition for *Inter Partes* Review. My compensation is not dependent on, and in no way affects, the substance of my statements in this Declaration.

11. I have worked or consulted for about 35 years in the fields of Electrical Engineering and Computer Science. My primary focus has been on communication and networking systems, with an emphasis on wireless communication networks. I have authored and co-authored numerous technical papers and book chapters related to wireless communication networks. I hold over twenty patents in the fields of high-speed networking, wireless networks, and optical communication/switching. My employment history following my graduation from Stanford University began at the Network Research Department of AT&T Bell Laboratories in 1988. At AT&T Bell Laboratories, I pursued research on wireless communications, mobility management, fast protocols, optical networks, and optical switching. During my tenure at AT&T, I also worked for the AT&T Wireless Center of Excellence, where I investigated various aspects of wireless and mobile networks.

12. In 1995, I joined the faculty of the School of Electrical & Computer Engineering at Cornell University, and with time I was promoted to Full Tenured Professor. At Cornell, I headed the Wireless Networks Lab, which has been a research group with extensive contributions in the area of wireless communication systems and networks. In 2013, I retired from Cornell with the title of Emeritus Professor, and I joined the Computer Science Department at the University of Texas at Dallas with the title of Professor and Distinguished Chair in Computer Science. At Cornell University and at the University of Texas, I have taught dozens of courses related to computer networking and wireless communications. I have also served on various committees for the benefit of the scientific community.

13. I am a member of a number of professional societies, including the Institute of Electrical and Electronic Engineers (IEEE) and the Association for Computing Machinery (ACM). In 2007, I was elevated to an IEEE Fellow, and in 2022, I was elevated to an ACM Fellow, both well-known distinctions. For example, the total number of IEEE Fellows which are selected in any given year does not exceed 0.1% of the total number of voting members of IEEE. Alike, with respect to the ACM Fellow grade, ACM states that “ACM's most prestigious member grade recognizes the top 1% of ACM members for their outstanding accomplishments in computing and information technology and/or outstanding service to ACM and the larger computing community.” *See* <https://awards.acm.org/fellows>. I have delivered

numerous tutorials at major IEEE and ACM conferences. I served as editor of several publications including the IEEE Transactions on Networking, the IEEE Transactions on Wireless Communications, the IEEE Communications Magazine, the Springer “Wireless Networks” journal, the Elsevier “Ad Hoc Networks” journal, the “Journal of High Speed Networks,” and the Wiley “Wireless Communications and Mobile Computing” journal. I was also a guest editor of *IEEE Journal on Selected Areas in Communications* issues on “Gigabit Networks,” “Mobile Computing Networks,” and “Ad-Hoc Networks.” Finally, I served as the Chair of the IEEE Technical Committee on Personal Communications (TCPC), today known as Wireless Communications Technical Committee (WTC).

14. I have received multiple awards in the field of wireless communications and networks. In 2016, I received the IEEE ComSoc AHSN Recognition Award “for outstanding contributions to securing ad hoc and sensor networks”. In 2012, I received the IEEE ComSoc WTC Recognition Award, which recognizes individuals “for outstanding technical contributions in the field for their service to the scientific and engineering communities.” In 2021, I received the “Best Paper Award” for co-authoring the paper “Engineering a Network in the Sky” from the 35th International Conference on Information Networking, (ICOIN21). In 2012, I received the “Best Paper Award for co-authoring “Collaborating with Correlation for Energy Efficient WSN” directed at Wireless Sensor Networking. I previously received the “Best

Paper Award” for co-authoring “Optimal Resource Allocation for UWB Wireless Ad Hoc Networks” directed at personal indoor and mobile radio communications. Finally, in 2003, I received the “Highly Commended Paper Award” for co-authoring “Performance Evaluation of the Modified IEEE 802.11 MAC for Multi-Channel Multi-Hop Ad Hoc Network,” directed at advanced information networking and applications.

15. Additional information regarding my education, technical experience and publications, including a list of the U.S. patents of which I am an inventor/co-inventor, is included in my *Curriculum Vitae*.

### **III. RELEVANT LEGAL STANDARDS**

16. I am not an attorney, I do not opine on matters of law, and I do not provide any legal opinions in this Declaration. In preparing and expressing my opinions and considering the subject matter of the ’590 Patent, I am relying on certain basic legal principles that counsel have explained to me. These principles are discussed below.

17. I have been informed by counsel that prior art to the ’590 Patent includes patents and printed publications in the relevant art that predate the priority date of the alleged invention recited in the ’590 Patent.

18. I have been informed by counsel that a patent claim is unpatentable under 35 U.S.C. § 102 if it is anticipated by prior art. I have been informed by

counsel that anticipation requires a finding that a single prior art reference discloses each limitation of a claim as the limitations are arranged in the claim. I have been informed by counsel that a prior art reference's disclosures may be express or inherent. I have been informed by counsel that a limitation is inherently disclosed by a prior art reference if the reference necessarily includes the limitation in question.

19. I have been informed by counsel that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. I have also been informed by counsel that the obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and the content of the prior art, and the differences between the prior art and the claimed subject matter. I have been informed by counsel that is impermissible within the framework of determining whether a claim is obvious to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.

20. I have further been informed by counsel that obviousness concerns whether a POSITA not only could have made but would have been motivated to

make the proposed combinations or modifications of prior art to arrive at the claimed invention. I have been informed by counsel that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include the following: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

#### **IV. SUMMARY OF THE '590 PATENT**

##### **A. The '590 Patent**

21. The '590 Patent describes methods for activating inactive cells of a telecommunications infrastructure that were inactivated for the purposes of reducing energy consumption or "electromagnetic radiation." EX1001, 1:19-24. The patent recognizes that prior art studies looked at reducing energy consumption in wireless access networks, and one conventional way to do that was to inactivate base stations

during periods of low load (*e.g.*, the night). *Id.*, 1:33-49. The '590 Patent also recognizes the obvious consequence that once a base station has been de-activated, it must at some point be re-activated (to become useful again). *Id.*, 1:53-56. The '590 Patent concedes that two conventional solutions for this decision would be to activate the base station at a “predetermined time” or when an active cell near the inactive cell detects a “certain traffic load exceeding a threshold.” *Id.*, 1:61-64. The '590 Patent contends that these solutions are inadequate and proposes to “improve these solutions by determining more accurately which base stations and/or cells should be activated.” *Id.*, at 1:65-67.

22. The steps of the claimed method for activating an inactive cell can be summarized as including (a) transmitting a “presence signal” from the inactive cell; (b) receiving measurements reports from terminals that indicate measurements of the presence signal; (c) “processing information” in the measurement reports to provide a “processing result;” and (d) activating the inactive cell “when the processing result fulfills at least one activation condition.”

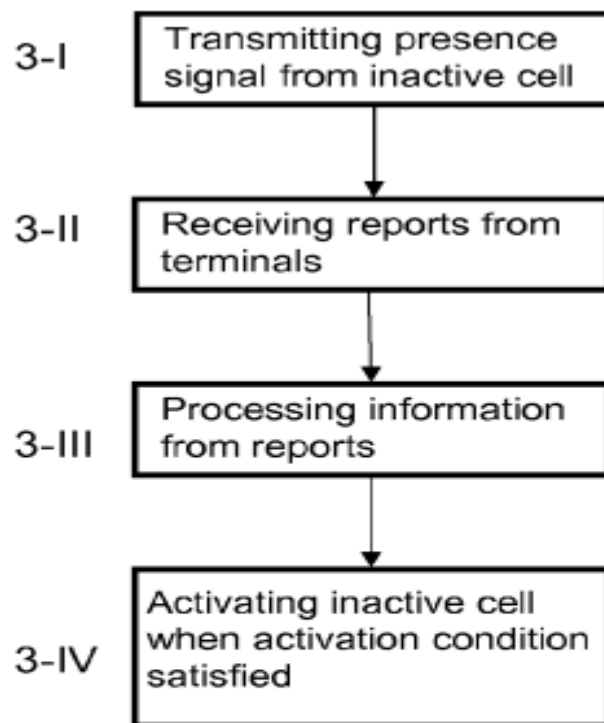
23. Claim 1 of the '590 Patent is representative, and recites:

A method for activating at least one inactive cell in a wireless access telecommunications infrastructure, the wireless access telecommunications infrastructure comprising an active cell containing a plurality of terminals, the method comprising:

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transmitting a presence signal by the at least one inactive cell;  
receiving measurement reports from the plurality of terminals detecting the presence signal, the measurement reports indicating measurements of the presence signal by the plurality of terminals;  
processing information contained in the received measurement reports in a processing system of the wireless access telecommunications infrastructure to provide a processing result; and  
activating the at least one inactive cell when the processing result fulfills at least one activation condition such that at least one of the plurality of terminals is within a coverage area of the at least one activated cell.

24. An illustrated embodiment of the claimed method is shown in Figure 3, which repeats the same four basic steps recited above.

**FIG. 3**

25. In some embodiments, the inactive cell performs “close to a minimum of functions, i.e., the transmission of the presence signal.” *Id.*, at 6:29-31. The ’590 Patent describes that the claimed “presence signal” may comprise a “beacon signal” or may be (downlink) “reference symbols in LTE in order to indicate the presence of the cell.” *Id.*, 4:39-41; 6:29-35. “The main purpose of the inactive cells to transmit the presence signal is to allow the terminals in the active cell to perform measurements on these inactive cells and to report such measurements to the

network.” *Id.*, at 4:65-5:1. These measurements may include measurements about “signal strength and/or quality of the presence signal.” *Id.*, at 5:52-55.

26. Notably, the method claimed above is described in the ’590 Patent specification as being partly performed by the inactive cell and partly performed by an active cell:

By using the (partly) existing capabilities of terminals to measure and report information received from neighbouring cells (typically applied for e.g. handover operations), ***the transmission of the presence signal in the currently inactive cell*** enables the telecommunications infrastructure to assess whether the terminals recognize this cell as an appropriate target, i.e. whether the terminals currently connected to or camping on the active cell are likely able to be connected to or camp on a currently inactive cell. The telecommunications infrastructure is configured to ***receive and process the information*** relating to the inactive cell(s) from the reports of various terminals ***within the active cell*** (possibly, but not necessarily, all terminals in the active cell).

*Id.*, 3:34-46.

### **B. The ’590 Patent’s Prosecution History**

27. The PCT application that led to the ’590 Patent was filed in the U.S. on November 5, 2012. EX1002, at 79 (transmittal of application). The Patent Office issued a first office action on December 12, 2014, in which the Examiner rejected then-pending claims 1-20. *Id.*, at 51. The Examiner rejected Claims 1-7, 9-18, and 20 over U.S. Patent Publication 2010/0002614 to Subrahmanya, and rejected Claims 8 and 19 over Subrahmanya in view of U.S. Patent 8,467,798 to Lee. *Id.*, at 54-59. In response to the Office Action, applicant filed an amendment to the claims on June

9, 2015, to specify that the recited “reports” are “*measurement reports indicating measurements of the presence signal by the plurality of terminals*”:

1. A method for activating at least one active cell in a wireless access telecommunications infrastructure, the wireless access telecommunications infrastructure comprising an active cell containing a plurality of terminals, the method comprising:

transmitting a presence signal ~~[[in]]~~ **by** the at least one inactive cell;

receiving measurement reports from the plurality of terminals detecting the presence signal, **the measurement reports indicating measurements of the presence signal by the plurality of terminals**;

processing information contained in the received measurement reports in a processing system of the wireless access telecommunications infrastructure to provide a processing result;

activating the at least one inactive cell when the processing result fulfills at least one activation condition such that at least one of the plurality of terminals is within a coverage area of the at least one activated cell.

*Id.*, at 24.

28. In the remarks accompanying this amendment, applicant argued that Subrahmanya fails to teach “transmitting a presence signal by the at least one inactive cell” and “receiving measurement reports from the plurality of terminals detecting the presence signal, the measurement reports indicating measurements of the presence signal by the plurality of terminals.” *Id.*, at 31-33. While the remarks acknowledged that Subrahmanya taught synchronization signals (which are signals the ’590 Patent teaches are “presence signals”), applicant argued there was no

teaching to measure or report on such signals in Subrahmanya nor any teaching to perform the processing and activating steps based on such measurement reports. *Id.*, at 33-35.

29. The Examiner found these remarks persuasive and issued a notice of allowance on August 7, 2015. *Id.*, at 7-14. The Examiner's reasons for allowance specifically found that Subrahmanya fails to disclose the limitations applicant argued in the prior response. *Id.*, at 12. The August 7, 2015 communication also include a notice of references cited that included reference to Frenger. *Id.*, at 15. Unlike for Subrahmanya, the Examiner gave no reasons for allowance over Frenger. *Id.*

## **V. LEVEL OF ORDINARY SKILL IN THE ART**

30. I have been informed and I understand that there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems.

31. A person of ordinary skill in the art ("POSITA") in the field of the '590 Patent, as of its earliest possible priority date, which I was instructed by counsel to assume to be May 4, 2011, would have been someone knowledgeable and familiar with the networking arts that are pertinent to the '590 Patent. It is my opinion that a POSITA would have had a Bachelor's degree in electrical engineering or similar

discipline with at least two to three years of relevant industry or research experience, including designing or implementing cellular systems, especially LTE systems. The POSITA would also have had knowledge of the LTE standard, its specifications, and the principles underlying its technical teachings. This definition is approximate, and lack of industry experience may be remedied by additional education, and vice versa. As at the priority date of the '590 Patent, I have had a Ph.D. degree for over 20 years, with numerous years of professional experience, I possessed and exceeded the experience and knowledge of POSITA. Thus, I am qualified to opine on the '590 Patent.

32. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions, such as those regarding my experience and the understanding of a POSITA generally (and specifically related to the references I consulted herein) reflect the knowledge that existed in the field as of the priority date of the '590 Patent. Unless otherwise stated, when I provide my understanding and analysis below, it is consistent with the level of a POSITA prior to the earliest possible priority date of the '590 Patent of May 4, 2011.

## **VI. CLAIM CONSTRUCTION**

33. I have been informed by counsel that in order to properly evaluate the '590 Patent, the terms of the claims must first be interpreted. I have been informed by counsel that for the purposes of this *inter partes* review, the claims are to be

construed under the so-called *Phillips* standard, under which claim terms are given their ordinary and customary meaning as would be understood by one of ordinary skill in the art in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term.

34. Additionally, I have been informed by counsel that claim terms are normally not interpreted in such a way that excludes embodiments disclosed in the specification, except in cases of clear disclaimer in the specification or the prosecution history. I have been further informed by counsel that claim terms only need to be construed to the extent necessary to resolve the obviousness inquiry. Accordingly, in order to construe the claim terms, I have reviewed the entirety of the '590 Patent, as well as its prosecution history.

35. In my opinion, except for the terms “inactive cell” and “presence signal,” all of the claim terms in the '590 Patent should be given their plain and ordinary meaning, as a POSITA would have understood them in light of the specification and the file history of the '590 Patent. Except as otherwise noted, I have applied such a plain and ordinary meaning in my analysis of the claims. I reserve the right to offer additional opinions on claim construction in response to arguments that may be made by Patent Owner.

36. For the purpose of my analysis below, I address two terms: “inactive cell” and “presence signal.”

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**A. Inactive cell**

37. A POSITA would recognize that “inactive cell” means “a cell that has at least one function switched off to conserve energy,” consistent with the specification’s description of this term. This meaning is consistent with the context of the alleged invention, which explains that it is directed to “activating inactive cells . . . for the purposes such as controlling energy consumption.” EX1001, at 1:21-24. To this end, the ’590 Patent recognizes that “the main saving potential resides in using variations in load over time, that allows to switch off parts of the resources, for example during the night.” *Id.*, at 1:44-49.

38. The specification states that an “inactive cell may be considered a cell that is not intended to carry any voice or data traffic but may transmit a presence signal.” *Id.*, at 5:64-66. Importantly, the specification does not limit an “inactive base station” to one that has been *fully* inactivated; the patent broadly describes that “an inactive cell” operates on a “*spectrum*” of functional capabilities, from “*close to full functionality*” to “*close to minimum functionality*.” *Id.*, at 5:66-6:8. On the one end of the range, the base station may merely not accept “normal” data or voice traffic but otherwise be close to fully functional. *Id.*, at 6:9-14. Such “inactive base stations” still communicate *some kinds of* traffic with terminals, including receiving and forwarding measurement reports and location area updates. *Id.*, at 6:9-28. On the other end of the range, the specification describes base stations operating with

“close to minimum functionality.” *Id.*, at 6:29-46. This end of the range is described as including base stations that “only perform close to the minimum of functions, i.e., the transmission of a presence signal.” *Id.*

39. Consistent with the descriptions above, the construction proposed above recognizes that the “inactive base station” as described in the specification encompasses a range of functionalities that may be shut off, but at a minimum at least one functionality (*e.g.*, “normal” voice and data traffic) is switched off temporarily due to inactivity.

**B. Presence signal**

40. A POSITA would recognize that “presence signal” means “a signal transmitted by an inactive cell that indicates the presence of the cell.” EX1001, at 4:39-42; 4:46-50. This is supported by the claim language itself which recites that it is the at least one inactive cell that transmits the presence signal. And consistent with the plain meaning of the term, a presence signal is described as being any number of cellular signals that are used to indicate presence of the inactive cell. *Id.*, at 4:39-42 (“*A presence signal* may comprise a beacon signal, such as BCCH in GSM network, CPICH in UMTS network or reference symbols in LTE *in order to indicate the presence of the cell.*”); *id.*, at 4:46-50 (“A presence signal may also include a synchronization channel (SCH), commonly used in mobile communication systems such as GSM, UMTS and LTE, for cell search, for identifying a cell and for

synchronization with a cell.”). Consistent with the claim language itself, the specification also makes clear that the “presence signal” is transmitted by the *inactive cell* to indicate presence and permit UE measurements of the inactive cell. *Id.*, at 2:6-7; 2:42-49; 2:63-67; 4:65-5:1.

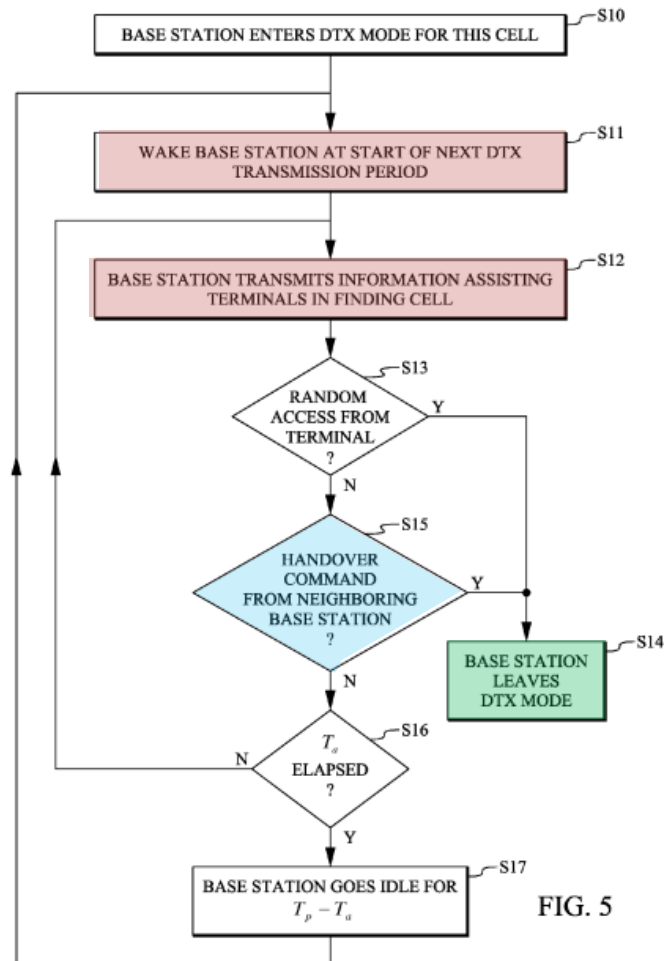
## VII. SUMMARY OF THE PRIOR ART

### A. Summary of Frenger (EX1004)

41. Like the '590 Patent, Frenger describes an arrangement for controlling energy consumption of a network by restricting downlink transmission “to intermittent transmission of information assisting active terminals not served by the cell in finding the cell.” EX1004, [0005]. As disclosed by Frenger, a base station so restricted is essentially an “idle cell” in the downlink. *Id.*, [0034]. Frenger discloses that the “idle cell” may enter a discontinuous transmission mode (DTX), where the base station wakes up periodically to transmit the signals necessary to assist terminals in finding the cell. *See* Figure 5. Notably, Frenger proposes to use the same type of signals as the claimed “presence signals” in the '590 Patent for this purpose; namely LTE “reference signals,” “synchronization signals,” and the “broadcast channel.” *Id.*, [0028]; [0061]-[0062]. The transmitted synchronization signals are used by the terminal for mobility cell search and to take signal strength measurements, which are then transmitted to a neighboring serving cell for a decision as to whether the terminal should be handed over to the idle cell. *Id.*,

[0030], [0035], [0036]. If the serving cell decides to “wake up” the idle cell, it sends a “wake up command” to the idle cell. *Id.*, [0040].

42. Frenger’s process for waking inactive base stations is shown in Figure 5, which is reproduced below with color annotations:



43. As shown above, Frenger discloses that the idle base station “wakes” (step S11) to “transmit information assisting terminals find the cell” (step S12). As discussed, these may include synchronization signals used for mobility cell search measurements and reports. *Id.*, [0028]. Frenger specifically explains that the base

station's DTX transmission period should be long enough to enable "signal measurements on the cell." *Id.*, [0035]-[0036], [0038]. Frenger explains that such measurements are typically reported to the serving cell to decide whether to handover to a candidate cell. *Id.*, [0030] ("Active terminals typically also report the received signal strength of reference signals (RSRP (Reference Signal Received Power) measurements) transmitted by the neighboring cells to the network, which takes a decision if the terminal should be handed over to the candidate cell.").

44. The active cell may decide to wake up an inactive cell in conjunction with the handover procedure using a "wake up command" sent over the X-2 interface between the base stations. *Id.*, [0030], [0040]. Notably, Frenger specifically contemplates that the serving eNodeB may base its handover decision on "if a cell is congested" or if the connection may be lost. *Id.*, [0046]. As mentioned above, Frenger also teaches that the handover decision may be made based on the mobility cell search measurement reports (which may contain measurements of the idle cell's DTX transmissions). *Id.*, [0030] ("Active terminals typically also report the received signal strength of reference signals (RSRP (Reference Signal Received Power) measurements) transmitted by the neighboring cells to the network, which takes a decision if the terminal should be handed over to the candidate cell."); *see id.*, [0036] (teaching that the idle cell's DTX cycle should be "large enough to allow the terminal to find synchronization with sufficiently high probability *as well as being*

*able to do signal measurements on the cell.”).*

45. As shown above at [decision point S15](#), the idle base station [detects whether any handover commands \(or, e.g., wake-up commands\) have been received](#). *Id.*, [0044]. For example, the idle base station may include a “handover command monitor,” which receives handover command during the base station’s DTX mode. *Id.*, [0049]. If a handover command is detected, the base station enters [normal continuous operation \(CTX\)](#) mode at [step S14](#). *Id.*, [0044]. While in [normal CTX mode](#), the base station is “active” and serves active terminals in the cell (while also running an algorithm to determine whether to become “idle” again if the number of active terminals falls below a threshold). *Id.*, [0041].

#### **B. Summary of TS 36.300 (EX1005)**

46. TS 36.300 is an “Overall description” of the Release 8 version of the 3GPP LTE standard. EX1005, at 1. 36.300 provides a detailed overview of the high-level requirements of LTE, and would have been relied on as a go-to reference for the skilled artisan seeking to implement an LTE-compliant base station or terminal. TS 36.300 provides a detailed overview of LTE handover procedures, including a description of the ability of an eNodeb (LTE base station) to initiate a handover to a neighboring eNodeB using the X-2 interface. *Id.*, at 43-45. As the POSITA would have recognized, the X-2 interface is an LTE-specified interface that allows communications between eNodeBs:

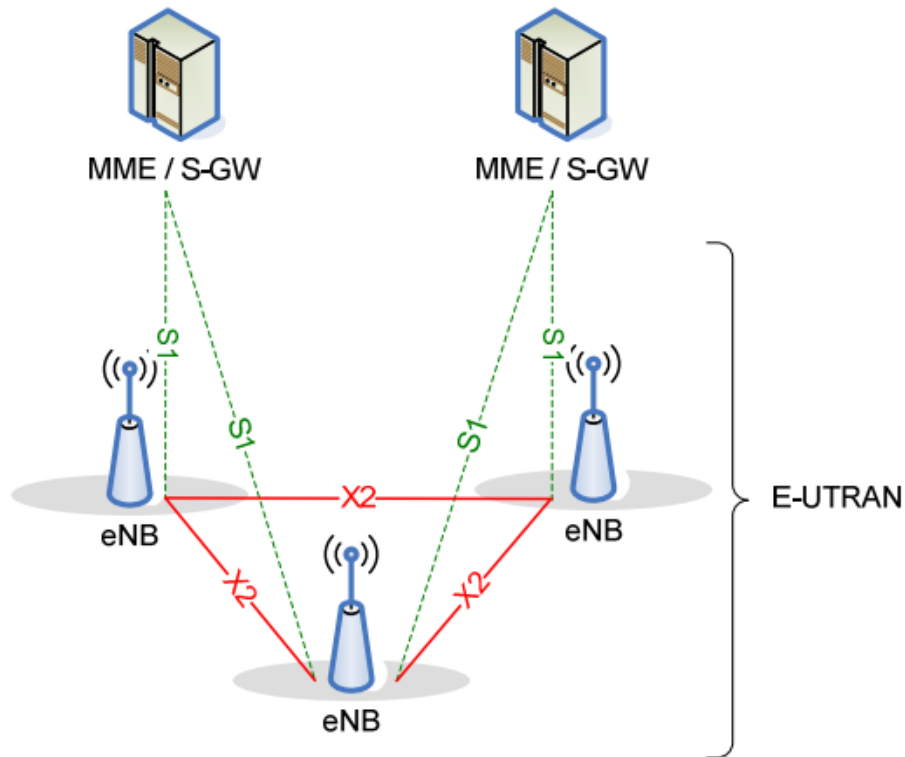


**Figure 4-1: Overall Architecture**

*Id.*, at 15.

47. The detailed procedure for handing over a UE (*e.g.*, terminal) from a source to target eNodeB is shown below in Figure 10.1.2.1.1-1, as reproduced from TS 36.300:

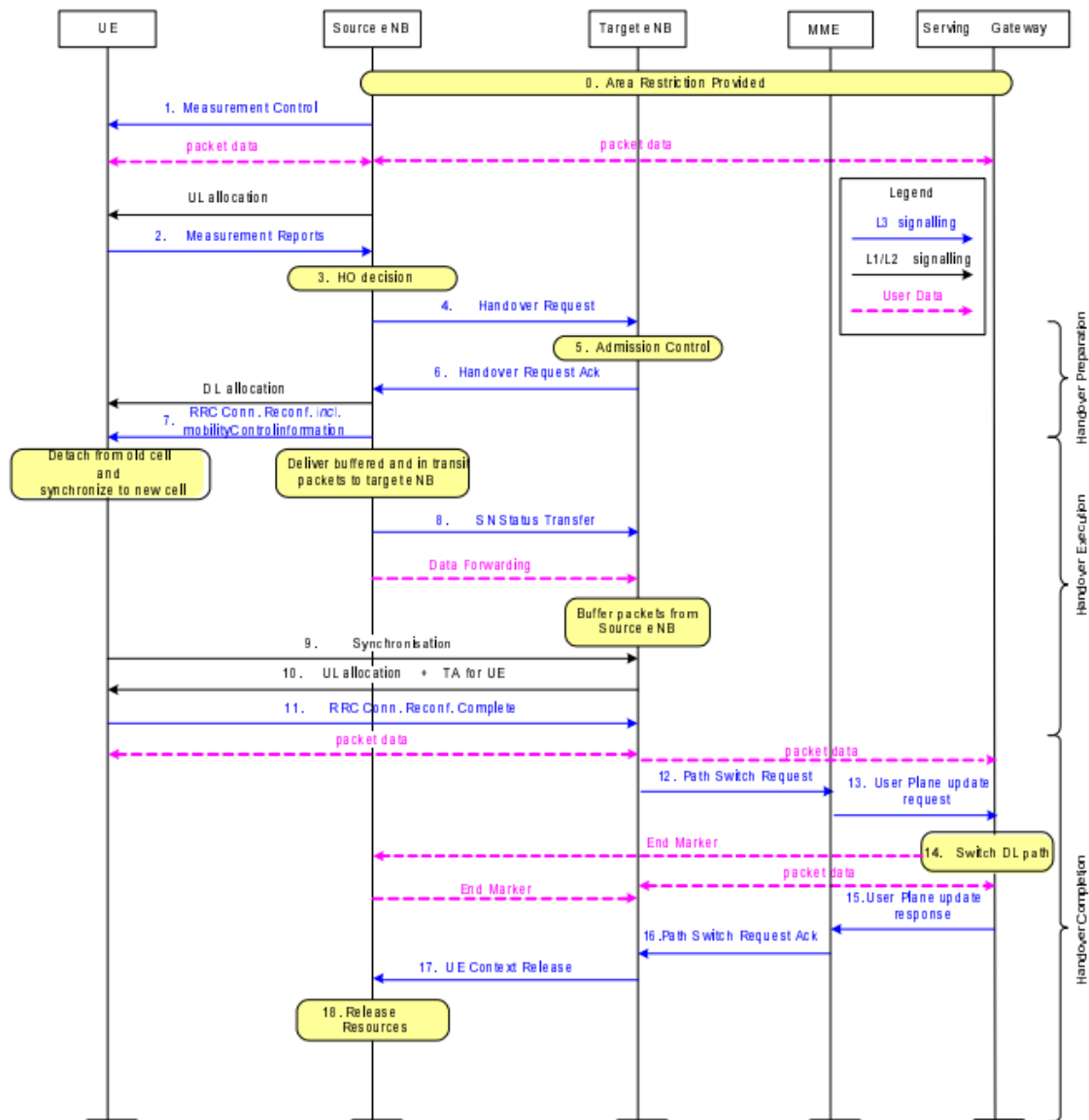


Figure 10.1.2.1.1-1: Intra-MME/Serving Gateway HO

*Id.*, 45.

48. As seen above, the UE transmits “measurement reports” to the source (*i.e.*, serving) eNodeB (step 2). *Id.* (“UE is triggered to send MEASUREMENT REPORT by the rules set by *i.e.* system information, specification etc.”). The

serving eNodeB then makes a “HO [*i.e.*, handover] decision” based on the received MEASUREMENT REPORT (step 3). *Id.*, at 46 (“Source eNB makes decision based on MEASUREMENT REPORT and RRM information to hand off UE.”). In the event of an HO (handover) decision, a handover request is transmitted to the target eNodeB at step 4. *Id.* (“The source eNB issues a HANDOVER REQUEST message to the target eNB passing necessary information to prepare the HO at the target side.”). The POSITA would have thus understood Frenger’s LTE embodiment to be referring to the handover process described above in TS 36.300.

### C. Summary of TS 36.331 (EX1006)

49. TS 36.331 is a “Protocol Specification” of the “Radio Resource Control” layer of LTE. EX1006, at 1. TS 36.331 teaches the POSITA how to construct LTE RRC signaling messages transmitted between the eNodeB and user equipment. *Id.*, at 12. Section 5.5.5 (“Measurement reporting”) of 36.331 defines the contents of the MEASUREMENT REPORT referenced above in TS 36.300. *Id.*, at 70. 36.331 illustrates the MeasurementReport as follows:

#### 5.5.5 Measurement reporting

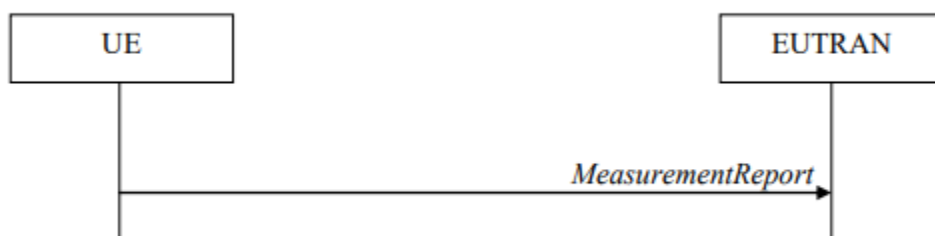


**Figure 5.5.5-1: Measurement reporting**

50. TS 36.331 confirms that the UE measurement report contains the measurement results in the field “*measResults*,” which contains the “*measResultServCell* to include the quantities of serving cell” and “*measResultNeighCells* to include the best neighbouring cells.” *Id.*, at 70. TS 36.331 further confirms that each of these containers are to include RSRP and RSRQ (Reference Signals Received Quality) measurements of the serving and neighbor cells. *Id.*, at 154-156.

– ***MeasResults***

The IE *MeasResults* covers measured results for intra-frequency, inter-frequency and inter- RAT mobility.

***MeasResults* information element**

```
-- ASN1START
MeasResults ::=
    measId
    measResultServCell
        rsrpResult
        rsrqResult
    },
    measResultNeighCells
        measResultListEUTRA
        measResultListUTRA
        measResultListGERAN
        measResultsCDMA2000
        ...
    }
    ...
}
```

SEQUENCE {  
    MeasId,  
    SEQUENCE {  
        RSRP-Range,  
        RSRQ-Range  
    }  
    CHOICE {  
        MeasResultListEUTRA,  
        MeasResultListUTRA,  
        MeasResultListGERAN,  
        MeasResultsCDMA2000,  
        ...  
    }  
}

OPTIONAL,

```
MeasResultEUTRA ::= SEQUENCE {
    physCellId
    cgi-Info
        cellGlobalId
        trackingAreaCode
        plmn-IdentityList
    }
    measResult
        rsrpResult
        rsrqResult
        ...
    }
}
```

PHysCellId,  
SEQUENCE {  
    CellGlobalIdEUTRA,  
    TrackingAreaCode,  
    PLMN-IdentityList2  
}

OPTIONAL,

SEQUENCE {  
    RSRP-Range  
    RSRQ-Range  
}

OPTIONAL,  
OPTIONAL,

*Id.*, at 154-155; *see id.* at 156 (“rsrpResult” refers to “Measured RSRP result of an E-UTRA cell” and “rsrqResult” refers to “Measured RSRQ result of an E-UTRA

cell.”). Accordingly, it would have been well understood by the POSITA that the LTE handover decision discussed in TS 36.300 was based at least in part on both serving and neighboring cell measurements.

**D. Summary of Furht (EX1007)**

51. Furht, “Long Term Evolution: 3GPP LTE Radio and Cellular Technology” (April 2009) is a book about the Release 8 version of LTE (“Furht”). EX1007. This book describes the principles underlying the LTE standard. *See*, EX1007, Preface, vii (“This book provides technical information about all aspects of 3GPP LTE. The areas covered range from basic concepts to research-grade material, including future directions. The book captures the current state of 3GPP LTE technology and serves as a source of comprehensive reference material on this subject.”). The targeted audience for this book is the POSITA, *e.g.*, one looking to design, implement, or study 3GPP LTE systems. *Id.* (“The targeted audience includes professionals who are designers or planners for 3GPP LTE systems, researchers, . . . , and those who would like to learn about this field”).

52. Furht serves to confirm that the POSITA would have understood that the measurement reports cited above in TS 36.300 include signal strength measurements of the serving and neighboring cell, which allows the serving eNodeB to move the UE connection to the cell with the best average path gain (an equivalent to the signal strength measurements described by Frenger and LTE):

The network-controlled and UE-assisted property of the handover ***means that the decision to move the radio link connection of the UE from one cell to the other is made by the network***—more specifically, by the eNodeB serving the UE, ***assisted by measurement reports received from the UE***. The eNodeB can utilize a number of other information sources as well for making the handover decision, including ***its own measurements, the availability of radio resources in the candidate cells, load distribution, etc.*** However, ***the most important aspect that should drive the handover decision is the UE path gain measure***. In other words, the handover control should ensure that ***the UE is always connected to the cell with the best average path gain***.

*Id.*, at 115. Notably, Furht includes a simplified version of the same handover procedure reproduced above from TS 36.300. *Id.*, at 117 (Figure 4.8). Accordingly, the POSITA would have looked to Furht and its explanation of the TS 36.300 handover procedures to better understand how and why the handover decision is made by the serving cell.

#### **E. Summary of TS 24.301 (EX1008)**

53. TS 24.301 is the “Non-Access (NAS) protocol for Evolved Packet System (EPS) of LTE. EX1008, at 1. TS 24.301 defines the procedures and protocols for mobility management between the UE and the Mobility Management Entity (MME). EX1008, at 16. TS 24.301 teaches the POSITA the procedures “for the support of inter-system mobility between E-UTRAN and other 3GPP or non-3GPP access networks.” *Id.* For example, 24.301 teaches the POSITA how the “tracking area update” procedure should be conducted, which is the mechanism in LTE for the UE to periodically update the network with its current location. *Id.*, at

48-49.

**VIII. GROUND 1: CLAIMS 1-20 ARE OBVIOUS OVER FRENGER (EX1004) IN LIGHT OF THE LTE STANDARD (AS DESCRIBED BY 36.300 AND (EX1005), 36.331 (EX1006), FURHT (EX1007), AND 24.301 (EX1008))**

**A. Motivation to Combine Frenger with 36.300 and Furht**

54. A POSITA would have been motivated to combine Frenger with the LTE standard as reflected in EX1005, EX1006, EX1008, and Furht at least because Frenger is intended as an improvement to the well-known LTE technology described by the cited LTE standard specifications and as explained by Furht. EX1004, at [0022]-[0023]. For example, the POSITA would have been motivated to extend Frenger's energy savings techniques to existing LTE systems, including the ability to wake-up an inactive base station during a handover, at least because Frenger expressly teaches the POSITA to implement his techniques using LTE base stations. *Id.*, [0023] ("the present invention will primarily be explained with reference to base stations, *especially LTE base stations.*"). Furht itself specifically explains that its intended audience includes "designers or planners for 3GPP LTE systems." EX1007, Preface, vii.

55. A POSITA looking to implement the teachings of Frenger would have needed to use various LTE specifications and references including references such as EX1005, EX1006, EX1007, and EX1008 to implement an LTE-compliant system that utilized Frenger's teachings. Following the teachings and principles of the LTE

standard would have been necessary to ensure that the combined system would have interoperability among LTE equipment manufactured by various vendors. And the POSITA would have looked to publications about LTE like Furht to better understand the teachings of the 3GPP standard including, for example, the technical principles underlying the LTE handover procedures. EX1007, Preface, vii; 114-115.

56. The POSITA would have looked to, for example, TS 36.300 to understand the call flow and signaling required to implement LTE-compliant handover procedure. EX1005, at 45-46. TS 36.300 goes on to explain that the UE should transmit a measurement report to the eNB for the purpose of the eNB's handover decision. *Id.* Furht explains the principles underlying the LTE handover procedure, including the desirability of handing over to the cell with the best average pathloss (*i.e.*, best SINR (Signal-To-Interference+Noise-Ratio) or signal quality) and other reasons a serving cell can use to decide to initiate a handover (*e.g.*, load balancing). EX1007, at 115. Furht would have provided the POSITA with the insight on how to utilize the measurement report taught by TS 36.300 to program the handover decision in the eNB, including by providing the insight that the UE measurement report is an important aspect of the base station's handover decision, and that the handover should target the UE for the base station with the best signal conditions.

57. The POSITA would have understood in light of Frenger and the

knowledge of 3GPP LTE technologies (as evidenced by TS 36.300 and Furht) that the handover/wake-up command described by Frenger could be triggered at the serving cell by 1) congestion at the serving cell, 2) potential loss of connection by the serving cell, 3) the relative pathloss and/or signal strength measurements of the serving and other cells, including the inactive cells, or 4) various other possible factors, such as the UE's trajectory for example. EX1005, at 46; EX1004, [0030], [0046].

58. The POSITA would have been motivated by this understanding to include these factors in the handover programming of the LTE base station. Doing so would have been accomplished with a reasonable expectation of success, at least because LTE technology was well-known and well-understood at the time, including the LTE handover procedures. This would have had the predictable result of implementing a wireless telecommunications infrastructure that contained LTE base stations capable of going idle and only transmitting "presence signals" during DTX on cycles. Frenger teaches that terminals should make measurements of those signals, and the ensuing measurement reports to the serving cell would have thereby included measurements of the idle cell's DTX signal transmissions (*i.e.*, the claimed "presence" signals). EX1004, at [0036].

59. It would have been a natural and obvious design consideration to consider the signal strength that the terminal would be expected to receive if the idle

cell were to wake up and begin serving the terminal. *Not* considering the signal strength of the candidate idle cell would have resulted in an undesirable and unstable system that would have had an unacceptably high probability at dropping the calls at handover. The POSITA would have been motivated to follow the basic principles of the LTE handover as taught by Furht and the 3GPP technical specifications to avoid this outcome.

60. Moreover, the POSITA would have been motivated to look to TS 36.331 to understand the LTE radio resource control (RRC) protocol, which, among other things, teaches the POSITA the specific measurements the UE should make for the handover procedure taught by TS 36.300, as well as the information elements and reporting format to use for that report. EX1006, at 154-156. This would have predictably allowed the base station to consider such measurements in its handover decisions, including using the reported serving- and neighbor-cell measurements to decide whether the inactive base station was a good candidate for handover for the particular UE.

61. The POSITA would have been motivated to look to TS 24.301 to implement portions of the LTE standard related to tracking area updates. These would have been necessary for the LTE system to allow for tracking area updates to facilitate UE mobility.

62. The predictable result of combining these references would have been

an LTE-compliant system that implemented the energy-saving mechanisms taught by Frenger. As a predictable result of the combined teachings of Frenger and the LTE standards, after a serving cell receives a measurement report from a UE, it can determine whether to handover the UE to an inactive base station based on the UE's measurement report and other factors, as discussed above. If the serving cell decided to wake-up an inactive base station, a handover/wake up command would be sent, as taught by Frenger. EX1004, at [0040]. Such base stations would predictably wake up to complete the handover and begin serving the UE. This would have predictably resulted in an LTE system that conserved energy by causing low-traffic base stations to go idle during periods of non-use, but still allowed those idle base stations to be put into use when needed by the telecommunications infrastructure (*e.g.*, when the serving cell decided to wake up the cell if the serving cell was congested or the idle cell was likely to have best signal strength).

**B. Reasonable Expectation of Success**

63. The POSITA would have had a reasonable expectation of success, as the combination of references discussed above would have merely involved following the instructions of each reference and creating a combined LTE-compliant system. Frenger specifically explains that its techniques are applicable to an LTE system, and it would have taken no more than ordinary skill to successfully create an LTE system according to the cited LTE specifications as explained by Furht and

to include the idle cell/wake-up procedures and techniques taught by Frenger.

**C. Claim 1**

**1. 1[p] A method for activating at least one inactive cell in a wireless access telecommunications infrastructure, the wireless access telecommunications infrastructure comprising an active cell containing a plurality of terminals, the method comprising**

64. I have been informed by counsel that a preamble of a claim may or may not be considered a limitation. To the extent the preamble is limiting, Frenger in light of the well-known LTE standard above discloses or renders obvious the preamble. Frenger discloses a method for activating idle base stations in a wireless telecommunications infrastructure. EX1004, at [0005], [0044], Figures 1-2 and 5. Frenger's method is disclosed with respect to a wireless access telecommunications infrastructure (such as an LTE system), where unused base stations may go "idle." *Id.*, [0022]-[0023], [0034]. Frenger's "idle cells" correspond to the claimed "inactive cell," which Frenger goes on to disclose activating when certain conditions are fulfilled. *Id.*, Fig. 5.

65. As disclosed by Frenger, LTE wireless access telecommunications infrastructure may also include active or non-active terminals, examples of which can be seen in Figures 1 and 2. For example, Figure 2 shows one base station (BS2) can serve a macro cell (RC2), while a second base station (BS1) may serve a micro cell (RC1) that is located within the coverage area of the macro cell:

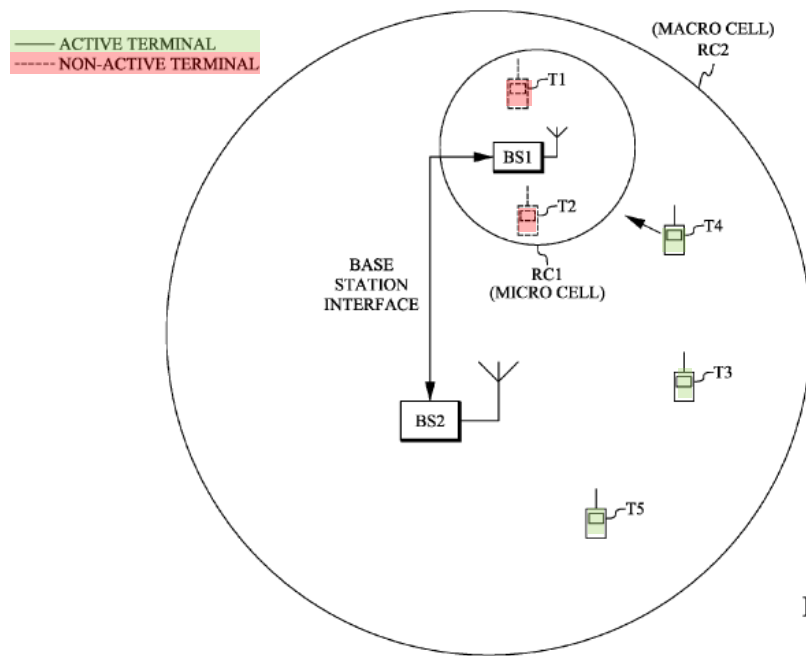


FIG. 2

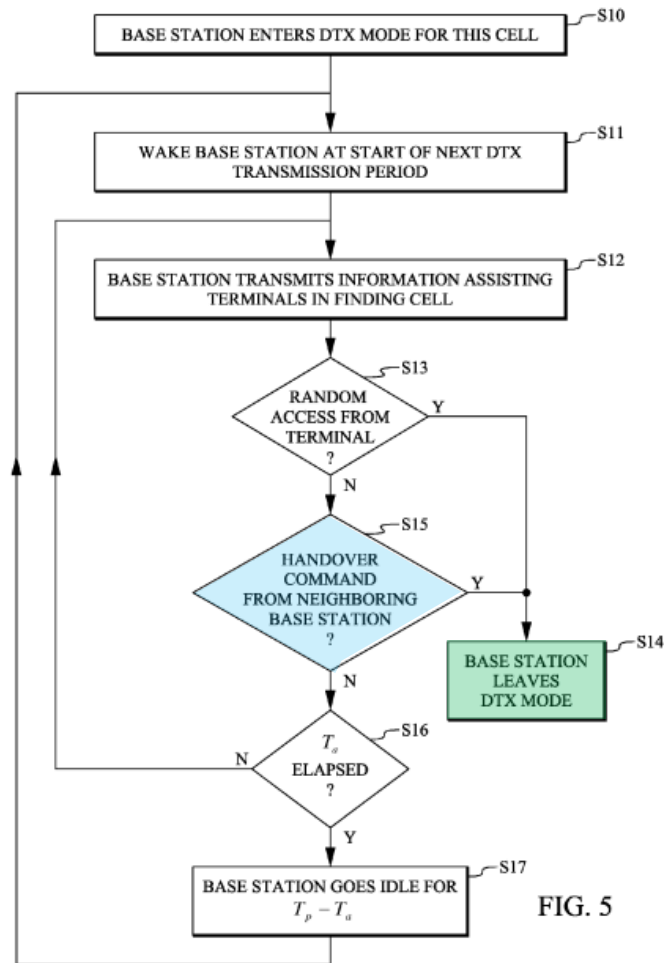
*Id.*, Fig. 2 (coloring added).

66. Figure 2 is an illustration of a well-known macro/microcell cellular deployment, where the microcell is placed within the broader coverage of the macrocell. *Id.*, [0033]. As shown above, BS1 is not serving any **active users** in the micro cell RC1 (**T1 and T2 are shown as inactive**). *Id.* Frenger recognizes that in this scenario (the absence of active terminals), the base station may “turn off the power amplifier as well as the baseband processing” and would “in essence be ‘idle’ in the downlink.” *Id.*, [0033], [0034]. As would have been understood to the POSITA, BS2 remains an active cell and continues to serve the illustrated plurality of **active terminals** (T4, T3, T5) while BS1 is in idle mode. *Id.*, Fig. 2. RC2 (served by BS2) and terminals T3-T5 thus map to the claimed “*active cell containing a*

*plurality of terminals.*” Frenger’s “idle” cell is the claimed “*inactive cell*” at least because it is described as having at least certain functionality (*e.g.*, power amp, baseband processing) shut off during periods of inactivity. *See* Section VI.A (“inactive cell” construction)

67. Frenger teaches that despite being in “idle” mode, the cell may nonetheless periodically transmit “the signals necessary for mobility and cell search” because a terminal would not otherwise be able to “find the cell.” EX1004, at [0034]. To accomplish these periodic transmissions, Frenger defines a discontinuous transmission (DTX) cycle for the inactive base station. *Id.*, [0035] (“despite being in idle mode, the signals necessary for mobility and cell search should be intermittently transmitted. This can be accomplished by defining a discontinuous transmission (DTX) cycle for the base station.”). Frenger also specifies that the idle cell’s DTX transmission cycle should be “selected large enough to allow the terminal to find synchronization with sufficiently high probability as well as being able to do signal measurements on the cell.” *Id.*, at [0036].

68. Frenger goes on to teach a method for activating the inactive cell in DTX mode, which is illustrated in Figure 5:



EX1004, Fig. 5 (coloring added).

69. As shown above, Frenger’s method of activation provides a decision point at step S15, which may cause the inactive base station to leave DTX mode (at step S14). *Id.* As described by Frenger, leaving DTX mode causes the base station to enter normal continuous operation (CTX) mode. *Id.*, [0044] (describing that “step S14 instructs the base station to leave DTX mode, and to enter normal CTX mode”). While in normal CTX mode, the base station serves active terminals in the cell (while also running an algorithm to determine whether to become “idle” again if the number

of active terminals falls below a threshold). *Id.*, [0041] (“In continuous transmission (CTX) mode, step S1 [in Fig. 4] monitors the number of active terminals served by the cell”). A POSITA would have understood that the idle (DTX) mode base station entering the CTX mode to serve active terminals is “activating at least one inactive cell” as claimed. Frenger thus discloses activating the inactive cell at step S14 of Figure 5.

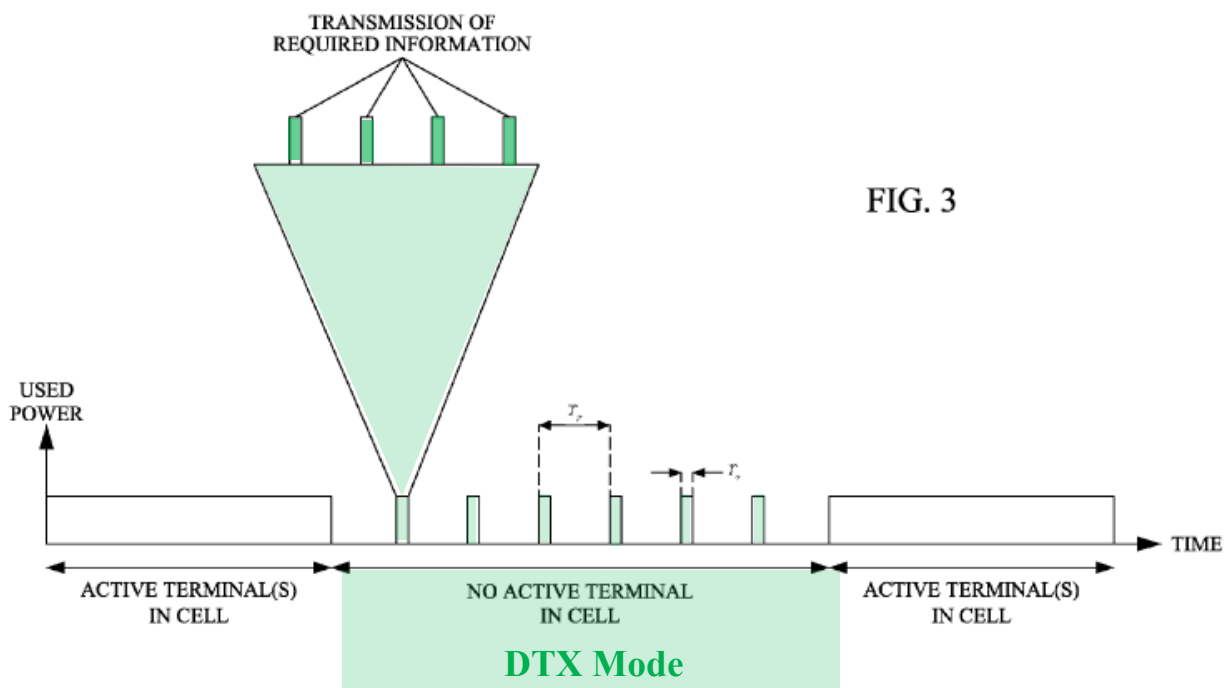
**2. 1[a] transmitting a presence signal by the at least one inactive cell**

70. Frenger discloses that the idle (DTX) mode base station transmits signals necessary to “find the cell” and “do signal measurements on the cell” while the base station is in idle mode, which are the claimed “presence signal.” EX1004, at [0034]-[0036]. As discussed above, Frenger teaches that despite being in “idle” mode, the cell nonetheless periodically transmits “the signals necessary for mobility and cell search” and explains that without these signals, a terminal would not otherwise be able to “find the cell” when in idle mode. *Id.*, [0034]; [0061]-[0062] (describing that reference signals and broadcast signals may also be used). These signals meet the claimed “presence signals,” because they are signals transmitted by an inactive cell that indicate the presence of the inactive cell. *See* Section VI.A (“inactive cell” construction), Section VI.B (“presence signal” construction).

71. Frenger teaches to utilize LTE synchronization signals during the idle cell’s DTX cycle, which are the same type of signals the ’590 Patent describes as

“presence signals.” EX1004, at [0034] (“the signals necessary for mobility and cell search should be intermittently transmitted”), [0030] (mobility cell search involves transmission of “synchronization signals”); *cf.* EX1001, at 4:46-50 (“*A presence signal may also include a synchronization channel (SCH), commonly used in mobile communication systems such as GSM, UMTS and LTE, for cell search, for identifying a cell and for synchronization with a cell.*”).

72. Frenger illustrates the transmission of these cell synchronization signals (labeled below as “required information”) during a DTX mode (when there are no active terminals in the cell), as shown in Figure 3:



EX1004, Fig. 3 (coloring and annotations added).

73. As shown above, the base station may be in active mode both before

and after its DTX cycle (when it is serving active terminals). This figure discloses that, in the base station's DTX mode, the base station is generally inactive, but wakes up every  $T_p$  seconds to transmit the required signals (*i.e.*, the claimed “*presence signals*”) for  $T_a$  seconds (shown above as annotated in light green). *Id.*, [0035] (explaining that “the DTX cycle is defined such that the base station is active every  $T_a$  out of  $T_p$  seconds as illustrated in FIG. 3.”). “The value of  $T_a$  should be selected large enough to allow the terminal to find synchronization with sufficiently high probability *as well as being able to do signal measurements on the cell.*” *Id.*, [0036]. As shown above in the illustrated example, Figure 3 shows sending four presence signals during each DTX active period (annotated as dark green). The transmission of the signals—needed to find synchronization—during the base station's DTX mode thus discloses transmission of the claimed “presence signals.” *See* Section VII.B.

**3. 1[b] receiving measurement reports from the plurality of terminals detecting the presence signal, the measurement reports indicating measurements of the presence signal by the plurality of terminals**

74. Frenger alone, or in light of the POSITA's knowledge of the LTE technology (at least as evidenced by EX1005-EX1007), teaches or at least renders obvious this limitation. As discussed above for Elements 1[p] and 1[a], Frenger teaches that idle base stations periodically wake up during DTX mode for the purposes of transmitting signals that permit the terminals to “find the cell” and allow

terminals “to do signal measurements on the [idle] cell.” EX1004, at [0034]-[0036], Figure 3.

75. Frenger also teaches that such measurements are “typically reported” to the network to allow a handover decision to be made with respect to the idle cell. *Id.*, [0030] (“Active terminals typically also ***report the received signal strength of reference signals*** (RSRP (Reference Signal Received Power) measurements) transmitted by the neighboring cells ***to the network, which takes a decision if the terminal should be handed over to the candidate cell.***”), [0040] (teaching that “***the network can also wake up idle base stations in conjunction with the handover procedure.***”).

76. I note that although Frenger refers generally to the network receiving the measurement reports, LTE specifications clarify that the element in receipt of such reports is the “source cell,” which is also known as the “serving cell.” EX1005, at 45-46. This would also be obvious to POSITA, as the UE’s communication with the network is through a base station.

77. Accordingly, although the applicant argued that the Examiner’s cited art (Subrahmanya) failed to disclose “the measurement reports indicating measurements of the presence signal by the plurality of terminals,” Frenger teaches that the UEs should take measurements on the idle cell’s synchronization signals (the claimed “*presence signals*”) and report those to the network for a handover

decision.

78. To apply Frenger's teachings to an illustrated embodiment, Frenger in light of LTE teaches that the active cell (*e.g.*, BS2 serving macro cell RC2 in Figure 2) receives measurement reports from a terminal (*e.g.*, terminal T4) of the neighboring, idle cell (*e.g.*, BS1 serving micro cell RC1 in Figure 2) for the purposes of deciding whether the terminal should be handed over. EX1004, at [0030] ("Active terminals typically also report the received signal strength of reference signals (RSRP (Reference Signal Received Power) measurements) transmitted by the neighboring cells to the network, which takes a decision if the terminal should be handed over to the candidate cell."), [0036] ("The value of  $T_a$  should be selected large enough to allow the terminal to find synchronization with sufficiently high probability as well as being able to do signal measurements on the cell."); EX1005, at 45-46.

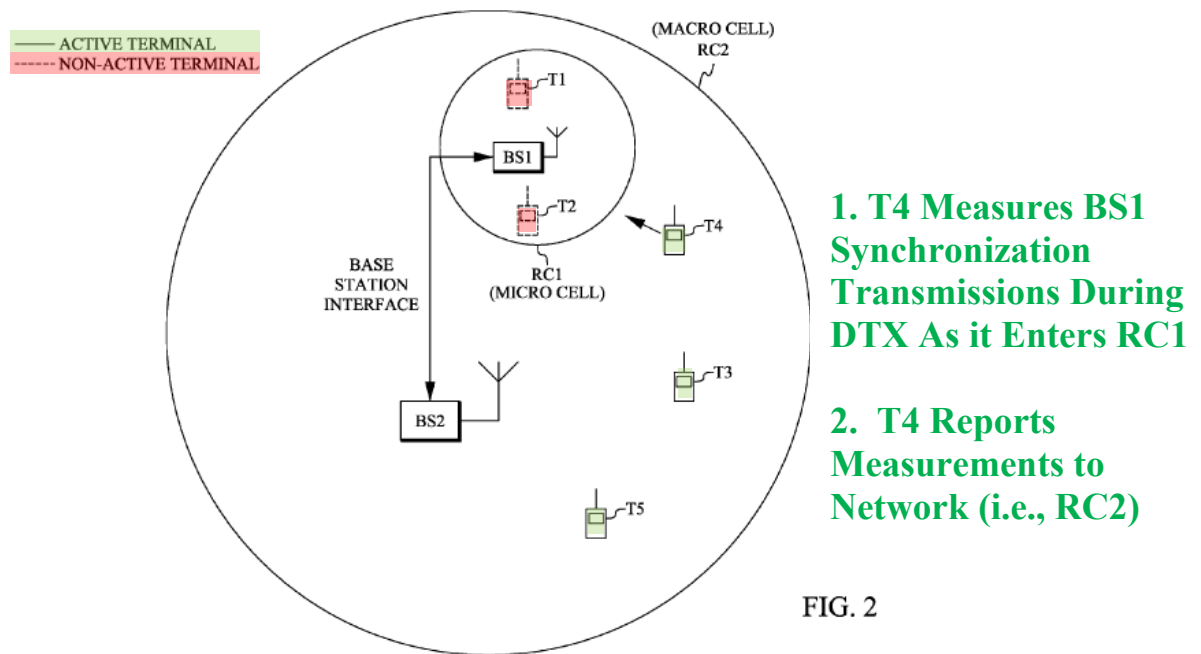


FIG. 2

EX1004, Fig. 2 (annotation and coloring added).

79. Frenger teaches that these measurements are taken of the idle cell (*e.g.*, BS1) during the idle cell's DTX cycle on the idle cell's synchronization signals. EX1004, at [0034]-[0036], [0038]. Frenger specifically teaches that the idle-mode base station DTX transmission cycle should be long enough to allow terminals to take “*signal strength measurements on the cell.*” *Id.*, at [0036]; *see also id.*, at [0038] (describing inactive terminals may wake up according to the base station's DTX to “perform neighboring cell measurements.”). In Figure 2, T4 would begin measuring idle cell BS1's DTX transmissions as it moves into the coverage area of RC1. *Id.*, at [0029], [0034].

80. Frenger also discloses that idle-mode terminals (*e.g.*, T1 and T2 in

Figure 2) can also be synchronized to measure the idle cell's DTX transmissions. *Id.*, at [0053], [0055]. The POSITA would have thus understood that the neighbor cell measurements reported to the network (*e.g.*, BS2 serving RC2) would have included the measurements that UEs took of the idle cell's DTX mode synchronization signals (*i.e.*, the claimed "presence signals").

81. Accordingly, in the illustrated example of Figure 2, terminals (*e.g.*, T1, T2, T4) measuring the idle base station's DTX signals later report those measurements to the serving base station (BS2) (under, for example, the trigger conditions described in the following paragraphs). *Id.*, at [0030].

**a) Frenger's Teaching to Measure and Report on the Idle Cell Are Consistent with the LTE requirement to Report Neighbor Cell Measurements to the Serving Cell**

82. Frenger's teachings are consistent with the requirements of the LTE standard, which specifies that terminals must take and report on signal strength measurements of neighbor cells. EX1006, at 63-69 (describing various measurement events that may trigger UE to send a measurement report). LTE requires the terminal to measure neighbor and serving cells, and to report those measurements to the serving cell in response to certain trigger event conditions. *See id.*, at 63-69 (describing various measurement events that may trigger UE to send a measurement report). For example, TS 36.331 describes that in LTE, the UE can be configured with certain event triggers to cause the UE to send a measurement report

based on at least the following conditions:

- Serving becomes better than threshold (A1)
- Serving becomes worse than threshold (A2)
- Neighbor becomes offset better than serving (A3)
- Neighbor becomes better than threshold (A4)
- Serving becomes worse than threshold1 and neighbor becomes better than threshold2 (A5).

*Id.*, at 63-69. Moreover, TS 36.331 specifies that the UE measurement report includes both serving cell measurements and the best neighboring cell measurements in terms of RSRQ and RSRP (well-known measurements of signal strength). *Id.*, at 70 (measurement report includes serving cell measurement results (*measResultServCells*) and neighbor cell measurements (*measResultNeighCells*)), 154-156 (measurement results include *rsrpResult* and *rsrqResult*).

83. This is shown in the excerpts of TS 36.331 reproduced and highlighted below:

– *MeasResults*

The IE *MeasResults* covers measured results for intra-frequency, inter-frequency and inter- RAT mobility.

***MeasResults* information element**

```
-- ASN1START
MeasResults ::= SEQUENCE {
    measId,
    measResultServCell
        SEQUENCE {
            rsrpResult,
            rsrqResult
        },
    measResultNeighCells
        CHOICE {
            measResultListEUTRA,
            measResultListUTRA,
            measResultListGERAN,
            measResultsCDMA2000
        },
    ...
}
OPTIONAL,

MeasResultEUTRA ::= SEQUENCE {
    physCellId,
    cgi-Info
        SEQUENCE {
            cellGlobalId,
            trackingAreaCode,
            plmn-IdentityList
        },
    measResult
        SEQUENCE {
            rsrpResult,
            rsrqResult
        },
    ...
}
OPTIONAL,
OPTIONAL,
OPTIONAL,
```

*Id.*, at 154-155; *see also id.*, at 156 (explaining that “measResultServCell” refers to the “Measured result of the serving cell;” “measResultListEUTRA” refers to a “List of measured results for the maximum number of reported best cells for an E UTRA measurement identity;” the “rsrpResult” refers to “Measured RSRP result of an E UTRA cell;” and “rsrqResult” refers to the “Measured RSRQ result of an E UTRA cell.”).

84. It would have been obvious to the POSITA in light of the requirements of LTE that to implement Frenger in an LTE system, the terminal should be

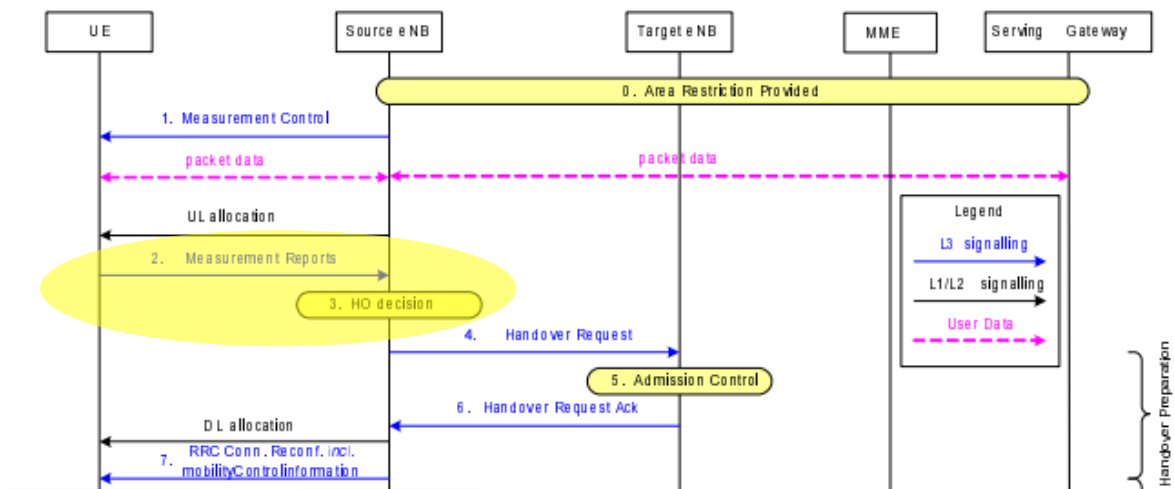
configured to take measurements of the DTX synchronization signals of the idle cell, and to report such measurements to the serving cell in response to any one or more of events A1 through A5, using the report format specified by TS 36.331. This would have had the predictable result of the terminal including signal strength measurements of the idle cell's DTX synchronization signals (*i.e.*, the claimed “*presence signals*”) in measurement reports received by the serving cell. Section VII.B (“*presence signal*” construction).

**b) Frenger’s Teachings to Report Measurements In Connection with the Handover Procedure Are Consistent with LTE’s Requirement to Submit Measurement Reports in Advance of a Handover Decision.**

85. Frenger also teaches that the active base station (BS2) may decide to wake up idle base stations “*in conjunction with the handover procedure.*” EX1004, at [0040] (“In addition, as handover is controlled by the network by sending commands to the terminals, the network can also wake up idle base stations in conjunction with the handover procedure. For example base station BS2 (managing cell RC2) commanding a terminal, for example [terminal] T4 in FIG. 1 or 2, to perform handover from cell RC2 to cell RC1 (managed by base station BS1) would, in addition to the handover command to the terminal, also send a wake up command to base station BS1 over a base station interface, for example the X2 interface in LTE.”).

86. Consistently, the LTE standard (as shown by TS 36.300 and TS 36.331)

requires that the receipt of neighbor cell measurements by the LTE serving cell (in response to, *e.g.*, any one or more of Events A1 to A5) as part of the LTE “the handover procedure” referred to by Frenger. EX1005, at 45. As illustrated by 36.300, the serving cell’s handover decision is preceded by the receipt of measurement reports from the UE (steps 2 and 3 below as highlighted):



**Portion of Figure 10.1.2.1-1: Intra-MME/Serving Gateway HO (yellow oval added)**

EX1005, at 45 (“UE is triggered to send MEASUREMENT REPORT by the rules set by i.e. system information, specification etc.”).

87. These rules include events A1 to A5, as taught by 36.331 and discussed above. As discussed above, 36.331 teaches that the terminal’s measurement report, which is shown above in Figure 10.1.2.1-1 of TS 36.300, includes both serving cell measurements and the best neighboring cell measurements in terms of RSRQ and RSRP. EX1006, at 70, 154-156. The POSITA would have understood these

measurements could be used to obtain the path gain. Turning back to the LTE handover procedure, TS 36.300 goes on to explain that the HO decision is made based on the received MEASUREMENT REPORT. EX1005, at 46 (“Source eNB makes decision based on MEASUREMENT REPORT and RRM information to hand off UE.”).

**c) Furht teaches that the Terminal’s Measurements Are the Most Important Consideration to the LTE Handover Decision.**

88. The Furht LTE textbook teaches that “the most important aspect that should drive the handover decision is the UE path gain measure. In other words, the handover control should ensure that the UE is always connected to the cell with the best average path gain.” EX1007, at 114-115. The POSITA would have thus understood that in the context of Frenger, the terminals’ measurements of the idle cell as reported to the serving cell would have been an important consideration that would have driven the handover decision. For example, processing and considering the measurement report including measurements of the idle cell would have been necessary for the serving cell to make sure that a terminal (e.g., **terminal T4**) has sufficient (if not the best) signal strength and coverage by the micro cell before deciding to handover a UE. *See id.* (teaching that “***the handover control should ensure that the UE is always connected to the cell with the best average path gain.***”). Indeed, as previously discussed, the LTE standard teaches that the UE can

be configured to trigger measurement reports when various events take place regarding the relative signal qualities of the serving base station and/or neighbor cell(s). EX1006, at 65-68. The LTE standard specifies that the network can configure the UE to trigger a measurement report when 1) the serving cell becomes better than a threshold, 2) the serving cell becomes worse than a threshold, 3) a neighbor cell becomes an offset better than the serving cell, 4) a neighbor cell becomes better than a threshold, or 5) the serving cell becomes worse than a first threshold and a neighbor becomes better than a second threshold. *Id.* (describing Events A1 to A5). Accordingly, the signal measurements of the serving and neighboring cell were a primary component of LTE measurement reports and driver of the LTE handover decision described above by Frenger and TS 36.300.

89. In the context of the illustrated example in Figure 2 of Frenger, the POSITA would have understood and found it obvious, for example, that as T4 moved towards the coverage area of the microcell within the macrocell's coverage area, T4 would have needed to take signal strength measurements on RC1 and report those to the serving macrocell (BS2) to trigger a handover decision by the macrocell (BS2) towards the idle microcell (BS1). EX1004, at [0030], [0034]-[0036], [0040].

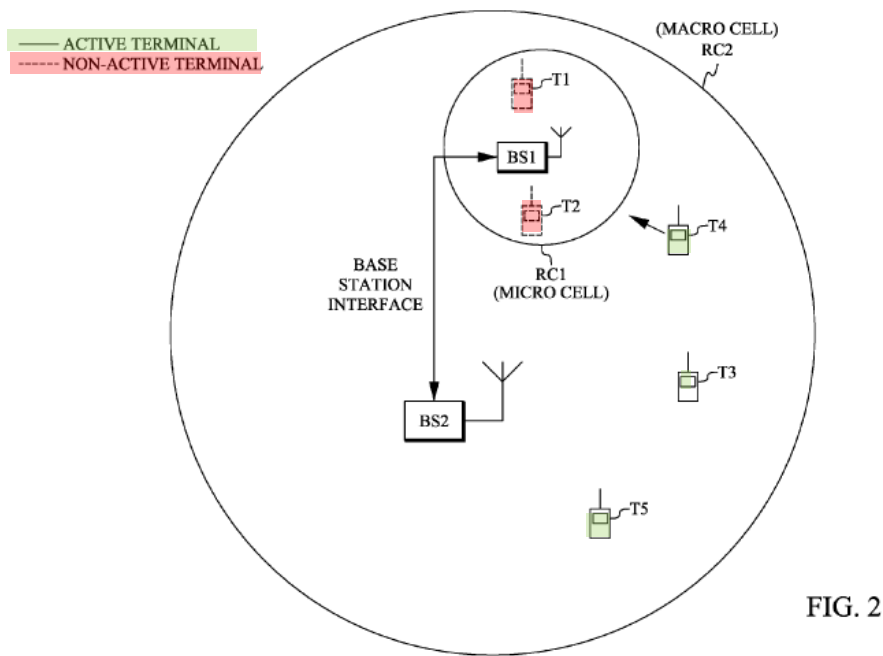


FIG. 2

*Id.*, Fig. 2 (coloring added).

90. The POSITA would have thus been motivated to follow the teachings of Frenger and the requirements of the LTE standard to include neighbor cell measurements of idle-mode base stations (*e.g.*, BS1) in reports to the serving cell (*e.g.*, BS2). This would have had the predictable result of making sure there would be sufficient signal quality in reception from the idle base station and would thereby avoid the terminal experiencing a disconnection and/or poor signal strength after the handover. It would have also had the obvious benefit of allowing the macro cell to offload traffic in the event of traffic congestion while ensuring the microcell had the coverage necessary to support the terminal to be handed over.

91. This would have had the predictable result of a system in which the

serving base station would receive measurement reports that included neighbor cell measurements of the idle base station (taken during the base station's DTX transmissions shown in Frenger's Figure 3) before deciding whether to initiate a handover to/wake up that base station. EX1007, at 115 (“*the most important aspect that should drive the handover decision is the UE path gain measure.*”). Aside from being a necessary part of the LTE standard handover procedure, the POSITA would have been motivated to determine whether the idle-mode base station is a good candidate for receiving the handover from the terminal. The POSITA would have been motivated to ensure that the serving cell did not initiate a handover to an idle-mode base station if the UE would subsequently encounter poor channel conditions (such as low RSRP) and/or a dropped connection. *See* EX1007, at 115 (“the most important aspect that should drive the handover decision is the UE path gain measure.”).

92. Accordingly, it is my opinion that these limitations are taught by Frenger alone and/or rendered manifestly obvious over Frenger in light of the LTE standard disclosures as discussed above.

**4. 1[c] processing information contained in the received measurement reports in a processing system of the wireless access telecommunications infrastructure to provide a processing result**

93. Frenger alone, and/or in light of the POSITA's knowledge of LTE technology (as evidenced by EX1005-EX1007), teaches or at least renders obvious

this limitation. Frenger teaches that the network (*i.e.*, a “processing system of the wireless telecommunications infrastructure”) processes information in the measurement report to provide a handover decision (*i.e.*, a “processing result”). *See* Element 1[b], above; *see* EX1004, at [0030] (“Active terminals typically also report the received signal strength of reference signals (RSRP (Reference Signal Received Power) measurements) transmitted by the neighboring cells to the network, which takes a decision if the terminal should be handed over to the candidate cell.”), [0046] (describing a handover decision can be made if there is a risk of losing a connection). Frenger thus discloses to the POSITA that that the network processes the received measurement reports for the purpose of making a handover decision. For example, the POSITA would have understood that the base station utilizes the measurement reports to determine if there is a risk that a connection could be lost (*e.g.*, the report showed an insufficiently strong signal at the serving cell).

94. The processing and use of the measurement reports in Frenger to make a handover decision is manifestly obvious in light of the LTE disclosures discussed above for Element 1[b]. As discussed above, LTE requires the terminal to report measurements of the neighbor cell in response to certain trigger events (*e.g.*, A1 through A5), and the serving base station processes those reports to make a handover decision. *See* Element 1[b], above (citing EX1006, at 63-69, EX1005, at 46). The LTE standard, shown in TS 36.300, requires that the “Source eNB makes decision

based on MEASUREMENT REPORT and RRM information to hand off UE.” EX1005, at 46. LTE thus teaches that the base station would process the measurement reports to make the designated handover decision. Moreover, as discussed above, Furht describes that UE measurements are the “most important” aspect of the handover decision. *See* Element 1[b], above (citing EX1007, at 115).

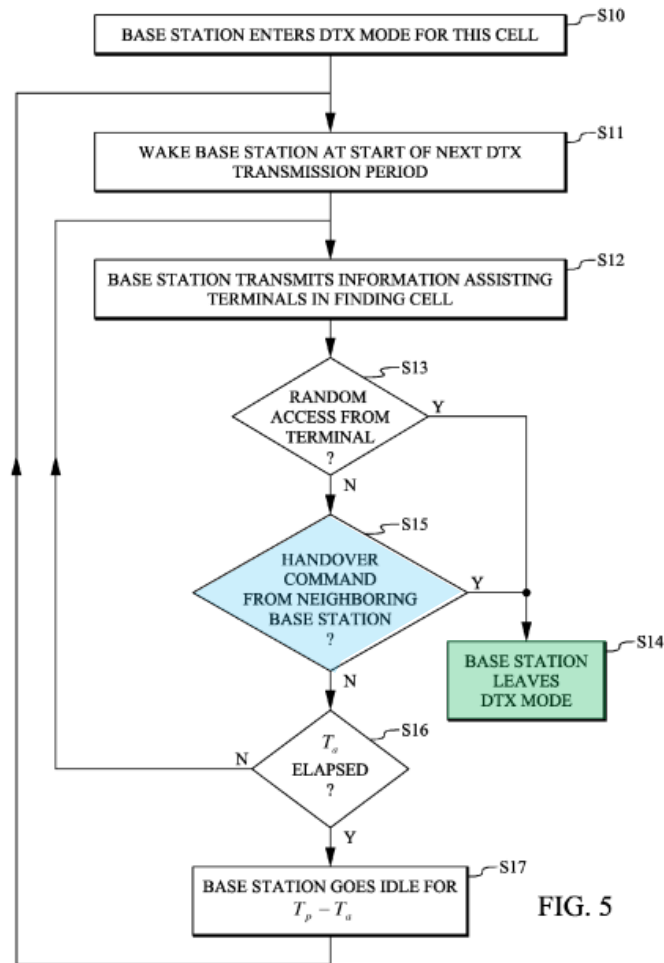
95. Accordingly, the POSITA would have understood and been motivated to process the measurement reports in the base station (at least because there are a limited number of places in the network where the processing could be done, and the base station would be the most obvious choice) and to consider the measurements received in the UE’s measurement reports as part of the handover decision taught by Frenger and LTE. *See also* EX1005, at 46 (“Source eNB makes decision based on MEASUREMENT REPORT and RRM information to hand off UE.”). The serving cell processes the reports in order to determine whether the measurements of the neighbor cell (here, the idle cell) could support a handover. *See* Element 1[b]; EX1007 at 114-115. The POSITA would have understood and found it obvious that this determination would have produced a “processing result” that reflected whether the idle cell measurements indicate radio conditions that support a handover, including *e.g.*, a comparison between the neighboring idle cell measurements and the serving cell measurements, as discussed above with respect to Events A1 to A5. For example, Frenger discloses that the serving cell provides a “processing result”

in the form of a “handover command” to the idle base station when the serving cell determines that the idle cell should be activated. EX1004, at [0044]. For example, the serving cell may decide to activate the idle cell if congested or at risk of losing a connection. *Id.*, [0046].

**5. 1[d] activating the at least one inactive cell when the processing result fulfills at least one activation condition such that at least one of the plurality of terminals is within a coverage area of the at least one activated cell.**

96. Frenger alone and/or in light of the POSITA’s knowledge of LTE technology (as evidenced by EX1005-EX1007) discloses or at least renders obvious activating the at least one idle-mode (inactive) base station when the processing result fulfills at least one activation condition, such that at least one of the plurality of terminals is within a coverage area of the at least one activated cell.

97. *First*, as discussed above with respect to Element 1[p], Frenger discloses a method that includes activating the inactive cell when certain conditions are met. *See* Element 1[p], above (citing steps S14 and S15 of Figure 5). Figure 5 (coloring added) is reproduced again for the convenience of the reader:



98. Frenger describes that the inactive cell activates when the idle base station receives “any handover commands” from neighboring base stations. EX1004, at [0044]. The idle-mode activation is in response to receipt of a “handover command” means that at least one activation condition has been fulfilled. For example, the “handover command” itself is at least one activation condition, because that command is a condition (*see* S15) that causes the idle-mode base station to wake up (*see* S14). In addition, Frenger discloses that the receipt of a “handover command” also means that other activation conditions have been fulfilled, such as

congestion in the serving cell or a determination that there is a risk of losing a connection. *Id.*, at [0046]. In addition, as would have been understood by the POSITA, other conditions that would have been fulfilled are one or more of events A1 to A5 as discussed above in element 1[b], which would have triggered measurement reports from the terminal indicating that the signal strength of the idle cell was sufficient to support a handover. EX1006, at 63-69.

99. *Second*, as discussed above with respect to Element 1[b] and 1[c], the LTE specifications herein teach that the handover decision (which is in Frenger accompanied by a wake-up command) should be based on the measurement report of the UE, and Furht teaches that the measurement report should drive the handover decision such that the UE is connected to the cell with the best signal quality. EX1005, at 45-46; EX1007, at 114-15. Furht also teaches that “load distribution” is another activation condition to initiate a handover, which is consistent with Frenger’s teaching that the handover to the idle cell may be initiated based on “congestion.” EX1007, at 114-115; EX1004, at [0046].

100. The POSITA would have thus been motivated by the requirements and principles of LTE to include having the best measurements as one activation condition of the idle cell (along with other activation conditions, such as the serving cell being congested). Accordingly, Frenger in light of these LTE disclosures teaches the POSITA to activate / wake up the idle-mode base station if there is

congestion and the UE's neighbor cell measurements indicate that the base station can support the connection with sufficient signal quality (*i.e.*, is “*within a coverage area of the at least one activated cell.*”).

101. The POSITA would have understood and found it obvious that sufficient signal strength in the idle cell is one of the at least several activation conditions Frenger's serving cell would consider before initiating a handover / activating the inactive cell. For example, Frenger also teaches that the handover/wake up decision should only be “accepted if a cell is congested or if there is an apparent risk of [losing] a connection.” EX1004, at [0046]. Accordingly, the POSITA would have also understood that the handover/wake up procedure could be initiated if the macro cell was congested or if signal quality in the macro cell was so poor that the terminal could lose connection in the absence of a handover. These represent additional activation conditions taught by Frenger.

102. As a result of Frenger's handover/wakeup procedure of the formerly-inactive cell (*e.g.*, the micro cell served by BS1), the terminals within the formerly-inactive cell's coverage area would be “*within a coverage area of the at least one activated cell.*” It is not clear from the language of Claim Element 1[d] whether “*the at least one activated cell*” refers to Claim Element 1[d]'s “*inactive cell*” that has been activated or to Claim Element 1[p]'s “*active cell.*” Nevertheless, Frenger discloses Claim Element 1[d] under both interpretations. As discussed above with respect to

Claim Element 1[p], Figure 2 of Frenger shows that micro cell (RC1) is located within the coverage area of a macro cell (RC2) (coloring added to RC1):

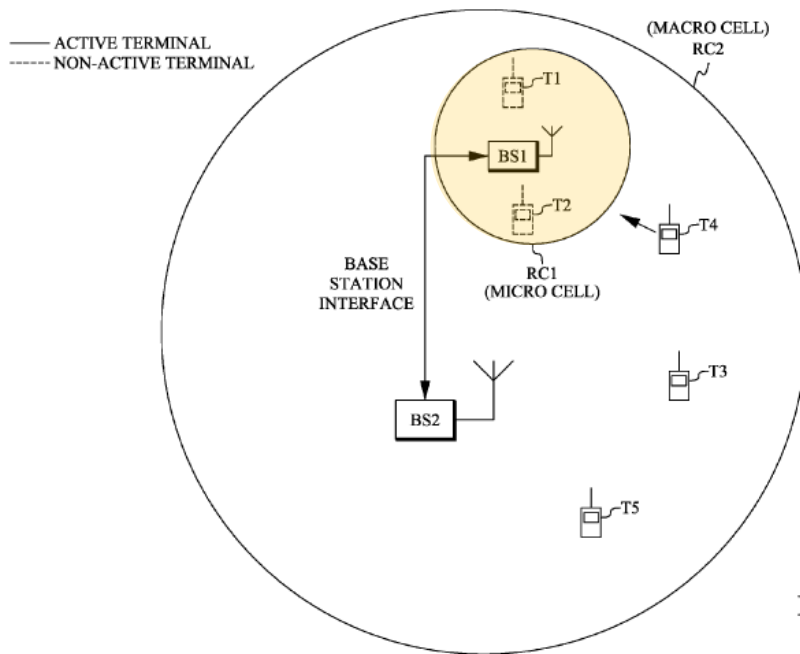


FIG. 2

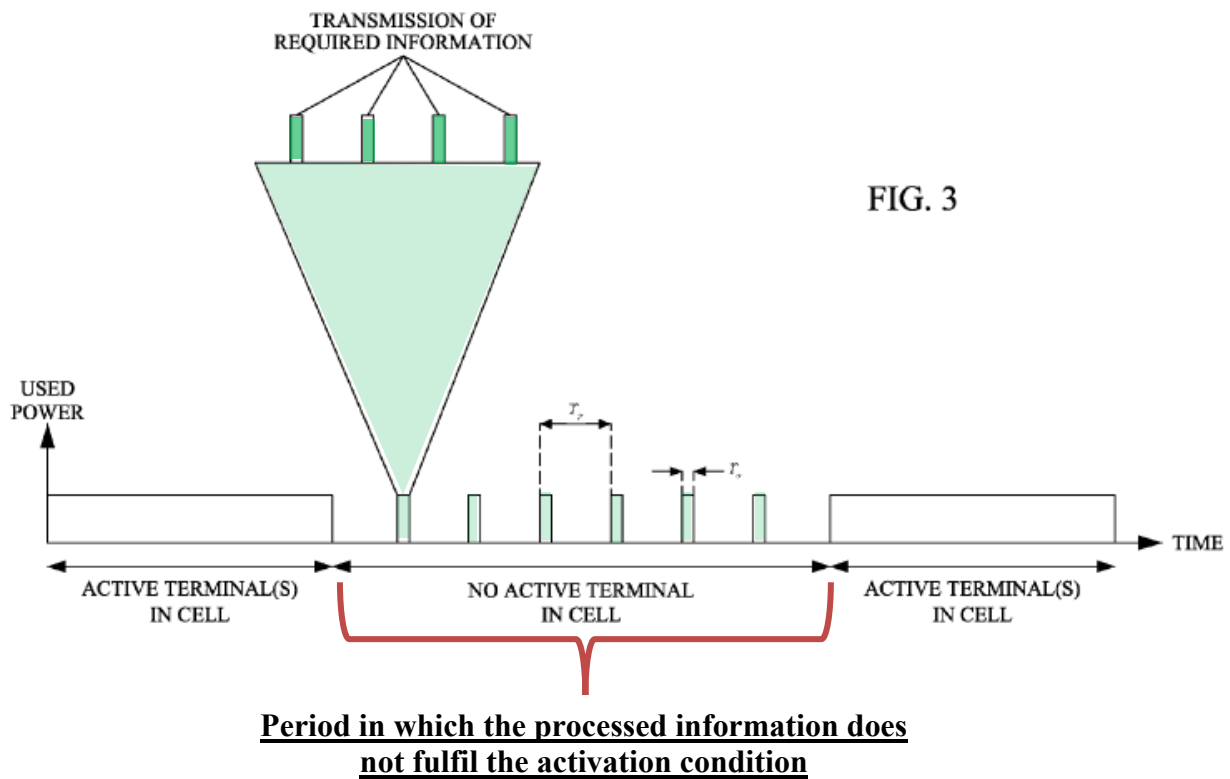
EX1004, Fig. 2. Thus, when the formerly-inactive micro cell RC1 is activated as described above, the terminals located within that cell (e.g., T1 and T2) are located within both (1) the now-active micro cell (RC1) and (2) already-active macro cell (RC2). Frenger therefore discloses this claim element.

#### D. Claim 2

**1. 2[a] The method according to claim 1, further comprising: terminating transmission of the presence signal by the at least one inactive cell when the processed information does not fulfill the at least one activation condition**

103. As discussed above, Frenger discloses or renders obvious the *method according to claim 1*.

104. Frenger discloses that the idle-mode base station remains idle when the activation condition is not met, and during that mode, the base station terminates transmission of the presence signals (*i.e.*, it only intermittently transmits the presence signals). See EX1004, Figures 3, 5. As shown in Figure 3, while in idle mode, the base station transmits presence signals regularly for time periods  $T_a$ :



EX1004, Fig. 3 (annotations and coloring added).

105. As shown above, the idle base station remains in a state of discontinuous transmission DTX when the activation condition has not been met (*e.g.*, the serving cell has not decided to handover and the idle base station has not received a handover/wake-up command). During periods when an activation

condition is not met, after each transmission period  $T_a$ , the idle-mode base station terminates transmission of the presence signals for the remainder of that time period  $T_p$ . *Id.*, at [0035] (explaining that “the DTX cycle is defined such that the base station is active every  $T_a$  out of  $T_p$  seconds as illustrated in FIG. 3.”).

106. This concept is also shown by Frenger at step s17 of Figure 5 (shown below with coloring added), which confirms that once the DTX transmission period  $T_a$  expires, the base station goes “idle” for the remainder of each  $T_p$  (and does not transmit the presence signals in the downlink):

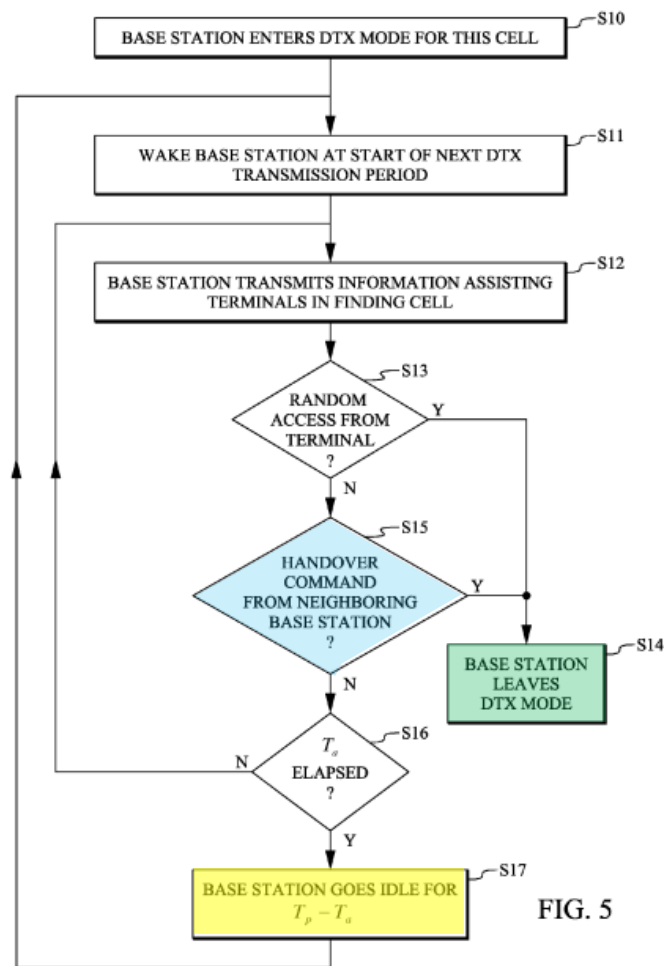


FIG. 5

EX1004, at [0044] (describing that if no handover commands are received at S15, “the base station goes idle (in the downlink) during the time period  $T_p - T_a$  in step S17.”)

**2. 2[b] transmitting the presence signal in the at least one inactive cell again at a later time.**

107. Frenger’s DTX cycle as described in Figures 3 and 5 disclose these limitations. More specifically, Figure 3 shows that the transmission period  $T_a$  recurs every  $T_p$  seconds. And as shown above in Figure 5, after the base station goes idle for the time period  $T_p - T_a$ , “the procedure returns to step S11 to wake up the base station again,” *i.e.*, *at a later time*, the base station wakes up “at the start of the next DTX transmission period” to again begin transmitting the presence signals. EX1004, at [0044].

**E. Claim 3. The method according to claim 1, further comprising providing the plurality of terminals in the active cell with at least one of measurement parameters or reporting parameters to obtain the information regarding the presence signal from the inactive cell.**

108. As discussed above, Frenger discloses or renders obvious the *method according to claim 1*.

109. Frenger alone, and/or in light of the POSITA’s knowledge of the LTE technology (as evidenced by EX1005-EX1007), discloses or at least renders obvious these limitations. Frenger specifically teaches that the UEs should be configured to take measurements on the idle cell’s DTX transmissions (*i.e.*, the claimed “presence

signals”). EX1004, at [0036] (describing the DTX transmission period should allow the terminal to “do signal measurements on the cell.”). Frenger also specifically teaches that the active base station may transmit “the DTX schedule of an idle base station” to the terminals, which maps to the claimed “*measurement parameters*.” *Id.*, at [0056]. The DTX schedule provides the UE with the instructions (*i.e.*, parameters) allowing it to “synchronize the mobility measurements with the intermittent transmission.” *Id.*, at [0055].

110. In addition, it would have been manifestly obvious in light of the LTE standard to provide the terminals with additional measurement parameters and/or reporting parameters to measure the DTX signals of the idle cell. For example, the LTE standard in TS 36.331 teaches the POSITA to include functionality in the base station for configuring the measurement reporting at the UE. EX1006, at 56 (“The UE reports measurement information in accordance with the measurement configuration as provided by E-UTRAN.”), 57-62 (providing details on how the UE can be configured for various measurements). The configurable measurement parameters include, *e.g.*, the quantity of measurements to take (“Quantity Configurations”), which cells to measure (“Measurement objects”), and when to begin measuring relative to the subframe (“Measurement gaps”). *Id.* The LTE standard describes each of these “measurement parameters” in detail in 36.331. *Id.*, at 58-59. These measurement parameters would be used by the UE to make RSRP

and/or RSRQ measurements on, *e.g.*, neighbor cells including the idle base station as taught by Frenger. EX1004, at [0030], [0036]. As explained in detail in my Claim 1[c] analysis, these measurements regarding the idle cell's DTX transmission comprise "*information contained in the measurement reports*" that is "*regarding the presence signal.*"

111. LTE also defines reporting parameters which define triggering events that cause the UE to report a measurement. EX1006, at 57 ("Reporting criterion: The criterion that triggers the UE to send a measurement report. This can either be periodical or a single event description."). As discussed above, these reporting parameters can include parameters for configuring the UE to report on its measurements of a neighboring cell. *Id.*, at 63-69. It would have been obvious, for the POSITA to include programming in the LTE base station to configure the plurality of terminals with the reporting and measurement parameters described by the LTE standard, which would allowed the network to configure the terminals to take the appropriate measurements described above with respect to Claim 1, including on the idle base station taught by Frenger. *See, e.g.*, Element 1[b] above.

**F. Claim 4. The method according to claim 1, wherein the wireless access telecommunications infrastructure comprises a plurality of inactive cells; and the method further comprises concurrently or sequentially transmitting the presence signal in the plurality of inactive cells.**

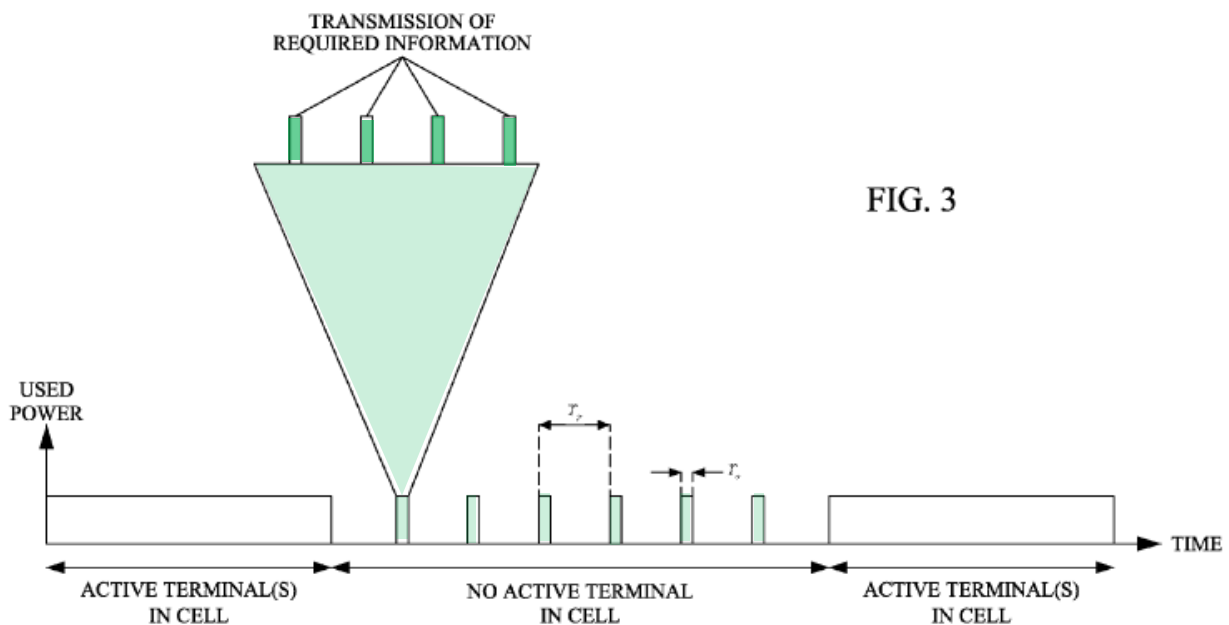
112. As discussed above, Frenger discloses or renders obvious the *method*

---

*according to claim 1.*

113. Frenger discloses, or at least renders obvious, methods that include a plurality of inactive cells and that the DTX modes of multiple idle base stations can be synchronized. EX1004, at [0023] (“the present invention will be described with reference to base stations, especially LTE base stations.”), [0057] (“***The network can synchronize the DTX mode of several base stations.*** Both local (base station to base station) and centralized (via the Operations Support System, OSS) synchronization is possible.”). The synchronization of base station DTX modes discloses a plurality of active cells and that those base station’s DTX transmissions would be synchronized (*i.e.*, transmitted concurrently).

114. The POSITA would have understood the description of synchronizing DTX modes to refer to ensuring that the DTX transmissions shown by Figure 3 would be simultaneous, or concurrent:



*Id.*, Fig. 3 (coloring added).

115. The POSITA would have understood the above Fig. 3 to disclose that during the base station's DTX mode, the base station is generally inactive, but wakes up every  $T_p$  seconds to transmit the required (*i.e.*, presence) signals for  $T_a$  seconds. *Id.*, at [0035] (explaining that “the DTX cycle is defined such that the base station is active every  $T_a$  out of  $T_p$  seconds as illustrated in FIG. 3.”). As described by Frenger, “*The network can synchronize the DTX mode of several base stations.*” *Id.*, at [0057]. When these modes are synchronized among multiple base stations, the transmissions would result in transmission periods  $T_a$  and  $T_p$  occurring concurrently in multiple base stations, as claimed.

**G. Claim 5. The method according to claim 1, wherein the at least one activation condition includes at least one of energy reduction for the wireless access telecommunications infrastructure, load reduction for the active cell, or reduction of electromagnetic radiation from the wireless access telecommunications infrastructure or from a particular set of cells in the infrastructure.**

116. As discussed above, Frenger discloses or renders obvious the *method according to claim 1*.

117. Frenger discloses an activation condition that includes at least load reduction for the active cell. I have been informed by counsel that it is not necessary to show an activation condition that also includes “energy reduction” or “reduction of electromagnetic radiation” at least because the claim uses an “or” to recite a list of alternatives and that the claim is invalid if any one of the alternatives is shown in the prior art. Frenger discloses that the serving cell may decide to handover/wakeup the inactive base station “if a cell is congested or if there is an apparent risk of [losing] a connection.” EX1004, at [0046]. The POSITA would have understood that if the cell is congested, the handover/wakeup procedure would accomplish a load reduction for the serving cell. Frenger thus discloses that the activation condition for the inactive cell includes load reduction in the active cell.

**H. Claim 6. The method according to claim 1, further comprising transmitting a reporting identifier in at least one of the active cell or the at least one inactive cell.**

118. As discussed above, Frenger discloses or renders obvious the *method according to claim 1*.

119. See Elements 1[b], Claim 3, above. Frenger renders these limitations obvious in light of the knowledge of LTE, at least as shown in EX1005-EX1008. As discussed above with respect to Claim 3, the measurement reports taught by LTE in TS 36.331 are configured by the network. EX1006, at 56. The configuration is provided to the terminal using a reconfiguration signaling message transmitted to the terminal by the serving cell. *Id.*, at 56 (“The UE reports measurement information in accordance with the measurement configuration as provided by E-UTRAN. E-UTRAN provides the measurement configuration applicable for a UE in RRC\_CONNECTED by means of dedicated signalling, i.e. using the *RRCConnectionReconfiguration* message”).

120. These measurement configuration messages may include “reporting identifiers” that identify what the terminal should measure (*e.g.*, which neighboring cells). *Id.*, at 57 (explaining the measurement configuration includes the “objects on which the UE shall perform the measurements.”), 60, 152 (explaining that the measurement object may include a list of neighboring cells to add/modify to the UE’s measurement configuration (*cellstoAddModList*)). These cell identifiers are “reporting identifiers”, at least because they are the same cell identifiers used by the UE to identify report measurements of the neighboring cells. *Cf* EX1006, at 152 (measurement configuration may include *cellstoAddModList*, which includes the cell’s physical cell id—*physCellId*); 85, 155 (measurement report message (*e.g.*,

*MeasResults*>>*MeasResultsListEUTRA*>>*MeasResultsEUTRA*) includes the cell's physical cell id—*physCellId*). This is shown in the excerpts from TS 36.331 reproduced and highlighted below:

### MeasObjectEUTRA information element (excerpt)

```

CellsToAddModList ::= SEQUENCE (SIZE (1..maxCellMeas)) OF CellsToAddMod
CellsToAddMod ::= SEQUENCE {
    cellIndex INTEGER (1..maxCellMeas),
    physCellId → → → → PhysCellId,
    cellIndividualOffset → → → Q-OffsetRange
}

```

### MeasResults

The IE *MeasResults* covers measured results for intra-frequency, inter-frequency and inter-RAT mobility.

### MeasResults information element

```

-- ASN1START
MeasResults ::= SEQUENCE {
    measId,
    measResultServCell SEQUENCE {
        rsrpResult,
        rsrqResult
    },
    measResultNeighCells CHOICE {
        measResultListEUTRA,
        measResultListUTRA,
        measResultListGERAN,
        measResultsCDMA2000,
        ...
    } OPTIONAL,
    ...
}

MeasResultEUTRA ::= SEQUENCE {
    physCellId,
    cgi-Info SEQUENCE {
        cellGlobalId,
        trackingAreaCode,
        plmn-IdentityList
    } OPTIONAL,
    measResult SEQUENCE {
        rsrpResult,
        rsrqResult,
        ...
    } OPTIONAL,
    ...
}

```

121. It would have been obvious to include a reporting identifier in the measurement configuration message in order to comply with the requirements of

LTE when implementing the teachings of Frenger in an LTE system. For example, the network may desire to specify which neighboring cells the terminal should measure for its measurement reporting purposes.

**I. Claim 7. The method according to claim 1, wherein at least one of the plurality of terminals in the active cell is an idle terminal when receiving the measurement report.**

122. As discussed above, Frenger discloses or renders obvious the *method according to claim 1*.

123. Frenger discloses these limitations. EX1004, at [0053]. For example, Figure 2 (shown below with coloring) shows that inactive terminals T1 and T2 are in both inactive in the micro cell served by BS1 *and* the macro cell of BS2 that is actively serving T3 through T5:

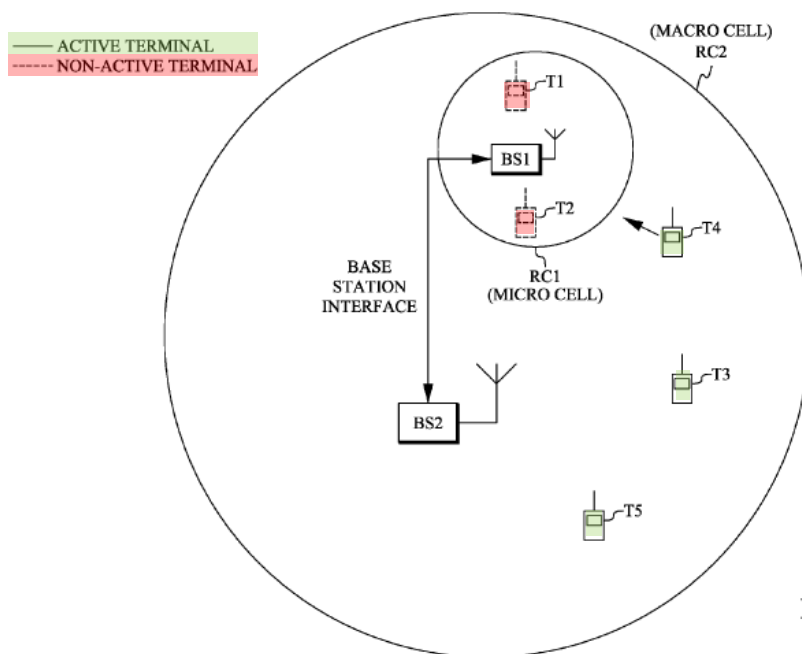


FIG. 2

124. Accordingly, Frenger discloses that T1 and T2 may be inactive when “Active terminals typically also report the received signal strength of reference signals (RSRP (Reference Signal Received Power) measurements) transmitted by the neighboring cells to the network.”). *Id.*, [0030]. Frenger thus discloses that there are inactive terminals “when [the network is] receiving the measurement report.” *Id.*, [0053] (describing that inactive terminals in the active cell can still synchronize to the DTX mode base station).

125. Frenger’s inactive terminals disclose “idle terminals.” Frenger explains that an inactive terminal is “not served by any base station” and “only listens to the paging channel.” *Id.*, [0053]. A POSITA would have understood that when an inactive terminal is “not served by any base station,” the inactive terminal is not connected to the base station. This is consistent with the ’590 Patent’s description of “idle terminals,” which are described as “terminals which do not have an active connection with the network.” *See* EX1001, 5:21-22.

**J. Claim 8. The method according to claim 7, further comprising temporarily decreasing a location area update period in at least one of the active cell or the at least one inactive cell.**

126. As discussed above, Frenger discloses or renders obvious the *method according to claim 7*.

127. Frenger in light of the knowledge of LTE evidenced by EX1008 renders these limitations obvious. The ’590 Patent admits that this concept of claim 8 is not

new; it concedes decreasing the location area update period “is advantageous as it requires no modifications to currently existing networks.” EX1001, at 12:30-34. The POSITA would have understood that a “location area update” was a name used in 3G and earlier location update procedures, and that the name was changed to “tracking area update” in LTE. Both procedures relate to the UE periodically reporting its location to the network for the purposes of mobility management. The LTE update procedure is described in detail in TS 24.301, and involves the UE initiating a tracking area update at the expiration of a “periodic tracking update timer (timer T3412)”:

Periodic tracking area updating is used to periodically notify the availability of the UE to the network. The procedure is controlled in the UE by the periodic tracking area update timer (timer T3412). The value of timer T3412 is sent by the network to the UE in the ATTACH ACCEPT message and can be sent in the TRACKING AREA UPDATE ACCEPT message. The UE shall apply this value in all tracking areas of the list of tracking areas assigned to the UE, until a new value is received.

EX1008, at 48-49. As is taught by 24.301, the UE periodically receives “a new value” for the T3412 update timer, which the POSITA would understand could *temporarily* decrease (or increase) the update timer on receipt of the ATTACH ACCEPT or TRACKING AREA UPDATE ACCEPT message. The UE would then use the new value for T3412 until the next time it received a new value, which could increase (or decrease) the update timer.

128. I note that the claim does not require any particular reason one would

decrease the location area update period, and that LTE's teaching regarding the ability to do so is sufficient to disclose this concept. With that said, I further note that the reasons for decreasing the location area update period were well known to POSITAs. For example, it was a well-known concept to the POSITA that the rate of location updates is inversely proportional to the size of the cell. EX1012, at 536. ("Due to the limited radio channel bandwidth, the cell size will be becoming smaller and smaller to increase the reuse of the bandwidth. However, the location update frequency of a mobile user will be increased dramatically."). This is because the smaller the cell size, the more likely it is that the terminal will have crossed a cell boundary between location areas, which is a time when the terminal performs a location update. *Id.*, at 536 ("A location update occurs as soon as a terminal enters a new location area."). Accordingly, it would have been obvious to the POSITA that the location area update period should be temporarily decreased during times in which the micro cell BS1 becomes inactive because the macro cell needs to serve a relatively larger area during those times.

**K. Claim 9. The method according to claim 7, wherein the measurement reports are received via the active cell.**

129. As discussed above, Frenger discloses or renders obvious the *method according to claim 7*.

130. With respect to the additional claim 9 element, *see* Element 1[b] above. As explained above, Frenger in light of LTE teaches that the serving active cell

receives the UE measurement reports for the purposes of assisting with the serving cell's handover decision. EX1004, at [0030]; EX1005, at 45-46.

**L. Claim 10. The method according to claim 7, further comprising transmitting a paging message in the active cell instructing the at least one idle terminal to obtain or report the information**

131. As discussed above, Frenger discloses or renders obvious the *method according to claim 7*.

132. Frenger discloses that a paging message may be transmitted in the active cell to synchronize the DRX mode of the terminal to the DRX time periods  $T_a$ , during which the terminal is to obtain measurements on the idle base station. EX1004, at [0053]. Because the UE “[t]ypically performs mobility measurements either just before or just after listening to the paging channel,” the paging message thus instructs the UE to take measurements on the idle cell, thus disclosing the claimed limitations. *Id.*, [0054] (the active terminal “may be *instructed* by a base station to perform measurements at time instants that lie in time periods  $T_a$  of a base station in DTX mode.”). This concept is illustrated in Figure 7 as copied below:

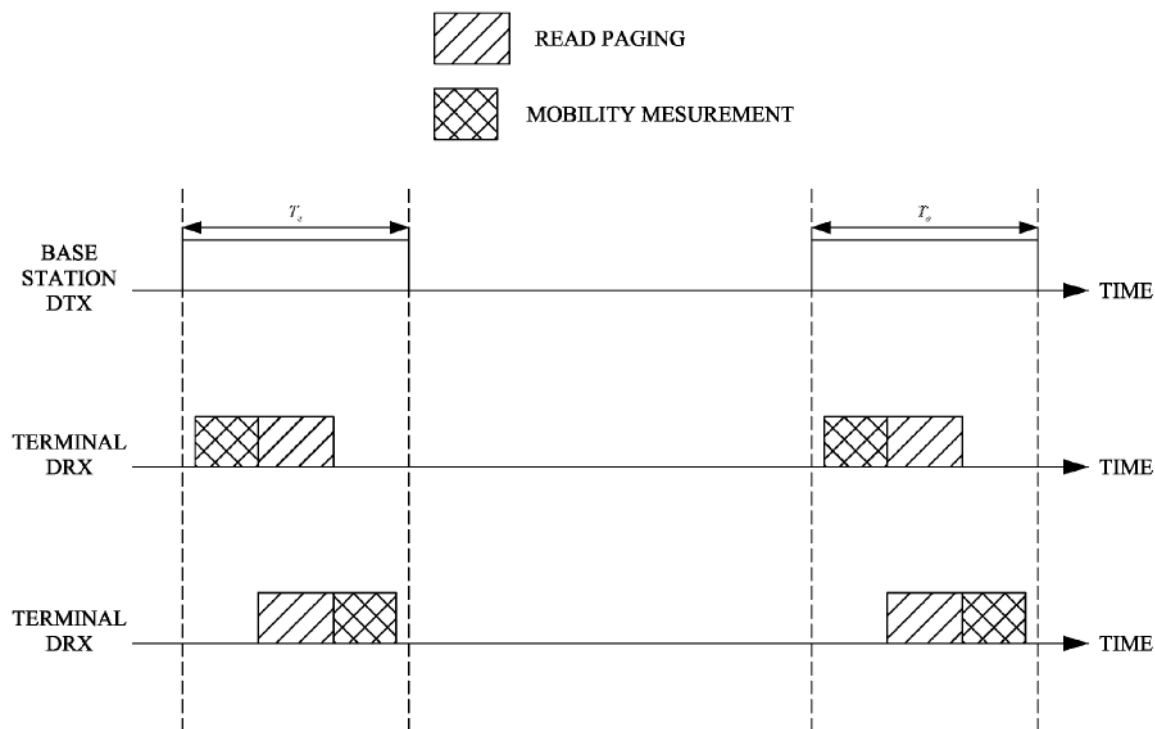


FIG. 7

**M. Claim 11**

**1. 11[p] A non-transitory computer-readable medium having instructions stored thereon that, when executed by one or more processing units, cause the one or more processing units to perform functions for activating at least one inactive cell in a wireless access telecommunications infrastructure, the wireless access telecommunications infrastructure comprising an active cell containing a plurality of terminals, the functions comprising:**

133. *See* Element 1[p] above. Frenger discloses that the claimed functions for activating at least one inactive cell in a wireless access telecommunications infrastructure are performed by terminals and/or base stations, which Frenger discloses comprises a non-transitory computer readable media programmed with instructions that caused a processing unit in the terminals and/or base stations to

execute the claimed functions. *See* EX1004, Figure 6 (illustrating a baseband processing unit), [0052] (“The functionality of the various blocks in FIG. 6 is typically implemented by one or several microprocessors or micro/signal processor combinations and corresponding software.”).

**2. 11[a] transmitting a presence signal by the at least one inactive cell**

134. *See* Element 1[a] above.

**3. 11[b] receiving measurement reports from the plurality of terminals detecting the presence signal, wherein the measurement reports indicate measurements of the presence signal by the plurality of terminals**

135. *See* Element 1[b] above.

**1. 11[c] processing information contained in the measurement reports received from the plurality of terminals in a processing system of the wireless access telecommunications infrastructure to provide a processing result.**

136. *See* Element 1[c] above.

**1. 11[d] activating the inactive cell when the processing result fulfills at least one activation condition such that at least one of the plurality of terminals is within a coverage area of the activated cell**

137. *See* Element 1[d] above

**N. Claim 12**

**1. 12[p] A wireless access telecommunications infrastructure for a wireless access telecommunications system comprising an active cell and at least one inactive cell, the active cell comprising a plurality of terminals, the wireless access telecommunications infrastructure comprising**

138. *See* Element 1[p] above

**2. [12a] a presence signal generator configured for transmitting a presence signal in the at least one inactive cell**

139. *See* Element 1[a] above. Frenger's LTE base stations are described as having the ability to transmit signals that comprise the claimed "presence signal," and thus are or include the claimed "presence signal generator." For example, the POSITA would have understood that in Figure 6, transmitter 12, in conjunction with baseband processing unit 14, would generate the presence signal during DTX activation periods. *See* EX1004, Figure 6 (illustrating a baseband processing unit), [0052].

**1. 12[b] a receiver configured for receiving measurement reports from the plurality of terminals detecting the presence signal, wherein the measurement reports indicate measurements of the presence signal by the plurality of terminals**

140. *See* Element 1[b], above. Frenger's LTE base stations are described as having the ability to receive measurements from terminals. *See, e.g.,* EX1004, at [0030]; *see also* EX1005. Those measurement reports indicate measurements of the presence signal (*i.e.*, DTX mode transmissions) by the plurality of terminals, which

is explained in detail in Element 1[b]. Thus, the base station would be or include *a receiver configured for receiving measurement reports from the plurality of terminals detecting the presence signal, wherein the measurement reports indicate measurements of the presence signal by the plurality of terminals.*

**2. 12[c] a processor system configured for processing information contained in the measurement reports received from the plurality of terminals to provide a processing result**

141. See Element 1[c] above. Each of Frenger's LTE base stations are or include a "processor system" configured to process information as claimed. See, e.g., Figure 6, Element 14 ("baseband processing" unit); EX1004, at [0052] ("The functionality of the various blocks in FIG. 6 is typically implemented by one or several microprocessors or micro/signal processor combinations and corresponding software."). As explained in detail in Element 1[c], the base station (and by extension its baseband processing unit) would have been the obvious place for processing information from terminal measurement reports consistent with the teachings of LTE.

**3. 12[d] an activator configured for activating the inactive cell when the processing result fulfills at least one activation condition such that at least one of the plurality of terminals is within a coverage area of the activated cell.**

142. See Element 1[d] above. Each of Frenger's LTE base stations include an "activator" capable of waking up an inactive base station. See, e.g., EX1004, Figure 5 (steps S14-S15); see also Figure 6 (Elements 18, 20, and SW). As shown

in Figure 6, the transmission controller 16 may activate the transmitter of the cell using switch (SW) when an appropriate indicator is received from elements 16, 22, or 24.

**O. Claim 13**

**1. 13[a] The wireless access telecommunications infrastructure according claim 12, wherein the presence signal generator is further configured for: terminating transmission of the presence signal in the at least one inactive cell when the processed information does not fulfill the at least one activation condition**

143. As discussed above, Frenger discloses or renders obvious the wireless access telecommunications infrastructure according [to] claim 12.

144. *See* Element 2[a] above.

**2. 13[b] transmitting the presence signal in the at least one inactive cell again at a later time**

145. *See* Element 2[b] above.

**P. Claim 14. The wireless access telecommunications infrastructure according to claim 12, further comprising a signal transmitted in a cell of the wireless access telecommunication system, wherein the signal contains a reporting identifier indicating that the cell is an inactive cell.**

146. As discussed above, Frenger discloses or renders obvious the wireless access telecommunications infrastructure according to claim 12.

147. Frenger discloses transmitting signals in a cell of the wireless access telecommunication system, which indicate a “time schedule for intermittent transmission of information from a cell,” which maps to the claimed “*reporting*

*identifier indicating that the cell is an inactive cell.”* EX1004, Fig. 8, [0055]-[0056].

The transmitted DTX schedule is or includes a reporting identifier, at least because it identifies the idle cell and indicates its DTX schedule, which is used to determine when the terminal is to make mobility measurements. *Id.*, [0056] (the terminal’s “[b]aseband processing unit 32 extracts, among other signals, *the DTX schedule of an idle base station*. . . . The DTX schedule is forwarded to a synchronizer 34, which controls the mobility measurement schedule of the receiver 30 and baseband processing unit 32.”). The POSITA would have understood that the DTX schedule would have represented or included an indication that the cell is inactive, because the terminal would have needed to know to which idle cell the DTX schedule should be applied to.

148. The DTX schedule’s identification of the idle base station is a “reporting identifier” at least because the base station’s identity is also used when the UE reports measurements to the serving cell, as discussed above with respect to Elements 1[b] and Claim 6. *See* EX1006, at 154-155 (“*physCellID*” included to identify which cell the measurements pertain to).

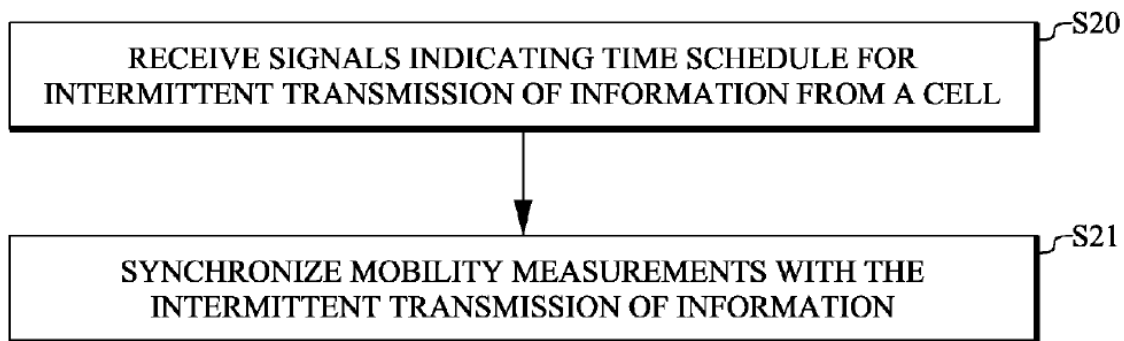


FIG. 8

**Q. Claim 15. The wireless access telecommunications infrastructure according to claim 14, further comprising a terminal configured for processing the signal.**

149. See Element 14 above, which shows that Frenger discloses the terminal processes the signal to synchronize its mobility measurements to the received DTX schedule. EX1004, at [0056] (the terminal's "[b]aseband processing unit 32 extracts, among other signals, *the DTX schedule of an idle base station*. . . . The DTX schedule is forwarded to a synchronizer 34, which controls the mobility measurement schedule of the receiver 30 and baseband processing unit 32."). The terminal's extraction of the DTX schedule and using it to control the mobility measurement schedule of the receiver and baseband processing unit 32 discloses a terminal configured for processing the signal.

**R. Claim 16.** The wireless access telecommunications infrastructure according to claim 12, wherein the presence signal generator is further configured for providing the plurality of terminals in the active cell with at least one of measurement parameters or reporting parameters to obtain the information regarding the presence signal from the inactive cell.

150. *See* Claim 3 above.

**S. Claim 17.** The wireless access telecommunications infrastructure according to claim 12, wherein the presence signal generator is further configured for transmitting the presence signal in the plurality of inactive cells, and wherein the wireless access telecommunications infrastructure further comprises a plurality of inactive cells.

151. *See* Claim 4 above.

**T. Claim 18.** The wireless access telecommunications infrastructure according to claim 12, wherein the presence signal generator is further configured for transmitting a reporting identifier in at least one of the active cell or the inactive cell.

152. *See* Claim 6 above.

**U. Claim 19.** The wireless access telecommunications infrastructure according to claim 12, wherein the at least one activation condition includes at least one of energy reduction for the wireless access telecommunications infrastructure, load reduction for the active cell, or reduction of electromagnetic radiation from the wireless access telecommunications infrastructure or from a particular set of cells in the infrastructure.

153. *See* Claim 5 above.

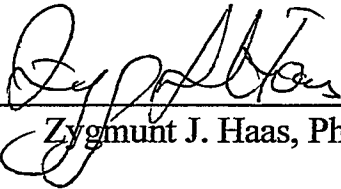
**V. Claim 20.** The wireless access telecommunications infrastructure according to claim 12, wherein at least one of the plurality of terminals in the active cell is an idle terminal when receiving the measurement report.

154. *See* Claim 7 above.

**IX. CONCLUSION**

155. This declaration and my opinions herein are made to the best of my knowledge and understanding, and based on the material available to me, at the time of signing this declaration. I reserve the right to add, delete, or change any of my opinions in this declaration upon becoming aware of new or additional material or information. I 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 or Title 18 of the United States Code.

Date: March 2, 2023

  
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Zygmunt J. Haas, Ph.D