

IPR2023-01414
Patent Owner
EX 2002

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 MEDiatek INC. and
4 NXP USA, INC.,
5 Petitioner,

6 V.

7 BELL NORTHERN RESEARCH, LLC,
8 Patent Owner

9 Case: IPR2023-01414
10 U.S. Patent No. 8,416,862

11 - - -

12 June 20, 2024

13 - - -

14 Oral deposition of JONATHAN WELLS,
15 Ph.D., taken via Zoom, beginning at 12:00
16 p.m., before LINDA ROSSI-RIOS, a Federally
17 Approved Registered Professional Reporter,
18 Certified Court Reporter and Notary Public.

19 - - -

20 VERITEXT LEGAL SOLUTIONS
21 MID-ATLANTIC DIVISION
22
23
24

Page 2 1 A P P E A R A N C E S : (Via Zoom unless otherwise indicated) 2 3 4 Representing the NXP USA, INC. DLA PIPER, LLP BY: ZACHARY LONEY, ESQUIRE 303 Colorado Street, Suite 3000 Austin, TX 78701 Zachary.Loney@us.dlapiper.com 5 6 7 8 9 Representing the Patent Owner DEVLIN LAW FIRM BY: JASON SHAPIRO, ESQUIRE SRIKANT CHERUVU, ESQUIRE 1526 Gilpin Avenue Wilmington, DE 19806 jshapiro@devlinlawfirm.com scheruvu@devlinlawfirm.com 10 11 12 13 14 15 - - - 16 17 18 19 20 21 22 23 24	Page 4 1 - - - 2 COURT REPORTER: The attorneys 3 participating in this deposition 4 acknowledge that I am not physically 5 present in the deposition room, and 6 that I will be reporting this 7 deposition remotely. 8 They further acknowledge that in 9 lieu of an oath administered in person, 10 I will administer the oath remotely. 11 The parties and their counsel 12 further agree that the witness may be 13 in a state where I am not a Notary and 14 stipulate to the witness being sworn in 15 by an out-of-state Notary. 16 If any party does have an 17 objection to this manner of reporting, 18 please state so now. 19 MR. SHAPIRO: No objection. 20 MR. LONEY: No objection. 21 - - - 22 JONATHAN WELLS, Ph.D., after 23 having been duly sworn, was examined 24 and testified as follows:
Page 3 1 I N D E X 2 WITNESS PAGE 3 JONATHAN WELLS, Ph.D. 4 BY MR. SHAPIRO.....5 5 BY MR. LONEY.....108 6 E X H I B I T S 7 MARKED DESCRIPTION PAGE 8 Exhibit Declaration of 18 BNR0001 Jonathan Wells, Ph.D 9 10 Exhibit 1001 US Patent Number 9 8,416,862 11 Exhibit 1003 Declaration of 9 Jonathan Wells, Ph.D. 12 13 Exhibit 1004 US Patent Number 11 7,236,748 14 Exhibit 1005 US Patent Application 12 Publication Number 15 2008/108310 16 Exhibit 1006 US Patent Number 12 7,312,750 17 18 Exhibit 1007 US Patent Application 13 Publication Number 19 2006/0092054 20 21 Exhibit 1008 Article, Reducing the 14 Computations of the Singular Value Decomposition Array Given By Brent and Luk 22 23 Exhibit 1009 US Patent Number 15 7,710,925 24	Page 5 1 - - - 2 EXAMINATION 3 - - - 4 BY MR. SHAPIRO: 5 Q. Good morning, Dr. Wells. 6 A. Good morning, Mr. Shapiro. 7 Q. Please to meet you. As you 8 know, I'm with the Devlin Law Firm, and we 9 represent the patent owner Bell Northern 10 Research. 11 Could you please state your full 12 name for the record? 13 A. My full name is Jonathan Andrew 14 Wells. 15 Q. Thank you. Have you ever been 16 deposed in connection with an inter partes 17 review before? 18 A. Yes, I have. 19 Q. Even though you've done this 20 before, let's go over some ground rules for 21 the deposition so we're all on the same page. 22 Is that okay? 23 A. Sure. 24 Q. During the deposition I'm going

Page 6 1 to ask you a series of questions. My 2 questions and your answers will be recorded by 3 the court reporter. To help the court 4 reporter do their job, it's important that we 5 don't talk over each other. I'll try to stop 6 and listen to you while you're speaking and 7 I'd ask that you do the same for me. Is that 8 okay? 9 A. Yes. 10 Q. It's also important that you 11 speak up and answer my questions orally 12 because the court reporter can't record you 13 nodding your head or shaking your head. 14 Do you understand that? 15 A. Yes. 16 Q. If you don't understand a 17 question for any reason, please let me know 18 and I'll try to ask it in a different way. 19 Okay? 20 A. Yes. 21 Q. Your attorney may object after 22 one of my questions. If that happens, you can 23 still answer the question as long as your 24 attorney doesn't instruct you not to answer.	Page 8 1 A. Yes, it is. 2 Q. If I refer to this inter partes 3 review or this IPR or this proceeding, do you 4 understand that I'm referring to inter partes 5 review IPR2023-01414? 6 A. Yes, okay, I understand that. 7 Q. And if I refer to the '862 8 patent, do you understand that I'm referring 9 to US Patent 8,416,862? 10 A. Yes, I understand that. 11 Q. Let's try -- 12 A. If I may, Mr. Shapiro, before 13 you start. 14 Q. Yes. 15 A. I do have some documents in 16 front of me. I just wanted to share that with 17 you. I have some of the exhibits in front of 18 me here. I have clean paper copies, no 19 markups, nothing on them. But I do have a 20 copy of the '862 patent. I do have a copy of 21 my Declaration and I have a copy of the prior 22 art that is used in this case. I could read 23 you the exhibit numbers if you wish. 24 Q. No, that's fine. Thank you.
Page 7 1 Okay? 2 A. Yes. 3 Q. I'll try to take a break every 4 hour or so. If you want to take a break at 5 some other time, just let me know and we'll 6 take one. The one exception is that if I've 7 already asked you a question, I'd like to get 8 your answer before we take the break. Okay? 9 A. Yep, sure. 10 Q. And finally, since you've done 11 this before, you understand that you're not 12 permitted to consult or confer with your 13 attorney regarding the substance of the 14 deposition at any time during the deposition 15 including any breaks. Do you understand? 16 A. Okay. 17 Q. Is there any reason, medical or 18 otherwise, why you could not testify fully, 19 truthfully, and accurately today? 20 A. No, there isn't. 21 Q. Dr. Wells, you understand that 22 you are being deposed in connection with inter 23 partes review number IPR2023-01414 of US 24 Patent 8,416,862. Is that correct?	Page 9 1 I'm still going to share just so 2 we'll all looking at the same thing. 3 A. Okay. 4 MR. SHAPIRO: Let's try Exhibit 5 Share. 6 - - - 7 (Exhibit 1001, US Patent Number 8 8,416,862, marked for identification.) 9 - - - 10 BY MR. SHAPIRO: 11 Q. I'm showing you a document 12 marked 1001. Have you received it on Exhibit 13 Share? 14 A. Yes, I have. 15 Q. Is this document that I just 16 shared with you US Patent Number 8,416,862? 17 A. Yes, it is. 18 Q. I'm going to share another 19 document with you. 20 - - - 21 (Exhibit 1003, Declaration of 22 Jonathan Wells, Ph.D., marked for 23 identification.) 24 - - -

Page 10 1 BY MR. SHAPIRO: 2 Q. I'm showing you a document 3 marked Exhibit 1003. Let me know when you've 4 received that. 5 A. Yes, I received that. 6 Q. Is the document that is marked 7 Exhibit 1003 that I just shared the 8 Declaration you submitted in this proceeding? 9 A. Yes, it is. 10 Q. In your Declaration, you provide 11 opinions on the obviousness of claims 1 12 through 4 and 9 through 12 of the '862 patent. 13 Is that correct? 14 A. Among other things, yes. 15 Q. Okay. What other things did you 16 provide opinions on? 17 A. I provided opinions on, for 18 example, the person of ordinary skill in the 19 art's support for some of the dates of various 20 patents. 21 Q. Okay. But in your Declaration, 22 you did provide opinions on the obviousness of 23 claims 1 through 4 and 9 through 12 of the 24 '862 patent. Correct?	Page 12 1 A. Yes. 2 - - - 3 (Exhibit 1005, US Patent 4 Application Publication Number 5 2008/108310, marked for identification.) 6 - - - 7 BY MR. SHAPIRO: 8 Q. I am showing you a document 9 marked Exhibit 1005. 10 Let me know when you receive it. 11 A. Yes, I have that. 12 Q. Is the document marked 13 Exhibit 1005 that I just shared with you US 14 Patent Application Publication Number 15 2008/0108310 to Tong, et al.? 16 A. Yes, it is. 17 Q. If I refer to Tong, do you 18 understand that I'm referring to US Patent 19 Application Publication Number 2008/0108310? 20 A. Yes, I do. 21 - - - 22 (Exhibit 1006, US Patent Number 23 7,312,750, marked for identification.) 24 - - -
Page 11 1 A. Yes. 2 Q. If I refer to the challenged 3 claims, do you understand that I'm referring 4 to the claims 1 through 4 and 9 through 12 of 5 the '862 patent? 6 A. Yes, I understand that. 7 Q. Let me show you, get the rest of 8 these out of the way. 9 - - - 10 (Exhibit 1004, US Patent Number 11 7,236,748, marked for identification.) 12 - - - 13 BY MR. SHAPIRO: 14 Q. I'm sharing with you a document 15 marked Exhibit 1004. Let me know when you've 16 received it. 17 A. Yes, I have that. 18 Q. Is the document marked 1004 that 19 I just shared US Patent 7,236,748, to Li, et 20 al.? 21 A. Yes, it is. 22 Q. If I refer to Li '748, do you 23 understand that I'm referring to US Patent 24 7,236,748?	Page 13 1 BY MR. SHAPIRO: 2 Q. I'm showing you a document 3 marked Exhibit 1006. Let me know when you see 4 it. 5 A. Yes, I have that. 6 Q. Okay. Is the document marked 7 Exhibit 1006 that I just shared with you US 8 Patent Number 7,312,750 to Mao, et al.? 9 A. Yes, it is. 10 Q. And if I refer to Mao, do you 11 understand that I am referring to US Patent 12 Number 7,312,750? 13 A. Yes, I do. 14 - - - 15 (Exhibit 1007, US Patent 16 Application Publication Number 17 2006/0092054, marked for identification.) 18 - - - 19 BY MR. SHAPIRO: 20 Q. I'm showing you a document 21 marked Exhibit 1007. Let me know when you see 22 it. 23 A. Yes, I have that. 24 Q. Is the document marked

Page 14 1 Exhibit 1007 that I just shared with you US 2 Patent Application Publication Number 3 2006/0092054 to Li, et al.? 4 A. Yes, it is. 5 Q. And if I refer to Li '054, do 6 you understand that I'm referring to US Patent 7 Application Publication Number 2006/0092054? 8 A. Yes, I do. 9 - - - 10 (Exhibit 1008, Article, 11 Reducing the Computations of the 12 Singular Value Decomposition Array 13 Given By Brent and Luk, marked for 14 identification.) 15 - - - 16 BY MR. SHAPIRO: 17 Q. I'm showing you a document 18 marked Exhibit 1008. 19 Let me know when you see it. 20 A. Yes, I see that. 21 Q. Is the document marked 22 Exhibit 1008 that I just shared with you the 23 article entitled "Reducing the Computations of 24 the Singular Value Decomposition Array Given	Page 16 1 A. Yes, I do. 2 Q. Thank you. 3 Let's look at Exhibit 1003. 4 This is your Declaration, Dr. Wells. Correct? 5 A. Yes, it is. 6 Q. If I refer to your Declaration 7 or the Declaration, you understand that I'm 8 referring to the Declaration you submitted in 9 this proceeding. Correct? 10 A. Yes. 11 Q. In paragraph 2 of your 12 Declaration, you stated that you previously 13 submitted an opinion in support of LG's 14 petition for inter partes review and 15 IPR2020-00108. Is that correct? 16 A. Yes, it is. 17 Q. In that same paragraph, you 18 state that the opinion that you submitted in 19 support of LG's petition was on the identical 20 grounds presented in your Declaration. Is 21 that correct? 22 A. That's what I state. 23 Q. So that's correct? 24 A. It's correct that I state that,
Page 15 1 By Brent and Luk," by Yang and Bohme, 2 published in the FIAM Journal of Matrix 3 Analysis and Applications in 1991? 4 A. Yes, it is. 5 Q. If I refer to Yang, do you 6 understand that I'm referring to the article 7 by Yang and Bohme that I just mentioned? 8 A. Yes, I do. 9 - - - 10 (Exhibit 1009, US Patent Number 11 7,710,925, marked for identification.) 12 - - - 13 BY MR. SHAPIRO: 14 Q. I'm showing to you a document 15 marked Exhibit 1009. Let me know when you see 16 it. 17 A. Yes, I have that. 18 Q. Is the document marked 19 Exhibit 1009 that I've just shared with you 20 US Patent Number 7,710,925 to Poon? 21 A. Yes, it is. 22 Q. If I refer to Poon, do you 23 understand that I'm referring to US Patent 24 Number 7,710,925?	Page 17 1 yes. 2 Q. Are there any differences 3 between the opinions given in your Declaration 4 and those submitted in support of LG's 5 petition for inter partes review in 6 IPR2020-00108? 7 A. I believe there are. 8 Q. What differences are there 9 between the opinions given in your Declaration 10 and those submitted in support of LG's 11 petition in IPR2020-00108? 12 A. I believe that in this 13 Declaration, I have also opined on claims 1 14 through 4 whereas the LG Declaration, or the 15 Declaration for the LG petition was, I 16 believe, just on claims 9 through 12. 17 Q. Are there any other differences? 18 A. There may be. 19 Q. You don't know if there are any 20 other differences? 21 A. That's the LG petition I wrote 22 five years ago. I think there's probably some 23 differences in this Declaration that I wrote 24 last year.

Page 18 1 Q. Do you recall if there are any 2 substantive differences between your 3 Declaration and the opinions that you gave in 4 support of LG's petition in IPR2020-00108? 5 A. The only substantive -- I'll say 6 the word. 7 The only main difference that I 8 can think of is that in this Declaration here 9 in the present proceedings I opine on claims 1 10 through 4 and 9 through 12. I believe that in 11 the LG petition I just opine on claims 9 12 through 12. 13 Q. I'd like to show you an exhibit. 14 - - - 15 (Exhibit BNR0001, Declaration of 16 Jonathan Wells, Ph.D, marked for 17 identification.) 18 - - - 19 BY MR. SHAPIRO: 20 Q. I'm marking the exhibit BNR0001. 21 Let me know when you can see Exhibit BNR0001. 22 A. Yes, I can see that. 23 Q. Is the document marked Exhibit 24 BNR0001 the Declaration you gave in support of	Page 20 1 communication or a person with equivalent 2 education, work, or experience in this field. 3 Correct? 4 A. Yes. 5 Q. Is that the same thing that you 6 wrote in your Declaration in this proceeding? 7 A. There's a minor difference, but 8 it's essentially the same opinion. 9 Q. What is the difference between a 10 person of ordinary skill in the art in the 11 Declaration you submitted in support of LG's 12 petition in IPR2020-00108 and your Declaration 13 in this proceeding? 14 A. Well, with regards to the 15 sentence you just read, in Exhibit BNR0001, I 16 put at least two to four years of experience. 17 In my Declaration, I put at least two years of 18 experience. 19 Q. Why did you change the person of 20 ordinary skill in the art in your Declaration 21 in this proceeding? 22 A. I don't think I really did 23 change it. I think in the original proceeding 24 it was two to four years or at least two to
Page 19 1 LG's petition in IPR2020-00108? 2 A. I believe that this is the one 3 that was used in that IPR proceeding. 4 Q. Do you have any reason to 5 believe that this is not the Declaration you 6 submitted in support of LG's petition in 7 IPR2020-00108? 8 A. I don't have reason to believe 9 it's not. I'm just looking at the opening 10 paragraph, I wrote this for Huawei, this 11 petition, and I believe that LG reused this 12 Huawei petition in their case. 13 Q. Can you take a look at 14 paragraph 23 of Exhibit BNR0001? 15 A. Yes, I'm there. 16 Q. In paragraph 23 of Exhibit 17 BNR0001, you indicate that based on your 18 knowledge and experience in the field and your 19 review of the '862 patent and its file 20 history, you believe that would have had a 21 bachelor's degree in electrical engineering, 22 computer engineering, computer science, or 23 related field, and at least two to four years 24 of experience in the field of wireless	Page 21 1 four years, and now I say at least two years. 2 I see there is a minor difference between the 3 terminology I've used, but they both say 4 essentially the same thing. I don't think it 5 would affect my opinions either way. 6 Q. So you can't tell me why you 7 made the change in your Declaration in this 8 proceeding? 9 A. Well, I don't think there is a 10 material change here. I've certainly refined 11 my opinions over the last five years since I 12 wrote this. And, again, I don't think it 13 changes the opinions that I provided in either 14 of these reports. 15 Q. You just told me that you 16 refined your opinions when preparing the 17 Declaration in this proceeding. Should I take 18 that to mean, then, you now believe that at 19 least only two years of experience is what is 20 required? 21 A. My opinion is that at least two 22 years of experience in wireless communications 23 or equivalent is what is required. 24 Q. And there appears to be a

Page 22 1 typographical error in paragraph 23 of your 2 Declaration. Correct? 3 A. Could you point me to that? 4 Q. In paragraph 23, when you say, 5 "I believe that would have had bachelor's 6 degree," what does that mean? 7 A. Well, this paragraph is under 8 the section of a person of ordinary skill in 9 the art. So I take your point that's a badly 10 written sentence, but I believe that a person 11 of ordinary skill in the art would have had a 12 bachelor's degree is what I should have said 13 there. 14 Q. So what you meant to say in your 15 Declaration is that a person in ordinary skill 16 in the art would have had a bachelor's degree 17 in electrical engineering, computer 18 engineering, computer science, or a related 19 field and at least two years of experience in 20 the field of wireless communication or person 21 with equivalent education, work, or experience 22 in this field. Is that correct? 23 A. Yes, it is. 24 Q. Would a person of ordinary skill	Page 24 1 I've provided. I think they would understand 2 what multiple input/multiple output 3 communications are. 4 Q. So, then, would a person of 5 ordinary skill in the art understand what 6 wireless communication networks that operate 7 in accordance with IEEE 802.11 standard are? 8 A. I'm not sure I really understood 9 that. Could you say that again, please? 10 Q. Would a person of ordinary skill 11 in the art understand what a wireless 12 communication network that operates in 13 accordance with IEEE 802.11 is? 14 A. Yes, I think they would. I 15 think that would be part of a bachelor's 16 degree in electrical engineering, computer 17 science, or computer engineering. 18 Q. And in paragraph 23 of your 19 Declaration, you state that "Additional 20 education could substitute for some of the 21 experience." Correct? 22 A. Yes. 23 Q. What do you mean by additional 24 education in paragraph 23 of your Declaration?
Page 23 1 in the art have had experience with wireless 2 communications networks that operate in 3 accordance with IEEE 802.11 standard? 4 A. Can you say the question again, 5 please? 6 Q. Would a person of ordinary skill 7 in the art have had experience with wireless 8 communication networks that operate in 9 accordance with the IEEE 802.11 standard? 10 A. They may have. 11 Q. In your opinion, experience with 12 wireless communication networks that operate 13 in accordance with the IEEE 802.11 standard is 14 not required of a person of ordinary skill in 15 the art? 16 A. I don't provide that opinion 17 here. I just say with regards to the field of 18 wireless communications or equivalents, I 19 don't say specifically which flavor of 20 wireless communications is required. 21 Q. Would a person of ordinary skill 22 in the art have had experience with multiple 23 input/multiple output wireless communications? 24 A. Again, that's not an opinion	Page 25 1 A. Additional education means 2 somebody who has higher qualifications than a 3 bachelor's degree. 4 Q. When you say higher education 5 than a bachelor's degree, do you mean higher 6 education in a field relevant to wireless 7 communication networks? 8 A. I don't explicitly say that, but 9 I think that would be a given. Higher 10 additional relevant education could substitute 11 for some of the experience. 12 Q. How much additional relevant 13 education is required to substitute for some 14 of the experience? 15 A. I couldn't give you a number. 16 It's not something that I've considered. 17 Q. And in paragraph 23 of your 18 Declaration, you also state that substantial 19 experience could substitute for some of the 20 educational background. Correct? 21 A. Yes, I do. 22 Q. What do you mean by substantial? 23 A. Well, substantial, it's plain 24 meaning. Substantial means a lot.

Page 26 1 Q. So how much experience in 2 paragraph 23 of your Declaration is required 3 to substitute for some of the educational 4 background? 5 A. Substantial. 6 Q. When you say some of the 7 educational background, what do you mean by 8 some of the educational background? 9 A. The bachelor's degree in 10 electrical engineering, computer engineering, 11 computer science or related field or some -- 12 well, it's that. 13 Q. So are you saying in 14 paragraph 23 of your Declaration that 15 substantial experience could substitute for a 16 bachelor's degree in one of those fields? 17 A. Yes, I am. 18 Q. Have you communicated with Dr. 19 Buehrer in connection with this proceeding? 20 A. Not that I can recall with -- 21 no, the answer is no. 22 Q. Do you know Dr. Buehrer? 23 A. I am aware of him, yes. 24 Q. Have you communicated with Dr.	Page 28 1 this calls for attorney-client 2 privileged information. Dr. Wells, you 3 can answer if you can answer without 4 divulging communications with counsel. 5 THE WITNESS: So I think the 6 question was what other materials have 7 I considered. Well, in informing my 8 knowledge and experience of 35 years of 9 wireless, I've considered hundreds of 10 documents. 11 BY MR. SHAPIRO: 12 Q. But you can't identify any 13 specific documents that you considered in 14 connection with your Declaration in this 15 proceeding other than those that are listed in 16 paragraph 26 of your Declaration. Is that 17 correct? 18 A. That is correct, yes. 19 Q. In paragraphs 51 and 52 of your 20 Declaration, you provide some background on 21 matrices and matrix algebra. Correct? 22 A. Yes, I do. 23 Q. Would a person of ordinary skill 24 in the art be familiar with matrices and
Page 27 1 Buehrer? 2 A. Over the course of my life, yes. 3 Q. Have you communicated with Dr. 4 Buehrer in connection with the '862 patent? 5 A. I don't believe I have, no. 6 Q. In paragraph 26 of your 7 Declaration, you list a number of publications 8 and materials that you claim to have 9 considered as part of your analysis for the 10 Declaration. Is that correct? 11 A. Yes, that's right. 12 Q. Does paragraph 26 of your 13 Declaration list all of the publications and 14 materials you considered? 15 A. It's the specific publications 16 and materials that I considered for this IPR. 17 But as I say before that, I'm also relying on 18 my own knowledge where I've considered many, 19 many publications and materials to inform 20 myself so that I can come into this 21 understanding the technology. 22 Q. What other publications and 23 materials did you consider? 24 MR. LONEY: Object to the extent	Page 29 1 matrix algebra? 2 A. Yes, I think they would. 3 Q. In paragraph 52 of your 4 Declaration, you state that using singular 5 value decomposition, or SVD, quote, an m by n 6 matrix A can be factored as A equals U Greek 7 symbol Sigma V superscript T. Correct? 8 A. Yes, I do. 9 Q. And in paragraph 53 of your 10 Declaration, you state that some of the 11 references you rely on use slightly different 12 nomenclature for describing the SVD operation. 13 Is that correct? 14 A. That is correct. 15 Q. You mention Li '748, Tong, Li 16 '054 and Poon in paragraph 53 of your 17 Declaration, but you don't mention Yang. Is 18 that correct? 19 A. I don't mention Yang in 20 paragraph 53. Correct. 21 Q. Does Yang also describe an SVD 22 operation? 23 A. Yes, it does. 24 Q. Let's take a look at Yang,

Page 30 1 Exhibit 1008, please. And please go to 2 page 2. Let me know when you have it in front 3 of you. 4 A. Yes, I'm there. 5 Q. Is equation (1) on page 2 of 6 Yang the same equation as in paragraph 52 of 7 your Declaration except for the matrix on the 8 left side of the equation and Yang being 9 called M instead of A? 10 A. Yes, it is. 11 Q. The sentence before equation (1) 12 in Yang says that the matrix M belongs to the 13 set of all real N-by-N matrices. Is that 14 correct? 15 A. I believe that's what the 16 nomenclature is saying. 17 Q. Are you unsure as to what the 18 nomenclature in Yang is saying? 19 A. Well, the sentence says let M be 20 a subset of an italic R which I think means 21 real to the power of N times N being matrix of 22 dimension N. So it's suggesting that M is a 23 matrix that is a subset of, I think that R 24 stands for real numbers.	Page 32 1 (A recess was taken from 2 12:55 p.m. to 1:12 p.m.) 3 - - - 4 BY MR. SHAPIRO: 5 Q. Dr. Wells, let's continue with 6 Exhibit 1008, if you will. 7 A. Okay. 8 Q. I just wanted to clarify one 9 point we discussed earlier. In the sentence 10 before equation (1) and the sentence after 11 equation (1), do you agree that R stands for a 12 set of real numbers? 13 A. I believe that's what R in 14 mathematical notation means. 15 Q. Okay. And in section 2 of 16 Exhibit 1008 we have equations (1) through 17 (6). We just discussed equation (1). Would 18 you agree that equations (2) through (6) are 19 concerned with diagonalizing the matrix M? 20 A. I think at least equation (2) is 21 diagonalizing in matrix M. 22 Q. And the rest of the equations? 23 Let me re-ask that. 24 So equation (2) on page 2 of
Page 31 1 Q. So then the sentence after the 2 equation (1) in Yang says that the matrices U 3 and V each belong to the set of all real 4 N-by-N matrices as well. Correct? 5 A. It uses the same nomenclature, 6 so yes, it's consistent with the way that the 7 matrix M is defined. 8 Q. Dr. Wells, you read Yang in its 9 entirety. Correct? 10 A. I have looked through it, yes. 11 Q. Do you have any reason to 12 believe that R on page 2 is not a set of real 13 numbers? 14 A. I have no reason to believe it's 15 not. 16 Q. Going back to paragraph 18 of 17 your -- 18 MR. SHAPIRO: You know what, 19 we're at 12:55, almost an hour. Why 20 don't we take a five-minute break and 21 then resume if that's okay with 22 everyone. 23 THE WITNESS: That's fine by me. 24 - - -	Page 33 1 Exhibit 1008 deals with diagonalizing the 2 matrix M. Correct? 3 A. That's what the sentence 4 suggests. 5 Q. What does equation (3) mean on 6 page 2 of Exhibit 1008? Did I say 7 equation (3)? 8 A. I think you did, yes. 9 Q. Okay. 10 A. Other than just reading the 11 sentence, I think I would need to consider it 12 carefully to give you an explanation of what 13 it means. It's not something that I opined 14 upon in my Declaration. 15 Q. When describing equation (2) on 16 page 2 of Exhibit 1008 Yang states that U and 17 V describe two rotations in the (i, j)-plane 18 where the angles are chosen to annihilate the 19 elements of the matrix M in certain positions. 20 Correct? 21 A. That's a paraphrase of what Yang 22 states. 23 Q. Do you disagree with the way I 24 paraphrased that sentence?

Page 34 1 A. No. You paraphrased it the way 2 you paraphrased it. I don't disagree with 3 that. 4 Q. And then do you agree that Yang 5 goes on in Exhibit 1008 on page 2 to talk 6 about several sweeps where sweep is a sequence 7 of two-sided rotations according to a special 8 ordering? 9 A. That's what Yang says. 10 Q. And does Yang in Exhibit 1008 on 11 page 2 state at equation (3) is possibly the 12 most frequently used ordering? 13 A. For a particular application, 14 yes, Yang says that. 15 Q. And with respect to equations 16 (4) and (5), would you agree that Yang says in 17 Exhibit 1008 at page 2 that the matrix M is 18 partitioned into 2-by-2 sub-matrices? 19 A. That's what Yang states on 20 page 2. 21 Q. Would you agree that Yang in 22 Exhibit 1008 at pages 2 to 3 states that the 23 equation -- that equation (6) is R of theta 24 from equation (4).	Page 36 1 paragraph 169, you cite to a portion of 2 Exhibit 1008 stating that the CORDIC -- I'm 3 sorry -- stating that the CORDIC algorithm in 4 the previous section, we have seen that the 5 main operations of the TPR method are plane 6 rotations and Cartesian-to-polar coordinates 7 conversions. Is that correct? 8 A. I'm sorry, I was a little lost 9 on that. Could you ask that one more time? 10 Q. In paragraph 169 of your 11 Declaration, you cite to 1008 for the 12 statement "The Cordic algorithm. In the 13 previous section, we have seen that the main 14 operations of the TPR method are plane 15 rotations and Cartesian-to-polar coordinates 16 conversions." Correct? 17 A. Yes, I do. 18 Q. But today you're telling me that 19 you didn't consider the TPR method that I just 20 asked you about. Is that correct? 21 MR. LONEY: Objection. 22 Mischaracterizes the witness' 23 testimony. 24 THE WITNESS: Yes, I don't think
Page 35 1 A. Yes. 2 Q. Would you agree that A and B in 3 equation (5) of Exhibit 1008 are the 2-by-2 4 sub-matrices that M is partitioned into? 5 A. I don't know. I would have to 6 think about that. 7 Q. Moving on to section 3 of Yang 8 beginning on page 3 of Exhibit 1008, does this 9 section deal with two plane rotation of the 10 sub-matrices? 11 A. I would need to read this 12 thoroughly. It's not something that I've 13 opined upon in my Declaration. 14 Q. In equation (7) on page 3 of 15 Exhibit 1008, do M, the italicized M 16 superscript ROT and italicized M superscript 17 REF refer to the same M as in equation (1)? 18 A. I don't know. I would need to 19 consider that. That's not something that I've 20 opined upon in my report. 21 Q. Can you turn to paragraph 169 of 22 your Declaration? 23 A. Yes, I'm there. 24 Q. In your Declaration in	Page 37 1 I said that. 2 BY MR. SHAPIRO: 3 Q. Did you consider the TPR method 4 in your opinion? 5 A. Yes, I did. 6 Q. Can you tell me what M 7 superscript ROT and M superscript REF in 8 equation (7) denote? 9 A. No, I can't, because I didn't 10 opine on that. That's not something that I 11 needed to opine on to come to the conclusions 12 that I came to. 13 Q. Dr. Wells, you didn't consider 14 equation (7) in rendering the opinions in your 15 Declaration. Let me restate that. 16 You didn't consider equation (7) 17 of Exhibit 1008 in the opinions you rendered 18 in your Declaration. Correct? 19 A. I didn't consider it explicitly, 20 no. I considered this whole Yang paper. And 21 the Yang paper says, actually in the next 22 section, how the TPR method which is defined 23 in section 3 confirms that there are plane 24 rotations in Cartesian-to-polar coordinates

Page 38 1 conversions. 2 Q. So are you saying that the TPR 3 method mentioned in section 4 of Yang in 4 Exhibit 1008 on page 5 is the TPR method that 5 is described in section 3 of Exhibit 1008 6 beginning on page 3? 7 A. That's what Yang says. 8 Q. Is that, Dr. Wells -- do you 9 have any reason to disagree that the TPR 10 method described in section 3 of Exhibit 1008 11 relates to the matrix M in equation (1)? 12 A. Well, it does relate to M in 13 equation (1). Yang is all about a 14 computationally efficient way of representing 15 the matrix M. And this TPR method is a way in 16 which you can convert Cartesian-to-polar 17 coordinates as part of producing that matrix 18 M. 19 Q. Let me make sure I understand. 20 So the TPR method described in section 3 of 21 Exhibit 1008 relates to the matrix M in 22 equation (1). Correct? 23 A. It appears that the TPR method 24 is a way of computing particular rotations	Page 40 1 Declaration. 2 In paragraph 16 of your 3 Declaration, you talk about anticipation and 4 the principles of inherency. Correct? 5 A. Yes, that's right. 6 Q. To be clear, even though you 7 talk about anticipation in paragraph 16, you 8 do not offer any opinions on anticipation in 9 your Declaration. Correct? 10 A. Correct. 11 Q. Even though you talk about 12 inherency in paragraph 16, you do not offer 13 any opinion on inherency in your Declaration. 14 Correct? 15 A. Correct. 16 Q. The opinions in your Declaration 17 are limited to obviousness. Is that correct? 18 A. That's right. 19 Q. In paragraph 18 of your 20 Declaration, you state that the obviousness 21 analysis must take into account "the 22 differences between the prior art and the 23 claims." Is that correct? 24 A. That's one of the -- one of the
Page 39 1 Yang shows how that method is used in 2 providing a computational efficient way of 3 simplifying the matrix M. 4 Q. Is the CORDIC algorithm 5 described in section 4 of Exhibit 1008 also 6 related to the matrix M in equation (1). 7 A. The CORDIC algorithm is a way of 8 doing the SVD algebra, so it's a way of 9 simplifying M in equation (1). 10 Q. Let's go back to paragraph 53 of 11 your Declaration. In paragraph 53 of your 12 Declaration, you state that the '862 patent, 13 Li '748, Li '054 and Poon all describe the SVD 14 equation as H equals UDV sometimes using 15 different nomenclature. Is that correct? 16 A. Yes. 17 Q. Does M in equation (1) of Yang 18 correspond to H in the '862 patent and the 19 references that you cite in paragraph 53 of 20 your Declaration? 21 A. Yes, it does. 22 Q. Let's go back to your 23 Declaration. Let's turn to paragraphs 15 24 through 20. 15 through 20 of your	Page 41 1 criteria, yes. 2 Q. Where in your Declaration do you 3 identify the differences between Li '748 and 4 claim 1 of the '862 patent? 5 A. In section VIII of my 6 Declaration. 7 Q. Can you be more specific, 8 please? 9 A. So with regards to Li '748 and 10 claim 1, I provide that analysis in paragraphs 11 73 through to 97. 12 Q. Can you give me an example of a 13 difference between Li '748 and claim 1 of the 14 '862 patent that appears in your Declaration? 15 A. I don't think there is a 16 difference. That's why I think that Li '748 17 renders the '862 patent invalid. Because to a 18 person of ordinary skill in the art, Li 19 discloses everything that is in the patent, 20 the '862 patent. There are no differences. 21 Q. Dr. Wells, why do you opine in 22 your Declaration that claim 1 is obvious over 23 Li in view of Tong and Mao if Li '748 24 discloses everything in claim 1?

Page 42 1 A. Because as I said in my report, 2 there are some things in Li that would be 3 obvious to a POSITA, a person of ordinary 4 skill in the art. But to the extent that 5 they're not explicitly disclosed, Tong and Mao 6 disclose those elements explicitly. 7 Q. Can you give me an example of a 8 limitation from claim 1 of the '862 patent 9 that is not explicitly disclosed by Li '748? 10 MR. LONEY: Objection. Vague. 11 THE WITNESS: Yes, I can. For 12 example, in paragraphs 88 through 91 13 with regards to -- and we're just 14 dealing with claim 1 here -- the 15 limitation about decomposing the matrix 16 V, I show how Li talks about reducing 17 the matrix in a way to reduce the 18 feedback. This is what the patent 19 talks about as being decomposing. Li 20 discloses that. But I would also seek 21 to find it obvious this is what Li is 22 talking about. But to the extent that 23 Li doesn't explicitly use the word 24 decomposition, I've shown that the Tong	Page 44 1 question back, please. 2 - - - 3 (The court reporter read the 4 pertinent part of the record.) 5 - - - 6 THE WITNESS: Yes. So the 7 answer to that question is yes. 8 BY MR. SHAPIRO: 9 Q. Is there any -- scratch that. 10 Does Li '748 explicitly disclose 11 element 1.a of claim 1? 12 A. I think a POSITA would have 13 found it obvious that it does. 14 Q. You're telling me two different 15 things here. 16 Does Li '748 explicitly disclose 17 element 1.a of claim 1 of the '862 patent? 18 A. Well, Li doesn't use the exact 19 words that are in claim limitation 1.a, but Li 20 certainly discloses the receiving wireless 21 communication device that receives a preamble 22 sequence from the transmitting wireless 23 device. A POSITA would have found it obvious. 24 Q. Does Li '748 explicitly disclose
Page 43 1 reference explicitly causes 2 decomposition of the V matrix. 3 BY MR. SHAPIRO: 4 Q. Can you give me any other 5 examples of claim limitations in claim 1 of 6 the '862 patent that are not explicitly 7 disclosed in Li '748? 8 A. Yes, I can. In the next 9 section, paragraphs 92 through 97, it would be 10 clear to a POSITA that Li discloses the -- 11 actually, excuse me one second. 12 No, the example that I gave in 13 the previous set of questions is the only time 14 in claim 1 that Li shows that something 15 supportive would necessarily be there, but 16 it's not explicitly stated. So I've used a 17 second reference to show the explicit use of 18 the same words as in the claim. 19 Q. In paragraphs 82 and 83 of your 20 declaration you're relying entirely on Li '748 21 for elements 1.a and 9.c. correct? 22 A. Can you ask the question again, 23 please. 24 MR. SHAPIRO: Can you read the	Page 45 1 a preamble? 2 A. Li doesn't explicitly -- Li '748 3 doesn't explicitly, explicitly disclose a 4 preamble. But as I've said here, a preamble 5 is what has been -- is used in the majority of 6 wireless cases and a POSITA would have 7 recognized this because it was customary 8 practice at the time in such wireless devices, 9 therefore, Li discloses a preamble. 10 Q. Does Li explicitly disclose a 11 preamble sequence? 12 A. So, again, Li discloses that you 13 have a sequence. That sequencer is training 14 symbols and a POSITA would understand that 15 they would be carried in a preamble sequence 16 because that was customary practice at the 17 time. 18 Q. And where in your Declaration do 19 you provide evidence showing that it was 20 customary to have a preamble sequence? Let me 21 ask that again. 22 Where in your Declaration do you 23 provide evidence that it was customary to 24 estimate the channel response using training

Page 46 1 symbols of a preamble? 2 A. Well, that's not exactly what 3 I've provided an opinion on. I've provided 4 the opinion that Li discloses sending training 5 signals that it used to determine a channel 6 response, and I've provided the opinion that 7 it was customary practice at the time to send 8 such symbols as training symbols in a 9 preamble. Therefore, a POSITA would have 10 found it obvious that Li discloses receiving a 11 preamble sequence in order to determine the 12 channel response. 13 Q. Where in your Declaration do you 14 provide evidence that it was customary to 15 provide such training symbols in a preamble? 16 A. I think you may have just asked 17 me the same question. So that's not quite my 18 opinion. My opinion is that Li discloses 19 sending training symbols that are used to 20 determine a channel response, and it was 21 customary practice at the time to send things 22 like such training symbols as part of a 23 preamble sequence. 24 Q. Where in your Declaration do you	Page 48 1 a POSITA would have recognized this was 2 customary practice at the time. 3 Q. Do you provide evidence in 4 support of that statement anywhere else in 5 your Declaration? 6 A. I may have a similar sentence to 7 that elsewhere, but it would be the same 8 sentence or the same sort of opinion that I 9 provide here in paragraph 83. 10 Q. Is your answer the same with 11 respect to element 9.c of claim 9 of the '862 12 patent? 13 A. You said 9.c, yes, that's the 14 same response. 15 Q. So with respect to claim 9 as 16 well, the only evidence of the customary 17 practice is what is presented in paragraph 83? 18 MR. LONEY: Objection. 19 Misstates the witness' testimony. 20 THE WITNESS: So for the Li '748 21 reference, yes, I state that, in 22 paragraph 83, that a POSITA would have 23 recognized that it was customary 24 practice at the time to send such
Page 47 1 provide evidence that it was customary 2 practice to provide such training symbols as 3 part of a preamble sequence? 4 MR. LONEY: Objection. 5 THE WITNESS: So I think with 6 respect you've asked me the same 7 question three times. So it's the same 8 answer like before. That's not quite 9 the opinion that I've given. My 10 opinion is that Li provides disclosure 11 of sending training symbols that are 12 used to determine the channel response 13 and the customary practice at the time 14 was to send such training symbols as 15 part of a preamble. 16 BY MR. SHAPIRO: 17 Q. You just said the customary 18 practice at the time was to send such training 19 symbols as part of a preamble. Correct? 20 A. Yes. 21 Q. Where in your Declaration do you 22 provide evidence that that was the customary 23 practice at the time? 24 A. I say that in paragraph 83, that	Page 49 1 things using a preamble. 2 BY MR. SHAPIRO: 3 Q. Where do you say that in 4 paragraph 83 of your Declaration? 5 A. It's in the second to last 6 sentence. 7 Q. The second to last sentence in 8 paragraph 83 of your Declaration says that "a 9 POSITA would have recognized this similarity 10 because it was a customary practice at the 11 time in such wireless devices." Correct? 12 A. Yes, that's right. 13 Q. You use the term "similarity" in 14 that sentence in paragraph 83 of your 15 Declaration. Correct? 16 A. Yes. 17 Q. The similarity you're talking 18 about in paragraph 83 of your Declaration is 19 the use of training symbols to estimate the 20 channel response. Correct? 21 A. Sending, quote/unquote, training 22 symbols. So some kind of sequence to estimate 23 the channel response. 24 Q. Do you agree that there is a

Page 50 1 difference between the term training symbols 2 and the term preamble sequence? 3 MR. LONEY: Objection. Vague. 4 Calls for a legal conclusion. 5 MR. SHAPIRO: Zach, can we just 6 take a break here? 7 In IPRs, according to the Trial 8 Practice Guide, when you make 9 objections, they're not supposed to be 10 speaking objections. It's basically 11 objection, form. And so I just wanted 12 to point that out because you're not 13 supposed to make speaking objections 14 unless it's an issue of privilege. 15 MR. LONEY: I hear you. I will 16 continue making the objections as I see 17 fit. But if that becomes a problem, 18 let me know. 19 MR. SHAPIRO: If it affects the 20 deposition in any way, then we'll have 21 to confer with the board and that could 22 call for a rescheduling. 23 MR. LONEY: I understand your 24 position.	Page 52 1 symbols must be in a preamble? 2 A. I'm not saying that they must be 3 in a preamble, but that is the conventional 4 way of sending training symbols. And in my 5 35 years of working with wireless systems, I 6 can't think of any other system that I've ever 7 seen that doesn't send -- when training 8 symbols are sent when they're not sent in a 9 preamble. And I think a POSITA would 10 recognize that as well. 11 Q. As part of the analysis -- 12 scratch that. 13 As part of your analysis of -- 14 scratch that. 15 As part of your obviousness 16 analysis of claim 1 over Li '748 in view of 17 Tong and Mao, did you construe any of the 18 terms in claim 1? 19 A. I used the plain and ordinary 20 meaning for all of the terms. 21 Q. Can you tell me what the plain 22 and ordinary meaning of "preamble sequence" in 23 claim 1 is? 24 A. Preamble sequence to a person of
Page 51 1 MR. SHAPIRO: Let's continue. 2 Can you read back my question, please. 3 - - - 4 (The court reporter read the 5 pertinent part of the record.) 6 - - - 7 THE WITNESS: I mean, I 8 understand that the words are 9 different. But the way that Li '748 10 uses those -- the terms training 11 symbols is the same way that preamble 12 sequence is used in the '862 patent. 13 So there is no difference in how they 14 are used between the two references. 15 BY MR. SHAPIRO: 16 Q. Earlier you told me that Li '748 17 doesn't explicitly disclose training symbols 18 in the preamble. Correct? 19 A. I'm not sure I exactly said 20 that. Li doesn't explicitly disclose a 21 preamble. But Li does disclose sending 22 training symbols that are used in the same way 23 as the 7.b as in the '862 patent. 24 Q. Are you saying that training	Page 53 1 ordinary skill in the art would be a sequence 2 which would be a -- I don't know -- a 3 distribution of information that is sent 4 before something else. 5 Q. Is that the construction you 6 used in preparing your opinion expressed in 7 your Declaration? 8 A. I provided what I felt would be 9 the plain and ordinary meaning. That's how I 10 interpreted these claims. 11 Q. Let's take a look at paragraphs 12 84 and 85. 13 MR. SHAPIRO: Actually, we've 14 gone about an hour now. Let's take 15 another break. About a ten-minute 16 break. 17 - - - 18 (A recess was taken from 19 2:07 p.m. to 2:20 p.m.) 20 BY MR. SHAPIRO: 21 Q. In paragraphs 84 and 85 of your 22 Declaration, you address element 1.b of claim 23 1 and element 9.d of claim 9 of the '862 24 patent. Correct?

Page 54 1 A. Correct. 2 Q. Paragraphs 84 and 85 of your 3 Declaration, you rely solely on Li '748 and 4 Tong to show limitation 1.b of claim 1 and 5 limitation 9.d of claim 9. Correct? 6 A. Correct. 7 Q. In paragraph 84 of your 8 Declaration, you cite to Li '748 at column 8 9 lines 4 through 7 and Figure 2. Correct? 10 A. Yes. 11 Q. And those are the only portions 12 of Li '748 that you rely on in paragraphs 84 13 and 85 of your Declaration? 14 A. That is correct. 15 Q. In the portions of Li '748 cited 16 in paragraph 84 of your Declaration, there is 17 no mention of training symbols. Correct? 18 A. Not in those -- not in that 19 paragraph 84. There is elsewhere, but not in 20 paragraph 84, not in the citations I provide 21 in paragraph 84. 22 Q. In fact, you don't cite to any 23 portions of Li '748 discussing training 24 symbols in your obviousness analysis with	Page 56 1 equate training symbols with received signals? 2 A. I talk about that in the 3 previous section where we're talking about 4 receiving a preamble sequence. And I show how 5 Li discloses sending training symbols to the 6 receiver. And then in the next limitation, 7 which is about estimating a channel response, 8 I show how those received signals are used to 9 estimate a channel state matrix. 10 Q. But there is no explicit 11 discussion of the equivalence between training 12 symbols and received signals in Li '748. 13 Correct? 14 A. No, I disagree. 15 Q. Can you point me to an explicit 16 disclosure in Li '748 equating the training 17 symbols with the received signals? 18 A. Yes, I can. If you go to 19 paragraph 82 and the excerpts that I've 20 provided in 82, I talk about how you send 21 training symbols to the receiver. If you send 22 something to a receiver, it is a received 23 signal. And then it says that the receiver 24 may evaluate H. And H is the channel state
Page 55 1 respect to elements 1.b and 9.d of the '862 2 patent. Correct? 3 A. Not explicitly, but I've already 4 dealt with the preamble sequence in the 5 previous paragraph. So while I don't cite to 6 it in 84, I talk about it extensively in 7 paragraphs 82 and 83, the preceding two 8 paragraphs. 9 Q. But the portions of Li '748 that 10 you rely on in paragraphs 84 and 85 of your 11 Declaration talk about "receive signals" as 12 opposed to "training symbols." Correct? 13 A. In that one paragraph, yes. 14 Q. Where in Li '748 is it 15 explicitly stated the channel response is 16 determined based on training symbols? 17 A. That's in Li, in paragraph 8, 18 lines 4 to 7 where it talks about channel 19 state information is estimated from received 20 signals. And then in paragraph -- in the same 21 section, it says that this channel state 22 information may include the channel state 23 matrix H. 24 Q. Where in your Declaration do you	Page 57 1 matrix. So there is an explicit statement 2 here that the training symbols are received 3 signals. 4 Q. Is there an explicit statement 5 in Li '748, that the receiver evaluates H 6 based on the training symbols? 7 A. Well, I think there is, yes. 8 Q. Can you point me to the explicit 9 statement in Li '748 that the receiver 10 evaluates H based on training symbols that it 11 receives? 12 A. Yes, I can. So in paragraph 84, 13 I talk about how channel state information is 14 estimated from received signals. This channel 15 statement information includes the matrix H. 16 And in paragraph 82 I talk about the training 17 symbols that are sent to the receiver and the 18 receiver may evaluate H. I think that that is 19 a disclosure of the training symbols being the 20 received signals that the wireless device uses 21 to estimate a channel response. 22 Q. Are training symbols the only 23 signals that are received -- 24 MR. LONEY: Objection to form.

Page 58 1 BY MR. SHAPIRO: 2 Q. -- in Li -- let me restate that. 3 Are training symbols the only 4 signals that are received in Li '748? 5 A. I don't know. I only analyzed 6 the claim language and how Li discloses the 7 claim language. 8 Q. Isn't it possible that Li '748 9 is referring to something else when it talks 10 about received signals? 11 MR. LONEY: Objection. Form. 12 THE WITNESS: I think given 13 those two paragraphs that I cited to 14 you, a POSITA would find it obvious 15 that the training symbols are being 16 sent to the receiver and the receiver 17 uses those training symbols, as Li 18 states, to estimate a channel response. 19 BY MR. SHAPIRO: 20 Q. Dr. Wells, what is the plain and 21 ordinary meaning of term preamble? 22 A. Preamble I think in the context 23 of wireless communications is a sequence that 24 is sent or a signal that is some kind of	Page 60 1 is sent earlier than something else, it 2 doesn't necessarily make it a preamble. 3 Q. What is a preamble sent earlier 4 than? 5 A. I don't know how to simplify it 6 further. Earlier meaning earlier in time. 7 Preamble is sent earlier than something else 8 because it's used for the purpose of whatever 9 follows it. This is a conventional way of 10 sending training symbols and other symbols in 11 wireless communications and has been for 12 decades. 13 Q. Let's talk about Tong. In 14 paragraph 85 of your Declaration, you talk 15 about Tong's "pilot symbols." Correct? 16 A. Yes. 17 Q. Where in Tong is it explicitly 18 stated that the pilot symbols are used to 19 estimate H? 20 A. So as I've said in paragraph 85, 21 Tong receives pilot symbols at the receiver 22 and the MIMO channel H is measured by the 23 receiver based on those pilot symbols, and 24 I've provided three cites within Tong to
Page 59 1 information that is sent earlier than 2 something else. 3 Q. Any kind of information that is 4 sent earlier than something else is a 5 preamble. Is that correct? 6 A. I don't think that logic 7 necessarily holds. But I think preamble is a 8 widely used term. Training sequences, pilot 9 sequences, pilot symbols are sent as 10 preambles. The '862 patent concedes that. 11 Q. But the plain and ordinary 12 meaning that you just provided me with 13 suggests that you could have multiple 14 preambles in a signal. Is that correct? 15 A. I mean, I hadn't thought about 16 that hypothetical. 17 Q. So in your opinion, a signal or 18 some kind of information that is sent earlier 19 than something else is a preamble. Is that 20 correct? 21 A. I mean, not necessarily. I 22 think that you could -- a preamble is 23 something -- information that is sent earlier 24 than something else. Just because something	Page 61 1 support that; paragraphs 211, paragraph 87 and 2 paragraph 90. 3 Q. In paragraph 90 of Tong, it 4 states, "In order to determine a channel 5 response for each of the sub-carriers, the 6 pilot signal is multiple pilot symbols that 7 are scattered among the data symbols 8 throughout the OFDM sub-carriers in a known 9 pattern in both time and frequency." 10 Correct? 11 A. Okay. I'm at paragraph 90. 12 Q. Let me ask it again. 13 In paragraph 90 of Tong, it 14 states "In order to determine a channel 15 response for each of the sub-carriers, the 16 pilot signal is multiple pilot symbols that 17 are scattered among the data symbols 18 throughout the OFDM sub-carriers in a known 19 pattern in both time and frequency." 20 Do you see that in paragraph 90 21 of Tong? 22 A. Yes, I do. 23 Q. What does that mean? What does 24 that quote from paragraph 90 of Tong mean to

Page 62 1 you, Dr. Wells? 2 A. Well, I mean, I'd need to review 3 it in the context of the whole patent. But 4 just off the top of my head, it's saying that 5 pilot signals was confirming that Tong uses 6 pilot signals to determine a channel response 7 and then it talks about how those pilot 8 signals are formatted. 9 Q. How are the pilot symbols 10 formatted in paragraph 90 of Tong, Dr. Wells? 11 A. It says that there are multiple 12 pilot symbols that are scattered among the 13 data symbols throughout the OFDM sub-carriers 14 in a known patent in both time and frequency. 15 That's how it explains it within that one 16 sentence. 17 Q. Would you agree the fact that 18 the pilot symbols are scattered among the data 19 symbols throughout the OFDM sub-carriers is an 20 indication that they're not in the preamble? 21 A. No, it still confirms that you 22 use a pilot symbol to determine a channel 23 response. It doesn't say anything about 24 whether they're in a preamble or not. But a	Page 64 1 A. Yes, I do. 2 Q. But none of the citations to Li 3 '054 in paragraph 150 explicitly state that 4 pilot symbols are used to measure channel H. 5 Correct? 6 A. Well, I would disagree with 7 that. 8 Q. Can you point me to an explicit 9 disclosure in Li '054 that you cite in 10 paragraph 150 that states that pilot symbols 11 were used to measure the channel H? 12 A. Well, I'm not trying to say that 13 Li explicitly states that sentence that you 14 just said. I'm arguing that or I'm showing 15 that Li '054 uses pilot symbols as training 16 symbols to compute the beamforming matrix as 17 shown in equation (1) and I then show that 18 equation (1) is the single value D composition 19 which enables you to determine the channel 20 state matrix H. So it's clear that Li '054 is 21 used in these pilot symbols to determine the 22 channel state matrix from the two paragraphs 23 that I've cited. 24 Q. What is the difference between
Page 63 1 POSITA will understand that it's common 2 practice to send pilot symbols as preambles. 3 Q. What are OFDM sub-carriers? 4 A. In a wireless system, based on 5 OFDM, these are the individual frequencies 6 that carry low data rate signals. 7 Q. And what are data symbols? 8 A. Information about data that is 9 sent in as part of a wireless communication 10 system. 11 Q. In paragraph 150 of your 12 Declaration, Dr. Wells, you discuss Li '054. 13 And in particular you state that Li '054 14 discloses receiving signals and measuring the 15 channel H using pilot symbols that were 16 received. Is that correct? 17 A. Sorry, you have to give me a bit 18 of time to get to these references. I'm at 19 paragraph 150. Can you ask the question 20 again, please? 21 Q. In paragraph 150, you state that 22 Li '054 discloses receiving signals and 23 measuring the channel H using pilot symbols 24 that were received. Correct?	Page 65 1 pilot symbols and training symbols, Dr. Wells? 2 A. In the way that Li '054 is using 3 pilot symbols, I'm not sure there really is a 4 difference between that and training symbols. 5 Q. Where does Li '054 use the term 6 pilot symbols? 7 A. Okay. I'm not sure it does. I 8 could go back to Li and search. In fact, let 9 me do a search. 10 So I think I misspoke. I did 11 say pilot symbols, you are correct, and I say 12 that in paragraph 150. But I think I should 13 have said training symbols instead of pilot 14 symbols. 15 Q. In paragraphs 150 and 152 of 16 your Declaration, are you arguing that the 17 training symbols of Li '054 are a preamble 18 sequence? 19 A. Yes, I am. 20 Q. Is it your position, Dr. Wells, 21 that the training symbols cannot be located in 22 another part of the signal other than the 23 preamble? 24 A. That's not my position. My

Page 66 1 position is that a POSITA would have 2 recognized that it was customary practice at 3 the time to send such training symbols as a 4 preamble. And in my 35 years of dealing with 5 wireless communications, I can't recall seeing 6 any other situations where such training 7 symbols have not been sent as preambles. So I 8 think a POSITA would recognize this is a 9 preamble sequence. 10 Q. Paragraphs 150 and 151 of your 11 Declaration are the only paragraphs dealing 12 with limitations 1.a and 9.c of the '862 13 patent with respect to ground 3. Correct? 14 A. Yes. 15 Q. And in paragraphs 150 and 151 of 16 your Declaration, there are no citations to 17 any evidence other than Li '054 who you assert 18 it was customary practice for the training 19 symbols to be located in the preamble. Is 20 that correct? 21 A. I don't think that's quite 22 correct, no. I mean, this is -- also embedded 23 in these opinions, as I stated in the front 24 piece, my knowledge as somebody who has worked	Page 68 1 discloses that and a POSITA would have found 2 it obvious that that is what was disclosed in 3 Li '054. 4 Q. Dr. Wells, is it disclosed in 5 Li '054 or is it obvious in view of Li '054? 6 MR. LONEY: Objection. Form. 7 THE WITNESS: I believe it's 8 disclosed in Li '054. 9 BY MR. SHAPIRO: 10 Q. So let me -- just to be clear, 11 you're stating today that Li '054 discloses 12 that the received signals used to estimate 13 channel state information include training 14 symbols in the preamble? 15 A. Li says that -- Li '054 says 16 that training symbols are used to compute the 17 channel state matrix and, as I've said, a 18 POSITA would have recognized that it was 19 customary practice to send such training 20 symbols as a preamble. Therefore, a POSITA 21 would have found that the explicit disclosures 22 in Li '054 would have been within a preamble. 23 Q. Isn't it true that Li -- the 24 portions of Li '054 that you've cited in
Page 67 1 in the field for a long time and understands 2 what a POSITA would understand. So that's 3 baked into these opinions as well. 4 Q. In paragraph 152 and 153 of your 5 Declaration, you analyze claim elements 1.b 6 and 9.d of the '862 patent. Correct? 7 A. That is correct. 8 Q. In paragraphs 152 and 153 of 9 your Declaration, you rely solely on Li '054 10 to show the limitations 1.b and 9.d of the 11 '862 patent claims are obvious. Correct? 12 A. Correct. 13 Q. Dr. Wells, like Li '748, Li '054 14 in Figure 3 refers to estimating channel state 15 information from "received signals." 16 Correct? 17 A. The first step in Figure 3 of 18 Li '054 certainly says that, yes. I would 19 have to reconfirm with the other Li reference. 20 Q. Is there an explicit statement 21 in Li '054 that the received signals comprise 22 training symbols in the preamble? 23 A. Again, those words are not 24 explicitly used, but Li '054 certainly	Page 69 1 paragraphs 152 and 153 say that channel state 2 information is estimated from "received 3 signals." There is no mention of estimating 4 channel state information from training 5 symbols. Correct? 6 A. Well, the answer to your 7 question is correct, but you're 8 misrepresenting what I have in my report. I 9 deal with the preamble sequence in the 10 previous section where I say that it's the 11 training where Li explicitly says that it's 12 training symbols that it used for computing 13 the channel state. So it's talked about in 14 the section prior to where you are limiting 15 your question. 16 Q. By the section prior, you mean 17 paragraphs 150 and 151? 18 A. That is correct. 19 Q. And in paragraph 150 of your 20 Declaration, you quote from Li '054 that the 21 receiver receives training symbols and 22 computes the beamforming matrix V, not H. 23 Correct? 24 A. You're only citing half a

Page 70 1 sentence. The rest of that sentence says as 2 shown above in equation (1). And if you go to 3 equation (1), it shows how you compute the 4 channel state matrix H in order to determine 5 what the beamforming matrix in V is. 6 Q. Okay. So I'm looking -- you're 7 citing to Li -- in paragraph 150 of your 8 Declaration, you cite to Li '054 in 9 paragraph 22. And in the cite to 10 paragraph 22, Li '054 says that the receivers 11 use training symbols and computes the 12 beamforming matrix V as shown above in 13 equation (1). And equation (1) is shown in 14 paragraph 18 of Li '054. Correct? 15 A. Yes. 16 Q. And paragraph 18 of Li '054 17 merely shows the singular value decomposition 18 of H. Correct? 19 A. No. 20 Q. Where in paragraph 18 of Li '054 21 does it explicitly state that the channel 22 response H is estimated using the training 23 symbols described in paragraph 22 of Li '054? 24 A. It doesn't explicitly use the	Page 72 1 the wireless industry, I don't think I've ever 2 come across an alternative way of sending such 3 training symbols. 4 Q. But the only evidence that 5 you've provided in paragraphs 150 through 153 6 are from Li '054. Correct? 7 A. I've also talked about the '862 8 patent and how it talks about training symbols 9 of a preamble that were known -- that 10 correspond to any number of techniques that 11 were also known in the art. 12 Q. And that's the only -- the 13 Li '054 and the quotes from the '862 patent 14 are the only evidence you provide in 15 paragraphs 150 through 153 of your 16 Declaration. Correct? 17 A. No. I also provide my opinion 18 based on my experience and knowledge that a 19 POSITA -- what a POSITA would have recognized 20 at the time. 21 Q. In your Declaration, Dr. Wells, 22 you rely on Mao solely for your analysis of 23 claims 9 through 12. Correct? 24 A. Yes, I believe that's true.
Page 71 1 words that you're saying. I'm arguing 2 obviousness here. It's very clear to a POSITA 3 and from the plain reading of Li '054, 4 frankly, that you used the equation (1), you 5 determine a channel state matrix, as is 6 conventional at the time, in order to 7 determine the matrix V, as was conventional at 8 the time, and Li says that she used training 9 symbols to compute the beamforming matrix V as 10 shown in equation (1). The logical and 11 conventional way of determining V is to use 12 the training symbols to determine H and from 13 that to determine V, consistent with the way 14 that Li '054 discloses. 15 Q. But neither paragraph 18 nor 16 paragraph 22 of Li '054 explicitly states that 17 the training symbols are in the preamble. 18 Correct? 19 A. So I think we've discussed this 20 question multiple times. Those words are not 21 explicitly used. But a person of ordinary 22 skill in the art would understand that is the 23 conventional way of sending such training 24 symbols. And in my 35 years of experience in	Page 73 1 Q. And for claims 9 through 12 of 2 the '862 patent you rely on Mao for teaching 3 baseband to RF conversion. Correct? 4 A. Performing a baseband signal and 5 a baseband to RF conversion, they're 6 explicitly disclosed in Mao. Even though 7 they're obvious from the other references Mao 8 specifically discloses that. 9 Q. And you don't rely on Mao for 10 any other purpose in your Declaration. 11 Correct? 12 A. I don't believe I do, no. 13 MR. SHAPIRO: It's 12:11 where 14 you're located. Right, Dr. Wells? 15 THE WITNESS: Yes, it is. 16 MR. SHAPIRO: Would you like to 17 take a lunch break? 18 THE WITNESS: Yes. 19 MR. SHAPIRO: Why don't we come 20 back around 3:45. Does that make 21 sense, my time? 22 THE WITNESS: So quarter to the 23 hour. That's fine. Thank you. 24 - - -

Page 74 1 (A recess was taken from 2 3:12 p.m. to 3:48 p.m.) 3 - - - 4 BY MR. SHAPIRO: 5 Q. Dr. Wells, let's go back to 6 paragraph 115 of your Declaration. Earlier we 7 talked about how in paragraph 115 of your 8 Declaration you cite to paragraph 90 of Tong. 9 I asked about the meaning of the sentence that 10 goes "In order to determine a channel response 11 from each of the sub-carriers, the pilot 12 signal is multiple pilot symbols that are 13 scattered among the data symbols throughout 14 the OFDM sub-carriers in a known pattern in 15 both time and frequency." 16 Do you recall that conversation? 17 A. Yes, I do. 18 Q. Is it true that OFDM 19 sub-carriers carry payload data? 20 A. I mean, it's a very broad 21 question. OFDM sub-carriers can be used for 22 carrying payload data. 23 Q. And if OFDM sub-carriers are 24 carrying payload data, would the preamble come	Page 76 1 whether you're talking about Tong or whether 2 you're talking generally. 3 Q. Let's talk generally first. If 4 I have data carriers that are carrying payload 5 data, would the preamble come before the 6 payload data? 7 A. I mean, the preamble is 8 something separate from data. Preamble, if it 9 was related to the data, it would come before. 10 If the preamble has nothing to do with the 11 data, it can come anywhere. 12 Q. So in a signal that has a 13 preamble and data symbols, would the preamble 14 come before the data symbols? 15 MR. LONEY: Objection. Form. 16 THE WITNESS: I think you just 17 asked me the same question again. I 18 mean, I don't know what system you're 19 talking about. I'd have to analyze 20 whatever system it is you're talking 21 about to understand that. 22 BY MR. SHAPIRO: 23 Q. Is there any -- is there any 24 disclosure in Tong of the pilot symbols being
Page 75 1 before the payload data? 2 A. I mean, this is a hypothetical 3 you're providing me. Could. 4 Q. What was your answer? 5 A. I mean, you're asking me about a 6 hypothetical wireless system here. The data 7 symbols could come before the -- the pilot 8 symbols could come before the data symbols. 9 Q. But the sentence says that the 10 pilot symbols are scattered among the data 11 symbols. Correct? 12 A. Yes. That's what it says. 13 Q. If the pilot symbols are 14 scattered among the data symbols, would the 15 preamble come before the data symbols? 16 A. It depends how they're 17 scattered. 18 Q. But in what you're calling a 19 hypothetical, where data carriers carry 20 payload data, would the preamble come before 21 the payload data? 22 A. Well, I could in theoretical 23 because you asked me can OFDM sub-carriers 24 carry data. Yes, they could. So I'm not sure	Page 77 1 scattered outside the data symbols? 2 A. I would need to read Tong to 3 answer that. I don't know. 4 Q. Did you read Tong in its 5 entirety in preparing your Declaration? 6 A. I have read Tong, yes. 7 Q. It seems like this is something 8 you would have noticed while reading Tong and 9 talking about pilot symbols. Correct? 10 MR. LONEY: Objection. Form. 11 THE WITNESS: Well, obviously 12 not, no. I can't recall. I studied, 13 looking at Tong and wrote a lot of 14 these opinions five years ago. I don't 15 know. You've asked me a very specific 16 question as to whether something is 17 disclosed in Tong. I would have to 18 read Tong to find that out. 19 BY MR. SHAPIRO: 20 Q. But the portions of Tong that 21 you've cited in paragraph 115 of your 22 Declaration do not disclose the pilot symbols 23 being outside the data symbols. Correct? 24 A. Not in the sections that I cite.

Page 78 1 Correct. 2 Q. Are you familiar with the IEEE 3 802.11 standard? 4 A. Generally, yes. 5 Q. In the IEEE 802.11 standard, 6 does the preamble come before the payload 7 data? 8 A. The standard is very long. It's 9 been revised over the last 25 years many 10 times. I would -- I can't answer that off the 11 top of my head. 12 Q. At the time of the '862 patent, 13 in the IEEE 802.11 standard, did the preamble 14 come before the payload data? 15 MR. LONEY: Objection. Scope. 16 Form. 17 THE WITNESS: I don't know. I 18 need to look at the standard. As I 19 said, it's a very big standard. It's 20 been even at the time of the '862 21 patent, it had been revised many times. 22 BY MR. SHAPIRO: 23 Q. So in your opinion, it's 24 possible that the preamble comes after the	Page 80 1 In paragraphs 190 and 191 of 2 your Declaration, you rely solely on Poon to 3 show the claim elements 1.a and 9.c of the 4 '862 patent would have been obvious. Is that 5 correct? 6 A. Not quite, no. I rely on Poon 7 and the knowledge of a POSITA. 8 Q. But the only piece of prior art 9 you rely on in paragraphs 190 and 191 of your 10 Declaration is Poon. Correct? 11 A. Yes. 12 Q. And in paragraphs 192 and 19 -- 13 I'm sorry, 193 -- restate that. 14 In paragraphs 192 and 193 of 15 your Declaration, the only piece of prior art 16 you rely on to show obviousness of claim 17 elements 1.b and 9.d of the '862 patent is 18 Poon. Correct? 19 MR. LONEY: Objection. Form. 20 THE WITNESS: That is correct. 21 BY MR. SHAPIRO: 22 Q. In paragraph 190 through 193, 23 you take the position that a person of 24 ordinary skill in the art would recognize that
Page 79 1 payload data in the IEEE 802.11 standard? 2 A. Well, I mean, the preamble as 3 it's used in the '862 patent has nothing to do 4 with the data. The preamble is being used for 5 determining a channel matrix. I mean, the two 6 are independent of each other. So I don't 7 know. 8 Q. So when you were preparing your 9 Declaration, if you saw a disclosure in Tong 10 that taught pilot symbols outside of data 11 symbols, you would have cited that in your 12 Declaration. Correct? 13 A. I don't know. I would have to 14 see if it's relevant to the claim terms that 15 I'm trying to -- that I show are disclosed in 16 Tong. Tong is about using the pilot signals 17 to estimate a channel response. Tong has 18 nothing to do with where the pilot signals are 19 located versus data symbols. 20 Q. Let's go to paragraph 190 of 21 your Declaration, Dr. Wells. 22 A. Yes, I'm there. 23 Q. So in paragraph 190 and 191 you 24 rely solely -- I'm sorry, let me restate that.	Page 81 1 the "training pattern" of Poon are signals 2 that the receiving station uses to determine 3 the channel response. Correct? 4 A. I didn't quite hear all of that. 5 Could you ask that one more time, please. 6 MR. SHAPIRO: Could you read it 7 back. 8 - - - 9 (The court reporter read the 10 pertinent part of the record.) 11 - - - 12 THE WITNESS: Yes. The answer 13 to that question is yes. 14 BY MR. SHAPIRO: 15 Q. Is there any difference between 16 a training pattern and training symbols? 17 A. Not really as it pertains to my 18 Declaration. 19 Q. Is there a difference between a 20 training pattern and pilot symbols? 21 A. Not as they're used in the prior 22 art. The prior art uses training symbols and 23 pilot whatever, pilot pattern or whatever you 24 said, for determining the channel state

Page 82 1 matrix. They're all used for the same 2 purpose. 3 Q. So, then, the training pattern 4 in Poon can also be scattered among data 5 symbols throughout OFDM sub-carriers just like 6 in Tong? 7 A. I don't think Poon says that, 8 no. 9 Q. But could they? 10 A. I mean, I have no idea. You're 11 presenting me with a hypothetical. I can't 12 answer that. 13 Q. Dr. Wells, you just told me that 14 pilot symbols like in Tong are the same as the 15 training pattern in Poon. I'm asking if the 16 training pattern in Poon then can also be 17 scattered among the data symbols throughout 18 OFDM sub-carriers as disclosed in Tong? 19 MR. LONEY: Objection. Form. 20 THE WITNESS: You're asking me 21 to mix and match two references. I'm 22 not sure that Poon, without going back 23 and reading it, applies to an OFDM 24 system. In that context, it couldn't.	Page 84 1 Q. What about the training symbols 2 in Li '748 and Li '054, can they be scattered 3 among data symbols throughout OFDM 4 sub-carriers like the pilot symbols in Tong? 5 MR. LONEY: Objection. Form. 6 THE WITNESS: I mean, I don't 7 know whether they are OFDM -- they have 8 OFDM sub-carriers in the same way that 9 Tong does. I don't know. 10 BY MR. SHAPIRO: 11 Q. So if Li '748 and Li '054 have 12 OFDM sub-carriers like Tong's, then the 13 training symbols can be scattered among the 14 data symbols throughout the OFDM sub-carriers? 15 A. I mean, you're presenting me 16 with a hypothetical. Is it possible in a 17 hypothetical? Yeah, maybe. I've seen no 18 evidence that anything like that is disclosed 19 in either of the two Li references. 20 Q. Did you see any evidence that 21 would suggest that it's not possible? 22 A. I don't think Li talks about 23 those at all. Even if they did, I wouldn't 24 have cited to it because it's not relevant to
Page 83 1 BY MR. SHAPIRO: 2 Q. And if Poon did pertain to an 3 OFDM system, could the training patterns then 4 be scattered among the data symbols throughout 5 the OFDM sub-carriers? 6 A. I mean, you're asking me a 7 hypothetical. It could do anything. 8 Q. So it's possible then? 9 A. I mean, it's possible I'll be 10 King of England one day, but I don't think 11 it's particularly probable. 12 Q. Why is it not probable? If Poon 13 related to an OFDM system, why is it not 14 probable? 15 A. I mean, I just don't know. 16 You're asking me a hypothetical as to whether 17 something is possible. I'm just saying 18 anything is possible. 19 Q. From a technical standpoint it's 20 possible? 21 A. I mean, I don't know what Poon 22 discloses. You're asking me a hypothetical. 23 Is something possible in a hypothetical? I 24 suppose so, yes.	Page 85 1 the claims that I've been asked to analyze. 2 Q. Where in Poon does it explicitly 3 disclose that the training pattern is located 4 in the preamble? 5 A. I don't argue that it is 6 explicitly disclosed. I'm arguing obviousness 7 here. As I said, a POSITA would recognize 8 that the training pattern in Poon is 9 conventionally sent in a preamble. Therefore, 10 it would have been obvious. 11 Q. Is there any evidence cited in 12 your Declaration that would corroborate your 13 statement that it was customary at the time of 14 the '862 patent to estimate channel response 15 using training symbols or pilot symbols or 16 training patterns in the preamble? 17 A. Yes, the '862 patent explicitly 18 says that. It says that after receiving 19 training symbols of the preamble, to estimate 20 a channel response could be done using any 21 number of techniques that are known in the 22 art. 23 Q. Do you cite to any other 24 evidence in your Declaration?

Page 86 1 A. I cite to the '862 patent and my 2 knowledge of -- my opinions as to what a 3 POSITA will understand. 4 Q. Any other evidence? 5 A. I think that's just the two that 6 I cite to. 7 Q. Does Li '748 teach a baseband 8 processor? Let's go to Exhibit 1004. Let me 9 ask the question again once you have that up. 10 Can I ask the question again, 11 Dr. Wells? 12 A. One second. 13 So my answer is yes, that Li 14 does disclose it or at least it renders -- and 15 it renders it obvious. 16 Q. Where in your Declaration do you 17 identify the baseband processor of Li '748? 18 A. In paragraphs 80 and -- in 19 paragraphs 80 and 81 of my Declaration. 20 Q. Can you point out in those 21 paragraphs of your Declaration which element 22 in Li '748 you consider a baseband processor? 23 A. Yes. As I've said in 24 paragraph 80, it's at least the processor 460	Page 88 1 reception of RF signals which includes low 2 noise amplifiers, filters, frequency 3 converters and the like. 4 Q. And so when you talk about 5 combining Li '748 and Tong, how would a person 6 of ordinary skill in the art go about 7 combining them? 8 A. So I think a person of ordinary 9 skill in the art would have taken the Li '748 10 reference and, to the extent that certain 11 functionality is not explicitly disclosed, 12 they would understand from the Tong reference 13 how that functionality could be implemented. 14 Q. Does Tong separately teach a 15 baseband processing module? 16 A. Yes. 17 Q. Where in your Declaration do you 18 identify the baseband processing module in 19 Tong? 20 A. In paragraph 112. 21 Q. Which element in Tong disclosed 22 in paragraph 112 of your Declaration do you 23 contend is a baseband processing module? 24 A. Tong's baseband processor.
Page 87 1 and I know this is a baseband processor 2 because it's connected to memory, reads 3 instructions and data from memory, and it 4 performs actions in response thereto. 5 Q. In paragraph 85 of your 6 Declaration, Dr. Wells, you state it would 7 have been obvious to implement Tong's approach 8 into Li '748's device. Correct? 9 A. Yes, I did. 10 Q. By implementing Tong's approach 11 into Li '748's device, are you proposing to 12 replace the baseband circuitry in Li '748 with 13 that of Tong? 14 A. No. 15 Q. Does Li '748 teach a plurality 16 of RF components? 17 A. Yes, it does. 18 Q. Where in your Declaration do you 19 identify the RF component in Li '748? 20 A. In paragraphs 75 and 76. 21 Q. Which components in particular 22 in Li '748 are you contending are RF 23 components? 24 A. The circuitry to support the	Page 89 1 Q. By Tong's baseband processor, 2 you mean Tong's baseband processor 34? 3 A. That is correct. 4 Q. Does Tong also teach a plurality 5 of RF components? 6 A. Yes. 7 Q. Where in your Declaration do you 8 identify the RF components of Tong? 9 A. In paragraph 111. 10 Q. Can you identify the particular 11 elements of Tong that you contend are RF 12 components that you identified in 13 paragraph 111? 14 A. Yes. It's received circuitry 15 that receives radiofrequency signals and down 16 converts them to base that frequency. 17 Q. So in paragraph 78 of your 18 Declaration, when you state "it would have 19 been obvious to a POSITA to implement the 20 wireless device of Li '748 in a manner 21 suggested by Tong so as to be operable to 22 receive an RF signal and then convert the RF 23 signal into a baseband signal," are you saying 24 that it would be obvious to replace the

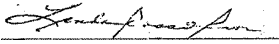
Page 90 1 processor in Li '748 with the baseband 2 processor of Tong? 3 A. No. 4 Q. And when you say in paragraph 78 5 of your Declaration that it would have been 6 obvious to a POSITA to implement the wireless 7 device of Li '748 in a manner suggested by 8 Tong so as to be operable to receive an RF 9 signal and then convert the RF signal into a 10 baseband signal, are you suggesting that it 11 would be obvious to replace the RF components 12 of Li '748 with the RF components of Tong? 13 A. I'm not saying to replace it, 14 no. I'm just saying that I believe that Li 15 '748 discloses these. But to the extent it 16 doesn't disclose the details of how they 17 convert a signal into a baseband signal, Tong 18 shows how that is conventionally done, how it 19 would be performed as known by a POSITA. 20 Q. And the functionality, the 21 missing functionality in Li that you're 22 talking about, isn't that functionality within 23 the baseband processor itself? 24 MR. LONEY: Objection. Form.	Page 92 1 what context I used it in. 2 BY MR. SHAPIRO: 3 Q. Dr. Wells, what is the 4 difference between real numbers and complex 5 parameters? 6 A. You broke up. Can you say that 7 again, please? 8 Q. What is the difference between 9 real numbers and complex parameters? 10 A. Real numbers are numbers such as 11 one, two, three, four. Complex parameters, 12 I'm assuming you're talking about complex 13 numbers. They're numbers with a real and an 14 imaginary part. 15 Q. And in mathematics, is N squared 16 minus 1 the same as N squared minus N for all 17 numbers? 18 A. No. 19 Q. In paragraph 88 of your 20 Declaration, you state that Li '748 teaches 21 that the beamforming matrix V is represented 22 by N squared minus 1 real numbers. Correct? 23 A. Yes, I do. 24 Q. And in paragraph 90 of your
Page 91 1 THE WITNESS: I'm not talking 2 about missing functionality in Li. 3 What I think we've been talking about 4 is the plurality of RF components that 5 convert an RF signal to a baseband 6 signal. I'm saying Li does this. It's 7 disclosed in Figure 4 of Li. To the 8 extent it doesn't show that specific 9 conversion, Tong confirms how that was 10 already well known and I've argued that 11 this is conventional how wireless 12 system has worked forever. 13 BY MR. SHAPIRO: 14 Q. Earlier you used the term 15 "missing functionality." 16 A. You broke up. 17 Q. Earlier you used the phrase 18 "missing functionality." What functionality 19 were you referring to in Li '748 that was 20 missing from the Li '748 disclosure? 21 MR. LONEY: Objection to form. 22 THE WITNESS: I don't remember 23 using that term. I don't know what 24 context. If I did use it, I don't know	Page 93 1 Declaration, you state that Tong teaches that 2 the V matrix can be represented by N squared 3 minus N independent complex parameters. 4 Correct? 5 A. Yes, I do. 6 Q. So based on paragraphs 88 and 7 paragraph 90 of your Declaration, are you 8 opining that N squared minus 1 real numbers 9 are equivalent to N squared minus N 10 independent complex parameters? 11 A. No. I mean -- well, sorry, let 12 me answer that. To the extent that Li 13 identifies a V matrix represented by a certain 14 number of numbers and Tong represents a V 15 matrix in a different way, they're equivalent 16 but they're different parameters. 17 Q. What are you saying exactly in 18 these two paragraphs, then, about Li '748 and 19 Tong? 20 A. Well, these excerpts that you've 21 picked, in one of them it says that Li can 22 represent the V matrix by N squared minus 1 23 real numbers. And Tong suggests or says that 24 he can represent the V matrix by N squared

Page 94 1 minus N independent complex parameters. 2 That's what my opinions are. 3 Q. What is the point you're trying 4 to make, Dr. Wells? 5 MR. LONEY: Objection to form. 6 THE WITNESS: The point I'm 7 trying to make is you've selected parts 8 of sentences from two different 9 paragraphs and you're trying to make me 10 tie -- or suggesting that I'm somehow 11 tying the two together. I'm saying 12 that one is a quote from Li, the other 13 is a quote from Tong. They both talk 14 about how each of them represents a V 15 matrix. That's all I'm trying to say. 16 BY MR. SHAPIRO: 17 Q. So, then, what you're saying is 18 that these two paragraphs can't be tied 19 together. Is that correct? 20 A. No, I'm not saying that. I'm 21 saying these are two different references, 22 represent a V matrix. 23 Q. And, again, what is the -- what 24 is the point of showing how these two	Page 96 1 prompted to use Tong's suggestion within Li's 2 disclosure. 3 Q. Aren't the teachings of Li '748 4 in paragraph 88 and Tong in paragraph 90 of 5 your Declaration incompatible mathematically? 6 A. No, I don't think so. They're 7 both used to estimate a beamforming matrix V. 8 Q. Well, can you explain to me how 9 N squared minus 1 real numbers as disclosed by 10 Li '748 can be interchangeable with N squared 11 minus N complex parameters as disclosed in 12 Tong? 13 A. Well, I mean, I can't, but I 14 haven't provided that opinion. My opinion is 15 that Li discloses a way in which the V matrix 16 can be decomposed consistent with the '862 17 patent, and Tong provides an alternative way 18 in which the V matrix can be decomposed. The 19 other claims just require that that decomposed 20 information is sent back. This seems to be a 21 red herring that you're providing to. They 22 don't have to both produce the same number of 23 real outputs. They just have to decompose the 24 matrix and send that information back to the
Page 95 1 references represent a V matrix? 2 A. Because in paragraphs 88 and 89 3 I show how Li estimates a V matrix and then it 4 decomposes that to produce -- transmit a 5 beamforming information. And then in 6 paragraphs 90 onwards, I show how Tong does 7 the same thing, how it decomposes the transmit 8 beamforming matrix V. 9 Q. So explain to me, Dr. Wells, how 10 you're proposing to combine Li, what Li does 11 in -- Li '748 does in paragraph 88 with what 12 Tong does in paragraph 90 of your Declaration? 13 A. So I outline that in the 14 following paragraph, paragraph 91. How it 15 would have been obvious to a POSITA to 16 implement the wireless device of Li '748 in a 17 manner that uses Tong's suggestion for a given 18 rotation-based decomposition. 19 Q. How exactly mathematically would 20 a person of ordinary skill in the art do what 21 you're suggesting? 22 A. I mean, I can't answer that 23 sitting here. I don't know. But I think a -- 24 my opinion is that a POSITA would have been	Page 97 1 transmitter. 2 Q. Dr. Wells, does Mao teach a 3 baseband processing module? 4 A. I don't know. I haven't 5 provided any opinions of that in my 6 Declaration. 7 Q. Does Mao teach a plurality of RF 8 components? 9 A. I don't know. I haven't 10 provided any opinions on that in my 11 Declaration. 12 MR. SHAPIRO: Let's take a 13 five-minute break, if that's okay. 14 - - - 15 (A recess was taken from 16 4:44 p.m. to 4:52 p.m.) 17 - - - 18 BY MR. SHAPIRO: 19 Q. Dr. Wells, in paragraph 98 of 20 your Declaration, you contend that Li '748 21 discloses producing the estimated transmitter 22 beamforming unitary matrix V in Cartesian 23 coordinates. Correct? 24 A. Yes.

Page 98 1 Q. And then you cite to a number of 2 portions of Li '748 as support. Can you show 3 me specifically where in Li '748 there is 4 disclosure producing the estimated transmitter 5 beamforming unitary matrix V in Cartesian 6 coordinates? 7 A. Yes. I talk about how, in the 8 same paragraph, that the matrix V is 9 represented by real numbers. Real numbers are 10 Cartesian coordinates. 11 Q. So you're referring to your cite 12 to Exhibit 1004 at column 2, line 63 to 67. 13 Correct? 14 A. Yes, I am. 15 Q. And in particular you're 16 referring to the statement in Exhibit 1004 17 that the beamforming matrix V is represented 18 by N squared minus 1 real numbers. Correct? 19 A. Well, I'm citing to that whole 20 two sentences which talks about beamforming 21 matrix being represented by real numbers. 22 Q. But, again, in paragraph 98 of 23 your Declaration, where you cite to 24 Exhibit 1004 at column 2, line 63 to 67, are	Page 100 1 A. Not in paragraph 98, no. 2 Q. Do you provide any other 3 evidence in another paragraph in your 4 Declaration, Dr. Wells? Let me restate that. 5 Are there any other portions of 6 Li '748 identified in your Declaration that 7 provide evidence that Li '748 converts the 8 estimated transmitter beamforming unitary 9 matrix V from Cartesian to polar coordinates? 10 A. Not as it pertains to claims 2 11 and 10. 12 Q. And with regard to your citation 13 to Li '748 at column 3, lines 5 through 11, 14 what portion of that citation discusses the 15 transmitter beamforming unitary matrix V? 16 A. Where it says the "beamforming 17 matrix." 18 Q. So are you saying, then, that 19 the statement in Li '748 that Hermitian 20 generator matrices utilized to represent the 21 beamforming matrix means that the beamforming 22 matrix is in polar coordinates? 23 A. Yes. Because that's what the 24 second half of that sentence says.
Page 99 1 you saying that the statement in Li '748, that 2 the beamforming matrix V is represented by N 3 squared minus 1 real numbers means that the 4 beamforming matrix V is in Cartesian 5 coordinates? 6 A. It is. Because it says real 7 numbers and -- so yes. 8 Q. And are the rest of the 9 citations to Li '748 in paragraph 98 support 10 for your contention that Li '748 discloses 11 converting the estimated transmitter 12 beamforming unit in matrix V to polar 13 coordinates? 14 A. That's the latter half of 15 paragraph 98 where it talks about the angles 16 and being polar coordinates. 17 Q. Which citations to Li '748 18 specifically are you relying on to show that 19 Li '748 discloses converting the estimated 20 transmitter beamforming unitary matrix V to 21 polar coordinates? 22 A. I'm using as an example column 23 3, lines 5 through 11. 24 Q. Anything else in Li '748?	Page 101 1 Q. Isn't it true that that sentence 2 is referring to numbers in the Hermitian 3 generator matrices, not the beamforming matrix 4 itself? 5 A. I don't know how to answer that. 6 The sentence says that the Hermitian generator 7 matrices represent the beamforming matrix. So 8 this is representation of the beamforming 9 matrix. 10 Q. So it's your position that the 11 Hermitian generator matrices are the same 12 thing as the beamforming matrix? 13 A. My position is that Li '748 14 states that the Hermitian generator matrices 15 represents the beamforming matrix. 16 Q. Is there a distinction between 17 the Hermitian generator matrices and the beam 18 forming matrix? 19 MR. LONEY: Objection. Form. 20 THE WITNESS: One represents the 21 other. So I'm not sure there is. 22 BY MR. SHAPIRO: 23 Q. And that's your answer? 24 A. That was my answer, yes.

Page 102 1 Q. Okay. 2 MR. SHAPIRO: Let's take another 3 five-minute break. I might be done. 4 Let me just take a break and look at my 5 notes. 6 - - - 7 (A recess was taken from 8 5:02 p.m. to 5:12 p.m.) 9 - - - 10 BY MR. SHAPIRO: 11 Q. Dr. Wells, please take a look at 12 Exhibit 1004, at the top of column 3. 13 A. Yes. 14 Q. At the top of column 3, Li '748 15 states that "the present invention exploit the 16 structure of unitary matrices and represent 17 the unitary matrices by a combination of N 18 squared minus 1 orthogonal generator matrices." 19 Correct? 20 A. Yes, it does. 21 Q. Isn't that proof that the 22 unitary matrix is not equal to an individual 23 orthogonal generator matrix? 24 A. Well, it doesn't quite say that.	Page 104 1 A. That's what this sentence says 2 or suggests. 3 Q. And it follows that a person of 4 ordinary skill in the art would understand 5 that each Hermitian generator matrix must be 6 of a different size and not equal to the 7 unitary beamforming matrix. Correct? 8 A. I don't think that follows 9 necessarily, no. 10 Q. Okay. Would a person of 11 ordinary skill in the art reading this 12 conclude that each Hermitian generator matrix 13 is not equal to the unitary beamforming 14 matrix? Let me say that a different way. I'm 15 sorry. 16 Would a person of ordinary skill 17 in the art reading this statement understand 18 that a single Hermitian generator matrix is 19 not equal to the unitary beamforming matrix? 20 A. From reading this one sentence, 21 that would appear to be the case because it 22 says that multiple matrices represents a 23 single matrix. So the same sentence, that 24 would appear to be true.
Page 103 1 It says unitary matrices, plural, are 2 represented by combination of orthogonal 3 generator matrices, plural. 4 Q. But a person of ordinary skill 5 in the art reading this statement at the top 6 of column 3 of Li '748 would understand that a 7 unitary matrix is represented by a plurality 8 of orthogonal generator matrices. Correct? 9 A. I need to read this closer. It 10 doesn't say that. It says that unitary 11 matrices, plural, are represented by 12 orthogonal generator matrices, plural. 13 Q. Okay. And then the next 14 sentence that we already talked about, the Li 15 '748 patent states that Hermitian generator 16 matrices, plural, may be utilized to represent 17 the beamforming matrix, singular. Correct? 18 A. It does say that, yes. 19 Q. So a person of ordinary skill in 20 the art would understand that the beamforming 21 matrix is unitary and that there are a 22 plurality of Hermitian generator matrices that 23 represent the unitary beamforming matrix. 24 Correct?	Page 105 1 Q. Dr. Wells, in your Declaration, 2 you don't rely on Li '054 to show that claims 3 2 and 10 are obvious. Correct? Let me strike 4 that. 5 Dr. Wells, you don't rely on 6 Li '054 to show the receiving wireless device 7 producing the estimated transmitter 8 beamforming unitary matrix V in Cartesian 9 coordinates or the receiving wireless device 10 converting the estimated transmitter 11 beamforming unitary matrix V to polar 12 coordinates. Correct? 13 A. So if that's claims 2 to 10 that 14 you're talking about, I don't use Li alone, I 15 use Li in combination with Mao and Yang to 16 show that that would have been obvious. 17 Q. Okay. But you're not saying 18 that Li '054 discloses producing V in 19 Cartesian coordinates and converting V to 20 polar coordinates. Correct? 21 A. So I think you're using the 22 language in claims 2 and 10. I'm not relying 23 on Li by itself to disclose claims 2 and 10. 24 I'm relying on a combination with others.

Page 106 1 Q. I understand that. But the -- 2 what is the -- what are you relying on Mao and 3 Yang for in claims 2 and 10 in ground 4. 4 A. So this is outlined in 5 paragraphs 169 through 171 of my report. I'm 6 relying on Yang disclosing the language of 7 claims 2 and 10 which, as you said, was 8 essentially transforming converting Cartesian 9 coordinates into polar coordinates, and I'm 10 using that with a combination of Li and Mao, 11 to disclose the method and device of claims 1 12 and 9 respectively. 13 Q. So for claims 2 and 10 in ground 14 4, you're not relying on Li '054 for producing 15 V in Cartesian coordinates and converting V to 16 polar coordinates. Correct? 17 A. That's correct. I'm using Yang. 18 Q. Okay. In paragraph 99 of your 19 Declaration, Dr. Wells, you state that Tong 20 discloses producing the beamforming unitary 21 matrix V in Cartesian coordinates and then 22 converting it into polar coordinates. 23 Can you point to a specific 24 citation in Tong that discloses producing the	Page 108 1 is to do the singular value decomposition and 2 I've not seen that done in polar coordinates. 3 Q. Do you know if it could be done 4 in polar coordinates? 5 A. I don't know one way or the 6 other. I've not seen any evidence that it 7 could. 8 Q. Have you seen any evidence 9 disclosed in your Declaration that it couldn't 10 be done? 11 A. I mean, it's kind of a double 12 negative. I've not seen any evidence that it 13 can't be done. I've not seen any evidence 14 that it can be done. I've not seen any 15 evidence that it can't be done. 16 MR. SHAPIRO: That's all I have 17 for now. I'm going to reserve the rest 18 of my time for recross if it's 19 necessary. 20 MR. LONEY: I just have a couple 21 questions. I'll try to be brief. 22 - - - 23 EXAMINATION 24 - - -
Page 107 1 transmitter beamforming unitary matrix V in 2 Cartesian coordinates? 3 A. So I talk about this in 4 paragraph 99, and it's really that Tong talks 5 explicitly about decomposing a beamforming 6 matrix to produce parameters V and C. The 7 fact that he's talking about decomposing the 8 two produce these polar coordinates, that is 9 suggesting to the POSITA that they'll be 10 converted from something, which suggests that 11 they have been converted from Cartesian 12 coordinate as was common at the time. 13 Q. But you don't cite to any other 14 evidence in your Declaration that the 15 beamforming matrix V in Tong was produced in 16 Cartesian coordinates. Correct? 17 A. No other evidence, no. Just the 18 fact that Tong talks about conversion and what 19 a POSITA would have recognized at the time. 20 Q. Is it possible that the 21 beamforming -- transmitter beamforming matrix V 22 could be produced in polar coordinates? 23 A. I don't know how that would be 24 done. I've not seen -- the prior step in Tong	Page 109 1 BY MR. LONEY: 2 Q. Dr. Wells, do you recall earlier 3 when you were asked whether the Mao reference 4 discloses a plurality of RF components? 5 A. Yes. 6 MR. SHAPIRO: Objection. Form. 7 BY MR. LONEY: 8 Q. What was your response to that 9 question? 10 MR. SHAPIRO: Objection. Form. 11 THE WITNESS: I think my 12 response was that I didn't rely on Mao 13 for disclosing that limitation, and so 14 I don't think I provided an opinion. 15 BY MR. LONEY: 16 Q. Can you turn to paragraph 70 of 17 your Declaration and let me know once you're 18 there? 19 A. Yes, I'm there. 20 Q. What does paragraph 70 of your 21 Declaration describe? 22 A. It's a summary of the Mao 23 reference. 24 Q. And can you go to paragraph 138

Page 110 1 and 139. 2 A. Yes, I'm there. 3 Q. What do these two paragraphs in 4 your Declaration describe? 5 A. Yes, again, these describe the 6 Mao reference. 7 Q. And how do you use the Mao 8 reference in these paragraphs? 9 MR. SHAPIRO: Objection. Form. 10 THE WITNESS: So in 11 paragraphs 70, 138 and 139, I talk 12 about Mao being a -- receive a 13 beamforming system as a plurality of RF 14 units and down converters, among other 15 things. 16 BY MR. LONEY: 17 Q. Let's go down to paragraph 144 18 through 146. 19 A. Yes, I'm there. 20 Q. What are you describing in 21 paragraphs 144 through 146? 22 MR. SHAPIRO: Objection. Form. 23 THE WITNESS: I'm showing in 24 these paragraphs how Mao discloses a	Page 112 1 MR. SHAPIRO: Objection. Form. 2 THE WITNESS: Yes. I have 3 discussed that and shown that the 4 plurality of RF components is disclosed 5 in the Mao reference. 6 MR. LONEY: No further 7 questions. 8 MR. SHAPIRO: I have no further 9 questions, either. 10 Thank you, Dr. Wells. I 11 appreciate your time today. 12 - - - 13 (Witness excused at 5:33 p.m.) 14 15 16 17 18 19 20 21 22 23 24
Page 111 1 wireless communication system with a 2 plurality of RF components that convert 3 an RF signal to a baseband signal. 4 BY MR. LONEY: 5 Q. And lastly, let's move to 6 paragraphs 185 through 187. 7 A. Yes, I'm there. 8 Q. What do paragraphs 185 through 9 187 of your Declaration describe? 10 MR. SHAPIRO: Objection to form. 11 THE WITNESS: Similar to the 12 previous answer, these sections or 13 these paragraphs show how Mao discloses 14 a wireless communication system with a 15 plurality of RF components that are 16 operable to receive an RF signal and 17 convert the RF signal to a baseband 18 signal. 19 BY MR. LONEY: 20 Q. In view of these paragraphs in 21 your Declaration, does that change your 22 opinion on whether Mao discloses -- whether 23 you have discussed whether Mao discloses a 24 plurality of RF components?	Page 113 1 C E R T I F I C A T E 2 3 I do hereby certify that I am a Notary 4 Public in good standing, that the aforesaid 5 testimony was taken before me, pursuant to 6 notice, at the time and place indicated; that 7 said deponent was by me duly sworn to tell the 8 truth, the whole truth, and nothing but the 9 truth; that the testimony of said deponent was 10 correctly recorded in machine shorthand by me 11 and thereafter transcribed under my 12 supervision with computer-aided transcription; 13 that the deposition is a true and correct 14 record of the testimony given by the witness; 15 and that I am neither of counsel nor kin to 16 any party in said action, nor interested in 17 the outcome thereof. 18 WITNESS my hand and official seal this 19 24th day of June 2024. 20 21  22 Linda Rossi-Rios, RPR, CSR 23 Notary Public 24

Page 114 1 INSTRUCTIONS TO WITNESS 2 Please read your deposition over 3 carefully and make any necessary corrections. 4 You should state the reason in the appropriate 5 space on the errata sheet for any corrections 6 that are made. 7 After doing so, please sign the errata 8 sheet and date it. 9 You are signing same subject to the 10 changes you have noted on the errata sheet, 11 which will be attached to your deposition. 12 It is imperative that you return the 13 original errata sheet to the deposing attorney 14 within thirty (30) days of receipt of the 15 deposition transcript by you. If you fail to 16 do so, the deposition transcript may be deemed 17 to be accurate and may be used in court. 18 19 20 21 22 23 24	Page 116 1 ACKNOWLEDGMENT OF DEPONENT 2 I, _____, do 3 hereby certify that I have read the foregoing 4 pages and that the same is a correct 5 transcription of the answers given by me to 6 the questions therein propounded, except for 7 the corrections or changes in form or 8 substance, if any, noted in the attached 9 Errata Sheet. 10 11 _____ 12 DATE SIGNATURE 13 14 Subscribed and sworn to before me this 15 _____ day of _____, 2024. 16 17 My commission expires: _____ 18 19 _____ 20 Notary Public 21 22 Assignment: PA 6747561 23 24
Page 115 1 ----- 2 E R R A T A 3 ----- 3 PAGE LINE CHANGE 4 ----- 5 Reason for Change: 6 _____ 7 ----- 8 Reason for Change: 9 _____ 10 ----- 11 Reason for Change: 12 _____ 13 ----- 14 Reason for Change: 15 _____ 16 ----- 17 Reason for Change: 18 _____ 19 ----- 20 Reason for Change: 21 _____ 22 ----- 23 Reason for Change: 24 _____	

0	106:11	108 3:5	16 40:2,7,12
054 14:5 29:16	1.a 43:21 44:11	11 3:12 99:23	169 35:21 36:1
39:13 63:12,13	44:17,19 66:12	100:13	36:10 106:5
63:22 64:3,9	80:3	111 89:9,13	171 106:5
64:15,20 65:2	1.b 53:22 54:4	112 88:20,22	18 3:8 31:16
65:5,17 66:17	55:1 67:5,10	115 74:6,7	40:19 70:14,16
67:9,13,18,21	80:17	77:21	70:20 71:15
67:24 68:3,5,5	10 100:11	12 3:14,16	185 111:6,8
68:8,11,15,22	105:3,13,22,23	10:12,23 11:4	187 111:6,9
68:24 69:20	106:3,7,13	17:16 18:10,12	19 80:12
70:8,10,14,16	1001 3:9 9:7,12	72:23 73:1	190 79:20,23
70:20,23 71:3	113:21	12:11 73:13	80:1,9,22
71:14,16 72:6	1003 3:11 9:21	12:55 31:19	191 79:23 80:1
72:13 84:2,11	10:3,7 16:3	32:2	80:9
105:2,6,18	1004 3:12	13 3:17	192 80:12,14
106:14	11:10,15,18	138 109:24	193 80:13,14,22
	86:8 98:12,16	110:11	19806 2:11
1	98:24 102:12	139 110:1,11	1991 15:3
1 10:11,23 11:4	1005 3:14 12:3	14 3:19	1:12 32:2
17:13 18:9	12:9,13	144 110:17,21	2
30:5,11 31:2	1006 3:16	146 110:18,21	2 16:11 30:2,5
32:10,11,16,17	12:22 13:3,7	15 3:22 39:23	31:12 32:15,18
35:17 38:11,13	1007 3:17	39:24	32:20,24,24
38:22 39:6,9	13:15,21 14:1	150 63:11,19,21	33:6,15,16
39:17 41:4,10	1008 3:19	64:3,10 65:12	34:5,11,17,18
41:13,22,24	14:10,18,22	65:15 66:10,15	34:18,20,22
42:8,14 43:5	30:1 32:6,16	69:17,19 70:7	35:3,3 54:9
43:14 44:11,17	33:1,6,16 34:5	72:5,15	98:12,24
52:16,18,23	34:10,17,22	151 66:10,15	100:10 105:3
53:23 54:4	35:3,8,15 36:2	69:17	105:13,22,23
64:17,18 70:2	36:11 37:17	152 65:15 67:4	106:3,7,13
70:3,13,13	38:4,5,10,21	67:8 69:1	20 1:9 39:24,24
71:4,10 92:16	39:5	1526 2:10	2006/0092054
92:22 93:8,22	1009 3:22	153 67:4,8 69:1	3:18 13:17
96:9 98:18	15:10,15,19	72:5,15	14:3,7
99:3 102:18			

2008/0108310 12:15,19 2008/108310 3:15 12:5 2024 1:9 113:19 116:15 211 61:1 22 70:9,10,23 71:16 23 19:14,16 22:1,4 24:18 24:24 25:17 26:2,14 24th 113:19 25 78:9 26 27:6,12 28:16 2:07 53:19 2:20 53:19	3:12 74:2 3:45 73:20 3:48 74:2	7	100:6,7,13,19 101:13 102:14 103:6,15 748's 87:8,11 75 87:20 76 87:20 78 89:17 90:4 78701 2:5
		7 35:14 37:8,14 37:16 54:9 55:18 7,236,748 3:13 11:11,19,24 7,312,750 3:16 12:23 13:8,12 7,710,925 3:23 15:11,20,24 7.b 51:23 70 109:16,20 110:11 73 41:11 748 11:22 29:15 39:13 41:3,9,13,16,23 42:9 43:7,20 44:10,16,24 45:2 48:20 51:9,16 52:16 54:3,8,12,15,23 55:9,14 56:12 56:16 57:5,9 58:4,8 67:13 84:2,11 86:7 86:17,22 87:12 87:15,19,22 88:5,9 89:20 90:1,7,12,15 91:19,20 92:20 93:18 95:11,16 96:3,10 97:20 98:2,3 99:1,9 99:10,17,19,24	8 8 54:8 55:17 8,416,862 1:7 3:10 7:24 8:9 9:8,16 80 86:18,19,24 802.11 23:3,9 23:13 24:7,13 78:3,5,13 79:1 81 86:19 82 43:19 55:7 56:19,20 57:16 83 43:19 47:24 48:9,17,22 49:4,8,14,18 55:7 84 53:12,21 54:2,7,12,16,19 54:20,21 55:6 55:10 57:12 85 53:12,21 54:2,13 55:10 60:14,20 87:5 862 8:7,20 10:12,24 11:5 19:19 27:4 39:12,18 41:4
3	4	4 10:12,23 11:4 17:14 18:10 34:16,24 38:3 39:5 54:9 55:18 91:7 106:3,14 460 86:24 4:44 97:16 4:52 97:16	5
	5		
3 33:5,7 34:11 34:22 35:7,8 35:14 37:23 38:5,6,10,20 66:13 67:14,17 99:23 100:13 102:12,14 103:6 30 114:14 3000 2:5 303 2:5 34 89:2 35 28:8 52:5 66:4 71:24	6	6 32:17,18 34:23 63 98:12,24 67 98:12,24 6747561 116:22	6
	6		

41:14,17,20 42:8 43:6 44:17 48:11 51:12,23 53:23 55:1 59:10 66:12 67:6,11 72:7,13 73:2 78:12,20 79:3 80:4,17 85:14 85:17 86:1 96:16 87 61:1 88 42:12 92:19 93:6 95:2,11 96:4 89 95:2	91 42:12 95:14 92 43:9 97 41:11 43:9 98 97:19 98:22 99:9,15 100:1 99 106:18 107:4	aforesaid 113:4 ago 17:22 77:14 agree 4:12 32:11,18 34:4 34:16,21 35:2 49:24 62:17 aided 113:12 al 11:20 12:15 13:8 14:3 algebra 28:21 29:1 39:8 algorithm 36:3 36:12 39:4,7 alternative 72:2 96:17 amplifiers 88:2 analysis 15:3 27:9 40:21 41:10 52:11,13 52:16 54:24 72:22 analyze 67:5 76:19 85:1 analyzed 58:5 andrew 5:13 angles 33:18 99:15 annihilate 33:18 answer 6:11,23 6:24 7:8 26:21 28:3,3 44:7 47:8 48:10 69:6 75:4 77:3	78:10 81:12 82:12 86:13 93:12 95:22 101:5,23,24 111:12 answers 6:2 116:5 anticipation 40:3,7,8 appeal 1:1 appear 104:21 104:24 appears 21:24 38:23 41:14 application 3:14,17 12:4 12:14,19 13:16 14:2,7 34:13 applications 15:3 applies 82:23 appreciate 112:11 approach 87:7 87:10 appropriate 114:4 approved 1:15 argue 85:5 argued 91:10 arguing 64:14 65:16 71:1 85:6 array 3:21 14:12,24
9	a		
9 3:9,11 10:12 10:23 11:4 17:16 18:10,11 48:11,15 53:23 54:5 72:23 73:1 106:12 9.c 48:11,13 66:12 80:3 9.c. 43:21 9.d 53:23 54:5 55:1 67:6,10 80:17 90 61:2,3,11,13 61:20,24 62:10 74:8 92:24 93:7 95:6,12 96:4	above 70:2,12 accordance 23:3,9,13 24:7 24:13 account 40:21 accurate 114:17 accurately 7:19 acknowledge 4:4,8 acknowledg... 116:1 action 113:16 actions 87:4 actually 37:21 43:11 53:13 additional 24:19,23 25:1 25:10,12 address 53:22 administer 4:10 administered 4:9 affect 21:5 affects 50:19		

art 8:22 20:10 20:20 22:9,11 22:16 23:1,7 23:15,22 24:5 24:11 28:24 40:22 41:18 42:4 53:1 71:22 72:11 80:8,15,24 81:22,22 85:22 88:6,9 95:20 103:5,20 104:4 104:11,17 art's 10:19 article 3:19 14:10,23 15:6 asked 7:7 36:20 46:16 47:6 74:9 75:23 76:17 77:15 85:1 109:3 asking 75:5 82:15,20 83:6 83:16,22 assert 66:17 assignment 116:22 assuming 92:12 atlantic 1:24 attached 114:11 116:8 attorney 6:21 6:24 7:13 28:1 114:13	attorneys 4:2 austin 2:5 avenue 2:10 aware 26:23 b b 3:6 35:2 bachelor's 19:21 22:5,12 22:16 24:15 25:3,5 26:9,16 back 31:16 39:10,22 44:1 51:2 65:8 73:20 74:5 81:7 82:22 96:20,24 background 25:20 26:4,7,8 28:20 badly 22:9 baked 67:3 base 89:16 baseband 73:3 73:4,5 86:7,17 86:22 87:1,12 88:15,18,23,24 89:1,2,23 90:1 90:10,17,23 91:5 97:3 111:3,17 based 19:17 55:16 57:6,10 60:23 63:4 72:18 93:6 95:18	basically 50:10 beam 101:17 beamforming 64:16 69:22 70:5,12 71:9 92:21 95:5,8 96:7 97:22 98:5,17,20 99:2,4,12,20 100:8,15,16,21 100:21 101:3,7 101:8,12,15 103:17,20,23 104:7,13,19 105:8,11 106:20 107:1,5 107:15,21,21 110:13 beginning 1:13 35:8 38:6 believe 17:7,12 17:16 18:10 19:2,5,8,11,20 21:18 22:5,10 27:5 30:15 31:12,14 32:13 68:7 72:24 73:12 90:14 bell 1:5 5:9 belong 31:3 belongs 30:12 big 78:19 bit 63:17 bnr0001 3:8 18:15,20,21,24	19:14,17 20:15 board 1:1 50:21 bohme 15:1,7 break 7:3,4,8 31:20 50:6 53:15,16 73:17 97:13 102:3,4 breaks 7:15 brent 3:21 14:13 15:1 brief 108:21 broad 74:20 broke 91:16 92:6 buehrer 26:19 26:22 27:1,4 c c 2:1 107:6 113:1,1 call 50:22 called 30:9 calling 75:18 calls 28:1 50:4 carefully 33:12 114:3 carried 45:15 carriers 61:5,8 61:15,18 62:13 62:19 63:3 74:11,14,19,21 74:23 75:19,23 76:4 82:5,18 83:5 84:4,8,12 84:14
--	---	--	--

carry 63:6 74:19 75:19,24 carrying 74:22 74:24 76:4 cartesian 36:6 36:15 37:24 38:16 97:22 98:5,10 99:4 100:9 105:8,19 106:8,15,21 107:2,11,16 case 1:7 8:22 19:12 104:21 cases 45:6 causes 43:1 certain 33:19 88:10 93:13 certainly 21:10 44:20 67:18,24 certified 1:16 certify 113:3 116:3 challenged 11:2 change 20:19 20:23 21:7,10 111:21 115:3,5 115:8,11,14,17 115:20,23 changes 21:13 114:10 116:7 channel 45:24 46:5,12,20 47:12 49:20,23 55:15,18,21,22	56:7,9,24 57:13,14,21 58:18 60:22 61:4,14 62:6 62:22 63:15,23 64:4,11,19,22 67:14 68:13,17 69:1,4,13 70:4 70:21 71:5 74:10 79:5,17 81:3,24 85:14 85:20 cheruvu 2:10 chosen 33:18 circuitry 87:12 87:24 89:14 citation 100:12 100:14 106:24 citations 54:20 64:2 66:16 99:9,17 cite 36:1,11 39:19 54:8,22 55:5 64:9 70:8 70:9 74:8 77:24 85:23 86:1,6 98:1,11 98:23 107:13 cited 54:15 58:13 64:23 68:24 77:21 79:11 84:24 85:11 cites 60:24	citing 69:24 70:7 98:19 claim 27:8 41:4 41:10,13,22,24 42:8,14 43:5,5 43:14,18 44:11 44:17,19 48:11 48:15 52:16,18 52:23 53:22,23 54:4,5 58:6,7 67:5 79:14 80:3,16 claims 10:11,23 11:3,4 17:13 17:16 18:9,11 40:23 53:10 67:11 72:23 73:1 85:1 96:19 100:10 105:2,13,22,23 106:3,7,11,13 clarify 32:8 clean 8:18 clear 40:6 43:10 64:20 68:10 71:2 client 28:1 closer 103:9 colorado 2:5 column 54:8 98:12,24 99:22 100:13 102:12 102:14 103:6 combination 102:17 103:2	105:15,24 106:10 combine 95:10 combining 88:5 88:7 come 27:20 37:11 72:2 73:19 74:24 75:7,8,15,20 76:5,9,11,14 78:6,14 comes 78:24 commission 116:17 common 63:1 107:12 communicated 26:18,24 27:3 communication 20:1 22:20 23:8,12 24:6 24:12 25:7 44:21 63:9 111:1,14 communicati... 21:22 23:2,18 23:20,23 24:3 28:4 58:23 60:11 66:5 complex 92:4,9 92:11,12 93:3 93:10 94:1 96:11 component 87:19
---	--	---	---

components 87:16,21,23 89:5,8,12 90:11,12 91:4 97:8 109:4 111:2,15,24 112:4	conclusions 37:11 confer 7:12 50:21 confirming 62:5 confirms 37:23 62:21 91:9 connected 87:2 connection 5:16 7:22 26:19 27:4 28:14 consider 27:23 33:11 35:19 36:19 37:3,13 37:16,19 86:22 considered 25:16 27:9,14 27:16,18 28:7 28:9,13 37:20 consistent 31:6 71:13 96:16 construction 53:5 construe 52:17 consult 7:12 contend 88:23 89:11 97:20 contending 87:22 contention 99:10 context 58:22 62:3 82:24	91:24 92:1 continue 32:5 50:16 51:1 conventional 52:3 60:9 71:6 71:7,11,23 91:11 conventionally 85:9 90:18 conversation 74:16 conversion 73:3,5 91:9 107:18 conversions 36:7,16 38:1 convert 38:16 89:22 90:9,17 91:5 111:2,17 converted 107:10,11 converters 88:3 110:14 converting 99:11,19 105:10,19 106:8,15,22 converts 89:16 100:7 coordinate 107:12 coordinates 36:6,15 37:24 38:17 97:23 98:6,10 99:5	99:13,16,21 100:9,22 105:9 105:12,19,20 106:9,9,15,16 106:21,22 107:2,8,16,22 108:2,4 copies 8:18 copy 8:20,20,21 cordic 36:2,3 36:12 39:4,7 correct 7:24 10:13,24 16:4 16:9,15,21,23 16:24 20:3 22:2,22 24:21 25:20 27:10 28:17,18,21 29:7,13,14,18 29:20 30:14 31:4,9 33:2,20 36:7,16,20 37:18 38:22 39:15 40:4,9 40:10,14,15,17 40:23 43:21 47:19 49:11,15 49:20 51:18 53:24 54:1,5,6 54:9,14,17 55:2,12 56:13 59:5,14,20 60:15 61:10 63:16,24 64:5 65:11 66:13,20
--	--	--	---

66:22 67:6,7 67:11,12,16 69:5,7,18,23 70:14,18 71:18 72:6,16,23 73:3,11 75:11 77:9,23 78:1 79:12 80:5,10 80:18,20 81:3 87:8 89:3 92:22 93:4 94:19 97:23 98:13,18 102:19 103:8 103:17,24 104:7 105:3,12 105:20 106:16 106:17 107:16 113:13 116:4 corrections 114:3,5 116:7 correctly 113:10 correspond 39:18 72:10 corroborate 85:12 counsel 4:11 28:4 113:15 couple 108:20 course 27:2 court 1:16 4:2 6:3,3,12 44:3 51:4 81:9 114:17	criteria 41:1 csr 113:22 customary 45:7 45:16,20,23 46:7,14,21 47:1,13,17,22 48:2,16,23 49:10 66:2,18 68:19 85:13 d d 3:1 64:18 data 61:7,17 62:13,18 63:6 63:7,8 74:13 74:19,22,24 75:1,6,8,10,14 75:15,19,20,21 75:24 76:4,5,6 76:8,9,11,13,14 77:1,23 78:7 78:14 79:1,4 79:10,19 82:4 82:17 83:4 84:3,14 87:3 date 114:8 116:12 dates 10:19 day 83:10 113:19 116:15 days 114:14 de 2:11 deal 35:9 69:9 dealing 42:14 66:4,11	deals 33:1 dealt 55:4 decades 60:12 declaration 3:8 3:11 8:21 9:21 10:8,10,21 16:4,6,7,8,12 16:20 17:3,9 17:13,14,15,23 18:3,8,15,24 19:5 20:6,11 20:12,17,20 21:7,17 22:2 22:15 24:19,24 25:18 26:2,14 27:7,10,13 28:14,16,20 29:4,10,17 30:7 33:14 35:13,22,24 36:11 37:15,18 39:11,12,20,23 40:1,3,9,13,16 40:20 41:2,6 41:14,22 43:20 45:18,22 46:13 46:24 47:21 48:5 49:4,8,15 49:18 53:7,22 54:3,8,13,16 55:11,24 60:14 63:12 65:16 66:11,16 67:5 67:9 69:20 70:8 72:16,21	73:10 74:6,8 77:5,22 79:9 79:12,21 80:2 80:10,15 81:18 85:12,24 86:16 86:19,21 87:6 87:18 88:17,22 89:7,18 90:5 92:20 93:1,7 95:12 96:5 97:6,11,20 98:23 100:4,6 105:1 106:19 107:14 108:9 109:17,21 110:4 111:9,21 decompose 96:23 decomposed 96:16,18,19 decomposes 95:4,7 decomposing 42:15,19 107:5 107:7 decomposition 3:21 14:12,24 29:5 42:24 43:2 70:17 95:18 108:1 deemed 114:16 defined 31:7 37:22 degree 19:21 22:6,12,16
--	---	--	--

24:16 25:3,5 26:9,16 denote 37:8 depends 75:16 deponent 113:7 113:9 116:1 deposed 5:16 7:22 deposing 114:13 deposition 1:12 4:3,5,7 5:21,24 7:14,14 50:20 113:13 114:2 114:11,15,16 describe 29:21 33:17 39:13 109:21 110:4,5 111:9 described 38:5 38:10,20 39:5 70:23 describing 29:12 33:15 110:20 description 3:7 details 90:16 determine 46:5 46:11,20 47:12 61:4,14 62:6 62:22 64:19,21 70:4 71:5,7,12 71:13 74:10 81:2	determined 55:16 determining 71:11 79:5 81:24 device 44:21,23 57:20 87:8,11 89:20 90:7 95:16 105:6,9 106:11 devices 45:8 49:11 devlin 2:9 5:8 devlinlawfir... 2:11,12 diagonalizing 32:19,21 33:1 difference 18:7 20:7,9 21:2 41:13,16 50:1 51:13 64:24 65:4 81:15,19 92:4,8 differences 17:2,8,17,20,23 18:2 40:22 41:3,20 different 6:18 29:11 39:15 44:14 51:9 93:15,16 94:8 94:21 104:6,14 dimension 30:22	disagree 33:23 34:2 38:9 56:14 64:6 disclose 42:6 44:10,16,24 45:3,10 51:17 51:20,21 77:22 85:3 86:14 90:16 105:23 106:11 disclosed 42:5 42:9 43:7 68:2 68:4,8 73:6 77:17 79:15 82:18 84:18 85:6 88:11,21 91:7 96:9,11 108:9 112:4 discloses 41:19 41:24 42:20 43:10 44:20 45:9,12 46:4 46:10,18 56:5 58:6 63:14,22 68:1,11 71:14 73:8 83:22 90:15 96:15 97:21 99:10,19 105:18 106:20 106:24 109:4 110:24 111:13 111:22,23 disclosing 106:6 109:13	disclosure 47:10 56:16 57:19 64:9 76:24 79:9 91:20 96:2 98:4 disclosures 68:21 discuss 63:12 discussed 32:9 32:17 71:19 111:23 112:3 discusses 100:14 discussing 54:23 discussion 56:11 distinction 101:16 distribution 53:3 division 1:24 divulging 28:4 dla 2:4 document 9:11 9:15,19 10:2,6 11:14,18 12:8 12:12 13:2,6 13:20,24 14:17 14:21 15:14,18 18:23 documents 8:15 28:10,13
---	--	--	--

doing 39:8 114:7 double 108:11 dr 5:5 7:21 16:4 26:18,22 26:24 27:3 28:2 31:8 32:5 37:13 38:8 41:21 58:20 62:1,10 63:12 65:1,20 67:13 68:4 72:21 73:14 74:5 79:21 82:13 86:11 87:6 92:3 94:4 95:9 97:2,19 100:4 102:11 105:1,5 106:19 109:2 112:10 duly 4:23 113:7	efficient 38:14 39:2 either 21:5,13 84:19 112:9 electrical 19:21 22:17 24:16 26:10 element 44:11 44:17 48:11 53:22,23 86:21 88:21 elements 33:19 42:6 43:21 55:1 67:5 80:3 80:17 89:11 embedded 66:22 enables 64:19 engineering 19:21,22 22:17 22:18 24:16,17 26:10,10 england 83:10 entirely 43:20 entirety 31:9 77:5 entitled 14:23 equal 102:22 104:6,13,19 equals 29:6 39:14 equate 56:1 equating 56:16 equation 30:5,6 30:8,11 31:2	32:10,11,17,20 32:24 33:5,7 33:15 34:11,23 34:23,24 35:3 35:14,17 37:8 37:14,16 38:11 38:13,22 39:6 39:9,14,17 64:17,18 70:2 70:3,13,13 71:4,10 equations 32:16,18,22 34:15 equivalence 56:11 equivalent 20:1 21:23 22:21 93:9,15 equivalents 23:18 errata 114:5,7 114:10,13 116:9 error 22:1 esquire 2:4,9 2:10 essentially 20:8 21:4 106:8 estimate 45:24 49:19,22 56:9 57:21 58:18 60:19 68:12 79:17 85:14,19 96:7	estimated 55:19 57:14 69:2 70:22 97:21 98:4 99:11,19 100:8 105:7,10 estimates 95:3 estimating 56:7 67:14 69:3 et 11:19 12:15 13:8 14:3 evaluate 56:24 57:18 evaluates 57:5 57:10 evidence 45:19 45:23 46:14 47:1,22 48:3 48:16 66:17 72:4,14 84:18 84:20 85:11,24 86:4 100:3,7 107:14,17 108:6,8,12,13 108:15 exact 44:18 exactly 46:2 51:19 93:17 95:19 examination 5:2 108:23 examined 4:23 example 10:18 41:12 42:7,12 43:12 99:22
e			
e 2:1,1 3:1,6 113:1,1 115:1 earlier 32:9 51:16 59:1,4 59:18,23 60:1 60:3,6,6,7 74:6 91:14,17 109:2 education 20:2 22:21 24:20,24 25:1,4,6,10,13 educational 25:20 26:3,7,8			

examples 43:5 except 30:7 116:6 exception 7:6 excerpts 56:19 93:20 excuse 43:11 excused 112:13 exhibit 3:8,9,11 3:12,14,16,17 3:19,22 8:23 9:4,7,12,21 10:3,7 11:10 11:15 12:3,9 12:13,22 13:3 13:7,15,21 14:1,10,18,22 15:10,15,19 16:3 18:13,15 18:20,21,23 19:14,16 20:15 30:1 32:6,16 33:1,6,16 34:5 34:10,17,22 35:3,8,15 36:2 37:17 38:4,5 38:10,21 39:5 86:8 98:12,16 98:24 102:12 exhibits 8:17 experience 19:18,24 20:2 20:16,18 21:19 21:22 22:19,21 23:1,7,11,22	24:21 25:11,14 25:19 26:1,15 28:8 71:24 72:18 expires 116:17 explain 95:9 96:8 explains 62:15 explanation 33:12 explicit 43:17 56:10,15 57:1 57:4,8 64:8 67:20 68:21 explicitly 25:8 37:19 42:5,6,9 42:23 43:1,6 43:16 44:10,16 44:24 45:2,3,3 45:10 51:17,20 55:3,15 60:17 64:3,13 67:24 69:11 70:21,24 71:16,21 73:6 85:2,6,17 88:11 107:5 exploit 102:15 expressed 53:6 extensively 55:6 extent 27:24 42:4,22 88:10 90:15 91:8 93:12	f f 113:1 fact 54:22 62:17 65:8 107:7,18 factored 29:6 fail 114:15 familiar 28:24 78:2 federally 1:14 feedback 42:18 felt 53:8 fiam 15:2 field 19:18,23 19:24 20:2 22:19,20,22 23:17 25:6 26:11 67:1 fields 26:16 figure 54:9 67:14,17 91:7 file 19:19 filters 88:2 finally 7:10 find 42:21 58:14 77:18 fine 8:24 31:23 73:23 firm 2:9 5:8 first 67:17 76:3 fit 50:17 five 17:22 21:11 31:20 77:14 97:13 102:3	flavor 23:19 following 95:14 follows 4:24 60:9 104:3,8 foregoing 116:3 forever 91:12 form 50:11 57:24 58:11 68:6 76:15 77:10 78:16 80:19 82:19 84:5 90:24 91:21 94:5 101:19 109:6 109:10 110:9 110:22 111:10 112:1 116:7 formatted 62:8 62:10 forming 101:18 found 44:13,23 46:10 68:1,21 four 19:23 20:16 21:1 92:11 fours 20:24 frankly 71:4 frequencies 63:5 frequency 61:9 61:19 62:14 74:15 88:2 89:16
--	--	--	--

frequently 34:12	79:20 86:8 88:6 109:24 110:17	104:5,12,18	imaginary 92:14
front 8:16,17 30:2 66:23	goes 34:5 74:10	herring 96:21	imperative 114:12
full 5:11,13	going 5:24 9:1 9:18 31:16	higher 25:2,4,5 25:9	implement 87:7 89:19 90:6 95:16
fully 7:18	82:22 108:17	history 19:20	implemented 88:13
functionality 88:11,13 90:20 90:21,22 91:2 91:15,18,18	good 5:5,6 113:4	holds 59:7	implementing 87:10
further 4:8,12 60:6 112:6,8	greek 29:6	hour 7:4 31:19 53:14 73:23	important 6:4 6:10
g	ground 5:20 66:13 106:3,13	huawei 19:10 19:12	include 55:22 68:13
generally 76:2 76:3 78:4	grounds 16:20	hundreds 28:9	includes 57:15 88:1
generator 100:20 101:3,6 101:11,14,17 102:18,23 103:3,8,12,15 103:22 104:5 104:12,18	guide 50:8	hypothetical 59:16 75:2,6 75:19 82:11 83:7,16,22,23 84:16,17	including 7:15
gilpin 2:10	h	i	incompatible 96:5
give 25:15 33:12 41:12 42:7 43:4 63:17	h 3:6 39:14,18 55:23 56:24,24 57:5,10,15,18 60:19,22 63:15 63:23 64:4,11 64:20 69:22 70:4,18,22 71:12	idea 82:10	independent 79:6 93:3,10 94:1
given 3:21 14:13,24 17:3 17:9 25:9 47:9 58:12 95:17 113:14 116:5	half 69:24 99:14 100:24	identical 16:19	indicate 19:17
go 5:20 30:1 39:10,22 56:18 65:8 70:2 74:5	hand 113:18	identification 9:8,23 11:11 12:5,23 13:17 14:14 15:11 18:17	indicated 2:1 113:6
	happens 6:22	identified 89:12 100:6	indication 62:20
	head 6:13,13 62:4 78:11	identifies 93:13	individual 63:5 102:22
	hear 50:15 81:4	identify 28:12 41:3 86:17 87:19 88:18 89:8,10	industry 72:1
	help 6:3	ieee 23:3,9,13 24:7,13 78:2,5 78:13 79:1	inform 27:19
	hermitian 100:19 101:2,6 101:11,14,17 103:15,22		information 28:2 53:3 55:19,22 57:13

57:15 59:1,3 59:18,23 63:8 67:15 68:13 69:2,4 95:5 96:20,24 informing 28:7 inherency 40:4 40:12,13 input 23:23 24:2 instruct 6:24 instructions 87:3 114:1 inter 5:16 7:22 8:2,4 16:14 17:5 interchangea... 96:10 interested 113:16 interpreted 53:10 invalid 41:17 invention 102:15 ipr 8:3 19:3 27:16 ipr2020-00108 16:15 17:6,11 18:4 19:1,7 20:12 ipr2023-01414 1:7 7:23 8:5 iprs 50:7	issue 50:14 italic 30:20 italicized 35:15 35:16 j j 33:17 jason 2:9 job 6:4 jonathan 1:12 3:3,8,11 4:22 5:13 9:22 18:16 journal 15:2 jshapiro 2:11 june 1:9 113:19 k kin 113:15 kind 49:22 58:24 59:3,18 108:11 king 83:10 know 5:8 6:17 7:5 10:3 11:15 12:10 13:3,21 14:19 15:15 17:19 18:21 26:22 30:2 31:18 35:5,18 50:18 53:2 58:5 60:5 76:18 77:3,15 78:17 79:7,13 83:15,21 84:7 84:9 87:1	91:23,24 95:23 97:4,9 101:5 107:23 108:3,5 109:17 knowledge 19:18 27:18 28:8 66:24 72:18 80:7 86:2 known 61:8,18 62:14 72:9,11 74:14 85:21 90:19 91:10 l language 58:6 58:7 105:22 106:6 lastly 111:5 law 2:9 5:8 left 30:8 legal 1:23 50:4 lg 17:14,15,21 18:11 19:11 lg's 16:13,19 17:4,10 18:4 19:1,6 20:11 li 11:19,22 14:3 14:5 29:15,15 39:13,13 41:3 41:9,13,16,18 41:23,23 42:2 42:9,16,19,21 42:23 43:7,10 43:14,20 44:10 44:16,18,19,24	45:2,2,9,10,12 46:4,10,18 47:10 48:20 51:9,16,20,21 52:16 54:3,8 54:12,15,23 55:9,14,17 56:5,12,16 57:5,9 58:2,4,6 58:8,17 63:12 63:13,22 64:2 64:9,13,15,20 65:2,5,8,17 66:17 67:9,13 67:13,18,19,21 67:24 68:3,5,5 68:8,11,15,15 68:22,23,24 69:11,20 70:7 70:8,10,14,16 70:20,23 71:3 71:8,14,16 72:6,13 84:2,2 84:11,11,19,22 86:7,13,17,22 87:8,11,12,15 87:19,22 88:5 88:9 89:20 90:1,7,12,14,21 91:2,6,7,19,20 92:20 93:12,18 93:21 94:12 95:3,10,10,11 95:16 96:3,10 96:15 97:20
---	--	--	--

98:2,3 99:1,9 99:10,17,19,24 100:6,7,13,19 101:13 102:14 103:6,14 105:2 105:6,14,15,18 105:23 106:10 106:14 li's 96:1 lieu 4:9 life 27:2 limitation 42:8 42:15 44:19 54:4,5 56:6 109:13 limitations 43:5 66:12 67:10 limited 40:17 limiting 69:14 linda 1:14 113:22 line 98:12,24 115:3 lines 54:9 55:18 99:23 100:13 list 27:7,13 listed 28:15 listen 6:6 little 36:8 llc 1:5 llp 2:4 located 65:21 66:19 73:14 79:19 85:3	logic 59:6 logical 71:10 loney 2:4 3:5 4:20 27:24 36:21 42:10 47:4 48:18 50:3,15,23 57:24 58:11 68:6 76:15 77:10 78:15 80:19 82:19 84:5 90:24 91:21 94:5 101:19 108:20 109:1,7,15 110:16 111:4 111:19 112:6 long 6:23 67:1 78:8 look 16:3 19:13 29:24 53:11 78:18 102:4,11 looked 31:10 looking 9:2 19:9 70:6 77:13 lost 36:8 lot 25:24 77:13 low 63:6 88:1 luk 3:21 14:13 15:1 lunch 73:17	m m 29:5 30:9,12 30:19,22 31:7 32:19,21 33:2 33:19 34:17 35:4,15,15,16 35:17 37:6,7 38:11,12,15,18 38:21 39:3,6,9 39:17 machine 113:10 made 21:7 114:6 main 18:7 36:5 36:13 majority 45:5 make 38:19 50:8,13 60:2 73:20 94:4,7,9 114:3 making 50:16 manner 4:17 89:20 90:7 95:17 mao 13:8,10 41:23 42:5 52:17 72:22 73:2,6,7,9 97:2 97:7 105:15 106:2,10 109:3 109:12,22 110:6,7,12,24 111:13,22,23 112:5	marked 3:7 9:8 9:12,22 10:3,6 11:11,15,18 12:5,9,12,23 13:3,6,17,21,24 14:13,18,21 15:11,15,18 18:16,23 marking 18:20 markups 8:19 match 82:21 material 21:10 materials 27:8 27:14,16,19,23 28:6 mathematical 32:14 mathematically 95:19 96:5 mathematics 92:15 matrices 28:21 28:24 30:13 31:2,4 34:18 35:4,10 100:20 101:3,7,11,14 101:17 102:16 102:17,18 103:1,3,8,11,12 103:16,22 104:22 matrix 15:2 28:21 29:1,6 30:7,12,21,23 31:7 32:19,21
--	--	---	---

33:2,19 34:17 38:11,15,17,21 39:3,6 42:15 42:17 43:2 55:23 56:9 57:1,15 64:16 64:20,22 68:17 69:22 70:4,5 70:12 71:5,7,9 79:5 82:1 92:21 93:2,13 93:15,22,24 94:15,22 95:1 95:3,8 96:7,15 96:18,24 97:22 98:5,8,17,21 99:2,4,12,20 100:9,15,17,21 100:22 101:3,7 101:9,12,15,18 102:22,23 103:7,17,21,23 104:5,7,12,14 104:18,19,23 105:8,11 106:21 107:1,6 107:15,21 mean 21:18 22:6 24:23 25:5,22 26:7 33:5 51:7 59:15,21 61:23 61:24 62:2 66:22 69:16 74:20 75:2,5	76:7,18 79:2,5 82:10 83:6,9 83:15,21 84:6 84:15 89:2 93:11 95:22 96:13 108:11 meaning 25:24 52:20,22 53:9 58:21 59:12 60:6 74:9 means 25:1,24 30:20 32:14 33:13 99:3 100:21 meant 22:14 measure 64:4 64:11 measured 60:22 measuring 63:14,23 mediatek 1:2 medical 7:17 meet 5:7 memory 87:2,3 mention 29:15 29:17,19 54:17 69:3 mentioned 15:7 38:3 merely 70:17 method 36:5,14 36:19 37:3,22 38:3,4,10,15,20 38:23 39:1	106:11 mid 1:24 mimo 60:22 minor 20:7 21:2 minus 92:16,16 92:22 93:3,8,9 93:22 94:1 96:9,11 98:18 99:3 102:18 minute 31:20 53:15 97:13 102:3 mischaracteri... 36:22 misrepresenti... 69:8 missing 90:21 91:2,15,18,20 misspoke 65:10 misstates 48:19 mix 82:21 module 88:15 88:18,23 97:3 morning 5:5,6 move 111:5 moving 35:7 multiple 23:22 23:23 24:2,2 59:13 61:6,16 62:11 71:20 74:12 104:22	n n 2:1 3:1 29:5 30:13,13,21,21 30:22 31:4,4 92:15,16,16,22 93:2,3,8,9,9,22 93:24 94:1 96:9,10,11 98:18 99:2 102:17 name 5:12,13 necessarily 43:15 59:7,21 60:2 104:9 necessary 108:19 114:3 need 33:11 35:11,18 62:2 77:2 78:18 103:9 needed 37:11 negative 108:12 neither 71:15 113:15 network 24:12 networks 23:2 23:8,12 24:6 25:7 nodding 6:13 noise 88:2 nomenclature 29:12 30:16,18 31:5 39:15
--	--	--	--

northern 1:5 5:9 notary 1:16 4:13,15 113:3 113:22 116:20 notation 32:14 noted 114:10 116:8 notes 102:5 notice 113:6 noticed 77:8 number 3:9,12 3:14,16,18,22 7:23 9:7,16 11:10 12:4,14 12:19,22 13:8 13:12,16 14:2 14:7 15:10,20 15:24 25:15 27:7 72:10 85:21 93:14 96:22 98:1 numbers 8:23 30:24 31:13 32:12 92:4,9 92:10,10,13,13 92:17,22 93:8 93:14,23 96:9 98:9,9,18,21 99:3,7 101:2 nxp 1:3 2:3	objection 4:17 4:19,20 36:21 42:10 47:4 48:18 50:3,11 57:24 58:11 68:6 76:15 77:10 78:15 80:19 82:19 84:5 90:24 91:21 94:5 101:19 109:6 109:10 110:9 110:22 111:10 112:1 objections 50:9 50:10,13,16 obvious 41:22 42:3,21 44:13 44:23 46:10 58:14 67:11 68:2,5 73:7 80:4 85:10 86:15 87:7 89:19,24 90:6 90:11 95:15 105:3,16 obviously 77:11 obviousness 10:11,22 40:17 40:20 52:15 54:24 71:2 80:16 85:6 ofdm 61:8,18 62:13,19 63:3	63:5 74:14,18 74:21,23 75:23 82:5,18,23 83:3,5,13 84:3 84:7,8,12,14 offer 40:8,12 office 1:1 official 113:18 okay 5:22 6:8 6:19 7:1,8,16 8:6 9:3 10:15 10:21 13:6 31:21 32:7,15 33:9 61:11 65:7 70:6 97:13 102:1 103:13 104:10 105:17 106:18 once 86:9 109:17 onwards 95:6 opening 19:9 operable 89:21 90:8 111:16 operate 23:2,8 23:12 24:6 operates 24:12 operation 29:12,22 operations 36:5 36:14 opine 18:9,11 37:10,11 41:21 opined 17:13 33:13 35:13,20	opining 93:8 opinion 16:13 16:18 20:8 21:21 23:11,16 23:24 37:4 40:13 46:3,4,6 46:18,18 47:9 47:10 48:8 53:6 59:17 72:17 78:23 95:24 96:14,14 109:14 111:22 opinions 10:11 10:16,17,22 17:3,9 18:3 21:5,11,13,16 37:14,17 40:8 40:16 66:23 67:3 77:14 86:2 94:2 97:5 97:10 opposed 55:12 oral 1:12 orally 6:11 order 46:11 61:4,14 70:4 71:6 74:10 ordering 34:8 34:12 ordinary 10:18 20:10,20 22:8 22:11,15,24 23:6,14,21 24:5,10 28:23 41:18 42:3
o			
oath 4:9,10 object 6:21 27:24			

52:19,22 53:1 53:9 58:21 59:11 71:21 80:24 88:6,8 95:20 103:4,19 104:4,11,16 original 20:23 114:13 orthogonal 102:18,23 103:2,8,12 outcome 113:17 outline 95:13 outlined 106:4 output 23:23 24:2 outputs 96:23 outside 77:1,23 79:10 own 27:18 owner 1:6 2:8 5:9	35:8,14 38:4,6 115:3 pages 34:22 116:4 paper 8:18 37:20,21 paragraph 16:11,17 19:10 19:14,16 22:1 22:4,7 24:18 24:24 25:17 26:2,14 27:6 27:12 28:16 29:3,9,16,20 30:6 31:16 35:21 36:1,10 39:10,11,19 40:2,7,12,19 47:24 48:9,17 48:22 49:4,8 49:14,18 54:7 54:16,19,20,21 55:5,13,17,20 56:19 57:12,16 60:14,20 61:1 61:2,3,11,13,20 61:24 62:10 63:11,19,21 64:3,10 65:12 67:4 69:19 70:7,9,10,14,16 70:20,23 71:15 71:16 74:6,7,8 77:21 79:20,23 80:22 86:24	87:5 88:20,22 89:9,13,17 90:4 92:19,24 93:7 95:11,12 95:14,14 96:4 96:4 97:19 98:8,22 99:9 99:15 100:1,3 106:18 107:4 109:16,20,24 110:17 paragraphs 28:19 39:23 41:10 42:12 43:9,19 53:11 53:21 54:2,12 55:7,8,10 58:13 61:1 64:22 65:15 66:10,11,15 67:8 69:1,17 72:5,15 80:1,9 80:12,14 86:18 86:19,21 87:20 93:6,18 94:9 94:18 95:2,6 106:5 110:3,8 110:11,21,24 111:6,8,13,20 parameters 92:5,9,11 93:3 93:10,16 94:1 96:11 107:6 paraphrase 33:21	paraphrased 33:24 34:1,2 part 24:15 27:9 38:17 44:4 46:22 47:3,15 47:19 51:5 52:11,13,15 63:9 65:22 81:10 92:14 partes 5:16 7:23 8:2,4 16:14 17:5 participating 4:3 particular 34:13 38:24 63:13 87:21 89:10 98:15 particularly 83:11 parties 4:11 partitioned 34:18 35:4 parts 94:7 party 4:16 113:16 patent 1:1,1,6,7 2:8 3:9,12,14 3:16,17,22 5:9 7:24 8:8,9,20 9:7,16 10:12 10:24 11:5,10 11:19,23 12:3 12:14,18,22 13:8,11,15
p			
p 2:1,1 p.m. 1:14 32:2 32:2 53:19,19 74:2,2 97:16 97:16 102:8,8 112:13 pa 116:22 page 3:2,7 5:21 30:2,5 31:12 32:24 33:6,16 34:5,11,17,20			

14:2,6 15:10 15:20,23 19:19 27:4 39:12,18 41:4,14,17,19 41:20 42:8,18 43:6 44:17 48:12 51:12,23 53:24 55:2 59:10 62:3,14 66:13 67:6,11 72:8,13 73:2 78:12,21 79:3 80:4,17 85:14 85:17 86:1 96:17 103:15 patents 10:20 pattern 61:9,19 74:14 81:1,16 81:20,23 82:3 82:15,16 85:3 85:8 patterns 83:3 85:16 payload 74:19 74:22,24 75:1 75:20,21 76:4 76:6 78:6,14 79:1 performed 90:19 performing 73:4 performs 87:4 permitted 7:12	person 4:9 10:18 20:1,10 20:19 22:8,10 22:15,20,24 23:6,14,21 24:4,10 28:23 41:18 42:3 52:24 71:21 80:23 88:5,8 95:20 103:4,19 104:3,10,16 pertain 83:2 pertains 81:17 100:10 pertinent 44:4 51:5 81:10 petition 16:14 16:19 17:5,11 17:15,21 18:4 18:11 19:1,6 19:11,12 20:12 petitioner 1:3 ph.d 3:8 18:16 ph.d. 1:13 3:3 3:11 4:22 9:22 phrase 91:17 physically 4:4 picked 93:21 piece 66:24 80:8,15 pilot 59:8,9 60:15,18,21,23 61:6,6,16,16 62:5,6,7,9,12 62:18,22 63:2	63:15,23 64:4 64:10,15,21 65:1,3,6,11,13 74:11,12 75:7 75:10,13 76:24 77:9,22 79:10 79:16,18 81:20 81:23,23 82:14 84:4 85:15 piper 2:4 place 113:6 plain 25:23 52:19,21 53:9 58:20 59:11 71:3 plane 33:17 35:9 36:5,14 37:23 please 4:18 5:7 5:11 6:17 23:5 24:9 30:1,1 41:8 43:23 44:1 51:2 63:20 81:5 92:7 102:11 114:2,7 plural 103:1,3 103:11,12,16 plurality 87:15 89:4 91:4 97:7 103:7,22 109:4 110:13 111:2 111:15,24 112:4	point 22:3,9 32:9 50:12 56:15 57:8 64:8 86:20 94:3,6,24 106:23 polar 36:6,15 37:24 38:16 99:12,16,21 100:9,22 105:11,20 106:9,16,22 107:8,22 108:2 108:4 poon 15:20,22 29:16 39:13 80:2,6,10,18 81:1 82:4,7,15 82:16,22 83:2 83:12,21 85:2 85:8 portion 36:1 100:14 portions 54:11 54:15,23 55:9 68:24 77:20 98:2 100:5 posita 42:3 43:10 44:12,23 45:6,14 46:9 48:1,22 49:9 52:9 58:14 63:1 66:1,8 67:2 68:1,18 68:20 71:2
--	---	--	---

72:19,19 80:7 85:7 86:3 89:19 90:6,19 95:15,24 107:9 107:19 position 50:24 65:20,24 66:1 80:23 101:10 101:13 positions 33:19 possible 58:8 78:24 83:8,9 83:17,18,20,23 84:16,21 107:20 possibly 34:11 power 30:21 practice 45:8 45:16 46:7,21 47:2,13,18,23 48:2,17,24 49:10 50:8 63:2 66:2,18 68:19 preamble 44:21 45:1,4,4,9,11 45:15,20 46:1 46:9,11,15,23 47:3,15,19 49:1 50:2 51:11,18,21 52:1,3,9,22,24 55:4 56:4 58:21,22 59:5 59:7,19,22	60:2,3,7 62:20 62:24 65:17,23 66:4,9,19 67:22 68:14,20 68:22 69:9 71:17 72:9 74:24 75:15,20 76:5,7,8,10,13 76:13 78:6,13 78:24 79:2,4 85:4,9,16,19 preambles 59:10,14 63:2 66:7 preceding 55:7 preparing 21:16 53:6 77:5 79:8 present 4:5 18:9 102:15 presented 16:20 48:17 presenting 82:11 84:15 previous 36:4 36:13 43:13 55:5 56:3 69:10 111:12 previously 16:12 principles 40:4 prior 8:21 40:22 69:14,16 80:8,15 81:21 81:22 107:24	privilege 50:14 privileged 28:2 probable 83:11 83:12,14 probably 17:22 problem 50:17 proceeding 8:3 10:8 16:9 19:3 20:6,13,21,23 21:8,17 26:19 28:15 proceedings 18:9 processing 88:15,18,23 97:3 processor 86:8 86:17,22,24 87:1 88:24 89:1,2 90:1,2 90:23 produce 95:4 96:22 107:6,8 produced 107:15,22 producing 38:17 97:21 98:4 105:7,18 106:14,20,24 professional 1:15 prompted 96:1 proof 102:21 proposing 87:11 95:10	propounded 116:6 provide 10:10 10:16,22 23:16 28:20 41:10 45:19,23 46:14 46:15 47:1,2 47:22 48:3,9 54:20 72:14,17 100:2,7 provided 10:17 21:13 24:1 46:3,3,6 53:8 56:20 59:12 60:24 72:5 96:14 97:5,10 109:14 provides 47:10 96:17 providing 39:2 75:3 96:21 public 1:16 113:4,22 116:20 publication 3:14,18 12:4 12:14,19 13:16 14:2,7 publications 27:7,13,15,19 27:22 published 15:2 purpose 60:8 73:10 82:2
---	---	---	--

pursuant 113:5 put 20:16,17	radiofrequency 89:15 rate 63:6 read 8:22 20:15 31:8 35:11 43:24 44:3 51:2,4 77:2,4,6 77:18 81:6,9 103:9 114:2 116:3 reading 33:10 71:3 77:8 82:23 103:5 104:11,17,20 reads 87:2 real 30:13,21 30:24 31:3,12 32:12 92:4,9 92:10,13,22 93:8,23 96:9 96:23 98:9,9 98:18,21 99:3 99:6 really 20:22 24:8 65:3 81:17 107:4 reason 6:17 7:17 19:4,8 31:11,14 38:9 114:4 115:5,8 115:11,14,17 115:20,23 recall 18:1 26:20 66:5 74:16 77:12	109:2 receipt 114:14 receive 12:10 55:11 89:22 90:8 110:12 111:16 received 9:12 10:4,5 11:16 55:19 56:1,8 56:12,17,22 57:2,14,20,23 58:4,10 63:16 63:24 67:15,21 68:12 69:2 89:14 receiver 56:6 56:21,22,23 57:5,9,17,18 58:16,16 60:21 60:23 69:21 receivers 70:10 receives 44:21 57:11 60:21 69:21 89:15 receiving 44:20 46:10 56:4 63:14,22 81:2 85:18 105:6,9 reception 88:1 recess 32:1 53:18 74:1 97:15 102:7 recognize 52:10 66:8 80:24 85:7	recognized 45:7 48:1,23 49:9 66:2 68:18 72:19 107:19 reconfirm 67:19 record 5:12 6:12 44:4 51:5 81:10 113:14 recorded 6:2 113:10 recross 108:18 red 96:21 reduce 42:17 reducing 3:19 14:11,23 42:16 ref 35:17 37:7 refer 8:2,7 11:2 11:22 12:17 13:10 14:5 15:5,22 16:6 35:17 reference 43:1 43:17 48:21 67:19 88:10,12 109:3,23 110:6 110:8 112:5 references 29:11 39:19 51:14 63:18 73:7 82:21 84:19 94:21 95:1
q			
qualifications 25:2 quarter 73:22 question 6:17 6:23 7:7 23:4 28:6 43:22 44:1,7 46:17 47:7 51:2 63:19 69:7,15 71:20 74:21 76:17 77:16 81:13 86:9,10 109:9 questions 6:1,2 6:11,22 43:13 108:21 112:7,9 116:6 quite 46:17 47:8 66:21 80:6 81:4 102:24 quote 29:5 49:21 61:24 69:20 94:12,13 quotes 72:13			
r			
r 2:1 30:20,23 31:12 32:11,13 34:23 113:1 115:1,1			

referring 8:4,8 11:3,23 12:18 13:11 14:6 15:6,23 16:8 58:9 91:19 98:11,16 101:2 refers 67:14 refined 21:10 21:16 regard 100:12 regarding 7:13 regards 20:14 23:17 41:9 42:13 registered 1:15 relate 38:12 related 19:23 22:18 26:11 39:6 76:9 83:13 relates 38:11 38:21 relevant 25:6 25:10,12 79:14 84:24 rely 29:11 54:3 54:12 55:10 67:9 72:22 73:2,9 79:24 80:2,6,9,16 105:2,5 109:12 relying 27:17 43:20 99:18 105:22,24 106:2,6,14	remember 91:22 remotely 4:7,10 rendered 37:17 rendering 37:14 renders 41:17 86:14,15 replace 87:12 89:24 90:11,13 report 35:20 42:1 69:8 106:5 reporter 1:15 1:16 4:2 6:3,4 6:12 44:3 51:4 81:9 reporting 4:6 4:17 reports 21:14 represent 5:9 93:22,24 94:22 95:1 100:20 101:7 102:16 103:16,23 representation 101:8 represented 92:21 93:2,13 98:9,17,21 99:2 103:2,7 103:11 representing 2:3,8 38:14	represents 93:14 94:14 101:15,20 104:22 require 96:19 required 21:20 21:23 23:14,20 25:13 26:2 rescheduling 50:22 research 1:5 5:10 reserve 108:17 respect 34:15 47:6 48:11,15 55:1 66:13 respectively 106:12 response 45:24 46:6,12,20 47:12 48:14 49:20,23 55:15 56:7 57:21 58:18 61:5,15 62:6,23 70:22 74:10 79:17 81:3 85:14,20 87:4 109:8,12 rest 11:7 32:22 70:1 99:8 108:17 restate 37:15 58:2 79:24 80:13 100:4	resume 31:21 return 114:12 reused 19:11 review 5:17 7:23 8:3,5 16:14 17:5 19:19 62:2 revised 78:9,21 rf 73:3,5 87:16 87:19,22 88:1 89:5,8,11,22,22 90:8,9,11,12 91:4,5 97:7 109:4 110:13 111:2,3,15,16 111:17,24 112:4 right 27:11 40:5,18 49:12 73:14 rios 1:14 113:22 room 4:5 rossi 1:14 113:22 rot 35:16 37:7 rotation 35:9 95:18 rotations 33:17 34:7 36:6,15 37:24 38:24 rpr 113:22 rules 5:20
---	--	---	---

s	26:11	52:7 56:20,21	46:23 47:3
s 2:1 3:6	scope 78:15	63:2 66:3	49:22 50:2
saw 79:9	scratch 44:9	68:19 96:24	51:12 52:22,24
saying 26:13	52:12,14	sending 46:4	53:1 55:4 56:4
30:16,18 38:2	seal 113:18	46:19 47:11	58:23 65:18
51:24 52:2	search 65:8,9	49:21 51:21	66:9 69:9
62:4 71:1	second 43:11	52:4 56:5	sequencer
83:17 89:23	43:17 49:5,7	60:10 71:23	45:13
90:13,14 91:6	86:12 100:24	72:2	sequences 59:8
93:17 94:11,17	section 22:8	sense 73:21	59:9
94:20,21 99:1	32:15 35:7,9	sent 52:8,8 53:3	series 6:1
100:18 105:17	36:4,13 37:22	57:17 58:16,24	set 30:13 31:3
says 30:12,19	37:23 38:3,5	59:1,4,9,18,23	31:12 32:12
31:2 34:9,14	38:10,20 39:5	60:1,3,7 63:9	43:13
34:16 37:21	41:5 43:9	66:7 85:9	several 34:6
38:7 49:8	55:21 56:3	96:20	shaking 6:13
55:21 56:23	69:10,14,16	sentence 20:15	shapiro 2:9 3:4
62:11 67:18	sections 77:24	22:10 30:11,19	4:19 5:4,6 8:12
68:15,15 69:11	111:12	31:1 32:9,10	9:4,10 10:1
70:1,10 71:8	see 13:3,21	33:3,11,24	11:13 12:7
75:9,12 82:7	14:19,20 15:15	48:6,8 49:6,7	13:1,19 14:16
85:18,18 93:21	18:21,22 21:2	49:14 62:16	15:13 18:19
93:23 99:6	50:16 61:20	64:13 70:1,1	28:11 31:18
100:16,24	79:14 84:20	74:9 75:9	32:4 37:2 43:3
101:6 103:1,10	seeing 66:5	100:24 101:1,6	43:24 44:8
104:1,22	seek 42:20	103:14 104:1	47:16 49:2
scattered 61:7	seems 77:7	104:20,23	50:5,19 51:1
61:17 62:12,18	96:20	sentences 94:8	51:15 53:13,20
74:13 75:10,14	seen 36:4,13	98:20	58:1,19 68:9
75:17 77:1	52:7 84:17	separate 76:8	73:13,16,19
82:4,17 83:4	107:24 108:2,6	separately	74:4 76:22
84:2,13	108:8,12,13,14	88:14	77:19 78:22
schervu 2:12	selected 94:7	sequence 34:6	80:21 81:6,14
science 19:22	send 46:7,21	44:22 45:11,13	83:1 84:10
22:18 24:17	47:14,18 48:24	45:15,20 46:11	91:13 92:2

94:16 97:12,18 101:22 102:2 102:10 108:16 109:6,10 110:9 110:22 111:10 112:1,8 share 8:16 9:1 9:5,13,18 shared 9:16 10:7 11:19 12:13 13:7 14:1,22 15:19 sharing 11:14 sheet 114:5,8 114:10,13 116:9 shorthand 113:10 show 11:7 18:13 42:16 43:17 54:4 56:4,8 64:17 67:10 79:15 80:3,16 91:8 95:3,6 98:2 99:18 105:2,6 105:16 111:13 showing 9:11 10:2 12:8 13:2 13:20 14:17 15:14 45:19 64:14 94:24 110:23 shown 42:24 64:17 70:2,12	70:13 71:10 112:3 shows 39:1 43:14 70:3,17 90:18 side 30:8 sided 34:7 sigma 29:7 sign 114:7 signal 56:23 58:24 59:14,17 61:6,16 65:22 73:4 74:12 76:12 89:22,23 89:23 90:9,9 90:10,17,17 91:5,6 111:3,3 111:16,17,18 signals 46:5 55:11,20 56:1 56:8,12,17 57:3,14,20,23 58:4,10 62:5,6 62:8 63:6,14 63:22 67:15,21 68:12 69:3 79:16,18 81:1 88:1 89:15 signature 113:21 116:12 signing 114:9 similar 48:6 111:11 similarity 49:9 49:13,17	simplify 60:5 simplifying 39:3,9 single 64:18 104:18,23 singular 3:20 14:12,24 29:4 70:17 103:17 108:1 sitting 95:23 situations 66:6 size 104:6 skill 10:18 20:10,20 22:8 22:11,15,24 23:6,14,21 24:5,10 28:23 41:18 42:4 53:1 71:22 80:24 88:6,9 95:20 103:4,19 104:4,11,16 slightly 29:11 solely 54:3 67:9 72:22 79:24 80:2 solutions 1:23 somebody 25:2 66:24 sorry 36:3,8 63:17 79:24 80:13 93:11 104:15 sort 48:8	space 114:5 speak 6:11 speaking 6:6 50:10,13 special 34:7 specific 27:15 28:13 41:7 77:15 91:8 106:23 specifically 23:19 73:8 98:3 99:18 squared 92:15 92:16,22 93:2 93:8,9,22,24 96:9,10 98:18 99:3 102:18 srikant 2:10 standard 23:3 23:9,13 24:7 78:3,5,8,13,18 78:19 79:1 standing 113:4 standpoint 83:19 stands 30:24 32:11 start 8:13 state 4:13,15,18 5:11 16:18,22 16:24 24:19 25:18 29:4,10 34:11 39:12 40:20 48:21 55:19,21,22
--	---	---	--

56:9,24 57:13 63:13,21 64:3 64:20,22 67:14 68:13,17 69:1 69:4,13 70:4 70:21 71:5 81:24 87:6 89:18 92:20 93:1 106:19 114:4 stated 16:12 43:16 55:15 60:18 66:23 statement 36:12 48:4 57:1,4,9,15 67:20 85:13 98:16 99:1 100:19 103:5 104:17 states 1:1 33:16 33:22 34:19,22 58:18 61:4,14 64:10,13 71:16 101:14 102:15 103:15 stating 36:2,3 68:11 station 81:2 step 67:17 107:24 stipulate 4:14 stop 6:5 street 2:5	strike 105:3 structure 102:16 studied 77:12 sub 34:18 35:4 35:10 61:5,8 61:15,18 62:13 62:19 63:3 74:11,14,19,21 74:23 75:23 82:5,18 83:5 84:4,8,12,14 subject 114:9 submitted 10:8 16:8,13,18 17:4,10 19:6 20:11 subscribed 116:14 subset 30:20,23 substance 7:13 116:8 substantial 25:18,22,23,24 26:5,15 substantive 18:2,5 substitute 24:20 25:10,13 25:19 26:3,15 suggest 84:21 suggested 89:21 90:7 suggesting 30:22 90:10	94:10 95:21 107:9 suggestion 95:17 96:1 suggests 33:4 59:13 93:23 104:2 107:10 suite 2:5 summary 109:22 superscript 29:7 35:16,16 37:7,7 supervision 113:12 support 10:19 16:13,19 17:4 17:10 18:4,24 19:6 20:11 48:4 61:1 87:24 98:2 99:9 supportive 43:15 suppose 83:24 supposed 50:9 50:13 sure 5:23 7:9 24:8 38:19 51:19 65:3,7 75:24 82:22 101:21 svd 29:5,12,21 39:8,13	sweep 34:6 sweeps 34:6 sworn 4:14,23 113:7 116:14 symbol 29:7 62:22 symbols 45:14 46:1,8,8,15,19 46:22 47:2,11 47:14,19 49:19 49:22 50:1 51:11,17,22 52:1,4,8 54:17 54:24 55:12,16 56:1,5,12,17,21 57:2,6,10,17,19 57:22 58:3,15 58:17 59:9 60:10,10,15,18 60:21,23 61:6 61:7,16,17 62:9,12,13,18 62:19 63:2,7 63:15,23 64:4 64:10,15,16,21 65:1,1,3,4,6,11 65:13,14,17,21 66:3,7,19 67:22 68:14,16 68:20 69:5,12 69:21 70:11,23 71:9,12,17,24 72:3,8 74:12 74:13 75:7,8,8 75:10,11,13,14
---	---	--	--

75:15 76:13,14 76:24 77:1,9 77:22,23 79:10 79:11,19 81:16 81:20,22 82:5 82:14,17 83:4 84:1,3,4,13,14 85:15,15,19 system 52:6 63:4,10 75:6 76:18,20 82:24 83:3,13 91:12 110:13 111:1 111:14 systems 52:5	88:4 94:13 98:7 107:3 110:11 talked 69:13 72:7 74:7 103:14 talking 42:22 49:17 56:3 76:1,2,19,20 77:9 90:22 91:1,3 92:12 105:14 107:7 talks 42:16,19 55:18 58:9 62:7 72:8 84:22 98:20 99:15 107:4,18 taught 79:10 teach 86:7 87:15 88:14 89:4 97:2,7 teaches 92:20 93:1 teaching 73:2 teachings 96:3 technical 83:19 techniques 72:10 85:21 technology 27:21 tell 21:6 37:6 52:21 113:7 telling 36:18 44:14	ten 53:15 term 49:13 50:1,2 58:21 59:8 65:5 91:14,23 terminology 21:3 terms 51:10 52:18,20 79:14 testified 4:24 testify 7:18 testimony 36:23 48:19 113:5,9,14 thank 5:15 8:24 16:2 73:23 112:10 theoretical 75:22 thereof 113:17 thereto 87:4 theta 34:23 thing 9:2 20:5 21:4 95:7 101:12 things 10:14,15 42:2 44:15 46:21 49:1 110:15 think 17:22 18:8 20:22,23 21:4,9,12 24:1 24:14,15 25:9 28:5 29:2 30:20,23 32:20	33:8,11 35:6 36:24 41:15,16 44:12 46:16 47:5 52:6,9 57:7,18 58:12 58:22 59:6,7 59:22 65:10,12 66:8,21 71:19 72:1 76:16 82:7 83:10 84:22 86:5 88:8 91:3 95:23 96:6 104:8 105:21 109:11,14 thirty 114:14 thoroughly 35:12 thought 59:15 three 47:7 60:24 92:11 tie 94:10 tied 94:18 time 7:5,14 36:9 43:13 45:8,17 46:7 46:21 47:13,18 47:23 48:2,24 49:11 60:6 61:9,19 62:14 63:18 66:3 67:1 71:6,8 72:20 73:21 74:15 78:12,20 81:5 85:13
t			
t 3:6 29:7 113:1 113:1 115:1 take 7:3,4,6,8 19:13 21:17 22:9 29:24 31:20 40:21 50:6 53:11,14 73:17 80:23 97:12 102:2,4 102:11 taken 1:13 32:1 53:18 74:1 88:9 97:15 102:7 113:5 talk 6:5 34:5 40:3,7,11 55:6 55:11 56:2,20 57:13,16 60:13 60:14 76:3			

107:12,19 108:18 112:11 113:6 times 30:21 47:7 71:20 78:10,21 today 7:19 36:18 68:11 112:11 together 94:11 94:19 told 21:15 51:16 82:13 tong 12:15,17 29:15 41:23 42:5,24 52:17 54:4 60:13,17 60:21,24 61:3 61:13,21,24 62:5,10 74:8 76:1,24 77:2,4 77:6,8,13,17,18 77:20 79:9,16 79:16,17 82:6 82:14,18 84:4 84:9 87:13 88:5,12,14,19 88:21 89:4,8 89:11,21 90:2 90:8,12,17 91:9 93:1,14 93:19,23 94:13 95:6,12 96:4 96:12,17 106:19,24	107:4,15,18,24 tong's 60:15 84:12 87:7,10 88:24 89:1,2 95:17 96:1 top 62:4 78:11 102:12,14 103:5 tpr 36:5,14,19 37:3,22 38:2,4 38:9,15,20,23 trademark 1:1 training 45:13 45:24 46:4,8 46:15,19,22 47:2,11,14,18 49:19,21 50:1 51:10,17,22,24 52:4,7 54:17 54:23 55:12,16 56:1,5,11,16,21 57:2,6,10,16,19 57:22 58:3,15 58:17 59:8 60:10 64:15 65:1,4,13,17,21 66:3,6,18 67:22 68:13,16 68:19 69:4,11 69:12,21 70:11 70:22 71:8,12 71:17,23 72:3 72:8 81:1,16 81:16,20,22 82:3,15,16	83:3 84:1,13 85:3,8,15,16,19 transcribed 113:11 transcript 114:15,16 transcription 113:12 116:5 transforming 106:8 transmit 95:4,7 transmitter 97:1,21 98:4 99:11,20 100:8 100:15 105:7 105:10 107:1 107:21 transmitting 44:22 trial 1:1 50:7 true 68:23 72:24 74:18 101:1 104:24 113:13 truth 113:8,8,9 truthfully 7:19 try 6:5,18 7:3 8:11 9:4 108:21 trying 64:12 79:15 94:3,7,9 94:15 turn 35:21 39:23 109:16	two 19:23 20:16,17,24,24 21:1,19,21 22:19 33:17 34:7 35:9 44:14 51:14 55:7 58:13 64:22 79:5 82:21 84:19 86:5 92:11 93:18 94:8,11 94:18,21,24 98:20 107:8 110:3 tx 2:5 tying 94:11 typographical 22:1
u			
u 29:6 31:2 33:16 u.s. 1:7 udv 39:14 under 22:7 113:11 understand 6:14,16 7:11 7:15,21 8:4,6,8 8:10 11:3,6,23 12:18 13:11 14:6 15:6,23 16:7 24:1,5,11 38:19 45:14 50:23 51:8 63:1 67:2			

71:22 76:21 86:3 88:12 103:6,20 104:4 104:17 106:1 understanding 27:21 understands 67:1 understood 24:8 unit 99:12 unitary 97:22 98:5 99:20 100:8,15 102:16,17,22 103:1,7,10,21 103:23 104:7 104:13,19 105:8,11 106:20 107:1 united 1:1 units 110:14 unquote 49:21 unsure 30:17 us.dlapiper.c... 2:6 usa 1:3 2:3 use 29:11 42:23 43:17 44:18 49:13,19 62:22 65:5 70:11,24 71:11 91:24 96:1 105:14,15 110:7	used 8:22 19:3 21:3 34:12 39:1 43:16 45:5 46:5,19 47:12 51:12,14 51:22 52:19 53:6 56:8 59:8 60:8,18 64:4 64:11,21 67:24 68:12,16 69:12 71:4,8,21 74:21 79:3,4 81:21 82:1 91:14,17 92:1 96:7 114:17 uses 31:5 51:10 57:20 58:17 62:5 64:15 81:2,22 95:17 using 29:4 39:14 45:24 49:1 63:15,23 65:2 70:22 79:16 85:15,20 91:23 99:22 105:21 106:10 106:17 utilized 100:20 103:16	93:2,13,14,22 93:24 94:14,22 95:1,3,8 96:7 96:15,18 97:22 98:5,8,17 99:2 99:4,12,20 100:9,15 105:8 105:11,18,19 106:15,15,21 107:1,6,15,21 vague 42:10 50:3 value 3:20 14:12,24 29:5 64:18 70:17 108:1 various 10:19 veritext 1:23 versus 79:19 view 41:23 52:16 68:5 111:20 viii 41:5	71:11,13,23 72:2 84:8 93:15 96:15,17 104:14 108:5 we've 53:13 71:19 91:3 wells 1:12 3:3,8 3:11 4:22 5:5 5:14 7:21 9:22 16:4 18:16 28:2 31:8 32:5 37:13 38:8 41:21 58:20 62:1,10 63:12 65:1,20 67:13 68:4 72:21 73:14 74:5 79:21 82:13 86:11 87:6 92:3 94:4 95:9 97:2,19 100:4 102:11 105:1,5 106:19 109:2 112:10 widely 59:8 wilmington 2:11 wireless 19:24 21:22 22:20 23:1,7,12,18,20 23:23 24:6,11 25:6 28:9 44:20,22 45:6 45:8 49:11 52:5 57:20
	v	w	
	v 1:4 29:7 31:3 33:17 42:16 43:2 69:22 70:5,12 71:7,9 71:11,13 92:21	want 7:4 wanted 8:16 32:8 50:11 way 6:18 11:8 21:5 31:6 33:23 34:1 38:14,15,24 39:2,7,8 42:17 50:20 51:9,11 51:22 52:4 60:9 65:2	

58:23 60:11	working 52:5	zachary.loney
63:4,9 66:5	written 22:10	2:6
72:1 75:6	wrote 17:21,23	zoom 1:13 2:1
89:20 90:6	19:10 20:6	
91:11 95:16	21:12 77:13	
105:6,9 111:1	x	
111:14	x 3:1,6	
wish 8:23	y	
witness 3:2	yang 15:1,5,7	
4:12,14 28:5	29:17,19,21,24	
31:23 36:22,24	30:6,8,12,18	
42:11 44:6	31:2,8 33:16	
47:5 48:19,20	33:21 34:4,9	
51:7 58:12	34:10,14,16,19	
68:7 73:15,18	34:21 35:7	
73:22 76:16	37:20,21 38:3	
77:11 78:17	38:7,13 39:1	
80:20 81:12	39:17 105:15	
82:20 84:6	106:3,6,17	
91:1,22 94:6	yeah 84:17	
101:20 109:11	year 17:24	
110:10,23	years 17:22	
111:11 112:2	19:23 20:16,17	
112:13 113:14	20:24 21:1,1	
113:18 114:1	21:11,19,22	
word 18:6	22:19 28:8	
42:23	52:5 66:4	
words 43:18	71:24 77:14	
44:19 51:8	78:9	
67:23 71:1,20	yep 7:9	
work 20:2	z	
22:21	zach 50:5	
worked 66:24	zachary 2:4	
91:12		

Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

Veritext Legal Solutions is committed to maintaining the confidentiality of client and witness information, in accordance with the regulations promulgated under the Health Insurance Portability and Accountability Act (HIPAA), as amended with respect to protected health information and the Gramm-Leach-Bliley Act, as amended, with respect to Personally Identifiable Information (PII). Physical transcripts and exhibits are managed under strict facility and personnel access controls. Electronic files of documents are stored in encrypted form and are transmitted in an encrypted

fashion to authenticated parties who are permitted to access the material. Our data is hosted in a Tier 4 SSAE 16 certified facility.

Veritext Legal Solutions complies with all federal and State regulations with respect to the provision of court reporting services, and maintains its neutrality and independence regardless of relationship or the financial outcome of any litigation. Veritext requires adherence to the foregoing professional and ethical standards from all of its subcontractors in their independent contractor agreements.

Inquiries about Veritext Legal Solutions' confidentiality and security policies and practices should be directed to Veritext's Client Services Associates indicated on the cover of this document or at www.veritext.com.