

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AT&T SERVICES INC., T-MOBILE USA, INC.,
CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS,
ERICSSON, INC., AND
NOKIA OF AMERICA CORPORATION

Petitioners

v.

INNOVATIVE SONIC LIMITED

Patent Owner

Patent No. 7,664,059

DECLARATION OF DR. ZYGMUNT J. HAAS

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I, Dr. Zygmunt J. Haas, declare as follows:

I. INTRODUCTION

1. I have been retained as an independent expert consultant on behalf of AT&T Services Inc., T-Mobile USA, Inc., Cellco Partnership d/b/a Verizon Wireless, Ericsson, Inc., and Nokia of America Corporation (collectively “Petitioners”) in this *Inter Partes* Review proceeding (“IPR”) before the Patent Trial and Appeal Board (“Board” or “PTAB”) of the United States Patent and Trademark Office (“PTO”) regarding U.S. Patent No. 7,664,059 (“the ’059 Patent”) (Ex. 1001).¹ I am being compensated at my rate of \$550 per hour for the time that I spend on this matter, in addition to expenses. My compensation in this case is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

2. This Declaration summarizes the opinions that I have formed to date and based on the material currently available to me. I reserve the right to modify my opinions, if necessary, based on further review and analysis of information that I receive subsequent to the filing of this Declaration, including in response to any

¹ In this Declaration, I reference documents by exhibit numbers that were provided to me by counsel and that, as I understand, are attached as exhibits in this *Inter Partes* Review of the ’059 Patent.

positions taken by Innovated Sonic Limited (“Patent Owner”) or its experts that I have not been provided yet, including any secondary consideration evidence that Patent Owner or its expert may consider and present.

3. In my view, the prior art discloses or suggests the features recited in Claims 1-8 (what I understand are the “Challenged Claims” in this *Inter Partes* Review) of the ’059 Patent. The ’059 Patent is invalid based on the following grounds that I understand are at issue in this IPR:

Ground	Claims	Basis for Unpatentability
1	1-3 and 5-8	§ 102 – 3GPP TS 04.60 V8.6.0 (2000-10): 3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/ Medium Access Control (RLC/MAC) protocol (Release 1999) (“3GPP-4.60-v860-Specification”) (Ex. 1004)
2	1-3 and 5-8	§ 103 – 3GPP-4.60-v860-Specification (Ex. 1004)
3	1-8	§ 103 – 3GPP TS 25.322 V6.3.0 (2005-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Link Control (RLC) protocol specification (Release 6) (“3GPP-25.322-v630-Specification”) (Ex. 1005) in view of 3GPP-4.60-v860-Specification (Ex. 1004)

II. EDUCATIONAL BACKGROUND AND QUALIFICATIONS

4. I have briefly summarized in this section my educational background, career history, publications, and other relevant qualifications. As I understand it, my full *curriculum vitae* is being submitted as Ex. 1003 to this proceeding.

5. I am a Professor and Distinguished Chair in Computer Science at the University of Texas in Dallas. I am also Professor Emeritus at the School of Electrical and Computer Engineering of Cornell University. In addition, I have provided technical consulting services on intellectual property matters, including matters involving computer networks and wireless communication technologies.

6. I received my Bachelor of Science Degree in Electrical Engineering, *summa cum laude*, from Technion (IIT), Israel, in 1979, and a Master of Science Degree in Electrical Engineering, *summa cum laude*, from Tel-Aviv University, Israel, in 1985. Subsequently, in 1988, I authored the thesis titled “Packet Switching in Fiber-Optic Networks” as part of earning my Ph.D. in Electrical Engineering from Stanford University, Stanford, California.

7. I have worked for about 35 years in the fields of Electrical Engineering and Computer Science. The primary focus of my work has been, in general, on communication and networking systems, with an emphasis on wireless communication and wireless and mobile networks.

8. Throughout my professional career, I have authored and co-authored

numerous technical papers and book chapters related to wireless communication networks. As shown in my curriculum vitae, I hold about twenty patents in the fields of high-speed networking, wireless networks, optical switching, etc. In my work, among other topics, I have researched in general wireless networks, including protocols for routing in ad hoc networks. Specifically, I have written numerous papers on various schemes for wireless ad hoc networks systems.

9. Some of my works on ad hoc networking systems have received prominent awards. For instance, in 2016, I received the IEEE Communication Society (ComSoc) AHSN Recognition Award for “outstanding contributions to securing ad hoc and sensor networks.” Additionally, in 2012, I received the IEEE ComSoc WTC² Recognition Award, which recognizes individuals for outstanding technical contributions in the field for their service to the scientific and engineering communities. As another example, I received the “Best Paper Award” for the paper “Optimal Resource Allocation for UWB Wireless Ad Hoc Networks” from the IEEE International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC) conference in 2005. Finally, in 2003, I received the “Highly Commended Paper Award” for co-authoring “Performance Evaluation of the Modified IEEE 802.11 MAC for Multi-Channel Multi-Hop Ad Hoc Network,” directed at advanced information networking and applications.

² Wireless Communications Technical Committee

10. Furthermore, many of my papers have been extensively cited by other authors, as indicated by various citation indices. For example, my paper on “Securing Ad Hoc Networks,” co-authored with a Ph.D. student at the time, has been cited over 4000 times by other publications according to the *Google Scholar* index.

11. I have also taught courses that cover wireless communications and networking technologies, at the graduate and the undergraduate levels. Some of those courses cover material on the evolution of 3GPP systems, including 5G systems and networks. In addition, I have been invited to many international conferences to make keynote speeches regarding wireless and mobile networks.

12. My employment history following my graduation from Stanford University began at the Network Research Department of AT&T Bell Laboratories in 1988. At AT&T Bell Laboratories, I pursued research on wireless communications, mobility management, network security, fast protocols, optical networks, and optical switching. During my tenure at AT&T, I also worked for the AT&T Wireless Center of Excellence, where I investigated various aspects of wireless and mobile networks. As part of my employment at AT&T, I also worked on multimedia conferencing systems.

13. In 1995, I joined the faculty of the School of Electrical & Computer Engineering at Cornell University, and with time was promoted to Tenured Full Professor. At Cornell, I headed the Wireless Networks Lab, a research group with

extensive contributions in the area of wireless communication systems and networks. In 2013, I retired from Cornell with the title of Emeritus Professor and joined the Computer Science Department at the University of Texas at Dallas with the title of Professor and Distinguished Chair in Computer Science. At Cornell and at the University of Texas, I have taught dozens of courses related to computer networking and wireless communications. I have also served on various committees for the benefit of the scientific community.

14. I am a member of the Institute of Electrical and Electronics Engineers (IEEE) and the Association for Computing Machinery (ACM). In 2007, I was elevated to an IEEE Fellow and, in 2021, I was elevated to an ACM Fellow, both well-known distinctions. For example, the total number of IEEE Fellows which are selected in any given year does not exceed 0.1% of the total number of voting members of IEEE. With respect to the ACM Fellow grade, ACM states that “ACM’s most prestigious member grade recognizes the top 1% of ACM members for their outstanding accomplishments in computing and information technology and/or outstanding service to ACM and the larger computing community.” See <https://awards.acm.org/fellows>. I have also been named a Fellow of the EAI (European Alliance for Innovation) and a Fellow of the IET (Institution of Engineering and Technology). I have been responsible for organizing several workshops and delivering numerous tutorials at major IEEE and ACM conferences.

I have served as editor of several publications including the IEEE Transactions on Networking, the IEEE Transactions on Wireless Communications, the IEEE Communications Magazine, the Springer “Wireless Networks” journal, the Elsevier “Ad Hoc Networks” journal, the “Journal of High Speed Networks,” and the Wiley “Wireless Communications and Mobile Computing” journal. I have also been a guest editor of IEEE Journal on Selected Areas in Communications for issues on “Gigabit Networks,” “Mobile Computing Networks,” and “Ad-Hoc Networks.” Finally, I have served as the Chair of the IEEE Technical Committee on Personal Communications (TCPC), now known as the IEEE Wireless Communications Technical Committee.

15. My curriculum vitae provides additional information regarding my education, technical experience, and publications.

III. MATERIALS REVIEWED AND TIME OF INVENTION

16. The opinions contained in this Declaration are based on the documents that I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding technologies related to the '059 Patent.

17. In forming my opinions expressed in this Declaration, I have reviewed at least:

- a. The '059 Patent (Ex. 1001);
- b. File history of the '059 Patent (Ex. 1007);
- c. 3GPP TS 04.60 V8.6.0 (2000-10): 3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol (Release 1999) ("3GPP-4.60-v860-Specification");
- d. 3GPP TS 25.322 V6.3.0 (2005-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Link Control (RLC) protocol specification (Release 6) ("3GPP-25.322-v630-Specification") (Ex. 1005); and
- e. Any other materials that I refer to in this Declaration in support of my opinions.

18. I have been asked to consider the time of the invention to be around April 5, 2005, which I understand is the filing date of the application (U.S. Provisional Application No. 60/594,415, the '415 Provisional) to which the '059 Patent claims priority. Ex. 1001, Cover. I have been informed by counsel that it is Patent Owner's burden to prove that the Challenged Claims are entitled to that April 5, 2005 date and, absent such proof, the Challenged Claims are entitled to the filing date on the face of the '059 Patent (which is April 4, 2006). However, I was asked by counsel to assume the priority date of the Challenged Claims to be April 5, 2005. My opinions in this matter will not change whether the date of the alleged invention is April 5, 2005, April 4, 2006, or a date in between.

19. My opinions reflect how a person of ordinary skill in the art (as I define in Section V below) would have understood the claims and the specification of the '059 Patent, the prior art to the '059 Patent, and the state of the art, at the time of the alleged invention.

IV. LEGAL STANDARDS

1. Overview

20. I am not an attorney or a legal expert, and I do not opine on matters of law. All the legal standards, which are listed in this section and which I applied in reaching the conclusions expressed throughout this Declaration, were provided to me by counsel. In preparing this Declaration, I have endeavored to faithfully apply these legal standards. I do not intend to offer opinions on the law. Below, I describe the law that I applied in analyzing the claims of the '059 Patent.

21. I have been informed by counsel that an issued patent is presumed valid and that the challenger of a patent's validity bears the burden of proving invalidity of the patent.

2. Patent Claims

22. I have been informed by counsel that a patent's claims describe the invention made by the inventors and describe what the patent owner owns and what the owner may prevent others from doing.

23. I have been informed by counsel that claims may describe products, such as machines or chemical compounds, or processes for making or using a product. Claims are usually divided into parts or steps called limitations.

24. I have been informed by counsel that there are two types of claims: independent claims and dependent claims. An independent claim sets forth all the requirements that must be met in order to be covered by that claim. Thus, it is not

necessary to look at any other claim to determine what an independent claim covers. A dependent claim does not itself recite all of the requirements of the claim, but refers to another claim for some of its requirements. In this way, a dependent claim depends on another claim. The law considers a dependent claim to incorporate all of the requirements of the claims to which it refers.

25. I have been informed by counsel that that a dependent claim then adds its own additional requirements. To determine what a dependent claim covers, it is necessary to look at both the dependent claim and any other claims to which it refers.

26. I have been informed by counsel that in a case where a dependent claim incorporates the limitations of an independent claim upon which it depends, if a reference fails to disclose any of the limitations of the independent claim, the claims which depend on that independent claim cannot be made invalid by such a reference. As a result, any of the references at issue in this proceeding that fail to disclose all of the limitations of an independent claim necessarily also fail to disclose all of the limitations of claims which depend on that independent claim.

3. Burden of Proof for Invalidity

27. I have been informed by counsel and I understand that the party challenging the validity of an issued U.S. patent in an IPR bears the burden of proving invalidity through facts supported by a preponderance of the evidence. I have been informed that a “preponderance of the evidence” means evidence

sufficient to prove that a fact is more likely true than it is not.

4. Claim Construction

28. I have been informed by counsel and I understand that the first step in determining validity is to properly construe the claims. I have further been informed by counsel that, in this proceeding, the Board must determine the scope of the claims by using the same claim construction standard that United States District Courts use. Under this standard, the words of a claim are given their “ordinary” and “customary” meaning as would have been understood by a person of ordinary skill in the art at the time of the invention. I have been informed that such a person looks to the claims, specification, and file history in understanding the meaning of the claim terms. I have applied this understanding in this Declaration.

5. Person of Ordinary Skill in the Art

29. I have been informed by counsel and I understand that a person having ordinary skill in the art may be defined by factors such as, when considered at the time of the alleged invention: (a) the levels of education and experience of the inventor and other persons actively involved in the field; (b) the types of problems encountered in the field; (c) prior art solutions to those problems; (d) rapidity with which innovations are made; and (e) the sophistication of the technology.

6. Anticipation

30. I have been informed by counsel and I understand that a patent claim can be found invalid as anticipated if each and every element of the claim, as

properly construed, is found either explicitly or inherently in a single prior art reference. If the single prior art reference does not disclose explicitly or inherently any one claim limitation, then that claim is not anticipated. I have further been informed by counsel that the single prior art reference cannot merely disclose each element; rather, it must disclose all of the elements as arranged in the claim. I have been informed by counsel that for a prior art reference to “inherently” disclose something, the reference must necessarily function in accordance with, or include the claimed limitations, to anticipate. The missing descriptive matter cannot merely probably or possibly include the claimed limitations. I have further been informed by counsel that, with respect to an anticipation analysis, it is improper to combine separate, distinct embodiments of a single prior art reference.

31. I have been informed by counsel that for a reference to be anticipatory, the reference must contain an enabling disclosure. I have been informed by counsel that merely naming or describing the subject matter is insufficient if it cannot be produced without undue experimentation.

7. Obviousness

32. I have been informed by counsel that a patent claim can be found invalid as obvious if the differences between the claim and the prior art references would have been obvious to a person of ordinary skill in the art at the time of the invention, taking into account (1) the scope and content of the prior art, (2) the

differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any objective indicia of non-obviousness. I have further been informed by counsel that a claim can be found to be obvious in light of either a single prior art reference or multiple prior art references. I have been informed by counsel that references qualify as prior art for an obviousness determination only when they are analogous to the claimed invention. Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

33. I have been informed by counsel that to be obvious in light of a single prior art reference or multiple prior art references, there must be a reason either to modify the single prior art reference or to combine the two or more prior art references to achieve the claimed invention. I have been informed by counsel that this reason may come from a teaching, suggestion, or motivation to combine which may come from the reference or references themselves, the knowledge or "common sense" of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole.

34. I have been informed by counsel that the combination of familiar elements according to known methods is likely to be obvious when it does no more

than yield predictable results.

35. I have further been informed by counsel that there is no suggestion to combine, however, if a reference teaches away from its combination with another source. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant, or if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. If, when combined, the references would produce a seemingly inoperative device, then they teach away from their combination. I have been informed by counsel that it is improper to combine references where the references teach away from their combination.

36. I have been informed by counsel that the degree of teaching away will depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. I have been informed by counsel that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the applicant.

37. I have been informed by counsel that if the teachings of a prior art

reference would lead one skilled in the art to make a modification that would render another prior art device inoperable, then such a modification would generally not be obvious. I have been informed by counsel that if a proposed modification would render the prior art device unsatisfactory for its intended purpose, then the proposed modification would generally not be obvious.

38. I have been informed by counsel that it is improper to use hindsight in making the obviousness determination.

39. I have been informed by counsel that some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness must be made. I have been informed by counsel that, for example, there may be no rational underpinning to support the legal conclusion of obviousness where systems are already complete and the party challenging validity seeks to mix and match components, which each exist in the separate systems, from these complete systems.

V. PERSON OF ORDINARY SKILL IN THE ART (POSITA)

40. Based on my review of the '059 Patent, the types of problems encountered in the art at and prior to the time of the alleged invention, prior solutions to those problems, the pace with which innovations were made during the relevant time period, the sophistication of the technology, and the educational level of active professionals in the field, I believe that a person of ordinary skill in the art (POSITA), at the time of the invention, would have had at least a Bachelor's degree in electrical engineering, computer science, or computer engineering; and at least one year of work experience in design, development, and/or testing of cellular networks. More education could have substituted for less work experience and vice versa.

41. All of my opinions in this Declaration are from the perspective of a POSITA, as I have defined it above and during the relevant time frame (e.g., early 2005). During that time frame, I possessed at least the qualifications of a POSITA, as defined above.

VI. CLAIM CONSTRUCTION

42. I understand that claim terms are typically given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the alleged invention. In considering the meaning of the claims, I also understand that one must consider the claim language, specification, prosecution history, and the knowledge of a POSITA at the relevant time.

43. In my opinion, all terms should be given their ordinary and customary meaning. I applied this understanding in my analysis.

VII. BACKGROUND OF THE RELEVANT TECHNOLOGY

44. The '059 patent is titled “Error handling in a wireless communications system.” Under the heading “Field of the Invention,” the '059 patent states that the “present invention is a method and a device of detecting an erroneous sequence number in a status report unit in a wireless communications system, in particular a method of effectively detecting a status report unit comprising the erroneous sequence number and activating a reset mechanism at an appropriate time, and a device implementing the method.” Ex-1001, 1:14-19.

45. In the “Background” section, the '059 patent describes that “third generation mobile communication was developed to have better usage of the frequency spectrum and higher-speed transmission service.” Ex-1001, 1:25-28. The '059 Patent states that “third generation mobile communication uses a Wideband Code Division Multiple Access (WCDMA) protocol for wireless access,” and “[t]he WCDMA protocol can satisfy different service requirements of QoS [Quality of Service],” among other things. Ex-1001, 1:31-38. The '059 patent specifically notes that “a specification set by the 3rd Generation Partnership Project (3GPP), the 3rd generation mobile communications system can provide different levels of transmission quality and operates in different modes,” which include “Transparent Mode (TM), Unacknowledged Mode (UM), Acknowledged Mode (AM).” Ex-1001, 1:39-44. The Acknowledged Mode of transmission “is used for robust services

requiring data accuracy but not instant transmission.” Ex-1001, 1:47-48.

46. Acknowledged Mode requires that every data packet (or Protocol Data Unit (PDU)) sent by a transmitter is received and acknowledged by the receiver, ensuring that no data loss occurs for a given data transmission. In Acknowledged Mode, “Radio Link Control (RLC) layers of a transmitter and a receiver initiate a status report procedure at an appropriate time to have the receiver transmit a status report unit.” Ex-1001, 1:49-52. The status report procedure is used to track the latest Protocol Data Units (PDUs) that have been sent by the transmitter, and which have been received and acknowledged by the receiver. The PDUs are numbered by Sequence Numbers (SNs) to indicate their order. Typically, the SNs are used by the receiver to confirm correct receipt of a PDU (or a group of PDUs) by sending (back to the transmitter) acknowledgement(s), which carry the SNs (or a representative SN). The transmitter then uses these SN(s) to decide which packet(s) might have not been received (or not correctly received) and will retransmit such PDU(s) to the receiver.

47. The '059 patent describes that the following terminology is set for Acknowledged Mode in the 3GPP specification:

1. Variable VT(S): represents a Sequence Number (SN) of a next Protocol Data Unit (PDU) to be transmitted for a first time (i.e. excluding retransmitted PDUs). The variable is updated after corresponding PDUs are transmitted. An initial value of the

variable is 0.

2. Variable VT(A): represents an SN of a next expected acknowledged PDU, meaning the SN following an SN of a last in-sequence acknowledged PDU. The variable is updated after a status report unit showing the expected PDU had been positively acknowledged.

Ex-1001, 1:58-67. The '059 patent explains that the “variables VT(S) and VT(A)” allow the RLC layer to “detect whether an SN in a status report unit is correct.”

Ex-1001, 2:1-3.

48. The '059 patent identifies the expression defined in the 3GPP specification that is used, in Acknowledged Mode, to identify whether an appropriate SN has been received. This expression is $VT(A) \leq SN \leq VT(S) - 1$. “Comparisons between SNs are done by modulus operations with VT(A) as a modulus base. With the base=VT(A) and a negatively acknowledged SNX, determination is made whether X lies outside an interval $\{x|(VT(A)-base) \bmod 4096 \leq (x-base) \bmod 4096 \leq (VT(S)-1-base) \bmod 4096\}$, in order to detect whether any erroneous SN is contained in the status report unit.” Ex-1001, 2:10-16.

49. The '059 Patent further describes two examples of the usage of the expression from the 3GPP specification, one that correctly identifies a protocol error, and one that fails to correctly identify a protocol error. In the first example, the transmitter has transmitted 250 PDUs (those with SNs from 0 to 249), and the receiver has positively acknowledged receipt of the first 200 PDUs (those with SNs

from 0 to 199). Ex-1001, 2:17-25. Because the last in sequence acknowledged PDU SN is 199, $VT(A) = 200$, which as explained above is the SN of the next expected PDU by the receiver. *Id.* The transmitter, meanwhile, will have a $VT(S)$ of 250, which is the SN of the next PDU to be transmitted. *Id.* If a protocol error occurs and the next PDU received has an SN of 300, then the interval expression $\{x|(VT(A)-base) \bmod 4096 \leq (x-base) \bmod 4096 \leq (VT(S)-1-base) \bmod 4096\}$ (where the base = $VT(A) = 200$) is not met. The '059 patent recites the following (line numbers added):

$$[1.1] \quad \{x|(VT(A)-base) \bmod 4096 \leq (x-base) \bmod 4096 \leq (VT(S)-1-base) \bmod 4096\}$$

$$[1.2] \quad = \{x|(200-200) \bmod 4096 \leq (x-200) \bmod 4096 \leq (250-1-200) \bmod 4096\}$$

$$[1.3] \quad = \{x|0 \leq (x-200) \bmod 4096 \leq 49\}$$

Ex-1001, 2:26-30. Because x is 300, the middle part of the expression simplifies to 100, the inequality expression shown in [1.3] reduces to $\{x|0 \leq 100 \leq 49\}$ and the expression fails (and thus detects a protocol error). Ex-1001, 2:31-34. The RLC layer may then initiate a reset procedure to recover the error.

50. The '059 patent further describes a second example in which the expression used in Acknowledged Mode as disclosed in the 3GPP specification does not correctly detect an error. When $VT(A)$ equals $VT(S)$, a protocol error may not be detected even when one has occurred. In this example, both $VT(A)$ and $VT(S)$

are equal to 200, as the transmitter has transmitted PDU SNs up to and including 199, and the receiver has positively acknowledged all of the transmitted PDUs. If a protocol error occurs and the next PDU received has an SN of 300, then the interval expression $\{x | (VT(A) - \text{base}) \bmod 4096 \leq (x - \text{base}) \bmod 4096 \leq (VT(S) - 1 - \text{base}) \bmod 4096\}$ (where the base = VT(A) = 200) does not detect an error. The '059 patent recites the following (line numbers added):

[2.1] $\{x | (VT(A) - \text{base}) \bmod 4096 \leq (x - \text{base}) \bmod 4096 \leq (VT(S) - 1 - \text{base}) \bmod 4096\}$

[2.2] $= \{x | (200 - 200) \bmod 4096 \leq (x - 200) \bmod 4096 \leq (200 - 1 - 200) \bmod 4096\}$

[2.3] $= \{x | 0 \leq (x - 200) \bmod 4096 \leq 4095\}$

Ex-1001, 2:53-57. In expression [2.2], the rightmost portion of the expression simplifies to $(-1 \bmod 4096)$, which equals 4095. This result then renders the expression [2.3] as satisfied without any error, $\{x | 0 \leq 100 \leq 4095\}$, and the protocol error that should have been detected is actually not detected. Ex-1001, 2:63-3:3.

51. The '059 patent explains that it was known and desired in the then-current 3GPP standard for protocol errors in sequence numbers to be accurately identified and corrected, but that the then-current 3GPP standard could not correctly do so in the instance when VT(A) equaled VT(S) while operating in the Acknowledged Mode.

VIII. THE '059 PATENT

52. The '059 patent explains that “the present invention detects whether the negatively acknowledged SN lies in a range of greater than or equal to an SN following an SN of a last in-sequence acknowledged packet of a transmitter and less than an SN of a next packet to be transmitted for the first time by the transmitter, meaning to detect whether the negatively acknowledged SN agrees with $VT(A) \leq SN < VT(S)$.” Ex-1001, 4:31-37.

53. The '059 patent further explains that “[a]s the equation $VT(A) \leq SN < VT(S)$ shows, a modulus operation with $VT(A)$ as a modulus base, meaning that $base=VT(A)$, is used to detect whether the SN x lies outside the set $\{x|(VT(A)-base) \bmod 4096 \leq (x-base) \bmod 4096 < (VT(S)-base) \bmod 4096\}$ and hence detect whether the status report unit comprises an erroneous SN.” Ex-1001, 4:41-46.

54. In particular, the '059 patent claims that the invention focuses on the following difference between expression [2.1], shown above as the expression used in the existing prior art 3GPP specification, and expression [3.1], the '059 patent's purported invention (color added to show differences, line numbers added)³:

³ In this Declaration, all emphases in cited material have been added, unless stated otherwise.

$$\begin{aligned} [2.1] \quad & \{x | (VT(A) - \text{base}) \bmod 4096 \leq (x - \text{base}) \bmod \\ & 4096 \leq (VT(S) - \text{base}) \bmod 4096\} \end{aligned}$$

$$\begin{aligned} [3.1] \quad & \{x | (VT(A) - \text{base}) \bmod 4096 \leq (x - \text{base}) \bmod \\ & 4096 < (VT(S) - \text{base}) \bmod 4096\} \end{aligned}$$

55. Using a similar setup as above (that is, in the example in which the error was not detected), the '059 patent explains the difference between the then-existing 3GPP expression and the '059 patent's purported invention. In that example, both VT(A) and VT(S) are equal to 200, as the transmitter has transmitted PDU SNs up to and including 199, and the receiver has positively acknowledged all of the same. If a protocol error occurs and the next PDU received has an SN of 300, then the interval expression $\{x | (VT(A) - \text{base}) \bmod 4096 \leq (x - \text{base}) \bmod 4096 \leq (VT(S) - \text{base}) \bmod 4096\}$ (where the base = VT(A) = 200) successfully detects an error. Ex-1001, 5:4-17.

$$[3.1] \quad \{x | (VT(A) - \text{base}) \bmod 4096 \leq (x - \text{base}) \bmod 4096 < (VT(S) - \text{base}) \bmod 4096\}$$

$$[3.2] = \{x | (200 - 200) \bmod 4096 \leq (x - 200) \bmod 4096 < (200 - 200) \bmod 4096\}$$

$$[3.3] = \{x | 0 \leq (x - 200) \bmod 4096 < 0\}$$

Ex-1001, 5:13-17 (line numbers added). In expression [3.2], the rightmost portion of the expression simplifies to $(0 \bmod 4096)$, which equals 0. Thus, for expression [3.3], because the boundaries require the middle term $((x - 200) \bmod 4096)$ to be both greater than or equal to zero (left inequality) and less than zero (right inequality), an

error will be detected. In the case where the next PDU's received SN is 300, the middle term calculates to 100, and an erroneous SN is detected. Ex-1001, 5:18-21.

56. The '059 patent thus makes the claim that “[t]he prior art cannot detect protocol errors in this case[] [i]n comparison to the present invention in the same situation.” Ex-1001, 5:27-28.

IX. PROSECUTION HISTORY OF THE '059 PATENT

57. The file history of the '059 patent explains that the claimed invention is narrowly focused on the specific edge-case described when $VT(A)$ equals $VT(S)$ in Acknowledged Mode.

58. I understand that the Examiner initially rejected claims 1-2 and 5-7 as being anticipated by a reference called Petrovic. Ex-101008 (U.S. Patent Pub. No. 2004/0208160); Ex-1007 (File History, Office Action dated January 23, 2008), 323. I understand that the Examiner also rejected claims 3-4 as being obvious over Petrovic and U.S. Patent No. 6,483,855 to Minagawa (1009) or U.S. Patent Pub. No. 2006/0067238 to Olsson (Ex-1010). Ex-1007 (File History, Office Action dated January 23, 2008), 323.

59. In a response to the Office Action rejection, I understand that the applicant admitted that “for the case of $VT(S) \neq VT(A)$, both Petrovic [cited prior art patent publication] and the claimed invention as set forth in claim 1 will work.” Ex-1007 (File History, Office Action Response dated April 23, 2008), 264. Thus, the scope of the invention is for the narrow case in which $VT(S) = VT(A)$.

60. I understand that the applicant further explained that Petrovic’s checking condition is “ $VT(A) \leq SN \leq VT(S)-1$ ” but that the '059 patent’s checking condition is “ $VT(A) \leq SN < VT(S)$.” Ex-1007 (File History, Office Action Response dated April 23, 2008), 262. In explaining the difference between Petrovic’s approach

and the '059 patent's approach, the applicant explained that "[w]hen VT(S) is a regular integer, the above two conditions are equivalent to each other. However, since VT(S) is represented by finite bits, say 12 bits, to overcome wrap[]around from the maximum representing value by the finite bits to zero, modulus operation with a modulo base must be used." Ex-1007, 262.

61. In an IDS filed on January 3, 2007, I understand that the file history cites to "Universal Mobile Telecommunications System (UMTS); Radio Link Control (RLC) protocol specification. ETSI TS125 322 V6.3.0. Date 2005-03," which is similar to one of the references relied upon in Ground 3. Ex-1007 ('059 Patent File History, Information Disclosure Statement dated January 3, 2007), 357. This reference is similar to 3GPP-25.322-v630-Specification, but I understand that the ETSI reference did not form the basis of a rejection by the Examiner, nor was it discussed by the Examiner or applicant in the prosecution history. After a few rounds of examination, I understand that the Examiner allowed the claims. *Id.*, 23. It is my understanding, there is no evidence that the Examiner was even aware of the 3GPP-4.60-v860-Specification prior art identified in this Declaration. And, as explained in detail below in Section XI, 3GPP-4.60-v860-Specification (relied upon for anticipation in Ground 1, single-reference obviousness in Ground 2, and a reference relied upon in combination with 3GPP-25.322-v630-Specification for Ground 3) discloses or suggests precisely what the Examiner found lacking in the prior art.

Because the prior art relied upon herein discloses each element of the '059 Patent, it is my understanding that the Examiner would not have allowed the application over the prior art discussed in the present Declaration.

X. THE PRIOR ART REFERENCES

62. The prior art references are both technical specifications from 3GPP, the 3rd Generation Partnership Project, that relate to wireless communication standards. It is my opinion that both relate to the same subject matter of the purported invention of the '059 patent.

63. I understand that both references are prior art to the '059 patent.

64. Both references discuss Radio Link Control (RLC) layers of a transmitter and receiver that is used with Acknowledged Mode (AM) transmission.

1. 3GPP-4.60-v860-Specification

65. 3GPP-4.60-v860-Specification is an 3GPP Technical Specification that is part of the Global System for Mobile Communications (GSM) EDGE Radio Access Network, 04.60 version 8.6.0 Release 1999 standard.

66. The full title of the Technical Specification is: 3GPP TS 04.60 V8.6.0 (2000-10): Technical Report: 3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/ Medium Access Control (RLC/MAC) protocol (Release 1999), which I refer to as "3GPP-4.60-v860-Specification."

67. 3GPP-4.60-v860-Specification describes and specifies various aspects of the GSM 04.60 version 8.5.0 Release 1999 standard, including the Radio Link

Control/Medium Access Control (RLC/MAC) protocol used in the General Packet Radio Service (GPRS) for Digital cellular telecommunications system (Phase 2+) for GSM.

68. I was notified by counsel that the 3GPP-4.60-v860-Specification was published on 3GPP's file server on October 11, 2000. I was further asked by counsel to assume that the 3GPP-4.60-v860-Specification qualifies as prior art to the '059 patent.

2. 3GPP-25.322-v630-Specification

69. 3GPP-25.322-v630-Specification is a 3GPP Technical Specification that is part of the 5G / 3GPP 38.213 standard. 3GPP-25.322-v630-Specification describes and specifies various aspects of the 38.213 standard, including error detection and operation using RLC in the Acknowledged Mode.

70. The title of the Technical Specification is: 3GPP TS 25.322 V6.3.0 (2005-03): Technical Specification: 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Link Control (RLC) protocol specification (Release 6), which I refer to as "3GPP-25.322-v630-Specification."

71. I was notified by counsel that the 3GPP-25.322-v630-Specification was published on 3GPP's file server on March 22, 2005. I was further asked by counsel to assume that the 3GPP-25.322-v630-Specification qualifies as prior art to the '059 patent.

XI. GROUND 1: CLAIMS 1-3 AND 5-8 ARE ANTICIPATED BY 3GPP-4.60-V860-SPECIFICATION

1. Claim 1

- a. “A method of detecting an erroneous sequence number of a status report unit in a wireless communications system, the method comprising”**

72. I was notified by counsel that patent claim preambles are not always limiting. To the extent that the preamble is limiting, 3GPP-4.60-v860-Specification discloses or suggests a method of detecting an erroneous sequence number of a status report unit in a wireless communications system. For example, 3GPP-4.60-v860-Specification discloses or suggests that it relates to the Global System for Mobile wireless communications standard (GSM), which is a standard for a wireless communication system. Ex-1004, 1. 3GPP-4.60-v860-Specification also discloses a Radio Link Control (RLC) acknowledged mode for packet transfer. Ex-1004, 19 (“The RLC function defines the procedures for segmentation and reassemble of LLC PDUs into RLC/MAC blocks and, in RLC acknowledged mode of operation, for the Backward Error Correction (BEC) procedures enabling the selective retransmission of unsuccessfully delivered RLC/MAC blocks.”); *id.* at 98 (“RLC acknowledged mode operation uses retransmission of RLC data blocks to achieve high reliability.”). 3GPP-4.60-v860-Specification discloses or suggests that the RLC acknowledged mode function is “responsible for ... Backward Error Correction (BEC) procedures enabling the selective retransmission of RLC data blocks.” Ex-

1004, 85. 3GPP-4.60-v860-Specification further discloses that valid sequence numbers for PDUs are detected in RLC acknowledged mode (AM); accordingly, sequence numbers that are not valid (i.e., those that are erroneous) may also be detected. Ex-1004, 86 (“All BSNs [Block Sequence Numbers] which meet that criteria are valid within the transmit window.”).

73. The ’059 patent discusses “detecting an erroneous sequence number,” as it states: “detecting that the status report includes an erroneous sequence number when a negatively acknowledged sequence number is not within the abovementioned range.” Ex-1001, Abstract. Other portions of the ’059 patent also discuss the purpose of detecting an erroneous sequence number. Ex-1001, 1:40-44 (“the 3rd generation mobile communications system can provide different levels of transmission quality and operates in different modes according to the different requirements, for instance ... Acknowledged Mode (AM)”), 1:49-54 (“In AM, for better data accuracy and robustness, Radio Link Control (RLC) layers of a transmitter and a receiver initiate a status report procedure at an appropriate time to have the receiver transmit a status report unit, or a piggybacked status report unit to the transmitter.”).

b. “receiving a status report unit output from a receiver of the wireless communications system,”

74. 3GPP-4.60-v860-Specification discloses or suggests this limitation. 3GPP-4.60-v860-Specification discloses or suggests receiving a packet control

acknowledgement from the RLC receiver of the wireless communication system:

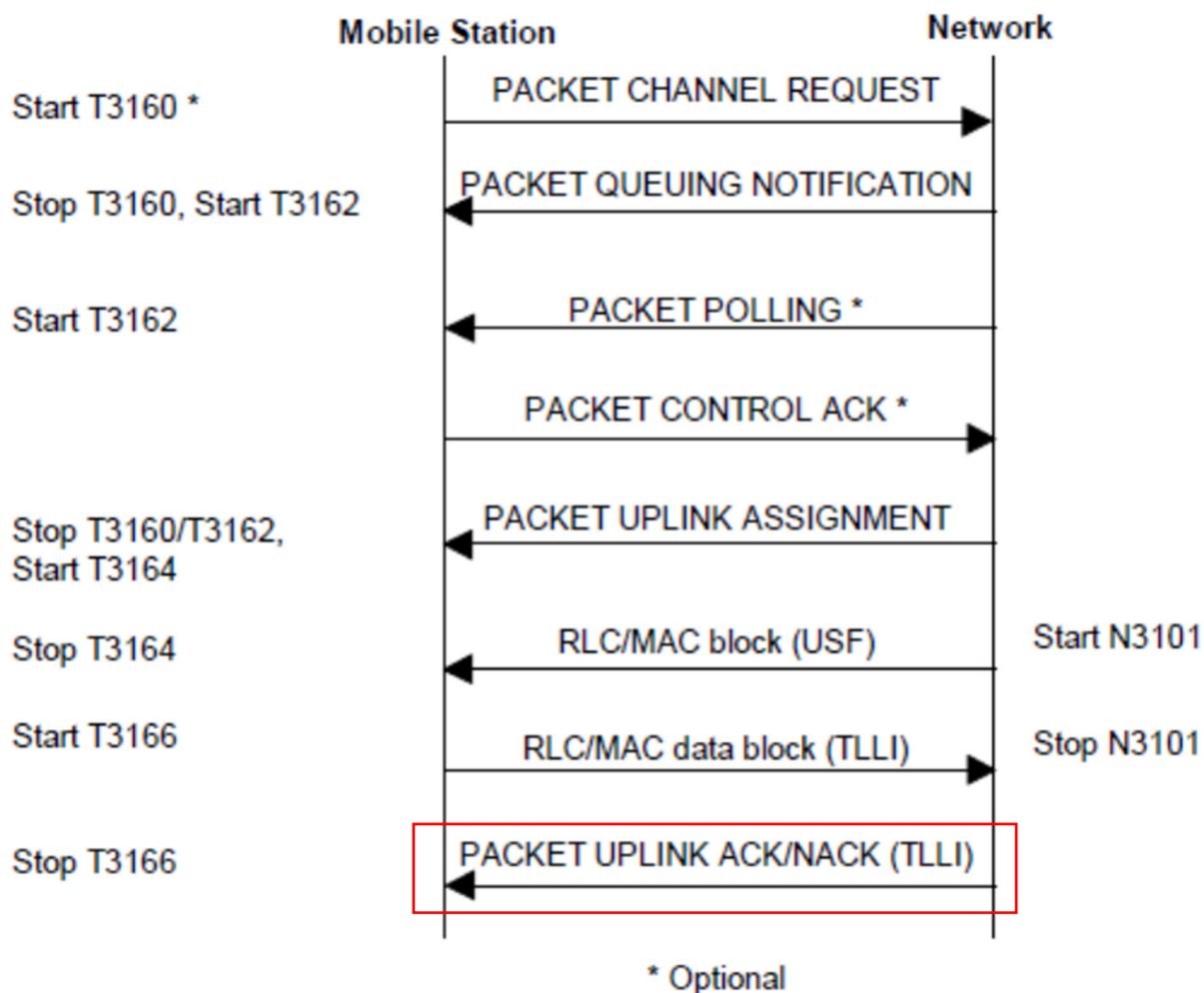


Figure C.1: Message Sequence Diagram for one phase packet access

Ex-1004, 286. The figure above identifies a Packet Uplink Ack/Nack, which is a “message [that] contains a starting sequence number (SSN) and a received block bitmap (RBB)” and “is sent by the RLC receiver and is received by the RLC transmitter.” Ex-1004, 89. 3GPP-4.60-v860-Specification states that the “network shall acknowledge packet transfers by sending PACKET UPLINK ACK/NACK messages on the PACCH during gaps in the uplink allocation.” Ex-1004, 65. The

Packet Uplink Ack/Nack includes sequence number information sent by the RLC receiver to the RLC transmitter (thus received from the RLC receiver as claimed), it is the claimed status report unit output. Thus, the RLC transmitter knows which PDUs have been acknowledged by the RLC receiver.

75. Thus, 3GPP-4.60-v860-Specification discloses receiving a status report packet control acknowledgement that was output from a receiver of the wireless communications system.

- c. **“detecting whether a negatively acknowledged sequence number lies in a range of greater than or equal to a sequence number following a sequence number of a last in-sequence acknowledged packet of a transmitter and less than a sequence number of a next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit; and”**

76. 3GPP-4.60-v860-Specification discloses or suggests “detecting whether a negatively acknowledged sequence number lies in a range of greater than or equal to a sequence number following a sequence number of a last in-sequence acknowledged packet of a transmitter and less than a sequence number of a next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit.” For example, 3GPP-4.60-v860-Specification discloses or suggests that the following inequality expression is used to evaluate whether the block sequence number BSN is within a

valid range: “In RLC acknowledged mode, the transmit window is defined by the send state variable V(S) in the following inequality:

$$[V(A) \leq BSN < V(S)] \text{ modulo SNS.}”.$$

EX-1004, 86.

77. Expression [3.1] below shows the '059 Patent's purported invention, compared against expression [4.1], which shows the inequality expression from the 3GPP-4.60-v860-Specification. Expressions [3.1] and [4.1] are equivalent, and Expression [4.2] shows expression [4.1] with the modulus operation distributed through the brackets. The 'x' represented in expression [3.1] is the sequence number (SN) of the PDU being received, which is analogous to the 'BSN' from expressions [4.1] and [4.2]. Thus, expressions [3.1], [4.1], and [4.2] are comparable.

$$[3.1] \{x|(VT(A)-base) \bmod 4096 \leq (x-base) \bmod 4096$$

$$< (VT(S) -base) \bmod 4096\}$$

$$[4.1] [V(A) \leq BSN < V(S)] \text{ modulo SNS}$$

$$[4.2] V(A) \bmod SNS \leq BSN \bmod SNS$$

$$< V(S) \bmod SNS$$

78. 3GPP-4.60-v860-Specification discloses or suggests that V(A) is the “Acknowledge state variable V(A)” and that in RLC acknowledged mode, “V(A) contains the BSN value of the oldest RLC data block that has not been positively acknowledged by its peer.” Ex-1004, 86. V(S) is the “Send state variable V(S)” and

“V(S) denotes the sequence number of the next in-sequence RLC data block to be transmitted.” Ex-1004, 86.

79. Therefore, the inequality expression that is used to evaluate the validity of the block sequence number BSN (i.e., the claimed negatively acknowledged sequence number) requires that BSN must be greater than or equal to the “oldest RLC data block that has not been positively acknowledged by its peer” (i.e., the claimed “a sequence number following a sequence number of a last in-sequence acknowledged packet of a transmitter”) and less than “the sequence number of the next in-sequence RLC data block to be transmitted” (i.e., “a sequence number of a next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit”). Ex-1004, 86.

80. Additionally, 3GPP-4.60-v860-Specification discloses or suggests that the modulus of each of these values is taken relative to the SNS, the “Sequence Number Space,” which is the entire space of values into which the sequence number may fall. Ex-1004, 73; *id.* at (disclosing that the inequality “[$V(A) \leq BSN < V(S)$] modulo SNS” is evaluated).

81. This is consistent with terms identified in the inequality expression disclosed in the ’059 patent. Ex-1001, 5:13-17. Accordingly, V(A) disclosed in the 3GPP-4.60-v860-Specification is analogous to VT(A) from the ’059 patent, V(S)

disclosed in the 3GPP-4.60-v860-Specification is analogous to VT(S) from the '059 patent, and BSN disclosed in the 3GPP-4.60-v860-Specification is analogous to SN from the '059 patent. The SNS disclosed in the 3GPP-4.60-v860-Specification is analogous to the '059 patent's disclosure of evaluating the terms of the inequality with "mod 4096," where "4096" represents the 12-bit number space for sequence numbers. Ex-1001, 2:4-5.

82. The '059 patent explains that the sequence number of a PDU is "represented by 12 bits." 12 bits for the sequence number allows for values up to 2^{12} , which is 4096. The sequence number may be any value from 0 to 4095 (i.e., $2^{12} - 1$), and '4096' is the resultant value used in the modulus operation against each of the terms in the inequality expression. Similarly, in the 3GPP-4.60-v860-Specification, the SNS, or sequence number space, is defined as the number "2048 [i.e., 11 bits] in EGPRS, and 128 [i.e., 7 bits] in GPRS," and the sequence number values could range from 0 to 2047, in the case of EGPRS, for example. Ex-1004, 86. The "modulo SNS" in 3GPP-4.60-v860-Specification is analogous to the "mod 4096" in the '059 patent.

d. "detecting that the status report unit comprises an erroneous sequence number when the negatively acknowledged sequence number is not in the range."

83. 3GPP-4.60-v860-Specification discloses or suggests this limitation, as explained above with respect to limitations 1(a) and 1(c). For example, 3GPP-4.60-

v860-Specification discloses or suggests that only negatively acknowledged sequence numbers are “valid” (i.e., not erroneous) if they fall within the range defined by the inequality:

In RLC acknowledged mode, the transmit window is defined by the send state variable $V(S)$ in the following inequality: $[V(A) \leq BSN < V(S)] \text{ modulo } SNS \dots$ All BSNs which meet that criteria are valid within the transmit window.

Ex-1004, 86. Thus, a POSITA would have understood that when a value falls outside of that window, an erroneous sequence number is detected.

2. Claim 2

- a. “The method of claim 1 further comprising initiating a reset procedure when the status report unit comprises the erroneous sequence number.”**

84. 3GPP-4.60-v860-Specification discloses or suggests claim 2. For example, 3GPP-4.60-v860-Specification discloses or suggests detecting an erroneous sequence number when the sequence number does not satisfy the expression determined by the inequality “[$V(A) \leq BSN < V(S)$] modulo SNS.” Ex-1004, 86.

85. When the inequality is not satisfied based on the corresponding values of BSN, $V(A)$, and $V(S)$, it is determined that the Block Sequence number is invalid, and a reset procedure to retransmit the erroneous sequence number is initiated. For example, 3GPP-4.60-v860-Specification discloses or suggests that Backward Error

Correction is used to selectively retransmit unsuccessfully delivered PDUs:

The RLC function defines the procedures for segmentation and reassemble of LLC PDUs into RLC/MAC blocks and, in RLC acknowledged mode of operation, for the Backward Error Correction (BEC) procedures enabling the selective retransmission of unsuccessfully delivered RLC/MAC blocks. In RLC acknowledged mode of operation, the RLC function preserves the order of higher layer PDUs provided to it.

Ex-1004, 19; *id.* at 85 (“The RLC function is responsible for ... Backward Error Correction (BEC) procedures enabling the selective retransmission of RLC data blocks.”); *id.* at 99 (“The receiving side sends PACKET Ack/Nack messages in order to request retransmission of RLC data blocks.”).

3. Claim 3

- a. **“The method of claim 1 wherein detecting whether the negatively acknowledged sequence number lies in the range of greater than or equal to the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter and less than the sequence number of the next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit is performed by modulus operation with the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter as a modulus base.”**

86. 3GPP-4.60-v860-Specification discloses or suggests claim 3. For example, 3GPP-4.60-v860-Specification discloses or suggests detecting an

erroneous sequence number with an inequality expression that uses a modulus operation: “[$V(A) \leq BSN < V(S)$] modulo SNS.” Ex-1004, 86 (emphasis added).

87. The ’059 Patent explains that an erroneous SN may be identified with “a modulus operation with $VT(A)$ as a modulus base, meaning that $base=VT(A)$, is used to detect whether the SN x lies outside the set $\{x \mid (VT(A)-base) \bmod 4096 \leq (x-base) \bmod 4096 < (VT(S)-base) \bmod 4096\}$.” Ex-1001, 4:41-46; *see also id.* at 4:47-65. The left side of the expression equals 0 when $VT(A)$ is used as the base (because $VT(A)-VT(A) = 0$), and the inequality expression becomes $\{x \mid (x-base) \bmod 4096 < (VT(S)-base) \bmod 4096\}$.

88. Similarly, the 3GPP-4.60-v860-Specification explains that a “valid BSN value in the RBB is one that is in the range [$V(A) \leq BSN < V(S)$] modulo SNS,” which “shall be interpreted in the following way: BSN is valid if, and only if, [$BSN - V(A)$] modulo SNS < [$V(S) - V(A)$] modulo SNS.” Ex-1004, 89. Subtracting $V(A)$ from both the BSN value and the $V(S)$ value discloses using $V(A)$ as the base.

4. Claim 5

- a. **“The method of claim 1, wherein the wireless communications system is a third generation mobile communications system.”**

89. 3GPP-4.60-v860-Specification discloses or suggests claim 5. In its introductory pages, 3GPP-4.60-v860-Specification identifies that certain documents

“contain provisions which, through reference in this text, constitute provisions of the present document.” Ex-1004, 15. One of the documents which contains provisions from 3GPP-4.60-v860-Specification is a 3G UMTS specification, which is a specification for a third generation mobile communications system: “3G TS 24.008: “Universal Mobile Telecommunications System; Mobile radio interface layer 3 specification.” *Id.* at 14. Thus, 3GPP-4.60-v860-Specification discloses or suggests a third generation mobile communications network.

5. Claim 6

- a. **“The method of claim 5 wherein the third generation mobile communications system is operating in an acknowledged mode.”**

90. 3GPP-4.60-v860-Specification discloses or suggests claim 6. Specifically, 3GPP-4.60-v860-Specification discloses or suggests a third generation mobile communications system. 3GPP-4.60-v860-Specification further discloses operating in acknowledged mode:

9.3.2 Acknowledged mode operation

The transfer of RLC data blocks in the RLC acknowledged mode uses retransmissions of RLC data blocks. The transmitting side numbers the RLC data blocks via the block sequence number (BSN). The BSN is used for retransmission and for reassembly. The receiving side sends PACKET Ack/Nack messages in order

to request retransmission of RLC data blocks.

Ex-1004, 99.

6. Claim 7

- a. **“A wireless device comprising a central processing unit in electrical communications with a memory, the memory comprising program code for implementing the method of claim 1.”**

91. 3GPP-4.60-v860-Specification inherently discloses claim 7. Though 3GPP-4.60-v860-Specification does not explicitly disclose “a wireless device comprising a central processing unit in electrical communications with a memory, the memory comprising program code for implementing the method of claim 1,” “a wireless device comprising a central processing unit in electrical communications with a memory, the memory comprising program code” is inherently disclosed.

92. The elements of claim 7 are inherent in 3GPP-4.60-v860-Specification’s disclosure. It is my opinion that a person of ordinary skill in the art, reading 3GPP-4.60-v860-Specification, would have understood that the disclosed wireless communications system must necessarily include at least one wireless device that comprises a central processing unit in electrical communications with a memory, where the memory comprises program code that is used to execute the wireless communication protocol disclosed in the 3GPP-4.60-v860-Specification. Claim 7, therefore, is inherently disclosed by 3GPP-4.60-v860-Specification.

7. **Claim 8**

- a. **“The method of claim 1 wherein it is determined that the status report unit comprises an erroneous sequence number when the negatively acknowledged sequence number is not in the range of greater than or equal to the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter and less than and not equal to the sequence number of the next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit.”**

93. 3GPP-4.60-v860-Specification discloses or suggests claim 8. For example, 3GPP-4.60-v860-Specification discloses or suggests detecting an erroneous sequence number when the sequence number does not satisfy the expression determined by the inequality “[$V(A) \leq BSN < V(S)$] modulo SNS.” Ex-1004, 86.

94. When the inequality is not satisfied when the corresponding value of BSN is not within the range of greater than or equal to $V(A)$ (that is, the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter), and less than and not equal to $V(S)$ (i.e., the next packet to be transmitted for the first time by the transmitter), then the negatively acknowledged sequence number in the status report unit is determined to comprise an erroneous sequence number.

95. 3GPP-4.60-v860-Specification also discloses that valid sequence

numbers may be confirmed “if, and only if, $[BSN - V(A)] \bmod SNS < [V(S) - V(A)] \bmod SNS$.” Ex-1004, 86.

XII. GROUND 2: CLAIMS 1-3 AND 5-8 ARE RENDERED OBVIOUS BY 3GPP-4.60-V860-SPECIFICATION

96. As I have explained above in Ground 1, each of the elements of claims 1-3 and 5-8 of the '059 patent are disclosed by 3GPP-4.60-v860-Specification. However, even if 3GPP-4.60-v860-Specification did not explicitly disclose the above-mentioned claim elements, the claim elements would have been obvious to a POSITA at the relevant time in light of 3GPP-4.60-v860-Specification for the reasons described below.

1. Claim 1

b. “receiving a status report unit output from a receiver of the wireless communications system,”

97. 3GPP-4.60-v860-Specification discloses or suggests each of the elements of claim 1. It is my opinion that the Packet Uplink Ack/Nack discloses the claimed status report unit output, as explained above.

98. To the extent that it is determined that the Packet Uplink Ack/Nack from 3GPP-4.60-v860-Specification does not meet the limitation 1(b), it would have been obvious to a POSITA at the time of the '059 Patent to modify the system to meet limitation 1(b). For example, it would have been obvious to have a separate status report procedure transmitted between a transmitter and receiver. The 3GPP-4.60-v860-Specification describes different types of communications between a

mobile station and the wireless communications network, a sampling of which are

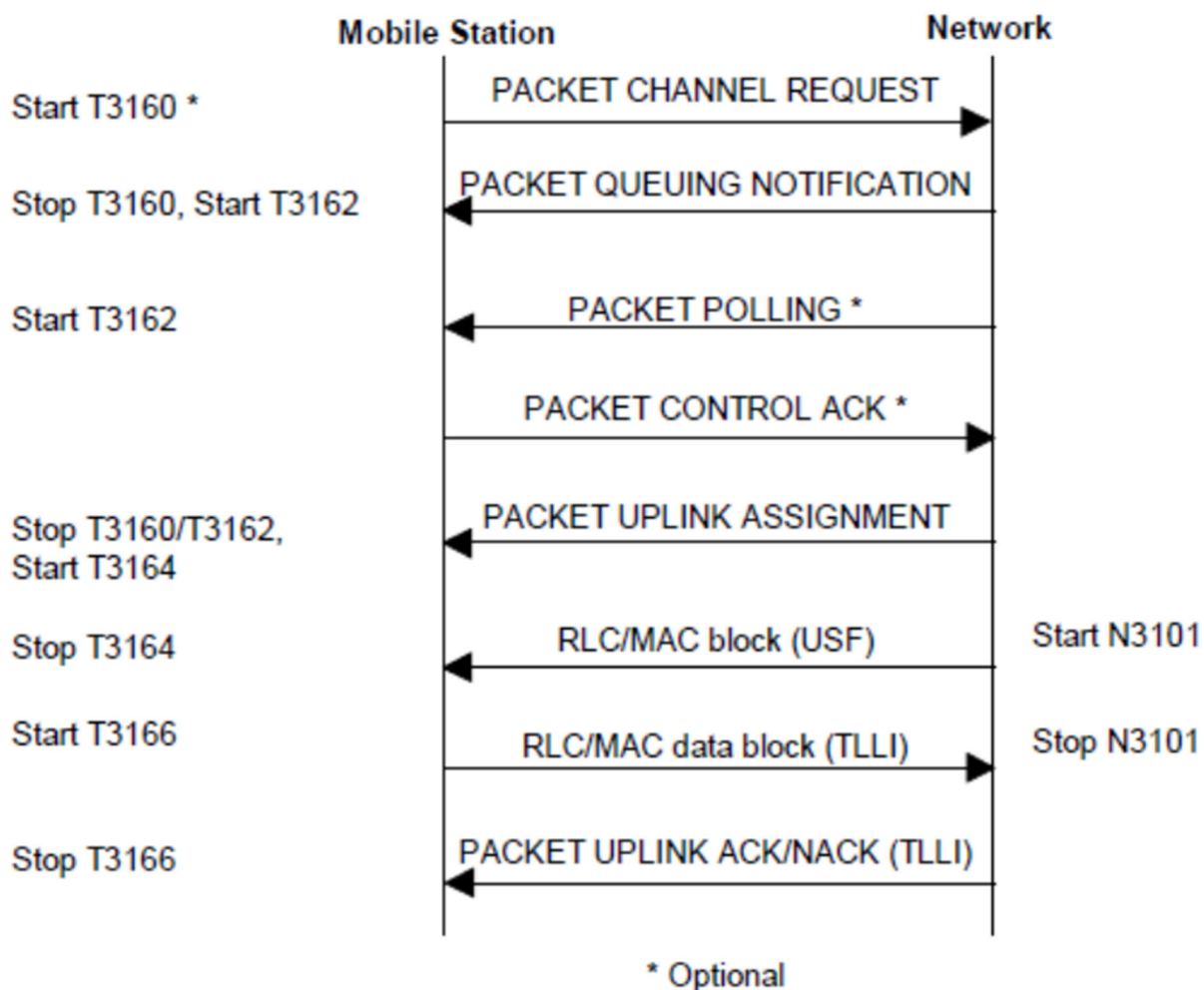


Figure C.1: Message Sequence Diagram for one phase packet access

shown below:

Ex-1004, 286.

99. As explained above in Section XI.1.b, the LRC receiver sends a Packet Uplink Ack/Nack to the transmitter, and this message includes information related to the sequence number. To the extent that it is determined that the sequence number in the Packet Uplink Ack/Nack does not meet the 1(b) limitation, it would have been

obvious to include acknowledged sequence number information in a separate status report unit sent by the receiver.

100. The transmitter needs to be able to identify the correct sequence number to send to the receiver in acknowledged mode, so information relating to the sequence number received by the receiver must be sent to the transmitter, to allow the transmitter to be able to identify the sequence numbers of PDUs that should be re-sent. Thus, a POSITA would have found it obvious to have the receiver send status update information to the transmitter.

2. Claim 3

- a. **“The method of claim 1 wherein detecting whether the negatively acknowledged sequence number lies in the range of greater than or equal to the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter and less than the sequence number of the next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit is performed by modulus operation with the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter as a modulus base.”**

101. 3GPP-4.60-v860-Specification discloses or suggests each of the elements from each of claims 2-3 and 5-8. To the extent that it is determined that 3GPP-4.60-v860-Specification does not disclose claim 3, it would have been obvious to modify 3GPP-4.60-v860-Specification to meet the limitations of that

claim. Claim 3 recites that “the negatively acknowledged sequence number is detected in the status report unit is performed by modulus operation with the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter as a modulus base.” One having skill in the art would have understood that the negatively acknowledged sequence number is detected based on a modulus operation. To the extent that 3GPP-4.60-v860-Specification does not disclose using “the last in-sequence acknowledged packet of the transmitter” as the modulus base, it would have been obvious to one having skill in the art to modify 3GPP-4.60-v860-Specification to do so.

102. As disclosed in 3GPP-4.60-v860-Specification, $V(A)$ represents the oldest RLC data block that has not yet been positively acknowledged by its peer. Ex-1004, 86. $V(S)$ represents the sequence number for the next in-sequence RLC data block to be transmitted. A POSITA would have understood that large values for $V(A)$ and $V(S)$ could trigger an overflow of the modulus operation used to evaluate the inequality expression “[$V(A) \leq BSN < V(S)$] modulo SNS.” One way to reduce the likelihood of triggering this potential overflow would be to subtract out the value of the last known positively acknowledged sequence number from each of the terms of the inequality. This would result in smaller absolute values for each of $V(A)$, BSN , and $V(S)$, each of which would be less likely to overflow the SNS (sequence number space). It would have been obvious for a POSITA to modify 3GPP-4.60-

v860-Specification to thus use “the last in-sequence acknowledged packet of the transmitter” as the modulus base in the inequality evaluation.

103. Further, the '059 Patent acknowledges in the Background of the Invention section that a base value is equal to the VT(A) value: “Comparisons between SNs are done by modulus operations with VT(A) as a modulus base.” Ex-1001, 2:10-12.

XIII. GROUND 3: CLAIMS 1-8 ARE RENDERED OBVIOUS BY 3GPP-25.322-V630-SPECIFICATION IN VIEW OF 3GPP-4.60-V860-SPECIFICATION

1. Claim 1

- a. “A method of detecting an erroneous sequence number of a status report unit in a wireless communications system, the method comprising”**

104. I was notified by counsel that patent claim preambles are not always limiting. To the extent that the preamble is limiting, 3GPP-25.322-v630-Specification discloses a method of detecting an erroneous sequence number of a status report unit in a wireless communications system. For example, 3GPP-25.322-v630-Specification discloses that it relates to Universal Mobile Telecommunications System (UMTS); Radio Link Control (RLC) protocol specification, which is a well-known standard for a wireless communication system. Ex-1005, 1. 3GPP-25.322-v630-Specification also discloses a Radio Link Control (RLC) acknowledged mode for packet transfer. Ex-1005, 8 (“The present document specifies the Radio Link Control protocol for the UE-UTRAN radio interface.”). One of the modes of

operation under RLC is Acknowledged Mode (AM), which includes supported functions such as error correction. Ex-1005, 8 (“Features for the current Release: ... Acknowledged mode”); *id.* at 18-19 (“The following functions are needed to support acknowledged data transfer [acknowledged mode]: ... Error correction” and “Protocol error detection and recovery”). The 3GPP-25.322-v630-Specification also discloses “10.1 Erroneous Sequence Number ... If an AM RLC entity receives ... including ‘erroneous Sequence Number’, it shall” *id.* at 57. Execution of a procedure that identifies such an “erroneous Sequence Number” amounts to “detecting of erroneous sequence number.” The 3GPP-25.322-v630-Specification also discloses that occurrence of “erroneous Sequence Number” would include one “in which the ‘Sequence Number’ of at least one AMD PDU that is negatively acknowledged is outside the interval $VT(A) \leq \text{‘Sequence Number’} \leq VT(S)-1$; ...” *id.*, at 57.

105. This mapping of “detecting an erroneous sequence number” is consistent with the ’059 patent. Ex-1001, Abstract (“detecting that the status report includes an erroneous sequence number when a negatively acknowledged sequence number is not within the abovementioned range”), 1:40-44 (“the 3rd generation mobile communications system can provide different levels of transmission quality and operates in different modes according to the different requirements, for instance ... Acknowledged Mode (AM)”), 1:49-54 (“In AM, for better data accuracy and

robustness, Radio Link Control (RLC) layers of a transmitter and a receiver initiate a status report procedure at an appropriate time to have the receiver transmit a status report unit, or a piggybacked status report unit to the transmitter.”).

b. “receiving a status report unit output from a receiver of the wireless communications system,”

106. 3GPP-25.322-v630-Specification discloses “receiving a status report unit output from a receiver of the wireless communications system.” 3GPP-25.322-v630-Specification discloses that “[t]he Receiver transmits status reports to the Sender in order to inform the Sender about which AMD PDUs have been received and not received. Each status report consists of one or several STATUS PDUs.” Ex-1005, 50. Therefore, 3GPP-25.322-v630-Specification discloses receiving a status report packet control acknowledgement that was output from a receiver of the wireless communications system.

c. “detecting whether a negatively acknowledged sequence number lies in a range of greater than or equal to a sequence number following a sequence number of a last in-sequence acknowledged packet of a transmitter and less than a sequence number of a next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit; and”

107. The above claim limitation would have been obvious to a person having skill in the art at the relevant time in light of 3GPP-25.322-v630-Specification in combination with 3GPP-4.60-v860-Specification. For example,

3GPP-25.322-v630-Specification discloses that a “STATUS PDU or Piggybacked STATUS PDU including ‘erroneous Sequence Number’ is a STATUS PDU or Piggybacked STATUS PDU that contains: ... a LIST, BITMAP or RLIST SUFI in which the ‘Sequence Number’ of at least one AMD PDU that is negatively acknowledged is outside the interval $VT(A) \leq \text{‘Sequence Number’} \leq VT(S)-1$.” Ex-1005, 57. 3GPP-25.322-v630-Specification further discloses that to evaluate this inequality expression, “a modulus base shall be used.” Ex-1005, 43.

108. 3GPP-25.322-v630-Specification defines the variables as follows: “VT(S)” is a “send state variable” that “contains the ‘Sequence Number’ of the next AMD PDU to be transmitted for the first time (i.e. excluding retransmitted PDUs).” Ex-1005, 43. “VT(A)” is an “acknowledge state variable” that “contains the ‘Sequence Number’ following the ‘Sequence Number’ of the last in-sequence acknowledged AMD PDU.” *Id.* Therefore, 3GPP-25.322-v630-Specification discloses detecting whether a negatively acknowledged sequence number lies in a range greater than or equal to a last in-sequence acknowledged packet of a transmitter (i.e., VT(A)), and less than or equal to a sequence number of a next packet to be transmitted for the first time by the transmitter (VT(S)), as claimed.

109. Even if 3GPP-25.322-v630-Specification did not teach that the sequence number is less than (but not equal to) the sequence number of a next packet/PDU to be transmitted for the first time by the transmitter (VT(S)), 3GPP-

4.60-v860-Specification discloses or suggests it. The present claim limitation would have been obvious to one having skill in the art in light of the combination of 3GPP-25.322-v630-Specification and 3GPP-4.60-v860-Specification.

110. First, the $V(A)$ value from 3GPP-4.60-v860-Specification corresponds to the $VT(A)$ value from the 3GPP-25.322-v630-Specification (and the '059 patent), and the $V(S)$ value from 3GPP-4.60-v860-Specification corresponds to the $VT(S)$ value from the 3GPP-25.322-v630-Specification (and the '059 patent). Therefore, a POSITA would have understood that the variables would be interchangeable.

111. Second, 3GPP-4.60-v860-Specification uses an inequality that explicitly recites that the received sequence number is less than the sequence number of the next packet/PDU to be transmitted for the first time: “[$V(A) \leq BSN < V(S)$] modulo SNS.” Ex-1004, 86. Therefore, 3GPP-25.322-v630-Specification and 3GPP-4.60-v860-Specification use a very similar inequality expression with the same terms to evaluate whether a sequence number is negatively acknowledged and thus erroneous.

112. Third, the 3GPP-25.322-v630-Specification and 3GPP-4.60-v860-Specification are both wireless communications standards, they both use RLC, and they both include an Acknowledged Mode.

113. Furthermore, a POSITA would have been motivated to replace the inequality expression from 3GPP-25.322-v630-Specification to the inequality from

3GPP-4.60-v860-Specification once the POSITA realized that the specific case of $VT(A) == VT(S)$ would fail for the inequality expression disclosed in 3GPP-25.322-v630-Specification. Due to the use of the modulus operation, when $VT(A) == VT(S)$, the term “ $VT(S) - 1 - \text{the modulus base}$ ” returns a value of ‘-1.’ This -1 value then cycles, due to the modulus operation, to the largest possible value for that variable. For example, a 12-bit representation of the “ $VT(S) - 1 - \text{the modulus base}$ ” returns ‘-1’ when $VT(S)$ equals $VT(A)$, and this equals 4095. A POSITA would have found it obvious to replace the inequality expression from 3GPP-25.322-v630-Specification, which can potentially evaluate to an incorrect solution when $VT(S)$ equals $VT(A)$, with the inequality expression from 3GPP-4.60-v860-Specification, which does not evaluate to an incorrect solution.

114. It is my opinion that a POSITA would also have been motivated to replace the expression from 3GPP-25.322-v630-Specification to the inequality from 3GPP-4.60-v860-Specification because the expression from the 3GPP-4.60-v860-Specification avoids an additional subtraction operation (“-1”). A POSITA would have been motivated to reduce computational operations involved in evaluating the inequality expression, which must be frequently computed.

115. In addition to being motivated to pursue the proposed combination, a POSITA would have had a reasonable expectation of success when combining the references. As noted above, the two specifications both relate to wireless

communications standards, and 3GPP-4.60-v860-Specification even references the UMTS, which is the subject of the 3GPP-25.322-v630-Specification. Both address the issue of identifying valid or invalid sequence numbers of PDUs in an acknowledged mode of data transmission, and both use inequalities to compare sequence numbers of PDUs that been received previously, against expected PDU sequence numbers. A POSITA would have understood that the inequality expression from 3GPP-25.322-v630-Specification could be substituted with the 3GPP-4.60-v860-Specification. This element would thus be obvious to a POSITA in view of 3GPP-25.322-v630-Specification combined with 3GPP-4.60-v860-Specification.

d. “detecting that the status report unit comprises an erroneous sequence number when the negatively acknowledged sequence number is not in the range.”

116. 3GPP-25.322-v630-Specification discloses this limitation. For example, 3GPP-25.322-v630-Specification discloses that negatively acknowledged sequence numbers are erroneous if they fall “outside” the range bounded by VT(A) and VT(S).

117. 3GPP-25.322-v630-Specification discloses that a “STATUS PDU or Piggybacked STATUS PDU including ‘erroneous Sequence Number’ is a STATUS PDU or Piggybacked STATUS PDU that contains: ... a LIST, BITMAP or RLIST SUFI in which the ‘Sequence Number’ of at least one AMD PDU that is negatively

acknowledged is outside the interval $VT(A) \leq \text{'Sequence Number'} \leq VT(S)-1$.” Ex-1005, 57.

2. Claim 2

- a. **“The method of claim 1 further comprising initiating a reset procedure when the status report unit comprises the erroneous sequence number.”**

118. 3GPP-25.322-v630-Specification discloses claim 2. For example, 3GPP-25.322-v630-Specification discloses detecting an erroneous sequence number when the sequence number is outside the range bounded by $VT(A)$ and $VT(S)$.

119. When the inequality is not satisfied based on the corresponding values of BSN, $VT(A)$, and $VT(S)$, it is determined that the sequence number is invalid, and a reset procedure to retransmit the erroneous sequence number is initiated. For example, 3GPP-25.322-v630-Specification discloses that “If an AM RLC entity receives a STATUS PDU or a Piggybacked STATUS PDU including ‘erroneous Sequence Number’, it shall: ... initiate the RLC reset procedure (see subclause 11.4).” Ex-1005, 57-58.

3. Claim 3

- a. **“The method of claim 1 wherein detecting whether the negatively acknowledged sequence number lies in the range of greater than or equal to the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter and less than the sequence number of the next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit is performed by modulus operation with the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter as a modulus base.”**

120. 3GPP-25.322-v630-Specification discloses claim 3. For example, 3GPP-25.322-v630-Specification discloses detecting an erroneous sequence number with an inequality expression that uses a modulus operation, and where the last in-sequence acknowledged packet of the transmitter serves as a modulus base:

This sub-clause describes the state variables used in AM and UM in order to specify the peer-to-peer protocol. All state variables are non-negative integers. UMD and AMD PDUs are numbered by modulo integer sequence numbers (SN) cycling through the field: 0 to $2^{12} - 1$ for AM and 0 to $2^7 - 1$ for UM. All arithmetic operations contained in the present document on VT(S), VT(A), VT(MS), VR(R), VR(H) and VR(MR) are affected by the AM modulus. All arithmetic operations contained in the present document on VT(US), VR(US), VR(UDH), VR(UDR) and VR(UOH) are affected by the UM modulus. When performing arithmetic comparisons of state variables or Sequence number

values a modulus base shall be used. This modulus base is subtracted (within the appropriate field) from all the values involved and then an absolute comparison is performed. At the Sender, VT(A) and VT(US) shall be assumed to be the modulus base in AM and UM respectively. At the Receiver, VR(R) and VR(US) shall be assumed to be the modulus base in AM and UM respectively.

Ex-1005, 43. As shown above, “all arithmetic operations ... on VT(S), VT(A) ... are affected by the AM modulus.” Ex-1005, 43. Furthermore, a modulus base “shall” be used “[w]hen performing arithmetic comparisons of state variables or Sequence number values.” Ex-1005, 43.

121. Further, as explained in the '059 Patent in the Background of the Invention section when it discussed the 3GPP specification that existed at the time, the modulus base is the same as VT(A): “Comparisons between SNs are done by modulus operations with VT(A) as a modulus base.” EX-1001, 2:10-12, 2:4-5.

4. Claim 4

a. “The method of claim 1 wherein the status report unit is a piggybacked status report unit.”

122. 3GPP-25.322-v630-Specification discloses claim 4. For example, 3GPP-25.322-v630-Specification discloses that:

STATUS PDUs can be piggybacked on the AMD PDU by using part or all of the padding space. A predefined “Length Indicator” shall be used to indicate the presence of a piggybacked STATUS

PDU. This “Length Indicator” replaces the padding “Length Indicator”. The piggybacked STATUS PDU shall be appended immediately following the PDU data.

Ex-1005, 31. Further, as discussed above for limitation 1(c), 3GPP-25.322-v630-Specification discloses that a:

STATUS PDU or Piggybacked STATUS PDU including ‘erroneous Sequence Number’ is a STATUS PDU or Piggybacked STATUS PDU that contains ... a LIST, BITMAP or RLIST SUFI in which the “Sequence Number” of at least one AMD PDU that is negatively acknowledged is outside the interval $VT(A) \leq \text{“Sequence Number”} \leq VT(S)-1$.

Ex-1005, 57.

5. Claim 5

- a. **“The method of claim 1, wherein the wireless communications system is a third generation mobile communications system.”**

123. 3GPP-25.322-v630-Specification discloses claim 5. In its introductory pages, 3GPP-25.322-v630-Specification is titled “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; protocol specification” and identifies that “[t]his Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).” Ex-1005, 1 and 7. Accordingly, 3GPP-25.322-v630-Specification discloses a third generation mobile communications network.

6. Claim 6

- a. **“The method of claim 5 wherein the third generation mobile communications system is operating in an acknowledged mode.”**

124. 3GPP-4.60-v860-Specification discloses or suggests claim 6. As noted above with respect to claim 5, 3GPP-25.322-v630-Specification discloses a third generation mobile communications system. 3GPP-25.322-v630-Specification further discloses operating in acknowledged mode: “The RLC sublayer consists of RLC entities, of which there are three types: Transparent Mode (TM), Unacknowledged Mode (UM), and Acknowledged Mode (AM) RLC entities.” Ex-1005, 10; *see also id.* at 15-17.

7. Claim 7

- a. **“A wireless device comprising a central processing unit in electrical communications with a memory, the memory comprising program code for implementing the method of claim 1.”**

125. 3GPP-25.322-v630-Specification inherently discloses claim 7. Though 3GPP-25.322-v630-Specification does not explicitly disclose “a wireless device comprising a central processing unit in electrical communications with a memory, the memory comprising program code for implementing the method of claim 1,” “a wireless device comprising a central processing unit in electrical communications with a memory, the memory comprising program code” is inherently disclosed.

126. A person of ordinary skill in the art, reading 3GPP-4.60-v860-Specification, would have understood that the disclosed wireless communications system must necessarily include a wireless device that comprises a central processing unit in electrical communications with a memory, where the memory comprises program code that is used to execute the wireless communication protocol disclosed in the 3GPP-25.322-v630-Specification. Claim 7, therefore, is inherently disclosed by 3GPP-4.60-v860-Specification.

8. Claim 8

- a. **“The method of claim 1 wherein it is determined that the status report unit comprises an erroneous sequence number when the negatively acknowledged sequence number is not in the range of greater than or equal to the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter and less than and not equal to the sequence number of the next packet to be transmitted for the first time by the transmitter when the negatively acknowledged sequence number is detected in the status report unit.”**

127. 3GPP-25.322-v630-Specification in combination with 3GPP-4.60-v860-Specification discloses or suggests claim 8. For example, 3GPP-4.60-v860-Specification discloses or suggests detecting an erroneous sequence number when the sequence number does not satisfy the expression determined by the inequality “[$V(A) \leq BSN < V(S)$] modulo SNS.” Ex-1004, 86.

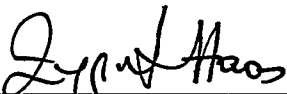
128. When the inequality is not satisfied based on the corresponding value of BSN not being within the range of greater than or equal to $V(A)$ (i.e., the sequence number following the sequence number of the last in-sequence acknowledged packet of the transmitter), and less than and not equal to $V(S)$ (i.e., the next packet to be transmitted for the first time by the transmitter), then it is determined that the status report unit comprises an erroneous sequence number. Indeed, the 3GPP-25.322-v630-Specification states that “A STATUS PDU or Piggybacked STATUS PDU including ‘erroneous Sequence Number’ is a STATUS PDU or Piggybacked STATUS PDU that contains: ... - a LIST, BITMAP or RLIST SUFI in which the ‘Sequence Number’ of at least one AMD PDU that is negatively acknowledged is outside the interval $VT(A) \leq \text{‘Sequence Number’} \leq VT(S)-1$; ...” Ex. 1005 at 57. And since the 3GPP-25.322-v630-Specification states that “If an AM RLC entity receives a STATUS PDU or a Piggybacked STATUS PDU including ‘erroneous Sequence Number’, it shall ... initiate the RLC reset procedure ...” (*id.*, at 57-58), it would have been obvious to POSITA that a determination of whether a status report unit comprises an erroneous sequence number needs to be performed based on the condition of above stated range calculation.

XIV. CONCLUSION

127. This Declaration represents the opinions that I have formed up to date based on the material currently available to me. I reserve the right to revise, supplement, and/or amend my opinions stated in this Declaration based on new information that becomes available to me and on my continuing analysis of the materials available to me.

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

Dated: July 18, 2024



Dr. Zygmunt J. Haas