

UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	Investigation No.
CERTAIN SEMICONDUCTOR DEVICES	)	337-TA-1366
AND METHODS OF MANUFACTURING	)	
SAME AND PRODUCTIONS	)	
CONTAINING THE SAME	)	
	)	

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1 UNITED STATES INTERNATIONAL TRADE COMMISSION
2 Washington, D.C.
3 BEFORE THE HONORABLE CLARK S. CHENEY
4 Chief Administrative Law Judge

5 _____
6 In the Matter of:) Investigation No.
7 CERTAIN SEMICONDUCTOR DEVICES) 337-TA-1366
8 AND METHODS OF MANUFACTURING)
9 SAME AND PRODUCTIONS)
10 CONTAINING THE SAME)
11 _____)

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14 International Trade Commission
15 500 E Street, S.W.
16 Washington, D.C.

17

18 March 1, 2024

19 VOLUME V

20

21 EVIDENTIARY HEARING - VOLUME V

22 The Hearing commenced, pursuant to notice of
23 the Judge in Courtroom A, at 9:00 a.m. Eastern.

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25 Reported by: Karen Brynteson, FAPR, RMR, CRR

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1 P R O C E E D I N G S

2 (9:00 a.m.)

3 CHIEF JUDGE CHENEY: Good morning, everyone.
4 Please take your seats.

5 We're back on the record now in the 1366
6 investigation. This is the fifth and final day of the
7 evidentiary hearing. When we left off yesterday evening, we
8 were listening to testimony from Complainant's expert
9 witness called in rebuttal, Dr. Schubert.

10 Mr. Davis, remind me, were we in direct
11 examination still?

12 MR. DAVIS: Yes, Your Honor.

13 CHIEF JUDGE CHENEY: Okay. And we're going to
14 resume that testimony now. And we have some things setup in
15 the hearing room for testimony of Dr. Doolittle later. And
16 I'm curious where people prefer Dr. Schubert to sit at this
17 point. We can either have him sit at the witness well if
18 you feel like those sight lines are okay, or we can have him
19 sit at the translator table.

20 MR. DAVIS: We don't have a preference, Your
21 Honor.

22 CHIEF JUDGE CHENEY: Okay. Then we'll have him
23 sit at the witness well.

24 Dr. Schubert, please come to the witness well.
25 And while you're coming up, I'm going to talk with the

1 parties about some housekeeping matters from yesterday. I
2 see Dr. -- or, Ms. Niemeyer, can you get to an open
3 microphone, please?

4 MS. NIEMEYER: Your Honor, I just wanted to ask
5 about the admission of exhibits. Do you want to do that now
6 or after Dr. Schubert has finished?

7 CHIEF JUDGE CHENEY: We can do it now.

8 MS. NIEMEYER: All right.

9 MR. DUARTE-GUEVARA: Good morning, Your Honor.
10 This is Carlos Duarte for Respondents.

11 CHIEF JUDGE CHENEY: Good morning, Mr. Duarte.

12 MR. DUARTE-GUEVARA: Thank you. We have an
13 agreement with the Complainant to move into evidence
14 exhibits used in the testimony of Dr. Marcon, Mr.
15 Schoettelkotte, and Dr. Lebby. So we're going to be
16 e-mailing those to the court reporter later today.

17 JUDGE CHENEY: Hearing no objection, the exhibits
18 will be admitted at this point in the record.

19 (Exhibits, as submitted by counsel and reflected
20 in the attached index, were received into evidence.)

21 MR. DUARTE-GUEVARA: Thank you.

22 CHIEF JUDGE CHENEY: Other housekeeping matters?
23 Mr. Kopsidas.

24 MR. KOPSIDAS: Good morning, Your Honor. No
25 issues, just a timing note for Your Honor.

1 The parties have been working very diligently to
2 minimize or eliminate all the issues with Dr. Doolittle's
3 slides and the exhibits he is going to present, and I
4 believe we're very, very close. They sent us the final
5 iteration of their slides around midnight last night, and so
6 we're reviewing those. We don't anticipate any significant
7 issues, but if there are, we will be prepared to discuss
8 those when Dr. Doolittle -- prior to his testimony.

9 CHIEF JUDGE CHENEY: Okay. So at the conclusion
10 of Dr. Schubert's testimony, we will take a short break to
11 make the Webex connections and bring Dr. Doolittle into the
12 courtroom over the wonders of the interwebs, and then after
13 that break, you can address whatever issues you might have
14 with Dr. Doolittle's slides. Does that timing work for you,
15 Mr. Kopsidas?

16 MR. KOPSIDAS: That works. Thank you, Your
17 Honor.

18 CHIEF JUDGE CHENEY: Respondents, does that work
19 for you?

20 MR. LAVENUE: That's fine, Your Honor. Thank
21 you.

22 CHIEF JUDGE CHENEY: Staff?

23 MR. WINSTON: That works for the Staff, Your
24 Honor. Thank you.

25 CHIEF JUDGE CHENEY: Okay. Any other

1 housekeeping matters?

2 MR. KOPSIDAS: Not from Complainant, Your Honor.

3 CHIEF JUDGE CHENEY: Respondents?

4 MR. LAVENUE: No, Your Honor.

5 CHIEF JUDGE CHENEY: Staff?

6 MR. WINSTON: Nothing from the Staff, Your Honor.

7 CHIEF JUDGE CHENEY: Okay. Let's resume the
8 testimony of Dr. Schubert.

9 Whereupon--

10 FRED SCHUBERT,
11 having been previously duly sworn/affirmed, was examined and
12 testified as follows:

13 CHIEF JUDGE CHENEY: Dr. Schubert, welcome back
14 to the witness well. You're under the same oath that you
15 took earlier in the week. Can you see counsel at the
16 lectern okay?

17 THE WITNESS: Yes. Thank you, Your Honor.

18 CHIEF JUDGE CHENEY: Okay. Mr. Davis, please
19 resume your examination.

20 MR. DAVIS: Thank you, Your Honor.

21 DIRECT EXAMINATION -- Resumed

22 BY MR. DAVIS:

23 Q. Good morning, Dr. Schubert.

24 A. Good morning.

25 Q. Hope you had a good rest yesterday. We were

1 talking about your slides, your demonstratives. And I
2 realize that we inadvertently skipped over slide 32. So
3 before we go on to slide 37, let's go back to slide 32, if
4 we could.

5 And, Dr. Schubert, could you explain this slide
6 to us, please.

7 A. I don't see the slide on my screen. And it would
8 be helpful to see the slide on my screen.

9 CHIEF JUDGE CHENEY: Okay. Let's go off the
10 record for a minute.

11 (Discussion off the record.)

12 CHIEF JUDGE CHENEY: We're back on the record now
13 after taking a brief moment to arrange for Dr. Schubert to
14 see a monitor with the evidence on it.

15 Mr. Davis, please proceed.

16 BY MR. DAVIS:

17 Q. Dr. Schubert, once again, could you please
18 explain what you're conveying here on slide 32.

19 A. The '508 patent has a ohmic contact module, and
20 the ohmic contact module is a two photo mask process, and
21 that two photo mask process is shown here in slide 32.

22 Q. Okay. Thank you. Now, we can go forward to
23 slide 37.

24 And -- and here on slide 37, in the heading it
25 reads "my understanding of Dr. Lebby's proposed process,"

1 what is that understanding?

2 A. This process follows from the combination of the
3 prior art reference Hikita in view of Beach624. And
4 Beach624 starts with the deposition of a dielectric layer in
5 which openings are made at some point and ohmic contact
6 metal is deposited and the second photo mask is used to form
7 the ohmic contact.

8 Now, Beach624 is a somewhat unique process
9 because it forms the source, gate, and drain contact at the
10 same time, and so those three contacts, even though they
11 have different functions, are coupled in their fabrication
12 sequence.

13 And what I illustrate here is a process sequence
14 that is Hikita in view of Beach624 that ultimately ends up
15 with a device that is not properly functioning, and it's not
16 functioning as the '508 patent process is intended to. In
17 particular, we have a dielectric layer under the gate, and
18 in this sense, we have a different type of transistor than
19 the transistor or the process that is disclosed in the '508
20 patent.

21 Q. Thank you, Dr. Schubert.

22 Can we go to the next slide, slide 38.

23 The heading on this slide also your understanding
24 of Dr. Leiby's proposed process, but it also reads
25 "alternative." What do you mean by that?

1 A. This slide, similarly, is a variation of the
2 process that follows from Hikita in view of Beach624. It
3 shares the feature of Beach624 to form the source, gate, and
4 drain contact at the same time. So sub-figure D includes a
5 photoresist that Beach624 envisions, and the photoresist is
6 used to define the three contacts, source, gate, and drain.
7 And as a result we get, again, a device that is
8 non-functioning.

9 Q. Thank you.

10 Next slide, please, slide 39.

11 This heading reads, "Hikita describes an
12 enhancement mode transistor." What are you trying to
13 convey?

14 A. Yes. This is the Hikita transistor. It is an
15 enhancement mode transistor. It has a magnesium-doped gate
16 semiconductor. And in that sense, the '508 patent is also
17 directed towards an enhancement mode transistor, and so it
18 matches the '508. In that sense, both are enhancement mode
19 transistors.

20 Q. And there's a reference on this slide to Hikita,
21 which is RX-41 at paragraph 11.

22 Does -- does that paragraph confirm your opinion
23 that Hikita describes an enhancement mode transistor?

24 A. Yes. In this paragraph, the transistor is
25 referred to as a normally off type. And a normally off type

1 is another way of saying enhancement mode transistor.

2 Q. Thank you.

3 Next slide, please, slide 40.

4 The heading here reads "Beach624 describes a
5 depletion mode transistor." What are you trying to convey?

6 A. Beach624 is a depletion mode transistor that is
7 -- it's a different type of transistor. Such depletion mode
8 transistors have been quite common and pretty much the only
9 type in the prior art. And the transistor is following a
10 unique fabrication process.

11 So we have three contacts in a transistor,
12 source, gate, and drain. The source and drain contact can
13 be referred to as the ohmic contacts. And the figure on the
14 right-hand side shows the ohmic contact 17. And the other
15 ohmic contact is not shown. It looks the same way as 17.
16 And then we have the gate contact 15.

17 And so we can see that Beach624 fabricates those
18 three contacts, source, gate, and drain, at the same time.

19 Q. And on this slide, there is a paragraph there
20 from Beach624, which is RX-286, paragraph 39.

21 Does that paragraph confirm your opinion?

22 A. Yes. If we look at the second to last line of
23 the paragraph, we read normally, nominally on. And
24 "nominally on" is another way of saying normally on. So
25 this transistor is referred to a normally on transistor,

1 which is a depletion mode transistor.

2 Q. Thank you.

3 Next slide, please, slide 41.

4 The heading here reads "no motivation to combine
5 Hikita and Beach624."

6 What are you trying to convey here?

7 A. Yes. So Hikita is a gate-last process, and so
8 the gate metal 411 is indeed the last process step of
9 Hikita. And that process can be abandoned in favor of the
10 contact process that is disclosed by Beach624. And Beach624
11 has the simultaneous contact formation.

12 So while we can say that Hikita is a gate-last
13 process, Beach624 is a process in which source, gate, and
14 drain are formed at the same time. And because we have the
15 p-type semiconductor, the pGaN in Hikita, under the gate but
16 not under the source and drain, therefore, the contact
17 formation at the same time causes the difficulties that I
18 pointed out on a previous slide where I showed a process
19 sequence where I showed a sequence of steps, and being
20 guided by the prior art on these steps, the resulting device
21 does not meet the claim limitations of the '508 patent.

22 Q. And at the bottom of this slide, Dr. Schubert, it
23 reads, "A POSA would be discouraged by incompatibilities
24 between Hikita's enhancement mode transistor and Beach624
25 depletion mode transistor."

1 Do you have anything to add with respect to that?

2 A. Yes. I would say that a -- when a person of
3 skill thinks about a transistor fabrication process, a
4 person of skill would have in his or her mind the images and
5 the sequences of that process. And a person of skill would
6 realize that modifying the Hikita process based on the
7 Beach624 process will cause issues, and for that reason, a
8 person would not be encouraged or would not proceed
9 combining these two processes as these processes would
10 suggest.

11 Q. Okay. Next slide, please.

12 And this is slide 42, where the heading reads
13 "Hikita describes a one photo mask source and drain
14 formation process."

15 What are you trying to convey with this slide?

16 A. Yes. If we look at the left-hand side, we can
17 see a series of sketches that disclose the process of
18 Hikita. The process starts at Figure 8A, which has the
19 epitaxial layer sequence, and then it ends at Figure 8F,
20 where we have the finished device. Now, if we look at the
21 figures and read the associated specification, we learn that
22 Hikita discloses a one photo mask process for source and
23 drain.

24 Now, the '508 patent has a two photo mask process
25 for source and drain, and just like Beach624, but just based

1 on the disclosure that we have here from Hikita, the
2 pictorial disclosure, as well as the narrative disclosure,
3 show that we have a one photo mask source and drain
4 formation process.

5 Q. And on this slide, there's, I think you
6 mentioned, figures from Hikita but there's Figures 8A
7 through 8F and, on the right side some paragraphs, from the
8 specification of Hikita, paragraphs 59 and -- and 60.

9 Are those the figures and text to which you were
10 referring?

11 A. Yes. The -- the contact description lacks the
12 metal etching process that is part of the two photo mask
13 process. In addition, the pictorial disclosure shows the
14 alignment of the source and drain contact with the
15 dielectric layer, 408.

16 And a person of skill would understand that this
17 is a lift-off process that is disclosed by Hikita, so a one
18 mask source and drain formation process.

19 Q. Next slide, please, slide 43.

20 And this slide, in the heading, reads "Beach624
21 describes a two photo mask source and drain formation
22 process."

23 What are you trying to convey with this slide?

24 A. Yes. On the left-hand side, we see a sequence of
25 process steps starting at Figure 1A and ending Figure 1E.

1 And if we inspect that process, then we can see that
2 Beach624 discloses the formation of gate and source and
3 drain contacts at the same time using photoresist pattern
4 number 13.

5 And if we look at the last figure, we can see
6 that ohmic contact 17 goes a little bit beyond the opening
7 in the dielectric layer. And this is a feature, typical or
8 a signature feature, for the two photo mask source and drain
9 formation process, which includes an etching step that
10 removes the metal where not needed.

11 Q. And on this slide, Dr. Schubert, there's, I
12 believe you mentioned them, some figures on the left,
13 Figures 1A through 1E in Beach624 and, then on the right,
14 two paragraphs from Beach624, paragraphs 42 and 47.

15 And do those figures in those paragraphs confirm
16 your opinions?

17 A. Yes. If we look at paragraph 47, the first
18 sentence refers to resist material, to a TiN, which is
19 deposited in a pattern to permit the formation of a gate 15
20 and ohmic contact 17. So in this sentence, Beach624
21 discloses not a gate-first or a gate-last process but a gate
22 simultaneously with source and drain type of process.

23 Q. Let's go to the next slide, please, slide 44.

24 On this slide at the bottom, it reads, "There is
25 no motivation to replace a one photo mask source and drain

1 source and drain process with a two photo mask source and
2 drain process."

3 Could you please explain that?

4 A. Yes. So as I mentioned, Hikita has a one photo
5 mask source and drain formation process. Those processes
6 are well established. They are referred to as liftoff
7 processes. And neither Hikita nor Beach624 teach any
8 drawback of that process. So based on the prior art, there
9 is not a motivation to give up on the Hikita ohmic contact
10 formation process. It has certain advantages, and maybe the
11 most significant advantage is the use of one photo mask
12 process is a faster process and it is a more efficient
13 process than the two photo mask source and drain formation
14 process.

15 So if we stay within the confines of the prior
16 art, a person of skill would not be motivated to give -- to
17 dismiss or to abandon a process that is proven to work.

18 Q. Thank you.

19 Next slide, slide 45, please.

20 This slide in the heading reads "Hikita describes
21 a gate-last process."

22 I think you mentioned some of this before, but
23 could you please explain?

24 A. Yes. Hikita has these process sequence steps,
25 Figure 1A to Figure 1F, and we can see that the gate metal

1 is only coming in the very last step, Figure 8F, gate metal
2 411. Gate electrode, gate metal 411 is only coming at the
3 very end. And so, therefore, we can refer to Hikita as a
4 gate-last process.

5 Now, the '508 patent is a gate-first process.
6 The very first step after the epitaxial growth is the
7 deposition of a contact metal. And in that sense, what the
8 '508 patent does as the very first step after the epitaxial
9 growth, Hikita does at the end of device processing, and in
10 that sense, these two processes are distinctly different in
11 this regard.

12 Q. And on this slide, there's again Figures 8A
13 through 8F of Hikita on the left and some paragraphs in
14 Hikita on the right, paragraphs 60 and 61.

15 And do those -- do those paragraphs support your
16 opinion with respect to Hikita describing a gate-last
17 process?

18 A. Yes. In reference to the last figure, Figure 8F,
19 paragraph 61 explains, starting in the fourth line,
20 "subsequently a gate electrode 411 of palladium is formed in
21 an associated one of the openings of the dielectric film,
22 silicon nitride film 408." So the final process step is the
23 formation of the gate electrode or gate metal 411.

24 Q. Next slide, please, slide 46.

25 And, again, I believe you mentioned this concept

1 before, that Beach624 describes simultaneous gate and ohmic
2 contact formation. So I'll just direct your attention to
3 the right portion of the slide that references paragraph 47
4 of Beach624. And that paragraph, which also I believe we
5 discussed before, that confirms your opinion?

6 A. Yes. So if we look at that paragraph, we can see
7 that the ohmic contact formation process is a two-step or
8 two photo mask process. And we see a reference to -- to the
9 formation of the gate and ohmic contact, gate 15 and ohmic
10 contact 17, in line 2 of paragraph 47.

11 Q. Okay. I think I can move on. Let's go to slide
12 47.

13 A. Yes.

14 Q. And on slide 47 at the bottom, there's language
15 that reads, "There is no motivation to combine a gate-last
16 process with a simultaneous gate and ohmic contact
17 formation."

18 A. Yes. So as I indicated earlier, the simultaneous
19 formation of source, gate, and drain contacts introduces
20 some restrictions on the process, and these restrictions are
21 imposing certain conditions on the process. And as I
22 indicated earlier for the Hikita process, we have the gate
23 contact and the source and drain contact have locally a
24 different environment. So the gate is on a p-type gallium
25 nitride layer; whereas source and drain are not.

1 And so if we deposit gate and drain at the same
2 time, we want to deposit the gate contact on the pGaN, but
3 we do not want to deposit source and drain on the pGaN. And
4 to accomplish this in a two photo mask process for source
5 and drain, we run into problems that a person of skill in
6 the art would realize.

7 Q. Are you ready for the next slide?

8 A. Yes.

9 Q. All right. Next slide, please. So slide 48.
10 Would you explain this slide for us, please.

11 A. Yeah. One can say that there are certainly many
12 types of FETs that are fabricated in a commercial setting,
13 and I'd like to point out that the simultaneous gate and
14 ohmic contact formation is really an uncommon process in the
15 field of FETs.

16 We may see that in Beach624, but in the
17 commercial fabrication, I'm not aware of such a process.
18 And the reason is that source and drain contacts have
19 different functions and have a different local environment
20 than the gate contact. The gate contact requires a
21 different local environment.

22 And those requirements are not really helped by
23 designing a process in which source, gate, and drain are
24 fabricated at the same time.

25 Q. Okay. Thank you.

1 Next slide, please, slide 49.

2 Slide 49, towards the bottom right-hand side, it
3 reads "two separate photo resistant patterns." What are you
4 trying to convey?

5 A. If we look at the claim 1, if we look at claim 1
6 of the '508 patent, we can see the different groups of
7 limitations. There is an epitaxial layer group of claims,
8 there is a gate formation process group of claims, and there
9 is a ohmic contact group of claims.

10 And the '508 patent is explicit about forming the
11 gate process in a different photolithographic step than the
12 source and drain step. So I have highlighted on the red the
13 photo resistant pattern that is used for the formation of
14 the gate structure, and Number 2 highlights a different
15 photo resistant pattern that is used for the source and
16 drain contact formation process.

17 So we have a teaching of the '508 patent to
18 fabricate gate and source and drain at different stages of
19 the process and by using a different photo resistant
20 pattern.

21 Q. Thank you.

22 Next slide, please.

23 A. And if we look at the corresponding process of
24 Beach624, we can see that the sub-figure, 1D, employs resist
25 material 13. Now, resist material 13 is used for both gate,

1 as well as source and drain.

2 So using Beach624 and its photo resistant pattern
3 13, we have a clear difference to the '508 patent. And so
4 in this regard, Beach624 is not able to meet the claim
5 limitations of the '508 patent.

6 Q. Does photoresist material 13 refer to one
7 photoresist or two photoresists?

8 A. Beach624 uses one photoresist 13, one photoresist
9 pattern 13.

10 Q. Okay. And for the record, again, there's a
11 reference to paragraph 47 of Beach. That's the text
12 included on this slide.

13 We can move on to the next slide.

14 CHIEF JUDGE CHENEY: Mr. Davis.

15 MR. DAVIS: Yes.

16 CHIEF JUDGE CHENEY: I'm hearing you, but I would
17 hear you better if you faced the microphone and boosted your
18 voice when you asked a question.

19 MR. DAVIS: Yes, Your Honor.

20 CHIEF JUDGE CHENEY: Thank you. Much better.
21 Please continue.

22 BY MR. DAVIS:

23 Q. We're almost done, Dr. Schubert. Slide 51 reads
24 "secondary considerations."

25 What can you explain about this slide?

1 A. Yes. I'm showing here secondary considerations
2 in support of non-obviousness. If an invention has
3 commercial success, if others have failed, if the invention
4 meets a long-felt but unresolved need, if there is praise by
5 others, if others have skepticism in the field, and if the
6 invention is copied, then these are secondary indicias that
7 the invention is non-obvious.

8 Q. And in the upper right-hand part of this slide,
9 there's language that reads "nexus required between
10 invention and secondary considerations."

11 What can you tell me about that?

12 A. Yes. The claimed invention is what matters. And
13 if the secondary -- if the secondary considerations are
14 connected, have a nexus with the claimed invention, that is
15 a condition, an additional condition, that is placed on the
16 secondary considerations.

17 Q. Next slide, please.

18 Now, the heading, it reads "'294 patent,
19 secondary considerations."

20 What can you tell me about this slide?

21 A. If we look at the whole picture, silicon MOSFETs
22 had their limitations. Silicon MOSFETs had switching
23 transistors, but they were no longer suitable or
24 sufficiently efficient and sufficiently fast and have a
25 sufficiently low on resistance for the application that we

1 have nowadays, for the switching applications, switching
2 transistor applications that we have nowadays.

3 And so silicon, for these most demanding
4 applications, is no longer a viable technology. A new
5 material, a better material than silicon is needed, was
6 needed. That material was identified as gallium nitride.

7 There was a need for new types of switching
8 transistors based on gallium nitride. The desirable type of
9 switching transistor was and is the enhancement mode device
10 that should have a low gate leakage and a low gate
11 capacitance and a high switching speed, resulting in high
12 efficiency during the switching process.

13 And that transistor has not been available until
14 the invention of the '294 patent and the invention of the
15 '508 patent arrived and have provided a viable switching
16 transistor that the field was longing for. So the
17 combination of '294 and '508, one disclosing the heart of
18 the technology and the other one disclosing a fabrication
19 process to bring that technology to the market, have the
20 desirable enhancement mode operation, have the low on
21 resistance, the reduced capacitance, the fast switching
22 speed, and the high efficiency that the market was looking
23 for.

24 Q. Let's focus on the bottom half of the page.
25 There's some language that reads "achieved due to claimed

1 structure of '294 patent, including compensated GaN layer in
2 gate material, which" -- and there's a parenthetical --
3 "acceptor-type dopants and semi-insulating," and a number of
4 bullet points.

5 What can you explain about that portion of the
6 slide?

7 A. The technology of the '294 patent results in low
8 leakage current and also reduced capacitance of the gate
9 electrode, and that helps with respect to the switching
10 speed. It also helps with respect to driving these
11 transistors. The same insulating nature of the gate
12 semiconductor has -- results in reduced leakage current.
13 And it allows us to turn on the transistor without a leakage
14 current penalty, fast switching speed, and so that is what
15 makes that transistor a success story.

16 Q. Thank you.

17 Next slide, please.

18 Slide 53 -- slide 53 -- thank you -- in the
19 heading reads "'508 patent, secondary considerations."

20 What can you tell me about this slide?

21 A. Yes. The '508 patent has the self-aligned gate
22 structure. The self-aligned gate structure allows one to
23 make shorter gate lengths and allows us to make the -- a
24 gate structure that has the desirable properties of low
25 leakage current, low capacitance, high switching speed. And

1 those short gate lengths were not attainable with prior art
2 processes, such as Hikita.

3 And, accordingly, the '508 patent with its
4 self-aligned gate structure minimized gate surface leakage
5 and provide an enhancement mode transistor. It is a
6 transistor with a low on resistance and a high efficiency
7 and allowed for smaller dimensions, smaller gate lengths
8 than the prior art transistors.

9 And these advantages have been realized by the
10 technical community and by the commercial community. And
11 there have been a number of awards or industry praise or
12 realizations that these transistors made a difference.

13 CHIEF JUDGE CHENEY: Let's go off the record for
14 a minute.

15 (Discussion off the record.)

16 CHIEF JUDGE CHENEY: We're back on the record now
17 in the 1366 investigation, after taking a moment to deal
18 with some technical issues.

19 Please proceed with your examination, Mr. Davis.

20 MR. DAVIS: Your Honor, I'm noticing --

21 THE REPORTER: On the side, Mr. Davis. Just
22 press there.

23 CHIEF JUDGE CHENEY: We're off the record.

24 (Discussion off the record.)

25 CHIEF JUDGE CHENEY: We're back on the record now

1 after dealing with some technical issues.

2 Mr. Davis, please continue.

3 BY MR. DAVIS:

4 Q. Dr. Schubert, would you please continue your
5 discussion of this slide, slide 53.

6 A. This slide concerns the secondary considerations
7 for the '508 patent. The self-aligned gate structure that
8 is disclosed in the '508 patent allows one to minimize
9 surface gate leakage, reduce cost of manufacture due to
10 simplicity, and also create an enhancement mode transistor.

11 And the transistor has a competitive advantage
12 over silicon MOSFETs. Silicon MOSFETs have reached their
13 limit. They are not suitable for the more demanding
14 applications that we're encountering nowadays. High power,
15 high efficiency, high reliability, and smaller, critical
16 dimensions, smaller gate features, smaller capacitance are
17 all features that are associated with the '508 patent and
18 that provide an advantage to the transistors fabricated
19 according to the '508 method.

20 As a result, these -- the advanced transistor
21 fabrication process has made an impact, has been recognized
22 by the technical community, and has resulted in what could
23 be called praise by others or awards that we are.

24 Q. And there is a number of exhibits listed on this
25 slide under the "industrial praise by others" section.

1 There's a bullet, "innovation and advancement recognition
2 throughout the industry." CX-28, CX-29, CX-31, CX-108,
3 CX-109, CX-113.

4 Did those exhibits help inform your opinion with
5 respect to praise by others?

6 A. Yes. My opinion was formed in part based on the
7 documents that are disclosed here.

8 Q. And -- okay. So I'll just read off the exhibits
9 for the next two bullets as well. Industrial publications
10 recognize EPC's revolution of transistor technology. That
11 is CX-110 and CX-111.

12 And the next bullet, awards in innovation and
13 product breakthroughs, CX-370, CX-375 through CX-380,
14 CX-383, CX-385 through CX-386, CX-410, and CX-417 through
15 CX-419.

16 And those exhibits also helped inform your
17 opinion, if I understood correctly?

18 A. Yes, correct.

19 Q. And in the bottom right-hand portion of this
20 slide, there is a blowup of some text, and the exhibit
21 number cited there is CX-28-0001.

22 That exhibit also helped inform your opinion?

23 A. Yes. That exhibit or that image indicates an
24 award for the commercialization of gallium nitride power
25 devices.

1 Q. And in the upper right-hand portion of this
2 slide, there's a paragraph or a column and lines highlighted
3 from the '508 patent, column 4, lines 13 through 17, some
4 highlighted language.

5 Why is that highlighted?

6 A. It gives the key in key desirable parameters. So
7 it mentions low gate leakage, improved gate reliability,
8 enhancement mode operation, among other quantities such as
9 lower on resistance.

10 Q. And, Dr. Schubert, were you in the courtroom
11 earlier this week when Dr. Lidow testified?

12 A. Yes.

13 Q. And did his testimony confirm your opinions with
14 respect to secondary considerations on the '294 patent and
15 the '508 patent?

16 A. Yes.

17 Q. Okay. Thank you, Dr. Schubert.

18 MR. DAVIS: I pass the witness.

19 CHIEF JUDGE CHENEY: Is there cross-examination
20 of Dr. Schubert?

21 MS. SPECHT: Yes, Your Honor.

22 CHIEF JUDGE CHENEY: Proceed when you're ready,
23 Ms. Specht.

24 MS. SPECHT: Thank you, Your Honor. I'm going to
25 give him one second to get the binders to Dr. Schubert.

1 CROSS-EXAMINATION

2 BY MS. SPECHT:

3 Q. And in the meantime, while we're working on the
4 binders, let's go ahead and load up RDX-0014, please.

5 Mr. Schubert -- Dr. Schubert, excuse me,
6 Dr. Schubert, good morning. I have a few questions for you,
7 and we're going to start with slide 2 of RDX-0014.

8 Slide 2 of this exhibit shows claim 1 of the '294
9 patent, which was JX-0014. And looking at claim 1, you
10 would agree with me that claim 1 does not explicitly recite
11 an enhancement mode transistor, correct?

12 A. No mention of the word "enhancement mode
13 transistor," but --

14 Q. Thank you. Let's turn to slide 3. And we're
15 going to talk about the Beach189 reference, RX-0011. And
16 moving on to slide 4, I've placed Figure 4 of Beach189 on
17 the left and paragraph 26 of Beach189 on the right. In
18 paragraph 27 and in the figure highlighted in purple is
19 element 25.

20 Do you see that?

21 A. Yes.

22 Q. And looking into paragraph 26 on the right-hand
23 side, Beach 289 states that element 25 is ultra resistive,
24 correct?

25 A. Beach recites an ultra-resistive field plate.

1 Q. Okay. And further down in paragraph 26, Beach189
2 states that compensated GaN, highlighted in purple here, is
3 one example of the highly electrically restrictive material.
4 Correct?

5 A. One example, correct. Yes.

6 Q. Let's move to slide 5. And here I've got
7 Beach189, paragraph 26, which we've been discussing, on the
8 left-hand side and the '294 patent, claim 1, on the
9 right-hand side.

10 You would agree that both Beach189's paragraph 26
11 and the '294 patent, claim 1, use the phrase "compensated
12 GaN," wouldn't you? The same words appear in both of those
13 excerpts on your screen, don't they?

14 A. The right-hand side, compensated gallium nitride,
15 is a term that has been construed or that has been proposed
16 to be construed.

17 Q. The question, Dr. Schubert, was, do the same
18 words appear on the left-hand side of the screen and on the
19 right-hand side of the screen? They do, don't they?

20 A. If we just look at the words and not think about
21 the meaning, then yes, these are the same words.

22 Q. Okay. Let's go to slide 6. And on slide 6, I
23 have Figure 4 from Beach189 on the left-hand side and
24 paragraph 25, this time, from Beach189 on the right-hand
25 side.

1 In Figure 18, do you see element 18 that's
2 highlighted in green?

3 A. Can I hear the question again?

4 Q. In Figure 4 shown on this screen, do you see
5 element 18 highlighted in green? It's in the upper
6 right-hand corner of the figure.

7 A. Yes, I see that.

8 Q. And on the upper left-hand side of Figure 4, do
9 you see element 20, also highlighted in green?

10 A. Yes, I do.

11 Q. And element 18 on the right-hand side is the
12 source electrode, correct?

13 A. Yes.

14 Q. And element 20 is the drain electrode, correct?

15 A. Yes.

16 Q. Let's go to slide 7.

17 Element 18, which you've just identified as the
18 source electrode, is in contact with element 25, the
19 compensated GaN, correct? Do you see the contact point
20 between elements 18 and 25?

21 A. Yes.

22 Q. And element 20, which you've identified as the
23 drain electrode, is also in contact with element 25, the
24 compensated GaN. Do you see the point of contact between
25 element 20 and 25 on the left-hand side of the figure?

1 A. Yes.

2 Q. And your testimony during your direct examination
3 is that it's your opinion that element 25 must be
4 electrically conductive, correct?

5 A. To the extent that 25 acts as a field plate, yes,
6 it must be electrically conductive.

7 Q. And if element 25 were electrically conductive,
8 because it has a contact with the source and a contact with
9 the drain, it would create a leakage current path, wouldn't
10 it?

11 A. It would create a source-drain leakage current
12 path, correct.

13 Q. And depending on the conductivity of element 25,
14 it could create a short-circuit, couldn't it?

15 A. In an extreme case, yes.

16 Q. Let's go --

17 A. In a general case, it would just create a leakage
18 current.

19 Q. Let's go to slide 8.

20 Slide 8 shows the cover of RX-0075. This is a
21 textbook titled Gallium Nitride Processing for Electronics,
22 Sensors, and Spintronics. You've seen this book before and,
23 in fact, testified about it at your deposition, didn't you?

24 A. Correct.

25 Q. Let's go to slide 9. In Figure 3.14 that's shown

1 on slide 9, the caption includes reference, and I have got
2 it underlined in red, to silicon dioxide field plate.

3 Do you see that?

4 A. Yes, I see that.

5 Q. And silicon dioxide is an electrical insulator,
6 isn't it?

7 A. The silicon dioxide field plate is an electrical
8 insulator, but it should not be confused with a field plate
9 of a transistor.

10 Q. So it's an electrical insulator. Silicon dioxide
11 is an electrical insulator. And an electrical insulator is
12 a non-conductive material, isn't it?

13 A. Correct.

14 Q. Let's go to slide 10.

15 Now we're going to talk about the Kigami
16 reference, which is Exhibit RX-0079. And let's move to
17 slide 11, which shows Figure 2 of the Kigami reference on
18 the left and paragraph 24 describing Figure 2 on the right.

19 Figure 2 shows two layers, layer 22 on the bottom
20 and 32 on the top. Do you see those two layers,
21 Dr. Schubert?

22 A. Yes.

23 Q. And looking to the right in paragraph 24, it
24 states that layer 22 is a sapphire substrate, doesn't it?

25 A. Can I hear the question again?

1 Q. Paragraph 24 shown on slide 11 indicates that
2 layer 22 is sapphire substrate. Do you see that in
3 paragraph 24?

4 A. Yes, I do.

5 Q. And also in paragraph 24, it states that layer 32
6 is a GaN semiconductor layer. Do you see that highlighted
7 in purple in paragraph 24 on the right?

8 A. Yes.

9 Q. Let's go to slide 12.

10 And now I've got underlined in red that paragraph
11 24 states that the semiconductor layer 32 of gallium
12 nitride, which contains magnesium, is formed on the sapphire
13 substrate.

14 Do you see that underlined in red?

15 A. Yes.

16 Q. And magnesium is a p-type impurity, isn't it?

17 A. In gallium nitride, yes.

18 Q. So the gallium nitride layer 32 of Kigami
19 includes magnesium impurities, according to paragraph 24,
20 doesn't it?

21 A. Yes.

22 Q. Let's go to slide 13. Now I've got Figure 5 of
23 Kigami, which is on slide 13. Colored in purple in this
24 slide is what you identified during your testimony yesterday
25 as the channel. Didn't you say that was the channel

1 yesterday?

2 A. The electron channel is directly below layer 52,
3 so 2DEG electron channel is located in 32, but directly
4 under layer 52.

5 Q. Okay. So the upper portion of layer 32 where the
6 end of the arrows are shown, that's the channel?

7 A. If we understand the channel to mean the 2DEG, it
8 would be directly below layer 52. If we understand the
9 channel to be the gallium nitride layer in which the channel
10 is located, then all of layer 32 would be the channel layer.

11 Q. Okay. I'm not sure that distinction matters for
12 the rest of my questions, so let's keep going.

13 Circled in red on Figure 5 at the top are
14 hydrogen atoms or hydrogen ions. Do you see that?

15 A. Yes.

16 Q. And regardless of how we want to characterize the
17 channel, I think you'll agree with me that these hydrogen
18 atoms are passivating the dopants in the channel. Will you
19 agree with that?

20 A. If I recall correctly, Kigami discloses a
21 passivation that is stronger at the top end of layer 32 and
22 weaker at the bottom end of layer 32.

23 Q. So you agree, then, that somewhere in the
24 channel, whatever that means, the hydrogen is passivating
25 the dopants in Kigami? If your position is so unclear, I

1 can just move on, but I thought you wanted to clarify your
2 position for the Court.

3 A. Can I hear the question again?

4 Q. Somewhere in 32, you've said, is a channel. And
5 in that channel, regardless of where it is, there are
6 dopants that are being passivated with hydrogen, according
7 to Kigami.

8 Is that right?

9 A. Could you clarify, when you say "channel," are
10 you referring to the layer 32, the channel layer 32, or are
11 you referring to the location of the 2DEG, which is directly
12 under 52?

13 Q. Let's say the location of the 2DEG, because
14 that's your understanding. So we'll define the channel as
15 the location of the 2DEG, and I think you said that's
16 directly under element 52.

17 If we call that the channel, which is your
18 understanding, you would agree that hydrogen atoms are
19 passivating the dopant in that channel, correct?

20 A. I'm sorry, I have to disagree with your
21 characterization of my understanding. My understanding is
22 as follows: The 2DEG is located directly under layer 52.
23 If we refer to channel as the channel layer, then all of 32
24 is the channel layer. That's my understanding.

25 And I think you said it somehow differently. So

1 I feel more comfortable explaining it myself.

2 Q. Let's just move on because none of this matters,
3 really. Let's get to slide 14.

4 And let's look at paragraph 26 of Kigami on the
5 right-hand side. The second paragraph down in paragraph 26,
6 halfway through that paragraph -- and Mr. Wilson has kindly
7 drawn it out for us -- Kigami states, "As needed, the region
8 into which the hydrogen is introduced, the concentration
9 distribution of the hydrogen atoms to be introduced, and the
10 like can be adjusted."

11 Do you see that underlined in red in the callout
12 on the screen?

13 A. Yes.

14 Q. And you would agree with me that Kigami discloses
15 that the region into which the hydrogen is introduced can be
16 adjusted, wouldn't you?

17 A. Yes.

18 Q. Let's turn to slide 15. And this shows Beach624,
19 which is Exhibit RX-0286.

20 Dr. Schubert, is it your opinion that Beach624
21 teaches only a depletion mode device?

22 A. That is my understanding, that Beach624 teaches a
23 depletion mode device. Correct.

24 Q. So let's pull up your demonstratives, slide 40,
25 if we can. This is a slide you just testified about a

1 moment ago, Dr. Schubert. And the heading says "Beach624
2 describes a depletion mode transistor." It's consistent
3 with what you've just told me, and I want to look at
4 paragraph 39. That is your only evidence of a depletion
5 mode device in Beach624.

6 And it says, "a fundamentally formed" --
7 "fundamentally formed III-nitride device" -- let me try this
8 again. "Fundamentally formed III-nitride devices are
9 nominally on." And it's -- yep, right there.

10 You see that, right?

11 A. I do.

12 Q. If "nominally on" means depletion mode, then
13 "nominally off" would mean enhancement mode, right?

14 A. Generally, "normally on" refers to a depletion
15 mode transistor and "normally off" refers to an enhancement
16 mode transistor.

17 Q. And you testified before this Court during your
18 direct examination that in this paragraph "nominally on" was
19 the same as "normally on," didn't you?

20 A. I'm sorry, I didn't hear the question.

21 Q. During your direct testimony, you said "nominally
22 on" as it appears in your slide was equivalent to "normally
23 on" and, therefore, a depletion mode device, correct?

24 A. Yes.

25 Q. Let's go back to slide 16 of RDX-0014 and look

1 earlier in the Beach624 reference where it frames the
2 purpose and intent of the invention of Beach624.

3 So we have on the screen now paragraph 4 of
4 Beach624. And you can see there highlighted in --
5 highlighted, and then key word is underlined, it says, "It
6 would be desirable to create an III-nitride heterojunction
7 device that is nominally off to avoid current conduction
8 problems during start-up and other modes."

9 Do you see that?

10 A. I do.

11 Q. And let's go to slide 17. This is a little bit
12 later in the portion of the patent where the inventors are
13 framing their intent. And it says, "Conventional design
14 devices using nitride material to obtain nominally off
15 devices rely on an additional insulator to act as a
16 confinement layer."

17 Do you see that?

18 A. Yes.

19 Q. Let's go one more to paragraph 12 on slide 18.

20 And paragraph 12 says, "It would be desirable to
21 obtain a power switch, power rectifier, synchronous
22 rectifier, current control device or other power devices
23 that are nominally off when no power is applied." Correct?

24 A. Correct.

25 Q. Okay. We can take the slides down now, and let's

1 pull up slide 37 of Dr. Schubert's demonstrative, CDX-0003.

2 Dr. Schubert, this is the diagram from your
3 direct examination, correct?

4 A. Yes.

5 Q. And the heading of your slide 37 says "my
6 understanding of Dr. Lebby's proposed process."

7 And by "proposed process," you mean Dr. Lebby's
8 combination of Hikita and Beach624, don't you?

9 A. Yes.

10 Q. So let's call out step B in this figure, which is
11 titled "depositing dielectric layer," correct?

12 A. Correct.

13 Q. And in step B, there's no metal layer shown above
14 the dielectric layer, is there? The top layer of this
15 figure is the dielectric, and no gate metal is shown; is
16 that correct?

17 A. I think that comes later.

18 Q. You add the gate metal later; is that your
19 testimony?

20 A. Well, if you look at the figures, you will see
21 that, at some point, the gate metal is deposited.

22 Q. Okay. Let's move on to step C, and let's call
23 that one out. And I think this is what you're talking about
24 here. So step C adds a pink layer on top of the dielectric
25 layer, which is the metal layer. And that metal layer is on

1 top of the dielectric, correct?

2 A. That metal layer is on top of dielectric layer,
3 correct.

4 Q. So it's your understanding that Dr. Lebby's
5 combination of Hikita and Beach -- in Dr. Lebby's
6 combination of Hikita and Beach624, the dielectric layer
7 would be deposited before the gate metal, correct?

8 A. Well, I have to say I don't have a full
9 understanding of Dr. Lebby's process sequence.

10 Q. This is how you've interpreted Dr. Lebby's
11 process sequence in this demonstrative, though, correct?
12 The dielectric is deposited before the gate metal. That's
13 what this says, right?

14 A. I would say that this process sequence is the
15 result of combining the Hikita reference with the Beach624
16 reference, which I understand is what Dr. Lebby is
17 proposing.

18 Q. Okay. Great. Let's go to slide 38 of your
19 slides, Dr. Schubert. And this is a similar -- similar
20 process to what is on slide 37. You've simply labeled it an
21 alternative.

22 Do you see that at the top?

23 A. I do.

24 Q. And in this alternative understanding that you've
25 put together, if we call out step C, the metal layer is once

1 again on top of the dielectric layer; isn't that right?

2 A. That is correct.

3 Q. And your testimony today was that the devices
4 you've shown on your slides 37 and 38 are non-functional
5 because the dielectric layer is under the gate metal. Is
6 that your position? And to help you, let's get rid of the
7 callout, and let's go to step E, which you've labeled
8 non-functioning transistor.

9 And I'll ask the question again. It's your
10 opinion that this transistor shown in your step E is
11 non-functioning because there is a dielectric layer under
12 the gate, correct?

13 A. Correct.

14 Q. So let's go to the Hikita reference on paragraph
15 -- sorry, the Hikita reference is Exhibit RX-0041. And we
16 want to go to paragraph 61 of the Hikita reference.

17 And, Dr. Schubert, you actually cite to paragraph
18 61 on your slide 45 as allegedly supporting your opinion
19 about this combination. And I want to point you to a
20 sentence in paragraph 61 that you did not testify about
21 previously. And it's right smack in the middle.

22 It says, "The source electrode, the drain
23 electrode, and the gate electrode may be formed before
24 formation of the silicon nitride film."

25 Do you see that in this paragraph of Hikita? Do

1 you see those words on the screen, Dr. Schubert? It's a yes
2 or no. It's highlighted on the screen, and I read it
3 verbatim. Do you see them?

4 A. Yes, I -- I do see the sentence.

5 Q. And silicon nitride is a dielectric layer, isn't
6 it?

7 A. Typically, it is.

8 Q. Let's go to RDX-0013, slide 96. This is a
9 demonstrative that you listened to Dr. Lebby testify about
10 yesterday.

11 And I want to point to the right-hand side of the
12 screen, where Dr. Lebby cites paragraph 61. And the
13 highlighting is in his original demonstrative.

14 Do you see on this screen that Dr. Lebby's
15 proposed combination relies on paragraph 61 where it states,
16 "The gate electrode 411 may be formed before the formation
17 of the silicon nitride film"?

18 A. I'm sorry, I do not have an understanding of
19 Dr. Lebby's combination --

20 Q. You don't have to understand it. The question
21 is, do you see on his slide where he relies on paragraph 61?
22 And the highlighted portion of paragraph 61, which you
23 omitted from your direct testimony, that states, "The source
24 electrode 409, the drain electrode 410, and the gate
25 electrode 411 may be formed before the formation of silicon

1 nitride film 408" is on the screen or isn't it?

2 A. The sentence that you just read is on the screen.

3 MS. SPECHT: I'll pass the witness.

4 CHIEF JUDGE CHENEY: Is there further
5 cross-examination from the Commission Investigative Staff?

6 MR. WINSTON: Your Honor, the private parties
7 have addressed the issues that I had, so the Staff has no
8 questions.

9 CHIEF JUDGE CHENEY: Okay. An issue came up in
10 Dr. Schubert's examination concerning a -- an alleged typo
11 in Figure 2A of Uemoto. Do the parties agree on that point,
12 or is that something that I should pursue with Dr. Schubert
13 further?

14 I think I know Mr. Davis's position from his
15 examination.

16 MR. DAVIS: Yeah.

17 CHIEF JUDGE CHENEY: What about Respondents'
18 position?

19 MR. LAVENUE: Sorry, Your Honor, one moment.

20 CHIEF JUDGE CHENEY: Sure. If you'd like a
21 reference, this came up in Dr. Schubert's direct testimony
22 at CDX-3C, slide 21.

23 As I understood the direct testimony, it was
24 contended that in the lower part of Figure 2A along the X
25 axis, the label 15b, according to Dr. Schubert's testimony,

1 is a typo that should be 15a.

2 MS. SPECHT: Your Honor, we agree that that is a
3 typo. In the reference itself, that should be 15a, and
4 that's consistent with the fact that the figure is labeled
5 2A, and on the next slide, it's 2B where it's referencing
6 15b, so we agree.

7 CHIEF JUDGE CHENEY: Thank you. Staff, do you
8 also agree?

9 MR. WINSTON: The Staff agrees.

10 CHIEF JUDGE CHENEY: Great. That eliminates some
11 questions.

12 Okay. Dr. Schubert, I have a question for you
13 about that same structure. Could we have slide CDX-3C,
14 perhaps slide 22.

15 And, Dr. Schubert, I'm just showing you this
16 slide to orient your mind to the point of the examination
17 where my question arose. My question is not particularly
18 about this slide.

19 But I seem to recall you saying, when looking at
20 a later diagram of 15b -- and maybe someone can tell me
21 where we would see that on a slide. Does anyone know that
22 answer, Mr. Davis perhaps?

23 MR. DAVIS: I'm sorry, Your Honor. I was reading
24 something over here. Could you repeat that?

25 CHIEF JUDGE CHENEY: Can you show me a later

1 diagram of element 15b in this reference? This looks like a
2 band gap energy diagram.

3 MR. DAVIS: Figure -- yes, Your Honor. Figure 7,
4 Your Honor.

5 CHIEF JUDGE CHENEY: Okay. Can you show it on
6 the screen?

7 MR. DAVIS: Slide -- I think slide 20 should be
8 sufficient.

9 CHIEF JUDGE CHENEY: Okay. Dr. Schubert, do you
10 remember talking about this Figure 7 from Uemoto?

11 THE WITNESS: Yes, Your Honor.

12 CHIEF JUDGE CHENEY: And I want to make sure I
13 understood your testimony correctly. Please correct me if I
14 mischaracterize it.

15 Were you saying that -- well, let me back up one
16 more step.

17 Do you remember giving testimony about
18 considering layer 15b in isolation? Do you remember giving
19 that testimony?

20 THE WITNESS: Yes, Your Honor.

21 CHIEF JUDGE CHENEY: Okay. Was the implication
22 of that testimony that the same material that composes 15b
23 might be compensated when arranged in relation to some
24 materials and when exposed to some voltage, but not in other
25 circumstances?

1 THE WITNESS: Your Honor, I would express it in a
2 slightly different way.

3 CHIEF JUDGE CHENEY: Please do.

4 THE WITNESS: So layer 15b is gallium nitride,
5 contains magnesium and hydrogen, is passivated, and is
6 non-conductive. So in that sense, it meets the claim term
7 "compensated gallium nitride."

8 But its location is in the wrong place. Layer
9 15b is in the wrong place. It should be in a different
10 place if it would serve as the compensated gallium nitride
11 layer that is claimed in the '294 patent.

12 CHIEF JUDGE CHENEY: Okay. So the -- stated
13 differently, in the '294 invention, the compensated gallium
14 nitride must be configured in a different location than
15 Figure 7 of Uemoto shows?

16 THE WITNESS: Yes, Your Honor.

17 CHIEF JUDGE CHENEY: Okay. So the earlier
18 testimony about considering the material of 15b in isolation
19 was not that the nature of the material would change if it
20 were positioned differently. It's, rather, that the
21 structure of the device in Figure 7 does not position the
22 compensated gallium nitride in the same place as the claimed
23 invention?

24 THE WITNESS: Correct, Your Honor, that is my
25 understanding.

1 CHIEF JUDGE CHENEY: Thank you.

2 No further questions. Is there any additional
3 redirect?

4 MR. DAVIS: Just some -- very little.

5 REDIRECT EXAMINATION

6 BY MR. DAVIS:

7 Q. Can we pull up slide 37, please. Thank you.

8 Dr. Schubert, do you recall being asked questions
9 about slide 37 during your cross-examination?

10 A. Yes.

11 Q. And let's go to slide 38.

12 And do you recall being asked questions about
13 slide 38 during your cross-examination?

14 A. Yes.

15 Q. Go to slide 36, please.

16 And I believe, during your cross-examination, you
17 were trying to provide some further explanation. Would you
18 like to provide that explanation?

19 A. Yes. As a first short point, I do not fully
20 understand the process sequence that Dr. Lebby envisions.
21 And he has not provided a pictorial sequence of process
22 steps, and he has not provided a narrative sequence of
23 process steps.

24 My understanding is based on his premise that he
25 combines Hikita with Beach624, and the slide 37 and 38 is

1 based on what a person of skill would do when combining
2 Hikita with Beach624.

3 Q. Thank you, Dr. Schubert.

4 MR. DAVIS: I have no further questions.

5 CHIEF JUDGE CHENEY: Is there any further
6 recross?

7 MS. SPECHT: There is not, Your Honor. No
8 questions from us.

9 MR. WINSTON: No, Your Honor.

10 CHIEF JUDGE CHENEY: Okay. Thank you,
11 Dr. Schubert, for providing your testimony. It helped me
12 understand the case. You are not going to be recalled, so
13 you're now free to leave.

14 THE WITNESS: Thank you, Your Honor.

15 (The witness stood down.)

16 CHIEF JUDGE CHENEY: Okay. Before we take our
17 break, let me talk with the attorneys about a few things.

18 When we rebooted the system to stop the blinking,
19 everything that we had carefully arranged for Dr. Doolittle
20 stopped working. So we're going to need some time to get
21 that restored.

22 We're probably going to take about a 30-minute
23 break, but I'd like you to be back in the courtroom in about
24 20 minutes just in case we get everything settled and we can
25 roll on. From my examination of the trial schedule, we need

1 every single minute that we can get today.

2 Does anyone have any question about what's going
3 to happen with the screens? You should have received an
4 e-mail from Ms. Chow with instructions about how to join the
5 Webex. Basically, if you're not Dr. Doolittle, don't join
6 the Webex and just watch the fireworks happen in the
7 courtroom with the rest of us.

8 Anything else? Any questions?

9 MR. DAVIS: No, Your Honor.

10 MR. LAVENUE: No, Your Honor.

11 MR. WINSTON: No, Your Honor.

12 CHIEF JUDGE CHENEY: Okay. Thanks. It would be
13 very helpful if you have representatives stay close in the
14 courtroom during this process, in case we have questions or
15 need assistance from you. We're now off the record.

16 (A recess was taken at 10:40 a.m., after which
17 the proceedings resumed at 11:01 a.m.)

18 CHIEF JUDGE CHENEY: We're back on the record now
19 in the 1366 investigation.

20 Before the morning break, we completed the
21 examination of Complainant's rebuttal expert on the issue of
22 patent validity, Dr. Schubert. And now we're ready to
23 continue with Respondents' case.

24 Do Respondents -- is there some housekeeping
25 matters before we continue with the Respondents' case?

1 MR. ZEINEDDIN: Yes, Your Honor, just briefly,
2 one issue.

3 CHIEF JUDGE CHENEY: Okay.

4 MR. ZEINEDDIN: Thank you, Your Honor.

5 Your Honor -- I will stick around here so I don't
6 have to look at your notes, if you don't mind. Forgive me
7 for doing this.

8 Your Honor, there are a lot of slides, as we have
9 gone through them, I think both parties have worked very
10 hard. There are two slides that we have an issue with.

11 Your Honor, would it be okay if the witness --
12 oh, we have an expert witness, so it is okay, it is not
13 sequestered. Forgive me.

14 So the slides are slides 110 and 111. And the
15 issue here is that the witness in these slides is making a
16 connection not so much to the testing structure, which you
17 have heard about, but is actually saying that Innoscience's
18 own devices. And this is in connection with Schottky.

19 So specifically he relies on two articles, RX-708
20 and RX-343. RX-708 and RX-343 were articles that were cited
21 in his report but not for the notion that it's in here.
22 First of all, they are cited with respect to the testing
23 structure and, second of all, they were cited as to how
24 Schottky can affect threshold voltage. That's the voltage
25 that turns on the device.

1 CHIEF JUDGE CHENEY: I'm going to just pause you
2 right there, Mr. Zeineddin, to make sure you and I are
3 talking about the same thing.

4 MR. ZEINEDDIN: Yes, Your Honor.

5 CHIEF JUDGE CHENEY: I am looking at Dr.
6 Doolittle's demonstrative slides at CDX-2C, slide 110. Is
7 that where you want me to look first?

8 MR. ZEINEDDIN: 12C. Forgive me, it is 12C,
9 slides 110, yes, Your Honor.

10 Yes, that is what I would like you to look at
11 first.

12 CHIEF JUDGE CHENEY: Sorry, I was in the wrong
13 exhibit. Give me one moment.

14 I am now in RDX-12C. Give me one moment still,
15 counsel. At what is labeled RDX-12C.110, I see reference
16 there to RX-708 and RX-343.

17 Am I looking at the right place, Mr. Zeineddin?

18 MR. ZEINEDDIN: Yes, Your Honor. If you take a
19 look, it is the same thing that has been displayed in front
20 of you.

21 CHIEF JUDGE CHENEY: Okay.

22 MR. ZEINEDDIN: So here, Your Honor, when Dr.
23 Doolittle -- there is a big distinction between any testing
24 or purported testing that was done and between the actual
25 Innoscience devices.

1 And here we have bridged that gap. I think they
2 were careful everywhere else. On those two slides, they
3 have bridged that gap. And we object to both of these
4 slides to the extent that they characterize or to the extent
5 that the witness now is going to say that he has actually
6 analyzed the Innoscience's devices as to how they are or not
7 consistent with Schottky.

8 He had not done that by the time he submitted his
9 expert report. His expert report does not mention that
10 part. And he had not done that by the time of his
11 deposition. We have testimony on that.

12 CHIEF JUDGE CHENEY: Okay.

13 MR. ZEINEDDIN: As long as he does it with the
14 testing structure, that's fine. Forgive me, Your Honor.

15 CHIEF JUDGE CHENEY: I didn't mean to interrupt.
16 I thought you were done, sorry.

17 MR. ZEINEDDIN: I'm done.

18 CHIEF JUDGE CHENEY: All right. In this figure
19 that is shown here on slide 110 I see some very light gray
20 data. Is that what you are concerned about?

21 MR. ZEINEDDIN: Well, I am concerned about the
22 actual -- if you take a look why Dr. Schubert is incorrect,
23 he says "other structures, e.g., Innoscience's Schottky. He
24 had not analyzed Innoscience's Schottky. There was some
25 testing that was done and the jury is still out on that.

1 And I think as long as they are careful and they mention
2 that whatever they are talking about is the testing, then
3 they can do that.

4 What we do not know by the time of his
5 deposition, after his expert report, they had done any
6 analysis on Innoscience's product regarding the effect of
7 any Schottky case.

8 CHIEF JUDGE CHENEY: Okay. Let me hear from Mr.
9 Lavenue.

10 MR. LAVENUE: Your Honor, Dr. MacDonald would
11 like to cover this objection if you don't mind.

12 CHIEF JUDGE CHENEY: Sure, Dr. MacDonald.

13 MR. MacDONALD: Thank you, Your Honor, Luke
14 MacDonald here.

15 It is true that Dr. Doolittle referred to the
16 Schottky gate of the testing structures. Those testing
17 structures are designed to mimic Innoscience's devices but
18 his testimony is not limited to the testing structures.

19 For example, in paragraph 141, when Dr. Doolittle
20 explains why he believes Dr. Schubert is wrong. He says
21 that the Schottky gate metal of Innoscience devices "bends
22 the energy bands." So he's making that argument.

23 And the paper in question here comes up in
24 paragraphs 131 and also 130.

25 CHIEF JUDGE CHENEY: What --

1 MR. MacDONALD: Go ahead.

2 CHIEF JUDGE CHENEY: What is the exhibit number
3 for the Doolittle expert report?

4 MR. MacDONALD: Your Honor, it is 0749, RX.

5 CHIEF JUDGE CHENEY: Give me just one moment.

6 MR. MacDONALD: Your Honor, are you looking at
7 paragraph 141?

8 CHIEF JUDGE CHENEY: I will, if that's where it
9 is best for me to look.

10 Okay, I have looked at paragraph 141.

11 MR. MacDONALD: So, Your Honor, in this paragraph
12 he's rebutting Dr. Schubert. And Dr. Doolittle's report
13 says, if we look about halfway through the paragraph, he
14 says that one such region appears in the energy band
15 diagrams on page 49 where the Schottky gate metal bends the
16 energy bands, indicating the presence of electric fields.

17 And this exact energy band discussion came up in
18 the context of Dr. Doolittle's deposition where counsel for
19 EPC questioned Dr. Doolittle about the disputed -- the
20 figure -- the paper on the disputed slide for over an hour,
21 probably over two hours.

22 And in there, he makes a connection between these
23 energy band diagrams and the Schottky gate metal, just like
24 he is doing in this report.

25 CHIEF JUDGE CHENEY: So to help me orient, what

1 diagrams on page 49 means in this report is what exhibit?

2 MR. MacDONALD: That would be the Schubert
3 report.

4 CHIEF JUDGE CHENEY: Okay. Page 49 of the
5 Schubert report, does it refer to one of the other two
6 Respondents' exhibits that Mr. Zeineddin is concerned about?
7 How does this all connect? I'm trying to see how it all
8 connects.

9 MR. MacDONALD: Yes, Your Honor.

10 So it has been Innoscience's position from the
11 beginning that a conductive pGaN is not compensated. And
12 Dr. Doolittle has explained in his report that the gate
13 structure is -- shows you the relationship between, you
14 know, the gate metal and the underlying layer, will show you
15 the relationship of how the devices respond on a current
16 voltage relationship.

17 And so in Dr. Doolittle's transcript, he
18 discusses Schottky throughout. He discusses it in his
19 report.

20 The word appears 50 times, over 50 times in his
21 deposition. And he says very clearly multiple times that
22 this Schottky behavior is very representative of the
23 titanium nitride products that Innoscience uses, for
24 example. That's from his transcript.

25 CHIEF JUDGE CHENEY: Okay. Let me just pause you

1 right there. I hope your argument is not that the word
2 Schottky appears in the report so we can say whatever we
3 want at trial. That's not your argument, right?

4 MR. MacDONALD: No, Your Honor.

5 CHIEF JUDGE CHENEY: Okay. So what I'm trying to
6 figure out is, is this description here in paragraph 141 of
7 Dr. Doolittle's report, the description that gives notice to
8 Complainants that there is a Schottky gate in the accused
9 device?

10 Is that your position?

11 MR. MacDONALD: This description is one of the
12 citations in the report. There are also paragraphs 250 to
13 260, which described the test structures that he designed to
14 mimic the Innoscience Schottky gate.

15 And in the deposition transcript, EPC had the
16 opportunity to question him. If we could pull that up, I
17 could show you some of that questions and answers about Dr.
18 Doolittle's position on whether or not a Schottky,
19 Innoscience's device practices Schottky.

20 CHIEF JUDGE CHENEY: Okay. I don't think it's
21 necessary yet, but let me hear from Mr. Zeineddin in
22 response.

23 MR. ZEINEDDIN: Thank you, Your Honor. If we can
24 go back to -- you have both slides 110 and 111.

25 CHIEF JUDGE CHENEY: Okay.

1 MR. ZEINEDDIN: So, Your Honor, I will shortcut
2 this for you. I think they wouldn't mind if I showed the
3 deposition transcript, even though the whole deposition
4 confidential, if you can clarify, if I can show this.

5 Your Honor, if you look at this slide, turn on
6 and leakage, you see leakage is the issue, Your Honor.
7 Leakage is the issue. What they are trying to do is take
8 Schottky, take the test structure, go there, then talk about
9 the threshold voltage and thread the needle all the way and
10 say oops, causes no damage. That is a problem. That is a
11 connection he never made anywhere.

12 CHIEF JUDGE CHENEY: Okay, okay.

13 MR. ZEINEDDIN: In his deposition --

14 CHIEF JUDGE CHENEY: Mr. Zeineddin, I heard you
15 use the word baby steps the other day. And that's what I
16 need.

17 MR. ZEINEDDIN: I understand.

18 CHIEF JUDGE CHENEY: So just take baby steps. I
19 thought we just started this discussion with a concern about
20 Schottky.

21 MR. ZEINEDDIN: Exactly.

22 CHIEF JUDGE CHENEY: Now you're directing my
23 attention to low leakage characteristics.

24 MR. ZEINEDDIN: Yes.

25 CHIEF JUDGE CHENEY: Should I now be asking the

1 other side to show me about notice on low leakage
2 characteristics?

3 MR. ZEINEDDIN: Absolutely, Your Honor. In his
4 deposition on pages 137 through 138 when we asked him about
5 the connection between leakage and the Schottky, he said
6 that is not something I have done an analysis on. I have
7 just addressed the issues here.

8 CHIEF JUDGE CHENEY: Okay.

9 MR. ZEINEDDIN: So the question here is exactly
10 that, Your Honor. They have done a lot of stuff about
11 Schottky all over the place. They can have it. They got to
12 this slide and now --

13 CHIEF JUDGE CHENEY: That little baby step is
14 getting bigger and bigger. So just let me -- if you're
15 citing things to me so that I can understand them --

16 MR. ZEINEDDIN: Right.

17 CHIEF JUDGE CHENEY: -- let me understand them.

18 MR. ZEINEDDIN: Okay.

19 CHIEF JUDGE CHENEY: So let me look up the
20 deposition so that I'm aware of that.

21 MR. ZEINEDDIN: Yes. So it is --

22 CHIEF JUDGE CHENEY: Which exhibit number is the
23 deposition?

24 MR. ZEINEDDIN: The deposition is not an exhibit
25 number, Your Honor, it is in your Box. We can display it on

1 the screen. They just confirmed it's not confidential.

2 CHIEF JUDGE CHENEY: So I should not be looking
3 in the Doolittle direct examination box, I should be looking
4 somewhere else?

5 MR. ZEINEDDIN: It's in Box. It's in the Box.
6 It's in the Box, but it's not -- it doesn't have, like, an
7 exhibit number.

8 CHIEF JUDGE CHENEY: Okay. How do I find it in
9 Box? Counsel, do you want to give some instructions?

10 MR. REYES: It is in the March 1st folder in your
11 Box under Doolittle cross and the file is named deposition
12 transcript of Dr. Doolittle.

13 MR. ZEINEDDIN: On page 137 at the bottom, 21,
14 Dr. Doolittle -- let's flip back to Exhibit 1, which is your
15 non-infringement report. And then it continues on page 138.

16 Let's go to page 51. And they say you talk
17 about, Page 51, paragraph 132, you mention gate leakage
18 here. Do you see that? And he says yes, um-hum.

19 And then you have several different, for lack of
20 a better word, factors that can impact gate leakage that are
21 enumerated down in paragraph 132.

22 Do you see that?

23 And he says: "I do see that."

24 "Question: Okay. What is your understanding of
25 how Innoscience decreases or limits the gate leakage in its

1 device?

2 He says: That is not something that I have done
3 an analysis on.

4 CHIEF JUDGE CHENEY: Okay.

5 MR. ZEINEDDIN: "I have just addressed the issues
6 in this case."

7 CHIEF JUDGE CHENEY: Thank you. Why isn't this
8 passage admitting that he talked about gate leakage in his
9 expert report? I think your question says, you talk about,
10 at page 51 at paragraph 152, you mention gate leakage.

11 MR. ZEINEDDIN: Right, Your Honor. The key is
12 the last -- from lines 12 to 17 on 138. He did not address
13 how Innoscience's devices decrease or limit the gate
14 leakage.

15 CHIEF JUDGE CHENEY: Okay. So you contend that
16 Dr. Doolittle can talk about gate leakage in the abstract
17 and how Schottky affects work and a gate that is a Schottky
18 and leakage current but he can't say this is what's
19 happening in the Innoscience device. Is that your --

20 MR. ZEINEDDIN: Absolutely. Especially when it
21 comes to quantifying it for sure.

22 CHIEF JUDGE CHENEY: Thank you very much. Let me
23 hear from the other side.

24 MR. MacDONALD: Your Honor, if we can start,
25 please, with the deposition at 109, 15: In his answer

1 between lines 15 and 17, Dr. Doolittle says and what I was
2 trying to say is that this Schottky behavior is very
3 representative of the titanium nitride products that
4 Innoscience uses.

5 So as a starting point, Dr. Doolittle is
6 explaining that Schottky device is what Innoscience has.

7 Again, on his transcript, going to page 125,
8 lines 8 to 17, in response to questions about EPC, he says,
9 "I should also point out that it shouldn't be at all
10 surprising that titanium nitride is a Schottky barrier to
11 p-type material. One of the things anyone in the art knows
12 is that if you're using titanium nitride for the source
13 drain, then it will be a Schottky character to p-type metal.
14 It's just the nature of the way these work functions that we
15 were talking about work out to be.

16 So his opinion is very clear that he believes
17 Innoscience has a Schottky device. And it is also supported
18 by the test structures.

19 CHIEF JUDGE CHENEY: I just want to make sure I
20 am not something. Were you reading from what's on the
21 screen or were you reading something else?

22 MR. MacDONALD: Yes. I was just reading my copy
23 in front of my eyeballs. I'm sorry, Your Honor.

24 CHIEF JUDGE CHENEY: Okay. So I am trying to
25 absorb all this information as fast as I can, but when

1 you're reading something that's not on the screen, I am
2 getting confused.

3 MR. MacDONALD: So I think I read lines 8 to 17.
4 Okay.

5 And I skipped a phrase. I apologize, Your Honor.

6 CHIEF JUDGE CHENEY: Okay. So try again. I am
7 concentrating as hard as I can.

8 MR. MacDONALD: Okay. So at line 8, Dr.
9 Doolittle testifies "I should also point out that it
10 shouldn't be at all surprising that titanium nitride is a
11 Schottky barrier to p-type material because one of the
12 things anyone in the art knows is that if you're using
13 titanium nitride for the source drain contacts, which
14 Innoscience is doing, and that's a good ohmic contact to
15 n-type material, then it will be a Schottky character to
16 p-type material. It's just the nature of the way these work
17 functions that we were talking about work out to be."

18 CHIEF JUDGE CHENEY: Okay. Thanks. So you have
19 shown me two places that you assert Dr. Doolittle gives the
20 opinion that Innoscience is using Schottky barrier type
21 material in its devices.

22 Am I gathering the point you're trying to make
23 correctly?

24 MR. MacDONALD: Yes, Your Honor.

25 CHIEF JUDGE CHENEY: Mr. Zeineddin.

1 MR. ZEINEDDIN: Your Honor, everything he's read
2 to you is prior to what I showed you, everything he has read
3 to you is about Innoscience doing the testing for Dr.
4 Doolittle of the testing structure. This is where the
5 rubber meets the road.

6 This is the issue. Let's isolate the testing
7 structure and even though it was Innoscience that did his
8 work for him, that is separate and apart from saying all of
9 a sudden, now, let's just put it on a slide and this equals
10 Innoscience's devices. Everything he's read to you was
11 about the testimony about the testing structure.

12 CHIEF JUDGE CHENEY: Okay. I'll let you make
13 that point in the post-hearing brief.

14 Let me hear from Staff before I rule.

15 MR. WINSTON: Your Honor, the Staff is of the
16 view this is best dealt with on cross-examination.

17 CHIEF JUDGE CHENEY: Okay. So you wouldn't
18 preclude the testimony?

19 MR. WINSTON: No, Your Honor.

20 CHIEF JUDGE CHENEY: Okay. Thank you. I am
21 going to overrule the objection. Please -- well --

22 MR. ZEINEDDIN: I'm not doctor.

23 CHIEF JUDGE CHENEY: I am going to -- rather than
24 overrule -- I am going to hold the objection in abeyance.
25 If you want to preserve it in the post-hearing brief, please

1 address why this testimony -- why you were not given timely
2 notice of this opinion, particularly with respect to the two
3 passages of deposition testimony that were just read.

4 MR. ZEINEDDIN: Yes, Your Honor.

5 CHIEF JUDGE CHENEY: Thanks.

6 Does that address -- are there any other issues
7 related to Dr. Doolittle?

8 MR. ZEINEDDIN: None, Your Honor.

9 MR. MacDONALD: Thank you, Your Honor.

10 CHIEF JUDGE CHENEY: Thank you all for your
11 patience with me as I struggled to understand the dispute.

12 Mr. Lavenue, are we ready to begin the
13 examination of Dr. Doolittle?

14 MR. LAVENUE: We are, Your Honor. I know that
15 you said you did not want to hear about time, but may I make
16 a quick comment on time before we continue?

17 CHIEF JUDGE CHENEY: Sure.

18 MR. LAVENUE: So the current timing for EPC is 12
19 hours and 33 minutes by our count, 8 hours and 34 minutes
20 by, for Innoscience.

21 So quite a big difference there. There is a
22 dispute over 20 minutes from yesterday, so the most that --
23 the least that EPC would still have remaining is 27 minutes,
24 if the disputed 20 minutes is added, that is 47 minutes, and
25 then I think that there is no dispute that we have

1 approximately three hours and 26 minutes.

2 CHIEF JUDGE CHENEY: Okay. Are you asking for
3 any relief or just stating that for the record?

4 MR. LAVENUE: Stating that for the record, Your
5 Honor, just so you know where we are on our timing.

6 CHIEF JUDGE CHENEY: Okay. Now we're going to
7 spend some more time talking about time to hear from the
8 other side.

9 MR. ZEINEDDIN: I'd just like to note that, Your
10 Honor, we switched witnesses. We had the last witness. To
11 accommodate Dr. Doolittle, to accommodate Respondents, and
12 now what we hear is that Respondents don't want us to have
13 the opportunity to cross Dr. Doolittle.

14 CHIEF JUDGE CHENEY: That's not what I heard. I
15 have faith that we're going to have due process for
16 everyone. Everyone is going to get to say all that they
17 want to say.

18 I have faith that that's going to happen. I am
19 not going to let someone's due process be denied.

20 MR. ZEINEDDIN: Thank you, Your Honor.

21 CHIEF JUDGE CHENEY: Okay. This is why I don't
22 like talking about time.

23 Let's -- are we ready to swear the witness, Mr.
24 Lavenue?

25 MR. LAVENUE: We're ready, Your Honor.

1 CHIEF JUDGE CHENEY: Mr. Lavenue, can you please
2 stand and I'm going to stand and both of our heads are going
3 to be cut off but it is for important for us to stand,
4 please raise your right hand while I administer the oath.
5 Whereupon--

6 ALAN DOOLITTLE,
7 having been first duly sworn/affirmed, was examined and
8 testified as follows:

9 THE WITNESS: I do.

10 CHIEF JUDGE CHENEY: Thank you. Please take your
11 seat. Just so the record is crystal clear, Dr. Doolittle,
12 can you see me?

13 THE WITNESS: I can see you. Thank you.

14 CHIEF JUDGE CHENEY: Can you hear me?

15 THE WITNESS: I can. Let me take the opportunity
16 to thank you for the provisions that you made in such an
17 unusual situation, Your Honor, you and the court as a whole.

18 CHIEF JUDGE CHENEY: Of course. I appreciate
19 your flexibility with us and I appreciate your effort to
20 come and provide this testimony even considering the
21 difficult circumstances.

22 Now we're going to make sure that you can see and
23 hear Mr. Lavenue.

24 Mr. Lavenue, can you say some words?

25 DIRECT EXAMINATION

1 BY MR. LAVENUE:

2 Q. Dr. Doolittle, hello. How are you doing this
3 afternoon?

4 A. Under the circumstances, about as best as I can
5 be.

6 CHIEF JUDGE CHENEY: Then the final thing I'm
7 going to say for everyone in the courtroom is that by
8 remaining in the courtroom, you are consenting to be
9 recorded and broadcast. So if you don't want to be recorded
10 or broadcast, please leave the hearing room.

11 And also please note that there is a camera
12 mounted in the back of the courtroom. It does not show any
13 details on your computer screens because the resolution is
14 not that good.

15 But if you're watching Netflix, people might
16 know. Just letting you know. Okay. Mr. Lavenue, please
17 proceed.

18 MR. LAVENUE: Thank you, Your Honor.

19 BY MR. LAVENUE:

20 Q. Dr. Doolittle, can you please state your name for
21 the record.

22 A. Dr. William Alan Doolittle.

23 Q. And what was your role in this investigation?

24 A. I was retained to render opinions in terms of
25 infringement and domestic industry.

1 Q. And what have you done to fulfill that role in
2 this investigation?

3 A. I have examined a whole bunch of documents,
4 including the patents, and prepared some reports and
5 declarations, as well as -- sorry, there was a loud ding
6 here -- I apologize -- distracted me -- as well as
7 overseeing a lot of the different testing and so forth that
8 was done, on the products.

9 Q. Did you prepare some slides to assist in your
10 testimony today?

11 A. Yes, I did.

12 Q. Okay. Let's go to slide 1, please. And this is
13 RDX-12.

14 And you said you prepared some slides today. Is
15 this the first slide in that presentation that you see on
16 the screen and are you able to see it on the screen there at
17 your location?

18 A. Yes, this is the slides.

19 Q. Let's go to slide 2, please. And here we have a
20 cover of your CV in RX-320. On slide 2, can you briefly
21 describe your educational background.

22 A. Yes. I received my Bachelor's degree in
23 electrical and computer engineering from Georgia Tech and
24 was admitted immediately into the Ph.D. program at Georgia
25 Tech under an honors program that allowed me to bypass the

1 Master's. I completed my Ph.D. in 1996 at Georgia Tech.

2 Q. And where do you work now?

3 A. I'm the Joseph Pettit Chair Professor of
4 Electrical and Computer Engineering at Georgia Tech.

5 Q. And what does your academic work focus on?

6 A. A significant portion of my academic, the vast
7 majority of it is in III-nitride semiconductor materials,
8 devices, and device physics, structures.

9 Q. Let's go to slide 3, please. Can you give us a
10 brief overview of the types of courses you teach at Georgia
11 Tech?

12 A. I teach everything from graduate level quantum
13 mechanics, graduate level microfabrication techniques, down
14 to undergraduate courses in what we call solid-state
15 physics, which is understanding how these semiconductors
16 work and circuits.

17 I also have developed courses in the
18 characterization of semiconductors and devices made from
19 semiconductor materials.

20 Q. What is the nature of your academic research at
21 Georgia Tech?

22 A. So I have published over 180 papers. About
23 90 percent of those are in the III-nitride space. My
24 specific expertise is in p-type doping; most notably
25 magnesium doped GaN. Where we're known as, my group is

1 known as the experts in p-type doping throughout the world.

2 And, in fact, we have been able to overcome
3 barriers in p-type doping to the point where we have, for
4 example, had all concentrations, which is a term imported in
5 this case, that are 40 times greater than what people used
6 to think was the limit.

7 So we are essentially the experts in that field.
8 But I also do transistor work and fabrication. Up until a
9 few weeks ago we had the record for the most conductive
10 III-nitride transistor in the field.

11 Q. Have you received any awards?

12 A. Yes. I received several institute awards,
13 National Science Foundation career aware. I have had three
14 MURI awards, which are competitive, that I was the main lead
15 on. I have also been involved in a second -- a fourth MURI
16 award there. We're competing for two more as we speak.

17 I have also been nominated to run, we call it
18 chair, the International Workshop and Conferences in nitride
19 semiconductor. These are the largest meetings in the world
20 in nitride semiconductors which says that the international
21 community respects our work.

22 I have also been involved with, as the program
23 chairs and program committees, essentially through the time
24 relevant in this work, which allows me to talk about, you
25 know, what type of work was prominent, what was being done,

1 and get a feel because in that role, you actually select
2 which papers are being presented and which papers will be
3 rejected from the conference.

4 MR. LAVENUE: Your Honor, at this time, we would
5 like to offer Dr. Doolittle, Professor Doolittle as an
6 expert in the field of 3 to 5 semiconductor materials and
7 devices, magnesium doping and III-nitride materials,
8 semiconductor device fabrication, and high-electron mobility
9 transistors.

10 CHIEF JUDGE CHENEY: Is there any objection?

11 MR. ZEINEDDIN: No objection, Your Honor.

12 MR. WINSTON: No objection, Your Honor.

13 CHIEF JUDGE CHENEY: Hearing no objection,
14 Dr. Doolittle will be accepted as an expert in the fields
15 tendered. Please proceed, counsel.

16 MR. LAVENUE: Thank you, Your Honor.

17 BY MR. LAVENUE:

18 Q. Let's go to slide 4, please.

19 Dr. Doolittle, what were you asked to do in this
20 investigation?

21 A. So I was asked to perform an analysis that
22 basically would, from the perspective of somebody that is a
23 person of ordinary skill in the art, whether or not EPC's
24 products practice the asserted claims and whether
25 Innoscience's products infringe the asserted claims of the

1 '294 and '508 patents.

2 Q. Let's go to slide 5, please.

3 What is the person of ordinary skill in the
4 relevant time of the '294 and '508 patents?

5 A. So basically you would have a Bachelor's degree
6 in one of the fields that I have listed here that are
7 related to semiconductor science and two years of work
8 experience or you could substitute some of that work
9 experience with more educational experience or vice versa.

10 Q. And did you, yourself, satisfy the requirements
11 for a person of ordinary skill in the art under that
12 definition as of the filing of the '294 and '508 patents?

13 A. Yes.

14 Q. Let's go to slide 6.

15 Which products did you study for the
16 investigation?

17 A. Excuse me. In terms of the Innoscience products,
18 there were many Innoscience products. I am not going to
19 read them all off, but they are listed on the screen here as
20 under two specific classes, the high voltage class of
21 materials, class of devices and then the low voltage class
22 of devices. Both of those product claims are highlighted in
23 pink.

24 From the EPC side, I looked at the EPC2016C and
25 EPC2215, which are both e-mode power transistors and they

1 were presented to me as being representative of EPC's
2 products.

3 Q. And for the record, Dr. Doolittle just referred
4 to CX-42, CX-5, and CX-6. Let's go to slide 7, please.

5 So at a high level, how did you analyze whether
6 the Innoscience products infringe the claims in the patents
7 at suit?

8 A. So I obviously reviewed the patent's history, Dr.
9 Schubert's opinions, but I also analyzed technical data.
10 This includes like the process flows and recipes, various
11 characterizations like the SIMS we will talk about and
12 various other operational data.

13 I looked at a lot of literature, peer-reviewed
14 literature that was out there, and then also I designed the
15 device testing and analyzed the results of the device
16 testing.

17 Q. And at a high level, how did you analyze whether
18 the EPC products practice the claims at suit?

19 A. So at a high level -- could you repeat the
20 question? I'm sorry.

21 Q. Sure. You just explained how you analyzed the
22 Innoscience and whether or not they are infringed by the
23 claims of the patents-in-suit.

24 My question is for the EPC products, how did you
25 analyze whether the EPC products practice the claims in

1 suit?

2 A. Oh, my apologies in that it would be the same.
3 Without having to go over the list again, it would be the
4 same type of analysis that I list here.

5 Q. Okay. Let's go to slide 8, please.

6 Let's discuss the '294 patent first and go to
7 slide 9.

8 So at a high level, what did you conclude on
9 whether Innoscience's products infringe the '294 patent.

10 A. Overwhelmingly from the data, it is clear
11 Innoscience's products do not have the compensated GaN layer
12 and, therefore, they are not infringing the claims. The
13 GaN -- compensated GaN layer is required in the claims and
14 it is just not there in Innoscience's products.

15 Q. And what did you conclude on whether EPC's
16 products practice the '294 patent?

17 A. I find no evidence at all that EPC's products
18 actually practice the compensated GaN layer. And,
19 therefore, I find no -- no domestic industry.

20 Q. Let's go to slide 10, please.

21 We're looking at the '294 patent and it is JX-14.

22 What is the title of the '294 patent?

23 A. The title is A Compensated Gate MISFET and Method
24 For Fabricating the Same.

25 Q. And what is a MISFET?

1 A. A MISFET is an acronym. It stands for metal
2 insulator semiconductor field effect transistor. And in
3 this case that metal insulator, particularly the insulator
4 is an important key aspect of how the device works.

5 Q. And what is a compensated gate MISFET as
6 described in the '294 patent, such as in the abstract?

7 A. So a compensated gate MISFET is described in the
8 abstract and also in critical parts of the specification as
9 being a layer that has a semi-insulating characteristic,
10 which we can define later, but is essentially a material
11 with a very high resistance to the flow of electricity.

12 Q. Just from a high level, based on your review of
13 the evidence and information and your studies, are any of
14 Innoscience products MISFETs?

15 A. No. The Innoscience products are not MISFETs,
16 no.

17 Q. Why are Innoscience products not considered
18 MISFETs?

19 A. Well, it's clear that Innoscience has a
20 conducting pGaN. And they also use a Schottky gate, which
21 is only possible in a conducting pGaN scenario.

22 Q. Let's go to slide 11.

23 Which claims are asserted in this investigation
24 for the '294 patent?

25 A. Claim 1 through 3 are asserted with claims 2 and

1 3 dependent on claim 1.

2 Q. Let's go to slide 12, please.

3 So looking at independent claim 1, what is claim
4 1 directed to?

5 A. Claim 1 is basically a compensated -- a GaN
6 transistor with a compensated layer. And I show the
7 elements of the claim, for example, on the color-coded
8 regions on the right, which I can explain further if you
9 like.

10 Q. And also on the right or actually on the left we
11 have Figure 1 identified in red, prior art.

12 What is that figure?

13 A. So what I have done is I have mapped the elements
14 of the claim that are considered, undisputed, old prior art
15 to the elements of Figure 1, so, for example, the substrate
16 is highlighted in red, the transition layers are highlighted
17 in yellow and so forth and so on.

18 Q. And I see you have color coding for some
19 elements. Why is one claim element not color-coded?

20 A. So this element, a compensated GaN layer above
21 the barrier layer is not -- is not -- it's the only element
22 that is not admitted prior art in this case.

23 Q. Thank you.

24 A. And I find that that's not in either of
25 Innoscience's products or EPC's products.

1 Q. Thank you. Let's go to slide 13. So on this
2 issue of compensated GaN layer, are you aware that the
3 parties in this investigation dispute the claim construction
4 of "compensated GaN"?

5 A. Yes, I'm aware of that. I believe I have the
6 claim constructions on the next slide.

7 Q. Let's go to the next slide, slide 14.
8 What were the constructions proposed by the
9 parties?

10 A. So here is the three constructions that were
11 considered. I also considered the judge's constructions --
12 I talk about in a moment -- but the ones that are listed, I
13 considered in the analysis as well.

14 Q. Do any of your conclusions change based upon
15 which claim construction is applied?

16 A. No. The conclusions remain the same.

17 Q. Let's go to slide 15. You mentioned this slide.
18 Do you know whether or not the Chief Judge has
19 provided any guidance regarding the compensated GaN layer
20 term?

21 A. Yes, I was informed that, from the Markman
22 transcripts that the judge gave some guidance. I don't want
23 to get it wrong so I will read word for word what was said:
24 "It sounds like it is just going to be plain and ordinary
25 meaning and you have a fact dispute over whether enough

1 compensation satisfaction has happened."

2 Q. Does your analysis take that guidance into
3 account?

4 A. Yes. And I tried to address my presentation
5 today, and the slides for this presentation to specifically
6 address that red underlined part, whether enough
7 compensation has happened.

8 Q. Let's go to slide 16. So for your analysis in
9 this investigation, how did you evaluate whether enough
10 compensation has happened?

11 A. I used two metrics. One metric from the patent
12 and one metric from the inventors. But the inventor's
13 metric is also consistent with the scientific literature
14 also.

15 The first metric is -- has a semi-insulating
16 resistivity been achieved or is it conductive? That would
17 be the first metric.

18 And then the second metric is that the hydrogen
19 concentration needs to be on par with or greater than the
20 magnesium concentration.

21 Q. Let's go to slide 17. Let's start with the first
22 metric that you mentioned.

23 Why did you say the patent tells you a
24 compensated GaN is semi-insulating?

25 A. Well, the patent repeatedly refers to the

1 compensated semiconductor layer 38 as semi-insulating. I
2 will refer you to specifically a paragraph on column 3,
3 starting at line 43. That paragraph starts off and says
4 "the critical step here." And it goes on to say that the
5 compensated GaN layer 38 is a highly compensated
6 semi-insulating material.

7 So the critical step is obviously that you have
8 got this compensated GaN which has this semi-insulating
9 character.

10 Q. Let's go to slide 18.

11 So does the patent distinguish a semi-insulated
12 GaN layer from the prior art?

13 A. Yes, it clearly says in that same paragraph,
14 again, under that critical step paragraph, that the prior
15 art there was a conductive p-type material. So if -- if you
16 have a p-type material, clearly it can't be a compensated
17 GaN because that was prior art.

18 Q. Let's go to slide 19.

19 I see you have two cartoons as you, in the
20 industry, call these with headers, conductive on the left
21 and compensated on the right.

22 What do these two cartoons represent?

23 A. Excuse me. I apologize.

24 So the material on the left is a material that
25 will be able to conduct electricity. And I will explain

1 further in future discussion how that happens, where the
2 material on the right would essentially block the conduction
3 of electricity.

4 Q. Let me ask you a couple of questions to break
5 down these cartoons.

6 I see both cartoons include pink circles with
7 magnesium indicated. In the pink circle. What do they
8 represent?

9 A. Yeah. So magnesium is added to gallium nitride
10 to cause it to conduct with what's called a hole. And that
11 hole is represented by the white circle that I have drawn an
12 arrow to that says a generated hole.

13 The way that it carries electricity is a little
14 different from just a simple electrons moving. In the case
15 of the holes, what happened is one of the electrons
16 neighboring that hole, for example, the one to the right,
17 for example, might jump into the hole, which effectively
18 looks like the hole is moving in the opposite direction of
19 the electrons.

20 And that -- that creates what we call a carrier
21 of electricity being a hole, the higher the hole
22 concentration, the more conductive that material is.

23 Q. And I think you referred to this but just for
24 clarification, in the cartoons there are blue circles with
25 an H. What do they represent?

1 A. So, yes. In all materials hydrogen exists, but
2 especially in gallium nitride that comes out of most CVD
3 systems, hydrogen is going to be abundant in the material.
4 So in some cases what happens, some of the magnesium is
5 actually bonded to hydrogen.

6 When that hydrogen bonds with a magnesium and it
7 forms a complex, and that hole is removed, as you can see I
8 have filled in the white circle is now a gray circle
9 indicating that the hydrogen's electron has taken up that
10 hole in.

11 Q. And so what are the differences between the
12 cartoons on the left marked as 'conductive' and the cartoon
13 on the right marked as "compensated"?

14 A. Well, fundamentally, on the left you would always
15 need more magnesium than hydrogen to make it conductive. On
16 the right-hand side you need magnesium that's on par with
17 and preferably actually higher than the magnesium
18 concentration to make it compensated or semi-insulating
19 resistivity.

20 I say that because hydrogen doesn't just bond to
21 magnesium. And I think this is an important point to
22 consider. Hydrogen actually bonds to other things in the
23 crystals like defects and surfaces. So whatever you count
24 the number of hydrogen is there, you need to make sure that
25 you have more hydrogen than you need for the magnesium to

1 become compensated.

2 Q. And how did you refer to the magnesium that is
3 not bonded to hydrogen?

4 A. So the magnesium that is not bonded to hydrogen,
5 we would call that activated. It gets its name from being
6 active in the conduction of electricity, if you will. And
7 we can also describe, for example, an important
8 characteristic of the difference in magnesium to the --
9 magnesium concentration minus hydrogen concentration, we can
10 call that the net magnesium concentration.

11 That number is the number that matters in terms
12 of how conductive the material is.

13 Q. Let's go to slide 20, please.

14 So you said that the patent describes a
15 semi-insulating material. What is a semi-insulating
16 material?

17 A. So on this point, myself, I believe Dr. Schubert
18 and also his book, for sure, and the literature as
19 represented here by the Gotz paper, which is a famous paper
20 on hydrogen passivation, but all the literature pretty much
21 agrees that the semi-insulating resistivity starts at 10 to
22 the 7 ohm centimeter and goes above that.

23 Said another way, that's 10 million ohm
24 centimeters that becomes semi-insulating. And anything
25 greater resistivity than that would also be semi-insulating.

1 Q. For the record, the Gotz paper, that is shown in
2 the slide at CX-4 at 97.

3 MR. LAVENUE: Let's go to slide 21. Now Your
4 Honor, we will be entering the confidential record?

5 CHIEF JUDGE CHENEY: Whose information is it?

6 MR. LAVENUE: Both parties, Your Honor.

7 CHIEF JUDGE CHENEY: If you're not authorized to
8 review confidential information, for both parties, please
9 leave the hearing room.

10 (Whereupon, the hearing proceeded in confidential
11 session.)

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1 O P E N S E S S I O N

2 CHIEF JUDGE CHENEY: We're now back on the public
3 record.

4 BY MR. LAVENUE:

5 Q. Let's go to slide 90, please.

6 So, Dr. Doolittle, did you get a chance to hear
7 Dr. Schubert's testimony last Tuesday?

8 A. Yes, I did.

9 Q. And Dr. Schubert testified that, in his opinion,
10 EPC and Innoscience do have compensated GaN. Did you hear
11 his testimony on that?

12 A. I -- I did hear his testimony, but I disagree
13 with his testimony.

14 Q. Let's go to slide 91.

15 What are your points of disagreement with
16 Dr. Schubert?

17 A. Let me pick my top 6, just for the sake of time.
18 I don't want to go through these individually here. It will
19 just take too much time to read them all, but we'll talk
20 about them individually one by one, starting with the one
21 that is probably not the most egregious error in my opinion,
22 but it's the one that violates the laws of physics.

23 Q. Well, let's go to slide 92.

24 So what is the first point of disagreement that
25 you have with Dr. Schubert that you wanted to address?

1 A. So here, Dr. Schubert has said that the electrons
2 accepted -- are accepted by the magnesium acceptors come
3 from the 2DEG, 2DEG electron gas. And that I find to be a
4 statistical or mathematical impossibility, whichever way you
5 want to describe it.

6 Q. Let's go to slide 93.

7 Why do you find that Dr. Schubert's opinion is
8 mathematically impossible, statistically impossible, I
9 didn't quite catch your phraseology, but whichever one you
10 used?

11 A. Yeah. So people don't like statistical
12 impossibilities because statistics scare people. Statistics
13 was the only B I made in college, so I -- I take that back.
14 It was -- I made a B in a lab class, but it was the only B
15 I made in a math class for sure. People don't like
16 statistics, so I'll say mathematical impossibility, even
17 though I'm really talking about statistics here.

18 There's three reasons why I feel like this is not
19 possible. And I'll start with the easiest one first for
20 people to understand. There's not even a 2DEG underneath
21 the pGaN to begin with. They don't exist. It's not there.
22 So the electrons don't exist to start with.

23 And then, secondly, even if the electrons were
24 present, the electron barrier layer, the AlGa_N layer -- we
25 call it a barrier layer because it's an electron and hole

1 barrier layer. It doesn't allow the flow of electrons in
2 holes across it, it blocks them from the pGaN.

3 And, finally, he reference Mr. Zhao's
4 description, but Mr. Zhao's description is a description
5 that we teach in undergraduate courses that don't account
6 for this polarization effects that are common in the
7 III-nitride materials. And so I'll explain why that
8 analysis is also incorrect.

9 Q. Let's go to slide 49 and start with the first
10 reason. Why are there no electrons under the pGaN to begin
11 with, as you noted?

12 A. So one of the things that we have to first
13 recognize is atoms have electrons on them, so there is
14 actually electrons everywhere in this structure that I'm
15 showing. But we don't care about every electron because
16 most of those electrons are doing nothing but holding that
17 crystal together. Okay? We are only interested in the ones
18 that have enough energy to move.

19 And so what happens here is that the pGaN
20 basically raises the energy necessary for the electrons to
21 conduct. And it turns out, underneath the pGaN, we do not
22 have enough energy to -- the electrons to move.

23 Q. What are you showing in this cartoon on top of
24 the demonstrative and below it as the AlGaN and the pGaN
25 above it?

1 A. So what I'm showing here is obviously the pGaN
2 layer where you would put your gate, and then you have your
3 AlGaN barrier, i.e., an electron barrier, a hole barrier, or
4 whatever you want to call it, and I'm showing the addition
5 of what we call polarization charge.

6 And that sounds like a fancy term, but literally
7 all it means is that the material has a net charge on the
8 bottom of it, in the yellow region, the AlGaN region that is
9 positive, and that's what draws the electrons up close to
10 that barrier and forms our two-dimensional electron gas.

11 And then it has also a net negative charge on the
12 other side that I point out that Dr. Schubert doesn't even
13 address in his images, as far as I can recall. You had to
14 ask him about it in the cross-examination for him to even
15 talk about it.

16 And then I also am showing the force associated
17 with the electric field. Electric fields scare people. So
18 I'm not going to show an electric field. I'm just going to
19 show you the force associated with an electric field.

20 And what I mean by that is the force is pushing
21 the electrons down. It is literally trying to keep the
22 electrons from moving up toward the surface or toward the
23 AlGaN layer. I'm sorry, toward --

24 THE REPORTER: I'm sorry. "Toward the" --

25 CHIEF JUDGE CHENEY: Dr. Doolittle, you're so

1 quick on the mute button that we are clipping the last bits
2 of your testimony. So --

3 THE WITNESS: Okay. I apologize.

4 CHIEF JUDGE CHENEY: -- we didn't hear. Moving
5 up toward the surface or toward the --

6 THE WITNESS: Toward the pGaN layer. So to
7 clarify, the force shown as the arrows is preventing the
8 electrons from moving up toward the AlGaN surface that's
9 exposed here in this image, at least, and also preventing
10 electrons from moving up into the pGaN as well.

11 CHIEF JUDGE CHENEY: Thank you.

12 Please continue, counsel.

13 BY MR. LAVENUE:

14 Q. And what is the 2DEG?

15 A. So the two-dimensional electron gas is a sheet of
16 charge, hence the term "two-dimensional," where the
17 electrons in that region have gained enough energy to where
18 they can conduct through the crystal. Remember we have a
19 lot of electrons everywhere, and we don't care about the
20 ones that are not carrying electricity. We only care about
21 the ones that are actually conducting electricity. And
22 those are the ones that have enough energy to conduct, as
23 indicated as the 2DEG.

24 Q. Let's go to slide 95.

25 So here you are showing us another cartoon or

1 diagram on the bottom of the slide. This has been added.

2 What is this diagram?

3 A. So this is what we call an energy band diagram.

4 And I've done -- all I've done with this energy band diagram
5 is I've also superimposed where the AlGa_N barrier in orange
6 would be and where the force arrows would be driving
7 electrons, essentially to the right, toward the channel
8 region which, would be right at kind of the vertex of those
9 two lines right at the AlGa_N layer, on the right side of the
10 AlGa_N.

11 Q. Let's go to slide 96.

12 I see that there is an E_c line that's blue. What
13 is the -- I'm sorry, an E_c line that is blue. What is the
14 E_c line in blue in the diagram?

15 A. Well, this is what we call the conduction band.
16 But it's actually just, said in simplistic terms, it's the
17 minimum energy necessary for the electrons to conduct
18 through the crystal.

19 Q. And there's also an E_f line in green. What is
20 the E_f line in green?

21 A. So we call this the Fermi energy. And the way to
22 think about this is this is a typical energy that an
23 electron would have. So as I indicate below, in the E_c
24 much, much greater than E_f , what we find is in this case
25 underneath the pGa_N where I've drawn this energy band

1 diagram, the typical energy shown in green is substantially
2 lower than the minimum energy to conduct shown in blue.

3 So what we're doing is we're changing the energy
4 necessary to conduct and raising and lowering, if you will,
5 this blue band, and that is what is depleting the
6 two-dimensional electron gas.

7 Q. At the bottom, you have a yellow box that says
8 that " E_c is greater than E_f ." Why is that noted?

9 A. So because if E_f is substantially less than E_c ,
10 in other words, if the typical energy is less than the
11 energy necessary to conduct, you wouldn't have any of these
12 two-dimensional electron gases underneath the pGaN because,
13 remember, those are only the electrons that have the energy
14 necessary to conduct.

15 Q. And how is the band diagram showing that there
16 are no 2DEG electrons under the pGaN?

17 A. Because the energy -- the typical energy is not
18 sufficient to reach the energy needed to conduct. The green
19 line is not close to the blue line, if you will.

20 Q. Let's go to slide 97 and your second reason.

21 Why does the electron barrier prevent electrons
22 from reaching the pGaN?

23 A. Well, these are what we call wide band gap
24 semiconductors. It's a fancy name to say that the
25 differences in these energies are enormous. They're not

1 like gallium arsenide. They're not like silicon and these
2 other semiconductors we've had in the past. The barrier
3 that this electron, if it were to exist, it doesn't exist.

4 So we put a little magic hat on it. I think you
5 called them in your opening statement a magic electron. But
6 they're magic for many reasons, if you will.

7 First, they don't exist to start with. But if
8 they did exist, they would have to go over that enormous
9 barrier to be able to get to the pGaN.

10 And that barrier is two electron volts. Electron
11 volts is just a convenient measure of energy. It's just a
12 number, think of it that way. The average energy of that
13 electron is 1/40th of an electron volt.

14 So the probability that an electron with
15 one/40ths is, 1 over 40 to be clear for the recording -- the
16 stenographer, the 1/40th an electron volt, it has to have 80
17 times its average energy to get over that barrier. Think of
18 what that would be on a probability distribution curve where
19 you have an average and you've got to go out, 80 times out
20 in a probability curve to determine that.

21 I'll tell you what the number is. We calculated
22 it, and it's easy to calculate it. The probability is 10 to
23 the minus 35 that it will ever make it over the barrier.

24 To put that in perspective, randomly firing 80
25 bullets simultaneously, that's the same probability that

1 those bullets would crash at the same point in space, at the
2 same time. And that is not happening here.

3 Q. Let's go to slide 98.

4 In addition to the barrier height, is there
5 anything else that prevents the electrons from crossing the
6 barrier into the pGaN?

7 A. So, yes, and I think this one is a little easier
8 to understand because we've drawn these force arrows here
9 that I've got added to the screen.

10 Any time you see a slope in these energy bands
11 like is found inside this AlGaN, you can remember that
12 electrons like to roll down the hill. That roll down the
13 hill is in response to an electric field's presence. In
14 other words, the force is actually driving them to the
15 right. You would have to have an electron that has a
16 different magic character that somehow it can oppose an
17 electric field to be able to move from right to left.

18 It's just not happening. You don't have
19 electrons that flow against the electric field.

20 Q. Let's go to slide 99.

21 So, Dr. Schubert, he described this concept of
22 tunneling. Would tunneling explain the 2DEG electrons
23 crossing the barrier into the pGaN?

24 A. To be clear, in the previous two descriptions, I
25 showed why Dr. Schubert's path A in his demonstrative that

1 he drew on the chart -- I don't remember the number -- but
2 his path A that he drew, I showed why that path A could not
3 happen.

4 Now we're talking about paths B and C, right, in
5 the next couple of slides. Here I'll address path B.

6 Tunneling requires that there be a state on the
7 other side to land in. What I mean by "a state" is there
8 has to be an energy position to put an electron in. And one
9 of the fundamental understandings of semiconductors is that
10 there are none of these available states, available slots
11 here, if you can imagine, between the EV and the EC.

12 Now, in defective material, we'll talk about that
13 in just a moment, you do have some states that can come in.
14 But for tunneling to happen, it has to be pretty darn close
15 to the energy that you start out at. So you have to be
16 pretty darn lucky that your defect just happens to put you
17 at the same horizontal position in the pGaN as you are with
18 this magic electron occupies in the channel region.

19 Q. Thank you, Professor.

20 Let's go to slide 100.

21 So during his testimony, Dr. Schubert discussed
22 Exhibit CX-509 as showing a type of tunneling called
23 trap-assisted tunneling.

24 Did you hear that testimony?

25 A. Yes, I did.

1 Q. And did you review Exhibit CX-509, the U book,
2 which we have on slide 100?

3 A. Yes, I did.

4 Q. Does CX-509 support Dr. Schubert's opinion of
5 tunneling from the 2DEG to the pGaN?

6 A. No, actually, this U reference actually refutes
7 his opinion. And there's -- before I even get into that, I
8 want to point out that this isn't even the same device that
9 we're talking about in this case. This device has no p-type
10 GaN. It is not an E-mode device; it's a depletion mode
11 device.

12 And you can see that the -- where we just talked
13 about, the Fermi energy is plotted as this dashed line in
14 the top curve on the A curve above there. The dashed line
15 is the Fermi energy. That's the typical energy, and it's
16 above the conduction band at the 2DEG that I've got kind of
17 circled in this kind of purplish/blueish-purple circle
18 there. So we -- you actually have a two-dimensional
19 electron gas that exists at zero volts in the device that U
20 discusses. So this is not even the same device, okay?

21 But that -- that aside, I also have problems with
22 the rest of his description that I'll talk about, referring
23 from here on out to the bottom graph.

24 Q. Well, let's go there, slide 101.

25 On the bottom slide, we have Figure B of CX-509,

1 page 145. And we see the electron jumping or hopping as
2 marked with the yellow arrows.

3 Do you see that?

4 A. Yes, I do see that.

5 Q. In what direction is the electron in Figure B
6 moving?

7 A. So to be clear, what I've done in this graph is
8 the arrows that were in the copy that we have here is very
9 faint. So all I've done is I've superimposed colored arrows
10 to make it clear here.

11 And you can see the direction the electron is
12 going is to the right. That electric field is driving that
13 electron to the right. Once again, if you drop an electron
14 in that AlGa_N layer, remember that electrons want to roll
15 down the hill. That's the response of the electric field.

16 So it refutes what Dr. Schubert is saying because
17 the electrons would move toward the 2DEG. And if they were
18 in the in the 2DEG, if they magically existed there anyway,
19 which in the pGa_N HEMT they don't, as we just talked about,
20 they couldn't move against that electric field. They would
21 always be pushed to the right.

22 Q. Let's go to slide 102.

23 You identified that there was a third opinion
24 from Dr. Schubert you wanted to address. What was that
25 opinion?

1 A. So Dr. Schubert relied on Mr. Zhao's testimony,
2 and I find that Mr. Zhao's testimony and I believe
3 Dr. Schubert -- well, I don't know that he knows this, but I
4 assume -- I've known Dr. Schubert for many years, I assume
5 he understands this, is -- was talking about material that
6 are non-polar.

7 When you have these polar materials like in
8 AlGa_N, you actually have a built-in electric field, as we
9 just saw, that's not present in the -- in the -- in the type
10 of situation that Mr. Zhao was talking about.

11 MR. LAVENUE: We're going to skip slide 103, Your
12 Honor, subject to an agreement on the objections.

13 BY MR. LAVENUE:

14 Q. Let's go to slide 104, please.

15 So what happens under a polarization field as
16 shown in slide 104?

17 A. So, unlike what Mr. Zhao was talking about, as we
18 said, the AlGa_N material is a polar field. You can think of
19 this as like a semiconductor with a battery on it, if you
20 will, is it has got a net positive charge on the right-hand
21 side. That's what draws the electrons up and forms that
22 two-dimensional electron gas in the first place. They're
23 attracted to that positive charge.

24 But what is not talked about by Dr. Schubert is
25 there's also a negative charge on the left-hand side that

1 I've got drawn with negative purple lines and the positive
2 charge with plus signs in purple. That creates an electric
3 field between that region. And that's what bends those
4 energy bands that have that little slope there.

5 By the way, this drawing is not to scale or
6 anything like that. It's just something Dr. Schubert made
7 up to represent this. So I'm not trying to represent that
8 this is an exact energy band diagram. I'm just using his
9 diagram for this discussion.

10 But the bottom line is, as we saw before that
11 force is created by that electric field, and it drives the
12 electrons to the right, keeping them in the 2DEG. And it
13 makes it virtually impossible, statistically impossible, for
14 them to make it over that barrier at zero bias voltage.
15 When I say "zero bias voltage," this is before you put any
16 voltage on the gate.

17 Q. Thank you, Professor.

18 Let's go to slide 105 and talk about the second
19 opinion from Dr. Schubert you wanted to address.

20 What was the opinion that you found problematic?

21 A. This is -- this is a perplexing one, to be honest
22 with you. It's that anybody can take two data sheets, one
23 from Innoscience and one from EPC in this case, and you can
24 look at a gate turn-on characteristic as it's shown in this
25 graph, for example, and you can say: Oh, with this gate

1 turn-on characteristic of 5 volts, Dr. Schubert says, low
2 gate leakage current up to about 5 volts is due to
3 compensated pGaN.

4 These devices have many layers that have many
5 engineering variables that can be traded off for other
6 engineering variables. And to be able to make such a
7 blanket statement like that, I -- I don't have an answer how
8 you can justify such a broad blanket statement.

9 Q. Let's go to slide 106.

10 And why do you disagree that low gate leakage is
11 equivalent to compensation GaN -- compensated GaN?

12 A. So I give three reasons. One is just a logical
13 argument, if you will. But then I want to talk a little bit
14 about how many variables are involved, just -- I want to
15 give you just a sampling. There's more than I want to talk
16 about of all the variables that affect the gate voltage
17 where this device turns on and the leakage currents that
18 these devices turn on with.

19 And then there's other structures that are used
20 and well-known in the literature that Dr. Schubert said he
21 didn't know of any other structure that this was -- that
22 would give you these results in one of his reports.

23 So I want to talk about all three of these
24 things.

25 Q. Okay. Let's go to slide 107.

1 Let's start with the first one. Why is
2 Dr. Schubert's opinion logically flawed?

3 A. Well, the example I would use is that, you know,
4 if a car is moving 60 miles an hour and say a bird is moving
5 60 miles an hour and a train is moving 60 miles an hour,
6 well, all three of those objects have to be a car. It just
7 doesn't make any sense.

8 If you look at a characteristic and you say this
9 is a performance characteristic, and then you conclude
10 they're the same from that performance characteristic? I
11 just -- logically, it doesn't make sense to me.

12 Q. Slide 108, please.

13 What about the second bullet, what are the
14 multiple variables that affect gate turn-on voltage and
15 leakage?

16 A. So we have listed here and we talked at great
17 length at my deposition about the many different variables
18 that affect both the gate turn-on voltage and the leakage
19 current associated with that.

20 It's not just the pGaN. And it's not just the
21 compensated GaN that Dr. Schubert attributes to. There's
22 things like the gate metal and contact chosen. You can
23 choose different metals. They can be Schottky. They can be
24 ohmic. They can -- you know, there's a lot of different
25 designs that you can do, but typically people use Schottky

1 in this field.

2 And then the quality of the layers matter. If
3 you have not grown these things well, maybe you do get some
4 extra traps and maybe you get more leakage there under bias.
5 You may get more leakage but not at equilibrium when there's
6 no voltage supplied.

7 And then there's the dimensions of the layers,
8 the thickness of the layers. I mean, it just makes sense,
9 if you have a thicker layer, it's going to be more
10 resistive. It's going to make more effort to get through a
11 thicker layer than a thinner layer. And when -- I think we
12 saw that in one of the demonstratives from the transcript
13 that I read, I didn't get to see yesterday. But the thicker
14 -- it was something EPC had that the thinner layer was
15 actually more leaky. That's not surprising. I mean, that's
16 known.

17 And then we have the presence of other layers.
18 Things like an AlGaIn cap will have a dramatic effect on the
19 leakage current. Things like having an etch stop layer
20 would have a lesser effect but still could affect the
21 leakage current. But there's a whole bunch of other
22 intervening layers that could exist that could affect the
23 leakage current and the gate turn-on voltage. And trying to
24 say that it's just two devices have similar gate turn-on
25 voltage and therefore it's compensated GaN, I don't -- I

1 don't follow that at all.

2 Q. Thank you, Professor.

3 This slide, by the way, references RX-708,
4 RX-343, RX-359C, and RX-287.

5 Let's go next to slide 109.

6 What sort of structures achieve the turn-on
7 voltage and leaking characteristics without a compensated
8 GaN?

9 A. Sorry about that. I started talking muted.

10 Basically, there's a lot of structural properties
11 and engineering tradeoffs that you can make in these
12 devices. And I think we talked well over two hours, I
13 think, about, you know, some of these in my deposition, some
14 of the different tradeoffs that you have to make and that
15 you can make.

16 But the primary one people have settled on is
17 what Innoscience is doing and what, you know, most of the
18 people in the -- not most, I'd say a large percentage of the
19 commercial market is doing, and that's the Schottky gate
20 device with a conductive pGaN. That would be the one that I
21 would say is the most commercial success and certainly the
22 one that has most of the academic papers associated with it.

23 Q. Let's go to slide 10.

24 Based upon your review, are there other
25 structures that achieve desirable electrical characteristics

1 without compensated GaN?

2 A. Yes. This is a figure from the Efthymiou paper.
3 It shows some of the tradeoffs that you can have. For
4 example, the red, blue, and the green curve -- I think I
5 highlight them with circles on the next slide, but for right
6 now, let me just draw your attention to the colored dashed
7 lines in this graph. Those represent different choices of
8 Schottky gate metals. And you can see that just by
9 selecting a different metal, you can shift the voltage at
10 which this gate turns on by a significant margin.

11 And this paper describes the physics of these
12 devices. Why do they turn on in the first place? How do
13 they actually function and what are the limitations of using
14 different metals, for example?

15 So the Schottky one, as I've been saying, is one
16 of the more popular ones, certainly in academia and a large
17 percentage of industry.

18 Q. Thank you, Professor.

19 Let's go to slide 111.

20 Are there other structures that can achieve the
21 5-volt gate turn-on and low leakage?

22 A. Yes. As I indicate here, all of these particular
23 choices of metals, they're defined by a certain energy
24 metric that is well known in the field, but in -- all of
25 these different metals achieve higher than 5-volt turn-on

1 for each of these choices. So the Schottky one has an
2 abundance of different choices that you can have.

3 Q. So Dr. Schubert felt very strongly about this.
4 Is a 5-volt gate turn-on with low gate leakage evidence of a
5 compensated GaN layer?

6 A. I -- I see no logical or scientific way to make
7 that comparison with a device that are these -- this
8 complicated. I mean, the difficulty that most laymen have
9 in just understanding this -- these devices would tell you
10 how complicated these devices are.

11 And there are many more variables than just
12 compensated GaN to determine the gate turn-on voltage and
13 the leakage current.

14 Q. Let's go to slide 112, please.

15 So Dr. Schubert -- the third opinion from
16 Dr. Schubert you wanted to address is here. What was the
17 opinion that you found problematic from Dr. Schubert's
18 opinion on this issue on slide 112?

19 A. Well, Dr. Schubert seems to be -- well, it
20 doesn't seem to be -- he is flat out saying that just
21 because hydrogen and magnesium occur in the same layer, that
22 that somehow is compensation.

23 No, that's not what compensation is. You've got
24 to achieve a semi-insulating metric. That's -- that's what
25 the patent says. It says it over and over again. It has to

1 have that semi-insulating resistivity. And as such, there
2 has to be enough hydrogen there to kill off enough holes to
3 be able to reach that semi-insulating metric. And as we've
4 shown, the metric is that the hydrogen has to be greater
5 than or on par with the magnesium concentration for this
6 material to be compensated.

7 Q. Let's go to slide 113.

8 Why is Dr. Schubert's interpretation of the data
9 incorrect?

10 A. One of the things that he says is that, hey,
11 hydrogen tracks magnesium. But it does that even in
12 conductive GaN. And there's lots of literature that is out
13 there to show that.

14 Another reason is he says hydrogen is present, it
15 can't be -- if hydrogen is present with magnesium, it
16 somehow is compensated. But hydrogen is present in all GaN
17 materials; in fact, in all of us, in all steels, and every
18 material that's out there. And hydrogen is known to be
19 present in large concentrations, even when it has strong
20 p-type conductivity. We show that.

21 And then EPC's data does not even allow us to
22 compare the magnesium in finished devices. So I don't know
23 how you can make that comparison. It's just sheer -- it's
24 literally speculation, is what's going on.

25 Q. Let's go next to slide 114.

1 You say that the hydrogen tracks magnesium even
2 in a conductive pGaN.

3 Why is that?

4 A. Yes. Throughout the literature, it's just
5 consistent, but represented here by the Giorgino Group where
6 they are using the typical Schottky junction device, which
7 we've been talking about, a conductive pGaN with a Schottky
8 junction, and they have a net acceptor concentration about
9 2, 10 to the 18, and we've seen numbers much larger than
10 that in the SIMS data that we've been looking at, but
11 they're using 2, 10 to the 18 here, and yet you still see
12 the hydrogen tracks the magnesium here in this, in this
13 figure, as indicated by the magnesium -- I guess that's kind
14 of a greenish, almost like an Army green magnesium trace
15 with a magenta hydrogen trace underneath it.

16 Q. So, Dr. Doolittle, I got to say that I'm getting
17 tired of going through Dr. Schubert's items, and so I think
18 I'm going to switch and we're going to come back to this.

19 CHIEF JUDGE CHENEY: Okay. Why don't we do that
20 after our afternoon break. Just because of the time we've
21 been losing here and there, this break is going to be ten
22 minutes. We're off the record.

23 (A recess was taken at 2:58 p.m., after which the
24 hearing resumed at 3:12 p.m.)

25 CHIEF JUDGE CHENEY: Please take your seats.

1 We're back on the record now after our afternoon break.

2 We're on the public record.

3 We are in the middle of hearing from Respondent's
4 expert, Dr. Doolittle, talking about issues relating to
5 allegations of infringement and satisfaction of the
6 technical prong of the domestic industry requirement.

7 Please continue with your examination, counsel.

8 MR. LAVENUE: Thank you, Your Honor.

9 BY MR. LAVENUE:

10 Q. So, Professor, I was getting weary of going
11 through all the Dr. Schubert criticisms, and I was going to
12 move to the '508, but with the break, I have now
13 consolidated some of your slides so that we can move a
14 little faster because time is not unlimited.

15 So what we will do is we will start with -- we
16 will go back to slide 114, we will finish out the criticisms
17 of Dr. Schubert, and then we will move into the '508. And
18 we're on the downhill path of completing this, so bear with
19 us and we will keep going.

20 Let's go to slide 114. And we were looking at
21 RX-340. And I had asked you why do you think -- or I was
22 going to ask you before the break, why do you think this
23 publication is relevant for your analysis of why
24 Dr. Schubert is incorrect on his third point that hydrogen
25 and magnesium present is an indication of a conductive pGaN.

1 A. Because hydrogen is in every pGaN layer. And as
2 you show in this particular publication, hydrogen clearly
3 tracks the magnesium. Hydrogen in magenta, magnesium in
4 greenish color inside the gallium nitride region, which is
5 the dashed circle region here.

6 And yet they are using a Schottky junction so it
7 is conductive. Me and Dr. Schubert agree that Schottky's
8 only apply to conductive material. And they even talk about
9 in that acceptor concentration that is lower than what we
10 are seeing in this case. So this is a clear indication that
11 the hydrogen tracks magnesium.

12 Q. And let me ask you a clearer question. Does a
13 correlation of hydrogen and magnesium indicate a layer is
14 compensated?

15 A. Not at all. You have to know the relative amount
16 of hydrogen and magnesium.

17 Q. Slide 116. So in this slide you're showing
18 RX-344.

19 What, if anything, is this publication teaching
20 about hydrogen tracking acceptors in the GaN?

21 A. So as this paper quotes in the lower box -- and I
22 will try to speed it up for reasons of time -- here is a
23 paper by Steve Pearton's group, a very famous group that did
24 a lot of important early work. And it shows that the
25 residual hydrogen concentration in all magnesium-doped GaN

1 tracks the acceptor concentration, all magnesium-doped GaN,
2 not just somehow compensated material, but also the
3 conductive material too.

4 Q. Slide 117.

5 Let's continue to the second point you have here.
6 Why do you say hydrogen tracks magnesium even in a highly
7 conductive pGaN?

8 A. So here you have, again, Steve Pearton saying
9 that the anneal only reduces the hydrogen concentration by a
10 factor of 2 or 3, but this is enough to have strong p-type
11 conductivity. So, once again, it says it tracks and yet
12 this material is still highly p-type conductivity.

13 Q. And slide 118, Professor, why is the description
14 in RX-344 relevant to your opinions?

15 A. Because it has been known for over 20 years that
16 hydrogen would be present even in conductive GaN. And you
17 cannot remove all the hydrogen after annealing, as Dr.
18 Pearton's paper shows here.

19 And with hydrogen still -- even with hydrogen
20 present, you're still going to result in strong p-type
21 conductivity is what he says here. And I agree with that.
22 And I don't think there is a dispute in the literature about
23 that.

24 Q. So hold your horses, Dr. Doolittle. I believe
25 that Dr. Schubert said you could remove all the hydrogen.

1 Didn't he say that?

2 A. I believe he said that. And I don't know, he
3 didn't provide any scientific data to support that opinion.
4 I have never seen any evidence that you could ever remove
5 all the hydrogen out of pGaN.

6 Q. So I think what we will do in the interest of
7 time is we will skip to slide 138, please.

8 And let's talk about the last opinion of
9 Dr. Schubert that you had in your list of criticisms. And
10 this is slide 138.

11 What did you want to talk about here?

12 A. So Dr. Schubert in his reports and in his
13 testimony has indicated that he doesn't believe Schottky
14 contacts are viable, I think he used the word at one point,
15 and then also he says that Schottky would cause high leakage
16 current.

17 And I think that is an incorrect statement. He
18 used the reference to the right to kind of support his
19 opinion on that, but that's not reflective of the broader
20 community as a whole. Just like attorneys come to court
21 because they have disputes, scientists have disputes as
22 well.

23 And over the course of years, the data has shown
24 that the Schottky gated pGaN devices have dramatically low
25 leakage currents, more than sufficient for commercial

1 applications.

2 Q. Let's go to slide 139.

3 Why is Dr. Schubert's opinion on the Schottky
4 contact viability incorrect?

5 A. Sorry. The Schottky gate leakage is associated
6 -- the Schottky gate leakage is not associated with high
7 leakage current. And basically the field is kind of
8 converging that the Schottky gate approach is really the
9 state-of-the-art approach. That's the one that most
10 companies -- I keep saying most -- I should say a
11 significant number of companies are using and certainly most
12 of the academic research has looked into that.

13 Q. Let's go to slide 140.

14 Can you give us an example of why Schottky gate
15 leakage is associated with low leakage and not high leakage?

16 A. Well, for example, this paper here from the Erius
17 group is that -- for the sake of time I will just read it --
18 a considerable portion of commercially available normally
19 off pGaN HEMTS have Schottky gate contacts to minimize gate
20 leakage and minimize the drivers through the driver circuit.

21 I want to explain that last part, but it clearly
22 shows the field is moving that direction, the field is
23 acceptable, has accepted the leakage current that's in these
24 devices as being low enough for the application.

25 Q. And for the record this is RX-323 that

1 Dr. Doolittle just referred to on slide 140.

2 So, Dr. Doolittle, I'm about to jump into the
3 '508 patent, but before I do so, I'd note that at the top of
4 slide 140, you have points 4 and 5 that you disagree with
5 Dr. Schubert.

6 We don't have time for those. But can you give a
7 quick summary, without being too much of a lecturer, on
8 what your arguments are for disagreeing with Dr. Schubert on
9 Number 4 and Number 5?

10 A. Well, let me just say that instead of taking the
11 evidence of actually measuring the SIMS, he says there's no
12 evidence of a post-epitaxy activation. But the SIM shows
13 it. The SIM -- I mean, you take a measurement over
14 speculation anyway in my opinion.

15 And, likewise, with the hydrogen cool-down,
16 basically, you know, there is multiple ways you can cool
17 down a device. Some will keep the hydrogen in there; some
18 will not. But go and measure it. They are -- we have shown
19 in this case that the measured hydrogen concentration is
20 substantially less than the magnesium concentration. And
21 that means there is enough net magnesium there to make it
22 conductive.

23 Q. And did you cover both points 4 and 5? I just
24 want to make sure.

25 A. At a high level, I did, yes.

1 Q. Okay. Let's get to the '508. I wanted to get
2 here 15 minutes here, so I am happy to be here.

3 Dr. Doolittle, slide 143, what topics will we be
4 discussing relating to the '508 patent today?

5 A. So, again, I will be talking about the issues of
6 non-infringement and whether DI is practiced.

7 Q. Slide 144, please.

8 When was the '508 patent filed?

9 A. So it was filed on April 8th, 2010 and has a
10 provisional application for a year earlier than that, which
11 is the priority date.

12 Q. And what is the date you applied to understand
13 how a person of ordinary skill in the art would have
14 understood the '508 patent?

15 A. April 8, 2009.

16 Q. And let's go to slide 145.

17 What is the '508 patent about? We can't hear
18 you, Dr. Doolittle.

19 A. Sorry. It talks about the invention is an
20 enhancement mode GaN HEMT device with a gate metal material
21 and doped GaN that is self-aligned. It goes on to say that
22 the gate metal and the -- as I show on the right-hand side
23 in the underlined region, the gate metal, the bottom of the
24 gate metal and top of the gate compound have the same
25 dimension.

1 Q. And what does that mean to have the same
2 dimension?

3 A. That's restating self-alignment.

4 Q. And what is self-alignment?

5 A. Well, it's kind of pictured in this, the figures
6 from the patent here where you're using, for example, a
7 photoresist mask that is used to pattern multiple layers, in
8 this case two layers, such that when you end up with that
9 final etched product, you have the same dimension that you
10 can easily measure with various tools in the semiconductor
11 industry.

12 And that same dimension is kind of indicated by
13 these little red circles that are superimposed over the
14 Figure 3C. I should say, clarify, I apologize, the same
15 dimension for where the gate metal touches the GaN material.

16 Q. Let's go to slide 146.

17 Now, what do you have on here on slide 146?

18 A. This is basically an animation that shows how you
19 can use a photoresist layer shown in blue to etch the gate
20 contact layer and then the doped GaN layer. And you can,
21 since you are using the same photoresist layer, you end up
22 with the same dimension at the point of contact between the
23 gate contact layer and the doped layer.

24 Q. Let's go to slide 147.

25 Does claim 1 of the '508 patent require a

1 self-aligned process?

2 A. Yes, it does. And the steps defining the
3 self-aligned process are steps 1 -F through 1-I.

4 Q. Slide 148. Can you explain the four gate
5 patterning steps of claim 1, please?

6 A. Yes. So first you apply the photoresist. And so
7 to make it easier to visually see, I have got these little
8 1, 2, 3, 4 steps to highlight each one.

9 So first apply to photoresist, then you etch the
10 gate metal, then you etch away the GaN layer, except a
11 portion of the doped GaN layer beneath the gate contact, and
12 then you would remove the photoresist.

13 And what you're left with is a self-aligned
14 process, as defined by having the same dimension at the
15 point of contact between the gate metal and the GaN layer.

16 Q. Let's go to slide 149.

17 Does self-alignment apply to all embodiments
18 described in the '508 patent?

19 A. It applies to every embodiment in the '508
20 patent.

21 Q. Let's go to slide 150. Well, actually, before I
22 go there, let's go back to slide 149.

23 The embodiments you have on the screen are 1
24 through 3, 4, and 7. Is that correct?

25 A. That is correct.

1 Q. Let's go to slide 150.

2 And here looking at the animation, is there any
3 additional gate etching after the self-alignment process in
4 embodiments 1 through 3, 4, and 7? We can't hear you.

5 A. I'm sorry again. Could you repeat the question?
6 I apologize. I answered it and then forgot what you asked.

7 Q. So we looked at the animation and the question
8 was: Is there any additional gate etching after the
9 self-alignment process of embodiments 1 through 3, 4, and 7?

10 A. No, there is no extra gate etching after that,
11 the finish of these embodiments.

12 Q. Let's go to slide 151.

13 Does self-alignment also apply to embodiments 5,
14 6, and 8 described in the '508 patent?

15 A. Yes, it does because the previous embodiments we
16 talked about, 1 through 3, 7, and 4, are actually
17 intermediate steps in the process of getting to steps 5, 8,
18 and 6. All that is done here is added an extra gate etch
19 step for embodiments 5, 8, and 6, which shrinks the gate
20 metal essentially isotropically.

21 Q. Can you explain why embodiments 5, 6, and 8 end
22 up with a narrow gate than the doped GaN layer as shown on
23 slide 151?

24 A. Yes. If you start with embodiments 1 through 3,
25 7 and 4, all you have to do to get to embodiments 5, 8, and

1 6 is apply a uniform etch that etches all the dimensions of
2 the gate metal and, therefore, will shrink the size of the
3 gate metal in the process to get embodiments 5, 8, and 6.

4 Q. Let's look at 152, slide 152.

5 What do we have here?

6 A. So, once again, here is an animation of that gate
7 shrinkage thing, that once you start out with the same
8 dimension between the gate metal and the gate contact and
9 then what you do is you uniformly etch the gate metal so
10 that it shrinks in height and width or basically ends up
11 with a different dimension, but it started out as an
12 intermediate dimension. It had the same dimension at the
13 point of contact between the gate and the doped GaN.

14 MR. LAVENUE: Your Honor, I would like to go on
15 the confidential record for Innoscience confidential
16 information.

17 (Whereupon, the hearing proceeded in confidential
18 session.)

19
20
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25

1 O P E N S E S S I O N

2 CHIEF JUDGE CHENEY: We're back on the public
3 record.

4 BY MR. LAVENUE:

5 Q. Let's go to 177, please.

6 What is the second reason you believe Innoscience
7 does not practice claim 1?

8 A. Well, it has to do with this "except" term. The
9 parties agreed to a construction, as shown in green, but in
10 a nutshell, there's a dispute about the application of the
11 construction and specifically what the "except" term means.

12 And I believe EPC is misapplying that agreed-to
13 construction.

14 Q. Let's go to 179.

15 What is your understanding of the agreed
16 construction?

17 A. So my understanding of the agreed construction is
18 etching away the doped GaN layer, except a portion of the
19 doped GaN layer beneath the gate contact means etching
20 everywhere that's not masked. I mean, this is how the
21 etching occurs. You put down a mask to protect the layer
22 you don't want etched.

23 And everything else outside of that masked area
24 gets etched because it's all happening simultaneously across
25 the wafer. If you don't protect it, it gets etched. If you

1 do protect it, it doesn't get etched.

2 Q. Let's go to 180, please.

3 Does the '508 patent describe self-alignment
4 requires the same dimension at the contact point between the
5 gate contact and the doped GaN layer?

6 A. Yes, it does. And that would be inconsistent
7 with your understanding of self-alignment because that's
8 where you actually would measure to see whether they are
9 aligned. You can't, for example, see access to a buried
10 layer center point because you're looking from the top,
11 right?

12 We're looking from the side so it looks easy to
13 see the center, but when you're looking from the top, you
14 can't see the center. You only can see the edges. And so
15 that's what you would typically align to.

16 Q. Let's go to 181.

17 And would EPC's interpretation that not
18 everywhere outside the gate contact needs to be etched
19 improperly cover a non-self-aligned process?

20 A. Sorry. EPC's process would cover, if you
21 interpret the "except" being allowing some portion not to be
22 etched outside of the gate contact, it would certainly cover
23 the two-mask process that I showed here where a second gate
24 mask is applied that's wider than the gate metal and then
25 the GaN is etched there.

1 That's a prior art claim. I don't think there is
2 any dispute that this would be a prior art claim for this
3 process. And if you interpret EPC's construction the way
4 they have proposed, this would cover the prior art claim.

5 Q. Let's go to 182.

6 What is the common understanding of the word
7 "except"?

8 A. So "except" just means "other than." I show a
9 dictionary definition here for RX-0228.

10 Q. And how would "except" be understood in the
11 semiconductor industry?

12 A. Well, since all the etching as I was saying
13 happens all the way across the wafer at the same time,
14 anything that is not masked is going to get etched, in part
15 or in whole, it is going to get etched.

16 And I can give you a pretty straightforward
17 analogy with mowing a lawn as well.

18 Q. Go ahead.

19 A. Basically if you hired a gardener and you said:
20 Hey, I want you to mow my lawn everywhere except the
21 backyard, you would expect him to mow the entire front yard.
22 You wouldn't expect him to leave a part of the front yard
23 unmowed.

24 Except is an exclusion. And, therefore, it
25 clearly defines where you do not want the lawn mowed. The

1 same thing is true with etching materials as with masked
2 materials.

3 Q. And you heard Dr. Schubert was asked about the
4 lawn mowing analogy?

5 A. Yes, I heard him say that.

6 (Whereupon, the hearing proceeded in confidential
7 session.)

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1 O P E N S E S S I O N

2 CHIEF JUDGE CHENEY: We're on the public record
3 now. I am going to repeat some things. The parties have
4 agreed in their post -- after the private parties finish
5 their post-hearing briefs, they have the option to submit on
6 April 2nd no more than ten pages addressing any issue that
7 has been raised in any post-hearing brief.

8 And the Staff will address everything in the
9 parties' briefs, as well as those last ten-page submissions
10 in the Staff's post-hearing brief.

11 Also on the public record, you're going to submit
12 a final motion for the admission of evidence no later than
13 the close of business on Monday, March 4th.

14 And now I want to encourage the principals to
15 continue to talk to each other and see if you can come up
16 with a business resolution to these issues. I learned a lot
17 this week, and I am going to be studying the evidence, which
18 is voluminous, very carefully as I read your post-hearing
19 briefs. My impression is no one is going to win on
20 everything.

21 So maybe fashion your own solution instead of
22 live with the one that I fashion. You can also save a lot
23 of money by not going through the laborious review and
24 appeals process. So that's my advice.

25 Now some happy things. Can we have the NEXT

1 advocates that participated stand up? Let's give them a
2 round of applause.

3 (Applause.)

4 CHIEF JUDGE CHENEY: Your performance was
5 excellent. And if no one told me that you were NEXT
6 advocates, I wouldn't have known. It was really, really
7 great.

8 And when I think back on my career and about my
9 early experiences standing up in a courtroom, I remember
10 with crystal clarity the things that the Judge said to me.
11 And I will never forget them. And I hope that what happened
12 in this trial will not damage you. I hope you will take
13 whatever happened and think of it in a constructive way,
14 because whatever I said or did was -- my only intention was
15 to give due process to everyone here, to get the best record
16 I can get so I can make the best decision that I am able to
17 make.

18 But I hope that what you take away is that you
19 are well on your way to a satisfying career. And I will be
20 happy to see you in my courtrooms again. I want to thank
21 everyone who labored under really trying circumstances,
22 especially today, with all of the technical problems that we
23 had.

24 Thank you for your patience and good cheer with
25 each other and professionalism. The clients should feel

1 really pleased with the representation that each side got.

2 Here at the ITC it is easy to forget how
3 incredibly well clients are represented in our forum because
4 we see it so consistently, we start to believe that that's
5 the way it is in every courtroom in America. And I know
6 that that's not the way it is in every courtroom in America.

7 And so I really commend all of the attorneys that
8 are here, because you have done a really fine job
9 representing your clients. It is hard what we do. The
10 profession is built around conflict and disagreement. And
11 you did a really great job in the midst of all of that.

12 I want to thank the Commission staff. I have had
13 a lot of staff supporting me on this investigation and I
14 appreciate them very much.

15 I want to thank our court reporter, both the
16 reporter who was here today, and the reporter that we had
17 earlier in the week. And I want to thank your paralegals
18 and your associates and those people that didn't speak that
19 did so much to keep the case moving, all those binders.
20 Someone put together all those binders in the back of the
21 courtroom, and I appreciate that.

22 So many contingencies were thought of to make
23 things go smoothly and I appreciate all of that.

24 So now I am going to be quiet and I am going to
25 dismiss you to a weekend of, I hope, satisfaction, feeling

1 that you have accomplished a lot. I hope you take care of
2 yourselves. Thanks very much for a great trial. We're off
3 the record.

4 (Whereupon, at 5:35 p.m., the hearing concluded.)

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C O N T E N T S

WITNESS	DIRECT	CROSS	REDIRECT	STAFF
FRED SCHUBERT	994	1016	1035	
ALAN DOOLITTLE	1054	1201	1252	1237

AFTERNOON SESSION: 1089

CONFIDENTIAL SESSIONS

1072 - 1143
1177 - 1184
1189 - 1262

1 E X H I B I T S

2 EXHIBIT LISTS SUBMITTED FOR ADMISSION:

3 Marcon:

4 RDX-0010C

5 RX-0748C

6 RX-0747C

7 RX-0284

8 CX-0935

9

10 Schoettelkotte:

11 RDX-0011C

12 RX-0670

13 RX-0671C

14 RX-0653C

15 RX-0652C

16 RX-0681

17 RX-0682

18 RX-0683

19 RX-0188C

20

21 Lebby:

22 RDX-0013

23 RDX-0100

24 RX-0198

25 RX-0079

1 RX-0073
2 RX-0041
3 RX-0043
4 RX-0288
5 RX-0300
6 RX-0298
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1 CERTIFICATE OF REPORTER

2 TITLE: Certain Semiconductor Devices

3 INVESTIGATION NO: 337-TA-1366

4 HEARING DATE: March 1, 2024

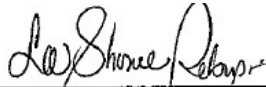
5 LOCATION: Courtroom A

6 NATURE OF HEARING: Evidentiary Hearing

7 I hereby certify that the foregoing/attached
8 transcript is a true, correct and complete record of the
above-referenced proceedings of the U.S. International
Trade Commission.

9 Date: March 2, 2024

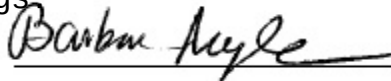
10 SIGNED:



11 Signature of the Contractor of the
Authorized Contractor's Representative
12 1220 L Street, N.W., Suite 206
Washington, D.C. 20005

13 I hereby certify that I am not the Court Reporter
14 and that I have proofread the above-referenced transcript
of the proceedings of the U.S. International Trade
15 Commission, against the aforementioned Court Reporter's
notes and recordings, for accuracy in transcription in the
16 spelling, hyphenation, punctuation and speaker
identification and did not make any changes of a
17 substantive nature. The foregoing/attached transcript is a
true, correct and complete transcription of the
18 proceedings.

19 SIGNED:

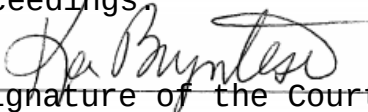


Signature of Proofreader

20

21 I hereby certify that I reported the above-referenced
proceedings of the U.S. International Trade Commission and
caused to be prepared from my tapes and notes of the
22 proceedings a true, correct and complete verbatim recording
of the proceedings.

23 SIGNED:



24 Signature of the Court Reporter

25