

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

ADVANCED MICRO DEVICES,	) Case No. IPR2023-00789
INC.,	)
	) U.S. Patent No. 7,936,245
Petitioner	)
	)
vs.	)
	)
REALTEK SEMICONDUCTOR	)
CORPORATION,	) REMOTE DEPOSITION OF
	)
Patent Owner	) DR. PAUL R. PRUCNAL

TRANSCRIPT of the stenographic notes of the
proceedings in the above-entitled matter, as taken by
and before NANCY CARIDES, RMR, CRR, Certified Court
Reporter and Notary Public of the State of New Jersey,
held via Zoom Videoconference at various locations,
with the witness located in Sanibel, Florida, on
Thursday, January 25, 2024, commencing at 9:02 a.m.

Page 2 1 A P P E A R A N C E S: (All via Zoom) 2 FOR THE PETITIONER: 3 WINSTON & STRAWN, LLP BY: JOSEPH C. MASULLO, ESQ. 4 BRIAN E. FERGUSON, ESQ. 1901 L Street, N.W. 5 Washington, D.C. 20036 202-282-5897 6 jmasullo@winston.com beferguson@winston.com 7 8 WINSTON & STRAWN, LLP BY: CHARLES LIU, ESQ. 9 2121 North Pearl Street Suite 900 10 Dallas, Texas 75201 214-453-6423 11 ccliu@winston.com 12 FOR THE PATENT OWNER: 13 K&L GATES, LLP 14 BY: R. GREGORY PARKER, ESQ. 501 Commerce Street 15 Suite 1500 Nashville, Tennessee 37203 16 615-780-6751 greg.parker@klgates.com 17 18 K&L GATES, LLP BY: ERIK J. HALVERSON, ESQ. 19 4 Embarcadero Center Suite 1200 20 San Francisco, California 94111 415-882-8238 21 erik.halverson@klgates.com 22 --- 23 24 25	Page 4 1 (All attorneys have agreed to the 2 witness being sworn in remotely.) 3 (Documents have been premarked for 4 identification.) 5 --- 6 DR. PAUL R. PRUCNAL, after having been 7 first duly sworn, was examined and testified 8 as follows: 9 --- 10 BY MR. PARKER: 11 Q. Good morning, Dr. Prucnal. How are 12 you? 13 A. Good morning. I'm fine, thank you. 14 How are you? 15 Q. Good. Will you state your full name 16 for the record? 17 A. Paul Richard Prucnal, P-R-U-C-N-A-L. 18 Q. And you understand that today you are 19 testifying with respect to two IPR proceedings; is 20 that correct? 21 A. Yes. 22 Q. And those two IPR proceedings involve 23 two patents; is that correct? 24 A. Yes. 25 Q. So, this morning, we are going to be
Page 3 1 I N D E X 2 WITNESS PAGE 3 DR. PAUL R. PRUCNAL 4 BY MR. PARKER: 4, 144 5 BY MR. MASULLO: 143 6 --- 7 8 E X H I B I T S 9 NUMBER DESCRIPTION PAGE 10 Exhibit 245-1001 U.S. Patent No. 7,936,245 55 11 Exhibit 245-1003 Prucnal '245 Patent 6 12 Declaration 13 Exhibit 245-1005 Ho-Hsiang U.S. Patent 68 14 Exhibit 245-1006 Christensen U.S. Patent 95 15 Exhibit 245-1007 Yang Patent Application 110 16 Publication 17 Exhibit 245-1018 Moinian Patent Application 32 18 Publication 19 --- 20 21 22 23 24 25	Page 5 1 focusing your testimony on the declaration that you 2 provided in support of a petition for inter partes 3 review of U.S. Patent No. 7,936,245. Do you 4 understand that? 5 A. Yes, I do. 6 Q. Excellent. So, I know you have 7 testified in a deposition many times. Have you 8 testified in a remote deposition before? 9 A. I think I have once or twice. 10 Q. Okay. Well, the rules are largely the 11 same. The difference is we're not in the room 12 together, so I won't be able to physically hand you 13 exhibits as I would normally do. So, we will be using 14 Exhibit Share to review exhibits today during your 15 deposition, and if you have any questions on how to 16 access or review something, just let me know. Okay? 17 A. Okay. 18 Q. You understand that you're under oath 19 today? 20 A. Yes. 21 Q. I'm going to be asking you questions. 22 I ask that you provide verbal responses so that the 23 court reporter can record an accurate transcript. Is 24 that okay? 25 A. That's okay.

Page 6 1 Q. Excellent. Okay. So, let's get 2 started. I am going to go ahead and pull up your 3 declaration. And you let me know when you have access 4 to it. 5 (Exhibit 245-1003 was introduced.) 6 THE WITNESS: Well, I thought I had 7 that window open, but Veritext is asking me to 8 provide a review on the proceedings. It's got 9 this review thing up, which I don't want. Oh, 10 here it is. I've got it now. 11 BY MR. PARKER: 12 Q. All right. I'm going to make sure that 13 you can see this. Okay. Do you have your 14 declaration, marked as Exhibit 245-1003? 15 A. No. What I'm seeing on my screen is 16 the Veritext Exhibit Share, with a number of 17 bookmarks, and then there's a window where I expect to 18 see something, but it says folder is empty. 19 Q. If we go to the Marked Exhibits folder 20 -- 21 A. Okay. I'm clicking on that. Okay. 22 That worked. 23 Q. You should see Exhibit 245-1003-EX-1003 24 Prucnal Declaration. Do you see that? 25 A. Yes.	Page 8 1 understanding of inductors and designing circuits that 2 included inductors. And in addition to that, I run a 3 research laboratory. I have a research laboratory 4 with graduate students and post-docs, and we build 5 circuits. So, I have experience with experiments that 6 involve circuits, primarily circuits that are 7 controlling those experiments. I would say in the 8 last decade, we have started designing chips that 9 include photonics and electronics, and sometimes those 10 electronics include inductors, as well. 11 Q. Understood. In the experience that you 12 just described where you are fabricating chips, have 13 you ever been specifically involved in designing 14 inductors in a way to optimize their quality factor? 15 A. Well, I know that I've been involved in 16 designing inductors for the purpose of impedance 17 matching, and I think that the Q of the inductor was 18 not the primary concern. 19 Q. Understood. So, you have not been 20 involved in designing inductors to optimize quality 21 factor; is that correct? 22 A. You know, it's a long history of doing 23 research and doing experiments, and I don't think it 24 would be correct to say that I've never been involved 25 in designing something that involves the Q factor.
Page 7 1 Q. So, if you would click on that. 2 A. Okay. I have it. 3 Q. Did that open for you? 4 A. Yes, it did. 5 Q. Okay. Excellent. And do you recognize 6 that as the declaration that you provided in the IPR 7 involving United States Patent No. 7,936,245? 8 A. Yes. 9 Q. And if I refer to the patent as the 10 '245 Patent, will you understand what I'm referring 11 to? 12 A. Yes. 13 Q. Excellent. So, what I'd like to do is 14 briefly go over your background. My understanding is 15 that you have significant experience in academia and 16 that you have some industry experience. Is that 17 correct? 18 A. Yes. 19 Q. I think what I sort of specifically 20 would like to discuss today is what experience you 21 have in the design of inductors. Do you have any 22 relevant experience designing inductors? 23 A. Well, I guess I would say my experience 24 related to inductors includes teaching, because I 25 taught circuits for many years, and that involved an	Page 9 1 The most recent experiments that we've done in 2 designing chips have involved inductors. As I said, 3 impedance matching has been the primary concern. The 4 Q of the inductor would also be a factor to the extent 5 that we needed to be sure that the impedance matching 6 circuit had sufficient bandwidth for the application. 7 So, it wasn't necessarily to maximize the Q, but the 8 design of the Q in some sense would have been a 9 factor. 10 Q. But you can't recall a specific example 11 of your involvement in designing an inductor structure 12 to specifically optimize Q; is that correct? 13 A. So, when you say optimize Q, I don't 14 take that to, necessarily, mean maximize Q, because 15 optimizing Q could be maximizing Q, but it also could 16 be achieving the desired Q also with the desired 17 bandwidth of the filter. So, the Q would have been 18 optimized in the sense that the filter would have been 19 optimized, but not necessarily just to get a maximum 20 Q. 21 Q. Let me ask this, have you been involved 22 in the design of transformers? 23 A. I would say my experience with 24 designing transformers would have only been through 25 teaching about transformers, and understanding their

Page 10 1 design, and teaching how the design works. I don't 2 think our laboratory work has specifically involved 3 designing transformers, at least not that I can recall 4 at the moment. 5 Q. Have you ever been involved in the 6 design of an inductor to be used in a transformer? 7 A. That would essentially be the same 8 answer as the one I just gave about designing a 9 transformer. 10 Q. And that answer is no, correct? 11 A. That answer is that I have been 12 involved in the design of transformers through 13 teaching, and examples of that would be not only 14 teaching the material, but constructing problems for 15 exams, where analysis of a transformer and the 16 inductors comprising the transformer would be 17 required. So, that's more like a theoretical analysis 18 than a hands-on experimental aspect. 19 Q. I want to turn to page 16 of your 20 declaration, which is marked as Exhibit 245-1003. 21 A. I need to familiarize myself with this. 22 On the copy that I'm looking at, do I click right to 23 go through the -- how do I go to page 16? 24 Q. That's a great question. So, I think 25 if you have a mouse, you would just scroll down, and	Page 12 1 words, the diameter of the loop, which provides the 2 area; and then, also, the number of loops that would 3 be in the inductor winding. 4 Q. So, the larger the area and the larger 5 the number of turns, does that result in a higher 6 inductance? 7 A. I know that the number of turns -- 8 increasing the number of turns would increase the 9 inductance. I don't recall, specifically, whether the 10 area relates directly to the inductance as a 11 proportionality, but it does figure in. 12 Q. If you scroll to paragraph 53, which is 13 on page 21, do you see that? 14 A. Yes. 15 Q. You'll see that paragraph 53 starts a 16 new section that says General Uses For Inductors. Do 17 you see that? 18 A. Yes. 19 Q. And the beginning of paragraph 53 you 20 state, "Inductors have several applications." Do you 21 see that sentence? 22 A. Yes. 23 Q. And you listed a number of applications 24 there, and then one of them that you list is 25 transformers. Do you see that?
Page 11 1 the pages will go top to bottom. 2 A. Okay. I'll do that. Okay. I'm there. 3 Q. Okay. So, do you see the section 4 entitled Background of the Technology? 5 A. Yes. 6 Q. And then underneath that is subsection 7 Inductor Basics; is that correct? 8 A. Yes. 9 Q. So, in the Inductor Basics section, my 10 understanding is that you are providing background 11 information on, sort of, the basics or the fundamental 12 principles of inductors. Is that correct? 13 A. That's correct. 14 Q. If you'll scroll down to paragraph 48, 15 and the last sentence of paragraph 48, you say, "The 16 inductance is largely a function of the area of the 17 loop and the number of turns in the winding." Do you 18 see that sentence? 19 A. Yes. 20 Q. Can you explain to me what that 21 sentence means? 22 A. Well, the inductance is the value of L, 23 which is the parameter that describes the inductor, 24 and in the physical design of an inductor, the L would 25 be related to how large the loop is; so, in other	Page 13 1 A. Yes. 2 Q. Okay. And then the next paragraph, 3 which is paragraph 54, you focus on the application of 4 inductors in transformers. And you state, "One of 5 these applications, the transformer, "finds wide and 6 important applications in RF circuits." Do you see 7 that? 8 A. Yes. 9 Q. The next sentence says, "Historically, 10 transformers have long been used in power systems for 11 voltage step-up and step-down." Do you see that 12 sentence? 13 A. Yes. 14 Q. Let me ask you this, are inductors used 15 in power systems for voltage step-up and step-down? 16 A. Well, first of all, inductors are used 17 as part of transformers, which are used for voltage 18 step-up and step-down. 19 Q. Would an inductor that is a standalone 20 inductor be used in a power system for voltage step-up 21 or step-down? 22 A. I would have to see the circuit to 23 answer that question. That would specifically be 24 dependent upon the circuit itself. 25 Q. Okay. So, if an inductor is not part

Page 14 1 of the transformer, in your experience, is it used in 2 a power system for voltage step-up or step-down? 3 A. Well, what I was speaking of is that 4 depends on how the inductor is used in the rest of the 5 circuit. To my knowledge, the inductor component in 6 isolation wouldn't be used for voltage 7 step-up/step-down, but the inductor would be in a 8 larger circuit. And that's where I'd need to know, 9 specifically, what that circuit is to answer the 10 question. 11 Q. Would an inductor component used in 12 isolation boost signals for long-range transmission? 13 A. Well, inductors in larger circuits 14 could be used to boost signals for long-range 15 transmissions, but inductors, by themselves, in 16 isolation -- you know, so I'm speaking of the inductor 17 itself, but when you say in the context, what did you 18 say, for long-range transmission? Then, presumably, 19 that inductor would be hooked into the long-range 20 transmission system in some way. It wouldn't be by 21 itself, in isolation. 22 So, an inductor could be used in a 23 long-range transmission system where it's serving part 24 of the function of impedance matching, and result in a 25 more efficient transfer of energy in the transmission	Page 16 1 core. So, that's all I can think of at the moment. 2 Q. In the next sentence, you say, and this 3 is right at the bottom of the page, "An ideal 4 transformer is characterized by a turns ratio "N". 5 Do you see that? 6 A. I do. 7 Q. What is an ideal inductor characterized 8 by? 9 A. Just its inductance. 10 Q. And would an ideal inductor be ideal 11 for the design of an ideal transformer? 12 A. Could you repeat that question, please? 13 Q. Would an ideal inductor be ideal for 14 the design of an ideal transformer? 15 A. Well, two inductors are used for the 16 design of the transformer. Presumably, if one is not 17 considering parasitics, then it's just the ideal 18 inductor that's being used, and they would be part of 19 the ideal transformer. 20 Q. You said, "Presumably, if one is not 21 considering parasitics." What did you mean by that? 22 A. The aspects of the component that make 23 it not ideal that would be present in a physical 24 device. 25 Q. And what would those be?
Page 15 1 system. 2 Q. If you're looking to accomplish a 3 step-up or a step-down in voltage in a power system, 4 would you look to use an inductor in isolation? 5 A. No. If I'm only trying to accomplish a 6 step-up or a step-down in voltage, I would use a 7 transformer. 8 Q. In the next paragraph, which is 9 paragraph 55, you state, "Essentially, a transformer 10 is just two magnetically-coupled inductors." Do you 11 see that sentence? 12 A. Yes. 13 Q. Why do you say "essentially?" 14 A. Well, the two magnetically-coupled 15 inductors would, presumably, be in close proximity, so 16 the transformer consists of two magnetically-coupled 17 inductors. Those are the parts of a transformer. So, 18 essentially, the two coupled inductors form the 19 transformer, but they also need to be in proximity. 20 Q. Is there anything else that's necessary 21 to create the transformer? 22 A. In the case of a transformer, these 23 inductors could be wound on a magnetic material. 24 Q. Anything else? 25 A. On a core, for example, on a magnetic	Page 17 1 A. Well, for example, parasitic 2 capacitance. 3 Q. And what would cause parasitic 4 capacitance in an inductor? 5 A. Well, whenever there are two plates 6 that can accumulate charge, two wires in proximity 7 could have capacitance between them. 8 Q. And how would that impact the design of 9 a transformer? 10 A. Well, in the design of an ideal 11 transformer, it wouldn't have an impact. In a 12 detailed design that involved modeling, where one 13 wanted to have a complete picture of how the 14 transformer behaves, one would need to include the 15 parasitics. But not in the design of an ideal 16 transformer. 17 Q. Let's scroll down to page 25 of your 18 declaration, and let me know when you're there. 19 A. Okay. I'm there. 20 Q. You'll see there's a subsection E 21 that's titled, "The meaning of Q-factor." Do you see 22 that? 23 A. Yes. 24 Q. And then there's paragraph 63 that 25 follows that subheading, and it says, "At its core,

Page 18 1 the Q-factor, or Quality Factor, of a coil is the 2 ratio of energy storage to energy loss in a practical 3 inductor over a cycle of excitation, as shown below." 4 And then there is a formula. Do you see that? 5 A. Yes. 6 Q. In that sentence, what do you mean by a 7 practical inductor? 8 A. A practical inductor would be an 9 inductor that has loss. 10 Q. And then if you go down to paragraph 11 65, which is at the top of the next page, you'll see 12 in the middle of that paragraph there's a sentence 13 that says, "The higher the Q-factor of the inductor, 14 the lower the energy loss of the device and the closer 15 it approaches the behavior of an ideal inductor." Do 16 you see that sentence? 17 A. I do. 18 Q. And then the next sentence says, "High 19 Q inductors are used with capacitors to make resonant 20 circuits in radio transmitters and receivers, which 21 are discussed in more detail below." Do you see that 22 sentence? 23 A. Yes. 24 Q. Are high Q inductors necessary to 25 design an ideal transformer?	Page 20 1 step-up and step-down a voltage, the turns ratio would 2 be of primary importance. There are other 3 applications where the frequency response of the 4 transformer or the bandwidth of the transformer might 5 come into play. So, in those cases, in those 6 applications, one might also be concerned with the Q, 7 but not here, not in the design of an ideal 8 transformer that's stepping up and stepping down 9 voltage. 10 Q. If we look at paragraph 66, you say, 11 "To improve an inductor and its Q-factor, we must 12 minimize the various loss mechanisms associated with 13 the inductor." Do you see that sentence? 14 A. Yes. 15 Q. What do you mean by "various loss 16 mechanisms" in that sentence? 17 A. Well, for example, a real inductor has 18 loops of wire of some kind of conductor, and real 19 conductors have loss, have resistance. The Q-factor 20 of the inductor decreases with the loss. So, whatever 21 loss mechanisms come into play will reduce the Q. 22 Q. So, that's helpful. I think what I'd 23 like to understand is what are those loss mechanisms, 24 and you know, what, structurally, causes them. Okay? 25 And so it looks like you, in the next sentence,
Page 19 1 A. So, the meaning of an ideal 2 transformer, first of all, is one that is 3 characterized by the turns ratio. I'm not sure what 4 paragraph we were looking at. I guess it was 5 paragraph 64. No, no, it was above that. 6 Q. It was paragraph 55, if you need to 7 refer to it above. 8 A. Thank you. Thank you. So, that's how 9 an ideal transformer was described. The voltage V2, 10 is proportional to the voltage V1 by the turns ratio. 11 So, in an ideal transformer, the turns ratio between 12 the primary and secondary is the only thing that comes 13 into play in describing the ideal transformer. And 14 because the transformer consists of two inductors, the 15 only characteristic of the inductors that's being 16 included would be the number of turns, and nothing 17 else. So, the Q doesn't come into this description of 18 an ideal transformer. 19 Q. So, if I'm trying to design an ideal 20 transformer, I'm more concerned about the number of 21 turns of the primary and secondary windings than I am 22 about the Q-factor of those windings. Is that 23 correct? 24 A. I mean, what you'd be concerned about 25 would depend on the application. If you're looking to	Page 21 1 identify loss mechanisms to include conductive losses, 2 internally-induced losses, such as skin effect, 3 externally-induced losses, such as eddy current 4 generated by nearby conductors, magnetization losses, 5 displacement current losses and radiative losses. Do 6 you see that? 7 A. Yes. 8 Q. So, if I'm designing an inductor, and 9 I'm going to use that inductor in a transformer, are 10 more of these loss mechanisms going to be present? 11 A. What do you mean by "are more of these 12 loss mechanisms?" 13 Q. Well, you say, "To improve an inductor 14 and its Q-factor, we must minimize the various loss 15 mechanisms associated with the inductor." And my 16 question is if you're using an inductor in a 17 transformer which, as you've noted, is effectively or 18 essentially just two magnetically-coupled inductors, 19 correct? 20 A. Yes. 21 Q. So, if we're using an inductor in a 22 transformer, as you've described, are more of the loss 23 mechanisms that you've referenced here going to be 24 present? 25 A. I'm sorry. I'm just not understanding

Page 22 1 by what you mean by "more of the loss mechanisms." I 2 just don't understand the sentence. 3 Q. So, you've stated here that, "To 4 improve an inductor and its Q-factor, we must minimize 5 various loss mechanisms associated with the inductor." 6 Correct? 7 A. Yes. 8 Q. Okay. Do you have to minimize more 9 loss mechanisms associated with an inductor when it is 10 part of the transformer to improve its Q? 11 A. Oh. So, may I say what I think you're 12 asking? 13 Q. Please. 14 A. I think you're asking me if I have an 15 inductor that I designed, and I have designed it in 16 such a way to increase the Q, and in doing so I tried 17 to minimize whatever loss there is in the inductor. 18 Are you asking me if I then want to use that inductor, 19 or instead want to use that inductor in a transformer, 20 do I have to minimize other loss mechanisms, or 21 minimize these loss mechanisms even more? 22 Q. Yes. 23 A. Again, that's going to depend on the 24 application where the transformer is used. So, the 25 transformer, when it's used in RF circuits, for	Page 24 1 A. It's going to involve how the component 2 windings are laid out, at least, and an understanding 3 of the coupling between things, and the parasitics 4 between things. That would be done on a case-by-case 5 basis. 6 Q. Whereas, if you're designing an 7 inductor in isolation, not to be used in a 8 transformer, you don't have to adapt it for coupling 9 or parasitics that are necessary in the design of a 10 transformer? 11 A. No. No. The same thing is true for an 12 inductor. If we're designing a physical inductor on a 13 chip, it would depend what its application is, but 14 generally speaking, we'd want to have a high Q, for 15 example. In general. Not always. So, we'd be 16 concerned with the resistance, the number of turns, 17 and other parasitic factors, like capacitance. So, 18 the overall behavior of that inductor, particularly in 19 RF circuits, is going to depend upon all of those 20 things. And all of those things would come into play 21 in the transformer, as well, but of course, the layout 22 would be different because it's two inductors, not 23 one. 24 Q. So, is it your testimony that the 25 design of an inductor as a standalone inductor on a
Page 23 1 example, high-frequency circuits, may be required to 2 be able to pass a certain frequency. It may be 3 required to be able to pass a range of frequencies. 4 So, in the case where I'm designing a transformer for 5 that application, I would be concerned with the Q, and 6 I would be concerned with the loss mechanisms in the 7 individual inductors. 8 Q. Understood. But how would you minimize 9 those loss mechanisms in the transformer? 10 A. Well, I have to say that depends upon 11 the physical design and how the transformer is laid 12 out; if we're talking about on a chip, for example. 13 And what I would have to do would be to create a 14 physical model, I mean, a model of a physical 15 transformer, that would include, based upon how it's 16 laid out and the relative location of things, that 17 model would include not only the inductance, and not 18 only include the number of turns and the area, but it 19 would include all of the parasitics. And so, that 20 would depend, specifically, on what application the 21 transformer was being designed for. 22 Q. So, if I could summarize that, the 23 application of the transformer and its layout are 24 going to influence how you design its component 25 windings; is that correct?	Page 25 1 chip is not going to be different than the design of 2 an inductor that's going to be used in a transformer 3 on the same chip? 4 A. I don't think that's exactly right. 5 What I was trying to say is that when an inductor is 6 designed on a chip, it's designed with goals, in terms 7 of what its performance goals will be. And the same 8 thing is true for when a transformer is designed on a 9 chip. The goals may be somewhat different in the two 10 cases. It's going to be application-dependent. But 11 what I was trying to get across was that in both 12 cases, the modeling of the physical device on a chip 13 is going to involve these various parasitics that 14 we've discussed. 15 Q. And if the goals are different in the 16 design of a transformer versus the design of an 17 inductor, would that influence how you design a 18 standalone inductor versus how you design an inductor 19 that would be part of a transformer? 20 A. I'm not sure that I can understand that 21 the way you've phrased it. I think you're asking if 22 the goals are different for a transformer and an 23 inductor, would I design them differently, would I 24 design the transformer differently than I design an 25 inductor, on a chip.

Page 26 1 Q. That's correct. 2 A. I think the answer to that is yes, that 3 if I were designing an inductor for a particular 4 application, I would have to take the requirements, or 5 I'd have to consider the requirements, to do the 6 design. And the same thing is true for a transformer. 7 The requirements of a transformer might be different 8 than the requirements of a standalone inductor. So, 9 they might be designed differently, depending upon 10 what they were going to be used for. 11 Q. Thank you. If we go to page 27 of your 12 declaration. 13 A. Okay. 14 Q. You'll see there's a subsection G 15 that's titled Singer Layer vs. Multi-Layer Inductors. 16 Do you see that? 17 A. Yes. 18 Q. And then paragraph 70 follows, and the 19 second sentence of that paragraph you state, "When 20 formed in integrated circuits, it was well known prior 21 to the priority date of the '245 Patent that the coils 22 of an inductor could be formed on a single metal layer 23 (planar) or multiple metal layers." Do you see that 24 sentence? 25 A. Yes.	Page 28 1 A. Yes. 2 Q. And that inductor appears to have two 3 windings on one layer. Agreed? 4 A. Yes. 5 Q. And then it has a bridge on a second 6 layer. Do you agree with that? 7 A. Yes. 8 Q. So, in that illustration of a spiral 9 inductor, would you agree that it uses a crossover 10 region on a separate layer than the winding to close 11 the circuit? 12 A. I would agree that the bridge goes 13 under the winding, and that is a separate layer. 14 Sometimes single-layer inductors can have an 15 incidental, sort of, underpass, the way it shows here, 16 and still be called a single-layer inductor, but the 17 bridge, as you've said, is actually on a separate 18 layer going under. 19 Q. And that bridge is not part of the 20 winding; is that correct? 21 MR. MASULLO: Objection, form. 22 THE WITNESS: I don't think I've opined 23 on that, specifically. Do you know if I've 24 referenced that in my report? 25 BY MR. PARKER:
Page 27 1 Q. And then if you scroll down to 2 paragraph 72, you'll see reference to a patent number 3 6,759,937 to Kyriazidou. Do you see that? 4 A. Yes. 5 MR. PARKER: And for the benefit of the 6 court reporter, that's K-Y-R-I-A-Z-I-D-O-U. 7 BY MR. PARKER: 8 Q. And if you scroll to the next page, 9 you'll see a figure from Kyriazidou, Figure 1 and 10 Figure 2, at the top of page 29. Do you see those 11 figures? 12 A. Yes. 13 Q. And in Figure 1, it says, "Prior art 14 single-ended multiple layer inductor." Do you see 15 that? 16 A. Yes. 17 Q. And that inductor appears to have three 18 windings on three layers. Would you agree? 19 A. Yes. 20 Q. But that inductor does not have any 21 crossover regions. Do you agree? 22 A. I agree. 23 Q. And in Figure 2, you have what's 24 described as "Prior art differential single layer 25 inductor." Do you see that?	Page 29 1 Q. No. I'm just more trying to understand 2 the figure, and I guess what I want you to explain to 3 me is we have a single-layer winding, right? And then 4 we have a second layer, where there's a bridge. And 5 I'm just looking to confirm that the metal layer that 6 is part of that bridge is not the same as the metal 7 layer that is the winding. Is that correct? 8 A. Well, what I can confirm is that the 9 metal layer of the bridge is on a different layer 10 than, I guess what I'd call the main winding, just as 11 it's shown in this diagram. As for whether the bridge 12 forms a part of the winding, I think I would say that 13 it does. I mean, the winding of an inductor is the 14 thing that produces the inductance. It's the metal 15 conductor that forms the loop. When the loop goes 16 under, the way it's shown here, to another layer, 17 that's still producing inductance. So, I don't know 18 at this point. I think I would say that it's part of 19 the winding, but it's specifically a bridge. I don't 20 know if I can say that that's not included in the 21 winding. 22 Q. Understood. But that bridge is 23 connected to the winding by vias. Would you agree? 24 A. Agreed. 25 Q. And then there are no turns coming off

8 (Pages 26 - 29)

Page 30 1 of the bridge itself. Would you agree? 2 A. Could you explain what you mean by 3 that? I'm not sure. 4 Q. Well, I guess the bridge is just a 5 bridge. There's no metal layer that extends around 6 the inductor coming straight off the bridge. 7 A. I see. So, I think you're asking 8 whether there is a turn on the second layer coming off 9 of the bridge, that's connected to the bridge. 10 Q. Correct. And there isn't one. 11 A. That's correct. 12 Q. Okay. And so, this is your background 13 on inductors, and stacked inductors, and single-layer 14 inductors, is part of it, and I just want to confirm 15 that this is a common way to close a circuit on a 16 spiral inductor. 17 MR. MASULLO: Objection, form. 18 THE WITNESS: Well, so, by "close the 19 circuit," I understand that to mean that the 20 loop that's on the top layer forms a 21 continuous current path by using the vias and 22 the bridge, or the underpass, I would call it, 23 to make sure that there's a continuous current 24 path. So, that's correct. As for whether 25 that's a common way, using an underpass or an	Page 32 1 A. Am I supposed to be seeing that exhibit 2 now? 3 Q. You will momentarily. 4 A. Okay. 5 (Exhibit 245-1018 was introduced.) 6 BY MR. PARKER: 7 Q. So, actually, you might be able to just 8 click the arrow to the right on the current exhibit, 9 and that might take you there. Let me know if that's 10 the case. 11 A. No, that takes me to a different 12 document. 13 Q. Maybe click it again. 14 A. That was my notice of remote 15 deposition. 16 Q. Okay. 17 A. Next is my declaration. 18 Q. And then if you click it again? 19 A. It looks like it's the notice of remote 20 deposition again, the exhibit ending in 1003. 21 Q. So, maybe go back to your marked 22 exhibits folder. 23 A. Now, I would like to do that without 24 disconnecting us. So, if you would give me some 25 guidance, I don't want to just click on things to
Page 31 1 overpass or a bridge was a well-known 2 technique in making inductors. 3 BY MR. PARKER: 4 Q. And if you remove the bridge from that 5 diagram, would you have an open circuit? 6 A. Yes. I guess I would add to that, just 7 so that I'm not too glib about it, it's an open 8 circuit when we consider that the terminals of the 9 inductor are at node 1 and node 2. And the idea here 10 is to make a continuous circuit from node 1 to node 2. 11 Removing the bridge would make it an open circuit. 12 Q. If you scroll to page 36 of your 13 declaration, you'll see at the top of the page a 14 top-view of a spiral inductor. Do you see that? 15 A. Yes. 16 Q. And would you agree that an underpass 17 that you described as well-known in the prior art 18 could be used to close this circuit? 19 A. Yes. 20 Q. And then in the paragraph below you'll 21 see that you reference a U.S. Patent Application 22 that's referred to as Moinian. Do you see that? 23 A. Yes. 24 Q. And I'm going to mark Moinian so we can 25 look at it. So, bear with me.	Page 33 1 figure out how to do that. 2 Q. There should be a tab at the top of 3 your browser. 4 A. I now have the marked exhibit page with 5 three exhibits there. 6 Q. Okay. If you could open the one that's 7 Exhibit 245-1018. 8 A. Got it. 9 Q. Do you recognize this as the Moinian 10 reference that you refer to in your declaration? 11 A. Yes. 12 Q. Now, if we look at the abstract, it 13 says, "An inductor device in an integrated circuit 14 includes a first winding portion, a bridge portion and 15 a second winding portion." Do you see that sentence? 16 A. Yes. 17 Q. Now, there's a figure at the bottom of 18 the front page of Moinian. What do you recognize that 19 figure to be illustrating? 20 A. I would actually have to look at the 21 description of that figure to tell you any more than 22 this is an inductor with windings and crossovers and 23 bridges. 24 Q. If you scroll down to page 9 of 13 of 25 Exhibit 1018.

Page 34 1 A. Okay. 2 Q. On the right-hand column it says 3 Summary of the Invention, and then you'll see a 4 paragraph 0006. Do you see that? 5 A. Yes. I'm wondering if I can enlarge 6 this. It's really difficult for me to see on the 7 screen. 8 Q. Yeah, there should be a button right 9 above the image of the document that has a plus or 10 minus sign that you can click on the plus to zoom in. 11 A. That helps a lot. Okay. So, I see 12 paragraph 6. 13 Q. Paragraph 6 states, "In accordance with 14 an aspect of the invention, an inductor device in an 15 integrated circuit includes a first winding portion, a 16 bridge portion and a second winding portion." Which 17 is similar to what we read in the abstract, correct? 18 A. Yes. 19 Q. The second sentence says, "The 20 integrated circuit has a first, a second, a third and 21 a fourth metallization level." Do you see that? 22 A. Yes. 23 Q. Do you understand that to mean there 24 are four different metallization layers? 25 A. I think that's what it means, yes.	Page 36 1 electrically connects the first winding portion to the 2 second winding portion." Do you see that? 3 A. Yes. 4 Q. In paragraph 0008, it states, and it's 5 just below there, "Advantageously, the illustrative 6 inductor device is characterized by a relatively high 7 Q-factor." Do you see that? 8 A. Yes. 9 Q. Then we've got brief descriptions of 10 the drawings. Figure 1 shows a plan view of the 11 inductor device. Figure 2 shows a plan view of the 12 inductor device with the polysilicon shielding portion 13 removed. And then figures 3, 4 and 5 show sectional 14 views. Do you agree? 15 A. Yes. 16 Q. So, if we scroll down to paragraph 20, 17 this paragraph describes the plan views in Figures 1 18 and 2, and shows that the illustrative inductor 19 device, which is labeled 100, comprises a single 20 octagonal inductor winding, which is labeled 110, that 21 terminates in a left signal node 120 and a right 22 signal node 130. Do you see that sentence? 23 A. Yes. 24 Q. It says, "The inductor winding, in 25 turn, can be separated into primary winding portions
Page 35 1 Q. Then after that it says, "The first 2 winding portion of the inductor device comprises a 3 first metal line formed on the first metallization 4 level, and a second metal line formed on the second 5 metallization level, the first metal line being 6 electrically connected in parallel with the second 7 metal line." Do you see that? 8 A. Yes. If you don't mind, I'd just like 9 to re-read that again. (Pause.) Okay. 10 Q. And then the next sentence says, "The 11 bridge portion comprises a third metal line formed on 12 the third metallization level, and a fourth metal line 13 formed on the fourth metallization level, the third 14 metal line being electrically connected in parallel 15 with the fourth metal line." Do you see that? 16 A. Yes. I'm trying to keep this all in 17 mind, but I do see it. 18 Q. Okay. And then it says, "Finally, the 19 second winding portion comprises a fifth metal line 20 formed on the first metallization level, and a sixth 21 metal line formed on the second metallization level, 22 the fifth metal line being electrically connected in 23 parallel with the sixth met line." Do you see that? 24 A. I see it. 25 Q. And then it says, "The bridge portion	Page 37 1 110P and bridge portions 110B." 2 A. Okay. 3 Q. And then it states, "The bridge 4 portions allow the inductor winding to cross over 5 itself and to be electrically continuous from the left 6 node to the right node." Do you see that? 7 A. Yes. 8 Q. So, I just want to go back up to the 9 figures and look at that. So, if we go to Figure 2, 10 which you can scroll up and find. Let me know when 11 you're there. 12 A. Yes, I'm there. 13 Q. And so, you'll notice that this is a 14 plan view of an inductor device, which is labeled as 15 100. 16 A. Yes. 17 Q. Comprising a single octagonal inductor 18 winding, which is labeled 110. And you would agree 19 this is octagonal, correct? 20 A. Yes. 21 Q. That terminates in a left single node 22 120, which is bottom left. Do you see that? 23 A. Yes. 24 Q. And a right signal node 130. Do you 25 see that?

Page 38 1 A. Yes. 2 Q. And then it says, "The inductor winding 3 can be separated into primary winding portions 110P. 4 Do you see those? Bottom right is where 110P is, 5 using arrows. 6 A. Yes, I do see that. 7 Q. And bridge portions 110B. Do you see 8 those? 9 A. Yes. 10 Q. Okay. And when they're pointing at the 11 bridge portions in 110B, do you see that those 12 portions are shaded differently than the winding? 13 A. Yes. On the top, the two bridge 14 portions, right, they're sort of filled in with dots, 15 whereas, the winding that goes above is crosshatched. 16 Presumably, that's also a bridge on the bottom. No, 17 that's true there, also. Yes. So, the answer is yes. 18 Q. And the different shading indicates to 19 you that that bridge portion is on a different layer, 20 correct? 21 A. I can surmise that from looking at 22 this. I probably would want to look more at the 23 description again, but I think that's fair to say. 24 Q. If we scroll down to Figure 5, do you 25 see that?	Page 40 1 through 6," and we're looking at Figure 5, "shows that 2 illustrative inductor device 100 is built into a 3 polysilicon level and seven metallization levels 4 labeled M1 through M7 in the figures." 5 A. Okay. 6 Q. And do you see those layers, M1 through 7 M7? 8 A. Unless I'm missing something, I only 9 see M3 through M7 labeled here. 10 Q. Well, then, I think at the bottom 11 you'll see poly, bottom right, and then above it, M1. 12 A. Oh, that was off of my page. 13 Q. No worries. 14 A. Because I had enlarged it. I'll make 15 it smaller. So, I do see M1, but I still don't see 16 M2. If you're asking me if I see M2, I don't. 17 Q. And I don't think M2 is labeled on any 18 of these images. But for purposes of our questions, 19 we're going to be focusing on M3 through M7. Do you 20 see those? 21 A. Yes. 22 Q. And you agree that M3 through M7 23 represent different metal layers? 24 A. Agreed. 25 Q. Okay. So, then, the specification
Page 39 1 A. Yes. 2 Q. Now, Figure 5 is a cross-sectional view 3 of the inductor. And you'll see that it labels the 4 top three layers 110P? 5 A. Yes. 6 Q. And then underneath those three layers 7 there are two layers that are labeled 110B. Do you 8 see that? 9 A. Well, so I think, just to be clear 10 about what I see here, the layers, I think, would be 11 the metal layers, which are labeled M7, M6, M5, M4, et 12 cetera. And the 110P and 110B, with the curly 13 brackets, seem to be, at least, labeling the 14 rectangles that they're next to. I'd probably have to 15 look at the description of Figure 5 to know whether 16 those are labels for the layers or for those metals 17 lines alone. 18 Q. Understood. I'm going to read it to 19 you, because it's hard to go back and forth. I'm 20 going to read to you the description of Figure 5, and 21 I want you to just follow along, and then I'll have 22 some questions for you. Is that okay? 23 A. Sure. 24 Q. So, the specification says, "Reference 25 now to the various sectional views in Figures 3	Page 41 1 continues, "The primary winding portions 110P of the 2 inductor winding 110 comprise metal lines built into 3 the M5 through M7 metallization levels." And do you 4 see those on this figure? 5 A. Yes. 6 Q. So, 110P bracket is bracketing the 7 primary winding portions of the inductor, right, that 8 are on levels M7, M6, and M5, correct? 9 A. Yes. 10 Q. The spec goes on, "The bridge portions, 11 110B, on the other hand, comprise metal lines built 12 into the M3 and M4 metallization levels." Do you see 13 that? 14 A. Yes. 15 Q. And so, the bridge portions of this 16 inductor are on different metal layers than the 17 primary winding, correct? 18 A. Yes. 19 Q. And so, is this, what you see here, 20 illustrative of what you've described as sort of an 21 underpass? 22 A. Well, this shows and describes a bridge 23 portion that's on layers M3 and M4, under the primary 24 windings. This is a cross-section of somewhere on 25 that inductor. I can assume that that's the underpass

Page 42 1 that I'm talking about. If it's a place where it 2 actually shows the cross-section, I could confirm 3 that, but I think it's fair to say if they're calling 4 it a bridge, that it's a bridge, and it's on the 5 layers M3 and M4. Do you know, is there a figure that 6 shows where this cross-section is taken? 7 Q. Yes. So, if you go to Figure 1, scroll 8 up. 9 A. Okay. 10 Q. Figure 5, which we were looking at, 11 shows the sectional view of Figure 1 cut along the 12 plane Y-Y prime, which you'll see is a vertical line 13 through the crossover region at the top of the 14 inductor. Do you see that? 15 A. Yes. So, looking at this combined with 16 what I just saw, the vertical line Y-Y prime is 17 cutting through at a point where there are two 18 underpasses next to each other, or crossovers, if you 19 will. And it's a little hard to discern, but I think 20 it's reasonable to say that the cross-section that you 21 just showed me would indicate that it's crossing the 22 bridge, and that the bridge is in the lower metal 23 layers relative to the top layers of the winding. 24 Q. Okay. And the specification goes on to 25 say, "It will be observed that in accordance with	Page 44 1 presumably, the purpose of that bridge is to complete 2 that circuit. 3 Q. And the bridge portion is separate from 4 -- excuse me. Let me rephrase that. The bridge 5 portion which is in metal layers 3 and 4 is below the 6 primary winding on metal layers 5, 6, and 7, correct? 7 A. Yes, the bridge portion is below what's 8 labeled as 110P, which is being described as the 9 primary winding. 10 MR. PARKER: Why don't we take a quick 11 break, let's say maybe ten minutes, and then 12 we'll come back and pick up. We'll come back 13 10:35 your time. 14 THE WITNESS: Sounds good. Thank you. 15 MR. PARKER: Off the record. 16 (A 10-minute recess was taken.) 17 BY MR. PARKER: 18 Q. Dr. Prucnal, if you'll go back to your 19 declaration, which you should be able to access by 20 clicking on the arrow to the right or left of your 21 Exhibit Share, if you'll scroll down to page 37, 22 you'll see a subheading that says Shape of Inductors 23 and Symmetry. Do you see that? 24 A. Yes. 25 Q. And you say, "The various shapes of
Page 43 1 aspects of the invention, the metal lines forming the 2 primary winding portions 110P are electrically 3 connected together by a multiplicity of contact vias 4 so that they are connected and parallel with each 5 other. (i.e., they are shunted.)" Do you understand 6 that the top three layers, M5 through M6, which 7 consists of the primary winding, are stacked on top of 8 each other connected by vias and in electrical 9 parallel, correct? 10 MR. MASULLO: Objection, form. 11 THE WITNESS: So, if I may, I'd like to 12 go back -- I'm looking at Figure 1, but I'd 13 like to go back to the cross-section figure. 14 Was that Figure 5? 15 BY MR. PARKER: 16 Q. Yes. 17 A. So, in this cross-section, I see that 18 layers 5, 6, 7, 110P, in the primary winding, are 19 connected by vias. At that point, they would appear 20 to be in parallel. At least, at that point, they're 21 electrically connected. That's about all I can say. 22 Q. And then below those three windings, 23 you've got two layers of a bridge that closes the 24 circuit of this inductor; is that correct? 25 A. There are two layers of a bridge, and	Page 45 1 inductors and their respective trade-offs were very 2 well known far before the priority date of the '245 3 patent." Do you see that? 4 A. Yes. 5 Q. The next sentence states, "A few of 6 these configurations are shown below." And then if 7 you scroll to the next page, you'll see a figure with 8 several inductor configurations. Do you see that 9 image? 10 A. Yes. 11 Q. Can you just describe what that image 12 illustrates? 13 A. Well, these are all inductors, and 14 they're all two-dimensional inductor types, which 15 means that they're on a plane, essentially on a plane, 16 and it describes three geometries. The upper left is 17 meander. You see that the conductor is, in fact, sort 18 of wandering up and down. The second one on the upper 19 right is rectangular. You see the shape is 20 rectangular. The lower left is circular, the shape is 21 circular. And the lower right is octagonal, and 22 that's an octagon. 23 Q. In paragraph 84 below that figure, you 24 state, "The circular geometry has the best electrical 25 performance of these shapes, whereas the meander line

Page 46 1 inductors are seldom used." Do you see that? 2 A. Yes. 3 Q. Can you explain why the circular 4 geometry has the best electrical performance of those 5 shapes? 6 A. Well, by virtue it's geometry, and I 7 don't know that I can recall off the top of my head 8 exactly what it is about the geometry, but by virtue 9 of the geometry, the circular-shaped inductor is able 10 to obtain what's called the highest SRF, which is the 11 self-resonant frequency. And that self-resonance 12 occurs when you have an L-C combination. So, when you 13 combine the inductance of the circular geometry with 14 the capacitance associated with the geometry, which 15 would be parasitic capacitance, that you are able to 16 get the highest self-resonant frequency, which is a 17 desirable thing. 18 Q. You also state that, "meander line 19 inductors are seldom used." Why are they seldom used? 20 A. Well, again, if we looked on the Table 21 3.1, on the next page, which is where I'm looking, it 22 sort of summarizes an advantage of each and a 23 disadvantage of each. And the reason cited that 24 there's a disadvantage of the meander is that it has a 25 lower self-resonant frequency. Again, the	Page 48 1 sitting, from right to left, is going to have current 2 wrapping around it, and that creates the magnetic 3 field, which is the way the inductor operates. By 4 putting the conductors close together, as you would in 5 most of these geometries, the circular, the octagonal 6 or rectangular, those magnetic fields can overlap and 7 then reinforce each other. So, you get a greater 8 magnetic field by doing that. 9 Q. And is that preferred when constructing 10 the layout of an inductor? 11 A. Well, again, as I said before, the 12 characteristics of the inductor depend on the detail 13 design and modeling. And generally speaking, you'd 14 want to make the inductor as efficient as possible in 15 producing that magnetic field. So, it's a very 16 sweeping generality. You'd prefer to have the 17 windings, I guess you would say, or the loops, close 18 together to create a high inductance as efficiently as 19 possible. 20 Q. In paragraph 85, which is underneath 21 the table you were referencing a moment ago, this is 22 on page 39 of your declaration, the second sentence 23 says, "When constructing a layout for a given 24 inductance value, it is best to have the highest 25 possible values of Q and SRF in the smallest possible
Page 47 1 self-resonant frequency is determined by a combination 2 of the inductance and parasitic capacitance. 3 Q. Understood. So, there's tradeoffs in 4 using these different configurations, correct? 5 A. That's correct. 6 Q. In the configurations that are 7 illustrated in the figure at the top of page 38, which 8 is the four 2-dimensional inductor types that you just 9 walked us through, it appears to me that regardless of 10 the geometric shape, rectangle, circular, octagonal, 11 the turns of these shapes are fairly close together. 12 Is there a reason for that? 13 A. Well, these are, of course, just 14 illustrations. I think they're probably artist 15 conceptions. But generally speaking, the inductor 16 operates by creating a magnetic field, and I don't 17 want to make this too lengthy, but if you have current 18 passing through the inductor through a conductor, and 19 I can't see myself on the screen, but say the current 20 is going in the direction of my thumb. So, this is, 21 generally, the inductor, and my thumb is pointing in 22 the direction of the current. Then the magnetic field 23 is created in the direction of my fingers, my right 24 hand's fingers, wrapping around it. So, each wire, 25 with current passing through it, say where I'm	Page 49 1 area of an inductor using standard process 2 techniques." Do you see that sentence? 3 A. Yes. 4 Q. What does that sentence mean with 5 respect to having an inductor configuration with tight 6 turns or loops as opposed to having an inductor 7 configuration where there is more space between the 8 turns or loops? 9 A. Well, again, this is speaking in 10 generalities. This statement is a very general 11 statement. But when an inductor is being fabricated 12 on a chip, real estate is precious. Inductors are 13 rather large components relative to other components 14 of integrated circuits. So, it's desirable to make 15 the inductor cover the smallest possible area. At 16 least, that's one consideration. And in doing so, one 17 would want to have, generally, the best performance. 18 And here, the two aspects of the performance that are 19 being considered are the Q and the self-resonant 20 frequency. 21 Q. And is that generally accomplished by 22 having more tightly-wound turns or loops in an 23 inductor configuration? 24 A. So, by more tightly wound, do you mean 25 that the loops are as close together as possible?

Page 50 1 Q. Yes. 2 A. I think this is ignoring all other 3 factors that would come into play in deciding the 4 inductor. So, it's not just having the windings close 5 together, although having the windings close together 6 are going to help improve -- increase the value of the 7 inductance. But there are other factors that come 8 into play other than the spacing. I'm not sure I can 9 recite those off the top of my head right here, but 10 there are things such as capacitive effects that might 11 be undesirable. So, there are a number of things that 12 are part of this consideration, one of them being the 13 spacing of the loops. 14 Q. What were the effects that you said 15 might be undesirable? Did you say -- I didn't catch 16 that word. I'm sorry. 17 A. I said capacitive. 18 Q. Okay. Capacitive effects, right. So, 19 generally speaking, if we turn to the next page, 20 paragraph 87, you talk about symmetry. Do you see 21 that? 22 A. Yes. 23 Q. And at the bottom of that paragraph you 24 say, "Note that in this configuration, each turn 25 involves a metal-level interchange, a process that	Page 52 1 level by vias. 2 Q. And the bridge is on a lower level, 3 correct? 4 A. Correct. 5 Q. Again, this is sort of synonymous with 6 what you described earlier as an underpass, correct? 7 A. Yes. 8 Q. If you could turn to page 49 of your 9 declaration. Let me know when you're there. 10 A. I am there. 11 Q. So, at page 49, you start a section in 12 your declaration titled the '245 Patent. Do you see 13 that? 14 A. Yes. 15 Q. And at this point, I assume you're 16 intimately familiar with the '245 Patent; is that 17 correct? 18 A. Yes. 19 Q. If you look at paragraph 98, which is 20 the first paragraph of that section, that paragraph 21 states, "The background of the invention section of 22 the '245 Patent states that it relates to a "stacked 23 structure of a spiral inductor, and more particularly, 24 to a stacked structure for improving quality factor by 25 making use of metal layers of a crossover region as
Page 51 1 requires vias." Do you see that sentence? 2 A. Yes. 3 Q. And if you go to the next page, you'll 4 see two figures. Do you see those two figures? 5 A. Yes. 6 Q. So, do those two figures involve a 7 metal-level interchange? 8 A. If I may, just to be sure, I'd like to 9 look back at the preceding paragraph, just for a 10 moment. 11 Q. No problem. 12 A. (Pause.) I think the answer to your 13 question, if I recall, is correct, that both of these 14 geometries in Figure 210 and 211 have crossovers. 15 Q. And so, in the statement that precedes 16 those two images, when you say, "Note that in this 17 configuration, each turn involves a metal-level 18 interchange, a process that requires vias," what do 19 you mean by a "metal-level interchange?" 20 A. A bridge. 21 Q. A bridge. Okay. And so, the bridge is 22 connected to the winding by vias, correct? 23 A. Well, again, I know that we discussed 24 before how windings should be defined. The bridge is 25 connected to the parts of the winding on the upper	Page 53 1 shunt windings." Do you so that sentence? 2 A. Yes. 3 Q. So, you would agree that one of the 4 stated objectives of the '245 Patent is to improve 5 Quality Factor of a spiral inductor, correct? 6 A. Correct. 7 Q. And you'd also agree that the '245 8 Patent attempts to improve Quality Factor of a spiral 9 inductor by making use of metal layers of a crossover 10 region as shunt windings, correct? 11 A. Correct. 12 Q. Now, if you go to paragraph 99 -- 13 A. Okay. 14 Q. -- you state that "The '245 Patent 15 acknowledges that symmetric inductors were common at 16 the time and they could include multiple metal layers 17 as a winding of the inductor." Do you see that 18 statement? 19 A. Yes. 20 Q. And we've looked at some of those 21 structures in the background art that you've cited. 22 Would you agree? 23 A. I think so, yes. 24 Q. The next sentence states, "The use of 25 vias and a crossover region were also known." Do you

Page 54 1 see that? 2 A. Yes. 3 Q. And we've looked at some art that 4 you've cited that illustrates the use of vias, as well 5 as crossover regions. Would you agree? 6 A. Agreed. 7 Q. Your next statement says, "But it 8 argues that prior art inductors had disadvantages, 9 namely, the parasitic resistor will be restricted by 10 the single metal layer, a conductivity of the 11 crossover region, a number of the vias, and the 12 resistance of the vias." Do you see that statement? 13 A. Yes. 14 Q. Do you agree with that statement? 15 A. Well, I understand from this statement 16 that the resistance is going to be an important 17 factor, and that the conductivity of the crossover 18 region will be an important factor. The number of 19 vias will affect the resistance. But I don't agree 20 that the prior art is restricted to a single metal 21 layer. We've been discussing prior art a few minutes 22 ago that had multiple layers tied together by vias, 23 for example. 24 Q. I'm going to mark another exhibit for 25 you to review.	Page 56 1 Q. And Patent No. 2008/0074229, I'll 2 represent to you, is the Moinian reference that we 3 looked at earlier this morning. Okay? 4 A. Okay. 5 Q. And that sentence goes on to say, "Such 6 that the inductor can have a lower series resistance 7 than a traditional singer-layer inductor, so as to 8 improve its Quality Factor. However, no matter the 9 structure with a single-metal layer or the structure 10 with multiple metal layers in parallel are concerned, 11 the metal layers of their crossover regions of the 12 inductor are different from the metal layers of the 13 windings." You would agree that that's consistent 14 with what we've reviewed in the prior art with respect 15 to Moinian? 16 MR. MASULLO: Objection, form. 17 THE WITNESS: So, this says Moinian 18 proposes multiple levels in parallel, 19 providing a lower series resistance than a 20 single layer, improves quality factor. Then 21 the next sentence is no matter whether a 22 single metal layer is used or multiple metal 23 layers in parallel, the metal layers of the 24 crossover regions and the inductors are 25 different from the metal layers of the
Page 55 1 (Exhibit 245-1001 was introduced.) 2 THE WITNESS: So, shall I use the right 3 and left arrows, or shall I refresh this 4 thing? 5 BY MR. PARKER: 6 Q. I'll tell you when to refresh. Give me 7 one moment, please. (Pause.) Okay. If you refresh, 8 you should be able to open Exhibit 245-1001, which is 9 a copy of Patent No. 7,936,245. Let me know when you 10 have it open. 11 A. I have it open. 12 Q. Okay, great. So, if you'll scroll down 13 to page 16 of that Exhibit 1001, you'll see in column 14 one, Background of the Invention. 15 A. Yes. 16 Q. Do you see that? Okay. If you'll just 17 read to yourself the paragraph that starts on line 21, 18 that starts with the word "recently." And let me know 19 when you've finished. 20 A. (Pause.) I have finished. 21 Q. At line 31, it says, "Hence, a 22 structure with multiple metal layers in parallel is 23 proposed, such as in the U.S. patent with Patent No. 24 2008/0074229." Do you see that? 25 A. Yes.	Page 57 1 windings. 2 So, going back to Moinian, I think the 3 question is whether Moinian, which had 4 multiple metal layers to reduce the resistance 5 and improve the quality factor, used different 6 metal layers for the crossover. And so, going 7 by memory what you showed me an hour ago, 8 maybe, was that there were top layers that 9 corresponded to the winding, and under those 10 layers were two layers for the crossover for 11 the bridge, which would make this accurate. 12 I have to say that when we were looking 13 at the Moinian cross-section, I wasn't looking 14 at the rest of the cross-section. I was just 15 looking where the bridge was. In other words, 16 I don't know whether Moinian did or did not 17 utilize the layers occupying the bridge for 18 something else. 19 BY MR. PARKER: 20 Q. Right. And we also looked at a single 21 metal layer inductor in Kyriazidou that utilized what 22 you described as an underpass that was on a lower 23 metal layer, correct? 24 A. Yes. 25 Q. And that formed the crossover region of

Page 58 1 that structure, correct? 2 A. That's right. 3 Q. And as you described earlier, the use 4 of an underpass to complete the circuit of an inductor 5 to form the crossover region of an inductor was a 6 well-known way to construct an inductor in the prior 7 art, correct? 8 A. Yes. 9 Q. And then this paragraph goes on to 10 state, "For this reason, the quality factor of the 11 inductor cannot be optimized." Now, do you understand 12 that to mean that the inventors are suggesting that 13 Q-factor can't be optimized in an inductor if the 14 crossover region is made up of a metal layer that's 15 different than a metal layer of the winding? 16 MR. MASULLO: Objection, form. 17 THE WITNESS: That's what they appear 18 to be suggesting here. I think that the 19 reality is slightly different than just 20 prohibiting the crossover from using different 21 metal than the winding. I think that the 22 reduction resistance comes about when the same 23 metal layer as the crossover for the bridge 24 can also be used to reduce the resistance of 25 the windings.	Page 60 1 Q. And do you agree with that statement? 2 A. The way they stated this, again, it's 3 not entirely clear that one follows from the other, 4 the way they're saying it here. Because in the first 5 sentence, they're saying that they're optimizing the 6 quality factor by making use of the metal layers of 7 the crossover, the metal layers, plural, of the 8 crossover region, as shunt windings. So, those metal 9 layers aren't just dedicated to the crossover. 10 They're also used as shunt windings. And that would 11 indicate to me that the windings will have lower 12 resistance and higher Q. 13 But then it continues by saying as a 14 result, the parasitic resistors won't be restricted by 15 the conductivity of the crossover region, which I 16 think is something slightly different. It's talking 17 about the conductivity of the crossover region, 18 whereas, the sentence before was talking about the 19 conductivity of the shunt windings. 20 Q. Understood. So, let's parse it out, 21 because I think this is referring back to what was 22 discussed in column 1 with respect to prior art 23 configurations, like Moinian or Kyriazidou, where they 24 are implementing a well-known underpass, right, to 25 complete the crossover region, rather than utilizing
Page 59 1 So, this is a true statement, I mean, 2 this is what they are saying, but I think that 3 the way it actually works is that when you can 4 use those layers of the bridge for the 5 windings, as well, those windings can now be 6 shunted together and have lower resistance, 7 which is a good thing. 8 BY MR. PARKER: 9 Q. So, if you scroll down to column 6, 10 which is on page 18 of Exhibit 1001 -- 11 A. Okay. 12 Q. At the top of that column it says, "As 13 can be known from the embodiments above, the stacked 14 structure of the spiral inductor disclosed in the 15 present invention is capable of optimizing a quality 16 factor of the inductor by making use of metal layers 17 of the crossover region as shunt windings." And 18 that's consistent with what you just said, correct? 19 A. Yes. 20 Q. "As a result," column 6 goes on to say, 21 "parasitic resistors of the spiral inductor won't be 22 restricted by a conductivity of the crossover region, 23 a number of the vias, and resistance of the vias." Do 24 you see that statement? 25 A. Yes.	Page 61 1 the metal layer of the crossover region also as a 2 winding. And in that scenario, you would agree that 3 those underpasses, they are on separate metal layers 4 than the winding itself, and as a result, there may be 5 additional conductivity of that crossover region, 6 separate from the conductivity of the shunted winding. 7 Would you agree with that? 8 MR. MASULLO: Objection to form. 9 THE WITNESS: I don't entirely agree 10 with what you just said. Again, I'll try to 11 play it back the way I understood it, and tell 12 me if I'm misunderstanding. I think you said 13 that the two references that we just 14 discussed, Moinian and Kyriazidou, had 15 crossovers on a different metal layer, and 16 they didn't also use that other metal layer 17 for shunt windings. And the claimed advantage 18 in the '245 is that when you don't also use 19 those other layers as shunt windings, you're 20 limited by the conductivity of the crossover 21 region. That's going to depend on how you 22 utilize all of the metal layers, whether you 23 use all the other metal layers to reduce the 24 conductivity of the crossover region itself. 25 So, I don't quite see the connection, the way

Page 62 1 you've stated it. Maybe you can try again and 2 I'd understand better. 3 BY MR. PARKER: 4 Q. Well, if there is a metal layer that is 5 solely used for the crossover region, how does that 6 impact the Q-factor of the inductor? 7 A. It impacts it because if, instead, you 8 use the metal layer for the crossover region to also 9 shunt the winding, then that's going to affect the 10 conductivity of the winding. And that's why I said so 11 the conductivity of the crossover region is going to 12 also depend upon what's done with that. 13 Q. So, to make sure I understand what 14 you're saying, if you use the metal layers of the 15 crossover region to construct the shunt winding, that 16 is going to improve Q-factor as compared to a 17 structure that utilizes separate metal layers for the 18 crossover? 19 A. Yes, because in this case, where you 20 have the metal layers for the crossover being utilized 21 to create a shunt winding, that shunt winding now has 22 multiple metal layers, and therefore, lower 23 resistance, and with lower resistance gets higher Q. 24 Q. Let's go back to your declaration, 25 which I think if you click on the arrow to the right	Page 64 1 A. Yes. 2 Q. And you note here that Figure 9A refers 3 to those as windings. Do you see that? 4 A. Yes. 5 Q. Now, Figure 9A shows a transformer that 6 has two intermingled windings, correct? 7 A. I think you can say that the windings 8 are intermingled, yes. 9 Q. And the footprint of this structure on 10 a chip is larger than the footprint of a single 11 winding that composes the structure, correct? 12 A. That's a little hard to say. I mean, 13 there are more windings. I think if I were to take 14 those inductors separately, it's a little hard to 15 visualize when I'm looking at the whole transformer. 16 But generally speaking, there are more windings here, 17 and the overall area covered by those windings would 18 be less than the overall area occupied by one 19 inductor. 20 Q. Okay. On the next page, which is page 21 63, you've isolated one of the windings of the 22 transformer illustrated in Figure 9A. Do you see 23 that? 24 A. Yes. And what I was trying to say in 25 my previous answer, if you don't mind me just
Page 63 1 or left, you'll eventually see your declaration, 2 Exhibit 1003. 3 A. I've got it. 4 Q. Let's scroll to page 61, and let me 5 know when you're there. 6 A. Okay, I'm there. 7 Q. And this is a section titled 8 Obviousness Based on Ho-Hsiang. Do you see that? 9 A. Yes. 10 Q. In paragraph 21, you say, "Ho-Hsiang 11 discloses multilayer inductors used for on-chip 12 transformer balun structures." Do you see that 13 sentence? 14 A. Yes. 15 Q. And then if you scroll down to page 62, 16 at the top of that page you'll see the last complete 17 sentence says, "In particular, Ho-Hsiang shows a 18 transformer including two inductors in Figure 9A." Do 19 you see that? 20 A. Yes. 21 Q. And then in Figure 9A, which you've 22 reproduced below on that page, you've highlighted what 23 you refer to as a first inductor, 902, in pink, and 24 what you refer to as a second inductor, 906, in green. 25 Do you see that?	Page 65 1 clarifying it, is that the pink winding is isolated 2 here. The green winding would more or less be this 3 pink winding but flipped over. And so, the green 4 winding and the pink winding have, more or less, the 5 same footprint. But I guess you could say if you 6 slide them together, the combination would have a 7 slightly larger footprint. 8 Q. Than -- 9 A. Either of them alone. 10 Q. Understood. So, Figure 9A shows one of 11 the windings isolated from the transformer structure, 12 correct? 13 A. Yes. 14 Q. And so, when we look at this structure 15 in isolation, it doesn't really look like any of the 16 other inductor structures we've looked at from your 17 background section. It doesn't appear to be a circle. 18 It doesn't appear to be a rectangle. It doesn't 19 appear to be a square. It doesn't appear to be an 20 octagon. Would you agree with that? 21 MR. MASULLO: Objection, form. 22 THE WITNESS: Well, not exactly. I 23 mean, the previous examples I gave of 24 geometries were never perfect circles or 25 perfect octagons. There were other

Page 66 1 connections and crossovers. At a high level, 2 this has an octagonal shape, to me. If I were 3 to cover over the bottom half, I would see a 4 generally octagonal shape on the top, and if I 5 were to cover the top half, I'd see a 6 generally octagonal shape on the bottom. So, 7 to me, if I wanted to identify the shape of 8 this, it would be an octagon, sort of with a 9 step in, a little bit of a step in. 10 BY MR. PARKER: 11 Q. But you would agree it's somewhat 12 irregular, in geometry, compared to what you 13 referenced as background art on inductor 14 configurations, correct? 15 A. It's not as simple as a pure octagon. 16 To answer your question, I'd have to look back at that 17 example of an octagon. I think it was a fairly 18 regular octagon, but I know there were some other 19 things going on, other than the pure octagonal shape. 20 So, this may look a little less like an octagon than 21 the other one, but of the shapes, of the possible 22 shapes, to me, this would not be the circular and not 23 be the square, not be the rectangle. It would be 24 octagonal. 25 Q. So, in addition to it having somewhat	Page 68 1 MR. MASULLO: Objection, form. 2 THE WITNESS: Well, the geometry of the 3 individual inductor is going to have to 4 accommodate the second inductor. This is not 5 a perfect octagon. As I said, the other 6 inductors we looked at weren't perfect 7 octagons. And it still does have a certain 8 symmetry to it. Symmetry is desired. We can 9 see that by making a vertical cut or a 10 vertical axis through the center, one can fold 11 this and have a certain symmetry. 12 BY MR. PARKER: 13 Q. So, let's take a look at Ho-Hsiang, 14 which I'm going to mark as an exhibit. 15 A. Can I ask something? 16 Q. Of course. 17 A. I wonder if we can take just a couple 18 minutes for a bio break? 19 MR. PARKER: No worries at all. Let's 20 take a quick break. 21 (Exhibit 245-1005 was introduced.) 22 (Pause.) 23 MR. PARKER: We can go back on the 24 record. 25 BY MR. PARKER:
Page 67 1 of an irregular shape, it also seems to have less 2 uniform spacing between the turns than the examples 3 you provided in your background art on inductors. 4 Would you agree with that? 5 A. Well, in the lower portion there's, 6 generally, one spacing between the turns of the 7 inductor, and in the upper spacing, there's a larger 8 spacing between the turns of the inductor. 9 Q. And why is that? 10 A. Well, because the transformer is -- 11 let's see. Well, simply put, there's a second 12 inductor that is intermingled, as you said before. 13 Q. So, is what you're saying that the 14 spacing, the regular spacing, between the turns of 15 this winding are there to accommodate intermingling 16 with another winding? 17 A. I would say that, generally speaking, 18 the shape of the overall transformer, which includes 19 the two windings, must accommodate the intermingling 20 of the two windings. 21 Q. Right. So, the reason that this 22 configuration of this winding lacks uniformity and 23 shape, and lacks uniformity and spacing between its 24 loops or turns, is because it has to be modified to be 25 used in a transformer with another winding?	Page 69 1 Q. I marked the Ho-Hsiang patent as an 2 exhibit. So, if you refresh your feed, Dr. Prucnal, 3 you should be able to open that exhibit by clicking on 4 the right or left arrows. 5 A. So, by refreshing, it put me right on 6 the exhibit page. 7 Q. So, if you go to Marked Exhibits, look 8 for Exhibit 245-1005. 9 A. Great. I've got it. 10 Q. Do you recognize that as the Ho-Hsiang 11 patent? 12 A. Yes. 13 Q. If you look in the abstract -- and you 14 may need to zoom in. 15 A. Okay. 16 Q. It states, "An electronic device 17 includes a first winding having a first port and a 18 second port. The first winding formed in a first 19 metal layer." Do you see that? 20 A. Yes. 21 Q. "A second winding has a third port and 22 a fourth port. The second winding includes a 23 plurality of segments formed in the first metal 24 layer." Do you see that? 25 A. Yes.

Page 70 1 Q. "The second plurality of winding 2 segments are connected by a bridge formed in a second 3 metal layer." Do you see that? 4 A. Yes. 5 Q. And you understand what that's 6 describing within the context of the transformer 7 picture at the bottom of the page there? 8 A. I just want a moment to review this, 9 please. (Pause.) Yes, I understand it. 10 Q. Okay. Now, if I were seeking to design 11 an inductor to improve Q, why would I consider this 12 reference? 13 A. Well, I think I might want to -- I 14 mean, I understand why, but I think it might be best 15 for me to see if there's a section of my report that 16 talks about that, specifically. If you know, that 17 would be helpful. 18 Q. We can go back to that. Let's just, 19 while we're on Ho-Hsiang, go through it real quick, 20 and then we'll circle back on that question. How does 21 that sound? 22 A. Sure. 23 Q. So, let's go to column 6 of Ho-Hsiang. 24 So, you'll have to scroll down through the images and 25 figures to page 21 of the exhibit.	Page 72 1 MR. MASULLO: Objection, form. 2 THE WITNESS: I see that it's probably 3 going to be helpful for me to look at the 4 figure, but I see what you read. 5 BY MR. PARKER: 6 Q. So, let's go look at Figure 9A, which 7 is on page 13. 8 A. Okay. 9 Q. Now, you would agree that this 10 illustration includes both the primary and the 11 secondary winding, correct? 12 A. Yes. 13 Q. So, while you're looking at that 14 figure, I will revisit the passage we just read so 15 that you can follow along with the figure. Okay? 16 A. Okay. 17 Q. So, Figure 9A is a top plan view of a 18 transformer 900, having a 2:2 turn ratio that utilizes 19 three metal layers in accordance with the present 20 invention." Do you see that? 21 A. I mean, I don't see the three metal 22 layers on the top, but -- 23 Q. You see the top view, though, correct? 24 A. Is see the top view, yes. Not the 25 layers.
Page 71 1 A. Okay. 2 Q. Line 10 starts a paragraph in column 6 3 that says, "In some embodiments, a balun or 4 transformer may be formed using three metal layers." 5 Do you see that sentence? 6 A. Yes. 7 Q. Then it refers to Figure 9A is a top 8 plan view of a transformer having a 2:2 turn ratio 9 that utilizes three metal layers in accordance with 10 the present invention." Do you see that? 11 A. Yes. 12 Q. And we'll go back to 9A in just a 13 second. "As shown in Figure 9A, a transformer 900 14 includes a primary winding, 902, comprising winding 15 segments 902a, 902b and 902c, which may be formed on a 16 first metal layer 920 and a second metal layer 930." 17 Do you see that? 18 A. Yes. 19 Q. "The primary winding segments 902a 20 through 902c are connected with bridges, 904a, 904b 21 and 904c, which may be formed on the second metal 22 layer." Do you see that? 23 A. Yes. 24 Q. So, those bridges are on the second 25 metal layer, not the first metal layer, correct?	Page 73 1 Q. "As shown in Figure 9A, transformer 900 2 includes a primary winding 902." Do you see that? 3 A. Yes. 4 Q. And 902 is the winding that you 5 isolated in your declaration, right? You sort of 6 extracted that to show us what that looks like alone, 7 correct? 8 A. I think that's correct, yes. 9 Q. "And that comprises winding segments 10 902a, 902b and 902c, which may be formed on a first 11 metal layer and a second metal layer." Do you see 12 that? 13 A. Yes, I do. 14 Q. "The primary winding segments 902a 15 through 902c are connected with bridges 904a, 904b and 16 904c, which may be formed on the second metal layer 17 930." Do you see that? 18 A. All right. I do see the bridges here. 19 Again, I'm not looking at a cross-section, but I do 20 see the bridges connecting those segments. 21 Q. Now, if you'll scroll down to 9C, 22 you'll see a cross-section of the transformer 23 illustrated in 9A. Do you see that? 24 A. Yes. 25 Q. "As shown in Figure 9C, the two metal

Page 74 1 layers 920 and 930 are vertically stacked over one 2 another." Do you see that? 3 A. Did you want me to look at 9B or 9C? 4 Q. 9C. 5 A. Oh, okay. So, in 9C, I'm looking for 6 metal layers stacked on top of each other. 7 Q. And 920 and 930 represent the first 8 metal layer and the second metal layer, respectively. 9 Do you see that? 10 A. Yes. 11 Q. And they're vertically stacked, 12 correct? 13 A. Correct. 14 Q. It says, "In some embodiments, metal 15 layers 920 and 930 are connected by one or more vias 16 925 formed in a first dielectric layer 970." Do you 17 see that portion of the cross-section? 18 A. Yes. 19 Q. A third metal layer, 940, is formed 20 below the first and second metal layers, 920, 930." 21 Do you see that? 22 A. Yes. 23 Q. Okay. So, if the first and second 24 metal layers compose the winding in this image, what 25 does the third metal layer represent?	Page 76 1 don't know if that metal layer is used for something 2 else somewhere else. 3 Q. Okay. So, if we go back to your 4 declaration, page 65, you should be able to click on 5 the arrow and go back to the exhibits, which is 1003. 6 A. I've got my declaration. What page did 7 you say? 8 Q. 65. 9 A. Okay. 10 Q. So, we just read through the 11 specification of Ho-Hsiang to identify what these 12 different segments are. This is the primary winding 13 902. 902a, b and c are segments. Would you agree 14 with that? 15 A. Yes. 16 Q. And then it says 904a, b and c are 17 bridges that are on a separate layer than the 18 segments, correct? 19 A. And the only bridge we see in this 20 figure is 904c, I believe. 21 Q. Yes, but 904a and 904b are also part of 22 this structure, correct? 23 A. Oh, that's right, yes. 24 Q. And those serve as bridges for coupling 25 with the other winding, correct?
Page 75 1 A. So, you're asking me what the -- the 2 third metal layer is labeled as, I believe, 940. 3 Q. That's correct. 4 A. I'd have to look at a description of 5 that. I'd have to look back at the spec to see how 6 940 is described. 7 Q. Okay. So, I'll help you out here. The 8 spec indicates that the input ports 914a, 914b for the 9 primary winding 902 are formed on a third metal layer 10 940. Do you see that? 11 A. Yes. So, right, I had forgotten. So, 12 if you don't mind, if we look at Figure 9D, we can see 13 the ports that you just read, 916a and 916b, for 14 example, and those ports extend under the winding, and 15 that's why they're on a third metal layer. 16 Q. Okay. So, the first and second metal 17 layers are the winding, and the third metal layer is 18 the ports, correct? 19 A. It's used for the ports, at least for 20 the ports, yes. 21 Q. What else is it used for? 22 A. I don't know. I just heard the 23 description that you read that 940, in Figure 9C are 24 the ports, and that corresponds to what I see in the 25 figures being the ports. So, I agree with that. I	Page 77 1 MR. MASULLO: Objection, form. 2 THE WITNESS: So, I see the 904a, b, 3 and c, which are bridges, and they allow this 4 winding to form a continuous loop or a couple 5 of continuous loops. So, there are bridges 6 within the winding. 7 BY MR. PARKER: 8 Q. If you go back up to page 62, you'll 9 see the transformer structure that is actually 10 disclosed in Ho-Hsiang. Do you see that, Figure 9A? 11 A. Yes. 12 Q. And you colored one winding pink, 13 correct? 14 A. Yes. 15 Q. And you colored another winding green, 16 correct? 17 A. Correct. 18 Q. At 904c, at the bottom, that represents 19 a crossover region of just the pink winding, correct? 20 A. Yes. 21 Q. And then at 904a and 904b, that 22 represents a crossover region of one winding 23 intermingled with a second winding, correct? 24 A. That's where the pink and green cross, 25 which are two different windings.

Page 78 1 Q. Okay. So, if you extract the pink 2 winding, as you've done on the next page, your opinion 3 that you render in this report is that this structure 4 renders obvious the claims of the '245 Patent. 5 A. Yes. 6 Q. And so, it's your understanding that 7 this structure is a stacked spiral inductor, correct? 8 A. Yes. 9 Q. And that shunt windings are formed by 10 the crossover region of the structure. 11 A. So, my opinion would be that the shunt 12 winding is formed by the vias between the layers. 13 That would be the shunting. 14 Q. Okay. And in order for there to be 15 shunting, there has to be more than one layer, 16 correct? 17 A. That is correct. 18 Q. So, at 904a and 904b, would you agree 19 that those are just a single layer? 20 A. I'd have to look at those crossovers, 21 but I think -- I'd really have to look at those 22 crossovers to understand that. So, I think that the 23 crossover that I was looking at in my report was the 24 -- well, I have to look at the report to tell which 25 one. But to answer your question, at 904a and 904b, I	Page 80 1 904b are each multiple layers? 2 Q. Well, we've already identified them as 3 single layers in this structure, and I guess what I'm 4 trying to understand is whether or not those parts of 5 this inductor are shunted, or how they could possibly 6 be shunted if they're a single layer. 7 A. I may not be understanding your 8 question, because it's the winding that's shunted by 9 the vias between two metal layers, and then the 10 crossover extends from one of those metal layers 11 providing a bridge to the remaining part of the 12 winding. 13 Q. So, Dr. Prucnal, when we isolate this 14 winding from the other winding in the transformer, 15 okay, we are only left with one crossover region, 16 correct? 17 A. Which is 904c, yes. 18 Q. Right. But we also have bridges at 19 904a and 904b, correct? 20 A. That's correct. 21 Q. And those bridges are intended to cross 22 over the other winding, but that winding is not part 23 of this single isolated structure, correct? 24 A. That's right, that other winding is a 25 different inductor.
Page 79 1 believe that the segments on either side are shunted, 2 multiple layers are shunted, on either side of 904a 3 and 904b. What I mean is on either side of the 4 bridge, or other side of the crossover, are shunted. 5 Q. But at 904a and 904b, this structure is 6 not shunted, correct? 7 MR. MASULLO: Objection, form. 8 THE WITNESS: I think I'd have to look 9 at that in cross-section, but I believe, my 10 understanding of the way this works, is that 11 say take 904a, we're looking at a bridge, and 12 on either side of the bridge there are vias 13 connecting two metal layers, and that's where 14 the shunting is. Similar for 904b. 15 BY MR. PARKER: 16 Q. But at the bridge, there is no 17 shunting, correct? 18 MR. MASULLO: Objection, form. 19 THE WITNESS: Well, at the bridge is on 20 either side of the bridge. The shunting 21 occurs on either side of the crossover. 22 BY MR. PARKER: 23 Q. Right, but not at 904a and 904b, 24 correct? 25 A. So, are you asking whether 904a and	Page 81 1 Q. So, when we isolate this winding from 2 the other winding, we are left with parts of the outer 3 loop that are a bridge, correct? 4 MR. MASULLO: Objection, form. 5 THE WITNESS: This winding has 904a and 6 b that are bridges, and that formed part of 7 the outer winding. 8 BY MR. PARKER: 9 Q. Right. And those parts of the outer 10 winding that are bridges are not in shunt, correct? 11 MR. MASULLO: Objection, form. 12 THE WITNESS: No, because the shunting 13 is where the vias attach the bridge to the 14 winding. So, 904a and b both have vias that 15 connect them to the winding. So, they still 16 form a shunt winding. 17 BY MR. PARKER: 18 Q. If this inductor were designed in 19 isolation, and not intended to couple with another 20 inductor, would there be bridges at 904a and 904b? 21 MR. MASULLO: Objection, form. 22 THE WITNESS: No. The purpose of these 23 bridges is to cross over or cross under the 24 upper inductor. So, if you just have an 25 inductor loop without any crossings required,

Page 82 1 you wouldn't have bridges at those locations. 2 BY MR. PARKER: 3 Q. Right. And in that instance, the 4 entire winding would be shunted except at the 5 self-crossing area, correct? 6 A. Right. Right, it's the portion of the 7 winding between the bridges that are shunted, and so 8 then the entire winding except at the crossover would 9 be shunted, that's correct. 10 Q. So, this inductor structure is modified 11 to accommodate coupling with another inductor 12 structure, correct? 13 A. Well, the inductor loop itself still 14 forms a continuous path, but to go over or under 15 another inductor, you need the crossovers, so you have 16 to put those crossovers in. 17 Q. Do you agree that transformer windings 18 are structurally modified to have high coupling? 19 MR. MASULLO: Objection, form. 20 THE WITNESS: I don't understand the 21 question. 22 BY MR. PARKER: 23 Q. Maybe I'll ask it another way. Do you 24 agree that transformers sacrifice quality factor to 25 optimize coupling coefficient?	Page 84 1 structure? 2 MR. MASULLO: Objection, form. 3 THE WITNESS: I don't think that's 4 necessarily the case. 5 BY MR. PARKER: 6 Q. Is it likely the case? 7 A. Well, the quality factor depends upon 8 the inductance and the resistance, and that would 9 depend how you made the octagon. So, if this were 10 changed to be a more regular octagon -- it just would 11 depend on a number of factors. 12 Q. If this were a more regular octagon 13 with closer-wound loops, wouldn't you have higher 14 inductance per area? 15 A. That's probably the case, yes. 16 Q. So, I think what I'm getting at here, 17 Dr. Prucnal, is when we isolate a winding like you've 18 done here from a transformer, the result is a winding 19 that has been specifically fabricated to accommodate 20 coupling with another winding, correct? 21 A. So, when you combine two windings to 22 form a transformer, the transformer is going to be 23 designed so those two windings will couple with one 24 another. You know, I think you said when you isolate 25 the winding, when you isolate one inductor. I'm not
Page 83 1 A. I would say that's possible. I would 2 have to look at that. I really haven't considered 3 that. It's possible, though. 4 Q. Would you agree that when you are 5 designing a transformer, intermingling the windings as 6 intimately as possible is preferable? 7 A. There's one aspect of doing that which 8 is preferable to increase the coupling coefficient. 9 There may be other factors at play that I probably 10 can't list right now, but there might be other types 11 of coupling that you want to avoid. But generally, 12 intermingling them in a way that increases the 13 coupling coefficient of the transformer would be 14 desirable. 15 Q. If you separate the windings of a 16 transformer, are you reducing the quality factor of 17 those individual windings? 18 A. That would have to be modeled in 19 detail, but I think if you take this inductor in 20 Figure 9A and compare its quality factor to when it's 21 combined with the transformer, there's just so many 22 things going on there, you know, in a physical circuit 23 that would come into play that it's hard to say. 24 Q. Would quality factor be improved in the 25 Figure 9A if it was a more regular octagonal	Page 85 1 sure what you were getting at. 2 Q. This winding in Figure 9A that you've 3 isolated or modified from the transformer has larger 4 spaces between the turns at the top of the winding 5 than it does at the bottom, correct? 6 A. Yes. If we look at the one inductor, 7 that forms part of the transformer. The fact that 8 it's part of the transformer, and that two inductors 9 were intermingled, led to there being a wider spacing 10 at the top here than might be otherwise. 11 Q. And for a standalone inductor that's 12 not going to be coupled in a transformer, having that 13 type of irregular spacing is not desirable, correct? 14 A. It would still be an inductor with the 15 wider spacing on the top than the bottom, but if you 16 were to design the inductor in isolation, you likely 17 would not purposely put wider spacing in. 18 Q. And if you were to design an inductor 19 in isolation, and your goal was to improve Q, you 20 would look to design a structure that has closer 21 spacing between its loops, correct? 22 A. I mean, if we're talking about an 23 inductor in isolation, but again, an inductor in a 24 circuit might have other considerations. I don't know 25 what they might be, as an example, but this inductor

Page 86 1 could be laid out in a particular way to accommodate 2 the rest of the circuit and other components. 3 Q. If the windings in the Figure 9A that 4 you've isolated were closer together in a more uniform 5 configuration, would you agree that they would take up 6 less surface area? 7 A. Well, that would depend upon whether 8 you expanded the inner loop or compressed the outer 9 loop. So, there would be other considerations 10 determining what the size of the loop would be. If 11 you compressed the outer loop, that would take up less 12 area. If you expanded the inner loop, it would take 13 up more area. 14 Q. So, the reason this isolated inductor 15 has this less uniform irregular shape is because the 16 goal when creating a transformer is to maximize the 17 coupling of its two windings, correct? 18 A. Well, in designing a transformer, the 19 two windings have to interact with one another, and 20 there are a number of ways that that can be done. In 21 this case, in this particular case, the windings were 22 intermingled to provide the coupling. 23 Q. Wouldn't a person of ordinary skill in 24 the art looking to optimize or improve quality factor 25 in an inductor rather have a regular-shaped,	Page 88 1 shunted all the way around the loop, it 2 provides a lower conductance, but where 3 bridges are required, they provide other 4 advantages. 5 BY MR. PARKER: 6 Q. If an inductor like the one you've 7 isolated in Figure 9A is not shunted all the way 8 around the loop, would you describe the winding as 9 shunted? 10 MR. MASULLO: Objection to form. 11 THE WITNESS: Well, that was a 12 heavily-discussed aspect of all of this, 13 because when Realtek identified the infringing 14 device, they pointed to just shunting of the 15 segment, segments 1 and 4, for example. They 16 didn't point to shunting of the entire loop. 17 On the other hand, shunting the entire loop 18 would provide lower conductance than just 19 shunting the segment they pointed out. 20 BY MR. PARKER: 21 Q. Okay. And so here, what you've got is 22 shunted segments, but not a shunted loop, correct, in 23 the isolated inductor in Figure 9A? 24 MR. MASULLO: Objection to form. 25 THE WITNESS: Well, it's shunted,
Page 87 1 uniform-shaped circle, square or polygon than the 2 shape that you've identified here in Figure 9A? 3 A. I think ideally, one wants to have a 4 symmetric inductor. Again, the difference between the 5 characteristics of this inductor and one that was 6 slightly more regular is not something I can say. In 7 other words, I don't know how meaningful the 8 difference would be in the performance of the inductor 9 with a slightly more regular or a slightly more 10 irregular. 11 Q. Now, you would agree that an inductor 12 that meanders is less than optimal, correct? 13 A. Generally, like the one we looked at 14 before, that's less than optimal. 15 Q. Would you also agree that someone 16 looking to design an inductor to optimize Q would 17 prefer to have the loops of the windings shunted in 18 their entirety than to have gaps in that shunting, as 19 you see here in 904a and 904b? 20 MR. MASULLO: Objection, form. 21 THE WITNESS: Well, the more shunting 22 there is, the more the conductance can be 23 improved. But there are always design 24 considerations -- I mean tradeoffs, design 25 tradeoffs. So, it may be that it's entirely	Page 89 1 except for the crossovers, which are necessary 2 for the geometry. So, everything else is in 3 parallel. Everything else is shunted in the 4 loop, other than the crossover. 5 BY MR. PARKER: 6 Q. Well -- 7 A. Shunted to the loop. Excuse me. 8 Q. Yeah, but in this inductor, the 9 standalone inductor that you are basing your analysis 10 on, it's not shunted on the sides where there are 11 bridges, correct? 12 A. Right. Where the bridges occur, the 13 shunting occurs on either side of the bridge for the 14 remainder of the loop until it reaches another bridge. 15 Q. Right. So, there's gaps in the 16 shunting at the bridges, correct? 17 A. Yes, that's correct. 18 Q. Do you agree that the isolated winding 19 that we see pictured here in Figure 9A that you've 20 modified, which is the basis of your analysis in your 21 declaration, would you agree that that isolated 22 winding would not function by itself as an on-chip 23 symmetrical transformer or balun device? 24 MR. MASULLO: Objection, form. 25 THE WITNESS: The one inductor shown

Page 90 1 here is not, by itself, a transformer or a 2 balun. 3 BY MR. PARKER: 4 Q. And you agree that Ho-Hsiang disclosed 5 a transformer balun structure, not an isolated 6 inductor structure that you have here, correct? 7 MR. MASULLO: Objection, form. 8 THE WITNESS: Ho-Hsiang is talking 9 about a transformer, but I believe 10 acknowledges that the transformer has two 11 inductors. 12 BY MR. PARKER: 13 Q. Right. And so, Ho-Hsiang sought to 14 provide a disclosure in teaching for an improved 15 substantially planar transformer suitable for use in 16 integrated circuits. Correct? 17 A. Yes. 18 Q. But the isolated winding that you're 19 using as the basis for your invalidity opinion 20 standing alone would not function as a planar 21 transformer suitable for use in integrated circuits, 22 correct? 23 A. This inductor standing alone in Figure 24 9A is not a transformer. It's part of a transformer. 25 Q. Okay, but this, standing alone, would	Page 92 1 that Ho-Hsiang is talking about for improving the 2 performance of the transformer would also improve the 3 performance of the inductor. 4 Q. But that wouldn't be the case if part 5 of the inductor winding is not shunted, correct? 6 MR. MASULLO: Objection, form. 7 THE WITNESS: No, that's not correct. 8 Any portion of the inductor winding that's 9 shunted is going to contribute to a lower 10 conductance. So, in other words, we want to 11 reduce -- so, the inverse of conductance is 12 resistance. What we want to do to have high Q 13 is to lower the resistance effectively. And 14 these resistances in the loop are a 15 combination of all of the resistances that are 16 in the loop. Going around the loop, the 17 resistance is the sum of the resistances that 18 comprise each segment of the loop, if you 19 will. So, the more of those, we can call them 20 segments, the more of those portions of the 21 loop that are shunted, the more that have a 22 reduced resistance or increased conductance. 23 So, you might get a little bit less resistance 24 if you also could shunt the bridges, but you 25 definitely benefit overall from having
Page 91 1 not work as a transformer on an integrated circuit, 2 correct? 3 A. No, this, standing alone, this single 4 inductor by itself, would not be a transformer. 5 MR. PARKER: Okay. Let's take a 6 10-minute break. 7 (A 10-minute recess was taken.) 8 BY MR. PARKER: 9 Q. Dr. Prucnal, we were just discussing 10 the Ho-Hsiang disclosure, and I wanted to circle back 11 on a question that I asked earlier, and that's why 12 would a person of ordinary skill in the art who is 13 looking to improve the quality factor of an inductor 14 consider the disclosure of a transformer balun 15 structure, as disclosed in Ho-Hsiang? 16 A. Well, again, I might have addressed 17 this in my report, so I would need to look at the 18 report to be very complete, but generally speaking, 19 Ho-Hsiang is teaching how to make an inductor with 20 crossovers, or a transformer, you could say, with 21 crossovers, as well, where multiple layers are shunted 22 together, multiple layers of metal in the winding 23 portion. And as we've discussed, shunting those metal 24 layers together reduces the resistance, increases the 25 conductance, and improves the Q. So, the same feature	Page 93 1 shunting on any portion, or in this case, most 2 of the winding. 3 BY MR. PARKER: 4 Q. Yeah, but that's not a novel concept 5 taught in Ho-Hsiang, correct? 6 A. Which concept? 7 MR. MASULLO: Objection, form. 8 BY MR. PARKER: 9 Q. That shunting lowers resistance. 10 A. No, that's not a novel concept to 11 Ho-Hsiang. Shunting is a well-known concept. 12 Q. Okay. So, if we're looking to improve 13 the quality factor of an inductor, why would we look 14 at a structure that has less segments that are 15 shunted, which is the case with the isolated inductor 16 that you have where there are unused parts of the 17 winding that are bridges? 18 MR. MASULLO: Objection, form. 19 THE WITNESS: We might be looking to 20 design an inductor that has crossovers in the 21 loop. And if we were going to design an 22 inductor with crossovers in the loop, and 23 wanted high Q and low resistance, what's 24 taught in Ho-Hsiang about shunting the 25 winding, as well as having a crossover or a

Page 94 1 bridge, would be desirable. 2 BY MR. PARKER: 3 Q. Okay. Do you have your declaration in 4 front of you? 5 A. If you want me to get a paper copy, I 6 have a clean copy behind me. 7 Q. No, no. Just project it on Exhibit 8 Share. Are you still looking at your declaration, 9 which is Exhibit 1003? 10 A. In fact, I am. 11 Q. Can you scroll down to page 111? 12 A. Okay. 13 Q. And you'll see there's a new section 14 that starts at the bottom of page 111 titled Ground 2: 15 Obviousness Based on Christensen. Do you see that? 16 A. Yes. 17 Q. And then you state in paragraph 192, 18 "Christensen discloses multilayer inductors used in an 19 on-chip transformer structure." Do you see that? 20 A. Yes. 21 Q. If you refresh your feed, it will take 22 you back to the exhibit folder, and we're going to 23 open up Christensen. 24 A. Okay. I did. 25 Q. If you go to Marked Exhibits,	Page 96 1 "According to the present invention, there is provided 2 a substantially planar transformer comprising a 3 plurality of windings and having an intermingled 4 portion in which at least a portion of a first winding 5 is intermingled with at least a portion of at least a 6 second winding." Do you see that? 7 A. Yes, I do. 8 Q. And is that your understanding of the 9 invention disclosed in Christensen? 10 MR. MASULLO: Objection, form. 11 THE WITNESS: Well, I would say that's 12 part of the invention. 13 BY MR. PARKER: 14 Q. Would you agree that Christensen is 15 seeking to improve a planar transformer by 16 intermingling its windings? 17 MR. MASULLO: Objection, form. 18 THE WITNESS: I would say that 19 Christensen is describing a transformer that 20 has two inductors as windings, that are 21 intermingled, and again, that's part of the 22 invention. That's part of the objective. In 23 other words, if I continue looking at this, it 24 goes on to say that in order to achieve this, 25 there are crossings, and then it goes on, this
Page 95 1 Christensen is Exhibit 1006. 2 (Exhibit 245-1006 was introduced.) 3 THE WITNESS: Got it. 4 BY MR. PARKER: 5 Q. And if you open that exhibit, do you 6 recognize that as the Christensen exhibit that's the 7 basis of your obviousness analysis in your 8 declaration? 9 A. Yes. 10 Q. So, if you scroll down to page 12 of 11 Christensen, you'll see in column 1, about halfway 12 down, Summary of the Invention section. Do you see 13 that? 14 A. Yes. 15 Q. And it says, "It is an object of the 16 present invention to provide an improved substantially 17 planar transformer suitable for use in integrated 18 circuits." Do you see that? 19 A. Yes. 20 Q. And you agree that one of the objects 21 of the Christensen invention is to improve 22 substantially planar transformers for use in 23 integrated circuits, correct? 24 A. Yes. 25 Q. Then the next paragraph says,	Page 97 1 is the very last sentence in the summary 2 section, that the bridge is "chamfered to 3 provide a terminal edge lying parallel to a 4 side edge of the bridge." This isn't the 5 entirety of it, but Christensen is also 6 talking about ways of increasing the 7 conductance by using multiple layers. 8 BY MR. PARKER: 9 Q. If you scroll up to Figure 1, do you 10 recognize that figure? 11 A. Yes. 12 Q. Would you agree that that figure is the 13 substantially planar transformer with two intermingled 14 windings that Christensen is disclosing and teaching? 15 A. I think so. 16 Q. And if you go to Figure 2, would you 17 agree that that is an image of one of the windings 18 isolated from the transformer structure? 19 A. Yes. 20 Q. Now, again, with this isolated winding, 21 we can observe a somewhat irregularly-shaped winding. 22 Would you agree? 23 MR. MASULLO: Objection, form. 24 THE WITNESS: Well, you know, I would 25 say that this generally has a square or

25 (Pages 94 - 97)

Page 98 1 rectangular aspect to it. Sort of like the 2 octagon that we saw, it was generally 3 octagonal, but then this bends inward, you 4 know, it has an area where the left side of 5 the square is smaller than the right side of 6 the square, so that they can be intermingled, 7 so that the two windings can be intermingled. 8 So, this is more irregular than a simple 9 square, but it has a square aspect to it. 10 BY MR. PARKER: 11 Q. Sir, the modifications to the 12 configuration to accommodate the intermingling is 13 purely a result of utilizing this winding as part of a 14 transformer structure, correct? 15 MR. MASULLO: Objection, form. 16 THE WITNESS: So, that's partly the 17 case. I mean, if we go back to Figure 1, 18 which we just looked at, we can see when the 19 two inductors are overlapped with one another, 20 we can see that it requires, at least in this 21 figure, it requires that the right-hand 22 primary winding, the primary inductor, has to, 23 sort of, slope inward at the middle in order 24 to accommodate the other inductor sloping 25 inward. So, that is a product of the fact	Page 100 1 MR. MASULLO: Objection, form. 2 THE WITNESS: That's a bit hard to say, 3 because there are a number of ways that 4 inductors can be placed close to one another 5 to make a transformer on an integrated circuit 6 on a planar substrate. So, that's the design 7 choice here that they've been brought together 8 in this particular way, and that they also are 9 allowing for crossovers in order to do so. 10 That's it. 11 BY MR. PARKER: 12 Q. If I were designing an inductor to be 13 used in isolation, not part of a transformer, would 14 there be a reason to use an irregular shape like this? 15 A. That's hard to say, in general. I 16 mean, as we've discussed just now, in this case, the 17 left side of this primary inductor in Figure 2 is 18 stepping in to accommodate the particular geometry of 19 this transformer. But you could have an inductor 20 that's accommodating other things in the circuit. In 21 general, it's hard for me to speculate, but there 22 could be other components in the circuit that one has 23 to place in various locations. I'm not saying that 24 would result in this particular geometry, but it could 25 affect the geometry of an inductor.
Page 99 1 that these two are intermingled. And you can 2 say that's responsible for some of the 3 irregularity, like you said. On the other 4 hand, you can say that part of the 5 irregularity has to do with the fact that the 6 leads of the transformer and the leads of the 7 inductors are sitting way out at the end like 8 that. So, you know, the fact that they're 9 sitting in Figure 2, I guess it is, the leads 10 5 and 6 are sitting all the way out at the 11 end, is purely a design choice. It doesn't 12 have to do with it being an inductor or a 13 transformer. 14 So, my answer is partly, it's due to 15 the intermingling, and partly, it's due to 16 just a design choice. 17 BY MR. PARKER: 18 Q. Certainly. But if we're looking at 19 Figure 2, if this inductor structure that you are 20 relying on for your analysis were not designed to, 21 sort of, maximize coupling with another winding to be 22 used in a transformer, wouldn't the inner loop simply 23 be a square or a rectangle, and wouldn't the outer 24 loop just proceed straight along a line, rather than 25 jet out 45 degrees from the inner loop?	Page 101 1 Q. Let's turn back to your declaration, 2 which you should be able to do by clicking on the 3 arrows. 4 A. Thank you. I've got it. 5 Q. Now, if we go to page 114, let me know 6 when you're there. 7 A. Okay. I'm there. 8 Q. Are you familiar with the images at the 9 top of page 114? 10 A. Yes. 11 Q. On the left, you have Figure 1, which 12 is an illustration of the planar transformer disclosed 13 by Christensen, and then in Figure 5, can you explain 14 to me what that figure represents? 15 A. Yes. So, Figure 1 is a planar view 16 looking down from the top, and Figure 5 is a 17 cross-section that has been -- I shouldn't say a 18 cross-section. I should say a 3-D view that's been 19 taken at the location that's indicated here in this 20 drawing. So, in other words, if you take Figure 1 on 21 the left, there's a crossover of the primary and 22 secondary winding on the left side with a dashed line 23 going across the bridge, or the overpass, and that 24 particular localized area is shown on the right-hand 25 side.

Page 102 1 Q. Understood. So, appreciating that the 2 dotted line in Figure 1 is illustrated in Figure 5, 3 you've got a situation, again, where the loops of the 4 winding, of both windings, are reduced to a single 5 layer where the windings cross over each other, 6 correct? 7 A. So, in this case, we'll call it the 8 purple winding, is crossing over, and the green 9 winding is crossing under, and each of those are a 10 single layer. And the windings are shunted on either 11 side of the overpass and underpass. 12 Q. Now, when you say overpass or 13 underpass, is it your understanding that the crossover 14 region of the two windings, which is 9f, which is 15 where the dotted line is, there's not a break in one 16 of the windings? 17 MR. MASULLO: Objection, form. 18 THE WITNESS: So, if we look at Figure 19 5, the purple winding, this is the upper 20 layer. I can't quite read the number, but do 21 you know what I mean by that? 22 BY MR. PARKER: 23 Q. Yes. You're saying the top 24 illustration, which is 10c, you're saying that's the 25 top layer?	Page 104 1 BY MR. PARKER: 2 Q. Well, those areas of the winding are 3 bridges, correct? 4 A. Well, if we just focus on 9b here, 5 there's a bridge that goes from the outer loop to the 6 inner loop within the oval or the circle, and then 7 there is also an underpass that goes from the inner 8 loop to the outer loop. So, electrically, there's 9 continuity across both of those places. However, the 10 shunted portion, as I've said before, extends from 11 where the vias connect the, we'll call it, first and 12 second layer. So, the parallel connection here of 13 multiple layers does not extend through the crossover. 14 It's on either end of the crossover. 15 Q. Yes, but it doesn't extend through the 16 segment that is labeled as 9a, or through the segment 17 that is labeled as 9e, or through the segment that's 18 labeled as 9f, or through the segment that's labeled 19 as 9c, correct? 20 MR. MASULLO: Objection, form. 21 THE WITNESS: I'm trying to make it 22 clear by explaining it rather than using 23 particular wording. The portions that are 24 shunted are only the ones that are in 25 parallel, and the portions of the shunting
Page 103 1 A. Exactly. So, in 10c, you've got the 2 winding, we'll call it the purple winding, is one of 3 the inductors. That continues uninterrupted across 4 that top layer 10c, whereas the green winding is 5 interrupted in the top layer, as we can see there. 6 The purple goes between the green, so the green is 7 interrupted. But these are shunted to the layer 8 below, and the layer below, which is called 10b, now 9 the green is continuous, without interruption going 10 across, and the purple is interrupted. And I don't 11 think we can see it here, but there are vias that 12 connect the upper and lower layers at the edges of the 13 bridge or overpass, and at the edges of the other 14 bridge or the underpass. 15 Q. If you scroll down to page 117, you'll 16 see Figure 2, which is an image of an isolated winding 17 of the Christensen transformer. Do you see that? 18 A. Yes. 19 Q. Now, similar to the isolated winding in 20 Ho-Hsiang, in this isolated structure you're going to 21 have a break in the shunt winding at 9a, 9e, 9f, and 22 9c, correct? 23 MR. MASULLO: Objection to form. 24 THE WITNESS: Could you please clarify 25 what you mean by break in the shunt winding?	Page 105 1 that are in parallel stop at the bridge and 2 then continue on the other side of the bridge. 3 BY MR. PARKER: 4 Q. Understood. So, we agree that there 5 are bridges located at 9a, 9e, 9f, and 9c in Figure 2 6 of Christensen? 7 A. Yes, those are all essentially similar. 8 Q. Right. And those bridges are 9 single-layer bridges designed to cross over the other 10 winding, correct? 11 MR. MASULLO: Objection, form. 12 THE WITNESS: Could we go back for a 13 moment and just look at that other figure that 14 shows the 3-D view? 15 BY MR. PARKER: 16 Q. Yes. It's up at the top of page 112. 17 A. I think I may be in the wrong place. 18 At the top of page 112, it just shows the top view, 19 and I think what I'm looking for is the 3-D 20 cross-sectional view, which is on page 114, Figure 5. 21 Do you have that? 22 Q. Top of 115. I'm with you. 23 A. Okay. It's the top of 114. 24 Q. I'm on it, yes. Figure 5, got it. 25 A. Okay, good. So, I am agreeing with you

Page 106 1 that, as we see here, in the region where there's a 2 crossover and a cross-under, there's a single layer 3 involved in the crossover and cross-under, but the 4 windings are shunted at the edges of those single 5 layers, and result in the winding that extends beyond 6 that to be in parallel and shunted. But at the point 7 where they cross over, as we can see here, of the 8 crossovers or the bridges with the underpass and 9 overpass are a single layer. 10 Q. And those places on the winding, it's 11 not shunted, correct? 12 A. The metal of the crossover itself, 13 within the crossover, is a single layer, and 14 therefore, it's not shunted to another layer. 15 Q. Understood. Okay. If we go back down 16 to the image on the top of page 117, would you agree 17 that this structure, in isolation, would have a lower 18 Q-factor than a comparable structure that does not 19 have four bridges along its winding? 20 MR. MASULLO: Objection, form. 21 THE WITNESS: That would be a bit hard 22 to compare. If you're asking me whether the 23 bridges increase the resistance a little bit, 24 the bridges would increase the resistance a 25 little bit. However, Christensen has spoken	Page 108 1 and 9c would not be necessary if you weren't coupling 2 this with another winding? 3 A. 9a, 9e, 9f, 9c, yes, those are the 4 bridges where the two inductors overlap, and those 5 bridges would not be needed if you weren't overlapping 6 the two inductors. 7 Q. Let me ask you this, the isolated 8 winding that's represented in Figure 2, would that 9 function as a substantially planar transformer 10 suitable for use in an integrated circuit, as 11 Christensen intended? 12 MR. MASULLO: Objection, form. 13 THE WITNESS: Well, I think we 14 discussed something similar earlier. The one 15 inductor, by itself, would not generally be 16 used as a transformer which requires two 17 inductors. 18 BY MR. PARKER: 19 Q. So, this winding standing alone would 20 not function as a planar transformer suitable for use 21 on an integrated circuit, correct? 22 MR. MASULLO: Objection, form. 23 THE WITNESS: Well, Christensen does 24 talk about transformers, but also talks about 25 inductors, as well. But an inductor by itself
Page 107 1 about wanting to make the conductivity of 2 these crossover regions as high as possible. 3 In fact, Christensen is teaching how to shape 4 that bridge area, the chamfering, I think he 5 called it, so that you can actually bring the 6 via as close as possible to the edge of the 7 bridge, and shorten the single layer as much 8 as possible. So, Christensen has in mind 9 designing this in order to minimize the 10 resistance, and, in turn, that would maximize 11 the Q. 12 BY MR. PARKER: 13 Q. For the transformer. 14 A. For each of the inductors. For the 15 transformer by extension. 16 Q. But the only reason you have bridges 17 along these windings is so that you can accommodate 18 the coupling necessary to fabricate a transformer, 19 correct? 20 A. Well, not if we consider just one 21 inductor. So, I believe that the bridge on the 22 right-hand side here, at 9b, would be necessary 23 whether or not this were intermingled with another 24 inductor. 25 Q. Right, but the bridges at 9a, 9e, 9f,	Page 109 1 is not a transformer. 2 BY MR. PARKER: 3 Q. Just so I'm clear, it's not your 4 opinion that this isolated winding would function as a 5 transformer? 6 A. No, the winding that's isolated is an 7 inductor, and it's not going to function as a 8 transformer. 9 MR. PARKER: Okay. I think now is a 10 good time to break for lunch, if it works for 11 you, Dr. Prucnal and J.C. How long would you 12 like to take? 13 MR. MASULLO: An hour? 14 MR. PARKER: Okay. Why don't we 15 reconvene at 12:50, which is 1:50 your time. 16 Is that right? 17 THE WITNESS: Yes. 18 MR. PARKER: All right. Thank you, 19 guys. 20 THE WITNESS: Thank you. 21 (A 1-hour recess was taken.) 22 MR. PARKER: Dr. Prucnal, are you ready 23 to go back on the record? 24 THE WITNESS: Yes, I am. 25 BY MR. PARKER:

Page 110 1 Q. Which exhibit do you have projected on 2 Exhibit Share right now? Is that your declaration? 3 A. Yes. 4 Q. So, if you could, will you hit refresh, 5 and go back to the Marked Exhibits folder? 6 A. Okay. 7 Q. And open up Exhibit 245-1007, which is 8 the Yang reference. Do you see that one? 9 (Exhibit 245-1007 was introduced.) 10 THE WITNESS: I've got it. 11 BY MR. PARKER: 12 Q. Great. Do you have that open? 13 A. Yes. 14 Q. Do you recognize that reference? 15 A. Yes. 16 Q. And you can zoom in if you need to, but 17 this Yang reference is one of the references that you 18 opine on in your declaration, correct? 19 A. Yes. 20 Q. Now, if we scroll down to page 4 of the 21 Yang reference, you will see the title of the 22 reference is Integrated Inductor. Do you see that? 23 A. Yes. 24 Q. If you zoom in, in the column on the 25 left-hand side you'll see Summary of the Invention.	Page 112 1 Q. What do you understand that sentence to 2 mean in the context of this Yang reference? 3 A. Well, it means that vias are used to 4 interconnect layers of metal. For example, in Figure 5 2, just one page above that, we can see that there are 6 vias that are labeled, the V with a subscript, 7 interconnecting three metal layers, and what that 8 sentence was saying is that those vias, at least in 9 one aspect of the invention, are formed using plugs or 10 hole-shaped -- the ones in the invention are using 11 line-shaped rather than, conventionally, hole-shaped 12 structures. 13 Q. Are you familiar with the term trench 14 via? 15 A. I believe I know what that means. 16 Q. When you read this description of one 17 aspect of the invention being the use of line-shaped 18 via structures, do you understand that to mean trench 19 via? 20 A. My understanding of a trench via would 21 be rather than making a hole through the insulator and 22 filling with metal, one would make a trench in the 23 insulation layer and fill it with metal. And that 24 pretty much looks like what is shown in Figure 2. So, 25 I think that trench vias and line-shaped vias are
Page 111 1 In paragraph 0008 it states, "It is one object of the 2 invention to provide a monolithic integrated inductor 3 with simple process, low cost and high Q-factor." Do 4 you see that? 5 A. Yes. 6 Q. And is it your understanding that 7 that's one of the objects of the invention disclosed 8 in this reference? 9 A. Yes. 10 Q. Then if you look in the next column on 11 the right, it says Detailed Description. Do you see 12 that section? 13 A. Yes. 14 Q. In that section, there's a paragraph 15 0014 that starts, "The invention pertains to an 16 improved integrated inductor structure capable of 17 improving the quality factor Q and reducing 18 manufacture cost thereof." Do you see that sentence? 19 A. Yes. 20 Q. The next sentence states, "From one 21 aspect, the invention uses line-shaped via structure, 22 instead of hole-shaped via plug, for electrically 23 connecting an upper level metal with a lower level 24 metal." Do you see that? 25 A. Yes.	Page 113 1 similar. I think a trench via would be a type of 2 line-shaped via. 3 Q. Okay. So, if you go back to page 4, 4 where the text is, just below Figure 2, if you look at 5 paragraph 6 in the left-hand column, it states, "One 6 of the most important characteristics of the inductor 7 is the quality factor Q, which relates to the 8 performance of the RF circuits and systems." Do you 9 see that? 10 A. Yes. 11 Q. And you agree with that sentence, 12 correct? 13 A. Yes, I do. 14 Q. The next sentence reads, "The quality 15 factor Q of an integrated circuit is limited by the 16 parasitic losses within the substrate itself." And we 17 discussed that today, and you agree with that 18 sentence, correct? 19 MR. MASULLO: Objection, form. 20 THE WITNESS: We discussed several 21 types of losses. I think we were talking 22 mostly about conductive losses through the 23 metal rather than in the substrate, but 24 substrate loss is one type. 25 BY MR. PARKER:

Page 114 1 Q. The next sentence reads, "These losses 2 include high resistance through metal layers of the 3 inductor itself." It then reads, "Consequently, in 4 order to achieve a high quality factor, resistance 5 within the inductor should be held to a minimum." Do 6 you agree with that sentence? 7 A. I think everything else being equal, if 8 one is considering only the resistance, that 9 minimizing the resistance would make the quality 10 factor higher. 11 Q. Then it states, "One approach to 12 minimizing the resistance of the inductor is 13 increasing the thickness of the metal used to 14 fabricate the inductor." Do you see that sentence? 15 A. Yes. 16 Q. Do you agree with that sentence? 17 A. Yes. I do believe, again, holding 18 everything else equal for a given width metal, 19 increasing its thickness would decrease the 20 resistance. 21 Q. Now, if I could turn your attention 22 back to your declaration. So, you can click to the 23 right or left until you see Exhibit 1003, or you can 24 go back to the Marked Exhibits folder and pull up 25 Exhibit 1003.	Page 116 1 you isolated in Ho-Hsiang, but an octagon that looks 2 fairly uniform in shape and in spacing between the 3 loops, correct? 4 MR. MASULLO: Objection, form. 5 THE WITNESS: Yes, this octagon is more 6 regular than the other one we just discussed. 7 BY MR. PARKER: 8 Q. Okay. And if you continue down to page 9 164, you'll see in paragraph 270, at the bottom, that 10 you reference Figure 2 of Yang, which you reproduced 11 on the following page, that shows a 12 sectional-perspective view of Figure 1. Do you see 13 that? 14 A. Yes. 15 Q. And if you scroll down, you'll see 16 Figure 2, which you pointed out when we were looking 17 at the Yang reference a minute ago, and that figure 18 shows several different layers. Would you agree? 19 A. Agree. 20 Q. And that top upper or first metal layer 21 you've highlighted in yellow, correct? 22 A. Yes. 23 Q. And then a lower or second metal layer 24 you've highlighted in blue. Do you see that? 25 A. Yes.
Page 115 1 A. I'll click to the right a couple times 2 and see what happens. There we go. So, this is my 3 declaration. 4 Q. Excellent. So, if you would go to page 5 162. 6 A. Okay. 7 Q. And on 162, you'll see there is a 8 section header towards the bottom that says 9 Obviousness Based on Yang. Do you see that section? 10 A. Yes. 11 Q. And then you note in paragraph 266 that 12 Yang discloses a symmetrical octagon-shaped inductor. 13 Do you see that? 14 A. Yes. 15 Q. And if you go to the next page, 163, 16 you'll see a picture of that inductor on the left. Do 17 you see that? 18 A. Yes. 19 Q. And do you recognize that figure on the 20 left to be from Yang? 21 A. I do. 22 Q. And the configuration of the Yang 23 inductor, you mentioned was an octagon, correct? 24 A. Yes. 25 Q. But not an octagon like the one that	Page 117 1 Q. Now, it looks like there is a third 2 metal layer that's not highlighted. Do you see that? 3 A. Yes. 4 Q. Is there a reason why that layer isn't 5 highlighted? 6 A. I assume I was only discussing the 7 upper two layers, but I would need to just review a 8 little bit before and after this figure to see what I 9 say about it. 10 Q. I actually think that's correct, Dr. 11 Prucnal. You are, for purposes of your analysis, 12 focusing on the top two layers. But you agree that 13 there's a third metal layer there, correct? 14 A. Yes. 15 Q. Okay. And then if we scroll down to 16 the next page, you'll see paragraph 272. You talk 17 about the figures, 1 and 2, of Yang, and then you say 18 in the last complete sentence on that page, "A POSITA 19 would have understood that this means multiple metal 20 layers (up to n) can be placed below the aluminum 21 metal layer (20) and above the substrate level (100)." 22 And there's a footnote in that paragraph where you 23 indicate that the specification of Yang notes 24 "preferably, n ranges between 4 and 8." And then you 25 state, "In other words, there are 4 to 8 metal layers

Page 118 1 total." Do you see that? 2 A. I do. 3 Q. And so, your understanding of Yang is 4 that the inductor that is disclosed could have 5 anywhere from four to eight metal layers, total, 6 correct? 7 A. That preferably, Yang is suggesting the 8 range would be between four and eight. 9 Q. So, even though Figure 2 only shows 10 three metal layers, it's our understanding of the 11 reference, based on what you've stated here and based 12 on what's in the specification, that there could be 13 several more metal layers as part of this inductor 14 structure, correct? 15 A. Yes. 16 Q. Now, in the structure that is 17 illustrated at the top of page 166 in Figure 1, there 18 are these lines, diagonal lines, that go through the 19 winding. Do you see those? 20 A. Yes. 21 Q. And what do you understand those 22 diagonal lines to represent? 23 A. Well, I understand them to represent, 24 for the purposes of illustration, a coloring-in of the 25 lines in the loop, basically showing from the top, the	Page 120 1 correct? 2 MR. MASULLO: Objection, form. 3 THE WITNESS: Well, the loops are 4 connected by crossovers. 5 BY MR. PARKER: 6 Q. And where is that illustrated in Figure 7 2? 8 MR. MASULLO: Objection, form. 9 THE WITNESS: No, it's illustrated in 10 Figure 1. And Figure 2 shows a cross-section 11 below the winding. So, ultimately, the 12 windings are connected by the crossovers in 13 the crossover shown in Figure 1, on the top 14 layer. 15 BY MR. PARKER: 16 Q. Right, but it's your position that 17 Figure 1 doesn't illustrate the whole crossover, 18 correct? 19 A. Figure 1 only shows the top layer 20 metal. And so, for example, the upper part of the 21 crossover is shown colored in yellow, and the lower 22 part of the crossover extending in the other direction 23 would be below that, on the metal layer below that. 24 Q. But that's not illustrated in Figure 1, 25 correct?
Page 119 1 top layer, where we consider there to be metal, it's 2 crosshatched with these lines, and when there's gaps 3 between the metal, it's not filled in. 4 Q. So, just so I'm clear, do you 5 understand those lines to illustrate the vias that are 6 connecting the metal layers of the winding? 7 A. I understand that the vias, according 8 to the way they're shown in Figure 2, are between the 9 metal layers. So, in Figure 2, we see aluminum on the 10 top, a via, and then a metal layer under that. And 11 those metal layers are a cross-section of the winding. 12 So, here we would have two turns of the winding sort 13 of next to each other in Figure 2, and the via would 14 be the line extending underneath it and connecting 15 those two metal layers. So, the vias are under the 16 loop, if you will, and the crosshatching represents 17 the metal on the top, for example, the aluminum layer. 18 Q. And your understanding is that the 19 cross-section that is illustrated in Figure 2 is taken 20 from the side of the Figure 1 winding, not the 21 crossover region, correct? 22 A. That's my understanding. 23 Q. And nothing in Figure 2 discloses to 24 you or anyone else reviewing this reference how the 25 loops of this winding are ultimately connected,	Page 121 1 MR. MASULLO: Objection, form. 2 THE WITNESS: No, Figure 1 is just 3 showing the top view of the metal, and 4 therefore, it's not showing the symmetric 5 crossover going in the other direction. 6 BY MR. PARKER: 7 Q. Is there anything else in Yang, picture 8 or otherwise, that illustrates a symmetric crossover 9 going the other direction on another metal layer? 10 MR. MASULLO: Objection, form. 11 THE WITNESS: Well, as I recall, Yang 12 is pretty short, and certain things are left 13 to the understanding of a person of ordinary 14 skill. And in this case, you know, I 15 understand that this is an inductor that has 16 to form a continuous loop in order to 17 function. So, he's showing the top layer 18 crossover. I know that there's going to be a 19 crossover below that to make the loop 20 electrically conductive. 21 BY MR. PARKER: 22 Q. Right, but that crossover section is 23 not illustrated in Yang, correct? 24 MR. MASULLO: Objection, form. 25 THE WITNESS: The, what I would call,

Page 122 1 underpass of the crossover is not illustrated 2 in Figure 1. It's left to the understanding 3 of a person of ordinary skill. 4 BY MR. PARKER: 5 Q. It's also not illustrated in Figure 2, 6 correct? 7 A. I'd like to just look back at the 8 patent. Figure 2 is a cross-section showing the two 9 windings, which are in yellow and blue. But it would 10 be helpful if I could look back at the description of 11 Figure 2 in the patent, since you're asking me about 12 this. 13 Q. Yeah, we can turn back to the patent, 14 but you agree that Figure 2 is a cross-section taken 15 on the side of the winding, not at the crossover 16 region of the winding, correct? 17 A. I believe so. The best way is to look 18 at the patent, because I think I could just be more 19 definitive in confirming that. But my understanding 20 is what I'm discussing here is a cross-section that 21 depicts two of the windings, a cross-section of two of 22 the windings. 23 Q. Correct. So, let's go back to Exhibit 24 1007, which is Yang, just so you can confirm your 25 understanding of that cross-section. I think if you	Page 124 1 Q. And that cross-section is not at the 2 crossover region of this inductor, correct? 3 A. Yes. 4 Q. So, given that Figure 2 is taken at the 5 side, you would agree that there's nothing in Figure 2 6 that illustrates what's happening at the crossover 7 region, correct? 8 MR. MASULLO: Objection, form. 9 THE WITNESS: Well, Figure 2 does show 10 several metal layers, three metal layers, to 11 be exact, and Figure 2, as we just discussed, 12 is the cross-section I-I prime, which in 13 Figure 1 is at the top of the octagon, the way 14 it's oriented on my page. So, I know that the 15 winding has that structure with the three 16 metal layers, and that winding is going to 17 come over to the boundary of the crossover, 18 and then I know that at each side of that 19 crossover I'll have these three metal layers, 20 and then what we have to do is get across 21 using bridges. 22 BY MR. PARKER: 23 Q. If you look at paragraph 18, do you see 24 that paragraph? 25 A. I'm getting there. Yes.
Page 123 1 go back to your Marked Exhibits folder you can pull it 2 up, or you can go right or left. 3 A. Okay. I clicked right, and I got it. 4 I'll just look at the description. 5 Q. While you're doing that, you would 6 agree that there's only two figures in Yang, right, 7 Figure 1 and Figure 2? 8 A. I'm pretty sure that's the case. I 9 agree, yes. 10 Q. Okay. And then if you go down to 11 paragraph 18 on page 4, that begins the discussion of 12 what's illustrated in Figure 1. 13 A. Okay. 14 Q. And then if you go down to the next 15 page, which is page 5 of 6, in paragraph 20 they begin 16 to describe what's shown in Figure 1 and 2. Do you 17 see that? 18 A. Yes. 19 Q. Now, Figure 2 is described in paragraph 20 13 as a sectional perspective view taken along the 21 line I-I prime of Figure 1, according to this 22 invention. And as you, sort of, previously indicated, 23 your recollection was that that I-I prime line was on 24 the side of the winding, correct? 25 A. Yes.	Page 125 1 Q. It says, "Figure 1 illustrates a top 2 view of an exemplary differential inductor 10 with 3 multi-turn windings according to this invention." 4 Then it says, "Figure 2 is a sectional perspective 5 view taken along line I-I prime of Figure 1 in 6 accordance with the one preferred embodiment of this 7 invention. For the sake of simplicity, only two 8 neighboring windings 12 of the differential pair are 9 shown in Figure 2." Do you see that? 10 A. Yes. 11 Q. So, for the sake of simplicity, they've 12 only shown those two, but there could be more, as you 13 mentioned earlier, optimally somewhere between four to 14 eight. Would you agree? 15 A. Well, I don't agree with the way you've 16 said it. I'm not sure if you intended to say it that 17 way, but my understanding of what this is saying is 18 Figure 1 has multi-turn linings. Figure 2 shows a 19 cross-section, but for the sake of simplicity, only 20 shows two windings. So, it's referring to there being 21 two windings, not two layers. I thought you said 22 layers. 23 Q. So, you would agree that there could be 24 more layers, I guess is what I'm getting at? 25 MR. MASULLO: Objection, form.

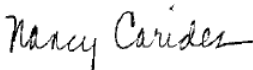
Page 126 1 THE WITNESS: Not from this particular 2 statement. I do agree that there can be more 3 layers than are shown in Figure 2, but this 4 statement, I think it's referring to the 5 cross-section and saying that only two 6 neighboring windings are shown in the 7 cross-section. So, if you look at Figure 2, 8 you see the two windings that are neighboring 9 are labeled 12. That's what I mean. And in 10 fact, in Figure 1, in the vicinity of that 11 cross-section, I-I prime, the two neighboring 12 windings are labeled 12, and that doesn't 13 relate to the number of layers. However, I do 14 agree that there could be more layers than are 15 shown. 16 BY MR. PARKER: 17 Q. So, I guess this is where the term 18 winding gets confusing, right? You're using winding 19 synonymous with loops, right? So, there's an outer 20 loop and an inner loop, and those are the two that are 21 reflected as 12, correct? 22 A. Yes. 23 Q. And what I'm saying is that the patent 24 teaches, or Yang teaches, that there could be more 25 metal layers than what is shown in Figure 2.	Page 128 1 Q. And so, it's your position that even 2 though a sixth segment is not disclosed in Yang, a 3 POSITA would have understood that it's inherently 4 there. Is that correct? 5 A. Yes, a POSITA would understand that 6 Yang's Figure 1 just shows the top metal layer, and 7 then in order to make this into an inductor that 8 functions with continuous loop, there needs to be a 9 sixth segment that completes the loop. So, it's 10 inherently there. 11 Q. Okay. Is there a reason why the sixth 12 segment would have to be on the second layer, as 13 you've suggested in paragraph 295? 14 A. Well, that would be an obvious way to 15 do it, but not the only way to do it. We know that at 16 the edges of the crossover that there are multiple 17 metal layers, and I've referred only to the top two 18 for the purposes of my discussions. Where the top 19 layer is crossing over to make, I guess that would be 20 the third segment that crosses over the top layer, is 21 a layer that's shown -- what's shown in Figure 1 is a 22 crossover that goes down from left to right. I think 23 that's the third segment. And I know that's in the 24 top layer, probably the aluminum layer. So, where 25 Yang has illustrated in Figure 2 that there are only
Page 127 1 A. Yes, I do agree with that. 2 Q. Okay. So, if we go back to your 3 declaration, let's go to page 178. Do you see that 4 page? 5 A. I haven't gotten there yet. Okay. 6 Q. Now, you say at the top of paragraph 7 293, which is at the bottom of the page, "A POSITA 8 would have understood that the sixth segment is 9 another portion of the winding found on the second 10 metal layer that is directly physically connected to 11 the fifth segment." Do you see that sentence? 12 A. Yes. 13 Q. Now, you acknowledged earlier that that 14 sixth segment is not illustrated in the figures of 15 Yang, correct? 16 MR. MASULLO: Objection, form. 17 THE WITNESS: Yes, that's correct. 18 BY MR. PARKER: 19 Q. So, at paragraph 294 on the next page 20 you state, "A POSITA would have understood that Yang 21 inherently discloses such a sixth segment as shown 22 below." And then below that, on the next page, is a 23 Figure 1 that you have annotated to add in a sixth 24 segment. Is that correct? 25 A. Correct.	Page 129 1 three metal layers, the underpass could be on the 2 second layer. You know, that would be an obvious way 3 to do it. It's not the only way to do it, because as 4 you've said, and I agree, there could be multiple 5 metal layers there. And that cross-under, that 6 underpass, could be on other ones. 7 Q. So, it doesn't really matter where that 8 underpass is, as long as there's an underpass, 9 correct? 10 MR. MASULLO: Objection to form. 11 THE WITNESS: What matters is that, 12 first of all, the loop be continued so there 13 isn't an open circuit, and second of all, that 14 the loop would be -- that the underpass would 15 be a continuation of a lower metal layer that 16 doesn't short with the other crossover. So, 17 there has to be a separation between the two. 18 It could be on other layers, but as I said, 19 layer 2 would be an obvious way to do it, 20 because that's what's being discussed here, is 21 the top two layers. 22 BY MR. PARKER: 23 Q. Well, that's what's being discussed 24 here for your purposes of analyzing this structure 25 with respect to the '245 Patent, but the Yang

Page 130 1 disclosure is not just focused on two layers, correct? 2 A. Correct. 3 MR. MASULLO: Objection to form. 4 BY MR. PARKER: 5 Q. The Yang disclosure actually states 6 that there could be four to eight layers, correct? 7 A. Yes. 8 Q. And so, to close the loop, you could 9 conceivably have an underpass on any of the layers 10 below the first layer, correct? 11 MR. MASULLO: Objection, form. 12 THE WITNESS: As long as the layers are 13 tied together by the vias shown, by the 14 line-shaped vias shown, so that they're 15 shunted as they're shunted in Figure 2, then 16 any layer would suffice to complete the 17 circuit going through the underpass. What's 18 shown in Figure 2 is only three layers. I 19 can't quite see what they're called. It looks 20 like they're called aluminum, Mn, Mn-1. So, 21 in referring to this diagram, all three of 22 these layers are shunted together, and as long 23 as they're shunted together on the other side, 24 as is explained in Yang, then you could cross 25 over with any of the others below. As long as	Page 132 1 that underpass is formed in would then be the sixth 2 segment. In other words, the sixth segment doesn't 3 have to be on the second layer. It could be on a 4 different layer. But there needs to be a sixth 5 segment to complete the circuit. 6 Q. Understood. You need a sixth segment 7 to complete the circuit, but you don't need a sixth 8 segment on the second metal layer, correct? 9 MR. MASULLO: Objection, form. 10 THE WITNESS: The completing of the 11 loop would occur whatever layer the sixth 12 segment is fabricated in, as long as the 13 winding is shunted at that point. 14 BY MR. PARKER: 15 Q. If the sixth segment is on the third 16 metal layer, would this be a closed circuit? 17 MR. MASULLO: Objection, form. 18 THE WITNESS: So, in the case of Figure 19 2, where there are three metal layers that are 20 shunted together, and the top metal layer is 21 used for the third segment, the overpass, the 22 sixth segment, could be used on the third 23 layer because it's connected to those other 24 shunted segments on each side of it. It still 25 provides electrical conductivity.
Page 131 1 they're all shunted together, any of the 2 layers below could serve as the underpass. 3 BY MR. PARKER: 4 Q. Understood. So, paragraph 295, you say 5 there are multiple reasons why you believe a POSITA 6 would have understood that Yang inherently discloses a 7 sixth segment, as you've illustrated in the annotated 8 Figure 1. Do you see that paragraph? 9 A. Yes, I do. 10 Q. Then you say, "First, it would have 11 been clear to a POSITA that without the sixth segment 12 where I have put it (directly physically connected to 13 the fifth segment), the inductor would not maintain 14 proper electrical conductivity among the various 15 windings. Now, that statement, given what we just 16 discussed, is not entirely accurate, correct? 17 MR. MASULLO: Objection, form. 18 THE WITNESS: I don't understand why 19 you're saying it's not accurate. 20 BY MR. PARKER: 21 Q. Well, because as we just discussed, the 22 underpass doesn't have to be on the second layer to 23 close the circuit, correct? 24 A. Well, but there needs to be an 25 underpass to complete the circuit, and whatever layer	Page 133 1 BY MR. PARKER: 2 Q. So, you could close the circuit by 3 putting the sixth segment on any layer below the top 4 metal layer, correct? 5 MR. MASULLO: Objection, form. 6 THE WITNESS: Provided the layers that 7 you're referring to as being any metal layer, 8 provided they're shunted together, and they're 9 in parallel, and a crossover segment connected 10 to one of those layers and connected to the 11 other side as a bridge would provide 12 electrical conductivity, it wouldn't really 13 matter, as long as the underpass isn't 14 touching the overpass on a different metal 15 layer. 16 BY MR. PARKER: 17 Q. Okay. If we consider Figure 1, the 18 unannotated version of Figure 1, and maybe we scroll 19 up for that just so there's no confusion, but the 20 unannotated version of Figure 1 shows the top view of 21 this inductor, which has at least three layers, now, 22 what if the top three layers are all identical 23 structures, connected by vias and in shunt, and then 24 the circuit is closed by a bridge or underpass that is 25 conducted by vias to the bottom layer.

Page 134 1 MR. MASULLO: Objection, form. 2 THE WITNESS: I can't quite visualize. 3 I got the first part of it, but could you try 4 to -- 5 BY MR. PARKER: 6 Q. So, you know earlier during your 7 deposition we talked about, you know, ways to close a 8 circuit, right? And Kyriazidou showed a bridge that 9 went underneath a layer, and it was connected by vias, 10 and then Moinian showed bridges that were alone, on 11 their own metal layers, that were connected to the 12 layers above them by vias. And you described that as 13 a well-known method of connecting an inductor, and you 14 referred to it as an underpass or a bridge. Do you 15 recall talking about that? 16 A. Yes. 17 Q. And couldn't we use the same structure 18 here to close this circuit? 19 MR. MASULLO: Objection, form. 20 THE WITNESS: I'd have to compare them 21 side-by-side. I'm having trouble translating 22 one to the other here. I'm not quite sure 23 what you're proposing. 24 BY MR. PARKER: 25 Q. So, if the three metal layers of this	Page 136 1 A. Yes. 2 Q. And then at the bottom of the bottom 3 layer, there is a bridge, connected to the bottom 4 layer by vias, that goes in the opposite direction to 5 close the loop on this inductor structure, just like 6 shown in Moinian and just like shown in Kyriazidou. 7 MR. MASULLO: Objection, form. 8 THE WITNESS: I don't recall the 9 similarity between the two. You're saying 10 that the existing Figure 1, that everything 11 that's shown, including the crossovers, are 12 three layers, and they're shunted together, 13 and then where there's an open circuit here, 14 that you cross over by going underneath all of 15 those? 16 BY MR. PARKER: 17 Q. Yes. The bottom layer is just a 18 bridge. 19 A. The bottom of the three layers, or an 20 additional layer below the three? 21 Q. Any of layer 4, 5, 6, 7, 8, 22 conceivably, but yeah, another layer beneath the three 23 is just a bridge that closes the loop. 24 A. I see. 25 Q. And you would agree that using an
Page 135 1 inductor are exactly the same, right, and by virtue of 2 them being exactly the same, the top view image 3 doesn't show a crossover section below that, right, so 4 where you see an outer loop going to an inner loop is 5 going to be the same for all three layers. Do you 6 understand what I'm talking about, stacking three 7 identical winding layers? 8 MR. MASULLO: Objection, form. 9 THE WITNESS: I think you're suggesting 10 that the crossover shown on the Figure 1 11 drawing also has three layers? Is that what 12 you're saying? 13 BY MR. PARKER: 14 Q. Yes. I guess what I'm saying is if 15 Figure 1 shows a 3-layer inductor from the top view, 16 and each layer is identical to what's shown there, 17 right, so you've got crossovers that overlap with each 18 other, right, going from an outer loop to an inner 19 loop on all three layers. 20 A. Including the crossover? 21 Q. Yes, including those diagonal pieces 22 that go from upper left to lower right. 23 A. Yes. 24 Q. And you've got three layers that all 25 look just like that. Can you envision that?	Page 137 1 underpass like that is well known in the art and would 2 close the loop? 3 MR. MASULLO: Objection, form. 4 THE WITNESS: I think I see what you're 5 saying now, so, in Figure 1, there are three 6 metal layers that are shunted together, as was 7 shown in Figure 2. 8 BY MR. PARKER: 9 Q. Yes. 10 A. But then I'm trying to scroll down 11 where I can see Figure 2. 12 Q. I think you can go to page 175 of your 13 declaration, and 1 and 2 are side-by-side. 14 A. Thanks. Okay. So, the shunt windings 15 are limited to the aluminum layer and the two metal 16 layers below that. The windings are just those three 17 layers, and the crossovers that are shown in Figure 1 18 are also the three layers. And now you're saying that 19 where the crossover is not shown, there would somehow 20 be a via that extends all the way down from the layers 21 that are shunted together, down to layer 8, or layer 22 7. 23 Q. Or layer 4. 24 A. Or layer 4. 25 Q. Right. And that layer is just a

Page 138 1 bridge. 2 A. And now there's just a bridge, and that 3 layer is not part of these three layers. That would 4 also provide electrical conductivity. That would 5 interconnect the shunted winding through another metal 6 layer to the shunted winding on the other side. In 7 principle, you could do that. 8 Q. And that would close the circuit, to 9 use a bridge on, say, layer 4, that's a standalone 10 metal layer? 11 A. That, by itself, would close the 12 circuit, but I think when these inductors are 13 designed, symmetry is a desirable thing, and so 14 usually, we're talking about symmetry in the 15 2-dimension plan looking from the top, but I think it 16 wouldn't be the first choice solution to use three 17 metal layers for the top crossover and then go below 18 them and down to the fourth level, and not utilize 19 that fourth layer for anything else. That would break 20 the symmetry. Also, it would seem to go against what 21 the patent is teaching, because this patent is 22 teaching -- so, Yang says, look, windings are 23 typically shunted using circular vias, but we want to 24 reduce the resistance, so we're using these lines to 25 reduce the resistance. So, if we use three layers for	Page 140 1 MR. MASULLO: Objection, form. 2 THE WITNESS: May I go back to the 3 paragraph in Yang that describes the -- 4 BY MR. PARKER: 5 Q. Yes, of course. 6 A. And I'm not sure I can pinpoint it now, 7 but -- 8 Q. I'll help you find it. Let me pull it 9 up, too. 10 A. And I'll go to there. 11 Q. So, Yang is 1007. 12 A. And I think I recall clicking to the 13 right is going to get me there. I've got it. Maybe 14 you can help me, because this is so small, but -- 15 Q. Try to zoom in, if you can, because I 16 agree it is small when it's zoomed out at 100 percent. 17 A. So, first of all, in paragraph 14, Yang 18 is talking about the invention. First of all, it says 19 he wants to improve the quality factor Q. And I 20 understand very quickly that he wants to improve the 21 quality factor Q by reducing the resistance of the 22 loops. So, he says next, the invention uses 23 line-shaped via structures instead of hole-shaped 24 plugs for electrical connections. So, we understand 25 that. The reason he's using line-shaped structures is
Page 139 1 one crossover, and then just one layer for the other, 2 it really wouldn't make a lot of sense, in light of 3 his teachings. 4 Q. Well, explain that, because you would 5 still have a line via connecting the bridge to the 6 bottom layer. 7 A. You would. Yes, you would. You would 8 have to fabricate another via at a lower level. 9 You're saying we wouldn't also use that lower level 10 for part of the inductor, so you're saying we're not 11 going to add another metal line that's going to be 12 shunted to the inductor winding, and then go through a 13 via down to a single metal layer that's not utilized. 14 And that would provide conduction, as you said, and I 15 agree, but I don't think it would make sense from the 16 perspective of Yang's goal to minimize the resistance. 17 In other words, if you're going to use metal layer 4, 18 why reserve it for just the underpass when Yang is 19 teaching that we can shunt the layers together and 20 reduce the resistance. 21 Q. Yeah, but Yang isn't teaching that 22 shunting reduces resistance. As you've previously 23 described, that was known in the art. Right? Yang is 24 just saying let's use trench vias instead of plugs, 25 right?	Page 141 1 to reduce the resistance. So, he goes on and says 2 conventionally, there are many plugs deposited for 3 electrical connection, conventional pole-shaped via 4 plugs have uniform shape and size; therefore, for the 5 sake of reducing resistance, an array of plugs is 6 utilized. I understand that he's trying to either add 7 more plugs closer together or make a line to reduce 8 the resistance and increase the Q. That's why I think 9 he has these three layers together, and if you put 10 another under it, that would be tied to it, because of 11 what he's saying here. I think there might have been 12 someplace else that was describing these lines, as 13 well. 14 Q. Let's go down to paragraph 21 on the 15 next page. It states, "One germane feature of this 16 invention is that the via plug layer Vn-1 and the via 17 plug layer Vn are both line-shaped." Do you see that? 18 A. Yes. 19 Q. So, again, it seems like the focus here 20 is on the use of these line-shaped vias instead of, I 21 think what he described as, conventional plugs. Would 22 you agree with that? 23 MR. MASULLO: Objection, form. 24 THE WITNESS: I agree that he's 25 focusing on using line-shaped plugs. They're

Page 142 1 not necessarily continuous lines. And it says 2 at the bottom of that paragraph in another 3 embodiment, the pattern of the line-shaped 4 plug may include several segmented-shaped 5 patents. But my point is that I agree that 6 he's teaching using line-shaped plugs, but the 7 reason for that is to improve the Q, by 8 reducing resistance, by tying the metal layers 9 together in the loop. 10 BY MR. PARKER: 11 Q. Just to circle back on the last point, 12 which is how to close the loop, given that it's not 13 illustrated or disclosed in Yang, we can agree that 14 there are a number of options that can be used, 15 correct? 16 A. Yes, we can agree on that in the 17 context of our discussion that as long as there's 18 electrical conductivity between the shunted layers on 19 either side, that can be done, in a number of ways. 20 Q. Understood. 21 MR. PARKER: Let's go off the record. 22 (Discussion held off the record.) 23 (Pause.) 24 MR. MASULLO: Back on. I'll just have 25 a couple redirect questions.	Page 144 1 Q. The latter. Well, first, why is 2 symmetry desirable? 3 A. Well, in making an inductor, one is 4 concerned about the magnetic field lines of the loops 5 reinforcing each other in an appropriate way, and 6 symmetry is going to favor that. 7 Q. And why would placement on the second 8 metal layer benefit that? 9 A. Well, I mean, it's immediately under 10 the first layer. You would have a single layer 11 connecting with the overpass, and a single layer 12 connecting with the underpass to the same shunted 13 windings on both sides. 14 MR. MASULLO: No further questions. 15 Thanks. 16 MR. PARKER: Just a couple follow-up, 17 Dr. Prucnal. 18 BY MR. PARKER: 19 Q. When you say symmetry, you don't mean 20 perfect symmetry, do you? 21 A. I don't mean that perfect symmetry can 22 be achieved, but perfect symmetry would be desirable. 23 Symmetry would be desired, is what I'm saying. 24 Q. And if the underpass were on a lower 25 level than the second metal layer, you would still
Page 143 1 BY MR. MASULLO: 2 Q. So, Dr. Prucnal, right before we went 3 to break, you were asked some questions about the 4 placement of the underpass in Yang, and whether it be 5 on the second metal layer, or the third metal layer, 6 or another subsequent metal layer. Do you recall that 7 discussion? 8 A. Yes. 9 Q. Do you have an opinion as to whether or 10 not a person of ordinary skill would have found it 11 obvious to put the underpass on the second metal 12 layer? 13 A. I do, yes. I think it would be 14 obvious, purely by reasons of symmetry. 15 Q. And when you say reasons of symmetry, 16 what do you mean? 17 A. Symmetry, I thought I had mentioned 18 that, that symmetry is desirable in making an 19 inductor, so the most obvious solution would be a 20 symmetric solution. So, one would have a crossover at 21 layer 1 and layer 2, right under it. 22 Q. Why? Why is that the case? 23 A. Do you mean why is it the case that 24 symmetry is desirable, or why would it be the case 25 that layer 2 would provide more symmetry?	Page 145 1 have symmetry, correct? 2 A. I think we discussed this before. I 3 mean, I think I addressed it before, that there's one 4 kind of symmetry when you're looking from the top, 5 down, at the shape of the inductor, and there would be 6 another kind of symmetry when you looked in 7 cross-section. So, it would be the latter. 8 Q. So, there would still be symmetry with 9 the underpass on a lower level, correct? 10 MR. MASULLO: Objection, form. 11 THE WITNESS: There wouldn't be 12 symmetry in the sense of looking at the 13 cross-section. 14 BY MR. PARKER: 15 Q. But there would be symmetry in the 16 sense of looking at it from the top, down? 17 MR. MASULLO: Objection, form. 18 THE WITNESS: So, looking at it from 19 the top, down, you would still have crossovers 20 going in either direction. 21 MR. PARKER: No further questions. 22 MR. MASULLO: No further questions on 23 the '245. Can we take a 20-minute break 24 before we start the other one? 25 MR. PARKER: Yes. Before we break,

Page 146 1 Doctor, first of all, thank you. It was good 2 to see you again, and I appreciate your time 3 today. 4 THE WITNESS: Likewise, it was great to 5 see you again. Off the record. 6 (Deposition concluded at 3:08 p.m.) 7 --- 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	
Page 147 1 REPORTER'S CERTIFICATE 2 3 I, Nancy Carides, RMR, CRR, a Notary Public and 4 Certified Court Reporter of the State of New Jersey, 5 License No. 30XI00236500, do hereby certify that prior 6 to the commencement of the examination, DR. PAUL R. 7 PRUCNAL was duly sworn by me to testify the truth, the 8 whole truth and nothing but the truth. 9 I DO FURTHER CERTIFY that the foregoing is a 10 true and accurate transcript of the testimony as taken 11 stenographically by and before me at the time, place 12 and on the date hereinbefore set forth. 13 I DO FURTHER CERTIFY that I am neither a 14 relative nor employee nor attorney nor counsel of any 15 of the parties to this action, and that I am neither a 16 relative nor employee of such attorney or counsel, and 17 that I am not financially interested in the action. 18 19  20 21 Notary Public of the State of New Jersey 22 My commission expires March 17, 2024 23 24 Certification Date: January 28, 2024 25	

&	100 36:19	120 36:21	116:16 117:17
& 2:3,8	37:15 40:2	37:22	118:9 119:8,9
0	117:21 140:16	1200 2:19	119:13,19,23
0006 34:4	1001 55:13	12:50 109:15	120:7,10 122:5
0008 36:4	59:10	13 33:24 72:7	122:8,11,14
111:1	1003 6:23	123:20	123:7,16,19
0014 111:15	32:20 63:2	130 36:22	124:4,5,9,11
1	76:5 94:9	37:24	125:4,9,18
1	114:23,25	14 140:17	126:3,7,25
1 27:9,13 31:9	1006 95:1	143 3:5	128:25 129:19
31:10 36:10,17	1007 122:24	144 3:4	130:15,18
42:7,11 43:12	140:11	1500 2:15	132:19 137:7
60:22 88:15	1018 33:25	16 10:19,23	137:11,13
95:11 97:9	10:35 44:13	55:13	138:15 143:21
98:17 101:11	10b 103:8	162 115:5,7	143:25
101:15,20	10c 102:24	163 115:15	20 36:16
102:2 109:21	103:1,4	164 116:9	117:21 123:15
116:12 117:17	110 3:15 36:20	166 118:17	145:23
118:17 119:20	37:18 41:2	17 147:22	20036 2:5
120:10,13,17	110b 37:1 38:7	175 137:12	2008/0074229
120:19,24	38:11 39:7,12	178 127:3	55:24 56:1
121:2 122:2	41:11	18 59:10	202-282-5897
123:7,12,16,21	110p 37:1 38:3	123:11 124:23	2:5
124:13 125:1,5	38:4 39:4,12	1901 2:4	2024 1:25
125:18 126:10	41:1,6 43:2,18	192 94:17	147:22,24
127:23 128:6	44:8	1:50 109:15	21 12:13 55:17
128:21 130:20	111 94:11,14	2	63:10 70:25
131:8 133:17	112 105:16,18	2 27:10,23 31:9	141:14
133:18,20	114 101:5,9	31:10 36:11,18	210 51:14
135:10,15	105:20,23	37:9 47:8	211 51:14
136:10 137:5	115 105:22	94:14 97:16	2121 2:9
137:13,17	117 103:15	99:9,19 100:17	214-453-6423
141:16 143:21	106:16	103:16 105:5	2:10
10 44:16 71:2	12 95:10 125:8	108:8 112:5,24	245 3:11 7:10
91:6,7 125:2	126:9,12,21	113:4 116:10	26:21 45:2

52:12,16,22 53:4,7,14 61:18 78:4 129:25 145:23 245-1001 3:10 55:1,8 245-1003 3:11 6:5,14,23 10:20 245-1005 3:13 68:21 69:8 245-1006 3:14 95:2 245-1007 3:15 110:7,9 245-1018 3:17 32:5 33:7 25 1:25 17:17 25629 147:20 266 115:11 27 26:11 270 116:9 272 117:16 28 147:24 29 27:10 293 127:7 294 127:19 295 128:13 131:4 2:2 71:8 72:18	3.1 46:21 30xi00236500 147:5 31 55:21 32 3:17 36 31:12 37 44:21 37203 2:15 38 47:7 39 48:22 3:08 146:6	136:21 501 2:14 53 12:12,15,19 54 13:3 55 3:10 15:9 19:6	8 8 117:24,25 136:21 137:21 84 45:23 85 48:20 87 50:20
	4	6	9
	4 2:19 3:4 36:13 44:5 88:15 110:20 113:3 117:24 117:25 123:11 136:21 137:23 137:24 138:9 139:17 415-882-8238 2:20 45 99:25 48 11:14,15 49 52:8,11	6 3:11 34:12,13 40:1 43:18 44:6 59:9,20 70:23 71:2 99:10 113:5 123:15 136:21 6,759,937 27:3 61 63:4 615-780-6751 2:16 62 63:15 77:8 63 17:24 64:21 64 19:5 65 18:11 76:4,8 66 20:10 68 3:13	9 33:24 900 2:9 71:13 72:18 73:1 902 63:23 71:14 73:2,4 75:9 76:13 902a 71:15,19 73:10,14 76:13 902b 71:15 73:10 902c 71:15,20 73:10,15 904a 71:20 73:15 76:16,21 77:2,21 78:18 78:25 79:2,5 79:11,23,25 80:19 81:5,14 81:20 87:19 904b 71:20 73:15 76:21 77:21 78:18,25 79:3,5,14,23 80:1,19 81:20 87:19 904c 71:21 73:16 76:20 77:18 80:17
3	5	7	
3 36:13 39:25 44:5 101:18 105:14,19 135:15	5 36:13 38:24 39:2,15,20 40:1 42:10 43:14,18 44:6 99:10 101:13 101:16 102:2 102:19 105:20 105:24 123:15	7 43:18 44:6 136:21 137:22 7,936,245 1:5 3:10 5:3 7:7 55:9 70 26:18 72 27:2 75201 2:10	

906 63:24 914a 75:8 914b 75:8 916a 75:13 916b 75:13 920 71:16 74:1 74:7,15,20 925 74:16 930 71:16 73:17 74:1,7 74:15,20 940 74:19 75:2 75:6,10,23 94111 2:20 95 3:14 970 74:16 98 52:19 99 53:12 9:02 1:25 9a 63:18,21 64:2,5,22 65:10 71:7,12 71:13 72:6,17 73:1,23 77:10 83:20,25 85:2 86:3 87:2 88:7 88:23 89:19 90:24 103:21 104:16 105:5 107:25 108:3 9b 74:3 104:4 107:22 9c 73:21,25 74:3,4,5 75:23 103:22 104:19	105:5 108:1,3 9d 75:12 9e 103:21 104:17 105:5 107:25 108:3 9f 102:14 103:21 104:18 105:5 107:25 108:3 a a.m. 1:25 able 5:12 23:2 23:3 32:7 44:19 46:9,15 55:8 69:3 76:4 101:2 above 1:15 19:5,7 34:9 38:15 40:11 59:13 112:5 117:21 134:12 abstract 33:12 34:17 69:13 academia 7:15 access 5:16 6:3 44:19 accommodate 67:15,19 68:4 82:11 84:19 86:1 98:12,24 100:18 107:17 accommodati... 100:20 accomplish 15:2,5	accomplished 49:21 accordance 34:13 42:25 71:9 72:19 125:6 accumulate 17:6 accurate 5:23 57:11 131:16 131:19 147:10 achieve 96:24 114:4 achieved 144:22 achieving 9:16 acknowledged 127:13 acknowledges 53:15 90:10 action 147:15 147:17 actually 28:17 32:7 33:20 42:2 59:3 77:9 107:5 117:10 130:5 adapt 24:8 add 31:6 127:23 139:11 141:6 addition 8:2 66:25 additional 61:5 136:20	addressed 91:16 145:3 advanced 1:4 advantage 46:22 61:17 advantageous... 36:5 advantages 88:4 affect 54:19 62:9 100:25 ago 48:21 54:22 57:7 116:17 agree 27:18,21 27:22 28:6,9 28:12 29:23 30:1 31:16 36:14 37:18 40:22 53:3,7 53:22 54:5,14 54:19 56:13 60:1 61:2,7,9 65:20 66:11 67:4 72:9 75:25 76:13 78:18 82:17,24 83:4 86:5 87:11,15 89:18 89:21 90:4 95:20 96:14 97:12,17,22 105:4 106:16 113:11,17 114:6,16
--	--	---	---

116:18,19 117:12 122:14 123:6,9 124:5 125:14,15,23 126:2,14 127:1 129:4 136:25 139:15 140:16 141:22,24 142:5,13,16 agreed 4:1 28:3 29:24 40:24 54:6 agreeing 105:25 ahead 6:2 allow 37:4 77:3 allowing 100:9 aluminum 117:20 119:9 119:17 128:24 130:20 137:15 analysis 10:15 10:17 89:9,20 95:7 99:20 117:11 analyzing 129:24 annotated 127:23 131:7 answer 10:8,10 10:11 13:23 14:9 26:2 38:17 51:12 64:25 66:16 78:25 99:14	appeal 1:2 appear 43:19 58:17 65:17,18 65:19,19 appears 27:17 28:2 47:9 application 3:15,17 9:6 13:3 19:25 22:24 23:5,20 23:23 24:13 25:10 26:4 31:21 applications 12:20,23 13:5 13:6 20:3,6 appreciate 146:2 appreciating 102:1 approach 114:11 approaches 18:15 appropriate 144:5 area 11:16 12:2 12:4,10 23:18 49:1,15 64:17 64:18 82:5 84:14 86:6,12 86:13 98:4 101:24 107:4 areas 104:2	argues 54:8 array 141:5 arrow 32:8 44:20 62:25 76:5 arrows 38:5 55:3 69:4 101:3 art 27:13,24 31:17 53:21 54:3,8,20,21 56:14 58:7 60:22 66:13 67:3 86:24 91:12 137:1 139:23 artist 47:14 asked 91:11 143:3 asking 5:21 6:7 22:12,14,18 25:21 30:7 40:16 75:1 79:25 106:22 122:11 aspect 10:18 34:14 83:7 88:12 98:1,9 111:21 112:9 112:17 aspects 16:22 43:1 49:18 associated 20:12 21:15 22:5,9 46:14	assume 41:25 52:15 117:6 attach 81:13 attempts 53:8 attention 114:21 attorney 147:14,16 attorneys 4:1 avoid 83:11 axis 68:10
			b
			b 3:8 76:13,16 77:2 81:6,14 back 32:21 37:8 39:19 43:12,13 44:12 44:12,18 51:9 57:2 60:21 61:11 62:24 66:16 68:23 70:18,20 71:12 75:5 76:3,5 77:8 91:10 94:22 98:17 101:1 105:12 106:15 109:23 110:5 113:3 114:22,24 122:7,10,13,23 123:1 127:2 140:2 142:11 142:24 background 7:14 11:4,10

30:12 52:21 53:21 55:14 65:17 66:13 67:3 balun 63:12 71:3 89:23 90:2,5 91:14 bandwidth 9:6 9:17 20:4 based 23:15 63:8 94:15 115:9 118:11 118:11 basically 118:25 basics 11:7,9 11:11 basing 89:9 basis 24:5 89:20 90:19 95:7 bear 31:25 beferguson 2:6 beginning 12:19 begins 123:11 behaves 17:14 behavior 18:15 24:18 believe 75:2 76:20 79:1,9 90:9 107:21 112:15 114:17 122:17 131:5	bends 98:3 beneath 136:22 benefit 27:5 92:25 144:8 best 45:24 46:4 48:24 49:17 70:14 122:17 better 62:2 beyond 106:5 bio 68:18 bit 66:9 92:23 100:2 106:21 106:23,25 117:8 blue 116:24 122:9 board 1:2 bookmarks 6:17 boost 14:12,14 bottom 11:1 16:3 33:17 37:22 38:4,16 40:10,11 50:23 66:3,6 70:7 77:18 85:5,15 94:14 115:8 116:9 127:7 133:25 136:2,2 136:3,17,19 139:6 142:2 boundary 124:17 bracket 41:6	bracketing 41:6 brackets 39:13 break 44:11 68:18,20 91:6 102:15 103:21 103:25 109:10 138:19 143:3 145:23,25 brian 2:4 bridge 28:5,12 28:17,19 29:4 29:6,9,11,19,22 30:1,4,5,6,9,9 30:22 31:1,4 31:11 33:14 34:16 35:11,25 37:1,3 38:7,11 38:13,16,19 41:10,15,22 42:4,4,22,22 43:23,25 44:1 44:3,4,7 51:20 51:21,21,24 52:2 57:11,15 57:17 58:23 59:4 70:2 76:19 79:4,11 79:12,16,19,20 80:11 81:3,13 89:13,14 94:1 97:2,4 101:23 103:13,14 104:5 105:1,2 107:4,7,21	133:11,24 134:8,14 136:3 136:18,23 138:1,2,9 139:5 bridges 33:23 71:20,24 73:15 73:18,20 76:17 76:24 77:3,5 80:18,21 81:6 81:10,20,23 82:1,7 88:3 89:11,12,16 92:24 93:17 104:3 105:5,8 105:9 106:8,19 106:23,24 107:16,25 108:4,5 124:21 134:10 brief 36:9 briefly 7:14 bring 107:5 brought 100:7 browser 33:3 build 8:4 built 40:2 41:2 41:11 button 34:8
			c
			c 2:1,3 4:17 46:12 76:13,16 77:3 california 2:20

call 29:10 30:22 92:19 102:7 103:2 104:11 121:25 called 28:16 46:10 103:8 107:5 130:19 130:20 calling 42:3 capable 59:15 111:16 capacitance 17:2,4,7 24:17 46:14,15 47:2 capacitive 50:10,17,18 capacitors 18:19 carides 1:17 147:3 case 1:4 15:22 23:4 24:4,4 32:10 62:19 84:4,6,15 86:21,21 92:4 93:1,15 98:17 100:16 102:7 121:14 123:8 132:18 143:22 143:23,24 cases 20:5 25:10,12 catch 50:15 cause 17:3	causes 20:24 ccliu 2:11 center 2:19 68:10 certain 23:2 68:7,11 121:12 certainly 99:18 certificate 147:1 certification 147:24 certified 1:17 147:4 certify 147:5,9 147:13 cetera 39:12 chamfered 97:2 chamfering 107:4 changed 84:10 characteristic 19:15 characteristics 48:12 87:5 113:6 characterized 16:4,7 19:3 36:6 charge 17:6 charles 2:8 chip 23:12 24:13 25:1,3,6 25:9,12,25 49:12 63:11 64:10 89:22	94:19 chips 8:8,12 9:2 choice 99:11,16 100:7 138:16 christensen 3:14 94:15,18 94:23 95:1,6 95:11,21 96:9 96:14,19 97:5 97:14 101:13 103:17 105:6 106:25 107:3,8 108:11,23 circle 65:17 70:20 87:1 91:10 104:6 142:11 circles 65:24 circuit 9:6 13:22,24 14:5 14:8,9 28:11 30:15,19 31:5 31:8,10,11,18 33:13 34:15,20 43:24 44:2 58:4 83:22 85:24 86:2 91:1 100:5,20 100:22 108:10 108:21 113:15 129:13 130:17 131:23,25 132:5,7,16 133:2,24 134:8 134:18 136:13	138:8,12 circuits 7:25 8:1,5,6,6 13:6 14:13 18:20 22:25 23:1 24:19 26:20 49:14 90:16,21 95:18,23 113:8 circular 45:20 45:21,24 46:3 46:9,13 47:10 48:5 66:22 138:23 cited 46:23 53:21 54:4 claimed 61:17 claims 78:4 clarify 103:24 clarifying 65:1 clean 94:6 clear 39:9 60:3 104:22 109:3 119:4 131:11 click 7:1 10:22 32:8,13,18,25 34:10 62:25 76:4 114:22 115:1 clicked 123:3 clicking 6:21 44:20 69:3 101:2 140:12 close 15:15 28:10 30:15,18 31:18 47:11
--	--	---	--

48:4,17 49:25 50:4,5 100:4 107:6 130:8 131:23 133:2 134:7,18 136:5 137:2 138:8,11 142:12 closed 132:16 133:24 closer 18:14 84:13 85:20 86:4 141:7 closes 43:23 136:23 coefficient 82:25 83:8,13 coil 18:1 coils 26:21 colored 77:12 77:15 120:21 coloring 118:24 column 34:2 55:13 59:9,12 59:20 60:22 70:23 71:2 95:11 110:24 111:10 113:5 combination 46:12 47:1 65:6 92:15 combine 46:13 84:21 combined 42:15 83:21	come 19:17 20:5,21 24:20 44:12,12 50:3 50:7 83:23 124:17 comes 19:12 58:22 coming 29:25 30:6,8 commencem... 147:6 commencing 1:25 commerce 2:14 commission 147:22 common 30:15 30:25 53:15 comparable 106:18 compare 83:20 106:22 134:20 compared 62:16 66:12 complete 17:13 44:1 58:4 60:25 63:16 91:18 117:18 130:16 131:25 132:5,7 completes 128:9 completing 132:10	component 14:5,11 16:22 23:24 24:1 components 49:13,13 86:2 100:22 compose 74:24 composes 64:11 compressed 86:8,11 comprise 41:2 41:11 92:18 comprises 35:2 35:11,19 36:19 73:9 comprising 10:16 37:17 71:14 96:2 conceivably 130:9 136:22 concept 93:4,6 93:10,11 conceptions 47:15 concern 8:18 9:3 concerned 19:20,24 20:6 23:5,6 24:16 56:10 144:4 concluded 146:6 conductance 87:22 88:2,18	91:25 92:10,11 92:22 97:7 conducted 133:25 conduction 139:14 conductive 21:1 113:22 121:20 conductivity 54:10,17 59:22 60:15,17,19 61:5,6,20,24 62:10,11 107:1 131:14 132:25 133:12 138:4 142:18 conductor 20:18 29:15 45:17 47:18 conductors 20:19 21:4 48:4 configuration 49:5,7,23 50:24 51:17 67:22 86:5 98:12 115:22 configurations 45:6,8 47:4,6 60:23 66:14 confirm 29:5,8 30:14 42:2 122:24
---	--	---	---

confirming 122:19	consider 26:5 31:8 70:11	continuous 30:21,23 31:10	64:6,11 65:12
confusing 126:18	91:14 107:20	37:5 77:4,5	66:14 71:25
confusion 133:19	119:1 133:17	82:14 103:9	72:11,23 73:7
connect 81:15	consideration 49:16 50:12	121:16 128:8	73:8 74:12,13
103:12 104:11	considerations 85:24 86:9	142:1	75:3,18 76:18
connected 29:23 30:9	87:24	contribute 92:9	76:22,25 77:13
35:6,14,22	considered 49:19 83:2	controlling 8:7	77:16,17,19,23
43:3,4,8,19,21	considering 16:17,21 114:8	conventional 141:3,21	78:7,16,17
51:22,25 70:2	consistent 56:13 59:18	conventionally 112:11 141:2	79:6,17,24
71:20 73:15	consists 15:16	copy 10:22	80:16,19,20,23
74:15 119:25	19:14 43:7	55:9 94:5,6	81:3,10 82:5,9
120:4,12	construct 58:6	core 15:25 16:1	82:12 84:20
127:10 131:12	62:15	17:25	85:5,13,21
132:23 133:9	constructing 10:14 48:9,23	corporation 1:8	86:17 87:12
133:10,23	contact 43:3	correct 4:20,23	88:22 89:11,16
134:9,11 136:3	context 14:17	7:17 8:21,24	89:17 90:6,16
connecting 73:20 79:13	70:6 112:2	9:12 10:10	90:22 91:2
111:23 119:6	142:17	11:7,12,13	92:5,7 93:5
119:14 134:13	continuation 129:15	19:23 21:19	95:23 98:14
139:5 144:11	continue 96:23	22:6 23:25	102:6 103:22
144:12	105:2 116:8	26:1 28:20	104:3,19
connection 61:25 104:12	continued 129:12	29:7 30:10,11	105:10 106:11
141:3	continues 41:1	30:24 34:17	107:19 108:21
connections 66:1 140:24	60:13 103:3	37:19 38:20	110:18 113:12
connects 36:1	continuity 104:9	41:8,17 43:9	113:18 115:23
consequently 114:3		43:24 44:6	116:3,21
		47:4,5 51:13	117:10,13
		51:22 52:3,4,6	118:6,14
		52:17 53:5,6	119:21 120:1
		53:10,11 57:23	120:18,25
		58:1,7 59:18	121:23 122:6
			122:16,23
			123:24 124:2,7
			126:21 127:15
			127:17,24,25

128:4 129:9 130:1,2,6,10 131:16,23 132:8 133:4 142:15 145:1,9 corresponded 57:9 corresponds 75:24 cost 111:3,18 counsel 147:14 147:16 couple 68:17 77:4 81:19 84:23 115:1 142:25 144:16 coupled 15:10 15:14,16,18 21:18 85:12 coupling 24:3,8 76:24 82:11,18 82:25 83:8,11 83:13 84:20 86:17,22 99:21 107:18 108:1 course 24:21 47:13 68:16 140:5 court 1:17 5:23 27:6 147:4 cover 49:15 66:3,5 covered 64:17 create 15:21 23:13 48:18	62:21 created 47:23 creates 48:2 creating 47:16 86:16 cross 37:4 39:2 41:24 42:2,6 42:20 43:13,17 57:13,14 73:19 73:22 74:17 77:24 79:9 80:21 81:23,23 101:17,18 102:5 105:9,20 106:2,3,7 119:11,19 120:10 122:8 122:14,20,21 122:25 124:1 124:12 125:19 126:5,7,11 129:5 130:24 136:14 145:7 145:13 crosses 128:20 crosshatched 38:15 119:2 crosshatching 119:16 crossing 42:21 82:5 102:8,9 128:19 crossings 81:25 96:25	crossover 27:21 28:9 42:13 52:25 53:9,25 54:5 54:11,17 56:11 56:24 57:6,10 57:25 58:5,14 58:20,23 59:17 59:22 60:7,8,9 60:15,17,25 61:1,5,20,24 62:5,8,11,15,18 62:20 77:19,22 78:10,23 79:4 79:21 80:10,15 82:8 89:4 93:25 101:21 102:13 104:13 104:14 106:2,3 106:12,13 107:2 119:21 120:13,17,21 120:22 121:5,8 121:18,19,22 122:1,15 124:2 124:6,17,19 128:16,22 129:16 133:9 135:3,10,20 137:19 138:17 139:1 143:20 crossovers 33:22 42:18 51:14 61:15 66:1 78:20,22	82:15,16 89:1 91:20,21 93:20 93:22 100:9 106:8 120:4,12 135:17 136:11 137:17 145:19 crr 1:17 147:3 curly 39:12 current 21:3,5 30:21,23 32:8 47:17,19,22,25 48:1 cut 42:11 68:9 cutting 42:17 cycle 18:3
			d
			d 3:1 27:6 101:18 105:14 105:19 d.c. 2:5 dallas 2:10 dashed 101:22 date 26:21 45:2 147:12,24 decade 8:8 deciding 50:3 declaration 3:12 5:1 6:3,14 6:24 7:6 10:20 17:18 26:12 31:13 32:17 33:10 44:19 48:22 52:9,12 62:24 63:1 73:5 76:4,6

89:21 94:3,8 95:8 101:1 110:2,18 114:22 115:3 127:3 137:13 decrease 114:19 decreases 20:20 dedicated 60:9 defined 51:24 definitely 92:25 definitive 122:19 degrees 99:25 depend 19:25 22:23 23:20 24:13,19 48:12 61:21 62:12 84:9,11 86:7 dependent 13:24 25:10 depending 26:9 depends 14:4 23:10 84:7 depicts 122:21 deposited 141:2 deposition 1:8 5:7,8,15 32:15 32:20 134:7 146:6 describe 45:11 88:8 123:16	described 8:12 19:9 21:22 27:24 31:17 41:20 44:8 52:6 57:22 58:3 75:6 123:19 134:12 139:23 141:21 describes 11:23 36:17 41:22 45:16 140:3 describing 19:13 70:6 96:19 141:12 description 3:9 19:17 33:21 38:23 39:15,20 75:4,23 111:11 112:16 122:10 123:4 descriptions 36:9 design 7:21 9:8 9:22 10:1,1,6 10:12 11:24 16:11,14,16 17:8,10,12,15 18:25 19:19 20:7 23:11,24 24:9,25 25:1 25:16,16,17,18 25:23,24,24 26:6 48:13 70:10 85:16,18 85:20 87:16,23	87:24 93:20,21 99:11,16 100:6 designed 22:15 22:15 23:21 25:6,6,8 26:9 81:18 84:23 99:20 105:9 138:13 designing 7:22 8:1,8,13,16,20 8:25 9:2,11,24 10:3,8 21:8 23:4 24:6,12 26:3 83:5 86:18 100:12 107:9 desirable 46:17 49:14 83:14 85:13 94:1 138:13 143:18 143:24 144:2 144:22 desired 9:16,16 68:8 144:23 detail 18:21 48:12 83:19 detailed 17:12 111:11 determined 47:1 determining 86:10 device 16:24 18:14 25:12 33:13 34:14	35:2 36:6,11 36:12,19 37:14 40:2 69:16 88:14 89:23 devices 1:4 diagonal 118:18,22 135:21 diagram 29:11 31:5 130:21 diameter 12:1 dielectric 74:16 difference 5:11 87:4,8 different 24:22 25:1,9,15,22 26:7 29:9 32:11 34:24 38:18,19 40:23 41:16 47:4 56:12,25 57:5 58:15,19,20 60:16 61:15 76:12 77:25 80:25 116:18 132:4 133:14 differential 27:24 125:2,8 differently 25:23,24 26:9 38:12 difficult 34:6 dimension 138:15
--	---	--	--

dimensional 45:14 47:8 direction 47:20 47:22,23 120:22 121:5,9 136:4 145:20 directly 12:10 127:10 131:12 disadvantage 46:23,24 disadvantages 54:8 discern 42:19 disclosed 59:14 77:10 90:4 91:15 96:9 101:12 111:7 118:4 128:2 142:13 discloses 63:11 94:18 115:12 119:23 127:21 131:6 disclosing 97:14 disclosure 90:14 91:10,14 130:1,5 disconnecting 32:24 discuss 7:20 discussed 18:21 25:14 51:23 60:22 61:14 88:12 91:23	100:16 108:14 113:17,20 116:6 124:11 129:20,23 131:16,21 145:2 discussing 54:21 91:9 117:6 122:20 discussion 123:11 142:17 142:22 143:7 discussions 128:18 displacement 21:5 docs 8:4 doctor 146:1 document 32:12 34:9 documents 4:3 doing 8:22,23 22:16 48:8 49:16 83:7 123:5 dots 38:14 dotted 102:2,15 dr 1:9 3:3 4:6 4:11 44:18 69:2 80:13 84:17 91:9 109:11,22 117:10 143:2 144:17 147:6	drawing 101:20 135:11 drawings 36:10 due 99:14,15 duly 4:7 147:7 e e 2:1,1,4 3:1,8 17:20 earlier 52:6 56:3 58:3 91:11 108:14 125:13 127:13 134:6 eddy 21:3 edge 97:3,4 107:6 edges 103:12 103:13 106:4 128:16 effect 21:2 effectively 21:17 92:13 effects 50:10,14 50:18 efficient 14:25 48:14 efficiently 48:18 eight 118:5,8 125:14 130:6 either 65:9 79:1 79:2,3,12,20,21 89:13 102:10 104:14 141:6 142:19 145:20	electrical 43:8 45:24 46:4 131:14 132:25 133:12 138:4 140:24 141:3 142:18 electrically 35:6,14,22 36:1 37:5 43:2 43:21 104:8 111:22 121:20 electronic 69:16 electronics 8:9 8:10 embarcadero 2:19 embodiment 125:6 142:3 embodiments 59:13 71:3 74:14 employee 147:14,16 empty 6:18 ended 27:14 energy 14:25 18:2,2,14 enlarge 34:5 enlarged 40:14 entire 82:4,8 88:16,17 entirely 60:3 61:9 87:25 131:16
---	--	---	--

entirety 87:18 97:5 entitled 1:15 11:4 envision 135:25 equal 114:7,18 erik 2:18 erik.halverson 2:21 esq 2:3,4,8,14 2:18 essentially 10:7 15:9,13,18 21:18 45:15 105:7 estate 49:12 et 39:11 eventually 63:1 ex 6:23 exact 124:11 exactly 25:4 46:8 65:22 103:1 135:1,2 examination 147:6 examined 4:7 example 9:10 15:25 17:1 20:17 23:1,12 24:15 54:23 66:17 75:14 85:25 88:15 112:4 119:17 120:20	examples 10:13 65:23 67:2 exams 10:15 excellent 5:6 6:1 7:5,13 115:4 except 82:4,8 89:1 excitation 18:3 excuse 44:4 89:7 exemplary 125:2 exhibit 3:10,11 3:13,14,15,17 5:14 6:5,14,16 6:23 10:20 32:1,5,8,20 33:4,7,25 44:21 54:24 55:1,8,13 59:10 63:2 68:14,21 69:2 69:3,6,8 70:25 94:7,9,22 95:1 95:2,5,6 110:1 110:2,7,9 114:23,25 122:23 exhibits 5:13 5:14 6:19 32:22 33:5 69:7 76:5 94:25 110:5 114:24 123:1	existing 136:10 expanded 86:8 86:12 expect 6:17 experience 7:15 7:16,20,22,23 8:5,11 9:23 14:1 experimental 10:18 experiments 8:5,7,23 9:1 expires 147:22 explain 11:20 29:2 30:2 46:3 101:13 139:4 explained 130:24 explaining 104:22 extend 75:14 104:13,15 extending 119:14 120:22 extends 30:5 80:10 104:10 106:5 137:20 extension 107:15 extent 9:4 externally 21:3 extract 78:1 extracted 73:6	f fabricate 107:18 114:14 139:8 fabricated 49:11 84:19 132:12 fabricating 8:12 fact 45:17 85:7 94:10 98:25 99:5,8 107:3 126:10 factor 8:14,21 8:25 9:4,9 17:21 18:1,1 18:13 19:22 20:11,19 21:14 22:4 36:7 52:24 53:5,8 54:17,18 56:8 56:20 57:5 58:10,13 59:16 60:6 62:6,16 82:24 83:16,20 83:24 84:7 86:24 91:13 93:13 106:18 111:3,17 113:7 113:15 114:4 114:10 140:19 140:21 factors 24:17 50:3,7 83:9 84:11
---	--	--	---

fair 38:23 42:3 fairly 47:11 66:17 116:2 familiar 52:16 101:8 112:13 familiarize 10:21 far 45:2 favor 144:6 feature 91:25 141:15 feed 69:2 94:21 ferguson 2:4 field 47:16,22 48:3,8,15 144:4 fields 48:6 fifth 35:19,22 127:11 131:13 figure 12:11 27:9,9,10,13,23 29:2 33:1,17 33:19,21 36:10 36:11 37:9 38:24 39:2,15 39:20 40:1 41:4 42:5,7,10 42:11 43:12,13 43:14 45:7,23 47:7 51:14 63:18,21 64:2 64:5,22 65:10 71:7,13 72:4,6 72:14,15,17 73:1,25 75:12	75:23 76:20 77:10 83:20,25 85:2 86:3 87:2 88:7,23 89:19 90:23 97:9,10 97:12,16 98:17 98:21 99:9,19 100:17 101:11 101:13,14,15 101:16,20 102:2,2,18 103:16 105:5 105:13,20,24 108:8 112:4,24 113:4 115:19 116:10,12,16 116:17 117:8 118:9,17 119:8 119:9,13,19,20 119:23 120:6 120:10,10,13 120:17,19,24 121:2 122:2,5 122:8,11,14 123:7,7,12,16 123:19,21 124:4,5,9,11,13 125:1,4,5,9,18 125:18 126:3,7 126:10,25 127:23 128:6 128:21,25 130:15,18 131:8 132:18 133:17,18,20	135:10,15 136:10 137:5,7 137:11,17 figures 27:11 36:13,17 37:9 39:25 40:4 51:4,4,6 70:25 75:25 117:17 123:6 127:14 fill 112:23 filled 38:14 119:3 filling 112:22 filter 9:17,18 finally 35:18 financially 147:17 find 37:10 140:8 finds 13:5 fine 4:13 fingers 47:23 47:24 finished 55:19 55:20 first 4:7 13:16 19:2 33:14 34:15,20 35:1 35:3,3,5,20 36:1 52:20 60:4 63:23 69:17,17,18,18 69:23 71:16,25 73:10 74:7,16 74:20,23 75:16	96:4 104:11 116:20 129:12 130:10 131:10 134:3 138:16 140:17,18 144:1,10 146:1 flipped 65:3 florida 1:23 focus 13:3 104:4 141:19 focused 130:1 focusing 5:1 40:19 117:12 141:25 fold 68:10 folder 6:18,19 32:22 94:22 110:5 114:24 123:1 follow 39:21 72:15 144:16 following 116:11 follows 4:8 17:25 26:18 60:3 footnote 117:22 footprint 64:9 64:10 65:5,7 foregoing 147:9 forgotten 75:11 form 15:18 28:21 30:17 43:10 56:16
---	--	--	---

58:5,16 61:8 65:21 68:1 72:1 77:1,4 79:7,18 81:4 81:11,16,21 82:19 84:2,22 87:20 88:10,24 89:24 90:7 92:6 93:7,18 96:10,17 97:23 98:15 100:1 102:17 103:23 104:20 105:11 106:20 108:12 108:22 113:19 116:4 120:2,8 121:1,10,16,24 124:8 125:25 127:16 129:10 130:3,11 131:17 132:9 132:17 133:5 134:1,19 135:8 136:7 137:3 140:1 141:23 145:10,17 formed 26:20 26:22 35:3,4 35:11,13,20,21 57:25 69:18,23 70:2 71:4,15 71:21 73:10,16 74:16,19 75:9 78:9,12 81:6 112:9 132:1	forming 43:1 forms 29:12,15 30:20 82:14 85:7 formula 18:4 forth 39:19 147:12 found 127:9 143:10 four 34:24 47:8 106:19 118:5,8 125:13 130:6 fourth 34:21 35:12,13,15 69:22 138:18 138:19 franciso 2:20 frequencies 23:3 frequency 20:3 23:1,2 46:11 46:16,25 47:1 49:20 front 33:18 94:4 full 4:15 function 11:16 14:24 89:22 90:20 108:9,20 109:4,7 121:17 functions 128:8 fundamental 11:11 further 144:14 145:21,22	147:9,13 g g 26:14 gaps 87:18 89:15 119:2 gates 2:13,18 general 12:16 24:15 49:10 100:15,21 generalities 49:10 generality 48:16 generally 24:14 47:15,21 48:13 49:17,21 50:19 64:16 66:4,6 67:6,17 83:11 87:13 91:18 97:25 98:2 108:15 generated 21:4 geometric 47:10 geometries 45:16 48:5 51:14 65:24 geometry 45:24 46:4,6,8,9,13 46:14 66:12 68:2 89:2 100:18,24,25 germane 141:15	getting 84:16 85:1 124:25 125:24 give 32:24 55:6 given 48:23 114:18 124:4 131:15 142:12 glib 31:7 go 6:2,19 7:14 10:23,23 11:1 18:10 26:11 32:21 37:8,9 39:19 42:7 43:12,13 44:18 51:3 53:12 62:24 68:23 69:7 70:18,19 70:23 71:12 72:6 76:3,5 77:8 82:14 94:25 97:16 98:17 101:5 105:12 106:15 109:23 110:5 113:3 114:24 115:2,4,15 118:18 122:23 123:1,2,10,14 127:2,3 135:22 137:12 138:17 138:20 139:12 140:2,10 141:14 142:21 goal 85:19 86:16 139:16
---	--	--	--

goals 25:6,7,9 25:15,22 goes 28:12 29:15 38:15 41:10 42:24 56:5 58:9 59:20 96:24,25 103:6 104:5,7 128:22 136:4 141:1 going 4:25 5:21 6:2,12 21:9,10 21:23 22:23 23:24 24:1,19 25:1,2,10,13 26:10 28:18 31:24 39:18,20 40:19 47:20 48:1 50:6 54:16,24 57:2 57:6 61:21 62:9,11,16 66:19 68:3,14 72:3 83:22 84:22 85:12 92:9,16 93:21 94:22 101:23 103:9,20 109:7 121:5,9,18 124:16 130:17 135:4,5,18 136:14 139:11 139:11,17 140:13 144:6 145:20	good 4:11,13 4:15 44:14 59:7 105:25 109:10 146:1 gotten 127:5 graduate 8:4 great 10:24 55:12 69:9 110:12 146:4 greater 48:7 green 63:24 65:2,3 77:15 77:24 102:8 103:4,6,6,9 greg.parker 2:16 gregory 2:14 ground 94:14 guess 7:23 19:4 29:2,10 30:4 31:6 48:17 65:5 80:3 99:9 125:24 126:17 128:19 135:14 guidance 32:25 guys 109:19	110:25 113:5 hand's 47:24 hands 10:18 happening 124:6 happens 115:2 hard 39:19 42:19 64:12,14 83:23 100:2,15 100:21 106:21 head 46:7 50:9 header 115:8 heard 75:22 heavily 88:12 held 1:21 114:5 142:22 help 50:6 75:7 140:8,14 helpful 20:22 70:17 72:3 122:10 helps 34:11 hereinbefore 147:12 high 18:18,24 23:1 24:14 36:6 48:18 66:1 82:18 92:12 93:23 107:2 111:3 114:2,4 higher 12:5 18:13 60:12 62:23 84:13 114:10	highest 46:10 46:16 48:24 highlighted 63:22 116:21 116:24 117:2,5 historically 13:9 history 8:22 hit 110:4 ho 3:13 63:8,10 63:17 68:13 69:1,10 70:19 70:23 76:11 77:10 90:4,8 90:13 91:10,15 91:19 92:1 93:5,11,24 103:20 116:1 holding 114:17 hole 111:22 112:10,11,21 140:23 hooked 14:19 hour 57:7 109:13,21 hsiang 3:13 63:8,10,17 68:13 69:1,10 70:19,23 76:11 77:10 90:4,8 90:13 91:10,15 91:19 92:1 93:5,11,24 103:20 116:1
	h		
	h 3:8 half 66:3,5 halfway 95:11 halverson 2:18 hand 5:12 34:2 41:11 88:17 98:21 99:4 101:24 107:22		

i	illustrating	50:6 53:4,8	increase 12:8
i.e. 43:5	33:19	56:8 57:5	22:16 50:6
idea 31:9	illustration	62:16 70:11	83:8 106:23,24
ideal 16:3,7,10	28:8 72:10	85:19 86:24	141:8
16:10,11,13,13	101:12 102:24	91:13 92:2	increased
16:14,17,19,23	118:24	93:12 95:21	92:22
17:10,15 18:15	illustrations	96:15 140:19	increases 83:12
18:25 19:1,9	47:14	140:20 142:7	91:24
19:11,13,18,19	illustrative	improved	increasing 12:8
20:7	36:5,18 40:2	83:24 87:23	97:6 114:13,19
ideally 87:3	41:20	90:14 95:16	indicate 42:21
identical	image 34:9	111:16	60:11 117:23
133:22 135:7	45:9,11 74:24	improves 56:20	indicated
135:16	97:17 103:16	91:25	101:19 123:22
identification	106:16 135:2	improving	indicates 38:18
4:4	images 40:18	52:24 92:1	75:8
identified 80:2	51:16 70:24	111:17	individual 23:7
87:2 88:13	101:8	incidental	68:3 83:17
identify 21:1	immediately	28:15	induced 21:2,3
66:7 76:11	144:9	include 8:9,10	inductance
ignoring 50:2	impact 17:8,11	17:14 21:1	11:16,22 12:6
illustrate 119:5	62:6	23:15,17,18,19	12:9,10 16:9
120:17	impacts 62:7	53:16 114:2	23:17 29:14,17
illustrated 47:7	impedance	142:4	46:13 47:2
64:22 73:23	14:24	included 8:2	48:18,24 50:7
102:2 118:17	impedence 8:16	19:16 29:20	84:8,14
119:19 120:6,9	9:3,5	includes 7:24	inductor 8:17
120:24 121:23	implementing	33:14 34:15	9:4,11 10:6
122:1,5 123:12	60:24	67:18 69:17,22	11:7,9,23,24
127:14 128:25	importance	71:14 72:10	12:3 13:19,20
131:7 142:13	20:2	73:2	13:25 14:4,5,7
illustrates	important 13:6	including 63:18	14:11,16,19,22
45:12 54:4	54:16,18 113:6	135:20,21	15:4 16:7,10
121:8 124:6	improve 20:11	136:11	16:13,18 17:4
125:1	21:13 22:4,10		18:3,7,8,9,13

18:15 20:11,13 20:17,20 21:8 21:9,13,15,16 21:21 22:4,5,9 22:15,17,18,19 24:7,12,12,18 24:25,25 25:2 25:5,17,18,18 25:23,25 26:3 26:8,22 27:14 27:17,20,25 28:2,9,16 29:13 30:6,16 31:9,14 33:13 33:22 34:14 35:2 36:6,11 36:12,18,20,24 37:4,14,17 38:2 39:3 40:2 41:2,7,16,25 42:14 43:24 45:8,14 46:9 47:8,15,18,21 48:3,10,12,14 49:1,5,6,11,15 49:23 50:4 52:23 53:5,9 53:17 56:6,7 56:12 57:21 58:4,5,6,11,13 59:14,16,21 62:6 63:23,24 64:19 65:16 66:13 67:7,8 67:12 68:3,4	70:11 78:7 80:5,25 81:18 81:20,24,25 82:10,11,13,15 83:19 84:25 85:6,11,14,16 85:18,23,23,25 86:14,25 87:4 87:5,8,11,16 88:6,23 89:8,9 89:25 90:6,23 91:4,13,19 92:3,5,8 93:13 93:15,20,22 98:22,24 99:12 99:19 100:12 100:17,19,25 107:21,24 108:15,25 109:7 110:22 111:2,16 113:6 114:3,5,12,14 115:12,16,23 118:4,13 121:15 124:2 125:2 128:7 131:13 133:21 134:13 135:1 135:15 136:5 139:10,12 143:19 144:3 145:5 inductors 7:21 7:22,24 8:1,2 8:10,14,16,20	9:2 10:16 11:12 12:16,20 13:4,14,16 14:13,15 15:10 15:15,17,18,23 16:15 18:19,24 19:14,15 21:18 23:7 24:22 26:15 28:14 30:13,13,14 31:2 44:22 45:1,13 46:1 46:19 49:12 53:15 54:8 56:24 63:11,18 64:14 67:3 68:6 85:8 90:11 94:18 96:20 98:19 99:7 100:4 103:3 107:14 108:4,6,17,25 138:12 industry 7:16 influence 23:24 25:17 information 11:11 infringing 88:13 inherently 127:21 128:3 128:10 131:6 inner 86:8,12 99:22,25 104:6	104:7 126:20 135:4,18 input 75:8 instance 82:3 insulation 112:23 insulator 112:21 integrated 26:20 33:13 34:15,20 49:14 90:16,21 91:1 95:17,23 100:5 108:10,21 110:22 111:2 111:16 113:15 intended 80:21 81:19 108:11 125:16 inter 5:2 interact 86:19 interchange 50:25 51:7,18 51:19 interconnect 112:4 138:5 interconnecti... 112:7 interested 147:17 intermingled 64:6,8 67:12 77:23 85:9 86:22 96:3,5 96:21 97:13
---	---	---	--

98:6,7 99:1 107:23 intermingling 67:15,19 83:5 83:12 96:16 98:12 99:15 internally 21:2 interrupted 103:5,7,10 interruption 103:9 intimately 52:16 83:6 introduced 6:5 32:5 55:1 68:21 95:2 110:9 invalidity 90:19 invention 34:3 34:14 43:1 52:21 55:14 59:15 71:10 72:20 95:12,16 95:21 96:1,9 96:12,22 110:25 111:2,7 111:15,21 112:9,10,17 123:22 125:3,7 140:18,22 141:16 inventors 58:12 inverse 92:11	involve 4:22 8:6 24:1 25:13 51:6 involved 7:25 8:13,15,20,24 9:2,21 10:2,5 10:12 17:12 106:3 involvement 9:11 involves 8:25 50:25 51:17 involving 7:7 inward 98:3,23 98:25 ipr 4:19,22 7:6 ipr2023-00789 1:4 irregular 66:12 67:1 85:13 86:15 87:10 98:8 100:14 irregularity 99:3,5 irregularly 97:21 isolate 80:13 81:1 84:17,24 84:25 isolated 64:21 65:1,11 73:5 80:23 85:3 86:4,14 88:7 88:23 89:18,21 90:5,18 93:15	97:18,20 103:16,19,20 108:7 109:4,6 116:1 isolation 14:6 14:12,16,21 15:4 24:7 65:15 81:19 85:16,19,23 100:13 106:17 j j 2:18 j.c. 109:11 january 1:25 147:24 jersey 1:19 147:4,21 jet 99:25 jmasullo 2:6 joseph 2:3 k k 27:6 k&l 2:13,18 keep 35:16 kind 20:18 145:4,6 klgates.com 2:16,21 know 5:6,16 6:3 8:15,22 12:7 14:8,16 17:18 20:24 28:23 29:17,20 32:9 37:10	39:15 42:5 46:7 51:23 52:9 55:9,18 57:16 63:5 66:18 70:16 75:22 76:1 83:22 84:24 85:24 87:7 97:24 98:4 99:8 101:5 102:21 112:15 121:14,18 124:14,18 128:15,23 129:2 134:6,7 knowledge 14:5 known 26:20 31:1,17 45:2 53:25 58:6 59:13 60:24 93:11 134:13 137:1 139:23 kyriazidou 27:3,9 57:21 60:23 61:14 134:8 136:6 l l 2:4 4:17 11:22 11:24 46:12 labeled 36:19 36:20 37:14,18 39:7,11 40:4,9 40:17 44:8 75:2 104:16,17
--	---	---	---

104:18,18 112:6 126:9,12 labeling 39:13 labels 39:3,16 laboratory 8:3 8:3 10:2 lacks 67:22,23 laid 23:11,16 24:2 86:1 large 11:25 49:13 largely 5:10 11:16 larger 12:4,4 14:8,13 64:10 65:7 67:7 85:3 layer 26:15,15 26:22 27:14,24 28:3,6,10,13,14 28:16,18 29:3 29:4,5,7,9,9,16 30:5,8,13,20 38:19 54:10,21 56:7,9,20,22 57:21,23 58:14 58:15,23 61:1 61:15,16 62:4 62:8 69:19,24 70:3 71:16,16 71:22,25,25 73:11,11,16 74:8,8,16,19,25 75:2,9,15,17 76:1,17 78:15 78:19 80:6	102:5,10,20,25 103:4,5,7,8 104:12 105:9 106:2,9,13,14 107:7 112:23 116:20,23 117:2,4,13,21 119:1,10,17 120:14,19,23 121:9,17 127:10 128:6 128:12,19,20 128:21,24,24 129:2,15,19 130:10,16 131:22,25 132:3,4,8,11,16 132:20,23 133:3,4,7,15,25 134:9 135:15 135:16 136:3,4 136:17,20,21 136:22 137:15 137:21,21,23 137:24,25 138:3,6,9,10,19 139:1,6,13,17 141:16,17 143:5,5,6,12,21 143:21,25 144:8,10,10,11 144:25 layers 26:23 27:18 34:24 39:4,6,7,10,11	39:16 40:6,23 41:16,23 42:5 42:23,23 43:6 43:18,23,25 44:5,6 52:25 53:9,16 54:22 55:22 56:10,11 56:12,23,23,25 57:4,6,8,10,10 57:17 59:4,16 60:6,7,9 61:3 61:19,22,23 62:14,17,20,22 71:4,9 72:19 72:22,25 74:1 74:6,15,20,24 75:17 78:12 79:2,13 80:1,3 80:9,10 91:21 91:22,24 97:7 103:12 104:13 106:5 112:4,7 114:2 116:18 117:7,12,20,25 118:5,10,13 119:6,9,11,15 124:10,10,16 124:19 125:21 125:22,24 126:3,13,14,25 128:17 129:1,5 129:18,21 130:1,6,9,12,18 130:22 131:2 132:19 133:6	133:10,21,22 134:11,12,25 135:5,7,11,19 135:24 136:12 136:19 137:6 137:16,17,18 137:20 138:3 138:17,25 139:19 141:9 142:8,18 layout 23:23 24:21 48:10,23 leads 99:6,6,9 led 85:9 left 36:21 37:5 37:21,22 44:20 45:16,20 48:1 55:3 63:1 69:4 80:15 81:2 98:4 100:17 101:11,21,22 110:25 113:5 114:23 115:16 115:20 121:12 122:2 123:2 128:22 135:22 lengthy 47:17 level 34:21 35:4 35:5,12,13,20 35:21 40:3 50:25 51:7,17 51:19 52:1,2 66:1 111:23,23 117:21 138:18 139:8,9 144:25
--	--	---	--

145:9 levels 40:3 41:3 41:8,12 56:18 license 147:5 light 139:2 likely 84:6 85:16 likewise 146:4 limited 61:20 113:15 137:15 line 35:3,4,5,7 35:11,12,14,15 35:19,21,22,23 42:12,16 45:25 46:18 55:17,21 71:2 99:24 101:22 102:2 102:15 111:21 112:11,17,25 113:2 119:14 123:21,23 125:5 130:14 139:5,11 140:23,25 141:7,17,20,25 142:3,6 lines 39:17 41:2 41:11 43:1 118:18,18,22 118:25 119:2,5 138:24 141:12 142:1 144:4 linings 125:18 list 12:24 83:10	listed 12:23 little 42:19 64:12,14 66:9 66:20 92:23 106:23,25 117:8 liu 2:8 llp 2:3,8,13,18 localized 101:24 located 1:23 105:5 location 23:16 101:19 locations 1:21 82:1 100:23 long 8:22 13:10 14:12,14,18,19 14:23 109:11 129:8 130:12 130:22,25 132:12 133:13 142:17 look 15:4 20:10 31:25 33:12,20 37:9 38:22 39:15 51:9 52:19 65:14,15 66:16,20 68:13 69:7,13 72:3,6 74:3 75:4,5,12 78:20,21,24 79:8 83:2 85:6 85:20 91:17 93:13 102:18	105:13 111:10 113:4 122:7,10 122:17 123:4 124:23 126:7 135:25 138:22 looked 46:20 53:20 54:3 56:3 57:20 65:16 68:6 87:13 98:18 145:6 looking 10:22 15:2 19:4,25 29:5 38:21 40:1 42:10,15 43:12 46:21 57:12,13,15 64:15 72:13 73:19 74:5 78:23 79:11 86:24 87:16 91:13 93:12,19 94:8 96:23 99:18 101:16 105:19 116:16 138:15 145:4 145:12,16,18 looks 20:25 32:19 73:6 112:24 116:1 117:1 130:19 loop 11:17,25 12:1 29:15,15 30:20 77:4 81:3,25 82:13	86:8,9,10,11,12 88:1,8,16,17,22 89:4,7,14 92:14,16,16,18 92:21 93:21,22 99:22,24,25 104:5,6,8,8 118:25 119:16 121:16,19 126:20,20 128:8,9 129:12 129:14 130:8 132:11 135:4,4 135:18,19 136:5,23 137:2 142:9,12 loops 12:2 20:18 48:17 49:6,8,22,25 50:13 67:24 77:5 84:13 85:21 87:17 102:3 116:3 119:25 120:3 126:19 140:22 144:4 loss 18:2,9,14 20:12,15,19,20 20:21,23 21:1 21:10,12,14,22 22:1,5,9,17,20 22:21 23:6,9 113:24 losses 21:1,2,3 21:4,5,5
---	---	--	--

113:16,21,22 114:1 lot 34:11 139:2 low 93:23 111:3 lower 18:14 42:22 45:20,21 46:25 52:2 56:6,19 57:22 59:6 60:11 62:22,23 67:5 88:2,18 92:9 92:13 103:12 106:17 111:23 116:23 120:21 129:15 135:22 139:8,9 144:24 145:9 lowers 93:9 lunch 109:10 lying 97:3	41:3,8 made 58:14 84:9 magnetic 15:23 15:25 47:16,22 48:2,6,8,15 144:4 magnetically 15:10,14,16 21:18 magnetization 21:4 main 29:10 maintain 131:13 make 6:12 16:22 18:19 30:23 31:10,11 40:14 47:17 48:14 49:14 57:11 62:13 91:19 100:5 104:21 107:1 112:22 114:9 121:19 128:7 128:19 139:2 139:15 141:7 making 31:2 52:25 53:9 59:16 60:6 68:9 112:21 143:18 144:3 manufacture 111:18	march 147:22 mark 31:24 54:24 68:14 marked 6:14 6:19 10:20 32:21 33:4 69:1,7 94:25 110:5 114:24 123:1 masullo 2:3 3:5 28:21 30:17 43:10 56:16 58:16 61:8 65:21 68:1 72:1 77:1 79:7 79:18 81:4,11 81:21 82:19 84:2 87:20 88:10,24 89:24 90:7 92:6 93:7 93:18 96:10,17 97:23 98:15 100:1 102:17 103:23 104:20 105:11 106:20 108:12,22 109:13 113:19 116:4 120:2,8 121:1,10,24 124:8 125:25 127:16 129:10 130:3,11 131:17 132:9 132:17 133:5 134:1,19 135:8	136:7 137:3 140:1 141:23 142:24 143:1 144:14 145:10 145:17,22 matching 8:17 9:3,5 14:24 material 10:14 15:23 matter 1:15 56:8,21 129:7 133:13 matters 129:11 maximize 9:7 9:14 86:16 99:21 107:10 maximizing 9:15 maximum 9:19 mean 9:14 16:21 18:6 19:24 20:15 21:11 22:1 23:14 29:13 30:2,19 34:23 49:4,24 51:19 58:12 59:1 64:12 65:23 70:14 72:21 79:3 85:22 87:24 98:17 100:16 102:21 103:25 112:2 112:18 126:9 143:16,23
m			
m1 40:4,6,11 40:15 m2 40:16,16,17 m3 40:9,19,22 41:12,23 42:5 m4 39:11 41:12 41:23 42:5 m5 39:11 41:3 41:8 43:6 m6 39:11 41:8 43:6 m7 39:11 40:4 40:7,9,19,22			

144:9,19,21 145:3 meander 45:17 45:25 46:18,24 meanders 87:12 meaning 17:21 19:1 meaningful 87:7 means 11:21 34:25 45:15 112:3,15 117:19 mechanisms 20:12,16,21,23 21:1,10,12,15 21:23 22:1,5,9 22:20,21 23:6 23:9 memory 57:7 mentioned 115:23 125:13 143:17 met 35:23 metal 26:22,23 29:5,6,9,14 30:5 35:3,4,5,7 35:11,12,14,15 35:19,21,22 39:11 40:23 41:2,11,16 42:22 43:1 44:5,6 50:25 51:7,17,19	52:25 53:9,16 54:10,20 55:22 56:9,10,11,12 56:22,22,23,25 57:4,6,21,23 58:14,15,21,23 59:16 60:6,7,8 61:1,3,15,16,22 61:23 62:4,8 62:14,17,20,22 69:19,23 70:3 71:4,9,16,16,21 71:25,25 72:19 72:21 73:11,11 73:16,25 74:6 74:8,8,14,19,20 74:24,25 75:2 75:9,15,16,17 76:1 79:13 80:9,10 91:22 91:23 106:12 111:23,24 112:4,7,22,23 113:23 114:2 114:13,18 116:20,23 117:2,13,19,21 117:25 118:5 118:10,13 119:1,3,6,9,10 119:11,15,17 120:20,23 121:3,9 124:10 124:10,16,19 126:25 127:10	128:6,17 129:1 129:5,15 132:8 132:16,19,20 133:4,7,14 134:11,25 137:6,15 138:5 138:10,17 139:11,13,17 142:8 143:5,5 143:6,11 144:8 144:25 metallization 34:21,24 35:3 35:5,12,13,20 35:21 40:3 41:3,12 metals 39:16 method 134:13 micro 1:4 middle 18:12 98:23 mind 35:8,17 64:25 75:12 107:8 minimize 20:12 21:14 22:4,8 22:17,20,21 23:8 107:9 139:16 minimizing 114:9,12 minimum 114:5 minus 34:10	minute 44:16 91:6,7 116:17 145:23 minutes 44:11 54:21 68:18 missing 40:8 misunderstan... 61:12 mn 130:20,20 model 23:14,14 23:17 modeled 83:18 modeling 17:12 25:12 48:13 modifications 98:11 modified 67:24 82:10,18 85:3 89:20 moinian 3:17 31:22,24 33:9 33:18 56:2,15 56:17 57:2,3 57:13,16 60:23 61:14 134:10 136:6 moment 10:4 16:1 48:21 51:10 55:7 70:8 105:13 momentarily 32:3 monolithic 111:2
---	---	--	---

morning 4:11 4:13,25 56:3 mouse 10:25 multi 26:15 125:3,18 multilayer 63:11 94:18 multiple 26:23 27:14 53:16 54:22 55:22 56:10,18,22 57:4 62:22 79:2 80:1 91:21,22 97:7 104:13 117:19 128:16 129:4 131:5 multiplicity 43:3	108:1 need 10:21 14:8 15:19 17:14 19:6 69:14 82:15 91:17 110:16 117:7 132:6,7 needed 9:5 108:5 needs 128:8 131:24 132:4 neighboring 125:8 126:6,8 126:11 neither 147:13 147:15 never 8:24 65:24 new 1:19 12:16 94:13 147:4,21 node 31:9,9,10 31:10 36:21,22 37:6,6,21,24 normally 5:13 north 2:9 notary 1:19 147:3,21 note 50:24 51:16 64:2 115:11 noted 21:17 notes 1:13 117:23 notice 32:14,19 37:13	novel 93:4,10 number 3:9 6:16 11:17 12:2,5,7,8,23 19:16,20 23:18 24:16 27:2 50:11 54:11,18 59:23 84:11 86:20 100:3 102:20 126:13 142:14,19	124:8 125:25 127:16 129:10 130:3,11 131:17 132:9 132:17 133:5 134:1,19 135:8 136:7 137:3 140:1 141:23 145:10,17 objective 96:22 objectives 53:4 objects 95:20 111:7 observe 97:21 observed 42:25 obtain 46:10 obvious 78:4 128:14 129:2 129:19 143:11 143:14,19 obviousness 63:8 94:15 95:7 115:9 occupied 64:18 occupying 57:17 occur 89:12 132:11 occurs 46:12 79:21 89:13 octagon 45:22 65:20 66:8,15 66:17,18,20 68:5 84:9,10 84:12 98:2
n		o	
n 2:1 3:1 4:17 16:4 117:20,24 n.w. 2:4 name 4:15 nancy 1:17 147:3 nashville 2:15 nearby 21:4 necessarily 9:7 9:14,19 84:4 142:1 necessary 15:20 18:24 24:9 89:1 107:18,22		o 27:6 oath 5:18 object 95:15 111:1 objection 28:21 30:17 43:10 56:16 58:16 61:8 65:21 68:1 72:1 77:1 79:7,18 81:4 81:11,21 82:19 84:2 87:20 88:10,24 89:24 90:7 92:6 93:7 93:18 96:10,17 97:23 98:15 100:1 102:17 103:23 104:20 105:11 106:20 108:12,22 113:19 116:4 120:2,8 121:1 121:10,24	

115:12,23,25 116:1,5 124:13 octagonal 36:20 37:17,19 45:21 47:10 48:5 66:2,4,6 66:19,24 83:25 98:3 octagons 65:25 68:7 office 1:1 offs 45:1 oh 6:9 22:11 40:12 74:5 76:23 okay 5:10,16 5:17,24,25 6:1 6:13,21,21 7:2 7:5 11:2,2,3 13:2,25 17:19 20:24 22:8 26:13 30:12 32:4,16 33:6 34:1,11 35:9 35:18 37:2 38:10 39:22 40:5,25 42:9 42:24 50:18 51:21 53:13 55:7,12,16 56:3,4 59:11 63:6 64:20 69:15 70:10 71:1 72:8,15 72:16 74:5,23	75:7,16 76:3,9 78:1,14 80:15 88:21 90:25 91:5 93:12 94:3,12,24 101:7 105:23 105:25 106:15 109:9,14 110:6 113:3 115:6 116:8 117:15 123:3,10,13 127:2,5 128:11 133:17 137:14 once 5:9 ones 104:24 112:10 129:6 open 6:7 7:3 31:5,7,11 33:6 55:8,10,11 69:3 94:23 95:5 110:7,12 129:13 136:13 operates 47:16 48:3 opine 110:18 opined 28:22 opinion 78:2,11 90:19 109:4 143:9 opposed 49:6 opposite 136:4 optimal 87:12 87:14 optimally 125:13	optimize 8:14 8:20 9:12,13 82:25 86:24 87:16 optimized 9:18 9:19 58:11,13 optimizing 9:15 59:15 60:5 options 142:14 order 78:14 96:24 98:23 100:9 107:9 114:4 121:16 128:7 ordinary 86:23 91:12 121:13 122:3 143:10 oriented 124:14 outer 81:2,7,9 86:8,11 99:23 104:5,8 126:19 135:4,18 oval 104:6 overall 24:18 64:17,18 67:18 92:25 overlap 48:6 108:4 135:17 overlapped 98:19 overlapping 108:5	overpass 31:1 101:23 102:11 102:12 103:13 106:9 132:21 133:14 144:11 own 134:11 owner 1:9 2:12 p p 2:1,1 4:17 p.m. 146:6 page 3:2,9 10:19,23 12:13 16:3 17:17 18:11 26:11 27:8,10 31:12 31:13 33:4,18 33:24 40:12 44:21 45:7 46:21 47:7 48:22 50:19 51:3 52:8,11 55:13 59:10 63:4,15,16,22 64:20,20 69:6 70:7,25 72:7 76:4,6 77:8 78:2 94:11,14 95:10 101:5,9 103:15 105:16 105:18,20 106:16 110:20 112:5 113:3 115:4,15 116:8 116:11 117:16 117:18 118:17
--	--	---	---

123:11,15,15 124:14 127:3,4 127:7,19,22 137:12 141:15 pages 11:1 pair 125:8 paper 94:5 paragraph 11:14,15 12:12 12:15,19 13:2 13:3 15:8,9 17:24 18:10,12 19:4,5,6 20:10 26:18,19 27:2 31:20 34:4,12 34:13 36:4,16 36:17 45:23 48:20 50:20,23 51:9 52:19,20 52:20 53:12 55:17 58:9 63:10 71:2 94:17 95:25 111:1,14 113:5 115:11 116:9 117:16,22 123:11,15,19 124:23,24 127:6,19 128:13 131:4,8 140:3,17 141:14 142:2 parallel 35:6,14 35:23 43:4,9 43:20 55:22	56:10,18,23 89:3 97:3 104:12,25 105:1 106:6 133:9 parameter 11:23 parasitic 17:1,3 24:17 46:15 47:2 54:9 59:21 60:14 113:16 parasitics 16:17,21 17:15 23:19 24:3,9 25:13 parker 2:14 3:4 4:10 6:11 27:5 27:7 28:25 31:3 32:6 43:15 44:10,15 44:17 55:5 57:19 59:8 62:3 66:10 68:12,19,23,25 72:5 77:7 79:15,22 81:8 81:17 82:2,22 84:5 88:5,20 89:5 90:3,12 91:5,8 93:3,8 94:2 95:4 96:13 97:8 98:10 99:17 100:11 102:22	104:1 105:3,15 107:12 108:18 109:2,9,14,18 109:22,25 110:11 113:25 116:7 120:5,15 121:6,21 122:4 124:22 126:16 127:18 129:22 130:4 131:3,20 132:14 133:1 133:16 134:5 134:24 135:13 136:16 137:8 140:4 142:10 142:21 144:16 144:18 145:14 145:21,25 parse 60:20 part 13:17,25 14:23 16:18 22:10 25:19 28:19 29:6,12 29:18 30:14 50:12 76:21 80:11,22 81:6 85:7,8 90:24 92:4 96:12,21 96:22 98:13 99:4 100:13 118:13 120:20 120:22 134:3 138:3 139:10 partes 5:2	particular 26:3 63:17 86:1,21 100:8,18,24 101:24 104:23 126:1 particularly 24:18 52:23 parties 147:15 partly 98:16 99:14,15 parts 15:17 51:25 80:4 81:2,9 93:16 pass 23:2,3 passage 72:14 passing 47:18 47:25 patent 1:1,2,5,9 2:12 3:10,11 3:13,14,15,17 5:3 7:7,9,10 26:21 27:2 31:21 45:3 52:12,16,22 53:4,8,14 55:9 55:23,23 56:1 69:1,11 78:4 122:8,11,13,18 126:23 129:25 138:21,21 patents 4:23 142:5 path 30:21,24 82:14
--	--	---	--

pattern 142:3 paul 1:9 3:3 4:6 4:17 147:6 pause 35:9 51:12 55:7,20 68:22 70:9 142:23 pearl 2:9 percent 140:16 perfect 65:24 65:25 68:5,6 144:20,21,22 performance 25:7 45:25 46:4 49:17,18 87:8 92:2,3 113:8 person 86:23 91:12 121:13 122:3 143:10 perspective 116:12 123:20 125:4 139:16 pertains 111:15 petition 5:2 petitioner 1:6 2:2 photonics 8:9 phrased 25:21 physical 11:24 16:23 23:11,14 23:14 24:12 25:12 83:22 physically 5:12 127:10 131:12	pick 44:12 picture 17:13 70:7 115:16 121:7 pictured 89:19 pieces 135:21 pink 63:23 65:1 65:3,4 77:12 77:19,24 78:1 pinpoint 140:6 place 42:1 100:23 105:17 147:11 placed 100:4 117:20 placement 143:4 144:7 places 104:9 106:10 plan 36:10,11 36:17 37:14 71:8 72:17 138:15 planar 26:23 90:15,20 95:17 95:22 96:2,15 97:13 100:6 101:12,15 108:9,20 plane 42:12 45:15,15 plates 17:5 play 19:13 20:5 20:21 24:20 50:3,8 61:11	83:9,23 please 16:12 22:13 55:7 70:9 103:24 plug 111:22 141:16,17 142:4 plugs 112:9 139:24 140:24 141:2,4,5,7,21 141:25 142:6 plural 60:7 plurality 69:23 70:1 96:3 plus 34:9,10 point 29:18 42:17 43:19,20 52:15 88:16 106:6 132:13 142:5,11 pointed 88:14 88:19 116:16 pointing 38:10 47:21 pole 141:3 poly 40:11 polygon 87:1 polysilicon 36:12 40:3 port 69:17,18 69:21,22 portion 33:14 33:14,15 34:15 34:16,16 35:2 35:11,19,25	36:1,2,12 38:19 41:23 44:3,5,7 67:5 74:17 82:6 91:23 92:8 93:1 96:4,4,5 104:10 127:9 portions 36:25 37:1,4 38:3,7 38:11,12,14 41:1,7,10,15 43:2 92:20 104:23,25 ports 75:8,13 75:14,18,19,20 75:24,25 posita 117:18 127:7,20 128:3 128:5 131:5,11 position 120:16 128:1 possible 48:14 48:19,25,25 49:15,25 66:21 83:1,3,6 107:2 107:6,8 possibly 80:5 post 8:4 power 13:10,15 13:20 14:2 15:3 practical 18:2,7 18:8 precedes 51:15
--	---	--	--

Page 65 of 81

86:24 91:13 93:13 111:17 113:7,14 114:4 114:9 140:19 140:21 question 10:24 13:23 14:10 16:12 21:16 51:13 57:3 66:16 70:20 78:25 80:8 82:21 91:11 questions 5:15 5:21 39:22 40:18 142:25 143:3 144:14 145:21,22 quick 44:10 68:20 70:19 quickly 140:20 quite 61:25 102:20 130:19 134:2,22	99:24 104:22 112:11,21 113:23 ratio 16:4 18:2 19:3,10,11 20:1 71:8 72:18 reaches 89:14 read 34:17 35:9 39:18,20 55:17 72:4,14 75:13 75:23 76:10 102:20 112:16 reads 113:14 114:1,3 ready 109:22 real 20:17,18 49:12 70:19 reality 58:19 really 34:6 65:15 78:21 83:2 129:7 133:12 139:2 realtek 1:8 88:13 reason 46:23 47:12 58:10 67:21 86:14 100:14 107:16 117:4 128:11 140:25 142:7 reasonable 42:20 reasons 131:5 143:14,15	recall 9:10 10:3 12:9 46:7 51:13 121:11 134:15 136:8 140:12 143:6 receivers 18:20 recent 9:1 recently 55:18 recess 44:16 91:7 109:21 recite 50:9 recognize 7:5 33:9,18 69:10 95:6 97:10 110:14 115:19 recollection 123:23 reconvene 109:15 record 4:16 5:23 44:15 68:24 109:23 142:22 146:5 rectangle 47:10 65:18 66:23 99:23 rectangles 39:14 rectangular 45:19,20 48:6 98:1 redirect 142:25 reduce 20:21 57:4 58:24 61:23 92:11	138:24,25 139:20 141:1,7 reduced 92:22 102:4 reduces 91:24 139:22 reducing 83:16 111:17 140:21 141:5 142:8 reduction 58:22 refer 7:9 19:7 33:10 63:23,24 reference 27:2 31:21 33:10 39:24 56:2 70:12 110:8,14 110:17,21,22 111:8 112:2 116:10,17 118:11 119:24 referenced 21:23 28:24 66:13 references 61:13 110:17 referencing 48:21 referred 31:22 128:17 134:14 referring 7:10 60:21 125:20 126:4 130:21 133:7
r			
r 1:9 2:1,14 3:3 4:6,17 27:6 147:6 radiative 21:5 radio 18:20 range 14:12,14 14:18,19,23 23:3 118:8 ranges 117:24 rather 49:13 60:25 86:25			

refers 64:2 71:7 reflected 126:21 refresh 55:3,6 55:7 69:2 94:21 110:4 refreshing 69:5 regard 142:21 regardless 47:9 region 28:10 42:13 52:25 53:10,25 54:11 54:18 57:25 58:5,14 59:17 59:22 60:8,15 60:17,25 61:1 61:5,21,24 62:5,8,11,15 77:19,22 78:10 80:15 102:14 106:1 119:21 122:16 124:2,7 regions 27:21 54:5 56:11,24 107:2 regular 66:18 67:14 83:25 84:10,12 86:25 87:6,9 116:6 reinforce 48:7 reinforcing 144:5 relate 126:13 related 7:24 11:25	relates 12:10 52:22 113:7 relative 23:16 42:23 49:13 147:14,16 relatively 36:6 relevant 7:22 relying 99:20 remainder 89:14 remaining 80:11 remote 1:8 5:8 32:14,19 remotely 4:2 remove 31:4 removed 36:13 removing 31:11 render 78:3 renders 78:4 repeat 16:12 rephrase 44:4 report 28:24 70:15 78:3,23 78:24 91:17,18 reporter 1:19 5:23 27:6 147:4 reporter's 147:1 represent 40:23 56:2 74:7,25 118:22 118:23	represented 108:8 represents 77:18,22 101:14 119:16 reproduced 63:22 116:10 required 10:17 23:1,3 81:25 88:3 requirements 26:4,5,7,8 requires 51:1 51:18 98:20,21 108:16 research 8:3,3 8:23 reserve 139:18 resistance 20:19 24:16 54:12,16,19 56:6,19 57:4 58:22,24 59:6 59:23 60:12 62:23,23 84:8 91:24 92:12,13 92:17,22,23 93:9,23 106:23 106:24 107:10 114:2,4,8,9,12 114:20 138:24 138:25 139:16 139:20,22 140:21 141:1,5 141:8 142:8	resistances 92:14,15,17 resistor 54:9 resistors 59:21 60:14 resonance 46:11 resonant 18:19 46:11,16,25 47:1 49:19 respect 4:19 49:5 56:14 60:22 129:25 respective 45:1 respectively 74:8 response 20:3 responses 5:22 responsible 99:2 rest 14:4 57:14 86:2 restricted 54:9 54:20 59:22 60:14 result 12:5 14:24 59:20 60:14 61:4 84:18 98:13 100:24 106:5 review 5:3,14 5:16 6:8,9 54:25 70:8 117:7
---	--	--	---

reviewed 56:14 reviewing 119:24 revisit 72:14 rf 13:6 22:25 24:19 113:8 richard 4:17 right 6:12 10:22 16:3 25:4 29:3 32:8 34:2,8 36:21 37:6,24 38:4 38:14 40:11 41:7 44:20 45:19,21 47:23 48:1 50:9,18 55:2 57:20 58:2 60:24 62:25 67:21 69:4,5 73:5,18 75:11 76:23 79:23 80:18,24 81:9 82:3,6,6 83:10 89:12,15 90:13 98:5,21 101:24 105:8 107:22,25 109:16,18 110:2 111:11 114:23 115:1 120:16 121:22 123:2,3,6 126:18,19 128:22 134:8 135:1,3,17,18	135:22 137:25 139:23,25 140:13 143:2 143:21 rmr 1:17 147:3 room 5:11 rules 5:10 run 8:2 s s 2:1 3:8 sacrifice 82:24 sake 125:7,11 125:19 141:5 san 2:20 sanibel 1:23 saw 42:16 98:2 saying 59:2 60:4,5,13 62:14 67:13 100:23 102:23 102:24 112:8 125:17 126:5 126:23 131:19 135:12,14 136:9 137:5,18 139:9,10,24 141:11 144:23 says 6:18 12:16 13:9 17:25 18:13,18 27:13 33:13 34:2,19 35:1,10,18,25 36:24 38:2 39:24 44:22 48:23 54:7	55:21 56:17 59:12 63:17 71:3 74:14 76:16 95:15,25 111:11 115:8 125:1,4 138:22 140:18,22 141:1 142:1 scenario 61:2 screen 6:15 34:7 47:19 scroll 10:25 11:14 12:12 17:17 27:1,8 31:12 33:24 36:16 37:10 38:24 42:7 44:21 45:7 55:12 59:9 63:4,15 70:24 73:21 94:11 95:10 97:9 103:15 110:20 116:15 117:15 133:18 137:10 second 26:19 28:5 29:4 30:8 33:15 34:16,19 34:20 35:4,4,6 35:19,21 36:2 45:18 48:22 63:24 67:11 68:4 69:18,21 69:22 70:1,2 71:13,16,21,24	73:11,16 74:8 74:20,23 75:16 77:23 96:6 104:12 116:23 127:9 128:12 129:2,13 131:22 132:3,8 143:5,11 144:7 144:25 secondary 19:12,21 72:11 101:22 section 11:3,9 12:16 41:24 42:2,6,20 43:13,17 52:11 52:20,21 57:13 57:14 63:7 65:17 70:15 73:19,22 74:17 79:9 94:13 95:12 97:2 101:17,18 111:12,14 115:8,9 119:11 119:19 120:10 121:22 122:8 122:14,20,21 122:25 124:1 124:12 125:19 126:5,7,11 135:3 145:7,13 sectional 36:13 39:2,25 42:11 105:20 116:12
---	---	--	--

123:20 125:4 see 6:13,18,23 6:24 11:3,18 12:13,15,17,21 12:25 13:6,11 13:22 15:11 16:5 17:20,21 18:4,11,16,21 20:13 21:6 26:14,16,23 27:2,3,9,10,14 27:25 30:7 31:13,14,21,22 33:15 34:3,4,6 34:11,21 35:7 35:15,17,23,24 36:2,7,22 37:6 37:22,25 38:4 38:6,7,11,25 39:3,8,10 40:6 40:9,11,15,15 40:16,20 41:4 41:12,19 42:12 42:14 43:17 44:22,23 45:3 45:7,8,17,19 46:1 47:19 49:2 50:20 51:1,4,4 52:12 53:17 54:1,12 55:13,16,24 59:24 61:25 63:1,8,12,16,19 63:25 64:3,22 66:3,5 67:11	68:9 69:19,24 70:3,15 71:5 71:10,17,22 72:2,4,20,21,23 72:24 73:2,11 73:17,18,20,22 73:23 74:2,9 74:17,21 75:5 75:10,12,24 76:19 77:2,9 77:10 87:19 89:19 94:13,15 94:19 95:11,12 95:18 96:6 98:18,20 103:5 103:11,16,17 106:1,7 110:8 110:21,22,25 111:4,11,18,24 112:5 113:9 114:14,23 115:2,7,9,13,16 115:17 116:9 116:12,15,24 117:2,8,16 118:1,19 119:9 123:17 124:23 125:9 126:8 127:3,11 130:19 131:8 135:4 136:24 137:4,11 141:17 146:2,5 seeing 6:15 32:1	seeking 70:10 96:15 seem 39:13 138:20 seems 67:1 141:19 segment 88:15 88:19 92:18 104:16,16,17 104:18 127:8 127:11,14,21 127:24 128:2,9 128:12,20,23 131:7,11,13 132:2,2,5,6,8 132:12,15,21 132:22 133:3,9 segmented 142:4 segments 69:23 70:2 71:15,19 73:9,14,20 76:12,13,18 79:1 88:15,22 92:20 93:14 132:24 seldom 46:1,19 46:19 self 46:11,11,16 46:25 47:1 49:19 82:5 semiconductor 1:8 sense 9:8,18 139:2,15	145:12,16 sentence 11:15 11:18,21 12:21 13:9,12 15:11 16:2 18:6,12 18:16,18,22 20:13,16,25 22:2 26:19,24 33:15 34:19 35:10 36:22 45:5 48:22 49:2,4 51:1 53:1,24 56:5 56:21 60:5,18 63:13,17 71:5 97:1 111:18,20 112:1,8 113:11 113:14,18 114:1,6,14,16 117:18 127:11 separate 28:10 28:13,17 44:3 61:3,6 62:17 76:17 83:15 separated 36:25 38:3 separately 64:14 separation 129:17 series 56:6,19 serve 76:24 131:2 serving 14:23
---	---	---	--

set 147:12 seven 40:3 several 12:20 45:8 113:20 116:18 118:13 124:10 142:4 shaded 38:12 shading 38:18 shape 44:22 45:19,20 47:10 66:2,4,6,7,19 67:1,18,23 86:15 87:2 100:14 107:3 116:2 141:4 145:5 shaped 46:9 86:25 87:1 97:21 111:21 111:22 112:10 112:11,11,17 112:25 113:2 115:12 130:14 140:23,23,25 141:3,17,20,25 142:3,4,6 shapes 44:25 45:25 46:5 47:11 66:21,22 share 5:14 6:16 44:21 94:8 110:2 shielding 36:12 short 121:12 129:16	shorten 107:7 show 36:13 73:6 124:9 135:3 showed 42:21 57:7 134:8,10 showing 118:25 121:3,4,17 122:8 shown 18:3 29:11,16 45:6 71:13 73:1,25 89:25 101:24 112:24 119:8 120:13,21 123:16 125:9 125:12 126:3,6 126:15,25 127:21 128:21 128:21 130:13 130:14,18 135:10,16 136:6,6,11 137:7,17,19 shows 28:15 36:10,11,18 40:1 41:22 42:2,6,11 63:17 64:5 65:10 105:14 105:18 116:11 116:18 118:9 120:10,19 125:18,20 128:6 133:20	135:15 shunt 53:1,10 59:17 60:8,10 60:19 61:17,19 62:9,15,21,21 78:9,11 81:10 81:16 92:24 103:21,25 133:23 137:14 139:19 shunted 43:5 59:6 61:6 79:1 79:2,4,6 80:5,6 80:8 82:4,7,9 87:17 88:1,7,9 88:22,22,25 89:3,7,10 91:21 92:5,9 92:21 93:15 102:10 103:7 104:10,24 106:4,6,11,14 130:15,15,22 130:23 131:1 132:13,20,24 133:8 136:12 137:6,21 138:5 138:6,23 139:12 142:18 144:12 shunting 78:13 78:15 79:14,17 79:20 81:12 87:18,21 88:14 88:16,17,19	89:13,16 91:23 93:1,9,11,24 104:25 139:22 side 79:1,2,3,4 79:12,20,21 89:13 97:4 98:4,5 100:17 101:22,25 102:11 105:2 107:22 110:25 119:20 122:15 123:24 124:5 124:18 130:23 132:24 133:11 134:21,21 137:13,13 138:6 142:19 sides 89:10 144:13 sign 34:10 signal 36:21,22 37:24 signals 14:12 14:14 signature 147:20 significant 7:15 similar 34:17 79:14 103:19 105:7 108:14 113:1 similarity 136:9 simple 66:15 98:8 111:3
--	---	--	--

simplicity 125:7,11,19 simply 67:11 99:22 singer 26:15 56:7 single 26:22 27:14,24 28:14 28:16 29:3 30:13 36:19 37:17,21 54:10 54:20 56:9,20 56:22 57:20 64:10 78:19 80:3,6,23 91:3 102:4,10 105:9 106:2,4,9,13 107:7 139:13 144:10,11 sir 98:11 sitting 48:1 99:7,9,10 situation 102:3 sixth 35:20,23 127:8,14,21,23 128:2,9,11 131:7,11 132:1 132:2,4,6,7,11 132:15,22 133:3 size 86:10 141:4 skill 86:23 91:12 121:14 122:3 143:10	skin 21:2 slide 65:6 slightly 58:19 60:16 65:7 87:6,9,9 slope 98:23 sloping 98:24 small 140:14,16 smaller 40:15 98:5 smallest 48:25 49:15 solely 62:5 solution 138:16 143:19,20 someplace 141:12 somewhat 25:9 66:11,25 97:21 sorry 21:25 50:16 sort 7:19 11:11 28:15 38:14 41:20 45:17 46:22 52:5 66:8 73:5 98:1 98:23 99:21 119:12 123:22 sought 90:13 sound 70:21 sounds 44:14 space 49:7 spaces 85:4 spacing 50:8,13 67:2,6,7,8,14	67:14,23 85:9 85:13,15,17,21 116:2 speaking 14:3 14:16 24:14 47:15 48:13 49:9 50:19 64:16 67:17 91:18 spec 41:10 75:5 75:8 specific 9:10 specifically 7:19 8:13 9:12 10:2 12:9 13:23 14:9 23:20 28:23 29:19 70:16 84:19 specification 39:24 40:25 42:24 76:11 117:23 118:12 speculate 100:21 spiral 28:8 30:16 31:14 52:23 53:5,8 59:14,21 78:7 spoken 106:25 square 65:19 66:23 87:1 97:25 98:5,6,9 98:9 99:23	srf 46:10 48:25 stacked 30:13 43:7 52:22,24 59:13 74:1,6 74:11 78:7 stacking 135:6 standalone 13:19 24:25 25:18 26:8 85:11 89:9 138:9 standard 49:1 standing 90:20 90:23,25 91:3 108:19 start 52:11 145:24 started 6:2 8:8 starts 12:15 55:17,18 71:2 94:14 111:15 state 1:19 4:15 12:20 13:4 15:9 26:19 45:24 46:18 53:14 58:10 94:17 117:25 127:20 147:4 147:21 stated 22:3 53:4 60:2 62:1 118:11 statement 49:10,11 51:15 53:18 54:7,12
--	--	---	--

54:14,15 59:1 59:24 60:1 126:2,4 131:15 states 1:1 7:7 34:13 36:4 37:3 45:5 52:21,22 53:24 69:16 111:1,20 113:5 114:11 130:5 141:15 stenographic 1:13 stenographic... 147:11 step 13:11,11 13:15,15,18,18 13:20,21 14:2 14:2,7,7 15:3,3 15:6,6 20:1,1 66:9,9 stepping 20:8,8 100:18 stop 105:1 storage 18:2 straight 30:6 99:24 strawn 2:3,8 street 2:4,9,14 structurally 20:24 82:18 structure 9:11 52:23,24 55:22 56:9,9 58:1 59:14 62:17 64:9,11 65:11	65:14 76:22 77:9 78:3,7,10 79:5 80:3,23 82:10,12 84:1 85:20 90:5,6 91:15 93:14 94:19 97:18 98:14 99:19 103:20 106:17 106:18 111:16 111:21 118:14 118:16 124:15 129:24 134:17 136:5 structures 53:21 63:12 65:16 112:12 112:18 133:23 140:23,25 students 8:4 subheading 17:25 44:22 subscript 112:6 subsection 11:6 17:20 26:14 subsequent 143:6 substantially 90:15 95:16,22 96:2 97:13 108:9 substrate 100:6 113:16,23,24 117:21	suffice 130:16 sufficient 9:6 suggested 128:13 suggesting 58:12,18 118:7 135:9 suitable 90:15 90:21 95:17 108:10,20 suite 2:9,15,19 sum 92:17 summarize 23:22 summarizes 46:22 summary 34:3 95:12 97:1 110:25 support 5:2 supposed 32:1 sure 6:12 9:5 19:3 25:20 30:3,23 39:23 50:8 51:8 62:13 70:22 85:1 123:8 125:16 134:22 140:6 surface 86:6 surmise 38:21 sweeping 48:16 sworn 4:2,7 147:7	symmetric 53:15 87:4 121:4,8 143:20 symmetrical 89:23 115:12 symmetry 44:23 50:20 68:8,8,11 138:13,14,20 143:14,15,17 143:18,24,25 144:2,6,19,20 144:21,22,23 145:1,4,6,8,12 145:15 synonymous 52:5 126:19 system 13:20 14:2,20,23 15:1,3 systems 13:10 13:15 113:8 t t 3:8 tab 33:2 table 46:20 48:21 take 9:14 26:4 32:9 44:10 64:13 68:13,17 68:20 79:11 83:19 86:5,11 86:12 91:5 94:21 101:20 109:12 145:23
---	--	---	--

taken 1:15 42:6 44:16 91:7 101:19 109:21 119:19 122:14 123:20 124:4 125:5 147:10 takes 32:11 talk 50:20 108:24 117:16 talked 134:7 talking 23:12 42:1 60:16,18 85:22 90:8 92:1 97:6 113:21 134:15 135:6 138:14 140:18 talks 70:16 108:24 taught 7:25 93:5,24 teaches 126:24 126:24 teaching 7:24 9:25 10:1,13 10:14 90:14 91:19 97:14 107:3 138:21 138:22 139:19 139:21 142:6 teachings 139:3 technique 31:2 techniques 49:2	technology 11:4 tell 33:21 55:6 61:11 78:24 ten 44:11 tennessee 2:15 term 112:13 126:17 terminal 97:3 terminals 31:8 terminates 36:21 37:21 terms 25:6 testified 4:7 5:7 5:8 testify 147:7 testifying 4:19 testimony 5:1 24:24 147:10 texas 2:10 text 113:4 thank 4:13 19:8 19:8 26:11 44:14 101:4 109:18,20 146:1 thanks 137:14 144:15 theoretical 10:17 thereof 111:18 thickness 114:13,19 thing 6:9 19:12 24:11 25:8	26:6 29:14 46:17 55:4 59:7 138:13 things 23:16 24:3,4,20,20 32:25 50:10,11 66:19 83:22 100:20 121:12 think 5:9 7:19 8:17,23 10:2 10:24 16:1 20:22 22:11,14 25:4,21 26:2 28:22 29:12,18 30:7 34:25 38:23 39:9,10 40:10,17 42:3 42:19 47:14 50:2 51:12 53:23 57:2 58:18,21 59:2 60:16,21 61:12 62:25 64:7,13 66:17 70:13,14 73:8 78:21,22 79:8 83:19 84:3,16,24 87:3 97:15 103:11 105:17 105:19 107:4 108:13 109:9 112:25 113:1 113:21 114:7 117:10 122:18 122:25 126:4	128:22 135:9 137:4,12 138:12,15 139:15 140:12 141:8,11,21 143:13 145:2,3 third 34:20 35:11,12,13 69:21 74:19,25 75:2,9,15,17 117:1,13 128:20,23 132:15,21,22 143:5 thought 6:6 125:21 143:17 three 27:17,18 33:5 39:4,6 43:6,22 45:16 71:4,9 72:19 72:21 112:7 118:10 124:10 124:15,19 129:1 130:18 130:21 132:19 133:21,22 134:25 135:5,6 135:11,19,24 136:12,19,20 136:22 137:5 137:16,18 138:3,16,25 141:9 thumb 47:20 47:21
---	--	---	---

thursday 1:25 tied 54:22 130:13 141:10 tight 49:5 tightly 49:22 49:24 time 44:13 53:16 109:10 109:15 146:2 147:11 times 5:7 115:1 title 110:21 titled 17:21 26:15 52:12 63:7 94:14 today 4:18 5:14 5:19 7:20 113:17 146:3 together 5:12 43:3 47:11 48:4,18 49:25 50:5,5 54:22 59:6 65:6 86:4 91:22,24 100:7 130:13,22,23 131:1 132:20 133:8 136:12 137:6,21 139:19 141:7,9 142:9 top 11:1 18:11 27:10 30:20 31:13,14 33:2 38:13 39:4 42:13,23 43:6	43:7 46:7 47:7 50:9 57:8 59:12 63:16 66:4,5 71:7 72:17,22,23,24 74:6 85:4,10 85:15 101:9,16 102:23,25 103:4,5 105:16 105:18,18,22 105:23 106:16 116:20 117:12 118:17,25 119:1,10,17 120:13,19 121:3,17 124:13 125:1 127:6 128:6,17 128:18,20,24 129:21 132:20 133:3,20,22 135:2,15 138:15,17 145:4,16,19 total 118:1,5 touching 133:14 towards 115:8 trade 45:1 trademark 1:1 tradeoffs 47:3 87:24,25 traditional 56:7	transcript 1:13 5:23 147:10 transfer 14:25 transformer 10:6,9,15,16 13:5 14:1 15:7 15:9,16,17,19 15:21,22 16:4 16:11,14,16,19 17:9,11,14,16 18:25 19:2,9 19:11,13,14,18 19:20 20:4,4,8 21:9,17,22 22:10,19,24,25 23:4,9,11,15,21 23:23 24:8,10 24:21 25:2,8 25:16,19,22,24 26:6,7 63:12 63:18 64:5,15 64:22 65:11 67:10,18,25 70:6 71:4,8,13 72:18 73:1,22 77:9 80:14 82:17 83:5,13 83:16,21 84:18 84:22,22 85:3 85:7,8,12 86:16,18 89:23 90:1,5,9,10,15 90:21,24,24 91:1,4,14,20 92:2 94:19	95:17 96:2,15 96:19 97:13,18 98:14 99:6,13 99:22 100:5,13 100:19 101:12 103:17 107:13 107:15,18 108:9,16,20 109:1,5,8 transformers 9:22,24,25 10:3,12 12:25 13:4,10,17 82:24 95:22 108:24 translating 134:21 transmission 14:12,18,20,23 14:25 transmissions 14:15 transmitters 18:20 trench 112:13 112:18,20,22 112:25 113:1 139:24 trial 1:2 tried 22:16 trouble 134:21 true 24:11 25:8 26:6 38:17 59:1 147:10
---	--	---	---

truth 147:7,8,8 try 61:10 62:1 134:3 140:15 trying 15:5 19:19 25:5,11 29:1 35:16 64:24 80:4 104:21 137:10 141:6 turn 10:19 30:8 36:25 50:19,24 51:17 52:8 71:8 72:18 101:1 107:10 114:21 122:13 125:3,18 turns 11:17 12:5,7,8 16:4 19:3,10,11,16 19:21 20:1 23:18 24:16 29:25 47:11 49:6,8,22 67:2 67:6,8,14,24 85:4 119:12 twice 5:9 two 4:19,22,23 15:10,14,16,18 16:15 17:5,6 19:14 21:18 24:22 25:9 28:2 38:13 39:7 42:17 43:23,25 45:14 49:18 51:4,4,6	51:16 57:10 61:13 63:18 64:6 67:19,20 73:25 77:25 79:13 80:9 84:21,23 85:8 86:17,19 90:10 96:20 97:13 98:7,19 99:1 102:14 108:4,6 108:16 117:7 117:12 119:12 119:15 122:8 122:21,21 123:6 125:7,12 125:20,21,21 126:5,8,11,20 128:17 129:17 129:21 130:1 136:9 137:15 tying 142:8 type 85:13 113:1,24 types 45:14 47:8 83:10 113:21 typically 138:23 u u 4:17 27:6 u.s. 1:5 3:10,13 3:14 5:3 31:21 55:23 ultimately 119:25 120:11	unannotated 133:18,20 under 5:18 28:13,18 29:16 41:23 57:9 75:14 81:23 82:14 102:9 106:2,3 119:10 119:15 129:5 141:10 143:21 144:9 underneath 11:6 39:6 48:20 119:14 134:9 136:14 underpass 28:15 30:22,25 31:16 41:21,25 52:6 57:22 58:4 60:24 102:11,13 103:14 104:7 106:8 122:1 129:1,6,8,8,14 130:9,17 131:2 131:22,25 132:1 133:13 133:24 134:14 137:1 139:18 143:4,11 144:12,24 145:9 underpasses 42:18 61:3	understand 4:18 5:4,18 7:10 20:23 22:2 25:20 29:1 30:19 34:23 43:5 54:15 58:11 62:2,13 70:5,9 70:14 78:22 80:4 82:20 112:1,18 118:21,23 119:5,7 121:15 128:5 131:18 135:6 140:20 140:24 141:6 understanding 7:14 8:1 9:25 11:10 21:25 24:2 78:6 79:10 80:7 96:8 102:13 111:6 112:20 118:3,10 119:18,22 121:13 122:2 122:19,25 125:17 understood 8:11,19 23:8 29:22 39:18 47:3 60:20 61:11 65:10 102:1 105:4 106:15 117:19
--	---	--	--

127:8,20 128:3 131:4,6 132:6 142:20 undesirable 50:11,15 uniform 67:2 86:4,15 87:1 116:2 141:4 uniformity 67:22,23 uninterrupted 103:3 united 1:1 7:7 unused 93:16 upper 45:16,18 51:25 67:7 81:24 102:19 103:12 111:23 116:20 117:7 120:20 135:22 use 15:4,6 21:9 22:18,19 52:25 53:9,24 54:4 55:2 58:3 59:4 59:16 60:6 61:16,18,23 62:8,14 90:15 90:21 95:17,22 100:14 108:10 108:20 112:17 134:17 138:9 138:16,25 139:9,17,24 141:20	used 10:6 13:10 13:14,16,17,20 14:1,4,6,11,14 14:22 16:15,18 18:19 22:24,25 24:7 25:2 26:10 31:18 46:1,19,19 56:22 57:5 58:24 60:10 62:5 63:11 67:25 75:19,21 76:1 94:18 99:22 100:13 108:16 112:3 114:13 132:21 132:22 142:14 uses 12:16 28:9 111:21 140:22 using 5:13 21:16,21 30:21 30:25 38:5 47:4 49:1 58:20 71:4 90:19 97:7 104:22 112:9 112:10 124:21 126:18 136:25 138:23,24 140:25 141:25 142:6 usually 138:14 utilize 57:17 61:22 138:18	utilized 57:21 62:20 139:13 141:6 utilizes 62:17 71:9 72:18 utilizing 60:25 98:13 v v 112:6 v1 19:10 v2 19:9 value 11:22 48:24 50:6 values 48:25 various 1:21 20:12,15 21:14 22:5 25:13 39:25 44:25 100:23 131:14 verbal 5:22 veritext 6:7,16 version 133:18 133:20 versus 25:16,18 vertical 42:12 42:16 68:9,10 vertically 74:1 74:11 vias 29:23 30:21 43:3,8 43:19 51:1,18 51:22 52:1 53:25 54:4,11 54:12,19,22 59:23,23 74:15	78:12 79:12 80:9 81:13,14 103:11 104:11 112:3,6,8,25,25 119:5,7,15 130:13,14 133:23,25 134:9,12 136:4 138:23 139:24 141:20 vicinity 126:10 videoconfer... 1:21 view 31:14 36:10,11 37:14 39:2 42:11 71:8 72:17,23 72:24 101:15 101:18 105:14 105:18,20 116:12 121:3 123:20 125:2,5 133:20 135:2 135:15 views 36:14,17 39:25 virtue 46:6,8 135:1 visualize 64:15 134:2 vn 141:16,17 voltage 13:11 13:15,17,20 14:2,6 15:3,6 19:9,10 20:1,9
--	--	---	---

vs 1:7 26:15	129:2,3,19	67:16,22,25	132:13 135:7
w	137:20 144:5	69:17,18,21,22	138:5,6 139:12
walked 47:9	ways 86:20	70:1 71:14,14	windings 19:21
wandering	97:6 100:3	71:19 72:11	19:22 23:25
45:18	134:7 142:19	73:2,4,9,14	24:2 27:18
want 6:9 10:19	we've 9:1 25:14	74:24 75:9,14	28:3 33:22
22:18,19 24:14	36:9 53:20	75:17 76:12,25	41:24 43:22
29:2 30:14	54:3,21 56:14	77:4,6,12,15,19	48:17 50:4,5
32:25 37:8	65:16 80:2	77:22,23 78:2	51:24 53:1,10
38:22 39:21	91:23 100:16	78:12 80:8,12	56:13 57:1
47:17 48:14	went 134:9	80:14,14,22,22	58:25 59:5,5
49:17 70:8,13	143:2	80:24 81:1,2,5	59:17 60:8,10
74:3 83:11	wide 13:5	81:7,10,14,15	60:11,19 61:17
92:10,12 94:5	wider 85:9,15	81:16 82:4,7,8	61:19 64:3,6,7
138:23	85:17	84:17,18,20,25	64:13,16,17,21
wanted 17:13	width 114:18	85:2,4 88:8	65:11 67:19,20
66:7 91:10	winding 11:17	89:18,22 90:18	77:25 78:9
93:23	12:3 28:10,13	91:22 92:5,8	82:17 83:5,15
wanting 107:1	28:20 29:3,7	93:2,17,25	83:17 84:21,23
wants 87:3	29:10,12,13,19	96:4,6 97:20	86:3,17,19,21
140:19,20	29:21,23 33:14	97:21 98:13,22	87:17 96:3,16
washington 2:5	33:15 34:15,16	99:21 101:22	96:20 97:14,17
way 8:14 14:20	35:2,19 36:1,2	102:4,8,9,19	98:7 102:4,5
22:16 25:21	36:20,24,25	103:2,2,4,16,19	102:10,14,16
28:15 29:16	37:4,18 38:2,3	103:21,25	106:4 107:17
30:15,25 48:3	38:12,15 41:1	104:2 105:10	120:12 122:9
58:6 59:3 60:2	41:2,7,17	106:5,10,19	122:21,22
60:4 61:11,25	42:23 43:2,7	108:2,8,19	125:3,8,20,21
79:10 82:23	43:18 44:6,9	109:4,6 118:19	126:6,8,12
83:12 86:1	51:22,25 53:17	119:6,11,12,20	131:15 137:14
88:1,7 99:7,10	57:9 58:15,21	119:25 120:11	137:16 138:22
100:8 119:8	61:2,4,6 62:9	122:15,16	144:13
122:17 124:13	62:10,15,21,21	123:24 124:15	window 6:7,17
125:15,17	64:11 65:1,2,3	124:16 126:18	winston 2:3,8
128:14,15	65:4,4 67:15	126:18 127:9	

winston.com 2:6,6,11 wire 20:18 47:24 wires 17:6 witness 1:23 3:2 4:2 6:6 28:22 30:18 43:11 44:14 55:2 56:17 58:17 61:9 65:22 68:2 72:2 77:2 79:8 79:19 81:5,12 81:22 82:20 84:3 87:21 88:11,25 89:25 90:8 92:7 93:19 95:3 96:11,18 97:24 98:16 100:2 102:18 103:24 104:21 105:12 106:21 108:13 108:23 109:17 109:20,24 110:10 113:20 116:5 120:3,9 121:2,11,25 124:9 126:1 127:17 129:11 130:12 131:18 132:10,18 133:6 134:2,20 135:9 136:8	137:4 140:2 141:24 145:11 145:18 146:4 wonder 68:17 wondering 34:5 word 50:16 55:18 wording 104:23 words 12:1 57:15 87:7 92:10 96:23 101:20 117:25 132:2 139:17 work 10:2 91:1 worked 6:22 works 10:1 59:3 79:10 109:10 worries 40:13 68:19 wound 15:23 49:22,24 84:13 wrapping 47:24 48:2 wrong 105:17 x x 3:1,8 y y 27:6 42:12,12 42:16,16 yang 3:15 110:8,17,21	112:2 115:9,12 115:20,22 116:10,17 117:17,23 118:3,7 121:7 121:11,23 122:24 123:6 126:24 127:15 127:20 128:2 128:25 129:25 130:5,24 131:6 138:22 139:18 139:21,23 140:3,11,17 142:13 143:4 yang's 128:6 139:16 yeah 34:8 89:8 93:4 122:13 136:22 139:21 years 7:25 yellow 116:21 120:21 122:9 z z 27:6 zoom 1:21 2:1 34:10 69:14 110:16,24 140:15 zoomed 140:16
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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.

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