

Page 1 UNITED STATES PATENT AND TRADEMARK OFFICE ----- BEFORE THE PATENT TRIAL AND APPEAL BOARD ----- HANSHOW AMERICA INC. AND HANSHOW TECHNOLOGY CO., LTD., Petitioner, v. SES-IMAGOTAG SA, Patent Owner, ----- Case No. IPR2024-00208 U.S. Patent No. 11,010,709 DEPOSITION OF EMMANOUIL (MANO) M. TENTZERIS, PhD Friday, August 23, 2024 1:29 p.m. - 3:02 p.m. EST Job No.: 12403 Pages: 1 - 45 Stenographically Reported By: Cara Foster, RPR, CA CSR No. 11973	Page 3 A P P E A R A N C E S ON BEHALF OF THE PETITIONER: ARCH & LAKE LLP By: Hao Tan, Esq. 10900 NE 4th Street Suite 2300 Bellevue, Washington 98004 425.289.7858 haotan@archlakelaw.com ON BEHALF OF THE PATENT OWNER: PERKINS COIE LLP By: Jessica Kaiser, Esq. 1900 Sixteenth Street Suite 1400 Denver, Colorado 90202 303.291.2300 kaiser-ptab@perkinscoie.com ALSO PRESENT: Matthew Lembo, Perkins Coie LLP Ellen Ji, Arch & Lake LLP Mano Avaldi, Arch & Lake LLP
Page 2 Deposition of EMMANOUIL (MANOS) M. TENTZERIS, PhD, conducted virtually via Zoom videoconference. Pursuant to notice, before Cara M. Foster, Registered Professional Reporter and Stenographic Certified Shorthand Reporter Number 11973, in and for the State of California and Stenographic Certified Shorthand Reporter Number 23006866, in and for the state of Washington.	Page 4 I N D E X PAGE EMMANOUIL (MANO) M. TENTZERIS, PhD Examination by Ms. Kaiser..... 5 E X H I B I T S EXHIBIT DESCRIPTION PAGE 1003 United States Patent No.: US 9,378,513 B2 Date of Patent: Jun. 28, 2016..... 6 1009 Declaration of Dr. Manos M. Tentzeris in Support of Petition for Inter Partes Review of U.S. Patent No. 10,674,340..... 27 1010 CV of Manos (Emmanouil) M. Tentzeris..... 34

1 P R O C E E D I N G S Page 5 2 * * * 3 THE STENOGRAPHER: We are going on the record. 4 The time is 1:29 p.m. 5 My name is Cara Foster. I am your California 6 CSR for today. My license number is 11973. 7 Before I swear in the witness, would counsel 8 place their appearances on the record, please? 9 MS. KAISER: Jessica Kaiser from Perkins Coie 10 on behalf of the Patent Owner. 11 MR. TAN: Hao Tan with Arch Lake for 12 Petitioner. Thank you. 13 EMMANOUIL (MANOS) M. TENTZERIS, PhD, 14 was called for examination, and after having been duly 15 sworn in under penalty of perjury by the stenographic 16 certified shorthand reporter, was examined and testified 17 as follows: 18 EXAMINATION 19 BY MS. KAISER: 20 Q. Hi, Dr. Tentzeris. Just to orient you, we're 21 now turning to your opinions in IPR2024-00208, all 22 right? 23 A. Yes. 24 Q. And you're appearing today from Atlanta, 25 Georgia; is that correct?	1 A. Yes, I do. Page 7 2 Q. And Exhibit 1003 is one of the prior art 3 references you relied on for your unpatentability 4 opinions in the 208 IPR; is that correct? 5 A. That is correct. 6 Q. If you look at Figure 2, which is on page 4 of 7 the PDF. 8 You're welcome to rotate it as well, if that's 9 helpful. 10 A. I'm at Figure 2. 11 Q. Okay. And in Figure 2, you see that the first 12 step in this flowchart is S101? 13 A. That is correct. 14 Q. And in S101, this flowchart is looking at the 15 label identifying information of the electronic shelf 16 label to be installed. 17 Do you see that? 18 A. Yes, I did. 19 Q. So it's your understanding of Figure 2 the Wu 20 reference is a process for installing a new electronic 21 shelf label; correct? 22 A. Figure 2, are we talking about S101 or in 23 general Figure 2? 24 Q. In general, Figure 2? 25 A. In general, Figure 2 is a technique to install
1 A. That is Atlanta, Georgia. Page 6 2 Q. And there's still no one in the room with 3 you? 4 A. No, it's only me. 5 Q. And do you have any hard copy documents with 6 you? 7 A. No hard copy. And all the documents are clean 8 as well. 9 Q. So you have an electronic set of the exhibits 10 from the 208 IPR; is that right? 11 A. Yes. 12 Q. And those are clean copies; correct? 13 A. They are clean copies, yes. 14 Q. Okay. And earlier when we were discussing the 15 189 IPR, I gave you some deposition basics. I'm not 16 going to repeat those here. But just a reminder that 17 the court reporter is taking down everything that we 18 each say, so we'll try not to talk over each other, all 19 right? 20 A. Definitely. 21 Q. All right. I'm going to put into the chat 22 Exhibit 1003. If you can pull that up? 23 A. 1003. Okay. 24 Q. Exhibit 1003 is the Wu reference. 25 Do you see that?	1 an electronic shelf label. And that's -- let me take a Page 8 2 look on the patent. But even in column 2 it says 3 Figure 2 illustrates a flow chart of an electronic shelf 4 label installing method. 5 Q. Okay. And if it's useful, I'll direct your 6 attention to column 3 of Wu, starting about line 43, 7 which is the description in Figure 2. 8 A. Okay. 9 Q. So in Figure 2, if you look at about -- I'm 10 sorry if you go back to column 3 -- again, this is the 11 description of Figure 2 about line 63, you see that it 12 says, "In step S102, which case the electronic shelf 13 label 110 to be installed is under is determined." 14 Do you see that? 15 A. Yes. 16 Q. And if you look at Figure 2, you see that in 17 step S102, there are three different options coming out 18 of that step? 19 A. Let me go back. Figure 2, yes. 20 Q. Okay. And if you look at the arrow coming out 21 of the left of S102 it says, "Only the electronic shelf 22 label to be installed is disposed on the shelf." 23 A. That is correct. 24 Q. And so that means that the shelf label that's 25 being installed in Figure 2, there's no other shelf

1 labels on that shelf, just this one? 2 A. This is one of the three options of installing 3 a new label so three things can happen. 4 One, no other shelf labels are installed next 5 to this and only the electronic shelf label to be 6 installed and disposed and that's S103. 7 Second possibility is another electronic shelf 8 label is already disposed on one side of the electronic 9 shelf to be installed, so there's only one adjacent 10 shelf label. 11 And the third potential case is two electronic 12 shelf labels are already disposed at both sides of the 13 electronic shelf label to be installed so there are 14 shelves left and right. 15 Q. Okay. So in the first case where the shelf 16 label to be installed is the only shelf label, the 17 method in Figure 2 goes to step S103; correct? 18 A. That is correct. 19 Q. And in step S103, the shelf label to be 20 installed is given a location code that is an initial 21 value. 22 Do you see that? 23 A. Yes. 24 Q. In the second scenario you mentioned, where 25 there is another electronic shelf label already on one	Page 9 1 A. Yes. Yes. 2 Q. And so is it your understanding that in 3 Figure 2, step S104 when the method of Figure 2 refers 4 to a mathematical extrapolation that would be an 5 addition or multiplication on the electronic shelf label 6 which is already installed? 7 A. No, I would disagree with that because 8 extrapolation -- and that's why in column 5 on line 7 9 says, "Mathematical extrapolation, such that the 10 location codes are incremented from left to right." 11 Now extrapolation -- and I have also listed 12 that in my declaration. Extrapolation inherently 13 creates something called "slope". Slope means, first 14 you figure out the starting point. The starting point 15 typically is well-known. And then based on whether you 16 want to have a directional increase, let's say from left 17 to right, if your new shelf to be installed, that means 18 starting from the known one to the left, you have to 19 create a line, more or less a linear function that would 20 be utilized for the extrapolation. 21 And that means if you want to have location 22 codes incremented directionally from left to right or 23 right to left, then if it's increasing from left to 24 right and to the known point is to the left, then the 25 line has to have a positive slope.
1 side of the electronic shelf label to be installed, the 2 method in Figure 2 goes to step S104; correct? 3 A. That is correct. 4 Q. And step S104 says that it obtains the location 5 code by performing a mathematical extrapolation. 6 Do you see that? 7 A. Yes. 8 Q. If you can go to column 5 of Wu? 9 A. Column 5. I'm on column 5. 10 Q. And do you see in column 5 it's giving an 11 example where the location code of the electronic shelf 12 label 110 already installed is R1? 13 A. Yes. 14 Q. And then it says, "The location code of the 15 electronic shelf label 110 to be installed can be R2 by 16 adding 1 to R1." 17 Do you see that? 18 A. R2 by adding 1 to R1, yes. 19 Q. And then if you look at the sentence after that 20 it says, "That is to say, the location code of the 21 electronic shelf label 110 to be installed can be 22 obtained by performing a mathematical extrapolation, 23 such as addition or multiplication on the electronic 24 shelf label 110 which is already installed." 25 Do you see that?	Page 10 1 Now, this line typically correlates the 2 position X, that's a linear extrapolation, with the 3 value you want to assign to an unknown point. That's 4 the point of extrapolation. And that means for a 5 different X or different distance, it will have a 6 different value since it's a line. 7 Now, if your known shelf is to the right, given 8 that the location codes are increased from left to 9 right, then this line will have a negative slope. So 10 you will have an expression like minus 3X, minus X 11 reference. And in this case, based on the distance from 12 a known point, you will have a different value. 13 So in my opinion, extrapolation involves a 14 combination of addition and multiplication. The example 15 here, R1 and R2, does not mean that necessarily R1, 16 plus 1. That would be one way of extrapolation of this 17 specific example. 18 But in general, talking about extrapolation is 19 something much more complicated than addition and 20 multiplication. It's care fitting. It's the 21 development of a line with a well-known slope that would 22 locate a different value for the new shelf based on the 23 known value of another shelf and based on your, as we 24 call, extrapolation rule which defines the direction of 25 extrapolation. So if it goes left, it goes right. If
	Page 11 Page 12

Page 13 1 it increases left, if it increases right. So it's 2 typically much more complicated whenever you use the 3 term "extrapolation". 4 Q. Can you point me to in Wu where Wu describes 5 extrapolation as applying a linear slope? 6 A. If you go to column 5, line 11, they gratify 7 the slope definition. "The same location codes can be 8 decremented from left to right." And actually 9 decremented should be decreased. I mean, not 10 decremented. 11 Whenever it says "decremented" from left to 12 right, that means depending on whether you want to add 13 your shelf left or right, the slope would be positive or 14 negative. This is the point of adding this comment, and 15 coupled with the term "mathematical extrapolation". 16 Now, in line 8 it says, "Mathematical 17 extrapolation, such as addition or multiplication." 18 Clearly -- and I would say that has to do with the way 19 they did the translation. If it was just a simple 20 addition like the line you told me, which is column 5, 21 line 5, where adding 1, plus R1, they just would not 22 need to say "extrapolation." 23 But the moment they define extrapolation such 24 as addition or multiplication, multiplication inherently 25 means the -- that's what I'd say even 11th graders would	Page 15 1 Q. So in the example there, you have an existing 2 shelf label with the location code R1; right? 3 A. That's correct. 4 Q. And then you install an electronic shelf label 5 to the right of that, and that electronic shelf label is 6 assigned the location code R2; is that correct? 7 A. You assign a new location code there too, yes, 8 depending on the location code of R1. Yes. 9 Q. And the way in this example that Wu arrives at 10 the location code R1 is by -- I'm sorry, at the location 11 R2, is by adding 1 to R1; correct? 12 A. As they say in this case, the location code in 13 line 5 of the electronic shelf label 110 to be installed 14 can be obtained by performing a mathematical 15 extrapolation. 16 What's given just as an example of simple 17 addition is the location code of the electronic 18 shelf 110 to be installed can be R2 by adding 1 to R1, 19 which is a special case of the term "extrapolation". 20 Clearly, in column 5, it stressed that 21 extrapolation can be multiplied, it's addition or 22 multiplication of the electronic shelf 110 such that the 23 location codes are incremented left to right. 24 So as an example, R2 could be R1, plus 1, but 25 as clearly defined in column 5, a mathematical
Page 14 1 know that -- that whenever you have extrapolation, it's 2 a multiplication of a slope number or a coefficient you 3 may want to assign, multiplied by the difference between 4 the position of your known "variable" which is the 5 electronic shelf to be added, minus the position of 6 the known variable which is the already installed shelf. 7 That's the point of the term "multiplication" in this 8 case. 9 So multiplication means, constant you choose 10 and this constant could be positive or negative based on 11 the rule given on line 11. 12 So, talking about addition, talking about 13 multiplication, and also talking about the order of the 14 decrease of location codes from left to right, these are 15 the fundamental parts defining the term "extrapolation" 16 and differentiating by just adding 1. 17 I would say, adding 1 is just a very simple 18 example for people that are not familiar with the term 19 "extrapolation". 20 Q. So in the example in column 5 of Wu -- 21 A. Column 5. Let me go back. 22 You know, all these examples I have to turn 23 around. Which 5, 5B? 5A? There's lots of 5s. 24 Q. Column 5, Dr. Tentzeris. 25 A. Column 5. Yes.	Page 16 1 extrapolation would be utilized in this case. 2 So the mathematical extrapolation typically 3 aims in providing a very accurate prediction for unknown 4 positions or unknown variables determined on the basis 5 of the obtained locations of existing smart shelves. 6 And that's what I have covered also in my declaration 7 paragraphs 128 to 130, for example. 8 In general, extrapolation -- and I will say 9 that again -- means a more complicated function than 10 just a simple example given in line 4. I mean, line 4 11 is just a simplification, just one example, just to show 12 that the location code of the electronic shelf label 110 13 can be determined on the basis of obtained location of 14 R1 of the existing ESL. 15 So in my opinion, lines 3 to 5 just serve as a 16 demonstration of the fact that the electronic shelf 17 label to be installed, location code can be determined 18 based on the location code of the already installed 19 electronic shelf label. That's the only reason these 20 examples are given. 21 And then clarification, in general the location 22 code of the electronic shelf label to be installed, can 23 be obtained by a mathematical extrapolation of the 24 location code of the electronic shelf label, which is 25 already installed.

Page 17 1 And also, clearly stressing that the 2 directionality is critical in this case. So location 3 codes are incremented from left to right or could be 4 decremented from left to the right. 5 Q. You agree with me that Wu doesn't use the term 6 "linear slope"; correct? 7 A. It uses the term "extrapolation". And every 8 person of ordinary skills, not of an engineer, just 9 somebody in mathematics knows that extrapolation could 10 take different forms. The simple form of extrapolation 11 is the linear extrapolation which involves a slope. 12 So the moment they utilize extrapolation, 13 immediately what a person of ordinary skill could think 14 is coming up with a slope of a line or even more 15 complicated curves depending on an existing starting 16 point. That's the point of extrapolation. 17 Q. To be clear, Wu doesn't say "linear 18 extrapolation," does it? 19 A. I gave one example over simple extrapolation. 20 There are other extrapolations. Instead of a line, you 21 could utilize a parabola cubic function or a spline. So 22 I just gave a simple example of an extrapolation just to 23 give the essence that you come up with a determination 24 of some parameters of some curve. You will need to 25 calculate the value of location as a function of a	Page 19 1 but extrapolation is not a simple thing. Extrapolation 2 requires known point, requires known position, and also 3 requires directionality. That's very important anytime 4 we talk about extrapolation. 5 Q. Okay. So let's take the example that's in Wu 6 column 5 at the top there. 7 A. Okay. 8 Q. Your known point, right, is location code R1? 9 A. Okay. 10 Q. And the mathematical relationship is from left 11 to right increment by one. So we add a new electronic 12 shelf label to the right of R1. 13 A. Okay. 14 Q. We increment up so that shelf label code gets a 15 location of R2; correct? 16 A. Yes. That's correct. 17 Q. And then if we were to start with R2 in the 18 same example and install another shelf label to the 19 right, that new shelf label you've installed would get a 20 location code R3; correct? 21 A. That would be R3. That would be location code 22 that would be larger than R1 and R2 based on what you 23 can see here in this example. So if the location codes 24 are incremented from left to right, R3 would be larger 25 than R1 and R2. So that would be the case. If you
Page 18 1 variable, maybe the distance, from an inference point. 2 In reality, if you look up the term 3 "extrapolation", I could make it much more complex and 4 say, "cubic spline," but it would be way too complicated 5 for our example. 6 It really depends. In the sense you utilize a 7 starting point, which in this case is the location code 8 of an already installed electronic shelf label, you use 9 the fact that this already installed shelf label is to 10 the left or to the right of the point you want to 11 calculate, and then you come up with some parameters of 12 the care you will utilize to do that. 13 Is it going to be a line? Is it going to be a 14 parabola? Is it going to be cubic? I would say it 15 would be an overkill for this case because you have a 16 linear shelf. 17 I mean, if you had the 3D weird shelf being 18 utilized in Nike or some other futuristic 19 demonstrations, yeah, you could need, like cubic splines 20 or a parabola. But in this case, a linear extrapolation 21 would be more than enough because the shelf is linear, 22 that would be the easiest extrapolation you do. 23 Wu does not specify because I'm sure different 24 tests could be used. So the approach could work 25 typically well no matter what extrapolation was used,	Page 20 1 added this to the right and the codes were increasing 2 from left to right, yeah, that's known. 3 Q. And that is the mathematical extrapolation in 4 the example that's at the top of column 5? 5 A. This is a very simple demonstration of 6 mathematical extrapolation. Just a simple one just to 7 show that R2 is calculated using the well-known R1 and 8 that's all. 9 But the moment that this patent clearly says in 10 line 7, performing a mathematical extrapolation using 11 addition or multiplication and definitely adding 1 to R1 12 is not multiplication. So since it talks about 13 additional multiplication, it would be clear to a person 14 of ordinary skills that to derive at R2, you would have 15 to go through a more complicated process using all the 16 specifics of some function-based extrapolation that 17 would involve multiplication. 18 So possibly R2 would be three times or would be 19 some constant multiplied by the position of R2, minus 20 the position of R1. That would be a linear example. 21 That would be another more complicated extrapolation 22 which would be R2, equal R1, multiplied by some constant 23 multiplied by position of R2, minus position of R1 24 square. That would be a square extrapolation and so 25 on.

1 Q. Okay. But you'll agree with me that Wu doesn't 2 disclose an example of the more complicated 3 extrapolations that you're talking about; is that 4 fair? 5 A. It discloses that the location code of the 6 electronic shelf label to be installed, as in line 5 7 column 5, can be obtained by performing a mathematical 8 extrapolation, such as addition or multiplication. So 9 that's the description technique, and clearly, they use 10 the term "mathematical extrapolation". 11 If Wu wanted to see something else, he would 12 not have used this term. So what Wu is saying, the 13 location of the electronic shelf label to be installed 14 can be obtained by performing a mathematical 15 extrapolation such as addition or multiplication, and 16 that's what's given in Wu. 17 So it could be addition, it could be 18 multiplication, and definitely could depend on the 19 direction you acquire the codes of the shelf label is 20 already installed, and that's the point of order of 21 increasing or decreasing location codes. 22 Q. Okay. So let's talk about multiplication. 23 We've talked about addition in the example that's at the 24 top of column 5 of Wu. Let's talk about multiplication. 25 So say instead of adding 1 as the	Page 21 1 A. Multiplied by 2. So you say R2 is going to be 2 2 times R1, that's what you're saying? 3 Q. So the shelf label that I installed to the 4 right of our R1, will have the location code R2? 5 A. It will have some location R2, yes. 6 Q. Okay. And then if I have as my starting point 7 now the shelf label with the location code R2. 8 A. Yes. 9 Q. I install a shelf label to the right of that 10 with the extrapolation now multiplied by 2. The third 11 shelf label, the next shelf label I put to the right, 12 will have the location code R4; correct? 13 A. Okay. That could be R4, okay. 14 Q. Okay. 15 A. So what you're saying -- because I'm trying to 16 understand. The term R4, you said like 2 times R2. 17 First of all, extrapolation does not mean that the 18 multiplication will have the same multiplication factor 19 for any arbitrary position. 20 What I said is, if you do linear extrapolation, 21 what you have to do is, you will have to have possibly 22 based on the distance from R1, the second label R2 could 23 be R1, times 1.33 based on the distance because 24 extrapolation, as we said in the beginning, has to do 25 with the variation of a function, which in our case is
Page 22 1 extrapolation, you had multiplied by 2, okay? 2 A. Okay. 3 Q. So you start with shelf label -- an existing 4 shelf label that has the location code of R1. 5 A. Okay. 6 Q. And then in this example, when you put in your 7 shelf label -- so say we're incrementing from left to 8 right again. 9 A. Okay. 10 Q. So existing shelf label R1, you install a new 11 shelf label to the right of R1, with the extrapolation 12 multiplied by 2, that new shelf label would have the 13 location code R2; correct? 14 A. Yes. 15 Q. And then we have our starting point R2 now. 16 The second shelf label has the location code R2. In 17 this example, then if I go in and install a new shelf 18 label to the right of R2, I would multiply by 2 and give 19 that shelf label location code R4; correct? 20 A. I lost you now for the R4. 21 So you have a starting point of R1 you said, 22 and then you want to add 1 shelf label to the right? 23 Q. Yes. 24 A. And you want to apply multiplication? 25 Q. Multiplied by 2?	Page 23 1 the location code of the electronic shelf label as a 2 function of a variable, which in this case is the 3 position. 4 So if, for example, the distance of the second 5 shelf to be installed for R1 was .2 meters, then R2 6 would be effectively R1, multiplied by 1.2. Just an 7 example. 8 Now, if the distance of the shelf to be 9 installed was .3 meters, then R2 could be 1.3 R1. If 10 the distance was 1 meter from R1, the distance could be 11 2 R1. 12 So what I'm trying to do is, extrapolation does 13 not use an arbitrary fixed number of additional 14 multiplication to come up with a value of a function as 15 a function of a variable. 16 Depending on different values of the variable, 17 in this case distance, extrapolation gives different 18 results. So different distances correspond to different 19 potential values of R2. That's what I'm trying to say. 20 This is the essential extrapolation otherwise it 21 would be just simple addition or multiplication. 22 Extrapolation enables you to have something we 23 call "a higher ground variety" in the prediction. So 24 assuming a shelf in this case is just one axis, just the 25 X and it could take any value from 0 to 1 meter,
	Page 24

Page 25	Page 27
1 extrapolation would give different corresponding values 2 of the shelf label to be installed location for 3 different distances. This is the part of extrapolation, 4 and that's what I'm trying to say. 5 So R2 is not going to be 2 times R1, and R4 is 6 not going to be 2 times R2 no matter what the distance 7 is. That would depend on the distance. So if the 8 distance between R1 and R2 is the same with the distance 9 between R2 and R4, possibly you would have R1, 2 R1, 10 4 R1 because you are doubling the distance. It's the 11 same space. 12 On the other side, if one is at .2 meters and 13 the other is at 1 meter, then you could go R1, 1.2 R1, 14 and then 1.8 R1. That's what I'm trying to say. 15 Extrapolation does not give fixed values no matter what 16 the starting point is, that's why you say 17 "extrapolation," otherwise you would just say "simple 18 addition" which is not what's given in this patent. 19 Q. So can you point me in Wu to where it says that 20 distance is taken into account in performing the 21 mathematical extrapolation? 22 A. What is clearly said -- let me read again the 23 description. 24 So if you go to column 5, line 5 it says, "That 25 is to say, the location code of the electronic shelf	1 "mathematical extrapolation," that must take into 2 account distance; is that your testimony? 3 A. My testimony is that mathematical extrapolation 4 has to depend on an independent variable. And given 5 this independent variable is declared in line 9 saying, 6 the location codes increment from left to right, my 7 testimony is that the mathematical extrapolation will 8 have to do with distance, which is the independent 9 variable in this case. 10 And that's what I have written even in my 11 expert declaration in paragraph 128 that's Exhibit 1009. 12 So my opinion is that Wu discloses that the computer 13 system determines the locations of the articles by 14 mathematical interpolation and extrapolation. 15 Q. Okay. I want to go back in Exhibit 1003 to 16 Figure 2. 17 A. Okay. 18 Q. In Step 102, the third case, the case on the 19 right-hand side is, "Two electronic shelf labels are 20 already disposed at two sides of the electronic shelf of 21 label to be installed." 22 Do you see that? 23 A. Yes, I do. 24 Q. And that means essentially that you would be 25 installing an electronic shelf label between two
Page 26	Page 28
1 label 110 to be installed can be obtained by performing 2 a mathematical extrapolation, such as addition or 3 multiplication on the electronic shelf label 110 which 4 is already installed." 5 So what's said here is what a person of 6 ordinary skills would understand, would say perform a 7 mathematical extrapolation on the electronic shelf label 8 110, which is already installed. 9 So the way I read this is, you have a starting 10 point for the extrapolation, the electronic shelf label 11 110, which is already installed, and you perform the 12 mathematical extrapolation depending on the increment 13 order. So in either what's listed on line 9 that says 14 such that the location codes are implemented from left 15 to right or the location codes could be decremented from 16 left to right. 17 But in the lines above it says, "performing a 18 mathematical extrapolation on the electronic shelf label 19 110 which is already installed." Typically, when you 20 say, "perform extrapolation on a starting point," that's 21 the typical mathematical terminology to use this point 22 as your starting point for the extrapolating curve. So 23 that's how a person of ordinary skills would read this 24 line. 25 Q. So in your opinion, when column 5 says,	1 existing electronic shelves? 2 A. That is correct. 3 Q. In that case, you go to Step 105. 4 Do you see that? 5 A. Yes, I do. 6 Q. And Step 105 says, "Obtain the location code by 7 performing a mathematical interpolation on the 8 electronic shelf labels which are already installed." 9 Do you see that? 10 A. Yes. 11 Q. If you go back to column 5 of Wu, if you go 12 down to about line 50, you see it says, "Regarding to 13 the location code of the electronic shelf label 110 to 14 be installed, the location code of the electronic shelf 15 label 110 located at the left side of the electronic 16 shelf label 110 to be installed is R1, and the location 17 of the electronic shelf label 110 located at the right 18 side of the electronic shelf label 110 to be installed 19 is R2." 20 Do you see that? 21 A. Yes, I do. 22 Q. So in this example, you have a shelf with one 23 shelf label R1 and a shelf label to the right R2? 24 A. That is correct. 25 Q. Okay. And the electronic shelf label to be

1 installed is going to be installed between R1 and R2; 2 correct? 3 A. Yes. 4 Q. And at column 5 at about line 55 it says, "The 5 location code of the electronic shelf label 110 to be 6 installed can be R1.5 by dividing the sum of the number 7 of R1 and R2 by 2, such that the location code of the 8 electronic shelf label 110 to be installed is between 9 those two location codes." 10 Do you see that? 11 A. Yes. 12 Q. And then the last sentence of that paragraph 13 says, "That is to say, the location code of the 14 electronic shelf label 110 to be installed can be 15 obtained by performing a mathematical interpolation, 16 such that the location codes are implemented from left 17 to right." 18 Do you see that? 19 A. Yes, I can see that. 20 Q. So in this example, the interpolation for the 21 electronic shelf label installed between R1 and R2 is to 22 take the mid-point that is 1.5? 23 A. Can you say that again? 24 Q. Sure. 25 A. You said something about interpolation or	Page 29 1 have two specific positions; one left, one right, and 2 also you have two specific shelf labels, R1 and R2. 3 Now, typically interpolation has three steps. 4 The number one step is you identify these two well-known 5 points. Number two is, you choose again the curve you 6 would perform your interpolation, which is more strict 7 even than the extrapolation, so you have two fixed. 8 Now again, mathematical interpolation means, 9 you have to come up with a curve, which again could be 10 linear, it could be parabolic, it could be cubic that 11 would correspond to R1 and R2 for position X1 and X2. 12 So for example, if you have a line, then the 13 slope would be R1 -- or R2, minus R1, over position 2, 14 minus position 1. That would be a potential slope if 15 you utilize linear interpolation. Again, you would have 16 complicated curves. 17 So knowing this and knowing this interpolating 18 curve, you assigned a different code R based on 19 different locations, because now the electronic shelf 20 label location code for the shelf to be installed would 21 be slope, position of this electronic shelf, minus the 22 position of the left and the right shelf. 23 So just to comment on the question about the 24 example in lines 55 and 57, because you asked me if 25 taking the half summation of R1 and R2 is the Page 31
1 mid-point. 2 Can you repeat it? 3 Q. Sure. 4 The mathematical interpolation that is 5 performed in the example in column 5, starting at about 6 line 50, is to divide by 2; correct? 7 A. Divide the sum by 2, you said, line 55? That's 8 what you mean? 9 Q. Yes. 10 A. So you're pointing me to line 57? 11 Q. Yes. 12 A. Okay. So what is the question? 13 Q. So the mathematical interpolation here in this 14 example is 1 plus 2, divide that sum by 2, gives you the 15 location code R1? 16 A. I don't agree with that again. Why is that? 17 Why did I say that? 18 Talking about interpolation -- and again, I 19 stress the fact of mathematical interpolation, so it's 20 not an arbitrary interpolation. It's interpolation 21 defined in a mathematical correct way. 22 Now, interpolation typically involves the 23 determination of a value of a function, which in this 24 case could be a location code, based on 2 values left 25 and right at well-known positions. So in this case, you Page 30	1 interpolation. Clearly, the patent says the location 2 code of shelf label 110 to be installed can be R1.5 by 3 dividing the sum of the number R1 and R2 by 2. Just 4 meaning that the R1.5 -- and this is just one example of 5 where to choose -- would be to rely on the numbers R1 6 and R2. And one very simple way to comprehend would be 7 to take the half summation. 8 I mean, this is just an example. And also this 9 one could be different for different locations. The 10 moment the patent says performing a mathematical 11 interpolation using the location codes of the two 12 shelves that are already known, that means a much more 13 complicated procedure corresponding to a different value 14 of a location code for the electronic shelf label to be 15 installed for a different position. That is the point 16 of mathematical interpolation. 17 And I have explained that also in paragraph 245 18 of my declaration saying that the interpolation method 19 necessarily involves measurement of relative distances 20 between the labels as the mathematical interpolation 21 necessarily and inherently uses such distances as input. 22 So that's my opinion. Terms like 23 "interpolation" and "extrapolation" mathematically are 24 much more complex than addition or half summation. 25 Q. So in Wu itself, where does Wu disclose using Page 32

1 actual physical distance as part of the mathematical 2 interpolation in column 5 starting at about line 50? 3 A. Let me take a look. 4 As we discussed before, Wu uses the term 5 "mathematical interpolation" on the location code of the 6 shelf label located on the left side of the electronic 7 shelf label to be installed and the location code of the 8 shelf label located at the right side of the electronic 9 shelf label. 10 Also, we discussed that mathematical 11 interpolation correlates the value of a function as a 12 value of some variable. And in the example of Figure 13 3D, a person of ordinary skills would understand that 14 the independent variable that would determine the -- 15 would provide sufficient information for mathematical 16 interpolation is the location. 17 You are talking about the location code of 18 electronic shelf labels left to right of the shelf label 19 to be installed. And the only variable in the location 20 code of these shelf labels they are correlated is the 21 position on the shelf. There is no other independent 22 variable that could be utilized performing a 23 mathematical interpolation in this case. 24 So the moment the patent talks about the 25 location code of the electronic shelf labels and	Page 33	1 A. Yes, that's right. 2 Q. Do any additions that you would have to 3 Exhibit 1010 relate to designing systems for retail 4 environments? 5 A. I was an invited speaker for some conferences 6 having to do with, I would say, smart logistic, smart 7 environment, and smart retail utilizing RFID and NFC 8 technologies. That would be IEEE FLEPS 2024 that took 9 place in Tampere, Finland this July. And also there was 10 talk on IEEE web, as I told you, for backscattering that 11 discussed backscattering environment such as, again, 12 smart logistics, smart retail, and so on. 13 So I discussed how RFID and NFC-based systems 14 could be utilized, not only for identification, but also 15 localization and selective interrogation. 16 Also, there have been numerous journal 17 publications, again, for IEEE journals having to do with 18 subcentimeter localization approaches utilizing RFID and 19 NFC-based technologies. They have been disclosed in 20 either International Microwave Symposium, also 21 transactions on microwave theory and techniques, and 22 also microwave journal. 23 On top of this, I have been interacting with a 24 variety of industries having to do with RFID and NFC 25 technologies. So collaborating with NXP making, I'd	Page 35
1 understanding the term "location code of an electronic 2 shelf label", any person of ordinary skills would 3 understand means that the mathematical interpolation 4 would take place as a function of the position defined 5 by the location code of individual electronic shelf 6 labels. 7 MS. KAISER: Okay. We've been going for 8 about an hour. Let's stop here for a break. 9 THE WITNESS: Okay. Great. 10 minutes? 10 MS. KAISER: Sure. 11 (Off the record: 2:26 p.m. - 2:40 p.m.) 12 BY MS. KAISER: 13 Q. Welcome back, Dr. Tentzeris. 14 I'm going to ask you to open your CV, 15 Exhibit 1010. 16 A. Okay. 17 Q. Give me one minute, and I will put it in the 18 chat. 19 A. Sure. 20 Q. All right. And you recognize Exhibit 1010 in 21 the 208 IPR as your up-to-date CV as of June 2023? 22 A. That is correct. 23 Q. You mentioned in prior depositions that you 24 have some additions to this for things that have 25 happened since June 2023; is that right?	Page 34	1 say, the most powerful NFC tags, as well as with 2 Honeywell, RFIDs to implement and see how these 3 technologies could enable smart logistics, smart retail, 4 and so on. 5 And I would say also if you want to include 6 some known RFID technologies, I've been involved in a 7 variety of tests utilized by companies, such as Verizon 8 and T-Mobile, trying to see how these technologies can 9 coexist in retail environments. So sensing how an RFID 10 and NFC could coexist with other standards offering, for 11 example, fast Internet like Wi-Fi or 5G and so on. So 12 there's quite an amount of additional activities on 13 this. 14 And I would say most of this has been triggered 15 by my position at Georgia Artificial Intelligence, Smart 16 Logistics, Smart Inventory Center that's called Georgia 17 AIM. I'm in charge of the wireless technologies. And 18 we have kind of, I'd say, the first world demonstrator 19 of realtime monitoring of smart shelves, smart 20 production lines that's being put together right now. 21 There's a new building at Georgia Tech that would be 22 exactly like that. So kind of like a showcase accessed 23 by the whole world to demonstrate how these technologies 24 work. 25 Q. In your answer, you mentioned subcentimeter	Page 36

1 localization approaches utilizing RFID and NFC-based 2 technologies? 3 A. Yes. 4 Q. What did you mean by that? 5 A. I meant we have come up with ways of utilizing 6 RFIDs operating at different frequencies that can enable 7 really, really good localization accuracy below 8 1 centimeter for a variety of applications. 9 Now, typically -- actually, that was, I would 10 say, one of the motivations for seminar or patent and 11 also prior art. One of the challenges, especially for 12 indoor environments, is the pretty bad resolution of 13 GPS, because indoor GPS is not working well. So we came 14 up with a variety of techniques utilizing RFID 15 technologies, and I counted NFC as part of this RFID, 16 that's why I'm using this as a collective noun. 17 I would say, RFID and NFC would develop 18 different ways of triangulation, trilateration, as well 19 as RFID-based gyros to improve on resolution. 20 Typically, this was quite important for dead reckoning 21 localization approaches being enabled by accelerometers 22 and we came up with ways of realizing this type of 23 accelerometers utilizing just RFIDs. So combining this 24 in a variety of figurations 1D, 2D, 3D to provide X, Y, 25 Z of an item in real space and real time.	Page 37	1 some time ago, but I would say it's 2007, 2008 as 2 well. 3 Q. Okay. 4 A. And the same thing as if you see also the 5 Undergraduate Special Project Students, that's page 9, 6 especially page 11 at the top, you could see a variety 7 of special topics were utilized. For example, Item 28 8 says, "RFID for container tracking applications," that 9 was in 2005. Item 29 was "Authentication algorithms." 10 And then Item 34 was talking about "Automotive passive 11 RFIDs within enhanced range." 12 And even before that, the Item 27, I'll say 13 that was the first effort we did in collaboration with 14 Technical University of Valencia, and they were 15 trying -- that's with Tom Ferrer, HF and UHF RFID 16 characterization. That's page 10, Item 27. 17 So what happened with this project and 18 collaboration with Valencia was Pricer which was the 19 first company that came up with the idea of smart 20 shelves, wanted to run a field test of smart shelves in 21 Valencia. That was in 2005, 2006. And they had a 22 product of smart shelves where they utilized for the 23 first time and modified this in wireless technologies. 24 That was the first smart shelf with wireless 25 capabilities.	Page 39
1 Q. And this is work that you've been doing within 2 the last year? 3 A. No, this is work we have been doing over the 4 last 15 years. Now, as I told you, a quite significant 5 amount of this work has been done for the industry. 6 I cannot disclose lots of information because 7 of NDAs, but I can tell you that we have performed for 8 Boeing, for Northrop, for Pirelli, and a variety of 9 companies that want to have a pretty good tracking 10 capability for themselves. 11 So the division was due to the NDA, but we have 12 been involved in this. And you can see this CV in bits 13 and pieces, not the whole thing, but in other words all 14 the information was allowed to be publish. But over the 15 last five years, this NDA expired, and we are able to 16 start disclosing this information. 17 Q. In Exhibit 1010, can you read the earliest 18 publication that relates to the technology that you were 19 just discussing? 20 A. I have to look. I think the earliest had to do 21 with tires because that had to do with verifying the 22 tires that were utilized by Pirelli. That had to be 23 like 2007, 2008. I'd say that was the time we had the 24 first publication. Now, I don't remember the exact 25 title because there's like 500 papers and that's quite	Page 38	1 And this company Pricer, since it was the 2 founder -- I mean, they had the first smart shelves in 3 '99, so they had the first field test. And it took 4 place in Valencia because it was much easier than the 5 U.S. Less legal problems. 6 On the special topics, and the idea was to 7 characterize HF and UHF verified RFIDs for the 8 environments of smart shelves for this Pricer test bed. 9 And that's what I would say is the earliest time spent 10 with smart shelves, smart retail systems that has to do 11 with the Valencia experimentation. 12 And then if I could, directly after that, 13 Pricer came out with a whole slew of smart shelves based 14 on the conclusions of the preliminary experiments we 15 were characterizing these technologies in the smart 16 shelf environment. 17 Q. And you are saying smart cell, c-e-l-l? 18 A. What I meant is self-equipped with electronic 19 shelf labels. Now the reason I'm saying smart shelf 20 systems is because that was -- 21 Q. I'm sorry. Are you saying cell or shelf? 22 A. Smart shelf. Smart shelf. 23 Q. Thank you. 24 A. The reason I use this term is because 25 electronic shelf labels, when initially utilized even	Page 40

1 for regular shelves, so one of the challenges was how to 2 provide power for that. And that's why I used the term 3 "smart shelf" because that was the next generation. Not 4 conventional shelves when we initially performed the 5 test, but specifically designed shelves that would 6 support specifically designed shelf labels. So it 7 started, I would say, 2005. Now I've pinpointed that. 8 In other words, like, Item 27, 2004 or 2005 when we 9 start working with these types of systems. 10 Q. When were you first retained for the 208 IPR? 11 A. I cannot recall exactly. That was some time in 12 late 2022, if I remember correctly. That was -- I don't 13 know. November 2022 or October 2022. Something like 14 that. 15 Q. And when did you first start drafting your 16 declaration for this matter? 17 A. This was about a month before the submission, 18 so about a month. 19 Q. And generally what was your process for 20 drafting your declaration in this matter? 21 A. Same as we discussed in the previous 22 declarations. I reviewed the patent 709, prior art, 23 other relevant exhibits, and then I formed my opinion 24 that I placed in my expert declaration. 25 Q. Do you find the prior art in your declaration	Page 41 1 WITNESS'S CHANGES OR CORRECTIONS Page 43 2 Deponent: EMMANOUIL (MANOS) M. TENTZERIS, PhD 3 NOTE: If you are adding to your testimony, print the 4 exact word/words you want to add. If you are deleting 5 words from your testimony, print the exact word/words 6 you want to delete. Specify with "Add" or "Delete" and 7 sign below. 8 PAGE LINE CHANGE/ADD/DELETE 9 _____ 10 _____ 11 _____ 12 _____ 13 _____ 14 _____ 15 _____ 16 _____ 17 _____ 18 _____ 19 Pursuant to Section 2025.520 of the Code of Civil 20 Procedure of the State of California, I hereby certify 21 that I have read my Statement Under Oath transcript, 22 made those changes and corrections that I deem 23 necessary, and approve the same as now true. 24 25 Date: _____ Signature: _____
1 in the 208 IPR or was it provided to you? Page 42 2 A. I found most of the prior art. There were 3 additional references provided by the counselors that I 4 reviewed, and I considered some of them. Good 5 additional prior art, I could include in my declaration. 6 So pretty much I formed my opinion on prior art I either 7 chose or I either collected. 8 Q. Did you make any notes in preparation for your 9 deposition today? 10 A. No notes. No notes. 11 MS. KAISER: I think I'm pretty close to done. 12 Let's take a five-minute break, and I'll just verify. 13 THE WITNESS: Sounds good. Thank you. 14 (Off the record: 2:56 p.m. - 3:02 p.m.) 15 MS. KAISER: Dr. Tentzeris, thank you for your 16 time today. I don't have any further questions on the 17 208 IPR, so I pass the witness to Mr. Tan. 18 MR. TAN: We don't have further questions as 19 well. So thank you so much. Thank you all. 20 THE STENOGRAPHER: We are going off the record. 21 The time is 3:02 p.m. 22 * * * 23 24 25	Page 44 1 DECLARATION UNDER PENALTY OF PERJURY 2 3 4 Case Name: CYIARK VS. INGLEWOOD SPORTSERVICE, INC. 5 6 Date of Deposition: Friday, August 23, 2024 7 8 9 I, EMMANOUIL (MANOS) M. TENTZERIS, PhD, hereby 10 certify under penalty of perjury under the laws of the 11 State of 12 _____ that the foregoing is true and 13 correct. 14 15 Executed this _____ day of 16 _____, 20____, at _____. 17 18 19 20 21 EMMANOUIL (MANOS) M. TENTZERIS, PhD 22 23 24 25

Page 45

Cara M. Foster
RPR, CSR No. 11973

WORD INDEX

< 0 >

0 24:25

< 1 >

1 1:23 10:16, 18
12:16 13:21 14:16,
17 15:11, 18, 24
20:11 21:25 22:22
24:10, 25 25:13
30:14 31:14 37:8

1.2 24:6 25:13**1.3** 24:9**1.33** 23:23**1.5** 29:22**1.8** 25:14**1:29** 1:18 5:4 45:11**10** 34:9 39:16**10,674,340** 4:13

1003 4:9 6:22, 23, 24
7:2 27:15

1009 4:11 27:11

1010 4:15 34:15, 20
35:3 38:17

102 27:18**105** 28:3, 6**10900** 3:5**11** 13:6 14:11 39:6**11,010,709** 1:12

110 8:13 10:12, 15,
21, 24 15:13, 18, 22
16:12 26:1, 3, 8, 11,
19 28:13, 15, 16, 17,
18 29:5, 8, 14 32:2

11973 1:24 2:10 5:6
45:25

11th 13:25**12403** 1:22**128** 16:7 27:11**130** 16:7**1400** 3:11**15** 38:4**189** 6:15**1900** 3:11**1D** 37:24

< 2 >

2 7:6, 10, 11, 19, 22,
23, 24, 25 8:2, 3, 7, 9,

11, 16, 19, 25 9:17
10:2 11:3 22:1, 12,
18, 25 23:1, 2, 10, 16
24:5, 11 25:5, 6, 9, 12
27:16 29:7 30:6, 7,
14, 24 31:13 32:3

2:26 34:11**2:40** 34:11**2:56** 42:14**20** 44:16**2004** 41:8**2005** 39:9, 21 41:7, 8**2006** 39:21**2007** 38:23 39:1**2008** 38:23 39:1**2016** 4:11**2022** 41:12, 13**2023** 34:21, 25

2024 1:17 35:8 44:6
45:11, 21

2025.520 43:19

208 6:10 7:4 34:21
41:10 42:1, 17

23 1:17 44:6 45:11**2300** 3:5**23006866** 2:12**245** 32:17

27 4:13 39:12, 16
41:8

28 4:11 39:7**28th** 45:21**29** 39:9**2D** 37:24

< 3 >

3 8:6, 10 16:15 24:9
3:02 1:18 42:14, 21
45:12

303.291.2300 3:12**34** 4:15 39:10

3D 18:17 33:13
37:24

3X 12:10

< 4 >

4 7:6 16:10 25:10**425.289.7858** 3:6**43** 8:6**45** 1:23**4th** 3:5

< 5 >

5 4:4 10:8, 9, 10

11:8 13:6, 20, 21

14:20, 21, 23, 24, 25

15:13, 20, 25 16:15

19:6 20:4 21:6, 7, 24

25:24 26:25 28:11

29:4 30:5 33:2

50 28:12 30:6 33:2**500** 38:25**55** 29:4 30:7 31:24**57** 30:10 31:24**5A** 14:23**5B** 14:23**5G** 36:11**5s** 14:23

< 6 >

6 4:11**63** 8:11

< 7 >

7 11:8 20:10**709** 41:22

< 8 >

8 13:16

< 9 >

9 26:13 27:5 39:5**9,378,513** 4:9**90202** 3:12**98004** 3:6**99** 40:3

< A >

able 38:15

accelerometers 37:21,
23

accessed 36:22**account** 25:20 27:2**accuracy** 37:7**accurate** 16:3**acquire** 21:19**action** 45:15, 17**activities** 36:12**actual** 33:1**add** 13:12 19:11

22:22 43:4, 6

added 14:5 20:1**adding** 10:16, 18

13:14, 21 14:16, 17

15:11, 18 20:11

21:25 43:3

addition 10:23 11:5

12:14, 19 13:17, 20,

24 14:12 15:17, 21

20:11 21:8, 15, 17, 23

24:21 25:18 26:2

32:24

additional 20:13

24:13 36:12 42:3, 5

additions 34:24 35:2**adjacent** 9:9**ago** 39:1

agree 17:5 21:1
30:16

AIM 36:17**aims** 16:3**algorithms** 39:9**allowed** 38:14**AMERICA** 1:5**amount** 36:12 38:5**answer** 36:25**anytime** 19:3**APPEAL** 1:3**appearances** 5:8**appearing** 5:24

applications 37:8
39:8

apply 22:24**applying** 13:5**approach** 18:24

approaches 35:18
37:1, 21

approve 43:23**arbitrary** 23:19

24:13 30:20

ARCH 3:4, 22, 23
5:11

arrives 15:9**arrow** 8:20

art 7:2 37:11 41:22,
25 42:2, 5, 6

articles 27:13**Artificial** 36:15**asked** 31:24

assign 12:3 14:3
15:7
assigned 15:6 31:18
assuming 24:24
Atlanta 5:24 6:1
attention 8:6
attorney 45:16
August 1:17 44:6
45:11, 21
Authentication 39:9
Automotive 39:10
Avaldi 3:23
axis 24:24

< B >

B2 4:9
back 8:10, 19 14:21
27:15 28:11 34:13
backscattering 35:10,
11
bad 37:12
based 11:15 12:11,
22, 23 14:10 16:18
19:22 23:22, 23
30:24 31:18 40:13
basics 6:15
basis 16:4, 13
bed 40:8
beginning 23:24
BEHALF 3:3, 9 5:10
Bellevue 3:6
bits 38:12
blood 45:15
BOARD 1:3
Boeing 38:8
break 34:8 42:12
building 36:21

< C >

CA 1:24
calculate 17:25 18:11
calculated 20:7
California 2:11 5:5
43:20
call 12:24 24:23
called 5:14 11:13
36:16
capabilities 39:25
capability 38:10

Cara 1:24 2:8 5:5
45:3, 24
care 12:20 18:12
Case 1:11 8:12 9:11,
15 12:11 14:8 15:12,
19 16:1 17:2 18:7,
15, 20 19:25 23:25
24:2, 17, 24 27:9, 18
28:3 30:24, 25 33:23
44:4
cell 40:17, 21
c-e-l-l 40:17
Center 36:16
centimeter 37:8
CERTIFICATE 45:1
Certified 2:10, 11
5:16 45:3
certify 43:20 44:10
45:5, 14
challenges 37:11
41:1
**CHANGE/ADD/DELE
TE** 43:8
CHANGES 43:1, 22
characterization
39:16
characterize 40:7
characterizing 40:15
charge 36:17
chart 8:3
chat 6:21 34:18
choose 14:9 31:5
32:5
chose 42:7
Civil 43:19
clarification 16:21
clean 6:7, 12, 13
clear 17:17 20:13
Clearly 13:18 15:20,
25 17:1 20:9 21:9
25:22 32:1
close 42:11
code 9:20 10:5, 11,
14, 20 15:2, 6, 7, 8, 10,
12, 17 16:12, 17, 18,
22, 24 18:7 19:8, 14,
20, 21 21:5 22:4, 13,
16, 19 23:4, 7, 12
24:1 25:25 28:6, 13,
14 29:5, 7, 13 30:15,

24 31:18, 20 32:2, 14
33:5, 7, 17, 20, 25
34:1, 5 43:19
codes 11:10, 22 12:8
13:7 14:14 15:23
17:3 19:23 20:1
21:19, 21 26:14, 15
27:6 29:9, 16 32:11
coefficient 14:2
coexist 36:9, 10
COIE 3:10, 22 5:9
collaborating 35:25
collaboration 39:13,
18
collected 42:7
collective 37:16
Colorado 3:12
column 8:2, 6, 10
10:8, 9, 10 11:8 13:6,
20 14:20, 21, 24, 25
15:20, 25 19:6 20:4
21:7, 24 25:24 26:25
28:11 29:4 30:5
33:2
combination 12:14
combining 37:23
come 17:23 18:11
24:14 31:9 37:5
coming 8:17, 20
17:14
commencement 45:9
commencing 45:11
comment 13:14
31:23
companies 36:7 38:9
company 39:19 40:1
complex 18:3 32:24
complicated 12:19
13:2 16:9 17:15
18:4 20:15, 21 21:2
31:16 32:13
comprehend 32:6
computer 27:12
conclusions 40:14
conducted 2:2
conferences 35:5
considered 42:4
constant 14:9, 10
20:19, 22

container 39:8
conventional 41:4
copies 6:12, 13
copy 6:5, 7
correct 5:25 6:12
7:4, 5, 13, 21 8:23
9:17, 18 10:2, 3 15:3,
6, 11 17:6 19:15, 16,
20 22:13, 19 23:12
28:2, 24 29:2 30:6,
21 34:22 44:13
CORRECTIONS
43:1, 22
correctly 41:12
correlated 33:20
correlates 12:1 33:11
correspond 24:18
31:11
corresponding 25:1
32:13
counsel 5:7
counselors 42:3
counted 37:15
coupled 13:15
court 6:17
covered 16:6
create 11:19
creates 11:13
critical 17:2
CSR 1:24 5:6 45:25
cubic 17:21 18:4, 14,
19 31:10
curve 17:24 26:22
31:5, 9, 18
curves 17:15 31:16
CV 4:15 34:14, 21
38:12
CYIARK 44:4

< D >

Date 4:11 44:6
Date: _____
____Signature 43:25
day 44:15 45:21
dead 37:20
Declaration 4:11
11:12 16:6 27:11
32:18 41:16, 20, 24,
25 42:5 44:1

declarations 41:22	different 8:17 12:5, 6, 12, 22 17:10 18:23 24:16, 17, 18 25:1, 3 31:18, 19 32:9, 13, 15 37:6, 18	either 26:13 35:20 42:6, 7	31:12, 24 32:4, 8 33:12 36:11 39:7
declared 27:5	differentiating 14:16	electronic 6:9 7:15, 20 8:1, 3, 12, 21 9:5, 7, 8, 11, 13, 25 10:1, 11, 15, 21, 23 11:5 14:5 15:4, 5, 13, 17, 22 16:12, 16, 19, 22, 24 18:8 19:11 21:6, 13 24:1 25:25 26:3, 7, 10, 18 27:19, 20, 25 28:1, 8, 13, 14, 15, 17, 18, 25 29:5, 8, 14, 21 31:19, 21 32:14 33:6, 8, 18, 25 34:1, 5 40:18, 25	examples 14:22 16:20
decrease 14:14	direct 8:5	Ellen 3:22	Executed 44:15
decreased 13:9	direction 12:24 21:19	EMMANOUIL 1:16 2:1 4:3, 15 5:13 43:2 44:9, 21 45:7	EXHIBIT 4:9 6:22, 24 7:2 27:11, 15 34:15, 20 35:3 38:17
decreasing 21:21	directional 11:16	employed 45:16	exhibits 6:9 41:23
decremented 13:8, 9, 10, 11 17:4 26:15	directionality 17:2 19:3	enable 36:3 37:6	existing 15:1 16:5, 14 17:15 22:3, 10 28:1
deem 43:22	directionally 11:22	enabled 37:21	experimentation 40:11
define 13:23	directly 40:12	enables 24:22	experiments 40:14
defined 15:25 30:21 34:4	disagree 11:7	engineer 17:8	expert 27:11 41:24
defines 12:24	disclose 21:2 32:25 38:6	enhanced 39:11	expired 38:15
defining 14:15	disclosed 35:19	environment 35:7, 11 40:16	explained 32:17
Definitely 6:20 20:11 21:18	discloses 21:5 27:12	environments 35:4 36:9 37:12 40:8	expression 12:10
definition 13:7	disclosing 38:16	equal 20:22	extrapolating 26:22
delete 43:6	discussed 33:4, 10 35:11, 13 41:21	ESL 16:14	extrapolation 10:5, 22 11:4, 8, 9, 11, 12, 20 12:2, 4, 13, 16, 18, 24, 25 13:3, 5, 15, 17, 22, 23 14:1, 15, 19 15:15, 19, 21 16:1, 2, 8, 23 17:7, 9, 10, 11, 12, 16, 18, 19, 22 18:3, 20, 22, 25 19:1, 4 20:3, 6, 10, 16, 21, 24 21:8, 10, 15 22:1, 11 23:10, 17, 20, 24 24:12, 17, 20, 22 25:1, 3, 15, 17, 21 26:2, 7, 10, 12, 18, 20 27:1, 3, 7, 14 31:7 32:23
deleting 43:4	discussing 6:14 38:19	essentially 27:24	extrapolations 17:20 21:3
demonstrate 36:23	disposed 8:22 9:6, 8, 12 27:20	Esq 3:4, 10	< F >
demonstration 16:16 20:5	distance 12:5, 11 18:1 23:22, 23 24:4, 8, 10, 17 25:6, 7, 8, 10, 20 27:2, 8 33:1	essence 17:23	fact 16:16 18:9 30:19
demonstrations 18:19	distances 24:18 25:3 32:19, 21	essential 24:20	factor 23:18
demonstrator 36:18	divide 30:6, 7, 14	EST 1:18 45:12	fair 21:4
Denver 3:12	dividing 29:6 32:3	exact 38:24 43:4, 5	familiar 14:18
depend 21:18 25:7 27:4	division 38:11	exactly 36:22 41:11	fast 36:11
depending 13:12 15:8 17:15 24:16 26:12	documents 6:5, 7	Examination 4:4 5:14, 18	Ferrer 39:15
depends 18:6	doing 38:1, 3	examined 5:16	field 39:20 40:3
Deponent 43:2	doubling 25:10	example 10:11 12:14, 17 14:18, 20 15:1, 9, 16, 24 16:7, 10, 11 17:19, 22 18:5 19:5, 18, 23 20:4, 20 21:2, 23 22:6, 17 24:4, 7 28:22 29:20 30:5, 14	figurations 37:24
DEPOSITION 1:16 2:1 6:15 42:9 44:6 45:6, 8, 10	Dr 4:11 5:20 14:24 34:13 42:15		
depositions 34:23	drafting 41:15, 20		
derive 20:14	due 38:11		
describes 13:4	duly 5:14 45:9		
DESCRIPTION 4:9 8:7, 11 21:9 25:23	< E >		
designed 41:5, 6	earlier 6:14		
designing 35:3	earliest 38:17, 20 40:9		
determination 17:23 30:23	easier 40:4		
determine 33:14	easiest 18:22		
determined 8:13 16:4, 13, 17	effectively 24:6		
determines 27:13	effort 39:13		
develop 37:17			
development 12:21			
difference 14:3			

Figure 7:6, 10, 11, 19, 22, 23, 24, 25 8:3, 7, 9, 11, 16, 19, 25 9:17 10:2 11:3, 14 27:16 33:12 financially 45:18 find 41:25 Finland 35:9 first 7:11 9:15 11:13 23:17 36:18 38:24 39:13, 19, 23, 24 40:2, 3 41:10, 15 fitting 12:20 five 38:15 five-minute 42:12 fixed 24:13 25:15 31:7 FLEPS 35:8 flow 8:3 flowchart 7:12, 14 follows 5:17 foregoing 44:12 45:5 form 17:10 formed 41:23 42:6 forms 17:10 forth 45:8 Foster 1:24 2:8 5:5 45:3, 24 found 42:2 founder 40:2 frequencies 37:6 Friday 1:17 44:6 45:11 function 11:19 16:9 17:21, 25 23:25 24:2, 14, 15 30:23 33:11 34:4 function-based 20:16 fundamental 14:15 further 42:16, 18 45:14 futuristic 18:18 < G > general 7:23, 24, 25 12:18 16:8, 21 generally 41:19 generation 41:3 Georgia 5:25 6:1 36:15, 16, 21	give 17:23 22:18 25:1, 15 34:17 given 9:20 12:7 14:11 15:16 16:10, 20 21:16 25:18 27:4 45:13 gives 24:17 30:14 giving 10:10 go 8:10, 19 10:8 13:6 14:21 20:15 22:17 25:13, 24 27:15 28:3, 11 goes 9:17 10:2 12:25 going 5:3 6:16, 21 18:13, 14 23:1 25:5, 6 29:1 34:7, 14 42:20 good 37:7 38:9 42:4, 13 GPS 37:13 graders 13:25 gratify 13:6 Great 34:9 ground 24:23 gyros 37:19 < H > half 31:25 32:7, 24 hand 45:20 HANSHOW 1:5 Hao 3:4 5:11 haotan@archlakelaw.com 3:7 happen 9:3 happened 34:25 39:17 hard 6:5, 7 helpful 7:9 hereinbefore 45:8 hereunto 45:20 HF 39:15 40:7 Hi 5:20 higher 24:23 Honeywell 36:2 hour 34:8 < I > idea 39:19 40:6	identification 35:14 identify 31:4 identifying 7:15 IEEE 35:8, 10, 17 illustrates 8:3 immediately 17:13 implement 36:2 implemented 26:14 29:16 important 19:3 37:20 improve 37:19 include 36:5 42:5 increase 11:16 increased 12:8 increases 13:1 increasing 11:23 20:1 21:21 increment 19:11, 14 26:12 27:6 incremented 11:10, 22 15:23 17:3 19:24 incrementing 22:7 independent 27:4, 5, 8 33:14, 21 individual 34:5 indoor 37:12, 13 industries 35:24 industry 38:5 inference 18:1 information 7:15 33:15 38:6, 14, 16 INGLEWOOD 44:4 inherently 11:12 13:24 32:21 initial 9:20 initially 40:25 41:4 input 32:21 install 7:25 15:4 19:18 22:10, 17 23:9 installed 7:16 8:13, 22, 25 9:4, 6, 9, 13, 16, 20 10:1, 12, 15, 21, 24 11:6, 17 14:6 15:13, 18 16:17, 18, 22, 25 18:8, 9 19:19 21:6, 13, 20 23:3 24:5, 9 25:2 26:1, 4, 8, 11, 19 27:21 28:8, 14, 16, 18 29:1, 6, 8, 14, 21	31:20 32:2, 15 33:7, 19 installing 7:20 8:4 9:2 27:25 Intelligence 36:15 Inter 4:13 interacting 35:23 interested 45:17 International 35:20 Internet 36:11 interpolating 31:17 interpolation 27:14 28:7 29:15, 20, 25 30:4, 13, 18, 19, 20, 22 31:3, 6, 8, 15 32:1, 11, 16, 18, 20, 23 33:2, 5, 11, 16, 23 34:3 interrogation 35:15 Inventory 36:16 invited 35:5 involve 20:17 involved 36:6 38:12 involves 12:13 17:11 30:22 32:19 IPR 6:10, 15 7:4 34:21 41:10 42:1, 17 IPR2024-00208 1:11 5:21 item 37:25 39:7, 9, 10, 12, 16 41:8 < J > Jessica 3:10 5:9 Ji 3:22 Job 1:22 journal 35:16, 22 journals 35:17 July 35:9 Jun 4:11 June 34:21, 25 < K > Kaiser 3:10 4:4 5:9, 19 34:7, 10, 12 42:11, 15 kaiser-ptab@perkinscoie.com 3:13 kind 36:18, 22
---	---	---	--

know 14:1, 22 41:13
knowing 31:17
known 11:18, 24
 12:7, 12, 23 14:4, 6
 19:2, 8 20:2 32:12
 36:6
knows 17:9

< L >

label 7:15, 16, 21 8:1,
 4, 13, 22, 24 9:3, 5, 8,
 10, 13, 16, 19, 25 10:1,
 12, 15, 21, 24 11:5
 15:2, 4, 5, 13 16:12,
 17, 19, 22, 24 18:8, 9
 19:12, 14, 18, 19 21:6,
 13, 19 22:3, 4, 7, 10,
 11, 12, 16, 18, 19, 22
 23:3, 7, 9, 11, 22 24:1
 25:2 26:1, 3, 7, 10, 18
 27:21, 25 28:13, 15,
 16, 17, 18, 23, 25 29:5,
 8, 14, 21 31:20 32:2,
 14 33:6, 7, 8, 9, 18
 34:2
labels 9:1, 4, 12
 27:19 28:8 31:2
 32:20 33:18, 20, 25
 34:6 40:19, 25 41:6
LAKE 3:4, 22, 23
 5:11
larger 19:22, 24
late 41:12
laws 44:10
left 8:21 9:14 11:10,
 16, 18, 22, 23, 24 12:8,
 25 13:1, 8, 11, 13
 14:14 15:23 17:3, 4
 18:10 19:10, 24 20:2
 22:7 26:14, 16 27:6
 28:15 29:16 30:24
 31:1, 22 33:6, 18
legal 40:5
Lembo 3:22
license 5:6
line 8:6, 11 11:8, 19,
 25 12:1, 6, 9, 21 13:6,
 16, 20, 21 14:11
 15:13 16:10 17:14,
 20 18:13 20:10 21:6

25:24 26:13, 24 27:5
 28:12 29:4 30:6, 7,
 10 31:12 33:2 43:8
linear 11:19 12:2
 13:5 17:6, 11, 17
 18:16, 20, 21 20:20
 23:20 31:10, 15
lines 16:15 26:17
 31:24 36:20
listed 11:11 26:13
LLP 3:4, 10, 22, 23
localization 35:15, 18
 37:1, 7, 21
locate 12:22
located 28:15, 17
 33:6, 8
location 9:20 10:4,
 11, 14, 20 11:10, 21
 12:8 13:7 14:14
 15:2, 6, 7, 8, 10, 12, 17,
 23 16:12, 13, 17, 18,
 21, 24 17:2, 25 18:7
 19:8, 15, 20, 21, 23
 21:5, 13, 21 22:4, 13,
 16, 19 23:4, 5, 7, 12
 24:1 25:2, 25 26:14,
 15 27:6 28:6, 13, 14,
 16 29:5, 7, 9, 13, 16
 30:15, 24 31:20 32:1,
 11, 14 33:5, 7, 16, 17,
 19, 25 34:1, 5
locations 16:5 27:13
 31:19 32:9
logistic 35:6
logistics 35:12 36:3,
 16
look 7:6 8:2, 9, 16,
 20 10:19 18:2 33:3
 38:20
looking 7:14
lost 22:20
lots 14:23 38:6

< M >

making 35:25
MANO 1:16 3:23
 4:3
MANOS 2:1 4:11,
 15 5:13 43:2 44:9,

21 45:7
marriage 45:15
mathematical 10:5,
 22 11:4, 9 13:15, 16
 15:14, 25 16:2, 23
 19:10 20:3, 6, 10
 21:7, 10, 14 25:21
 26:2, 7, 12, 18, 21
 27:1, 3, 7, 14 28:7
 29:15 30:4, 13, 19, 21
 31:8 32:10, 16, 20
 33:1, 5, 10, 15, 23
 34:3
mathematically 32:23
mathematics 17:9
matter 18:25 25:6,
 15 41:16, 20 45:18
Matthew 3:22
mean 12:15 13:9
 16:10 18:17 23:17
 30:8 32:8 37:4 40:2
meaning 32:4
means 8:24 11:13,
 17, 21 12:4 13:12, 25
 14:9 16:9 27:24
 31:8 32:12 34:3
meant 37:5 40:18
measurement 32:19
mentioned 9:24
 34:23 36:25
meter 24:10, 25
 25:13
meters 24:5, 9 25:12
method 8:4 9:17
 10:2 11:3 32:18
Microwave 35:20, 21,
 22
mid-point 29:22 30:1
minus 12:10 14:5
 20:19, 23 31:13, 14,
 21
minute 34:17
minutes 34:9
modified 39:23
moment 13:23 17:12
 20:9 32:10 33:24
monitoring 36:19
month 41:17, 18
motivations 37:10
multiplicated 15:21

multiplication 10:23
 11:5 12:14, 20 13:17,
 24 14:2, 7, 9, 13
 15:22 20:11, 12, 13,
 17 21:8, 15, 18, 22, 24
 22:24 23:18 24:14,
 21 26:3
multiplied 14:3
 20:19, 22, 23 22:1, 12,
 25 23:1, 10 24:6
multiply 22:18

< N >

name 5:5 44:4
NDA 38:11, 15
NDA's 38:7
NE 3:5
necessarily 12:15
 32:19, 21
necessary 43:23
need 13:22 17:24
 18:19
negative 12:9 13:14
 14:10
new 7:20 9:3 11:17
 12:22 15:7 19:11, 19
 22:10, 12, 17 36:21
NFC 35:7, 24 36:1,
 10 37:15, 17
NFC-based 35:13, 19
 37:1
Nike 18:18
Northrop 38:8
NOTE 43:3
notes 42:8, 10
notice 2:8
noun 37:16
November 41:13
Number 2:10, 12 5:6
 14:2 24:13 29:6
 31:4, 5 32:3
numbers 32:5
numerous 35:16
NXP 35:25

< O >

Oath 43:21
Obtain 28:6

obtained 10:22 15:14 16:5, 13, 23 21:7, 14 26:1 29:15 obtains 10:4 October 41:13 offering 36:10 OFFICE 1:1 Okay 6:14, 23 7:11 8:5, 8, 20 9:15 19:5, 7, 9, 13 21:1, 22 22:1, 2, 5, 9 23:6, 13, 14 27:15, 17 28:25 30:12 34:7, 9, 16 39:3 open 34:14 operating 37:6 opinion 12:13 16:15 26:25 27:12 32:22 41:23 42:6 opinions 5:21 7:4 options 8:17 9:2 order 14:13 21:20 26:13 ordinary 17:8, 13 20:14 26:6, 23 33:13 34:2 orient 5:20 outcome 45:18 overkill 18:15 Owner 1:9 3:9 5:10 < P > p.m 1:18 5:4 34:11 42:14, 21 45:11, 12 PAGE 4:2, 9 7:6 39:5, 6, 16 43:8 Pages 1:23 papers 38:25 parabola 17:21 18:14, 20 parabolic 31:10 paragraph 27:11 29:12 32:17 paragraphs 16:7 parameters 17:24 18:11 part 25:3 33:1 37:15 Partes 4:13	parties 45:15, 16 parts 14:15 pass 42:17 passive 39:10 PATENT 1:1, 3, 9, 12 3:9 4:9, 11, 13 5:10 8:2 20:9 25:18 32:1, 10 33:24 37:10 41:22 PDF 7:7 penalty 5:15 44:1, 10 people 14:18 perform 26:6, 11, 20 31:6 performed 30:5 38:7 41:4 performing 10:5, 22 15:14 20:10 21:7, 14 25:20 26:1, 17 28:7 29:15 32:10 33:22 perjury 5:15 44:1, 10 PERKINS 3:10, 22 5:9 person 17:8, 13 20:13 26:5, 23 33:13 34:2 Petition 4:13 Petitioner 1:6 3:3 5:12 PhD 1:16 2:1 4:3 5:13 43:2 44:9, 21 45:7 physical 33:1 pieces 38:13 pinpointed 41:7 Pirelli 38:8, 22 place 5:8 34:4 35:9 40:4 placed 41:24 please 5:8 plus 12:16 13:21 15:24 30:14 point 11:14, 24 12:3, 4, 12 13:4, 14 14:7 17:16 18:1, 7, 10 19:2, 8 21:20 22:15, 21 23:6 25:16, 19 26:10, 20, 21, 22 32:15	pointing 30:10 points 31:5 position 12:2 14:4, 5 19:2 20:19, 20, 23 23:19 24:3 31:11, 13, 14, 21, 22 32:15 33:21 34:4 36:15 positions 16:4 30:25 31:1 positive 11:25 13:13 14:10 possibility 9:7 possibly 20:18 23:21 25:9 potential 9:11 24:19 31:14 power 41:2 powerful 36:1 prediction 16:3 24:23 preliminary 40:14 preparation 42:8 PRESENT 3:21 pretty 37:12 38:9 42:6, 11 previous 41:21 Pricer 39:18 40:1, 8, 13 print 43:3, 5 prior 7:2 34:23 37:11 41:22, 25 42:2, 5, 6 problems 40:5 procedure 32:13 43:20 process 7:20 20:15 41:19 product 39:22 production 36:20 Professional 2:9 45:4 Project 39:5, 17 provide 33:15 37:24 41:2 provided 42:1, 3 providing 16:3 publication 38:18, 24 publications 35:17 publish 38:14 pull 6:22 Pursuant 2:8 43:19	put 6:21 22:6 23:11 34:17 36:20 < Q > question 30:12 31:23 questions 42:16, 18 quite 36:12 37:20 38:4, 25 < R > R1 10:12, 16, 18 12:15 13:21 15:2, 8, 10, 11, 18, 24 16:14 19:8, 12, 22, 25 20:7, 11, 20, 22, 23 22:4, 10, 11, 21 23:2, 4, 22, 23 24:5, 6, 9, 10, 11 25:5, 8, 9, 10, 13, 14 28:16, 23 29:1, 7, 21 30:15 31:2, 11, 13, 25 32:3, 5 R1.5 29:6 32:2, 4 R2 10:15, 18 12:15 15:6, 11, 18, 24 19:15, 17, 22, 25 20:7, 14, 18, 19, 22, 23 22:13, 15, 16, 18 23:1, 4, 5, 7, 16, 22 24:5, 9, 19 25:5, 6, 8, 9 28:19, 23 29:1, 7, 21 31:2, 11, 13, 25 32:3, 6 R3 19:20, 21, 24 R4 22:19, 20 23:12, 13, 16 25:5, 9 range 39:11 read 25:22 26:9, 23 38:17 43:21 real 37:25 reality 18:2 realizing 37:22 really 18:6 37:7 realtime 36:19 reason 16:19 40:19, 24 recall 41:11 reckoning 37:20 recognize 34:20 record 5:3, 8 34:11 42:14, 20 45:12
---	--	--	--

reference 6:24 7:20 12:11	room 6:2	13, 19 22:3, 4, 7, 10, 11, 12, 16, 17, 19, 22	space 25:11 37:25
references 7:3 42:3	rotate 7:8	23:3, 7, 9, 11 24:1, 5,	speaker 35:5
refers 11:3	RPR 1:24 45:25	8, 24 25:2, 25 26:3, 7,	special 15:19 39:5, 7 40:6
Regarding 28:12	rule 12:24 14:11	10, 18 27:19, 20, 25	specific 12:17 31:1, 2
Registered 2:9 45:4	run 39:20	28:8, 13, 14, 16, 17, 18,	specifically 41:5, 6
regular 41:1	< S >	22, 23, 25 29:5, 8, 14,	specifics 20:16
relate 35:3	S101 7:12, 14, 22	21 31:2, 19, 20, 21, 22	specify 18:23 43:6
related 45:14	S102 8:12, 17, 21	32:2, 14 33:6, 7, 8, 9,	spent 40:9
relates 38:18	S103 9:6, 17, 19	18, 20, 21, 25 34:2, 5	spline 17:21 18:4
relationship 19:10	S104 10:2, 4 11:3	39:24 40:16, 19, 21,	splines 18:19
relative 32:19	SA 1:8	22, 25 41:3, 6	SPORTSERVICE 44:4
relevant 41:23	saying 21:12 23:2,	shelves 9:14 16:5	square 20:24
relied 7:3	15 27:5 32:18 40:17,	28:1 32:12 36:19	standards 36:10
rely 32:5	19, 21	39:20, 22 40:2, 8, 10,	start 19:17 22:3 38:16 41:9, 15
remember 38:24 41:12	says 8:2, 12, 21 10:4,	13 41:1, 4, 5	started 41:7
reminder 6:16	14, 20 11:9 13:11, 16	Shorthand 2:10, 12	starting 8:6 11:14, 18 17:15 18:7 22:15,
repeat 6:16 30:2	20:9 25:19, 24 26:13,	5:16 45:4	21 23:6 25:16 26:9,
Reported 1:24	17, 25 28:6, 12 29:4,	show 16:11 20:7	20, 22 30:5 33:2
Reporter 2:9, 10, 12	13 32:1, 10 39:8	showcase 36:22	State 2:11, 12 43:20 44:11
5:16 6:17 45:1, 4	scenario 9:24	side 9:8 10:1 25:12	Statement 43:21
requires 19:2, 3	Second 9:7, 24 22:16	27:19 28:15, 18 33:6, 8	STATES 1:1 4:9
resolution 37:12, 19	23:22 24:4	sides 9:12 27:20	STENOGRAPHER 5:3 42:20
results 24:18	Section 43:19	sign 43:7	Stenographic 2:9, 11 5:15 45:1, 3
retail 35:3, 7, 12	see 6:25 7:11, 17	significant 38:4	Stenographically 1:24
36:3, 9 40:10	8:11, 14, 16 9:22	simple 13:19 14:17	step 7:12 8:12, 17, 18 9:17, 19 10:2, 4
retained 41:10	10:6, 10, 17, 25 19:23	15:16 16:10 17:10,	11:3 27:18 28:3, 6 31:4
Review 4:13	21:11 27:22 28:4, 9,	19, 22 19:1 20:5, 6	steps 31:3
reviewed 41:22 42:4	12, 20 29:10, 18, 19	24:21 25:17 32:6	stop 34:8
RFID 35:7, 13, 18, 24	36:2, 8 38:12 39:4, 6	simplification 16:11	Street 3:5, 11
36:6, 9 37:1, 14, 15,	selective 35:15	Sixteenth 3:11	stress 30:19
17 39:8, 15	self-equipped 40:18	skill 17:13	stressed 15:20
RFID-based 37:19	seminar 37:10	skills 17:8 20:14	stressing 17:1
RFIDs 36:2 37:6, 23	sense 18:6	26:6, 23 33:13 34:2	strict 31:6
39:11 40:7	sensing 36:9	slew 40:13	Students 39:5
right 5:22 6:10, 19,	sentence 10:19 29:12	slope 11:13, 25 12:9,	subcentimeter 35:18 36:25
21 9:14 11:10, 17, 22,	serve 16:15	21 13:5, 7, 13 14:2	submission 41:17
23, 24 12:7, 9, 25	SES-IMAGOTAG	17:6, 11, 14 31:13, 14, 21	sufficient 33:15
13:1, 8, 12, 13 14:14	1:8	smart 16:5 35:6, 7,	Suite 3:5, 11
15:2, 5, 23 17:3, 4	set 6:9 45:8, 20	12 36:3, 15, 16, 19	sum 29:6 30:7, 14 32:3
18:10 19:8, 11, 12, 19,	shelf 7:15, 21 8:1, 3,	39:19, 20, 22, 24 40:2,	
24 20:1, 2 22:8, 11,	12, 21, 22, 24, 25 9:1,	8, 10, 13, 15, 17, 19, 22	
18, 22 23:4, 9, 11	4, 5, 7, 9, 10, 12, 13, 15,	41:3	
26:15, 16 27:6 28:17,	16, 19, 25 10:1, 11, 15,	somebody 17:9	
23 29:17 30:25 31:1,	21, 24 11:5, 17 12:7,	sorry 8:10 15:10 40:21	
22 33:8, 18 34:20, 25	22, 23 13:13 14:5, 6	Sounds 42:13	
35:1 36:20	15:2, 4, 5, 13, 18, 22		
right-hand 27:19	16:12, 16, 19, 22, 24		
	18:8, 9, 16, 17, 21		
	19:12, 14, 18, 19 21:6,		

summation 31:25 32:7, 24 Support 4:13 41:6 sure 18:23 29:24 30:3 34:10, 19 swear 5:7 sworn 5:15 45:9 Symposium 35:20 system 27:13 systems 35:3, 13 40:10, 20 41:9 < T > tags 36:1 take 8:1 17:10 19:5 24:25 27:1 29:22 32:7 33:3 34:4 42:12 taken 25:20 45:10 talk 6:18 19:4 21:22, 24 35:10 talked 21:23 talking 7:22 12:18 14:12, 13 21:3 30:18 33:17 39:10 talks 20:12 33:24 Tampere 35:9 Tan 3:4 5:11 42:17, 18 Tech 36:21 Technical 39:14 technique 7:25 21:9 techniques 35:21 37:14 technologies 35:8, 19, 25 36:3, 6, 8, 17, 23 37:2, 15 39:23 40:15 TECHNOLOGY 1:5 38:18 tell 38:7 TENTZERIS 1:16 2:1 4:3, 11, 15 5:13, 20 14:24 34:13 42:15 43:2 44:9, 21 45:7 term 13:3, 15 14:7, 15, 18 15:19 17:5, 7 18:2 21:10, 12 23:16 33:4 34:1 40:24 41:2 terminology 26:21 Terms 32:22 test 39:20 40:3, 8 41:5 testified 5:16 testimony 27:2, 3, 7 43:3, 5 45:12 tests 18:24 36:7 Thank 5:12 40:23 42:13, 15, 19 theory 35:21 thing 19:1 38:13 39:4 things 9:3 34:24 think 17:13 38:20 42:11 third 9:11 23:10 27:18 three 8:17 9:2, 3 20:18 31:3 time 5:4 37:25 38:23 39:1, 23 40:9 41:11 42:16, 21 times 20:18 23:2, 16, 23 25:5, 6 tires 38:21, 22 title 38:25 T-Mobile 36:8 today 5:6, 24 42:9, 16 told 13:20 35:10 38:4 Tom 39:15 top 19:6 20:4 21:24 35:23 39:6 topics 39:7 40:6 tracking 38:9 39:8 TRADEMARK 1:1 transactions 35:21 transcript 43:21 translation 13:19 TRIAL 1:3 triangulation 37:18 triggered 36:14 trilateration 37:18 true 43:23 44:12 45:12 try 6:18 23:15 24:12, 19 25:4, 14 36:8 39:15 turn 14:22 turning 5:21 two 9:11 27:19, 20, 25 29:9 31:1, 2, 4, 5, 7 32:11 type 37:22 types 41:9 typical 26:21 typically 11:15 12:1 13:2 16:2 18:25 26:19 30:22 31:3 37:9, 20 < U > U.S 1:12 4:13 40:5 UHF 39:15 40:7 Undergraduate 39:5 understand 23:16 26:6 33:13 34:3 understanding 7:19 11:2 34:1 UNITED 1:1 4:9 University 39:14 unknown 12:3 16:3, 4 unpatentability 7:3 up-to-date 34:21 use 13:2 17:5 18:8 21:9 24:13 26:21 40:24 useful 8:5 uses 17:7 32:21 33:4 utilize 17:12, 21 18:6, 12 31:15 utilized 11:20 16:1 18:18 33:22 35:14 36:7 38:22 39:7, 22 40:25 utilizing 35:7, 18 37:1, 5, 14, 23 < V > Valencia 39:14, 18, 21 40:4, 11 value 9:21 12:3, 6, 12, 22, 23 17:25 24:14, 25 30:23 32:13 33:11, 12 values 24:16, 19 25:1, 15 30:24 variable 14:4, 6 18:1 24:2, 15, 16 27:4, 5, 9 33:12, 14, 19, 22 variables 16:4 variation 23:25 variety 24:23 35:24 36:7 37:8, 14, 24 38:8 39:6 verified 40:7 verify 42:12 verifying 38:21 Verizon 36:7 videoconference 2:2 virtually 2:2 VS 44:4 < W > want 11:16, 21 12:3 13:12 14:3 18:10 22:22, 24 27:15 36:5 38:9 43:4, 6 wanted 21:11 39:20 Washington 2:13 3:6 way 12:16 13:18 15:9 18:4 26:9 30:21 32:6 45:17 ways 37:5, 18, 22 web 35:10 weird 18:17 welcome 7:8 34:13 well 6:8 7:8 18:25 36:1 37:13, 18 39:2 42:19 well-known 11:15 12:21 20:7 30:25 31:4 we're 5:20 22:7 We've 21:23 34:7 WHEREOF 45:20 Wi-Fi 36:11 wireless 36:17 39:23, 24 witness 5:7 34:9 42:13, 17 45:5, 8, 13, 20			
--	--	--	--

WITNESS'S 43:1 word/words 43:4, 5 words 38:13 41:8 43:5 work 18:24 36:24 38:1, 3, 5 working 37:13 41:9 world 36:18, 23 written 27:10 Wu 6:24 7:19 8:6 10:8 13:4 14:20 15:9 17:5, 17 18:23 19:5 21:1, 11, 12, 16, 24 25:19 27:12 28:11 32:25 33:4 < X > X1 31:11 X2 31:11 < Y > yeah 18:19 20:2 year 38:2 years 38:4, 15 < Z > Zoom 2:2			
--	--	--	--

WORD LIST

< 0 >	2024 (5)	< 9 >	art (7)
0 (1)	2025.520 (1)	9 (3)	articles (1)
< 1 >	208 (6)	9,378,513 (1)	Artificial (1)
1 (19)	23 (3)	90202 (1)	asked (1)
1.2 (2)	2300 (1)	98004 (1)	assign (3)
1.3 (1)	23006866 (1)	99 (1)	assigned (2)
1.33 (1)	245 (1)	< A >	assuming (1)
1.5 (1)	27 (4)	able (1)	Atlanta (2)
1.8 (1)	28 (2)	accelerometers (2)	attention (1)
1:29 (3)	28th (1)	accessed (1)	attorney (1)
10 (2)	29 (1)	account (2)	August (4)
10,674,340 (1)	2D (1)	accuracy (1)	Authentication (1)
1003 (6)	< 3 >	accurate (1)	Automotive (1)
1009 (2)	3 (4)	acquire (1)	Avaldi (1)
1010 (5)	3:02 (4)	action (2)	axis (1)
102 (1)	303.291.2300 (1)	activities (1)	< B >
105 (2)	34 (2)	actual (1)	B2 (1)
10900 (1)	3D (3)	add (5)	back (6)
11 (3)	3X (1)	added (2)	backscattering (2)
11,010,709 (1)	< 4 >	adding (11)	bad (1)
110 (23)	4 (4)	addition (19)	based (12)
11973 (4)	425.289.7858 (1)	additional (5)	basics (1)
11th (1)	43 (1)	additions (2)	basis (2)
12403 (1)	45 (1)	adjacent (1)	bed (1)
128 (2)	4th (1)	ago (1)	beginning (1)
130 (1)	< 5 >	agree (3)	BEHALF (3)
1400 (1)	5 (30)	AIM (1)	Bellevue (1)
15 (1)	50 (3)	aims (1)	bits (1)
189 (1)	500 (1)	algorithms (1)	blood (1)
1900 (1)	55 (3)	allowed (1)	BOARD (1)
1D (1)	57 (2)	AMERICA (1)	Boeing (1)
< 2 >	5A (1)	amount (2)	break (2)
2 (43)	5B (1)	answer (1)	building (1)
2:26 (1)	5G (1)	anytime (1)	< C >
2:40 (1)	5s (1)	APPEAL (1)	CA (1)
2:56 (1)	< 6 >	appearances (1)	calculate (2)
20 (1)	6 (1)	appearing (1)	calculated (1)
2004 (1)	63 (1)	applications (2)	California (3)
2005 (4)	< 7 >	apply (1)	call (2)
2006 (1)	7 (2)	applying (1)	called (3)
2007 (2)	709 (1)	approach (1)	capabilities (1)
2008 (2)	< 8 >	approaches (3)	capability (1)
2016 (1)	8 (1)	approve (1)	Cara (5)
2022 (3)		arbitrary (3)	care (2)
2023 (2)		ARCH (4)	Case (26)
		arrives (1)	cell (2)
		arrow (1)	c-e-l-l (1)

Center (1)	conferences (1)	definition (1)	doubling (1)
centimeter (1)	considered (1)	delete (2)	Dr (5)
CERTIFICATE (1)	constant (4)	deleting (1)	drafting (2)
Certified (4)	container (1)	demonstrate (1)	due (1)
certify (4)	conventional (1)	demonstration (2)	duly (2)
challenges (2)	copies (2)	demonstrations (1)	< E >
CHANGE/ADD/DELETE (1)	copy (2)	demonstrator (1)	earlier (1)
CHANGES (2)	correct (28)	Denver (1)	earliest (3)
characterization (1)	CORRECTIONS (2)	depend (3)	easier (1)
characterize (1)	correctly (1)	depending (5)	easiest (1)
characterizing (1)	correlated (1)	depends (1)	effectively (1)
charge (1)	correlates (2)	Deponent (1)	effort (1)
chart (1)	correspond (2)	DEPOSITION (9)	either (4)
chat (2)	corresponding (2)	depositions (1)	electronic (66)
choose (3)	counsel (1)	derive (1)	Ellen (1)
chose (1)	counselors (1)	describes (1)	EMMANOUIL (9)
Civil (1)	counted (1)	DESCRIPTION (5)	employed (1)
clarification (1)	coupled (1)	designed (2)	enable (2)
clean (3)	court (1)	designing (1)	enabled (1)
clear (2)	covered (1)	determination (2)	enables (1)
Clearly (8)	create (1)	determine (1)	engineer (1)
close (1)	creates (1)	determined (4)	enhanced (1)
code (52)	critical (1)	determines (1)	environment (3)
codes (17)	CSR (3)	develop (1)	environments (4)
coefficient (1)	cubic (5)	development (1)	equal (1)
coexist (2)	curve (5)	difference (1)	ESL (1)
COIE (3)	curves (2)	different (22)	especially (2)
collaborating (1)	CV (4)	differentiating (1)	Esq (2)
collaboration (2)	CYIARK (1)	direct (1)	essence (1)
collected (1)	< D >	direction (2)	essential (1)
collective (1)	Date (2)	directional (1)	essentially (1)
Colorado (1)	Date: _____	directionality (2)	EST (2)
column (26)	____Signature (1)	directionally (1)	exact (3)
combination (1)	day (2)	directly (1)	exactly (2)
combining (1)	dead (1)	disagree (1)	Examination (3)
come (5)	Declaration (11)	disclose (3)	examined (1)
coming (3)	declarations (1)	disclosed (1)	example (37)
commencement (1)	declared (1)	discloses (2)	examples (2)
commencing (1)	decrease (1)	disclosing (1)	Executed (1)
comment (2)	decreased (1)	discussed (5)	EXHIBIT (10)
companies (2)	decreasing (1)	discussing (2)	exhibits (2)
company (2)	decremented (6)	disposed (5)	existing (7)
complex (2)	deem (1)	distance (19)	experimentation (1)
complicated (10)	define (1)	distances (4)	experiments (1)
comprehend (1)	defined (3)	divide (3)	expert (2)
computer (1)	defines (1)	dividing (2)	expired (1)
conclusions (1)	defining (1)	division (1)	explained (1)
conducted (1)	Definitely (3)	documents (2)	expression (1)
		doing (2)	

extrapolating (1)
 extrapolation (83)
 extrapolations (2)

< F >

fact (3)
 factor (1)
 fair (1)
 familiar (1)
 fast (1)
 Ferrer (1)
 field (2)
 figurations (1)
 Figure (22)
 financially (1)
 find (1)
 Finland (1)
 first (14)
 fitting (1)
 five (1)
 five-minute (1)
 fixed (3)
 FLEPS (1)
 flow (1)
 flowchart (2)
 follows (1)
 foregoing (2)
 form (1)
 formed (2)
 forms (1)
 forth (1)
 Foster (5)
 found (1)
 founder (1)
 frequencies (1)
 Friday (3)
 function (11)
 function-based (1)
 fundamental (1)
 further (3)
 futuristic (1)

< G >

general (6)
 generally (1)
 generation (1)
 Georgia (5)
 give (5)
 given (10)

gives (2)
 giving (1)
 go (13)
 goes (4)
 going (13)
 good (4)
 GPS (2)
 graders (1)
 gratify (1)
 Great (1)
 ground (1)
 gyros (1)

< H >

half (3)
 hand (1)
 HANSHOW (2)
 Hao (2)
 haotan@archlakelaw.c
 om (1)
 happen (1)
 happened (2)
 hard (2)
 helpful (1)
 hereinbefore (1)
 hereunto (1)
 HF (2)
 Hi (1)
 higher (1)
 Honeywell (1)
 hour (1)

< I >

idea (2)
 identification (1)
 identify (1)
 identifying (1)
 IEEE (3)
 illustrates (1)
 immediately (1)
 implement (1)
 implemented (2)
 important (2)
 improve (1)
 include (2)
 increase (1)
 increased (1)
 increases (2)
 increasing (3)

increment (4)
 incremented (5)
 incrementing (1)
 independent (5)
 individual (1)
 indoor (2)
 industries (1)
 industry (1)
 inference (1)
 information (5)
 INGLEWOOD (1)
 inherently (3)
 initial (1)
 initially (2)
 input (1)
 install (6)
 installed (55)
 installing (4)
 Intelligence (1)
 Inter (1)
 interacting (1)
 interested (1)
 International (1)
 Internet (1)
 interpolating (1)
 interpolation (28)
 interrogation (1)
 Inventory (1)
 invited (1)
 involve (1)
 involved (2)
 involves (4)
 IPR (7)
 IPR2024-00208 (2)
 item (7)

< J >

Jessica (2)
 Ji (1)
 Job (1)
 journal (2)
 journals (1)
 July (1)
 Jun (1)
 June (2)

< K >

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 know (3)
 knowing (2)
 known (13)
 knows (1)

< L >

label (87)
 labels (14)
 LAKE (4)
 larger (2)
 late (1)
 laws (1)
 left (34)
 legal (1)
 Lembo (1)
 license (1)
 line (34)
 linear (13)
 lines (4)
 listed (2)
 LLP (5)
 localization (5)
 locate (1)
 located (4)
 location (73)
 locations (4)
 logistic (1)
 logistics (3)
 look (9)
 looking (1)
 lost (1)
 lots (2)

< M >

making (1)
 MANO (3)
 MANOS (8)
 marriage (1)
 mathematical (43)
 mathematically (1)
 mathematics (1)
 matter (6)
 Matthew (1)
 mean (9)
 meaning (1)

means (13)	obtained (9)	pinpointed (1)	R1 (56)
meant (2)	obtains (1)	Pirelli (2)	R1.5 (3)
measurement (1)	October (1)	place (4)	R2 (45)
mentioned (3)	offering (1)	placed (1)	R3 (3)
meter (3)	OFFICE (1)	please (1)	R4 (7)
meters (3)	Okay (29)	plus (4)	range (1)
method (5)	open (1)	point (27)	read (5)
Microwave (3)	operating (1)	pointing (1)	real (2)
mid-point (2)	opinion (7)	points (1)	reality (1)
minus (8)	opinions (2)	position (19)	realizing (1)
minute (1)	options (2)	positions (3)	really (3)
minutes (1)	order (3)	positive (3)	realtime (1)
modified (1)	ordinary (7)	possibility (1)	reason (3)
moment (5)	orient (1)	possibly (3)	recall (1)
monitoring (1)	outcome (1)	potential (3)	reckoning (1)
month (2)	overkill (1)	power (1)	recognize (1)
motivations (1)	Owner (3)	powerful (1)	record (6)
multiplicated (1)	< P >	prediction (2)	reference (3)
multiplication (27)	p.m (10)	preliminary (1)	references (2)
multiplied (10)	PAGE (7)	preparation (1)	refers (1)
multiply (1)	Pages (1)	PRESENT (1)	Regarding (1)
< N >	papers (1)	pretty (4)	Registered (2)
name (2)	parabola (3)	previous (1)	regular (1)
NDA (2)	parabolic (1)	Pricer (4)	relate (1)
NDAs (1)	paragraph (3)	print (2)	related (1)
NE (1)	paragraphs (1)	prior (8)	relates (1)
necessarily (3)	parameters (2)	problems (1)	relationship (1)
necessary (1)	part (3)	procedure (2)	relative (1)
need (3)	Partes (1)	process (3)	relevant (1)
negative (3)	parties (2)	product (1)	relied (1)
new (11)	parts (1)	production (1)	rely (1)
NFC (6)	pass (1)	Professional (2)	remember (2)
NFC-based (3)	passive (1)	Project (2)	reminder (1)
Nike (1)	PATENT (17)	provide (3)	repeat (2)
Northrop (1)	PDF (1)	provided (2)	Reported (1)
NOTE (1)	penalty (3)	providing (1)	Reporter (8)
notes (3)	people (1)	publication (2)	requires (3)
notice (1)	perform (4)	publications (1)	resolution (2)
noun (1)	performed (3)	publish (1)	results (1)
November (1)	performing (13)	pull (1)	retail (6)
Number (9)	perjury (3)	Pursuant (2)	retained (1)
numbers (1)	PERKINS (3)	put (5)	Review (1)
numerous (1)	person (7)	< Q >	reviewed (2)
NXP (1)	Petition (1)	question (2)	RFID (12)
< O >	Petitioner (3)	questions (2)	RFID-based (1)
Oath (1)	PhD (8)	quite (4)	RFIDs (5)
Obtain (1)	physical (1)	< R >	right (53)
	pieces (1)		right-hand (1)
			room (1)

rotate (1)	specific (3)	talking (9)	turning (1)
RPR (2)	specifically (2)	talks (2)	two (11)
rule (2)	specifics (1)	Tampere (1)	type (1)
run (1)	specify (2)	Tan (5)	types (1)
< S >	spent (1)	Tech (1)	typical (1)
S101 (3)	spline (2)	Technical (1)	typically (10)
S102 (3)	splines (1)	technique (2)	< U >
S103 (3)	SPORTSERVICE (1)	techniques (2)	U.S (3)
S104 (3)	square (2)	technologies (12)	UHF (2)
SA (1)	standards (1)	TECHNOLOGY (2)	Undergraduate (1)
saying (8)	start (5)	tell (1)	understand (4)
says (22)	started (1)	TENTZERIS (14)	understanding (3)
scenario (1)	starting (15)	term (16)	UNITED (2)
Second (5)	State (4)	terminology (1)	University (1)
Section (1)	Statement (1)	Terms (1)	unknown (3)
see (26)	STATES (2)	test (4)	unpatentability (1)
selective (1)	STENOGRAPHER	testified (1)	up-to-date (1)
self-equipped (1)	(2)	testimony (6)	use (7)
seminar (1)	Stenographic (5)	tests (2)	useful (1)
sense (1)	Stenographically (1)	Thank (6)	uses (3)
sensing (1)	step (13)	theory (1)	utilize (5)
sentence (2)	steps (1)	thing (3)	utilized (10)
serve (1)	stop (1)	things (2)	utilizing (6)
SES-IMAGOTAG (1)	Street (2)	think (3)	< V >
set (3)	stress (1)	third (3)	Valencia (5)
shelf (127)	stressed (1)	three (5)	value (13)
shelves (15)	stressing (1)	time (9)	values (5)
Shorthand (4)	strict (1)	times (6)	variable (13)
show (2)	Students (1)	tires (2)	variables (1)
showcase (1)	subcentimeter (2)	title (1)	variation (1)
side (8)	submission (1)	T-Mobile (1)	variety (8)
sides (2)	sufficient (1)	today (4)	verified (1)
sign (1)	Suite (2)	told (3)	verify (1)
significant (1)	sum (4)	Tom (1)	verifying (1)
simple (13)	summation (3)	top (5)	Verizon (1)
simplification (1)	Support (2)	topics (2)	videoconference (1)
Sixteenth (1)	sure (5)	tracking (2)	virtually (1)
skill (1)	swear (1)	TRADEMARK (1)	VS (1)
skills (6)	sworn (2)	transactions (1)	< W >
slew (1)	Symposium (1)	transcript (1)	want (13)
slope (15)	system (1)	translation (1)	wanted (2)
smart (27)	systems (5)	TRIAL (1)	Washington (2)
somebody (1)	< T >	triangulation (1)	way (8)
sorry (3)	tags (1)	triggered (1)	ways (3)
Sounds (1)	take (10)	trilateration (1)	web (1)
space (2)	taken (2)	true (3)	weird (1)
speaker (1)	talk (5)	try (1)	
special (4)	talked (1)	trying (7)	
		turn (1)	

welcome (2)
well (8)
well-known (5)
we're (2)
We've (2)
WHEREOF (1)
Wi-Fi (1)
wireless (3)
witness (8)
WITNESS'S (1)
word/words (2)
words (3)
work (5)
working (2)
world (2)
written (1)
Wu (23)

< X >

X1 (1)

X2 (1)

< Y >

yeah (2)

year (1)

years (2)

< Z >

Zoom (1)