

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

DISH NETWORK LLC,

Petitioner,

v.

Case: IPR2024-00373

U.S. Patent No.

ENTROPIC COMMUNICATIONS,

7,594,249

LLC,

Patent Owner.

DEPOSITION OF

SCOTT ACTON, Ph.D.

September 18, 2024

9:10 a.m. - 2:18 p.m.

Charlottesville, Virginia

Deposition of SCOTT ACTON, Ph.D., taken
and transcribed on behalf of the Patent Owner,
stenographically reported by Kimberly L.
Ribaric, Registered Professional Reporter,
Certified Court Reporter and Notary Public in
and for the Commonwealth of Virginia at large,
pursuant to notice, and by Notice to Take
Depositions; commencing at 9:10 a.m.,
September 18, 2024, at Veritext, 415 4th Street
NE, Suite 4, Charlottesville, Virginia 22902.

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E X H I B I T S

(NO EXHIBITS MARKED HEREIN)

1 (September 18, 2024, 9:10 a.m.)

2 SCOTT ACTON, Ph.D.,

3 first duly sworn, testified as follows:

4 - - -

09:05:06

5 MR. HALVERSON: Morning, Dr. Acton.

09:10:02

6 THE WITNESS: Good morning.

09:10:04

7 - - -

09:10:06

8 EXAMINATION

09:10:06

9 BY MR. HALVERSON:

09:10:06

10 Q. Can you state your full name for the
11 record, please.

09:10:07

09:10:09

12 A. Sure. Scott Thomas Acton.

09:10:09

13 Q. Can you spell your last name?

09:10:12

14 A. A-C-T-O-N.

09:10:14

15 Q. And, Dr. Acton, have you been deposed
16 before?

09:10:17

09:10:18

17 A. I have.

09:10:18

18 Q. Approximately how many times?

09:10:18

19 A. Excuse me. Approximately 20.

09:10:21

20 Q. So I suspect the rules are pretty much
21 the same as they were the other 20 times. But just
22 so that we're all on the same page, the way this
23 goes is I ask a question and you give answers to
24 those questions to the best of your ability. Sound
25 right?

09:10:24

09:10:25

09:10:29

09:10:32

09:10:35

09:10:38

1 of whatever it is that's being asked. Is that 09:11:47
2 fair? 09:11:50

3 A. I think that's fair, yes. 09:11:50

4 Q. I will do my best to take a break about 09:11:51
5 every hour so that you can stretch, use the 09:11:54
6 restroom, have water, coffee, tea, whatever it may 09:11:58
7 be. 09:12:01

8 If at any point in time before I offer a 09:12:01
9 break, you need a break, just ask, I'm happy to do 09:12:04
10 it with one caveat, if there's a question that's 09:12:07
11 been posed, I ask that you wait and answer that 09:12:10
12 question before we go on break. Is that fair? 09:12:13

13 A. That is fair. 09:12:16

14 Q. And then last, is there -- not last. 09:12:21
15 Because this is all being taken down by transcript, 09:12:25
16 it's very important that we try not to talk over 09:12:28
17 each other. 09:12:30

18 I am not a particularly fast talker, but 09:12:32
19 I do tend to try to jump in. And so I will do my 09:12:34
20 best to not jump in, but if you could make sure 09:12:37
21 that you wait until after I've finished asking the 09:12:40
22 full question before you offer up an answer, just 09:12:43
23 so that Kim can get everything taken down. Is that 09:12:46
24 fair? 09:12:49

25 A. I will do my best, as well. 09:12:49

1 Q. Is there any reason why this morning 09:12:51
2 you're not able to give truthful and accurate 09:12:52
3 testimony about your declaration? 09:12:55

4 A. None. 09:12:57

5 Q. And you have in front of you your 09:12:58
6 declaration, which has been already marked as 09:13:00
7 Exhibit 1003. 09:13:05

8 You have in front of you the patent at 09:13:05
9 issue in this proceeding, which is -- can you read 09:13:08
10 the patent number for me? 09:13:15

11 A. 7,594,249. 09:13:18

12 Q. And is it fair to call that the '249 09:13:22
13 Patent for purposes of our discussion today? 09:13:27

14 A. Please. 09:13:30

15 Q. You also have a number of references that 09:13:30
16 you relied on in your declaration. One of them 09:13:33
17 I've referred to as Amit, but it's been marked as 09:13:38
18 Exhibit 1005. Can you read the Amit patent number 09:13:44
19 into the record for us? 09:13:54

20 A. I can. It is U.S. 7,127,734. 09:13:56

21 Q. And is it fair to refer to that today as 09:14:03
22 "Amit," we'll know what I'm talking about? 09:14:07

23 A. Yes. 09:14:10

24 Q. There are also two textbooks, the 09:14:10
25 ADSL/VDSL textbook, which has been marked as 09:14:18

1 Exhibit 1006 in the underlying proceeding. You 09:14:22
2 have that in front you too? 09:14:25

3 A. I do. 09:14:27

4 Q. As well as the DSL textbook, which has 09:14:27
5 been marked as Exhibit 1008 in this proceeding. 09:14:30

6 You have both of those two in front of 09:14:33
7 you? 09:14:35

8 A. Yes, sir. 09:14:35

9 Q. And then finally there is a article that 09:14:36
10 I have referred to as Jacobsen, that's been marked 09:14:41
11 as Exhibit 1007 in this proceeding. 09:14:44

12 Do you have a different or preferred way 09:14:49
13 of referring to Jacobsen or is that a fair 09:14:50
14 characterization? 09:14:54

15 A. Jacobsen is fine. 09:14:54

16 Q. All right. Let's dive in. 09:14:57

17 Dr. Acton, are you currently employed? 09:15:03

18 A. I am. 09:15:07

19 Q. Where? 09:15:07

20 A. The University of Virginia. 09:15:08

21 Q. And what do you do for the University of 09:15:09
22 Virginia? 09:15:12

23 A. I am professor and chair of electrical 09:15:12
24 and computer engineering. 09:15:15

25 Q. And do you teach as part of that role? 09:15:17

1 A. I do. Right now I'm teaching a class 09:15:22
2 called Signals and Systems, which is basically a 09:15:25
3 first course in communications and single 09:15:29
4 processing. 09:15:31

5 Q. Is that an undergraduate course or a 09:15:31
6 graduate course? 09:15:34

7 A. It is an undergraduate course. 09:15:35

8 Q. Approximately how many people take that 09:15:37
9 course per semester? 09:15:38

10 A. Right now, there's 45 in my section. 09:15:39

11 Q. And is that a freshman level course? 09:15:46

12 A. No. It's a second year level course. 09:15:49

13 Q. In addition to Signals and Systems, are 09:15:54
14 you teaching any other courses this semester? 09:15:58

15 A. No. 09:16:00

16 Q. Do you normally teach more than one class 09:16:00
17 a semester? 09:16:04

18 A. Never. 09:16:05

19 Q. And what is your -- is that your typical 09:16:07
20 fall class that you teach? 09:16:11

21 A. I don't know if there is a typical fall 09:16:13
22 class. I have a repertoire which includes a number 09:16:15
23 of courses. 09:16:19

24 Q. Do you teach graduate level courses as 09:16:20
25 well? 09:16:23

1 A. I do. 09:16:23

2 Q. And over the last five years, 09:16:25
3 approximately, what percentage of the courses that 09:16:30
4 you've taught have been graduate versus 09:16:32
5 undergraduate courses? 09:16:36

6 A. It's probably been about a quarter 09:16:39
7 graduate. And typically we will allow advanced 09:16:44
8 fourth years to take some of our graduate courses, 09:16:51
9 so they aren't purely graduate. 09:16:53

10 And I might mention that I've served as 09:16:56
11 chair for two-plus years. 09:16:59

12 But the three years before that, I was at 09:17:01
13 the National Science Foundation and was not 09:17:04
14 teaching. 09:17:09

15 Q. We'll get into the history in just a 09:17:09
16 second. 09:17:12

17 A. Okay. 09:17:12

18 Q. Don't worry, we'll get there, I promise. 09:17:13

19 Do you know what you're going to be 09:17:16
20 teaching in the spring? 09:17:19

21 A. No. 09:17:22

22 Q. And do you recall what you taught last 09:17:24
23 spring? 09:17:27

24 A. I did not teach. 09:17:27

25 Q. And so over the last two years, how many 09:17:29

1 semesters have you taught a class? 09:17:33

2 A. Two. 09:17:36

3 Q. Beyond teaching, what else do you do in 09:17:40
4 your role at the University of Virginia? 09:17:43

5 A. So I'm director of a laboratory, it's 09:17:46
6 called Virginia Image and Video Analysis. We do 09:17:49
7 signal and image processing research as well as 09:17:55
8 machine learning, which seems to be the happening 09:17:59
9 area at the point. 09:18:03

10 I also -- so that's -- research is a big 09:18:07
11 part of my life. Now, service is also a major 09:18:09
12 portion of my life. I'm the leader of the 09:18:15
13 department, I'm the chair, and so I'm the 09:18:17
14 supervisor of approximately 40 professors. 09:18:20

15 Q. In that lab that you mentioned, you had 09:18:24
16 referred to signal and imaging -- image processing 09:18:31
17 as well as machine learning. So I want to focus on 09:18:38
18 the signal and image processing part of that first. 09:18:41

19 What kind of research is being done in 09:18:45
20 your lab on the signal and image processing side? 09:18:46

21 A. Good question. So we're doing a lot of 09:18:49
22 image analysis, a lot of biological image analysis, 09:18:54
23 meaning looking at images of biological objects, 09:18:57
24 such as bacteria, trying to segment the bacteria, 09:19:02
25 which means to tell one bacterium from another, 09:19:05

1 trying to track the bacteria, trying to figure out 09:19:08
2 what these organisms do in a living state. That's 09:19:13
3 one area. 09:19:17

4 We also do some medical imaging. Right 09:19:20
5 now we're doing some medical imaging using magnetic 09:19:23
6 resonance imaging. And that imaging is to prepare 09:19:28
7 a patient for a procedure, which is called focused 09:19:35
8 ultrasound. And focused ultrasound can relieve one 09:19:40
9 of a tremor in the hand, for example, by ablating a 09:19:45
10 certain area of the brain. And our imaging and 09:19:50
11 image analysis helps the planning of that process. 09:19:55

12 We also have some work in education where 09:19:58
13 we're processing videos. 09:20:01

14 And we have worked for the military on 09:20:05
15 image analysis. 09:20:13

16 And I could go on, but maybe that's 09:20:15
17 enough for right now. 09:20:17

18 Q. It's a good background. 09:20:18

19 How many researchers are part of that 09:20:21
20 lab, approximately? 09:20:23

21 A. Right now, eight. 09:20:26

22 Q. And are those post docs? 09:20:30

23 A. We have one post doc currently, we had 09:20:33
24 two last year. 09:20:39

25 Q. And who are the remaining folks? 09:20:39

1 A. Graduate students, and then two paid 09:20:41
2 undergraduate students. 09:20:45

3 Q. Where does the funding for that lab come 09:20:46
4 from? 09:20:49

5 A. Good question. From a variety of 09:20:49
6 sources. National Science Foundation. Army 09:20:53
7 Research Office. A foundation called Robertson. A 09:20:59
8 foundation called Schmidt Futures. And the NIH, 09:21:06
9 the National Institutes of Health. 09:21:14

10 Q. And so of those five entities that you 09:21:17
11 identified, I think, which one is the biggest 09:21:28
12 source of funding for that lab? 09:21:31

13 A. The National Science Foundation. 09:21:33

14 Q. And beyond those five entities, are there 09:21:36
15 additional funders? Or let me, perhaps, ask a 09:21:39
16 better question. 09:21:49

17 Approximately what percentage of the 09:21:49
18 overall funding do those five funders provide? 09:21:50

19 A. Right now, almost 100 percent. And I 09:21:54
20 hesitate to say a hundred percent because we have 09:22:00
21 some internal money, basically some money from the 09:22:03
22 University of Virginia to pursue a new topic. 09:22:08

23 Q. And is that over the horizon, potential 09:22:14
24 research, or is that for something that is 09:22:17
25 currently being done? 09:22:20

1 Q. What did you do in 2000 as a professor 09:23:50
2 here? 09:23:54
3 MR. RIFFE: Objection. Form. 09:23:57
4 THE WITNESS: So I came as associate 09:24:01
5 professor. And basically the short answer to 09:24:03
6 the question is teaching and research. 09:24:07
7 BY MR. HALVERSON: 09:24:10
8 Q. Did the lab that you're currently working 09:24:11
9 with exist in 2000? 09:24:13
10 A. It was founded in 2000. 09:24:16
11 Q. Did you found it? 09:24:18
12 A. Yes, sir. 09:24:19
13 Q. And what kind of projects was it working 09:24:21
14 on in the 2000 to 2005 time frame? 09:24:24
15 A. A lot of signal and image processing 09:24:28
16 work. Some work for the Army, some work for the 09:24:37
17 National Science Foundation, some work for the 09:24:43
18 National Institutes of Health. But mainly 09:24:45
19 concentrating on signal and image processing. 09:24:48
20 Q. And so was it similar type of research, 09:24:49
21 just earlier in time as to what's happening today? 09:24:53
22 A. I would agree with that characterization. 09:24:56
23 Q. Where did you get your Ph.D. from, 09:25:13
24 Dr. Acton? 09:25:17
25 A. The University of Texas. 09:25:17

1 Q. And did you go straight from the 09:25:19
2 University of Texas to University of Oklahoma? 09:25:22

3 A. To Oklahoma State University? 09:25:26

4 Q. Yes, to Oklahoma State University? 09:25:32

5 A. Essentially. The caveat or the condition 09:25:35
6 I'll add to that is I -- Motorola funded my Ph.D. 09:25:39
7 work and I stayed there for a few months, and then 09:25:44
8 also did a brief postdoctoral stint at a place 09:25:48
9 called the Center for Space Research. 09:25:53

10 Q. What is the Center for Space Research? 09:25:55

11 A. It's a research unit that basically works 09:25:57
12 on remote sensing and space-oriented research in 09:26:01
13 Texas. 09:26:08

14 Q. Is that associated with the government or 09:26:08
15 is that a private entity? 09:26:11

16 A. It's associated with the University of 09:26:14
17 Texas but it's an independent entity. 09:26:18

18 Q. And then you said you said you were 09:26:20
19 spending a little bit of time working for Motorola 09:26:23
20 or doing work for Motorola, excuse me. 09:26:25

21 What was your -- what were you providing 09:26:28
22 to Motorola? 09:26:32

23 A. So I was on a team that designed 09:26:33
24 automated inspection systems. So if you think 09:26:37
25 about Motorola making chips and components at that 09:26:40

1 point, the chips and the other components would 09:26:45
2 come down the factory line and we would use cameras 09:26:48
3 and computers to inspect them to see if they were 09:26:53
4 functional or cosmetically proper. 09:26:56

5 Q. And that was image-based analysis? 09:27:03

6 A. Yes. 09:27:07

7 Q. Was there any hardware testing that went 09:27:09
8 into that process? 09:27:12

9 A. Definitely. 09:27:13

10 Q. And what kind of hardware testing was 09:27:13
11 being done? 09:27:17

12 A. So the images we would take and interpret 09:27:18
13 would image these gold bond loops, which were gold 09:27:22
14 wires protruding from the circuit board, if you 09:27:26
15 will. And then we would measure the inductance of 09:27:29
16 those wires to see if they met specifications. 09:27:36

17 Q. And when you say you would measure the 09:27:43
18 inductance, was that modeled inductance or was that 09:27:44
19 an actual measurement taken? 09:27:50

20 A. That's an actual measurement taken. 09:27:52

21 Q. Did you ever teach a class on coaxial 09:27:54
22 cables? 09:28:11

23 A. Is there such a class? 09:28:11

24 Q. I don't know. Is there? 09:28:14

25 A. So if I could rephrase the question. 09:28:16

1 Have I ever taught coaxial cables? The answer is 09:28:25
2 yes. 09:28:28

3 And one of the courses in which I teach 09:28:28
4 coaxial cables is the Signs of Information. 09:28:33

5 Q. And is the coaxial cable -- excuse me, 09:28:37
6 start over. 09:28:43

7 Is the coaxial cable aspect of that class 09:28:44
8 a, like, lesson within the class or is it something 09:28:49
9 that is tangential or ancillary to the overall 09:28:54
10 purpose of the class? 09:28:59

11 A. I don't know if I would take those two as 09:29:05
12 mutually exclusive, but it's a lesson in the class, 09:29:07
13 the first item you mentioned. 09:29:11

14 Q. And so is that, like, coax cable day on 09:29:14
15 day six of the lecture or is there something else 09:29:21
16 that is being contemplated there? 09:29:24

17 A. It's more akin to physical layer day. So 09:29:26
18 there's a lot of methods that we teach in signal 09:29:31
19 processing and communications and information 09:29:38
20 theory. 09:29:40

21 And many of these methods apply to 09:29:44
22 different manifestations in the physical layer. 09:29:46
23 One could be twisted pair, another could be coax, 09:29:48
24 another could be air. We're speaking through the 09:29:54
25 medium of air right now. 09:29:56

1 Q. What's twisted pair? 09:30:04

2 A. Twisted pair essentially is the coupling 09:30:08
3 of two copper wires. And it's really quite 09:30:16
4 brilliant, because you can send the signal through 09:30:19
5 one of those wires and then send the inverse of the 09:30:23
6 signal through the other wire. 09:30:26

7 They'll be subject to the same noise, and 09:30:33
8 when you difference them, you'll get basically a 09:30:36
9 boosted version of the signal and a quite reduced 09:30:39
10 version of the noise. 09:30:42

11 So simply using two wires is a really 09:30:44
12 nice way to reduce noise over what we might call 09:30:49
13 the telephone network. 09:30:54

14 Q. You've heard the term "Cat 5" or 09:30:55
15 "Category 5"? 09:31:01

16 A. I have. 09:31:01

17 Q. What is that? 09:31:02

18 A. That is a twisted pair cable. And the 09:31:04
19 beautiful thing about Cat 5 is that it allows a 09:31:07
20 greater frequency range than the telephone cabling 09:31:11
21 that you had in your house circa 1975. 09:31:17

22 Q. Is there a Cat 4? 09:31:18

23 A. I believe there's a series of cats. 09:31:21

24 Q. Do you know when Cat 5 was commercially 09:31:23
25 released? 09:31:29

1 A. I don't, but if you represent it to me, 09:31:29
2 I'll accept it. 09:31:32

3 Q. Was Cat 5 available when you started here 09:31:34
4 at the University of Virginia in approximately 09:31:39
5 2000? 09:31:40

6 A. I think that's actually fair to say, 09:31:42
7 because we have Cat 5 in the wall; it's still 09:31:45
8 there. We don't use it. 09:31:47

9 Q. Has the twisted pair environment 09:31:48
10 progressed beyond Cat 5 as of today? Said 09:31:55
11 otherwise, is there a Cat 6? 09:32:01

12 A. I'm uncertain. 09:32:04

13 Q. So you talked a little bit about what the 09:32:08
14 physical medium of twisted pair is. What is the 09:32:13
15 physical medium of coax cable? 09:32:15

16 A. Okay. So the reason it's called coaxial 09:32:20
17 is because there's a center access, generally 09:32:24
18 copper, and that's going to be delivering your 09:32:27
19 signal. And then there's a shield that shares the 09:32:30
20 same axis, coaxial, and that shield prevents, to 09:32:34
21 some degree, interference from the outside, noise, 09:32:39
22 that sort of disturbance, to the signal. 09:32:45

23 And yeah, that's my basic description of 09:32:48
24 coaxial. 09:32:55

25 And I might add, the cool thing about it, 09:32:57

1 it was invented by Alexander Graham Bell. 09:33:00

2 Q. I did not know that. 09:33:05

3 A. Yeah. 09:33:06

4 Q. When you said "axis" there, that was 09:33:06

5 A-X-I-S, right, as in like the radial axis? 09:33:10

6 A. Correct. 09:33:13

7 Q. The coax that Mr. -- Dr. -- Alex, the 09:33:14

8 coax Alexander Graham Bell invented, do you know 09:33:28

9 how that's different from the coaxial that's 09:33:31

10 available today? 09:33:37

11 A. One thing would be plastics, obviously. 09:33:38

12 Plastics were unavailable back then, so the outer 09:33:40

13 coating would be different. 09:33:44

14 Q. Do you know whether or not the coax of 09:33:49

15 the early telephone days was capable of the same 09:33:53

16 bandwidth and throughput as the coax available 09:34:00

17 today? 09:34:05

18 A. First, I think -- I don't know if I would 09:34:06

19 use the word "early telephone days." Do you want 09:34:11

20 to -- 09:34:13

21 Q. What would you use? I'm happy to 09:34:13

22 rephrase that. 09:34:17

23 A. Earlier days of coaxial communication. 09:34:18

24 Q. Do you know whether or not the coaxial 09:34:22

25 cables of the early days of coaxial communications 09:34:28

1 were capable of the same bandwidth and throughput 09:34:30
2 as the coax available today? 09:34:35
3 A. I do know. 09:34:37
4 Q. And? 09:34:38
5 A. They're not. 09:34:39
6 Q. What has driven the development and 09:34:39
7 progression of the physical medium of coax cables 09:34:45
8 over the history of those cables? 09:34:50
9 A. One would say materials engineering, 09:34:53
10 which is outside my expertise. 09:34:57
11 Q. Do you know what the standard operating 09:35:17
12 frequencies are today of coaxial cables? 09:35:25
13 I'm sorry. Which was the first one that 09:36:29
14 you were looking at? 09:36:32
15 A. The patent? 09:36:33
16 Q. Yeah. What patent was that one? Was 09:36:34
17 that the '249? 09:36:36
18 A. '249. 09:36:37
19 Maybe a good example is Figure 5 of Amit, 09:37:59
20 which shows, you know, a range in megahertz up to 09:38:07
21 940 megahertz. 09:38:14
22 Q. Do you want to keep looking or are you 09:38:51
23 good with a range of megahertz up to 940? 09:38:55
24 A. Counsel, was your question asking about 09:39:11
25 2024, the current? 09:39:22

1 Q. That question was today. Yeah. 09:39:24

2 A. Okay. So maybe the answer to that is I'm 09:39:29
3 not certain. 09:39:32

4 Q. Then the next question is going to be, 09:39:33
5 how about as of 2000, approximately, when you 09:39:34
6 started here at UVA? 09:39:39

7 A. Around the time of the priority date of 09:39:40
8 the patent? 09:39:45

9 Q. Yes. 09:39:45

10 A. Yeah, up to around 900 megahertz, I would 09:40:09
11 say. 09:40:14

12 Q. Are you familiar with the term "bit rate" 09:40:16
13 or the concept bit rate? 09:40:23

14 A. Of course. 09:40:25

15 Q. What's bit rate? 09:40:26

16 A. Generally speaking, bit rate is the 09:40:28
17 number of bits per unit time that can be 09:40:32
18 transmitted. 09:40:37

19 Q. Are you familiar with the approximate bit 09:40:39
20 rate of coaxial cables today? 09:40:48

21 A. Definitely. And there's laboratory tests 09:41:16
22 and there's actual bit rates over coax. 09:41:26

23 If I were using a rule of thumb in a 09:41:38
24 class, I might say a hundred megabits per second. 09:41:42

25 Q. And is that a rule of thumb that's an 09:41:46

1 academic rule of thumb or is that a rule of thumb 09:41:50
2 that would that be a real-world implementation rule 09:41:51
3 of thumb? 09:41:53
4 A. The latter. 09:41:54
5 Q. And are you familiar with the approximate 09:41:55
6 bit rates of coaxial cables as of about 2000, when 09:41:57
7 you started here at UVA? 09:42:00
8 A. Yeah, it would be much lower. 09:42:03
9 Q. Approximately how much lower? 09:42:04
10 A. Maybe 1 megabit per second. Or more. 09:42:07
11 Q. When you say "or more," are we talking 09:42:30
12 like 1 to 2, or 1 to 12, or 1 to 100? What's your 09:42:34
13 qualifier band for "or more"? 09:42:39
14 A. 1 to 10. And as you mention, in academic 09:42:44
15 or laboratory scenarios, there might be greater 09:42:49
16 boasts of higher bit rates. 09:42:51
17 Q. And so that rule of thumb of one or more, 09:42:55
18 is that real world like it was for the current rule 09:42:59
19 of thumb, or was that an academic rule of thumb? 09:43:02
20 A. Real world. 09:43:07
21 Q. Do you know what the current twisted pair 09:43:41
22 operating frequency ranges are? 09:43:47
23 A. They're lower. 09:43:56
24 Q. Than? 09:44:02
25 A. Coax. 09:44:04

1 Q. By approximately how much? 09:44:12

2 A. So there's two answers to your question. 09:46:16

3 One that I can answer right off the bat, which is 09:46:19

4 the bandwidth of twisted pair, you get 09:46:22

5 approximately about 5,000 hertz of bandwidth, maybe 09:46:28

6 5 kilohertz. And that was the sort of the 09:46:35

7 invention of DSL. They figured out, hey, you only 09:46:37

8 need 3 kilohertz to talk through the phone and you 09:46:41

9 can use the rest of the bandwidth maybe for a 09:46:45

10 signal, for data. 09:46:48

11 What I'm blanking on is the carrier 09:46:57

12 frequencies at which these bands are transmitted. 09:47:00

13 There's multiple. 09:47:03

14 So I don't know if you want to point me 09:47:03

15 to something, but off the top of my head I'm 09:47:05

16 uncertain in answering. 09:47:07

17 Q. Now, just for completeness on the coax 09:47:11

18 side, do you know what bandwidths are supported 09:47:18

19 over coax? 09:47:21

20 A. So Jacobsen says the -- oh, never mind. 09:47:52

21 Sorry. Okay. So Jacobsen on 308 mentions a 09:48:05

22 bandwidth of 6 megahertz. 09:48:33

23 Q. And do you know, is that a theoretical 09:48:42

24 bandwidth or an actual bandwidth? 09:48:43

25 A. What do you mean by that? 09:48:48

1 Q. So Jacobsen is a simulation of a coaxial 09:48:50
2 network, right? 09:48:58

3 A. I believe so, yes. 09:48:59

4 Q. And so is that 6 megahertz what was 09:49:00
5 simulated, or is that 6 megahertz in your opinion 09:49:05
6 the actual available bandwidth on a coaxial network 09:49:10
7 at that time? 09:49:17

8 A. The allocation would have to be the same. 09:49:18
9 It wouldn't matter if it was simulation or not. 09:49:20

10 Q. And we did bit rates on coax, but I don't 09:49:37
11 know that we got bit rates on twisted pair. If we 09:49:40
12 did and this is a repeat, I apologize. 09:49:43

13 But do you know the bit rates of twisted 09:49:46
14 pair today? And the next question is going to be 09:49:49
15 do you know them as of 2000. 09:49:53

16 A. You're asking with regard to twisted 09:50:02
17 pair? 09:50:06

18 Q. Correct. 09:50:06

19 A. So the ADSL/VDSL book provides a nice 09:50:25
20 table on page 14 which shows sort of the history of 09:50:30
21 going all the way from a hundred kilobits per 09:50:34
22 second to the very high bit rate, DSL at 25 or so 09:50:38
23 megabits per second. 09:50:48

24 There hasn't been that much advance in 09:50:54
25 twisted pair work over the last 20 years. Maybe 09:50:58

1 better materials, slightly better modulation. But 09:51:02
2 there hasn't been a great revelation that's changed 09:51:06
3 twisted pair. And as you know, we mostly go 09:51:12
4 wireless at this point. 09:51:17

5 Q. And just so we're all on the same page, 09:51:18
6 when you say page 14, you're talking about the page 09:51:21
7 number that's been applied on the bottom of 09:51:26
8 Exhibit 1006, not the textbook page number; is that 09:51:29
9 right? 09:51:29

10 A. Thank you for correcting that. I should 09:51:33
11 use page number 12 in the textbook. 09:51:35

12 Q. And so that table that you're referring 09:51:38
13 to with a number of different DSL technologies; is 09:51:41
14 that right? 09:51:41

15 A. That's correct. 09:51:44

16 Q. Do you know when ADSL first came to be? 09:51:44

17 A. I don't. Early '90s, late '80s. 09:51:58

18 Q. And so this progression from 09:52:01
19 approximately 64 kilobytes per second in MDSL, 09:52:19
20 which looks like it is the lowest upstream bit 09:52:27
21 rate, up to 25 megabits per second for VDSL, is 09:52:32
22 that a chronological progression or is this 09:52:41
23 reflecting differences in chronologically 09:52:47
24 equivalent technologies tied to something other 09:52:53
25 than some sort of advancement? 09:52:58

1 MR. RIFFE: Objection. Compound. 09:52:59

2 THE WITNESS: And I'm sorry, Counsel, I'm 09:53:05

3 confused by question. 09:53:05

4 BY MR. HALVERSON: 09:53:07

5 Q. It's not a great question. That makes a 09:53:07

6 lot of sense. Let me try again. 09:53:10

7 So MDSL has a lower band of its upstream 09:53:11

8 bit rate at approximately 64 kilobits per second, 09:53:18

9 right? 09:53:18

10 A. And you said upstream, right? 09:53:21

11 Q. Upstream, yeah. 09:53:24

12 A. Yes. 09:53:25

13 Q. And if you look at the downstream column 09:53:25

14 adjacent to that, the lowest bit rate is IDSL; is 09:53:30

15 that right? 09:53:30

16 A. Correct. 09:53:49

17 Q. You looked at the next page for that. 09:53:54

18 Was there something on page 13 that gave you some 09:53:57

19 insight on how to interpret the table on page 12? 09:54:00

20 A. On page 14, yes. I was trying to 09:54:03

21 remember what the "I" in IDSL was. And it's the 09:54:07

22 ISDN standard DSL, which is an acronym within an 09:54:12

23 acronym, which is annoying. 09:54:16

24 And if I could ask you, to the point 09:54:18

25 where we are talking about acronyms, if you could 09:54:21

1 spell them out for me as much as you can, that 09:54:26
2 would be great. 09:54:29

3 Q. As in IDSL or as in say the words that 09:54:29
4 make up what IDSL stands for when you say spell 09:54:34
5 them out? 09:54:37

6 A. And not particularly for IDSL, but later, 09:54:37
7 you know, if we're talking about an acronym that 09:54:41
8 might have multiple antecedents, just to keep the 09:54:44
9 record clean, if we could spell them out. 09:54:47

10 Q. I will do my best if I know what they 09:54:49
11 are. 09:54:51

12 A. Thank you. 09:54:51

13 Q. So the collection of DSL technologies in 09:54:52
14 the table of page 12 of the textbook, ADSL/VDSL 09:54:56
15 textbook, there are seven different technologies. 09:55:03
16 What are the different technologies on that table 09:55:13
17 used for? 09:55:16

18 MR. RIFFE: Objection. Form. 09:55:17

19 THE WITNESS: Broadly speaking, 09:55:21
20 transporting data. 09:55:29

21 BY MR. HALVERSON: 09:55:35

22 Q. Over what? 09:55:35

23 A. Over DSL, which we've been talking about 09:55:41
24 this morning at the physical layer is manifested in 09:55:45
25 twisted pair. 09:55:50

1 Q. And so how would you characterize the 09:55:53
2 difference between ADSL and VDSL? 09:55:54

3 A. All right. So ADSL is asynchronous DSL. 09:56:00
4 And the idea was we don't need to be symmetric. 09:56:05
5 You're more likely to be receiving content, like a 09:56:09
6 movie or a file from the worldwide web, than you 09:56:12
7 are to be communicating back to, say, AT&T. 09:56:18

8 So we will allocate more bandwidth to 09:56:22
9 downstream, and that's why it's asymmetric. 09:56:29

10 And if I said asynchronous, I apologize. 09:56:33

11 Q. You did. But you meant asymmetric? 09:56:39

12 A. Yes, sir. 09:56:41

13 Q. And then so how does that differ from 09:56:44
14 VDSL? 09:56:47

15 A. So VDSL came later. And I believe a lot 09:56:48
16 of the work was done at Bell Labs up in New Jersey. 09:56:55
17 But essentially the book on page 15 calls VDSL the 09:56:59
18 big brother of ADSL. 09:57:05

19 It could be either symmetric or 09:57:09
20 asymmetric. It has some fancy modulation schemes 09:57:11
21 that we may or may not get into today, depending on 09:57:18
22 the questions. 09:57:21

23 It allows for fiber to the curb, as we 09:57:29
24 say. And then the neighborhood could be supplied 09:57:32
25 by twisted pair from a box and deliver high rates 09:57:37

1 as such. 09:57:45

2 Q. And you said "fiber to the curb." That 09:57:50
3 refers to from the network to the curb, not from 09:57:53
4 the home or premise to the curb, right? 09:57:59

5 A. Correct. 09:58:01

6 Q. And -- 09:58:01

7 A. And there's similar ideas -- oh, sorry to 09:58:04
8 talk over you. There's similar ideas with cable TV 09:58:06
9 and coax, as well. 09:58:09

10 Q. And so the section that you're reading 09:58:12
11 from on page 15 also says: The maximum possible 09:58:13
12 length of a VDSL loop is much less than that of an 09:58:18
13 ADSL loop. 09:58:23

14 Do you see that at the top of the second 09:58:23
15 paragraph under the VDSL heading? 09:58:26

16 A. Yes. And that's a difference. 09:58:28

17 Q. What is the loop? 09:58:28

18 A. Basically the loop is essentially the 09:58:31
19 upstream distance plus the downstream distance in 09:58:45
20 terms of cable distance. 09:58:49

21 Q. And where are those measured from? 09:58:51

22 A. Typically from what we call the head end. 09:58:54

23 Q. And where are those measured to? 09:59:04

24 A. To the home. 09:59:07

25 Q. Ever heard of the acronym CMTS? 09:59:10

1 THE WITNESS: So that's a great question, 10:02:35
2 but I don't think I can answer it. 10:02:36

3 BY MR. HALVERSON: 10:02:41

4 Q. So keep going in that same paragraph on 10:02:41
5 page 15, the one that you're on. Refers to access 10:02:46
6 nodes, see that in the third line, that are remote 10:02:56
7 from the cable office, CO, and are fed by high 10:02:59
8 bandwidth fiber? 10:03:04

9 A. Yes. 10:03:05

10 Q. What does it mean to be fed by high 10:03:05
11 bandwidth fiber? 10:03:10

12 A. So you're receiving not by twisted pair 10:03:11
13 to that access node, you're receiving by fiber, by 10:03:18
14 fiberoptic cable, which as we know has large 10:03:22
15 bandwidth and low loss. 10:03:26

16 Q. So that's describing a fiberoptic input 10:03:29
17 into this -- I was going to say regional, but it's 10:03:33
18 not. Sorry. Let me start over. 10:03:37

19 So that's describing a high bandwidth 10:03:39
20 fiberoptic input into that small access node that 10:03:41
21 is remote from the cable office, and then on the 10:03:46
22 other side of that small access node out comes a 10:03:52
23 twisted pair line? 10:03:57

24 A. I think that's a fair characterization, 10:03:58
25 yes. 10:04:01

1 Q. And you had said "kilometers" a little 10:04:04
2 bit ago. What's the basis for that conclusion? 10:04:07

3 A. I'm just thinking of remote locations 10:04:12
4 that are actually serviced by DSL needing, you 10:04:15
5 know, approximately -- we used to say kilofeet, but 10:04:22
6 meaning probably somewhere on the order of a 10:04:28
7 kilometer of distance to get from the access point. 10:04:31

8 Q. I've never heard the phrase "kilofeet" 10:04:38
9 before. Who is the "we" that used to say kilofeet? 10:04:42

10 A. Old people. 10:04:48

11 MR. RIFFE: We've been going about an 10:04:50
12 hour. Are you guys okay or want to take a 10:04:51
13 break? 10:04:53

14 MR. HALVERSON: I'm good with a quick 10:04:54
15 break. Want to take five or ten minutes? 10:04:56

16 THE WITNESS: Yes. 10:04:59

17 MR. HALVERSON: Go off the record. 10:04:59

18 (Recess taken at 10:04 a.m., proceedings 10:05:02
19 resumed at 10:17 a.m.) 10:16:52

20 BY MR. HALVERSON: 10:16:52

21 Q. Welcome back, Dr. Acton. You're 10:17:17
22 currently in which textbook? ADSL/VDSL? 10:17:20

23 A. Yes, sir. 10:17:24

24 Q. So are you familiar with that textbook 10:17:25
25 outside of your work on this case? 10:17:27

1	MR. RIFFE: Objection. Form.	10:17:31
2	THE WITNESS: If so, vaguely familiar.	10:17:41
3	BY MR. HALVERSON:	10:17:43
4	Q. You don't teach that textbook in class?	10:17:43
5	A. I do not.	10:17:46
6	Q. How about the other one?	10:17:47
7	A. Same.	10:17:48
8	Q. And so that's, forgive me, Exhibits 1006	10:17:49
9	and 1008?	10:17:55
10	A. That is correct.	10:18:00
11	Q. Did you identify those to the lawyers or	10:18:03
12	did the lawyers identify those to you?	10:18:08
13	A. I can't recall. We had a number of	10:18:12
14	references, some that I identified, some that they	10:18:15
15	brought to my attention.	10:18:20
16	Q. Do you remember which ones that you	10:18:22
17	identified?	10:18:25
18	A. No.	10:18:25
19	Q. Is there anything in your declaration	10:18:25
20	that would give you any indication as to which	10:18:29
21	references you identified?	10:18:34
22	A. No.	10:18:35
23	Q. And these are excerpts of the book, is	10:18:36
24	that right, of each of those books? Sorry. Let me	10:18:39
25	ask a cleaner question.	10:18:42

1 Exhibit 1006, the one that's open in 10:18:44
2 front of you, is an excerpt of a textbook; is that 10:18:46
3 right? 10:18:49
4 A. It's excerpts, yes. 10:18:49
5 Q. Did you review the entire textbook? 10:18:52
6 A. I did. 10:18:54
7 Q. And did you choose what pages to excerpt? 10:18:55
8 A. I chose which pages to reference, and I 10:19:01
9 believe attorneys chose what chapters to produce in 10:19:07
10 your language. 10:19:10
11 Q. And then same question for Exhibit 1008, 10:19:11
12 the other book. 10:19:15
13 A. Same answer. 10:19:16
14 Q. And for Exhibit 1008, did you review the 10:19:20
15 entire book? 10:19:23
16 A. Yes. 10:19:24
17 Q. Was there anything in the pages that were 10:19:24
18 not included in those two exhibits that you would 10:19:29
19 deem to be important or pertinent to the opinions 10:19:32
20 that you're offering in your declaration? 10:19:35
21 A. No, but I think they would support my 10:19:40
22 opinions. 10:19:43
23 Q. Can you go to the front cover of the one 10:20:00
24 in front of you, Exhibit 1006. 10:20:03
25 A. I can. 10:20:06

1 Q. Do you know Dr. Dennis J. Rauschmayer? 10:20:06

2 A. I do not know him. 10:20:14

3 Q. You ever heard of him? 10:20:15

4 A. Outside of being the author of this text, 10:20:19
5 no. 10:20:22

6 Q. And then in Exhibit 1008, Dr. Walter Y. 10:20:29
7 Chen. You ever heard of Dr. Chen? 10:20:37

8 A. So outside of this textbook, no. But I 10:20:49
9 will say that we both worked at two companies and 10:20:52
10 maybe even at the same time, AT&T and Motorola, but 10:20:56
11 I did not run into him at either company. 10:21:01

12 Q. When did you work at AT&T? 10:21:04

13 A. Oh. AT&T was 1980 through 1984. I was a 10:21:07
14 computer programming intern at the AT&T long lines 10:21:16
15 in Oakton, Virginia. 10:21:21

16 Q. I apologize, perhaps intern means 10:21:24
17 something different; but were you an intern for 10:21:31
18 four years? 10:21:34

19 A. Yes. I was in high school at that point, 10:21:35
20 and so I would go there after school and work for a 10:21:38
21 couple hours. 10:21:42

22 Q. What a cool high school job. 10:21:45

23 A. Yeah. 10:21:47

24 Q. What were you programming? 10:21:48

25 A. Great question. I was programming the 10:21:51

1 Commodore 64 in the BASIC language, and then also 10:21:56
2 in the 6502 assembly language, which is the native 10:22:00
3 processor for the Commodore 64. I was programming 10:22:06
4 a typing test for the typing pool so that that 10:22:09
5 process could be automated. 10:22:14

6 Q. And so did that have anything to do with 10:22:22
7 the long lines that AT&T was supporting in the 10:22:29
8 '80s? 10:22:32

9 A. Only to the extent that your typing rate 10:22:35
10 was a big statistic in being hired as a secretary 10:22:39
11 at that point. 10:22:44

12 Q. So it was -- you were -- sorry. Let me 10:22:44
13 start over. 10:22:49

14 You were providing a typing test that was 10:22:50
15 used to hire administrative assistants into AT&T? 10:22:52

16 A. Correct. 10:22:58

17 Q. You were not providing source code that 10:22:58
18 was used to control how data was transmitted over 10:23:02
19 AT&T's long lines? 10:23:05

20 A. That's correct. 10:23:08

21 Q. Do you know, were those typing tests 10:23:09
22 remote tests or were they administered in person? 10:23:11

23 A. They were administered in person and at 10:23:19
24 various locations on the East Coast. 10:23:22

25 Q. But as part of your high school 10:23:26

1 internship, you don't think you had any reason to 10:23:29
2 have bumped into Dr. Walter Chen? 10:23:33

3 A. No. And I suppose he would probably be 10:23:36
4 at the Basking Ridge, New Jersey, location. 10:23:39

5 Q. Actually for completeness, do you have 10:23:57
6 Amit, the patent? Yeah. 10:24:00

7 A. I do. 10:24:04

8 Q. Do you know who Mati Amit, M-A-T-I, 10:24:07
9 A-M-I-T is? 10:24:18

10 A. Yes. 10:24:19

11 Q. Who? 10:24:20

12 A. He's the inventor of the '734 Patent. 10:24:21

13 Q. You ever met him? 10:24:25

14 A. No. 10:24:26

15 Q. So when you say you know him, you know 10:24:26
16 him in the sense of what his relationship is to 10:24:28
17 this case? 10:24:31

18 A. Correct. 10:24:32

19 Q. How about in the '249 Patent, the patent 10:24:32
20 that's at issue in this case, are you familiar 10:24:38
21 with -- excuse me. 10:24:41

22 Are you personally familiar with any of 10:24:41
23 the individuals who are listed as inventors on that 10:24:44
24 patent? 10:24:47

25 A. I am not. 10:24:47

1 Q. How about the company that they work for, 10:24:54
2 Entropic Communications -- pardon me. 10:24:58

3 What about the company that they worked 10:25:00
4 for, Entropic Communications, Inc.? 10:25:02

5 A. I'm not familiar and I don't know if it's 10:25:08
6 practicing at this point. 10:25:09

7 Q. And then the last reference for this 10:25:13
8 portion, the cover of Jacobsen lists two authors. 10:25:17
9 Apologies. If you flip in a couple of pages, you 10:25:25
10 get the cover page of the article listing two 10:25:29
11 authors, Krista Jacobsen and somebody Cioffi. 10:25:31

12 Do you know either one of those 10:25:42
13 individuals? 10:25:44

14 A. I know of Professor John Cioffi, he's 10:25:45
15 still at Stanford University I believe in the 10:25:48
16 electrical and computer engineering department. 10:25:51

17 Q. And the other author, do you know her? 10:25:58

18 A. Krista Jacobsen, I don't know. She's, I 10:26:00
19 believe, a patent attorney on the West Coast. 10:26:03

20 Q. Have you ever worked with Dr. Cioffi? 10:26:08

21 A. I have not. 10:26:14

22 Q. How did you become aware that Dr. Cioffi 10:26:15
23 is a professor? 10:26:20

24 A. Just through communications and signal 10:26:21
25 processing work. We have a conference called 10:26:24

1 ICASSP, I-C-A-S-S-P, it stands for International 10:26:27
2 Conference on Acoustics, Speech, and Signal 10:26:33
3 Processing. And so I've heard of him through those 10:26:38
4 circles. I believe I have not met him in person. 10:26:40
5 Q. Do you recall whether or not you 10:26:57
6 identified either of the Jacobsen reference or the 10:26:58
7 Amit reference in the first instance in this 10:27:02
8 proceeding? 10:27:04
9 A. I can't recall. 10:27:09
10 Q. Are you familiar with an acronym TDD? 10:27:10
11 A. Yes. 10:27:25
12 Q. What is TDD? 10:27:25
13 A. I know this one, but for the future I may 10:27:29
14 fail at the acronym guessing game. TDD is time 10:27:33
15 division duplex. 10:27:38
16 Q. And what is time division duplex? 10:27:40
17 A. Well, the way I explain it to my class is 10:27:42
18 the following. Let's say I'm speaking with you. I 10:27:45
19 get to speak for the first time slot, you get to 10:27:49
20 speak for the second time slot. And we both 10:27:53
21 communicate at the same frequency over the same 10:27:57
22 frequency band, but we share time. Sort of like 10:28:01
23 the way we're doing in the deposition where we 10:28:05
24 don't speak over one another. But it's timed and 10:28:07
25 synchronized. 10:28:11

1 Q. And so for a TDD system, it's important 10:28:12
2 that you and I both have an understanding of who is 10:28:17
3 talking when, right? 10:28:19

4 A. Correct. 10:28:21

5 Q. And so we did that in our deposition at 10:28:23
6 the very beginning by saying, I'm going to do my 10:28:25
7 best to wait for you to finish your answers before 10:28:28
8 I dive into my next question. 10:28:31

9 A. Perfect. 10:28:33

10 Q. Are you familiar with the acronym TDM? 10:28:40

11 A. Yes. 10:28:45

12 Q. What is TDM? 10:28:45

13 A. Time division multiplexing. 10:28:49

14 Q. And what is time division multiplexing? 10:28:54

15 A. So what if there were five people at the 10:29:00
16 table, as there are now, and we wanted to have five 10:29:02
17 users. We could divide up time five ways, maybe 10:29:07
18 equally, and use the same frequency band to 10:29:11
19 communicate. 10:29:17

20 Q. And so is TDD an example of TDM? 10:29:17

21 A. I think it's fair to say that it's the 10:29:26
22 simplest example, yes. 10:29:29

23 Q. Do people in the industry consider TDD to 10:29:31
24 be a subset of TDM? 10:29:40

25 A. I don't see any reason why that would be 10:29:44

1 an unfair characterization, so I say yes. 10:29:49

2 Q. And you -- pardon me. A TDD system 10:29:53

3 requires there to only be two entities 10:30:17

4 communicating with each other; is that right? 10:30:21

5 A. What do you mean? 10:30:23

6 Q. So you and I and Kim, can we divide up -- 10:30:24

7 can we communicate using TDD? 10:30:32

8 A. That wouldn't be a good solution, no. 10:30:37

9 Q. Why? 10:30:38

10 A. Because we're having the time instead of 10:30:39

11 taking the time into thirds. 10:30:46

12 Q. Now, if there were four of us, would that 10:30:49

13 change the answer? 10:30:52

14 A. It could. And maybe I'm thinking too 10:30:54

15 much into your question. But we could have a 10:31:01

16 system where I get every other first time slot 10:31:03

17 instead of every first time slot. Sure. 10:31:07

18 Q. And I guess what I'm ultimately getting 10:31:10

19 at is, is there a cap on the number of signal 10:31:14

20 sources in a TDD system? 10:31:21

21 A. Not necessarily, no, because you could 10:31:29

22 also use different frequencies, right? 10:31:36

23 Q. So I guess what is the difference between 10:31:50

24 TDD and TDM? 10:31:53

25 A. TDM would be a more generalized form, and 10:31:56

1 is, in fact, used in cell phone technology of the 10:32:01
2 '90s. The French used it. 10:32:05

3 Q. Are you familiar with the -- continuing 10:32:13
4 down the fun-filled acronym route -- DMT? 10:32:16

5 A. I am. And I guess I'm going against my 10:32:21
6 word in answering all these acronym questions. 10:32:23
7 It's discrete multitone. 10:32:26

8 Q. What is DMT -- sorry. What is discrete 10:32:28
9 multitone? 10:32:31

10 A. Discrete multitone is basically a 10:32:33
11 multichannel method of communications where you 10:32:40
12 have N channels, N as in Nevada. And you basically 10:32:44
13 transmit on each channel individually and use the 10:32:53
14 Fourier transform, F-O-U-R-I-E-R, to essentially go 10:33:01
15 between the frequency domain and the time domain. 10:33:06

16 Maybe I'm answering too much, so I'll let 10:33:10
17 you probe further into that. 10:33:12

18 Q. When you say "between the frequency 10:33:13
19 domain and the time domain," what does the time 10:33:16
20 domain have to do with DMT? 10:33:19

21 A. So we communicate as humans in the time 10:33:25
22 domain. So the input signal and the receive signal 10:33:28
23 have to at some point become transformed into the 10:33:33
24 time domain because that's the usable domain. 10:33:37

25 The Fourier domain or the frequency 10:33:42

1 domain is the domain in which we can separate a 10:33:46
2 signal into multiple channels and to manipulate 10:33:49
3 those channels separately. 10:33:52

4 Q. So you were talking about time slots in 10:33:55
5 TDD and TDM where there would need to be some sort 10:34:00
6 of synchronization across the -- is "node" a fair 10:34:03
7 word to use as far as the source and receipt, or is 10:34:09
8 there a better word that you'd like to use? 10:34:12

9 A. That's fine. 10:34:13

10 Q. So you were talking about time slots 10:34:14
11 across -- when we were talking about TDD and TDM so 10:34:19
12 that the different nodes had an understanding of 10:34:23
13 when it was their turn to communicate. 10:34:25

14 Do you recall that? 10:34:28

15 A. Yes. 10:34:28

16 Q. Is there a corresponding time slot 10:34:29
17 allotment in a DMT system? 10:34:31

18 A. Not necessarily. But I will say the 10:34:41
19 modems of the '90s, the modulator/demodulator 10:34:45
20 hardware of the '90s showed that you could combine 10:34:49
21 the kitchen sink and modulation schemes. 10:34:52

22 So there's no reason why you couldn't 10:34:55
23 combine modulation schemes, but not necessarily for 10:34:58
24 DMT itself. 10:35:04

25 Q. And the last part of that answer when you 10:35:11

1 said "not necessarily for DMT itself," that was 10:35:13
2 the -- are you saying that you couldn't combine 10:35:17
3 modulation schemes in DMT or were you saying that 10:35:21
4 there isn't a corresponding time slot allotment in 10:35:25
5 DMT? 10:35:30

6 A. There isn't a time slot or a beacon, we 10:35:30
7 haven't gotten into that yet, but no. 10:35:34

8 Q. A couple more acronyms. 10:35:50

9 A. Okay. 10:35:51

10 Q. Are you familiar with FDM? 10:35:51

11 A. Yes. 10:35:54

12 Q. What is FDM? 10:35:54

13 A. It's frequency domain multiplexing. 10:35:57

14 Q. And how does that -- well, what is 10:36:02
15 frequency domain multiplexing? 10:36:10

16 A. So FDM, basically instead of dividing up 10:36:14
17 time and sharing time, like you and I were talking 10:36:20
18 about earlier, we're basically dividing up the 10:36:23
19 spectrum and sharing the spectrum. 10:36:27

20 And so there would be multiple slots in 10:36:30
21 which one could communicate and use the available 10:36:35
22 bandwidth. 10:36:40

23 Q. So is it fair to say that in FDM there is 10:36:43
24 not time division or -- what did we call it before? 10:36:46
25 Let me ask the same question using the same words. 10:36:51

1 and OFDM, pretty much the same thing in the field. 10:38:24

2 So if you've got DMT, you have OFDM. If you have 10:38:29

3 OFDM, you have DMT. 10:38:37

4 Maybe one distinction is DMT 10:38:39

5 traditionally uses bit loading. But we can talk 10:38:42

6 about that later if you want. 10:38:45

7 Q. So in your description of what OFDM is, 10:38:47

8 the concept of the orthogonality didn't come up. 10:38:53

9 What does the 0 -- how does the 0 impact OFDM? 10:38:57

10 A. Great question. So the best analogy is 10:39:01

11 an X and a Y vector. If you think about an X and a 10:39:07

12 Y vector, they tell you in high school that if you 10:39:11

13 multiply those two together, you get nothing 10:39:15

14 because they're orthogonal, they're at 90 degrees. 10:39:18

15 The same thing is going to be true of 10:39:22

16 these frequency bands. They don't overlap. And 10:39:24

17 they're orthogonal in the sense that they're 10:39:28

18 completely independent and don't share frequencies. 10:39:32

19 Q. And you said DMT traditionally uses bit 10:39:51

20 loading and then when you were distinguishing OFDM 10:39:56

21 and DMT. 10:40:00

22 So does OFDM not use bit loading? 10:40:01

23 A. It certainly can. 10:40:04

24 Q. So why is that a distinction between OFDM 10:40:06

25 and DMT? 10:40:09

1 A. It's really not. 10:40:11

2 Q. Are there any distinctions between OFDM 10:40:13
3 and DMT? 10:40:15

4 A. Over the years, I think they have sort of 10:40:19
5 blended together. 10:40:22

6 Q. When you say "over the years," what time 10:40:25
7 frame are you referring to? 10:40:29

8 A. Good question. So these were known in 10:40:30
9 the '90s. And probably by 2000 or so, people would 10:40:34
10 refer to them interchangeably. I don't know if it 10:40:42
11 was one company, say AT&T, that was promoting one 10:40:45
12 acronym, and another company was promoting a 10:40:48
13 different acronym. Sometimes that's how things go. 10:40:51
14 Like VHS and Beta. 10:40:55

15 Q. So as of 2000, it's your opinion that 10:40:57
16 OFDM and DMT were the same thing? 10:41:01

17 A. They're basically the same thing, yes. 10:41:04

18 Q. And so you hedged with a qualifier, 10:41:09
19 "basically." What are you -- why that? 10:41:12

20 A. I guess I would think of them as the same 10:41:17
21 thing. But if you're asking me did I have in my 10:41:21
22 report, which we're calling a declaration, an 10:41:25
23 analysis of the historical differences between DMT 10:41:28
24 and OFDM, I haven't performed that analysis. 10:41:33

25 Q. Got one more acronym for you. This one 10:41:56

1 might need some context. Are you familiar with the 10:42:00
2 acronym ADC? And I am looking for the application 10:42:02
3 delivery controller, not analog to digital 10:42:09
4 converter. 10:42:13

5 Have you heard of application delivery 10:42:15
6 controllers? 10:42:17

7 A. Application delivery controllers. Can 10:42:19
8 you point me to something in the references or in 10:42:23
9 my declaration? 10:42:25

10 Q. I'm not sure that it's in there. 10:42:27

11 A. I am familiar with analog to digital 10:42:29
12 conversion, so I can help you with that. 10:42:43

13 Q. Not the ADC that I am interested in. 10:42:46

14 Do you have the '249 Patent in front of 10:43:04
15 you? 10:43:09

16 A. Yes. 10:43:09

17 Q. Can you go back to the claims, please. 10:43:10
18 Specifically claim 1. 10:43:12

19 Does claim 1 require multicarrier 10:43:32
20 frequencies? 10:43:37

21 MR. RIFFE: Objection. Calls for a legal 10:43:38
22 conclusion. 10:43:45

23 THE WITNESS: So there's one claim 10:43:59
24 element that mentions at least one of the 10:45:32
25 terminal devices providing frequency bins with 10:45:36

1 more transmit bits which occupy parts of the 10:45:41
2 channel where the signal-to-noise ratio is high. 10:45:45

3 So I guess my answer would be it's not 10:46:04
4 totally explicit, but it seems to hint at 10:46:06
5 multicarrier. 10:46:12

6 BY MR. HALVERSON: 10:46:13

7 Q. And what about that do you think hints at 10:46:14
8 multicarrier? 10:46:17

9 A. Frequency bins. 10:46:19

10 Q. The fact that it's plural or the fact 10:46:20
11 that it describes one or more frequency bin? 10:46:24

12 A. What's the -- 10:46:29

13 MR. RIFFE: Object to form. 10:46:31

14 BY MR. HALVERSON: 10:46:33

15 Q. So frequency bins, plural, suggests that 10:46:33
16 there must be two or more. The existence of a 10:46:40
17 frequency bin is at least one frequency bin. 10:46:51

18 And so what is it about providing 10:46:55
19 frequency bins that you think hints at 10:46:57
20 multicarrier? 10:47:01

21 And if you want me to clarify further, I 10:47:05
22 have one more thing I could clarify with. 10:47:08

23 A. So earlier in the morning we mentioned 10:47:10
24 bit loading. And so it seems to hint at bit 10:47:17
25 loading. And the idea, and I teach this in class, 10:47:20

1 if you have a channel that has signal to noise 10:47:28
2 ratio, that's good, you want to load more bits in 10:47:31
3 there; if you have a low signal-to-noise ratio, you 10:47:35
4 can transmit fewer bits, a more simple 10:47:40
5 constellation. I don't know if we'll get into that 10:47:44
6 today. 10:47:47

7 But you can also even transmit no bits 10:47:48
8 over a certain channel, which would be congruent 10:47:52
9 with frequency bins. 10:47:57

10 Q. And so does the ability to transmit a 10:47:59
11 constellation that includes more than one bit 10:48:05
12 necessarily mean that there are multiple carrier 10:48:08
13 frequencies? 10:48:13

14 A. No. 10:48:18

15 Q. So you can transmit a constellation 10:48:20
16 having a plurality of bits on a single carrier? 10:48:23

17 A. Yes. And Amit and Jacobsen discuss such. 10:48:30

18 Q. And so is it the -- take one step further 10:48:34
19 back. What's a frequency bin? 10:48:46

20 MR. RIFFE: Objection. Legal conclusion. 10:48:48

21 THE WITNESS: So I'm not providing any 10:48:54
22 construction and I don't know if there's any 10:49:07
23 arguments or not. And I used plain and ordinary 10:48:59
24 meaning. And the plain and ordinary meaning to 10:49:05
25 me is basically a slot of frequencies. 10:49:11

1 BY MR. HALVERSON: 10:49:15

2 Q. And does that slot include more than one 10:49:15

3 frequency? 10:49:19

4 A. Yes. 10:49:22

5 Q. Go back to the cover of '249. See 10:49:30

6 Broadband in the title, the top left corner? 10:49:38

7 A. I do. 10:49:44

8 Q. What's broadband? 10:49:44

9 MR. RIFFE: Objection. Legal conclusion. 10:49:48

10 THE WITNESS: Well, it's a company -- 10:49:52

11 that's broad com. Excuse me. 10:49:56

12 Broadband refers to, you know, the 10:50:00

13 contrast with narrow band. 10:50:03

14 BY MR. HALVERSON: 10:50:05

15 Q. All right. What's narrow band? 10:50:05

16 A. Narrow band would be using a narrow band 10:50:07

17 of frequencies. So it's a somewhat relative term. 10:50:12

18 Q. So in the industry, is there a general 10:50:20

19 understanding of the width of the band of 10:50:21

20 frequencies that are used in a narrow band 10:50:24

21 communication network? 10:50:27

22 A. I think any such definition could be 10:50:28

23 counter-exemplified in the sense that different 10:50:33

24 applications it would be different. 10:50:35

25 Q. So in the industry, is there a general 10:50:37

1 understanding of the width of the band of 10:50:40
2 frequencies that are used in a broadband 10:50:42
3 communication network? 10:50:44

4 A. Same answer. If one were to specify 10:50:45
5 such, you'd probably find an application where that 10:50:51
6 wasn't the case. 10:50:55

7 Q. So it's your opinion that depending on 10:50:56
8 who you talk to, something that is a broadband 10:50:59
9 network in the eyes of one person would be a narrow 10:51:04
10 band network in the eyes of somebody else? 10:51:08

11 MR. RIFFE: Objection. Mischaracterizes 10:51:12
12 testimony. 10:51:13

13 THE WITNESS: It's possible. It's sort 10:51:17
14 of like the word "advanced." What's advanced to 10:51:19
15 one person could be basic to the other. And it 10:51:23
16 might be a nice way of selling a product. 10:51:26

17 BY MR. HALVERSON: 10:51:28

18 Q. In the coax context, does broadband have 10:51:29
19 a general understanding in the industry? 10:51:32

20 MR. RIFFE: Objection. Speculation. 10:51:35

21 THE WITNESS: I don't know if it has a 10:51:50
22 specific definition, no. 10:51:51

23 BY MR. HALVERSON: 10:51:56

24 Q. How about in the twisted pair context? 10:52:07

25 MR. RIFFE: Objection. Speculation. 10:52:10

1 Form. 10:52:11

2 THE WITNESS: It would be the same. It's 10:52:18

3 sort of like words like dark and light. 10:52:19

4 BY MR. HALVERSON: 10:52:24

5 Q. And for those two questions about 10:52:24

6 broadband in the context of coax and twisted pair, 10:52:27

7 your answers apply to both approximately 2000 when 10:52:31

8 you started at UVA as well as today? 10:52:33

9 A. Yes. 10:52:36

10 Q. Go to paragraph 102 of your declaration, 10:52:40

11 it's page 57 at the bottom. Let me know when 10:53:07

12 you're there. 10:53:18

13 A. Paragraph 102? 10:53:18

14 Q. 102, yeah. 10:53:21

15 A. Okay. 10:53:40

16 Q. So the second sentence there says: Both 10:53:41

17 references are analogous art because they are in 10:53:43

18 the same field of endeavor as the '249 Patent, 10:53:46

19 i.e., broadband networks. 10:53:51

20 Do you see that? 10:53:51

21 A. I do. 10:53:52

22 Q. What do you mean there? 10:53:53

23 A. Not narrow band networks. 10:53:57

24 Q. All right. What are you excluding? 10:54:01

25 MR. RIFFE: Objection. Foundation. 10:54:06

1 THE WITNESS: A narrow band network. 10:54:12

2 BY MR. HALVERSON: 10:54:13

3 Q. And in your mind, how do you define what 10:54:13
4 a narrow band network is? 10:54:16

5 A. It's narrower than broadband. 10:54:18

6 Q. So if presented with a network, how do 10:54:22
7 you tell whether or not it falls within the same 10:54:29
8 field of endeavor as the '249 Patent? 10:54:32

9 MR. RIFFE: Objection. Foundation. 10:54:48
10 Incomplete hypothetical. 10:54:51

11 THE WITNESS: I think what I've done and 10:55:06
12 what one would do, is to look for similar 10:55:10
13 problems. You know, what's motivating the work? 10:55:12
14 Are there ideas in one that are fully explained 10:55:18
15 in the other? Are there problems in one that 10:55:23
16 could be solved with existing methods of the day 10:55:27
17 and communications? 10:55:30

18 That's a good place to start. 10:55:32

19 BY MR. HALVERSON: 10:55:52

20 Q. Is there anything else you would do to 10:55:52
21 figure out whether or not something fell in the 10:55:55
22 same field of endeavor as the '249 Patent? 10:55:59

23 A. I mean, you would certainly look at the 10:56:04
24 references. 10:56:15

25 When one looks at, for example, the '249 10:56:15

1 Patent, you see the ADSL/VDSL textbook reference, 10:56:18
2 you see the DSL textbook reference. 10:56:24

3 Basically a patent can't have all the 10:56:28
4 details in the world. 10:56:30

5 And what the inventor of '249 is saying, 10:56:31
6 hey, if you need more explanation on some of these 10:56:37
7 modulation schemes that are brought forth by DSL, 10:56:39
8 look at these two textbooks. So that's one way. 10:56:43

9 Can I keep going? 10:57:02

10 Q. Sure. 10:57:22

11 A. So you look for mentions of similar 10:57:24
12 technology. 10:57:28

13 For example, Amit mentions both cable 10:57:30
14 modems and DSL modems, DSL modems in his patent. 10:57:35

15 And if one wanted to know more about DSL 10:57:42
16 modulation, why not look at the DSL-Book. That 10:57:45
17 makes sense. Or more advanced versions, 10:57:51
18 ADSL/VDSL-Book. So looking for the particulars, 10:57:57
19 looking at the problems, looking at the area. 10:57:59

20 And I might mention when I teach these 10:58:03
21 modulation schemes, for example, QAM, I call it 10:58:07
22 QAM, I don't teach it with regard to a certain 10:58:14
23 physical layer manifestation, I just teach QAM. 10:58:18

24 And can you use that in cable modem? 10:58:22

25 Sure. 10:58:25

1 Can you use it in twisted pair? Sure. 10:58:26

2 But those details aren't really relevant 10:58:28
3 to teaching the modulation. 10:58:30

4 Q. And you used cable modem there. When you 10:58:32
5 used cable modem there, were you implying a coaxial 10:58:36
6 cable modem? 10:58:41

7 A. Yes. Thank you. 10:58:42

8 Q. So when you teach QAM, the physical layer 10:58:42
9 manifestation doesn't matter. Whether or not it's 10:58:50
10 over twisted pair or coax doesn't impact how you 10:58:54
11 teach QAM; is that right? 10:58:58

12 A. That is totally correct. 10:59:03

13 And I might say that that is a tie, QAM 10:59:05
14 that binds between Amit and VDSL/ADSL, and Amit and 10:59:10
15 DSL, and Amit and Jacobsen, is the common ground of 10:59:17
16 that QAM, which I guess can be pronounced QAM or 10:59:24
17 QAM. 10:59:29

18 Q. Are you familiar with 802.11? 10:59:31

19 A. I am. 10:59:36

20 Q. What is 802.11? 10:59:37

21 A. It is a wireless standard of the IEEE, 10:59:38
22 the Institute of Electrical and Electronics 10:59:43
23 Engineers. 10:59:47

24 Q. We refer to that as Wi-Fi? 10:59:47

25 A. Right. And as you know, there's a bunch 10:59:50

1 of letters after that, so a bunch of different 10:59:52
2 manifestations. 10:59:54

3 Q. And those letters correspond to different 10:59:55
4 versions of that standard? 10:59:58

5 A. Correct. 11:00:00

6 Q. They have progressed over time dating 11:00:00
7 back to the '80s? 11:00:02

8 A. I guess I first learned about it in the 11:00:06
9 early '90s. 11:00:11

10 Q. In school or at work? 11:00:16

11 A. Probably at the University of Texas. 11:00:18

12 Q. Does Wi-Fi use QAM? 11:00:23

13 A. Yes. 11:00:28

14 Q. What other kind of networks use QAM? 11:00:29

15 A. Point-to-point networks. You might want 11:00:34
16 to communicate a military message point to point 11:00:40
17 rather than broadcasting it to the world. 11:00:45

18 We see it here in the references that I 11:00:50
19 brought to the table. We see it in cable TV. We 11:00:55
20 see it in DSL, which basically is an internet 11:01:00
21 service to remote areas of the world. It's fading 11:01:04
22 fast and becoming not relevant or irrelevant. 11:01:07
23 Those are a few. 11:01:12

24 Q. Can you flip to Amit. 11:01:14

25 A. I can. 11:01:27

1 Q. I want to ask you a couple of questions 11:01:27
2 about Amit's discussion on dual frequency mode. Do 11:01:30
3 you recall that portion of Amit? 11:01:35

4 A. No. 11:01:39

5 Q. We'll get there. So is it fair to say 11:01:40
6 that Amit is a coax cable-based medium reference? 11:01:50

7 MR. RIFFE: Objection. Legal conclusion. 11:01:58

8 THE WITNESS: Well, one thing I'd just 11:02:04
9 mentioned earlier in our discussion is that 11:02:08
10 Amit -- Amit admits that there are a variety of 11:02:14
11 devices in the home, some of which could be DSL, 11:02:18
12 which I think you would consider twisted pair, 11:02:22
13 and some of which could be CATV or cable TV, so 11:02:25
14 there's a mixture. 11:02:30

15 And by the way, CATV is one of those 11:02:32
16 acronyms. We call it cable television but it 11:02:36
17 really started as community access television. 11:02:39

18 So in any case, Amit admits that there 11:02:42
19 are several technologies inside the home. 11:02:48

20 BY MR. HALVERSON: 11:02:50

21 Q. And so if you look in the background of 11:02:51
22 Amit in column 1, starting at about line 30. And I 11:02:53
23 apologize, when I say columns and lines, you 11:03:03
24 understand what I'm talking about in a patent, 11:03:05
25 right? 11:03:08

1 A. Yes. 11:03:08

2 Q. So if you look at Amit in Column 1 at 11:03:09
3 about line 30, down through the rest of the 11:03:11
4 background, so through 230, so approximately the 11:03:19
5 entirety of the background, Amit describes a number 11:03:24
6 of home networking solutions that existed. Is that 11:03:27
7 fair? 11:03:32

8 A. Completely fair. 11:03:34

9 Q. Then if you go to the summary of the 11:03:34
10 invention, it's talking about cable infrastructure. 11:03:37
11 Is that fair? So we're looking at column 2, 11:03:43
12 line 35. 11:03:47

13 A. That's fair, as well. 11:04:00

14 Q. So is there anywhere in the summary of 11:04:02
15 the invention or the detailed description of the 11:04:13
16 invention of Amit that refer to a physical medium 11:04:16
17 other than coaxial cable? 11:04:25

18 MR. RIFFE: Objection. Legal conclusion. 11:04:51

19 THE WITNESS: Yes. 11:05:05

20 BY MR. HALVERSON: 11:05:05

21 Q. And what are you looking at? 11:05:06

22 A. One example I just started reading is 11:05:07
23 line 51 of column 2 refers to propagation by air, 11:05:11
24 television antenna. 11:05:20

25 Q. And is that describing how Amit 11:05:30

1 propagates its signals throughout the system of 11:05:34
2 Amit or how the signals arrive at the home that is 11:05:38
3 described in Amit? 11:05:41

4 A. The latter. 11:05:43

5 Q. So maybe we can short circuit this a 11:05:47
6 little bit. If you go back to the Figure 2 of Amit 11:05:50
7 depicts a network; is that fair? 11:06:01

8 A. Fair. 11:06:07

9 Q. So there's an input into the network at 11:06:07
10 201 -- or -- yeah, pardon me. Let me start over. 11:06:11

11 There is an input into the network at 201 11:06:15
12 and it comes from the regional cable TV or, I 11:06:19
13 forgot what you had called it, cable access 11:06:26
14 television? 11:06:29

15 A. Community access. 11:06:29

16 Q. Community access television. 11:06:31

17 And that's a signal that comes in from 11:06:34
18 somewhere else; is that right? 11:06:36

19 A. True. 11:06:37

20 Q. And then there are a number of devices 11:06:38
21 connected to a splitter, and those appear in the 11:06:43
22 middle of Figure 2, VCR, TV set, all the way down 11:06:46
23 that column, right? 11:06:50

24 A. Exactly. 11:06:52

25 Q. And so those devices are connected to the 11:06:54

1 RF splitter via, in this example of Amit, coaxial 11:06:57
2 cables, right? 11:07:07
3 MR. RIFFE: Objection. Foundation. 11:07:10
4 THE WITNESS: Correct. But as long as 11:07:13
5 you're in Figure 2, you can see there's a 11:07:15
6 twisted pair connection to the phone 215, which 11:07:18
7 I think you would agree is not a coaxial cable. 11:07:21
8 BY MR. HALVERSON: 11:07:24
9 Q. And if you go just one box lower than 11:07:25
10 that, you see a wireless link between the wireless 11:07:29
11 phone and the notebook/PC in the right-hand column, 11:07:33
12 and the wireless access point labeled as Bluetooth 11:07:37
13 207 in the middle column, right? 11:07:41
14 A. I think we make a good team. Yes. 11:07:43
15 Q. So there are things to the right of the 11:07:45
16 network devices 204, 205, 206, 207, and 212. You'd 11:07:50
17 agree with that, right? 11:07:57
18 A. I guess I need you to repeat that 11:08:00
19 question. 11:08:01
20 Q. There are things, devices, to the right 11:08:02
21 of the network devices 204, 205, 206, 207, and 212. 11:08:05
22 You would agree with that, right? 11:08:12
23 A. Yeah, there's some terminals. 11:08:14
24 Q. And when you are characterizing Amit in 11:08:17
25 your declaration as far as terminals, are you 11:08:28

1 referring to 204, 205, 206, and 207, that column? 11:08:30

2 I did not intentionally leave off 212, so also 212. 11:08:36

3 Or are you referring to 211, 208, 215, 209, that 11:08:40

4 right-hand column? 11:08:46

5 A. Generally, in my -- if I recall 11:08:48

6 correctly, my claim-by-claim, 11:08:52

7 limitation-by-limitation analysis I am referring to 11:08:55

8 204, 205, 206, 207, and 212 as coupled to the 11:08:59

9 splitter. 11:09:04

10 Q. And so the network of Amit that you're 11:09:06

11 analyzing is to the -- is inclusive of the middle 11:09:10

12 column, 204, 5, 6, 7, and 12. And the splitter and 11:09:15

13 filter to the left of that column, but not the 11:09:23

14 stuff to the right? 11:09:26

15 A. I guess I'm not understanding why you 11:09:28

16 want to exclude the stuff to the right. 11:09:31

17 Q. So you had said that Amit is not 11:09:33

18 necessarily a coax network. And I'm trying to 11:09:37

19 figure out where that came from. 11:09:40

20 A. I think -- I know you're not trying to 11:09:47

21 mischaracterize me, but I think what I would say is 11:09:50

22 that Amit admits the universe contains more than 11:09:54

23 coax. And, in fact, in the network shown in 11:09:57

24 Figure 2, you see twisted pair, and as you pointed 11:09:59

25 out, you see wireless. 11:10:02

1 Q. If you know, can you transmit phone 11:10:09
2 signals over coax? 11:10:12

3 A. You can. 11:10:14

4 Q. So would you agree that Amit describes 11:10:17
5 two different embodiments, a connected home 11:10:39
6 embodiment and a -- I think you used the phrase 11:10:43
7 single home -- bear with me one second, yes, 11:10:46
8 connected home and a single home embodiment? 11:10:53

9 A. So within Amit, do you want to point me 11:10:57
10 to -- 11:11:01

11 Q. Column 8. Approximately line 24. It's 11:11:01
12 the little table there. 11:11:08

13 And then I'll direct you back to 11:11:22
14 column 7, line 12 through 15. And then further 11:11:25
15 down in column 7, at approximately line 24, and 11:11:41
16 then the subsequent couple of indented paragraphs. 11:11:45

17 MR. RIFFE: Objection. Compound. 11:11:51

18 BY MR. HALVERSON: 11:11:59

19 Q. And so once you've skimmed those, let me 11:11:59
20 know. 11:12:03

21 A. I've skimmed. 11:12:53

22 Q. So would you agree that Amit describes 11:12:55
23 two incompatible embodiments? 11:13:01

24 A. No. 11:13:05

25 Q. Why? 11:13:07

1 THE WITNESS: So I would go back to the 11:14:56
2 line 24 where it says the HomeCN supports two 11:14:57
3 operation modes. So it supports both operation 11:15:02
4 modes. 11:15:05

5 So can it be both? It seems like yes. 11:15:06

6 BY MR. HALVERSON: 11:15:18

7 Q. All right. So can you go to column 20 11:15:19
8 for me. 11:15:20

9 A. Okay. 11:15:27

10 Q. And feel free to look wherever you want, 11:15:29
11 but there is a sentence at column 20, line 15, that 11:15:34
12 begins, "The two frequency mode." 11:15:36

13 Do you see that? 11:15:41

14 A. I do. 11:15:42

15 Q. And then the two paragraphs later refers 11:15:42
16 to a dual frequencies mode. 11:15:45

17 Do you see that? 11:15:49

18 A. I do. 11:15:49

19 Q. Is it your opinion that those are two 11:15:50
20 ways of referring to the same concept? 11:15:58

21 MR. RIFFE: Objection. Legal conclusion. 11:16:10

22 THE WITNESS: It looks like it's sort of 11:16:35
23 a coarse version of the frequency domain 11:16:41
24 multiplexing that we talked about earlier. 11:16:44
25

1 BY MR. HALVERSON: 11:16:46

2 Q. What do you mean by that? 11:16:46

3 A. So Amit says in column 20 that in this 11:16:48

4 two frequency mode, transmission occurs in a 11:16:53

5 certain band, 900 to 906 megahertz, and reception 11:17:00

6 occurs in a different band, 910 to 916 megahertz. 11:17:06

7 And basically that's a crude version, if 11:17:12

8 you will, of what we talked about earlier of 11:17:18

9 splitting up frequency bands and using them for 11:17:22

10 different communiques, if you will. 11:17:25

11 Q. So my understanding of what two frequency 11:17:31

12 mode in Amit is -- and perhaps you can correct me 11:17:33

13 where you think I'm going astray here -- a signal 11:17:36

14 is transmitted from a device, HCNU2, to a second 11:17:40

15 device, HCNU3; and the signal that leaves HCNU2 is 11:17:48

16 carried in one channel and is transferred to a 11:17:58

17 different channel before it arrives at HCNU3 by a 11:18:01

18 transponder module. 11:18:08

19 And Amit -- well, is that consistent with 11:18:11

20 your understanding of what this two frequency mode 11:18:16

21 is? And so -- I'm sorry, go ahead. 11:18:19

22 A. I guess with the addition that so when 11:18:31

23 HCNU transfers to the transfer -- to the 11:18:35

24 transponder module, there's some sort of frequency 11:18:39

25 change from the upstream frequency to the 11:18:48

1 downstream frequency. And then it can get HCNU3 -- 11:18:55

2 can be received at HCNU3 it says with no echo. 11:19:03

3 Q. And so I agree with that. 11:19:14

4 My question is, is the frequency change, 11:19:16

5 do you agree that that means that the frequency 11:19:21

6 that the signal leaves HCNU2 is not the same 11:19:25

7 frequency that is received by HCNU3? 11:19:29

8 And specifically I'm looking at, you 11:19:34

9 know, a couple lines further down. That's what I 11:19:36

10 understand line 32 to be getting at. 11:19:40

11 A. I think that's an entirely reasonable 11:19:46

12 interpretation. 11:19:48

13 Q. Do you know how that eliminates an echo? 11:19:49

14 A. Yes. 11:19:55

15 Q. How? 11:20:01

16 A. So if you're transmitting on one band and 11:20:04

17 listening on another, you don't have to worry about 11:20:09

18 echos from your transmission being -- interfering 11:20:13

19 with the signal that's received. 11:20:21

20 Q. So it's not that it eliminates the echo, 11:20:23

21 it's that the echo is not part of what the receiver 11:20:26

22 is looking for in the receive signal? 11:20:30

23 A. It's not what the receiver listens to, 11:20:33

24 correct. 11:20:36

25 Q. Is this two frequency mode or dual 11:20:36

1 frequencies mode of Amit something that exists in 11:20:43
2 Amit's single home mode, connected home mode, or is 11:20:47
3 it uncertain as far as you can tell? 11:20:54

4 A. Mr. Halverson? 11:21:42

5 Q. Yes, sir. 11:22:07

6 A. Is that right? 11:22:08

7 Q. It is. 11:22:09

8 A. I'm not finding anything on that. Do you 11:22:10
9 want to help me? 11:22:13

10 Q. I'm not sure that it is. I haven't found 11:22:14
11 it either. 11:22:16

12 A. Okay. 11:22:17

13 Q. I would tell you if I did. But as far as 11:22:17
14 I can tell, it doesn't specify. And I'm not sure 11:22:21
15 if there's some description somewhere that one 11:22:23
16 would rely on to figure that out or not. But if 11:22:26
17 you're not aware of one, then that's fine. 11:22:29

18 A. I'm not aware. 11:22:32

19 Q. Would you agree that Amit -- sorry. One 11:22:35
20 second. Ask a precursor question. 11:22:52

21 So the transponder module in this dual 11:22:59
22 frequency mode of Amit, is that a different 11:23:03
23 component or at least different portion of a 11:23:07
24 component than the notch filter of Amit? 11:23:11

25 MR. RIFFE: Objection. Foundation. 11:23:24

1 BY MR. HALVERSON: 11:24:23

2 Q. And in the interest of full disclosure, 11:24:23

3 if you look at 20, line 49. 11:24:26

4 A. Beautiful. So yeah, they're mentioned 11:24:40

5 separately where it says the transponder module can 11:24:43

6 be inserted with a notch filter and with an 11:24:47

7 amplifier. 11:24:50

8 Q. So they are different -- when I say 11:24:51

9 "components" here, I'm not trying to say that they 11:24:55

10 are different boxes, but they are different 11:24:57

11 components, could be within the same box, but they 11:25:00

12 do different things, they are -- they can be 11:25:03

13 mutually exclusive? 11:25:06

14 A. I agree with that. And Figure 20 shows 11:25:07

15 the transponder module in a box. And Figure 7 11:25:10

16 shows the notch filter in a box. 11:25:15

17 And the fact that the transponder 11:25:17

18 solution is present doesn't negate the fact that 11:25:21

19 Amit has the notch filter 707. 11:25:26

20 MR. HALVERSON: I believe we've been 11:25:32

21 going about an hour. 11:25:33

22 MR. RIFFE: Yeah. 11:25:35

23 MR. HALVERSON: Take another five-, 11:25:35

24 ten-minute break. 11:25:38

25 (Recess taken at 11:25 a.m., proceedings 11:25:39

1 resumed at 11:35 a.m.) 11:34:45

2 BY MR. HALVERSON: 11:34:45

3 Q. Welcome back, Dr. Acton. 11:35:08

4 A. Thank you. 11:35:10

5 Q. Would you agree that Amit does not talk 11:35:13

6 about the use of OFDM in its network? 11:35:40

7 MR. RIFFE: Objection. Legal conclusion. 11:35:44

8 THE WITNESS: What Amit talks about in 11:35:59

9 column 8, for example, line 30, is QAM, which 11:36:01

10 we've talked about this morning, such as the QAM 11:36:08

11 use in the OFDM scheme of ADSL/VDSL or in the 11:36:14

12 DMT scheme of Jacobsen. 11:36:25

13 What he also talks about is different 11:36:27

14 modulation methods, as we've mentioned. And 11:36:33

15 somewhere he talks about frequency domain 11:36:40

16 multiplexing. 11:36:46

17 BY MR. HALVERSON: 11:36:48

18 Q. Also column 8? 11:36:48

19 A. Also column 8. Thank you. 11:36:50

20 Q. 45. 11:36:52

21 A. 45. Thank you very much. 11:36:55

22 And does he mention OFDM explicitly? No. 11:36:58

23 Q. And there's nothing about the QAM 11:37:05

24 references in column 8 that is unique to QAM on an 11:37:10

25 OFDM network versus any other kind of network, 11:37:16

1 right? 11:37:16

2 A. QAM is QAM. I think we covered it. It's 11:37:22

3 quadrature amplitude modulation. Quadrature is 11:37:24

4 Q-U-A-D-R-A-T-U-R-E. 11:37:30

5 Q. Doing great with the acronyms today. 11:37:35

6 A. Thanks. 11:37:40

7 Q. And I believe we had gotten to the point 11:37:44

8 where it was your opinion that DMT and OFDM were 11:37:48

9 the same thing. But there's nothing in here that 11:37:52

10 talks about -- in Amit that talks about DMT either, 11:37:54

11 right? 11:37:59

12 MR. RIFFE: Objection. Legal conclusion. 11:37:59

13 THE WITNESS: I would say aside from what 11:38:04

14 we mentioned, including FDM, as you pointed out 11:38:07

15 on line 45 of column 8, which divides up 11:38:13

16 frequencies. 11:38:17

17 And the problems that Amit is looking at, 11:38:19

18 including reflection; both Amit and Jacobsen say 11:38:22

19 they're doing what they're doing because of 11:38:29

20 problems with reflection. 11:38:31

21 And if you wanted to find a specific 11:38:33

22 answer to that problem, maybe you'd look at 11:38:35

23 Jacobsen or maybe you'd look at one of the DSL 11:38:39

24 references that teach you how to do FDM. 11:38:42

25

1 BY MR. HALVERSON: 11:38:58

2 Q. And so for OFDM, you said does he mention 11:38:58

3 OFDM explicitly, and then said no. 11:39:03

4 Is there something about DMT that causes 11:39:04

5 you to give a different answer, or would you agree 11:39:09

6 that Amit does not mention explicitly DMT? 11:39:11

7 MR. RIFFE: Objection. Asked and 11:39:15

8 answered. 11:39:19

9 THE WITNESS: Amit doesn't mention DMT. 11:39:25

10 It just mentions the problem with reflection and 11:39:27

11 imperfect channels, which one might look to 11:39:30

12 Jacobsen or DSL to find a solution. 11:39:34

13 BY MR. HALVERSON: 11:39:35

14 Q. And so the FDM -- go back to column 8 in 11:39:37

15 Amit. The FDM mentioned in column 8 at line 45 is 11:39:41

16 done only in the connected home operation mode, 11:39:52

17 right? 11:39:52

18 A. That's what it says on line 47. 11:40:16

19 Q. And that's because that assignment comes 11:40:18

20 from the head end, right? And by "assignment," I 11:40:22

21 mean the assignment of the frequency for a given 11:40:25

22 home network. 11:40:29

23 MR. RIFFE: Objection. Foundation. 11:40:30

24 THE WITNESS: It's done by the management 11:40:39

25 system, which I think is reasonable to call the 11:40:41

1 head end. 11:40:45

2 BY MR. HALVERSON: 11:41:17

3 Q. We were talking a little bit earlier 11:41:18

4 about the DSL textbooks. And I forgot what you 11:41:20

5 said. But do you recall when the ADSL standard was 11:41:23

6 finalized and adopted? 11:41:27

7 I don't believe it was in that table. 11:41:31

8 But it did -- in the right-hand column of that 11:41:36

9 table that we were talking about on page 14, I 11:41:39

10 think it's 14, it did say that it was an adopted 11:41:44

11 standard or a finalized standard. 11:41:49

12 A. So one can surmise, based on the 11:41:56

13 publication date of 1999, that it was before that. 11:42:00

14 Q. Do you know when before that? 11:42:04

15 A. No. 11:42:05

16 Q. VDSL, in that same table, still an 11:42:05

17 underdevelopment thing -- that's an awful word. 11:42:11

18 Let me try it again. 11:42:16

19 VDSL, in that same table, is still an 11:42:17

20 underdeveloped communication method. 11:42:21

21 Do you know if that standard was ever 11:42:25

22 finalized and adopted? 11:42:28

23 A. And what do you mean by "adopted"? 11:42:33

24 Q. That's a fair question. 11:42:50

25 So the right-hand column of this table on 11:42:51

1 page 12 of the textbook, excuse me, is labeled 11:42:54
2 Standardization. 11:42:58
3 Do you see that? 11:42:59
4 A. Yes. 11:42:59
5 Q. What does that mean? 11:43:00
6 A. It means that a standards body has issued 11:43:01
7 a final standard. 11:43:09
8 Q. And so do you know whether a final 11:43:18
9 standard for VDSL was ever issued by a standards 11:43:21
10 body? 11:43:26
11 A. I believe it was. I can't say when. But 11:43:32
12 the methods that I'm citing in both of these 11:43:37
13 textbooks are published before the time, 11:43:41
14 regardless. 11:43:49
15 And I don't know if I'm short-circuiting 11:43:52
16 the question, but the methods are there. 11:43:53
17 Q. And I guess -- I think we might be 11:43:59
18 talking past each other. I think what you are 11:44:01
19 saying there -- and feel free to correct me if you 11:44:05
20 disagree or I mischaracterize -- but you're saying 11:44:08
21 that the things that you rely on are part of the 11:44:11
22 textbook and the textbook was published? 11:44:13
23 A. Correct. 11:44:15
24 Q. My question is different. And it's just, 11:44:16
25 do you know whether or not a standard setting body 11:44:20

1 ever issued a standard -- a textual standard 11:44:24
2 outlining how the operation of VDSL should go in 11:44:28
3 order to qualify as VDSL for interoperability 11:44:33
4 purposes? 11:44:38

5 A. I don't. 11:44:39

6 Q. And you would agree that -- well, never 11:44:40
7 mind. 11:44:40

8 What is DSL? 11:44:52

9 A. It's another one of these acronyms that I 11:44:53
10 was telling you about that have multiple meanings. 11:44:57
11 It's digital subscriber line. But originally do 11:44:59
12 you know that it was actually digital subscriber 11:45:04
13 loop? And we talked about loops earlier. I didn't 11:45:06
14 know we were going to talk about loops. So I don't 11:45:10
15 know if that's enough. 11:45:14

16 Q. It is for now. 11:45:15

17 Digital subscriber line, what is that? 11:45:19

18 A. So here's the basic idea. You're in 11:45:25
19 rural Virginia, like we are right now. And Comcast 11:45:29
20 or AT&T or Cox doesn't feel like you're worth it to 11:45:35
21 lay cable and deliver internet to your home. But 11:45:40
22 the U.S. Government, by law, says that you have to 11:45:44
23 have telephone service. 11:45:49

24 So brilliant people at Bell Labs and 11:45:50
25 other places, including overseas in Britain and in 11:45:55

1 Israel, came up with the idea of using the 11:46:01
2 telephone lines as data lines. 11:46:05

3 And as we mentioned before, you know, you 11:46:07
4 might get around 5 kilohertz of bandwidth. So if 11:46:10
5 you can afford it, why not use multiple telephone 11:46:14
6 lines. 11:46:18

7 And so in DSL, there are digital 11:46:18
8 communications over the subscriber line and those 11:46:20
9 lines could be multiple. 11:46:24

10 And I can go farther if you want. 11:46:26

11 Q. Let's go farther. So is DSL -- not ADSL 11:46:37
12 or VDSL or any of the other ones in the table -- 11:46:47
13 but is DSL a standard? 11:46:50

14 A. It's a good question. And maybe I should 11:47:20
15 say I shouldn't speculate. 11:47:58

16 Q. And then so you had said, you know, using 11:48:10
17 telephone lines as data lines in your description 11:48:15
18 of what DSL is. 11:48:18

19 And so is DSL simply the idea that you 11:48:20
20 send data over a telephone line or is there a 11:48:23
21 mechanism by which DSL operates that is the 11:48:28
22 defining feature of DSL, or what is it that DSL is? 11:48:31

23 MR. RIFFE: Objection. Compound. 11:48:39

24 THE WITNESS: Also a good question. And, 11:48:45
25 you know, we've been talking about two textbooks 11:48:49

1 today, DSL-Book and ADSL/VDSL book. 11:48:53

2 And so for me to put in a phrase or one 11:48:56

3 sentence what DSL is, is probably going to leave 11:49:00

4 something out. 11:49:06

5 But I like the question, and I'll say at 11:49:09

6 a bare minimum it involves telephone lines, 11:49:12

7 which we've discussed earlier in the morning as 11:49:17

8 twisted pair. It involves digital data. So it 11:49:19

9 definitely involves data, and those data are 11:49:25

10 digital. 11:49:27

11 It has an aspect of reaching the 11:49:32

12 consumer. It's not a company-to-company 11:49:37

13 technology. It's a company-to-consumer 11:49:40

14 technology that makes use of the PSTN, which I 11:49:44

15 think is public switch telephone network. And 11:49:49

16 we call that, as well, POTS, plain old telephone 11:49:52

17 system. 11:49:58

18 As we've discussed and as you've read, 11:50:00

19 there's a variety of modulation schemes used in 11:50:04

20 DSL, almost the full gamut of what was developed 11:50:08

21 in the '90s and before. 11:50:13

22 There is error correction, which started 11:50:15

23 in the '40s, but the error correction they used 11:50:19

24 is from 1960, Reed-Solomon. 11:50:22

25 What else? Equalization. 11:50:26

1 That's a good start to your question. A 11:50:32
2 good office hours question, I think. 11:50:41
3 BY MR. HALVERSON: 11:50:44
4 Q. Not a lecture question. 11:50:45
5 Have you ever heard of DSL being used as 11:50:56
6 the -- here's a better question. 11:50:59
7 Is DSL a mode of communication? 11:51:00
8 A. I don't want to read anything extra into 11:51:07
9 "mode." But if you are just asking me that out on 11:51:11
10 4th Street here in Charlottesville, I'd say yes. 11:51:14
11 Q. And so have you ever seen or heard of DSL 11:51:16
12 being the mode of communication used in a local 11:51:19
13 network? 11:51:22
14 A. Well, Amit mentions DSL modems in 11:51:24
15 conjunction with his home network. That's one. 11:52:11
16 Q. And in that context, the DSL modem is the 11:52:18
17 source of information from outside the home, not 11:52:25
18 describing how the local area network is 11:52:30
19 configured, right? 11:52:36
20 MR. RIFFE: Objection. Foundation. 11:52:37
21 THE WITNESS: I guess I'm having trouble 11:52:44
22 unpeeling your question. 11:52:46
23 BY MR. HALVERSON: 11:52:47
24 Q. So you had said when we were talking 11:52:48
25 about what DSL was, it's a company-to-consumer 11:52:51

1 technology that makes use of the PSTN or POTS. And 11:52:55
2 so that, to me, is outside the home. PSTN is the 11:53:00
3 network that exists from someone's house to someone 11:53:05
4 else's house. 11:53:08

5 But you wouldn't characterize anybody's 11:53:09
6 home network as a PSTN, right? 11:53:12

7 A. I think we're getting at something we can 11:53:19
8 agree on. I definitely wouldn't consider anyone's 11:53:21
9 home network to be a PSTN. 11:53:24

10 Q. And so DSL, insofar as -- what I was 11:53:27
11 trying to set up is what I was asking what DSL is. 11:53:31

12 But DSL is a communication mechanism that 11:53:34
13 is used over the PSTN to allow for more data to get 11:53:39
14 to a subscriber's home if the telephone company 11:53:44
15 isn't going to give them a cable line, right? 11:53:49

16 A. Or some other company. 11:53:53

17 Q. But DSL is not a technology that would be 11:53:59
18 used to communicate within your home; you would not 11:54:03
19 set up a DSL network in your house, right? 11:54:06

20 MR. RIFFE: Objection. Speculation. 11:54:11

21 THE WITNESS: I mean, you could say the 11:54:13
22 same thing about cable TV. But until the 11:54:15
23 invention of Amit and the invention of the '249, 11:54:18
24 which came a little later, that wouldn't be the 11:54:22
25 initial description, no. 11:54:26

1 BY MR. HALVERSON: 11:54:37

2 Q. I want to go back to that DSL modem in 11:54:37

3 Amit. Where are you pointing so that we can get on 11:54:43

4 the same page, literally? 11:54:47

5 A. Okay. It's in column 1 at line 25. 11:55:16

6 Q. And so before when we were talking about 11:55:23

7 column 1, that was the background aspect of the 11:55:26

8 Amit patent, right? 11:55:30

9 A. Right. 11:55:33

10 Q. So here, in column 1 it is listing out 11:55:34

11 devices between which a home network may exist; is 11:55:40

12 that fair? 11:55:47

13 A. Yeah. I think at line 17 and 18 it says: 11:55:47

14 Home networks will connect between computing 11:55:52

15 devices. 11:55:55

16 And then it goes on to say entertainment 11:55:55

17 devices, IO devices, and modems, which are -- is 11:55:59

18 where the DSL modem comes in. 11:56:06

19 Q. And the description of modem actually 11:56:08

20 continues after that parenthetical and concludes 11:56:11

21 with: That connect the home outside. 11:56:15

22 Is that right? 11:56:16

23 A. Yeah. 11:56:17

24 Q. And it's not your interpretation of Amit 11:56:17

25 that the phrase "that connect the home outside" 11:56:23

1 applies to everything in that list, like the home 11:56:26
2 appliances or IO devices, right, just the modem? 11:56:29

3 A. I think we can agree on this. The modem 11:56:35
4 modulates and demodulates and connects to the 11:56:38
5 outside. 11:56:44

6 Q. And that's primarily used for, for 11:56:44
7 example, connecting to the internet, right? 11:56:47

8 A. Connecting to the internet is one usage. 11:56:52

9 Q. What else, in 2000, were people using 11:56:54
10 modems for? 11:56:56

11 A. You might connect to another local 11:56:59
12 network. For example, if you worked at IBM -- and 11:57:14
13 this is way back in the '90s -- you might dial up 11:57:19
14 the IBM system and then you would be connected not 11:57:23
15 to the internet but to IBM's internal network. 11:57:26

16 Q. And so you could dial into another local 11:57:30
17 area network, but doing that would go over some 11:57:34
18 sort of public backbone of sorts, right? 11:57:37

19 A. You would have to have some medium of 11:57:40
20 transmission, yes. 11:57:43

21 Q. Have you ever seen a twisted pair-based 11:58:14
22 network, so the physical wire, that uses a splitter 11:58:17
23 as opposed to, for example, a switch or a hub? 11:58:23

24 A. I have not. 11:58:34

25 Q. The reason I ask is I know Ethernet 11:58:39

1 splitters are a thing, but as far as I can tell 11:58:42
2 they're not a thing that anybody uses for anything. 11:58:46
3 Is that generally fair? 11:58:49
4 MR. RIFFE: Objection. Calls for 11:58:52
5 speculation. 11:58:57
6 THE WITNESS: I just don't understand the 11:58:57
7 question. 11:58:59
8 BY MR. HALVERSON: 11:58:59
9 Q. Have you ever used an Ethernet splitter 11:59:00
10 in any network that you've ever either analyzed or 11:59:03
11 designed or built or looked at? 11:59:05
12 A. Or used. 11:59:07
13 Q. Or used? 11:59:09
14 A. Yes. 11:59:10
15 Q. You have. Where have you seen an 11:59:10
16 Ethernet splitter being used? 11:59:12
17 A. I believe in our network room at UVA. 11:59:16
18 Q. Do you know what it does? 11:59:25
19 A. It splits the signal. 11:59:28
20 Q. Do you know why a splitter versus a hub 11:59:30
21 or a switch is used in that network room at UVA? 11:59:33
22 A. If you had sufficient power, so in 11:59:36
23 general with a passive splitter you're going to 11:59:39
24 loose 60 dBe power. D-B-E meaning decibels, small 11:59:47
25 d, big B. 11:59:51

1 So if you had enough power, you could 11:59:52
2 split maybe between two offices; otherwise you'd 11:59:56
3 probably want to boost, like you said, I can't 11:59:59
4 remember the exact words you said. 12:00:03

5 Q. Switch and hub? 12:00:05

6 A. Switch and hub. 12:00:07

7 Q. Do you know whether or not an Ethernet 12:00:10
8 splitter is cheaper or more expensive than a switch 12:00:17
9 or a hub? 12:00:23

10 A. I do. 12:00:23

11 Q. And? 12:00:24

12 A. Cheaper. 12:00:25

13 Q. The two textbooks, ADSL/VDSL and then the 12:00:25
14 DSL textbook -- and actually, forgive me for a 12:00:41
15 second. 12:00:49

16 We were talking a little bit ago about 12:00:50
17 DSL networks, what it was, how they work, whether 12:00:53
18 or not you would use them in a local network versus 12:01:01
19 whether or not they exist kind of out in the 12:01:05
20 broader wide area network. 12:01:07

21 And I only asked the questions in the 12:01:09
22 context of DSL. 12:01:13

23 Is there a distinction between those 12:01:15
24 answers that you gave with DSL and any of the other 12:01:17
25 flavors of DSL that are identified in that table in 12:01:22

1	the ADSL/VDSL textbook, including but not limited	12:01:30
2	to ADSL or VDSL?	12:01:33
3	MR. RIFFE: Objection. Form. Compound.	12:01:35
4	THE WITNESS: I don't think there's any	12:01:37
5	distinction. But if you want to ask a specific	12:01:38
6	question, you can.	12:01:41
7	BY MR. HALVERSON:	12:01:45
8	Q. Either one of those two textbooks talk	12:01:50
9	about the need to isolate different devices?	12:01:53
10	A. I was going to ask you if you wanted me	12:02:01
11	to read, but I don't even have the full textbooks	12:02:04
12	here.	12:02:07
13	Q. As far as you know, does DSL care, any	12:02:07
14	favor of DSL care about device isolation?	12:02:13
15	MR. RIFFE: Objection. Foundation.	12:02:16
16	THE WITNESS: I don't know if you want to	12:02:22
17	point me to any opinion in my declaration that's	12:02:24
18	relevant.	12:02:27
19	BY MR. HALVERSON:	12:02:28
20	Q. I'm not sure you gave that opinion. I'm	12:02:29
21	just asking whether or not you are familiar with	12:02:30
22	that.	12:02:33
23	A. I can't say one way or the other.	12:02:34
24	Q. Another acronym for you. PSD, do you	12:02:38
25	know what that one is?	12:02:46

1 Bear with me one second because those are 12:05:07
2 different. Here's a better way of doing it. 12:05:09
3 So if you look at the first chapter of 12:05:22
4 1006, which is the open exhibit on your right hand, 12:05:26
5 yeah, right there where you're already at, at page 12:05:28
6 3. That is page 3, right? On the bottom. 12:05:33
7 But if you flip to the next page of 1006, 12:05:41
8 page 4 of 1006, we see a page 2 up in the top 12:05:44
9 left-hand corner. Right? 12:05:48
10 A. Where do you see page 2? 12:05:55
11 Q. And so you flip the shoddy quality 2001 a 12:06:00
12 couple of pages, keep going, one more, there. 12:06:04
13 Page 2, the bottom left of the page that you're 12:06:12
14 looking at in 2001 labeled 5 of 11 is the same page 12:06:17
15 2 that you see in 1006? 12:06:23
16 MR. RIFFE: Objection. Calls for 12:06:25
17 speculation. 12:06:27
18 THE WITNESS: It looks the same, although 12:06:35
19 pixilated. 12:06:38
20 BY MR. HALVERSON: 12:06:42
21 Q. So where I want to go is the page 7 of 11 12:06:42
22 in the left-hand doc. 12:06:52
23 A. Page 7? 12:06:56
24 Q. Of 11 in the left-hand doc, which is 12:06:58
25 2001. There, we see a, albeit pixilated, PSD graph 12:07:09

1 for ADSL upstream. Do you see that? 12:07:11

2 A. I do. 12:07:16

3 Q. And I believe that's not part of 12:07:17

4 Exhibit 1006. If you can find it in 1006, the 12:07:23

5 quality in 1006 is a much higher quality, but I 12:07:26

6 don't believe there is a 111 in there. 12:07:30

7 A. You are correct. 12:07:41

8 Q. So we're stuck with the pixilated 12:07:42

9 version. 12:07:45

10 So this graph on page 111 or page 7 of 11 12:07:46

11 of 2001, describes theoretical and implementation 12:07:54

12 ADSL upstream PSD with a linear frequency scale and 12:07:59

13 a log frequency scale. 12:08:05

14 Do you see that? 12:08:07

15 A. I do. 12:08:09

16 Q. And my understanding is the PSD is on the 12:08:17

17 Y axis of this and the frequency scale is on the X 12:08:21

18 axis of this. Is that right? 12:08:25

19 A. Correct. 12:08:27

20 Q. What do you measure PSD in? 12:08:28

21 A. I don't want to complain about your graph 12:08:32

22 again, but -- 12:08:40

23 Q. It's bad, I know. 12:08:40

24 A. Are they using decibels times hertz? 12:08:42

25 Q. Is that a unit that you're familiar with? 12:08:50

1 A. I would think it would just be decibels 12:08:59
2 which -- 12:09:01
3 Q. Is -- go ahead. 12:09:02
4 A. Which would be the reasonable measurement 12:09:03
5 of power. And it's relative, right, because the -- 12:09:05
6 like, as you see, there's negative decibels. And 12:09:11
7 so it's relative to the -- what's actually 12:09:16
8 transmitted. 12:09:21
9 Q. And so in a signal, do you want a high 12:09:22
10 PSD or low PSD for quality of receive signal? 12:09:27
11 A. You want a high PSD portion. 12:09:31
12 Q. And so this graph shows a band that has a 12:09:36
13 high PSD, looks to be in the roughly 10 to the 5th, 12:09:40
14 10 to the 6th range. See the flat cap portion of 12:09:49
15 the graph? 12:09:54
16 A. Agreed. It goes into the megahertz 12:09:55
17 region. 12:09:57
18 Q. And then drops off pretty significantly 12:09:58
19 after that? 12:10:02
20 A. And drops off pretty significantly after 12:10:02
21 that. 12:10:05
22 Q. And then below or at a lower frequency, 12:10:06
23 the PSD is still low but it's still higher than it 12:10:11
24 is at the particularly high frequencies to the 12:10:16
25 right of that flat portion, right? 12:10:19

1 A. Are you talking theoretical or PSD 12:10:22
2 method? 12:10:25
3 Q. Just the solid black line which appears 12:10:27
4 to be theoretical. Ah, I see. Yes, the 12:10:30
5 theoretical PSD. 12:10:32
6 A. I guess the theoretical PSD goes off sort 12:10:36
7 of in a linear fashion on this logarithmically 12:10:41
8 scaled graph of frequency. 12:10:50
9 Q. And it should be decibels over hertz? 12:10:53
10 A. Per hertz. 12:11:20
11 Q. Per hertz. According to Josh. 12:11:21
12 A. Thanks, Josh. 12:11:25
13 Q. So you said the theoretical PSD goes off 12:11:26
14 in a linear fashion. Can you point out where 12:11:30
15 you're referring to when you say that? 12:11:35
16 A. On the left side basically below 12:11:36
17 1 kilohertz. But it stays flat on the PSD method, 12:11:52
18 which I haven't reviewed. 12:11:45
19 Q. Do you know what PSD method is? 12:11:46
20 MR. RIFFE: Objection. Speculation. 12:11:50
21 THE WITNESS: So on page 1 of 4 it 12:12:11
22 describes it as a variation of DMT that we've 12:12:17
23 been talking about earlier. Discrete multitone. 12:12:21
24 BY MR. HALVERSON: 12:12:26
25 Q. It describes PSD as a variation of DMT or 12:12:26

1	describes VPSD of a DMT-based system?	12:12:31
2	A. Yeah, I think I like your description	12:12:54
3	better than my initial description.	12:12:56
4	Q. Another acronym for you. ISI, familiar	12:13:11
5	with that one?	12:13:15
6	A. Yep.	12:13:15
7	Q. What is it?	12:13:15
8	A. Intersymbol interference.	12:13:17
9	Q. And what is that?	12:13:20
10	A. It's a problem that plagues all digital	12:13:22
11	communication systems.	12:13:26
12	Q. What causes ISI?	12:13:30
13	A. Imperfection.	12:13:37
14	Q. In what?	12:13:40
15	A. So I'll cite to sources that are relevant	12:13:44
16	to our discussion today. One source is the	12:13:48
17	imperfection of the channel. And we were just	12:13:52
18	looking at PSDs. There's obviously frequency	12:13:56
19	channels that have higher signal-to-noise ratios	12:14:01
20	than others.	12:14:07
21	There's distortions in magnitude and	12:14:09
22	phase in those channels. They are imperfect	12:14:12
23	channels. And those imperfections lead to one	12:14:17
24	symbol bleeding into another in time. That is	12:14:20
25	intersymbol interference.	12:14:25

1 And the way these symbols are usually 12:14:27
2 thought about are in terms of constellations, 12:14:33
3 little dots on the real imaginary axis -- axis in 12:14:36
4 this case, A-X-I-S. That's one source. 12:14:41

5 And the other source is when I speak in 12:14:48
6 this room, you hear my voice, but you also might 12:14:51
7 get an echo off that cabinet. And that's another 12:14:58
8 source of ISI, when you get reflections. 12:15:03

9 And Amit, as well as '249, teach us that 12:15:07
10 reflections can be useful, but they could also be 12:15:10
11 hazardous, which Amit and Jacobsen discuss. 12:15:14

12 Q. And so ISI over the channel is caused by 12:15:18
13 some sort of imperfection on the channel, right? I 12:15:25
14 think that's what you said. 12:15:31

15 Could be of the physical medium, could be 12:15:34
16 some sort of outside influence. But it's not tied 12:15:36
17 to the interaction of a given symbol with some sort 12:15:40
18 of outside device? 12:15:46

19 A. So I didn't catch the last part. I was 12:15:49
20 agreeing with you for a little while. 12:15:52

21 Q. Where did you stop? 12:16:01

22 A. Something about outside device. 12:16:04

23 Q. So ISI over the channel is caused by some 12:16:06
24 sort of either degradation of the channel -- so if 12:16:10
25 we're looking at a wire, there could be some sort 12:16:15

1 of imperfection in the physical wire, there could 12:16:17
2 be some sort of radiation on the wire that 12:16:20
3 interferes with the signals being transmitted 12:16:24
4 across the wire. 12:16:28

5 Are there any other things that could 12:16:32
6 cause the imperfection that you identified on the 12:16:33
7 actual channel? 12:16:38

8 A. Yes. 12:16:40

9 Q. What else? 12:16:40

10 A. Jacobsen identifies interference from 12:16:41
11 other sources, including amateur radio operators 12:16:44
12 that she calls ham radio. 12:16:49

13 Q. And so I would consider ham radio to be 12:16:53
14 some sort of external radiation. Is there some 12:16:55
15 distinction that you are drawing between radiation 12:16:58
16 on the wire that interferes with the signal and the 12:17:02
17 sort of ham radio interference? 12:17:04

18 A. Yes. 12:17:07

19 Q. What? 12:17:07

20 A. As you said, one comes from outside 12:17:09
21 sources and one comes from the medium or the 12:17:10
22 channel. 12:17:14

23 Q. What comes from the channel if we're 12:17:19
24 looking at radiation and ham radio signals? 12:17:24

25 A. Well, we're trying -- 12:17:30

1 MR. RIFFE: Object to form. 12:17:31

2 Go ahead. 12:17:34

3 THE WITNESS: We're trying to transmit a 12:17:34

4 signal, and the -- I like to think of the 12:17:38

5 frequency domain. The signal is distorted by 12:17:45

6 the channel, but at the same time it could also 12:17:52

7 be distorted by an interfering source. I don't 12:17:56

8 know if we're tracking together. 12:18:00

9 BY MR. HALVERSON: 12:18:01

10 Q. So I agree with you on that. You can 12:18:02

11 have something outside of the wire that sends radio 12:18:04

12 frequency waves and they can interfere with 12:18:11

13 whatever is happening on your copper line. 12:18:14

14 And that, in my mind, is radiation. 12:18:16

15 That's a signal that radiates out over the air and 12:18:23

16 can interfere with what's going on there. That can 12:18:28

17 be caused by a radio broadcast, it could be caused 12:18:30

18 by like, you know, right-hand rule, magnetic waves. 12:18:35

19 These are all external radiations that can 12:18:41

20 interfere with the signal on the line. 12:18:46

21 But you had said that this ham radio is 12:18:48

22 different than that. And I'm wondering what it is 12:18:58

23 about that or maybe we're misunderstanding each 12:19:00

24 other. 12:19:03

25 But is there something about ham radio 12:19:04

1 that you think is different than other external 12:19:05
2 radio sources? 12:19:09

3 A. It would be an external radio source. 12:19:09

4 Q. Okay. And ham radio is just like a 12:19:12
5 hobbyist in their basement with an antenna on their 12:19:15
6 roof and they're talking to somebody 12 states over 12:19:20
7 because they like the building of the radio and all 12:19:22
8 of that fun stuff, right? They're like hobbyists? 12:19:25

9 A. Right. And they're given access to 12:19:28
10 actually broadband frequencies. 12:19:34

11 Q. Broadband one word or two words? 12:19:34

12 A. One as an adjective. 12:19:37

13 Q. Are they given access to a broad space 12:19:41
14 band of frequencies or are they given access to 12:19:46
15 broadband frequencies, or are those the same thing? 12:19:51

16 MR. RIFFE: Objection. Compound. 12:19:55

17 THE WITNESS: It's a broad spaced band of 12:19:55
18 frequencies, and there's power limitations 12:20:01
19 therein, of course. 12:20:02

20 BY MR. HALVERSON: 12:20:21

21 Q. So you said there are ISI considerations 12:20:21
22 in all forms of communication, all forms of -- 12:20:24
23 sorry. 12:20:29

24 What kind of communication mediums are 12:20:32
25 impacted by ISI? 12:20:34

1 A. Digital communications. 12:20:37

2 Q. That's because it impacts whether or not 12:20:38
3 one constellation bumps into or interferes with 12:20:40
4 another constellation? 12:20:45

5 A. I agree if you're using constellations, 12:20:50
6 yes. 12:20:55

7 Q. Can you have ISI interference if you're 12:20:55
8 not using constellations? 12:20:59

9 A. Yeah. 12:21:01

10 Q. How? 12:21:01

11 A. Let's try an acronym. ASK, that's -- 12:21:02

12 Q. Okay. 12:21:08

13 A. -- amplitude shift keying. So you have 12:21:10
14 no constellation, basically you have one frequency. 12:21:12
15 You turn it on, that's a 1. You turn it off, 12:21:16
16 that's a zero. And if they bleed into one another, 12:21:19
17 you're in trouble. 12:21:23

18 Q. Do you know the operating frequencies 12:21:44
19 that are used for ham radios? 12:21:47

20 A. I didn't hear the end of your question. 12:21:50

21 Q. Do you know the operating frequencies 12:21:51
22 that are used for ham radios? 12:21:55

23 A. Okay. I didn't know if you said ham or 12:21:58
24 a.m. 12:22:04

25 I know that from this patent work that 12:22:05

1 BY MR. HALVERSON: 01:24:58

2 Q. Welcome back, Dr. Acton. 01:27:29

3 A. Thank you. 01:27:31

4 Q. How was lunch? 01:27:32

5 A. It was good. 01:27:33

6 Q. Over the course of that break did you 01:27:34

7 talk about your testimony, the substance of your 01:27:37

8 testimony, with anybody? 01:27:40

9 A. I did not. 01:27:41

10 Q. Wonderful. Let's dive back in. 01:27:43

11 How many papers, approximately, would you 01:27:47

12 say you are listed as an author on, academic 01:27:55

13 papers? 01:27:59

14 A. Somewhere in the neighborhood of 325 to 01:28:00

15 350 what I would call refereed papers. 01:28:05

16 Q. Unfamiliar with that phrase. What is a 01:28:09

17 refereed paper? 01:28:13

18 A. So one can submit an abstract, a short 01:28:14

19 abstract to some conferences and it's immediately 01:28:17

20 accepted. I probably have 25 or 50 of those and so 01:28:21

21 I'm not counting those. 01:28:25

22 Q. So your 325 to 350 is full, multipage 01:28:26

23 hypothesis analysis conclusion-type research 01:28:33

24 papers? 01:28:37

25 A. It's reasonable to say that, yes. 01:28:37

1 Q. Do all of them have citations? 01:28:39

2 A. No. 01:28:42

3 Q. And by citations there, I don't mean 01:28:43
4 citations to them, but citations in them to other 01:28:46
5 articles. 01:28:50

6 A. Yes. 01:28:50

7 Q. They all do have citations in them? 01:28:50

8 A. Yes, sir. 01:28:53

9 Q. Ever heard of a MARC record, M-A-R-C? 01:28:59

10 A. Is it an acronym? 01:29:08

11 Q. It is, but I don't know what it stands 01:29:12
12 for. 01:29:14

13 A. Okay. I can't recall. 01:29:14

14 Q. How many of your papers have other 01:29:23
15 authors on them also? 01:29:25

16 A. A lot. 01:29:29

17 Q. Would you say more than 90 percent? 01:29:30

18 A. I don't know. 01:29:35

19 Q. In the ones that -- I guess it doesn't 01:29:38
20 really matter. 01:29:42

21 For all of them, and this may be pushing 01:29:42
22 the outer bounds of the memory, but approximately 01:29:46
23 how many were you responsible for the research for? 01:29:50

24 A. What does that mean? 01:29:53

25 Q. So you were identifying and pulling 01:29:56

1 references for citations to support propositions 01:29:59
2 that you're making in the paper. 01:30:04

3 And I'm not trying to say that if you are 01:30:07
4 the lead author, that you're not responsible for 01:30:09
5 those citations. But how many of them were you 01:30:12
6 actually, like, the person who was saying let's 01:30:15
7 cite to that textbook? 01:30:17

8 A. I don't think there is a person. I think 01:30:20
9 I always suggest references even if I didn't get 01:30:25
10 the initial list of references. 01:30:30

11 Q. As part of your Ph.D. program, did you 01:30:37
12 have any classes that taught you how to do 01:30:40
13 research? 01:30:46

14 MR. RIFFE: Objection. Form. 01:30:47

15 THE WITNESS: I would say I -- and this 01:30:59
16 goes for what happens at the University of 01:31:04
17 Virginia too, we get research credits that come 01:31:06
18 across as classes. And I was under the 01:31:09
19 mentorship of one Allen C. Bovik. He was my 01:31:12
20 mentor and taught me how to do research and how 01:31:17
21 to do ethical research. But it wasn't a class 01:31:20
22 called research, no. 01:31:23

23 BY MR. HALVERSON: 01:31:25

24 Q. And was that mentor a librarian or was 01:31:25
25 that mentor like a Ph.D. in engineering or a 01:31:27

1 science background? 01:31:33

2 A. Al Bovik is a Ph.D. in engineering from 01:31:35

3 your alma mater, the University of Illinois, and is 01:31:40

4 a member of the national academy. 01:31:45

5 Q. I like it when the witnesses do reverse 01:31:47

6 research. 01:31:51

7 A. Thank you. 01:31:51

8 Q. Have you ever had any classes taught to 01:31:57

9 you by a librarian about doing research? 01:32:01

10 MR. RIFFE: Objection. Scope. 01:32:08

11 THE WITNESS: Hmm. So my -- in 01:32:17

12 elementary school at Foothill Elementary, my 01:32:21

13 librarian was Mrs. Groves, and she taught a 01:32:29

14 class. 01:32:31

15 BY MR. HALVERSON: 01:32:31

16 Q. On, like, the Dewey decimal system or on, 01:32:31

17 like, basic reading? 01:32:35

18 A. And Library of Congress. 01:32:36

19 Q. Okay. Cool. 01:32:38

20 Do you have Jacobsen in front of you 01:32:42

21 still? 01:32:44

22 A. Yes. 01:32:46

23 Q. So I want to start with the cover of 01:32:48

24 Jacobsen. There's a stamp there. Do you see it? 01:32:53

25 A. I do. 01:33:02

1 Q. Can you make out the year on it? 01:33:04

2 A. I can only make out the first name, which 01:33:07
3 is Linda, which means beautiful in Spanish. 01:33:09

4 Q. How about on the next page, there is 01:33:13
5 another stamp. And we still see Linda, right? 01:33:14

6 A. Yes. And now I can make out a bottom 01:33:21
7 word, which is library. And I still can't make out 01:33:24
8 the date. Is your copy better? 01:33:28

9 Q. It is not. I can zoom in and I think 01:33:32
10 there is a word that says "Feb" in the middle but I 01:33:37
11 can't see anything to the right of that. And I 01:33:43
12 just want to know whether you can see anything 01:33:45
13 either, Feb or otherwise, or anything to the right 01:33:48
14 in the middle of that stamp. 01:33:51

15 MR. RIFFE: Objection. Scope. 01:33:52

16 THE WITNESS: Feb looks like a reasonable 01:33:55
17 interpretation of the first three letters, 01:33:58
18 although I can't truly make them out. 01:33:59

19 BY MR. HALVERSON: 01:34:06

20 Q. So if you flip a few pages in to the meat 01:34:06
21 of the article, I believe it's page 8 on the 01:34:10
22 bottom. 01:34:20

23 Would you agree that Jacobsen is a coax 01:34:24
24 based in the form of the physical medium that's 01:34:29
25 being used referenced? 01:34:33

1 MR. RIFFE: Objection to form. 01:34:48

2 THE WITNESS: I guess as a first matter, 01:35:29

3 that's not a classification in my brain, a coax 01:35:31

4 reference. 01:35:35

5 BY MR. HALVERSON: 01:35:38

6 Q. I think it was coax based. But does that 01:35:38

7 change anything? 01:35:42

8 A. No. 01:35:43

9 Q. Would you characterize Jacobsen as a 01:35:48

10 broadband network? 01:35:51

11 And in the interest of full disclosure 01:35:57

12 again, because I don't want to trip you up, go to 01:35:59

13 your declaration, paragraph 252. So on 252 -- 01:36:01

14 A. Yeah, I would agree with that. Sorry. 01:36:25

15 Sorry to speak over you. I would agree with your 01:36:27

16 characterization, yes. 01:36:31

17 Q. So I think 252 is saying that Jacobsen is 01:36:32

18 a broadband coax network reference. Is that fair? 01:36:34

19 MR. RIFFE: Objection. Form. 01:36:38

20 THE WITNESS: I don't think I said that. 01:36:40

21 So not fair. 01:36:42

22 BY MR. HALVERSON: 01:36:43

23 Q. All right. So when you say, "would have 01:36:43

24 looked to analogous references that address 01:36:45

25 broadband coaxial networks, including Jacobsen," 01:36:50

1 what are you saying? 01:36:54

2 A. I'm saying that Amit states some 01:36:59
3 problems, some problems with, say, in-home 01:37:05
4 communication using cable TV and coaxial media, 01:37:10
5 coaxial physical layers. 01:37:19

6 And some of the problems that Amit states 01:37:21
7 one could look to Jacobsen, that would be 01:37:27
8 reasonable, because she's talking about cable TV 01:37:29
9 and she talks about the problem of reflection and 01:37:34
10 she gives solutions, such as equalizers. 01:37:36

11 Q. So you're not saying that Jacobsen is a 01:37:43
12 broadband coaxial network reference? 01:37:47

13 MR. RIFFE: Objection. Mischaracterizes 01:37:51
14 testimony. 01:37:53

15 THE WITNESS: Yeah, I don't see that as a 01:37:54
16 category of references. I would say Jacobsen 01:37:57
17 certainly plays into that world, but it's 01:38:06
18 essentially a communications reference that 01:38:12
19 teaches various modulation schemes and various 01:38:16
20 equalization schemes. 01:38:22

21 BY MR. HALVERSON: 01:38:24

22 Q. And so would you characterize the field 01:38:25
23 of endeavor of Jacobsen as a broadband coaxial 01:38:27
24 network? 01:38:30

25 A. I would characterize the field of 01:38:34

1 Jacobsen as digital communications. 01:38:44

2 Q. And would you characterize the field of 01:38:49
3 endeavor of the '249 Patent as broadband coaxial 01:38:51
4 networks? 01:38:55

5 MR. RIFFE: Objection to the extent it 01:39:02
6 calls for a legal conclusion. 01:39:04

7 THE WITNESS: So I'm not disagreeing that 01:39:11
8 those words are there. It's just not a category 01:39:13
9 that I've contemplated of references. 01:39:15

10 I would consider the '249 Patent, if we 01:39:18
11 look at column 1, lines 14 through 16, this 01:39:26
12 invention relates to broadband communication 01:39:31
13 networks and specifically to network interfaces 01:39:34
14 devices and network wiring. I'm fine with that 01:39:37
15 as the technical field for '249 by Garantz 01:39:42
16 (phonetic). 01:39:49

17 BY MR. HALVERSON: 01:39:49

18 Q. And so in paragraph 252 you don't say 01:39:49
19 that, though. 01:39:53

20 You say that: A POSITA seeking to 01:39:54
21 implement Amit's coaxial cable home network would 01:39:58
22 have looked to analogous references that address 01:40:03
23 broadband coaxial networks, including Jacobsen, 01:40:06
24 which is in the same field of endeavor as the '249 01:40:08
25 Patent. 01:40:08

1 And so nothing in there is talking about 01:40:13
2 the '249 Patent being related to broadband 01:40:16
3 communication networks and network interface 01:40:20
4 devices and wiring. 01:40:23

5 And I'm trying to figure out what it is 01:40:24
6 that you are saying is the field of endeavor of the 01:40:26
7 '249 Patent in paragraph 252. 01:40:30

8 A. Well, I think you'll admit or we can 01:40:35
9 agree that I also combine with DSL-Book in 01:40:38
10 ADSL/VDSL book, which are not coaxial networks, so 01:40:41
11 to speak, explicitly. We've been talking about 01:40:48
12 them being twisted pair networks. 01:40:51

13 So I would say the field of endeavor is 01:40:53
14 digital communications, which is true of the '249 01:40:57
15 Patent, as well. 01:40:59

16 And some of the problems that are 01:41:01
17 mentioned in Amit, one could look to Jacobsen. 01:41:03
18 Both of them talk about in-home reflection being a 01:41:05
19 problem. And Jacobsen has a solution. Amit isn't 01:41:09
20 as explicit on those solutions. 01:41:13

21 Q. So in Amit, there is a figure. I want to 01:41:19
22 direct your attention to -- once I find my copy of 01:41:23
23 Amit. Figure 2 -- sorry. 01:41:31

24 In Jacobsen, there is a figure that I 01:41:33
25 want to direct your attention to. Figure 2 of 01:41:35

1 Jacobsen, which appears on the tenth page of the 01:41:40
2 PDF, 307 on the bottom. Let me know when you're 01:41:43
3 there. 01:41:46

4 A. I'm there. 01:41:47

5 Q. And so Figure 2 is describing a CATV, 01:41:47
6 which we've described today as a community access 01:41:52
7 TV system or cable TV system, as that has kind of 01:41:54
8 evolved. 01:42:01

9 As of 2000, approximately, when you 01:42:01
10 started here at UVA, was the bleeding of CATV 01:42:04
11 between those two different terms understood to 01:42:12
12 be -- let me start over. That was a terrible 01:42:15
13 question that has completely gone off the rails. 01:42:18

14 In approximately 2000, when you started 01:42:21
15 here at UVA, did CATV have a meaning that 01:42:23
16 encompassed both community access television and 01:42:27
17 cable TV network? 01:42:31

18 MR. RIFFE: Objection. Speculation. 01:42:33

19 THE WITNESS: I don't think it's 01:42:36
20 critically the way. I was just saying that 01:42:37
21 sometimes these acronyms start out like digital 01:42:39
22 versatile disc and become digital video disc. 01:42:43
23 Right? 01:42:47

24 So I think it's fair to say cable TV 01:42:47
25 is -- was known in 2000. I don't know if that's 01:42:56

1 signals going into homes? 01:44:17

2 A. So Jacobsen, on page 305 using the 01:44:19

3 Jacobsen numbering, second paragraph, which is the 01:44:55

4 first complete paragraph, she says: In particular, 01:44:59

5 splitters in subscriber homes are known to have 01:45:09

6 poor isolation characteristics. The effect of 01:45:13

7 reflected signals on the frequency transfer 01:45:17

8 characteristic of a CATV channel is pass band 01:45:19

9 ripple, which is known to cause ghosting in 01:45:25

10 received analog signals. 01:45:29

11 So if the reflected signal is the signal 01:45:30

12 you're talking about in your question, yes, that is 01:45:33

13 within the home. 01:45:37

14 Q. So other than the ghost signal -- well, 01:45:43

15 let me start over. 01:45:53

16 Do you understand that that sentence or 01:45:54

17 that passage of Jacobsen is describing a signal 01:45:55

18 that originates from within the home and is being 01:45:58

19 used to transmit information from one device within 01:46:02

20 the home to another device in the home, or is that 01:46:05

21 passage of Jacobsen referring to simply a ghost 01:46:09

22 signal that originates due to the physical 01:46:12

23 characteristics of a splitter in a cable network or 01:46:14

24 something else? 01:46:17

25 MR. RIFFE: Objection. Compound. Sorry. 01:46:22

1 THE WITNESS: My understanding would be 01:46:24
2 the latter. 01:46:25

3 BY MR. HALVERSON: 01:46:26

4 Q. Something else? 01:46:26

5 My question was a poor question because I 01:46:35
6 asked about three things and you said the latter, 01:46:37
7 so the objection is well-founded. 01:46:39

8 What do you understand that portion of 01:46:45
9 Jacobsen to be describing? 01:46:46

10 A. My understanding is that Jacobsen is 01:46:54
11 describing in-home reflection which results in 01:46:57
12 ghosting. You can think of a second outline of a 01:47:01
13 body on a television screen that was undesirable. 01:47:04

14 Q. And is that caused by the television 01:47:10
15 channel going through a splitter and some internal 01:47:15
16 reflection within the splitter leading to a slight 01:47:18
17 time delay of that signal ultimately reaching the 01:47:21
18 television? 01:47:26

19 A. I think that's a fair description, yes. 01:47:26

20 Q. So that ghosting is not a signal from the 01:47:29
21 television to another device in the home asking the 01:47:31
22 other device in the home to do something? 01:47:34

23 A. No, but it is a signal. 01:47:37

24 Q. And so other than the ghosting signals of 01:47:39
25 Jacobsen, are there any other in-home signals, 01:47:43

1 in-home generated signals that are described? 01:47:47

2 A. I don't think so. And that's not really 01:47:59
3 the purpose of Jacobsen. Right? 01:48:02

4 The purpose is to basically compare the 01:48:04
5 single channel with a multichannel solution, and to 01:48:09
6 provide a solution to the ISI. 01:48:13

7 Q. And that single channel versus 01:48:17
8 multichannel, the comparison that was being made 01:48:21
9 was is it more efficient to use a single carrier 01:48:23
10 frequency and perform equalization on that single 01:48:27
11 carrier or to instead rely on a multicarrier 01:48:31
12 carrier frequency without equalization; is that 01:48:37
13 right? 01:48:50

14 MR. RIFFE: Objection. Form. 01:48:50

15 THE WITNESS: I think it's close to the 01:48:54
16 truth, but you have to also look at footnote 4 01:48:55
17 on page 309 in which Jacobsen says, and I'll 01:48:58
18 paraphrase: Hey, you could also use the time 01:49:02
19 domain equalizer in conjunction with a 01:49:06
20 multicarrier solution. 01:49:10

21 And that's really beyond the scope of 01:49:11
22 this paper. 01:49:13

23 BY MR. HALVERSON: 01:49:15

24 Q. And she points to two other areas that 01:49:16
25 they could look to to try to ascertain what those 01:49:18

1 details are? 01:49:21

2 A. Yes, 5 and 9. References 5 and 9. 01:49:23

3 Q. Two references by an individual last name 01:49:30

4 Chow (phonetic)? 01:49:34

5 A. Yes. They're both Stanford references. 01:49:35

6 Q. One's -- ostensibly the Ph.D. thesis was 01:49:38

7 successful, so we'll assume that's the case. But 01:49:45

8 one is Dr. Chow's thesis. And then the other is a 01:49:47

9 paper written by then not Dr. Chow based on the 01:49:52

10 timing of the two, and the same Dr. Cioffi that is 01:49:56

11 the author of 1007, right? 01:50:00

12 A. Yes. And because these equalization 01:50:04

13 techniques were well known. 01:50:07

14 Q. And one of the things that you point to 01:50:23

15 Jacobsen for is this concept of frequency bins; is 01:50:32

16 that right? 01:50:32

17 A. Do you want to point me to a part of my 01:50:40

18 dec? 01:50:42

19 Q. I'd love to. 01:50:47

20 If you look at the top of page 115, it 01:51:03

21 says within some analysis that you did on claim 01:51:08

22 element 1-C3, which relates to frequency bins among 01:51:13

23 other things, beginning with paragraph 272. 01:51:19

24 And when you get down to paragraph 274 01:51:23

25 talking about bits being assigned to subchannels in 01:51:28

1 proportion to subchannel signal-to-noise ratios. 01:51:32

2 Do you see that? 01:51:36

3 A. I do. 01:51:36

4 Q. And it's your opinion that that, in 01:51:37

5 combination with other disclosures from Amit, 01:51:44

6 renders obvious claim limitation 1-C3; is that 01:51:47

7 right? 01:51:47

8 A. It's my opinion that the combination of 01:51:53

9 Amit and Jacobsen renders the so-called bit loading 01:51:56

10 limitation obvious by one of three. 01:52:02

11 Q. And so I want to ask you about these 01:52:09

12 quotes that you've got in there. 01:52:11

13 The second quote beginning with the word 01:52:14

14 "instead," says: Bits are originally assigned to 01:52:16

15 subchannels just after training during system 01:52:20

16 initialization. 01:52:23

17 What assigns those bits? 01:52:26

18 A. I want to look at the reference. 01:52:35

19 Q. I believe you're citing to 307 on the 01:53:08

20 reference. 01:53:11

21 A. Thank you. 01:53:11

22 So in Jacobsen, it's unclear. I looked 01:54:45

23 at the previous page too. 01:54:47

24 Q. So you propose a combination of Amit and 01:54:53

25 Jacobsen as part of the obviousness analysis that 01:55:00

1 you performed in your declaration; is that right? 01:55:05

2 A. Definitely. 01:55:08

3 Q. Do you have an opinion on what carrier 01:55:17

4 frequency bands would be used in that combination? 01:55:28

5 A. The simplest answer is no. 01:55:31

6 Q. Do you have the textbook PDF still? The 01:56:03

7 better one of that. Yes. 01:56:17

8 Is there anywhere in there that talks 01:56:23

9 about port-to-port isolation? 01:56:26

10 A. Wow. I don't know. Do you want me to 01:56:34

11 read? 01:56:36

12 Q. Not particularly. Hang on. Let me see 01:56:43

13 if I can short-circuit this slightly. 01:56:48

14 So go to paragraph 331 of your 01:57:06

15 declaration, keeping that guy handy still. 01:57:12

16 A. Paragraph 330. 01:57:16

17 Q. Sorry. I may need to re-ask a couple of 01:57:22

18 predicate questions first. But paragraph 331. So 01:57:25

19 once you've skimmed 331, let me know and I'll ask 01:57:36

20 my predicate questions again. 01:57:42

21 A. Okay. 01:58:13

22 Q. So I had the wrong textbook. In the 01:58:14

23 other exhibit, 1008, is there anything in there 01:58:18

24 that talks about port-to-port isolation? 01:58:22

25 A. Do you want me to read that one? 01:58:41

1 Q. Also not particularly. But if you need 01:58:49
2 to, I'm happy to -- or happy to have you. 01:58:51

3 The reason I ask is because what I 01:58:56
4 understand you to be doing in 331 is saying that 01:58:58
5 all three references, which include that DSL-Book, 01:59:01
6 are reasonably pertinent to the problems identified 01:59:05
7 in the '249, which as you quote here, are 01:59:08
8 port-to-port isolation. 01:59:11

9 And you don't have any citation to that 01:59:14
10 textbook. And I'm not sure if there is a missing 01:59:17
11 citation, but I don't recall that talking about 01:59:19
12 port-to-port isolation. But if there is, I would 01:59:22
13 like to know where within that book that comes 01:59:25
14 from. 01:59:30

15 A. Okay. So it's kind of hard for me to be 01:59:33
16 complete or exhaustive. But one type of distortion 01:59:40
17 or violation of port-to-port isolation would be if 01:59:45
18 you had echos between ports. 01:59:49

19 And page 451 in this book is an example 01:59:52
20 of doing echo cancellation. I may not use the same 01:59:58
21 words, but essentially echo cancellation is one way 02:00:08
22 to isolate one port from another, if you'll allow 02:00:14
23 me to use that terminology of ports. 02:00:19

24 And I believe this also talks about other 02:00:22
25 forms of distortion that could be ameliorated by 02:00:28

1 various methods, including equalization that are 02:00:34
2 tied in DSL-Book. 02:00:39

3 Q. What else causes echo other than improper 02:00:41
4 port-to-port isolation? 02:00:55

5 A. Okay. So I agree with the premise of 02:00:59
6 your question. And in electrical engineering, 02:01:02
7 basically any impedance mismatch will cause an 02:01:09
8 echo. In various forms of communication, you might 02:01:13
9 get echos off of objects, especially specular 02:01:19
10 objects, which are in an electromagnetic sense like 02:01:25
11 mirrors. 02:01:32

12 And I don't know if I'm exhaustively 02:01:41
13 answering your question, but those are some 02:01:44
14 examples. 02:01:46

15 Q. The book that you're in right now, does 02:01:52
16 it have anything to do with coaxial networks? 02:01:55

17 A. Which book am I in? 02:01:59

18 Q. You are in the DSL-Book, Exhibit 1008. 02:02:02

19 A. In a sense, I think this is a 02:02:11
20 classification that you're trying to impose that 02:02:13
21 I'm not comfortable with. 02:02:17

22 For example, chapter 8 of the DSL-Book, 02:02:19
23 beautiful chapter, it's on channel equalization. 02:02:24

24 And does that apply to a coaxial network 02:02:27
25 or does it apply to a wireless network, which is 02:02:31

1 almost outside the scope of this matter today? 02:02:35

2 Sure. 02:02:37

3 When we teach equalization, when I teach 02:02:38

4 equalization, I don't say, imagine you're on a 02:02:40

5 coaxial cable or imagine you're inside a twisted 02:02:43

6 pair. I just teach equalization. I say the 02:02:47

7 channel is imperfect. How do you make the channel 02:02:50

8 perfect? One way is to invert the frequency 02:02:54

9 response of the channel. 02:02:56

10 And then if you get echo; ooh, that is a 02:02:58

11 bad problem. You might have to use something like 02:03:01

12 LMS, which is another acronym, least mean squares 02:03:03

13 filter, maybe something adaptive which relates to 02:03:07

14 the claims. 02:03:10

15 So I wouldn't -- so I would say yeah, 02:03:10

16 sure, it relates to wireless, it relates to 02:03:14

17 different types of wires. Sure. 02:03:17

18 Q. Can you go to paragraph 281 in that guy, 02:03:20

19 it's on page 116, the very bottom of 116 that 02:03:26

20 bleeds into 117. 02:03:33

21 There you say, quoting Jacobsen: 02:03:38

22 Jacobsen further explains that, quote, in contrast 02:03:42

23 to traditional frequency division multiplexing, FDM 02:03:46

24 techniques, multicarrier modulation does not 02:03:53

25 constrain the number of bits per subchannel to be 02:03:55

1 equal for all subchannels. 02:04:00

2 Do you see that? 02:04:01

3 A. I do. And that's correct. 02:04:01

4 Q. Did I read that right? 02:04:03

5 A. Yes. 02:04:05

6 Q. Does FDM constrain the number of bits per 02:04:06

7 subchannel to be equal for all subchannels? 02:04:11

8 A. I think what Jacobsen is saying, that 02:04:23

9 yeah, traditional FDM basically doesn't consider 02:04:28

10 bit loading, bit packing, or whatever you want to 02:04:31

11 call it. 02:04:35

12 But if you look at my method, which is 02:04:36

13 multichannel and multicarrier, I have a different 02:04:39

14 QAM for every channel based on the signal-to-noise 02:04:43

15 ratio. And that's one of the things that a person 02:04:47

16 of ordinary skill in the art, at the time of the 02:04:49

17 invention, would borrow from Jacobsen and maybe 02:04:53

18 apply to Amit. 02:04:57

19 Q. Do you know what pilot tone is? 02:05:13

20 A. I do. 02:05:19

21 Q. What's pilot tone? 02:05:19

22 A. Do you want to have me answer in the 02:05:23

23 context of FDM or OFDM? 02:05:26

24 Q. OFDM would be great. 02:05:30

25 A. Okay. So pilot tone, think about your 02:05:32

1 favorite sinusoid minus cosine. And we are going 02:05:36
2 to use one of the channels to just generate this 02:05:43
3 cosign over and over and over and over again. And 02:05:48
4 basically it allows the receiver to be in sync with 02:05:53
5 the transmitter by way of that pilot tone. 02:05:57

6 Q. And so is that a frequency-based 02:06:04
7 synchronization, an amplitude synchronization, a 02:06:08
8 time synchronization, or some other form of 02:06:13
9 synchronization that I'm not thinking of right now? 02:06:18

10 A. So as I said, it's at one frequency, it's 02:06:22
11 one cosine, it's monochromatic. And the way the 02:06:25
12 receiver interprets it, if you think about it, the 02:06:32
13 phase displacement is going to be relative to the 02:06:35
14 time of transmission. 02:06:45

15 If we think about distance equals 02:06:46
16 velocity times time, which we were taught in maybe 02:06:49
17 high school physics, the receiver can compute a 02:06:54
18 delay in time using that one frequency. 02:07:01

19 Q. Assuming it knows the distance or -- 02:07:05

20 A. No. 02:07:11

21 Q. -- just with the -- sorry, I did not mean 02:07:11
22 to interrupt. 02:07:14

23 When you say "delay in time," you mean 02:07:23
24 the amount of time it takes for the signal to 02:07:25
25 propagate from the transmitter to the receiver? 02:07:28

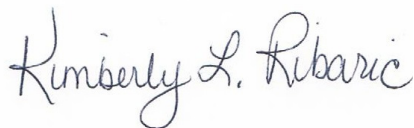
1 A. No. If you chose sine, we could just 02:09:10
2 shift by pi over 2 or 90 degrees and we'd both be 02:09:14
3 happy. 02:09:20
4 MR. HALVERSON: Got it. Let's take one 02:09:25
5 more break. 02:09:27
6 (Recess taken at 2:09 p.m., proceedings 02:09:28
7 resumed at 2:18 p.m.) 02:18:09
8 MR. RIFFE: Back on the record. I don't 02:18:09
9 have any further questions either. 02:18:15
10 MR. HALVERSON: Wonderful. Dr. Acton, 02:18:17
11 thank you very much. 02:18:18
12 THE WITNESS: Thank you. 02:18:19
13 THE REPORTER: I have instructions of a 02:18:19
14 rough draft for you. 02:20:09
15 MR. HALVERSON: I'd love a rough. 02:20:09
16 Standard final. 02:20:11
17 THE REPORTER: Tim, are you ordering a 02:20:11
18 copy today? 02:20:13
19 MR. RIFFE: Sure. Rough. Yeah. Do we 02:20:15
20 have any standing instructions for this case? 02:20:15
21 THE REPORTER: I don't have them if you 02:20:15
22 do, but I can ask. 02:20:15
23 MR. RIFFE: Okay. 02:18:23
24 (Deposition concluded at 2:18 p.m.) 02:18:23
25 (Signature rights reserved.)

COMMONWEALTH OF VIRGINIA AT LARGE, to wit:

I, Kimberly L. Ribaric, Registered Professional Reporter, Certified Court Reporter and Notary Public in and for the Commonwealth of Virginia at Large, and whose commission expires August 31, 2028, do certify that the aforementioned appeared before me, was sworn by me, was thereupon examined by counsel, that review was requested; and that the foregoing is a true, correct, and full transcript of the testimony adduced.

I further certify that I am neither related to nor associated with any counsel or party to this proceeding, nor otherwise interested in the event thereof.

Given under my hand and notarial seal at Fluvanna County, Virginia, this 6th day of October 2024.

A handwritten signature in cursive script that reads "Kimberly L. Ribaric".

Kimberly L. Ribaric, RPR, CCR
Notary Public Registration No. 348266
Commonwealth of Virginia at Large

Veritext Legal Solutions
1100 Superior Ave
Suite 1820
Cleveland, Ohio 44114
Phone: 216-523-1313

October 7, 2024

To: TIMOTHY W. RIFFE, ESQUIRE

Case Name: Dish Network LLC v. Entropic Communications LLC

Veritext Reference Number: 6897738

Witness: Scott Acton , PhD Deposition Date: 9/18/2024

Dear Sir/Madam:

Enclosed please find a deposition transcript. Please have the witness review the transcript and note any changes or corrections on the included errata sheet, indicating the page, line number, change, and the reason for the change. Have the witness' signature notarized and forward the completed page(s) back to us at the Production address shown above, or email to production-midwest@veritext.com.

If the errata is not returned within thirty days of your receipt of this letter, the reading and signing will be deemed waived.

Sincerely,
Production Department

NO NOTARY REQUIRED IN CA

DEPOSITION REVIEW
CERTIFICATION OF WITNESS

ASSIGNMENT REFERENCE NO: 6897738

CASE NAME: Dish Network LLC v. Entropic Communications LLC

DATE OF DEPOSITION: 9/18/2024

WITNESS' NAME: Scott Acton , PhD

In accordance with the Rules of Civil Procedure, I have read the entire transcript of my testimony or it has been read to me.

I have made no changes to the testimony as transcribed by the court reporter.

Date Scott Acton , PhD

Sworn to and subscribed before me, a Notary Public in and for the State and County, the referenced witness did personally appear and acknowledge that:

They have read the transcript;
They signed the foregoing Sworn Statement; and
Their execution of this Statement is of their free act and deed.

I have affixed my name and official seal

this _____ day of _____, 20____.

Notary Public

Commission Expiration Date

DEPOSITION REVIEW
CERTIFICATION OF WITNESS

ASSIGNMENT REFERENCE NO: 6897738

CASE NAME: Dish Network LLC v. Entropic Communications LLC

DATE OF DEPOSITION: 9/18/2024

WITNESS' NAME: Scott Acton , PhD

In accordance with the Rules of Civil Procedure, I have read the entire transcript of my testimony or it has been read to me.

I have listed my changes on the attached Errata Sheet, listing page and line numbers as well as the reason(s) for the change(s).

I request that these changes be entered as part of the record of my testimony.

I have executed the Errata Sheet, as well as this Certificate, and request and authorize that both be appended to the transcript of my testimony and be incorporated therein.

Date

Scott Acton , PhD

Sworn to and subscribed before me, a Notary Public in and for the State and County, the referenced witness did personally appear and acknowledge that:

They have read the transcript;

They have listed all of their corrections in the appended Errata Sheet;

They signed the foregoing Sworn Statement; and

Their execution of this Statement is of their free act and deed.

I have affixed my name and official seal this _____ day of _____, 20____.

Notary Public

Commission Expiration Date

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ERRATA SHEET
VERITEXT LEGAL SOLUTIONS MIDWEST
ASSIGNMENT NO: 6897738

PAGE/LINE(S) /	CHANGE	/REASON

Date Scott Acton , PhD
SUBSCRIBED AND SWORN TO BEFORE ME THIS _____
DAY OF _____, 20_____ .

Notary Public

Commission Expiration Date

DISH Network LLC v. Entropic Communications
USPTO PTAB Case: IPR2024-00373
US Patent No. 7,594,249

Errata Sheet of Scott Acton, Ph.D.

Page: Line	Change	Reason
10:3	“single” to “signal”	Typographical error
19:4	“Signs” to “Science”	Typographical error
21:17	“access” to “axis”	Typographical error
85:24	“dBE” to “dB”	Typographical error
89:19	“pixilated” to “pixelated”	Typographical error
90:8	“pixilated” to “pixelated”	Typographical error
103:12	“Foothill” to “Flint Hill”	Typographical error
115:10	“one of three” to “§103”	Typographical error
121:1	“sinusoid minus cosine” to “sinusoid, mine is cosine”	Typographical error
122:23	“cosign” to “cosine”	Typographical error

10-30-2024

Date



Scott Acton, Ph.D.

&	111 90:6,10	89:8,10,13,15	207 64:13,16,21
& 3:3	115 114:20	108:23,25	65:1,8
1	116 119:19,19	109:5 110:16	208 65:3
1 25:10,12,12	117 119:20	123:2	209 65:3
25:12,14 51:18	11:25 72:25	20 5:19,21	211 65:3
51:19 61:22	11:35 73:1	27:25 68:7,11	212 64:16,21
62:2 83:5,7,10	12 25:12 28:11	69:3 72:3,14	65:2,2,8
92:17,21 98:15	29:19 30:14	126:16 127:22	215 64:6 65:3
99:14 107:11	65:12 66:14	128:22	216-523-1313
114:22 115:6	77:1 97:6	2000 15:16,23	125:3
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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

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