

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.
Petitioner,

v.

PANTECH CORPORATION,
Patent Owner.

IPR2025-00762
U.S. Patent No. 10,863,573

**REPLY DECLARATION OF DR. TITUS LO,
IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW**

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I, Titus Lo, do hereby declare as follows:

I. INTRODUCTION

1. I have been asked by Counsel for Petitioner (“Counsel”) to respond to certain opinions expressed by Patent Owner’s (“PO”) expert in the Declaration of Dr. Paul Min in support of Patent Owner’s Response to Petition for *Inter Partes* Review (EX2012) (“Min Declaration”). My opinions, and the basis for those opinions, are set forth below.

2. As I stated in my earlier declaration in this proceeding (“Lo Declaration”) (EX1003), I am being paid my standard hourly rate. My compensation in no way depends on the outcome of this matter. I have no other financial interest in this proceeding. EX1003, ¶4.

3. I provided my qualifications in the Lo Declaration. EX1003, ¶¶10-18.

II. MATERIALS CONSIDERED

4. My opinions contained in this Reply Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge of the field.

5. In forming my opinions expressed in this Reply Declaration, I have reviewed and considered the Min Declaration, exhibits cited by the Min Declaration, materials identified in this Reply Declaration, and materials listed in the Lo Declaration (EX1003, ¶5).

6. As I stated in the Lo Declaration, my opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the specification of the '573 Patent at the time of the alleged invention, which I have been asked to consider as being no earlier than May 10, 2010. EX1003, ¶19.

III. CLAIM CONSTRUCTION

7. I have been asked to provide my opinions regarding the meaning of “in-sequence timer” and to respond to Dr. Min regarding his opinions. Dr. Min opines that “in the context of the '573 patent, an ‘in-sequence timer’ is *a timer that begins upon the detection of an out-of-sequence SDU and lasts for a period of time.*” EX2012, ¶97 (emphasis added). I disagree with Dr. Min’s conclusions and find it unnecessary and improper to add such extra conditions in the “construction” of this term in the context of claims 1 and 8. In fact, Dr. Min provides no citations to any evidence in paragraphs 94 to 97, and where he does provide citations, he does not explain how that evidence supports his conclusions. I explain my reasoning below.

8. To begin with, it is my opinion that a POSITA, and even a lay person, would have understood the meaning of “timer.” A timer is a device, mechanism, or software component that measures, records, or indicates the passage of a specific amount of time. It is uncontroversial that timer can be set to start upon a specific condition and expires after a certain amount has time has passed.

9. The '573 patent does not expressly define “in-sequence timer.” And in my opinion, an “in-sequence timer” is not limited to the PDCP entity. For example, the '573 patent explains at column 15 lines 38 to 39 that “[t]he inseqTimer field indicates *an in-sequence timer value.*” *Id.* (emphasis added). Although this field is shown in the “PDCP-Config” portion of an RRC message (shown in Table 1 of the '573 patent), the field is generic.

10. Regardless, the function of the timer is described in the '573 patent as it relates to a PDCP entity. Regarding the trigger for the timer, i.e., what makes it start, the '573 patent describes the timer as starting “when an SN prior to the PDCP SN of the PDCP SDU is missed.” EX1001, 13:46-47. The '573 patent explains that “the PDCP sequence number (SN) of the PDCP SDU correspond[s] to the PDP PDU received in the PDCP entity.” *Id.*, 13:43-44. Every other description of the “in-sequence timer” is the same with respect to its start condition. *See id.*, 14:23-55, 15:37-45, 14:54-56.

11. As I explained in the Lo Declaration, PDCP sequence number (“SN”) resides in the header of the protocol data unit (“PDU”). EX1003, ¶88; *see also* '573 patent, 13:43-44, 14:15-17. “These SNs play a crucial role in ensuring that data is delivered in the correct order to the next layer at the receiver by enabling PDU reordering.” EX1003, ¶88. Further, I also explained that the service data unit (“SDU”) is part of the PDU and is the unprocessed portion of the PDU that is passed to the

next layer. *Id.*, ¶¶75-76.

12. The '573 patent discloses that the timer lasts for a duration based on “considering the receiving delay of the transmission path of the PDCP PDU in the case of multi-flows. Alternatively, the duration of the in-sequence timer may be determined by considering an overall situation of the system.” *Id.*, 13:48-53; *see also* EX1003, ¶¶44, 47. Thus, in my opinion the specification of the '573 patent does not disclose the duration of the in-sequence timer with any specificity. The claims of the '573 patent also do not specify any range of values for the in-sequence timer. Rather, the claims merely recite that there must be “a field indicating a value of the in-sequence timer” (claim 1) or the “processor determines the value of [the] in-sequence timer based on the PDCP-configuration IE” (claim 8). Thus, in my opinion, the '573 patent allows for a wide variety of timer durations. These allowable timer duration values may be due to delay in the transmission or reception of data, or the duration values may be due to other factors associated with the overall system.

13. The '573 patent discloses five values, 20 to 60 milliseconds, in Table 1 (partially reproduced and annotated below) as example durations. EX1003, ¶147.

TABLE 1			
-- ASN1START			
PDCP-Config ::=	SEQUENCE {		
discardTimer	ENUMERATED {		
	ms50, ms100, ms150, ms300, ms500,		
	ms750, ms1500, infinity		
}		OPTIONAL,	-- Cond Setup
inseqTimer	ENUMERATED {		
	ms20, ms30, ms40, ms50, ms60,		
}		OPTIONAL,	-- Cond Setup
rlc-AM	SEQUENCE {		
statusReportRequired	BOOLEAN		
}		OPTIONAL,	-- Cond Rlc-AM
rlc-UM	SEQUENCE {		
pdcP-SN-Size	ENUMERATED {len7bits, len12bits}		

These possible durations may result from the transmission delay due to transmitting through the small base station. *See, e.g.*, EX1001, 11:44-65, 13:49-51. This delay is caused by transmitting the PDU from the macro base station through the small base station and then from the small base station to the user equipment (“UE”). However, a POSITA would have understood that this delay may be longer or shorter, depending on the “overall situation of the system.” *Id.*, 13:51-53. Thus, I disagree with Dr. Min’s assertions that the durations of in-sequence and t-Reordering timers are significantly different. EX2012, ¶95. Notably, the possible durations of the in-sequence timer listed in Table 1 are also listed as possible duration values for t-Reordering timer (0-200ms), as I had shown in the Lo Declaration (and I reproduce below with annotations). EX1003, ¶147, ¶151 (citing EX1014, 219-220 showing the values of t-Reordering). I also understand that Dr. Min agrees that the 3GPP specification allows for these “shorter values.” EX1057 89:17-90:17.

```
T-Reordering ::=
    ENUMERATED {
        ms0, ms5, ms10, ms15, ms20, ms25, ms30, ms35,
        ms40, ms45, ms50, ms55, ms60, ms65, ms70,
        ms75, ms80, ms85, ms90, ms95, ms100, ms110,
        ms120, ms130, ms140, ms150, ms160, ms170,
        ms180, ms190, ms200, spare1}
```

EX1014, 219-220.

14. The '573 patent explains that one purpose of the in-sequence timer is to allow time for the PDCP entity in the UE to receive any missed PCDP PDU in order to allow in-sequence delivery of SDUs corresponding to the received PDU to higher layers. *Id.*, 13:54-14:2. If the missed PDU is received before the timer expires, the SDU corresponding to the PDU is transmitted to the upper layer. *Id.*, 13:62-14:2. However, if the in-sequence timer expires before the missing PDCP PDU (and the corresponding PDCP SDU) is received, the UE assumes the PDU will not be received because “of the discard timer at the transmission side of the PDCP entity of the macro base station.” *Id.*, 13:54-61. In the case that the PDU is not received, the UE assumes the data is lost and will not be received. In other words, the “in-sequence timer” is associated with lost packets (which include PDUs, SDUs, and SNs) in the user equipment.

15. I have reviewed the Institution Decision (Paper 10, “DI”) and substantively agree with the Board’s understanding of “in-sequence timer.” Although I understand that the Board did not “explicitly construe the phrase ‘in-sequence timer’” (DI, 11), they understood it to mean a timer “used to place the SDUs that were received out of order back into sequence (‘reordered[.]’).” This

understanding is substantively the same as I have explained above. *See also* EX1003, ¶46. However, I note that because claims 1 and 8 already recite “for the PDCP SDUs,” it is not necessary to repeat the word “SDUs” in the providing a claim construction for in-sequence timer; in my opinion, the construction of the in-sequence timer should be “a timer used to place packet data that were received out of order back into sequence.” In other words, the “in-sequence timer” is associated with missing packets (which include PDUs, SDUs, and associated SNs) in the user equipment.

16. I disagree with Dr. Min’s opinions, regarding the proper meaning of “in-sequence timer.” EX2012, ¶¶94-101.

17. First, despite apparent agreement with the Board’s understanding, Dr. Min opines that “[t]he in-sequence timer does not address the case of packet loss.” EX2012, ¶95. Dr. Min bases his opinion on his unsupported assertion that “the in-sequence time taught by the ’573 Patent is implemented specific to the difference between the latencies in the slow path (e.g., via the small base station and the fast path (e.g., large base station).” *Id.* As I explained above, although the ’573 patent provides some specific timer duration values, it does not limit them. Moreover, it is unclear why Dr. Min dismisses the in-sequence timer’s relation to packet loss, considering the clear explanation in the ’573 patent that the in-sequence timer expires when a packet is not received, i.e., the packet was lost. ’573 patent, 13:54-61; claim 5. Therefore, in my opinion, the in-sequence timer’s expiry includes, and

is associated, with packet loss.

18. As stated above, Dr. Min opines that “in-sequence timer” in the ’573 patent means “a timer that begins upon the detection of an out-of-sequence SDU and lasts for a period of time.” EX2012, ¶97. I disagree that this is the proper construction for this claim term. As I explained above, the ’573 patent does not limit the duration of the in-sequence timer. Further, the rest of Dr. Min’s construction is already recited in the claims and is not needed for proper construction of this term. As I also explained above, claims 1 and 8 already recite that the timer is “for the PDCP SDUs.” And the conditions to start the timer are recited in the dependent claims, which are consistent with my description above. For example, claim 3 recites:

...driving the in-sequence timer with respect to the PDCP SDU of PDCP SN #n when there is the PDCP SDU of PDCP SN #n-1 which is missed.

19. Thus, the in-sequence timer begins, as recited in claim 3, “upon the detection of an out-of-sequence SDU.” Claim 11 recites a similar limitation.

20. Dr. Min appears to simply incorporate limitations of other claims into his proposed construction of “in-sequence timer” that is part of claims 1 and 8. But a POSITA would have understood the meaning of in-sequence timer to be broader and mean “a timer used to place packet data that were received out of order back into sequence.”

21. I also understand Dr. Min opines that I agree with him that “the claimed

in-sequence timer is a timer that begins upon the detection of an out-of-sequence SDU.” EX2012, ¶100. First, I was addressing a specific embodiment. In particular, I was asked whether the description in Column 13 of the 573 patent describes that the in-sequence timer starts when an out-of-sequence SDU is detected. EX2013, 54:20-25, 64:13-21. I was not asked, and did not opine, whether starting the timer based on detection of a missing SDU must be part of construction for the term “in-sequence timer” that appears in claim 1 (and claim 8). Second, I clearly stated that “[i]f [a] PDU [is] missing, the timer is driven. That's an equivalent operation because they are the same. The PDU and SDU are the same.” EX2013, 64:22-65:3. My testimony was consistent with my previous declaration, explaining a missing SN from a PDU is a missing SN for the SDU. EX1003, ¶¶74-76, 88, 134, 136, 143.

22. Thus, I disagree with Dr. Min’s proposed meaning for “in-sequence timer,” and instead substantively agree with the Board’s understanding that an “in-sequence timer” is “a timer used to place packet data that were received out of order back into sequence.”

IV. DEENOO IS SUPPORTED BY ITS PROVISIONAL APPLICATIONS

23. Deenoo claims priority to provisional application No. 61/753,867 (the “’867 Provisional App”) (EX1054), filed on January 17, 2013, and/or provisional application No. 61/811,233 (the “’233 Provisional App”) (EX1055), filed on April 12, 2013. I have been asked to consider whether the provisional applications support

the disclosure of Deenoo relied upon in the Petition and the Lo Declaration. In my opinion, and as explained below, they do.

24. Dr. Min opines that “these provisional applications lack support for Deenoo.” EX2012, ¶152. He alleges that “paragraph 211 and Figure 8 of Deenoo are not present or otherwise described in the priority applications.” EX2012, ¶153. I disagree.

A. Figure 8 is supported by paragraphs 208 to 210 of Deenoo

25. Deenoo expressly discloses that “FIG. 8 illustrates an example representation of the aforementioned sequence that captures the triggers for status check and the actions related to reordering timer.” Deenoo, ¶211. In my opinion, the “aforementioned sequence” refers to and is disclosed in paragraphs 208 to 210. I understand that Dr. Min agrees. EX1057, 114:11-115:16. Thus, Deenoo itself confirms that Figure 8 is supported by the sequence described in paragraphs 208 to 210. Furthermore, the sequence of paragraphs 208 to 210 is identically disclosed at paragraph 128 in both provisional applications. EX1054, ¶128; EX1055, ¶128. Accordingly, the subject matter of Figure 8 is also disclosed at paragraph 128 and by the provisional applications.

26. To remove any doubt, below, I have annotated Figure 8 of Deenoo showing how each of the steps of paragraphs 208 to 210 are shown in Figure 8. In Figure A, I have reproduced both Figure 8 and paragraphs 208 to 210 of Deenoo on

the same figure for reference.

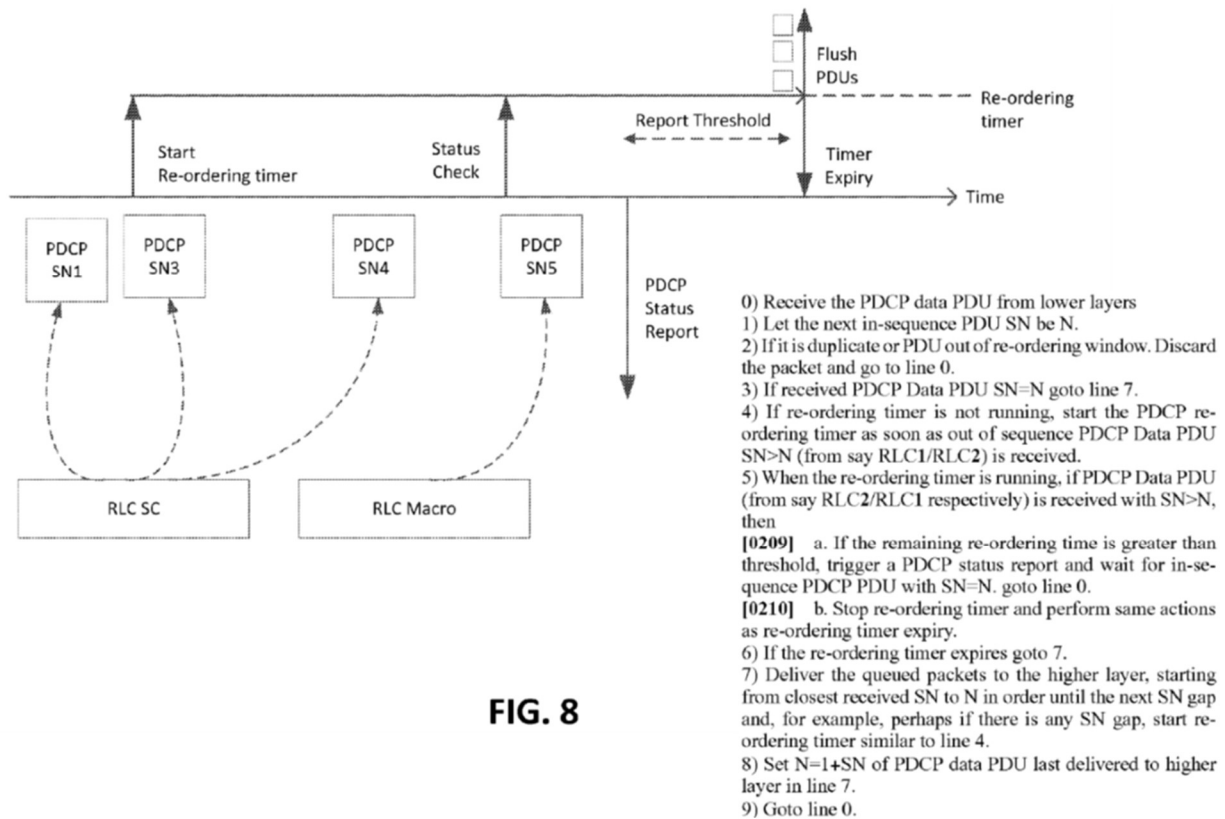


FIG. 8

Figure A

27. I note that Figure 8 does not show every possible permutation of the sequence of steps of paragraphs 208 to 210. For example, Figure 8 does not show the condition of step 3 when the missing PDCP SN is received while the re-ordering timer is running.¹

¹ In this case, the sequence discloses moving to step 7 and delivering the received packets to the higher layer. In this case as shown in Figure 8, the “closest received SN to N” would be SN=2. Thus, the packets with SN=2 through 3, 4 or 5 would be delivered to the higher layer, depending on when SN=2 was received.

28. Below in Figure B, I have annotated Figure 8 to illustrate which step in the sequence is shown, starting with step 0 up to step 5a. I have assumed that the next in-sequence PDU SN is SN=1. I have also assumed that the re-ordering window is greater than five because Figure 8 shows five PDCP data PDUs being received. At step 0, the PDCP receives a PDCP data PDU with SN=1, as shown by my annotation of "A." Because the next expected SN is 1, the sequence branches to step 7. In step 7, the SDU associated with PDCP data PDU number 1 is sent to the higher layer. Because there are no gaps detected in the sequence numbers, step 8 is performed. In step 8, N is set to 2 (the next expected sequence number). Then in step 9, the sequence returns to step 0 to wait for the next PDCP data PDU.

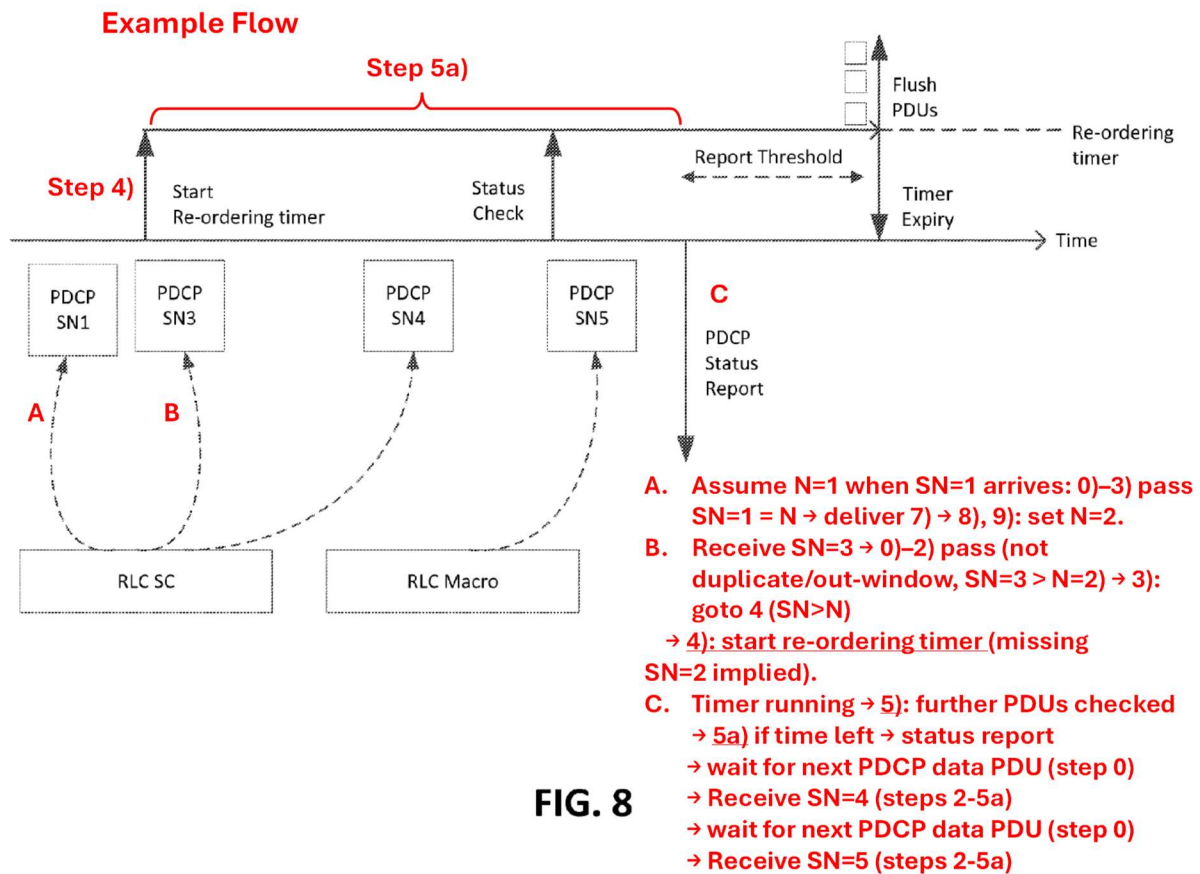
**FIG. 8**

Figure B

29. Next, the PDCP receives PDCP data PDU with sequence number of 3, as shown at my annotation “B.” Because SN=3 is received and the previous SN was 1, this is not a duplicate (i.e., unique) and it is within the re-ordering window. Thus, the sequence moves to step 3. Because SN=3 and not 2 (the expected sequence number) is received, the procedure moves to step 4. As specified in step 4, the re-ordering timer is started as soon as the “out of sequence PDCP data PDU” is received,

as shown at annotations “Step 4).”² At step 5a, a PDCP status report may be triggered. In this case the report is not sent until after PDCP data PDU 5 is received (shown at annotated “C” in the figure). The procedure then reverts to step 0 again to wait for the next PDCP data PDU. The same procedure is followed when PDCP data PDU numbers 4 and 5 are received. Thus, as shown in Figure 8 of Deenoo, the steps up to 5a) are illustrated as indicated by my annotation of “Step 5a).”

30. Below in Figure C, I have annotated Figure 8 to illustrate which step in the sequence is shown, starting with step 5b up to step 9. As shown in Figure 8, after PDCP data PDU number 5 is received, the re-ordering timer is below “Report Threshold” or expires. If the timer has not expired, but instead is less than the report threshold, step 5b recites that the timer is stopped the procedure moves to step 7 (step 5b says that “same actions as re-ordering timer expiry” are performed), as shown with annotation “D.” If, on the other hand, the timer expires, step 6 dictates that the procedure move on to step 7, as shown with annotation “E.”

² I note that the above sequence of events is no different than what the ’573 patent recites at column 14, lines 23 to 30.

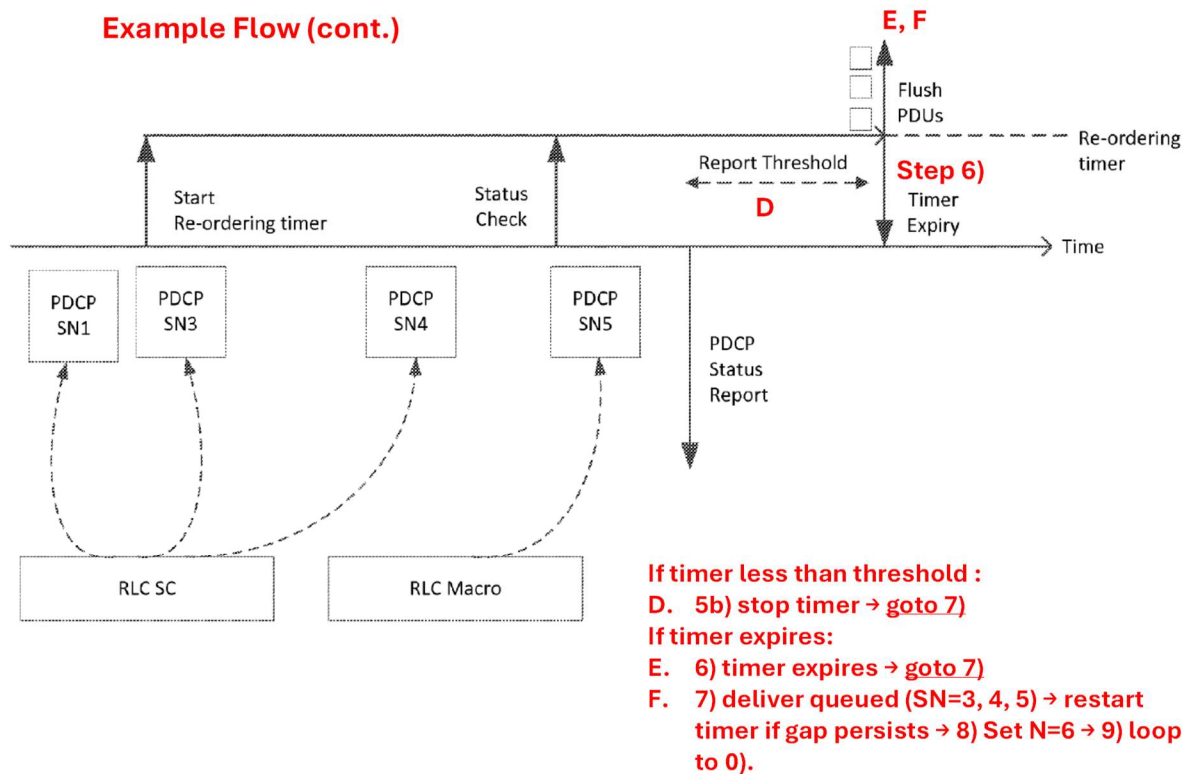
**FIG. 8**

Figure C

31. At step 7, the SDUs associated with PDCP data PDUs 3 to 5 are delivered to the higher layer, as shown at annotation “F.” The figure shows “Flush PDUs,” indicating that the “queued packets” are delivered to the higher layer. In my opinion, “flush the PDUs” is equivalent to “deliver the SDUs corresponding to the PDUs” to the higher layer because the operation is indicated with an arrow pointing to the higher layer and once the packets are delivered, a POSITA would have understood that they would have been cleared from the queue. Thus, “flushing” is merely another term for the process in step 7, where the packets are delivered to the next higher layer. After delivering (e.g., flushing) the packets, the next expected SN is set to 6 and the procedure returns to step 0 to wait for the next PDCP data PDU.

32. Accordingly, as I have explained above, Figure 8 is “an example representation” of the sequence disclosed in paragraphs 208 to 210. Deenoo, ¶211.

B. Paragraph 211 of Deenoo is supported by paragraphs 208 to 210

33. In my opinion, all of paragraph 211 is supported by the sequence disclosed in paragraphs 208 to 210 of Deenoo. Thus, because paragraph 128 in each of the provisional applications is identical to paragraphs 208 to 210 in Deenoo, the provisional applications support the relied upon disclosure of Deenoo. Below I explain why a POSITA would have understood paragraphs 208 to 210 to support paragraph 211.

34. The first two sentences of paragraph 211 recite:

“FIG. 8 illustrates an example representation of the aforementioned sequence that captures the triggers for status check and the actions related to reordering timer. One or more embodiments contemplate techniques for PDCP re-ordering that may include starting a reordering timer, for example perhaps when an out of sequence packet may be received from any one of RLC entities.”

35. As explained above, Figure 8 is supported by paragraphs 208 to 210. Furthermore, the sequence discloses “triggers” for checking whether the received PDCP data PDU is received in order (e.g., a status check) and “actions related to reordering timer,” e.g., starting and stopping the timer depending on whether the PDCP entity receives out-of-sequence PDCP data PDUs.

36. Moreover, the Lo declaration relies only on these two sentences. I understand that at his deposition, Dr. Min took issue with me using the word “flush”

instead of “deliver” to explain that PDU data is sent to a higher layer. But as explained above, a POSITA would have understood flushing the data is equivalent to, or at least includes, delivering the data to a higher layer. *See* ¶31; *see also, e.g.*, EX1003, ¶205 (“The UE may then wait for the missing packet while the timer is running or flush the PDCP data to a higher layer if the timer expires.”).

37. I also understand that Dr. Min at his deposition implied that unique sequence numbers are not received because step 2 of the sequence involves deduplication. I disagree. As I explained in my previous declaration, one function of the PDCP is to deduplicate data received from lower layer. EX1003, ¶71. Thus, checking for duplicates is an operation of all PDCP entities. Regardless, as I also explained above, paragraphs 208 to 210 allow for receiving PDCP data PDUs with unique sequence numbers, as shown in Figure 8 (showing SN1, 3, 4, and 5) and prevents duplicate sequence numbers from being processed. *See also* ¶29.

38. Paragraph 211 goes on to recite that “[t]echniques may also include marking the missing sequence number.” A POSITA would have understood that marking the missing SN is disclosed in steps 1 and 8, where the next expected sequence number is set.

39. Paragraph 211 next recites:

A status check procedure may be performed, for example perhaps when a new (e.g. fresh or updated) packet may be received from another RLC entity. The status check may include matching the marked sequence number with sequence number in the new packet, perhaps in some

embodiments when the new packet sequence may be greater than the marked sequence number.

40. A POSITA would have understood that step 4 discloses this portion of paragraph 211 because step 4 checks the received sequence number to the next expected sequence number to determine if it is greater than what was expected.

41. Paragraph 211 next recites:

A PDCP status report may be transmitted, for example to trigger retransmission, perhaps in some embodiments if the time to expiry for the reordering timer may be more than a configured report threshold.

42. A POSITA would have understood that step 5a discloses this passage because step 5a discloses triggering a status report if the timer is running and the timer value is greater than a specified threshold.

43. Finally, paragraph 211 recites:

One or more, or all, queued PDUs and/or advancing the PDCP receive window and/or canceling the re-ordering timer may be done, for example perhaps if the time to expiry for the reordering timer may be less than a configured report threshold.

44. Dr. Min takes issue with this sentence, opining that “[t]his is not described in paragraphs 208-210 of Deenoo.” EX2012, ¶154. I disagree. Dr. Min makes no attempt to explain why the sequence of paragraphs 208 to 210 do not describe this portion of paragraph 211. In my opinion, this sentence is supported by and describes steps 5b and 7 of the sequence of paragraph 210. For example, the sentence specifies “[o]ne or more, or all, queued PDUs...may be done, for example

perhaps if the time to expiry for the reordering timer may be less than a configured report threshold.” This process is disclosed in step 5b because the time to expiry is less than the threshold (specified in 5a) and a POSITA would have understood that “[o]ne or more, or all, queued PDUs...may be done” refers to processing the queued packets, as described in step 7, to which step 5b directs the algorithm. Furthermore, the phrase “canceling the re-ordering timer may be done” corresponds to step 5b because when the time to expiry is less than the threshold, step 5b directs the timer to be stopped. A POSITA would have also recognized that stopping the timer is a similar action to canceling it because the timer is in either case not running. A POSITA would have also understood that the status report would trigger retransmission of PDUs. *See, e.g.,* Deenoo, ¶205 (“This PDCP status report may then be sent using the target RLC (e.g. in target SCeNB). UE may receive this PDCP status report and may start transmitting from the first missing UL PDCP PDU.”).³

45. Considering the above, the subject matter in Deenoo that was relied upon in my previous declaration has clear support in both provisional applications. Furthermore, given that paragraph 128 in each of Deenoo’s provisional applications identically discloses paragraphs 208 to 210 of Deenoo, all of the relied-upon sections

³ Deenoo’s paragraph 205 is disclosed at paragraph 126 in both provisional applications.

of Deenoo are also described in the Deenoo provisional applications.

V. ARGUMENTS RELATED TO PRIOR ART

A. Koskinen

1. Claims 1[c] and 8[b]

46. Dr. Min opines that “[t]here is a literal difference between Koskinen’s reordering timer ‘observing a gap in a sequence of protocol data units,’ which accounts for ‘all possible HARQ and ARQ retransmissions at MAC and RLC level therein,’ and the claimed in-sequence timer that detects ‘an out-of-sequence SDU’ due to the difference in the latencies between the fast path (e.g., from the large base station to the UE) and the slow path (e.g., from the small base station to the UE).” EX2012, ¶113. It is unclear, based on paragraphs 110 to 112, why there is a “literal difference.” Paragraphs 110 to 112 of Dr. Min’s declaration discuss the duration of Koskinen’s timer. But as I explained above, the ’573 patent does not limit the time duration of the in-sequence timer. In particular, there is no meaningful difference between the ’573 patent’s explanation that “the duration of the in-sequence timer [is] determined by considering the receiving delay of the transmission path of the PDCP PDU in the case of the multi-flows” and Koskinen’s description of “by considering an overall situation of the system,” of which HARQ and ARQ retransmissions would be an optional part of. ’573 patent, 13:48-53.

47. Regardless, if the difference is between the recitation of a PDU and an

SDU, I have already explained that the SDU and SN are part of the PDU and thus when a PDCP PDU is missed, a gap in the corresponding SDU is observed. EX1003, ¶¶75, 143, 161-62. Moreover, a gap in the sequence numbers means that PDUs are out-of-sequence, and by extension also are SDUs. This was well-known to a POSITA, and explained in 3GPP documents, as I explained earlier; the '573 patent also confirms this understanding, explaining “when a PDCP PDU corresponding to the PDCP SDU #3 is received by the PDCP entity of the UE, a PDCP PDU corresponding to PDCP PDU #2 may not be received.” '573 patent, 14:25-28. In other words, when the PDU is not received, the corresponding SDU, which is part of the PDU is also not received. Moreover, the '573 patent confirms that the reception of a PDU triggers the in-sequence timer by stating that “an in-sequence timer for PDCP PDU #3 is driven.” *Id.*, 14:29-30. In my opinion, there is no meaningful difference between the timer of Koskinen and the in-sequence timer of the '573 patent.

48. Dr. Min also opines that “Koskinen’s description to ‘repurpose’ RLC state variables for PDCP acknowledged-mode (AM) data transfer does not teach to convert its reordering timer into the claimed in-sequence timer for PDCP SDUs.” EX2012, ¶114. Dr. Min further opines that I have not “explain[ed] *how* a POSITA would know how to take Koskinen’s RLC timer, which has been repurposed for the PDCP layer, and then somehow further reconfigure it to be the claimed in-sequence

timer for PDCP SDUs,” and that such a task would be “ambiguous at best.” *Id.*, ¶115 (emphasis in original).

49. As I have explained, Koskinen teaches using state variables from the PDCP and RLC layers and repurpose them in the PDCP layer to implement the Koskinen reordering timer in the PDCP layer. EX1005, ¶38; EX1003, ¶¶123, 140. Furthermore, Koskinen explains that these variables are used to deliver SDUs to upper layers. *See, e.g.*, Koskinen, ¶8. Koskinen incorporates 3GPP TS 36.322 and 3GPP TS 36.323 by reference and further explains the operation of the state variables in the respective layers and how SDUs are delivered to higher layers. Koskinen, ¶¶8-17. The 3GPP specifications further define and describe the variables. EX1011, 26 and EX1013, 13-15. As I explained at my deposition, Koskinen and the 3GPP specifications provide the required information to allow a POSITA to implement Koskinen’s PDCP timer with a reasonable chance of success. EX2013, 94:2-97:2.

50. Finally, Dr. Min opines that the prosecution history of the ’573 patent “supports [his] opinion that the Challenged Claims are not obvious based on the teachings of Koskinen.” EX2012, ¶117. Dr. Min appears to imply that Koskinen’s PDCP timer is like the timers distinguished during prosecution. During prosecution the Examiner agreed that a “cell activation/deactivation timer” and a “discard timer” did not render obvious the claimed in-sequence timer. EX1002, 42, 128.

51. Dr. Min does not explain why Koskinen’s timer is purportedly no

different than the timers distinguished during prosecution. On the contrary, Koskinen's reordering timer is quite different than the above prior art timers. Koskinen's timer (just as the claimed in-sequence timer) is implemented in the UE and therefore cannot be a discard timer because a discard timer is implemented in the base station. EX1003, ¶44 ("a discard timer may be operated at the transmission side of PDCP entity"). Dr. Min agrees. EX2012, ¶57 ("discard timer [is] implemented at the transmitting base station"). Thus, it would have been clear to a POSITA that a timer in the base station is different than Koskinen's timer implemented in the UE. And Koskinen's timer does not "relate[] to [] controlling activation or deactivation [of] a cell" like that of the Hong reference. EX1002, 42. Koskinen is clear that the disclosed timer is a "reordering timer." Koskinen, ¶37. Thus, a POSITA would have understood that Koskinen's timer does not control activation/deactivation of a "configured BS-associated cell." EX1002, 42.

2. Claims 3 and 10

52. Claim 3 recites "confirming whether there is a PDCP SDU of PDCP SN #n-1 which is missed notwithstanding obtaining a PDCP SDU of PDCP SN #n; and driving the in-sequence timer with respect to the PDCP SDU of PDCP SN #n when there is the PDCP SDU of PDCP SN #n-1 which is missed."

53. Dr. Min opines that "[n]othing in Koskinen would be recognized by a POSITA as teaching 'confirming' that a PDCP SDU has been missed." I disagree.

Koskinen describes observing a gap in PDCP PDUs. Koskinen ¶¶18, 21, 24, 35-36, 38, Fig. 2; EX1003, ¶164. A POSITA would have understood that “observing a gap” in the sequence is equivalent to (or at least renders obvious) “confirming” the gap in the sequence. This is particularly the case since an action is taken (starting the timer) when the observation is made (i.e., confirming). Dr. Min does not suggest otherwise.

54. Furthermore, as I have previously explained, a gap in PDUs means there is also a gap in the corresponding SDUs. *See* ¶47. That a gap is observed means that a PDCP SDU with a previous SN (as contained in the PDCP PDU) was not received relative to the PDCP SN that was received, which triggers the timer to start. EX1003, ¶¶160-65. This means, or renders obvious, that a gap was present, it was detected, was acted upon, and thus confirmed.

55. I also note that Dr. Min appears to advance an interpretation that claims 1 and 8 only cover a specialized packet flow scenario for multiple PDCP entities with specialized sequence numbers for SDUs. EX2012, ¶51. And Dr. Min appears to interpret the claims to require multiple in-sequence timers tied to those specialized sequence numbers. EX2012, ¶187; EX1057, 101:18-21. I disagree with both interpretations.

56. First, the claims relate to dual connectivity and multi-flow systems with a single EPS bearer. ’573 patent, cls. 1 & 8. These systems, as shown in Figures 9 and 13, contain a single PDCP entity with a PDCP PDU containing a single sequence

number corresponding to the PDU and SDU. Second, the claims also recite “an” in-sequence timer and later refer to “the” in-sequence timer. ’573 patent, cl. 1. Thus, the claims only require a single in-sequence timer. Regardless, Koskinen expressly discloses that the timer is started “whenever a gap in the received [PDUs] is observed” and “*the at least one* identified [PDU]” can be prevented from “blocking delivery of service data units to a higher layer.” Koskinen, ¶¶38, 41.⁴ Accordingly, a POSITA would have understood that Koskinen does not limit its system to a single reordering timer or detecting a single out-of-sequence sequence number.⁵

3. Claim 4

57. Dr. Min opines that “Koskinen fails to teach delivering PDCP SDUs ‘to the upper layer according to the order of the PDCP SN’ when ‘the PDCP SDU of PDCP SN #n-1 is obtained’ prior to expiration of the ‘in-sequence timer for the PDCP SDU of PDCP SN #n.’” EX2012, ¶135. Dr. Min further opines that “Koskinen does not teach what happens when PDUs are received out of order prior to the expiration of the reordering timer.” *Id.* I disagree.

58. As I explained in my previous declaration, Koskinen expressly

⁴ Deenoo also discloses determining *one or more* missing sequence numbers.

Deenoo, ¶14.

⁵ In my opinion, the same is true of Deenoo.

discloses to “deliver service data units to higher layer” (Koskinen ¶¶44; EX1003, ¶¶156-57, 170) and Koskinen’s timer is set to be “long enough *so the that the timer does not expire during normal delivery delay* of the protocol data units.” Koskinen ¶39 (emphasis added); EX1003, ¶167. Thus, as I have explained, a POSITA would have recognized that in at least some circumstances, the UE would receive the missing PDU (and SDU) prior to expiration of the Koskinen’s timer to allow the delivery of the SDUs to the upper layer. EX1003, ¶168. Further, Koskinen incorporates by reference 3GPP TS 36.322 and 36.323 and explains that the timer operates in accordance with those specifications. Koskinen, ¶¶37-39. Furthermore, the 3GPP specifications and Koskinen clearly show that SDUs are reordered and sent to higher layers. EX1011, 26 (“For PDCP entities for DRBs mapped on RLC AM the variable Last_Submitted_PDCP_RX_SN indicates the SN of the last PDCP SDU delivered to the upper layers.”); EX1013, 13-15 (“reassemble RLC SDUs from any UMD PDUs with SN that falls outside of the reordering window, remove RLC headers when doing so and deliver the reassembled RLC SDUs to upper layer in ascending order of the RLC SN if not delivered before” and “reassemble RLC SDUs from any UMD PDUs with SN < updated VR(UR), remove RLC headers when doing so and deliver the reassembled RLC SDUs to upper layer in ascending order of the RLC SN if not delivered before”); Koskinen ¶¶8, 10, 12, 45. Accordingly, as I have explained, a POSITA would have understood that SDUs are reordered and

sent to the higher layer when the missing PDCP PDU, with corresponding SN and SDU, is received prior to the timer expiring. EX1003, ¶168.

B. Deenoo in combination with Sammour

1. Claims 1[c] and 8[b]

59. Dr. Min opines that “Deenoo’s re-ordering timer and Sammour’s flush timer do not teach ‘a timer that begins upon the detection of an out-of-sequence SDU and lasts for a period of time.’” EX2012, ¶171. As I have explained above, Dr. Min’s claim construction is incorrect. Furthermore, as I have explained in my previous declaration, Deenoo in combination with Sammour, teaches the claims under the proper construction, as recognized by the Board.

60. Dr. Min further opines that “neither Sammour nor Deenoo explicitly teach the use of sequence numbers for the PDCP SDU.” *Id.* I disagree. Deenoo discloses in paragraphs 208 to 210 that the “PDCP data PDU SN” is used to trigger the re-ordering timer. *See* ¶29. And as I previously explained, the SN (i.e., sequence number) is part of the PDU and identifies the SDU. *See* ¶47.

61. Dr. Min also repeats his opinion regarding the prosecution history, stating “[a]pplicant distinguished other forms of timers to achieve allowance of the patent application.” Again, Dr. Min fails to explain why Deenoo’s timer is no different than the cell “activation/deactivation timer” and “discard timer” discussed in the prosecution. And as explained above, Deenoo’s timer is clearly

distinguishable from the timers referenced during the prosecution: a discard timer is in the base station—unlike Deenoo’s UE-based timer—and Deenoo’s timer does not control activation/deactivation of a configured BS-associated cell.

2. Claims 3 and 4

62. Dr. Min opines that “Deenoo and Sammour do not teach ‘confirming’ that a PDCP SDU has been missed.” EX210, ¶187. Deenoo, however, explains that certain actions are taken based on the missing PDCP data PDU and SN. Deenoo, ¶¶208-210. A POSITA would have thus understood that this effectively “confirms” that they are missing.

63. I also note that Dr. Min further opines that “the flush timer of Sammour and the reordering timer of Deenoo are triggered by any single missing PDCP PDU” and the timer stays active, “whether or not any additional PDCP PDU(s) becoming missing before these timers expire.” EX2012, ¶187. Thus, according to Dr. Min, “the timers would not be retrIGGERED and continue until the predetermined duration of time.” *Id.* As I explained above in paragraphs 55 and 56, I disagree with this opinion. Furthermore, what Dr. Min describes is not recited in the claims. I further note that Deenoo expressly discloses to “[d]eliver queued packets to the higher layer” and “if there is any SN gap, start reordering timer.” Deenoo, ¶210. In other words, Deenoo retriggers the reordering timer on each detected gap in PDCP sequence numbers.

64. Regarding claim 4, Dr. Min opines that “Deenoo and Sammour do not

disclose any functionality of delivering PDCP SDUs to the upper layer... prior to expiration of the ‘in-sequence timer.’” EX2012, ¶191. I disagree. The sequence in Deenoo’s paragraphs 208 to 210 discloses the exact functionality that PO argues is missing because it explicitly states “deliver the queued packets to the higher layer, starting from closest received SN to N in order.”

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 or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: March 31, 2026



Titus Lo