

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS CO., LTD. AND
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioner,

-against-

APEX BEAM TECHNOLOGIES LLC,

Patent Owner.

- - - - -x

December 19, 2023

10:02 a.m.

Virtual Deposition of
APOSTOLOS K. KAKAES, Ph.D., taken by
Patent Owner, pursuant to Notice, held
remotely, before Sharon Pearce, RDR, CRR,
CRC, NYRCR, a Registered Diplomat
Reporter, Certified Realtime Reporter, and
Notary Public of the State of New York.

* * *

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* * *

1 KAKAES, Ph.D.

2 A P O S T O L O S K. K A K A E S, Ph.D.,
3 having first been duly sworn by
4 Sharon Pearce, the Notary Public,
5 was examined and testified as
6 follows:

7 EXAMINATION

8 BY MR. PYMENTO:

9 Q. Good morning. Could you please
10 state your full name for the record.

11 A. Good morning. My name is
12 Apostolos K. Kakaes.

13 Q. So I'm Julian Pymento, counsel
14 for Apex Beam Technologies LLC in this
15 proceeding, and I'll be taking your
16 deposition today.

17 Have you ever had your
18 deposition taken before?

19 A. Yes, I have.

20 Q. Approximately how many times?

21 A. I don't remember, but a number
22 of times.

23 Q. Could you tell approximately how
24 many times?

25 A. More than 10 and less than 50, I

1 KAKAES, Ph.D.

2 would say.

3 Q. Were each of those prior
4 depositions in the context of inter partes
5 reviews?

6 A. No.

7 Q. In what context were you deposed
8 previously?

9 A. In a number of different
10 contexts.

11 Q. Have you been deposed in
12 district court litigation, related to
13 district court litigation?

14 A. Yes, I have.

15 Q. In those cases, did you provide
16 a written report of your opinions like you
17 did in this case with your declaration?

18 A. I have provided various
19 different declarations and various
20 different reports as required in each
21 respective case.

22 Q. Have those depositions occurred
23 in the last three years before today?

24 A. Some of them have. Many of them
25 have not.

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2 Q. Do you recall how many in the
3 past three years?

4 A. No. I wouldn't be accurate.

5 Q. All right. So just in case,
6 I'll just go over some of the ground rules
7 briefly. Basically, I'll be asking you
8 questions, and you'll be giving me
9 answers.

10 Do you understand that?

11 A. Yes. I have an understanding of
12 that.

13 Q. You're required to answer my
14 questions truthfully and fully. And if
15 you don't understand my question, please
16 don't hesitate to ask me to rephrase it.

17 Do you understand that?

18 A. I have an understanding of that.

19 Q. And if you do provide me with an
20 answer, I'll assume that you understood my
21 question.

22 Do you understand that?

23 A. You can correctly assume that I
24 will have an understanding of your
25 question.

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2 Q. Also, I do need verbal answers,
3 so a head nod or "uh-huh" doesn't show up
4 very good on the record for the court
5 reporter, so we'll try to avoid that.

6 Is that understood?

7 A. Yes, it is.

8 Q. I also typically take breaks
9 about once an hour. But if you would like
10 a break at any time prior to me calling
11 for a break, then you can just let me
12 know. I'll be happy to go off the record
13 for, you know, a five-minute or a
14 ten-minute bathroom break or to get a cup
15 of coffee if you need it. The only thing
16 I'm going to request is that if there's a
17 question pending, then we'll get an answer
18 on the record before we take a break.

19 Do you understand that?

20 A. Yes, I do.

21 Q. Dr. Kakaes, is there any reason
22 that you can't testify truthfully today?

23 A. No, there is not.

24 Q. Have you taken any drugs or
25 alcohol that could impair your ability to

1 KAKAES, Ph.D.

2 think today?

3 A. No, I have not.

4 Q. Where are you located right now
5 physically?

6 A. At the Finnegan office in
7 Reston, Virginia.

8 Q. Is there anyone in the room with
9 you?

10 A. Yes.

11 Q. Who is in the room with you?

12 A. Ms. Yu Yi. I may be
13 mispronouncing the name. And if so, I
14 apologize. And I don't recall the last
15 name of the attorney that's here. His
16 first name is Josh, if I remember
17 correctly.

18 Q. And if that changes, would you
19 please -- oh, I'm sorry. Go ahead.

20 A. And one more person,
21 Ms. Heather, and I don't recall her last
22 name.

23 Q. If that changes, the number of
24 people in the room, or someone leaves the
25 room or enters the room, would you please

1 KAKAES, Ph.D.

2 let me know?

3 A. I will try to remember to do
4 that.

5 Q. Okay. What programs do you have
6 currently running on your computer aside
7 from this Zoom meeting?

8 A. Adobe Acrobat.

9 MS. YU: Counsel, I would like
10 to just cut in if I may. So we have
11 provided access for the witness for
12 the documents in the record of this
13 proceeding. And he has a computer
14 with the Zoom, and we did provide the
15 electronic version of the documents in
16 the record for him.

17 MR. PYMENTO: Okay. That sounds
18 good.

19 Q. Just for the record, do you have
20 any communication programs open, such as
21 Outlook or any email program or chat
22 program?

23 A. No.

24 Q. All right. So I actually
25 provided the exhibits on the Exhibit Share

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2 already and introduced them and marked
3 them.

4 So I'm just going to read off
5 what each of the exhibits are. They're
6 all from the record. But I'll read them
7 off here.

8 The first document, which I'm
9 going to call Exhibit 1 to this IPR, is
10 U.S. Patent No. 10,944,527 or the '527
11 patent. So that's the subject patent in
12 this proceeding.

13 (Exhibit 1, U.S. Patent No.
14 10,944,527, was hereby marked for
15 identification, as of this date.)

16 Q. Exhibit 2 is your declaration
17 that was submitted in this IPR proceeding.

18 (Exhibit 2, Declaration of
19 Apostolos K. Kakaes, Ph.D., was hereby
20 marked for identification, as of this
21 date.)

22 Q. Exhibit 3 is U.S. Patent
23 Publication No. U.S. 2013/0182594, which
24 we will call Kim.

25

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2 (Exhibit 3, U.S. Patent
3 Publication No. U.S. 2013/0182594, was
4 hereby marked for identification, as
5 of this date.)

6 Q. Exhibit 4 is PCT Publication No.
7 WO 2015/199414, which we will call Zhang.

8 (Exhibit 4, PCT Publication No.
9 WO 2015/199414, was hereby marked for
10 identification, as of this date.)

11 Q. Exhibit 5 is U.S. Patent
12 Publication No. U.S. 2015/0195025, which
13 we will call Kang.

14 (Exhibit 5, U.S. Patent
15 Publication No. U.S. 2015/0195025, was
16 hereby marked for identification, as
17 of this date.)

18 Q. Exhibit 6 is the U.S. Patent
19 Application No. 15/765356, which we will
20 call Park.

21 (Exhibit 6, U.S. Patent
22 Application No. 15/765356, was hereby
23 marked for identification, as of this
24 date.)

25 Q. And last, we have the

1 KAKAES, Ph.D.
2 institution decision in this IPR
3 proceeding, which will be Exhibit 7.

4 (Exhibit 7, Institution
5 Decision, was hereby marked for
6 identification, as of this date.)

7 MS. YU: Counsel, because we
8 just have access to the documents in
9 the record, it would be helpful if you
10 can also provide the exhibit number of
11 the record for the witness.

12 MR. PYMENTO: Yeah. That's no
13 problem. Will do.

14 BY MR. PYMENTO:

15 Q. Dr. Kakaes, I'd like you to open
16 your declaration in this proceeding.

17 Just let me know when you have
18 that open.

19 A. So I do have that open. I also
20 would like to mention that I have the hard
21 copy of the declaration. I also have the
22 hard copy of the declaration just because
23 I thought it might be easy for me to find
24 things on the hard copy sometimes and on
25 the soft copy other times. So I have both

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2 the hard copy here next to me as well as a
3 soft copy which I just opened.

4 Q. That's no problem.

5 Is the hard copy annotated or is
6 it a clean copy?

7 A. No. It's a clean copy. It was
8 just printed.

9 Q. Okay. No problem.

10 Sitting here today, do you
11 believe that you considered any other
12 materials aside from the documents cited
13 in the declaration?

14 A. I'm sorry. Could you repeat the
15 question?

16 Q. Sure. Do you believe that you
17 considered any other materials aside from
18 the documents cited in the declaration?

19 A. It's been almost a year, and
20 just speaking from experience, it is
21 likely that I may have considered other
22 documents which I did not find to be
23 relevant or adding any useful information.
24 So it's likely I considered other
25 documents that I did not find a need to

1 KAKAES, Ph.D.

2 refer to.

3 Q. So Paper No. 10, which I have
4 marked as Exhibit 7, is the decision
5 granting institution in this case. It was
6 created by the Patent Office after you
7 submitted your declaration.

8 Have you reviewed that decision
9 in preparation for today's deposition?

10 A. I read through it quickly, yes.

11 Q. About how much time did you
12 spend preparing for this deposition?

13 A. Several hours.

14 Q. Somewhere between 10 and 20? Is
15 that fair?

16 A. I mean, could you explain your
17 question again, exactly what you mean?

18 Q. Sure. Did you spend somewhere
19 between 10 and 20 hours preparing for this
20 deposition?

21 A. I mean, what do you mean
22 preparing for this deposition?

23 Q. I mean talking to attorneys or
24 your own personal study of the record.
25 How much time did you spend doing that in

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2 preparation for today's deposition?

3 A. I would say it's more than
4 20 hours.

5 Q. About how much time did you
6 spend preparing the declaration?

7 A. I don't recall. It's, like I
8 said, almost a year ago. Many hours.

9 Q. Would you consider it to be more
10 than ten hours?

11 A. Absolutely.

12 Q. Would you consider it to be more
13 than 20 hours?

14 A. Yes. I'm certain it was more
15 than 20 hours.

16 Q. How about more than 50 hours?

17 A. Yeah. It's been a long time.
18 And I don't remember the exact length of
19 time it took. But it took a long time to
20 go through the documents and prepare the
21 declaration.

22 Q. Aside from your counsel at
23 Finnegan, did you communicate with anyone
24 else about your deposition today?

25 A. Could you repeat the question?

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2 Q. Sure. Aside from your counsel
3 at Finnegan, did you communicate with
4 anyone else in preparation for your
5 deposition today?

6 A. I'm not sure I understand the
7 question. I don't have counsel at
8 Finnegan.

9 Q. Okay. Aside from the attorneys
10 sitting in the room with you today, did
11 you communicate with anyone else about --
12 in preparation for your deposition today?

13 A. No, I did not.

14 Q. Have you corresponded with
15 Samsung prior to today?

16 A. No, I have not.

17 Q. Aside from your attorneys at
18 Finnegan, was anyone else involved in the
19 preparation of your declaration in this
20 action?

21 A. Again, I don't understand the
22 question, because I don't have my
23 attorneys.

24 Q. Aside from the attorneys at
25 Finnegan, was anyone else involved in the

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2 preparation of your declaration in this
3 action?

4 A. No. I only worked with
5 attorneys at Finnegan.

6 Q. Aside from the '527 patent,
7 which is the patent owned by Apex Beam in
8 this case, can you tell me how the prior
9 art documents were located in this case?

10 MS. YU: I'm going to object on
11 the basis of privilege. Just to
12 caution the witness not to reveal the
13 substance of any communication with
14 attorneys. You may answer the
15 question if you don't reveal the
16 substance of your communication with
17 attorneys.

18 A. Could you repeat the question?

19 Q. Sure. Considering, you know --
20 without mentioning anything that is
21 attorney-client privileged, could you
22 mention or tell me how the prior art
23 documents were located in this case.

24 A. They were located by looking for
25 prior art, and I found some of the

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2 documents, and I don't remember the
3 specifics of how each and every one
4 document was found.

5 Q. So is it fair to say the
6 documents -- the prior art documents were
7 located through a mix of both you and the
8 attorneys at Finnegan?

9 A. I think it's accurate to say
10 that Finnegan attorneys alerted me to the
11 existence of some documents. I reviewed
12 those documents. I found additional
13 documents. Some of those documents were
14 used in the declaration. Other documents,
15 I decided that they did not provide any
16 meaningful, useful additions to my --
17 showing that the claims were invalid, so
18 they were not used.

19 So it was, you know -- searching
20 on one document leads to searching other
21 documents, and those documents can show --
22 get other documents. So that's the
23 process I get involved in when I attempt
24 to find the right documents to show
25 whatever it is that I'm trying to show.

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2 Q. Did you personally conduct a
3 search for any other prior art documents?

4 A. I don't remember.

5 Q. So I'd like to talk about your
6 background a little bit.

7 Your CV was attached to your
8 declaration as Appendix A. And I believe
9 that's on page 132 of your declaration.
10 Please let me know when you reach there.

11 A. Yes.

12 Q. Do you mind taking a quick look
13 at your CV and just letting me know if
14 this CV is still accurate?

15 A. Yes, I think it is.

16 Q. Going through your employment
17 history, could you briefly describe which
18 of these jobs related to MIMO Technology?

19 A. So when I was teaching in the
20 George Washington University in the
21 department of electrical engineering and
22 computer science, I taught mostly graduate
23 courses in communication engineering, and
24 some of those courses included
25 MIMO-related transmission and reception.

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2 More currently, as I do
3 consulting, as I have been doing consult
4 in the area of wireless communications,
5 many of the projects that I have been
6 involved in involve consulting for network
7 operators and engineers who design,
8 operate, determine performance
9 characteristics and determining techniques
10 to improper techniques of the network.
11 MIMO is one of the techniques that has
12 been used, and therefore, I have consulted
13 on how MIMO can be exploited to the
14 benefit of the network's operation.

15 Q. Let's turn to paragraph 65 of
16 your declaration.

17 Let me know when you're there.

18 A. Okay.

19 Q. Do you see where it says, "A
20 person of ordinary skill in the art
21 ('POSITA') would have had at least a
22 master's degree in electrical engineering
23 or a similar field and at least two years
24 of experience working with multiple-input
25 multiple-output (MIMO) technology in

1 KAKAES, Ph.D.

2 telecommunications systems"?

3 A. Yes, I do.

4 Q. Did you draft this section
5 yourself?

6 A. I drafted -- this is my
7 declaration, and everything there
8 represents my opinion, so this is my
9 opinion.

10 Q. How did you arrive at this
11 understanding of a POSITA?

12 A. By taking into consideration the
13 various aspects -- various factors as I
14 explain in the previous paragraph. So for
15 example, in paragraph 64, I explain that
16 "I have considered factors such as
17 educational level and years of experience
18 of those working in the pertinent art" --
19 obviously, the pertinent art of the patent
20 at hand -- "the types of problems
21 encountered in the art, the teachings of
22 the prior art, patents of publications of
23 other persons or companies, and the
24 sophistication of the technology" involved
25 in the patent. So those are among the

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2 factors I considered.

3 Q. Did you provide the first draft
4 of this section on the POSITA?

5 A. I don't remember.

6 Q. Are there any sections in this
7 report or in this declaration that were
8 drafted by your attorneys?

9 A. I don't understand the question.

10 Q. Are there any sections in this
11 report where the attorneys provided you
12 the first draft?

13 A. I don't recall that there was
14 any sections that the attorneys provided
15 the draft of the full section without any
16 input of mine. We worked closely, and the
17 end product underwent a number of edits to
18 where I was satisfied that my opinions
19 were sufficiently, clearly, and completely
20 explained, and that became the
21 declaration.

22 Q. Let's turn to Claim 1 of the
23 '527 patent. So that's Exhibit 1001 in
24 the PTAB record.

25 Let me know when you're there.

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2 A. Okay.

3 Q. Do you see the term "antenna
4 port group"?

5 A. Hang on for a second.

6 Q. Okay.

7 A. Okay. I'm at Claim 1.

8 Q. Do you see the term "antenna
9 port group"?

10 A. Yes, I do.

11 Q. What is your understanding of
12 that term, "antenna port group" or
13 "antenna port groups"?

14 A. Well, antenna -- well, antenna
15 port groups means it's more than one
16 antenna port group. So an antenna port
17 group is a group of antenna ports.

18 Q. Do you see the claim limitation
19 that says -- and it's at the end of Claim
20 1 -- "the K is a positive integer greater
21 than 1"?

22 A. Yes, I do.

23 Q. Based on that claim limitation,
24 what is the lowest integer that K could
25 be?

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2 A. Two.

3 Q. Do you see the term "time
4 resource pool" in Claim 1?

5 A. I do.

6 Q. What is your understanding of a
7 time resource pool?

8 A. It's a pool of time resources.

9 Q. In your opinion, does the term
10 "time resource pool" mean anything
11 different than the term "time resource"?

12 A. Time resource pool is the pool
13 of time resources. So yes, it's
14 different. Time resource is a time
15 resource. A time resource pool is a pool
16 of time resources.

17 Q. Could you describe what is a
18 pool?

19 A. So it's a plain and ordinary
20 meaning of the word "pool."

21 Q. In your opinion, what is the
22 plain and ordinary meaning of the word
23 "pool"?

24 MS. YU: Objection.

25 A. I mean, the plain and ordinary

1 KAKAES, Ph.D.

2 meaning of the word "pool" is pool.

3 It's -- the first time resource pool is a
4 pool of resources.

5 Q. Is it fair to say that a pool is
6 a group of time resources?

7 MS. YU: Objection. Form.

8 A. So then the question becomes
9 what is a group? So I'm not sure I
10 would -- I would characterize that.

11 Q. In your opinion, does -- oh, I'm
12 sorry. Go ahead.

13 A. I was going to say that the
14 patent shows examples. For example, at
15 Figure 6, it shows the progression of
16 time, and it shows subframes that are in
17 the first time resource pool. So it shows
18 an example of at least what a time
19 resource pool is. It consists of a number
20 of subframes. So that is one example of
21 what a time resource pool could be, just a
22 specific set of subframes.

23 Q. Since we're at Figure 6 in the
24 '527 patent, does Figure 6 disclose a time
25 resource?

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2 A. The horizontal axis of Figure 6
3 is labeled "time," and a person of
4 ordinary skill in the art reading that --
5 seeing that Figure 6 and reading the
6 language that describes that figure, it
7 shows time resources. Each subframe is a
8 time resource, and certain subframes
9 belong to the first time resource pool;
10 namely, Subframes No. 1, No. 3, No. 5, and
11 No. 7 belong to that first time resource
12 pool. And a person of ordinary skill in
13 the art would understand that that set of
14 subframes constitute the first time
15 resource pool.

16 Q. Sticking with Figure 6, does
17 Figure 6 show a time resource subpool?

18 A. Would you repeat the question,
19 please?

20 Q. Sure. Does Figure 6 show a time
21 resource subpool?

22 A. Yes, it does. It shows an
23 example of a subpool.

24 Q. In this figure, can you describe
25 what the first time resource subpool is?

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2 A. As the word "subpool" suggests,
3 it's a subset of the pool. It's something
4 smaller than the pool. And in this
5 example, the first time resource subpool
6 that's indicated in Figure 6 consists of
7 Subframes No. 3 and No. 7.

8 Q. In your opinion, can a portion
9 of a subframe be a time resource subpool?

10 A. Could you repeat the question?

11 Q. Sure. In your opinion, can a
12 portion of a subframe be a time resource
13 subpool?

14 A. There would be some conditions.
15 For example, that portion would have to be
16 part of the pool. But in principle, to
17 answer your question, yes, it could be.

18 Q. Can you please turn to Figure 7
19 of the '527 patent. And let me know when
20 you're there.

21 A. Okay.

22 Q. Does Figure 7 show a time
23 resource block?

24 A. Yes, it does.

25 Q. In this Figure 7 of the '527

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2 patent, can you describe what the time
3 resource block is?

4 A. Just give me one second. I want
5 to rotate this figure so I can actually
6 read it. Can you repeat your question? I
7 apologize.

8 Q. No. No worries at all.

9 In this Figure 7 of the '527
10 patent, can you describe what the time
11 resource block is?

12 A. This figure provides an example
13 of the time resource block. It's labeled
14 as being resource block No. K and consists
15 of a sequence of symbols labeled Symbol
16 No. 1, Symbol No. 2... Symbol No. M. So a
17 person of ordinary skill in the art would
18 understand that that time resource block K
19 consists of M symbols.

20 Q. And in your opinion, can any
21 number of symbols comprise a time resource
22 block?

23 A. Yes.

24 Q. Let's turn to Park, which is
25 Exhibit 1007 in the PTAB record. And

1 KAKAES, Ph.D.

2 let's turn to Figure 3 of Park.

3 Please let me know when you're
4 there.

5 A. Okay.

6 Q. Does Figure 3 of Park disclose a
7 time resource pool?

8 A. Figure 3 of Park discloses a
9 certain structure that's used in LTE and
10 consisting of slots and symbols and
11 various different ways of using it. So
12 I'm not sure in what context you are
13 referring to, to this figure.

14 Q. With a POSITA's understanding of
15 the term "time resource pool," generally,
16 would you say that Figure 3 of Park
17 discloses a time resource pool?

18 MS. YU: Objection to form and
19 scope.

20 A. The opinions I offer with
21 respect to the time resource pool are
22 included in my declaration where I pointed
23 to the time resource pool as taught by
24 Kim, and I did not need to make a
25 determination whether or not what's

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2 disclosed in Figure 3 of Park would
3 constitute the time resource pool.

4 Q. Sorry about that.

5 So is it your testimony that you
6 relied on only Kim to disclose a time
7 resource pool?

8 MS. YU: Objection. Form.

9 A. What I relied to form my opinion
10 on validity, I detail very specifically in
11 my declaration. So in terms of what my
12 opinion is with respect to the first
13 occurrence of the time resource pool
14 phrase, which appeared in Claim 1, I
15 explained that that is disclosed by Kim.

16 Q. Does this Figure 3 of Park
17 disclose a time resource subpool?

18 MS. YU: Objection. Form and
19 scope.

20 A. Again, I explained what forms
21 the time resource subpool in my
22 declaration and what exactly forms the
23 subpool, I can go back to my declaration
24 and I can point it out to you. And
25 Figure 3 of Park discloses the structure

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2 of the subframe.

3 Q. Does Figure 3 of Park disclose a
4 time resource block?

5 A. Again, the time resource block
6 is a term used in some of the claims, and
7 I have pointed to a time resource block in
8 the respective claims.

9 Q. Do you mind turning to page 115
10 of your declaration. I think maybe this
11 will help a little bit.

12 A. Okay. I'm at page 115.

13 Q. What does the graphic on
14 page 115 of your declaration show?

15 A. I'm sorry. Could you repeat the
16 question?

17 Q. Sure. What does the graphic on
18 page 115 of your declaration show?

19 A. It shows the annotated picture
20 of the original of Figure 3 of Park where
21 I used that annotation to explain why, in
22 my opinion, Park discloses that the second
23 time resource pool required by Claim 3, I
24 think -- yes, by Claim 3 includes two time
25 resource blocks. And that's shown -- in

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2 part, it's shown in Figure 3, and in part,
3 it's shown in Figure 5B, which I have used
4 on the next page.

5 Q. Sticking with this annotated
6 Figure 3 of Park, what would be the
7 equivalent, in your opinion, of a time
8 resource subpool in this figure, if at
9 all?

10 MS. YU: Objection. Scope.

11 A. So as best as I recall, the
12 claims of the '527 patent require a first
13 time resource pool and a first -- and the
14 subpool of that first time resource pool.
15 And also Claim 3 requires the second time
16 resource pool, but I don't recall a
17 subpool of the second time resource pool.
18 So I did not form an opinion as to what
19 would be a subpool of that second time
20 resource pool.

21 Q. And in this annotated figure, is
22 it your testimony that the second time
23 resource pool is a portion of one
24 subframe?

25 MS. YU: Objection. Form.

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2 A. The second time resource pool is
3 the first slot, is the repetitive
4 occurrence of the first slot of subframes.

5 Q. Let's turn to Claim 1 again in
6 the '527 patent. Let me know when you're
7 there.

8 A. I'm not sure what "there" is.

9 Q. Claim 1 of the '527 patent.

10 A. Okay. Let me just go back to
11 the '527 patent. Okay.

12 Q. Do you see the claim limitation
13 "at least one of a first antenna
14 virtualization vector and a second antenna
15 virtualization vector is associated with
16 the first antenna port group"?

17 A. I'm not sure if you read it
18 erroneously or if I heard it erroneously.
19 So could you repeat it?

20 Q. Sure. Do you see where Claim 1
21 recites "at least one of a first antenna
22 virtualization vector and a second antenna
23 virtualization vector is associated with
24 the first antenna port group"?

25 A. Yes, I do.

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2 Q. Can you describe what a person
3 of ordinary skill in the art would
4 understand by an antenna virtualization
5 vector being associated with an antenna
6 port group?

7 A. A person of ordinary skill in
8 the art would understand the plain and
9 ordinary meaning of "is associated" to be
10 that the antenna port group has some
11 relationship with that first antenna port
12 group -- or -- I'm not sure I said this
13 right -- that the relevant antenna
14 virtualization vector has some association
15 with that first antenna port group.

16 Q. What is an antenna
17 virtualization vector?

18 A. It's a vector used for antenna
19 virtualization in the most general sense.
20 Of course, the '527 patent provides
21 example or discussion or explanation of
22 what that means in the context of the '527
23 patent, which is the context that's
24 relevant in my opinion.

25 And that I will point you to --

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2 just one second. Let me find it. In
3 Column 2, at line 34, the '527 patent
4 explains that, for example, the antenna
5 port is formed by superimposing multiple
6 physical antennas through antenna
7 virtualization; The mapping coefficients
8 from the multiple physical antennas to the
9 antenna port or ports constitute an
10 antenna virtualization vector for the
11 antenna virtualization.

12 So a person of ordinary skill in
13 the art would understand that that antenna
14 virtualization is formed by superimposing
15 multiple physical antennas through antenna
16 virtualization, and the mapping
17 coefficients from the multiple physical
18 antennas to the antenna port constitute an
19 antenna virtualization vector.

20 Q. So I'm going to pose a
21 hypothetical. If I have a system which
22 utilizes one antenna virtualization vector
23 associated with an antenna group, how can
24 a person of ordinary skill in the art
25 modify that system to utilize two antenna

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2 virtualization vectors associated with
3 that same antenna group?

4 MS. YU: Objection. Form and
5 scope.

6 A. There are just too many moving
7 parts for me to try to answer that
8 question. The hypothetical needs context,
9 et cetera. So I'm not sure I can answer
10 that question.

11 Q. What kind of context would help
12 to make the hypothetical more clear?

13 MS. YU: Objection to form.

14 A. A more complete description of
15 what the system is that you would want me
16 to try to modify.

17 Q. What kind of systems do you have
18 in mind?

19 A. I don't --

20 Q. Types of systems?

21 A. I don't. I mean, you're
22 creating a hypothetical, and I don't know
23 what system you have in your mind.

24 Q. I guess, all else being equal,
25 if I have a system which utilizes one

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2 antenna virtualization vector associated
3 with an antenna group, can a person of
4 ordinary skill in the art modify that
5 system to utilize two antenna
6 virtualization vectors associated with
7 that same antenna group?

8 MS. YU: Objection. Form and
9 scope.

10 A. The question is not -- I don't
11 understand the question, basically.

12 Q. Is it your testimony that there
13 needs to be more specification as to the
14 purpose of that system?

15 A. So the -- it's not just the
16 purpose of that system. The claim
17 language, specific as to the portion that
18 you read, that the first antenna
19 virtualization vector is an antenna
20 virtualization vector available to the
21 base station, and the second antenna
22 virtualization vector is antenna
23 virtualization vector available to the
24 user equipment. So it's not just some
25 abstract first and second antenna

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2 virtualization vector. So the claim is
3 more specific in terms of what those
4 antenna virtualization vectors are
5 required to be in the context of the
6 claim, of the '527 patent.

7 MS. YU: We've been going for
8 over an hour. If we can take a break
9 sometime soon.

10 MR. PYMENTO: Yeah. I'll just
11 finish up this line of questioning,
12 and sure, we can take a break.

13 BY MR. PYMENTO:

14 Q. I guess to try and clear it up a
15 little bit.

16 In this claim limitation that
17 we're discussing where at least one of a
18 first antenna virtualization vector and a
19 second antenna virtualization vector is
20 associated with the first antenna port
21 group, I'm asking, in the context of this
22 claim in particular -- and I guess the
23 '527 patent as a whole -- is it possible
24 for a person of ordinary skill in the art
25 to modify the system such that it changes

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2 from where one of the first antenna
3 virtualization vectors is associated with
4 the first antenna port group to both the
5 first and second antenna virtualization
6 vectors to be associated with the first
7 antenna port group?

8 MS. YU: Objection. Form.

9 A. You mentioned your question is
10 to modify the system. It's as if as I
11 have a system in place. I don't know what
12 system you're referring to. The claim
13 requires -- the claim language is the
14 claim language you read, and what it
15 requires is at least one of the first
16 antenna virtualization vector and the
17 second antenna virtualization vector is
18 associated with the first antenna port
19 group and that the first antenna
20 virtualization vector is an antenna
21 virtualization vector available to the
22 base station in the first time resource
23 pool and that the second antenna
24 virtualization vector is an antenna
25 virtualization vector available to the

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2 user equipment in the first time resource
3 pool.

4 So if you're asking the
5 hypothetical of a system that meets half
6 of this requirement but, for example, has
7 the first antenna virtualization vector
8 which is available at the base station but
9 doesn't have the second one that's
10 available at the UE, what's required is
11 the presence of the second one that's
12 present -- that's available to the UE.
13 Just like any other claim, if there's a
14 claim element missing from the system,
15 what's required to meet the claim is the
16 missing claim element.

17 Q. So is it your testimony that
18 both the first antenna virtualization
19 vector and the second antenna
20 virtualization vector are associated with
21 the first antenna port group as a
22 requirement of this claim?

23 MS. YU: Objection. Form and
24 scope.

25 A. I will point you to -- let me

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2 find it for a second. I explained this
3 very clearly in paragraph 108, that I came
4 to realize that the patent owner was
5 interpreting this phrase to only require
6 either one -- either the first or the
7 second antenna virtualization vector.

8 And I provided that Kim in view
9 of Zhang would render this limitation
10 obvious in light of that interpretation.
11 However, I also recognize that the
12 construction of the phrase at least one of
13 A and B may require each item listed in
14 the phrase.

15 So with that interpretation of
16 the claim, I determined that Kim in view
17 of Zhang and in view of Kang rendered this
18 limitation obvious because Kim in view of
19 Zhang and Kang do disclose both the first
20 and the second antenna virtualization
21 vector associated with the first antenna
22 port group, one being at the base station,
23 the other one being at the mobile. So if
24 that is the proper construction of the
25 claim, I have shown that to be

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2 demonstrated to rendering the claim
3 invalid, along with everything else, of
4 course, by Kim, Zhang, and Kang.

5 Now, I also recognize, having
6 quickly read the board's opinion, that the
7 board took a slightly somewhat broader
8 view that only one of them is required to
9 be associated, and whichever -- with that
10 interpretation of the claim, my
11 demonstration that Kim in view of Zhang
12 and Kang rendered this limitation obvious
13 still holds, because in the board's
14 opinion, at least one needs to be
15 associated. They're both associated. So
16 certainly, with the board's opinion,
17 that's also met.

18 Q. So is it your testimony that Kim
19 in view of Zhang and Kang show both
20 antenna virtualization vectors associated
21 with the antenna port group?

22 A. As I explained in detail in my
23 declaration, they're both associated with
24 the first antenna port group in the
25 proper -- let me just go back to the claim

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2 language for a second. They're both
3 associated in the first time resource
4 pool.

5 Q. All right. Let's --

6 A. Just to make sure that my
7 sentence is complete. So yes, indeed,
8 Kim, in light of Zhang and Kang, showed
9 that the first antenna virtualization
10 vector and the second antenna
11 virtualization vector are associated with
12 the first antenna port group and that the
13 first antenna virtualization vector is an
14 antenna virtualization vector available to
15 the base station in that first time
16 resource pool and that the second antenna
17 virtualization vector is an antenna
18 virtualization vector available to the
19 user equipment in that first time resource
20 pool.

21 Q. All right. I think now is a
22 good time for a break. How long would you
23 like? Ten minutes is okay?

24 A. Yeah. Ten minutes sounds good.

25 Q. All right. Let's do that.

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2 (A recess was taken from

3 11:10 a.m. until 11:27 a.m.)

4 BY MR. PYMENTO:

5 Q. Do you mind turning to Claim 3
6 of the '527 patent.

7 Let me know when you're there at
8 Claim 3 of the '527 patent.

9 A. One more second here. Okay.

10 Q. Sort of midway down Claim 3,
11 there is a claim limitation that states,
12 "The first signaling is a dynamic
13 signaling."

14 Do you see that?

15 A. Okay. Yeah. I see that now.

16 Q. Could you describe for me your
17 understanding of the term "dynamic
18 signaling."

19 MS. YU: Objection. Scope.

20 A. I did not form or offer an
21 opinion on dynamic signaling as used in
22 this claim. So I wouldn't be able to
23 offer an opinion now either.

24 Q. Do you mind turning to Claim 5
25 of the '527 patent.

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2 A. Okay. I'm at Claim 5.

3 Q. And do you see the term "the
4 first signaling is a semi-static
5 signaling"?

6 A. Yes, I do.

7 Q. Could you describe your
8 understanding of the term "semi-static
9 signaling"?

10 A. The term "semi-static signaling"
11 would be understood by a person of
12 ordinary skill in the art to be signaling
13 that's not static, and it's not dynamic,
14 but it is semi-static.

15 Q. What does it mean to have a
16 static signal?

17 MS. YU: Objection. Scope.

18 A. I don't believe the patent uses
19 static signal, or at least the claims that
20 I've analyzed I don't recall using that
21 term. But the term "semi-static" is used
22 both in the '527 patent and in the prior
23 art I pointed to. And if you give me a
24 minute, I will try to find that in my
25 report.

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2 (Pause)

3 A. So consistent with what a person
4 of ordinary skill in the art would
5 understand semi-static signaling to be,
6 the '527 patent at Column 14, starting at
7 line 54, it says, "The first signaling is
8 a semi-static RRC signaling."

9 So RRC signaling stands for
10 radio resource control signaling, which is
11 understood to be signaling which is
12 semi-static because -- and it can be
13 performed by including one or more RRC
14 information elements. So a person of
15 ordinary skill in the art recognizes that
16 information elements are the building
17 blocks, for a lack of a better word, of a
18 radio resource control signaling message.
19 And those constitute semi-static
20 information. And that's what semi-static
21 signaling would -- this would be an
22 example of semi-static signaling.

23 Q. Would you turn to paragraph 141
24 of your declaration. It's on page 83.

25 A. Okay.

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2 Q. In the first sentence of that
3 paragraph, you note that "Kim discloses
4 that the first signaling (signaling
5 including control information) is a
6 semi-static signaling."

7 Is -- does signaling that
8 includes control information -- sorry.
9 Strike that.

10 Is signaling that includes
11 control information always semi-static
12 signaling?

13 A. No.

14 Q. Why not?

15 A. Because it depends on the kind
16 of control information.

17 Q. What kind of control information
18 would result in semi-static signaling?

19 A. Information that's desired to be
20 transmitted in a semi-statically fashion.

21 Q. What does it mean to be
22 semi-static transmission?

23 MS. YU: Objection. Form.

24 A. I don't know.

25 Q. How would you describe

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2 semi-static signaling or semi-static
3 transmission to a layman?

4 A. The claim requires a semi-static
5 signaling, and in the '527 patent,
6 semi-static signaling is provided for, in
7 example, by RRC signaling. So the way I
8 would describe it in the context of the
9 patent is information that sends -- that
10 is sent over the radio resource control is
11 information that is being signaled
12 semi-statically.

13 Now, if I want to describe it to
14 a layman, I will have to give the layman a
15 tutorial of the layered structure
16 architecture in the communication system,
17 explain what Layer 1, Layer 2, and Layer 3
18 are, and explain what the RRC is in that
19 architecture, and then would have a
20 complete tutorial of explaining what the
21 semi-static signaling is.

22 Q. In paragraph 141, there's
23 a sentence on page 84 that states that
24 "The '527 patent confirms that the
25 semi-static signaling includes a higher

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2 layer signaling, such as RRC signaling."

3 Do you see that?

4 A. Yes, I do.

5 Q. Is higher layer signaling, such
6 as RRC signaling, always semi-static
7 signaling?

8 A. In the context of the '527
9 patent, it certainly is, as well as in the
10 context of the Kim patent. In other
11 contexts, the word "always" is a very
12 broad word. So I will have to consider
13 that question, and I have not considered
14 that -- that question as to whether or not
15 it always is.

16 Q. You mentioned earlier that you
17 reviewed -- quickly, albeit -- the
18 institution decision in this proceeding
19 prior to this deposition.

20 Based on reviewing that
21 decision, did you want to revise anything
22 in your declaration?

23 A. I have not been asked to
24 consider revising anything or forming any
25 new opinions. So so far, I have not been

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2 asked to consider making any additional
3 declaration. If I'm asked to, then I'll
4 consider it, and I'll provide the opinions
5 on whatever questions I'm asked to provide
6 an opinion on.

7 Q. But sitting here today, you
8 don't have an opinion of your own as to
9 whether you would want to revise anything
10 in your declaration if you had the choice?

11 A. I haven't given that any
12 thought.

13 Q. Okay.

14 MR. PYMENTO: I do not have any
15 further questions. I'll pass the
16 witness.

17 (Continued on the next page to
18 allow for signature line and jurat.)
19
20
21
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23
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25

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2 MS. YU: Can we take a short
3 break?

4 MR. PYMENTO: Sure.

5 MS. YU: Five minutes.

6 MR. PYMENTO: Sounds good.

7 (A recess was taken from 11:40
8 a.m. until 11:43 a.m.)

9 MS. YU: We have no further
10 questions.

11 (TIME NOTED: 11:43 a.m.)
12
13

APOSTOLOS K. KAKAES, Ph.D.

14
15

16 Subscribed and sworn to
before me this -----
17 day of -----, 2024.

18 -----
Notary Public
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I N D E X

WITNESS	EXAMINATION BY	PAGE
APOSTOLOS KAKAES	MR. PYMENTO	3

E X H I B I T S

DEPOSITION	DESCRIPTION	PAGE
Exhibit 1	U.S. Patent No. 10,944,527	9
Exhibit 2	Declaration of Apostolos K. Kakaes, Ph.D.	9
Exhibit 3	U.S. Patent Publication No. U.S. 2013/0182594	10
Exhibit 4	PCT Publication No. WO 2015/199414	10
Exhibit 5	U.S. Patent Publication No. U.S. 2015/0195025	10
Exhibit 6	U.S. Patent Application No. 15/765356	10
Exhibit 7	Institution Decision	11

CERTIFICATION

I, SHARON PEARCE, RDR, CRR, CRC,
NYRCR, a Notary Public for and within the
State of New York, do hereby certify:

That the witness whose testimony as
herein set forth, was duly sworn by me;
and that the within transcript is a true
record of the testimony given by said
witness.

I further certify that I am not
related to any of the parties to this
action by blood or marriage, and that I am
in no way interested in the outcome of
this matter.

IN WITNESS WHEREOF, I have hereunto
set my hand this 4th day of January,
2024.



SHARON PEARCE

RDR, CRR, CRC, NYRCR

* * *

ERRATA SHEET
VERITEXT/NEW YORK REPORTING, LLC

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DATE OF DEPOSITION: December 19, 2023
WITNESS' NAME: APOSTOLOS K. KAKAES, Ph.D.
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APOSTOLOS K. KAKAES, Ph.D.
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