

Page 1 1 UNITED STATES PATENT AND TRADEMARK OFFICE 2 BEFORE THE PATENT TRIAL AND APPEAL BOARD 3 ----- 4 SMA SOLAR TECHNOLOGY AMERICA, LLC, 5 Petitioner, 6 vs. CASE NO. IPR2023-00879 7 TIGO ENERGY, INC., 8 Patent Owner. 9 ----- 10 11 12 13 REMOTE VIDEOCONFERENCE DEPOSITION OF 14 DOUGLAS R. HOLBERG, PH.D. 15 16 17 January 18, 2024 18 7:30 a.m. (MST) 19 20 21 22 23 24 25 Michele Koss, RMR, RPR	Page 3 1 INDEX OF EXAMINATION 2 3 WITNESS: DOUGLAS R. HOLBERG, PH.D. 4 EXAMINATION PAGE 5 By Mr. Ullmer 4, 84 6 By Mr. Eschweiler 79 7 INDEX TO EXHIBIT 8 PREVIOUSLY MARKED EXHIBITS 9 1001 10 1002 11 1003 12 1005 13 1007 14 15 16 17 18 19 20 21 22 23 24 25
Page 2 1 APPEARANCES OF COUNSEL 2 3 On Behalf of the Petitioner 4 THOMAS G. ESCHWEILER, ESQ. 5 NATHAN J. SMITH, ESQ. 6 ESCHWEILER & POTASHNIK LLC 7 195 S. Main Street, Suite 400 8 Akron, Ohio 44308 9 216.502.0600 10 teschweiler@epiplaw.com 11 njsmith@epiplaw.com 12 On Behalf of the Patent Owner 13 STEPHEN M. ULLMER, ESQ. 14 GREENBERG TRAURIG, LLP 15 1144 15th Street, Suite 3300 16 Denver, Colorado 80202 17 303.685.7418 18 ullmers@gtlaw.com 19 20 21 22 23 24 25	Page 4 1 DEPOSITION OF DOUGLAS R. HOLBERG 2 January 18, 2024 3 DOUGLAS R. HOLBERG, 4 having been first duly sworn, testified as follows: 5 MR. ULLMER: Do you want introductions from 6 counsel as well? 7 THE COURT REPORTER: Yes, please. 8 MR. ULLMER: I am Stephen Ullmer of the law 9 firm Greenberg Traurig representing Tigo Energy, Inc., 10 the patent owner. 11 MR. ESCHWEILER: My name is Thomas 12 Eschweiler from Eschweiler & Potashnik, and I am 13 representing SMA Solar Technology AG, the Petitioner in 14 this proceeding. 15 MR. SMITH: I am Nathan Smith also from 16 Eschweiler & Potashnik also representing SMA. 17 EXAMINATION 18 BY MR. ULLMER: 19 Q Good morning, Dr. Holberg. We never met 20 before, right? 21 A Correct. 22 Q And I have never taken your deposition or 23 defended you in a deposition so I want to make sure we 24 understand some basic ground rules for today's 25 deposition.

Page 5 1 You are testifying today in relation to a 2 declaration that you provided in an inter partes review 3 in Case No. 2023-00879; is that right? 4 A I don't have the number memorized, but I am 5 pretty sure that is correct. 6 Q If you would like, I think this information 7 would be on the first page of your declaration which is 8 Exhibit 1007 in this proceeding. 9 A Yes, APR 2023-00879. 10 Q Okay. So if I refer to an IPR today, just 11 as a shorthand, that is the IPR that I am referring to. 12 Can we agree on that? 13 A We can. 14 Q And there is a U.S. patent that is at issue 15 in that IPR that is U.S. Patent 9,584,021, correct? 16 A 9,584,021, correct. 17 Q Okay. The same thing, for patents we 18 typically refer to them by their last three digits. So 19 if I call something the zero two one or the '021 patent, 20 I am referring to that U.S. patent that we just 21 discussed the full number on, right? 22 A Correct. 23 Q And, similarly, if I refer to the '021 24 patent, what I am talking about is actually marked as an 25 exhibit, Exhibit 1001 in this case, correct?	Page 7 1 that you not communicate with others, no text messages, 2 no instant messaging or emailing with other people 3 during the deposition. 4 Is that fair? 5 A Yes, sir, that is fair. 6 Q In general, have you been deposed before? 7 A Yes. 8 Q How many times? 9 A Eighteen. 10 Q Eighteen times. 11 So you are fairly familiar with the 12 procedures and the process of being deposed, right? 13 A Yes, I am. 14 Q Have you been deposed remotely before like 15 we are doing today via Zoom? 16 A Yes. 17 Q Okay. So Zoom will occasionally cause 18 issues with a deposition. It may be that you do not 19 understand my question because my internet or your 20 internet dropped out or there is some glitch. If that 21 is the case, please just let me know and I will reask my 22 question. 23 If the same thing happens to me during your 24 answer, I will make sure that I have you repeat that 25 answer so we get a full and complete record.
Page 6 1 A That is correct. 2 Q Okay. Generally speaking, are you familiar 3 with the exhibit numbering that we used in this case so 4 that the U.S. patent we just talked about is Exhibit 5 1001, and then your counsel has marked additional 6 exhibits going up from there. So 1002 up through, I 7 believe, 1017 and your declaration itself is Exhibit 8 1007, right? 9 A Yes. And they are, in my folder they are 10 numbered, although mine only goes up to 1015 here. 11 Maybe there were a couple of exhibits that I did not 12 put in this folder. 13 Q Okay. There may be exhibits that you just 14 have not seen that have been filed in this proceeding. 15 That is fine. We may get to those and, if we have to, 16 we can send you those documents if need be. 17 A Okay. 18 Q So you are using a computer to view 19 documents for this deposition; is that right? 20 A That is correct. 21 Q And you have a folder containing the 22 exhibits and those exhibits are unmarked and not 23 annotated by you, right? 24 A Correct. 25 Q So because you are using a computer, I ask	Page 8 1 Is that reasonable? 2 A That is reasonable. 3 Q All right. 4 Is there any reason you are not able to give 5 full and accurate testimony today? 6 A No. 7 Q You are not under the influence of any 8 medications or drugs or alcohol, right? 9 A No. 10 Q You have Exhibit 1007 up on your screen? 11 A Yes, it is. 12 Q Let us look at Section 7 of your Table of 13 Contents. 14 A Okay. 15 Q So Section 7 indicates that there are four 16 grounds; Ground A, Ground B, Ground C and Ground D, 17 correct? 18 A Correct. 19 Q The first ground is what you labeled 20 anticipation of claims 1 to 7 and 9 in view of Mieth; is 21 that right? 22 A Correct. 23 Q Ground B is anticipation/obviousness of 24 claims 1 to 12, 15 to 18 and 20 in view of Mieth and 25 reference what I will call Balogh?



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Page 9 1 A Okay. Yes. 2 Q I don't know if that should be said 3 differently. Our expert in these cases is actually 4 named Baylog without the H, so I usually just use the 5 name Baylogh out of habit. 6 A Wow, your expert is Baylog, okay. 7 Q Different Baylogh. I always have to remind 8 myself it is not the same guy. 9 A All right. 10 Q Ground C is obviousness of Claims 13 and 14 11 in view of Mieth, Balogh, and further in view of Nishi, 12 correct? 13 A Right. 14 Q Ground D is the last of your four grounds, 15 Obviousness of Claim 19 in view of Mieth, Balogh and 16 further in view of Liu, right? 17 A Correct. 18 Q Okay. So the first, if you go down to the 19 next page after that Table of Contents, there is an 20 introduction section of your declaration, right? 21 A Correct. 22 Q I have seen your CV. It is not part of this 23 declaration, but I was sent your CV by counsel. 24 Having looked at the CV in your declaration, 25 it looks like you graduated with a BS in electrical	Page 11 1 for three or four years until the end of 1984 when our 2 little company got funded with venture capital money and 3 we changed our name and became Crystal semi-conductor. 4 And at Crystal I was designing -- I 5 continued to support the pacemaker effort for a little 6 while, and then I started working designing a universal 7 filter using CMOS switch technology. 8 And then all that time I was, you know, I 9 had this passion for getting a Ph.D. and I was taking 10 remote classes actually while I was still in the Dallas 11 area at SMU and then some at University of Texas. 12 Finally I decided I am just going to quit 13 and work full-time on my master's degree. I did that in 14 August of '87, I believe. I got the master's in '89 and 15 the Ph.D. in '92. 16 Then I went back to Crystal, which since 17 that time had been purchased by Cirrus Logic. So that 18 covered the time span that you were asking about. 19 Q Okay. So what kind of technology did you 20 work on at Cirrus Logic? 21 A So the first thing that I worked on, I went 22 into -- Cirrus had an effort to get into the analog 23 side of disk drives. They were already supporting the 24 disk drive manufacturers with controllers which were 25 all digital.
Page 10 1 engineering in 1977, right? 2 A That is correct. 3 Q And then at some point you went back to 4 pursue further education and earned a master's in 1989, 5 right? 6 A Yes. 7 Q And a Ph.D. in 1992? 8 A That is correct. 9 Q Okay. Between earning your bachelor's in 10 1977 and going back to get your master's in 1989, what 11 were you doing? 12 A So when I graduated I went to work for 13 Multek Corporation in 1978, January 2 of 1978. I 14 worked for them until -- at Multek I was doing 15 integrated circuit design and CMOS technology for 16 telecom type applications, home generators, ringers and 17 such. 18 And then in June of 1980 my former boss at 19 Multek invited me to join him in a little startup 20 company called Texas Micro Engineering, and that is when 21 I moved to the central Texas from Dallas area. 22 And we were -- you know, quite frankly, we 23 were doing whatever we could find to get revenue input. 24 I was designing a pacemaker sense amplifier for a 25 company named InterMedix. And so I was working on that	Page 12 1 And so Cirrus -- Crystal/Cirrus, we still 2 went by the name Crystal even though we were a 3 wholly-owned subsidiary of Cirrus, but we were a more 4 analog oriented company. 5 So I started working on the hard drive, what 6 they call the read channel which is basically taking 7 input off of the -- there is a sense amplifier that is 8 right at the head of an arm on a rotating hard drive, a 9 spinning hard drive, and that sends an analog signal 10 back to what is called a read channel unit and that is 11 amplified, filtered, you sync up with it. I worked on 12 that program doing synthesizers, PLLs of that sort. 13 And then I worked on -- after that I moved 14 up in the company to -- I cannot remember what my titles 15 were. Anyway, I had more people working for me. I 16 still had a program doing telecom chip, kind of a custom 17 chip for a company out in Alabama, Adtran. 18 Then after that I started, I had this work 19 project I was fascinated with imaging and the technology 20 of digital imagery and this was actually pretty early. 21 This is probably '97-ish, '98. I started a project to 22 develop a CMOS imager. 23 At the same time we were designing circuits 24 for front ends to CCDs. So we already had a foot in the 25 door with imaging. Although we were not doing the



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Page 13 1 imagery itself, we were interfacing with CCDs. 2 Anyway, in 1999 or late '98 I got tapped on 3 the shoulder by one of the venture capitalists at Austin 4 Ventures and he said, hey, would you be interested in 5 starting this company? I got two guys, a marketing guy 6 and a president type guy. We need the engineering lead. 7 And so I said, well, what the heck. So we 8 started this company called Cygnal, C-y-g-n-a-l. The 9 focus was, you know, kind of a 21st, it was not the 21st 10 century at the time, but 21st century micro-controllers. 11 So we developed an 8051 base 12 micro-controller that, you know, a typical 8051 might 13 be, I don't recall exactly, but maybe 10 to 12 cycles 14 per instruction. So we developed one that was, you 15 know, 70 percent of the instructions you can do in one 16 clock cycle and the other 30 percent was two, three and 17 four. I do not remember specifics. 18 So it was a very fast architecture, but it 19 used the classic 8051 instruction set. So you could 20 take advantage of the huge, huge, enormous world of code 21 that had already been written, but we added onto that a 22 flash support. So we had flash memory on the chips so 23 you could store, typically you would find it external to 24 the chip, so you could store your code on the chip. We 25 also added various analog peripherals. We had a 12-byte	Page 15 1 I did some other things corporate wise 2 setting up their annual, their annual technical forum, 3 which they still do. 4 Anyway, in 2008 I kind of had a difficult 5 time, and I decided to resign for purely family reasons. 6 I will not go into all of that. 7 Silicon Labs said, look, we are going to 8 keep you, keep your badge active and you can come in and 9 out any time. So I kind of did not much of anything. I 10 was a scoutmaster at the tenants office. I was pretty 11 involved with, you know, taking high venture trips and 12 camping and whatnot. 13 So I thought maybe a year later, I don't 14 know, maybe earlier, sometime after I left I was invited 15 by my first boss, the same guy that hired me to go to 16 Crystal or Texas Micro that became Crystal that became 17 Cirrus, he wanted me to help him with some patent stuff. 18 So I started working, you know, not many 19 hours per week, but I started helping out in the SD 20 microelectronics licensing group. 21 And so over three or four or five years, I 22 don't remember how long it lasted, I spent, I put more 23 and more hours into that. 24 And then after the America Invents Act that 25 kind of established this whole IPR thing I believe and
Page 14 1 A to D and later we added -- we did very many models of 2 this. We had a ten-byte DAC. We had temp sensors, 3 precision oscillators. 4 Anyway, so basically you could solve, you 5 know, an analog digital world problem that required code 6 and some processing power all with a single chip. So we 7 were pretty successful. 8 Then three years into that, in 2003, late 9 2003, just by happenstance I ran into the CEO or the 10 chairman of the board of Silicon Labs whom I knew very 11 well but I had not been hanging out with him that much. 12 I ran into him and he wanted to know what we were up to. 13 I said, this is what we are doing. 14 He said, you know what, we spent about an 15 hour and a half over a hamburger and he said, we are 16 going to buy you, and so they did. They bought us. 17 And so then I went to Silicon Labs. And I 18 hope this is not boring. And I went to Silicon Labs and 19 there I was promoted to Vice President of Technology 20 which is kind of an inward looking CTO. I was not an 21 outward facing CTO. 22 There I was passionate about methodology so 23 I tried to -- I had the CAD group under me. I was 24 trying to develop these standardized methodologies so we 25 can just generate more chips faster.	Page 16 1 licensing kind of went out the door. So they shutdown 2 that program. 3 And so I just, you know, waited for phone 4 calls for people that wanted help with patent cases. I 5 never advertised or actively pursued it. It's just 6 somebody knows me. And so I picked up a few cases here 7 and there and did work for Silicon Labs. They called me 8 a few times to help them on some cases. And so that is 9 what I have been pretty much doing. 10 I did some contract work for a medical 11 device company designing, I designed, I did -- some of 12 my patents, the last few patents are in this area, it is 13 a smart knee. Let us just call it that. It is the 14 electronics in the knee for when you put -- when 15 somebody gets a new knee, the electronics are embedded 16 that will provide gyroscopic data, accelerometer data 17 and even magnetic compass data, although I always argued 18 that those guys, that they did not need a compass in a 19 knee but they wanted it, and I could get it. 20 So I developed the prototype for that and 21 went around and pitched this with them for six months. 22 And then they handed it over to a medical device company 23 to design it to get it through the FDA and they just 24 gave me some equity in the company. So I have not 25 really -- I am still officially, I guess, I am a



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Page 17 1 consultant, but they have not called me in four or five 2 years. 3 Q Okay. 4 A So that is pretty much, that is pretty much 5 it. I don't take a lot of cases anymore because I am 6 getting old. I am more interested in watchmaking and 7 grandchildren than I am in doing patent work. 8 Q Okay. There are a couple of items I want to 9 followup on from that answer. I am probably missing 10 something because it was a good summary of the last 30 11 years of your life I think. 12 A Forty. 13 Q Forty. Fair enough. 14 So the first is you mentioned a couple of 15 acronyms. The first one was PLL. I think that is 16 phase-locked loop; is that right? 17 A That is correct. 18 Q And then CCD, I think this relates to 19 digital cameras and I think that means something like 20 charge-couple device; is that right? 21 A That is what it is, correct. 22 Q Okay. And then you have also mentioned CMOS 23 imagers. 24 Is that also related to digital camera 25 applications?	Page 19 1 Q The other one was, I think you said a 2 ten-byte DAC. 3 Is that a digital-to-analog converter? Is 4 that what that was? 5 A Correct. 6 Q Okay. So do you have any experience in the 7 solar industry? 8 A No. 9 Q How about in high power applications? 10 A What do you mean by high? How high is 11 high? 12 Q Well, so in power generation applications, 13 so if it is not solar, which you indicated previously 14 that you didn't have solar industry experience, is there 15 other power generation experience that you have had? 16 A Well, I have done a lot of work, patent 17 related work in switch mode power supplies but not 18 inverters in terms of power generation like an inverter 19 where you are providing power to the mains. 20 Q Right. That is kind of what I was thinking 21 is inverters and technology of that sort. 22 So in your CV I think that you listed you 23 are a named inventor on quite a number of patents. 24 Do you mind summarizing sort of what the 25 technology of those patents relate to?
Page 18 1 A Yes. 2 Q Okay. What does CMOS refer to? 3 A It is complementary metal-oxide 4 semiconductor. 5 One thing that I left out which is fairly 6 important that kind of flowed through that whole process 7 is sometime in the mid-eighties my former professor 8 asked me to co-author a book with him. We wrote the 9 book CMOS Analog Circuit Design. I think it was 10 published in '87. 11 And then we wrote two subsequent editions, 12 second and third edition, and it was translated into 13 Chinese twice. I don't think they translated the third 14 edition. The last edition, I cannot remember the date, 15 it was 2000 or something. I don't know. It is easy to 16 find out, but I don't recall the actual dates. 17 Q Yes, I think I can look at your CV and find 18 that out if I need to. I think we are okay on that 19 front. 20 A couple more acronyms. I just want to make 21 sure that the record is clear and I know what you are 22 talking about when I look back at that summary. And one 23 of those was A to D, and I think that just means analog 24 to digital, correct? 25 A Yes.	Page 20 1 A Yes. Most of them are CMOS analog circuit 2 related. The only ones that are outside of that that I 3 can recall are these last few which is the smart knee 4 and they are the patents owned by Canary Medical. 5 In some of the other parents in the group 6 there might be packaging related patents, but it is all 7 related to integrated circuits. 8 Q As your counsel and I were discussing, as we 9 get older, things start breaking. I am excited to get a 10 really fancy knee someday. 11 A Okay. 12 Q So you also listed that you have authored 13 and co-authored various publications in your CV. 14 There was an acronym there that I was not 15 sure about. The acronym was EEPR4. 16 Do you recall that, and can you tell me what 17 that means? 18 A Yes, that would have been the disk drive 19 area, and it was a standard -- actually, I cannot 20 remember what the acronym stands for, but it is a 21 standard for the way you detect the signals coming off 22 the drive. 23 Q If you still have Exhibit 1007 up, can you 24 turn to paragraph 10? 25 A Yes.

Page 21 1 Q So here you are listing experience with the 2 technology that is described in the '021 patent. You 3 list resistors, capacitors, diodes, inductors, 4 transistors, transformers, oscillators, operational 5 amplifiers, comparators, general integrated-circuit 6 technology. 7 Those are also just sort of basic building 8 blocks of circuits and a typical portion of an 9 electrical engineering career, right? 10 A Correct. 11 Q So you also mention in here floor-planning I 12 think. 13 Can you explain what that means? 14 A So when you design an integrated circuit 15 there is two aspects of it. One is the schematic 16 rendering of it which is how the transistors, resistors 17 and all the components connect together. 18 In order for that to be converted to 19 silicon, you have to, you have to layout the physical 20 implementation of all of those devices. 21 For example, very simply, to make a 22 transistor, an MOS transistor, you have to have, define 23 an area called the active area. And then you have to 24 define the area you call the gate that crosses the 25 active area which creates the drain and the source	Page 23 1 want to get chips to work optimally. 2 Q Okay. Let us turn to the next paragraph, 3 paragraph 11. This is just describing or explaining 4 that your analysis in the declaration that you provided 5 is informed by your experience in the field of 6 electrical engineering. 7 Do you see that? 8 A Yes. 9 Q And then the last sentence of that paragraph 10 says, Based on my above-described experience, I believe 11 that I am considered to be an expert in the field. 12 I just want to make sure that I am clear on 13 one thing which is, is the field you are referring to 14 there the field of electrical engineering or the field 15 of the '021 patent which may be something separate? 16 A Well, electrical engineering in general. I 17 mean, the '021 patent, apart from the PV array itself 18 is just circuitry, the kind of stuff that I have worked 19 on, you know, my entire career. 20 So, yes, it would be in the field of 21 electrical engineering circuit design. Everything that 22 you can collectively draw from my CV, yes, essentially 23 that. 24 Q Did you have an opinion on the field of the 25 '021 patent separate from the field of electrical
Page 22 1 regions as a result of a crossing in a modern 2 technology, and you have contacts that have to be placed 3 on that. 4 So that's -- you have to actually literally 5 draw that stuff on a Computer-Aided Design system, a CAD 6 system. And once you move up to the next level, the 7 transistor is connected with another transistor to make 8 an op amp and the op amp is connected with another op 9 amp to make say a filter. The filter is connected with 10 a DSP in order to process the analog results. 11 So you have all of these pieces that have to 12 be integrated and you have to decide well, okay, where 13 am I going to put the op amp? Is it going to be down 14 here on the left corner? Is it going to be right in the 15 middle of the chip? Where am I going to put the DSP? 16 So the floor-planning exercise is where you 17 say, okay, so in order to manage noise and perhaps other 18 issues, let's put all of the digital, you know, let us 19 draw the line down the middle of the chip if you can, if 20 it is convenient, it is not always convenient, we will 21 put all the digital on right side and we will isolate it 22 and maybe we will do deep well underneath it to keep the 23 minimized substrate interference. That is the whole 24 floor-planning exercise where you figure out where all 25 the blocks go. It is just a necessary process if you	Page 24 1 engineering? 2 A I don't think that I stated that in my 3 declaration. 4 Q I don't recall seeing it. That is why I was 5 asking. I was just curious. 6 Let's turn to paragraph 34 of your 7 declaration. It starts on the bottom of page 7. 8 A Yes, I am there. 9 Q This is where you refer to a claim 10 construction standard. 11 Do you see that? 12 A Yes. 13 Q You mention in this paragraph the Phillips 14 standard. 15 What is the Phillips standard in your view? 16 A Yes. I am not an attorney obviously so I 17 have been informed of this. The Phillips standard is, 18 my understanding is it is just the plain and ordinary 19 meaning that you get from reading the claim. 20 Q And as far as I can tell, you did not define 21 any terms in the '021 patent? 22 You did not separately construe, other than 23 stating that you applied the ordinary and customary 24 meaning of terms, you did not separately define any 25 specific terms, did you?

Page 25 1 A No, I did not. 2 Q Are you aware of any claim constructions 3 relating to the '021 patent that have been issued or 4 ordered by a judge? 5 A Yes, I did see the Markman order by the 6 judge. 7 Q Okay. So you have seen that but that came 8 out after you submitted this declaration I am guessing; 9 is that right? 10 A Yes. Right. I just saw that in the last 11 week, I believe. 12 Q Okay. I would like to ask you some 13 questions about your declaration and the Mieth 14 reference. 15 So Mieth is Exhibit 1002; is that right? 16 A Yes. 17 Q You provide an overview of Mieth starting 18 on, I think it is page 23, beginning at paragraph 68, if 19 you want to flip down there. 20 A Yes. Give me the paragraph number. 21 Q Paragraph 68. Let me know when you are 22 there. 23 A I am scrolling. 24 Q We are going to start on paragraph 70. 25 A Okay. I am on paragraph 70 now.	Page 27 1 know which figure we are talking about. 2 A That works. 3 Q So in the Figure 1 for Mieth that you have 4 labeled Figure 9 in paragraph 70, there are various 5 annotations provided by you, right? 6 A Correct. 7 Q So I believe that -- sorry about that. I 8 believe all the highlighting and coloring is yours, 9 right? So the yellow and the green and the blue and the 10 orange, that is yours, right? 11 A Right. 12 Q And are the text labels capacitor, first 13 output, second output and load, are those yours as well? 14 A Yes. 15 Q Are there any other annotations that you 16 added that were not in the original figure? 17 A No. 18 Q Okay. So if we look up one paragraph, 19 paragraph 69, here you are describing the basic 20 functionality of the circuit that is depicted in Mieth's 21 Figure 1; is that right? 22 A Yes. Yes. 23 Q And to roughly summarize that, at a lower 24 voltage, a preliminary load is switched in to the 25 circuit, while a downstream auxiliary power supply
Page 26 1 Q Okay. So, again, in an effort to make sure 2 we are talking the same language here today, I want to 3 look at paragraph 70 because there is a reference to 4 Figure 9. If you look at the figure that you have shown 5 there, there is two figure labels. 6 Do you see that? 7 A Correct. 8 Q So if I am understanding this correctly, I 9 think that the Figure 1 is the label that Mieth uses for 10 its figures and Figure 9 is the figure that you have 11 attached to this figure because of your annotations; is 12 that right? 13 A That is correct. That is throughout the 14 whole document I decided that I was going to do my own 15 figure annotations, which can be a little confusing. I 16 think it is all clean and clear and, if not, we will 17 fix anything that is disturbing. 18 Q Yes. I think just in terms of my 19 questioning today, I am going to try to refer to the 20 Mieth figure number rather than your figure number to 21 try and avoid confusion in the written transcript. But 22 if you are ever confused, just ask. 23 A Okay. 24 Q I will do my best to try to keep that 25 straight and refer to paragraph numbers as well so we	Page 28 1 circuit is disabled and then vice versa, at higher 2 voltage the preliminary load is switched out of the 3 circuit; is that right? 4 A Yes, that is what is stated there. 5 Q And if we look down at Figure 1, the 6 preliminary load that you are referring to, I think that 7 is callout 11; is that right? 8 A That is correct. 9 Q And callout 11, that is just a resister; is 10 that right? 11 A That is correct. 12 Q So in Figure 1 the resister 11 is the 13 preliminary load that you described in paragraph 69? 14 A Correct. Operating of course in concert 15 with the transistor 12 to provide a current path across 16 the two terminals. 17 Q Sure. There is other stuff in the -- 18 A Yes. 19 Q I just wanted to make sure the scope of what 20 was the preliminary load there. 21 If you can look down to paragraph 95. Let 22 me know when you are there. 23 A Okay. I am there. 24 Q So this is the first paragraph in your 25 section for Ground A which is the anticipation ground

Page 29 1 for Claims 1 through 7 and 9 based on Mieth; is that 2 correct? 3 A That is correct. 4 Q So then paragraph 96 relates to what you 5 label limitation 1A, a method to supply power, right? 6 A Yes. 7 Q And then you have the next limitation, 8 limitation 1B which is the method comprising, providing 9 a power supply having a first stage and a second stage, 10 and there is a couple of paragraphs under that section, 11 right, maybe five paragraphs? 12 A There is some number of paragraphs, yes. 13 Q Okay. So the first of those paragraphs is 14 paragraph 97? 15 A Correct. 16 Q And you are indicating here that you are 17 relying on Mieth for limitation 1B, right? 18 A Correct. 19 Q And you refer to Figure 1 of Mieth and say 20 that Mieth discloses the power supply of limitation 1B, 21 right? 22 A Correct. 23 Q According to limitation 1B, that power 24 supply has to have a first stage and a second stage and 25 for the first stage you are relying on Mieth's capacitor	Page 31 1 you rely on capacitor 2 for Mieth to meet the first 2 stage limit portion of the limitation. 3 Are you relying on anything other than 4 capacitor 2? 5 A No. 6 Q So if we look to limitation 1C, that 7 limitation, which comes right after paragraph 101, that 8 limitation requires wherein the first stage converts 9 power from a direct current input into a first output. 10 Do you see that? 11 A I do. 12 Q And this limitation you discuss in 13 paragraphs 102 and 103, right? 14 A Yes. 15 Q Paragraph 102 you indicate that solar 16 generators generate a direct current so that that would 17 meet the direct current portion of the limitation. 18 Do I have that right? 19 A That's correct. 20 Q In paragraph 103 you contend that solar 21 Generator 1 in Mieth provides direct current to 22 Capacitor 2. 23 So here again you are relying on capacitor 2 24 as the first stage that converts a direct current into a 25 first output, right?
Page 30 1 2, right? 2 A That is correct. 3 Q If you look down at paragraph 98 here, you 4 are referring to how a person of ordinary skill in the 5 art would understand the term stage, right? 6 A I believe that is the paragraph. Let me 7 just check. Yes. 8 Q There is a reference to a booster chopper in 9 this paragraph. 10 What is a booster chopper? 11 A Where is that reference? 12 Q It is like four lines from the bottom of the 13 page. 14 A That is from Nishi. I do not recall 15 offhand what Nishi said in terms of the chopper. 16 So that comes from Nishi's Figure 8 prior 17 art where he is showing a boost converter implemented in 18 pretty much the classic way. 19 Q So a boost converter referring to a 20 conventional DC-to-DC converter that the output voltage 21 is higher than the input voltage; is that what you are 22 talking about? 23 A Correct. 24 Q So your section on limitation 1B goes down 25 to paragraph 105. Are you -- we mentioned earlier that	Page 32 1 A Correct. 2 Q Again, you are not relying on any other 3 component for the first stage in Ground A, right? 4 A Correct. 5 Q And that is consistent throughout your 6 declaration where you are relying on Mieth for the first 7 stage, you are only relying on capacitor 2, right? 8 A I am pretty sure that is the case. 9 Q In paragraph 103 you refer to a person of 10 ordinary skill in the art's understanding of how a 11 capacitor works. 12 And specifically you say that the voltage 13 across the capacitor is proportional to the integral of 14 the current through the capacitor. 15 Do you see that? 16 A I do. 17 Q And for reference there is another copy of 18 Figure 1 from Mieth, which is your Figure 18, on the 19 next page, if it is helpful to refer to that. 20 My question is, can you explain how the 21 capacitor works in Mieth's Figure 1 with respect to this 22 integral of the current through the capacitor notion 23 that you mention in your declaration? 24 A Well, the voltage across the capacitor is 1 25 over C, the value of the capacitor times the integral

Page 33 1 of IDT. And so as current flows into the capacitor, a 2 voltage results across the capacitor from the current 3 that flows into the capacitor. 4 Q Okay. 5 A So as a result of current flowing from the 6 direct current as stated in the claim, the direct 7 current flowing from the solar generator will result in 8 a voltage across the capacitor at the first stage. 9 Q Okay. And in the last sentence on page 40, 10 so just above the figure, you say, Thus capacitor 2 of 11 Mieth can stabilize the voltage across it (at the first 12 output) due to fluctuations from the direct current 13 input. 14 Can you explain further what you mean by 15 that? 16 A Well, the charge that is forward on the 17 capacitor -- the capacitor tends to, it is well known 18 in the art to provide kind of a filtering function such 19 that as currents fluctuate, the charge flows in and out 20 of the other circuits around it and kind of essentially 21 smooths the operation or smooths the voltage. It is a 22 filtering function. 23 Q So would it be reasonable to say that the 24 capacitor in this type of circuit acts as kind of like a 25 battery where it gets charged up and then can put some	Page 35 1 converter circuit? 2 MR. ULLMER: Objection to relevance. 3 Feel free to answer. 4 A I mean, in my declaration I did not go into 5 or describe how a buck converter works, but I am happy 6 to, you know, provide that information. 7 Essentially what a buck converter is or the 8 components of a buck converter are switches, inductors, 9 capacitors and diodes and so plus a controller of some 10 sort that drives the switch. And it is easy to think of 11 it in terms -- and the switch is driven in a pulse width 12 modulator mode such that the duty cycle -- if you take 13 the average of the duty cycle of a pulse width modulated 14 signal, that represents a voltage, okay. So if you 15 increase the duty cycle, the voltage goes up. 16 Of course you have to smooth all of that out 17 with an inductor and a capacitor, but the output, the 18 way these operate is the output voltage is sent, it goes 19 into a PWM generator that adjusts the duty cycle based 20 upon the output voltage and that then drives a switch of 21 some sort, a MOSFET generally in today's technology, to 22 turn on and off providing power into the load at that 23 duty cycle. 24 And if the voltage is low at the output, you 25 need the on time of the switch to be longer; and so the
Page 34 1 energy back into the circuit too when the input is 2 lower? 3 A It could. I think most solar generators or 4 at least some of them are isolated with a diode so the 5 current cannot flow back into the solar generator but 6 certainly can act as a battery to the rest of the 7 circuit to the right. 8 Q Right. That is kind of the smoothing 9 function, right, where if the input dips, the capacitor 10 can provide, fill that gap a little bit; is that right? 11 A Correct. 12 Q Let's talk about power converters in a more 13 general sense. 14 There are many known DC-to-DC converters, 15 correct? 16 A Yes, there is a variety of them. 17 Q So one example would be a buck converter, 18 right? 19 A Yes. 20 Q And can you explain what a buck converter 21 does? 22 A A buck converter converts a higher voltage 23 to a lower voltage. 24 Q And in a conventional buck converter, can 25 you explain what components are used to create the buck	Page 36 1 duty cycle is adjusted so it is greater. 2 If the voltage at the output is too high, 3 the switch needs to be on less time percentage wise and 4 so the duty cycle is reduced. So it is just a servo 5 feedback loop essentially that adjusts the PWM duty 6 cycle in order to achieve the desired output voltage. 7 Q Okay. Another conventional DC-to-DC 8 converter is a boost converter, right? 9 A Correct. 10 Q And that converts a lower input voltage to a 11 higher output voltage conventionally, right? 12 A Correct. 13 Q Does it otherwise work with similar 14 components that you just described for the buck 15 converter? 16 A Same components, just configured 17 differently. 18 Q And another conventional DC-to-DC converter 19 is a buck boost converter. 20 I believe the reason it is called a buck 21 boost is because you can configure it to either do the 22 bucking or the boosting; is that right? 23 A Correct. 24 Q There are a few others that I am familiar 25 with. One is the, I believe it is called a CUK

Page 37 1 converter. 2 Are you familiar with that type of DC-to-DC? 3 A C-u-k. I don't know the proper way to 4 pronounce it. I guess CUK (pronouncing) would probably 5 be the most appropriate way to pronounce that. 6 I am just vaguely familiar with them. I am 7 aware of their existence. I have never worked on one, 8 nor have I been on a case where I have had to argue one. 9 I am aware of their existence. 10 Q Okay. I will not ask you how to properly 11 say that word or exactly the conventional topology of 12 that. 13 What about a SEPIC converter, is that 14 another type of conventional DC-to-DC converter? 15 A Yes, it is. I never worked on one. I did 16 analyze one years ago and I cannot remember why. It 17 may have been just curiosity. I don't tend to see 18 those very much. I am not sure why, but I am aware of 19 their existence, yes. 20 Q Okay. What about a flyback converter, is 21 that another conventional DC-to-DC converter? 22 A Yes, I have worked on those. Typically 23 they are used for cases where you want isolation from 24 the input to the output. 25 Q Okay. And what about a forward converter,	Page 39 1 go ahead. 2 A Well, I can say that when current flows 3 through a resistor it results in a voltage across the 4 resistor. It results in power dissipation from the 5 resistor or into the equation T equals V times I where 6 V is the voltage across it and I is the current through 7 it. So, you know, it converts currents to voltages and 8 the result is power dissipated. 9 Q So is a resistor a power converter or not? 10 A Let me think. Yes, in the sense of the way 11 that I am reading it consistent with my understanding 12 of the claims in this patent, I would say it is 13 converting power from a current mode to a voltage mode. 14 Q Okay. What about a battery, does a battery 15 convert power? 16 A It converts some chemical process into 17 power. I would say it does. 18 Q Okay. Let me ask a more specific question. 19 Does a battery convert DC input to an 20 output? 21 A No, a battery source sources power as a 22 result of a chemical reaction inside the battery cell. 23 Q What about a diode, does a diode convert a 24 DC input to an output? 25 A When current flows through a diode, the
Page 38 1 is that another type? 2 MR. ESCHWEILER: Objection on relevance. 3 A Forward, I do not remember how that applies 4 but yeah, the term is used in the field of switch mode 5 power supplies. 6 Q Okay. Are there any other conventional 7 DC-to-DC converters that have these kind of unique names 8 that I have not mentioned? 9 A There may be. I don't know. I didn't 10 discuss the entire field in my declaration, nor did I 11 prepare to talk about them so. 12 Q Fair enough. 13 A That is the best that I recall, yes. 14 Q There are also many typical circuit elements 15 that aren't expressly called power converters, right? 16 A I don't follow the question. When you say 17 circuit elements, we are talking about resistor, 18 capacitor, diode, transistor? 19 Q I can give you a more specific example. 20 Is a resistor a power converter? 21 A Well, what do you mean -- in this case, 22 what do you mean by power converter? 23 Q I am asking for your opinion on whether a 24 resistor is a power converter. And if you would like to 25 define what you mean by power converter, by all means,	Page 40 1 result is a voltage across the diode and an exponential 2 relationship between current and voltage. 3 Q Okay. So is a diode a power converter? 4 A In the same sense that I applied it to the 5 resistor question and, of course, the capacitor at 6 stage one of Mieth. 7 Q I think that was a yes; is that right? 8 A Yes, I think so. 9 MR. ESCHWEILER: Just real quick. Objection 10 because Claim 1 is not reciting a converter. It is 11 reciting a stage. 12 MR. ULLMER: I don't believe that I asked 13 about Claim 1. But Claim 1 does say the first stage 14 converts power from a direct current input into a first 15 output and other claims refer specifically to a power 16 converter. 17 So I am just trying to examine the witness' 18 opinion on what he believes to be a power converter. 19 MR. ESCHWEILER: Sure. 20 Q (BY MR. ULLMER) So back to those questions, 21 Dr. Holberg. 22 Is a Zener diode a power converter? 23 A In the same sense that I have construed it 24 for the resistor and the diode, yes. 25 Q What about an inductor, is an inductor a

Page 41 1 power converter? 2 A The way I have construed it in the context 3 of this read is in the same sense that it is for a 4 resistor or a diode. 5 Q Is a transistor a power converter? 6 A Yes. 7 Q So the same would be true for a MOSFET? In 8 your opinion, a MOSFET is a power converter? 9 A Yes. 10 Q What about a generic switch, is a switch a 11 power converter? 12 A Let me ponder that. 13 Well, to be consistent with my other reads, 14 I would say there is no power dissipated in an ideal 15 switch. I don't know. I kind of don't think so, but I 16 would have to ponder that more thoroughly. It is a 17 non-dissipative element. 18 Q That is an idealized switch, right? 19 A Correct. 20 Q So if the switch was not ideal and some 21 amount of power dissipated when using the switch, you 22 would consider it to be a power converter? 23 A Then it would have resistance associated 24 with it, and I would put it in the same category as the 25 other resistor and diode, it dissipates power when	Page 43 1 MR. ESCHWEILER: Sure. 2 MR. ULLMER: Let us go off the record and be 3 back in five. 4 (Recess was taken.) 5 Q (BY MR. ULLMER) Dr. Holberg, we are back on 6 the record. 7 Did you talk about this deposition with 8 anyone during the break? 9 A No, I did not. 10 Q Before we took a quick break there we had 11 turned to Ground B on page 65 starting at paragraph 151 12 of your declaration. 13 A Correct. 14 Q And that is where you discuss your ground 15 that is Anticipation/obviousness ground involving the 16 references Mieth and Balogh; is that right? 17 A Correct. 18 Q So we talked a little bit about a portion of 19 Claim 1 earlier. 20 Claim 1 is an independent claim, right? 21 A Yes. 22 Q And in this Ground B the other, there are 23 two additional independent claims that are at issue 24 which are Claims 10 and 18, right? 25 A Let me look. Did you say dependent claims?
Page 42 1 enabled or when current flows through it. 2 Q What about an incandescent light bulb, is 3 that a power converter? 4 A In the same context the way I read it on 5 the other items, yes, it would be. 6 Q Okay. What about a long, thin copper wire, 7 would that be a power converter? 8 A That is a resistor, yes. 9 Q So can you think of anything that dissipates 10 power that you would not consider a power converter in 11 the context of the '021 patent? 12 A Not offhand. You said that dissipates 13 power? 14 Q Correct. 15 A Yes, not offhand. 16 Q Let's go look at Ground B which is your 17 Mieth and Balogh ground. I am looking for the paragraph 18 number. I should have written it down and did not. 19 A Well, I will start scanning. 20 Q It is paragraph 151, page 65. 21 A Okay. 22 Q Actually, would you mind if we take a quick 23 five-minute break? We have been going for a little over 24 an hour I think. 25 A That is fine with me.	Page 44 1 Q Independent. 2 A Oh, I am pretty sure you are correct. I am 3 making sure. 4 Q You can feel free to look in the patent as 5 well, if you would like. 6 A Right. Yes. All right. So now we want to 7 go back to paragraph 130 something? 8 Q 151 is the start of Ground B. 9 A Okay. Okay. 10 Q I just want to make sure that I am 11 understanding this ground. 12 So I believe what you are saying, at least 13 what you are implying from the heading, is that you are 14 making some anticipation arguments based on Mieth and 15 some obviousness arguments based on Mieth and Balogh 16 combined; is that right? 17 A Yes. 18 Q So is there a reason that you did not 19 include all of your anticipation arguments regarding 20 Mieth in Ground 1 or Ground A, excuse me? 21 A You mean for all the same claims? Is that 22 what you are asking? 23 Q Well, so this ground relates to Claims 1 to 24 12, 15 to 18 and 20, right? 25 A Yes.

Page 45 1 Q And Ground A refers to a subset of those 2 claims which are Claims 1 to 7 and 9, right? 3 A Right. 4 Q And if I am understanding at least your 5 heading here correctly, you are making additional 6 anticipation arguments based on Mieth regarding claims 7 other than Claims 1 to 7 and 9; is that right? 8 A Well, obviousness Ground B is 1 through 12 9 and 15 to 18. I will have to look through here because 10 I do not remember the specifics, but I will have to 11 look to see. 12 I think what you are trying to ask is I made 13 some anticipation argument in Mieth in this Ground B 14 that I didn't in the earlier one for -- I am not 100 15 percent sure. 16 Q That is what I am trying to understand. We 17 can walk through this more specifically so you do not 18 need to go through and look. We will walk through the 19 paragraphs. 20 A That would be better. 21 Q I was just sort of -- I was wondering at a 22 high level if there was a reason you separated the 23 anticipation portions of your arguments into two 24 different grounds. If so, if you can explain that to 25 me.	Page 47 1 Q So in your opinion is step -- sorry. I will 2 withdraw that question and restate it. 3 In your opinion, a capacitor is not a 4 step-down converter; is that right? 5 A No. 6 Q Is a capacitor a step-up converter? 7 A Not in the context of -- for both the 8 questions, step-down and step-up in the context of 9 switch mode power supplies, then no. As the term is 10 applied, step-up and step-down and switch mode power 11 supplies, a capacitor would be neither of those. 12 Q Okay. And, in your opinion, Claim 8 13 requires a switch mode power supply? 14 A A person of ordinary skill in the art would 15 read Claim 8 understanding a step-down converter is a 16 switch mode power supply. 17 Q And an example of a step-down converter 18 would be a Buck converter, right? 19 A Correct. 20 Q Look down a few paragraphs. So your 21 analysis of independent Claim 10 starts on page 72. I 22 want to keep going a little bit passed that to paragraph 23 168 which relates to limitations 10C. Let me know when 24 you are there. 25 A I am there.
Page 46 1 A Well, I drew in Balogh, as I state in this 2 first paragraph, that Mieth teaches the first stage. 3 However, Balogh also discusses the first stage. 4 So if you don't like, if you don't like 5 Mieth, the judges do not like Mieth because I think they 6 make the ultimate decision, then Balogh was perfectly 7 aligned with this technology and provides, you know, 8 some of the elements of the claims in a different way 9 that might be more convincing I guess. 10 Q Okay. Well, let's start with the first new 11 claim that comes up for Ground B which is Claim 8. 12 So let us scroll down to that. That is 13 paragraph 163. 14 A Okay. 15 Q And as you reiterate or as you show here in 16 paragraph 163, Claim 8 depends from Claim 1 and 17 requires, wherein the first stage comprises a first 18 step-down converter; and the second stage comprises a 19 second step-down converter. 20 Do you see that? 21 A Correct. 22 Q And so to meet Claim 8 you propose in the 23 context of Ground B replacing Mieth's capacitor 2 with a 24 step-down converter from Balogh; is that right? 25 A That is correct.	Page 48 1 Q Limitation 10C is a first stage power 2 converter configured to convert the direct current 3 into -- I will withdraw that. 4 Limitation 10C is a first stage power 5 converter configured to convert the direct current input 6 into a first output, right? 7 A Correct. 8 Q And I believe that you have two different 9 arguments for this limitation. 10 The first is that you seem to be making the 11 same argument that you raised about limitation 1C which 12 is that Mieth's capacitor is the first stage power 13 converter; is that right? 14 A Correct. 15 Q And so we briefly looked at limitation 1C 16 earlier and that limitation is slightly different from 17 10C in that 1C requires wherein the first stage converts 18 power from a direct current input into a first output as 19 opposed to limitation 10C, which we are looking at on 20 this page, which requires a first stage power converter 21 configured to convert the direct current input into a 22 first output, right? 23 A Right. 24 Q At a high level the difference really is 25 that Claim 1 refers to a first stage that converts power

Page 49 1 and Claim 10 refers to a first stage power converter, 2 right? 3 A Let me just pull up Claim 1. I think that 4 you are right. I just want to be -- make sure I have 5 it. 6 The language of 1C, wherein the first stage 7 converts power from a direct current input into a first 8 output. 9 And then 10C, the first stage power 10 configured to convert the direct current input into a 11 first output. 12 So the last portion of both of those claims, 13 direct current input into a first output, but the first 14 portion of Claim 1C says wherein the first stage 15 converts power and 10C is first stage power converter. 16 That is the distinction between the two. I am not sure 17 that makes a difference to me but, anyway, I see the 18 difference. 19 So now is there a question attached to this? 20 Q I think that you kind of anticipated what 21 the question is which is, do you think those two, that 22 difference in phrasing makes a difference in the scope 23 of the claims? 24 A Let me ponder that. 25 MR. ESCHWEILER: I guess I will give an	Page 51 1 A Well, what did I say? I said -- I had the 2 split screen on. Now I have to find the paragraph. 3 158 or 160? 4 Q 168 is the paragraph. 5 A Yes, I say it here. I say, As discussed 6 infra in accordance with figure 1C above, feature 1C 7 above, capacitor 2 converts power and thus capacitor 2 8 teaches a first stage power converter. Thus, the 9 capacitor 2 of Mieth is anticipatory of Claim 10 for 10 the same reasons discussed in accordance with 1C, yes. 11 Q Okay. How does the capacitor in Mieth 12 convert power? 13 A Like I said earlier, I think that I 14 answered that, it is just my read, the way that I read 15 it was you have got the current provided by the PV, the 16 solar cell, and that current goes into the capacitor 17 resulting in a voltage. And, you know, voltage across 18 the capacitor that is then used to power the rest of 19 the circuit that follows to the right, if you look at 20 the circuit left to right. 21 Q Does a capacitor dissipate power? 22 A No, not real power, not ideally. Real 23 capacitors do. They actually can get hot, but ideally 24 no. 25 Q Okay. Let us look at the second portion of
Page 50 1 objection just because this already goes to claim 2 construction which has already been resolved by the 3 District Court in the Markman Hearing. 4 Q You can answer that question. 5 A I am still working on it. I am not going 6 to not answer it. I am still pondering it. 7 So the way the language reads in the 10C 8 case the noun, the subject is the first stage and it is 9 modified by power converter in 10C. 10 And in 1C it is the first stage converts 11 power. 12 But if you grab, and I am not an expert at 13 this language parsing here, but the way that I read it 14 was the first stage power converter is configured in one 15 case and it converts in the other case. So essentially 16 I think -- 17 Q I can ask a couple more specific questions, 18 if you would like. 19 A Yes, maybe you can drill down. 20 Q Okay. So regarding limitation 1C, in your 21 opinion Mieth's capacitor 2 converts power, right? 22 A Right. That was my read. 23 Q And regarding limitation 10C, you also 24 believe Mieth's capacitor 2 is a power converter, 25 correct?	Page 52 1 the argument about this limitation which is in relation 2 to the Balogh reference. 3 So if you look down at paragraph 169, you 4 included a figure from Balogh there, right? 5 A Right. 6 Q And you highlighted a first stage power 7 converter. 8 Do you see that? 9 A Yes. 10 Q What kind of power converter is that? 11 A That is a flyback converter, but it is a 12 Buck converter in a flyback configuration. 13 Q It is a step-down converter of some kind, 14 right? 15 A Right. 16 Q What components are in that converter? 17 A I mean, it is all the components that I 18 have highlighted in yellow. I think Balogh describes 19 it as, you know, auxillary outputs. You have two 20 outputs. I don't deal with the first output which is 21 over to the right with the two circles. I go into 22 converter two which is the other output down below. 23 Q Okay. In terms of the components that are 24 included in this first stage power converter that you 25 have highlighted, there are two capacitors, right?

Page 53 1 A Yes. 2 Q Two diodes, right? 3 A Yes. 4 Q Some kind of transistor I believe; is that 5 right? 6 A Yes. 7 Q A control box? I am not sure. There is a 8 square or a rectangle there with control one in it, 9 right? 10 A Correct. 11 Q What does that control box do? 12 A Back when I was describing how Buck 13 converters work, I told you there has to be some 14 controller that senses the output and then adjusts the 15 PWM duty cycle to a switch in the circuit that is 16 switched based upon that duty cycle. That controller 17 is that element. 18 There could be other things in there like 19 undervoltage detection and stuff like that, but in the 20 simplest manifestation of a converter, it is a PWM 21 probably. 22 I mean, it could be a pulse frequency 23 modulation, and I don't recall what Balogh says, if he 24 gives any details. It provides that feedback to say, 25 hey, the voltage needs to go up or the voltage needs to	Page 55 1 Q And Ground D is a combination you are using 2 to address a single claim that is Claim 19, right? 3 A Yes. 4 Q And for this proposed combination you are 5 combining Mieth, Balogh and a reference you call Liu, 6 right? 7 A Correct. 8 Q That is Mieth, which is Exhibit 1002; Balogh 9 is Exhibit 1003 and Liu is Exhibit 1005, right? 10 A Correct. 11 Q Can you explain why a skilled person would 12 combine Mieth, Balogh and Liu? 13 A Well, first of all, they are all in the 14 same technology areas, switch mode power supplies. So 15 if you were designing, if you were taking Balogh as 16 your starting point for example and designing a 17 two-stage Buck converter or two-stage switch mode power 18 supply, you might look around to see what other people 19 have done and you might land on Liu. 20 Now, grant it Liu is not a series of two 21 Buck converters. It has a boost followed by a Buck. 22 But in your searching you might land on that and see the 23 capacitor he used to be a storage capacitor when the 24 first stage of intermittent or if you need -- in the 25 case of Liu, he is using it as kind of a buffer in a way
Page 54 1 go down based upon what I am measuring. 2 Q Okay. This converter also has an inductor 3 in it, right? 4 A Yes. 5 Q There is also a transformer. 6 Is the transformer how you knew this was in 7 a flyback configuration? 8 A I mean, it could be a transformer and not 9 be. I don't think -- it looks like it is a flyback 10 configuration to me, but it was not germane to my 11 argument. 12 Q Okay. In general I am trying to understand 13 your proposed combination of Mieth and Balogh. 14 Are you proposing that you replace Mieth's 15 capacitor with this first stage power converter from 16 Balogh? 17 A Yes. 18 Q Okay. Let us look at, scroll down to 19 paragraph 294, page 123. 20 A Okay. 21 Q You are quicker than me. I am still working 22 on this. 23 This is where you start discussing Ground D, 24 right? 25 A Correct.	Page 56 1 so that when you have a high current draw on the output 2 that you don't want to perturb the source of, your power 3 source. So that is done with capacitors. 4 And in the case of Liu, Liu realized that 5 yes, it is easy enough to do. You just put a big 6 capacitor but they take up a lot of space. So one 7 clever thing was to boost it up and use a lower value 8 capacitor and still get the same charge store, Q to CV, 9 but have a much smaller footprint in your design. So, I 10 mean, that is why Liu did that. 11 And so when the demand on the output of 12 Liu's second stage converter through a current event, 13 maybe it is a power -- in this case it is a power amp 14 for a cell phone I think, then that extra current is 15 provided by the capacitor rather than your source which 16 is a high impedance battery. That is what Liu is all 17 about anyway. 18 But to answer your question, it is in the 19 same field. It is in switch mode power supplies. You 20 would be looking around and see that and say, hey, that 21 is a good idea. 22 Q Okay. So in this combination you started 23 with Mieth and then you removed Mieth's capacitor and 24 replaced it with Balogh's Buck converter and then when 25 you added Liu, you are now adding a capacitor back in.

1 Do I have that right? 2 A That is correct. 3 Q Is this figure, and I am looking to be 4 specific, I am looking at paragraph 296, your label 5 Figure 51, I believe it is Figure 5 from Liu, does that 6 have at least three different power converters in it? 7 A Yes, it is from Figure 5. I am checking to 8 make sure it is correct. It is Figure 5 of Liu. 9 The question is, does it have -- in that 10 configuration does it have three different power 11 converters? 12 Q Yes. To be more specific, there is a boost 13 converter, a Buck converter and then a capacitor in 14 between the two of them. 15 Is that three different power converters? 16 A The claim says -- to be consistent, even 17 the '021 calls it a power, a capacitor a power 18 absorption circuit which in some sense could be 19 understood to be conversion from an act of static. I 20 guess, to be consistent, I guess you could call it a 21 power conversion unit or device or whatever you said. 22 Q Okay. 23 A I mean, the '021 calls it a power 24 absorption device. Okay. So what does that mean? 25 That is just a capacitor that absorbs power.	Page 57	1 right? 2 A That is correct. 3 Q You see that the figure from Balogh is 4 labeled prior art, right? 5 A I do, yes. 6 Q Are you relying on Balogh figures that are 7 labeled prior art because they are related to 8 conventional Buck converter technology? 9 MR. ESCHWEILER: Objection. Relevance. 10 A Well, I am just relying on it because it 11 had the, the design that was prior art that was 12 suitable for my arguments. 13 Q Do you recall what Balogh did differently 14 from the prior art that the inventors identified in the 15 reference? 16 A Offhand I do not recall. 17 Q Okay. Let's take a look at Exhibit 1001 18 which is the '021 patent. 19 A Okay. 20 Q Let us look at Claim 18, the last page of 21 the reference. 22 A Okay. 23 Q Is there an inverter involved in any of the 24 elements of Claim 18? 25 A Let us see. A system to supply power, the	Page 59
1 Q Okay. 2 A The claim itself is a little clumsy. 3 Q Is the capacitor 2 in Mieth performing a 4 different function than the capacitor you are using from 5 Liu in your proposed combination for Ground D? 6 A A different role, yes. 7 Q What is the difference? 8 A Well, in the case of Ground D that 9 capacitor is performing a power absorption function. 10 Whereas in Ground 1C I guess it is a power conversion 11 function. 12 Q It is not absorbing power from a solar 13 generator in the same way that the capacitor in your 14 proposed combination for Ground D is absorbing power? 15 A If indeed capacitors absorb power as this 16 claim states, then it would be I suppose. 17 Q Let's look at -- let us go back up to 18 paragraph 237. This is just an example of a figure from 19 Balogh in your annotations. This is on page 100 of your 20 declaration. 21 A Okay. I am there. 22 Q So this has independent -- sorry. The 23 Figure 1D that you have labeled Figure 42 here in 24 paragraph 237, each of the first and second stage power 25 converters has its own independent control circuit,	Page 58	1 system comprising a photovoltaic panel to provide a 2 direct current input; a first stage power converter 3 connected to the photovoltaic panel to generate a first 4 output from the direct current input; a second stage 5 power converter connected to convert the first output 6 to a second output; a micro-controller; a power 7 absorption circuit; and a control circuit coupled with 8 the first stage power converter and the second stage 9 power converter; and the control circuit powered by the 10 first output to control the second stage power 11 converter, wherein when the second stage power 12 converter is disabled in providing the second output to 13 the micro-controller, the control circuit monitors a 14 voltage of the first output powering the power 15 absorption circuit and signals the second stage power 16 converter to continue disabling the providing of the 17 second output to the micro-controller during a time 18 period in which the voltage is below a threshold; when 19 the voltage is above the threshold, the control circuit 20 signals the second stage power converter to enable the 21 providing of the second output to the micro-controller 22 even though there is no inverter involved in Claim 18. 23 Q Right. This is not a system that is 24 designed to supply power from a solar generator to an 25 inverter, right?	Page 60



Page 61 1 A Correct. Well, I say correct. I know what 2 it does. It does not describe an inverter. Certainly 3 that is the case. I don't recall if -- they may not 4 have needed to for this patent. So they certainly did 5 not describe an inverter. That is a fact. Whether or 6 not they used this circuit with an inverter on the back 7 end, I have no idea. 8 Q Okay. Well, part of this claim involves 9 photovoltaic panel for generating a first output, right? 10 Sorry. I will withdraw that. I was 11 combining two limitations. 12 So part of Claim 18 requires a photovoltaic 13 panel, right? 14 A Yes. 15 Q And that photovoltaic panel has to provide a 16 direct current input, correct? 17 A Correct. 18 Q Are you familiar with what type of voltage 19 level a PV panel would generally output? 20 A Well, I think a huge range of voltages. 21 One of the references that I used, although I didn't 22 really call this out, I didn't discuss it in my 23 declaration, I only referenced a couple of data sheets, 24 but Nishi talks about voltages in the range of 50 to 25 several hundred volts from a PV panel.	Page 63 1 A The file name is labeled that. Actually, 2 it is labeled ES.1003-Balogh. 3 Q Okay. But it is not stamped with an exhibit 4 number? 5 A No, it is not like a Bates number or 6 something like that, no, it does not have any of that. 7 I am not sure if any of mine do. No. Liu is not 8 stamped. Balogh is not stamped. 9 MR. ESCHWEILER: Doug, when I emailed you a 10 number of exhibits a bit ago, those were the ones that 11 would be stamped with the exhibit number on those. I am 12 assuming that you are looking, you are pulling up the 13 exhibit from one of your previous directories and not 14 the ones that I sent you. 15 Now, the ones that you have are not 16 annotated, but if you pull up the ones that I sent you 17 in the email, even the file names have the exhibit 18 numbers on those and those would have the footer 19 information that Steve is talking about. 20 THE WITNESS: All right. Let me go back. I 21 know that I didn't label any of these files with exhibit 22 numbers. I do see an email from the 12th, yes, you sent 23 some of the exhibits. 24 MR. ESCHWEILER: Yes. 25 THE WITNESS: There are several emails that
Page 62 1 Q If you were going to try and take that power 2 generated by the solar to the PV panel and provide it to 3 an inverter -- I will withdraw that question. 4 Would you typically use voltages in the 5 range of 50 to a couple of hundred volts generated by a 6 photovoltaic panel to power a micro-controller? 7 A If all you needed -- if I were designing a 8 system to power a micro-controller that ran off of 3.3 9 volts, I would not need to start with a panel that 10 output 150 volts or even 80 volts. I would just need a 11 panel that provided, you know, something well above the 12 three volts. Maybe 10 volts. Maybe 15 volts. 13 Q What kind of -- withdrawn. 14 I have a couple of questions about the 15 exhibits in this case. So if you would not mind, let us 16 look at Exhibit 1003. 17 So are you looking at a copy of Balogh that 18 has in the bottom right a stamp on it that says SMA 19 Solar Technology America LLC Exhibit 1003? 20 A Mine does not have any annotations. This 21 has a bar code at the top. I don't know if that is 22 something that they put on patents. There is no SMA 23 notation. 24 Q Is there an Exhibit 1003 label on your 25 exhibit?	Page 64 1 you sent. Okay. Let me open one of them. Okay. From 2 that -- where did I get the other ones from? Yes, I see 3 these. Do you want me to download the ones from the 4 email? 5 Q Yes, let us make sure that you download at 6 least Exhibits 1001, 1002, 1003, 1005 and 1007. 7 A I am going to close out all of these in my 8 PDF reader. All right. So I have got 1001, 1003, 9 1005, 1007. 10 Q You will need 1002, which is Mieth as well. 11 A Okay. All right. So I have all of those. 12 I still need another one. 13 Q Let us start with Exhibit 1001. When we 14 were looking at the '021 patent previously and you were 15 looking at your version of Exhibit 1001, is that the 16 same document as the stamped copy that you just 17 downloaded? 18 A Yes, I am sure it is. 19 Q If you would not mind just comparing the 20 documents that you just downloaded to the versions that 21 you were looking at previously. 22 A Okay. 23 Q I just want to confirm that -- 24 A No, I get it. I understand. I am not sure 25 how this happened. Let us see. I am going to open it

Page 65 1 in a new window. I am 100 percent certain they are the 2 same. There is no way to prove that beyond a shadow of 3 a doubt. There are ways to do it, and I know how to do 4 it, but it would take a lot of time. I just had the 5 wrong file name number or whatever that was annotated. 6 Q Correct. I am not suggesting that there is 7 anything, any mischief going on. 8 A I understand. 9 Q I am just now worried that what you were 10 looking at does not have a stamp on it. I need to 11 confirm that everything that you were answering 12 questions about and testifying about is the same 13 document. 14 A I will testify to that. 15 Q Let us just formalize this a little bit. 16 Exhibit 1001, do you have both copies, the 17 stamped copy and the previous copy that you were using? 18 Can you open both of those? 19 A They are both open on my screen. 20 Q Are both of those U.S. Patent 9,584,021? 21 A Yes, they are. 22 Q And let us look at your version of Exhibit 23 1002 and the stamped version of Exhibit 1002. 24 Are those both German Patent Office with the 25 named inventor Mieth? I may have misphrased that.	Page 67 1 I am only aware of a stamped version of your 2 declaration. 3 Was the version of your declaration Exhibit 4 1007, was that stamped at the bottom with SMA Solar 5 Technology America? 6 A No. 7 Q No? Is there any difference between the 8 stamped version of Exhibit 1007 and the version that you 9 were looking at? 10 A I didn't download that one. Well, wait. 11 Hold on. No. No. Here it is. Here is the stamped 12 version. I am sure there is no difference. 13 Q Let us just look at a couple of things. 14 Is it 137 pages long? 15 A Let me look. 137 pages long. The printed 16 page number is page 134; and then this one is 137 17 pages, printed page 134. Yes, it has one hanging 18 portion of a column on that last page. Yes, they are 19 the same. 20 Q If you go to page 129 in both, both have 21 your signature just above a line saying executed on 22 April 21, 2023, right? 23 A Let me look. I have already closed that. 24 Let me go back. Yes. 25 Q Okay. Now I have a couple of questions
Page 66 1 A I know what you are asking. I will confirm 2 that. I am trying to figure out if this will allow me 3 to open it. I do not want it to open in another tab. 4 I will just do that. Let us just do that. 1002. 5 Okay. Let me go to the top. This one is 6 labeled SMA Solar Technology. This one is not. It is 7 German Patent Office DE 37 25 476. This is DE 37 25 8 476. The date of filing is July 31, '87. The date of 9 this filing is July. 10 Q So they appear to be the same Mieth 11 reference that we were talking about today, right? 12 A Yes, indeed. Yes. 13 Q Okay. Let us look at Exhibit 1003, both the 14 stamped version and the version that you were looking at 15 previously. 16 Are both of those documents U.S. Patent 17 6,246,592? 18 A This is Balogh. 6,246,592. Yes, they are 19 both the same. 20 Q Okay. And then the same question for the 21 stamped version of Exhibit 1005 and the version you were 22 previously looking at, if you opened Liu, is that both 23 U.S. Patent 6,798,177? 24 A 6,798,177 both, yes. 25 Q Okay. And then one final question on this.	Page 68 1 about the exhibits. So let's look at the stamped 2 copies, not the copies that you had before, even though 3 they appear to be the same document. 4 Open the stamped version of Balogh, please, 5 Exhibit 1003. 6 A Okay. I got it. 7 Q So I have this document open, Exhibit 1003, 8 and as far as I can tell it is not, there is no 9 annotations that my side has made on this document. 10 So I am curious, is there a highlighted, a 11 blue highlighting of June 12, 2001 at the top right on 12 your copy? 13 A No. 14 Q Okay. And then so the same question, if you 15 look at the filing date which is kind of in the middle 16 in the left column, June 21, 2000, that is not partially 17 highlighted in blue, is it? 18 A No, it is not. 19 MR. ULLMER: Let us go off the record for a 20 quick break. 21 (Recess was taken.) 22 Q Dr. Holberg, did you communicate with anyone 23 during the short break we just had? 24 A No, I did not. 25 Q Do you have any sense of what type of

Page 69 1 applications the power supply system -- I will withdraw 2 that and make sure that I use the exact language. 3 If you would not mind turning to, let us 4 look at Claim 18 again of Exhibit 1001 which is the '021 5 patent. 6 A Okay. 7 Q And Claim 18 is directed to a system, right? 8 A Yes, it says the system comprising. 9 Q Do you have any sense of what kind of 10 applications the system claimed in Claim 18 would be 11 used for? 12 MR. ESCHWEILER: Objection. It calls for 13 speculation. 14 A I am reading through the claim right now 15 again. I read it earlier, but I had a break in 16 between. 17 Q Fair enough. 18 A No, the larger system where this might be 19 placed, I mean, Claim 18 does not enlighten me to what 20 that might be. 21 Q Have you read the specification of the '021 22 patent? 23 A I did. At the beginning of this case I 24 did. 25 Q If you can turn to column 1, lines 20 to 42	Page 71 1 power outputs to drive a motor and an arm that opens the 2 gate. Okay. 3 So imagining this application, this design 4 being described here in that context, then all of the 5 control circuitry, micro-controller and whatever else 6 there might be, the LEDs that blink on and off that 7 indicate status, that would be all running at the low 8 voltage, the 3.3 volts. 9 And then you may need higher voltages to 10 drive power MOSFETs to drive the motors that pull the 11 gate back and forth. So that is one application. 12 Certainly another application would be if 13 you were trying to power an inverter that either 14 provides AC power to power a refrigerator or connect 15 back into the mains, the switchover device. So that 16 background could apply to a broad range of applications 17 I think. 18 Q In general is it fair to say that what is 19 being described in the '021 patent relates to a power 20 system that uses power generated by a photovoltaic 21 system to power auxiliary power supplies? 22 A Well, I don't -- it may have said that 23 somewhere in that. I know the first portion of the 24 specification goes through a long description of MOSFET 25 physics basically which motivates the need to be able
Page 70 1 of the specification, and read that to yourself. I just 2 have a couple of questions about that. 3 A Okay. 4 Q You just read the Field of the Technology 5 and Background sections of the '021 patent, right? 6 A That's correct. 7 Q Did those sections shed any light on what 8 the inventors were trying to come up with in the context 9 of this patent? 10 A Well, they imply or they stated that they 11 wanted to provide two power supply voltages. One for a 12 micro-controller, and then in addition some higher 13 voltages to be, to be used to drive MOSFETs might lead 14 one to believe that they could be used in a system 15 where you need some high power MOSFETs to switch 16 things, some additional circuitry on and off. And so 17 that is why they wanted to provide the 10 and 12 volt 18 supplies to have a good drive voltage for those 19 devices. 20 That in of itself does not tell me what that 21 might be. It could be an inverter. It could be -- one 22 of the things, one of my hapless jobs is I manage the 23 entry gates for our subdivision, and I have had to work 24 on the electronics and they are also designed to be 25 powered via photovoltaic. They have to provide some high	Page 72 1 to drive it with a larger voltage to get the maximum 2 efficiency. I just do not recall what they said that 3 was ultimately, those MOSFETs were going to be driving 4 an inverter or a lightbulb or another power supply. 5 Do the figures help me in knowing that? I 6 was reading the claims in the end an understanding them 7 in the context of the elements of the specification that 8 informed me of what the claims mean. And, as I noted 9 with Claim 18, it does not describe, it does not 10 enlighten me as to the larger nature of the system. 11 Q But in Claim 18 the power does come from a 12 photovoltaic panel, right? 13 A Certainly. 14 Q So there would be no need for some of these 15 elements if you were just getting your power directly 16 from the grid, right? 17 A Let me think about that question. That is 18 an interesting question. 19 MR. ESCHWEILER: I will object for relevance 20 purposes. 21 A Well, let me think about this. So we have 22 in Claim 18, if we throw out the photovoltaic panel, 23 PV, we have first stage power converter, first output, 24 a second stage power converter, second output, a 25 micro-controller, the power absorption circuit.



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Page 73 1 So, I mean, all over my house I have got 2 switch mode power supplies plugged into the main. So 3 they start with, you know, 110 volt RMS AC. And then 4 they provide the power to charge up my phone or 5 flashlight or whatever needs to be charged up. 6 Now, they may not have some of these other 7 elements that is the latter part of the claim where when 8 the second stage power converter is disabled, for 9 example, those particular things that are scattered 10 around the house do not have that feature. It may be in 11 my UPS device. I do not know. I have a UPS device 12 under my desk connected to the battery and the main and 13 provides power when the power company decides not to 14 provide it. 15 So who knows what is in there, all kinds of 16 things that are turning this on, that on and that off in 17 order to deal with an adverse situation, but I am not 18 trying to read this claim on my UPS device. 19 I don't know. I am not saying that it is or 20 it is not. I think, I don't think that the elements of 21 Claim 18 necessarily require a photovoltaic panel, if 22 that is what you are saying or asking. 23 Q Well, I mean, literally speaking Claim 18 24 does require a photovoltaic panel? 25 A I think what I said is those other	Page 75 1 A Yes, the output of the panel will change as 2 a function of the amount of solar energy that is 3 shining on it. 4 Q So at some point in that process you may be 5 able to generate enough power to drive an auxiliary 6 power system and at other points in time in that process 7 you would not be able to, right? 8 A That is true. 9 Q Is that scenario present if you are just 10 getting your power from the mains assuming the power 11 company is providing power? 12 A Well, I think this UPS device may be a 13 great example. I didn't realize it going into this 14 day, but it has to address the situation where the 15 power from the mains goes into what is called a 16 brownout situation and it is a complicated circuit I am 17 sure, and it decides whether it is going to switch one 18 power delivery method versus another power delivery 19 method being the battery. So it deals with varying 20 inputs. 21 There is lots of systems. I mean, to have 22 to deal with a fluctuating input and probably a wind 23 generator would be an example of that. That is not 24 photovoltaic. 25 Let me see what other cases that I can think
Page 74 1 elements. Yes, certainly Claim 18 stipulates a 2 photovoltaic panel, but if you allotted that out, all 3 of the other elements of what that is describing of a 4 circuit with the input different from PV, maybe. I 5 don't think there is anything that -- there is nothing 6 fundamental to say that that couldn't happen. 7 Q Let me try to get at this a different way 8 which is, what does a PV panel generate when it is dark 9 out in the middle of the night? 10 A It is probably nothing, no current output. 11 Q So what happens when the sun starts to rise 12 and a little bit of sunlight starts to hit the panel? 13 A A little bit of current starts to flow out 14 of the panel. 15 Q What is the voltage output at that time? 16 A Well, I mean, you would have to look. You 17 can look at the data sheets from these PV panels and 18 they will tell you that. Some of that depends upon -- 19 a panel looks like a current source for a lot of its 20 output characteristics. So that is my understanding. 21 So the voltage would depend upon whatever it is driving 22 into, whatever load it is driving. 23 Q That will change as the sun continues to 24 rise and then starts to set, right, the output 25 characteristics of the panel will change, right?	Page 76 1 of. So wind generator. My own power of Pedernales 2 Electric Coop dips from time to time. You can see it. 3 I have an alarm that goes off and my UPS says, hey, you 4 have problems. We are switching over to battery because 5 you are in a brownout mode. 6 Are there any other situations? Offhand I 7 cannot think of any, but those are the ones that came to 8 mind. 9 Q Okay. Let us look at Figure 3 of the '021 10 patent. Let me know when you are there. 11 A Let me rotate it. 12 Q I did the same thing. 13 A Okay. 14 Q Specifically let us look at Buck 1. 15 A Okay. 16 Q So the callout 301 is pointing to a Buck 17 converter labeled Buck 1? 18 A Correct. 19 Q There are various components in that Buck 20 converter, right? 21 A Yes. 22 Q There is a transistor 302. It is a MOSFET 23 actually, right? 24 A Yes. 25 Q An inductor 306, right?

Page 77 1 A Correct. 2 Q A diode 305? 3 A Correct. 4 Q A capacitor 307, right? 5 A Correct. Yes. Sorry. 6 Q And there is some other elements in there as 7 well, right? 8 A Correct. 9 Q All of those components we just looked at 10 play a role in converting the input voltage to that Buck 11 converter into an output voltage, right? 12 A Yes. 13 Q And typically speaking that Buck converter 14 would convert an input voltage to a lower output 15 voltage, correct? 16 A Correct. 17 MR. ULLMER: Okay. I think that I have no 18 further questions. I will pass the witness. 19 MR. ESCHWEILER: Is there anything else that 20 you wish to cover and how do you want to proceed? I can 21 go ahead and ask Dr. Holberg some questions and then you 22 come back around and ask anything further. How do you 23 typically want to do that? 24 MR. ULLMER: So if you have redirect 25 questions right now, you can ask them. Otherwise, I	Page 79 1 I just asked. As long as we are on the same page on 2 that front. We will need to call the Board if you go 3 into topics that I did not touch on. 4 MR. ESCHWEILER: I think I understand. When 5 you are talking about topics, you talked about claim 6 construction in general, but my questions would be 7 limited to the terms that you were talking about solely. 8 MR. ULLMER: Okay. That I have no issue 9 with. 10 MR. ESCHWEILER: That is what you are saying 11 though, right, as opposed to, hey, we talked about claim 12 construction. Let us talk about claim construction. 13 MR. ULLMER: Yes. Yes. So I am just giving 14 you a heads up that we will have to pause again and talk 15 if you have things that go into issues that I did not 16 raise, then we will have to discuss that. We can take 17 that as it comes. I will say there is a particular 18 issue we are going to be very sensitive about and we 19 will call the Board about to prevent from coming into 20 the record. 21 MR. ESCHWEILER: I appreciate it. That is 22 why this conversation is good. I have no problems with 23 that. Let's convene in 30 minutes. 24 (Recess was taken.) 25 EXAMINATION
Page 78 1 think that we end the deposition. 2 MR. ESCHWEILER: Okay. 3 THE WITNESS: Well, the normal, I don't know 4 if the rules have changed, but normally there is an 5 opportunity for SMA counsel and myself offline and then 6 we go to redirect. I don't know if the rules have 7 changed. 8 MR. ULLMER: That is up to you guys. 9 MR. ESCHWEILER: It is noon right now. I 10 want to be sensitive to your time because you guys are 11 Mountain time. So this is not lunch time for you, 12 correct? 13 MR. ULLMER: Correct. 14 MR. ESCHWEILER: Why don't we take 30 15 minutes and reconvene. I do have a number of questions 16 that I would like to ask, but I don't think they are 17 going to be significant. 18 So my thought would be is, you know, if we 19 get back here maybe around 12:40, which would be 10:40 20 your time, I would think that we would probably be done 21 in 30 minutes. I think that we might have, at most, 30 22 minutes of cross. 23 MR. ULLMER: So, to be clear, so I don't 24 know what you want to ask about, but your redirect has 25 to be, it cannot go outside the scope of questions that	Page 80 1 BY MR. ESCHWEILER: 2 Q Dr. Holberg, throughout the morning you have 3 been asked a number of questions with regards to the 4 meaning of various claim terms, for example, stage and a 5 power converter. 6 Are you aware of whether a Markman decision 7 has been rendered in the corresponding District Court 8 litigation? 9 A Yes. 10 Q What is your understanding -- what is a 11 Markman opinion? 12 A A Markman, it is a District Court, 13 oftentimes when you look at claims, there is a dispute 14 as to what some of the claim terms might mean; and the 15 Markman is a process whereby each side presents their 16 case to the District Court judge and then he ultimately 17 decides what the elements mean, what the claim elements 18 mean that were at issue. 19 Q And do you understand that at this time, 20 regardless of what your opinion is with regards to the 21 meaning of the claim terms, that the District Court's 22 opinion is what dictates the meaning of a particular 23 claim element? 24 A That is my understanding. 25 MR. ULLMER: Objection.



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Page 81 1 Q Okay. Can we look at paragraphs 151 through 2 153 of your expert opinion, Exhibit 1007. 3 A Okay. I am there now. 4 Q These are the paragraphs that are dealing 5 with your views on the combination of Balogh with the 6 Mieth reference. 7 Could you briefly review paragraphs 151 8 through 153 and then provide me a little bit of input as 9 to what your thought process was in deciding whether the 10 combination of these two references made sense? 11 A So Balogh discloses the cascaded inverter 12 arrangement. It states that these arrangements include 13 first and second Buck converter and are used in 14 applications where there is a large input-output 15 conversion ratios. A PHOSITA will understand that that 16 is a similar situation in PV systems. When the PV 17 cells are put together, the panels are made, the 18 modules realize high input output -- high output 19 voltages that are input to the converters and such 20 input voltages need large conversion ratios to 21 step-down to the desired needed voltage. 22 These voltages are going to be as high as 23 80. Nishi talks in terms of even higher voltages than 24 that. 25 And so, you know, motivation to combine	Page 83 1 Exhibit 1001, particularly you spent a decent amount of 2 time talking about Claim 18. 3 A Yes, I recall. 4 Q Okay. Now, you were asked a significant 5 number of questions about whether this system would 6 connect to an element that is not in the claim such as 7 an inverter. 8 I want to ask you more about this claim 9 itself and what is going on within the actual claim 10 terms themselves. 11 You read the final paragraph of the claim 12 and you were going through that with opposing counsel. 13 Can you read that "when" paragraph for me, 14 please? 15 A When the voltage is above the threshold, 16 the control circuit signals the second -- let me read 17 it again. 18 When the voltage is above the threshold, the 19 control circuit signals the second stage power converter 20 to enable the providing of the second output to the 21 micro-controller. 22 Q So what is the second output? 23 A Well, that would be the second stage 24 output. 25 Q Okay. The second stage output of the second
Page 82 1 Balogh was that it is in the same space and it had the 2 same need that the '021 expressed. 3 Balogh makes it clear that the cascade 4 step-down converters or Buck converters readily find use 5 in photovoltaic applications where significant down 6 ratios or step-down ratios are needed. 7 Q Okay. And then why did you take a look at 8 the Xu reference for reliance on the general knowledge 9 of a person of ordinary skill? 10 A Well, Xu discussed the efficiency issue. 11 It says -- I will just read what I said. 12 In addition, Xu reflects further general 13 knowledge of a PHOSITA that cascaded converters 14 advantageously improve circuit efficiency. Xu states 15 that in some applications where there is a lower 16 input-to-output ratio voltage ratio even the first stage 17 can still be used and configured as an L-C filter. 18 For these reasons it would have been obvious 19 for a PHOSITA to combine Balogh with Mieth in view of 20 the general knowledge of a PHOSITA, as shown by the 21 teaching of Xu, where large output/input ratios are 22 more efficient when implemented with cascaded Buck 23 converters. 24 Q All right. Well, thank you. 25 One last couple of questions is dealing with	Page 84 1 stage power converter? 2 A For the claim it begins, it says, a first 3 stage power converter connected to the photovoltaic 4 panel to generate a first output from the direct 5 current output; a second stage power converter 6 connected to convert the first output to a second 7 output. So the second output is what the second stage 8 power converter generates. 9 Q Okay. So when a second output is provided 10 to the micro-controller, what happens? 11 A It powers the micro-controller. 12 Q Okay. And when the micro-controller is 13 powered, does it consume power? 14 A It draws current. It consumes power. It 15 is effectively a load. 16 MR. ULLMER: Objection. 17 MR. ESCHWEILER: All right. Well, thank 18 you. That is all the questions that I have. 19 FURTHER EXAMINATION 20 BY MR. ULLMER: 21 Q All right. Dr. Holberg, you were asked 22 about claim construction. 23 Is it your understanding that the Board that 24 is, the panel of administrative patent judges that is 25 overseeing this IPR has issued a claim construction

Page 85

1 order in this proceeding?
2 A No, I don't think that they have.
3 Q Well, you do understand that in a different
4 case in a District Court litigation the judge there has
5 issued a claim construction order, correct?
6 A I do understand that.
7 MR. ULLMER: Okay. No further questions.
8 MR. ESCHWEILER: I am all finished.
9 MR. ULLMER: Thank you for your time,
10 Dr. Holberg.
11 MR. ESCHWEILER: All right. You guys have a
12 great day.
13 (The deposition concluded at 10:47 a.m.)
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Page 86

1 C E R T I F I C A T E
2 I, MICHELE KOSS, a Shorthand Reporter and
3 notary public, within and for the State of Colorado, do
4 hereby certify:
5 That DOUGLAS R. HOLBERG, the witness whose
6 examination is hereinbefore set forth, was first duly
7 sworn by me and that this transcript of said testimony
8 is a true record of the testimony given by said witness.
9 I further certify that I am not related to any
10 of the parties to this action by blood or marriage, and
11 that I am in no way interested in the outcome of this
12 matter.
13 IN WITNESS WHEREOF, I have hereunto set
14 my hand this 22nd day of January, 2024.
15
16 
Michele Koss, RMR, RPR
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