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Transcript of John Hart, Ph.D. (IPR2023-00687)

Date: April 4, 2024

Case: Realtek Semiconductor Corp. -v- ATI Technologies ULC (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

1 (1 to 4)

1	UNITED STATES PATENT AND TRADEMARK OFFICE	1	A P P E A R A N C E S
2	BEFORE THE PATENT TRIAL AND APPEAL BOARD	2	ON BEHALF OF THE PETITIONER:
3	-----	3	MR. JEFFREY JOHNSON
4	REALTEK SEMICONDUCTOR CORP.,	4	MR. ROBERT BENSON (Remotely)
5	Petitioner,	5	BAKER BOTTS, L.L.P.
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10	Patent Owner.	10	
11	-----	11	ON BEHALF OF THE PATENT OWNER:
12	Case IPR2023-00687	12	MR. REZA DOKHANCHY
13	U.S. Patent No. 8,854,381	13	MINTZ, LEVIN, COHN, FERRIS,
14	-----	14	GLOVSKY & POPEO, P.C.
15		15	3580 Carmel Mountain Road, Suite 300
16	Deposition of JOHN HART, Ph.D.	16	San Diego, California 92130
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19	8:59 a.m. CST	19	
20	Job No.: 530860	20	ALSO PRESENT:
21	Pages: 1 - 184	21	Mr. Steven Baik (Remotely)
22	Reported By: Michelle M. Yohler, CSR, RMR, CRR	22	Massoud Pedram, Ph.D. (Remotely)
2		4	
1	Deposition of JOHN HART, Ph.D., held at the	1	E X A M I N A T I O N S
2	location of:	2	WITNESS PAGE
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6	I Hotel and Conference Center	6	By Mr. Johnson..... 175
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5 1 PROCEEDINGS 2 (WHEREUPON, the witness was duly sworn.) 3 JOHN HART, Ph.D., 4 called as a witness herein, having been first duly 5 sworn, was examined and testified as follows: 6 EXAMINATION 7 BY MR. JOHNSON: 8 Q Good morning, Dr. Hart. How are you? 9 A I'm fine. How are you? 10 Q Good. 11 So we've done this little dance before. 12 So I know you've had your deposition taken many 13 times, and, in fact, I've deposed you before, 14 correct? 15 A Correct. 16 Q And I deposed you before on the same 17 patents that we're going to talk about today and 18 tomorrow, correct? 19 A Yes, I believe so. 20 Q Any reason you can't give any truthful 21 answers today? 22 A No.	7 1 of time, I would like yes/no answers for those 2 particular questions, okay? 3 A (No verbal response.) 4 Q Sorry. I didn't get a response to that. 5 A Oh. I'll answer the questions you ask me, 6 and I'll try to keep the answers as concise as 7 possible. 8 Q What did you do to prepare for your 9 deposition today? 10 A I wrote a report. I reviewed the report. 11 I reviewed it with Reza and Nana. 12 Q Who is the second person you said? 13 A Nana. I don't remember her last name. 14 MR. DOKHANCHY: Nana Liu. 15 BY MR. JOHNSON: 16 Q Is that an attorney? 17 A Yeah. 18 Q And other than reviewing your report, did 19 you review any other documents? 20 A Just the report and the documents cited in 21 the report. 22 Q And did you write your own report?
6 1 Q You're not on any medications that impair 2 your abilities in any way? 3 A No. 4 Q Okay. And did you bring anything with you 5 today, notes or documents of any kind? 6 A No. 7 Q You know the rules of the deposition. 8 Please don't talk over me, and I'll try not to 9 talk over you. If you need a break, just ask for 10 one, and I'll try to find a stopping place and 11 give you a break. 12 If you don't understand my question, let 13 me know, and I'll try to reask it or try to figure 14 out what the problem is. If you answer it, then 15 I'll assume you understood it, okay? 16 A Okay. 17 Q I'll probably ask a bunch of yes-and-no 18 questions today. Try to answer yes or no. If you 19 don't -- if it can't be answered yes or no, which 20 is fair, just let me know that you can't answer 21 yes or no, and I'll try to either rework it or 22 figure out what the issue is. But in the interest	8 1 A Yep. 2 Q Okay. You wrote the first draft? 3 A I wrote the report. I mean -- 4 Q That's not my question. 5 Did you make the initial draft of the 6 declaration? 7 A Yes. 8 Q Okay. Did you review the drafts of the 9 patent owner response before you wrote your 10 declaration? 11 A Before I finished the declaration, 12 absolutely. I don't recall the order in which I 13 reviewed all of the items cited in the declaration 14 during the writing of the declaration. 15 Q I'm just trying to figure out where the 16 arguments in the patent owner response, did they 17 come from you or did they come from the attorneys 18 and then you supported them? What was the 19 ordering? 20 A I don't recall. I was asked to provide 21 opinions, and I provided opinions. I don't recall 22 the specific documents that they were used in --

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9 1 whatever's in the report is documented in the 2 report. I don't recall any details beyond that. 3 Q You said you were asked to provide 4 opinions. You were asked to provide opinions on 5 what? 6 A The patent. The '371 patent and the prior 7 art. It is '371, right? 8 Q I think it's '381. 9 A '381. 10 Q And then there's also a motion to amend; 11 are you aware of that? 12 A Yes. 13 Q And I believe you also provided a 14 declaration in support of patent owner's motion to 15 amend; is that correct? 16 A Yes, I provided a declaration regarding 17 the motion to amend. 18 Q And do you remember the timing with 19 respect to your declaration for that? 20 A No. 21 Q Did you have any involvement in crafting 22 any of the amendments to the new claims in the	11 1 A Computer science. 2 Q Undergrad or graduate level? 3 A All of the above. 4 Q So I take it then you have a research 5 group? 6 A Yes. 7 Q And how large is that? 8 A Right now, it's down to one student. Most 9 of my time is spent on administrative appointment. 10 I also oversee professional education for the 11 University of Illinois, which provides the same 12 opportunities to students that have the privilege 13 to be able to be on campus and study full-time. 14 I try to make those opportunities 15 available to a broader section of the general 16 public that doesn't have that privilege. 17 Q What is your research focus? 18 A Computer graphics. 19 Q And would that include graphics processing 20 systems that are the subject of the '381 patent? 21 A Very much so. 22 Q And you teach classes related to graphics
10 1 motion to amend? 2 A I remember being asked for my opinions on 3 that matter, and I provided my opinions. I don't 4 recall the details of the order of what came when. 5 Q So they provided to you drafts of the 6 amendments and then you gave opinions on those 7 amendments? 8 A I was asked to provide opinions. I don't 9 recall the details of what I was provided and 10 when. It was a while ago, and I've had a lot of 11 things to work on since. 12 Q Did you contribute to any of the amendment 13 language? 14 A I don't recall. I was asked to provide my 15 opinions on that. I don't know if that went into 16 the language of the amendment -- or of the claims 17 or how that was used. I just provided those 18 opinions. 19 Q Where do you work? 20 A I'm a professor here at the University of 21 Illinois Urbana-Champaign. 22 Q And what do you teach?	12 1 processing systems; is that right? 2 A Yes, I do. 3 Q Do you agree that there are lots of 4 different types of tasks that could be executed in 5 a graphics processing system? 6 A Yes. I think that was a main part of the 7 '381 patent. 8 Q Have you ever heard of a physics task? 9 A Yes. 10 Q Can you tell me what a physics task is in 11 the context of computer graphics? 12 A Yeah, I have a paragraph on that in my 13 report, so I'd refer you to that paragraph from 14 the report. But there are -- I think just off the 15 top of my head, I think I differentiated a physics 16 task from a rendering task or a graphics 17 processing task. 18 Q Can you give me a definition of a physics 19 task? 20 A I'd have to refer to my report. I don't 21 recall word for word what I put down. 22 Q I understand.

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13 1 But you teach this material, correct? 2 A Yes. 3 Q So can you not provide me with some 4 general description about what a physics task is? 5 A I mean, I could, but that's not the 6 subject matter we're here to discuss. We're here 7 to discuss the '381 patent and my opinions 8 regarding that. Those are documented in my 9 report. 10 And I'd refer you to my report and the 11 specific definitions of -- and language I used for 12 those, because that was oriented specifically to 13 the details of the '381 and the prior art. 14 Q That's not my question. 15 I want to know: Can you give me a general 16 description of a physics task in the context of 17 computer graphics in general? 18 MR. DOKHANCHY: Objection. Asked and 19 answered. 20 BY THE WITNESS: 21 A I don't believe so. I believe I'm here to 22 respond to my opinions regarding the '381 patent	15 1 BY MR. JOHNSON: 2 Q What I'm asking you is: Are you going to 3 answer questions about subject matter that is not 4 in your report? 5 MR. DOKHANCHY: Objection. Asked and 6 answered. 7 BY THE WITNESS: 8 A My understanding of the scope of why I'm 9 here is to respond to opinions that are in my 10 report. 11 BY MR. JOHNSON: 12 Q So that's a no, you're going to refuse to 13 answer questions that -- if I ask you a question 14 and it's not in your report; is that correct? 15 A Maybe I'm not understanding the question. 16 I'm here to respond to the opinions that are in my 17 report, so that's why I'm here. I will answer 18 questions about the material in my report. 19 Q Can you describe what a physics task is in 20 general? 21 A I could. But the general description of a 22 physics task, I could go into the $F = ma$ and how
14 1 in response to Dr. Pedram's opinions. Those are 2 in my report, and I'd refer you to that report. 3 BY MR. JOHNSON: 4 Q Are you saying that you refuse to answer 5 general questions unless you specifically 6 addressed it in your report? 7 A Maybe I'm misunderstanding why I'm here. 8 I believe I'm here to respond to opinions that are 9 in that report. 10 Q Well, I'm asking you: Are you going to 11 refuse to answer questions all day if the subject 12 matter is not directly in your report? 13 A I'd like to be able to refer to my report. 14 The opinions I wrote are documented in the wrote. 15 I believe I had a copy of my report the last time 16 we did this. I don't have my report memorized. 17 And I wouldn't want to provide opinions 18 that somehow, due to my misremembering word for 19 word what's in my report I wasn't able to convey 20 properly. 21 MR. JOHNSON: Objection. Nonresponsive. 22	16 1 you integrate physics in general. That's not 2 pertinent to the '381 patent. What is pertinent 3 is what I put in the report. 4 Q Do you agree or disagree that a physics 5 task refers to the simulation of physical 6 phenomenon within a virtual environment? 7 A I don't recall writing that. I don't 8 recall putting that in the report. I don't recall 9 that particular detail being pertinent to the 10 '381 patent, so I don't know that I have that 11 opinion or that statement is relevant. 12 Q So you don't have an opinion on that? 13 A That's not what I said. I said that's not 14 my opinion. My opinion is -- 15 Q Well, do you have an opinion on it? 16 A Yes. It's in my report. 17 Q The question that I asked: Do you have an 18 opinion on whether or not a physics task refers to 19 the simulation of physical phenomena within a 20 virtual environment? 21 A I know I have an opinion on a physics 22 task, and it's in my report. That's not the

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17 1 opinion I gave. So I don't -- I don't have an 2 opinion on that particular quote. I don't recall 3 that particular quote. I don't have my report in 4 front of me. I can't determine if that's related 5 to what I documented in the report or not. 6 Q As you sit here today as a professor in -- 7 and a research professor in graphics processing, 8 can you tell me whether or not you agree or 9 disagree that a physics task refers to the 10 simulation of physical phenomena within a virtual 11 environment? 12 A I haven't formed a general definition of 13 what a physics -- physical task is. I have formed 14 a definition of what a physical task is in 15 comparison to a graphics processing task as an 16 example of two tasks for the purposes of the 17 '381 patent. 18 I think you're asking me about something 19 far more general. I didn't prepare for a more 20 general encyclopedic definition of a physics task. 21 Q I'm just asking you a yes-or-no question. 22 Do you agree or disagree that a physics	19 1 is? 2 A Yes. I believe I referred to the compute 3 shader in the declaration. 4 Q What's a compute shader? 5 A I don't recall what I said in the compute 6 shader -- I said about a compute shader in the 7 declaration. 8 But, generally, a compute shader is 9 well-known to a person of ordinary skill in the 10 art as a shader that does not have to go through 11 the standard vertex shader and pixel shader 12 routines of a graphics processing. 13 Q So I think you testified earlier that you 14 at least have heard of a physics task, correct? 15 A Yes. 16 Q And can you give me some examples of what 17 a physics task might be? 18 A I don't have my report in front of me. I 19 believe I gave some examples of that in the report 20 based on a vague recollection. So based on what I 21 can recall, a physics task would govern the 22 motions of bodies as opposed to their appearance.
18 1 task refers to the simulation of physical 2 phenomena within a virtual environment? 3 A And I did not prepare an opinion based on 4 a general definition of something outside the 5 scope of the '381 patent. 6 Q I believe you said in your declaration, 7 that certain tasks in video game application are 8 non-graphics tasks such as physics tasks. 9 Do you recall saying that? 10 A Vaguely, yeah. I didn't memorize the 11 declaration, so I can't say for sure. 12 Q Do you agree that physics tasks consist of 13 compute shaders? 14 A I'd have to see the physics task, how the 15 physics task was implemented, what platform the 16 physics task was implemented on. 17 Q So you can't make that generic statement? 18 A No, I don't have an opinion on a generic 19 physics task. My opinions are based on the 20 '381 patent and with respect to Dr. Pedram's 21 opinions. 22 Q Okay. Do you know what a compute shader	20 1 Q What does that mean? 2 A If a character in a video game threw an 3 axe, it would be the motion of an axe. 4 Q Do you agree or disagree that a compute 5 shader is a type of shader program? 6 A I'd have to see what context the compute 7 shader was used in. 8 Q Well, in the context of processing 9 graphics? 10 A Well, that's just it. We use compute 11 shaders as alternatives to vertex shaders and 12 pixel shaders. Sometimes they're used in 13 graphics; sometimes they're not. 14 When you say "a shader," are you talking 15 about a particular hardware implementation of a 16 shader, are you talking about a RenderMan shader. 17 I have no idea what the context is of this 18 question. 19 Q So without context, you can't answer the 20 question? 21 A That's right. I would need more context 22 to be able to provide an answer.

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21 1 Q Is it possible to have a compute shader 2 that is a type of shader program? 3 A I'd have to know the context of what you 4 meant by a shader program, which form of compute 5 shader you're talking about. 6 Q So shadow programs are mentioned in the 7 '381 patent, correct? 8 A Shadow programs? 9 Q Shader. 10 A Shader. 11 Yes, the '381 -- from memory, the '381 12 mentions shaders. 13 Q So is it possible to have a compute shader 14 that is a type of shader program, as those are 15 used in the context of the '381 patent? 16 A I don't recall. I don't have the 17 '381 patent in front of me. I don't recall from 18 memory if those terms are used or where those 19 terms are used. 20 Q I'm not asking if it's in the '381 patent. 21 I'm just asking whether or not you can say it is 22 possible to have a compute shader that is a type	23 1 have the patent in front of me. I know I do have 2 opinions on claim 19. I can remember that much 3 from my report, but I don't have my report in 4 front of me. 5 Beyond that, I don't recall. I'd have to 6 refer to my report. 7 Q What is a compute shader in the context of 8 performing general compute tasks on a GPU; for 9 example, doing a fast 48 transfer or calculating 10 some complex nonlinear function? 11 MR. DOKHANCHY: Objection. Vague. 12 BY THE WITNESS: 13 A Those are applications that could be 14 completed using a compute shader. 15 BY MR. JOHNSON: 16 Q Do you know what a scheduling task is? 17 A I would have to see the context. 18 Scheduling task is far too vague to provide an 19 opinion on. I mean, I did look to see if I have 20 opinions on a scheduling task in my report. I 21 don't recall in my report what I have on a 22 scheduling task.
22 1 of shader program in your vast experience? 2 A I think I -- 3 Q You can pick any shader program you want. 4 A I think I answered that. I would need to 5 see the context of what you mean by a shader, what 6 you mean by a compute shader. I'm here to offer 7 opinions on the '381 patent. 8 Q You understand the context of a shader 9 program with respect to the '381 patent, don't 10 you? 11 A Yes. 12 Q Okay. So that's the context for the 13 shader program. I shouldn't have to give you any 14 more information about the shader program. 15 A Well, that's a different question than you 16 asked before. And in the context of the '381, I'd 17 have to see the '381 patent to be able to look at 18 that. I don't recall in my opinions if I have an 19 opinion regarding a compute shader in relationship 20 to a regular shader. 21 My vague recollection is that was in 22 claim 19. I don't know for sure because I don't	24 1 Q Have you ever heard the term "scheduling 2 task"? 3 A It doesn't ring a bell. 4 Q Okay. So then do you have an opinion on 5 what a scheduling task is in the context of a GPU? 6 A I don't know. I don't have my report in 7 front of me. I don't recall. 8 Q Do you know what the context -- I'm sorry. 9 Strike that. 10 Do you know what a scheduling task is in 11 the context of a CPU? 12 A I don't know that I have any opinions 13 regarding a scheduling task on a CPU. I don't 14 think that was one of Dr. Pedram's opinions. I 15 don't think that was relevant to the '381. 16 Q Is it possible to have a task in the 17 context of a GPU that refers to the processing of 18 assigning computational tasks to different 19 processing units within the GPU? 20 A From my vague recollection of the '381, 21 not having the '381 in front of me, and from my 22 vague recollection of the declaration, not having

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25 1 my declaration in front of me, I do recall an 2 element of the '381 and claim 15 requiring 3 something similar to that. 4 Q Would that be a scheduling task? 5 A I'd have to refer to my report or at least 6 the patent. 7 Q I'm just asking you in your experience, 8 would you consider that to be a task that does 9 scheduling? 10 A My opinions regard the '381. I don't 11 recall having to provide any opinions from my 12 experience on anything beyond what was in the 13 '381. 14 Q So you can't answer that today? 15 A It's too vague. My opinions are focused 16 on the '381, and "task" is one of the terms used 17 in the claim language. I focused my opinions very 18 carefully on the Court's constructions and the 19 other construction -- or the PTAB's construction 20 and the other constructions we used for analyzing 21 the '381. 22 Q Do you agree or disagree that GPU	27 1 and a particular case, but I don't recall off the 2 top of my head any situation where I had to 3 analyze that. 4 BY MR. JOHNSON: 5 Q So, again, if it's not in your report, 6 you're refusing to answer, correct? 7 A My understanding is I'm here to respond to 8 the opinions in my report, and so I would need to 9 refer to my report to be able to do that. 10 BY MR. JOHNSON: 11 Q Do you know what a mipmap is? 12 A Yes. 13 Q What is it? 14 A A mipmap is a texture that's stored at a 15 variety of different resolutions. 16 Q Do you know what a mipmap task is in the 17 context of graphics processing? 18 A No. I've never seen anything referred to 19 as a mipmap task. 20 Q Do you know how mipmaps are used? 21 A Yes. 22 Q Can you tell me how they're used?
26 1 scheduling involves determining the order in which 2 tasks should be executed? 3 A Can you repeat the question? 4 Q Sure. Do you agree or disagree that GPU 5 scheduling involves determining the order in which 6 tasks should be executed? 7 A I would have to see an example of where 8 that scheduling was occurring, the design of the 9 GPU, other details. 10 Q Do you agree or disagree that GPU 11 scheduling could involve tasks determining the 12 order in which tasks should be executed? 13 A I wouldn't be able to say without knowing 14 more details about the specifics of the GPU design 15 and how it was being operated. 16 Q How would you characterize a task that 17 involves determining the order in which tasks 18 should be executed within a GPU? 19 MR. DOKHANCHY: Objection. Vague. 20 BY THE WITNESS: 21 A I don't recall that particular question. 22 If it's in my report, I could refer to my report	28 1 A Sure. In a graphics application, you're 2 rendering, creating a display, and that display 3 may include texture, and that texture -- when that 4 texture's applied, it may result in aliasing, 5 which results in a mismatch of the displayed 6 resolution and the texture resolution. 7 And so a mipmap is one of the methods used 8 to vary the resolution of the texture to better 9 match the resolution of the display. 10 Q How is a mipmap generated? 11 A A variety of ways. The typical way a 12 mipmap is stored is as an image pyramid. At the 13 bottom of that pyramid, you have a full resolution 14 texture, and each layer above that is half the 15 resolution horizontally and vertically. 16 Q Are they stored in memory alongside the 17 original texture; is that what you said? 18 A Yeah, typically. 19 Q Are they used by the GPU to optimize 20 texture sampling? 21 A Yes. 22 Q And how do they do that?

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29 1 A When a texture sampler goes to a texture 2 and needs a particular sample over a region, 3 instead of averaging all of the pixels in that 4 region, you can go higher in that pyramid to a 5 lower resolution texture where a single pixel in 6 that lower resolution texture corresponds to many 7 pixels at a higher resolution. 8 Q If a mipmap is a method used to vary the 9 resolution of a texture, does it comprise one or 10 more tasks as defined in the '381 patent? 11 A I don't recall having any opinion 12 involving the '381 focused on any tasks involving 13 a mipmap. I didn't really analyze that. That was 14 not something I recall Dr. Pedram analyzing. So I 15 don't have an opinion regarding a '381 task being 16 applied to a mipmap. 17 Q So you can't answer that question today? 18 A I'm not prepared for it. It wasn't -- 19 Dr. Pedram didn't come up with any examples on a 20 mipmap, and I don't have my report in front of me. 21 I didn't prepare any opinions involving that. I'd 22 have to see how that task was organized, issued,	31 1 Q Do you agree or disagree that each 2 processing element in a GPU has a unit capable of 3 performing arithmetic logic computations needed as 4 part of a graphics processing task? 5 A I would have to see a specific GPU to 6 know -- to be able to have an opinion on that. 7 I'd have to look at a particular architecture to 8 determine that. 9 Q I'm skipping a bunch of stuff, so give me 10 a second. 11 Do you agree or disagree that you would 12 need to know the context of the task to determine 13 if it is a graphics processing task? 14 A We speak of tasks and graphics processing 15 tasks in the claims of the '381. I think that, in 16 particular, it's spoken of in claim 319. So I 17 would need to know quite a bit about that task to 18 be able to make that determination. 19 I did have opinions on claim 19, and I'd 20 refer you to my report on those opinions. 21 Q Does texture processing involve ALU 22 calculations?
30 1 processed with respect to the '381 or what other 2 system was used. 3 Q So just based on your vast experience, you 4 can't answer my question today, correct? 5 A My opinions here are on the '381. And you 6 asked about a task. Task is a claim term. It has 7 a construction that we are using relevant to the 8 claims and how a person of ordinary skill in the 9 art would understand it. 10 I'd have to see how this process you're 11 describing was being applied, whether it's '381 or 12 prior art or what system is being used. And I 13 would need time to be able to perform that 14 analysis, similar to the time I used to perform 15 the analysis in my other opinions in my report. 16 Q Do you know what an ALU task is? 17 A No. I mean, I've not seen that. I don't 18 recall an ALU task as a term in the '381 or in 19 Dr. Pedram's opinions. I don't think I have an 20 opinion on an ALU task. 21 Q Do you know what an ALU is? 22 A Yes.	32 1 A I don't think I have an opinion on that. 2 I think texture processing was part of another 3 patent, not the '381 that I looked at, and I don't 4 recall if it talked about an ALU or not. 5 I think it -- I think there was some 6 related stuff about that, so I'd have to refer to 7 the other patent. 8 I think I'm here today to talk about the 9 '381, and I don't recall any opinions in my report 10 on the '381 that had to look at any relationship 11 between an ALU and texture processing. 12 Q And just in your experience, can you tell 13 me whether or not texture processing in a graphics 14 processing system might involve an ALU 15 calculation? 16 A I don't recall seeing that as being 17 necessary, but I'd have to check my notes. 18 I didn't prepare anything in preparing my 19 opinions on the '381. I don't recall that coming 20 up in my declaration on the '381. I'd have to see 21 my report. 22 Q So if I hand you your declaration, you'll

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33 1 be able to answer that question? 2 A If you hand me my report and you ask me a 3 question about my opinions on the '381, which is 4 what I understand the subject of today's 5 deposition to be, then I'd be happy to answer any 6 questions. 7 (WHEREUPON, Exhibit No. 2006 was presented 8 to the witness.) 9 BY MR. JOHNSON: 10 Q Okay. So here is a copy of your report. 11 And, for the record, it's marked as Exhibit 2006 12 in this proceeding. 13 And I'm asking you: In your vast 14 experience, can you tell me whether or not texture 15 processing in graphics processing systems might 16 involve an ALU calculation? 17 A I'm not seeing that I formed any opinions 18 on that. I don't know that I needed to refer to 19 any -- anything in my experience about that, so I 20 didn't really analyze that. I don't believe I 21 have an opinion on that relevant to the '381. 22 Q Okay. So as you sit here today, can you	35 1 A Yes. 2 Q And in any of that research, has any of 3 your systems involved an ALU calculation as part 4 of texture processing? 5 A With the term "ALU," I don't recall seeing 6 the term "ALU" being used in the '381. 7 I do recall it being used in the '053, 8 which is the other patent I believe we're 9 discussing tomorrow. And so it had very specific 10 meanings in and usage with reference to that 11 patent. 12 In my research on texture processing, I 13 certainly use arithmetic in that texture 14 processing, and that arithmetic is performed in 15 the processing of that texture. But that's 16 entirely separate from how those terms are used 17 and applied in, for example, that other patent. 18 So I can go as far as saying my research 19 has involved performing arithmetic on textures. I 20 don't know that I would say that I depended on an 21 ALU or any particular piece of hardware to do that 22 arithmetic. I used whatever was available on the
34 1 answer my question? 2 MR. DOKHANCHY: Objection. Asked and 3 answered. 4 BY THE WITNESS: 5 A Can you repeat the question? 6 BY MR. JOHNSON: 7 Q Sure. Based on your vast experience, can 8 you tell me whether or not texture processing in a 9 graphics processing system might involve an ALU 10 calculation? 11 MR. DOKHANCHY: Same objection. 12 BY THE WITNESS: 13 A No, I couldn't tell you one way or the 14 other. I'd need to refer to some details of past 15 graphics systems and how they're used. 16 I don't recall and I don't see that that's 17 being -- that situation was -- came up in any of 18 Dr. Pedram's opinions. I don't have any opinions 19 in my report that I see regarding an ALU being 20 used in the -- for texture regarding the '381. 21 Q Do you have any experience with texture 22 processing in your research?	36 1 graphics processor I was using at the time. 2 Q And when you say "arithmetic," do you mean 3 computations? 4 A Yes. Arithmetic performed by a computer. 5 Q And does vertex processing involve ALU 6 calculations? 7 MR. DOKHANCHY: Objection. Vague. 8 BY THE WITNESS: 9 A So the '381 speaks of vertex processing, 10 and it speaks of the arithmetic performed on a 11 vertex. 12 I don't recall an ALU -- if an ALU is 13 specifically used in the '381. I'd have to -- is 14 there a particular opinion involving the ALU that 15 I could look at and confirm? 16 But I don't recall an ALU being used in a 17 vertex -- a vertex shader or vertex processing 18 coming up from Dr. Pedram's opinions or my 19 opinions in response to his opinions. 20 BY MR. JOHNSON: 21 Q Are you aware of any graphics processing 22 systems that do not involve arithmetic?

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37 1 A Certainly the ones referred to in the '381 2 required arithmetic. 3 Q And do they require arithmetic for all the 4 types of tasks that they perform? 5 A I didn't really look at the question. I'm 6 not sure what we're calling within the realm of 7 arithmetic and outside the realm of arithmetic. 8 That distinction didn't really come up in 9 Dr. Pedram's opinions or my opinions in response 10 to his opinions. 11 Q By "arithmetic," I just mean computations. 12 A The '381 – I mean, for example, I 13 analyzed claim 15. I believe claim 15 was 14 directed at a computer. And so the tasks would be 15 computational in nature. 16 Q For all of the tasks that are being 17 performed; is that correct? 18 A So claim 15 requires, as I recall – I 19 don't have that claim language in front of me. 20 It's a – oh, here we go. 21 So claim 15 requires a computer system 22 with a memory and at least one processor or at	39 1 BY THE WITNESS: 2 A I believe that's a different question. 3 Does there exist an ALU that can perform a shift? 4 Probably. 5 I didn't need to find one in forming my 6 opinions on '381, but I do believe any person of 7 ordinary skill in the art would expect that there 8 existed at least one ALU that could perform a 9 shift operation. 10 BY MR. JOHNSON: 11 Q Is a hardware unit needed in a GPU to 12 perform an add or shift calculation in an ALU? 13 A I believe everything in a GPU is hardware. 14 It's a graphics processing unit. It's a piece of 15 hardware. 16 Claim 15 requires a computer – a 17 computing system, which one would expect to be 18 hardware. 19 Q Do you agree or disagree that both 20 graphics processing engine and/or compute task can 21 perform arithmetic logic operations such as 22 addition or multiplication?
38 1 least one processing unit. So the tasks would be 2 executed computationally. 3 Q What kinds of calculations can an ALU 4 perform? 5 A I would have to see the ALU. 6 Q Can all ALUs perform add computations? 7 A I don't know. I haven't seen all ALUs. 8 I'm familiar with some, but there's a wide variety 9 of ALUs. I would expect most could add. 10 Q And as a person of ordinary skill in the 11 art, would you expect that an ALU can perform a 12 shift function? 13 A I think a person of ordinary skill in the 14 art working with an ALU would want to see the ALU 15 specs to know what it could and couldn't do. 16 Q That's not my question. 17 As a person of ordinary skill in the art, 18 would you understand that there is an ALU that can 19 perform a shift calculation? 20 MR. DOKHANCHY: Objection. Asked and 21 answered. 22	40 1 A So I have opinions on claim 19, which 2 describes a first task – which requires a first 3 task, comprises a graphics processing task. And 4 the second task comprises a general compute task. 5 And so I analyzed the graphics processing 6 tasks and general compute tasks in response to 7 Dr. Pedram's opinions. I don't recall looking at 8 whether either required an ALU. I don't recall 9 any opinions from Dr. Pedram on whether or not a 10 general compute task required an ALU. 11 Q I'm asking you as an expert and a person 12 of ordinary skill in the art whether or not both 13 graphics processing and general compute tasks 14 involve arithmetic logic operations such as 15 addition or shift or multiplication? 16 A I understand both to utilize arithmetic 17 operations. 18 Q Is a task that simply adds all elements in 19 a one-dimensional array of integer values a 20 graphic processing task or a general compute task? 21 A I wouldn't be able to answer that based on 22 that amount of information. I would need to see

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41 1 how it was being used, why those array elements 2 were being added. I wouldn't know. 3 Q Is a task that finds the average of values 4 stored in a two-dimensional three-by-three array 5 of floating point values a graphics processing 6 task or a general compute task? 7 A I wouldn't know just based on that amount 8 of information. Give me one moment. 9 I think what you're describing might be 10 referred to as thread sequences of instructions. 11 They wouldn't qualify necessarily as tasks without 12 knowing what they were doing. 13 A task is a unit of processing work 14 decomposable into two or more related threads. I 15 would need to know what work was being done, what 16 the application was to know to be able to speak of 17 it as a task instead of just a sequence of 18 instructions. 19 Q Now that you have your report in front of 20 you, can you tell me whether or not a physics task 21 is a general compute task? 22 A So I used a physics task as an example of	43 1 claim construction a little bit. So if you want 2 to go to that portion of your report, which I 3 think starts on Page 8 of Exhibit 2006. 4 A Okay. 5 Q So do you agree that a task was defined at 6 the ITC as a unit of processing work or a portion 7 of an application to be executed? 8 A Yes. 9 Q And do you agree with that construction? 10 A It's not really agree or disagree. I 11 found a more accurate construction to be a unit of 12 processing of work decomposable into two or more 13 related threads. 14 Q And so that's the construction that you 15 used -- 16 A Yes. 17 Q -- in forming all of your opinions in your 18 declaration? 19 A Yes. 20 Q You did not use the construction as 21 adopted by the ITC, correct? 22 A I mean, the construction I used is a task
42 1 a non-graphics task that could be -- could consist 2 of a plurality of what are known as compute shader 3 threads. 4 Q And is that a general compute task? 5 A Depending on the architecture. It could 6 be implemented as a general compute shader, not a 7 general compute task. 8 Q What's the difference? 9 A So the example I gave is a physics task as 10 being performed as a non-graphics task. 11 A task, as I mentioned before, is a unit 12 of processing work decomposable into two or more 13 related threads, and so one way of implementing 14 that physics task would be with two or more 15 compute shader threads. 16 MR. JOHNSON: We've been going about an 17 hour. Let's take a break. 18 (WHEREUPON, a recess was had.) 19 BY MR. JOHNSON: 20 Q Are you ready, Dr. Hart? 21 A Yes. 22 Q All right. So we're going to talk about	44 1 as a unit of processing work. The ITC's 2 construction is a unit of processing work. 3 And instead of a portion of application to 4 be executed, I used the -- that the unit of 5 processing work is decomposable into two or more 6 related threads. 7 All of the examples I saw in the '381 and 8 in the prior art -- I didn't see any examples of 9 task in a prior art, but the '381, they were -- 10 that I recall. I didn't see specific examples of 11 a task in the prior art that I can recall. 12 The tasks that I saw used in the '381, all 13 of those examples could be decomposed into two or 14 more threads. So that's what I used. 15 Q Do you agree that a task can be a portion 16 of an application to be executed? 17 A My -- what I agreed to is my construction, 18 which is a unit of processing work decomposable 19 into two or more related threads. So that's -- 20 that's what my opinions are based on. 21 Q So in your opinion, a portion of an 22 application to be executed is not a task, correct?

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45 1 A I didn't use that construction for a task. 2 I didn't form an opinion that -- on anything where 3 I saw something that was a portion of an 4 application to be executed in those terms that 5 explicitly where I needed to determine that was a 6 task or not. 7 What I did see was examples in the '381 of 8 tasks that were decomposable into two or more 9 related threads, and so that's what I used instead 10 of "portion of an application to be executed." 11 Q What I'm trying to get to is that the 12 phrase "portion of an application to be executed" 13 was in the construction by the ITC, and you 14 removed it, and so I'm trying to understand why 15 you removed it from the construction. 16 Is it because you do not believe that a 17 portion of an application to be executed is a 18 task? 19 A I replaced it. It's the same unit of 20 processing work but decomposable into two or more 21 related threads. Two or more related threads are 22 also a portion of an application to be executed	47 1 CPU that's non-threaded that could be a single 2 thread. That was not really described in the 3 '381. Everything in the '381 had multiple 4 threads. And so that's why I specified that the 5 unit of processing work needed to be decomposable 6 into two or more related threads. 7 Q So you agree that there can be 8 single-threaded tasks? 9 A No. "Task" is a claim term of the '381. 10 I looked at task and the way a person of ordinary 11 skill in the art would understand task as used in 12 the claims in light of the specification. 13 And the specification was very clear that 14 a task could be decomposed into -- was a unit of 15 processing work that could be decomposed into two 16 or more threads. 17 Q Outside of the context of the '381 patent, 18 is there such a thing as a single-threaded task? 19 A There are single -- there are threaded 20 processors, there are processors that are not 21 multithreaded. Those weren't really part of the 22 '381. I didn't really look at the tasks in those
46 1 but a bit more specific. 2 For example, it eliminates the idea that a 3 task could be a single thread. We know that a 4 task is not a thread. Pedram -- Dr. Pedram and I 5 agree that a thread is not a task. A task is more 6 than a single thread. 7 And it was unclear what a portion would be 8 in the ITC construction. And based on the '381 9 and all of the examples in the '381 using multiple 10 threads, I was able to come up with a more 11 accurate construction using that a task be 12 decomposable into two or more related threads. 13 Q So is your understanding of a unit of 14 processing work to be something that has to be 15 related to threads? 16 A My opinion is that a task is a unit of 17 processing work that's decomposable into two or 18 more related threads. I don't think a person of 19 ordinary skill in the art would see a unit of 20 processing work necessarily as being decomposable 21 into two or more related threads. 22 There could be a CPU task on an ordinary	48 1 contexts. 2 That's why I was very careful that the 3 tasks that we examined in the '381 were as they 4 were intended and as they would be understood by a 5 person of ordinary skill in the art reading the 6 '381. 7 Q I just want a simple yes or no. 8 Is there such a thing, outside the context 9 of the '381 as a single-threaded task? 10 MR. DOKHANCHY: Objection. Asked and 11 answered. 12 BY THE WITNESS: 13 A I don't have an opinion on a task outside 14 of the '381. All of my opinions are focused on a 15 task as it relates to the '381. I don't have any 16 opinions beyond that. 17 BY MR. JOHNSON: 18 Q Earlier you said, "There could be a CPU 19 task on an ordinary CPU that's non-threaded that 20 could be a single thread," correct? 21 A Yeah, as an example to why I chose two or 22 more threads in the definition of what a task is

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49 1 in the '381 patent. 2 Q Have you in your research ever used a CPU 3 that's non-threaded that had the ability to run a 4 single-threaded task? 5 A I have used a CPU that was not 6 multithreaded. 7 Q Does that mean it could run a 8 single-threaded task? 9 A I'm not sure what a single-threaded task 10 is. I'm not sure what you mean by that. That 11 term doesn't come up with the '381. It's not a 12 generally used term. 13 Threads are – tasks are not threads. 14 Q Is there a task that you are aware of that 15 could be decomposed into a single thread? 16 A I didn't need to really investigate that 17 in the '381. I think Dr. Pedram was clear in 18 stating that a thread is not a task, a task is not 19 a thread, a task is not a single thread. And we 20 are speaking about a task in terms of how a '381 21 refers to a task. 22 Q I'm not talking about the '381 patent.	51 1 single thread that is being executed multiple 2 times, each time on a different data element. So 3 that would be a case where you've got multiple 4 executions of that single instruction of that 5 single thread through the execution. 6 I believe that was understood in the '381. 7 I don't really refer to instructions in that level 8 of detail, but you're executing a thread as a 9 sequence of instructions in SIMD as a single 10 thread that – where the instructions are being 11 replicated across all of the processing elements. 12 Q So was that a yes or a no to my question? 13 A Can you repeat the question? 14 Q Do you agree that a GPU where all 15 processing elements perform the same instruction 16 stream can only run one thread at a time? 17 A So you're not referring that question to 18 any particular – to the '381 patent or any of the 19 prior art. There is some variance in the way 20 people refer to threads across the processing 21 elements of a SIMD processor. 22 So the construction I used for a thread
50 1 I'm asking you about your statement where you 2 said, "There could be a CPU task that could be a 3 single thread." 4 A I was differentiating that from a '381 5 task. 6 Q Right. And so that's exactly right. So 7 what I'm asking you is: What is the CPU task that 8 could be a single thread that's differentiated 9 from the '381 patent? 10 A I think I, as I said before, have used 11 processors that were not multithreaded. So 12 anything you run on a – on one of those 13 processors that's not multithreaded would be 14 running as a single thread. 15 Q Do you agree that a GPU where all 16 processing elements perform the same instruction 17 stream can only run one thread at a time? 18 A So a thread is a sequence of instructions. 19 And so a SIMD processor, single instruction, 20 multiple data items, that same instruction is 21 being executed on multiple processing elements. 22 So that single instruction is part of a	52 1 was a sequence of instructions. And if that 2 thread -- that sequence of instructions, if that 3 instruction is being replicated across all of the 4 processing elements, then all of those processing 5 elements are each -- are collectively executing a 6 single thread. 7 Each processing element executing that 8 thread on different data items, that's using my 9 construction of a thread as a sequence of 10 instructions and using a SIMD processor as used in 11 the '381. 12 Q If I have an example of adding values in a 13 1D array of integers, can that task be implemented 14 as a single thread? 15 A A task -- a thread is not a task. I would 16 have to see what was the purpose of that. I'd 17 have to see the context to be able to determine 18 how that was, you know, performed as a unit of 19 processing work and then determine what threads 20 were being used, if that was something that would 21 be considered a task for the '381. 22 Q Did you make a determination as to what

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53 1 the smallest unit of processing work would be 2 within the '381 patent? 3 A Well, the construction I used is a unit of 4 processing work decomposable into two or more 5 related threads. So the smallest would be a unit 6 of processing work decomposable into two related 7 threads. 8 Q Could a unit of processing work take the 9 form of something other than something that could 10 be decomposable into threads? 11 A I mean, I used the construction that the 12 task was a unit of processing work decomposable 13 into two or more related threads. That sufficed 14 in understanding a task for the '381 and also the 15 analysis of all the prior art. 16 I didn't have to consider that particular 17 situation. 18 Q Do you know whether or not a unit of 19 processing work can take the form of something 20 other than something that could be decomposable 21 into threads? 22 A I didn't need to consider that. Didn't	55 1 tasks received by the engines? 2 A No, I don't think I offered any opinions 3 on that particular situation that I recall. 4 Q Okay. Well, you have the claim in front 5 of you, right? 6 A Yes. Claim 15? 7 Q So reading claim 15, do you believe that 8 those tasks have to be the same? 9 A I don't know. I didn't really analyze 10 that. 11 I'm not a lawyer. "The plurality of 12 engines configured to receive from a scheduling 13 module associated with a second processing unit, a 14 plurality of tasks and then the shader core 15 configured to receive the plurality of tasks from 16 at least one of the plurality of engines." 17 So the fact that we're speaking of "a 18 plurality" and "the plurality" seems to be 19 referring to that. But I haven't analyzed any 20 examples where there would be other tasks not 21 received. 22 I don't know if that -- those examples
54 1 see any examples. None come to mind where that 2 came up, so I didn't really consider that. 3 Q Again, I'm not asking for your opinion; 4 I'm asking whether or not you have any knowledge 5 of that at all? 6 A Not off the top of my head. I'd have 7 to -- I'd have to look. 8 Q Is it your opinion that the tasks received 9 by the shader core in claim 15 must be the same 10 tasks received by the engines in claim 15? 11 A I don't know that I ever needed to 12 consider that. I never -- I don't recall from 13 Dr. Pedram's report that he ever offered an 14 opinion where the tasks received by the shader 15 core were different than the tasks received by the 16 engines. 17 If there was an opinion there, then I 18 could take a look at it, but I don't recall 19 Dr. Pedram offering that possibility. 20 Q I'm asking you whether or not you formed 21 an opinion as to whether or not the tasks received 22 by the shader core in claim 15 must be the same	56 1 just never appeared in Dr. Pedram's report, so I 2 didn't really look at it. 3 Q It's your opinion that a thread is not a 4 task, correct? 5 A Yes. I agree with Dr. Pedram on that 6 point. 7 Q What's the difference between a thread and 8 a task? 9 A Well, one difference is that a task is a 10 unit of processing work decomposable into two or 11 more related threads. 12 Q So task in the claims has to be in a 13 construct that has not yet been decomposed, 14 correct, according to your construction? 15 A If I'm looking at something that is a 16 task, it represents more than a single thread. So 17 it would be executed as two or more threads. 18 Q That's not my question. 19 Your definition of a task is something 20 that must be decomposable into two or more 21 threads, correct? 22 A Yes, it's a unit of processing work

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57 1 decomposable into two or more threads. 2 Q So if it's already decomposed into 3 threads, it's no longer a task, correct; because 4 it's just threads? 5 A No. That's not what that -- that's not 6 what that definition states. I would have to see 7 the particular system, how the task was 8 represented, how the threads were represented to 9 determine what the task was, what the threads 10 were. 11 Q But your construction says "is 12 decomposable," correct? 13 A Yes, my -- it doesn't say "is." It's a 14 unit of processing work decomposable into two or 15 more related -- 16 Q So if I have a collection of threads, 17 those are not decomposable into two or more 18 threads, correct? 19 A A random collection of threads might not 20 be a task. 21 Q If I have a task and I -- it decomposes 22 into two threads, can you assume that for me?	59 1 Q That's not a task -- right? -- because 2 it's already been decomposed -- 3 MR. DOKHANCHY: Objection. 4 BY MR. JOHNSON: 5 Q -- those are just threads? 6 MR. DOKHANCHY: Incomplete hypothetical. 7 BY THE WITNESS: 8 A I don't know. I would need to see how 9 those two threads were represented, how the tasks 10 was represented. It's not -- decomposable doesn't 11 speak of when that decomposition happens. 12 It's talking about the relationship 13 between tasks and threads. A thread is not a 14 task. A task is decomposable into threads, 15 multiple threads. 16 And so the task doesn't have some 17 requirement that that decomposition happen at one 18 stage or another. That's not part of this 19 definition. It's just that it -- 20 BY MR. JOHNSON: 21 Q So then you agree -- 22 A -- decomposing.
58 1 A I -- 2 Q Let me strike it. I just want to be clear 3 what I'm talking about. 4 A task under your construction must be 5 decomposable into at least two threads, correct? 6 A And it also must be a unit of processing. 7 It must represent a unit of processing work. 8 Q Right. Let's assume it's a unit of 9 processing work and it's decomposable into two 10 threads, okay? 11 A Okay. 12 Q That's the task that we're going to talk 13 about. Do you understand that? 14 A Okay. 15 Q So now assume that it's already been 16 decomposed into its two component threads, okay? 17 Do you understand that? 18 A Okay. 19 Q And so I have then saved in memory just 20 the two decomposed threads. Do you understand 21 that? 22 A Okay.	60 1 Q I didn't mean to talk over you. 2 So then you agree that I could receive two 3 threads and that would be a task, correct? 4 A I would have to see the system, see what 5 is -- 6 Q No. No. 7 A -- see what is receiving it. 8 Q Just hold on. 9 We're talking about the hypothetical I 10 gave you. That's the only thing we're talking 11 about. We're talking about the two threads that 12 are decomposed from the unit of work that we just 13 set up, okay? That's the only two threads we're 14 talking about. 15 So we agreed that we have a task under 16 your definition that is a unit of work, and it was 17 decomposed into two threads. And all I'm saying 18 is, if I receive those two threads, then I would 19 be receiving a task; is that correct? 20 MR. DOKHANCHY: Objection. Incomplete 21 hypothetical. 22

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61 1 BY THE WITNESS: 2 A No. So an example might be Stuttard. 3 Stuttard is a system that receives threads. It's 4 thread-based. It doesn't really -- its processor 5 doesn't know about the tasks; it's just receiving 6 threads. 7 It could be receiving threads from one 8 task or from multiple tasks; it just doesn't know. 9 It's just receiving those threads and executing 10 those threads. 11 You need to know more about the system in 12 order to make any determination like that. And so 13 I made that determination with the '381, and, for 14 example, the Stuttard to be able to differentiate 15 what was processing tasks and what was processing 16 threads. 17 And that's where the definition of a task, 18 that that unit of processing work was helpful in 19 understanding what was going on. 20 BY MR. JOHNSON: 21 Q So I'm not talking about Stuttard. I gave 22 you a hypothetical that's very specific. We have	63 1 executing threads in kind of a task-agnostic 2 manner. It doesn't know about tasks. 3 BY MR. JOHNSON: 4 Q So are you saying that the processor must 5 know that it's receiving a task in order for the 6 threads to be a task? 7 A That's what the '381 is about is tasks. 8 And engines that receive tasks and a shader core 9 that receives tasks and the structure for around 10 those tasks. That structure is missing in other 11 systems; for example, Stuttard. 12 Q So I have an engine that receives a task 13 under your construction. It meets all the 14 limitations of your construction. 15 Can you assume that? 16 A Okay. 17 Q And that engine breaks that task down into 18 two threads that represent the entire task and 19 sends those two threads to a shader core, and that 20 shader core understands that those two threads are 21 a task. 22 Has the shader core received a task?
62 1 a task that is within your proposed construction. 2 It's a unit of work, it's decomposed into two 3 threads. That's the task that we're talking 4 about, okay? Not Stuttard. Not anything else, 5 just your definition of a task. 6 And I have those two threads. If I send 7 those two threads to a different component, have I 8 sent the task or have I sent threads? 9 MR. DOKHANCHY: Objection. Incomplete 10 hypothetical. 11 BY THE WITNESS: 12 A There are examples that go both ways. It 13 depends on the design of the system. The '381 had 14 a system that would send threads to the, like, 15 vertex shader threads and pixel shader threads for 16 processing that were part of the task. And the 17 '381 had the structure in order to manage that as 18 a task. 19 Other systems, for example Stuttard, do 20 not have that structure that addresses things at 21 that task level. They only -- Stuttard only 22 addresses the thread level, and so it's just	64 1 A So the shader core needs to be configured 2 to receive the plurality of tasks from at least 3 one of the plurality of engines. 4 When you're saying that an engine sends 5 threads to a shader core, in that hypothetical, 6 there's not enough information there to know if 7 we're talking about a shader core configured to 8 receive the plurality of tasks from at least one 9 of the plurality of engines. 10 Q Okay. That's fine. If you want more 11 information, we can play this game. 12 So assume that I have a system that meets 13 every limitation of the claim. 14 A Of claim 15. 15 Q Of claim 15. Okay. And the only details 16 that I want to provide is that the task that's 17 received by the engine meets your proposed 18 construction of a task, it's a unit of work 19 decomposable into two threads. And we'll assume 20 we have two of them, since we need a plurality, 21 okay? 22 And then those engines send the four

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65 1 threads to the shader core so that it's getting 2 two tasks under your proposed definition, and the 3 shader core understands that they're tasks or that 4 those four threads represent tasks. 5 Has it received a task, or did it just 6 receive threads? 7 A If you have a system that meets every 8 element of claim 15, then that system would have a 9 shader core configured to receive the plurality of 10 tasks. 11 I would have to see the details of the 12 system to determine if the way you characterize 13 the portion of that transmission regarding threads 14 is sufficient to meet that element of claim 15. 15 Q What additional information would you need 16 to know to determine whether or not it was 17 receiving a task? 18 A I've looked at the '381 and the 19 embodiments in the '381 to determine that those 20 shader cores were receiving tasks. I looked at 21 the embodiments of Stuttard and saw that the 22 structure there was just focusing only on thread	67 1 threads. 2 Q And I told you that it does. 3 A Yes. And you also told me that this 4 system met all of the elements of claim 15. So 5 there must be something in the shader core that's 6 receiving a task and not just threads. I would 7 need to see what that was. 8 Q Can a task be executed on a multithreaded 9 processor or only threads? 10 A Well, a task is a unit of processing work 11 decomposable into two or more related threads. 12 Those threads would then be executed. 13 Q So is the task being executed or the 14 threads? 15 A I don't know that I've seen any 16 terminology in the '381 speaking of the execution 17 of a task. 18 Yeah, claim 15. "To execute a first task 19 from the plurality of tasks while executing a 20 second task from the plurality of tasks." 21 All the examples I saw from the '381 and 22 from the prior art were executing that task as
66 1 details, not any -- anything related to a task to 2 determine that it was not receiving a task. 3 It was just receiving threads. 4 Q What additional information would you need 5 to know to determine whether or not a shader core 6 was receiving a task in the hypothetical that I 7 gave you? 8 A I wouldn't be able to do it in a 9 hypothetical. I need to see much more detail 10 about the configuration of that shader core and 11 what it's receiving from the engines. 12 You told me that this hypothetical system 13 met all of the elements of claim 15. And so if 14 they're there, I would need to find out how that's 15 meeting it. 16 If a shader core is just receiving 17 threads, that's not enough. 18 Q Okay. What additional thing must you know 19 in order to know that those threads are a task? 20 A Well, one is they need to meet the 21 definition of a task, a unit of work -- a unit of 22 processing work decomposable into two or more	68 1 threads, as at least two threads. 2 Q As threads. What does that mean when you 3 say "as threads," executing the task as threads? 4 A I was trying to answer your question. 5 Q So it's executing threads, not tasks, 6 correct? 7 A It's doing both. The task is decomposable 8 in the threads. Executing the threads will 9 execute the task. 10 Q So how does the system of the '381 know if 11 the shader core is receiving a task or just 12 threads? 13 A I don't know if I have any specific answer 14 to that question in the report. 15 One way would be that the shader core also 16 receives state data associated with the task, and 17 so you would want to make sure that that state 18 data regarding the task is available to the shader 19 core. 20 Q So if the shader core receives state data, 21 it will know that it's receiving a task? 22 A If it receives state data corresponding to

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69 1 the task, then that's one way of -- that's one 2 part of knowing that a shader core is receiving 3 the task. 4 Q So does that mean that I could send 5 threads related to multiple tasks, but the state 6 data will identify what tasks are present as it's 7 received by the shader core? 8 A If we look at a system like Stuttard, it's 9 not receiving any state data regarding to the 10 tasks that those threads are a part of. It's just 11 receiving the threads and data regarding the 12 threads at the thread level, not at the task 13 level. 14 So that's certainly part of what you would 15 look for if you wanted to make sure that a shader 16 core was receiving tasks and not just threads. 17 Q So I'm just trying to understand your 18 distinction. 19 Are you saying that the shader core has to 20 know that it received all the threads for a 21 particular task in order for it to have received a 22 task?	71 1 examine that, so I don't really have an opinion on 2 that particular situation. I'd have to see an 3 example to know. There -- 4 Q Dr. Hart, with all due respect, I mean, 5 you're much smarter than I am. So I'm just trying 6 to understand the distinction of how or -- strike 7 all that. 8 I just want to know: What is your opinion 9 about whether or not a shader core receives a 10 task? Is it that it has to know it's a task? Is 11 it that it's receiving all the threads of a task? 12 How do I know when a shader core has received a 13 task? 14 MR. DOKHANCHY: Objection. Compound. 15 Vague. 16 BY THE WITNESS: 17 A It needs to satisfy claim 15 as the 18 element for the shader core. It needs to be 19 configured to receive a plurality of tasks from at 20 least one of the plurality of engines and then 21 execute -- execute the tasks, and part of that is 22 the state data it also understands of the tasks.
70 1 A No. I don't know that I ever said that. 2 I don't know that Dr. Pedram ever looked at that 3 as a requirement. I think what I did say was that 4 the shader core needed to receive state data 5 associated with each of the tasks. 6 Q If a shader core receives all the threads 7 associated with a task that were decomposed from 8 the task and all the state data, would it have 9 received the task? 10 A If it receives -- I'm sorry. Can you ask 11 that question again? 12 Q Sure. If the shader core of the -- I'm 13 sorry. Strike that. 14 If a shader core received all of the 15 threads that were decomposed from a particular 16 task and it received all the state data associated 17 with those -- with that task, would that mean that 18 that shader core received the task, even if it 19 didn't know it was a task? 20 A I don't recall looking at that particular 21 situation. I don't recall Dr. Pedram coming up 22 with that particular situation. I didn't have to	72 1 BY MR. JOHNSON: 2 Q And what does it mean to you to be 3 configured to receive a plurality of tasks? 4 A I didn't come up with a construction for 5 that claim term. 6 Q But you identified whether or not the 7 prior art met that limitation, correct? 8 A I found that the prior art did not meet 9 that limitation. 10 Q So in order to determine that the prior 11 art does not meet a limitation, don't you have to 12 first know what that limitation means? 13 A I know that a thread is not a task. And 14 if I find a shader core that's only looking at 15 thread information and nothing beyond thread 16 information, then it's not receiving a task. 17 Q Okay. So if it receives all of the 18 threads from a decomposed -- strike that. 19 If that shader core receives all of the 20 decomposed threads from a task, it may still not 21 know it's receiving a task, and, therefore, it 22 would not be receiving a task under your

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73 1 interpretation, correct? 2 MR. DOKHANCHY: Objection. Misstates 3 prior testimony. 4 BY THE WITNESS: 5 A Right. You would need, for example, the 6 state data associated with the task. If all 7 you're receiving is thread data, the thread and 8 any state data regarding those particular threads, 9 you don't know that they're coming from the same 10 task or different tasks. 11 BY MR. JOHNSON: 12 Q If a shader core receives all of the 13 decomposed threads from a task and its state data, 14 but the shader core does not know it's a task, 15 then is it receiving a task? 16 A You said "its data." What data? 17 Q I said, "its state data," the associated 18 state data with the threads as required by the 19 claim. 20 A No. If you have a shader core that's only 21 receiving threads, it's not receiving a task. 22 Q That's not what I said. I said: If the	75 1 the Board? 2 A If a shader core just receives threads, 3 it's unclear to me how it would know if those 4 threads were part of the same task or a different 5 task. That wouldn't satisfy claim 15 that 6 requires a shader core configured to receive a 7 plurality of tasks. 8 Q And the part of your answer that I don't 9 understand is: Does the shader core need to know 10 that the threads were part of the same task or a 11 different task? 12 A The shader core needs to receive tasks. 13 It's a shader core configured to receive the 14 plurality of tasks from at least the plurality of 15 engines. I don't have any opinions beyond that 16 because I didn't need to examine that particular 17 situation. 18 If you showed me an example from 19 Dr. Pedram's report or from my report where I look 20 at a shader core that was not disclosed in the 21 '381 from the prior art that received information 22 that that was a task, then I'd be happy to respond
74 1 shader core receives all of the decomposed threads 2 from a task and its associated state data as 3 required by claim 15, is that shader core 4 receiving a task? 5 A If the shader core satisfies claim 15, 6 then it's a shader core configured to receive a 7 plurality of tasks. 8 What you said is a shader core that just 9 receives thread -- all the threads from a task and 10 the state data of those threads. If all it's 11 receiving is thread information, it's not 12 receiving any task information, I don't see how it 13 could be receiving tasks. 14 Q I'm not sure how I could ask it any 15 simpler. 16 What I want the Board to be able to 17 understand is whether or not your interpretation 18 is that the shader core can receive the threads 19 and that would be representative of a task. Or 20 does it have to receive the task before it's 21 decomposed into threads? 22 Can you answer that question or not for	76 1 to it, but I didn't see any. 2 I did not see any examples -- any shader 3 cores, anything alleged to be a shader core in the 4 prior art that was configured to receive the 5 plurality of tasks and satisfy claim 15. 6 Q And earlier you told me that you had not 7 formed an opinion as to whether or not the tasks 8 received by the shader core must be the same tasks 9 that were received by the engines, correct? 10 A I did not see any examples put forward by 11 Dr. Pedram, nor any examples from the '381 or the 12 prior art where that would have been the 13 situation. 14 Q Look at Page 58 of your declaration and 15 Paragraph 110. 16 The first sentence says, "Based on the 17 claim language, which refers to the tasks received 18 by the shader core as 'the' plurality of tasks, a 19 POSITA would understand that the tasks received by 20 the shader core must be the same tasks received 21 earlier by the engines, even if the tasks have 22 been decomposed into threads."

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77 1 Did I read that correctly? 2 A Yes. 3 Q So you did form an opinion as to whether 4 or not the tasks have to be the same, correct? 5 A Yeah. Yeah. I didn't recall that. 6 Thanks for showing me that. And it's consistent 7 with what I said before regarding "the." 8 Q How does the system in the '381 patent 9 know that any received thread that the shader core 10 belong to the same task? 11 A It looks like column 7 of the '381, that 12 "Arbitration logic merely provides tasks to the 13 shader core." So that's speaking of the 14 embodiment in Figure 2 of the '381, specifically 15 of that arbitration logic that lies between the 16 engines and the shader core. 17 And so column 7 is describing that that 18 arbitration logic provides tasks to the shader 19 core, so the shader core is receiving tasks in 20 that embodiment. 21 Q So the arbitration logic provides tasks to 22 the shader core, correct?	79 1 '381 has a shader core that's receiving tasks 2 because it says so in column 7. 3 BY MR. JOHNSON: 4 Q That's not my question. So answer my 5 question. Can you? 6 A I didn't examine that question in my 7 opinions on the '381 because my opinions on the 8 '381 were responsive to Dr. Pedram's opinions, and 9 that particular detail didn't come up. Dr. Pedram 10 didn't raise it, and I didn't consider it further 11 than what's in column 7 describing that Figure 2 12 embodiment. 13 Q But you have argued in your declaration 14 that the various prior art shader cores are not 15 receiving tasks, correct? 16 A I'd have to look at my arguments. But if 17 you take a system like Stuttard, Stuttard is 18 operating entirely at the thread level. It 19 doesn't know what's disclosed there, what's being 20 received by the shader core. The alleged shader 21 core in Stuttard doesn't know about tasks. It's 22 not receiving tasks.
78 1 A It's part of the connection where the 2 shader core is receiving tasks from the engines. 3 Q And my question was: How does the shader 4 core know it's receiving tasks? 5 A It gets them through the arbitration logic 6 in the '381 Figure 2 embodiment. 7 Q So does the arbitration logic identify 8 that what it is sending is a task? 9 A I didn't reproduce the quote. I didn't 10 really look at those details of the arbitration 11 logic in this response. It's talking about the 12 role of the shaders and that shaders alone are not 13 engines. 14 Q So a system where the shader core receives 15 and executes all of the decomposed threads of a 16 task along with the required state data may or may 17 not satisfy the claim depending on whether or not 18 the shader core knows it's attached, correct? 19 MR. DOKHANCHY: Objection. Asked and 20 answered. 21 BY THE WITNESS: 22 A I know that the Figure 2 embodiment in the	80 1 Q But if in Stuttard its shader core 2 receives all of the decomposed threads from a task 3 along with all the required state data, would that 4 satisfy the claim language? 5 A I looked at Stuttard the way that Stuttard 6 was presented. I looked at Stuttard in the way 7 that Dr. Pedram presented Stuttard. I did not see 8 that Stuttard satisfied claim 15. 9 MR. DOKHANCHY: I don't know if now is a 10 good time for a break, but whenever you get a 11 chance, Jeff. 12 BY THE WITNESS: 13 A Paragraph 140, "Stuttard discloses that 14 the alleged plurality of engines only receive 15 threads, not tasks." 16 And Paragraph 141, "The alleged shader 17 core, Stuttard's processing blocks, does not 18 receive the claim tasks but threads." 19 So I did not see any evidence in Stuttard. 20 A person of ordinary skill in the art would not 21 understand Stuttard, what was put forth as its 22 shader core according to Dr. Pedram as receiving

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81 1 tasks, it received threads. 2 BY MR. JOHNSON: 3 Q And my question is: If Stuttard is 4 receiving all the threads that were decomposed 5 from a task, did it receive the task? 6 A I don't know how Stuttard would know it 7 was receiving a task if all it's receiving is 8 threads. A thread is not a task. If there's no 9 information about the task, how would a shader 10 core know it's receiving all the threads of a task 11 or some threads from one task and some threads 12 from another task. 13 Q And is knowledge requirement by the shader 14 core a limitation in the claim? 15 A Claim 15 requires a shader core that 16 receives tasks. 17 Based on that specification, regardless of 18 knowledge or some other thing that we want to read 19 into the claim, I looked at whether or not the 20 shader core received tasks, and I found that in 21 this Stuttard example, the shader core did not 22 receive the claim tasks.	83 1 A Yes. 2 Q So it's your opinion that an engine, as 3 recited in the '381 claims, must perform two 4 functions: The first one being receiving a task 5 from a scheduling module; and the second one 6 loading the state data associated with the task, 7 correct? 8 A Yes. That's in Paragraph 35 of my report. 9 Q Is there an ordering between those two 10 recited functions? 11 A No. I don't see anything in this 12 construction that I came up with that requires an 13 order. 14 Q And so -- 15 A I didn't need to consider -- 16 Q -- to be clear what we're talking about, 17 what I mean is does it have to receive the task 18 before loading the state data? 19 A I don't see a requirement of that in this 20 construction. 21 Q Okay. So you didn't apply any sort of 22 ordering requirement in your analysis, correct?
82 1 Q Because it doesn't identify it as a task, 2 correct? 3 A Because all it receives are threads. 4 Q But if it receives all of the threads 5 decomposed from a task, wouldn't it have received 6 the task? 7 MR. DOKHANCHY: Objection. Asked and 8 answered repeatedly. 9 BY THE WITNESS: 10 A Yeah, as I said before, I don't know how 11 something that just receives threads knows where 12 those threads came from, if they were decomposed 13 from one task or multiple tasks. All this 14 receives is threads. 15 All Stuttard's alleged shader core 16 receives are threads. 17 MR. JOHNSON: We can take a break. 18 (WHEREUPON, a recess was had.) 19 BY MR. JOHNSON: 20 Q So I want to move to the term "engine," 21 okay? 22 Are you ready?	84 1 A Not that I recall. 2 Q And do you agree that the engine in the 3 '381 patent claims can be software, hardware, or 4 some combination of the two? 5 A Yeah, I don't see any requirement in this 6 construction that it be software, hardware, or 7 some combination of the two. 8 Q Do you recall whether or not the 9 '381 patent describes any hardware-only embodiment 10 of an engine? 11 A I don't recall. I'm not sure that any 12 hardware/software issues -- I'm trying to recall 13 if that came up in Dr. Pedram's report. I don't 14 recall any specifics of that. 15 Q Do you recall the term "virtual engine" 16 being disclosed in the '381 patent? 17 A Yes. 18 Q And in your experience is a virtual engine 19 hardware, or software, or some combination of the 20 two? 21 A I examined the '381 patent, I examined it 22 how a person of ordinary skill in the art would

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85 1 read it, and I didn't see any -- anything stating 2 any requirement on a virtual engine like that. 3 Q I take it from your answer that you mean 4 to say that it could be software or hardware or 5 some combination of the two? 6 A The term "virtual engine" was synonymous 7 with engine. I didn't see anything that made it 8 distinct. 9 Q When reading the '381 patent and forming 10 your opinion that each engine must perform these 11 two functions, did you determine whether or not 12 each function was being performed in hardware or 13 software? 14 A I don't recall making the distinction in 15 my opinions that were responsive to Dr. Pedram's 16 opinions in this matter. 17 Q Is it possible that the two recited 18 functions for an engine in the '381 patent could 19 be performed both in hardware and still satisfy 20 the claim language? 21 A I didn't really look at that, whether they 22 were hardware, software, or otherwise. I looked	87 1 things were implemented on a particular platform. 2 Q Has your research focused more on hardware 3 or software? 4 A Both. 5 Q Would you consider yourself a hardware guy 6 or a software guy? 7 A Both. 8 Q Okay. Claim 15 refers to the engines as a 9 plurality of engines, correct? 10 A Yes. The limitation on engine begins a 11 plurality of engines. 12 Q And you agree with me that claim 15 does 13 not use the phrase "each engine" anywhere in it, 14 correct? 15 A Yeah, I don't see "each engine" mentioned. 16 Q So you would agree with me that the basis 17 for your opinion that each engine must be 18 configured to independently receive tasks and load 19 state data comes from the embodiments in the 20 specification, correct? 21 A The way I read the claims and the way a 22 person of ordinary skill in the art would read the
86 1 at them functionally. And so I focused on the 2 function and that sufficed to analyze the '381 and 3 the prior art. 4 Q So as a person of ordinary skill in the 5 art, as a professor of many, many years and a 6 research professor in this field, is it possible 7 to perform those two functions in hardware only? 8 A I don't know. The -- I haven't looked at 9 a lot of specific implementations of these. 10 These -- the engine came -- these engines were 11 implemented in NVIDIA products, but I didn't look 12 at the architecture at that level of detail of the 13 NVIDIA products. 14 Q So you have no experience with these two 15 functions being performed in hardware only? 16 A Sorry. ATI products, not NVIDIA products. 17 Can you repeat the question? 18 Q Do you have any experience in performing 19 these two functions in hardware only? 20 A Not at that level of detail. I haven't -- 21 I've used the functionality, but I didn't dig down 22 into the transistor level of logic of how these	88 1 claims is, in the light of the specification, the 2 specification uses embodiments as examples for its 3 terms. And in all of the examples it used for 4 those terms as well as in the way it described 5 those terms, the engines were -- the engines met 6 this construction. 7 Q So based on the examples in the patent, 8 you believe that each engine must be configured to 9 independently receive tasks and load state data, 10 correct? 11 A Not only on the examples, but also in 12 everywhere that the engines were referred to in 13 the patent and how they were being described, both 14 in the embodiments and apart from the embodiments. 15 Q Is there any part of the claim language 16 itself that requires each engine to independently 17 receive tasks and load state data? 18 A The claim requires a plurality of engines. 19 A person of ordinary skill in the art reading that 20 claim would see what is required of those engines 21 for claim 15, but that they also be engines and 22 then would refer to the specification to

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89 1 understand what an engine was; and, from that, 2 understand that it be required to independently 3 receive from a scheduling module at least one task 4 and load state data. 5 Q So could you identify for the Board 6 whether or not there is claim language that 7 specifically requires each engine to independently 8 receive tasks and load state data? 9 A Claim 15 requires a plurality of engines. 10 Q Are the claimed engines limited to virtual 11 engines? 12 A As I mentioned before, I didn't see any 13 real distinction between virtual engines and 14 engines. 15 Q Do you recall in the ITC investigation 16 whether or not Judge Elliot addressed whether or 17 not each engine must receive tasks and load state 18 data? 19 A I'm offering up construction here. So I 20 don't recall the ITC construction that was used. 21 So I don't know that I have the ITC construction 22 or what construction the judge was using. I don't	91 1 Exhibit 1100 is a version of the initial 2 determination from the 1318 investigation that you 3 were a part of. 4 And as Counsel has indicated, it is 5 redacted to remove confidential information 6 because this is the more public version, okay? 7 A Okay. 8 Q And if you will turn to Page 91 -- 9 actually, looking at Page 90, you will see that 10 this part of the determination by Judge Elliot is 11 addressing claim construction. 12 Do you see that? 13 A Yes. 14 Q And on Page 91, he's addressing the term 15 that we're talking about, which is "a plurality of 16 engines configured to receive a plurality of tasks 17 and the load state data associated with each of 18 those plurality of tasks." 19 Do you see that? 20 A Yes. 21 Q And in the last paragraph of that page, 22 Judge Elliot wrote, "AMD is not persuasive here.
90 1 recall off the top of my head. 2 MR. JOHNSON: This is going to be 3 confusing because I believe that this was marked 4 as Exhibit 2002 in the '053 IPR. 5 MR. DOKHANCHY: Okay. 6 MR. JOHNSON: And I don't think it was 7 marked in the '381 IPR, so I'm not really sure 8 what exhibit number to give it. 9 MR. DOKHANCHY: I would guess 2100 is -- 10 or not 2100. 1100 is probably safe. 11 MR. JOHNSON: Yeah, let's do that. So can 12 you mark this as Exhibit 1100, please. 13 (WHEREUPON, a certain document was marked 14 Exhibit No. 1100, for identification.) 15 MR. DOKHANCHY: This is redacted to remove 16 claimant's confidential information and presumably 17 AMD's? 18 MR. JOHNSON: Yes. 19 MR. DOKHANCHY: Okay. Sorry. I meant 20 respondent's, not claimant's. 21 BY MR. JOHNSON: 22 Q So what I've handed you that was marked as	92 1 The limitation refers to a plurality of engines as 2 receiving a plurality of tasks. 3 "In a plain and ordinary sense, this means 4 the plurality as a group do the receiving. If 5 there was subsequent language regarding each 6 engine, for example, then AMD's position would 7 have more merit, but there is not. 8 "Similarly, as written, it is the entire 9 group of engines which loads the state data to be 10 evaluated as a group. There is no reference to 11 what each engine must do. This clear language of 12 the claims controls." 13 Did I read that correctly? 14 A I believe so. 15 Q Did you take into account Judge Elliot's 16 analysis when forming your opinion as to whether 17 or not each engine must load state data and 18 receive tasks? 19 A So the materials considered is on Page 4 20 in Paragraph 14. I considered order number 31 21 from this matter. I don't see anything else 22 regarding this matter. So I considered order 31.

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93 1 Q This is not order 31. Order 31 in the 2 13 investigation is a claim construction ruling 3 which does not have this analysis in it -- 4 A Okay. 5 Q -- he didn't rule on that. 6 A Then I did not consider this in preparing 7 my -- 8 Q Does that change your opinion as to 9 whether or not each engine must receive tasks and 10 load state data? 11 A No. But I have some rather detailed 12 explanations for this beginning on Page 11, 13 Paragraph 30, all the way through to Page 14, 14 Paragraph 35 on why I believe this construction 15 more accurately represents what a person of 16 ordinary skill in the art would understand when 17 reading "engine." 18 Q You agree with me that the shader core in 19 claim 15 must be configured to receive the 20 plurality of tasks from at least one of the 21 plurality of engines, correct? 22 A Correct.	95 1 A I don't think I disagreed with that. 2 Q Okay. I was just trying to clarify your 3 statement. 4 MR. JOHNSON: Why don't we break and take 5 lunch then. 6 (WHEREUPON, a recess was had.) 7 BY MR. JOHNSON: 8 Q Okay, Dr. Hart, are you ready to resume? 9 A Sure. 10 Q Claim 20 of the '381 patent recites the 11 term "priority," correct? 12 A I believe so. Let me confirm. 13 Yeah. 14 Q Have you run across task priority prior to 15 this case? 16 A I've run across things that followed that 17 same concept. I mean, "task" is a claim term, and 18 "priority" is a claim term, so they mean something 19 very specific in claim 20 and for the '381. But 20 I've run across similar things. 21 Q So what does it mean to give a task a 22 priority?
94 1 Q And you agree with me that language means 2 that a single engine may send the entire plurality 3 of tasks to the shader core, correct? 4 A There would need to be more than that to 5 satisfy claim 15. But claim 15 allows the 6 plurality of tasks to be received by the shader 7 core from at least one of the plurality of 8 engines. So that would include one engine. 9 Q You agree with me that if one engine can 10 send the entire plurality of task as claimed, then 11 that entire plurality of task must have been 12 received by that one engine from the scheduling 13 module, correct? 14 A Claim 15 doesn't really talk about 15 sending; it talks about receiving. The shader 16 core is configured to receive the plurality of 17 tasks from at least one of the plurality of 18 engines. And so it doesn't really say anything 19 about an engine sending anything. 20 Q How can shader core receive from one 21 engine a plurality of tasks if that engine didn't 22 ever have the plurality of tasks?	96 1 A So I don't know that we've got the figure 2 in front of us, but there was a figure in the '381 3 that showed a couple different engines. One of 4 them was a low latency engine, and that low 5 latency engine could have a higher priority -- 6 could hold higher -- or receive higher priority 7 tasks than the other engines and then use that 8 priority to make sure that those tasks were 9 responded to with lower latency than the other 10 tasks. 11 Q What does low latency mean? 12 A More immediate. Latency is delay. And so 13 low latency means a lower delay. 14 Q And what do you mean by "delay"? 15 A Computation, how quickly you do something 16 and then how quickly you get a response. 17 Typical example of graphics in latency is 18 the user interface you do something and then how 19 quickly do you see the response. 20 Q So if something is a low latency test, 21 does that mean it needs a faster response or 22 slower response?

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97 1 A Well, faster and slower could, you know, 2 imply changing the rate of computation. You're 3 not really changing the rate of computation. The 4 whole point of these engines is to keep the GPU 5 busy working on these things. 6 And the low-latency engine can use those 7 priorities, for example, to make sure those tasks 8 get addressed more quickly. They don't -- the 9 processing doesn't need to be faster; it could be 10 the same rate of processing. 11 It's just that the response or the amount 12 of GPU resources is greater or more immediately 13 available for those tasks. 14 Q Okay. I understand. I was just trying to 15 understand how the delay related to the latency 16 issue, so -- or how it was processed. I didn't 17 know if it meant it needs to be processed sooner 18 in time or it needs to be processed faster or it 19 could be either one? 20 A Just with lower latency. 21 Q Okay. And so -- I lost track of what we 22 were talking about since I got off.	99 1 the context of claim 20? 2 A I don't believe I provided a construction 3 of priority. I didn't need to provide a 4 construction for priority for claim 20. I thought 5 it was well understood from its description in 6 '381. 7 Q Do you believe that assigning a priority 8 is limited to the embodiments of the specification 9 in the '381? 10 A I didn't need to consider that. I looked 11 at claim 21 and its requirement that a shader core 12 is configured to receive the plurality of tasks 13 based on a priority associated with each of the 14 priority -- plurality of tasks, and that that 15 didn't require a particular embodiment. 16 I understood priority from the description 17 in the specification and its demonstration by that 18 one embodiment. And that was sufficient to 19 understand how it worked in the '381 and to 20 analyze the prior art provided by Dr. Pedram along 21 with his opinions. 22 Q I'm just trying to understand if you
98 1 So going back to my original question, 2 what does it mean to give a task a priority, did 3 you have an understanding as to what the plain and 4 ordinary meaning of that would be in the time 5 frame of the invention? 6 A I certainly understood from the 7 '381 patent, and a person of ordinary skill in the 8 art would have understood from the '381 patent, 9 with their example of a low latency engine and 10 tasks from that low latency engine having a higher 11 priority so that the -- they could be processed 12 with a more immediate response time than other 13 tasks. 14 Q And is the -- is that the only type of 15 priority mentioned in the '381 patent? 16 A I don't know. I don't have the 17 '381 patent in front of me. It's the one I recall 18 off the top of my head. I believe I really 19 addressed priority with respect to claim 20 in 20 response to Dr. Pedram's opinions on claim 20. 21 Q And did you form an opinion as to what the 22 full scope of signing a priority would mean within	100 1 formulated an opinion as to the full scope of what 2 a priority could be? 3 A No, I didn't. My opinions don't include 4 anything regarding the full scope of the priority. 5 The opinions I have are as stated. 6 Q But you determined that the prior art does 7 not show a priority, correct? 8 A I did not find claim 20 to be rendered 9 obvious under any of the grounds, so I did not 10 find it satisfied by any of the prior art. 11 Q I'm just trying to determine if you don't 12 know what the full scope of the term means, how 13 you determined that what was in the prior art is 14 outside the scope? 15 A So I responded to Dr. Pedram's opinions. 16 And so Dr. Pedram provided an opinion, for 17 example, with respect to Wilt and the use of 18 priority. And Dr. Pedram's opinion was that it 19 was disclosed because of context-swapping. 20 And so my opinions were based on what 21 context swapping is and how that relates to what 22 one would expect from priority based on the '381

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101 1 and how they aren't really dependent on each 2 other, they're not related in the way that 3 Dr. Pedram presented. 4 So I didn't need the full scope of 5 priority to understand how Dr. Pedram was 6 presenting context swapping with respect to 7 priority. I was fully informed on what priority 8 was from the '381 patent. 9 Q Okay. So that's what I'm keying on. 10 You were fully informed on what priority 11 was from the '381 patent. So what does that mean? 12 What is the full scope of priority in the '381? 13 A I'm giving my recollections from the 14 '381 patent. I don't have it in front of me. I 15 don't have an opinion that outlines a full 16 definition of priority. 17 What I do have is opinions responsive to 18 Dr. Pedram. Dr. Pedram suggested, for example, 19 that context swapping was an example of priority, 20 and I showed in these paragraphs at 89, 90, 91, 21 that it is not. 22 Q But you did not make a determination as to	103 1 the -- that's not part of my opinions, what the 2 extent of priority is and is not. 3 My opinions are in response to 4 Dr. Pedram's opinions, and I understood the 5 disclosure of priority well enough to be able to 6 respond to Dr. Pedram's opinions. I didn't go 7 beyond that. 8 (WHEREUPON, Exhibit No. 1001 was presented 9 to the witness.) 10 BY MR. JOHNSON: 11 Q So I've handed you what's been marked in 12 this IPR proceeding as Exhibit 1001, which is a 13 copy of the '381 patent. So to the extent you 14 need it, you can use it. 15 And, again, I think we're talking past 16 each other. 17 You determined that the prior art does not 18 show a priority. Dr. Pedram put forth an opinion 19 that there are priorities, things that would fall 20 within the full scope of priority in the patent 21 claims. 22 I need to know how you made the
102 1 what the full scope of priority was in the '381, 2 correct? 3 A I had a full understanding of what 4 priority was from the '381. I don't believe I 5 have an opinion that articulates that full 6 understanding as a construction. 7 Q Okay. What is your full understanding of 8 what a priority is? 9 A I don't know that I've articulated it or 10 rendered an opinion of that. 11 Q Yeah, but you had to have that in order to 12 determine that something is not within it, so I 13 need to know what that is so that I can test your 14 methodology. And if you can't articulate it to 15 me, I don't have any way to test your methodology. 16 So you need to give me your full understanding of 17 what a priority is. 18 A I mean, I'm going off the top of my head. 19 I would -- 20 Q You have your declaration so -- 21 A I don't have the '381. I would need to go 22 through and analyze that. That's not one of	104 1 determination that the priorities that Dr. Pedram 2 says are in the prior art were not within the full 3 definition of priority. 4 A I can certainly tell you how I performed 5 that. I looked at the '381, the specification and 6 the claims, and then I looked at Dr. Pedram's 7 opinions, and I read the references, the -- in 8 this case, Wilt and the other prior art references 9 Dr. Pedram relied on. 10 And based on my knowledge and 11 understanding of priority of claim '21 from the 12 specification and the embodiments of the 13 '381 patent, I was able to make a determination 14 whether or not Dr. Pedram's opinions were correct 15 or not. And I disagreed with Dr. Pedram's 16 opinions regarding priority. 17 Q And what is your understanding of priority 18 from the '381 Patent? 19 A I did not come up with an articulation or 20 an opinion on the broad scope or limitations of 21 priority. 22 I came up with an understanding of

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105 1 priority from the '381 sufficient to be able to 2 respond to Dr. Pedram's opinions. 3 Q What's the difference between the priority 4 that Dr. Pedram identifies and your understanding 5 of priority in the '381 patent? 6 A That difference is what I've issued an 7 opinion on. I've issued an opinion on 8 Dr. Pedram's opinions in response to Dr. Pedram's 9 opinions, which is what I was asked to do. 10 I did not create an opinion articulating 11 the full scope of what a priority could be 12 relating to claim 21 across anything. 13 Q Do you agree with me that a priority is 14 anything that impacts the order in which the 15 shader core receives tasks? 16 A I haven't seen that definition. I don't 17 think I've needed to rely on that particular 18 definition in responding to Dr. Pedram's opinions. 19 Is that from Dr. Pedram's report? 20 Q I'm just asking you -- 21 A I responded to Dr. Pedram's report. I 22 don't recall that in Dr. Pedram's report. I don't	107 1 based on a priority? 2 A I don't recall looking at that particular 3 example. Is that one of Pedram's examples? 4 Q I'm just asking. Can you answer the 5 question? 6 A Not without understanding what system is 7 executing what tasks, no. I would need to see, 8 you know, details of the system, how it was 9 being -- if it even met the requirements of 10 claim 15, and how it was meeting the requirements 11 of claim 15 and then how it was using whatever 12 mechanism it was using for -- 13 Q So you need to understand all of the 14 infrastructure in order to understand if something 15 is a priority or not, correct? 16 A There is enough information in Wilt and 17 when -- such that when Dr. Pedram opined that Wilt 18 disclosed context swapping and that somehow 19 context swapping was disclosing task priority in 20 the use of "priority" in how the shader core is 21 configured to receive a plurality of tasks, there 22 was enough there to show that that wasn't the
106 1 think I relied on that particular definition, but 2 I just don't recall where that definition would 3 have come from. 4 Q Is -- strike that. 5 When you applied your analysis of priority 6 to the prior art that Dr. Pedram identified, did 7 you consider that a priority could be anything 8 that impacts the order in which the shader core 9 receives tasks? 10 A I don't believe I said it in those terms. 11 The way I applied the understanding of priority, a 12 person of ordinary skill in the art would 13 understand from '381 is described in the report, 14 for example, at Paragraphs 89, 90, and 91 with 15 respect to Wilt. 16 Q Can you identify for me what sentences in 17 Paragraphs 89, 90, and 91 would let me know what 18 your definition of "priority" is? 19 A I don't see a definition in these 20 paragraphs of "priority," no. 21 Q If a shader core receives older tasks 22 before newer tasks, would it be receiving tasks	108 1 case. 2 Q Have you ever heard of a ping-pong buffer? 3 A No. No. Not -- 4 Q Have you ever heard of a round-robin 5 buffer? 6 A Yes. 7 Q What does a round-robin buffer do? 8 A I don't know about a round-robin buffer. 9 Round-robin is a technique used for scheduling 10 threads. 11 Q And is that a form of priority? 12 A Well, not one that applies here because 13 we're talking about task priority, not thread 14 priority. 15 Q I see. So threads are not tasks, right? 16 A That's right, threads are not tasks. 17 Q And so even if I've received all of the 18 decomposed threads and they have a priority, 19 that's not a task priority, correct? 20 A Who knows. I don't know the system that 21 you're talking about. I don't know if these are 22 threads from different tasks or the same task.

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109 1 Q Okay. So you don't know whether or not a 2 priority assigned to all of the decomposed threads 3 of a task would create a task priority? 4 A I would need more information about the 5 system. I'd have to examine it. I don't recall 6 that. 7 Q And what more -- 8 A I'd have to see the situation. 9 Q -- information would you need? 10 A Something similar to what Dr. Pedram 11 produced with Wilt or Stuttard or Jiao. 12 Q Do you teach priorities in any of your 13 classes? 14 A I don't recall having any lectures on 15 priority. They're more of an operating systems, 16 architecture, computer organization topic. 17 Q Do you know what a FIFO buffer is? 18 A Yes. 19 Q What is it? 20 A FIFO stands for first in, first out. So a 21 FIFO buffer is a buffer that outputs items in the 22 order it receives them.	111 1 for a priority? 2 A I don't have any opinions on that 3 particular example. It wasn't one presented by 4 Dr. Pedram. I haven't formulated an opinion. And 5 I would need to see, you know, what that 6 priority -- how that priority was implemented, 7 whether it met the requirements of a task 8 priority, whether it was dealing with tasks and in 9 a system that met the other requirements. 10 Q I didn't ask whether or not you'd 11 formulated an opinion on it. I'm asking you to 12 tell the Board as an expert and a person of 13 ordinary skill in the art, as somebody who's 14 studied the patents and the claims and presumably 15 made some determination about what priority means 16 in the claims, whether or not you can say age of a 17 task could be the basis for a priority? 18 MR. DOKHANCHY: Objection. Asked and 19 answered. 20 BY THE WITNESS: 21 A I'm here to respond -- speak to my report. 22 Those are in response to the opinions of
110 1 Q If some tasks are sent to the shader core 2 before other tasks, once they reach a certain age, 3 the shader core would be receiving those tasks 4 based on a priority, correct? 5 A I would have to see the system to know if 6 that was based on a task priority and how that -- 7 how that operated. 8 I know that an example of Wilt simply 9 doing preemptive context swapping wasn't 10 sufficient to show task priority. 11 Q Is it possible that age can be a basis for 12 a priority? 13 A I don't know. My opinions were responsive 14 to Dr. Pedram's opinions. When it comes to task 15 priority required for claim 20, I'd have to see a 16 system that was implemented and the priority to 17 make sure it was fitting all the requirements. 18 Q I'm just asking you as an expert, as a 19 person of ordinary skill, as somebody who's 20 studied the patents and the claims and presumably 21 made some determination about what priority means, 22 whether or not age of a task could be the basis	112 1 Dr. Pedram. I didn't need to do that analysis in 2 my response to Dr. Pedram, so I haven't really 3 considered that. 4 I would need time to consider that and see 5 the details of a system similar to what was 6 presented by Dr. Pedram in the prior references. 7 BY MR. JOHNSON: 8 Q So despite your study, despite your 9 experience, as you sit here today, you can't say 10 whether or not age of a task could be considered a 11 priority? 12 A Not without knowing more details about 13 this hypothetical system, no, I wouldn't be able 14 to make an opinion in the way I've been -- I've 15 made these other opinions. 16 Q Is the scope of the '381 patent covering 17 GPU task scheduling, whether it is done by the 18 operating system or done by an arbiter in the 19 system itself? 20 A So there's a variety of scheduling that 21 was disclosed in the '381 patent; for example, 22 Figure 4 has an OS scheduler and a scheduling

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113 1 module. And I think, you know, similarly there's 2 an arbiter in Figure 2 -- arbitration logic in 3 Figure 2. 4 So there's a variety of things controlling 5 scheduling in the '381. 6 Q Do you have experience designing graphics 7 processing systems like the ones in the 8 '381 patent? 9 A Yes. I've worked on GPU design in the 10 past. 11 Q And would you be able to design a graphics 12 processing system within the scope of the 13 '381 patent claims in which age would satisfy the 14 priority limitation? 15 A I imagine I could make an effort in 16 designing any number of GPUs doing any number of 17 things. 18 Q So doesn't that answer my question that 19 age could be a priority for a task? 20 A Well, when you say "a priority for a 21 task," you're using claim terms and specifically 22 claim terms from claim 20, and my opinions are	115 1 anything to do with Dr. Pedram's opinions. You're 2 an expert. I'm entitled to ask you hypothetical 3 questions. You can either answer them or you 4 can't. 5 So is age of a task something that could 6 be the basis of a priority for claim 20? 7 A My understanding is I'm here to speak 8 about my opinions in this declaration responsive 9 to Dr. Pedram's opinions in his declaration 10 regarding the '381 patent. That was not a 11 question I considered in the formulation of those 12 opinions. 13 There's not enough information there to 14 make -- to give you an answer. So I think the 15 answer is: I can't answer that based on the 16 information given. 17 Q So if the system that satisfies the 18 limitations of the claims were to send video tasks 19 such as 2D video processing to the shader core 20 before other tasks such as 3D rendering, would 21 that be receiving task based on a priority? 22 A I don't know if system is using priorities
114 1 regarding the claims of the '381 patent. 2 And so you're asking if age can be 3 something satisfying a priority scheme for 4 claim 20. In order to make that determination, I 5 would need to see the system in the same way that 6 I evaluated Wilt, Jiao, and Stuttard with respect 7 to claim 20 and Dr. Pedram's opinions. 8 Q But I'm not asking about a specific 9 system. I'm just asking you: Could age of a task 10 satisfy the priority limitation of claim 20 in a 11 given system that you could make up? 12 MR. DOKHANCHY: Objection. Asked and 13 answered. 14 BY THE WITNESS: 15 A And the answer is there's not enough 16 information there. I would need time to analyze 17 that, and even after analyzing that, I think 18 without having -- I'd have to synthesize 19 something, and that wouldn't be responsive to 20 Dr. Pedram's opinions. 21 BY MR. JOHNSON: 22 Q I don't understand why my question has	116 1 or not. I don't know if those priorities are 2 associated with tasks. I don't know how those 3 tasks are issued or received. I would need to see 4 more details about the system. If it met the 5 requirements of claim 20, then it would meet the 6 requirements of claim 20. 7 Q What's the definition of an "engine" for 8 purposes of the '381 patent claims? 9 A An engine is required to independently 10 receive from a scheduling module at least one task 11 and load state data. 12 Q I understand that's the functions it 13 carries out, but is -- without knowing -- without 14 using the functional language, what is an engine? 15 A I'm not sure I understand the question. 16 Q Okay. So then let's focus on the 17 function. 18 So you've identified two functions that 19 the engine must have in order to be an engine, 20 right? 21 A Yes. 22 Q Does an engine need to be able to process

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117 1 data at all? 2 A I haven't considered that. If there is an 3 example Dr. Pedram put forward, I would have done 4 that analysis, but I don't recall one. 5 Q So you don't know whether or not an engine 6 has to process data in order to be an engine 7 within the context of the '381 patent, correct? 8 A It's not part of my definition. I haven't 9 really considered it. It just needs to receive a 10 task from a scheduling module and then load state 11 data. 12 Q So you have no opinion as to whether or 13 not an engine must also do some sort of processing 14 of the tasks? 15 A It's not something I required of the 16 engine in this definition. 17 Q Okay. Would you agree then that an engine 18 could satisfy the claim language even if it does 19 not process a task as long as it receives the task 20 and it loads the state data? 21 A It would need to -- in order to satisfy 22 claim 15, it would need to satisfy all of the	119 1 associated with each of those tasks. 2 Q Okay. So it has to also be connected to a 3 scheduling module that satisfies the claim 4 language, correct? 5 A And the scheduling module needs to be part 6 of it -- 7 Q Okay. 8 A -- process. 9 Q So setting aside the scheduling 10 limitation, are there any other limitations in 11 claim 15 that restrict what an engine must be? 12 A Yeah, I mean, there's -- there has to be a 13 shader core, and that shader core needs to receive 14 the plurality of tasks from at least one of the 15 plurality of engines. 16 Q Okay. 17 A That's another example. 18 Q So the engine must be -- have a pathway to 19 send a -- the plurality of tasks to the shader 20 core, correct? 21 A No. The shader core needs to be able to 22 receive the tasks -- the plurality of tasks from
118 1 elements of claim 15. And when claim 15 refers to 2 an engine, a person of ordinary skill in the art 3 would understand that to independently receive 4 from a scheduling module at least one task and one 5 state data. 6 Q And that's your construction of an engine, 7 that it must be able to receive tasks and load 8 state data, correct? 9 A Yeah, independently. 10 Q Independently. Correct. 11 And it doesn't have to do anything else in 12 order to be an engine, correct? 13 A Well, to satisfy claim 15, it would have 14 to satisfy everything required by claim 15. 15 Q Well, okay. What other requirements in 16 claim 15 are there in order for something to be an 17 engine? 18 A This is what's required to be an engine. 19 You'd have to look at claim 15, which requires a 20 plurality of engines to receive from a scheduling 21 module associated with a second processing unit, a 22 plurality of tasks, and to load state data	120 1 at least one of a plurality of engines. 2 Q So is that shader core limitation a 3 restriction on each engine? 4 A It says, "A shader core is configured to 5 receive the plurality of tasks from at least one 6 of the plurality of engines." So -- 7 Q Right. So I'm trying to understand what 8 the definition of an engine is for you. 9 A Right. And I've given it to you. 10 Q Okay. And I'm trying to understand it, 11 though. I understand you've put a bunch of words 12 on the page, but I don't understand them yet. 13 So an engine has to -- each engine has to 14 independently receive tasks, it has to 15 independently load state data, correct? 16 A Yes. That's my definition of engine is 17 that it's required to independently receive from a 18 scheduling module at least one task and load state 19 data. 20 Q Okay. And it has to be configured to 21 receive those tasks from a scheduling module as 22 required by the claims, correct?

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121 1 A So that's not in my definition of an 2 engine, but that is part of claim 15. 3 Q Okay. So within your definition of an 4 engine, what other requirements are there in order 5 to be an engine? 6 A There are no other requirements to be an 7 engine. I've spelled out what's required to be an 8 engine in this definition here in Paragraph 35. 9 Q So with respect to just engine, it doesn't 10 have to do anything else other than independently 11 load state data and receive tasks, correct? 12 A From a scheduling module. "Engine" is a 13 claim term, and so I've analyzed engine with 14 respect to claim 15 and its dependent claims, and 15 that was the construction that articulates the way 16 a person of ordinary skill in the art would 17 understand engine in those claims. 18 Q Is there anything -- any other limitation 19 that is required in order to be an engine? 20 A No. I've -- 21 Q Okay. 22 A -- stated that "engine" for the -- as a	123 1 Q I don't know, but it seems like the 2 definition of "engine" changes year to year with 3 you. 4 We'll show that testimony to the Board 5 and -- 6 A I don't think -- 7 Q -- and see how it goes. 8 A I don't think my understanding of engine 9 has changed. I think I -- in providing an 10 understanding of engine, that same understanding 11 of engine, in a way that's clear and in a way 12 that's necessary to be responsive to Dr. Pedram's 13 opinions. 14 This is what I used to respond to 15 Dr. Pedram's opinions. I don't recall Dr. Pedram 16 putting forth an opinion in this current matter 17 where an engine did any processing or needed to do 18 any processing. 19 So there was -- that wasn't a necessary 20 understanding of engine to respond to Dr. Pedram's 21 opinions. 22 Q What is state data?
122 1 claim term should be understood to be something 2 that receives from the scheduling module at least 3 one task and loads state data and does so 4 independently. 5 Q So you've never formed an opinion that an 6 engine should be capable of doing some processing 7 as well, correct? 8 A My opinions are responsive to Dr. Pedram's 9 opinions. I don't know that I needed to look at 10 an engine doing any processing to analyze his 11 opinions. 12 Q Okay. And so do you recall that in the 13 ITC case, that Dr. Pedram testified that an engine 14 must be able to be capable of doing some 15 processing? 16 A I don't recall. 17 Q And do you recall whether or not you gave 18 a rebuttal in -- during your testimony of that 19 hearing? 20 A I don't recall that specific issue. 21 Q Okay. 22 A Is that, like, a year ago?	124 1 A Data regarding state. It's data regarding 2 the state of some processor situation. 3 Q State data is mentioned twice in claim 15, 4 isn't it? 5 A There is state data associated with each 6 of the plurality of tasks and respective state 7 data associated with each of the first and second 8 tasks. 9 Q And in the state data associated with each 10 of the first and second tasks, is that a subset of 11 the state data associated with each of the 12 plurality of tasks? 13 A Can I get that again? Can you repeat the 14 question? 15 Q Yeah. Sure. The state data associated 16 with each of the first and second tasks in 17 claim 15, is that a subset of the state data 18 associated with each of the plurality of tasks in 19 claim 15? 20 A I don't know that the -- that claim 15 21 requires that all of the state data associated 22 with the plurality of tasks in the plurality of

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125 1 engines element is necessarily the respective 2 state data associated with each of the first and 3 the second tasks. 4 The respective state data in the shader 5 core element means that there are state data 6 associated with the first and second tasks that is 7 used by the shader core. 8 Q So the state data associated with each of 9 the first and second tasks could be completely 10 different state data than was included as the 11 state data associated with each of the plurality 12 of tasks, correct? 13 A I don't think I have an opinion on that. 14 I didn't come across a situation like that in 15 Dr. Pedram's opinions, so I didn't really need to 16 look at a situation where that was the case. 17 Q You attended the ITC hearing in the 18 1318 investigation, correct? 19 A Yes. 20 Q And, in fact, you testified at the ITC 21 hearing, correct? 22 A Correct.	127 1 And do you recall that claim 19 requires 2 that there be both a general compute task and a 3 graphics processing task executed at the same 4 time? 5 A Yeah, claim 15 requires a shader core 6 configured to execute a first task from -- while 7 executing a second task. 8 And claim 19 is the computing system -- 9 computing system of claim 15 wherein the first 10 task comprises a graphics processing task and the 11 second task comprises a general compute task. 12 Q And so starting at Line 18, Dr. Pedram 13 explained that a -- or actually Line 19, "A 14 general compute task is any kind of task that 15 would cause general computation such as 16 instruction, fetch and decode, doing simple 17 arithmetic logic calculations, decoding, stuff 18 like that." 19 Do you see that? 20 A I see that. 21 Q Do you recall that testimony? 22 A Not off the top of my head.
126 1 Q And your testimony was in rebuttal for -- 2 to Dr. Pedram's testimony on the validity of the 3 '381 and '053 patents, correct? 4 A Correct. 5 Q And were you present in the courtroom when 6 Dr. Pedram testified? 7 A Yes. 8 MR. JOHNSON: Can you mark this as 1101. 9 (WHEREUPON, a certain document was marked 10 Exhibit No. 1101, for identification.) 11 BY MR. JOHNSON: 12 Q So what I've marked as Exhibit 1101 is a 13 copy of a portion of the hearing transcript in the 14 1318 investigation. Specifically it is the 15 portion from March 15th, 2023, containing 16 Pages 697 through 955. And even then, it is only 17 the open session portion. So if there's any 18 confidential information, it should be not 19 included, okay? 20 And if you could turn to Page 950 -- 949, 21 I'm sorry. On Page 949, Dr. Pedram is giving his 22 testimony related to claim 19.	128 1 Q Do you agree or disagree with Dr. Pedram's 2 description of a general compute task? 3 A Dr. Pedram's testimony is differentiating 4 a general compute task from a graphics processing 5 task. And so he's referring to it as an, 6 "instruction, fetch and decode, doing simple 7 arithmetic, logic calculations, decoding, stuff 8 like that," as opposed to a graphic processing 9 task that requires graphics processing, pixel 10 processing, geometry processing, and so on. 11 So that's the distinction. I would not 12 have characterized it that way. 13 Q So what would you change in his 14 characterization? 15 A I did so in Paragraph 26 of this -- of my 16 declaration in this matter. A person of ordinary 17 skill in the art would have understood that a 18 graphics task consisted of a plurality of vertex 19 shader threads and a plurality of pixel shader 20 threads and optionally a plurality of geometry 21 shader threads. 22 A person of ordinary skill in the art

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129 1 would have understood that a non-graphics task, 2 for example, such as a physics task from a video 3 game application relating to non-graphics physical 4 motion simulation, consisted of a plurality of 5 what were known as compute shader threads. 6 Q And so a physics task is a general compute 7 task, correct? 8 A In that example it is. 9 Q And do video game applications have both 10 general compute and graphics-related tasks? 11 A I think that's the case for some video 12 games. 13 Q So your definition of a -- I want to be 14 clear because the last sentence of Paragraph 26 15 says, "A POSITA would have understood that a 16 non-graphics task consisted of a plurality of what 17 were known as compute shader threads." 18 Is that your definition of a general 19 compute task? 20 A That would be -- that would suffice as an 21 example of a general compute task. 22 Q Okay. So that's just one example of a	131 1 is? 2 A No, I didn't need to. What I had here was 3 sufficient to understand -- to articulate a person 4 of ordinary skill in the art's understanding of 5 material and in response to Dr. Pedram's opinions. 6 Q When you evaluated the prior art and to 7 determine whether or not it had a general compute 8 task, did you compare it with this one example and 9 to see whether or not it consisted of a plurality 10 of what were known as computer shader threads? Is 11 that how you made your determination on whether or 12 not it was a general compute task? 13 A No. I made my determination based on what 14 a person of ordinary skill in the art would have 15 understood to be a general compute task. 16 Q Okay. So what would a person of ordinary 17 skill in the art understood to be a general 18 compute task? 19 A For example, with Jiao, I did not need to 20 come up with a complete definition of a compute 21 task because I have Pedram's opinions, and, in 22 fact, Pedram's definition here, "Graphics
130 1 general compute task. 2 So can you then give me an overall 3 definition of a general compute task so I can come 4 up with other examples? 5 A That's what I've provided in my opinions 6 that sufficed to differentiate the examples that 7 Dr. Pedram put forward in his opinions. 8 I think what's shown here is the 9 characterization that graphics tasks are ones that 10 where you have vertex shader threads and pixel 11 shader threads; whereas, general compute tasks 12 would, for example, just refer to compute shader 13 threads and not utilize the other graphic-specific 14 machinery of a processor. 15 Q Do graphics processing tasks do any 16 computation? 17 A Yes. 18 Q So both graphics processing tasks and 19 general compute tasks do computation, correct? 20 A Yes. 21 Q Are you saying that you did not provide a 22 general definition of what a general compute task	132 1 processing task is a task that requires graphics 2 processing, pixel processing, geometry processing 3 and so on." 4 That was the sum total of what he pointed 5 to in Jiao. And so I used his definition of 6 graphics processing there to show that he's not 7 identifying any general compute tasks because 8 everything he pointed to in Jiao is being 9 processed using pixel processing and geometry 10 processing and vertex processing, graphics 11 processing. 12 So nothing would fit any other category 13 that he used. 14 MR. JOHNSON: Objection. Nonresponsive. 15 BY MR. JOHNSON: 16 Q What would a person of ordinary skill in 17 the art understand to be a general compute task? 18 A So I've given examples of that, that were 19 sufficient to indicate what a person of ordinary 20 skill in the art would understand. I did not 21 formulate a full dictionary definition of what a 22 general compute task was as part of my opinions,

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133 1 nor did I need to. 2 Q And the one example that you provided is 3 in the last sentence of Paragraph 26, correct? 4 A The example is a physics task. But a 5 person of ordinary skill in the art would have 6 understood that a non-graphics task consisted of a 7 plurality of what were known as compute shader 8 threads. 9 Q Right. So that sentence is the only 10 examples that you've provided in your declaration 11 of a general compute task, correct? 12 A Well, the physics task is one of the 13 examples. It's an example of what could be 14 computed in a compute shader thread. It's a task 15 that could comprise two or more compute shader 16 threads as demonstrating what a person of ordinary 17 skill in the art would understand to be a general 18 compute task. 19 Q And is this video game application, is it 20 running on a system that meets all the 21 requirements of claims in the '381 patent? 22 A I'm describing what a person of ordinary	135 1 understanding of a graphics processing task is 2 provided as examples as well in Paragraph 26 in 3 the sentence immediately preceding the last 4 sentence, correct? 5 A Yes. That a graphics task would utilize 6 vertex shaders and pixel shaders -- vertex shader 7 threads and pixel shader threads and be utilizing 8 the graphics hardware. 9 Q And is that the example that you used to 10 compare the prior art when rendering your opinions 11 in your declaration? 12 A I used the understanding of a person of 13 ordinary skill in the art of these two as 14 demonstrated by these examples. 15 Q And did you provide any other examples in 16 your declaration of what a graphics processing 17 task would be? 18 A When I talk about engines, engines receive 19 tasks. And I talk about the term "engine" from 20 game development, which further illustrates what a 21 person of ordinary skill in the art would have 22 understood that the plain and ordinary meaning of
134 1 skill in the art would have understood of a 2 non-graphics task. 3 A non-graphics task is a claim term from 4 claim 19, so that's what a person of ordinary 5 skill in the art would understand in 6 differentiating a graphics task from a 7 non-graphics task for -- or a general compute task 8 in claim 19 for a system, for example, a system 9 that satisfied claim 15 and also claim 19. 10 Q So these are not general statements; these 11 are only statements with respect to technology 12 that falls within the '381 patent, correct? 13 A These are statements I've made about the 14 '381 patent in response to Dr. Pedram's opinions. 15 So all of the statements, especially the ones on 16 utilizing claim terms, are specific to the claims 17 of the '381. 18 Q So getting back to my original question. 19 Is there any other examples in your 20 declaration of a general compute task? 21 A Not that I recall. 22 Q Okay. And the basis for your	136 1 engine before looking at the specifics that the 2 '381 applied to it. And that included a graphics 3 engine, an AI engine, a physics engine, and 4 others. 5 So a person of ordinary skill in the art 6 would also consider AI tasks being received by an 7 AI engine. 8 Q Have you ever heard of a general system 9 control task? 10 A That's a pretty generic term. 11 Q Would a general system control task 12 involve computations? 13 A I would have to see the task. 14 Q Could a general system control task 15 involve computations? 16 A I'd have to see the system. That's a very 17 vague term. 18 Q Have you ever, in your experience as a 19 teacher or a research professor or your experience 20 building or making graphics processing systems, 21 ever run across a general system control task that 22 involved computations?

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137 1 A Not in those terms. Not in those explicit 2 terms. 3 Q Would you consider a general system 4 control task to be a type of a general compute 5 task? 6 A It would depend on the task. I'd have to 7 see the task. 8 Q So it could then? 9 A I don't know. 10 Q Well, if you say you would need to see the 11 task, then you're allowing for the fact that it 12 might be a general system -- I'm sorry, a general 13 compute task, correct? 14 A I have no idea what you're referring to. 15 I mean, that terminology is very vague. It could 16 be speaking of something that shows up someplace 17 else as a general system kind of task. I don't 18 know. I would need to see the task. I can't tell 19 just from the name what it does. 20 Q What type of operation is being performed 21 in a general compute task? 22 A It could be executing a plurality of	139 1 that have used the term "task," but not in this 2 sense, so I don't know how they would be relevant. 3 Q Taking your understanding of what a 4 general compute task is and a graphics processing 5 task from the context of the '381 and looking at 6 all of the things that you've experienced, have 7 you ever encountered a graphics processing task, 8 regardless of whether or not that's the words they 9 used at the time, that included a general compute 10 task? 11 A I'm not sure how to answer that. Those 12 are both claim terms, and you're asking me to 13 consider it using other terms I don't know. 14 Typically what I would expect is if I had 15 vertex shader threads and pixel shader threads, 16 those would be run independently of compute shader 17 threads. You either can do one or the other. 18 Q Do you agree that vertex, geometry, and 19 pixel processing tasks are types of graphics 20 processing tasks? 21 A I'm not sure those are tasks. What's 22 referring to those as tasks?
138 1 compute shader threads. Compute shader threads 2 are ones that do not utilize the graphics-specific 3 hardware on a graphics processor. 4 So things like a rasterizer or a scan 5 converter, things that convert groupings of 6 vertices into groupings of pixels. 7 Q Can a graphics processing task include a 8 general compute task within it? 9 A I don't recall seeing that situation 10 presented by Dr. Pedram. I never really needed to 11 consider that. 12 They're differentiated in claim 19 as 13 being two different kinds of tasks. Claim 19 14 doesn't really speak to whether one is inside 15 another. In fact, I don't recall in '381 a task 16 ever being inside of another task. 17 Q In your experience, have you ever 18 encountered a general computer task to be within a 19 graphics processing task? 20 A These are both claim terms. My opinions 21 on this are based on the '381 and its claim terms. 22 I mean, I've worked with a variety of other things	140 1 Q What? 2 A The 3- -- 3 Q Can you not answer the question? 4 A The '381 doesn't refer to those as tasks; 5 the '381 refers to them as threads. 6 Q So in general, do you agree that vertex, 7 geometry, and pixel processing tasks are types of 8 graphics processing tasks? 9 A Again, in the '381, I did not see a 10 situation, both in the patent or in Dr. Pedram's 11 opinions, where I had to deal with tasks inside 12 another task or tasks being parts of other tasks. 13 Q So you can't answer the question outside 14 the context of providing an opinion in your 15 declaration? 16 A "Tasks" are a claim term. I'm here to 17 speak about the '381, and the tasks I would speak 18 about are related to the '381. I don't have a 19 context to speak about tasks in other definitions. 20 MR. DOKHANCHY: We've been going over an 21 hour, when you get a chance. 22 MR. JOHNSON: Sure. Let's take a break.

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141 1 (WHEREUPON, a recess was had.) 2 BY MR. JOHNSON: 3 Q Do you agree or disagree that a compute 4 shader would carry out general compute tasks? 5 A So the example I gave was that a 6 non-graphical -- a non-graphics task, for example 7 a general compute task, could consist of a 8 plurality of computer shader threads. 9 Q Do you know what a vertex geometry and 10 fragment shaders are? 11 A Yes. 12 Q Do those shaders process graphics 13 processing tasks? 14 A They are the examples I gave for what a 15 person of ordinary skill in the art would have 16 understood a graphics task to consist of. They 17 would consist of a plurality of vertex shader 18 threads, pixel shader threads, and geometry shader 19 threads. 20 Q Do you agree or disagree that a 21 graphics -- well, strike that. 22 Do you agree or disagree that graphics	143 1 report. What I'm asking you is: Can a graphics 2 processing be achieved by performing a series of 3 general compute tasks? 4 MR. DOKHANCHY: Objection. Argumentative. 5 BY THE WITNESS: 6 A I didn't come across such a situation in 7 Dr. Pedram's report, and so I didn't respond to 8 that. I haven't really considered it. 9 BY MR. JOHNSON: 10 Q So you don't know whether or not a general 11 compute -- I'm sorry. Strike that. 12 So you do not know as you sit here today 13 whether or not graphics processing can be achieved 14 by performing a series of general compute tasks? 15 A I sit here today to provide my opinions in 16 response to Dr. Pedram's opinions. That situation 17 didn't come up, and so I don't have an opinion on 18 that. I haven't considered it to the extent I've 19 considered these other opinions. 20 Q Can a vertex processing task involve one 21 or more general compute tasks? 22 A I did not come across a situation in the
142 1 processing may be achieved by performing a series 2 of general compute tasks? 3 A I never really referred to that. I think 4 I've referred to graphics tasks as consisting of 5 threads -- in this case, vertex shader thread, 6 pixel shader thread, and geometry shader 7 threads -- and of non-graphics tasks, such as a 8 general compute task to consist of a plurality of 9 compute shader threads. 10 Q Okay. But I'm asking you as an expert: 11 Do you agree or disagree that graphics processing 12 may be achieved by performing a series of general 13 compute tasks? 14 A As an expert in this case, in a report 15 responsive to Dr. Pedram's opinions, I didn't need 16 to consider that. I'm speaking of a graphics 17 processing task. I didn't give an example where a 18 graphics processing task would consist of 19 sub-tasks. And I also didn't give an example 20 where a graphics processing task would consist of 21 compute shader threads. 22 Q I know what you did and didn't do in your	144 1 '381 or in Dr. Pedram's report where any task 2 consisted of other tasks. 3 Q In your experience, have you ever 4 encountered a vertex processing task that involved 5 one or more general compute task? 6 A I wouldn't have used that terminology, and 7 I don't -- there's nothing I can draw from that 8 that would apply to that generally. 9 Q Do you agree some general compute tasks 10 are data parallel and some are not? 11 A All of the examples I've seen in the '381 12 and also what I looked at in the prior art based 13 on Dr. Pedram's opinions were tasks that were 14 decomposed into threads, and those threads were 15 executed on data parallel processors. 16 Q So do you agree with my statement or not? 17 A Can you repeat the statement? 18 Q Do you agree some general compute tasks 19 are data parallel and some are not? 20 A I don't know what you mean by a data 21 parallel task. I've not -- that's not a term used 22 in the '381, not one I've considered, not one that

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145 1 I needed to consider in response to Dr. Pedram's 2 opinions. 3 Q Do you agree that some tasks can be both 4 general computing tasks and graphics processing 5 tasks? 6 A I didn't need to consider any tasks that 7 were considered both in response to Dr. Pedram's 8 opinions. I didn't come up with that -- come 9 across that situation. 10 Q Do you know whether or not some tasks 11 could be both a general computing task and a 12 graphics processing task? 13 A Those are both claim terms. They're in 14 claim 19, and they are used to differentiate a 15 task -- one set of tasks from another set of 16 tasks. So I don't believe claim 19 would -- had 17 considered a task that could be both of them. 18 Claim 19 talks about a graphics processing 19 task and a general compute task. 20 Q Please identify for the Board whether or 21 not some tasks, based on your vast experience, 22 could be both a general computing task and a	147 1 A So a task -- task is a unit of processing 2 work decomposable into two or more related 3 threads. Those threads -- a thread is a sequence 4 of instructions, so an instruction could be an IF 5 conditional instruction. 6 A sequence of instructions could consist 7 of an IF THEN ELSE. That would be the way that an 8 IF THEN ELSE, would appear within a task. 9 Q So do you agree that a task containing a 10 conditional statement can result in two different 11 instruction strings being executed? 12 A I would have to see the hardware 13 performing the execution, issues about how 14 that -- you know, what instructions are 15 responsible for carrying out the IF THEN ELSE. It 16 would be hardware-dependent. 17 Q What hardware unit can perform A plus B or 18 A minus B calculations? 19 A A processor. 20 Q Could an ALU perform those calculations? 21 A I mean, those are both examples of 22 arithmetic.
146 1 graphics processing task. 2 A I didn't come across any in the '381 or in 3 Dr. Pedram's opinions in the prior art of any 4 tasks that would fall under both. The focus was 5 on the -- on how the threads are executed, whether 6 they're executed using compute shader threads or 7 using the graphics hardware's handling of vertex 8 and pixel shader threads. 9 Q So you have no experience as to whether or 10 not a general computing task and a graphics 11 processing task could be the same type of task, 12 correct? 13 A The tasks I'm looking at are the ones 14 described by the '381 patent. The task is a claim 15 term for claim 15. And so my opinions are focused 16 on tasks that meet the requirements of claim 15 or 17 whether something does or does not meet the 18 requirements of a task for claim 15 and the 19 dependent claims. 20 Q If a task contains conditional statements 21 such as IF THEN ELSE, is the set of instructions 22 that get executed always the same?	148 1 Q Would you consider in coding a 2D video to 2 be a general compute task? 3 A I'd have to see what method it was -- was 4 being used for the encoding, what hardware the 5 encoding was occurring on, the operating system, 6 the organization. I'd need some details to be 7 able to determine that, and if it met the 8 requirements of a '381 task. 9 Q Based on your experience, do you know 10 whether or not encoding a 2D video could be a 11 general compute task? 12 A I'd have to see more detail on the system 13 to make any determination like that. 14 Q What detail would you need to determine 15 whether or not encoding a 2D video could be a 16 general compute task? 17 A The hardware that's doing the encoding, 18 the organization of the hardware doing the coding, 19 the operating system, how the encoding is 20 happening, the codec. 21 Q But you can't categorically deny that the 22 encoding of a 2D video could be a general compute

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1 task, correct? 2 A It wasn't one of the examples that 3 Dr. Pedram put forward, so I never did any 4 analysis of that. 5 What I did characterize for a general 6 compute task was one that would use computer -- 7 compute shader threads. 8 Q Are you saying that based on your 9 experience, you don't know whether or not an 10 encoding of a 2D video is a general compute task, 11 or you would just need to go and do some research 12 to find out? 13 A A general compute task is a claim term 14 from claim 19. I would need to do analysis to 15 determine if any application was performing tasks 16 that would satisfy claim 19 and the claim 15 it 17 depends on. 18 Q In Paragraph 26 of your report, you talk 19 about physical motion simulation, correct? 20 A Yes. 21 Q Would executing an algorithm related to 22 motion, estimation, or compensation when	149 1 person of ordinary skill in the art would have as 2 illustrated by those examples. 3 Q Would all general compute tasks consist of 4 a plurality of what were known as compute shader 5 threads? 6 A Again, I didn't state anything like that. 7 These are examples. 8 Q Do graphics processing tasks consist of a 9 plurality of what were known as compute shader 10 threads? 11 A I think the example I gave was that 12 graphics tasks consist of vertex shader threads 13 and pixel shader threads and that the example here 14 is that general computing tasks, non-graphics 15 tasks consist of compute shader threads. 16 Q But I'm asking you as an expert do you 17 know whether or not a graphics processing task 18 could consist of a plurality of what were known as 19 compute shader threads? 20 A Certainly not for the situations put 21 forward by Dr. Pedram. It was clear what he was 22 indicating were graphics processing tasks and
150 1 processing video data involve general compute 2 tasks? 3 A So I speak specifically of physical motion 4 simulation. As an example of a non-graphics task, 5 it could be implemented on compute shader threads. 6 I don't know about the other applications you 7 spoke about. I didn't use those as examples. 8 Q So am I to understand that any task that 9 could be implemented using a plurality of compute 10 shader threads would be a general compute task? 11 A I use that as an example of a non-graphics 12 task would be one that bypassed the graphics 13 vertex shader and pixel shader in the underlying 14 graphics hardware. 15 Q Are all non-graphics tasks general compute 16 tasks? 17 A I don't know. I didn't say that in this 18 opinion. I didn't need to come up with such a -- 19 such a definition. I was able to look at the 20 examples that Dr. Pedram provided as graphics 21 tasks and general compute tasks and be able to 22 differentiate them using the understanding of a	151 1 which were general computing tasks, and I did not 2 see that situation arising in the examples he put 3 forward. 4 Q That's not what I'm asking you. I'm 5 asking you for a foundational definition. 6 Could a graphics processing task include a 7 plurality of what were known as compute shader 8 threads? 9 A I didn't consider that, I didn't need to 10 consider that, and I did not put forward a 11 foundational definition. 12 Q Is quantization a physics task? 13 A In general, the term "quantization" refers 14 to rounding. It's -- I don't know if I would 15 consider that a task. It's an operation, a few 16 instructions, a thread. 17 Q What about image compression like JPEG; is 18 that a general compute task? 19 A I would have to see how it was 20 implemented. 21 (WHEREUPON, Exhibit No. 1005 was presented 22 to the witness.)

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1 BY MR. JOHNSON: 2 Q I've handed you what is marked as 3 Exhibit 1005 in this IPR proceeding, and I'll 4 represent that it is a copy of the Jiao reference. 5 Do you see that? 6 A Yes, I do. 7 Q And do you agree that Jiao discloses 8 programmable vertex, geometry, and pixel shaders? 9 A Yes. 10 Q And you agree that Jiao discloses 11 execution units that are marked as 420? 12 A Yes. 13 Q And do you agree that Jiao teaches that 14 each of the execution units 420 are identical in 15 design? 16 I can direct you to column 9. Starting at 17 column 25 if this will help. Actually starting on 18 line 31, I'm sorry. 19 A "Each of these execution units is 20 identical in design and configurable for 21 programmed operation." 22 So, yes, they are identical in design in	1 capable of executing a graphics processing task? 2 A My opinion is that it does not disclose or 3 render obvious claim 19. I don't know if I have 4 an opinion whether or not Jiao can execute a 5 graphics task. 6 Q Okay. So you didn't form an opinion as to 7 whether or not Jiao executes any graphics 8 processing tasks? 9 A No, I don't think that's one of my 10 opinions. 11 Q Okay. Did you form an opinion as to 12 whether or not Jiao executes a general compute 13 task at any time? 14 A I don't think that's one of my opinions 15 either. If it is, I'm not aware of -- aware of 16 it. 17 Q Okay. So you don't know whether or not 18 Jiao executes either a graphics processing task or 19 a general compute task at any time? 20 A Claim 19 requires both. Requires a first 21 task comprising a graphics processing task and the 22 second task comprising a general compute task.
1 this particular embodiment. 2 Q And do you agree that Jiao teaches that 3 each of the execution units 420 are programmable 4 as well as being identical? 5 A Yes. They are configurable for programmed 6 operation. 7 Q Do you recall that Jiao discloses an EUDP? 8 A An EADB? 9 Q DP. 10 A EUDP. I don't recall an EUDP. 11 Q For example, in column 11, starting on 12 line 4. 13 A Okay. 14 Q Do you agree that EUDP is located within 15 GPU 114? 16 A Yes. 17 Q So it's your opinion that Jiao is not 18 configured to execute a graphics processing task 19 while executing a general compute task, correct? 20 A Yes. Jiao does not disclose or render 21 obvious claim 19. 22 Q Is it your opinion that Jiao is not	1 And that's what I focused my opinions on. 2 Q Right. I understand. But what I'm trying 3 to understand is whether or not you formed an 4 opinion whether or not Jiao executes a general 5 compute task at any time? 6 A Paragraph 118 says, "Dr. Pedram has not 7 pointed to a single disclosure in Jiao which 8 provides that Jiao's system can even execute 9 general compute tasks, much less executing them 10 while executing a graphics processing task." 11 So I did not see -- you know, I don't have 12 an opinion showing that Jiao executes general 13 compute tasks, nor did I find anything from 14 Dr. Pedram that showed a disclosure in Jiao to 15 execute a general compute task. 16 Q So you didn't form an opinion as to 17 whether or not Jiao could execute or was capable 18 of executing a general compute task? 19 A My opinions are in response to 20 Dr. Pedram's opinions, and given Dr. Pedram's 21 opinion, I did not find a -- I did not see that 22 Jiao's system could execute general compute tasks.

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157 1 In fact, a person of ordinary skill in the 2 art would understand that any purported tasks 3 generated by Jiao's shaders are specific to 3D 4 graphics processing. 5 Q And your opinion is that tasks specific to 6 3D graphics processing cannot include a general 7 compute task, correct? 8 A As I stated before, I don't recall having 9 any opinions or seeing any opinions from 10 Dr. Pedram about tasks containing tasks. 11 Q So you didn't form an opinion as to 12 whether or not tasks specific to 3D graphics 13 processing could include a general compute task, 14 correct? 15 A That was not anything offered up by 16 Dr. Pedram, and my opinions are in response to 17 Dr. Pedram's opinions. 18 (WHEREUPON, Exhibit No. 1004 was presented 19 to the witness.) 20 BY MR. JOHNSON: 21 Q I've now handed you what's been marked 22 previously as Exhibit 1004 in this proceeding, and	159 1 host interface? 2 Let me ask it differently to make it 3 easier for you. 4 In Figure 2, PPU 0 is shown with a host 5 interface 206, correct? 6 A Yes. The embodiment in Figure 2 includes 7 206 host interface. 8 Q And we've already established that all of 9 the PPUs can be identical, so each of them could 10 have its own host interface, correct? 11 A Correct. In this embodiment. 12 Q And in PPU 0 shown in Figure 2, it also 13 has a set of -- strike that. 14 Shown in PPU 0, there is a plurality of 15 cores, correct? 16 A The column 6, line 36 states, "In one 17 embodiment, each core 208 includes an array of 18 parallel processing engines 302." 19 It refers to a core 208, not core 208, 20 200208-1 through 208 C minus 1. So it's unclear 21 whether we're looking at a core and separating 22 those out as separating those out into parallel
158 1 I'll represent for the record that it is a copy of 2 the Wilt prior art reference. 3 You have that in front of you? 4 A Yes. 5 Q And you recall that Wilt discloses 6 something he called a PPU, correct? 7 A Correct. 8 Q And do you agree that each of Wilt's PPUs 9 are identical? 10 A No. 11 Q Why not? 12 A Column 5, line 45, "The PPUs in a 13 multi-PPU system may be identical to or different 14 from each other." 15 Q So they can be identical, correct? 16 A Yeah, they may be identical. 17 Q And do you recall that Wilt's PPUs are 18 configured in parallel? 19 A Yes. 20 Q And do you agree that each PPU 21 has -- strike that. 22 Do you agree that each PPU has its own	160 1 processing engines or if each one is an individual 2 core. 3 Q So as represented in Figure 2 in PPU 0, 4 there is a core 0, core 1 through core C-1, 5 correct? 6 A Yes. That's the way it's labeled in 7 Figure 2. 8 Q And each of those have a pathway to the 9 work distribution unit, correct? 10 A Correct. 11 Q And PPU 0's host interface has pathway up 12 to the memory bridge 105, correct? 13 A Correct. 14 Q And Figure 2 represents that the pathways 15 between PPU 0, PPU 1, and PPU U-1, that go to the 16 memory bridge are identified as a communication 17 path 113, correct? 18 A Yeah, it's via a BUS or other 19 communication path 113 such as a PCI express, 20 accelerated graphics board HP, or a hyper 21 transport link. 22 Q And you agree that each PPU can either be

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161 1 processing graphics, processing tasks, or general 2 compute tasks, correct? 3 A Can you ask that again? 4 Q Sure. Do you agree that a given PPU in 5 Wilt could be used for general-purpose 6 computations? 7 A Wilt states that, "Some PPUs can be used 8 for graphics" -- "used as graphics processors, and 9 some can be used for general purpose 10 computations." But that's the limit to what I've 11 seen. 12 Q Okay. And would a person of ordinary 13 skill in the art understand that general purpose 14 computations could include a general compute task? 15 A No. Because computations are not tasks. 16 "Tasks" is a claim term. 17 Q And would a person of ordinary skill in 18 the art understand that a PPU that operates as a 19 graphics processor would involve executing tasks 20 that are graphics processing tasks? 21 A Again, no. When Wilt talks about the PPUs 22 being used as graphics processors, that's not	163 1 opinion? Is it because they have not received all 2 of the threads from that task, or is it because 3 they're receiving threads, not tasks? 4 A Because they're receiving threads, not 5 tasks. 6 Q Okay. So the decomposed threads of a task 7 can't be the task then? 8 A I don't know how something receiving just 9 threads knows if those threads came from the same 10 task or different tasks or would receive the state 11 associated with the task or the other requirements 12 of the task. 13 MR. JOHNSON: How long have we been going? 14 MR. DOKHANCHY: 45 minutes. 15 MR. JOHNSON: Let's take a break. 16 (WHEREUPON, a recess was had.) 17 BY MR. JOHNSON: 18 Q So earlier we talked about a physics task 19 and -- do you recall that? 20 A I recall us talking about that physics 21 example from my report. 22 Q Let me skip that for a second.
162 1 talking about tasks in the sense of a task that's 2 used in the '381 that would be required for 3 claim 15 and dependent claim 19. 4 Q And why is it not a task? 5 A What's received by these PPUs are commands 6 or command streams. Those would be threads. 7 There's nothing showing in Wilt that identifies 8 any of these as tasks or provides the 9 identification required to meet the requirements 10 of a task. 11 Q And a task is a unit of work that is 12 decomposable into two or more command threads, 13 correct? 14 A That's certainly for a task. And then the 15 rest of claim 15, yes. 16 Q And so your opinion is that even if the 17 PPUs are executing the two or more decomposed 18 threads of a task, they're not executing the task, 19 correct? 20 A My opinion is that the PPUs are not 21 receiving tasks. 22 Q I know. But what's the basis for that	164 1 We talked about scheduling task. And I 2 did not ask you how would a person of skill in the 3 art understand a scheduling task? 4 A In what context? 5 Q In context of the '381 patent. 6 A So there's multiple scheduling -- 7 schedulers happening. There are tasks described 8 in the '381, so I wasn't sure what you meant by "a 9 scheduling task." 10 Is there a particular part of the '381 11 referring to a scheduling task? 12 Q No. I just want to know how would a 13 person of ordinary skill in the art understand a 14 scheduling task in the context of the '381 patent? 15 And if there's multiple types of scheduling tasks 16 within the '381 patent in your opinion, could you 17 provide me those examples? 18 A I don't recall specifically the term 19 "scheduling task" in the '381. 20 Q Is there scheduling that goes on in the 21 '381 patent? 22 A Yes.

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165 1 Q And is that scheduling related to tasks? 2 A Yes. A plurality of engines receive from 3 a scheduling module a plurality of tasks. 4 Q Is it possible to have a task that's 5 directed at scheduling? 6 A I didn't consider that. That wasn't one 7 of the examples Dr. Pedram came up with. It 8 wasn't one of the examples I saw in the '381, so I 9 didn't really consider that. 10 Q As a person of ordinary skill in the art, 11 do you know whether or not it is possible to have 12 a task that's directed at scheduling? 13 A So "task" is a claim term, and my opinions 14 on the '381, specifically around anything 15 involving the term "task" are very careful about 16 what the term "task" is used for. 17 And so a task is something that fits the 18 construction I've provided and that I would need 19 to evaluate whether that task satisfied claim 15. 20 I didn't see anything called a scheduling task 21 where I did any sort of analysis like that. 22 Q Would a person of ordinary skill in the	167 1 command. 2 Q And it's used within the '381 patents, 3 correct? 4 A I don't recall. It's not one of the terms 5 that I recognize. 6 Q So you didn't form an opinion as to what a 7 command was in the context of the '381 patent, 8 correct? 9 A It wasn't one of the construed terms, and 10 I didn't provide a construction for command. 11 Q Are instructions tasks -- 12 A So -- 13 Q -- within the context of the '381 patent? 14 A So a task is a unit of processing work 15 decomposable into two or more related threads, and 16 a thread is a sequence of instructions, so tasks 17 are not instructions. 18 Q Okay. Is one plus one a task? 19 A I don't recall something as simple as that 20 being put forward by Dr. Pedram as a task or the 21 '381 as a task. So, no, I wouldn't call that a 22 task. I didn't confront anything of the sort as a
166 1 art understand an ALU task to include general 2 compute tasks? 3 A As I said before, my analysis of the '381 4 and my opinions in response to Dr. Pedram never 5 considered a task within a task. Dr. Pedram never 6 put forward a situation where you would have a 7 task within a task. 8 Q Is a command a task? 9 A So in Wilt's system, Wilt's system 10 receives commands or command streams, and those 11 are threads, sequences of instructions; they're 12 not tasks. So in that particular case, a Wilt 13 command is not a '381 task. 14 Q I'm not asking about Wilt. I'm asking 15 about the '381. Could a command be a task within 16 the context of the '381 patent? 17 A I'd have to see what the command 18 corresponded to. I don't know what command you're 19 speaking of. 20 Q You know what a command is, right? 21 A There's a word "command"; it's used in a 22 variety of context. I need to know the context of	168 1 task. 2 Q As a person of ordinary skill in the art, 3 would you consider one plus one to be a task? 4 A So "task" is a claim term. A person of 5 ordinary skill in the art would understand a task 6 as I've defined it based on the '381. Something 7 as simple as adding two numbers might result from 8 a single instruction; so I wouldn't consider that 9 a task, I would consider that an instruction. 10 Q So I assume your answer would be the same 11 if I change one plus one to A plus B, correct? 12 A I would have know what A plus B were, but 13 if A plus B were register A plus register B, that 14 would also be at the level of an instruction. 15 Q What other things could A plus B mean? 16 A A plus B could be 16 in hexadecimal. 17 Q And would that be a task? 18 A That's something I just added in my head. 19 It's not something I considered as a task in the 20 '381 -- what a person of ordinary skill in the art 21 would understand a task to be from the '381. 22 Q I understood your previous answer to mean

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169 1 that A represented a register and B represented a 2 register, correct? 3 A Yeah, I think a person of ordinary skill 4 in the art would be familiar with an add 5 instruction that added the contents of a first 6 register with the contents of a second register. 7 Q And that would not be a task is what you 8 said, correct? 9 A I think a person of ordinary skill in the 10 art would understand that to be an instruction. A 11 task is, among other things, a plurality of 12 threads, two or more threads, and thread is a 13 sequence of instructions. 14 Q Let's see. Can you look at, I think it's 15 Paragraph 89 in your declaration. You can read 16 the whole paragraph to get your context, but the 17 sentence I want to focus on is the second-to-last 18 sentence that starts, "The CPU is not Dr. Pedram's 19 alleged shader core." 20 Do you see that sentence? 21 A Yes. 22 Q So feel free to read the paragraph, and	171 1 with a higher priority aided by pushing context to 2 and popping context from a stack can pause the 3 execution of a task with a lower priority. 4 And the rest of this goes on to show that 5 context swapping does not imply priority. There's 6 all sorts of other reasons you would perform 7 context swapping. 8 The particular sentence here in 9 Paragraph 89 regarding the CPU is to describe the 10 context in which Dr. Pedram referred to Wilt. 11 12-64 to 65, and 53 to 56, these are in the 12 context of CPU threads and how they correspond to 13 operations -- computations performed on the PPU. 14 And so my reference to the CPU is because of 15 Wilt's reference to the CPU in column 12. 16 Q So is it your opinion that if the priority 17 of the task is assigned at the CPU before arriving 18 to the GPU, that that priority would not satisfy 19 the claim language? 20 A I'm not seeing a priority at all. 21 Q That's not my question. 22 Is it your opinion that if the priority of
170 1 then I'll ask the question about this sentence. 2 A Okay. 3 Q So I don't understand what this sentence 4 means, so could you just explain it to me. 5 First of all, let me read it into the 6 record, just so it's in the record. So the 7 sentence I'm talking about is the second-to-last 8 sentence in Paragraph 89 on Page 48 of your 9 declaration, which is Exhibit 2006 in this 10 proceeding. 11 It states, "The CPU is not Dr. Pedram's 12 alleged shader core, and, thus, Wilt's disclosure 13 of PPU context (which applies only to the CPU) 14 does not apply to the claimed shader core for this 15 other reason." 16 A Okay. So what's the question? 17 Q What does that sentence mean? 18 A So Dr. Pedram opines that Wilt discloses 19 context swapping using the PPU context stack, and 20 that's because he's -- Dr. Pedram was trying to 21 show somehow that context swapping is necessitated 22 by tasks of different priority, such that a task	172 1 a task was assigned at the CPU before arriving at 2 the GPU, would that priority satisfy the claim 3 language? 4 A That was not the case for Wilt, so I 5 didn't address that particular situation in 6 Paragraph 89. 7 Dr. Pedram is citing to a section of Wilt 8 that refers to the PPU working in concert with the 9 CPU, but -- as a way of satisfying claim 20, which 10 requires claim 15, but the engines and the shader 11 core are all identified as PPU components and do 12 not involve the CPU. 13 So it's not clear why the CPU somehow is 14 involved in a claim 15 and dependent claim 20 15 argument. 16 Q So if Dr. Pedram's argument is that the 17 priority of the tasks is assigned at the CPU and 18 that that priority is maintained all the way 19 through to the shader core, do you not have an 20 opinion as to whether or not that priority would 21 still satisfy the claim language? 22 A That was not Dr. Pedram's opinion. I did

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173 1 not see that in Dr. Pedram's opinion, so -- 2 Q I understand that -- 3 A -- not addressed -- 4 Q -- understood what he argued, but I'm 5 asking you to assume that if Dr. Pedram's opinion 6 is that a priority is assigned at the CPU level 7 and carries with it -- with that task all the way 8 to the shader core, would that satisfy the claim 9 language? 10 A Wilt would not. Furthermore, Dr. Pedram 11 is showing context swapping. Context swapping 12 alone does not satisfy claim 20. There's all 13 sorts of reasons you would do context swapping 14 that are unrelated to priority. 15 And I did not see a priority coming from 16 the CPU, whether or not I'm trying to imagine it 17 now or however you want to put it. 18 MR. JOHNSON: I have no further questions. 19 I pass the witness. 20 MR. DOKHANCHY: I have just a couple 21 questions. 22	175 1 A That's correct. 2 Q And by the same token, the receipt of 3 tasks, as long as the engines and the core over 4 time receive the threads that constitute a task 5 and you could show the correspondence to a task, 6 if you could show that, you would know that the 7 receipt of the task has happened; is that right? 8 A Yes. Yes. I mean, there's any number of 9 underlying ways that could happen, but yes. 10 Q And it's that lack of correspondence that 11 you take issue with in the prior art references; 12 is that right? 13 A That's right. 14 Q I have no further questions. 15 FURTHER EXAMINATION 16 BY MR. JOHNSON: 17 Q So how do you show that correspondence? 18 That's what I've been trying to get at the whole 19 day. 20 A It was characterized in the '381. For 21 example, what was passed to the core from the 22 arbitration -- arbiter logic in Figure 2 is one
174 1 EXAMINATION 2 BY MR. DOKHANCHY: 3 Q Dr. Hart, you were asked in this last 4 session about what it means to receive a task and 5 execute a task, vis-à-vis threads; do you recall 6 that? 7 A Vaguely, yeah. 8 Q And in claim 15 when the shader core 9 executes tasks, is it right that what it actually 10 does is execute the threads that are making up 11 that task? 12 A The shader core? 13 Q Yeah. 14 A Yeah, the shader core receives the tasks, 15 and it executes a first task from the plurality of 16 tasks while executing the second task from the 17 plurality of tasks. 18 As I mentioned before, tasks, one of the 19 things a task is is two or more threads, and so it 20 would execute those threads. 21 Q From the technical perspective, what's 22 actually happening is it's executing threads?	176 1 example. 2 And when I look at the prior art, Jiao, 3 Wilt, and Stuttard, they're all operating at the 4 thread level; they're not using any task 5 information. 6 Q That's not what I asked. 7 In the '381 patent, you just testified 8 that as long as the shader core receives the 9 correspondence to a task for a group of threads, 10 then it would be receiving the task? 11 MR. DOKHANCHY: Objection. Misstates 12 prior testimony. 13 BY MR. JOHNSON: 14 Q So what is the correspondence that it must 15 receive in order to know that it's receiving a 16 task? 17 MR. DOKHANCHY: Objection. Misstates 18 prior testimony. 19 BY THE WITNESS: 20 A As I said before, one of the places I saw 21 evidence of it was through the arbitration logic. 22

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177 1 BY MR. JOHNSON: 2 Q And what is the arbitration logic sending 3 to let the shader core know that the group of 4 threads that it's receiving is a task? 5 A Arbitration logic 222 includes a plurality 6 of multiplexes to provide the tasks from the 7 different virtual engines of command processor 232 8 shader core 214. 9 Q It just says it provides the tasks, okay? 10 So how does the shader core know it's a task? 11 A Because it says here that the arbitration 12 logic is what -- is how the shader core receives 13 tasks from the engines. 14 Q But if it's receiving the threads, what is 15 it receiving in addition to the threads so that it 16 knows it's a task? 17 A One thing it would receive is the 18 respective state data associated with each of the 19 tasks. 20 Q That's already in the claim, right? 21 A Yes. 22 Q Okay. So as long as it receives the	179 1 '381, a person of ordinary skill in the art would 2 see in '381, information about the tasks making it 3 all the way to the shader core. 4 That's not the case with Jiao, Wilt, or 5 Stuttard. They operate in a task-agnostic manner. 6 They focus on threads and information about 7 threads that is not task-specific. 8 Q The question I asked you was: The receipt 9 of tasks, as long as the engines and the core over 10 time receive the threads that constitute a task, 11 and you could show the correspondence to a task, 12 if you could show that, would you know that the 13 receipt of the task has happened? 14 And you answered yes. And you said there 15 are any number of underlying ways that could 16 happen. 17 So give me some examples of these 18 underlying ways that you've testified about. 19 A The arbitration logic. 20 Q Give me a different example. 21 A I don't -- I don't have one off the top of 22 my head.
178 1 threads and it receives the state data, then it's 2 receiving a task, correct? 3 A State data of the tasks, that's -- that's 4 certainly required. 5 Q But does the shader core have to know it's 6 a task? 7 A So the shader core is required to execute 8 a first task from the plurality of tasks while 9 executing a second task from the plurality of 10 tasks. So it has to be able to execute two tasks. 11 Q That's not my question. 12 A Well, how does it know it's executing two 13 tasks? 14 Q That's my question. Does it need to know? 15 A I just see here that it's required to 16 execute two tasks -- 17 Q Does it need to know that it's executing 18 tasks? 19 A It needs to know something about the tasks 20 above what it would know about threads -- 21 Q And what is that? 22 A -- I didn't -- I saw -- I saw -- I see in	180 1 Q Then how do you know there is another way 2 to do it? 3 A I don't need to know that there's another 4 way to do it. I know that the '381 does it, and I 5 did not see any way that any of the prior art did 6 it. 7 Q So if the shader core receives all the 8 tasks for -- I'm sorry. Strike that. 9 If a shader core receives all the threads 10 that constitute a task, including all the state 11 data, then it's received the tasks; that's all 12 that's necessary, correct? 13 A How does it know? 14 Q So it has to know, correct? That, under 15 your theory, it has to -- the shader core has to 16 know it's a task? 17 A It's simpler than that. In the prior art, 18 there is no information getting to the -- 19 Q I'm not asking about prior art. 20 MR. DOKHANCHY: Let him finish. Let him 21 finish. 22 Finish your answer, Dr. Hart.

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181 1 BY THE WITNESS: 2 A In the prior art, there was no information 3 beyond the thread level, no information at the 4 task level that made it to what was purported to 5 be a shader core, so I knew that there was -- that 6 was not satisfying claim 15. I didn't need to 7 look further than that. 8 BY MR. JOHNSON: 9 Q Does the shader core need to know that 10 it's executing tasks? 11 A I didn't need to consider the specifics of 12 that. I considered what Dr. Pedram put forward in 13 the prior art that he opined satisfied the shader 14 core, and when I looked at that shader core, it 15 did not receive any task information. 16 MR. JOHNSON: Okay. I'm done. 17 MR. DOKHANCHY: Nothing further from me. 18 (WHEREUPON, the deposition was concluded 19 at 3:08 p.m. CST) 20 21 22	183 1 CERTIFICATE OF REPORTER 2 3 I, MICHELLE M. YOHLER, a Certified 4 Shorthand Reporter within and for the County of 5 Will, State of Illinois, do hereby certify: 6 That previous to the commencement of the 7 examination of the witness, the witness was duly 8 sworn to testify the whole truth concerning the 9 matters herein; 10 That the foregoing deposition transcript 11 was reported stenographically by me, was 12 thereafter reduced to typewriting under my 13 personal direction and constitutes a true record 14 of the testimony given and the proceedings had; 15 That the said deposition was taken before 16 me at the time and place specified; 17 That I am not a relative or employee or 18 attorney or counsel, nor a relative or employee of 19 such attorney or counsel for any of the parties 20 hereto, nor interested directly or indirectly in 21 the outcome of this action. 22
182 1 ACKNOWLEDGMENT OF DEPONENT 2 I, JOHN HART, Ph.D., do hereby acknowledge 3 that I have read and examined the foregoing 4 testimony and the same is a true, correct, and 5 complete transcription of the testimony given by 6 me and any corrections appear on the attached 7 errata sheet signed by me. 8 9 _____ 10 (SIGNATURE) (DATE) 11 12 13 14 15 16 17 18 19 20 21 22	184 1 IN WITNESS WHEREOF, I do hereunto set my 2 hand and affix my seal of office at Chicago, 3 Illinois, this 6th day of April, 2024. 4 5 6 7 <i>Michelle M. Yohler</i> 8 9 Michelle M. Yohler, CSR, RMR, CRR 10 Certified Shorthand Reporter 11 CSR No.: 84-4531 12 13 14 15 16 17 18 19 20 21 22

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