

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

3
4 NXP USA, INC.,

5 Petitioner,

6 v.

7 BELL SEMICONDUCTOR, LLC,

8 Patent Owner.

9
10 IPR2024-00168

11 Patent 7,345,245 B2

12
13 Deposition of DR. JOSEPH BERNSTEIN

14 Conducted virtually via Zoom

15 Thursday, November 7, 2024

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21 Reported by: THERESA A. VORKAPIC,

22 CSR, RMR, CRR, RPR

1
2 Deposition of Dr. Joseph Bernstein,
3 conducted virtually via Zoom, pursuant to notice
4 before Theresa A. Vorkapic, a Certified Shorthand
5 Reporter, Registered Merit Reporter, Certified
6 Realtime Reporter, Registered Professional
7 Reporter and a Notary Public in and for the State
8 of Illinois.

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(Retained by counsel.)

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P R O C E E D I N G S

THE REPORTER: Would you raise your right hand, please.

(The witness was duly sworn.)

DR. JOSEPH BERNSTEIN,
called as a witness herein, having been first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. TAYLOR:

Q Good afternoon, Dr. Bernstein.

A Good afternoon.

Q My name is Tim Taylor and I'll be taking your deposition today.

Am I correct that you're presently located in Israel?

A I am.

Q Excellent. Can you please state your full name for the record.

A Joseph Barry Bernstein, J-o-s-e-p-h
B-a-r-r-y B-e-r-n-s-t-e-i-n.

Q Thank you.

MR. TAYLOR: Counsel, I want to confirm

1 that this deposition is being taken pursuant to
2 the IPR rules that permit the taking of remote
3 depositions where the witness is in a foreign
4 country.

5 MR. SHAPIRO: Yes. Patent owner agrees.

6 MR. TAYLOR: We're proceeding pursuant to
7 the agreement that his testimony will be the same
8 as if given in person in the United States,
9 correct?

10 MR. SHAPIRO: That's correct.

11 BY MR. TAYLOR:

12 Q Thanks. Dr. Bernstein, are you a US
13 citizen?

14 A I am.

15 Q Are you presently located at your home in
16 Israel?

17 A Yes. This is my home in Israel.

18 Q Could you please provide the address?

19 A The street name is called Mesesh Hochma
20 M-e-s-e-s-h, Mesesh, it's Hebrew, what can you
21 say, H-o-c-h-m-a, Mesesh Hochma, No. 48. I could
22 have gotten an address that's like Route 2 or

1 something.

2 Q That's all right.

3 A Modi'in Ilit, M-o-d-i-i-n I-l-i-t in
4 Israel.

5 Q Doctor, is there anyone else in the room
6 with you today?

7 A No. I'm here alone. I have a screen up
8 over my bed so it doesn't look like a bedroom.

9 Q Can you confirm that you don't have any
10 chat or other application windows open on your
11 computer that you're using?

12 A I have no chats. In fact, what I'll do is
13 I'll even close my Skype and I can close my chat
14 message thing, how is that, just to make sure.
15 Okay, all closed.

16 Q Can you confirm that you don't have your
17 phone or any electronic device that could be used
18 to communicate with anyone else during the
19 deposition?

20 A I have a phone but I could take it out of
21 the room or put it on silent. Can I take it out
22 of the room or put it in a drawer or something?

1 Q You can put it in a drawer.

2 A Whatever you say. Most people have phones
3 with them. Okay.

4 Q I want to confirm that you don't have any
5 means available to you for communicating with
6 anyone other than through this deposition portal;
7 is that correct?

8 A At the moment that's absolutely true.

9 Q Have you been deposed before?

10 A Yes. I've had depositions before.

11 Q About how many times?

12 A It's hard to count. I've been doing this
13 for almost 30 years now. So at least maybe
14 between 12 and 20, 50, I don't know. It's more
15 than 10, maybe less than -- I don't think I had
16 one a year so average is somewhere in the middle.

17 Q Have you provided testimony in other IPRs?

18 A Yes, I have.

19 Q Have you provided testimony in connection
20 with District Court patent litigation?

21 A I have, yes.

22 Q So you understand how this process works;

1 you're pretty familiar with it; is that correct?

2 A Pretty familiar with it, yes.

3 Q During this deposition, I'm going to ask
4 you a series of questions. My questions and your
5 answers will be recorded by the court reporter.
6 And to help the court reporter do their job, it's
7 important that we don't talk over each other so
8 I'll try and stop to listen while you're speaking
9 and I'd ask that you do the same for me; is that
10 okay?

11 A That's okay.

12 Q Excellent. If you don't understand a
13 question, though, please feel free to clarify. If
14 you don't ask to clarify, I'll assume that you
15 understood the question.

16 A Okay.

17 Q It's also important that you speak up and
18 answer my questions orally as the court reporter
19 won't be able to record nonverbal responses such
20 as a thumb's up or a head nod or shaking your
21 head. Okay?

22 A Yes, I understand.

1 Q Excellent. Your attorney may object after
2 I answer a question. If that happens you still
3 must answer the question unless your attorney
4 instructs you to not answer on the basis of
5 privilege.

6 Do you understand?

7 A I do understand.

8 Q Is there any reason you are unable to give
9 truthful and complete testimony today?

10 A I should hope not.

11 Q You understand that you're under oath?

12 A Yes.

13 Q And, therefore, you're legally obligated
14 to give truthful testimony during this deposition,
15 correct?

16 A Correct. I understand that I am under
17 oath.

18 Q Is there any reason, medical or otherwise,
19 why you cannot testify fully, truthfully and
20 accurately today?

21 A Not that I know of.

22 Q I'll try to take a break every hour or so.

1 If you want to take a break at some other time,
2 that's fine. Just ask me. However, my only
3 request is that if I've currently asked a question
4 that we finish answering the question and then
5 we'll take a break; is that okay?

6 A That is okay.

7 Q Excellent. Do you understand that you may
8 not consult with or confer with your attorney
9 regarding the substance of this deposition at any
10 time during the deposition including during
11 breaks?

12 A Yes, I understand that.

13 Q Excellent. Do you understand that you're
14 being deposed in connection with inter partes
15 review No. IPR 2024-00168 regarding US Patent
16 No. 7,345,245?

17 A I can review the number. And I'll assume
18 your number is correct, yes.

19 Q Just for shorthand, I'll generally use the
20 terminology the '245 patent. I'm referring to US
21 Patent 734,245.

22 You are familiar with that shorthand?

1 A Yes, yes. That's the shorthand I'm
2 familiar with.

3 Q Excellent. When were you first retained
4 by Bell Semiconductor for this IPR?

5 A Oh, I'm going to have to go through my
6 notes, if I can remember from my billing, I've had
7 seven bills and the last one was a few months. So
8 at least I'd say about eight months ago, seven or
9 eight months ago perhaps.

10 Q So it would be sometime in March?

11 A I guess so, March, April, May, June, July,
12 August, September, yes, something like that.

13 Q In this case in the IPR regarding the '245
14 patent, you submitted two separate declarations;
15 is that correct?

16 A That is correct.

17 Q Your first declaration in this case was
18 signed on February 20, 2024, and that is labeled
19 as Bell Semic Exhibit 2001 and I can share that
20 with you?

21 A It obviously tells me that it was before
22 March that I had started on this.

1 Q Yes, so February?

2 A At least February, or maybe January, I
3 don't know, in that timeframe.

4 Q Can you see my screen, Doctor?

5 A Yes, I see very well.

6 (A certain document was marked Bernstein
7 Deposition Exhibit 2001 for
8 identification, as of 11/07/2024.)

9 BY MR. TAYLOR:

10 Q Excellent. Is this your first declaration
11 in the IPR regarding the '245 patent?

12 A Yes.

13 Q Is this document marked Bell Semic
14 Exhibit 2001 that I'm sharing with you?

15 A It's marked that way at the bottom, yes.

16 Q If I refer to Exhibit 2001 or your first
17 declaration, do you understand that I'm referring
18 to this document?

19 A Yes, I do.

20 Q You had a second declaration as well.
21 This one is labeled as Bell Semic 2003.

22 A Yes.

1 Q This was signed by you on August 21, 2024
2 and if I refer to this Exhibit 2003 or your second
3 declaration, do you understand that I'm referring
4 to this document, Bell Semic 2003 your second
5 declaration.

6 Do you understand that this is the
7 document I'm referring to?

8 (A certain document was marked Bernstein
9 Deposition Exhibit 2003 for
10 identification, as of 11/07/2024.)

11 MR. SHAPIRO: Objection. Form.

12 BY THE WITNESS:

13 A Yes, I'll understand that the second
14 declaration refers to this which was my second
15 declaration calling patent owner response as
16 opposed to preliminary patent owner response. You
17 can also refer to preliminary or the POR. Either
18 way, I'll understand.

19 MR. SHAPIRO: Did the court reporter --
20 was she able to get my objection there?
21 Objection. Form.

22 THE REPORTER: Yes, I got it.

1 MR. SHAPIRO: Okay, great. Thank you.

2 BY MR. TAYLOR:

3 Q All right. Perfect.

4 Doctor, who prepared the first
5 declaration?

6 A As with most declarations, I like to take
7 charge of most of the writing and, of course, then
8 we send it to the lawyers to do the editing and
9 there's a bit of back and forth as is the usual
10 case of these declarations, but I do like to take
11 most of the charge myself because, you know, this
12 way I'm in control and, therefore, in the
13 deposition I feel like I'm more comfortable
14 answering questions. So I mostly -- okay,
15 whatever.

16 Q And the second declaration, who prepared
17 the second declaration?

18 A It was the same basic protocol. As I
19 said, I take notes and I write it to some order
20 that I have, I give it to them to put it in
21 whatever format and then we have our discussions
22 back and forth until it's what it is.

1 Q How much time would you estimate you spent
2 on the first declaration?

3 A Again, I mean, I could look at my bills.
4 This was not exorbitant. It was fairly less than
5 my usual so it was probably, I don't know, it's
6 hard to give a number. Maybe 30 hours altogether,
7 for the first one itself is less because I think
8 it was in the order of 20-something hours. So
9 something in that order. I don't remember. I
10 could look at my notes if you want me to look at
11 my bills and get exact numbers.

12 Q That's okay. So you would estimate
13 between 20 and 30 hours on your first declaration?

14 A I'm thinking it may be less. It's hard to
15 say. 20, somewhere in that range. Maybe less
16 than 20. I don't remember for the first one.

17 Q On the second declaration, how much time
18 would you say you estimated you spent on the
19 second declaration?

20 A Back in August, don't think it was much
21 more time so I'll say less than 30 probably. I'm
22 pretty sure between the two of them I'm pretty

1 sure it was less than 50. So they were both --
2 yeah, the second one I would say probably less
3 than 30, maybe more than 20. Again, I'd have to
4 look at my notes and look at my bank account.

5 Q Thank you. Did you read the '245 patent
6 prior to preparing or doing work on your
7 declarations?

8 A Certainly I read the patents, uh-huh.

9 Q Did you read the prosecution history prior
10 to or during your work on the declarations?

11 A I had gone through the prosecution
12 history. I don't know that I read the whole
13 thing. There's lots and lots of legal stuff in
14 between there, but the important parts or the
15 parts that were guided to me through the counsel I
16 did read.

17 Q Thank you. So did you write -- you said
18 you worked with counsel. Sorry. Strike that.

19 You said you worked with counsel on the
20 declaration kind of in corroboration.

21 How much of the first declaration would
22 you say you wrote yourself?

1 A You mean which words were used as opposed
2 to -- again, it's hard to say. I have extensive
3 notes that I write and I try to put them in an
4 order could be like a declaration format and then
5 many of those words are put in and either modified
6 or put in the order that they would like to see
7 from a legal point of view, because I'm writing
8 from a scientific paper point of view and they
9 need to put it in a legal point of view. So which
10 words are used exactly were mine. It's really
11 hard to say what percentage. That's a very
12 difficult number to, you know -- I guess even if I
13 were to go through it with you, I probably
14 couldn't say which are their words and which are
15 my words. So it's really hard to distinguish.

16 Q Thank you.

17 I just want to confirm that you stand
18 behind all of your statements in both your first
19 and second declarations; is that correct?

20 A Yes, I stand by it. I signed it and I am
21 under oath so I believe that I'm holding that this
22 is a document that I agree with and as a truthful

1 conveyor of my knowledge and my experience, I
2 believe that it is all honestly portrayed in my
3 declarations.

4 Q Thank you.

5 So I want to turn to Exhibit 2001, your
6 first declaration, and go to Page 9.

7 Do you see that, Doctor?

8 A Yes.

9 Q Paragraph 24, you state that the first
10 step in performing a validity analysis of patent
11 claims is to interpret the meaning and scope of
12 the claims by construing the terms and phrases
13 found in those claims.

14 Is that correct?

15 MR. SHAPIRO: Objection. Form.

16 BY THE WITNESS:

17 A That's way I was informed by the counsel
18 as I wrote that's how I understand it, so yes,
19 that's correct, by the way I understand it.

20 BY MR. TAYLOR:

21 Q So in your first declaration, did you
22 construe the claims?

1 A Well, as we say, this is where we have to
2 make the distinction of the legal document which
3 is the patent itself being a legal document trying
4 to convey scientific meanings which is why in
5 these kinds of definitions and interpretation and
6 language, we're trying to convey the proper
7 scientific understanding in words. So I think you
8 need a collaboration. So obviously, you know,
9 construing sounds like a legal term for which I
10 don't know if I'm actually construing or I am
11 assisting in putting the proper words to what I
12 think fits to the most closely correct scientific
13 meaning.

14 Q So, Doctor, in your analysis, did you
15 interpret what the claims meant?

16 MR. SHAPIRO: Objection. Form.
17 BY THE WITNESS:

18 A Well, obviously I have to come to some
19 understanding of what the claim means in order to
20 make an analysis.

21 So I'm coming to my own understanding.
22 Again, as I said, I'm not the lawyer and I am not

1 the wordsmith, so to speak. I'm here to make my
2 scientific opinion and based on my experience and
3 if my understanding of the meaning based on a
4 simple understanding or as we said what I would
5 assume the understanding of a POSITA at the time
6 frame of the invention how he would have
7 understood it, that's the frame in which I'm
8 trying to understand the language for the meaning
9 and scope of the claim.

10 Q In the first declaration, did you
11 interpret the claims in their plain and ordinary
12 meaning?

13 MR. SHAPIRO: Objection. Form.

14 BY THE WITNESS:

15 A My understanding is we always interpret
16 the language in the plain and ordinary meaning to
17 someone who is skilled in the art, a person of
18 ordinary skill and how would that person
19 understand this language in it's plain and
20 ordinary meaning if that answers your question. I
21 think that's what I said.

22 Q Yes. Thank you. Okay. So now I want to

1 turn to your second declaration. This is
2 Exhibit 2003.

3 Doctor, in your second declaration in
4 Paragraph 82, you stated: "The petition fails to
5 specify the meaning of three claim terms that are
6 critical to this proceeding"; is that correct?

7 A Yes, I said that.

8 Q You then list three terms on the bottom of
9 Page 24 to Page 25, and those are marked with
10 numerals I, II and III.

11 Do you see that?

12 A Yes, I see that.

13 Q I'm going to refer to these different
14 terms as Claim Term I, Claim Term II and Claim
15 Term III based off of your notation. Is that
16 okay?

17 A That's okay.

18 Q And if you're ever confused about what
19 claim term I'm discussing, we can always come back
20 here to verify that Claim Term I is Roman
21 Numeral I, Claim Term II is Roman Numeral II and
22 Claim Term III is Roman Numeral III here, is that

1 okay?

2 A Just one second. My vision -- I'm going
3 to change my glasses or maybe you can expand a
4 little bit. Is it possible to do that?

5 Q Let me see if I can zoom in.

6 A These glasses are better. These are my
7 reading classes. Those multifocals are sometimes
8 not perfect for the computer screens. Okay,
9 reading glasses are good.

10 Q So from the first declaration that we
11 looked at, there was no specific claim
12 construction put forth and then in the second
13 declaration that we're looking at now we have a
14 claim construction from Pages 24 down to Page 38;
15 is that correct?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A That's what we have in front of you. I
19 didn't review the first one to know by my own
20 firsthand, but I will rely on counsel over here
21 that he did that analysis, but it sounds about
22 correct.

1 Q Okay. What changed from your first
2 declaration to your second declaration?

3 MR. SHAPIRO: Objection. Form.

4 BY THE WITNESS:

5 A I believe there was a response from the --
6 you're the petitioner, right, and we're the patent
7 owner? I just to make sure we get our claims
8 correct.

9 I believe there was an institution
10 decision. There was something in between. There
11 was I believe it was the institution decision
12 which I think made it clear to us that the
13 definitions that we were using and that the
14 opposing side was using were not quite aligned.
15 So we decided it was important that we make clear
16 definitions as to how we wanted to define these
17 terms. It becomes critical, as I say here it's
18 critical to the proceeding because if we can't
19 define something as a simple as a signal trace or
20 a bottom routing layer or all these terms, then
21 we're two ships passing in the night.

22 BY MR. TAYLOR:

1 Q So what changed between the first
2 declaration and the second declaration was the
3 institution decision; is that correct?

4 MR. SHAPIRO: Objection. Form. And I'm
5 going to caution the witness not to reveal any
6 privileged communications between himself and
7 counsel.

8 BY THE WITNESS:

9 A Okay. Well, there were discussions based
10 on -- I believe the only thing that changed in the
11 record would have been the institution decision.
12 I think there's a petition and then our
13 preliminary response, and then there was an
14 institution decision and then we came along with
15 our patent owner full response.

16 So I believe that the major motivation for
17 making a second declaration would be the response
18 of the board from the institution decision, and
19 obviously that would involve discussions between
20 counsel.

21 BY MR. TAYLOR:

22 Q Is there any -- strike that.

1 Did you review the institution decision
2 before our meeting today?

3 A That was not one of the things I
4 immediately read between -- I think between
5 yesterday and today. I have reviewed at some
6 point -- I think that was on my list of things
7 that I reviewed. I had a long flight from
8 San Diego and I reviewed a number of documents.
9 It probably was one of them, but I can't recall
10 sitting here that I actually reviewed it again
11 carefully or the whole thing so obviously I've
12 read it before I had written my declaration, but I
13 can't certify that that was one of the documents I
14 reviewed carefully before this deposition.

15 Q Thank you.

16 Doctor, do you recall the Claim Term I
17 which I'll highlight here for you, do you recall
18 that being discussed in the institution decision?

19 A I don't remember the specifics of the
20 institution decision, but if you show me where it
21 is in the institution decision, I'll be happy to
22 opine on it or discuss more about what I remember.

1 Q Okay. Thank you Doctor, in your second
2 declaration looking at Page 25 here, Claim Term
3 II, do you recall that term being discussed in the
4 institution decision?

5 A It's the same thing, sitting here today
6 even having reviewed whether I reviewed it, this
7 is a question I can't remember what I was thinking
8 at the moment when I -- you know, I didn't review
9 it immediately enough and carefully enough to
10 remember what came from the institution decision.
11 So I can't really answer that other than, you
12 know, it says what it says.

13 Q I'm going to pull up Paper 19 of IPR
14 2024-00168.

15 Doctor, can you confirm that this document
16 is marked Paper 19?

17 A I can confirm that, yes.

18 Q This is the institution decision?

19 A I see that.

20 Q When I refer to the institution decision,
21 do you understand that I'm referring to this
22 document?

1 A Yes.

2 Q Doctor, I can give you control of the
3 document if you like, but can you read through the
4 claim construction portion of this document,
5 please.

6 A Okay.

7 Q And while you're reading through, can you
8 try to see which claim terms they are discussing
9 during this section?

10 A Okay. You're saying I can scroll that
11 somehow?

12 MR. TAYLOR: Theresa, can you give
13 Dr. Bernstein control?

14 THE REPORTER: I cannot. You have to give
15 him control.

16 BYMR. TAYLOR:

17 Q Or if you like, it's a short section --

18 A It that's fine.

19 MR. SHAPIRO: Dr. Bernstein, do you have a
20 clean copy of all the documents or not?

21 THE WITNESS: I do have most of them. I
22 can see if I have -- that's okay? I have many

1 documents here. Let me see which one --
2 institution, yes, I do have it.

3 BY MR. TAYLOR:

4 Q Page 9.

5 A I can go to Page 9. This does make it a
6 little easier, yes.

7 Claim construction, starting from claim
8 construction is the part to review, "the board
9 interprets claim language," is that what you want
10 me to read?

11 Q Yes. You don't have to read it out loud
12 if you don't want to.

13 A I understand. I want to make sure I read
14 the right paragraphs. Okay. I read it, thank
15 you.

16 Q Do you also have your first and second
17 declarations available?

18 A Yes, I have my second declaration. Let me
19 pull out my first declaration.

20 Q If you can pull up your second declaration
21 on Page 24.

22 A Okay. My second declaration on Page 24.

1 Yes, I see claim construction, what you were just
2 showing me.

3 Q You'll see the three claim terms there
4 that you state were critical to this proceeding in
5 your second declaration, correct?

6 A Yes, correct.

7 Q So from the institution decision section
8 that you just read, the claim construction
9 section, what of the three claim terms was
10 mentioned in that section?

11 MR. SHAPIRO: Objection. Form.

12 BY MR. TAYLOR:

13 Q Doctor, I'm sorry, I just wanted to make
14 sure you read it. I got it, you're reading, thank
15 you.

16 A "Wherein none of the signal traces are
17 located over ball pads of the ball pad layer which
18 are disposed in an area."

19 That's the one claim language that they
20 mentioned as a recitation in their analysis.

21 Q So earlier you said the only thing that
22 changed between the first declaration and the

1 second declaration was the institution decision;
2 is that correct?

3 MR. SHAPIRO: Objection. Form.

4 BY THE WITNESS:

5 A I believe I said that that was the one
6 significant change other than the discussions with
7 the counsel, of course.

8 BY MR. TAYLOR:

9 Q Okay. So what caused you to change the
10 definition of Claim Term II in your second
11 declaration?

12 MR. SHAPIRO: Objection. Form, and,
13 again, I'm going to caution the witness not to
14 reveal any attorney-client privileged
15 communications with counsel.

16 BY THE WITNESS:

17 A I don't think we changed the meaning. I
18 think we just felt it was important to clarify
19 what a POSITA would have understood these terms to
20 mean. Obviously I didn't change any meanings of
21 anything. You can't change the meaning of a
22 patent after it's out there, but clarifying

1 because it looked like there was some confusion in
2 not only that one phrase that the board brought up
3 but we thought that there were these other two
4 sort of terms that needed to be clarified and what
5 they mean.

6 BY MR. TAYLOR:

7 Q Do you remember why the other terms needed
8 to be clarified?

9 A I don't specifically --

10 MR. SHAPIRO: Objection to Form.

11 BY THE WITNESS:

12 A I don't specifically remember which -- you
13 know, what data that we had come up with that we
14 decided that but I think it was a consensus that
15 it was important that we understand, make it clear
16 what these terms would mean to a POSITA in order
17 to properly understand the meaning of the patent.

18 BY MR. TAYLOR:

19 Q Looking on Page 25 of your second
20 declaration, Claim Term III, within two-ball-pad
21 pitches of the corner of the die...

22 A Yes, sir.

1 Q Was that term construed the same way in
2 the first declaration as it was in the second
3 declaration?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A Honestly I did not review the first one so
7 I don't really recall how we defined it over there
8 if there was any difference at all, but my
9 assumption is that we didn't change our
10 understanding of these terms. If you can show me
11 that there was a difference, I'll be happy to
12 discuss it.

13 BY MR. TAYLOR:

14 Q Thank you. Can you turn to Page 30 of
15 your second declaration, please?

16 A Yes, sir.

17 Q And look at Paragraph 102.

18 A Yes, I have it.

19 Q You stated: "The present invention makes
20 it possible to reliably use high density ball grid
21 arrays (such as packages with ball pads dispersed
22 throughout the ball pad layer) with dies of

1 various sizes."

2 Is that correct?

3 MR. SHAPIRO: Objection. Form.

4 BY THE WITNESS:

5 A That's exactly what I wrote here, so
6 that's what I said.

7 BY MR. TAYLOR:

8 Q Doctor, how does the invention make it
9 possible to use BGAs with dies of various sizes?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A Well, the patent uses this terminology
13 because the -- they give an example -- again, off
14 the top of my head, I don't remember which figure
15 where they show a small die versus a big die and
16 the point was you can put dies in different sizes
17 without having to change the ball grid array
18 underneath.

19 So the idea is exactly what he's saying
20 here, to reliably use a high ball array for
21 different size dies, that would be chips of
22 different sizes can fit on the same configuration

1 of balls.

2 BY MR. TAYLOR:

3 Q Can you open Exhibit 1001 which would be
4 the '245 patent.

5 A It's open.

6 Q Can you please go to Figure 4.

7 A Yes, I'm on Figure 4.

8 Q Does Figure 4 show a high stress zone
9 labeled with reference number 58?

10 A I'll have to check the number, but that is
11 the point of those boxes.

12 Q And then there is the high stress zone 60
13 also shown in Figure 4?

14 A Yes.

15 Q Is the ball grid shown the same for high
16 stress zone 58 and high stress zone 60?

17 A I believe that is the point of this figure
18 to show exactly what I said there, two different
19 chip die sizes fitting on the same package
20 configuration. So they're showing two examples
21 sort of on the same package.

22 Q Does the size of the die, does that change

1 the amount of stress in the high stress zone?

2 MR. SHAPIRO: Objection. Form.

3 BY THE WITNESS:

4 A What are you asking me exactly? If I have
5 a bigger die? The difference --

6 BY MR. TAYLOR:

7 Q So you have high stress zones. Where is
8 the stress coming from?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A Well, the patent defines the area of
12 increased stress as -- the stress crack that we're
13 concerned about is the -- is emanating from the
14 lower, from the ball based on the increased stress
15 interacting with the corner and I don't believe it
16 makes a difference as to the size of the chip if
17 it's located to where the corner is.

18 Again, that made me opine -- I don't know
19 if it's in the patent itself but the point was it
20 was about the corner and not the size of the die
21 itself because you can do different size dies and
22 it's the same area relative to the corner.

1 BY MR. TAYLOR:

2 Q So no matter the size of the die, the
3 stress will be the same?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A Whether the stress is the same or the
7 stress is not the same, that all depends on all of
8 the areas, but this was the invention as they
9 decided they have found through the work towards
10 this invention that it's dependent on the area
11 around the corner regardless of the size of the
12 die, that is to say, the reliability aspect.
13 Whether the actual stress is higher or lower that
14 I don't think is specified and I did not analyze
15 that.

16 BY MR. TAYLOR:

17 Q Can you go to paragraph -- back to
18 Paragraph 102 on Page 30 of your second
19 declaration.

20 A Yes.

21 Q It begins by stating: "By providing a
22 methodology for signal trace routing in the high

1 stress area"; is that correct?

2 A Correct.

3 Q So is the signal trace routing methodology
4 mentioned in Paragraph 102 -- is that based on the
5 ball pad pitch?

6 MR. SHAPIRO: Objection. Form.

7 BY THE WITNESS:

8 A The methodology of the patent is as it
9 says, it gives a couple of specifications in terms
10 of where you should wire the lower routing line in
11 relation to where the ball pads are. So, maybe
12 let me clarify the question. What do you mean by
13 relation to the ball pad pitch?

14 BY MR. TAYLOR:

15 Q Well, does the ball pad pitch have any
16 effect on signal trace routing?

17 MR. SHAPIRO: Objection. Form.

18 BY THE WITNESS:

19 A Well, certainly. The idea is he's giving
20 us a methodology that's independent of the pitch
21 because for a smaller pitch there's obviously
22 going to be smaller space, less space between the

1 balls and a larger pitch there'll be more space
2 between the balls considering the pitch is the sum
3 of the ball and the space between the balls and
4 assuming the routing between the balls that will
5 make a difference in this methodology.

6 BY MR. TAYLOR:

7 Q So is the signal trace routing based in
8 any way on the size of the die?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A As I recall, this patent makes no
12 distinction about the routing as a function of the
13 size of the die itself, only the pitch.

14 BY MR. TAYLOR:

15 Q Doctor, how does the signal trace routing
16 change, then, based on the pitch?

17 MR. SHAPIRO: Objection. Form.

18 BY THE WITNESS:

19 A The pitch is just size, so how many wires
20 a given width you can put between two pads is
21 going to depended on the space that's available in
22 your design. So that's -- so it depends on the

1 routing algorithm, how low resistance you need in
2 the traces and all the design considerations of
3 getting signals in and out of a chip.

4 BY MR. TAYLOR:

5 Q So in Paragraph 102 of your second
6 declaration, a methodology for signal trace
7 routing, are you saying that is being able to
8 route more signals when you have a larger ball pad
9 pitch?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A No, no. It's saying for any ball pad
13 pitch it's a methodology by which you can make a
14 more reliable set of signal traces. The
15 methodology is how to improve the reliability of
16 thermal excursion, testing for thermal excursion.
17 It's not saying anything about how thick your
18 lines or how much space there is. So the
19 methodology is telling you how to avoid traces on
20 the first interconnect level in the presence of
21 ball pads within that size. So the pitch really
22 is just telling you the area in which we have to

1 use this methodology.

2 Outside of that area the point is I can
3 still get maximum density and I don't need to
4 apply this methodology. That's why it's not
5 dependent on the chip size as they state in their
6 patent.

7 BY MR. TAYLOR:

8 Q Thank you.

9 So Doctor, still looking at Paragraph 102,
10 Page 30, second declaration, in the parentheses
11 you stated packages with ball pads disbursed
12 throughout the ball pad layer; is that correct?

13 A Yes, that's correct.

14 Q In that phrase, does the word "throughout"
15 imply that the ball pad layer is a full ball grid
16 array?

17 MR. SHAPIRO: Objection. Form.

18 BY THE WITNESS:

19 A I'm saying that I think right in the
20 beginning of the patent I think that is the
21 objective because we're trying to increase package
22 density which means that you put pads, as many

1 pads as you can in as small an area as possible to
2 be close to -- what I can say close to the size of
3 the chip itself. The chip scale package is the
4 goal. It's been the goal for many years. So,
5 yes, I'm talking about dispersed throughout means
6 that we're trying to increase the package density
7 which is a stated goal of the patent while
8 maintaining reliability under thermal cycles.

9 BY MR. TAYLOR:

10 Q So when ball pads are dispersed throughout
11 the ball pad layer, does that mean that it's a
12 full ball grade array?

13 MR. SHAPIRO: Objection. Form.

14 BY THE WITNESS:

15 A Well, it's not necessarily full. Very
16 often I've seen many packages where there will be
17 a few pins missing in a sense just so to label how
18 to align the pin. So it's not necessarily
19 completely full, but for the most part, there will
20 be at least a large number of balls under the area
21 where -- in the vicinity of the chip itself and
22 you need to have -- I have as I've defined many

1 times, you need to have balls around the corner as
2 we've been saying because that's the specific
3 patent as we've been defining it here and that's
4 what I think is one of the critical issues.

5 BY MR. TAYLOR:

6 Q Thank you. So you're saying that if you
7 use the term throughout when mentioning ball pads
8 are dispersed throughout the ball pad layer that
9 would at least infer that there's ball pads around
10 the corner of the die; is that correct?

11 MR. SHAPIRO: Objection. Form.

12 BY THE WITNESS:

13 A In order for this patent to be applicable,
14 there needs to be near the corner of the die but
15 this would imply it should even be inside the area
16 there would be as close to as many pins as
17 possible in the area without using up real estate
18 without pins.

19 BY MR. TAYLOR:

20 Q So, Doctor, if you removed the word
21 throughout and you just stated packages with ball
22 pads on the ball pad layer, would that change the

1 meaning of that sentence?

2 MR. SHAPIRO: Objection. Form.

3 BY THE WITNESS:

4 A Again, we're -- the point here is we're
5 trying to exclude the partial array where there
6 are no ball pads directly under the chip or near
7 the corners. So throughout it obviously is
8 meaning to imply that there are as many as
9 possible. It doesn't mean that they are
10 completely filled because there are other reasons
11 we may want to leave a couple of balls out, so to
12 speak, so I didn't say a complete array. We used
13 the word throughout to have flexibility in the
14 language as to how it's applied to a real chip.

15 BY MR. TAYLOR:

16 Q So then the word throughout just means a
17 full ball pad array but not a complete full ball
18 pad array?

19 MR. SHAPIRO: Objection. Form.

20 BY THE WITNESS:

21 A I think by using the term full grid array
22 it means it's completely full. I'm saying it

1 could be that there would be spaces somewhere in
2 the vicinity where there may be balls missing. So
3 that's I didn't want to use the word full array
4 here so we just used the word throughout, yeah, so
5 we used the word throughout, dispersed throughout
6 as a more flexible term than a full ball pad
7 array.

8 BY MR. TAYLOR:

9 Q So then, Doctor, it's possible that a
10 partial ball pad array could be used?

11 MR. SHAPIRO: Objection. Form.

12 BY THE WITNESS:

13 A I think we're saying the patent applies or
14 not a place. We're saying if there are no balls
15 in the vicinity of the corner, then we're saying
16 that this patent is not appropriate and you can
17 certainly make a chip, we know Celeron, we know
18 many, many people have put chips on partial arrays
19 with zero pins in the middle and I would say those
20 are not covered by the claims of this patent, but
21 if you are putting pins in the vicinity of the
22 corner, then you could potentially be using this

1 patent. It's only a matter whether the patent
2 applies or not. You can do whatever you want as a
3 designer and put chips on any kind of package you
4 want.

5 BY MR. TAYLOR:

6 Q So, Doctor, in your opinion the '245
7 patent can apply to partial ball grid arrays as
8 well?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A All right. If you wanted to define
12 partial array as to something other than a full
13 grid array, again, as long as there are balls that
14 are directly under the corner even if it's a
15 partial array, that is to say, if there are balls
16 missing within the array, then, what did I say, it
17 would only apply if there are balls under the
18 array. So if it's a complete partial array like
19 the examples that were given where there's a
20 completely empty space under the chip in the
21 vicinity around the chip, but if you have a
22 partial array where the chip overlaps the balls,

1 then it would apply and I believe the patent
2 language itself does make accommodation for that.

3 BY MR. TAYLOR:

4 Q So to make sure I understood you
5 correctly, you're defining a full ball grid array
6 as a completely full area on the ball pad layer
7 for balls?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A It sounds kind of funny. I'm sorry. It's
11 full of balls. My son loves to play with balls.
12 Okay. Sorry.

13 You know, to be honest, I haven't really
14 considered too much only because there's this word
15 of art. I have seen what are considered full ball
16 pad arrays where there are small numbers of pins
17 missing and it could be referred to still as a
18 full ball grid array which is why I'm having
19 difficulty exactly categorizing, limiting this
20 question.

21 So maybe I'll just say it as I mean it
22 because obviously when you're missing a lot of

1 pins, then you can say it's a partial array, when
2 it's missing just one or two pins it could still
3 be considered a full array so it's missing a few.
4 There is sort of a continuum.

5 I have seen what looks like a partial
6 array and there are still some balls even in the
7 middle so you can see balls of all different types
8 and sizes, but when I say full array, generally we
9 mean that it's mostly filled with balls, partial
10 array it's mostly empty of balls in the middle,
11 but it could be, there could be a ball array which
12 is a partial array and there's a chip that
13 overlaps the balls and in that case we'd be moving
14 into the category of the '245 patent.

15 And I hope that wasn't too many words.

16 BY MR. TAYLOR:

17 Q That's all right.

18 So you're defining a -- I just want to
19 make sure that we're clear. You're defining a
20 full ball grid array as a layer of balls that's
21 mostly to completely full of balls?

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A I think it's fair to say that that's how
3 I'm defining the full ball grid array is one that
4 is full if they are missing one or two or some
5 small number.

6 BY MR. TAYLOR:

7 Q So, Doctor, what's your definition of a
8 partial ball grid array?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A Well, in the proceeding so far, my general
12 understanding has been the partial array is the
13 one where the balls start outside of the chip.
14 The general term for the partial array is one
15 where there's this clear area as I think as it's
16 been defined and inside the clear area where there
17 are no balls that is the area on which the chip is
18 mounted and that I would say for all intents and
19 purposes that's a partial array and a full array
20 is one where there are balls everywhere.

21 As far as the patent is earned concerned
22 it's really just the balls in the area of the

1 corners that are significant, but we know the goal
2 of packaging is to make as many pins as possible
3 so the more pins the better.

4 BY MR. TAYLOR:

5 Q So a partial ball grid array in your
6 definition is an area in the center that does not
7 have balls?

8 MR. SHAPIRO: Objection. Form, asked and
9 answered.

10 BY THE WITNESS:

11 A I think that is what I said. The partial
12 array we've been using in these proceedings is the
13 one that is empty of balls in the middle on which
14 the chip lies and there's no overlap at the corner
15 with balls. That's been how I've been for the
16 most part defining it.

17 BY MR. TAYLOR:

18 Q Thank you.

19 A Yes, uh-huh.

20 Q Doctor, can you go to Paragraph 110 of
21 your second declaration, please.

22 A Yes, I'm there.

1 Q You stated: "It is appropriate to
2 construe area of increased, i.e., high stress in
3 accordance with the meaning provided in the
4 specification".

5 Is that correct?

6 A That's correct.

7 Q Does this mean that an area of increased
8 stress is the same as high stress?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A Well, this is something that I've been
12 thinking how it's going to come up.

13 We know, well, not only from experience,
14 even from one of the simulation papers that you
15 had provided that there are all kinds of stresses
16 in everything, certainly in a packaging when it's
17 heated up, an organic package especially. So
18 everything is relative when you say high, if I'm
19 sitting on the 12th floor and you're sitting on
20 the sixth floor, I'm higher than you. So there is
21 increases and decreases is a relative term so we
22 have to use it based on how it's specified in the

1 241 {sic} patent when describing a relative term
2 like high or increased, increased from what or
3 high relative to what.

4 So that's what I say right here, in
5 accordance with the meaning provided in the
6 specification. Everything is relative.

7 BY MR. TAYLOR:

8 Q So an area of increased stress, that's --
9 that means high stress?

10 MR. SHAPIRO: Objection. Form. Asked and
11 answered.

12 BY THE WITNESS:

13 A I believe the patent does sort of use area
14 of high stress almost interchangeably and, again,
15 I could refer to it again, but I believe both
16 terms are used which is why that's the i.e.

17 BY MR. TAYLOR:

18 Q Doctor, can you look at the '245 patent.

19 A Yes, sir.

20 Q Can you tell me where in the '245 patent
21 it uses the term "area of increased stress"?

22 A I can do a search. Okay. That's

1 interesting.

2 I mean, other than reading every word, I
3 can try to do a search. It's not finding the
4 increased. I think my search isn't working
5 properly.

6 It certainly uses high stress area a lot,
7 and it's not a very long patent, high stress zone.
8 You've probably read this carefully. Does it say
9 increased stress in the patent itself at all? You
10 can tell me if you've read it instead of trying to
11 do a search.

12 Q If you look in Claim 7, the last two lines
13 of the claim?

14 A Okay, oh, area of increased stress defined
15 by the corner of the die. Okay. I believe we've
16 disavowed Claim 7 as a claim but is that the only
17 place it appears in the patent? You've done an a
18 better search than I. I'm seeing high stress area
19 high stress zone so I guess it is used at least
20 once, but I believe were.

21 Q You used area of increased stress in your
22 second declaration there in Paragraph 110.

1 A Okay.

2 Q And you said that that was a high stress
3 area?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A I'm saying that the meaning could be
7 potentially interchangeable. If it's not in the
8 patent language and you're catching me on
9 something like that but I -- at least it's in
10 there somewhere. If we're making the quote "area
11 of increased stress", but as I said for some
12 reason my Adobe is not finding a search. It
13 couldn't even find that one. So somehow it's not
14 enabled my thing. So I'm asking you, if you can
15 point me to another place. I used on quotes so
16 I must have learned it from something.

17 BY MR. TAYLOR:

18 Q I believe that's the only place it's
19 mentioned but you had mentioned it here in
20 Paragraph 110.

21 A I think I said it as high also because I
22 believe as I said they are pretty much

1 interchangeably by the meaning of the --

2 Q So the high stress zone is interchangeable
3 with an area of increased stress; is that correct?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A i.e. high, at least in the simple
7 understanding, I don't think that there's a
8 distinction. As I said, it didn't -- when I read
9 that it didn't occur to me that there was
10 something that was not understood. So we said
11 high here to mean high stress zone or area of
12 increased stress. Obviously both of these are
13 relative terms, relative to what, as we said, the
14 stress -- I think we even saw something in the
15 deposition from Dr. Baker that the corner in the
16 presence of a ball will certainly have a higher
17 stress than just a corner without a ball, but
18 everything is relative and a corner versus a side
19 you could make all kinds of relative stresses. In
20 fact, you had a whole paper on simulations with
21 lots of colors of all the various stresses that
22 will happen in an organic BGA in the presence of

1 thermal stresses -- thermal excursions with a
2 chip. So I don't think that this is a very
3 difficult term here, but if there's something not
4 clear I'm happy to clarify if I can clarify more
5 than I did. I think I've clarified as much as I
6 can.

7 Q Thank you. So these terms are relative,
8 then, in your definition?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A Well, they're relative, but that's why we
12 needed to make a definition for the claim term
13 high stress area as we said, and that's why we
14 spent a lot of time with those pages on
15 definition.

16 (Reporter clarification).

17 MR. SHAPIRO: We've been going for more
18 than an hour now. Should we take a short break?

19 MR. TAYLOR: Would you like 10 minutes,
20 does that work?

21 THE WITNESS: Fine for me. I'm ready to
22 go.

1 MR. SHAPIRO: That's fine with me.

2 MR. TAYLOR: We'll take a ten-minute
3 break.

4 MR. SHAPIRO: Thank you.

5 (A recess was had.)

6 BY MR. TAYLOR:

7 Q Doctor, did you have any discussions with
8 counsel during the break?

9 A Not at all. Just a little water and I
10 said hello to my wife in the kitchen.

11 Q Thank you. So before we left for break,
12 we were discussing Dr. Baker's declaration that
13 you said you read and that he mentioned lots of
14 different factors that would increase stress
15 around the corner of the die; is that correct?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A Lots of stress, I'm saying there was a
19 paper that one of the prior art publications which
20 you'd given showing simulations and we did have a
21 quote from him in my declaration, I think it was
22 in my declaration, where I recorded when he was

1 asked if a corner with a ball will have more
2 stress than a corner without a ball and obviously
3 it's one of those things you really need to do
4 full simulations to find out how much stress, what
5 increases, and decreases in stress and in the
6 plastic and silicon which are vastly
7 different form of expansion coefficients, there
8 are stresses in both places and, of course,
9 corners are stress concentration points as we call
10 them. So we have to consider all of these things
11 in a reliable package design.

12 Q To ensure clarity on what you just
13 mentioned as far as the factors that can increase
14 stress around the die corner, those would be
15 thermal mismatches between the materials?

16 MR. SHAPIRO: Objection. Form.

17 BY MR. TAYLOR:

18 Q Is that correct?

19 MR. SHAPIRO: Objection. Form.

20 BY THE WITNESS:

21 A When one wants to determine stresses in
22 materials, you do simulations of the material

1 properties and the most important
2 material property -- well, there are two
3 properties, one is, of course, density and, of
4 course, thermal expansion coefficient which would
5 be a linear expansion when you heat, generally a
6 linear contraction when you cool down and the
7 interaction of two bonded materials with two
8 different thermal expansions are going to cause,
9 well, increases or decreasing in stress depending
10 on the configuration, the internal stress, many,
11 many, many factors, that's why we turn to
12 simulations to try to have some idea.

13 BY MR. TAYLOR:

14 Q So the thermal mismatch, that will cause
15 an increase in stress?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A Could cause a decrease in stress. There
19 are many cases where it is built-in stress and
20 actually increase in the heat could, in fact,
21 decrease the stress so it does very much depend on
22 the geometry and as I recall in the deposition I

1 think Dr. Baker was making this point as well it
2 very much depends on the geometry and the
3 materials and you can't make one statement that's
4 generally -- that's always true let's say.

5 BY MR. TAYLOR:

6 Q So in some instances, a thermal mismatch
7 could cause an increase in stress; is that
8 correct?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A A thermal mismatch is a place where --
12 let's say a junction between two materials is
13 always going to be increasing or decreasing stress
14 depending on one of the materials will be
15 expanding faster than the other, that causes a
16 tensile stress and in the other direction it could
17 be a compressive stress. So some are compressive
18 and some are tensile and edges only because of the
19 geometry will exaggerate.

20 In the case of our patent, we're concerned
21 for an organic ball grid array -- one second.
22 That's not supposed to happen when my phone is

1 off. Oh, well. What was I saying?

2 So in the case of a thermal expansion if
3 you have a highly thermally expansive material
4 like a plastic directly bonded to a very
5 thermally, let's say, relative hard material like
6 silicon then you expect as you increase the
7 temperature, there will be an increase of stress
8 at that junction. Of course a corner will be
9 higher than a flat connection and a triple corner,
10 let's say an edge, for instance, will have more
11 than the other side and, of course, if there's two
12 concentration factors next to each other, for
13 instance, a ball grid array, metal is also low
14 thermal expansion compared to the plastic. So the
15 metal connecting the ball grid array will also
16 have a thermal expansion associated with it.

17 So it's a very three-dimensional
18 multi-material process that tells you where
19 stresses are.

20 BY MR. TAYLOR:

21 Q So you agree there are lots of factors
22 that increase stress?

1 MR. SHAPIRO: Objection. Form.

2 BY THE WITNESS:

3 A How do I turn that off? Can I quit?

4 Sorry. Whatever.

5 Okay. Sorry for the distraction. I
6 thought -- I turned my phone off completely does
7 it do that? The first time I had a smartphone so
8 I don't know what I'm doing here.

9 Okay. Let me get back. I'm sorry. Can I
10 get back on the record.

11 Q Yes, please continue.

12 A Yes, there are many factors that go into
13 the actual stresses and stress distributions when
14 there's various materials of different strengths,
15 hardnesses and thermal expansion coefficients.

16 Q So do you agree that there's more stress
17 generally all other things being equal near a die
18 corner?

19 MR. SHAPIRO: Objection. Form.

20 BY THE WITNESS:

21 A There are relative -- that's why I say the
22 patent had to clarify what it means by a high

1 stress area because there are stresses all over.
2 There is stresses at the corner of the die
3 compared to the bottom, and as I said there was
4 one of the publications that you brought with a
5 simulation showing lots of different colors,
6 showing the various stresses that are within a
7 material.

8 The patent wants to focus on what they're
9 defining as a high stress area, as I said, is one
10 that will lead to a failure. So it's not just a
11 generic high stress. It's one that they're
12 concerned about that could lead to a failure in
13 thermal stresses and that's the subject of this
14 patent when they define a high stress area,
15 they're specifically referring to the combination
16 of the lower stress from the ball pad in
17 combination with the corner stress of the chip.
18 You know, generally, of course, a corner will be
19 higher stress than a flat surface or just an edge,
20 but as we said there are many factors so it's not
21 so simple.

22 Q So you do agree that a corner generally

1 has more stress than the edge of the die?

2 MR. SHAPIRO: Objection. Form.

3 BY THE WITNESS:

4 A Yes, but as I said, it depends on what
5 floor you're on. A sixth floor is higher than the
6 ground floor and 12th floor is higher than the
7 sixth floor, so a combination of things as I think
8 we're trying to define it here is generally
9 understood -- the corner alone -- in fact, I think
10 that paper that you brought showed very nicely
11 that the corner alone is not sufficient
12 necessarily as a reliability concern so that's why
13 for the most part this failure mechanism was not
14 necessarily known. I believe that was one of the
15 inventions here is, in fact, the problem itself.
16 I think I mention that in my document.

17 BY MR. TAYLOR:

18 Q Do you have Exhibit 1016 available,
19 Doctor?

20 A Which is 1016?

21 Q It's entitled: Critical Review and
22 Technology Assessments.

1 A Was that one of the exhibits that you had
2 delivered?

3 Q Yes. I thought that was the exhibit you
4 were just referring to.

5 A It might be and I'm sure that I have it
6 somewhere, but let me see where.

7 Do you have the name of the author? Is
8 that Thomas Moore: The effect of in-plane
9 orthotropic properties... that was one of the
10 papers you gave. That was what I was thinking of.

11 Q So you were thinking of something
12 different?

13 A Again, you had a couple of papers that --

14 Q I can share my screen with you.

15 A And Process capability study of thermal
16 fatigue life prediction from Xie & Wang?

17 Q No, it was Exhibit 1016. It was critical
18 review and technology assessments.

19 A This paper also I think made a lot of the
20 points where stresses are, thermal cycles, yeah.

21 MR. SHAPIRO: Maybe share the document
22 with him.

1 BY THE WITNESS:

2 A If you show me your document --

3 BY MR. TAYLOR:

4 Q Yes, I can do that.

5 (Reporter clarification).

6 BY MR. TAYLOR:

7 Q Doctor, I'm sharing Exhibit 1016 with you.

8 A Yes.

9 Q When I refer to Exhibit 1016 you
10 understand that I'm referring to this document?

11 A Okay.

12 Q So you'll see that there's a section on
13 Page 249 that discusses thermal mismatch?

14 A Yes, sir.

15 Q This is not what you were discuss
16 discussing earlier?

17 A All these papers are --

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A Sorry. I'm saying basically I'm sure this
21 encompasses a lot of the information that we've
22 seen from many of the references that pretty much

1 say the same thing. Anyone involved in material
2 packaging, silicon packaging is innately familiar
3 with thermal mismatch issues. So this is -- I see
4 you outlined cracking generally near the corner,
5 that's true, that's strength, uh-huh.

6 In fact, my first patent was also metal
7 lines that are hit with a laser and I take
8 advantage of cracking at the corners to melt the
9 materials together and make a link. I thought it
10 was a clever invention but, you know, I couldn't
11 sell it.

12 BY MR. TAYLOR:

13 Q So cracking generally occurs near the
14 corners of the chip; you said you saw that on
15 Page 250 of this document, Exhibit 1016; is that
16 correct?

17 A That's what you're showing me, yes,
18 tracking generally occurs in the other corner of
19 the chips, resulting failure modes include
20 functional failures, short links or openness.

21 Q Thank you. Let's say.

22 On Page 252 of Exhibit 1016, Doctor, does

1 it state to reduce thin film cracking and, again,
2 by locating critical circuitry away from the die
3 corners?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A Latest improvement to reduce thin film
7 cracking can be gained by locating critical
8 circuitry away from the die corners. It does say
9 that. And filling the die with sacrificial
10 anchoring structures, and I think you had a
11 picture from one of your other simulation pictures
12 with underfill material. They call these
13 anchoring structures.

14 BY MR. TAYLOR:

15 Q So you said you had a patent that dealt
16 with cracking near the corner of the die, is that
17 correct?

18 A Not of the die. My cracks were aluminum
19 wires. I had square aluminum wires I hit with
20 laser and it was on the chip actually. It's a
21 similar idea, but I simulated it, that was my big
22 excitement when I was at Lincoln Lab is one of my

1 earlier days of feeling smart is I simulated by
2 taking a met of metal and surrounding it with
3 epoxy, I froze it. I put it into liquid nitrogen
4 to simulate the metal heating up and it cracks at
5 the corners and I said: "Oh, Eureka."

6 Q Based on what we just read, do you agree
7 that it was known at the time of the '245 patent
8 that cracking can occur near the corner of the
9 die?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A Again, for the most part I think everyone
13 knows we have to be careful. I mean, one of your
14 papers said explicitly that the corner of the
15 chip, the whole chip structure itself on board was
16 much more important because it's much larger area
17 and, in fact, they specifically were not worried
18 relative to the corner of the chip. They were
19 less concerned, as I said, it's not a problem on
20 the silicon to the package, but, of course,
21 everything depends on the materials and everything
22 else, but the corners are always a place to look

1 if there's going to be -- if there's going to be
2 damage.

3 BY MR. TAYLOR:

4 Q So all other things being equal, is there
5 more stress near the corner of the die or on the
6 edge of the die?

7 MR. SHAPIRO: Objection. Form.

8 BY THE WITNESS:

9 A All things being equal if you have a die
10 which has a corner and there is a thermal mismatch
11 which there is between plastic and silicon, there
12 will be an increased stress. The question is will
13 that lead to a failure. That's the subject of --
14 how do we deal with it. Do we like a partial
15 array which I believe was the prior art you just
16 keep all the balls far away which was a very good
17 solution, but it leaves that routing density or
18 this was the suggestion over here. There's no
19 discussion of the extent. So that's why we have
20 to do the research and that's where I believe this
21 invention becomes significant when you can
22 isolate -- when you can characterize the problem,

1 this look and I believe the prior art does not
2 characterize the problem as coming from the ball
3 pin. This is trying to characterize the crack
4 initiating from the corner of the silicon itself
5 and that's not the failure mode that our patent is
6 addressing.

7 Q Thanks. Can you turn to your second
8 declaration, please.

9 A Okay.

10 Q On Page 33?

11 A Yes, sir.

12 Q Paragraph 112?

13 A Yes.

14 Q You state embodiments without ball pads
15 under the corner of the die were disavowed during
16 prosecution?

17 A That's my understanding.

18 Q In this paragraph, do you cite any portion
19 of the specification you base that assertion on?

20 A I believe this is referring to an earlier
21 place or is this simply just from consultation
22 with counsel and going through the prosecution

1 history where there was -- I believe that was in
2 the prosecution history itself and more than that
3 I'm not really prepared to give an exact place
4 where I found this reference.

5 Q So you stated that embodiments without
6 ball pads in the corner of the die were disavowed,
7 but you just don't know where in the prosecution
8 history or any specification that that was
9 specifically disavowed; is that correct?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A I had written this a number of months
13 ago and where exactly I pointed to it I didn't
14 make reference to it here I see, but I believe I
15 discuss this other places. I know that we
16 disavowed No. 7 and I think I pointed out that
17 Claim 7 potentially can be read as to where there
18 would not be pads and we disavowed that as a claim
19 and I believe that this was -- again, where was it
20 in the prosecution history, I don't remember. I
21 have to say it was a long time ago that I reviewed
22 the prosecution history. So I just can't point to

1 where I got this from right now.

2 BY MR. TAYLOR:

3 Q Okay. Thank you.

4 In Paragraph 128 if we go down to Page 37
5 of your second declaration...

6 A Yes.

7 Q ...you discuss examples of if a high
8 stress area was defined as a circle large enough
9 to circumscribe or small enough to fit inside what
10 you've defined as a polygon shown in Figures 4 and
11 5, and you state that this would -- if you did
12 draw these circles it would needlessly reduce
13 signal density without increasing reliability; is
14 that correct?

15 MR. SHAPIRO: Objection. Form.

16 BY THE WITNESS:

17 A We're pointing out that the patent
18 specifically has polygons because we're defining
19 the pitch of the ball grid array, and pitch
20 certainly means that it's a regular, you know,
21 ball-space-ball-space, so it's a regular area. So
22 it's definitely in let's say Manhattan style, you

1 know, north south east west connections. So
2 they're specifically not having circles which
3 would either be too small or too large. If you
4 try to circumscribe a polygon with a circle
5 there'll be extra space and if you try to put it
6 inside, it will be a different area.

7 So they're specifically focusing on the
8 ball grid array itself as the source of the stress
9 that could lead to a failure, and that was the
10 invention basically, not just a random circle or
11 an area of a certain size.

12 BY MR. TAYLOR:

13 Q So you're saying that if you drew the high
14 stress area as a circle as opposed this polygon
15 that there would be extra space that you wouldn't
16 be able to route and that would needlessly reduce
17 signal density; is that correct?

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A In forming a circle if you try to
21 circumscribe it there would be areas that would go
22 above the pitch, I mean, it's as simple if you

1 have a square and you make a circle, part of the
2 circle is above the square and that would be area
3 that you couldn't -- you would needlessly not be
4 allowed to route there by would reduce the routing
5 capability.

6 BY MR. TAYLOR:

7 Q Doctor, did you say square?

8 A I said obviously with a square, but we are
9 talking about the polygon which I guess is an
10 octagon in our case because we see that it takes
11 the two closed pins and draws an angle between
12 them that's where you would route where there's
13 space between the balls. The pads are square so
14 you have to route between the square pads.

15 Q Doctor, are you saying that the invention
16 being this polygon shape that provides benefits
17 over circle shapes -- let me strike that and ask
18 you again.

19 So, Doctor, are you saying that a polygon
20 shape provides benefits that a circular high
21 stress shape does not?

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A I'm not making an opinion on whether I
3 think it's beneficial. I'm saying only saying in
4 the context of a patent is that they sort of
5 disqualify the idea of a circle. So I did not do
6 the research on this so I don't know firsthand if
7 it's more or less. I'm just saying by the
8 understanding of this patent is that the they
9 intentionally made square lines to be defined as
10 the pads and the pad pitch, that is to say, the
11 spacing between the pitches is not the circular
12 and they seem to not like the circular in their
13 what they called the earlier -- what they called
14 the other ideas or something.

15 BY MR. TAYLOR:

16 Q So, Doctor, are you saying that the '245
17 patent doesn't include circular high stress zone
18 shapes?

19 MR. SHAPIRO: Objection. Form.

20 BY THE WITNESS:

21 A I'm saying that the patents do not cover
22 what would be a circular drawn shape as compared

1 to a, you know, this sort of a polygon shape. I'm
2 saying that I think it would not be covered if you
3 were -- well, I'm trying to think of how to
4 implement, I don't even know, but they do
5 disparage this circular shape and there's no
6 example of anything like that and, in fact, they
7 say not to use the circular. So, again, I didn't
8 do the study. I'm only saying what the patent --
9 I'm trying to relay what the patent is claiming.

10 BY MR. TAYLOR:

11 Q Can you pull up the '245 patent, please.

12 A Okay.

13 Q Where in the description of the '245
14 patent does it define the shape?

15 A Ahh, well, we show --

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A Well, I believe if we look at -- let me
19 see an example -- the only embodiment that shows
20 is the Figure 4 of course. Figure 4 we've seen,
21 you've shown me, and I believe it is described --
22 well, he says the high stress area 58 defined in

1 connection with the layer L9 also is represented
2 on that layer L8 signal traces 64 and other metal
3 structures are provided throughout the layer.

4 So he's doing it with an illustration, and
5 he doesn't describe the shape other than to say
6 that it's demonstrated in what is Figure 4 there
7 and he gives you the lines and the high stress
8 area he's defining as 58.

9 Q And you're saying the only portion of the
10 '245 patent that describes the shape is just the
11 Figure 4?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A Well, considering that there's only five
15 figures in the patent and three of them are prior
16 art, it's a pretty short patent. So any
17 description at all is all we have.

18 BY MR. TAYLOR:

19 Q Figure 4 is the high stress zone, is that
20 No. 58 or 60?

21 A I believe --

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A 58 is the high stress zone for the small
3 die and 60 is the high stress zone for the large
4 die. As I recall we just read that.

5 BY MR. TAYLOR:

6 Q Doctor, are these high stress zones shown
7 in Figure 4 are they drawn to scale?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A We know that patent drawings are not
11 generally precisely to scale. It's to represent
12 the idea. In fact, I tried to go through it
13 myself and I think it's not really to scale, but
14 it gives you a good idea because you can see what
15 it means by ball pitch because you see the corner
16 and you can go two balls and the space between
17 them away, you can go up north and south, you go
18 left and right and then you see how he connects
19 the two corner ones with the diagonal. And
20 clearly he's talking about routing around these
21 places. He wants to maximize the routing area
22 which as I said is what motivated my statement

1 about the circle because you should be able to
2 route closely between those two pins and since
3 it's the ball pitch that is what determines the
4 stress zone according to this invention, I would
5 be allowed to route straight, you know, close to
6 those pins like we see on line 58 in the back, you
7 can see it most clearly a straight line having two
8 corners that are 45-degree angle because that
9 would be a potential routing area whereas if you
10 put a circle, that routing area would not be
11 there. I think that might have clarified your
12 previous question.

13 BY MR. TAYLOR:

14 Q Thank you. So just to be clear, you're
15 saying that most of the time patent drawings are
16 not to scale; is that correct?

17 MR. SHAPIRO: Objection. Form.

18 BY THE WITNESS:

19 A I think we can never depend on the scale
20 of a patent drawing as, you know, whatever, to
21 depend on the scale as a scale.

22 BY MR. TAYLOR:

1 Q Thank you. So can you zoom in a little
2 bit on to corner 54-A.

3 A Yes.

4 Q What is the distance in ball pad pitch in
5 your opinion from the corner 54-A if you went
6 diagonally 45 degrees to the northeast of the
7 corner of the die in a high stress zone?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A Okay. Well, it would be, let's see, let's
11 say that corner looks about to be in the middle of
12 those four pins so one pitch away would be to the
13 middle of the next four balls and to the middle of
14 the next four balls. So certainly the north and
15 south look to be two ball pitches away and then to
16 the other side because we have to go in the
17 direction of where there is a ball. So I'd be
18 obligated to make that last one in the 45-degree
19 you can probably do the geometry, but it would be
20 obviously this square root of two times that ball
21 pitch because that would be a square. So it looks
22 to be about, maybe it's a little bit short, maybe

1 it's not exactly drawn to scale, but I would have
2 made it a little bit higher just like the one
3 north and south are a little bit lower, but to be
4 to scale, it would have to go the same distance
5 from the, let's say, northeast side to that corner
6 line, that angled line.

7 BY MR. TAYLOR:

8 Q You said that the corner of the die 54-A
9 is in the middle of four ball pads shown in
10 Figure 4 and if you went to the northeast on
11 diagonal from that corner, there would be roughly
12 a little more than a one ball pad pitch to the
13 edge; is that correct?

14 A It might be a little bit --

15 MR. SHAPIRO: Objection. Form.

16 BY THE WITNESS:

17 A Right, if we notice clearly this is where
18 there's I'll say you don't trust the scales
19 because we see that the line which I think is
20 labeled 58 around that second ball pad where it's
21 a little bit beyond the ball pad and the one above
22 it on the north, northeast, it's actually touching

1 the ball pad, so clearly it should be the same
2 distance on both sides. So maybe the guy drawing
3 it you can even see there's a little bit of double
4 lines, so it was hand drawn. It might not have
5 been exact in his presentation. It should be the
6 same distance from both those ball pads if it's
7 the same distance out, but clearly it's touching
8 according to this picture on one and not touching
9 on the other and that clearly is not the intent.

10 BY MR. TAYLOR:

11 Q Thank you. Can you go back to your second
12 declaration, please, Paragraph 174. That's going
13 to be on Page 48?

14 A Okay.

15 Q You stated in Paragraph 174 that the
16 two-ball-pad pitch implementation depends on the
17 size of the die; is that correct?

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A It explains that the two-ball-pad pitch
21 depends on the size of the die and how the ball
22 pads are dispersed.

1 BY MR. TAYLOR:

2 Q How does the two-ball-pad pitch
3 implementation depend on the size of the die?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A I have to think about that a moment.
7 That's a good question.

8 I did use the word die here. I can only
9 say that as to potentially, again, I guess that's
10 your job is to get me to find these details. But
11 I can only say as to where the die sits between,
12 around or among those balls if it's on top of the
13 ball itself or next to the ball or between the
14 balls, so the size of the die will determine where
15 it sits relative to those pads and that would make
16 a difference in terms of how you would draw these
17 lines as we were seeing the one implementation
18 it's in the middle of the balls and another one
19 it's pretty much on top of the ball. So that
20 would make a difference.

21 BY MR. TAYLOR:

22 Q So if the die was sitting differently over

1 the ball pads, that will change the two-ball-pad
2 pitch implementation?

3 A Yes.

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A Yeah, oh, right. I don't mean yes. Yes,
7 I understand what you're asking. Depending on
8 where the die is we are drawing the two-ball-pad
9 pitch from the corner of the die. This whole pad
10 is the interaction of the corner of the die with
11 the ball pads. So the relative plating of placing
12 of the die will encompass the two-ball-pad
13 pitches. It's important that it's two-ball-pad
14 pitches because there will always be two ball pads
15 in that area. The question is where we start the
16 extent and end the extent of that two-ball-pad
17 pitch which is a distance will depend on where
18 that corner is relative to the balls.

19 BY MR. TAYLOR:

20 Q You're saying that in each direction there
21 will be two balls; is that correct?

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A Well, considering we're talking about the
3 pitch which includes a ball and a space, so if
4 you're in the middle of a space, you will include
5 two balls and a little space. If its over the
6 ball, it will include -- it will go to the middle
7 of the first ball and then the middle of the
8 second ball. So there will always be two full
9 balls and two full spaces in that area, however
10 they are put together. That's the distance.

11 BY MR. TAYLOR:

12 Q There will always be -- to make sure I
13 understand you correctly, there will always be two
14 balls and two spaces in each direction from the
15 corner of the die?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A That's why I said in the pitch going
19 certainly -- assuming a square array which I think
20 is always the assumption here, then you will be
21 going up two and down two, right two and left to
22 and then the corner of those other two is where we

1 allow -- because it's got to be outside -- it has
2 to be the same distance. We are talking about
3 pitches so if it's a pitch by definition if you
4 match two pitches you have to have two balls and
5 two spaces, even though you may start in the
6 middle of one ball that may be like a half a ball
7 connecting with a full ball and then another half
8 a ball, there would always be the space of two
9 full balls and two full spaces if we define a
10 pitch that way.

11 BY MR. TAYLOR:

12 Q So two-ball-pad pitches means two balls
13 and two spaces; is that correct?

14 MR. SHAPIRO: Objection. Form.

15 BY THE WITNESS:

16 A Yes, two-ball-pad pitches.

17 BY MR. TAYLOR:

18 Q Doctor, earlier you were stating that it
19 depends on where the die corner sits on the ball
20 array, and that will determine the two-ball-pad
21 pitch implementation.

22 Are you saying that the distance from the

1 edge of the high stress zone to the corner of the
2 die, is that going to change based on where the
3 corner of the die is?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A You use the word high stress zone and we
7 define the high stress zone is that region between
8 the balls in that two area and the corner. So
9 it's sort of a three dimensional high stress zone.
10 To clarify your question --

11 BY MR. TAYLOR:

12 Q So, Doctor, what I was trying to get at is
13 you mention that there was some difference based
14 on the size of the die and the placement of that
15 die over the balls?

16 A Yes.

17 Q And that you would need to go maybe
18 further out in order to encompass your two balls
19 and your two spaces; is that correct?

20 MR. SHAPIRO: Objection. Form.

21 BY THE WITNESS:

22 A It's exactly the same distance,

1 relative -- as I say a two-ball-pad pitch is
2 fixed. A pitch is fixed, a space and a ball
3 together. So if your pin is over a ball, then
4 you're two-ball grid layer will be exactly the
5 same place on the other ball. So you would
6 include the space as the same space. It's like a
7 ruler, you know. The pins are like the ruler.

8 BY MR. TAYLOR:

9 Q So I was just trying to understand what
10 you meant by saying the two-ball-pad pitch
11 implementation depends on the size of the die.

12 A Because the placement --

13 MR. SHAPIRO: Objection. Form.

14 BY THE WITNESS:

15 A Okay. The placement of that die will
16 determine where it is in that array. If it's a
17 very small die, then you will have like it shows,
18 it shows a small die and larger die. There will
19 be fewer pins there, may be more difficult to
20 route under those corners, if it's a larger die
21 it's the extent from corner that's what's
22 important here. That's the learning of this

1 patent. So a smaller die will have a more
2 restrictive area in that vicinity but a larger die
3 will have less restrictive area and where it sits
4 exactly relative to the pins is going to tell you
5 whether you can utilize more of the space, you
6 know, between or you have to go outside because
7 again it's exactly two balls and two spaces.

8 Q If you can read Paragraph 173 of your
9 second declaration. That's just right above here
10 on Page 48 and it says: "Even though petitioner
11 the mischaracterizes the two-ball-pad pitch
12 implementation as merely being a larger version of
13 the one millimeter solution, the actual size
14 depends on the ball pad pitch of the package".

15 So you're stating here that the actual
16 size is based on the ball pad pitch; is that
17 correct?

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A I've been saying the same thing all along.
21 A ball pad pitch is a space and a ball pad.
22 That's the only measure we have here. It's the

1 only ruler. We have no millimeters and we just
2 have geometry and pads and space.

3 BY MR. TAYLOR:

4 Q So in Paragraph 173, what do you mean by
5 the two-ball-pad pitch implementation?

6 MR. SHAPIRO: Objection. Form.

7 BY THE WITNESS:

8 A By two-ball-pad pitch implementation, I'm
9 referring to the claim language about the
10 two-ball-pad pitch which means, as I said, it has
11 to be perpendicular. A pitch is only in one
12 dimension or it's either to the north or to the
13 south or whatever or to the east, those are where
14 the pitches are. Of course, we have the second
15 set of pitches because we have to go two-ball-pad
16 pitches away, but a pitch is very clearly
17 understood by anyone in the art to mean a full
18 ball and a full space. So that if you can measure
19 from one side to the other and you measure ball
20 space ball space to the end of the first ball
21 divided by the distance from it, you can get the
22 packaging density. That's the way we characterize

1 the density of our ball grids, by the pitch, not
2 necessarily by the size of the ball itself. So
3 I'm only clarifying by relating to the pitch, not
4 necessarily the size of the ball if that helps.

5 BY MR. TAYLOR:

6 Q So that I understand correctly, a ball pad
7 pitch is one ball and one space, correct?

8 A By definition, yes.

9 MR. SHAPIRO: Objection. Form.

10 BY MR. TAYLOR:

11 Q I just wanted to make sure we were on the
12 same page.

13 You state in Paragraph 173 that the
14 two-ball-pad pitch implementation is
15 mischaracterized and you mentioned a one
16 millimeter solution.

17 So it appears, and correct me if I'm
18 wrong, but it appears that the two-ball-pad pitch
19 implementation you're meaning that to have a
20 particular shape of the two-ball-pad pitch?

21 MR. SHAPIRO: Objection. Form.

22 BY MR. TAYLOR:

1 Q Sorry. That was a long question. Let me
2 ask you that again, Doctor.

3 I was just trying to get to again how
4 the -- I was trying to understand how you were
5 interpreting the two-ball-pad pitch implementation
6 to depend on the size of the die.

7 And so you're saying that no matter where
8 the die is located, the two-ball-pad pitch will be
9 the same; is that correct?

10 MR. SHAPIRO: Objection form.

11 BY THE WITNESS:

12 A Well, there are four corners on each die
13 so you're trying to understand Paragraph 174 by my
14 understanding of 173, is that what you're telling
15 me you're trying to clarify? You're trying to
16 clarify my use of the word depends on the size of
17 the die.

18 BY MR. TAYLOR:

19 Q In relation to the two-ball-pad pitch
20 implementation term, yes.

21 MR. SHAPIRO: Objection. Form.

22 BY THE WITNESS:

1 A I maybe don't understand the contradiction
2 you're seeing. I said the petition
3 mischaracterizes what I've defined here as the
4 two-ball-pad implementation which is how we
5 understand the claim language to be understood and
6 characterized to mean as you said pad space in one
7 direction in a pitch, you know, pitch is an
8 important word because it's periodic, and I'm
9 comparing that to what the one millimeter solution
10 which I understand is fairly ambiguous and it
11 seems to be presented in a fairly ambiguous way
12 and I won't clarify what I mean by that but that's
13 what I'm characterizing right here.

14 So just putting a circle around a corner
15 that's one millimeter is not the same as a
16 two-ball-pad pitch and the dependence on the size
17 of the die, as I said, it will depend on where the
18 die fits on top of the ball pad because that's
19 really the whole patent is the combination of the
20 corner and the edges of the ball pads. So you
21 need to put those two together. The size of the
22 die and where the die is placed will determine the

1 beginning of your two-ball-pad pitch in let's say
2 eight directions.

3 BY MR. TAYLOR:

4 Q So the size of the die will determine the
5 beginning of where you measure for the
6 two-ball-pad pitch implementation; is that
7 correct?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A I mean, I guess we'll have to clarify what
11 you mean by beginning, but let's just say we have
12 four examples of that Figure 4 it will be on all
13 four -- it will located on all four corners. So
14 that is just showing you one corner representation
15 and it will be implemented four times across the
16 whole chip and the array. So that's just showing
17 you one quadrant. So if we're saying the same
18 thing, then I think that's the answer.

19 BY MR. TAYLOR:

20 Q I understand what you're saying now.

21 Thank you.

22 Doctor, can you look at the '245 patent,

1 please.

2 A Yes, sir.

3 Q Can you go to the first column, lines 18,
4 starting with line 18 and it will go down to 19.

5 A Starting with "typically"...

6 Q Yes.

7 A Can you read that sentence, please.

8 MR. SHAPIRO: Wait a minute, could you
9 read back where you're --

10 MR. TAYLOR: Yes, Column 1, Line 18.

11 MR. SHAPIRO: Okay.

12 BY THE WITNESS:

13 A You want me to read that out loud or
14 should I read it to myself?

15 BY MR. TAYLOR:

16 Q You can read it out loud.

17 A "Typically the regions are under the die
18 corner are regions of stress concentration."

19 Q That's fine.

20 A That's well known. This is background and
21 showed me the pictures, that's fine. Now he's
22 saying under cyclothermic excursions, cracks can

1 initiate from the ball pad edges and spread into
2 the layers above the ball pad layer. And I want
3 to say that's more or less not necessarily well
4 known because I think that is I think is what I'll
5 say is the discovery here. Depending on the
6 design these cracks may pose a reliability hazard.
7 I believe that that sentence he's setting up for
8 you the problem and I think that is specifically
9 what was not known in the art.

10 BY MR. TAYLOR:

11 Q So to clarify, you're saying that stress
12 from ball pads was not known in the art?

13 MR. SHAPIRO: Objection. Form.

14 BY THE WITNESS:

15 A In the region of the die corner. The die
16 corner regions as you pointed out that's --
17 everyone knows there is going to be increased
18 stress by corners, but there's this combination
19 that the patent what do you want to say revealed,
20 uncovered, discovered, I believe that this was
21 their critical problem that they found which led
22 to the invention. That's how I understand this is

1 the background.

2 BY MR. TAYLOR:

3 Q Okay.

4 A The main thing -- sorry, that the ball
5 pad, the crack initiates from the ball pad itself
6 in the vicinity. That's what I think is the
7 critical learning.

8 Q Can you go to Column 2, Line 27?

9 A Yes.

10 Q On the same exhibit, 1001.

11 A Yes.

12 Q And you can read that to yourself if you
13 like or read it out loud, but can you read the
14 objects and summary of the invention section,
15 please.

16 A I'll just read it. It seems easy enough.

17 "The primary object of an embodiment of
18 the present invention is to provide an improved
19 package with no failures. Another object of the
20 embodiment of the present invention is to provide
21 an improved package which eliminates the
22 occurrence of cracks in the signal traces."

1 Yes. That's good. Should I go on? Those
2 are the important objectives here and then he goes
3 on, he says it very clearly. It's a beautiful
4 patent I think.

5 "Briefly and in accordance with the
6 foregoing an embodiment of the present invention
7 provides an improved package in which a high
8 stress area associated with die corner is defined
9 in which the signal traces are routed away from
10 the high stress areas at the die corner"
11 meaning -- ahh, okay but he says here is
12 associated with the die corner is defined and it's
13 not defined here obviously, that's -- we define it
14 in a different place, but the high stress area
15 associated with the die corner is defined and in
16 which the signal traces are routed away from the
17 high stress areas at the die corner. The
18 invention describes a methodology for signal trace
19 routing on the high stress area under the die
20 corner that incorporates a range of die sizes.

21 Now, he does not mention the ball pad in
22 this case but when he defines he's saying it is

1 defined and I understand this to mean it is
2 defined the other place when he says in particular
3 in the area of the corners because that's his --
4 that was his observation at the beginning of the
5 patent, so that's how we can clarify that.

6 And I know it doesn't say ball pads here,
7 but it does say that the area is defined and
8 that's just the summary, but that's okay. He
9 defined it pretty much early on like we said
10 because the crack is initiating from the ball
11 pads, not just the corner. The corner is
12 obviously an increased stress point, but the 12th
13 floor is with a ball pad under it, sixth floor is
14 the corner.

15 Q I think earlier that last sentence maybe
16 this is where you'd gotten that from it states the
17 invention describes a methodology for signal trace
18 routing in the high stress area under the die
19 corner that incorporates a range of die sizes; is
20 that correct?

21 A That's correct.

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A It's correct. It does say it incorporates
3 a range of die sizes we discussed before in those
4 other paragraphs about the die sizes and where it
5 fits on the ball grid.

6 BY MR. TAYLOR:

7 Q So does this change your interpretation of
8 the methodology for signal trace routing as it
9 relates to a range of die sizes?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A I think I answered it in the correct way.
13 A range of die sizes -- die size he's -- oh,
14 you're saying -- I think I answered that
15 correctly. What did I say that contradicted that?
16 Do you want to read back to me what you think I
17 didn't say correctly?

18 BY MR. TAYLOR:

19 Q I just wanted to verify that your
20 interpretation hadn't changed since we'd discussed
21 earlier based off of that.

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A I think this clarifies exactly what I said
3 before because where those corners are, how big
4 the die is that just depends how much of the area
5 and how it is all designed, but this is very
6 consistent I think. I don't see how it's not
7 consistent.

8 BY MR. TAYLOR:

9 Q Thank you. If we look at Column 4 of the
10 '245 patent, if you look at Claim 1, Column 4, I
11 believe it starts at Line 17. It states:

12 "Wherein none of the signal traces of the bottom
13 routing layer..."

14 Do you see that?

15 A Yes, yes.

16 Q After the word wherein, what is like the
17 first term in that sentence?

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A Wherein none of the signal traces, it's
21 talking about signal traces.

22 BY MR. TAYLOR:

1 Q Thank you. Can we go to Paragraph 204 of
2 your second declaration.

3 A Okay.

4 Q That's going to be on Page 54.

5 A I'm glad you're going in order. That
6 makes it much easier. Yes, finally I understand.

7 Q Yes.

8 A Okay.

9 Q So go down to Page 55. You stated: "The
10 claim package is significant because it is less
11 prone to cracking than alleged prior art packages
12 and is more reliable for all packaging
13 technologies".

14 Is that correct?

15 A I believe these --

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A Differently from alleged prior art in
19 being less prone to cracking and more reliable for
20 all packaging technologies due to the
21 adjustability of the two-package limitations.

22 So what's the question?

1 BY MR. TAYLOR:

2 Q I was just verifying that you had written
3 that and understood that and then I was going to
4 ask the question.

5 The question is can you define what "all
6 packaging technologies" means?

7 A As I recall, the patent refers to the fact
8 that the packaging pitch, the ball pad pitch can
9 be increased or decreased in density and he was
10 defining packaging technology pretty much as the
11 ball pad pitch.

12 So if you have a standard that's not a
13 millimeter that's not a measure but rather a
14 pitch, then that pitch would scale for
15 technologies, for instance, one millimeter,
16 1.2 millimeter, .6, .5, whatever scale technology
17 you use you'd be able to scale this -- you would
18 be able to scale the methodology as he calls it.

19 Q A packaging technology, what does that
20 term generally mean to you?

21 MR. SHAPIRO: Objection. Form, asked and
22 answered.

1 BY THE WITNESS:

2 A I can clarify in this patent it's talking
3 about organic package, a chip package which would
4 be for a ball grid array. He's not referring to
5 all packaging technology but packaging technology
6 means how do you package a chip so that it will be
7 able to be placed on a board. This is the
8 intermediary between the chip and the board is
9 what we'll call the package. So there are many,
10 many, many packaging technologies going back to,
11 you know, seventies, blah blah blah, and here
12 we're referring specifically to organic ball grid
13 arrays.

14 BY MR. TAYLOR:

15 Q So to clarify, all packaging technologies
16 only includes organic ball grid arrays?

17 MR. SHAPIRO: Objection. Form.

18 BY THE WITNESS:

19 A Okay. I believe in this patent he's using
20 all packaging technologies. Again, my simple
21 understanding is at least at the level of a
22 POSITA, at least my simple understanding I didn't

1 even blink about that as to I don't think --
2 certainly he's not including anything other than a
3 ball grid. In fact, due to the adjustability of
4 the two-ball-pad pitches, he's referring to all --
5 right, he should have clarified all organic BGA
6 packaging technologies.

7 BY MR. TAYLOR:

8 Q Okay. Thank you. Are all organic BGAs
9 limited to full ball arrays?

10 MR. SHAPIRO: Objection form.

11 BY THE WITNESS:

12 A You can make an organic ball any way you
13 want. I believe there are many examples of
14 non-full ball grid arrays. More common today,
15 everything is pretty much ball grid array because
16 of the goal to chip scale package which has even
17 been defined by some standards organizations which
18 is 1.2 size times the size of the chip. It's a
19 very aggressive goal, but earlier days there were
20 many, many examples of non-full array packaging.

21 BY MR. TAYLOR:

22 Q Okay. Thank you.

1 In your second declaration if -- and I
2 apologize, we're going to go back a little bit,
3 Page 22; Paragraph 71?

4 A Okay.

5 Q You stated: "There is ample evidence that
6 the problem and existing solution should not be
7 considered admitted prior art."

8 Is that correct?

9 A That's exactly what I said.

10 Q How do you define applicant's admitted
11 prior art?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A I believe the petition is making a broad
15 stroke to say there existing solution, and there's
16 no intrinsic evidence. I don't think anywhere in
17 the patent itself, that's at least how you saw
18 that I'm understanding it. So in the intrinsic
19 evidence itself doesn't say that it was prior art.
20 It just says there is an existing solution. I
21 understand this to be an AT&T -- is this a Bell
22 Labs patent and I know that they have many, many

1 different types of technologies they try out.
2 They don't all become patents so this could -- I
3 understood this to mean there was a solution that
4 they had tried and it was not successful as far as
5 I can tell to achieve the goal that they were
6 looking for. I did not see this as a prior art.
7 I didn't see any extrinsic evidence, either. I
8 didn't see any -- anyone else who showed that they
9 have an invention of this one millimeter circle or
10 whatever it was.

11 And the second idea of having the layers
12 of metal, I don't know where that came up from
13 although I think that could be more of a problem
14 potentially because if you're going to get a crack
15 it's going to show up between that grounding
16 plane. So I would think that I could imagine that
17 that wouldn't be a good solution, either. So even
18 though they're calling existing solutions, I don't
19 believe they're patented or presented anywhere.
20 So I don't see how -- again, in consultation with
21 counsel would that be defined as prior art and I
22 believe that, well, as I said, this was between

1 counsel and myself we came up with this wording to
2 understand that it doesn't say prior art and it's
3 only your petition that seems to claim that this
4 is prior art and application whatever you call it,
5 admitted prior art.

6 So I'm objecting to that because I don't
7 see where they said it's prior art or where anyone
8 else outside has presented it as prior art.

9 BY MR. TAYLOR:

10 Q In Paragraph 64 of the second declaration
11 if you go up, you stated that these existing
12 solutions that we were just discussing is in the
13 background of the invention section of the '245
14 patent; is that correct?

15 A Yes, that's where it states it.

16 Q Can we go to the background section of the
17 '245 patent?

18 A Okay, I'm here, can you tell me -- okay, I
19 have it.

20 Q It's going to start on Column 2, Line 3.

21 A Yes.

22 Q So if we kind of flip back to the

1 declaration, if you can go to your first
2 declaration, Page 20.

3 MR. SHAPIRO: Can you put that up on the
4 screen, Tim.

5 MR. TAYLOR: Sure.

6 BY THE WITNESS:

7 A I'm not as prepared for this first
8 declaration, but I have it here.

9 BY MR. TAYLOR:

10 Q Can you see that?

11 A I can read it from yours. I have my
12 glasses on you see.

13 Q You stated in Paragraph 61 that Figures 1
14 through 3 of the '245 patent are labeled prior
15 art. Is that correct?

16 A Yes, labeled. Those are the pictures,
17 yes.

18 Q And it shows you stated it shows a full
19 ball -- strike that.

20 You stated in Paragraph 61 of the first
21 declaration that these prior art figures show a
22 full area ball array package; is that correct?

1 A That's what it says.

2 Q If we go back to the '245 patent.

3 A I'm use your picture here. I can see it.

4 Q Looking at Figure 1 of the '245 patent,
5 does the figure describe itself as prior art?

6 A Yes.

7 Q Same question for Figure 2, does figure it
8 describe itself as prior art?

9 A Yes.

10 Q And does Figure 3 of the '245 patent
11 describe itself as the prior art?

12 A Yes.

13 Q Are there any other descriptions in
14 Figure 3?

15 MR. SHAPIRO: Objection. Form.

16 BY THE WITNESS:

17 A No, in fact, as an exercise of my own, I
18 actually was able to make a composite of all three
19 and they actually lined up beautifully one on top
20 of the other, so you can see that he's describing
21 them as three layers, I guess there is only two
22 layers, the balls and the bonding and the wiring.

1 BY MR. TAYLOR:

2 Q Is there a number, reference number 38-A
3 shown in Figure 3?

4 A Yes.

5 Q What is reference number 38-A describing
6 or pointing to?

7 A He's pointing to the corner of the die
8 that would be sitting on top of this whole array
9 on the top left from Figure 1 seen from the
10 cross-sectional point of view. Go back to
11 Figure 1. That's the thing in three dimensions.
12 I always tell this to my class. So that ball is
13 going to as I recall, is that the top level, L1,
14 I'm pretty sure that's the upper level connecting
15 to the chip. So the chip would sit on those
16 little balls and then go down to the big ball at
17 the bottom and he's showing you layer eight, I
18 believe, is their Figure 3. So he's showing you
19 L9 is the first Figure 2 I believe -- that's going
20 to be ball grid layer, right, that's going to be
21 the ball grid and it's showing you where the
22 corner is of the die relative you see you have 38.

1 Q Yep.

2 A That's the corner of the die sitting on
3 top of that package, yes.

4 Q So you're saying that Figure 2 is layer L9
5 from prior art Figure 1?

6 A Right. Looking at it -- it's like an
7 x-ray. You have to think of an x-ray picture
8 because this whole patent is emphasizing the
9 corner in relation to the bottom layer as opposed
10 to those simulations that you were showing which
11 was the corner itself being the stress point.

12 Q So Figure 3 is a prior art figure and this
13 is showing layer eight; is that correct?

14 A I believe so. I'll have to read it again,
15 but I'm pretty sure that was the lower wiring
16 layer. So the layer eight which is the concern
17 for our -- yes, the concern for our patent. So
18 you see the three dimensional effect.

19 Q Can you read this text, Doctor?

20 A Can you make your screen a little bit
21 bigger, from where, that's okay, the background?

22 Q In Column 2, Line 3, it states: "One

1 existing solution to overcoming this problem is to
2 place metal planes on layer L9 under the die
3 corner 28."

4 Is that correct?

5 A That's what it says, yes.

6 Q So is that sentence that I just read is
7 that using elements from the prior art figures
8 that we just looked at?

9 MR. SHAPIRO: Objection. Form.

10 BY THE WITNESS:

11 A I'm sorry. No, this is an existing
12 solution that is not shown under prior art at all.
13 If you go back to your Figure 1, please, so if you
14 see L9 has -- is not a single plane, that's the
15 ball grid array area. So clearly it's not
16 describing what's shown in the -- what he's using
17 as the prior art. He's making solution that
18 they've thought of but it's not implemented in the
19 prior art. That's how I understand that.

20 BY MR. TAYLOR:

21 Q So you're saying that metal planes were
22 not implemented in the prior art near a die

1 corner?

2 A Right.

3 MR. SHAPIRO: Objection. Form.

4 BY THE WITNESS:

5 A I don't see it here. We see No. 30 which
6 is the ball pad, but that's not a metal plane. So
7 there's no metal plane shown in any prior art or
8 even described as a prior art. But it does say
9 existing solution, but it doesn't say where it
10 exists, with whom it exists, where it came from.
11 It could be something that's in an archive at AT&T
12 for all I know.

13 BY MR. TAYLOR:

14 Q Thank you.

15 MR. SHAPIRO: We've been going I guess a
16 little over an hour. Maybe we should take another
17 like a five-minute break if that's okay with
18 everyone.

19 THE WITNESS: I'm ready to go.

20 MR. SHAPIRO: I need a five-minute break.

21 MR. TAYLOR: We'll take a five-minute
22 break.

1 MR. SHAPIRO: Thanks.

2 (A recess was had.)

3 BY MR. TAYLOR:

4 Q Doctor, turning to Figure 3 of the '245
5 patent?

6 A Okay, should we use your screen again so
7 we can point or should I just look at it
8 separately?

9 Q Sure. I can share that with you.

10 A With these glasses on it was hard to walk
11 down the stairs, but at least I can see my
12 computer screen.

13 Q How is that? Can you see that?

14 A Yes.

15 Q Can you see my cursor?

16 A Yes.

17 Q In Figure 3 of the '245 patent, do you see
18 a line that kind of circumscribes the corner of
19 die 38-A?

20 MR. SHAPIRO: Objection. Form.

21 BY THE WITNESS:

22 A Yes. I see that --

1 BY MR. TAYLOR:

2 Q You see what appears to be a polygonal
3 shape that circumscribes corner 38-A?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A Yes, I see that.

7 BY MR. TAYLOR:

8 Q What do you suppose that polygonal shape
9 means in Figure 3 of the '245 patent?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A I think it's quite clear because if you go
13 to Figure 5, I believe, you can say that same
14 polygonal shape with that same corner but the
15 difference is the routing.

16 So obviously when they're showing the
17 prior art, they're showing it in relative to the
18 Figure 5 so now if you put Figure 5 and Figure 3
19 together, superimpose one on the other you'll
20 understand that the normal routing has no concern
21 for that polygonal area and their invention has
22 concern for the polygonal area and that is the

1 invention.

2 BY MR. TAYLOR:

3 Q Okay. Thank you. If we can go down -- I
4 guess I have the keys here, and we can scroll down
5 to Section 3, Lines 50 and 51, I'll read this here
6 for you. It says: "Traces on L8" meaning layer 8
7 "may be routed over sections of continuous solid
8 plane on L9," meaning layer nine, "within the high
9 stress region."

10 Does this mean that there's a solid plane
11 on Layer 9 within the high stress region?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A Well, as I said, we didn't say that the
15 existing solution was prior art. I didn't need
16 it. But he's saying that there could be a solid
17 plane -- well, it's interesting. Yeah. Okay.
18 There could be obviously something about a trace
19 that it may be routed over sections of continuous
20 solid plane as if they were implementing one of
21 their potential solutions, I suppose, but I can
22 only opine that he does say continuous on a plane.

1 The only problem is that there can't be a solid
2 plane because that's the ball pad layer according
3 to that map. So that's why I'm a little confused.

4 Can we see Figure 1 again to see what
5 Layer 9 is just to make sure we're aligned?

6 L9 is that metal if L9 is the ball pad
7 metal, then it can't be a continuous line. Here
8 it is not shown as a solid plane.

9 Q I can go back down to that section.

10 A Let me just see if he defines that.

11 Q It says the high stress area 58 is defined
12 in connection with layer L9 that's lines 38 and 39
13 of Column 3 of the '245 patent. And then down on
14 lines 50 and 51 of Column 3 of the '245 patent, it
15 says: "Traces on L8 may be routed over sections
16 of the continuous solid plane on L9 the high
17 stress region."

18 A Okay. So obviously it's not shown from
19 the L9 of the same picture that we see up there.

20 I just want to point out if they labeled
21 that bottom layer as No. 30, right, and it -- can
22 we go back to your Figure 1? So it looks like 30

1 is at the same level as L9. I guess I'm not
2 asking you questions. It looks like 30 and he
3 defines 30 in Column 1, Line 40, it says a
4 plurality of ball pads 30 one of which is shown
5 provided on layer L9. So my confusion here is how
6 can you have a ball pad and a continuous plane.

7 BY MR. TAYLOR:

8 Q That was my question.

9 A Yeah, I don't know what the patent means
10 by that, then.

11 Q Okay. Thank you.

12 A If I could just add you're really smart.
13 You were very observant to have found such a
14 thing.

15 Q Let's look at your second declaration,
16 Doctor. Let me ask you a question on metal
17 planes.

18 A Okay.

19 Q Given your experience, someone at the time
20 of the '245 patent, would they have known that
21 metal planes existed?

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A It's no secret that you can make -- in
3 fact, very often in high level stacks most of like
4 a whole level could be, in fact, one voltage, that
5 would be a plane even of course there are lots of
6 holes for vias and things to go through it. You
7 could call that like a V&D plane or a ground plane
8 which would be inside so people, of course, knew
9 you could make a whole layer one voltage.

10 BY MR. TAYLOR:

11 Q Were metal planes at that time sometimes
12 not a full plane?

13 MR. SHAPIRO: Objection. Form, outside
14 the scope.

15 BY THE WITNESS:

16 A Again, a plane generally means without
17 holes in it, but clearly if you are having any
18 layer of a package between the balls and the top,
19 they have to get signals up you have to have holes
20 in your plane. I think a plane does not mean a
21 solid metal in that context but this is not really
22 an art term. I mean, plane is used also

1 generically like it could mean a ground plane, we
2 call it a ground plane, and it's not necessarily a
3 full plane. It could be moving pieces of metal.

4 BY MR. TAYLOR:

5 Q So as you mentioned earlier, if you had a
6 metal plane on Layer 9, that would indicate that
7 you couldn't have a ball pad there, correct?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A Again, if you were to have a plane like in
11 their figure, you can't imagine let's say a grid
12 that could be considered a plane at the same level
13 where there is space. I think in the Figure 1,
14 bring up Figure 1 again, and I can show you where
15 there is that piece of metal to the left of the
16 ball and those could be continuous as if like a
17 plane connecting down to the metal balls. I have
18 seen many examples where there'll be layers where
19 like all the voltages will be on one layer and
20 then the ground will be on another layer so there
21 would be whole planes being layered and it's more
22 like a honeycomb pattern where they'll be moved

1 around. I would refer to it as a plane I suppose
2 you could refer to it as a plane, but as I said
3 it's not really a term of art in this area. I
4 mean, if someone were to refer to it as a plane I
5 would say, okay. You know, I wouldn't object but
6 usually as you seem to indicate a plane would mean
7 a continuous plane but clearly a continuous plane
8 has to have spaces for the balls in between.
9 Again, show that Figure 1 again. Maybe we can
10 understand it that way.

11 Q I think you answered the question. Thank
12 you.

13 Continuing to your second declaration,
14 Paragraph 123.

15 A Yes, sir.

16 Q You stated that: "In the embodiment
17 illustrated in Figures 4 and 5, it can be seen
18 that the routing directions defined by the ball
19 pads are horizontal, vertical and diagonal." Is
20 that correct?

21 A That's what I said.

22 Q It appears from this Paragraph 123 that

1 the only place in the '245 patent that you're
2 basing this paragraph on is Figures 4 and 5; is
3 that correct?

4 MR. SHAPIRO: Objection. Form.

5 BY THE WITNESS:

6 A I believe as we said the description in
7 words is very small and they rely a lot on
8 pictures so that's how I rely for this as well.

9 BY MR. TAYLOR:

10 Q Thank you. Do you know if the '245 patent
11 ever uses the word horizontal?

12 A Other than doing a word search, I don't
13 know if they -- wait a minute. It sounds like
14 you've probably read the patent and know. Can you
15 tell me is there a place where it's written?

16 Q As far as I know there is not a place that
17 uses that word.

18 A Okay.

19 Q Does the '245 patent ever use the word
20 vertical?

21 A We talk about vertical in terms of the
22 stacking but do we talk about -- let's see,

1 questions. It talks about directions. We talk
2 about the directions in relation to the ball --

3 Q How does the patent describe the
4 direction?

5 A Well, I'm just noticing in Line 25 of
6 Column 3 where it says the high stress zone 58
7 extends approximately two ball pitches away from
8 the die corner in each direction. So he says
9 there are two directions, the high stress zone 60
10 extends approximately two ball pitches away from
11 the die corner in each direction, so it's not
12 using vertical and horizontal, but it's certainly
13 clearly -- that's why I said the ball pitch, you
14 have to have a pitch so there is clearly a
15 definition of directions at least directions of
16 the ball pad. So ball pad array is in directions.
17 So I think that's certainly understood.

18 Q Does the '245 mention directions?

19 A (Inaudible).

20 Q You just read to me Column 3, lines -- I
21 believe 24 to 28 where it says: "The high stress
22 zone extends approximately two-ball-pad pitches

1 away from the die corner from each direction."

2 A Yes.

3 Q Each direction, how many directions is
4 that?

5 A Well, we -- if you start from the center
6 and you go out two ball grids in each direction,
7 which means two up, two down, two to the right two
8 to the left, or north south east west, he doesn't
9 make a convention I think, but he does show
10 directions and he does show a shape in that you
11 show that shape not only -- he imposed that shape
12 on the prior art which maybe you can say can be
13 confused as if he's trying to say it is part of
14 the prior art, but I think it's clear by Figure 5
15 that he did not intend it to be prior art rather
16 than to show how it is not concerned and he shows
17 what he means by direction and he shows a shape
18 that is -- all the shapes he shows are this square
19 with angles sort of like octagonal, polygonal
20 shape.

21 Q So you're saying he does show the high
22 stress area in Figure 3 of the '245 patent; is

1 that correct?

2 MR. SHAPIRO: Objection. Form.

3 BY THE WITNESS:

4 A He's saying showing what -- where the high
5 zone is that the prior art is not concerned for
6 because you see it's the exact same shape that he
7 puts in Figure 5 to show you how the invention
8 utilizes the knowledge of that being the high
9 stress area, and so actually it's not just
10 Figure 4, it's also Figure 3 and 5 where he shows
11 the same polygonal shape and there is no
12 implication of anything circular as we said and
13 he's definitely talking about directions and I'm
14 defining this as I said I'm thinking it's clear
15 that he's talking about routing directions.
16 That's why we're saying the north south east west
17 because the claim language itself does say -- said
18 the ball pad layer having a polarity of ball
19 pads -- just a minute -- wherein none of the
20 signal traces of the bottom routing layer are
21 located over ball pads of the ball pad layer which
22 are disposed in an area of two-ball-pad pitches at

1 the corner of the die. So I'm understanding why
2 does it talk about the pitch. It's talking about
3 regular array. You only have a pitch if it's ball
4 space, ball space, a pitch is always used in all
5 packaging and wiring technology as the line and
6 the space. So it would have to be regularly
7 pitched amounts so the pitch is definitely
8 implying direction. Here in the specification
9 he's saying in each direction so and then he shows
10 three pictures of a polygonal shape. I think it's
11 all consistent. And he defines that as the high
12 stress zone very clearly, high stress seen 60
13 extends approximately -- there we are, okay.

14 Q But you would agree that the '245 patent
15 never actually uses the words horizontal or
16 vertical?

17 A Again, my word search is not working and
18 I'll rely on you that it does not because you
19 wouldn't have asked me the question if it did, but
20 he does say directions and I understand directions
21 as someone as a POSITA would have understand
22 direction in an array to mean north south east

1 west or up down left right or however you want to
2 describe it.

3 Q So if we go to Paragraph 120 of your
4 second declaration, I'm going to be on Page 34, we
5 will start there and go to Page 35 you stated:
6 "To ensure high density signal routing, it is
7 important that the high stress area be no larger
8 than required to eliminate the occurrence of
9 tracks and signal traces."

10 A I'm sorry. Which paragraph are you
11 reading?

12 Q Sorry. That was Paragraph 120 on your
13 second declaration. That should be on Page 34.

14 A However, to ensure high density signal
15 routing it's important -- that's what you're
16 reading?

17 Q Yes.

18 A I was looking for it and you were reading
19 it so I wasn't together. Okay. I have it now.

20 Q You then stated in Paragraph 121 that:
21 "The aforementioned goal is realized by defining
22 the high stress area as two-ball-pad pitches from

1 the corner of the die."

2 MR. SHAPIRO: Objection. Form.

3 BY THE WITNESS:

4 A In each routing direction, defined by the
5 ball pads, I said it there.

6 BY MR. TAYLOR:

7 Q But what I read was accurate?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A What you read is exactly what I wrote and
11 I think that came from the patent.

12 BY MR. TAYLOR:

13 Q Excellent. So then are you saying here in
14 Paragraphs 120 and 121 that the area -- the high
15 stress area is defined by two-ball-pad pitches?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A He defines it very clearly, two-ball-pad
19 pitches within the vicinity of the corner.
20 There's two aspects because the directions start
21 from where the corner is on a vertical direction
22 down as we said like an x-ray from the corner down

1 to the bottom.

2 BY MR. TAYLOR:

3 Q So in Paragraph 120 where you say it's
4 important that the high stress area be no larger
5 than required, are you stating, then that
6 two-ball-pad pitches is the maximum distance that
7 the high stress area can be?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A The whole point is you can extend this
11 region. The invention is trying to tell you that
12 you can actually increase the density by limiting
13 it here. We saw from many of the examples from
14 the partial arrays and the Celeron and other
15 places, they put those pads way out in the middle
16 of no man's land and they're wasting a lot of
17 space.

18 So, yeah, you can go as far as you want
19 but the issue is if you want to maximize your
20 space and maintain reliability, that's the
21 suggestion of this patent. You want to maximize
22 your routing with the maximum reliability. The

1 goal is there should be no failures which is as a
2 reliability engineer a very difficult goal.

3 BY MR. TAYLOR:

4 Q So you said that the high stress area
5 would be no larger than required.

6 What I'm asking is the high stress area,
7 that is defined by two-ball-pad pitches, correct?

8 MR. SHAPIRO: Objection. Form.

9 BY THE WITNESS:

10 A Yes.

11 BY MR. TAYLOR:

12 Q When you say that the high stress area can
13 be no larger than required, are you stating that
14 the maximum distance it can be one two-ball-pad
15 pitches?

16 MR. SHAPIRO: Objection. Form,
17 mischaracterizes testimony.

18 BY THE WITNESS:

19 A I do think it does mischaracterizes --
20 okay, by maximum of the high stress area I'm using
21 this term here to mean the high stressed area
22 where the routing should be avoided or in the

1 worst case like it says not going over any balls,
2 but obviously that's what -- we're defining that
3 in this patent; in fact, we said defining the high
4 stressed area as the two ball pitches from the
5 corner. So we're making this definition of what
6 the patent refers to as high stress area.
7 Clearly, you know, if you want to say, hey, I'm
8 worried that it's going to be three ball pitches
9 away, you know, go ahead. If someone else wants
10 to go, you know, five millimeters or someone wants
11 to make a completely clear area with no ball pads,
12 go ahead, but this patent is telling you to
13 maximize -- to be reliable if you're inside that
14 area you worry about reliability and if you're
15 outside that area, you're less worried about
16 reliability, but if you want to maximize you're
17 limited by this region. I think that's exactly
18 what it says. I don't think there's anything to
19 mischaracterize here.

20 Q I just wanted to be clear that the high
21 stress area then is just exactly two-ball-pad
22 pitches? That's how you define it, right?

1 MR. SHAPIRO: Objection. Form. You keep
2 asking the same thing, Tim.

3 BY THE WITNESS:

4 A I'm saying it's a definition for this
5 patent. It's not an overall statement. If I were
6 to do simulations of where the stress is I'm
7 saying by definition of this patent we are
8 defining this high stress zone that has to be --
9 have the routing go around is defined by this
10 area. The reality of stresses whatever else,
11 again, I did not study that. You can do all kinds
12 of simulation, but I'm saying for the purpose of
13 the definition within this patent, I think I even
14 said it in my -- a patent is allowed to define its
15 own terms and this patent here defined its own
16 term as a high stress area one where the routing
17 has to be going around.

18 So I don't want to say characterizing it
19 as a generally high stress area because I'm sure
20 you can find some professor with some simulation
21 to make stresses anywhere you want because it's
22 very complicated. We're talking about for the

1 purpose of this patent.

2 BY MR. TAYLOR:

3 Q Okay. Thank you. Maybe to clarify let's
4 go back to the '245 patent and Claim 1.

5 A I'm there.

6 Q Are you saying that -- let me just ask
7 you, Doctor.

8 Where does Claim 1 define the size of the
9 high stress zone?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A The claim language as the way I've shown
13 and I think I've said many times it is very clear
14 wherein none of the signal traces of the bottom
15 routing layer are located over ball pads of the
16 ball pad layer which are disposed in an area
17 within two-ball-pad pitches of the corner of the
18 die.

19 So this language comports or is in
20 agreement with what the language of the
21 specification calls high stress region as we've
22 said before or high stress zone that has to be

1 avoid the routing. So this claim is clearly
2 describing in claim language the legal language
3 what the specification is describing as a physical
4 phenomenon of potential failures, how to avoid
5 them.

6 BY MR. TAYLOR:

7 Q So just to be clear, Doctor, the size of
8 the high stress zone in Claim 1, are you saying
9 that is defined by the two-ball-pad pitches from
10 the corner of the die?

11 MR. SHAPIRO: Objection. Form.

12 BY THE WITNESS:

13 A It's in the claim language. It's telling
14 you none of the signal traces of the bottom
15 routing layer located over ball pads of the -- so
16 he's describing in a claim language what we've
17 been saying all along here. There is that Claim 7
18 that we disavowed where he uses the language of
19 high stress region as I recall. That's the area
20 of increased stress, okay, which we define by the
21 corner of the die and we disavow seven because of
22 the ambiguity I believe, but I didn't make that

1 decision. I don't know --

2 MR. SHAPIRO: I'm going to caution the
3 witness not to discuss any communications that you
4 may have had with counsel that might have been
5 privileged.

6 THE WITNESS: Thank you. Thank you.

7 BY THE WITNESS:

8 A But otherwise Claim 1, which is a good
9 claim, is defining for us where to avoid the
10 signal traces in order for the implementation of
11 this patent and to have an organic BGA without
12 failures.

13 BY MR. TAYLOR:

14 Q Thank you, Doctor. Let me see if I can
15 jog your memory and ask you this question. If you
16 can go to your first declaration on paragraph or
17 sorry on Page 35?

18 MR. SHAPIRO: Can you show that on the
19 screen, Tim?

20 MR. TAYLOR: Yes, I can do that again.

21 BY MR. TAYLOR:

22 Q Doctor, can you see that?

1 A Yes.

2 Q I'll try and zoom in for you.

3 A That's okay.

4 Q So Paragraph 123 of your first declaration
5 Exhibit 2001, it states: "The size or shape of
6 the high stress zone is clearly defined by the
7 language of Claim 1."

8 So what I was asking is if we go back to
9 the patent is where in Claim 1 -- you said it
10 defines both the size and the shape clearly in
11 Claim 1, I just wanted to get your reasoning
12 for -- where did you find in Claim 1 that it
13 defined the size and the shape?

14 MR. SHAPIRO: Objection. Form.

15 BY THE WITNESS:

16 A I think we said that that last claim
17 element wherein none of the single traces of the
18 bottom routing layer are located and it describes
19 here over ball pads of the ball pad layer which
20 are disposed in an area within two-ball-pad
21 pitches of the corner of the die. So there is the
22 corner of the die and two-ball-pad pitches. We

1 know what a pitch is. What know what directions
2 are. We know a pitch is a regular array and
3 arrays are generally in two dimensions so we know
4 how it means and we understand from figures, what
5 is it, five and three what that shape means and
6 four, and the -- again, the only real descriptions
7 are the pictures and they're all the same kind of
8 shape so we know what he means.

9 I don't see what's not clear. With the
10 context of the whole patent this definition for
11 the size and area he's giving I think very exact
12 dimensions.

13 BY MR. TAYLOR:

14 Q Thank you.

15 Can you turn to Page 48 on your second
16 declaration, please, and Paragraph 176.

17 A 48, 166, maybe, I don't see -- there's no
18 176 on Page 48.

19 Q On your second declaration.

20 A Hold on a second. 48.

21 Q So maybe that's the PDF number. The PDF
22 number is 51.

1 A Maybe just refer to paragraph number.
2 Maybe that's easier.

3 Q Paragraph 176?

4 A That's on my Page 50, but that's okay. It
5 starts with two-ball-pad pitch implementation?

6 Q That's Paragraph 176.

7 A I think this is the right document. The
8 two-ball-pad pitch limitation of Claim 1 as
9 opposed to hard coating a one millimeter circle,
10 is that the sentence you want me to read?

11 Q Yeah, that's correct. Again, we're back
12 at the two-ball-pad pitch implementation term.

13 When you say two-ball-pad pitch
14 implementation, you're describing that polygonal
15 shape that's in Figure 5; is that correct?

16 A Yes.

17 MR. SHAPIRO: Objection. Form.

18 BY MR. TAYLOR:

19 Q You state in Paragraph 176 that this is
20 critical to the invention; is that correct?

21 MR. SHAPIRO: Objection. Form.

22 BY THE WITNESS:

1 A That's what I'm saying this two-ball-pad
2 pitch implementation is critical to the invention,
3 yes.

4 BY MR. TAYLOR:

5 Q Thank you. I was just trying to figure
6 out -- in your first declaration, I didn't see any
7 particular shape mentioned and so I was curious if
8 it was critical to the invention why did we not
9 discuss that in the first declaration?

10 MR. SHAPIRO: Objection. Form, and I'm
11 going to caution the witness not to reveal any
12 communications with counsel that are privileged.

13 BY THE WITNESS:

14 A Okay, well, how we came from the first one
15 to the second one mostly depends on how we
16 understood the preliminary to be interpreted.

17 So clearly we didn't need to emphasize it
18 or discuss it because we didn't think that it
19 needed explanation and clearly based on the
20 responses and the results from that preliminary we
21 felt, you know, that it was important to clarify
22 this case and you see we spent a lot of time

1 clarifying this with definitions, claim language
2 constructions. We did a lot of things to clarify
3 this as well as we could.

4 BY MR. TAYLOR:

5 Q Thanks.

6 I want to just go back to Paragraph 125 of
7 the second declaration.

8 A Okay, I'm there.

9 Q You basically are describing the area of
10 high stress and how it extends from the corner of
11 the die, and you use horizontally, vertically,
12 diagonally and then if you go down below you'll
13 see the picture of Figure 4 right below
14 Paragraph 126.

15 A Yes, I see all that.

16 Q The resulting area of stress is therefore
17 a polygon.

18 So based off of what you're stating what I
19 wanted to know is you're going to basically
20 make -- you're saying you're basically going to
21 make eight separate points from the corner of the
22 die; is that right? You'll go one direction and

1 maybe I don't have -- let me see if I can -- maybe
2 drawing on it would be easier.

3 A I'll look at your screen, then.

4 Q Let me pull that up real quick. Doctor,
5 can you see that?

6 A Yes.

7 Q Let me see if I can find that drawing tool
8 here.

9 A It's that pen with the little squiggle
10 under it? Is that it? That's not it.

11 Q You're saying if we start from the corner
12 of the die and go horizontally in a direction, is
13 that what you stated?

14 A That's what I stated.

15 Q Let's see if I can select another one.

16 So you're going to basically go eight
17 different directions, horizontally one way,
18 horizontally the other one, then you'll go
19 vertically in two directions?

20 A Yes.

21 Q And then you're going to go diagonally in
22 four separate directions?

1 A It would be the same thing.

2 Q So if we were going to count by degrees,
3 this would be 0 degrees, 90, 180, 270 and then we
4 would also do 45, 135, 225, 315?

5 A That is -- okay.

6 Q That's basically -- so that's kind of --
7 that's what you're stating in paragraph -- let me
8 go back to it -- Paragraph 125 here, how the area
9 of high stress extends from the die corner?

10 MR. SHAPIRO: Objection. Form.

11 BY THE WITNESS:

12 A I'm describing basically that horizontal
13 vertical and then I talk about I say northeast or
14 something.

15 BY MR. TAYLOR:

16 Q So my question is how are the lines are
17 perpendicular if you were to draw it out from the
18 die corner does the high stress area edge is that
19 going to be perpendicular to the line that you
20 drew out?

21 A Again --

22 MR. SHAPIRO: Objection. Form.

1 BY THE WITNESS:

2 A -- the high stress edge is defined by this
3 patent in that we'll call it a octagon, and so
4 again, we're saying what the inventors found if we
5 keep the wiring outside of the area on the eighth
6 level, then you will have not this crack failure
7 emanating from one of those ball pads going up
8 towards the corner.

9 BY MR. TAYLOR:

10 Q What I'm asking is this exterior edge of
11 the high stress zone, and let me see if I can draw
12 it in with a different color. Do you see that?

13 A Yes.

14 MR. SHAPIRO: Objection. Form.

15 BY MR. TAYLOR:

16 Q So this edge of the high stress zone is
17 that perpendicular to the line that you drew from
18 the die corner to get to the edge of the high
19 stress zone?

20 MR. SHAPIRO: Objection. Form.

21 BY THE WITNESS:

22 A Well, it would because it's 45 degrees in

1 a square zone those two pads in that angular so to
2 speak is going to be defined by a 45-degree angle.
3 I think your wire should be in a little bit or
4 their drawing isn't exact, but you know the idea.

5 BY MR. TAYLOR:

6 Q If you're perpendicular to each point and
7 if you're perpendicular to this point, let me draw
8 one more line, what I'm getting at, Doctor, is
9 where do you define where the edge of the high
10 stress zone meets the other edge of the high
11 stress zone coming off of another -- of your eight
12 points that you use to route from the center of
13 the die corner?

14 MR. SHAPIRO: Objection. Form.

15 BY THE WITNESS:

16 A Well, if you use that size, you'll see
17 that it encompasses, for instance, here your
18 corner is in between two pads, your blue line, the
19 middle of your blue line is between two ball pads,
20 so it would extend out on either side covering
21 over those two pads and, again, so right there.
22 So it would go out. As we see these liens were

1 probably drawn by hand and you would have to make
2 like a T on top but only to the extent that when
3 you draw the perpendicular horizontal line you
4 will cross that extra tangent and you draw a T up
5 and a T 45 degrees down and they will only meet at
6 one point in the middle. So if you take a T and
7 another T and another T, those will make an exact
8 octagon and I'm pretty sure that's how it's
9 describing it.

10 Q So a high stress zone is basically an
11 exact octagon; is that correct?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A Basically. I think Figure 5 is a little
15 more clear or as you were showing his little
16 picture -- it's backwards a little bit. It's hard
17 to be clear because we don't know it's coming
18 from the -- this is extending from Figure 3.
19 Figure 3 and Figure 5 if you lay them one on top
20 of the other you'll see the difference between
21 what they called the prior art. I know this for
22 myself at some point, you can superimpose them so

1 I guess maybe it isn't easier to see. What you're
2 drawing is probably the more accurate way to
3 actually see it because here he's comparing it to
4 regular wires.

5 Let me draw your attention, please, to
6 that left corner, where you are, Figure 5, go back
7 to Figure 5, you see that upper left corner, where
8 54 --

9 Q Let me sort of orient this page.

10 A I'm going to want you to sort of look at
11 that in comparison to Figure 3, yes, right, so you
12 want to line up those two blocks. So you see
13 where there are angles on the top and the bottom,
14 he's basically saying those wires that go through
15 that octangular zone and he's routing them around
16 in the way of Figure 5 and that's his
17 implementation of the patent. It's very dense
18 above 54, all those wires together, and very dense
19 on the other side below 64, so he's taking the
20 wires that would have otherwise gone in the middle
21 and pushing them out. So he's defining with
22 pictures what he means.

1 Q Thank you.

2 A Okay.

3 Q I'll keep my screen share on because I am
4 going to go to the first declaration.

5 You stated in Paragraph 37 here -- can you
6 see that, Doctor?

7 A Yes.

8 Q You said that: "I understand that
9 obviousness analysis, therefore, considers the
10 inferences and creative steps that a person of
11 ordinary skill would employ under the
12 circumstances."

13 In your opinion, would inferences and
14 creative steps, would that modify the high stress
15 zone in any way?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A I think don't think I understand the
19 question. What do you mean?

20 BY MR. TAYLOR:

21 Q Well, you stated here in Paragraph 37 that
22 an obviousness analysis could consider inferences

1 and creative steps that a person of ordinary skill
2 in the art would employ.

3 I was just asking you do you think at the
4 time of the invention of inferences or creative
5 steps would that include maybe changing the shape
6 of the high stress zone?

7 MR. SHAPIRO: Objection. Form.

8 BY THE WITNESS:

9 A I think to answer your question, we have
10 to understand what does a normal POSITA do in
11 terms of inferences and normal steps. I'm very
12 much involved in the failure analysis community
13 and the hardest thing of finding out how to solve
14 a problem is to find out what the problem is.
15 Once a problem is found and discovered, very often
16 the invention will come by understanding a problem
17 and figuring out a solution to the problem, but
18 first you have to out what the problem is.

19 I think as you saw very much in the prior
20 art that the sources you showed me and all the
21 other sources the corner is the normal place to
22 look for stresses. The discovery of the patent is

1 that the failures are occurring from the bottom
2 up, and I believe that you're not going to find
3 that in the prior art, the problem, and I believe
4 that was the major part of the invention.

5 So that I believe was a very difficult
6 task because failure analysis on electronic
7 packaging I can tell you that that is 90 percent
8 of the failure analysis costs of any company and
9 it could be millions and millions of dollars. I
10 was just at a conference and it's a huge -- lots
11 and lots of money on failure analysis equipment is
12 getting the proper analysis tools, mapping, they
13 have to cut them. It's an extremely costly and
14 complicated process to find the failure especially
15 in a package. For some reason packaging failures
16 are very difficult and complicated.

17 So if the problem was not found it is not
18 all -- there is no such thing as an ordinary step
19 in terms of failure analysis. Every failure is
20 different. I can assert that and I can show you a
21 hundred reliability and testing engineers who will
22 tell you that as probably you can probably imagine

1 because you can't predict your failures because
2 you predicted it to work.

3 So once you discover the failure, then I
4 can argue, ahh, now we have to find a solution and
5 maybe you can argue from that point there could be
6 some steps that may be a POSITA would have, but I
7 don't believe this failure mechanism was known. I
8 don't believe that this failure mechanism is shown
9 in the prior art. As we see all the prior arts
10 are concerned with the corner of the chip. They
11 are not concerned with the ball grid in connection
12 with the corner and that was their discovery, and
13 once they found it, you know, I think that was the
14 important start of the inventive process here.

15 BY MR. TAYLOR:

16 Q Doctor, that was a lot of information. I
17 just wanted to clarify.

18 So a creative step would that include or
19 not include changing the shape of a high stress
20 area?

21 MR. SHAPIRO: Objection. Form.

22 BY THE WITNESS:

1 A Starting from where? Starting from what
2 insight? It all depends on the insight that
3 you're starting with.

4 Once you've discovered the failure
5 mechanism, which could have taken most of the time
6 and energy, you can say that -- I don't even know
7 what you can say. It's hard to judge what
8 creativity goes into but there's enormous
9 creativity that goes into every failure analysis
10 and small change so it's hard to tell what is a
11 predictive -- a predictable solution means you
12 have to know what the problem is, right.

13 BY MR. TAYLOR:

14 Q Thank you.

15 A Thank you. Okay.

16 Q We can go down and you can still see my
17 screen Paragraph 53 of the first declaration.

18 You stated: "High density packages such
19 as those with full ball arrays can have ball pads
20 under the die corner;" is that correct?

21 A That's correct. I stand by that.

22 Q But you say that the word can in that

1 sentence does that imply an option or a
2 requirement?

3 MR. SHAPIRO: Objection. Form.

4 BY THE WITNESS:

5 A I think I said earlier on here there is no
6 requirement on any package. The only requirement
7 is what the customer wants. So if you want a full
8 array with every possible place for a ball, then
9 you can order that. If you want a reduced array
10 because it fits better into your package or you
11 don't need so many IOs, you can do that also. So
12 I'm saying you can. It doesn't have to be a full
13 array.

14 BY MR. TAYLOR:

15 Q You're saying that can means sometimes
16 there's ball pads into the die corner and
17 sometimes there aren't?

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A I'm saying it's not required.

21 MR. TAYLOR: Okay. Thank you. How are we
22 doing on time? Is everybody good?

1 MR. SHAPIRO: Yes, I think so.

2 BY THE WITNESS:

3 A I'm still filling my coffee. Until I
4 start falling asleep. I'm still a little bit on
5 California time so we're lucky there.

6 BY MR. TAYLOR:

7 Q Excellent. I want to go to Column 3 of
8 the '245 patent and it states on line 52 to 54:
9 "In the event a larger sized die is used the
10 signal traces 64 will be routed outside the high
11 stress zone 60 defined in connection with layer
12 L9".

13 So is that saying in an embodiment the
14 traces can be completely outside of the high
15 stress zone 60?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A Let me read this again carefully. I'm
19 using your screen.

20 In the event a larger size die is used,
21 that is to say there is a larger die, most of the
22 balls are inside I assume, the signal traces -- is

1 this adding something as opposed to just the
2 normal procedure. I don't know what it's adding,
3 it's saying normally the routing will be outside
4 the high stress zone. Unless it's saying because
5 there are fewer pads beyond -- I don't know. I
6 can only opine -- I can only make a guess and I
7 don't think it's saying anything radical. It's
8 just telling you if you have a very large die on a
9 full array pad like going back to figure Figure 4,
10 I think I'll tell you what it looks like it means
11 to me, I think I'm not going to get -- I think
12 it's okay to do this. Right now we have 56 is
13 sort of in the early corner. Imagine if that were
14 moved way out so you have a big die relative to
15 the pads. You can go further, go further. Let's
16 say four rows, right there. Let's make that the
17 corner of the die. So logically there is fewer
18 pins that you have to route to if your die is that
19 large.

20 So he's just saying that there will be
21 fewer in that zone because it's just less routing.
22 Most of the routing is in the middle when you have

1 to get from the small die to lots and lots of
2 places way out here there is a lot of routing but
3 if your die is very big --

4 BY MR. TAYLOR:

5 Q Doctor, specifically, I can zoom in here
6 for you, this is talking about signal traces in
7 reference to the high stress zone, correct?

8 A Right. So the high stress zone is small
9 parts of the corner. If you have a big die it is
10 less relative to the chip size. We know it's the
11 same size physically, but relative to the size of
12 the die, they are way out in the corners. So he's
13 describing very large die which means that there
14 are fewer traces that go beyond it.

15 Q So just to be clear in the event a larger
16 size die is used, are you saying that signal
17 traces can be routed in the high stress zone or
18 they can't be routed in the high stress zone?

19 MR. SHAPIRO: Objection. Form.

20 BY THE WITNESS:

21 A They will be. I said they will be routed
22 outside the high stress zone defined in this

1 connection with layer L9. I think it's not saying
2 anything new or particular. The traces on line L8
3 may be routed over sections -- they are giving
4 some options in the event of a large die the
5 signal traces will be routed outside of the high
6 stress zone defined by connection with layer L9.

7 BY MR. TAYLOR:

8 Q So if all the signal traces are routed
9 outside the high stress zone, whether or not ball
10 pads exist in there, they wouldn't crack if they
11 are outside the high stress zone; is that correct?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A Okay. Lines, traces that are outside the
15 high stress zone, our patent is telling us if
16 you -- that's what the methodology is you make
17 sure they're not in that high stress zone defined
18 by this geometry we were talking about in
19 connection with the corner and the ball pads. So
20 if the routing is outside of that, then it won't
21 crack. So the signal traces are routed outside
22 the high stress zone so that means they won't

1 crack. I don't understand your question. I think
2 he just says it very clearly.

3 BY MR. TAYLOR:

4 Q Okay. Thank you. If you can go to your
5 second declaration, Paragraph 52?

6 A Yes.

7 Q I'm on it so you can see it. It says:
8 "The full packages with a full area ball array
9 were also adopted to reduce the package body side
10 and provide a high input/output signal density."

11 So it uses the words also adopted. So
12 what are the other ways around that time that they
13 would find a high IO signal density?

14 MR. SHAPIRO: Objection. Form.

15 BY THE WITNESS:

16 A You're saying also. They are saying also
17 here I meant as opposed to the partial array which
18 has a lower density. By definition more pins is
19 more dense because it's all the same area. So
20 there were high -- there were Celeron type chips
21 and many chips, in fact, I think there was even
22 one in the prior art that the Patent Office

1 considered where there is a partial array chip
2 sits inside it. Lots of people have done that.
3 It's very reliable. They are wonderful except
4 that if you have a chip that's 10 times the
5 size -- you have a package that's 10 times the
6 size of your chip, and that's not very high
7 density.

8 I told you today the standard, the
9 industry standard is to define a chip scale
10 package as the package is 1.2 times the size of
11 the actual chip. So the goal is really to get as
12 many pins in there as possible.

13 BY MR. TAYLOR:

14 Q So when you use the term also in this
15 paragraph, you weren't referring to other ways
16 that you could reduce package body size and also
17 provide a high input/output signal density?

18 MR. SHAPIRO: Objection. Form.

19 BY THE WITNESS:

20 A Looking at this now I'm very sure is that
21 the full ball grid array is the most dense that
22 was being considered at that time. So I would not

1 have said also. Also is there to modify packages
2 with -- were also adopted I'll say as compared to
3 the non-partial array which are less dense. I can
4 see where then you could use that also to modify
5 something else nor did I mean it -- another
6 reason, anyway, I did not mean it like there is
7 another solution.

8 BY MR. TAYLOR:

9 Q Are there other ways to increase signal
10 density in a package other than using a full ball
11 grid array?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A Do you mean at the time of the invention
15 or today?

16 BY MR. TAYLOR:

17 Q Yes. At the time of the invention.

18 A Well, again, even at the time of the
19 invention there was a goal of chip scale package
20 and I believe there were -- where they would put
21 bumps on the chip, but I believe that they were
22 not commercially -- I think there were -- I don't

1 know that it was so commercially available. I
2 don't think those really came out until much
3 later. Now there's many of those kind, but you're
4 asking me to opine on the entire industry and
5 packaging technology is fairly straightforward. I
6 mean, you pick up your book, you have your one you
7 showed me and pretty much all the different ways
8 of sticking a chip into a package are well known,
9 and BGAs still to this day are used because that
10 became the technology. Once they were commercial
11 became pretty much the best solution.

12 Q Doctor, let me ask it a different way.

13 So are packages using a full area ball
14 array, is that the only way to increase signal
15 density in a package?

16 MR. SHAPIRO: Objection. Form.

17 BY THE WITNESS:

18 A As I said, there have been many solutions
19 that were considered. Is it the most commercially
20 viable? As I said you can maybe a chip scale
21 package but it might not have been commercially
22 viable. You can package from two sides of the

1 chip if I want. I can do all kinds of things but
2 not necessarily the commercially viable way that's
3 going to be reliable. So I can't define an only
4 way. I mean, anyone can -- I'm sure there are
5 lots of patents out there of different even maybe
6 higher density, but the question is is it
7 commercially viable and reliable.

8 BY MR. TAYLOR:

9 Q Thank you. If we can go to Paragraph 75
10 of your second declaration.

11 A Yes.

12 Q It says: "The invention is described
13 throughout the patent in a way that encompasses
14 the second existing solution."

15 Can you tell me what you mean by that?

16 A Well, the second existing solution was
17 that the circles as I recall, I forget which was
18 the first and which was the second. They were the
19 two solutions that they suggested existing, one
20 was the plane on the lower level and the other was
21 the one millimeter circle.

22 Q I believe you meant the one millimeter

1 circle. So under that knowledge, what does the
2 invention as described in the patent in a way that
3 encompasses the second existing solution mean?

4 A Defining the a circular shape of one
5 millimeter, okay. Let me think about this a
6 moment.

7 I don't see what's the context that I'm
8 reading this in. The second -- the second
9 existing solution is to define a circular shape
10 area with one millimeter within the circular --
11 which paragraph are you referring me to?

12 Q 75. I want to know what was meant by the
13 invention and the '245 patent encompasses the
14 second existing solution.

15 A What did I mean there? You have to get
16 this into context here because I'm a little bit
17 obviously a little -- I need a moment.

18 Q Take your time.

19 A I think the next paragraph more or less
20 clarifies it. I'm saying within that two-ball-pad
21 pitch would be, for example, that circle you could
22 make the circle inside there. So I believe it's

1 describing it would encompass the existing
2 solution which would be the one millimeter circle
3 which is smaller at least in the technology they
4 had in those days. So within the larger high
5 stress area as defined by the patent could be or
6 would be this automatically is going to be what
7 we're calling the second existing solution. So
8 it's encompassed and I believe that's what it
9 means. I can read this again and be careful.

10 For example, I clarify it, in the abstract
11 the applicant describes the invention generally as
12 defined as a high stress area associated with the
13 corners of the dies and routing signal traces away
14 from the high stress area and use the term
15 preferably when describing embodiment where the
16 high stress area is defined as two-ball-pad
17 pitches from the corner of the die.

18 So we're saying that within that would be
19 a one millimeter circle at least in the way it was
20 implemented at that time.

21 Q So you're saying the high stress area is
22 greater than one millimeter; is that correct?

1 A Certainly --

2 MR. SHAPIRO: Objection. Form.

3 BY THE WITNESS:

4 A Certainly in the examples they are showing
5 here at the time of the invention the ball grids
6 pitch were much larger than one millimeter and it
7 would have to be larger than half a millimeter
8 pitch, I guess, so there are much larger.

9 So the way it's described I believe it's
10 trying to say it encompasses because -- it says
11 the one millimeter was not sufficient. I think
12 that's why the implication is this would be
13 encompassed within the invention is there -- the
14 existing solution because I think it said that is
15 not sufficient was the term they used why they
16 didn't use the second solution. Not sufficient
17 would mean I would have to go larger.

18 BY MR. TAYLOR:

19 Q Thank you. If you scroll down to
20 Paragraph 79.

21 A Yes.

22 Q You'll state in Paragraph 79 that

1 independent Claim 7 of the '245 patent is, in
2 fact, broader than the existing solution because
3 it does not specify a specific shape or size of
4 the surrounding area of increased stress; is that
5 correct?

6 A That's correct.

7 Q So you're saying that in Claim 7 there's
8 no specific size or shape defined?

9 A Yes. It is not defining a shape or a
10 size.

11 Q Thank you. What do you mean by
12 independent Claim 7 is, in fact, broader than the
13 existing solution?

14 A The existing solution.

15 MR. SHAPIRO: Objection. Form.

16 BY THE WITNESS:

17 A The existing solution is giving us a
18 specific way to define the area, and this is just
19 saying an increased stress area and you would have
20 to go back to the specification to understand
21 where this is and it could be potentially
22 interpreted to be a broader area which could

1 either be smaller or larger. It doesn't have
2 bounds. And for whatever reason, as I said, we
3 didn't focus on 7, but it's clearly having some
4 difference between Claim 7 and Claim 1. We've
5 statutorily disclaimed it. I should say the
6 client statutorily disclaimed it, and I would go
7 into it more, but it clearly is more broad because
8 it doesn't give a definition of that zone.

9 BY MR. TAYLOR:

10 Q You said since there was no bounds it
11 could be either a smaller or larger, correct?

12 MR. SHAPIRO: Objection. Form.

13 BY THE WITNESS:

14 A I said that offhandedly. I believe
15 it's -- we can look at it exactly and I can
16 probably make a more coherent answer. Wherein
17 none of the signal traces of the bottom routing
18 layer are located within the area of increased
19 stress defined by the corner of the die.

20 So here he doesn't make an extension. He
21 doesn't use the word high stress region which
22 there is high stress zone which would maybe say

1 the same exact thing as the first one. If Claim 7
2 is to be different than the first one then it's
3 hard to understand exactly what's defining here
4 but there is an increased stress and maybe he's
5 referring to not having a connection between the
6 bounds.

7 I think I said somewhere that this may be
8 interpreted to be an area here which does not have
9 ball pads under it and we want to make sure that
10 that's not the case because we want to make sure
11 that we defined our patent as only being a corner
12 in conjunction with ball pads in that vicinity.

13 Q So then an area of increased stress, then,
14 could include no ball pads in that area?

15 A Potentially --

16 MR. SHAPIRO: Objection. Form.
17 BY THE WITNESS:

18 A Potentially. I didn't make a full
19 analysis of Claim 7 as I said and wasn't asked to
20 opine on what that would really mean.

21 BY MR. TAYLOR:

22 Q You did make an analysis on Claim 8; is

1 that correct?

2 A I did, yes.

3 Q And Claim 8 is a dependent claim which
4 means it depends from an independent claim and
5 that depends from independent Claim 7; is that
6 correct?

7 A Ahh, so this explains why because Claim 8
8 includes traces of the bottom layer located within
9 two-ball-pad pitches of the corner of the ball.
10 So now we've clarified that we need ball pad
11 pitches whereas Claim 7 may be the claim without
12 the ball pad. So we need to include 8 with 7 in
13 order for 7 to be defined.

14 Q Let's look at Claim 1 of the '245 patent.
15 I just want to make sure we're clear on the term
16 that's in the last two lines of the claim.

17 When it says in an area within
18 two-ball-pad pitches, are you saying that when
19 that phrase is used it's automatically a high
20 stress area?

21 MR. SHAPIRO: Objection. Form.

22 BY THE WITNESS:

1 A I think our specification defines the high
2 stressed area as we said as the corner and the two
3 stress area starting from -- starting out we'll
4 say horizontally if you want to call it that way
5 from the corner of the die as like the x-ray
6 picture like on Figure 5 and Figure 4.

7 MR. TAYLOR: Counsel, that's all I have.

8 MR. SHAPIRO: Okay. Let me -- this is
9 actually a good time to take a break and could we
10 take like a 15-minute break and when we get back
11 we'll let you know if we'll want to do some
12 redirect.

13 MR. TAYLOR: Sure.

14 (A recess was had.)

15 EXAMINATION

16 BY MR. SHAPIRO:

17 Q Dr. Bernstein, earlier you were asked
18 whether Claim 7 of the '245 patent requires ball
19 pads under the corner of the die.

20 Would you like to add anything to the
21 answer that you gave?

22 MR. TAYLOR: Objection. Form.

1 BY THE WITNESS:

2 A Well, I think I defined it -- can you hear
3 me? Yes, okay.

4 I believe I defined the Claim 7 because
5 that's the place where it uses the increased
6 stress area. Let me just get to the package Claim
7 7. It uses the terminology located within the
8 area of increased stress defined by the corner of
9 the die. I think at the time I was saying -- I
10 said that this did not require that there would be
11 ball pads there, but I see that because I did
12 define high stress area and increased stress area,
13 as I said, I defined it earlier in terms of
14 definition, then I'm going to say it's the same
15 thing increased stress which would require that
16 there would be ball pads -- we said Claim 8
17 clarifies that you need to have the ball pads in
18 the same place.

19 So I think it's ambiguous enough about
20 what it means the increased stress because it's
21 not defined, but if I say a person of ordinary
22 skill would say the increased stress would be the

1 same as high stressed area, then obviously it
2 would include even though I think I stated that it
3 did not include that, but it was ambiguous enough
4 but that was probably a mistake that I think would
5 have been inconsistent with what I said earlier
6 having high stress zone and area of increased
7 stress being the same thing. That was one of the
8 first questions he asked. So that might not have
9 been inconsistent. So right. Claim 7 would imply
10 that there are ball pads to make it increased and
11 high stress. I think. If that's how I would have
12 to interpret that.

13 Q Can we look at your declaration which is
14 Exhibit 2003 for a moment.

15 A Yes.

16 Q Do you have it available in front of you?

17 A Yes, it's in front of me.

18 Q Can you go to paragraphs 107 and 108.

19 A Okay.

20 Q Can you read paragraphs 107 and 108,
21 please, to yourself.

22 A Okay. Yep. I do say it defines areas of

1 high stress as those associated with the die
2 corners and in particular the ball pads which are
3 positioned under the areas surrounding the die
4 corner, and I guess high stress here we would have
5 to mean that the claim language increased -- area
6 of increased stress would be the same thing which
7 as I said in the earlier paragraph. So I guess I
8 did clarify it that would be a contradiction if I
9 said it excludes the ball pads. That would not be
10 correct. It was an oversight by myself if that
11 was my answer.

12 MR. TAYLOR: Objection. Theresa, I didn't
13 realize a question was being asked. I don't
14 believe a question was asked so I'm going to
15 object to that.

16 BY MR. SHAPIRO:

17 Q Dr. Bernstein, do you still agree with the
18 opinion you gave in Paragraphs 107 and 108 of your
19 declaration?

20 MR. TAYLOR: Objection. Form.

21 BY THE WITNESS:

22 A I understand that the patent owner

1 response construes the term said die having a
2 corner defining surrounding area of increased
3 stress in Claim 8 by virtue of its dependence on
4 the statutory disclaimed independent Claim 7 to
5 mean said die having a corner defining a
6 surrounding area of increased stress associated
7 with ball pads -- ahh, I said it directly, I agree
8 with that conclusion. Yes, I still hold that this
9 is correct. I didn't change any opinion on this
10 that was in here and if I said something that
11 contradicted this then obviously I didn't mean
12 that.

13 BY MR. SHAPIRO:

14 Q Dr. Bernstein, could you turn to
15 Paragraph 203 of your declaration, please.

16 A Yes.

17 Q Can you just read 203, please, to
18 yourself.

19 A Okay.

20 Q So you were asked earlier about the
21 meaning of all packaging technologies.

22 Do you recall being asked that?

1 A Yes, I do.

2 Q Can you clarify what you meant by all
3 packaging technologies in Paragraph 203, please?

4 MR. TAYLOR: Objection. Form.

5 BY THE WITNESS:

6 A I think I was asked this, and I think I
7 clarified it. And if I didn't then maybe we can
8 make it clear again, because I think that was the
9 question that was posed.

10 Clearly in the context of the patent, all
11 packaging technologies does not mean all packaging
12 technologies. It doesn't mean through holes or
13 anything else. I think I said and if I didn't
14 then what I meant is, and please tell me if I
15 didn't say this correctly, it means organic BGA
16 packaging for a semiconductor devices. That's
17 what's related to here. And I say specifically
18 organic to distinguish it from, let's say, ceramic
19 or other types because this patent is only dealing
20 with organic BGA, and I think I've said that many
21 times throughout this deposition. We're only
22 talking about organic BGA. Mostly we're talking

1 about full grid, but as it's been pointed out, it
2 can be missing pads, balls at the bottom or
3 whatever, but that's what I meant all packaging
4 technology really is limited to the scope of this
5 patent which is organic BGA.

6 I think that is exactly my answer and if
7 it's not, this is what I meant. We can go through
8 the transcript and find out.

9 Q So why -- could you explain to me why it's
10 directed to organic BGA packaging?

11 MR. TAYLOR: Objection. Form.

12 BY THE WITNESS:

13 A This patent is dealing specifically with a
14 thermal expansion mismatch of a very highly
15 expansive plastic or an organic material in
16 contact directly with the chip, which is a silicon
17 which is a very hard crystal, and there are large
18 stresses and we have seen lots of references in
19 many other potential solutions for the
20 reliability.

21 So we're worried about specifically the
22 reliability of thermal expansion mismatch which

1 happens in organic materials and does not occur in
2 ceramics, for instance, where ceramics have the
3 similar thermal expansion and also very hard like
4 the silicon.

5 So it became technologically important as
6 the packaging a cheaper important technology which
7 is the organic and that's when all these problems
8 started happening and that's where the prior art
9 and everyone else is trying to find ways of making
10 it more reliable and hence this patent really is
11 not only really, it is, only dealing with this
12 very limited packaging technology even though they
13 say all packaging technology. I'm pretty sure I
14 said it, too, all packaging here means all ball
15 pitches is really all he meant, organic BGA, but
16 he meant it was more all pad pitches that can be
17 defined by the ball grid array area in terms of
18 the -- what they are defining as the high region.
19 So, yeah, it's a very limiting term even though it
20 sounds very general.

21 MR. SHAPIRO: That's all I have for now.

22 FURTHER EXAMINATION

1 BY MR. TAYLOR:

2 Q I have one more question on recross.
3 Let's see if I can share my screen with you.

4 Doctor, can you see that?

5 A Yes.

6 Q I shaded in an area around and this is --
7 sorry. Let me clarify. This is Exhibit 1005,
8 this is a excerpt from that. We can mark this as
9 Exhibit 1025.

10 (A certain document was marked Bernstein
11 Deposition Exhibit 1025 for
12 identification, as of 11/07/2024.)

13 BY MR. TAYLOR:

14 Q This is Figure 3 of Devnani from
15 Exhibit 1005. It's showing signal traces being
16 routed away from a die corner.

17 Dr. Bernstein, do you see the shaded area
18 there in Figure 3?

19 A I do.

20 Q Is there any signal traces shown in that
21 area?

22 A If you read Devnani, those are not really

1 signal traces, but they are transmission lines.
2 They are not signal traces and they are coming out
3 parallel to the corner because Devnani is making
4 signal -- he's not making signal traces, he's
5 making transmission lines that are characterized
6 by aluminum oxide between two wires. Each of
7 those are double lines. They're not a single line
8 if you look at them.

9 Q So what you're classifying as transmission
10 lines, are there any transmission lines in the
11 green shaded area of this figure?

12 A Well, in where you've shaded green but you
13 label the area of increased stress and I'm going
14 to disagree that Devnani has area of increased
15 stress.

16 Q Just in that shaded area regardless of
17 what it's labeled as, is there any metal structure
18 shown in that area on this figure?

19 A You're referring to those routings. All
20 we see are the balls which is strange that you
21 drew the edge of the ball in the middle of what
22 would be the solder bumps going to the chip.

1 Wouldn't the chip encompass all of the balls? I'm
2 saying I don't think the chip is written
3 correctly. The chip should go out to the end of
4 where those little balls are because those are the
5 balls going up to the chip so I think your chip is
6 not written there properly, in which case if the
7 chip does go up further -- anyway, yeah, if you're
8 saying simply in that area, which we don't know
9 how large it is, obviously you don't see a wire
10 going through, but these wires as they describe
11 are in higher levels. It's not relating to our
12 patent.

13 Q Thank you.

14 Is the shape shown that's shaded, is that
15 a circular shape?

16 A No. You did not show a circular shape
17 shaded area.

18 Q Thank you.

19 A I also think that the corner goes up to
20 the end of those balls, but it's also Devnani is a
21 ceramic. It's not organic so there's no stress
22 here at all.

1 MR. TAYLOR: That's all I have.

2 FURTHER EXAMINATION

3 BY MR. SHAPIRO:

4 Q I have another one or two questions on
5 redirect.

6 Dr. Bernstein, you just testified that
7 there's no stress in Devnani because it's ceramic.

8 Did I understand you correctly?

9 A Yes. That's exactly what I said.

10 Q Can you explain why it's your opinion that
11 there is no stress in Devnani or let me strike
12 that.

13 A I said there is no high stress zone.

14 Q Can you explain to me what you meant when
15 you said there is no stress in Devnani because
16 it's ceramic?

17 MR. TAYLOR: Objection. Form.

18 BY THE WITNESS:

19 A Well, Devnani is not describing a plastic
20 BGA as we were saying many times. Devnani is
21 describing higher levels. If you notice the way
22 Devnani describes all those wires, these are

1 transmission lines which are parallel plates with
2 aluminum oxide insulator between them. So you
3 have a 50 ohm transmission line going from the
4 input which would be the balls on the out through
5 the chip and up.

6 These are balls in intermediate layers
7 within a ceramic chip and it can only be ceramic
8 and he defines that very clearly, it would not
9 work with plastic. So you're not talking about
10 any sort of organic or material with a high
11 thermal expansion. We're talking about a ceramic.
12 Aluminum oxide has with a very low thermal
13 expansion even chaired to silicon and silicon
14 dioxide and he suggests using a glass, silicon
15 dioxide glass as other type of glass, but he very
16 clearly wants a high dielectric material between
17 them which would be a ceramic material like a
18 tantalum oxide or something in order to maintain
19 his thing. So it's not at all related to our
20 technology.

21 Q Dr. Bernstein, why do you say it's not at
22 all related to the technology? When you say our

1 technology, are you referring to the technology of
2 the '245 patent?

3 MR. TAYLOR: Objection. Form.

4 BY THE WITNESS:

5 A The '245 patent clearly he says all along
6 it's worried about the thermal stress of the
7 thermal mismatch and ceramics, in fact, it's the
8 opposite. It's a thermally harder than silicon,
9 it wouldn't be a thermal expansion mismatch and
10 there wouldn't be this cracking problem so there
11 is no high stress zone by the definition of our
12 patent. It's just sort of an irrelevant patent.

13 MR. SHAPIRO: I have no further questions
14 on redirect.

15 MR. TAYLOR: Thank you for your time
16 today, Dr. Bernstein. Appreciate it.

17 That concludes deposition.

18 (Deposition concluded at 12:38 p.m. CST.)
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22

1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

2 I, Theresa A. Vorkapic, Certified
3 Reporter and Notary Public within and for the
4 State of Illinois do hereby certify:

5 That DR. JOSEPH BERNSTEIN, the witness whose
6 deposition is hereinbefore set forth,

7 Was duly sworn by me before the
8 commencement of such deposition and that such
9 deposition was taken before me and is a true
10 record of the testimony given by such witness.

11 I further certify that the adverse
12 party, Petitioner, was represented by counsel at
13 the deposition.

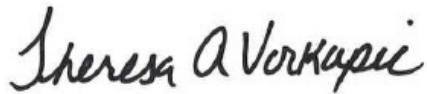
14 I further certify that the deposition of
15 DR. JOSEPH BERNSTEIN, occurred virtually on Thursday,
16 November 7th, 2024, commencing at 8:02 a.m. to 12:38
17 p.m. CST.

18 I further certify the inspection,
19 reading and signing of said deposition was not
20 waived on the record by agreement of all parties.

21 I further certify that I am not related
22 to any of the parties to this action by blood

1 or marriage, I am not employed by or an attorney
2 to any of the parties to this action, and that I
3 am in no way interested, financially or otherwise,
4 in the outcome of this matter.

5 IN WITNESS WHEREOF, I have hereunto set
6 my hand this 12th day of November, 2024.
7 My commission expires November 6, 2027.

8
9 
10

11 Theresa A. Vorkapic, CSR, RMR, CRR, RPR
12 NOTARY PUBLIC IN AND FOR
13 THE STATE OF ILLINOIS
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Transcript of Dr. Joseph Bernstein
Conducted on November 7, 2024

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