

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA INC.,
Petitioner,

v.

INTELLECTUAL VENTURES II LLC,
Patent Owner.

U.S. Patent No. 10,136,416

**DECLARATION OF DR. ZHI DING,
UNDER 37 C.F.R. § 1.68 IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW**

TABLE OF CONTENTS

I.	Introduction.....	4
II.	Qualifications and Professional Experience	5
III.	Level of Ordinary Skill in the Art	11
IV.	Relevant Legal Standards	12
V.	Background.....	13
	A. Cellular Communication	13
	B. Paging.....	15
VI.	Overview of the '416 Patent.....	17
	A. Summary of the '416 Patent.....	17
	B. Prosecution History	21
VII.	Claim Construction.....	21
VIII.	Identification of how the Claims are Unpatentable.....	22
	A. Ground 1: Claims 1-12 are obvious under 35 U.S.C. § 103 over Kim and Vayanos.....	22
	1. Summary of Kim	22
	2. Summary of Vayanos	28
	3. Reasons to Combine Kim and Vayanos	31
	4. Claim 1.....	35
	5. Claim 2.....	62
	6. Claim 3.....	65
	7. Claim 4.....	65
	8. Claim 5.....	66

9.	Claim 6.....	69
10.	Claims 7-12.....	71
11.	Claim 7.....	71
12.	Claim 8.....	72
13.	Claim 9.....	73
14.	Claim 10.....	73
15.	Claim 11.....	73
16.	Claim 12.....	73
B.	Ground 2: Claims 1-12 are obvious under 35 U.S.C. § 103 over Kim, Vayanos, and AAPA.	73
1.	Applicant Admitted Prior Art (AAPA)	74
2.	Reasons to Combine the AAPA with Kim and Vayanos 74	
3.	Claim Analysis.....	78
4.	Claim 1.....	79
5.	Claims 2-4.....	81
6.	Claim 5.....	81
7.	Claim 6.....	82
8.	Claim 7.....	82
9.	Claims 8-10.....	84
10.	Claim 11.....	84
11.	Claim 12.....	84
IX.	Conclusion	85

I, Dr. Zhi Ding, do hereby declare as follows:

I. INTRODUCTION

1. I am making this declaration at the request of Tesla Inc. in the matter of the *Inter Partes* Review of U.S. Patent No. 10,136,416 (“the ’416 patent”) to Beale *et al.*

2. 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 the specifics of my testimony, and I have no other interest in this case or the parties thereto.

3. I have been asked to provide my opinions regarding whether claims 1-12 (“the Challenged Claims”) of the ’416 patent are unpatentable as they would have been obvious to a person having ordinary skill in the art (“POSITA”) at the time of the alleged invention, in light of the prior art. It is my opinion that all of the limitations of the challenged claims would have been obvious to a POSITA.

4. In the preparation of this declaration, I have studied:

- a. the ’416 patent, Ex.1001;
- b. the prosecution history of the ’416 patent (“’416 File History”), Ex.1002;
- c. U.S. Patent No. 8,761,814 to Kim et al. (“Kim”), Ex.1005;
- d. U.S. Patent No. 8,144,735 to Vayanos et al. (“Vayanos”), Ex.1006;

5. In forming the opinions expressed below, I have considered:

the documents listed above;

U.S. Patent No. 7,606,226 to Yi et al. (“Yi”), Ex.1007;

the relevant legal standards, including the standard for obviousness, and any additional authoritative documents as cited in the body of this declaration; and

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

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 can be found in Exhibit 1004. The following is a brief summary of my relevant qualifications and professional experience.

8. I presently hold the title of Distinguished Professor in the Department of Electrical and Computer Engineering at the University of California, Davis. Before my appointment on July 1, 2020, I held the position of professor for the prior 24 years and have served as a faculty member at several United States universities for over 34 years. I am also a private technical consultant on various

technologies related to information systems. In total, I have more than three decades of research experience on a wide range of topics related to data communications and signal processing.

9. I earned my Bachelor of Science degree in 1982 in wireless engineering from the Nanjing Institute of Technology (later renamed as Southeast University) in Nanjing, China. I earned my Master of Science degree in 1987 in electrical engineering from the University of Toronto in Toronto, Canada. I earned my Ph.D. in 1990 in electrical engineering from Cornell University in Ithaca, New York.

10. My responsibilities as a Professor at University of California, Davis, include classroom instruction on various topics of communication systems and signal analysis, as well as mentoring undergraduate students and supervising graduate students in their research and development efforts on various topics related to digital communications. I have directly supervised such research and development works ranging from signal detection to wireless networking. As the chief academic advisor, I have also directly supervised the completion of over 20 Masters' theses and over 30 Ph.D. dissertations on various topics related to digital communications. I have served full time as a faculty member at three major research universities in the United States over the past 30 years, including Auburn University from 1990 to 1998, University of Iowa from 1999 to 2000, and

University of California, Davis, from 2000 to present.

11. Since 1990, I have been selected as the principal investigator of multiple highly competitive federal and local research grants, including more than twenty major research projects supported by the National Science Foundation and two research projects funded by the U.S. Army Research Office. These competitive research projects focused on developing more efficient and effective digital communication transceivers, networks, and signal processing tools. I have also participated in several large-scale projects supported by the Defense Advanced Research Projects Agency (DARPA) with teams of researchers. I have applied for, and received support from, other federal, state, and industry sponsors.

12. I have published over 250 peer-reviewed research articles in premier international journals, in addition to over 250 refereed technical articles at top international conferences on communications and information technologies. According to Google Scholar, my published works have been cited by over 20,000 times by peers. I also authored two books on communications technologies. My most recent book, coauthored with B.P. Lathi, is entitled, “Modern Digital and Analog Communication Systems,” 5th edition, and was published by the Oxford University Press in 2018. The 4th edition of this book (published in 2009) had been widely adopted as an introductory textbook to communication systems.

13. In addition to the over 500 published technical papers that have been

cited over 20,000 times according to Google Scholar, I am also co-inventor of 4 issued U.S. patents on communication technologies.

14. I am a member of the Institute of Electrical and Electronics Engineers (IEEE) and was elevated to the grade of Fellow in January 2003 for contributions made in signal processing for communication. The IEEE is the world's largest professional society of engineers, with over 400,000 members in more than 160 countries. The IEEE has led the development of many standards for modern digital communications and networking, most notably, the IEEE 802 series of network standards. The IEEE Grade of Fellow is conferred by the Boards of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The total number selected in any one year does not exceed one-tenth of one percent of the total voting Institute membership.

15. I have served the IEEE in the following capacities:

- Chief Information Officer of the IEEE Communications Society from Jan. 2018 to present.
- Chief Marketing Officer of the IEEE Communications Society from Jan. 2020 to present.
- General Chair of the 2016 IEEE International Conference on Acoustics, Speech, and Signal Processing, the flagship conference of the IEEE Signal Processing Society.

- Chair of the Steering Committee for the IEEE Transactions on Wireless Communications from 2008 to 2010.
- Distinguished Lecturer of the IEEE Communications Society from January 2008 to December 2009.
- Technical Program Chair of the 2006 IEEE Globecom, one of two flagship annual IEEE Communication Society conferences.
- Distinguished Lecturer of the IEEE Circuits and Systems Society from 2004 to 2005.
- Associate Editor of the IEEE Transactions on Signal Processing from 1994 to 1997 and from 2001 to 2004.
- Member of the IEEE Statistical Signal and Array Processing for Communications Technical Committee from 1993 to 1998.
- Member of the IEEE Signal Processing for Communications Technical Committee from 1998 to 2004.

16. In 2012, I received the Wireless Communications Technical Committee Recognition Award from the IEEE Communications Society, an award given to a person with a high degree of visibility and contribution in the field of "Wireless and Mobile Communications Theory, Systems, and Networks." I received the 2020 Education Award from the IEEE Communications Society. According to the Society, this award "recognizes distinguished and significant

contributions to education within the Society's technical scope."

17. I have also served as a technical consultant for the telecommunication industry. For example, in 1995 I consulted for Analog Devices, Inc., on the development of the first generation DOCSIS cable modem systems. I have also consulted for other companies, including Nortel Networks and NEC US Laboratories. I worked as a visiting faculty research fellow at NASA Glenn Research Center in 1992 and at U.S. Air Force Wright Laboratory in 1993. I have served on multiple review panels of the National Science Foundation to evaluate competitive research proposals in the field of communication. I have also reviewed a large number of research proposals at the request of the National Science and Engineering Research Council (NSERC) of Canada as an expert panelist from 2010 to 2013, and also at the request of the Research Grant Council (RGC) of Hong Kong as an external reviewer.

18. I have served as an expert witness or consulting expert on a number of matters related to intellectual property, mostly in the arena of telecommunications, including cellular communications, Wi-Fi technologies, Bluetooth, and optical communications. For example, since 2007, I have been engaged to work on various litigations involving cellular, WiFi, Bluetooth, and optical communication networks. Many of my expert works related to the standard essentiality of patents with respect to the 3GPP 2G/3G/4G/5G technical specifications, the IEEE 802.11

standards, and the Bluetooth standards. I have provided testimonies at court trials or hearings in multiple jurisdictions, both in the United States and internationally. I have submitted declarations to PTAB as expert on a number of inter partes reviews of challenged patents.

III. LEVEL OF ORDINARY SKILL IN THE ART

19. I understand 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.

20. It is my understanding that the earliest possible priority date for the '416 patent is September 27, 2007. A person of ordinary skill in the art ("POSITA") in the field of the '416 patent, as of September 27, 2007, would have been someone knowledgeable and familiar the wireless communication arts that are pertinent to the '416 patent. That person would have a bachelor's degree from an accredited program in electrical engineering, computer engineering, computer science, or equivalent training, and approximately two years of experience working in the relevant field. Lack of work experience can be remedied by additional education, and vice versa.

21. 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 alleged priority date of the '416 patent (i.e., September 27, 2007). Unless otherwise stated, when I provide my understanding and analysis below, it is consistent with the level of a POSITA as of the alleged priority date of the '416 patent.

IV. RELEVANT LEGAL STANDARDS

22. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the '416 patent, I am relying on certain basic legal principles that counsel have explained to me. These principles are discussed below.

23. I understand that prior art to the '416 patent includes patents and printed publications in the relevant art that predate the priority date of the alleged invention recited in the '416 patent.

24. I have been informed 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 content of the prior art, and the differences between the prior art and the claimed subject matter.

25. 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.

V. BACKGROUND

A. Cellular Communication

26. The background section of the '416 patent describes conventional cellular communication systems. "Known cellular communication systems such as a Universal Mobile Telecommunications System (UMTS) Radio Access Network

(UTRAN), standardised by the 3rd Generation Partnership Project (3GPP), typically consist of a set of radio network controllers (RNCs), Node B, also known as Node-Bs, and mobile stations (MSs), also known as User Equipment (UEs).”

’416 Patent, 1:25-30. In the example cellular communication system 100 shown below, “Node Bs 110 are connected to an RNC 105 via an interface (Iub) 115.”

’416 patent, 1:47-48. “The Node Bs are connected wirelessly to the UEs 120.”

’416 patent, 1:52-53.

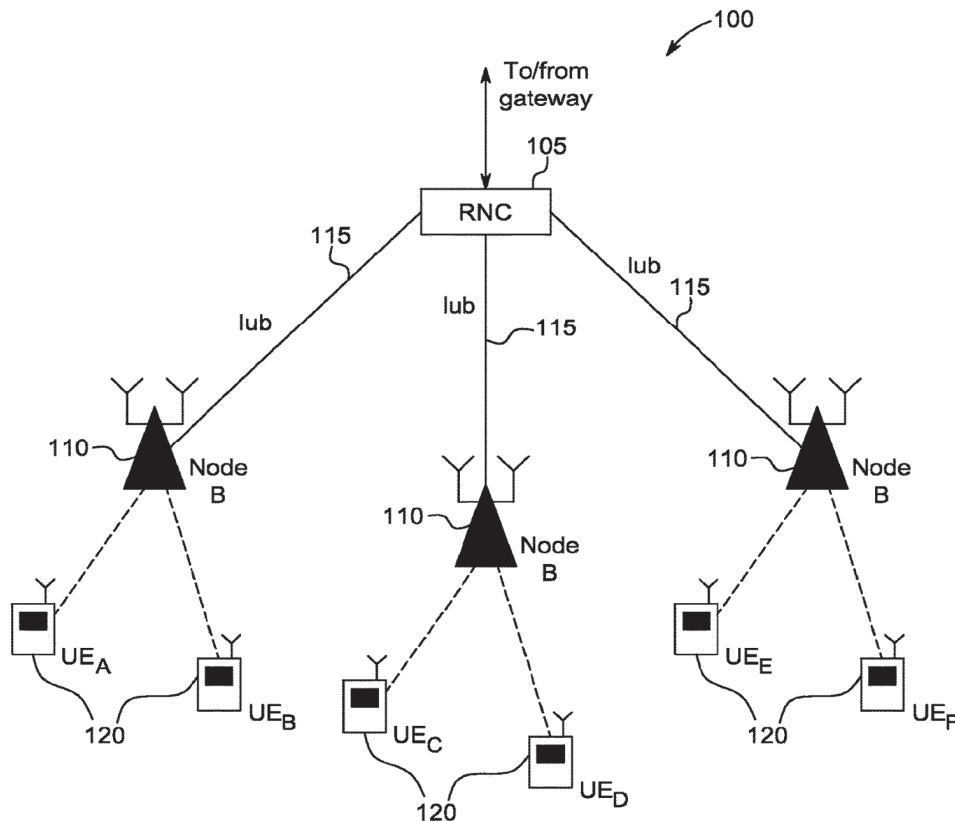


FIG. 1
PRIOR ART

’416 patent, Fig. 1.

27. The Node Bs (base-stations) communicate with the terminals by transmitting signals that are formatted into frames. An example frame is shown in Fig. 3 below.

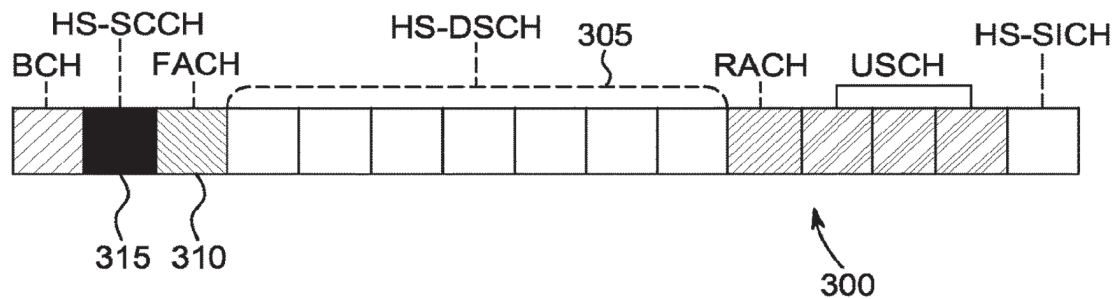


FIG. 3
PRIOR ART

'416 patent, Fig. 3.

28. The conventional frame above includes a Broadcast Channel BCH, a signal channel (e.g., Forward Access Channel FACH), and shared channels (e.g., High Speed Downlink Shared Channels HS-DSCH). See '416 patent, 3:47-57

B. Paging

29. When a UE is not involved in active connections, the UE enters an idle state, whereby the UE powers down its radio frequency circuitry (RF) to conserve battery power. '416 patent, 1:54-57. The UE will “periodically power up its radio circuitry in order to monitor specific channels in order to determine whether it is required to establish a connection with the network,” for example, for an in-coming call. '416 patent, 1:58-64; *see also* Ex.1015, 134 (describing the known paging procedure).

30. When the idle UE powers on its radio circuitry, it monitors information on what is called the Paging Indication Channel PICH. “The PICH comprises multiple indicator bits. Each UE is associated with one of the indicator bits within the PICH.” ’416 patent, 2:12-14. “When in the idle state, the UE periodically decodes the PICH to see if the indicator bit with which it is associated has been set.” ’416 patent, 2:16-18. “If the relevant indicator has been set, the UE then reads the [Paging Channel] PCH.” ’416 patent, 2:19-20. “The PCH is a downlink transport channel that is used to carry control information to a UE.” ’416 patent, 2:7-8.

31. To decode the information in the Paging Channel PCH, the UE uses an identifier. “Each UE has a unique identifier (UE-ID).” ’416 patent, 2:21-25. When the network pages a UE, as previously mentioned, the network ... transmits the UE-ID for the UE being paged, and the relevant message within the PCH.” ’416 patent, 2:21-25. The base station transmits the identifier in the Paging Channel PCH because “more than one UE may be associated with an indicator bit in the PICH.” ’416 patent, 2:25-27. “[T]he UE-ID enables a UE to determine whether the message is intended for that UE or not. If the PCH contains the UE-ID for the UE, the UE then reads the message, and performs the required actions.” ’416 patent, 2:27-30. Accordingly, “in the known art, the indicator bits are used in a paging channel to inform the UE whether it needs to turn its radio on for reading

the PCH (i.e. as a battery saving mode).” ’416 patent, 2:30-31.

VI. OVERVIEW OF THE ’416 PATENT

A. Summary of the ’416 Patent

32. The ’416 patent relates to “allocating channel resources within a physical channel of a cellular communication system.” ’416 patent, 1:20-21. In particular, the ’416 patent purports to solve the known problem of wasting resources on unused signaling channels: “As will be appreciated by a skilled artisan, the fact that the FACH timeslot 310 is required to be reserved, particularly during light use of the FACH, is an inefficient use of physical resources.” ’416 patent, 3:58-61. The ’416 patent also states that while “embodiments of the invention will be described in a context of a Forward Access Channel (FACH) ... the inventive concept described herein may be applied to any direct signalling channel, such as a paging channel.” ’416 patent, 9:38-41.

33. But the ’416 patent seeks to address this waste of resources by using techniques that were already known and used. The purported novelty of the ’416 patent is to use indicator bits in the broadcast channel (BCH) to indicate whether a particular timeslot within a frame should be used for signaling or as a shared channel. *See* ’416 patent, 9:38-58. “[T]he indicator bits are used to inform the UE whether it should be reading the resources ‘reserved’ for FACH as a FACH channel, or whether it should be ignoring those resources (for

example when they are being used for another channel such as HS-DSCH).”

’416 patent, 9:53-58.

34. The specification of the ’416 patent describes how a signaling channel such as a FACH is conventionally allocated within a frame. As can be seen below in Fig. 3 (admitted prior art), a frame includes a Broadcast Channel (BCH), a Forward Access Channel 310 (FACH), and several High-Speed Downlink Shared Channel (HS-DSCH 305 timeslots.

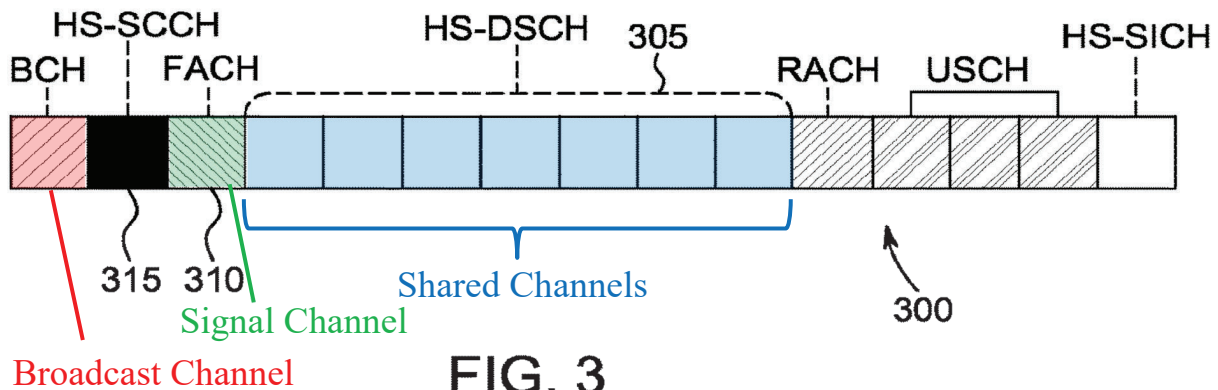
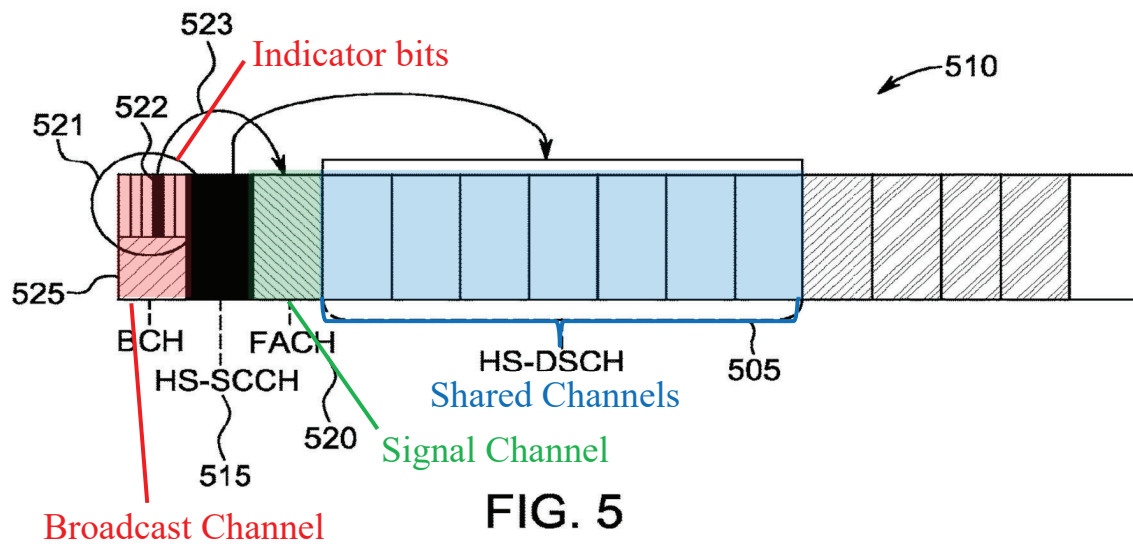


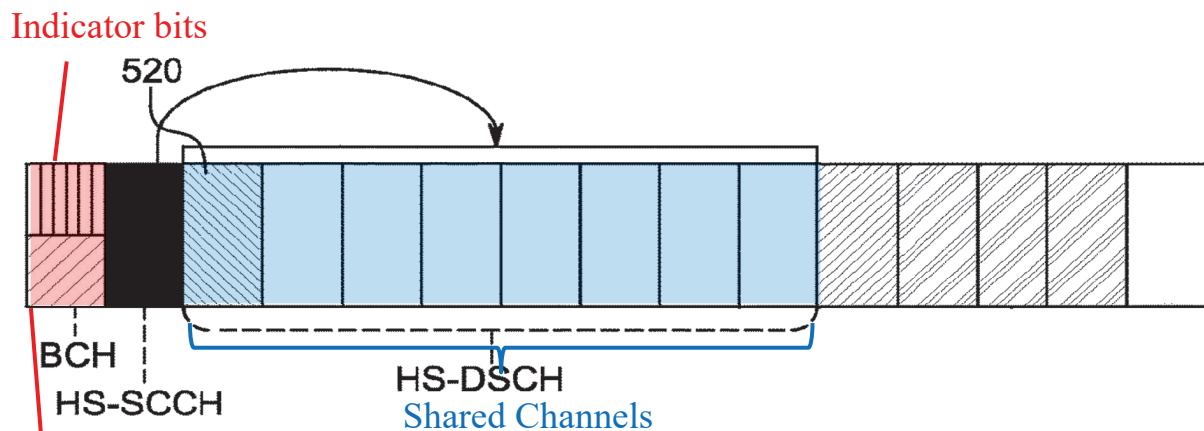
FIG. 3
PRIOR ART
'416 patent, Fig. 3 (annotated).

35. The ’416 patent illustrates its purported novelty of using indicator bits within the broadcast channel, shown in Fig. 5 below.



'416 patent, Fig. 5 (annotated).

36. The '416 patent explains that an indicator bit (e.g., indicator bit 522) “is used is used to indicate whether a FACH channel to which it relates is ‘active.’” '416 patent, 12:3-4. Thus, “[w]hen the NODE B 410 is required to send a FACH message, ... the NODE B 410 sets the FACH indicator bit 522.” '416 patent, 12:7-10. If, however, “no FACH message is required to be transmitted ... the FACH indicator bit 522 ... is not set.” Ex.1001, 12:25-28. This allows the system to “reallocate the FACH timeslot 520 for use by a channel other than the FACH, when no FACH message is required to be transmitted.” '416 patent, 12:40-42. For example, “the FACH timeslot 520 is reallocated for use by the HS-DSCH 505. The HS-DSCH 505 is a shared channel.” '416 patent, 12:43-45. The reallocated time slot is shown below in Fig. 6.

**FIG. 6**

'416 patent, Fig. 6 (annotated).

37. When the indicator bit in the Broadcast Channel BCH does indicate the presence of the FACH channel, as shown in Fig. 5, the UEs follow the normal procedure for reading and decoding the FACH. *See* '416 patent, 12:17-23. "If there is a FACH message, the UE 430 is able to read the contents of the FACH channel, and determine whether, or not, the message is intended for itself." '416 patent, 10:47-49. "Upon reading a set FACH indicator bit, the UE 430 determines that the NODE B 430 is transmitting a FACH message, and ... is able to decode the FACH message." '416 patent, 12:17-21. "If the identity of the UE 430 matches the identity transmitted within the FACH message, the UE 430 acts on the message content." '416 patent, 12:21-23

38. However, for the reasons I explain below, it was already known to use indicator bits in the broadcast channel to indicate whether a particular time slot is

to be used as a signaling channel (e.g., FACH or PCH) or as a shared high speed data channel (e.g., HS-DSCH).

B. Prosecution History

39. The '416 patent was filed on June 1, 2020. *See* Ex.1002. It ultimately claims priority through a series of continuations to an application filed September 27, 2007. *See* Ex.1002, 118. The originally filed with claims were nearly identical to those of the parent application (U.S. Patent No. 9,674,818, Ex.1009). *See* Ex.1002, 154-56.

40. In the first office action, the Examiner made only a double patenting rejection and indicated that the claims were otherwise allowable. Ex.1002, 65-67. In response, the Applicant cancelled all pending claims and added 12 new claims on March 30, 2018. Ex.1002, 55-61. The Examiner allowed the new claims without comment. Ex.1002, 19-23.

VII. CLAIM CONSTRUCTION

41. It is my understanding that in order to properly evaluate the '416 patent, the terms of the claims must first be interpreted. It is my understanding 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. For the purposes of my analysis below, I do not believe any claim terms require explicit construction.

VIII. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

42. I have been asked to provide my opinion as to whether the Challenged Claims of the '416 patent would have been obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references identified below teach the limitations of the Challenged Claims of the '416 patent.

43. As part of my analysis, I have considered the scope and content of the prior art and any differences between the alleged invention and the prior art. I describe in detail below the scope and content of the prior art, as well as any differences between the alleged invention and the prior art, on an element-by-element basis for each Challenged Claims of the '416 patent.

44. As described in detail below, the alleged invention of the Challenged Claims would have been obvious in view of the teachings of the identified prior art references as well as the knowledge of a POSITA. My obviousness analysis relies on the combined teachings of the references and not on a physical incorporation of elements

A. Ground 1: Claims 1-12 are obvious under 35 U.S.C. § 103 over Kim and Vyanos.

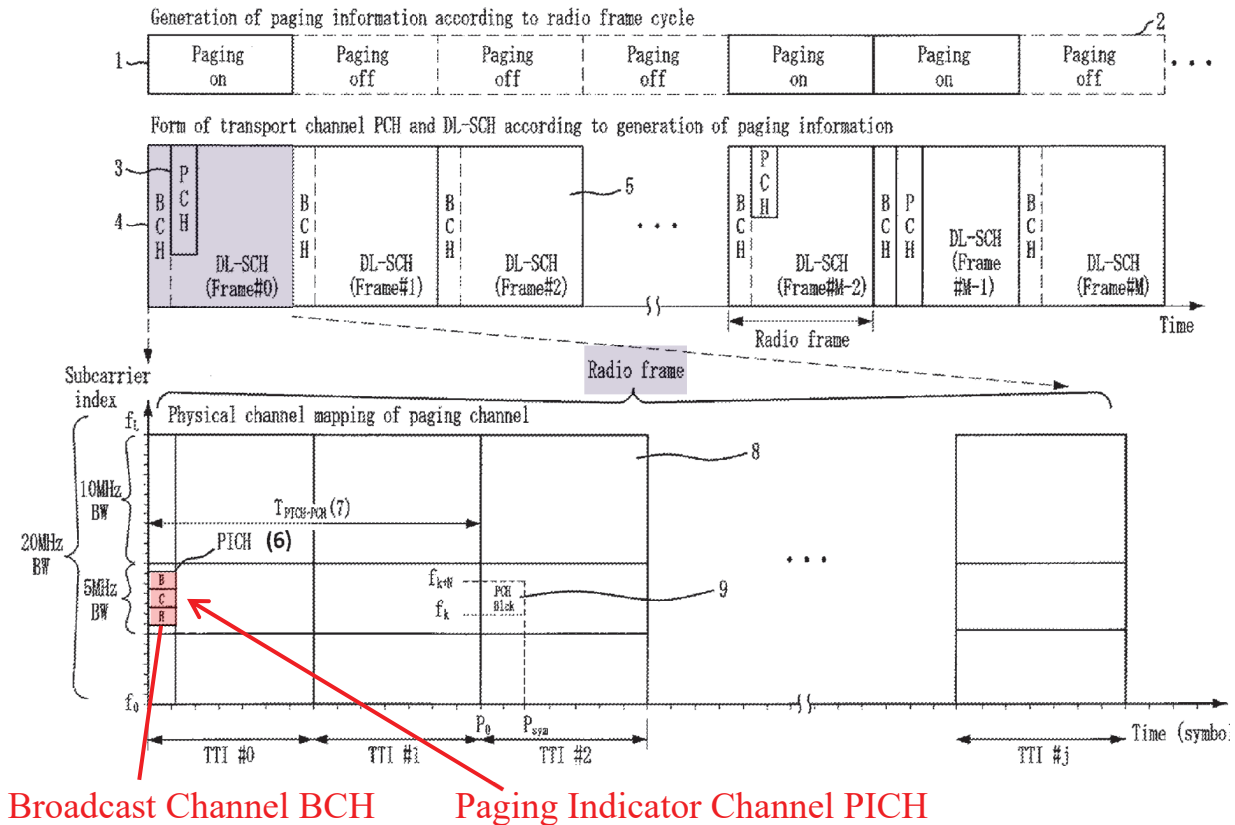
1. Summary of Kim

45. Like the '416 patent, Kim “relates to a method for transmitting paging

information in a cellular system.” Kim, 1:6-8. Kim identifies the same problem described in the ’416 patent—wasted radio resources. The ’416 patent explains that “timeslots reserved for FACH transmissions could be utilised for a traffic channel during periods when no FACH transmissions were required to be sent.” ’416 patent, 3:67-4:3. Kim similarly explains that when there is no information to be sent in a control channel (e.g., a paging channel PCH), “radio resource[s], i.e., power, are allocated and thus radio resources are wasted.” Kim, 1:34-37. Kim solves this problem with the same solution concept described and claimed in the ’416 patent. Kim describes using indicator bits in the Broadcast Channel BCH to indicate whether a particular time slot will be used as a signaling channel (e.g., a Paging Channel PCH) or as a downlink shared channel. *See* Kim, 4:36-5:21.

46. Like in the ’416 patent, Kim’s base station sends out radio frames. Fig. 2 of Kim illustrates a series of frames (Frame#0-Frame#M). The bottom portion of Fig. 2 illustrates a single frame (Frame#0) (purple) in more detail, with paging indicator channel PICH 6 embedded within in the broadcast channel (BCH) (blue).

FIG. 2

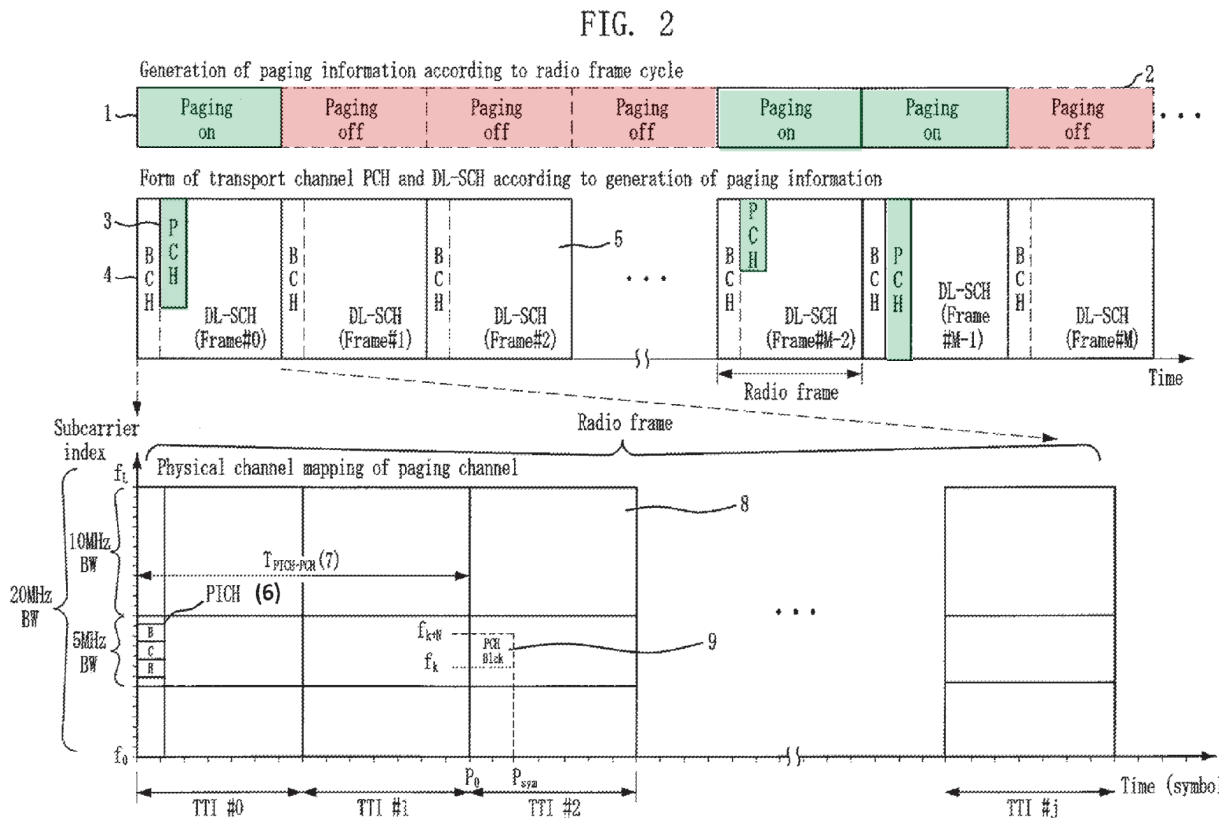


Kim, Fig. 2 (annotated).

47. Kim describes its Paging Indication Channel (PICH) consistent with known paging procedures. “[T]he base station sets up a paging indication channel 6 corresponding to the terminal or the terminal group indicated by the paging information and forms the paging indication channel 6.” Kim, 4:58-61. The base station schedules the PICH within the broadcast channel: “The scheduler performs scheduling on broadcasting channel (BCH) information, created paging channel information ... to be transmitted to the terminal.” Kim, 4:53-56. “[P]aging information is transmitted to the terminals in the RRC Idle state through the paging

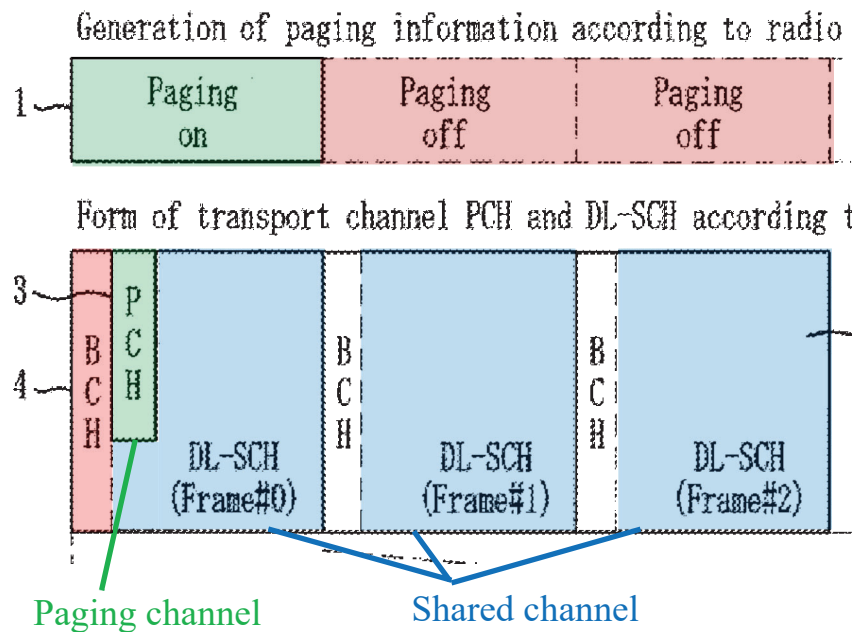
indication channel [PICH], which is a physical channel.” Kim, 4:42-45.

48. Referring back to Fig. 2, the top portion illustrates whether paging information for a particular frame is ON (green) or OFF (red), and if paging is ON for a particular frame, a PCH (green) is transmitted within the corresponding DL-SCH downlink frame. Kim, 4:48-52.



Kim, Fig. 2 (annotated).

49. The top left portion of Fig. 2 is enhanced below to show more detail:



Kim, Fig. 2 (partial).

50. As shown in the example of Fig. 2 above, paging is ON for Frame#0 and thus the paging channel (PCH) is included within the frame. In Frame#1 and Frame#2, however, the paging indication is OFF and thus no paging channel is included within the frame. Kim explains that “[w]hen no paging information is generated (see 2 of FIG. 2), the paging channel does not exist in the transport channel of the radio frame (see 5 of FIG. 2). In this case, the paging indication channel is not also set up.” Kim, 5:13-17. In other words, because the PCH is not needed, it is not scheduled and thus does not waste resources.

51. When the paging information for a frame is OFF, however, there is no PCH scheduled within the frame. “When no paging information is generated (see 2 of FIG. 2), the paging channel does not exist in the transport channel of the radio

frame (see 5 of FIG. 2). In this case, the paging indication channel is not also set up.” Kim, 5:13-17. In other words, because the PCH is not needed, it is not scheduled and thus does not waste resources. As shown in the example of Fig. 2 above, paging is ON for Frame#0 and thus the paging channel (PCH) is included within the frame. In Frame#1 and Frame#2, however, the paging indication is OFF and thus no paging channel (PCH) is included within the frame.

52. When the paging information is OFF, the spared radio resources within the frame can instead be used for a downlink shared channel DL-SCH. “Therefore, downlink shared channel (DL-SCH) information for user data transmission and not paging information of the paging channel is transmitted to the radio resource block location of the physical layer fixed and allocated for the paging channel.” Kim, 2:17-21. Kim thus explains that its teachings “can improve applicability of a limited radio resource by variably and flexibly setting up and mapping a transport channel and physical channel in a method for transmitting information notifying start of down link information from a base station to a terminal in a cellular system for packet transmission.” Kim, 2:51-61.

53. Kim also describes the conventional operation of the Paging Channel PCH in which a terminal will monitor the PICH and decode the PCH when it is determined there is a message for itself. “The terminals monitor the paging indication channel [PICH] every monitoring cycle.” Kim, 1:43-45. When the

indication bits in the PICH indicate to a group of terminals that there is paging information for one of those terminals, each terminal in the paging group will then check the PCH. “[W]hen it is sensed that indication information corresponding to the group including the terminal exists in the paging indication channel, the terminals search PCH information ... and decode paging information.” Each terminal in the paging group checks the PCH to see if the paging information is for that particular terminal. This is done by using “an identifier (ID) such as international mobile subscriber identity (IMSI), temporary mobile subscriber identity (TMSI), UMTS terrestrial radio access network-radio network temporary identifier (U-RNTI).” Kim, 1:49-52. The terminals decoding the paging information performs following procedures corresponding to the paging information.

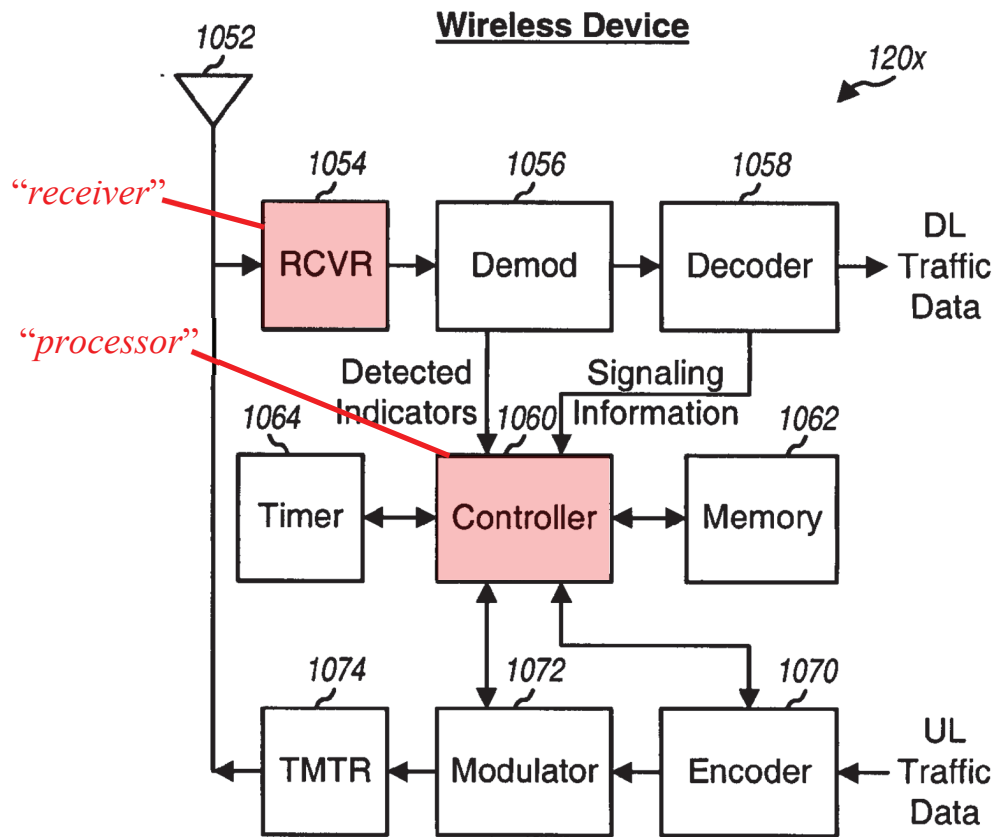
54. Accordingly, Kim describes the same solution to the same problem identified in the ’416 patent—using indicator bits in the broadcast channel to indicate whether to use radio resources as a signaling channel (e.g., PCH) or a shared channel (e.g., DL-SCH).

2. Summary of Vayanos

55. Like Kim and the ’416 patent, Vayanos “relates generally to communication, and more specifically to techniques for transmitting signaling information for broadcast ... services in a communication system.” Vayanos, 1:17-

20. Vayanos describes additional details about the terminal hardware, such as the receiver and processor.

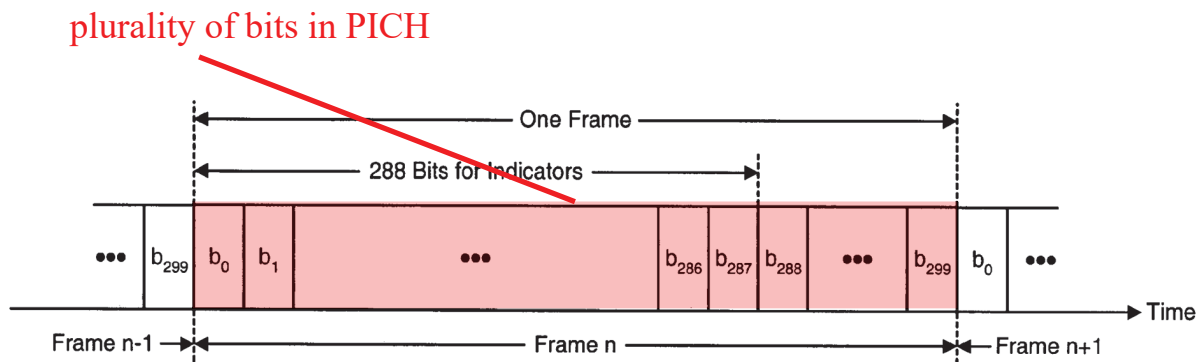
56. Vayanos describes a “wireless device 120x” in which “an antenna 1052 receives the downlink signal from base station 110x and provides a received signal to a receiver unit (RCVR) 1054.” Vayanos, 12:12-24. The wireless device also includes a controller 1060 that “perform[s] various functions for transmission and reception, respectively, of notification indicators and signaling information for the services.” Vayanos explains that “the processing units used to transmit signaling information may be implemented within one or more application specific integrated circuits (ASICs), **digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors.** The processing units used to receive signaling information may also be implemented within one or more ASICs, DSPs, and so on.” Vayanos, 12:53-64.



Vayanos, Fig. 10 (partial).

57. Accordingly, Vayanos provides evidence that it was known for terminals in cellular communication systems to include receivers and processors.

58. Vayanos also provides evidence that it was known for the Paging Indicator Channel PICH to include a plurality of bits. In Vayanos, "FIG. 2B shows the format of one frame for the PICH. Each PICH frame includes 300 bits, which are labeled as bits b_0 through b_{299} ." Vayanos, 3:26-28.

**FIG. 2B**

Vayanos, Fig. 2B (annotated).

59. Accordingly, Vayanos provides examples of known paging techniques and the known format for various aspects of standardized frames, which include a PICH having a plurality of bits.

3. Reasons to Combine Kim and Vayanos

60. A POSITA would have found it obvious for Kim's paging process to use standardized techniques as evidenced by Vayanos. For example, it would have been obvious for Kim's Paging Indicator Channel PICH to include a plurality of bits consistent with the known implementation of the PICH as evidenced by Vayanos.

61. A POSITA would have found it obvious for Kim's paging technique to be consistent with known 3GPP paging techniques, as Kim is directed to cellular communication systems that follow 3GPP standards. *See* Ex.1005, 3:42-46.

Vayanos provides additional details as to the known 3GPP paging techniques, such as the format of the PICH. It would have thus been obvious for Kim's paging

techniques to use known 3GPP paging techniques such as the known format of the PICH.

62. Kim describes a known method for “setting a **paging indication channel (PICH)** based on the paging information and forming the paging indication channel in a radio resource of a physical layer.” Kim, 2:34-37. Kim further explains that “the base station sets up a paging indication channel 6 corresponding to the terminal or the terminal group indicated by the paging information and forms the paging indication channel 6 at step S140 such that the terminal in the system can be divided into groups.” Kim, 4:58-63. “[P]aging information is transmitted to the terminals in the RRC Idle state through the paging indication channel.” Kim, 4:42-45.

63. Vayanos similarly describes a paging indicator channel (PICH) with the same functionality. “In UMTS, a Page Indicator Channel (PICH) is used to send paging indicators to idle wireless devices.” Vayanos, 2:56-57. “The paging indicators for each idle wireless device indicate whether messages might be sent on a Paging Channel (PCH) for the wireless device.” Vayanos, 2:62-65.

64. Vayanos also provides additional implementation details for the PICH including a known formatting technique for the PICH. “FIG. 2B Shows the format of one frame for the PICH. Each PICH frame includes 300 bits, which are labeled as bits b_0 through b_{299} .” Vayanos, 3:26-28. The indicator bits within a PICH frame

are shown below.

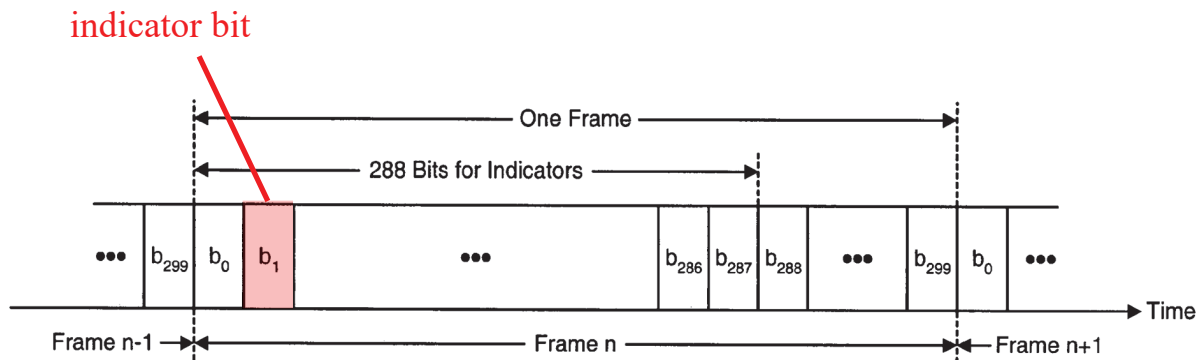


FIG. 2B

Vayanos, Fig. 2B (annotated).

65. A POSITA would have found it obvious for Kim’s PICH to be implemented in consistency with Vayanos’s format because doing so would have been consistent with UMTS in 3GPP standards. Vayanos explains that “UMTS is a system that uses W-CDMA and/or GSM as radio access technologies and is described in documents from a consortium named ‘3rd Generation Partnership Project’ (3GPP).” Vayanos, 2:46-49. Vayanos further explains that “[i]n UMTS, a Page Indicator Channel (PICH) is used to send paging indicators to idle wireless devices.” Vayanos, 2:56-57. Kim similarly relates to a UMTS system. *See* Kim, 1:38-55.

66. A POSITA would have found it beneficial to implement base stations and terminals according to known standards to ensure compatibility and marketability of the product. Moreover, it is beneficial and advantageous to

implement such devices with standardized techniques that have already been well vetted and tested for workability.

67. A POSITA would have had a reasonable expectation of success because the PICH performs the same function in Kim as it does in Vayanos—paging specific groups of terminals. “In UMTS, a Page Indicator Channel (PICH) is used to send paging indicators to idle wireless devices.” Vayanos, 2:56-57. “The terminals monitor the paging indication channel every monitoring cycle.” Kim, 1:43-45.

68. A POSITA also would have had a reasonable expectation of success because both Kim and Vayanos are directed to cellular communication systems that follow 3GPP standards. *See* Kim, 3:42-46 (“A 3rd Generation Partnership Project (3GPP) long term evolution (LTE) system, which is being standardized as the cellular system for the packet service.”); Vayanos, 2:46-50 (“UMTS is a system that uses W-CDMA and/or GSM as radio access technologies and is described in documents from a consortium named ‘3rd Generation Partnership Project’ (3GPP)”). Kim explains that its teachings are “for simplifying and integrating diverse kinds of transport channels operated in the conventional WCDMA method.” Kim, 2:3-6. Accordingly, both Kim and Vayanos describe known methods according to 3GPP standards.

69. Accordingly, the combination of Kim and Vayanos merely represents

applying a known technique (a PICH with a plurality of bits as taught by Vayanos) to a known method (Kim's paging procedure that uses a PICH) ready for improvement to yield predictable results (paging specific groups of terminals based on specific bits within the PICH). The combination also represents combining prior art elements (Kim and Vayanos's paging procedures) according to known methods (3GPP standards) to yield predictable results (paging specific groups of terminals based on specific bits within the PICH).

4. Claim 1

[1.0] *A user equipment (UE) comprising:*

70. Kim describes transmissions from a base station to a terminal ("*user equipment (UE)*").

The present invention relates to a method for transmitting paging information in a cellular system; and, more particularly, to a method for transmitting paging information notifying generation of downlink information from a base station **to a terminal** in a cellular system for providing a packet service.

Kim, 1:5-10.

71. A POSITA would have understood that a terminal is a UE as claimed. Indeed, as was known in the art, a "wireless device may be fixed or mobile and **may also be called a user equipment (UE)**, a mobile station, **a terminal**, or some other terminology." Vayanos, 2:23-25.

72. Thus, because Kim relates to transmitting information from a base station to a terminal, and a terminal was also referred to in the art as a user equipment (UE), Kim renders obvious “[a] *user equipment (UE)*” as claimed.

[1.1] *a receiver, the receiver configured to receive broadcast information including a plurality of bits,*

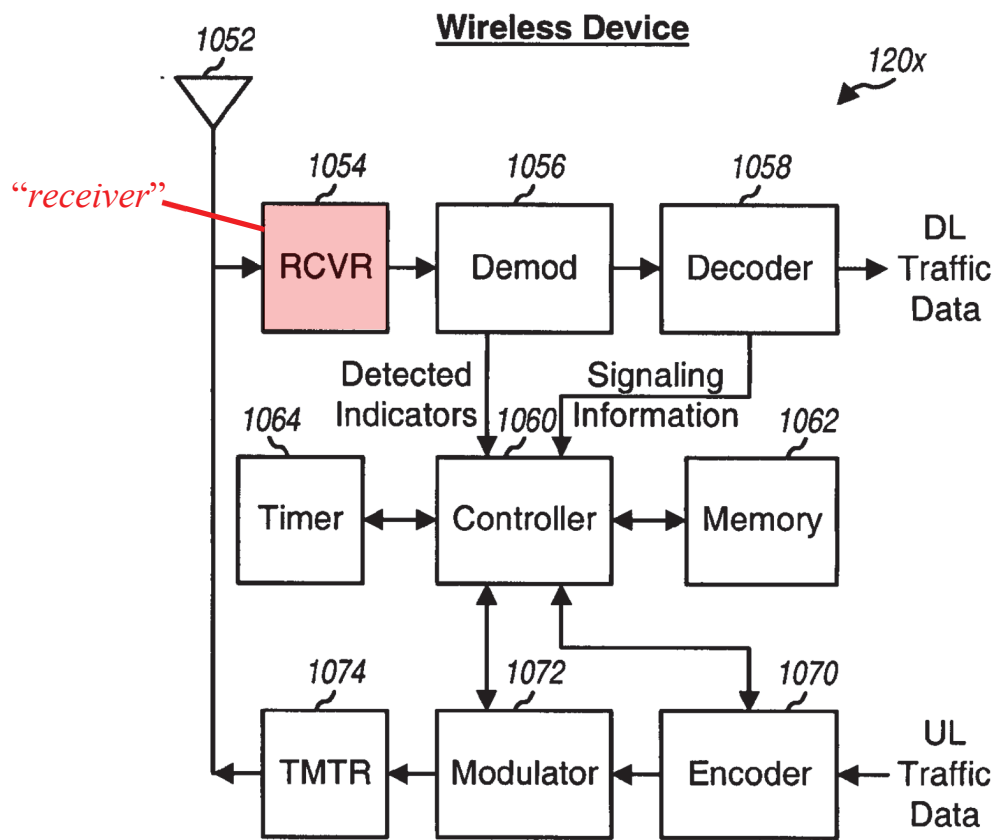
73. First, Kim’s terminal receives transmission from the base station and thus a POSITA would have understood Kim’s terminal to include “*a receiver.*” As explained at [1.0], Kim relates to “a method for transmitting paging information notifying generation of downlink information from a base station **to a terminal** in a cellular system for providing a packet service.” Kim, 1:5-10.

74. Vayanos further renders obvious that Kim’s terminal includes a receiver. Vayanos describes a standard UE, like Kim’s, that receives information from a base station:

At wireless device 120x, an antenna 1052 receives the downlink signal from base station 110x and provides a received signal to a receiver unit (RCVR) 1054. Receiver unit 1054 conditions (e.g., filters, amplifies, and frequency down converts) the received signal, digitizes the conditioned signal, and provides data samples. A demodulator (Demod) 1056 processes the data samples and provides symbol estimates. Demodulator 1056 further performs detection for notification indicators, paging indicators, and counting flags, as directed by a controller 1060. A decoder 1058 processes (e.g., demaps, deinterleaves, and decodes) the symbol estimates and provides decoded

data for the transmitted traffic data and signaling sent by base station 110x.

Vayanos, 12:12-24.



Vayanos, Fig. 10 (partial).

75. Accordingly, because Kim's terminal receives radio transmissions, it would have been obvious for Kim's terminal to include a receiver, as evidenced by Vayanos. While a POSITA would have recognized that Kim's terminal would have inherently included a receiver, a POSITA would have also found it obvious for Kim's terminal to include a receiver as taught by Vayanos.

76. Kim describes that a mobile terminal that receives and decodes

information. For example, a terminal receives paging information from the base station: “The terminals monitor the paging indication channel every monitoring cycle.” Kim, 1:43-45. The terminal also decodes that information: “[W]hen it is sensed that indication information corresponding to the group including the terminal exists in the paging indication channel, the terminals search PCH information transmitted to the S-CCPCH channel and decode paging information.” Kim, 1:45-50. Vayanos similarly describes a terminal that receives and decodes information. “Each idle wireless device monitors the PICH for its paging indicators.” Vayanos, 2:66-67. “If these paging indicators are set to ‘1’, then the wireless device processes the S-CCPCH to look for any messages sent for the wireless device.” Vayanos, 2:67-3:2. The S-CCPCH includes the Paging Channel PCH: “The PCH is a transport channel that is carried in a Secondary Common Control Physical Channel (S-CCPCH).” Vayanos, 2:64-66.

77. Vayanos’s terminal predictably performs these receiving functions with a receiver, as explained above at XI.C.2. Vayanos describes a “wireless device 120x” in which “an antenna 1052 receives the downlink signal from base station 110x and provides a received signal to a receiver unit (RCVR) 1054.” Vayanos, 12:12-24.

78. A POSITA would have found it obvious for Kim’s terminal to similarly include a receiver. Because Kim’s terminal receives radio transmissions,

it would have been obvious—if not inherent—for the terminal to include a receiver, as taught by Vayanos. Doing so would achieve the predictable result of Kim’s terminal receiving radio transmissions through a receiver and processing the received information with a processor.

79. Accordingly, the combination of Kim and Vayanos merely represents combining prior art elements (Kim’s terminal having a receiver, as taught by Vayanos) according to known methods (providing a terminal with a receiver, as taught by Vayanos) to yield predictable results of configuring a wireless terminal with a receiver. The combination also represents applying a known technique (implementing a terminal with a receiver as taught by Vayanos) to a known device (Kim’s terminal) ready for improvement to yield predictable results (receiving transmissions with the receiver and processing received data with the processor).

80. **Second**, Kim’s terminal, and thus receiver, receives paging information (“*broadcast information*”) through a paging indication channel PICH.

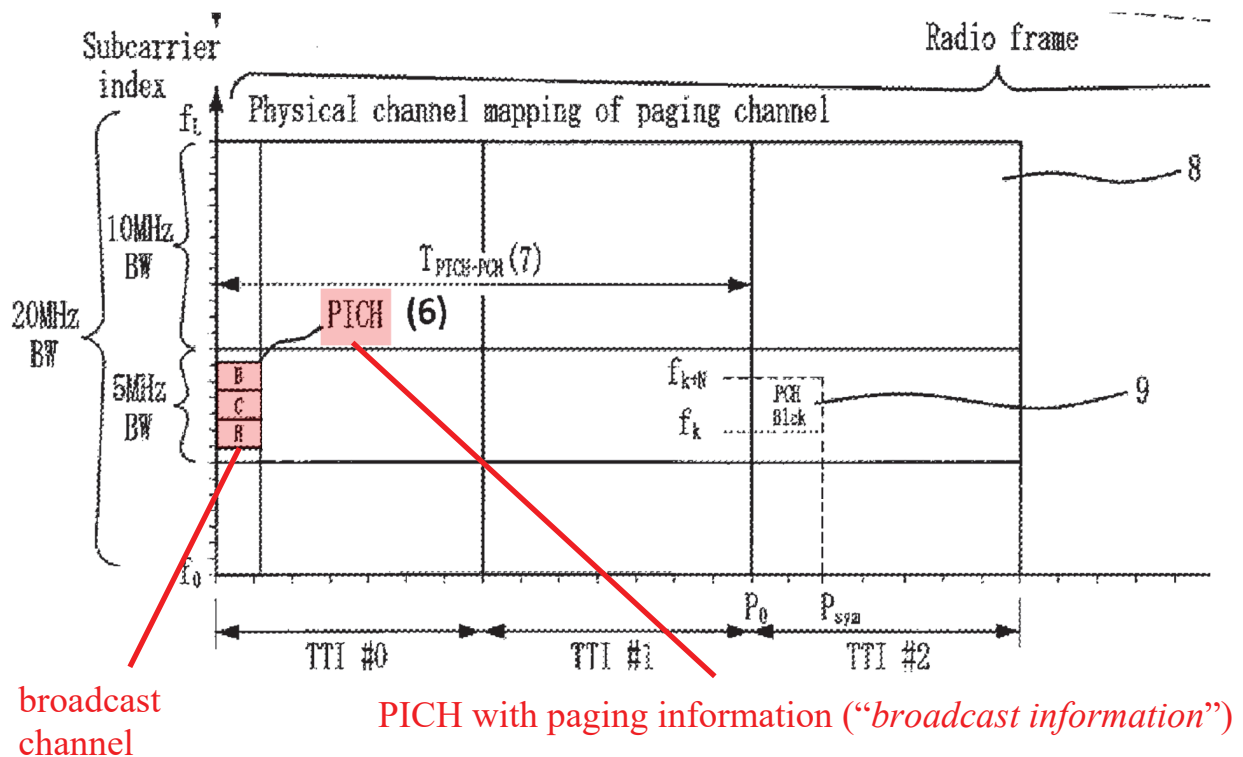
In the present embodiment, **paging information is transmitted to the terminals in the RRC Idle state through the paging indication channel**, which is a physical channel. A paging information transmitting procedure will be described in detail according to the embodiment with reference to FIGS. 1 and 2.

When **paging information 1** on a terminal or a group of terminals at a predetermined time is generated at step S110, the base station has a

paging channel (PCH) included in the transport channel based on the generated paging information at step S120.

Kim, 4:42-57.

81. The paging information is “*broadcast*” information because the Paging Indication Channel PICH is part of the Broadcast Channel BCH. The second row of Fig. 2, which shows a series of frames, illustrates the broadcast channel BCH, as shown below in Fig. 2. Ex.1005, Fig. 2.



Kim, Fig. 2 (partial, annotated).

82. Accordingly, the paging information in the PICH is “*broadcast information*” as claimed.

83. Third, it was known in the art that the PICH (which includes

“broadcast information”) is structured as “a plurality of bits.” Vayanos, for example, provides more details as to the known format of a PICH.

FIG. 2B Shows the format of one frame for the PICH. Each PICH frame includes 300 bits, which are labeled as bits b_0 through b_{299} . The first 288 bits are used for N_p paging indicators, and the last 12 bits are reserved. The number of paging indicators (N_p) in each PICH frame is configurable by the system and can take on a value of 18, 36, 72 or 144. Each paging indicator is sent in $288/N_p$ consecutive bits in the PICH frame, where $288/N_p$ can take on a value of 16, 8, 4 or 2. The $288/N_p$ bits are all set to 1 if the paging indicator is equal to 1 and are set to 0 if the paging indicator is equal to 0. The N_p paging indicators are sent in N_p paging indicator locations that are numbered from 0 through N_p-1 (not shown in FIG. 2B).

Each idle wireless device is mapped to a specific PI value based on its IMSI. **The wireless device is also assigned a paging indicator in each paging occasion**. This paging indicator is sent at a location that is determined based on a hash function $f(PI, SFN)$. The location of the paging indicator for the wireless device is thus determined by both the IMSI for the wireless device and the SFN for the paging occasion.

Vayanos, 3:26-45.

84. Accordingly, it was known for the PICH to be structured as a plurality of bits. These bits are referred to as “paging indicators.” Vayanos, 3:26-45. “The paging indicators for each idle wireless device indicate whether messages might be sent on a Paging Channel (PCH) for the wireless device.” Vayanos, 1:62-65.

Because multiple UEs may be assigned to the same paging indicator bit (or bits), a particular bit (or bits) in the PICH represents a group of terminals. This group is sometimes referred to as a paging group. *See e.g.*, Kim, 1:38-40 (“Terminals are included in a specific paging group defined for an efficient paging procedure in a system”).

85. The plurality of bits within a single PICH frame are shown in Fig. 2B below.

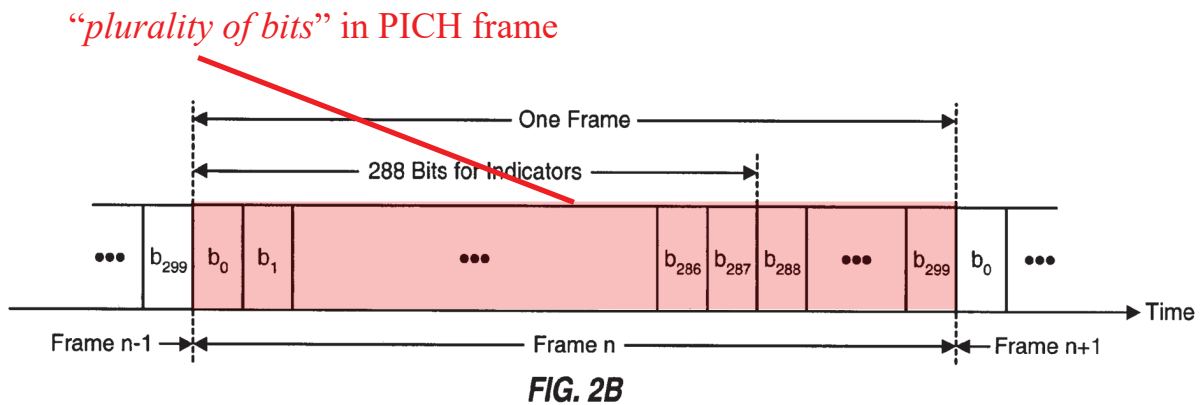
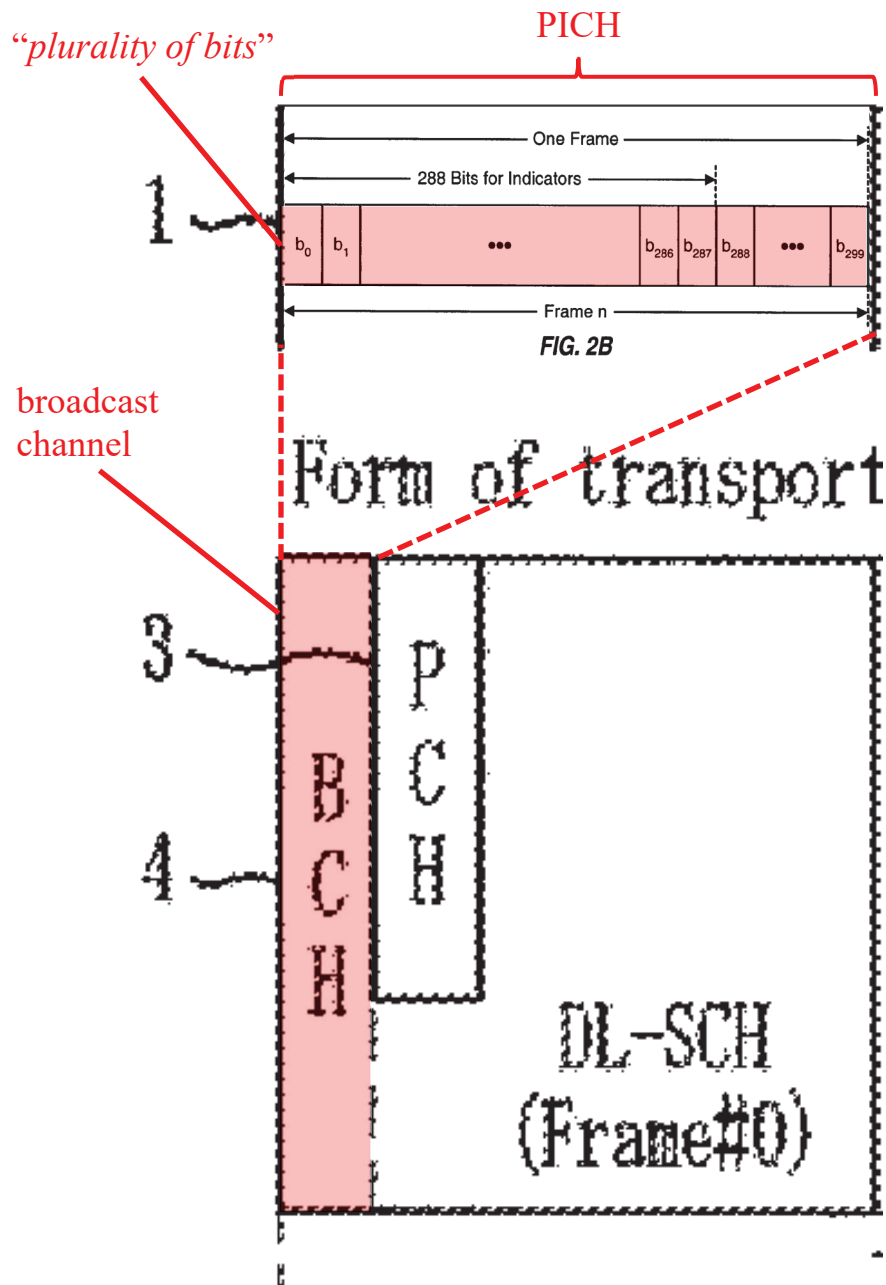


FIG. 2B

Vayanos, Fig. 2B (annotated).

86. As explained above, the PICH is part of the broadcast channel in each frame. Accordingly, for each of Kim’s frames, the PICH within the broadcast channel would include the PICH bits illustrated in Fig. 2B of Vayanos.



Vayanos, Fig. 2B and Kim, Fig. 2 (partial) (annotated).

87. Additionally, a POSITA would have understood based on background knowledge—evidenced by the Holma textbook—that a PICH includes multiple bits. *See* Ex.1015, 131-132 (“Each PICH frame carries 288 bits to be used by the

paging indicator bit.”)

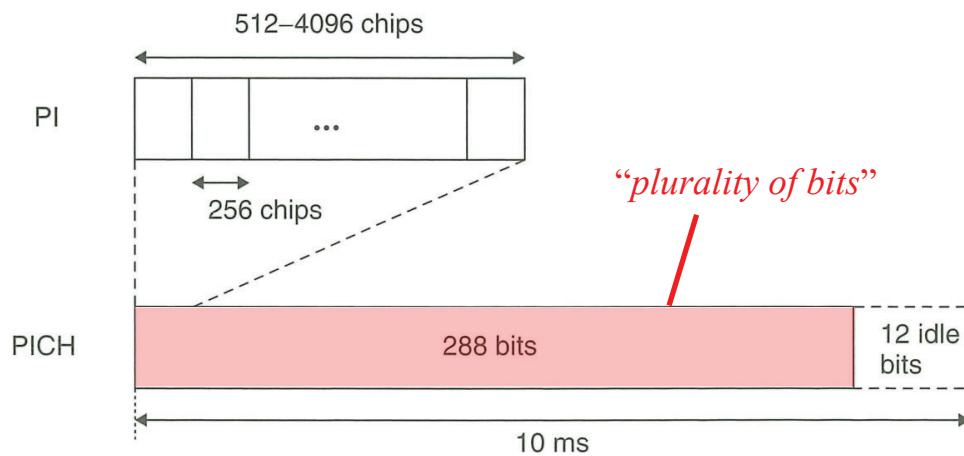


Figure 6.23. PICH structure with different PI repetition rates

Holma, Fig. 6.23 (annotated).

88. Thus, because Kim describes receiving paging information within a paging indicator channel (PICH) in the broadcast channel, and it was known for the PICH to include a plurality of indicator bits as evidenced by Vayanos, Kim and Vayanos render obvious “a receiver, the receiver configured to receive broadcast information including a plurality of bits” as claimed.

[1.2] wherein each of the plurality of bits indicates a respective time interval that physical shared channel resources are utilized to signal channels; and

89. First, as explained above at [1.1], Kim’s frames include a Paging Indication Channel PICH with “paging information,” and Vayanos teaches that such PICH paging information comprises a plurality of “paging indicators” (“plurality of bits”). Kim, 4:48-52; Vayanos, 3:26-45. Each of these paging indicators is associated with and indicates a respective time interval in which a

Paging Channel PCH may be found—e.g., if a paging indicator for a UE is set to ON, the UE looks in a specific portion of the frame for the PCH.

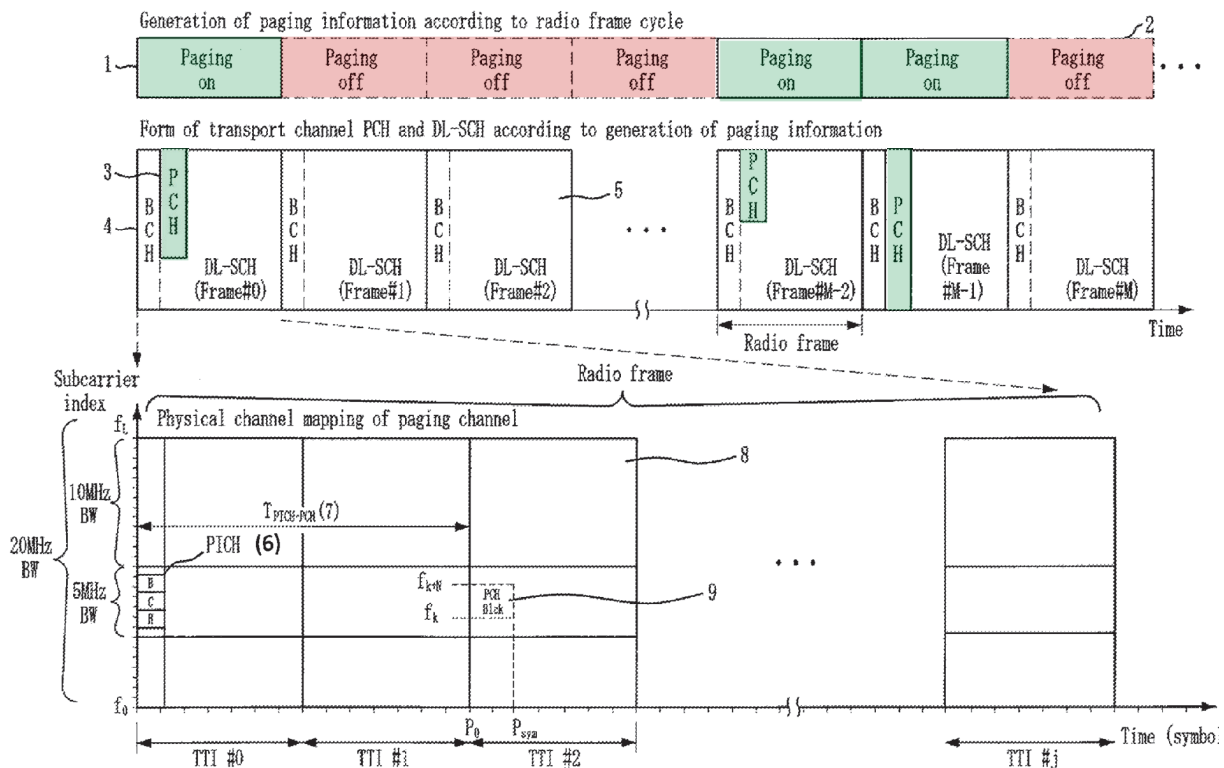
A general paging procedure is as follows. Terminals are included in a specific paging group defined for an efficient paging procedure in a system. Therefore, the base station notifies that a paging message arrives at terminals included in a corresponding group through the paging indication channel (PICH), which is a physical layer channel. The terminals monitor the paging indication channel every monitoring cycle. As a result of monitoring, when it is sensed that indication information corresponding to the group including the terminal exists in the paging indication channel, the terminals search PCH information transmitted to the S-CCPCH channel and decode paging information that an identifier (ID) Such as international mobile subscriber identity (IMSI), temporary mobile subscriber identity (TMSI), UMTS terrestrial radio access network-radio network temporary identifier (U-RNTI) exists. The terminals decoding the paging information performs following procedures corresponding to the paging information.

Kim, 1:38-55.

90. First, paging information (“*a plurality of bits*”) for each specific frame (“*respective time interval*”) indicates whether a PCH will be placed within that respective frame. In other words, if the PICH for a particular frame is ON, a PCH (green) is included in the that frame as shown below in Fig. 2. Ex.1005, 4:48-52 (“When paging information 1 on a terminal or a group of terminals at a predetermined time is generated at step S110, the base station has a paging channel

(PCH) included in the transport channel.”).

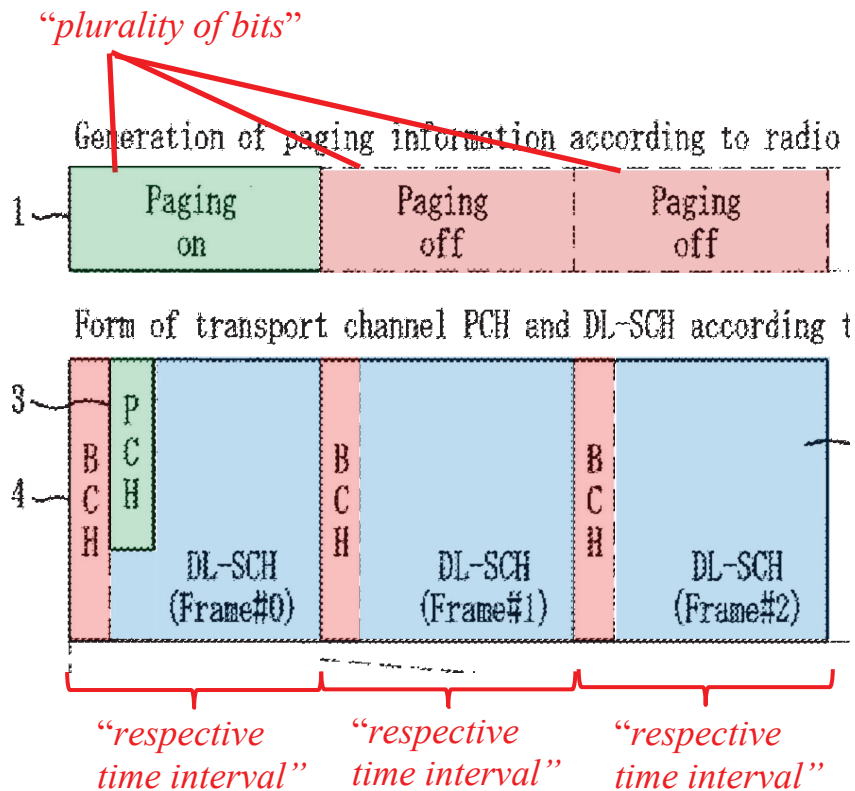
FIG. 2



Kim, Fig. 2 (annotated).

91. Accordingly, each frame is a “*respective time interval*” and the paging information for any particular frame indicates whether or not there will be a PCH within that frame. Each of these paging indicators is thus associated with and indicates a respective time interval in which a Paging Channel PCH will be found—e.g., if a paging indicator for a UE is set to ON, the UE looks in a specific frame (*time interval*) for the PCH. In other words, if any of the bits of the paging information (“*each of the plurality of bits*”) are ON for a particular frame (“*respective time interval*”), there will be a PCH within that frame as indicated by

the paging information. For example, because the paging information is on for Frame#0, there is a PCH within Frame#0. The paging information also indicates for Frame#1 and Frame#2 with “Paging off” (“*respective time intervals*”) that there will be no PCH. Kim, 1:38-55.

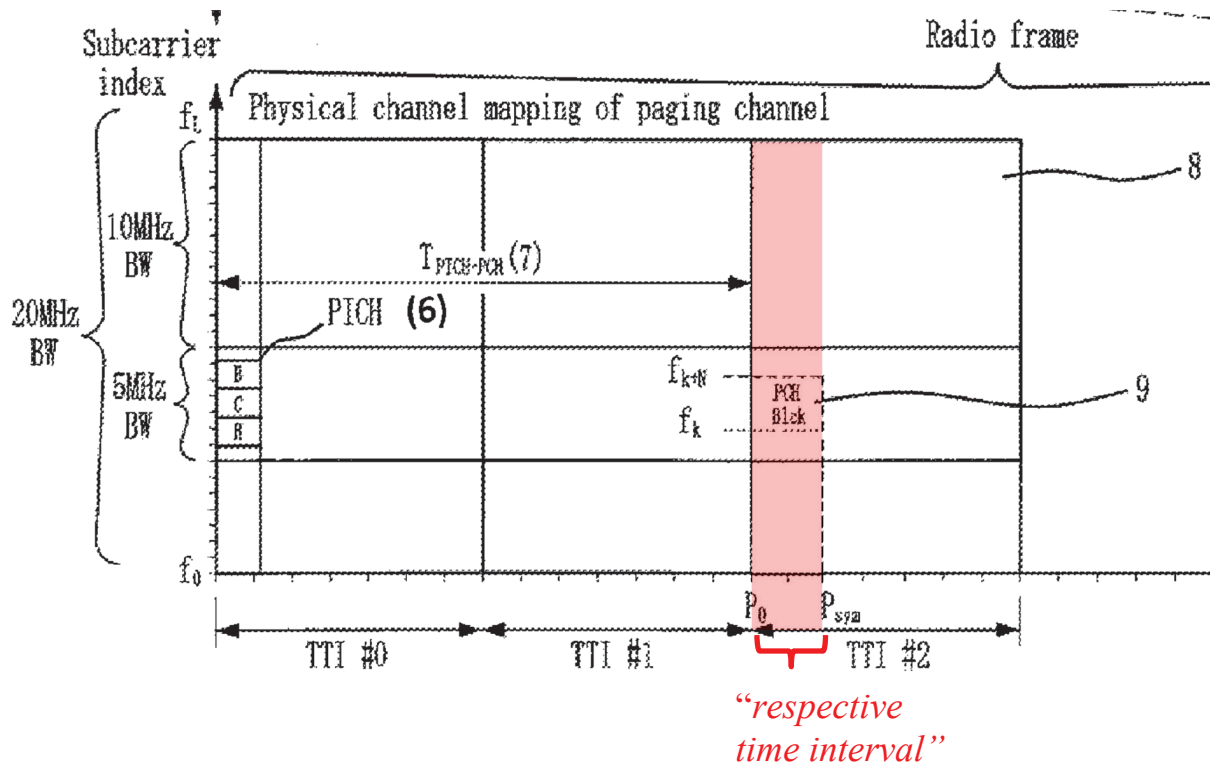


Kim, Fig. 2 (partial, annotated).

92. In an alternative example, a specific TTI within each frame is a “*respective time interval*” and the paging information for each respective frame indicates whether that frame will include a signaling channel (e.g., PCH) at a specific TTI within that frame. Kim, 4:64-6:8. Kim’s base station determines the specific time interval for each frame based on a $T_{\text{paging indication channel-PCH}}$ value 7.

“ $T_{\text{paging indication channel-PCH}}$ value is a parameter notifying a time difference between the paging indication channel and the TTI that the paging channel is transmitted.

The $T_{\text{paging indication channel-PCH}}$ value is set up as a multiple TTI.” Kim, 4:64-6:8.

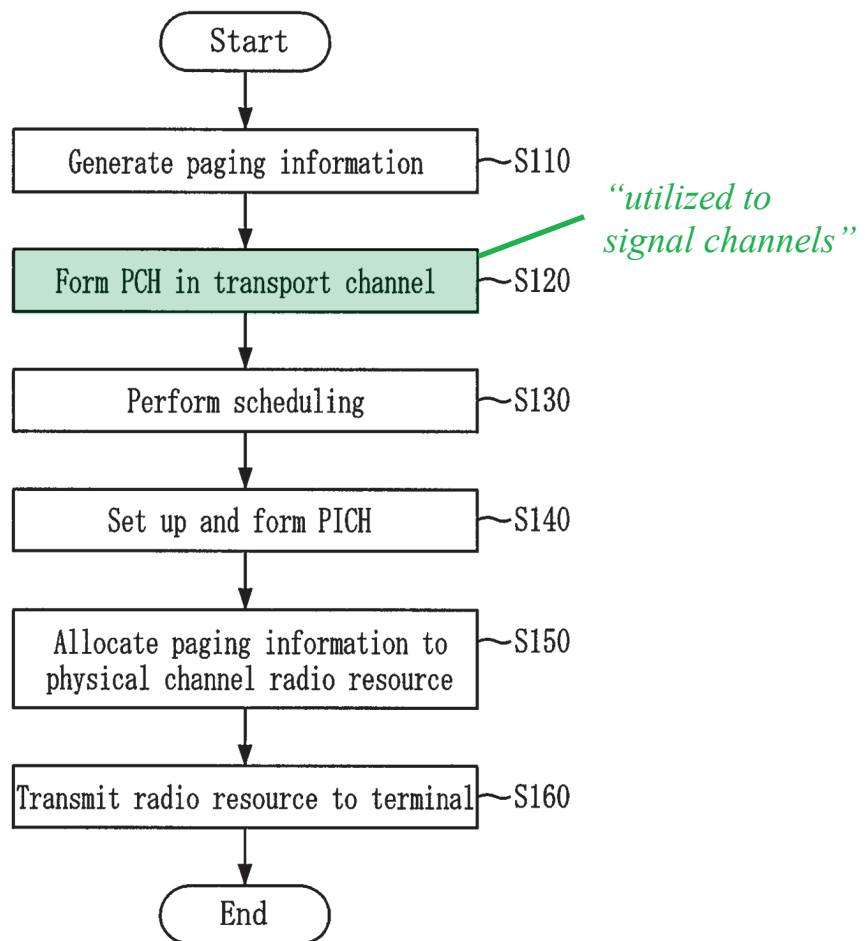


Ex.1005, Fig. 2 (partial, annotated).

93. Accordingly, for Frame#0, the paging information indicates that there will be a PCH within the frame. The bits in the paging information are thus associated with and indicate that at a respective time interval within that frame, a Paging Channel PCH may be found. Kim, 1:38-55. The UE will then check TTI#2 (“*respective time interval*”) for the PCH. See Kim, 4:64-5:9.

94. **Second**, the paging information in the PICH indicates for the respective time frame whether resources will be used as downlink shared channel

DL-SCH resources (“*shared channel resources*”) or as a paging channel (“*utilized to signal channels*”). Kim, 4:48-52, 5:8-21. Kim explains that “[w]hen paging information 1 on a terminal or a group of terminals at a predetermined time is generated at step S110, **the base station has a paging channel (PCH) included in the transport channel based on the generated paging information** at step S120.” Kim, 4:48-52.

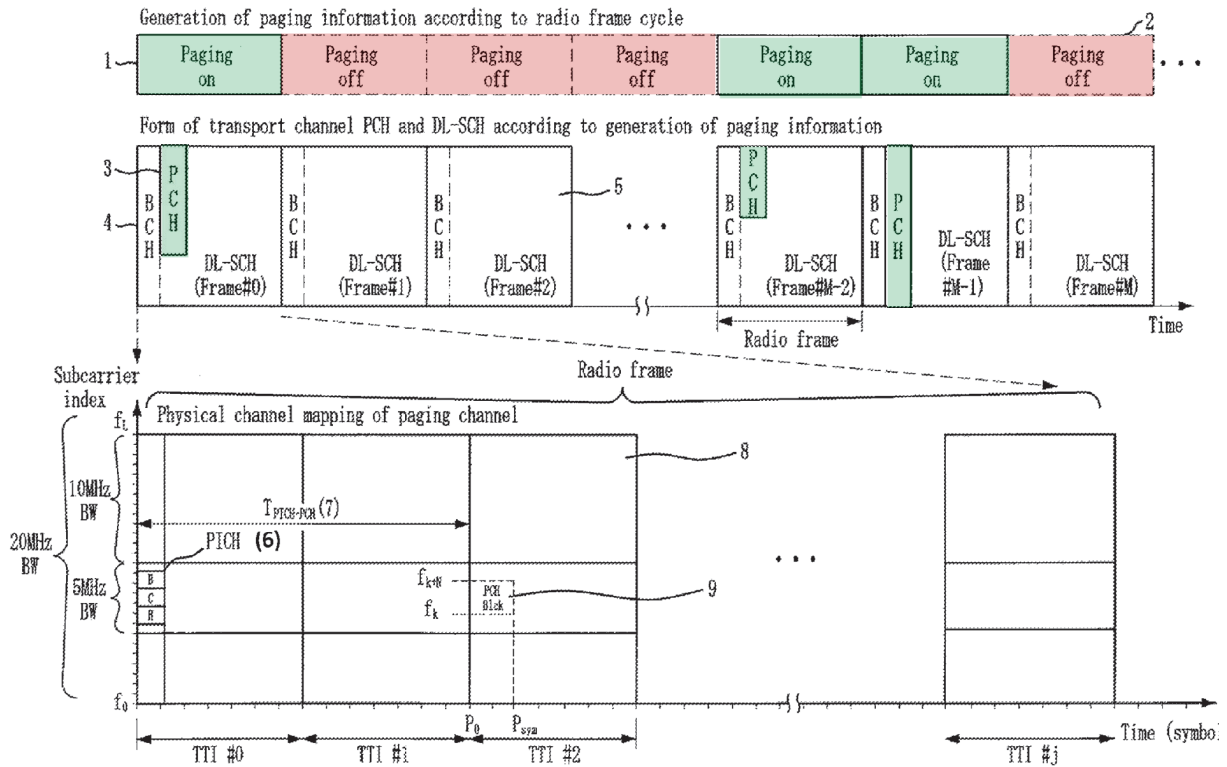


Kim, Fig. 1 (partial, annotated).

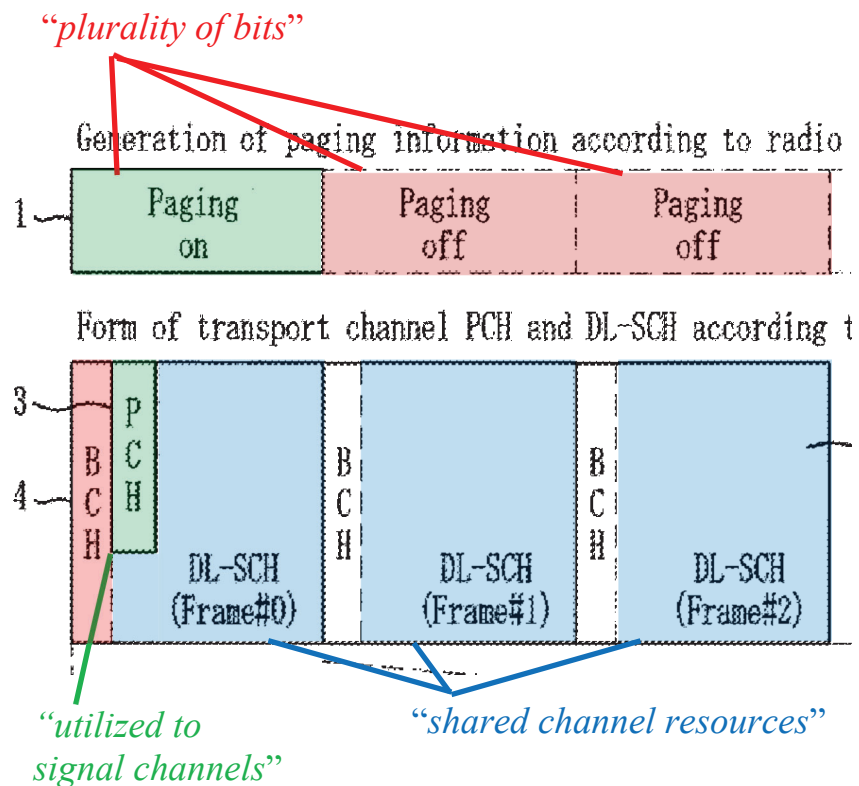
95. In other words, if the paging information (“*plurality of bits*”) for any terminal or group of terminals is ON, then a Paging Channel PCH will be included within the frame.

96. However, “[w]hen no paging information is generated (see 2 of FIG. 2), the paging channel does not exist in the transport channel of the radio frame (see 5 of FIG. 2). In this case, the paging indication channel is not also set up.” Kim, 5:8-21. Therefore, downlink shared channel (DL-SCH) information for user data transmission and not paging information of the paging channel is transmitted to the radio resource block location of the physical layer fixed and allocated for the paging channel.” Kim, 5:8-21; In other words, if no terminal within the cell is being paged and thus the paging information is OFF, then no PCH is placed within the frame. Instead, those resources are used instead as a part of downlink shared channel (DL-SCH). Kim, 5:8-21.

FIG. 2



Kim, Fig. 2 (annotated).



Kim, Fig. 2 (partial, annotated).

97. Kim illustrates this concept with respect to Fig. 2 shown above. When the paging information for any particular terminal is ON (in frame#0), the PCH is included in the frame. When the paging information is OFF (in frame#1 and frame#2), the PCH is *not* included in the frame. Instead, those radio resources are used as part of the downlink shared channel DL-SCH (*"shared channel resources"*). See Kim, 5:8-21. Accordingly, if any terminal is being paged, which may be indicated by any of the bits in the PICH (*"each of the plurality of bits"*) for each respective frame, there will be a Paging Channel PCH within that respective frame. Otherwise, those radio resources are used for shared channels. Kim, 5:8-21.

98. The PCH is a “*signal channel*” as claimed because it is used for signaling control information. Kim, 1:18-22. Kim explains that “a paging channel (PCH) is a transport channel and is transmitted through a secondary common **control** physical channel (S-CCPCH), which is a physical layer channel for transmitting **common control information**.” Kim, 1:18-22.

99. The ’416 patent itself indicates that the Paging Channel PCH is a signaling channel. ’416 patent, 9:38-42. The ’416 patent explains that “it will be appreciated by a skilled artisan that the inventive concept described herein may be applied to **any direct signalling channel, such as a paging channel**, an allocation channel such as HS-SCCH or applied to alternative comparable services.” ’416 patent, 9:38-42.

100. Thus, because the indicator bits in the PICH indicate whether the PCH (a signaling channel) is to be used in place of the DL-SCH (a shared resource channel) for each respective frame, Kim renders obvious “*each of the plurality of bits indicates a respective time interval that physical shared channel resources are utilized to signal channels*” as claimed.

[1.3] a processor, the processor communicatively coupled to the receiver and

101. **First**, as explained above at [1.1], Kim describes a terminal for receiving information.

102. **Second**, POSITA would have found it obvious for Kim’s terminal to

include a processor. For example, Vayanos describes how terminals include processors.

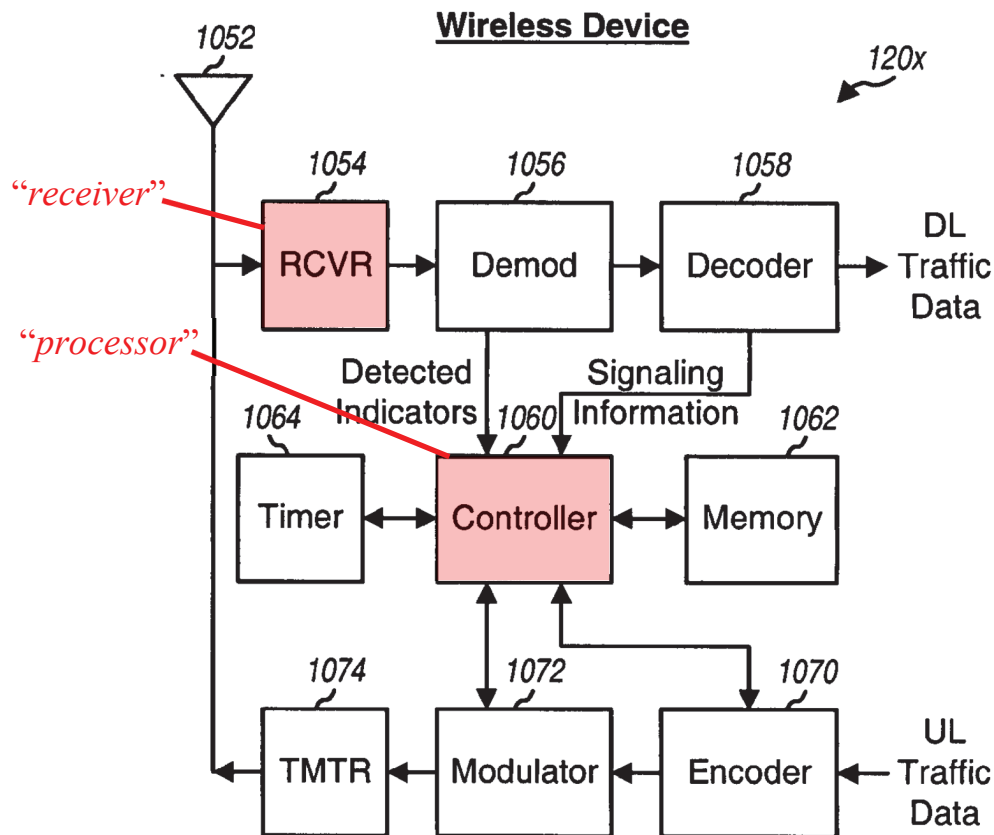
Controllers 1020 and 1060 direct the operation at base station 110x and wireless device 120x, respectively. Controllers 1020 and 1060 may also perform various functions for transmission and reception, respectively, of notification indicators and signaling information for the services. For example, controller 1020 may perform process 700 in FIG. 7 for transmission of signaling information. **Controller 1060 may perform process 800 in FIG. 8 for reception of signaling information and process 900 in FIG.9 for the counting procedure.**

Memory units 1022 and 1062 store data and program codes for controllers 1020 and 1060, respectively. A timer 1024 provides time information for controller 1020, which uses the time information to maintain the MCCH schedule. A timer 1064 provides time information for controller 1060, which uses the time information to determine when to wake up to process the PICH and MICH as well as to maintain the MCCH schedule.

The signaling transmission techniques described herein may be implemented by various means. For example, these techniques may be implemented in hardware, software, or a combination thereof. For a hardware implementation, the processing units used to transmit signaling information may be implemented within one or more application specific integrated circuits (ASICs), **digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAS), processors, controllers, micro-controllers,**

microprocessors, other electronic units designed to perform the functions described herein, or a combination thereof. The processing units used to receive signaling information may also be implemented within one or more ASICs, DSPs, and so on.

Vayanos, 12:33-64.



Vayanos, Fig. 10 (partial).

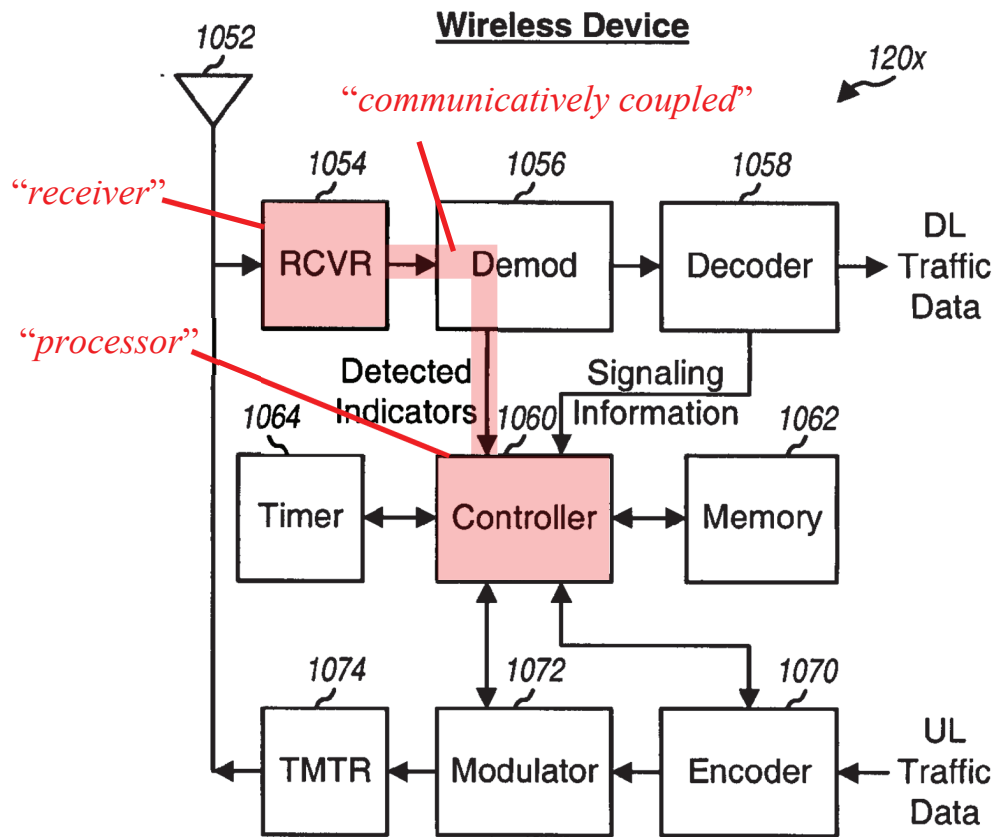
103. Third, because the controller processes data received through the receiver, the controller is “*communicatively coupled to*” the receiver.

At wireless device 120x, an antenna 1052 receives the downlink signal from base station 110x and provides a received signal to a receiver unit (RCVR) 1054. Receiver unit 1054 conditions (e.g., filters, amplifies,

and frequency down converts) the received signal, digitizes the conditioned signal, and provides data samples. A demodulator (Demod) 1056 processes the data samples and provides symbol estimates. Demodulator 1056 further performs detection for notification indicators, paging indicators, and counting flags, as directed by a controller 1060. A decoder 1058 processes (e.g., demaps, deinterleaves, and decodes) the symbol estimates and provides decoded data for the transmitted traffic data and signaling sent by base station 110x.

Vayanos, 12:12-24.

104. Accordingly, it would have been obvious for Kim's terminal to similarly include a processor that is communicatively coupled to the receiver as further illustrated in Fig. 10 below.



Vayanos, Fig. 10 (partial, annotated).

105. While a POSITA would have recognized that Kim’s terminal would have typically included a processor, a POSITA would have also found it obvious for Kim’s terminal to include a processor as taught by Vayanos.

106. Kim describes that a mobile terminal that receives and decodes information. Vayanos’s terminal predictably performs these processing functions with a processor. Vayanos describes a controller 1060 that “perform[s] various functions for transmission and reception, respectively, of notification indicators and signaling information for the services.” Vayanos, 12:34-36.

107. A POSITA would have found it obvious for Kim's terminal to similarly include a processor. Because Kim's terminal decodes and processes the received radio transmissions, it would have been obvious—if not inherent—for the terminal to include a processor, as taught by Vayanos. Doing so would achieve the predictable result of Kim's terminal receiving radio transmissions through a receiver and processing the received information with a processor.

108. Accordingly, the combination of Kim and Vayanos merely represents combining prior art elements (Kim's terminal having a processor and terminal, as taught by Vayanos) according to known methods (configuring a terminal to have a receiver and processor) to yield predictable results (a terminal with a processor to process incoming data, as taught by Vayanos). The combination also represents applying a known technique (implementing a terminal with a receiver and processor as taught by Vayanos) to a known device (Kim's terminal) ready for improvement to yield predictable results (processing received data with the processor).

109. Thus, because Kim describes a terminal that receives and processes information, and therefore it would have been obvious that that terminal would include a receiver coupled to a processor as evidenced by Vayanos, Kim and Vayanos render obvious “*a processor, the processor communicatively coupled to the receiver*” as claimed.

[1.4] a processor ... configured to monitor the signaled channels in indicated time intervals, to determine whether signaling information for the UE is present based on an identification of the UE, and

110. Kim explains that the terminals search the PCH (“*signal channels*”) at the designated time frame within each cycle (“*in the indicated time intervals*”).

According to known paging procedures, when the base station has a message for a terminal in the idle state, it will indicate as such through the bit or bits in the PICH that are assigned to that terminal (UE). *See* Kim, 1:38-40. Each of the multiple terminals (UEs) assigned to that bit or bits will then check the paging information in the paging channel (PCH) to determine whether the paging message is for that specific terminal.

A general paging procedure is as follows. Terminals are included in a specific paging group defined for an efficient paging procedure in a system. Therefore, the base station notifies that a paging message arrives at terminals included in a corresponding group through the paging indication channel (PICH), which is a physical layer channel. **The terminals monitor the paging indication channel every monitoring cycle.** As a result of monitoring, when it is sensed that indication information corresponding to the group including the terminal exists in the paging indication channel, **the terminals search PCH information transmitted to the S-CCPCH channel and decode paging information that an identifier (ID) such as international mobile subscriber identity (IMSI), temporary mobile subscriber identity (TMSI), UMTS terrestrial radio access network-radio**

network temporary identifier (U-RNTI) exists. The terminals decoding the paging information performs following procedures corresponding to the paging information.

Kim, 1:38-40.

111. Accordingly, each terminal in the paging group checks the paging channel (PCH) and checks the identifier (e.g., IMSI, TMSI, or U-RNTI) to see if the paging message is for that particular terminal. Vayanos describes this process as well.

In UMTS, a Page Indicator Channel (PICH) is used to send paging indicators to idle wireless devices. An idle wireless device is a wireless device for which the PICH and MICH are useful. An idle wireless device may be a wireless device operating in an idle mode, a wireless device operating in an RRC connected mode but in a CELL PCH/URA PCH state. The paging indicators for each idle wireless device indicate whether messages might be sent on a Paging Channel (PCH) for the wireless device. The PCH is a transport channel that is carried in a Secondary Common Control Physical Channel (S-CCPCH). **Each idle wireless device monitors the PICH for its paging indicators. If these paging indicators are set to '1', then the wireless device processes the S-CCPCH to look for any messages sent for the wireless device.**

Vayanos, 2:56-3:2.

112. As explained above at [1.3], the terminal is controlled by a processor.

See Vayanos, 12:33-64. Accordingly, in a known paging procedure, the terminals

will read the PCH and use their identifiers to determine whether there is a message for that terminal “*configured to monitor the signaled channels in indicated time intervals, to determine whether signaling information for the UE is present based on an identification of the UE.*”

113. Thus, because Kim describes the known paging procedure in which a terminal receiving a paging indicator through the PICH will search the Paging Channel (PCH) for any messages based on that terminal’s identifier, Kim renders obvious “*a processor ... configured to monitor the signaled channels in indicated time intervals, to determine whether signaling information for the UE is present based on an identification of the UE*” as claimed.

[1.5] *a processor ... to process the signaling information in response to the determination that signaling information for the UE is present.*

114. Kim explains that the terminals decode the paging information in which an identifier exists (“*process the signaling information*”), which happens in response to determining that the PCH message is for that terminal (“*in response to the determination that signaling information for the UE is present.*”)

As a result of monitoring, when it is sensed that indication information corresponding to the group including the terminal exists in the paging indication channel, the terminals search PCH information transmitted to the S-CCPCH channel and decode paging information that an identifier (ID) such as international mobile subscriber identity (IMSI), temporary mobile subscriber identity

(TMSI), UMTS terrestrial radio access network-radio network temporary identifier (U-RNTI) exists. **The terminals decoding the paging information performs following procedures corresponding to the paging information.**

Kim, 1:53-55.

115. Vayanos provides additional details as to this known paging procedure. For example, Vayanos explains that “[e]ach idle wireless device monitors the PICH for its paging indicators. If these paging indicators are set to ‘1’, then the wireless device processes the S-CCPCH to look for any messages sent for the wireless device.” Vayanos 2:65-3:2. “Whenever the notification indicator for any desired service is set to 1, the wireless device further processes the S-CCPCH to look for updated signaling information sent for that service.” Vayanos, 4:14-18. As explained above at [1.3], the terminal is controlled by a processor. *See* Vayanos, 12:33-64.

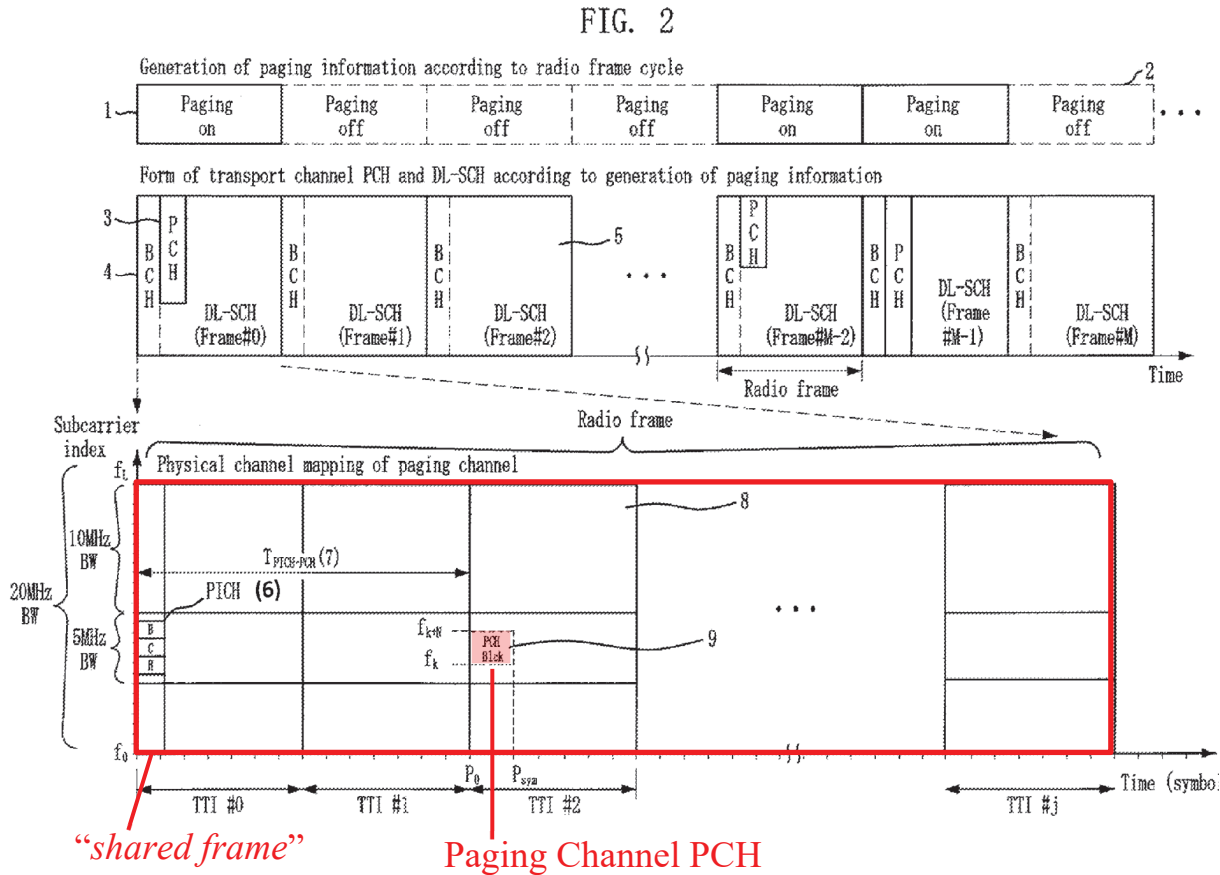
116. Thus, because Kim describes the known paging procedure in which a processor causes the terminal to process signaling information in the paging channel PCH if that signaling information is intended for that terminal, Kim renders obvious “*a processor ... to process the signaling information in response to the determination that signaling information for the UE is present*” as claimed.

5. Claim 2

[2.1] *The UE of claim 1, wherein the respective time interval or each indicated*

time interval is part of a shared frame that is allocated by a network device.

117. First, as explained above at [1.2], one example of a “time interval” as claimed is the TTI in which the PCH is placed. As illustrated within Kim’s Fig. 2, the TTI for the PCH 9 is within a radio frame (“shared frame”).



Kim, Fig. 2 (annotated).

118. Kim’s radio frame is a “shared” frame because it is shared by multiple terminals. Indeed, a portion of each frame is a broadcasting channel (BCH) as shown in Fig. 2 of Kim and another portion is used as a “downlink shared channel DL-SCH.” Kim, 5:17-18. “The cellular system for the packet service may

maximize applicability of a limited radio resource by sharing the radio resource between a base station and a terminal in consideration of a burst characteristic of packet service data differently from a circuit.” Kim, 3:38-40. “**In the packet transmission system**, since **the terminals in the base station share radio resources**, scheduling information for addressing the radio resource allocated to a terminal or a terminal group should be transmitted such that the terminals in the base station can recognize the scheduling information.” Kim, 4:29-36.

119. Second, the shared frames are allocated by a base station (“*network device*”). See Kim, 4:64-67 (“The base station performs mapping on the paging channel with a radio resource block location 9 of a physical layer allocated at TTI 8 as a fixed size and location.”); Kim 4:57-61 (“the base station sets up a paging indication channel 6 corresponding to the terminal or the terminal group indicated by the paging information”). Accordingly, because the paging indication channel and paging channel PCH are established and scheduled by the base station, the frames to which they belong are allocated by the base station.

120. Thus, because Kim describes that the paging channel PCH is within a shared radio frame that is scheduled and transmitted by the base station, Kim renders obvious “*wherein the respective time interval or each indicated time interval is part of a shared frame that is allocated by a network device*” as claimed.

6. Claim 3

[3.1] The UE of claim 1, wherein the broadcast information is received on a broadcast channel.

121. As explained above at [1.1], the paging information (“*broadcast information*”) is received on a broadcasting channel BCH. Kim, 4:42-57; Fig. 2. Accordingly, Kim renders obvious “*wherein the broadcast information is received on a broadcast channel*” as claimed.

7. Claim 4

[4.1] The UE of claim 1, wherein the respective time interval or each indicated time interval is two or more timeslots.

122. As explained above at [1.2], one example of the claimed “*respective time interval*” is the respective frame in which the PCH is scheduled. As shown in Kim’s Fig. 2, each frame includes multiple transmission time intervals (TTIs) (“*two or more timeslots*”).

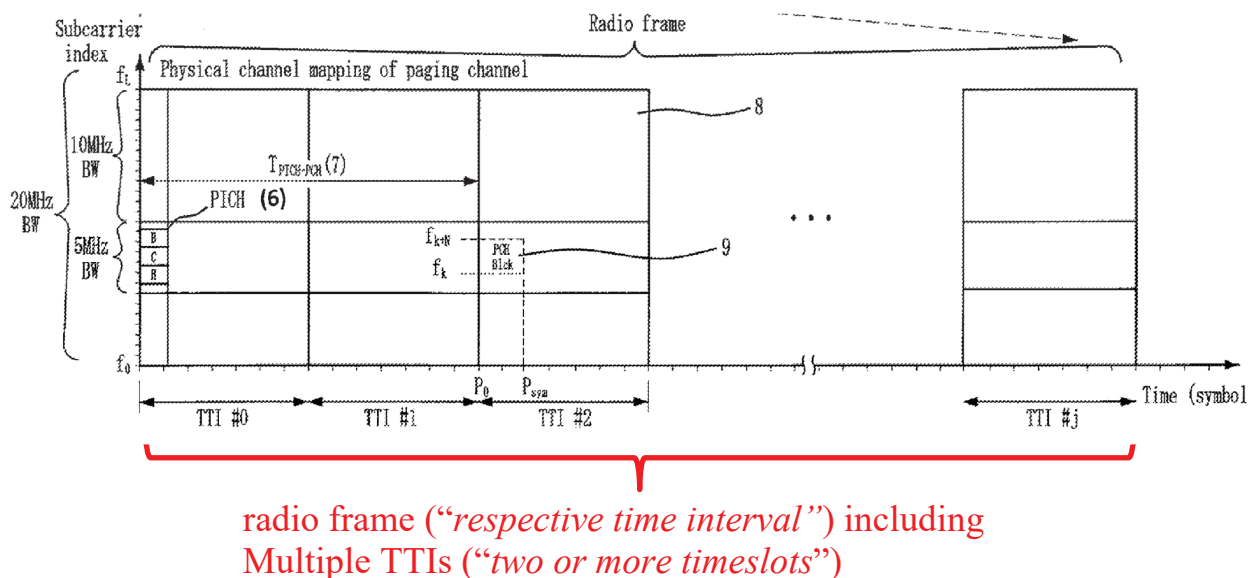
The scheduler performs scheduling on broadcasting channel (BCH) information, created paging channel information and, traffic information to be transmitted to the terminal **based on a transmission time interval (TTI) at step S130.**

Kim, 4:53-56.

The base station performs mapping on the paging channel with a radio resource block location 9 of **a physical layer allocated at TTI 8** as a fixed size and location, e.g., a time index and a sub-carrier index, based on a $T_{\text{paging indication channel-PCH}}$ value 7 at step S150, modulates and codes

a radio resource based on the pre-setup modulating and coding methods, and transmits the radio resource to the terminal at step S160. $T_{\text{paging indication channel-PCH}}$ value is a parameter notifying a time difference between the paging indication channel and the TTI that the paging channel is transmitted. The $T_{\text{paging indication channel-PCH}}$ value is set up as a multiple TTI.

Kim 4:64-5:8.



123. Thus, because Kim's radio frame includes multiple TTIs, Kim renders obvious "wherein the respective time interval or each indicated time interval is two or more timeslots" as claimed.

8. Claim 5

[5.1] The UE [of] claim 1, wherein the UE powers down radio circuitry outside of the indicated time intervals.

124. First, Kim explains that mobile terminals will enter an idle state at low power when not engaged in active communication with the base station.

Conventional paging information is transmitted to the terminals in an idle state, i.e., the terminals performing low power consumption, through a paging channel, and the terminals providing a service through a dedicated channel. In the LTE system, the terminals are defined as following states in consideration of Radio Resource Control (RRC) and Medium Access Control (MAC).

In consideration of RRC, the terminal state is managed as RRC Connected and RRC_Idle states. The RRC_Connected denotes a state that the RRC is connected between the base station and the terminal. In the RRC_Connected state, the base station manages mobility of the terminal, and stores and manages a RRC_context. **The RRC Idle denotes a state that the RRC is not connected between the base station and the terminal.** In the RRC_Idle state, access GateWay (aGW) manages mobility of the terminal. **The terminal in the RRC-Idle state performs a low power consumption, i.e., power saving operation,** according to a discontinuous reception (DRX) cycle based on RRC configuration.

Kim, 3:48-67.

125. Vayanos similarly describes terminals entering the low power state.

In UMTS, a Page Indicator Channel (PICH) is used to send paging indicators to idle wireless devices. An idle wireless device is a wireless device for which the PICH and MICH are useful. **An idle wireless device may be a wireless device operating in an idle mode,** a wireless device operating in an RRC connected mode but in a CELL PCH/URA PCH state. The paging indicators for each idle wireless device indicate whether messages might be sent on a Paging Channel (PCH) for the

wireless device. The PCH is a transport channel that is carried in a Secondary Common Control Physical Channel (S-CCPCH). **Each idle wireless device monitors the PICH for its paging indicators. If these paging indicators are set to '1', then the wireless device processes the S-CCPCH to look for any messages sent for the wireless device.**

Vayanos, 2:56-3:2.

126. Second, by entering the idle state, the terminal “*powers down radio circuitry*” as claimed. Kim explains that a “terminal in the RRC_Idle state performs a low power consumption, i.e., power saving operation, according to a discontinuous reception (DRX) cycle based on RRC configuration.” Kim, 3:64-67. “Conventional paging information is transmitted to the terminals in an idle state, i.e., the terminals performing low power consumption.” Kim, 3:49-51. “Conventional paging information is transmitted to the terminals in an idle state, i.e., the terminals performing low power consumption.” Kim, 4:57-59. Kim further explains that the power is used for radio resources: “another radio resource, i.e., power,” Accordingly, by entering into an idle state (low power state), a terminal provides less power to the radio circuitry of that terminal.

127. Third, the terminal remains in the idle state in frames where there is no paging information for that terminal (“*outside of the indicated time intervals*”). As explained above at [1.2], the claimed time interval is a specific frame in which the PICH indicates there is paging information for a terminal.

128. Thus, because Kim’s terminal—following known paging procedures—goes into an idle state to power down its radio circuitry outside of frames with a PCH placed within, Kim renders obvious “*wherein the UE powers down radio circuitry outside of the indicated time intervals*” as claimed.

9. Claim 6

[6.0] *The UE of claim 1, wherein the identification of the UE is assigned by a network device to decode the signaling information.*

129. First, as mentioned above at [1.4], Kim uses an assigned identifier “such as international mobile subscriber identity (IMSI), temporary mobile subscriber identity (TMSI), UMTS terrestrial radio access network-radio network temporary identifier (U-RNTI)” to identify a particular terminal.

130. Second, a POSITA would have understood that the U-RNTI is assigned by the RNC (“*a network device*”) within the UTRAN network. *See generally* Holma. A U-RNTI is a UTRAN Radio Network Temporary Identifier that is assigned by the RNC during a connection set-up request. As explained in Holma, a 3GPP textbook:

In the RRC connection establishment procedure this initial UE identifier is used only for the purpose of uniqueness and can be discarded by UTRAN after the procedure ends. Thus, when these UE identities are later needed for the higher layer (non-access stratum) signalling, they must be resent (in the higher layer messages). **The RRC Connection set-up message may** include a dedicated physical

channel assignment for the UE (move to Cell_DCH state), or it can **command the UE to use common channels** (move to Cell_FACH state). In the latter case, **a radio network temporary identity (U-RNTI and possibly C-RNTI) to be used as UE identity on common transport channels is allocated to the UE.**

Holma, 171.

131. As shown in Fig. 7.17 below, the RRC Connection set-up message, which allocates the U-RNTI, is sent by the RNC (“a network device”).

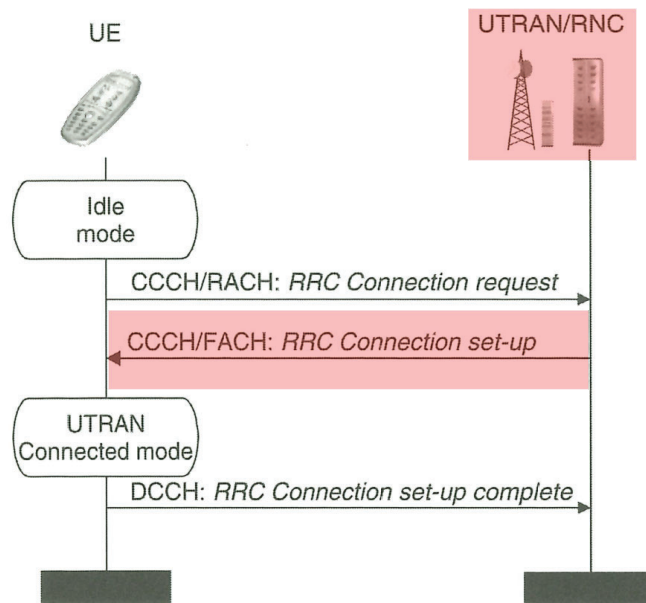


Figure 7.17. RRC connection establishment procedure

Holma, Fig. 7.17 (annotated).

132. Accordingly, a POSITA would have understood—based on background knowledge evidenced by the Holma textbook—that Kim’s U-RNTI is assigned by a radio network controller (RNC). *See also.*, Yi, 3:65-66 (“**U-RNTI** (UTRAN RNTI) consists of an SRNC identity and an S-RNTI”); Yi, 3:54-55 (“S-

RNTI (Serving RNC RNTI) is **assigned by an SRNC (Serving RNC)**). In other words, the U-RNTI is not something that is assigned by the UE's manufacturer, but is a temporary identifier used for RRC connection sessions. *See* Holma, 171-72.

133. Third, as also explained above at [1.4], the identifier such as the U-RNTI is used to decode the information within the PCH.

134. Thus, because Kim's terminal uses a U-RNTI assigned by the base station to decode paging information, and a POSITA would have understood that the U-RNTI is assigned by the RNC, Kim renders obvious "*wherein the identification of the UE is assigned by a network device to decode the signaling information*" as claimed.

10. Claims 7-12

135. Claims 7-15 recite a "method" that performs the functions of the user equipment (UE) recited in claims 1-6, respectively. Accordingly, in the analysis of claims 7-12 below, I refer back to the corresponding limitation of claims 1-6, respectively, where appropriate.

11. Claim 7

[7.0] *A method performed by a user equipment (UE), the method comprising:*

136. *See* [1.0]. As explained above at [1.0], Kim explains that a terminal ("UE") receives transmissions from a base station. Specifically, Kim describes "a **method** for transmitting paging information ... from a base station **to a terminal**"

(“*user equipment (UE)*”) in a cellular system. Ex.1005, 1:5-10; *see also* Ex.1005, claim 1 (“A **method** for decoding paging information **at a terminal** in a wireless communication system.”). For the reasons that Kim’s UE performs the functionality recited in claim 1, Kim teaches the method steps performed by the UE as recited in the claim.

[7.1] *receiving, by the UE, broadcast information including a plurality of bits,*

137. See [1.1].

[7.2] *wherein each of the plurality of bits indicates a respective time interval that physical shared channel resources are utilized to signal channels;*

138. See [1.2].

[7.3] *monitoring, by the UE, the signaled channels in indicated time intervals;*

139. See [1.4].

[7.4] *determining, by the UE, whether signaling information for the UE is present based on an identification of the UE; and*

140. See [1.4].

[7.5] *processing, by the UE, the signaling information in response to the determination that signaling information for the UE is present.*

141. See [1.5].

12. Claim 8

[8.1] *The method of claim 7, wherein the respective time interval or each indicated time interval is part of a shared frame that is allocated by a network device.*

142. See [2.1].

13. Claim 9

[9.1] *The method of claim 7, wherein the broadcast information is received on a broadcast channel.*

143. *See [3.1].*

14. Claim 10

[10.1] *The method of claim 7, wherein the respective time interval or each indicated time interval is two or more timeslots.*

144. *See [4.1].*

15. Claim 11

[11.1] *The method [of] claim 7, wherein the UE powers down radio circuitry outside of the indicated time intervals.*

145. *See [5.1].*

16. Claim 12

[12.1] *The method of claim 7, wherein the identification of the UE is assigned by a network device to decode the signaling information.*

146. *See [6.1].*

B. Ground 2: Claims 1-12 are obvious under 35 U.S.C. § 103 over Kim, Vayanos, and AAPA.

147. To the extent it is argued that any of the limitations for which AAPA is cited below is not sufficiently taught by Kim and Vayanos, it would have been obvious for Kim or Vayanos to be implemented according to known prior art techniques as evidenced by the AAPA.

1. Applicant Admitted Prior Art (AAPA)

148. The background section of the '416 patent provides several columns of text that describe what was known in the art as of the earliest claimed priority date of the '416 patent, particularly the known paging procedures. *See* '416 patent, 1:25-5:50. The background section refers to three separate figures, each of which is labeled as prior art. *See* '416 patent, Figs. 1-3. The background repeatedly uses phrases such as “in the known art” and “it is known.” *See* '416 patent, 1:25-5:50. It is my opinion that the background section of the '416 patent represents Applicant Admitted Prior Art (AAPA) that is representative of the background knowledge of a POSITA.

149. The analysis in Ground 1 shows how each claim limitation is taught by the prior art references Kim and Vayanos. Ground 2 additionally cites to the AAPA of the '416 patent background to show that the teachings of Kim and Vayanos are consistent with what the applicant of the '416 patent understood to be prior art. For example, the AAPA also shows that (i) a PICH includes a plurality of bits (relevant to [1.1]), (ii) the terminal monitors the PCH at the designated time interval (relevant to [1.4]), and (iii) the terminal processes the signaling information (relevant to [1.5]). *See* '416 patent, 1:25-5:50

2. Reasons to Combine the AAPA with Kim and Vayanos

150. A POSITA would have found it obvious for Kim's terminal to operate

according to known paging procedures consistent with the 3GPP standards, which are described in the AAPA of the '416 patent background section.

151. Kim describes a known method for paging, which includes using the Paging Indication Channel PICH and the Paging Channel PCH. In particular, Kim describes “setting a **paging indication channel (PICH)** based on the paging information and forming the paging indication channel in a radio resource of a physical layer.” Kim, 2:34-37. “[P]aging information is transmitted to the terminals in the RRC Idle state through the paging indication channel.” Kim, 4:42-45. “The terminals monitor the paging indication channel every monitoring cycle.” Kim, 1:43-44. “As a result of monitoring, when it is sensed that indication information corresponding to the group including the terminal exists in the paging indication channel, the terminals search PCH information transmitted to the S-CCPCH channel and decode paging information.” Kim, 1:44-49.

152. Kim further describes how an identifier is used for decoding the information in the paging channel. “[T]he terminals search PCH information transmitted to the S-CCPCH channel and decode paging information that an identifier (ID) such as international mobile subscriber identity (IMSI), temporary mobile subscriber identity (TMSI), UMTS terrestrial radio access network-radio network temporary identifier (U-RNTI) exists.” Kim, 1:47-52.

153. The AAPA in the background section of the '416 patent describes a

similar paging process. Like the RRC idle state described in Kim (4:42-45), the AAPA explains that to conserve battery power, “it is known for the UE 120 to go into an idle state, whereby the UE powers down its radio frequency circuitry (RF).” ’416 patent, 1:54-57. When the idle UE powers on its radio circuitry, it will check what is called the Paging Indication Channel PICH. ’416 patent, 2:11-20. “The PICH comprises multiple indicator bits. Each UE is associated with one of the indicator bits within the PICH.” ’416 patent, 2:12-14. “When in the idle state, the UE periodically decodes the PICH to see if the indicator bit with which it is associated has been set.” ’416 patent, 2:16-18.

154. According to the AAPA, and like what is described in Kim, the Paging Indication Channel PICH is associated with a Paging Channel PCH. “If the relevant indicator has been set, the UE then reads the [Paging Channel] PCH.” ’416 patent, 2:19-20. “The PCH is a downlink transport channel that is used to carry control information to a UE.” ’416 patent, 2:7-8.

155. To decode the information in the Paging Channel PCH, the AAPA describes that the UE uses an identifier. ’416 patent, 2:21-34. “Each UE has a unique identifier (UE-ID).” ’416 patent, 2:21-25. When the network pages a UE, as previously mentioned, the network ... transmits the UE-ID for the UE being paged, and the relevant message within the PCH.” ’416 patent, 2:21-25. Accordingly, “in the known art, the indicator bits are used in a paging channel to inform the UE

whether it needs to turn its radio on for reading the PCH (i.e. as a battery saving mode).” ’416 patent, 2:30-31.

156. A POSITA would have found it obvious for Kim’s terminals to operate in the known manner of performing paging operations as described in the AAPA. Both Kim and the AAPA describe similar paging procedures. Indeed, both Kim and the AAPA refer to industry standards for UMTS systems as provided by 3GPP. The AAPA refers to “Known cellular communication systems, such as a **Universal Mobile Telecommunications System (UMTS)** Radio Access Network (UTRAN), standardised by the 3rd Generation Partnership Project (**3GPP**).” ’416 patent, 1:25-28. Kim similarly describes a “conventional cellular system” such as a “3rd Generation Partnership Project (**3GPP**) system of a Wideband Code Division Multiple Access (WCDMA) method,” which may use a “**UMTS** terrestrial radio access network-radio network temporary identifier (U-RNTI).” Kim, 1:14-17, 1:51-52. A POSITA would have recognized that Kim’s 3GPP system of a WCDMA method is also known as the UMTS radio network. Because both Kim and the AAPA describe various aspects of the known paging procedure, a POSITA would have reasonably expected success in implementing Kim’s terminal with any of the known paging procedures as described by the AAPA.

157. A POSITA would have found it beneficial to implement known and standardized paging procedures (such as those described in the AAPA) to ensure

compatibility and marketability of the product. Moreover, a POSITA would have found it beneficial and advantageous to implement Kim's devices with standardized paging techniques (e.g., bits in the PICH, monitoring the PCH, decoding the PCH using an identifier) because such standardized techniques have already been well vetted and tested for workability. Indeed, the combination is nothing more than the predictable use of prior art elements according to their established functions.

158. Thus, the combination of Kim with the AAPA is merely combining prior art elements (Kim's devices and AAPA paging procedures) according to known methods (e.g., bits in the PICH, monitoring the PCH, decoding the PCH using an identifier) to yield predictable results (using the PICH to instruct specific terminals to check and decode information in the PCH). The combination is also merely a known technique (AAPA paging procedures that were known in the art) to a known method (Kim's paging procedure) to yield predictable results (using the PICH to instruct specific terminals to check and decode information in the PCH).

3. Claim Analysis

159. The claim analysis for this ground is substantially the same as that of Ground 1. To the extent Patent Owner argues that the teachings of Kim or Vayanos are lacking for any limitation in Ground 1 that additionally cites to AAPA, it would have been obvious to modify Kim for the reasons explained at VIII.B.2.

4. Claim 1

[1.0] *A user equipment (UE) comprising:*

160. See [1.0], Ground 1.

[1.1] *a receiver, the receiver configured to receive broadcast information including a plurality of bits,*

161. See [1.1], Ground 1.

162. Additionally, the AAPA in the '416 patent background section confirms that a PICH includes a plurality of bits. "**In the known art**, the PCH comprises two blocks: the Paging Indicator CHannel (PICH) and the PCH itself. **The PICH comprises multiple indicator bits**. Each UE is associated with one of the indicator bits within the PICH." '416 patent, 2:11-14. Accordingly, it would have been obvious for Kim's PICH to similarly include a plurality of bits.

163. Thus, because Kim's disclosure of a terminal receiving paging information within a paging indicator channel (PICH) in the broadcast channel, in view of Vayanos's disclosure of a receiver in a terminal receiving the standard PICH with a plurality of indicator bits and confirmed by AAPA, the prior art renders obvious "*a receiver, the receiver configured to receive broadcast information including a plurality of bits*" as claimed.

[1.2] *wherein each of the plurality of bits indicates a respective time interval that physical shared channel resources are utilized to signal channels; and*

164. See [1.2], Ground 1.

[1.3] *a processor, the processor communicatively coupled to the receiver and*

165. See [1.3], Ground 1.

[1.4] *configured to monitor the signaled channels in indicated time intervals, to determine whether signaling information for the UE is present based on an identification of the UE, and*

166. See [1.4], Ground 1.

167. Additionally, the AAPA of the '416 patent background confirms that this paging procedure is known. The '416 patent explains that "Each UE has a unique identifier (UE-ID). When the network pages a UE, as previously mentioned, the network sets the relevant indicator within the PICH for that UE, and transmits the UE-ID for the UE being paged, and the relevant message within the PCH." '416 patent, 2:21-25. "In this manner, since more than one UE may be associated with an indicator bit in the PICH, the UE-ID enables a UE to determine whether the message is intended for that UE or not." '416 patent, 2:26-28. "If the PCH contains the UE-ID for the UE, the UE then reads the message, and performs the required actions. Thus, in the known art, the indicator bits are used in a paging channel to inform the UE whether it needs to turn its radio on for reading the PCH (i.e. as a battery saving mode)." '416 patent, 2:28-34.

168. Thus, because Kim describes the known paging procedure (confirmed by AAPA) in which a terminal receiving a paging indicator through the PICH will search the Paging Channel (PCH) for any messages based on that terminal's

identifier, Kim renders obvious “*configured to monitor the signaled channels in indicated time intervals, to determine whether signaling information for the UE is present based on an identification of the UE*” as claimed.

[1.5] *to process the signaling information in response to the determination that signaling information for the UE is present.*

169. See [1.5], Ground 1.

170. Additionally, the AAPA in the ’416 patent background also shows that this was part of the known paging procedure. “In this manner, since more than one UE may be associated with an indicator bit in the PICH, the UE-ID enables a UE to determine whether the message is intended for that UE or not. If the PCH contains the UE-ID for the UE, the UE then reads the message, and performs the required actions.” ’416 patent, 2:25-30.

171. Thus, because Kim describes the known paging procedure (confirmed by AAPA) in which a terminal processes signaling information in the Paging Channel PCH if that signaling information is intended for that terminal, Kim renders obvious “*to process the signaling information in response to the determination that signaling information for the UE is present*” as claimed.

5. Claims 2-4

172. See claims 2-4, Ground 1.

6. Claim 5

[5.1] *The UE claim 1, wherein the UE powers down radio circuitry outside of the*

indicated time intervals.

173. See [5.1], Ground 1.

174. Additionally, the idle state described by Kim is consistent with the idle state described in the '416 patent, in which radio circuitry is powered down. The AAPA in the '416 patent background section states: “In order to conserve battery life, when a UE 120 is not involved in active connections, it is known for the UE 120 to go into an idle state, whereby the UE powers down its radio frequency circuitry (RF).” '416 patent, 1:54-67. Further, “it is known for a UE 120 to periodically power up its radio circuitry in order to monitor specific channels in order to determine whether it is required to establish a connection with the network.” '416 patent, 1:54-67.

175. Thus, because Kim’s terminal—following known paging procedures (confirmed by AAPA)—goes into an idle state to power down its radio circuitry outside of frames with a PCH placed within, Kim renders obvious “*wherein the UE powers down radio circuitry outside of the indicated time intervals*” as claimed.

7. Claim 6

[6.0] *The UE of claim 1, wherein the identification of the UE is assigned by a network device to decode the signaling information.*

176. See [6.1], Ground 1.

8. Claim 7

[7.0] *A method performed by a user equipment (UE), the method comprising:*

177. See [7.0], Ground 1. As explained above at [1.0], Kim explains that a terminal (“UE”) receives transmissions from a base station. For the reasons that Kim’s UE performs the functionality recited in claim 1, Kim teaches the method steps performed by the UE as recited in the claim.

[7.1] *receiving, by the UE, broadcast information including a plurality of bits,*

178. See [7.1], Ground 1. Additionally, for the reasons explained above at [1.1], Ground 2, the AAPA confirms the prior art teachings and thus further renders obvious the claim limitations.

[7.2] *wherein each of the plurality of bits indicates a respective time interval that physical shared channel resources are utilized to signal channels;*

179. See [7.2], Ground 1.

[7.3] *monitoring, by the UE, the signaled channels in indicated time intervals;*

180. See [7.3], Ground 1. Additionally, for the reasons explained above at [1.4], Ground 2, the AAPA confirms the prior art teachings and thus further renders obvious the claim limitations.

[7.4] *determining, by the UE, whether signaling information for the UE is present based on an identification of the UE; and*

181. See [7.4], Ground 1. Additionally, for the reasons explained above at [1.4], Ground 2, the AAPA confirms the prior art teachings and thus further renders obvious the claim limitations.

[7.5] *processing, by the UE, the signaling information in response to the determination that signaling information for the UE is present.*

182. See [7.5], Ground 1. Additionally, for the reasons explained above at [1.5], Ground 2, the AAPA confirms the prior art teachings and thus further renders obvious the claim limitations.

9. Claims 8-10

183. See claims 8-10, Ground 1.

10. Claim 11

[11.1] *The method claim 7, wherein the UE powers down radio circuitry outside of the indicated time intervals.*

184. See [11.1], Ground 1. Additionally, for the reasons explained above at [5.1], Ground 2, the AAPA confirms the prior art teachings and thus further renders obvious the claim limitations.

11. Claim 12

[12.1] *The method of claim 7, wherein the identification of the UE is assigned by a network device to decode the signaling information.*

185. See [12.1], Ground 1.

IX. CONCLUSION

186. 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 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: Nov. 19, 2024



Digitally signed by
Zhi Ding
Date: 2024.11.19
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Zhi Ding