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Transcript of **RUDIGER L. URBANKE**

Date: February 25, 2015

Case: THE CALIFORNIA INSTITUTE OF TECHNOLOGY v. HUGHES
COMMUNICATIONS, INC., ET AL

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Court Reporting | Videography | Videoconferencing | Interpretation | Transcription

Apple vs. Caltech
IPR2017-00700
Apple 1040

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

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THE CALIFORNIA INSTITUTE :
OF TECHNOLOGY, :
Plaintiff, :

v. : Case No.:

HUGHES COMMUNICATIONS, INC., : 2:13-cv-07245-MRP-JEM
HUGHES NETWORK SYSTEMS, LLC, :
DISH NETWORK CORPORATION, :
DISH NETWORK, LLC, and DISHNET:
SATELLITE BROADBAND, LLC, :
Defendants.:

-----x

Videotaped Deposition of RÜDIGER L. URBANKE
Palo Alto, California
Wednesday, February 25, 2015
9:57 a.m.

Job No.: 77059
Pages: 1 - 332
Reported by: James Beasley, RPR, CA CSR No. 12807

VIDEOTAPED DEPOSITION OF RUDIGER L. URBANKE
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Videotaped Deposition of RÜDIGER L. URBANKE,
held at the offices of:

WILMER CUTLER PICKERING HALE AND DORR LLP
950 Page Mill Road
Palo Alto, California 94304
(650) 858-6000

Pursuant to Notice, before James Beasley,
Registered Professional Reporter, California Certified
Shorthand Reporter, CSR No. 12807.

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A P P E A R A N C E S

ON BEHALF OF THE PLAINTIFF:

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ALSO PRESENT: JOSEPH MOURGOS, Videographer

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By Mr. Dowd	9

E X H I B I T S

(Attached to transcript)

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Exhibit 1 Document entitled: "Curriculum Vitae of Prof. Rüdiger Urbanke"; three pages (double-sided).	12
Exhibit 2 Document entitled: "Expert Report of Dr. Rüdiger Urbanke Regarding Validity of U.S. Patent Nos. 7,116,710; 7,421,032; 7,916,781; and 8,284,833"; 39 pages (double-sided).	30
Exhibit 3 Document entitled: "United States Patent No. 7,916,781 B2"; 12 pages (double-sided).	42
Exhibit 4 Document entitled: Exhibit B - Materials Considered"; two pages (double-sided).	49
Exhibit 5 Article entitled: "Irregular Repeat-Accumulate Codes"; eight pages (double-sided).	50

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1	E X H I B I T S C O N T I N U E D		
2	URBANKE DEPOSITION EXHIBIT		PAGE
3	Exhibit 6	Article entitled: "Coding	54
4		Theorems for 'Turbo-Like'	
5		Codes"; 10 pages (double-sided).	
6	Exhibit 7	Table, one page.	111
7	Exhibit 8	Table, one page.	114
8	Exhibit 9	Article entitled: "Practical	117
9		Loss-Resilient Codes"; 11 pages	
10		(double-sided).	
11	Exhibit 10	Table labeled: "Random	123
12		Permutation," with handwriting;	
13		one page.	
14	Exhibit 11	Table labeled: "Random	124
15		Permutation," no handwriting;	
16		one page.	
17	Exhibit 12	Table labeled: "Random	131
18		Permutation," with red and blue	
19		lines; one page.	
20	Exhibit 13	Table labeled: "Random	136
21		Permutation," no red and blue	
22		lines; one page.	
23	Exhibit 14	Article entitled: "Graph-based	148
24		Codes and Iterative Decoding";	
25		115 pages (double-sided).	

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Exhibit 15 Article entitled: "Gallager Codes Recent Results"; 12 pages.	165
Exhibit 16 Source code; 16 pages (double-sided).	185
Exhibit 17 Article entitled: "Analysis of Low Density Codes and Improved Designs Using Irregular Graphs"; 11 pages (double-sided).	215
Exhibit 18 E-mail from ART@scarpia.research.bell-labs.com to dariush@shanon.jpl.nasa.gov, dated 4/05/1999; one page.	244
Exhibit 19 E-mail from ART@scarpia.research.bell-labs.com, sent April 05, 1999; one page.	244
Exhibit 20 Article entitled: "Design of Provably Good Low-Density Parity Check Codes"; 36 pages (double-sided).	249
Exhibit 21 Article entitled: "Irregular Turbocodes"; eight pages (double-sided).	265

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Exhibit 22 E-mail from Brendan Frey to Dariush Divsalar, dated 12/08/1999; one page.	287
Exhibit 23 Document entitled: "Provisional Application for Patent"; 35 pages.	301
Exhibit 24 Article entitled: "Irregular Turbo-Like Codes"; 11 pages (double-sided).	311
Exhibit 25 Document entitled: "United States Patent No. 6,081,909"; 42 pages (double-sided).	312
Exhibit 26 Document entitled: "United States Patent No. 4,623,999"; seven pages (double-sided).	313
Exhibit 27 Article entitled: "Comparison of Construction of Irregular Gallager Codes"; six pages (double-sided).	314
Exhibit 28 Article entitled: "Low Density Parity Check Codes with Semi-Random Parity Check Matrix"; two pages.	315

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Palo Alto, California

Wednesday, February 25, 2015

9:57 a.m.

P R O C E E D I N G S

THE VIDEOGRAPHER: Here begins Video No. I	09:56:28
in the videotaped deposition of Rüdiger Urbanke, in	09:56:30
the matter of The California Institute of Technology	09:56:35
versus Hughes Communications, Incorporated, et al.,	09:56:44
in the United States District Court, for the Central	09:56:44
District of California. The case number is	09:56:48
2:13-cv-07245-MRP-JEM.	09:56:52
Today's date is February 25th, 2015 and	09:57:01
the time on the video monitor is 9:57 a.m.	09:57:07
The videographer today is Joseph Mourgos,	09:57:11
representing Planet Depos. This video deposition is	09:57:15
taking place at 950 Page Mill Road, Palo Alto,	09:57:18
California.	09:57:24
Would counsel please voice identify	09:57:25
yourselves and state whom you represent.	09:57:30
MR. DOWD: Go ahead.	09:57:30
MR. GLASS: Sure. James Glass from Quinn,	09:57:31
Emanuel, Urquhart, & Sullivan, representing	09:57:34
plaintiff Caltech and deponent, Dr. Urbanke. With	09:57:35

VIDEOTAPED DEPOSITION OF RUDIGER L. URBANKE
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1	me today is Robert Kang, also of Quinn, Emanuel.	09:57:40
2	MR. DOWD: Jim Dowd of WilmerHale for the	09:57:42
3	defendants.	09:57:45
4	THE VIDEOGRAPHER: Thank you. The court	09:57:46
5	reporter today is James Beasley, representing Planet	09:57:48
6	Depos. Would the reporter please administer the	09:57:51
7	oath.	09:57:55
8	---	09:57:56
9	RÜDIGER L. URBANKE,	
10	being first duly sworn and/or affirmed by the	
11	Certified Shorthand Reporter to tell the truth, the	
12	whole truth and nothing but the truth, testified as	
13	follows:	
14	---	
15	E X A M I N A T I O N	
16	---	09:58:14
17	BY MR. DOWD:	09:58:14
18	Q. Good morning.	09:58:15
19	A. Good morning.	09:58:15
20	Q. Thanks for coming.	09:58:15
21	A. You're welcome.	09:58:17
22	Q. Have you ever been deposed before?	09:58:18
23	A. No.	09:58:19
24	Q. Okay. Let me just go over a few ground	09:58:20
25	rules.	09:58:22

VIDEOTAPED DEPOSITION OF RUDIGER L. URBANKE
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1	Your counsel may have already discussed	09:58:23
2	this with you, but because what we say is being	09:58:25
3	taken by a court reporter, it's important that we	09:58:27
4	don't speak over one another. So I'll do my best	09:58:30
5	not to speak when you're speaking and if you could	09:58:33
6	do your best to do the same, I'd appreciate it;	09:58:35
7	fair?	09:58:39
8	A. Fair.	09:58:39
9	Q. Okay. You understand that although we're	09:58:40
10	in a conference room at the law firm of WilmerHale,	09:58:42
11	that the transcript and the video that's being taken	09:58:45
12	will actually be used in a court of law in	09:58:48
13	Los Angeles?	09:58:51
14	A. Yes.	09:58:52
15	Q. Okay. Is there any reason why you can't	09:58:53
16	provide complete and truthful answers today?	09:58:55
17	A. No.	09:58:58
18	Q. All right. You're not on any medications	09:58:59
19	or suffering from any conditions?	09:59:01
20	A. No.	09:59:03
21	Q. We'll take breaks periodically. If you	09:59:06
22	need a break, just let me know. The only thing that	09:59:09
23	I would ask, though, is that if I have a question	09:59:13
24	that is pending to you, if you could answer that	09:59:16
25	question before we take the break, and then we'll --	09:59:18

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1	then we'll take the break.	09:59:19
2	Okay?	09:59:20
3	A. Understood.	09:59:21
4	Q. Okay. Could you please state your full	09:59:22
5	name for the record.	09:59:24
6	A. It's Rüdiger L. Urbanke.	09:59:24
7	Q. Where do you work?	09:59:29
8	A. At -- I'm a full professor at EPFL in	09:59:30
9	Switzerland.	09:59:34
10	Q. What do you do there?	09:59:34
11	A. I'm a full professor in the department of	09:59:35
12	computer science and communications systems.	09:59:38
13	Q. Do you work in the computer science	09:59:43
14	department?	09:59:45
15	A. It's a mixed department of communications	09:59:45
16	and computer science.	09:59:48
17	Q. Okay. And so does that mean that that	09:59:49
18	department has professors who are both in the	09:59:52
19	computer science field and in the communications	09:59:55
20	field?	09:59:58
21	A. That's correct.	09:59:59
22	Q. And you work together?	09:59:59
23	A. That's correct.	10:00:01
24	MR. DOWD: Let's mark as Exhibit 1 a copy	10:00:03
25	of your CV.	10:00:05

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1	(Urbanke Exhibit 1 was marked for	10:00:06
2	identification and attached to the	10:00:06
3	transcript.)	10:00:34
4	(Discussion off the record.)	10:00:34
5	BY MR. DOWD:	10:00:35
6	Q. Do you have before you Exhibit 1?	10:00:35
7	A. Yes.	10:00:37
8	Q. Do you recognize it?	10:00:37
9	A. Yes.	10:00:39
10	Q. What is it?	10:00:39
11	A. It's a CV of -- it's my CV.	10:00:40
12	Q. Is it complete?	10:00:44
13	A. Could you please, you know, make it a	10:00:46
14	little bit more specific what you mean by	10:00:51
15	"complete"?	10:00:53
16	Q. Is there anything that's important to your	10:00:54
17	background that's missing from this CV for the	10:00:56
18	purposes of this case?	10:01:00
19	A. It's, I think, a fair representation.	10:01:01
20	There is, of course, many, many other aspects of my	10:01:04
21	professional life that I could have added, but I	10:01:07
22	wanted to keep it, you know, relatively short.	10:01:10
23	Q. Okay. So Exhibit 1, was this prepared for	10:01:12
24	this case?	10:01:14
25	A. Not specifically. It's a standard CV --	10:01:15

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1	Q.	And is this --	10:01:15
2	A.	-- that I have.	10:01:18
3	Q.	Is Exhibit 1 material that you believe	10:01:18
4		best qualifies you to be an expert in this case?	10:01:23
5	A.	I think it would give a fair idea of who I	10:01:26
6		am and, you know, what my qualifications are.	10:01:30
7	Q.	Okay. On Page 3 there's a list of	10:01:33
8		patents; do you see that?	10:01:38
9	A.	Right.	10:01:39
10	Q.	Those are all U.S. patents?	10:01:39
11	A.	I believe so, yes.	10:01:42
12	Q.	Those are all related to error correction	10:01:43
13		codes.	10:01:47
14	A.	They're perhaps in a wider area, not just	10:01:51
15		error correction.	10:01:55
16	Q.	Is any -- withdrawn.	10:01:56
17		Are any of the patents in the field of	10:01:59
18		computer science?	10:02:01
19		MR. GLASS: Objection to the extent it	10:02:01
20		calls for a legal conclusion.	10:02:05
21		THE WITNESS: I -- I'm not sure exactly	10:02:06
22		if -- if I know what you mean.	10:02:07
23		BY MR. DOWD:	10:02:08
24	Q.	Have you heard -- well, withdrawn.	10:02:09
25		You used the term "computer science"	10:02:10

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1	earlier today. When you used that term what did you	10:02:13
2	mean?	10:02:16
3	A. Professors in computer science.	10:02:16
4	Q. Okay. Using that same understanding, do	10:02:18
5	any of the patents that you've listed on Page 3	10:02:20
6	relate to the field of computer science?	10:02:23
7	MR. GLASS: Same objection.	10:02:26
8	THE WITNESS: Most of these patents would	10:02:44
9	probably be well characterized as relating more to	10:02:46
10	physical layer communication.	10:02:51
11	BY MR. DOWD:	10:02:52
12	Q. Physical layer communication? Did I hear	10:02:52
13	that correctly?	10:02:54
14	A. Mostly, not -- not all of them, but, you	10:02:54
15	know, it's -- it's -- that's my main area of	10:02:58
16	expertise.	10:03:02
17	Q. Okay. So your area is in the physical	10:03:02
18	layer as opposed to the MAC layer or other areas; is	10:03:05
19	that correct?	10:03:08
20	A. It's a fair assessment that most of my	10:03:08
21	work has to do with that aspect, but codes are used	10:03:11
22	in a much wider area of applications.	10:03:15
23	Q. I -- I'm just asking about your	10:03:17
24	experience. So your experience is in the PHY layer?	10:03:19
25	A. My experience has to do in general with	10:03:22

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1	coding.	10:03:25
2	Q. Okay. Now, if we look to the Ph.D. work	10:03:26
3	that you did, am I correct that your Ph.D. thesis	10:03:36
4	related to the field of turbo codes?	10:03:41
5	A. To some degree. This was not the main	10:03:46
6	focus of my Ph.D., but there were some aspect in my	10:03:49
7	Ph.D. that had to do with turbo code.	10:03:52
8	Q. Okay. Now, in addition to turbo codes,	10:03:55
9	you said there were other aspects; what were those?	10:03:57
10	A. The main aspects had to do with what's	10:03:58
11	multiple-access communication. A simple example of	10:04:02
12	what might -- might be meant with this is if you	10:04:05
13	imagine you have your cell phones and many people	10:04:07
14	are trying to communicate to a common cell phone	10:04:10
15	tower, the question is how do you do this	10:04:13
16	efficiently.	10:04:16
17	Q. And am I correct that one of the ways that	10:04:17
18	you investigated was a turbo code?	10:04:19
19	A. Slightly more specifically, I looked at	10:04:25
20	particular ways, information theoretic ways of how	10:04:28
21	to accomplish that. And when you actually implement	10:04:30
22	such a scheme, there's also coding involved and in	10:04:34
23	that aspect, I apply turbo codes.	10:04:34
24	THE REPORTER: I'm sorry.	10:04:34
25	"And in that aspect" --	10:04:34

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1	Repeat that portion, please.	10:04:41
2	THE WITNESS: Right. So in that aspect	10:04:41
3	when you're actually trying to implement that	10:04:44
4	scheme, that involves coding, and for that portion I	10:04:46
5	used turbo codes.	10:04:50
6	BY MR. DOWD:	10:04:51
7	Q. Did you look at any other form of coding?	10:04:52
8	A. I think this was the main form of coding	10:04:55
9	that I used at that time.	10:04:57
10	Q. I see. Have you ever been an expert	10:04:59
11	witness before?	10:05:08
12	A. No.	10:05:09
13	Q. Have you ever been involved in litigation	10:05:09
14	in the United States before?	10:05:11
15	A. No.	10:05:13
16	Q. Welcome.	10:05:17
17	Okay. What is your relationship with	10:05:22
18	Dr. McEliece?	10:05:25
19	MR. GLASS: Objection. Lacks foundation.	10:05:27
20	Go ahead.	10:05:28
21	THE WITNESS: Dr. McEliece is a very, you	10:05:29
22	know, honored colleague. He is someone that, when I	10:05:34
23	was a student, I read his book, a fantastic book. I	10:05:37
24	met him during conferences. I found him to be an	10:05:42
25	extremely original thinker, someone that would	10:05:46

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1 typically never -- never, you know, follow simply 10:05:50
2 the pack but would lead, have original ideas, have 10:05:52
3 extremely good presentation skills, and he's one of 10:05:56
4 our most valued luminaries in the field of 10:06:01
5 information theory and coding. Just one example of 10:06:04
6 why that is true is what's called a Shannon awardee. 10:06:07
7 That's the highest honor that is given by the 10:06:11
8 information field society for people working in that 10:06:15
9 field. 10:06:18
10 BY MR. DOWD: 10:06:21
11 Q. So when -- withdrawn. 10:06:21
12 Would you consider Dr. McEliece a friend? 10:06:22
13 A. I did not have many -- you know, not -- 10:06:28
14 you know, my contacts were relatively infrequent. I 10:06:31
15 had a few e-mail exchanges with him. I would meet 10:06:37
16 him at, you know, a few conferences, perhaps 10:06:41
17 workshops. The closest contact I ever had with him 10:06:44
18 was about two years when I interviewed him for one 10:06:48
19 of the conferences. This conference takes place 10:06:51
20 every year in San Diego. It's called ITA, 10:06:54
21 information theory and applications. 10:06:59
22 And as part of this conference, there 10:07:00
23 is -- you know, there's a more entertainment section 10:07:03
24 in there, and part of this entertainment section 10:07:07
25 involves interviewing some of our most, you know, 10:07:10

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1	well-known people. And I have done this now with a	10:07:14
2	variety of people and Dr. McEliece was one of them.	10:07:17
3	And so there was a segment, perhaps 30	10:07:20
4	minutes long, where we would talk about his life and	10:07:24
5	his accomplishments, but also other aspects of his	10:07:27
6	life that are not necessarily related to, you know,	10:07:30
7	his technical work, simply to show people who he	10:07:33
8	was.	10:07:36
9	Q. Have you ever published a paper together?	10:07:36
10	A. I believe not.	10:07:41
11	Q. Have you ever conducted a research study	10:07:42
12	together?	10:07:45
13	A. No.	10:07:46
14	Q. Have you ever worked for the same	10:07:46
15	employer?	10:07:48
16	A. Certainly not at the same time. I don't	10:07:51
17	know if he ever worked for Bell Labs. Bell Labs	10:07:54
18	is -- I was at Bell Labs. Bell Labs is -- you know,	10:07:56
19	has a long history. He might have at some point	10:07:58
20	been an employee, perhaps, or visited during the	10:08:02
21	summer, not during the time I was there, but I	10:08:05
22	cannot exclude that perhaps at some point in this	10:08:09
23	past he might have had some connections to	10:08:11
24	Bell Labs.	10:08:13
25	Q. And do you have any social relationship	10:08:13

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1	with Dr. McEliece?	10:08:16
2	A. No, other than the one time where I	10:08:17
3	interviewed him. I visited him for a couple hours	10:08:19
4	up in -- in Caltech in order to get some material	10:08:22
5	for him, simply some pictures, some other things	10:08:26
6	that I -- that we could discuss. And at that point	10:08:29
7	we talked about some points in, you know, his life,	10:08:32
8	some events that happened. That was the closest I	10:08:33
9	ever interacted with him.	10:08:36
10	Q. Now, you mentioned that that was about two	10:08:37
11	years ago?	10:08:39
12	A. I believe it was exactly two years ago,	10:08:40
13	around February. So I must have visited end of	10:08:43
14	January or something like that.	10:08:46
15	Q. And that would be --	10:08:50
16	THE REPORTER: Wait, wait. One at a time	10:08:50
17	and you need to repeat the last portion of your	10:08:50
18	answer.	10:08:52
19	THE WITNESS: I believe that the -- so it	10:08:52
20	was two years ago, and I believe it would have been	10:08:55
21	towards the end of January.	10:08:59
22	BY MR. DOWD:	10:09:01
23	Q. Of 2013?	10:09:01
24	A. Of 2013, yeah.	10:09:05
25	Q. Not to get into too sensitive of a	10:09:07

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20

1 subject, but I've been informed that his health is 10:09:11
2 impaired at this point; was he in good health at 10:09:13
3 that point? 10:09:17

4 A. He had some problems. He did well during 10:09:18
5 the interview. But he had some -- you know, he had 10:09:23
6 had some medical issues. I don't know the details 10:09:26
7 of them. 10:09:28

8 Q. Fair enough. Fair enough. 10:09:29

9 Do you know Dr. Khandekar, who's another 10:09:30
10 named inventor in this case? 10:09:36

11 A. I might -- I must have met him sometimes 10:09:37
12 during a conference, but I had the least contact 10:09:42
13 with him as -- as far as I know. 10:09:46

14 Q. Can you recall any specific instance where 10:09:47
15 you met? 10:09:50

16 A. So we have a yearly conference called 10:09:50
17 International Symposium on Information Theory. It's 10:09:53
18 almost sure that at some point we must've met during 10:09:56
19 this conferences, because essentially this is a 10:10:01
20 conference involving about a thousand people, a 10:10:02
21 thousand participants, and essentially everyone in 10:10:05
22 our field would go to this conference. So it's a 10:10:07
23 virtual certainty that we must've met.

24 THE REPORTER: Hold on. You're going to
25 have to slow down for me; Okay? You're going --

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21

1 THE WITNESS: Okay. Sorry.

2 THE REPORTER: -- too fast. I have a
3 little trouble understanding your accent.

4 THE WITNESS: Okay.

5 THE REPORTER: So I need you just to start
6 the last portion over, slow down.

7 THE WITNESS: So there's a conference 10:10:22
8 called the international -- International Symposium 10:10:26
9 of Information Theory. It takes place every year, 10:10:29
10 typically around June. It involves on the order of 10:10:34
11 a thousand participants. And since almost everyone 10:10:38
12 in the field would attend that conference, it's a 10:10:43
13 virtual certainty that at some point I must have run 10:10:47
14 into him, exchanged a few words. I don't recall the 10:10:51
15 specific instance but I think there's a very good 10:10:55
16 chance that that happened. 10:10:57

17 BY MR. DOWD: 10:10:58

18 Q. Okay. And you mentioned the International 10:10:59
19 Symposium on Information Theory; are you also 10:11:02
20 familiar with a conference called Ambleside? 10:11:04

21 A. I -- I've heard the name, although I'm not 10:11:08
22 sure right now where. But I've heard that name 10:11:12
23 before, Ambleside, yes. 10:11:15

24 Q. Have you ever attended the Ambleside 10:11:16
25 conference? 10:11:19

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1 A. I don't think so. If you can tell me 10:11:19
2 exactly where that is -- I -- I've heard the name 10:11:22
3 in -- in -- in the context of our conferences, but I 10:11:24
4 don't believe I've actually been there. 10:11:26
5 Q. You probably know better than me -- 10:11:28
6 A. Okay. 10:11:32
7 Q. -- but my understanding is that it's -- 10:11:32
8 the -- the -- the location is Ambleside and I 10:11:34
9 believe it's in -- 10:11:36
10 A. Yeah. 10:11:36
11 Q. -- the UK. 10:11:37
12 A. Yeah, I don't think I've ever been 10:11:38
13 there -- 10:11:40
14 Q. Okay. 10:11:40
15 A. -- in Ambleside, yeah. 10:11:40
16 Q. How about the Allerton conference; are you 10:11:42
17 familiar with that conference? 10:11:45
18 A. Yes, I'm familiar with that conference. 10:11:46
19 Q. What is the Allerton conference? 10:11:48
20 A. The Allerton conference is another yearly 10:11:50
21 conference. It typically takes place around end of 10:11:53
22 September or beginning of October. It's a 10:11:57
23 conference that has a focus topics in communications 10:12:01
24 and control. Although lately the topics have 10:12:04
25 shifted a little bit. 10:12:12

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23

1	And so it's a yearly conference that is	10:12:12
2	mostly visited by invitation; most of the people	10:12:15
3	there go by invitation.	10:12:18
4	Q. And what sorts of folks attend?	10:12:20
5	A. Mostly from academia. There are special	10:12:23
6	sessions that are organized, and depending on the	10:12:26
7	topic, certain people are invited. And it's	10:12:29
8	organized by faculty, typically from UIUC, from the	10:12:33
9	University of Illinois, Urbana-Champaign.	10:12:44
10	Q. Have you attended?	10:12:44
11	A. Yes.	10:12:46
12	Q. When?	10:12:46
13	A. Perhaps the first time might have been in	10:12:47
14	1992, perhaps. I'm not 100 percent sure. I -- I	10:12:50
15	went to Washington University, which is not very far	10:12:54
16	away, and I started in 1990 at Wash U, so perhaps I	10:13:00
17	probably didn't go the first year, perhaps not the	10:13:06
18	second year, but it's a fair guess that around 1992	10:13:09
19	I started going to this conference.	10:13:12
20	Q. Okay. And -- and have been every year	10:13:14
21	ever since or --	10:13:16
22	A. No. I went for a few years in a row, and	10:13:17
23	then I haven't been now in quite a few years. But	10:13:21
24	I've gone there for perhaps a total of 10 years,	10:13:29
25	perhaps.	10:13:32

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24

1	Q.	Okay. So the key kind of time frame here	10:13:33
2		is about 1997 to about 2000. Did you attend in	10:13:36
3		those -- those years?	10:13:41
4	A.	I -- I can't be for sure. There's a	10:13:46
5		chance that I attended some of these conferences,	10:13:48
6		but I don't know for sure. I would have to check.	10:13:50
7	Q.	Is there any during that period that you	10:13:52
8		recall that you did attend?	10:13:56
9	A.	Not specifically.	10:13:57
10	Q.	All right. You mentioned the IEEE	10:13:58
11		earlier; is there an IEEE transactions on	10:14:09
12		communications?	10:14:12
13	A.	Yes.	10:14:12
14	Q.	What is that conference about?	10:14:13
15	A.	Oh, that's -- I thought you're referring	10:14:16
16		to a journal.	10:14:19
17	Q.	Ah, pardon me.	10:14:20
18	A.	Okay.	10:14:22
19	Q.	Is there an IEEE-sponsored conference in	10:14:22
20		this field?	10:14:26
21	A.	So the transaction of -- sorry, the	10:14:26
22		IEEE -- International Symposium on Information	10:14:31
23		Theory is sponsored by IEEE.	10:14:34
24	Q.	Pardon me.	10:14:37
25	A.	So is the -- is ITA, and I believe that so	10:14:37

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25

1 is now the Allerton conference, although I believe 10:14:42
2 that this is only very recently so that the Allerton 10:14:48
3 conference is associated to IEEE. I believe that 10:14:51
4 this might only be the last, perhaps, five, six 10:14:54
5 years or so. 10:14:58
6 Q. Uh-huh. And as you move from conference 10:14:59
7 to conference, International Symposium on 10:15:02
8 Information Theory, the Allerton conference, the ITA 10:15:07
9 conference, I think we also mentioned Ambleside, is 10:15:10
10 it generally the same folks attending these 10:15:14
11 conferences? 10:15:17
12 MR. GLASS: Objection. Vague. Lacks 10:15:18
13 foundation. 10:15:20
14 THE WITNESS: There's some overlap of 10:15:20
15 people, but they're also distinct people that would 10:15:24
16 only go to some of these conferences. 10:15:28
17 BY MR. DOWD: 10:15:31
18 Q. Okay. But you would see some of the same 10:15:32
19 people over and over again at these different 10:15:34
20 conferences? 10:15:37
21 MR. GLASS: Same objections. 10:15:37
22 THE WITNESS: Some of them; some of 10:15:38
23 these -- some of these people might be at various 10:15:39
24 conferences. 10:15:42
25 ///

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1	BY MR. DOWD:	10:15:42
2	Q. Okay. Let's return to the inventors.	10:15:42
3	The third named inventor on the patents	10:15:48
4	that we're dealing with is a Dr. Jin; do you know	10:15:50
5	Dr. Jin?	10:15:54
6	A. I must've also met him at some of these	10:15:55
7	conferences.	10:16:00
8	Q. Do you have a personal relationship with	10:16:01
9	him?	10:16:02
10	A. No.	10:16:03
11	Q. Do you recall any specific instance where	10:16:03
12	you've met him?	10:16:05
13	A. I'm afraid not any particular date and	10:16:06
14	time. But I'm sure I must've met him, I must've	10:16:09
15	talked to him at some point, not extensively --	10:16:14
16	Q. Uh-huh.	10:16:14
17	A. -- and I might have had an occasional	10:16:18
18	e-mail exchange at some point, but various -- you	10:16:20
19	know, perhaps a few. But I don't recall any	10:16:22
20	particular e-mail exchange or any particular time	10:16:24
21	that I met him.	10:16:26
22	Q. Got it. Let's turn to the preparation for	10:16:27
23	the deposition.	10:16:32
24	What did you do to prepare for the	10:16:32
25	deposition today?	10:16:34

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1	MR. GLASS: As phrased I'm going to object	10:16:35
2	to that question. It calls for -- potentially	10:16:37
3	calling for attorney-client privileged information	10:16:39
4	and instruct the witness not to answer.	10:16:42
5	THE WITNESS: Could you just please repeat	10:16:44
6	the question?	10:16:45
7	BY MR. DOWD:	10:16:45
8	Q. Sure. What did you do to prepare for your	10:16:46
9	deposition today?	10:16:48
10	MR. GLASS: And the same objection as	10:16:49
11	phrased and instruct the witness not to answer.	10:16:51
12	MR. DOWD: Are you going to follow that	10:16:52
13	instruction?	10:16:54
14	THE WITNESS: Yes.	10:16:54
15	MR. DOWD: That's an improper instruction.	10:16:55
16	MR. GLASS: I think as phrased, that	10:16:57
17	question is overbroad. We both know the boundaries	10:16:58
18	of the question, so...	10:17:02
19	MR. DOWD: I'm not going to waste time	10:17:02
20	debating it with you.	10:17:04
21	MR. GLASS: Sure.	10:17:05
22	MR. DOWD: To the extent you continue to	10:17:06
23	make improper instructions, we'll raise it with the	10:17:08
24	judge.	10:17:11
25	MR. GLASS: That instruction was not	10:17:12

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1 improper, but I agree let's not waste time. 10:17:13

2 MR. DOWD: There's not supposed to be 10:17:13

3 speaking objections here. 10:17:15

4 BY MR. DOWD: 10:17:15

5 Q. Now, Dr. Urbanke, did you prepare for your 10:17:18

6 deposition today? 10:17:20

7 A. I wrote this expert report. 10:17:20

8 Q. Okay. Other than writing the expert 10:17:23

9 report, without getting into any details, did you do 10:17:26

10 anything else? 10:17:29

11 A. Nothing specific. 10:17:29

12 Q. Okay. In advance of coming to the 10:17:31

13 deposition today, did you meet with counsel; "yes" 10:17:33

14 or "no"? 10:17:36

15 A. In advance to meet -- I met with counsel 10:17:36

16 several times also preparing for the report. 10:17:39

17 Q. Okay. So let's talk first about the -- 10:17:42

18 the preparation of the -- preparation for the 10:17:45

19 deposition, okay? 10:17:47

20 When did you first meet to prepare for the 10:17:50

21 deposition? 10:17:53

22 A. There was no specific time to prepare for 10:17:54

23 this thing. This is a continuation of writing my 10:17:58

24 report. I'm simply making sure that, you know, 10:18:00

25 everything is in order, that I know all the facts. 10:18:03

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1 Q. Okay. You have a document in front of 10:18:06
2 you; is that your report? 10:18:08
3 A. Yes. 10:18:09
4 Q. Can you hand over whatever you have there? 10:18:10
5 A. (Witness complied.) 10:18:12
6 Q. Actually, why don't you hand over the full 10:18:13
7 stack. Great. Thanks. 10:18:16
8 So who selected the documents that you 10:18:52
9 have in front of you? 10:18:54
10 A. These are documents that are deemed 10:18:55
11 important -- I deem important for, you know, the 10:18:58
12 preparation for today. 10:19:01
13 Q. Okay. The last document in the stack is a 10:19:03
14 paper by Dr. MacKay; do you see that? 10:19:06
15 A. Yes, I see that. 10:19:11
16 Q. Who is Dr. MacKay? 10:19:12
17 A. Dr. MacKay is originally a physicist in 10:19:14
18 the area of statistic physics. I believe he has 10:19:18
19 some connections to Bob McEliece. Perhaps he was 10:19:21
20 his student or he was his post doc. I don't know. 10:19:25
21 Q. Uh-huh. 10:19:25
22 A. And for some point in time, he got 10:19:28
23 interested in error code decoding. He wrote -- he 10:19:30
24 wrote some papers on it. He then got out and is now 10:19:33
25 in a different area. And he's, you know, located in 10:19:38

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1	Great Britain.	10:19:41
2	Q. Okay. Just because I don't remember the	10:19:43
3	title from -- by heart, what was the title of the	10:19:45
4	paper that you have there?	10:19:47
5	A. This paper is entitled:	10:19:54
6	"Comparison of Constructions of	10:19:56
7	Irregular Gallagher Codes."	10:19:58
8	Q. Why did you select that paper to bring	10:20:00
9	with you today?	10:20:03
10	A. It's, you know, one paper that deals with	10:20:04
11	the general area that we're talking about.	10:20:07
12	Q. Okay. So MacKay worked in the area that	10:20:10
13	relates to this case?	10:20:13
14	A. Yes.	10:20:16
15	MR. DOWD: Let's mark as Exhibit 2 a copy	10:20:16
16	of your report. Feel free to use either the exhibit	10:20:19
17	version or your own version.	10:20:23
18	(Urbanke Exhibit 2 was marked for	10:20:26
19	identification and attached to the	10:20:26
20	transcript.)	10:20:51
21	BY MR. DOWD:	10:20:51
22	Q. Do you recognize Exhibit 2?	10:20:52
23	A. Yes.	10:20:53
24	Q. What is it?	10:20:53
25	A. It's my expert report.	10:20:54

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1	Q.	Now, when were you first engaged for this	10:20:56
2		case?	10:21:00
3	A.	I believe it must have been January,	10:21:01
4		sometime in January.	10:21:07
5	Q.	Of 2015?	10:21:08
6	A.	Yes.	10:21:09
7	Q.	And how were you contacted?	10:21:10
8	A.	I was contacted by an attorney. His name	10:21:14
9		is Mark Tung who asked me to -- if I	10:21:19
10		was --	10:21:24
11		MR. GLASS: I'm going to caution the	10:21:24
12		witness not to divulge any communications between	10:21:26
13		you and counsel.	10:21:28
14		BY MR. DOWD:	10:21:30
15	Q.	Well, let me ask, when in January did	10:21:30
16		Mr. Tong contact you?	10:21:33
17	A.	I don't recall the exact date.	10:21:34
18	Q.	Was it around New Year's or was it around	10:21:36
19		the end of the month?	10:21:39
20	A.	It was earlier.	10:21:41
21	Q.	Okay. Now, did Mr. Tong provide to you	10:21:44
22		any facts that you've relied on in the course of	10:21:52
23		reaching the opinions expressed in Exhibit 2?	10:21:55
24	A.	No.	10:22:00
25	Q.	What were you asked to do?	10:22:00

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1	A.	So the general question that was posed to	10:22:09
2		me is what is stated in my report. I was asked to	10:22:11
3		give a general opinion about the state-of-the-art	10:22:16
4		and to give some opinions relating to a paper that	10:22:20
5		I'm a co-author with. It's Richardson, et al.	10:22:24
6		And also I added some opinions that have	10:22:28
7		to do with the Luby '79 and the Luby '98 papers.	10:22:32
8	Q.	Is that Luby '97?	10:22:38
9	A.	Sorry, what did I say? Yeah, sorry. '97	10:22:39
10		and '98, yeah.	10:22:42
11	Q.	And if I refer to the Richardson paper	10:22:44
12		that you're a co-author on as Richardson '99, will	10:22:47
13		that make sense?	10:22:52
14	A.	Correct.	10:22:53
15	Q.	Okay. Now, how long did you spend working	10:22:55
16		on the case between the time that you were	10:22:58
17		originally contacted and the time that the report	10:23:01
18		was produced on February 17th?	10:23:03
19	A.	I don't have the exact hours, but I would	10:23:05
20		guess that, perhaps, it took me on the order of	10:23:09
21		maybe 50 hours or something like that. But that's a	10:23:13
22		rough estimate. I don't have the exact, you know,	10:23:16
23		number; I have not tallied up the number.	10:23:18
24	Q.	Okay. Who wrote the report?	10:23:22
25	A.	I didn't type every single word, but this	10:23:23

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1	is my report. I wrote this report.	10:23:26
2	Q. Okay. Who typed it?	10:23:28
3	A. Various parts were, you know, typed up.	10:23:30
4	Q. Okay. Did you receive any portion of this	10:23:35
5	already written?	10:23:39
6	A. No. Well, this is my -- this is my --	10:23:41
7	it's my opinion, my work, and this is my -- my	10:23:44
8	things. But I didn't type everything up myself.	10:23:47
9	Q. Okay. You understand that there are also	10:23:50
10	reports from a Dr. Shokrollahi and a Dr. Divsalar in	10:23:52
11	this case?	10:23:59
12	A. I've heard names mentioned, but I have no	10:23:59
13	particular knowledge about, you know, who -- who	10:24:02
14	is -- might be other experts or something like that.	10:24:04
15	I've heard some names mentioned, but that's it.	10:24:07
16	Q. If paragraphs of your report are	10:24:10
17	word-for-word identical to the paragraphs in	10:24:13
18	Dr. Shokrollahi or Dr. Divsalar's report, can you	10:24:15
19	explain how that happened?	10:24:18
20	MR. GLASS: Objection. Vague. Lacks	10:24:19
21	foundation.	10:24:23
22	THE WITNESS: If you could point out a	10:24:23
23	particular paragraph that might have the	10:24:25
24	characteristic.	10:24:27
25	///	

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1	BY MR. DOWD:	10:24:28
2	Q. Sure. I will. I'll come back to that.	10:24:29
3	Let me look at Paragraph 5 with you for a	10:24:31
4	second.	10:24:35
5	A. Sure.	10:24:36
6	Q. It's on educational background?	10:24:37
7	Do you see in the second line it starts	10:24:43
8	talking about time frequency transform?	10:24:50
9	A. Yes.	10:24:50
10	Q. Is that just an error?	10:24:53
11	THE REPORTER: Wait. Hold on. Hold on.	
12	"Do you see in the second line" --	
13	Start there and slow down.	
14	Q. It starts talking about time frequency	
15	transform. Is that just an error?	
16	A. Yeah, that's an error.	10:24:55
17	Q. Okay. Are you aware of any other errors	10:24:57
18	in the report?	10:25:00
19	A. I don't think anything grave. I think,	10:25:00
20	you know, University of Vienna should technically be	10:25:04
21	University Vienna, I missed that word. But there's	10:25:07
22	only one university in Vienna, so there's no	10:25:11
23	possible cause of confusion.	10:25:16
24	Q. Okay. After -- I guess between your	10:25:20
25	retention in January and the date of the report,	10:25:24

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1	February 17th, how many times did you meet with	10:25:28
2	counsel?	10:25:31
3	A. "Meet" means exactly what?	10:25:36
4	Q. Meeting in person.	10:25:38
5	A. Between -- what was the time frame, again,	10:25:41
6	I'm sorry?	10:25:44
7	Q. When you were retained for the case and	10:25:45
8	the February 17th date on your report?	10:25:47
9	A. I believe once.	10:25:49
10	Q. Where was that meeting?	10:25:50
11	A. In San Francisco.	10:25:52
12	Q. When did that take place?	10:25:54
13	A. When exactly was that? Today was the	10:26:04
14	25th. Perhaps two weeks ago.	10:26:07
15	Q. Okay.	10:26:14
16	A. Perhaps a little bit more, yeah.	10:26:14
17	Q. How long was the meeting?	10:26:16
18	A. I would say, perhaps, two or three hours	10:26:19
19	or something on this order.	10:26:29
20	Q. And what was the purpose?	10:26:31
21	A. In general to get some legal counsel. I'm	10:26:35
22	not a lawyer.	10:26:38
23	Q. Okay. Did it relate to any of the	10:26:44
24	opinions that are stated in your report?	10:26:52
25	A. No.	10:26:54

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1	Q.	Okay. At any time between when you were	10:26:54
2		retained and when you signed your report on	10:26:56
3		February 17th, were you provided with any facts that	10:26:59
4		you were asked to assume for the purpose of this	10:27:02
5		case?	10:27:05
6	A.	No.	10:27:05
7	Q.	If we'd turn to the last page, Page 36,	10:27:05
8		that is your signature?	10:27:09
9	A.	Yes.	10:27:10
10	Q.	Okay. Now, I take it you've been retained	10:27:14
11		by Caltech for the case; is that correct?	10:27:19
12	A.	I'm not sure I understand exactly. Can	10:27:22
13		you tell me what that means, "retained by	10:27:26
14		Caltech," --	10:27:27
15	Q.	Who --	10:27:27
16	A.	-- as opposed -- as opposed to who else	10:27:28
17		would -- I'm not sure exactly what, you know -- what	10:27:30
18		exactly means "retained" here.	10:27:35
19	Q.	Well, I don't know the facts of how you	10:27:37
20		came to be retained, so if you could just tell me	10:27:40
21		who retained you, that's what I'm after.	10:27:43
22	A.	I -- as I mentioned, I was contacted to be	10:27:46
23		an expert witness in this case.	10:27:48
24	Q.	Okay. Did you sign any form of engagement	10:27:50
25		letter?	10:27:54

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1	A.	No.	10:27:54
2	Q.	Did you sign any form of agreement?	10:27:54
3	A.	No.	10:27:57
4	Q.	Are you receiving any form of compensation	10:27:57
5		for your opinions?	10:28:00
6	A.	Yes, as stated in my expert report, I	10:28:01
7		receive a compensation that is based on an hourly	10:28:05
8		charge.	10:28:08
9	Q.	Okay. So how much are you being paid for	10:28:09
10		the opinions in your report?	10:28:12
11	A.	I'm being paid \$500 per hour.	10:28:13
12	Q.	Now, you understand the case involves four	10:28:18
13		patents?	10:28:22
14	A.	Yes.	10:28:22
15	Q.	And if I refer to them as the '710, the	10:28:26
16		'032, the '781, and the '833 patents, does that make	10:28:31
17		sense to you?	10:28:36
18	A.	Yes.	10:28:37
19	Q.	Okay. Before being retained by -- for	10:28:39
20		this case -- well, just because it's going to bug	10:28:41
21		me, so you don't know whether you were retained by	10:28:45
22		Caltech or by the law firm that represents Caltech;	10:28:48
23		is that the issue?	10:28:51
24	A.	Yes.	10:28:52
25	Q.	All right. Before you were retained, had	10:28:53

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1	you ever seen the '710 patent?	10:28:56
2	A. I don't believe so.	10:28:58
3	Q. Had you ever seen the '032 patent?	10:29:00
4	A. I don't believe so.	10:29:03
5	Q. How about the '781?	10:29:04
6	A. I don't believe so.	10:29:06
7	Q. How about the '833?	10:29:06
8	A. I don't believe so.	10:29:09
9	Q. Have you ever read any of these patents	10:29:10
10	before you were retained?	10:29:12
11	A. I don't believe so.	10:29:13
12	Q. Okay. When is the first time that you	10:29:14
13	heard of these patents?	10:29:20
14	A. When I reviewed the case history, that's	10:29:22
15	when, you know, I heard about these particular	10:29:24
16	patents.	10:29:27
17	Q. Okay. And that was sometime in January?	10:29:27
18	A. January throughout -- yes, January and	10:29:29
19	then February -- extending to February until the	10:29:32
20	report was written, yes.	10:29:35
21	Q. Okay. Of this year?	10:29:36
22	A. Yes.	10:29:38
23	Q. Okay. Have you analyzed the claims of the	10:29:38
24	'710 patent?	10:29:50
25	A. No.	10:29:51

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1	Q.	How about the '032?	10:29:52
2	A.	No.	10:29:53
3	Q.	'781?	10:29:53
4	A.	No.	10:29:55
5	Q.	'833?	10:29:55
6	A.	No.	10:29:59
7	Q.	I -- I noticed when I was reading the	10:29:59
8		report, there's no opinion that compares any	10:30:02
9		specific prior art reference to any claim	10:30:06
10		limitation; is that correct?	10:30:11
11	A.	That's correct.	10:30:12
12	Q.	Okay. So you -- you've not attempted to	10:30:12
13		determine whether any reference or combination of	10:30:14
14		references discloses the limitations of one of the	10:30:17
15		asserted claims?	10:30:24
16	A.	I have been asked to comment on the report	10:30:25
17		of Dr. Frey, and so my response was my expertise was	10:30:27
18		in response to what was written by Dr. Frey, but not	10:30:33
19		specifically to the claims of the patent.	10:30:36
20	Q.	Okay. And -- and -- and just so there's	10:30:38
21		no mystery about it, part of the processes, so that	10:30:39
22		I can understand what are the right areas to ask you	10:30:43
23		and what are the wrong areas to ask you --	10:30:46
24	A.	Right.	10:30:48
25	Q.	-- and I just want to confirm that you	10:30:48

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1 have not formed any opinion about whether the 10:30:51
2 Divsalar reference, for example, the Luby '97, 10:30:54
3 Luby '98, Richardson '99, Frey '99, you've not 10:30:59
4 formed any opinion about whether those specific 10:31:04
5 references disclose the specific limitations of any 10:31:06
6 claim that's asserted in this case? 10:31:09
7 A. No. 10:31:11
8 Q. Okay. When is the first time you heard 10:31:13
9 the term "IRA code"? 10:31:15
10 MR. GLASS: Lacks foundation. 10:31:18
11 MR. DOWD: I hope not. 10:31:24
12 THE WITNESS: Sorry? 10:31:26
13 MR. DOWD: I said: "I hope not." 10:31:27
14 THE WITNESS: I didn't understand. 10:31:31
15 MR. GLASS: You can go ahead and answer 10:31:31
16 the question. 10:31:33
17 THE WITNESS: Okay. 10:31:34
18 BY MR. DOWD: 10:31:34
19 Q. Let me ask the question again. I was just 10:31:34
20 being funny. Your counsel said that it lacks 10:31:37
21 foundation which would suggest that you never heard
22 the term "IRA code," which would be a funny thing if
23 you're giving testimony about IRA codes.
24 THE REPORTER: Sir --
25 MR. DOWD: You don't have to take it down.

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1 THE REPORTER: Yeah, this is being
2 videotaped and I've got to take a clear record, so I
3 just need you to slow down; okay?

4 MR. DOWD. Yeah, fair enough.

5 THE REPORTER: Thank you.

6 MR. DOWD: I'll just reask the question.

7 THE REPORTER: I appreciate that.

8 MR. DOWD: I'll just reask the question. 10:31:51

9 THE REPORTER: Go ahead. 10:31:52

10 BY MR. DOWD: 10:31:52

11 Q. So the question was, when is the first 10:31:54

12 time you heard the term "IRA codes"? 10:31:56

13 A. I can't assert with certainty when exactly 10:31:59

14 I heard it, but it must have been -- or, you know, 10:32:03

15 there was a conference at the International 10:32:07

16 Symposium on Information Theory, for example, in 10:32:10

17 probably June or July 2000, certainly there I 10:32:13

18 must've heard about it. Whether or not I heard 10:32:17

19 about it slightly prior to it, I don't know. 10:32:20

20 Q. Okay. So the first concrete time that you 10:32:23

21 can recall is a conference in June/July 2000? 10:32:25

22 A. I don't actually recall the event, but 10:32:28

23 since I was there at the conference and I do 10:32:31

24 remember that, you know, there was some excitement 10:32:33

25 about those codes, it must have been at that point 10:32:35

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1	in time that, you know, that happened. That's the	10:32:39
2	most logical explanation.	10:32:41
3	Q. All right. IRA codes, the I, the R, the A	10:32:44
4	it's an acronym, right?	10:32:48
5	A. Exactly.	10:32:49
6	Q. What does I stand for?	10:32:50
7	A. Irregular.	10:32:59
8	Q. What does R stand for?	10:33:00
9	A. Repeat.	10:33:01
10	THE REPORTER: Wait. Slow down. You guys	10:33:01
11	are going to have to just slow down. Start with.	10:33:01
12	"What does I stand for" --	10:33:01
13	THE WITNESS: Irregular.	10:32:59
14	BY MR. DOWD:	10:33:00
15	Q. What does R stand for?	10:33:00
16	A. Repeat.	10:33:01
17	Q. And what does A stand for?	10:33:02
18	A. Accumulate.	10:33:04
19	MR. DOWD: Why don't we mark as Exhibit 3	10:33:12
20	a copy of the '781 patent just for reference.	10:33:17
21	(Urbanke Exhibit 3 was marked for	10:33:21
22	identification and attached to the	10:33:21
23	transcript.)	10:33:44
24	BY MR. DOWD:	10:33:44
25	Q. Do you have Exhibit 3?	10:33:45

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1	A.	Yes, I do.	10:33:46
2	Q.	Have you seen it before?	10:33:47
3	A.	Yes.	10:33:49
4	Q.	What is it?	10:33:49
5		MR. GLASS: Objection. Vague.	10:33:51
6		THE WITNESS: Let me just check here,	10:34:16
7		sorry. So this is the third one in a continuation	10:34:18
8		of patents, the third out of the four patents that	10:34:45
9		were filed by these three inventors.	10:34:48
10		BY MR. DOWD:	10:34:53
11	Q.	Okay. So is this a copy of the '781	10:34:53
12		patent?	10:34:58
13	A.	Sorry, are you asking me if that's a copy?	10:34:58
14	Q.	Yes. Exhibit 3 is a copy of the '781	10:35:02
15		patent?	10:35:06
16	A.	Yes, I believe so.	10:35:06
17	Q.	Okay. Now, if you turn to the last page,	10:35:07
18		which has on the bottom the page number ending in	10:35:10
19		3 -- 6351, you see there are claims that are recited	10:35:14
20		there?	10:35:21
21	A.	Yes.	10:35:21
22	Q.	Have you read these claims before?	10:35:21
23	A.	I very quickly skimmed through them simply	10:35:24
24		for the purpose of determining that they relate to	10:35:27
25		IRA codes, but I didn't examine these claims in any	10:35:30

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1	detail.	10:35:33
2	Q. Okay. Do you understand what a claim	10:35:33
3	limitation is?	10:35:36
4	A. I have a very vague understanding of what	10:35:37
5	it is.	10:35:40
6	Q. What is your understanding?	10:35:40
7	A. Sorry, what the -- what the limitations in	10:35:45
8	general -- the claims in general are? That's what	10:35:48
9	the question is?	10:35:48
10	THE REPORTER: I'm sorry.	10:35:48
11	THE WITNESS: Okay.	10:35:48
12	THE REPORTER: I didn't catch that.	10:35:48
13	You're going to have to repeat yourself, please.	10:35:54
14	THE WITNESS: Okay. Sorry, perhaps I	10:35:54
15	didn't understand the previous question exactly.	10:35:55
16	Okay.	10:35:57
17	BY MR. DOWD:	10:35:57
18	Q. What is your understanding of what a claim	10:35:57
19	limitation is, generally?	10:36:00
20	A. I understand what -- the very basic idea	10:36:03
21	of what claims are, what the limitations in	10:36:07
22	particular are. If that refers to something	10:36:10
23	different than the claims, I'm not sure I	10:36:12
24	understand.	10:36:13
25	Q. Okay. Let me -- let me see if I can	10:36:13

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1	approach it a different way.	10:36:15
2	If you focus on the right column, there's	10:36:17
3	a Claim 19?	10:36:20
4	A. Yes.	10:36:22
5	Q. Do you understand that it's the words that	10:36:24
6	are recited in Claim 19 that define the right of the	10:36:27
7	patent?	10:36:31
8	A. Yes.	10:36:33
9	MR. GLASS: Objection. Vague. Calls for	10:36:34
10	a legal conclusion.	10:36:35
11	BY MR. DOWD:	10:36:35
12	Q. Okay. So when I'm referring to the	10:36:36
13	"limitations of the claim," I'm referring to the	10:36:38
14	words that are used.	10:36:40
15	A. The elements.	10:36:41
16	Q. Right. And do you understand that unless	10:36:42
17	something's recited by the claim, it's not required	10:36:45
18	by the claim?	10:36:48
19	A. Okay. I wasn't aware of that particular	10:36:53
20	limitation.	10:36:57
21	Q. Okay. So in -- in performing the analysis	10:36:58
22	reflected in your report, you were not aware that	10:37:01
23	it's the limitations of the claim that define the	10:37:07
24	rights?	10:37:10
25	MR. GLASS: Objection. Mischaracterizes	10:37:10

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1 testimony. 10:37:12

2 THE WITNESS: I did not do a patent -- I 10:37:12

3 did not -- I did not do a claim investigation or a 10:37:15

4 claim thing. The only reason I looked at these 10:37:19

5 claims was to determine that in general they refer 10:37:22

6 to IRA codes. That's the extent to which I looked 10:37:25

7 at the claims. 10:37:29

8 BY MR. DOWD: 10:37:30

9 Q. Okay. But you do know that if the claim 10:37:31

10 doesn't require -- withdrawn. 10:37:37

11 If the claim doesn't recite a requirement, 10:37:39

12 then the claim doesn't require that requirement, 10:37:43

13 right? 10:37:47

14 A. Might very well be so. I'm not a lawyer; 10:37:47

15 I don't know. 10:37:50

16 Q. You can't answer that one way or the 10:37:51

17 other? 10:37:53

18 A. If you say so, I trust you that that's 10:37:53

19 true but -- 10:37:56

20 Q. Okay. 10:37:56

21 A. -- I'm not a lawyer. 10:37:56

22 Q. Let's just focus on Claim 19, for example. 10:37:58

23 There's no reference in Claim 19 to the 10:38:05

24 Shannon limit, right? 10:38:09

25 MR. GLASS: Objection. Calls for a legal 10:38:17

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1 conclusion. 10:38:18
2 THE WITNESS: There's not the word 10:38:18
3 "Shannon" in there directly, but that doesn't 10:38:19
4 necessarily mean it doesn't reference it in some 10:38:22
5 indirect way. I have not investigated that with 10:38:24
6 respect to this aspect, so I don't know. 10:38:28
7 BY MR. DOWD: 10:38:30
8 Q. Okay. So you have no opinion about 10:38:30
9 whether Claim 19 requires performance within some 10:38:32
10 percentage of the Shannon limit, correct? 10:38:35
11 A. I have not done this analysis. I don't 10:38:38
12 know. 10:38:41
13 Q. All right. And that's true for all claims 10:38:41
14 that are asserted in this case? 10:38:43
15 A. Yes, I have not looked at the claims with 10:38:44
16 respect to a particular question. 10:38:47
17 Q. You see Claim 19 also does not recite any 10:38:49
18 encoding or decoding that -- that it has to be in 10:38:53
19 linear time as opposed to something else, right? 10:38:58
20 MR. GLASS: Objection. Calls for a legal 10:39:01
21 conclusion. 10:39:02
22 THE WITNESS: Might be. As -- as I said, 10:39:02
23 I've -- I've not been asked to do that analysis, and 10:39:05
24 so I have not done it. I don't know. 10:39:08
25 ///

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1 BY MR. DOWD: 10:39:10
2 Q. Okay. So you have no opinion about -- 10:39:10
3 withdrawn. 10:39:10
4 So you have formed no opinion that 10:39:15
5 Claim 19 or any other claim asserted in this case 10:39:18
6 requires encoding or decoding in linear time? 10:39:22
7 A. No, I have not done this analysis. 10:39:25
8 Q. All right. Now, Claim 19 also doesn't 10:39:28
9 recite anything about complexity, a minimum 10:39:35
10 complexity, does it? 10:39:41
11 MR. GLASS: Calls for a legal conclusion. 10:39:42
12 THE WITNESS: Same -- same answer as 10:39:43
13 before. It might very well be, but I have not 10:39:44
14 looked at that. 10:39:47
15 BY MR. DOWD: 10:39:48
16 Q. Okay. So you have no opinion about 10:39:48
17 whether any claim at issue in this case has a 10:39:50
18 minimum complexity requirement? 10:39:53
19 A. No. 10:39:54
20 Q. Okay. Let's turn back to your report for 10:40:08
21 a second, and if we could go to Paragraph 82, 10:40:11
22 please. Just let me know when you have that. 10:40:15
23 A. Yes, I have I found the paragraph. 10:40:35
24 Q. And that paragraph begins: 10:40:37
25 "As the paper by Dr. McEliece and his 10:40:39

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1 teammates demonstrates, inventing" -- 10:40:47
2 THE REPORTER: Wait. I'm sorry, slow
3 down.
4 "As the"?
5 BY MR. DOWD:
6 Q. -- "paper by Dr. McEliece and his
7 teammates demonstrates, inventing IRA 10:40:50
8 codes consisted of more than," -- 10:40:50
9 And then it continues; do you see that? 10:40:52
10 A. Right. 10:40:54
11 Q. What paper are you talking about? 10:40:55
12 A. I referred to the paper that irregular IRA 10:40:58
13 codes -- one version of this -- a short version of 10:41:05
14 this paper was -- was published or was represented 10:41:10
15 at the -- the International Symposium of Information 10:41:14
16 Theory. 10:41:22
17 MR. DOWD: Let's mark as Exhibit 4, I 10:41:22
18 believe, a copy of the Exhibit B from your report, 10:41:30
19 the list of materials considered. 10:41:33
20 (Urbanke Exhibit 4 was marked for 10:41:35
21 identification and attached to the 10:41:35
22 transcript.) 10:41:59
23 BY MR. DOWD: 10:41:59
24 Q. Do you have Exhibit 4? 10:41:59
25 A. Yes, I have Exhibit 4. 10:42:00

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1	Q.	And this is the list of materials that you	10:42:02
2		considered in forming the opinions in your report in	10:42:05
3		the case; is that correct?	10:42:08
4	A.	Yes.	10:42:09
5	Q.	Can you identify which paper you're	10:42:09
6		talking about in Paragraph 82?	10:42:13
7	A.	It must be the second International	10:42:23
8		Symposium on Turbo Codes and Related Topics.	10:42:25
9	Q.	Is that the one that begins:	10:42:31
10		"Jin et al., irregular	10:42:34
11		repeat-accumulate codes"?	10:42:35
12	A.	Yes.	10:42:38
13	Q.	Six from the bottom?	10:42:38
14	A.	Yes.	10:42:41
15		MR. DOWD: Let's mark as a copy of	10:42:44
16		Exhibit 5 the Jin et al., IRA codes paper.	10:42:46
17		(Urbanke Exhibit 5 was marked for	10:42:52
18		identification and attached to the	10:42:52
19		transcript.)	10:43:18
20	BY MR. DOWD:		10:43:18
21	Q.	Do you have Exhibit 5?	10:43:19
22	A.	Let me just check that that's the same.	10:43:28
23		Yes, I do.	10:43:35
24	Q.	Okay. And is Exhibit 5 a copy of the Jin	10:43:35
25		et al., IRA codes paper that you're referring to in	10:43:40

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1	Paragraph 82?	10:43:43
2	A. Yes.	10:43:44
3	Q. Okay. Now, when you were performing your	10:43:45
4	analysis, did you use the Jin et al., IRA codes	10:43:49
5	paper?	10:43:53
6	A. I looked at that paper, yes.	10:43:54
7	Q. And in performing your analysis, you	10:43:58
8	compared the prior art references that we discussed	10:44:01
9	earlier, the Luby '97 and '98, the Richardson '99,	10:44:06
10	and the other references to IRA codes; do you recall	10:44:09
11	that?	10:44:13
12	A. Yes.	10:44:13
13	Q. When you performed this analysis, were the	10:44:17
14	IRA codes that you had in mind the codes in the	10:44:21
15	paper that we marked as Exhibit 5?	10:44:23
16	A. IRA codes have various representation;	10:44:29
17	this is one particular representation of these	10:44:31
18	codes.	10:44:33
19	Q. Okay. And so my question is, when you	10:44:33
20	performed the comparison of the prior art to IRA	10:44:36
21	codes, were the IRA codes that you had in mind the	10:44:39
22	ones from Exhibit 5?	10:44:42
23	A. I had in mind in general application of	10:44:45
24	IRA codes. There are various ways of representing	10:44:49
25	them. And so my understanding for IRA codes applies	10:44:52

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1 to the general way of thinking of IRA codes. 10:44:55
2 Q. Okay. And so that would include the IRA 10:44:59
3 codes in Exhibit 5; is that right? 10:45:02
4 A. That is one particular way of representing 10:45:04
5 IRA codes. 10:45:06
6 Q. All right. 10:45:07
7 Okay. Let's turn to Paragraph 57 in your 10:45:56
8 report. And you begin a discussion there of a 10:45:59
9 repeat-accumulate codes; do you have that in mind? 10:46:10
10 A. You said Paragraph 58 or 57, sir? 10:46:12
11 Q. If I misspoke, I apologize; I meant 51. 10:46:15
12 A. You're talking about the one product of 10:46:26
13 the research, trying to analyze? 10:46:28
14 Q. Yes. So there's a discussion from 10:46:31
15 Paragraph 51 through about 58 of RA codes, right? 10:46:35
16 A. Yes. 10:46:42
17 Q. What are RA codes? 10:46:43
18 A. Repeat-accumulate codes. 10:46:45
19 Q. So repeat-accumulate codes are serial 10:46:48
20 concatenated codes, correct? 10:46:53
21 A. Repeat-accumulate codes are a particular 10:46:56
22 version of turbo codes, which were invented by the 10:47:01
23 set of -- or which were published by a set of 10:47:05
24 authors in an attempt to try to understand why turbo 10:47:10
25 codes which were introduced in '93 behaved so well. 10:47:15

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1 It was at that point, you have to 10:47:17
2 imagine -- a, you know, quite a confused time in 10:47:19
3 which people didn't really understand why these 10:47:24
4 codes were doing so well. And whereas most people 10:47:27
5 at that point in time would have gone off and tried 10:47:32
6 to make codes more complicated and trying to get 10:47:35
7 even better numbers, you know, RA codes went the 10:47:40
8 opposite way and tried to simplify it in an attempt 10:47:44
9 to come up with something that was so simple that 10:47:49
10 potentially they could be analyzed. 10:47:52

11 They were never thought to be codes that 10:47:53
12 could potentially could actually be used in 10:47:57
13 practice. It was considered a toy or as a teaching 10:48:00
14 tool. 10:48:04

15 Q. So when you said RA codes "are a 10:48:04
16 particular version of turbo codes," what did you 10:48:07
17 mean? 10:48:12

18 A. You take an RA code, you take a turbo code 10:48:12
19 and you essentially eliminate everything and bring 10:48:14
20 it down to the simplest possible version which is 10:48:17
21 not revealed. 10:48:20

22 Q. Which is not trivial? 10:48:24

23 A. You -- you -- you're trying to eliminate 10:48:25
24 all kinds of complexity so that what you end up with 10:48:27
25 is still something that, you know, is not, you know, 10:48:31

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1 the empty set or not something empty. So it's the 10:48:36
2 simplest possible version which shows -- excuse 10:48:38
3 me -- which shows some characteristics of turbo 10:48:40
4 codes, but it was not intended to accurately reflect 10:48:42
5 what turbo codes do, nor was it ever intended to 10:48:46
6 match in any way the performance of turbo codes. 10:48:50
7 Q. I understand. 10:48:53
8 A. Okay. 10:48:54
9 Q. I'm just getting at what your 10:48:54
10 understanding of an RA code is. 10:48:56
11 And is it fair to say that an RA code is 10:48:58
12 an attempt to take a turbo code and simplify it down 10:49:01
13 to basic elements for the purpose of analysis? 10:49:06
14 A. Yes. 10:49:08
15 Q. Okay. 10:49:08
16 MR. DOWD: Let's mark as Exhibit 6, I 10:49:16
17 believe -- 10:49:21
18 THE REPORTER: Yes. 10:49:21
19 MR. DOWD: -- a copy of the paper, "Coding 10:49:22
20 Theorems for 'Turbo-Like' Codes," by Divsalar et 10:49:25
21 al., bears Bates numbers HUGHES1916 through 1925. 10:49:32
22 (Urbanke Exhibit 6 was marked for 10:49:37
23 identification and attached to the 10:49:37
24 transcript.) 10:50:02
25 ///

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1	BY MR. DOWD:	10:50:02
2	Q. Do you have Exhibit 6?	10:50:02
3	A. Yes.	10:50:04
4	Q. Do you recognize it?	10:50:04
5	A. Yes.	10:50:07
6	Q. What is it?	10:50:10
7	A. It's the paper entitled:	10:50:11
8	"Coding Theorems for Turbo-Like	10:50:13
9	Codes."	10:50:17
10	Q. And if I refer to this as the "Divsalar	10:50:17
11	paper," will that make sense to you?	10:50:21
12	A. Yes.	10:50:23
13	Q. When's the first time you saw the Divsalar	10:50:23
14	paper?	10:50:28
15	A. It must have been about the time when it	10:50:28
16	was published, so I guess '98, around that time, I	10:50:31
17	believe. I have to check exactly when the	10:50:38
18	publication date was.	10:50:40
19	Q. And how did you come to read it in '98?	10:50:42
20	A. Let me see if I see the conference --	10:50:54
21	either through the conference or I must've received	10:50:58
22	it by one of the office. Let me check.	10:51:02
23	So I must say I don't know exactly how I	10:52:02
24	first received it, but I assume that I, perhaps, saw	10:52:04
25	a talk that they gave relating to this, perhaps	10:52:08

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1 the -- either the International Symposium of 10:52:13
2 Information Theory or perhaps at the Allerton 10:52:17
3 conference, could have been either. 10:52:20
4 Q. Okay. Is there a reason why this paper 10:52:22
5 sticks out in your mind? 10:52:24
6 A. Yes. 10:52:26
7 Q. Why is that? 10:52:26
8 A. Because IRA codes were an important 10:52:27
9 development of turbo codes exactly for the reason 10:52:32
10 that they simplified things and they showed a 10:52:34
11 particular analysis which is called the input/output 10:52:38
12 weight distribution analysis or -- and/or, you know, 10:52:42
13 he's referred I think in a particular sentence as 10:52:45
14 interleaver gain analysis, has various other names 10:52:49
15 in the literature. 10:52:52
16 And so this was, I believe, the first time 10:52:54
17 interleaver gain exponent conjecture -- sorry, 10:52:58
18 interleaver gain exponent conjecture and I believe 10:53:02
19 it's the first time that people managed to carry 10:53:03
20 through this analysis for something that looked like 10:53:09
21 a turbo code. And so that's why it was an important 10:53:12
22 paper in the development of coding theorem. 10:53:15
23 Q. Okay. Just as a digression, you mentioned 10:53:23
24 that you may have received a copy of this from one 10:53:31
25 of the authors; do you recall that? 10:53:35

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1 A. I -- as I said, I don't recall whether or 10:53:36
2 not I downloaded it perhaps on a conference web page 10:53:39
3 or perhaps I received the paper directly, perhaps by 10:53:43
4 going to the conference, perhaps people might have 10:53:46
5 distributed the copy. 10:53:50
6 So there are various ways of -- of how 10:53:51
7 this might have happened, but I don't recall how I 10:53:52
8 might have first come to see it. 10:53:55
9 Q. We're going to come to this when we get to 10:53:57
10 the -- to your Richardson '99 paper, but was it 10:54:00
11 common at this time, '98, '99, 2000, for people 10:54:03
12 working in the field to e-mail copies of their 10:54:08
13 papers to each other? 10:54:11
14 MR. GLASS: Objection. Vague. 10:54:12
15 Go ahead. 10:54:13
16 THE WITNESS: Not very common, I think. 10:54:14
17 BY MR. DOWD: 10:54:16
18 Q. Okay. But it did happen? 10:54:17
19 A. It happened on occasions. 10:54:18
20 Q. All right. You mentioned the interleaver 10:54:21
21 gain exponent conjecture; do you recall that? 10:54:28
22 A. Yes. 10:54:32
23 Q. And that's referring to the fact that in 10:54:32
24 an RA code the repeat and the accumulate are 10:54:35
25 separated by an interleaver? 10:54:38

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1	A.	Yes.	10:54:40
2	Q.	And the idea was, what, that the	10:54:41
3		interleaver approved performance over either of	10:54:44
4		those two codes alone?	10:54:47
5	A.	The idea was that the -- the accumulate	10:54:50
6		itself is a trivial code that doesn't give any	10:54:56
7		coding gain whatsoever, but that for a particular	10:55:00
8		combination of these elements, nevertheless some not	10:55:04
9		very good, but a reasonable, you know, code could be	10:55:09
10		constructed. As I said, it was not a good code;	10:55:13
11		there were much better codes out there. These were	10:55:16
12		not considered to be any particularly ground	10:55:19
13		breaking codes. But they had some characteristics	10:55:24
14		of turbo codes, and since at that point the analysis	10:55:26
15		that one wanted to carry out for turbo codes was not	10:55:30
16		possible to do, it was carried out first here, just	10:55:33
17		showing that, in principal, some type of analysis	10:55:37
18		could be carried through for some codes that had	10:55:41
19		some of the characteristics of turbo codes.	10:55:46
20	THE REPORTER:	Wait.	10:55:46
21		"Could be carried through"?	10:55:47
22	THE WITNESS:	Carried through for some	10:55:47
23		codes that had some of the characteristics of turbo	10:55:50
24		codes.	10:55:53
25		///	

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1	BY MR. DOWD:	10:55:54
2	Q. You mentioned a couple times the idea of a	10:55:54
3	good code; is your idea of a good code related to	10:55:58
4	its performance against the Shannon limit?	10:56:05
5	A. So there are many parameters in which a	10:56:07
6	code can be good. Let me just mention a few. It's	10:56:10
7	not a one dimensional issue.	10:56:13
8	Q. Uh-huh.	10:56:16
9	A. One important one is, indeed, the -- what	10:56:17
10	sometimes is called the gap to capacity, how close a	10:56:20
11	code can operate reliably close to the Shannon	10:56:24
12	limit. But there are many, many other parameters	10:56:28
13	that are important for a code.	10:56:32
14	The encoding complexity, that's the number	10:56:33
15	of operations that are needed to perform the	10:56:37
16	encoding operation; the decoding complexity, so the	10:56:39
17	number of operations that are required to perform	10:56:44
18	the decoding, these are both related also to the	10:56:47
19	energy consumption that the code has.	10:56:52
20	Further characteristics might be the error	10:56:55
21	floor that relates to whether or not a code, even	10:56:59
22	though it might be possible to decode essentially	10:57:04
23	all the bits, there might still be, with some	10:57:08
24	nonnegotiable probability, a few of the bits that	10:57:12
25	are left and cannot be decoded.	10:57:16

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1 And, you know, these are, perhaps, some of 10:57:19
2 the main characteristics. Further ones that are 10:57:22
3 important in practice is how such a code could be 10:57:26
4 mapped into hardware. So depending on hardware or 10:57:28
5 software, depending on what platform, what 10:57:33
6 application. 10:57:36
7 And all of this together gives a fairly 10:57:36
8 complex vector that needs to be optimized, criteria 10:57:41
9 to be optimized. And depending on the application, 10:57:47
10 one would then judge which code would be best for 10:57:50
11 that particular application. 10:57:53
12 Q. Okay. And let me pause on that for a 10:57:54
13 minute. Am I correct that you could perform 10:57:58
14 miserably on all of those characteristics and still 10:58:01
15 be an IRA code? 10:58:04
16 MR. GLASS: Objection. Vague. 10:58:07
17 THE WITNESS: There are probably some 10:58:09
18 tweaks you can do. That probably would depend on 10:58:16
19 very fine definition of what you imply with an -- 10:58:20
20 with an RA code. So you could probably on purpose, 10:58:23
21 trying to, you know, choose something that is very 10:58:29
22 bad. 10:58:33
23 BY MR. DOWD: 10:58:33
24 Q. And I'm using the definition of RA code 10:58:33
25 you gave me earlier. 10:58:35

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1	My only question is, some IRA codes could	10:58:37
2	be optimized to perform very well under these	10:58:43
3	criteria; some could be not optimized and perform	10:58:48
4	poorly on some or all of these criteria; both would	10:58:50
5	be IRA codes?	10:58:55
6	MR. GLASS: Objection. Vague. Outside	10:58:55
7	the scope.	10:58:56
8	Go ahead.	10:58:56
9	THE WITNESS: Not all. IRA codes are very	10:58:57
10	special in many -- in many parameters. So I agree	10:59:00
11	that, for example, in terms of the Shannon limit you	10:59:03
12	could have differences depending on how exactly one	10:59:05
13	chose it. But no matter how you do it, it will	10:59:08
14	always be linear time encodable and there will	
15	always --	
16	THE REPORTER: Hold on. Hold on. Slow	
17	down.	
18	"But no matter how" --	
19	Start there.	10:59:13
20	THE WITNESS: How you do it, there will	10:59:13
21	always be linear time encodable; there will be	10:59:16
22	linear time decodable, and they're very natural to	10:59:21
23	be mapped into, you know, hardware applications.	10:59:25
24	BY MR. DOWD:	10:59:28
25	Q. Okay. And so those characteristics,	10:59:28

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1	linear time encodable, linear time decodable, easy	10:59:31
2	to map into hardware, that's also all true of RA	10:59:36
3	codes, right?	10:59:41
4	MR. GLASS: Same objections.	10:59:42
5	THE WITNESS: RA codes have some of these	10:59:43
6	characteristics, I agree, yes.	10:59:45
7	BY MR. DOWD:	10:59:47
8	Q. Those three that I just mentioned, right?	10:59:47
9	MR. GLASS: Same objections.	10:59:50
10	THE WITNESS: RA codes are linear time	10:59:54
11	encodable, that's correct.	10:59:56
12	BY MR. DOWD:	10:59:58
13	Q. And they're, from a hardware standpoint,	10:59:58
14	relatively easy to implement, correct?	11:00:00
15	A. That's correct.	11:00:04
16	Q. Okay. And I think we agreed a moment ago	11:00:04
17	that, with respect to the performance against the	11:00:07
18	Shannon limit or what you referred to as the gap to	11:00:11
19	capacity, you could have an IRA code that performs	11:00:15
20	very well or you could have an IRA code that	11:00:19
21	performs poorly, both of which would be IRA codes,	11:00:22
22	right?	11:00:28
23	MR. GLASS: Outside the scope. Outside	11:00:28
24	the scope.	11:00:31
25	THE WITNESS: Yes.	11:00:31

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1	BY MR. DOWD:	11:00:31
2	Q. Okay. And that's also true of RA codes,	11:00:31
3	right?	11:00:35
4	MR. GLASS: Same objections.	11:00:35
5	THE WITNESS: RA codes almost uniformly	11:00:36
6	are not very good codes. I don't think you can have	11:00:38
7	RA codes that are very good codes in pretty much any	11:00:42
8	application.	11:00:45
9	BY MR. DOWD:	11:00:45
10	Q. Let me ask it a slightly different way,	11:00:46
11	because I meant to ask a different question, so	11:00:48
12	sorry.	11:00:51
13	You can have RA codes that perform closer	11:00:51
14	to the Shannon limit and RA codes that perform	11:00:54
15	farther away from the Shannon limit, right?	11:00:57
16	A. RA codes would be uniformly relatively far	11:01:02
17	away from the Shannon limit.	11:01:05
18	Q. I don't disagree with you that they would	11:01:07
19	all be probably worse than IRA codes, or maybe	11:01:10
20	there's an overlap, I don't know. But my point is	11:01:14
21	only that you can have better performing and worse	11:01:17
22	performing codes when you -- when you're looking at	11:01:20
23	as your criteria a gap to capacity, right?	11:01:24
24	MR. GLASS: Vague. Outside the scope.	11:01:26
25	THE WITNESS: I don't exactly agree	11:01:36

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1 with -- with you, because RA codes, the way they are 11:01:37
2 is essentially one RA code for a particular rate 11:01:39
3 that you want. So -- so you cannot really compare 11:01:44
4 various RA codes for the same application. So 11:01:47
5 essentially there is one RA code that you have in 11:01:50
6 essence if you think about large ones. 11:01:53
7 So it's not really that you could compare 11:01:56
8 one with another one. 11:01:58
9 BY MR. DOWD: 11:02:01
10 Q. I don't want to spend too much time on 11:02:03
11 this because I think I'm together with you, but you 11:02:05
12 can design different RA codes for different rates, 11:02:08
13 right? 11:02:11
14 A. Right. 11:02:11
15 Q. Those may perform closer to the Shannon 11:02:12
16 limit or farther away from the Shannon limit for 11:02:17
17 that particular channel? 11:02:19
18 MR. GLASS: Same objections. 11:02:22
19 THE WITNESS: The Shannon limit is a 11:02:23
20 function of the rate, so you cannot really directly 11:02:24
21 compare these. 11:02:27
22 BY MR. DOWD: 11:02:28
23 Q. I understand that. What I'm saying is 11:02:28
24 that if you look from channel to channel, sometimes 11:02:31
25 the RA code will be closer and sometimes it will be 11:02:37

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1	farther away.	11:02:39
2	THE REPORTER: "From channel"?	11:02:39
3	Hold on.	11:02:39
4	"From channel to channel"?	11:02:39
5	BY MR. DOWD:	11:02:39
6	Q. Sometimes the RA code will be closer;	11:02:37
7	sometimes it will be farther away?	11:02:39
8	MR. GLASS: Same objections.	11:02:40
9	THE WITNESS: You would have to give me a	11:02:41
10	definition of what "closeness" means since we are	11:02:43
11	not talking about the same case. You're comparing	11:02:45
12	essentially apples to oranges, so unless you give me	11:02:48
13	a definition of what the -- you know, what the --	11:02:52
14	what the difference the Shannon limit would be for	11:02:54
15	various different rates and how you would compare	11:02:55
16	different cases I cannot answer that question.	11:02:59
17	BY MR. DOWD:	11:03:01
18	Q. All right. We can -- we can come back to	11:03:02
19	that.	11:03:04
20	MR. DOWD: Why don't we take our first	11:03:10
21	break.	11:03:12
22	THE VIDEOGRAPHER: Going off the record.	11:03:13
23	The time is 11:03 a.m.	11:03:14
24	(Recess taken at 11:03 a.m.)	11:03:16
25	THE VIDEOGRAPHER: We are back on the	11:11:24

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1	record. The time is 11:11 a.m.	11:11:25
2	BY MR. DOWD:	11:11:28
3	Q. Now, before the break we discussed	11:11:29
4	Dr. MacKay at one point; do you recall that?	11:11:33
5	A. Yes.	11:11:36
6	Q. Do you know Dr. MacKay?	11:11:36
7	A. Yes.	11:11:38
8	Q. Have you met him personally?	11:11:39
9	A. Yes.	11:11:41
10	Q. How do you know him?	11:11:41
11	A. I met him at conferences. He also visited	11:11:42
12	me, I think, on one or two occasions at EPFL as a	11:11:45
13	speaker as we have many other people that are	11:11:49
14	visiting. And I might have been once at -- I'm not	11:11:52
15	sure if it was Cambridge or at least some university	11:11:55
16	in the UK where he had organized the workshop and I	11:11:59
17	was invited as one of the speakers there too.	11:12:03
18	Q. Okay. Back in this time frame, '98	11:12:06
19	through about 2000, were you aware of Dr. MacKay's	11:12:10
20	work?	11:12:14
21	A. This was a very, very confused time frame,	11:12:15
22	so just maybe a little bit to set the stage.	11:12:17
23	Essentially there was the invention of turbo codes	11:12:23
24	in '93, and starting, perhaps, in '95, there were	11:12:25
25	three or four different groups that, from very	11:12:29

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1	different directions, started to working on coding.	11:12:32
2	Some of them were traditional people in	11:12:35
3	coding, typically in the E community, typically	11:12:39
4	trying to improve turbo codes.	11:12:41
5	But at the -- at the same time, there were	11:12:43
6	two other groups that got into the game; one was	11:12:45
7	David MacKay, and I think Dr. Frey at some point	11:12:50
8	connected up with him and there were several papers	11:12:56
9	together.	11:13:01
10	They essentially rediscovered what is	11:13:01
11	called the Gallagher codes or LDPC codes and -- at	11:13:03
12	some point and, you know, realized that they had	11:13:09
13	rediscovered concepts from the '60s.	11:13:11
14	At the same time they had a background in	11:13:14
15	physics. Brendan Frey probably is more computer	11:13:18
16	science.	11:13:23
17	On the other hand, there was a group	11:13:25
18	involving Luby and his co-authors. They have a	11:13:28
19	background of theoretical computer science and	11:13:32
20	mathematics and they were interested in a completely	11:13:35
21	different aspect, not the physical layer	11:13:39
22	applications or transmission but they were	11:13:41
23	interested in content distribution.	11:13:45
24	And they, themselves, have started	11:13:47
25	independently, particularly Spielman and --	11:13:50

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1	THE REPORTER: Wait. Wait. I need you to	11:13:55
2	repeat that again. I didn't understand it.	11:13:56
3	THE WITNESS: Right. So they, themselves,	11:13:56
4	in particular amongst a group of authors that are on	11:13:58
5	the Luby et al., papers, in particular Spielman and	11:14:01
6	Luby themselves, have started independently in	11:14:08
7	various groups, at some point they connected, and	11:14:11
8	they were interested in content distribution.	11:14:14
9	And they also rediscovered a version of	11:14:18
10	Gallagher codes and a version of this decoding	11:14:20
11	algorithm. And at some point realized that they had	11:14:24
12	basically rediscovered that concept themselves.	11:14:29
13	Now, all these groups were in very	11:14:31
14	different communities, some of them in theoretical	11:14:35
15	computer science. They would publish at conferences	11:14:38
16	like STOCK or FOX which are theoretical computer	11:14:40
17	science conferences.	11:14:44
18	MacKay had a physics background, that	11:14:44
19	meant, again, he would, even though he had a	11:14:50
20	similar goal of coming up with error correcting	11:14:55
21	codes, would have a very different --	11:14:55
22	THE REPORTER: Wait.	11:14:55
23	"Even though he had a similar goal"?	11:14:57
24	THE WITNESS: Goal of finding good error	11:14:57
25	correcting codes, he would use a very, very	11:15:02

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1	different language.	11:15:04
2	And then there were people in EE that used	11:15:05
3	traditional language that is used for coding. And	11:15:08
4	it took quite a while for these groups to somehow	11:15:11
5	merge to find a common language and to understand	11:15:14
6	that they were talking about similar concepts or the	11:15:18
7	same concepts but expressed in this very different	11:15:21
8	languages.	11:15:24
9	BY MR. DOWD:	11:15:26
10	Q. Have you finished your answer?	11:15:26
11	A. Yes.	11:15:28
12	Q. So my question was, were you familiar with	11:15:31
13	Dr. MacKay's work in 1998 through 2000?	11:15:34
14	A. Certainly by the year 2000, I would have	11:15:37
15	known him.	11:15:40
16	Q. How about '99?	11:15:41
17	A. I would have to -- you know, I cannot be	11:15:49
18	absolutely positive, but it's -- it's possible,	11:15:52
19	yeah.	11:15:54
20	Q. What's your best understanding?	11:15:54
21	A. Now, in the '99 preprint version of our	11:16:14
22	paper, he's not cited as one of the references. So	11:16:18
23	perhaps he was at that point not high on my radar	11:16:22
24	screen. Whether I heard his name before it or not,	11:16:25
25	I cannot swear. Right now I don't know. But he's	11:16:29

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1 not as one -- listed as one of the references in 11:16:32
2 the -- in the '99 paper, which was '99, April 6. 11:16:34
3 So at that point he was not mentioned in 11:16:37
4 the list of references. 11:16:39
5 Q. When did he first give a visiting lecture 11:16:40
6 at your university? 11:16:44
7 A. Oh, perhaps 2004, 2005. I don't know. 11:16:45
8 Perhaps later. 11:16:49
9 Q. Now, you talked about a group in the 11:16:51
10 physics or computer science area; you talked about a 11:16:55
11 group in the coding theory area? 11:16:59
12 A. Right. 11:16:59
13 Q. Do you recall that? 11:17:02
14 A. Right. 11:17:03
15 Q. The group in the computer science physics 11:17:05
16 area is looking at LDPC codes, right? 11:17:09
17 A. Yes, they rediscovered something which 11:17:14
18 later turned out to be LDPC codes. 11:17:16
19 Q. And that's Luby MacKay? 11:17:19
20 A. No, MacKay was not part of this group. 11:17:22
21 Q. Okay. 11:17:22
22 A. It's Luby -- it's Luby, Mitzenmacher, 11:17:26
23 Shokrollahi and Spielman, so these are the main 11:17:28
24 actors in that round. 11:17:32
25 Q. And then we've been talking before about 11:17:33

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1	Divsalar and the RA codes?	11:17:35
2	A. Right.	11:17:36
3	Q. You say that's a different group working	11:17:36
4	on different types of research?	11:17:39
5	A. Yes.	11:17:41
6	Q. Is your opinion in the case based on a	11:17:42
7	belief that a person in the RA codes group would not	11:17:47
8	have been aware of the Luby '97, Luby '98,	11:17:51
9	Richardson '99 papers?	11:17:57
10	A. It's my opinion that they were not widely	11:17:58
11	read. There certainly must have been some people	11:18:03
12	that were aware. I first became aware when Aamod	11:18:06
13	joined Bell Labs --	11:18:06
14	THE REPORTER: "I first became aware" --	11:18:06
15	THE WITNESS: I first became aware of that	11:18:13
16	line of work when Aamod joined Bell Labs. I believe	11:18:13
17	it was '99, although I don't know the exact date	11:18:18
18	when he joined.	11:18:22
19	At that point he told us -- since he was	11:18:22
20	part of the other group as well, he told us about	11:18:25
21	that work and I became aware of that work.	11:18:28
22	BY MR. DOWD:	11:18:28
23	Q. Let me ask you, then, the direct question.	11:18:31
24	Is it your opinion that a person of	11:18:34
25	ordinary skill in the art in 1999 would not have	11:18:38

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1 been aware of the Luby '97 and Luby '98 references? 11:18:43

2 A. It's very unlikely that they would have 11:18:46

3 been aware. 11:18:50

4 Q. And is your opinion in the case based on 11:18:50

5 them not being aware of those references? 11:18:52

6 A. Sorry, what was the first question? I 11:18:55

7 thought these were different questions. I -- can 11:18:57

8 you repeat the first question again, please. 11:18:59

9 Q. The -- are the opinions that you've 11:18:59

10 expressed in your report in this case based on your 11:19:02

11 belief that a person of ordinary skill would not 11:19:04

12 have been aware of the Luby '98 or '98 --

13 A. No --

14 THE REPORTER: Wait. Wait. Hold on.

15 MR. DOWD: Yes, sir.

16 THE REPORTER: You need to slow down for

17 me, please.

18 And you need to allow him to ask the

19 complete --

20 THE WITNESS: Sorry.

21 THE REPORTER: -- question before you

22 answer.

23 THE WITNESS: Sorry.

24 THE REPORTER: Okay? Can I get a clean

25 question without interruption, please. 11:19:22

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1	BY MR. DOWD:	11:19:22
2	Q. Are the opinions that are expressed in	11:19:25
3	your report based on your belief that a person of	11:19:28
4	ordinary skill in information theory would not have	11:19:31
5	been aware of the Luby '97 or Luby '98 references?	11:19:35
6	A. No, not entirely. There's simply one	11:19:38
7	other aspect that I mentioned, but...	11:19:41
8	Q. Okay. So when you say they're "not	11:19:43
9	entirely," are they based in part on your belief	11:19:46
10	that a person of ordinary skill in information	11:19:48
11	theory would not have been aware of Luby '97 and	11:19:50
12	Luby '98?	11:19:54
13	A. No, let me rephrase it.	11:19:55
14	My opinion that it would have been not	11:19:57
15	obvious to combine this is not based on the fact	11:19:59
16	that they would not have been available. But I also	11:20:02
17	expressed the opinion that these papers at that	11:20:05
18	point in time would have been very unlikely to be	11:20:07
19	known by people in various areas.	11:20:10
20	Q. "Unlikely to be known," is that what you	11:20:12
21	said?	11:20:15
22	A. That someone of ordinary skills would have	11:20:15
23	been aware of these papers.	11:20:19
24	Q. It is "unlikely"?	11:20:19
25	A. It's very unlikely, yes.	11:20:21

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1 Q. Okay. And your opinions in your report 11:20:23
2 are in part based on that belief, correct? 11:20:25
3 A. No, it's just one other aspect that I 11:20:27
4 mentioned. 11:20:31
5 Q. Well, when you say it's one aspect that 11:20:31
6 you mentioned, am I correct that you mention it 11:20:34
7 because it affects your opinions in this case? 11:20:36
8 A. It doesn't -- it doesn't affect the 11:20:38
9 opinion whether a person of ordinary skills could 11:20:41
10 have combined it. I just thought that I also 11:20:44
11 mentioned that these were completely different 11:20:47
12 communities. And so it's another reason that a 11:20:49
13 person might not have even been aware of the papers. 11:20:52
14 Q. Okay. So you have no actual basis to 11:20:55
15 believe that there was not a person in 1999 who, in 11:20:58
16 fact, knew about Richardson '99, Luby '98, Luby '97, 11:21:04
17 and the Divsalar paper? 11:21:11
18 A. I cannot be certain that there were no -- 11:21:14
19 no people that knew all these papers combined. 11:21:17
20 That's correct. 11:21:21
21 Q. Okay. Let's go back to the Divsalar 11:21:22
22 paper, Exhibit 6. And I'd like to focus on the -- 11:21:28
23 the Figure 3, which you had reproduced in your 11:21:33
24 report, which appears on Page 5, original Page 5 of 11:21:37
25 the Divsalar paper. 11:21:46

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1	Do you have that?	11:21:47
2	A. Yes.	11:21:48
3	Q. And I'd like to walk through how this	11:21:48
4	works from left to right, okay?	11:21:51
5	A. Right.	11:21:55
6	Q. So what's shown here in Figure 3 and	11:21:56
7	discussed on Page 5 is a method of encoding a	11:21:59
8	signal, right?	11:22:05
9	A. That's correct.	11:22:06
10	Q. And reading from left to right, the first	11:22:06
11	thing that happens is that the encoder receives a	11:22:09
12	block of data N in the signal to be encoded, right?	11:22:14
13	MR. GLASS: Objection. Calling for a	11:22:18
14	legal conclusion.	11:22:21
15	THE WITNESS: On a technical basis,	11:22:21
16	there's a stream of bits that come in there. And	11:22:23
17	these bits are repeated by factor Q.	11:22:27
18	BY MR. DOWD:	11:22:30
19	Q. Well, if you look above the figure, do you	11:22:31
20	see the third sentence of the paragraph where it	11:22:35
21	says:	11:22:37
22	"An information block of length N"?	11:22:37
23	A. The third -- can you just please, again,	11:22:42
24	say where it is.	11:22:45
25	Q. Yes. Above the figure, the third sentence	11:22:46

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1 of the paragraph, says: 11:22:50
2 "An information block of length N." 11:22:52
3 Do you see that? 11:22:53
4 A. Yes. 11:22:54
5 Q. And then in the figure we see, there's N 11:22:55
6 coming in from the left, right? 11:22:58
7 A. Yes. 11:23:00
8 Q. So that is a block of information bits, 11:23:00
9 right? 11:23:03
10 MR. GLASS: Same objection. Outside the 11:23:03
11 scope. Calling for a legal conclusion. 11:23:05
12 THE WITNESS: To me it could be a block; 11:23:08
13 it could be a sequence. It's information that 11:23:11
14 starts at some point in time. 11:23:14
15 BY MR. DOWD: 11:23:15
16 Q. Okay. And at least we know the Divsalar 11:23:15
17 paper says it's a "block of length N," right? 11:23:19
18 A. There is a sentence that contains the word 11:23:25
19 "block," yes. 11:23:27
20 Q. Now, the next thing that happens is the 11:23:37
21 encoder in Figure 3 performs an encoding operation 11:23:58
22 using the N information bits as the input, right? 11:24:08
23 A. How do you mean "the next" -- the whole 11:24:15
24 diagram represents the encoding. 11:24:17
25 Q. Okay. Well, let's see if we can just 11:24:18

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1	agree that the encoder of Figure 3 performs an	11:24:21
2	encoding operation using the N information bits as	11:24:25
3	its input, right?	11:24:30
4	MR. GLASS: Same objections.	11:24:31
5	THE WITNESS: So there is a sequence of	11:24:33
6	bits that are shifted into this register or into	11:24:37
7	this particular systems. You know, the whole	11:24:42
8	diagram is a systems point of view in which you have	11:24:44
9	various boxes and information shifted from the left	11:24:47
10	to the right, and as it is shifted through, every	11:24:50
11	box performs certain operations on that particular	11:24:53
12	sequence.	11:24:57
13	BY MR. DOWD:	11:24:57
14	Q. Okay. And in a repeat-accumulate code,	11:24:58
15	the repeat-accumulate code, like what's shown in	11:25:06
16	Figure 3, will perform an encoding operation, right?	11:25:10
17	MR. GLASS: Same objections. Calling for	11:25:14
18	a legal conclusion. Outside the scope of the expert	11:25:16
19	report.	11:25:20
20	THE WITNESS: So the systems point of view	11:25:26
21	is a point of view in which information is	11:25:28
22	transformed, and that overall description is a	11:25:35
23	description of an encoder, yes.	11:25:37
24	BY MR. DOWD:	11:25:39
25	Q. Okay. Let's just focus briefly on what	11:25:39

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1	each one of these blocks is, okay; do you have that	11:25:42
2	in mind?	11:25:46
3	A. Sure.	11:25:47
4	Q. The first block is a rate 1 over Q	11:25:47
5	repetition encoder, right?	11:25:51
6	A. Correct.	11:25:52
7	Q. The next block labeled: "P," that's an	11:25:52
8	interleaver, right?	11:25:56
9	A. Correct.	11:25:57
10	Q. And then the final block labeled:	11:25:58
11	"Rate-1, one over one plus D," that's an	11:26:02
12	accumulation block, right?	11:26:05
13	A. Correct.	11:26:07
14	Q. Okay. So the encoding operation will	11:26:08
15	include repeating the N bits Q times in the repeater	11:26:15
16	block, right?	11:26:20
17	A. The repetition will repeat incoming bits,	11:26:21
18	every incoming bit Q times; that's correct.	11:26:25
19	Q. Okay. And that means every bit in the	11:26:29
20	block of N bits will be repeated Q times, right?	11:26:32
21	A. Each of the incoming bits will be repeated	11:26:36
22	Q times --	11:26:36
23	(Overlapping speakers.)	11:26:36
24	THE REPORTER: Wait. I -- go ahead.	11:26:39
25	MR. GLASS: Same objections. Outside the	11:26:39

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1	scope. I didn't mean to interrupt.	11:26:42
2	THE REPORTER: It's okay.	11:26:42
3	And then can I get your answer again,	11:26:42
4	please.	11:26:43
5	THE WITNESS: Incoming bits, every	11:26:43
6	incoming bit will be repeated Q times.	11:26:48
7	BY MR. DOWD:	11:26:51
8	Q. And that's every bit of the information	11:26:51
9	block N, right?	11:26:54
10	MR. GLASS: Same objections.	11:26:55
11	THE WITNESS: Now, you know, this paper is	11:26:58
12	not particularly the one that I was asked to opinion	11:27:02
13	on. And, you know, it's not clear to me that I	11:27:05
14	would like to do another realtime analysis of this	11:27:11
15	particular paper. I was not asked to do so for my	11:27:15
16	expert report.	11:27:19
17	BY MR. DOWD:	11:27:21
18	Q. Well, sir, this figure appears in	11:27:22
19	Paragraph 54 of your expert report, correct?	11:27:25
20	A. That's true. And it's -- in general it's	11:27:26
21	a -- you know, a particular repeat --	11:27:30
22	repeat/accumulate code, takes information, repeats	11:27:34
23	it Q times, permutes it, and then puts it through an	11:27:36
24	accumulator.	11:27:42
25	Q. All right. So let's walk through how that	11:27:43

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1	works.	11:27:47
2	The output of the repeater is shown as qN	11:27:47
3	bits, right?	11:27:51
4	A. Correct.	11:27:52
5	MR. GLASS: Same objections.	11:27:53
6	BY MR. DOWD:	11:27:54
7	Q. And that means that there are Q copies of	11:27:54
8	each of the N bits, right?	11:27:57
9	MR. GLASS: Same objections. Outside the	11:27:59
10	scope.	11:28:01
11	THE WITNESS: As I said, a repeat	11:28:14
12	accumulator code takes bits, repeats them, permutes	11:28:16
13	them, and then accumulates them. That's what I've	11:28:21
14	also written in my expert report. These are the	11:28:25
15	components. And that's the degree to which I have,	11:28:30
16	you know, examined the exact ramifications of that	11:28:35
17	particular scheme.	11:28:38
18	BY MR. DOWD:	11:28:39
19	Q. Well, what -- what I'd like to do is --	11:28:40
20	and I understand you've said that, but let's walk	11:28:42
21	through the pieces of that so that we can understand	11:28:46
22	and be on the same page.	11:28:48
23	So "yes," "no," "I don't know."	11:28:51
24	The rate-1 over Q repetition block will	11:28:54
25	produce at its output qN repeated bits?	11:28:59

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1	MR. GLASS: Same objections. Outside the	11:29:05
2	scope.	11:29:06
3	THE WITNESS: The repetition will take	11:29:06
4	every incoming bit and will repeat it Q times.	11:29:11
5	BY MR. DOWD:	11:29:14
6	Q. Okay. And is there something about the	11:29:14
7	math that would yield a different result than qN	11:29:17
8	repeated bits?	11:29:20
9	MR. GLASS: Vague. Outside the scope.	11:29:20
10	Go ahead.	11:29:22
11	THE WITNESS: What a repeater does, that's	11:29:23
12	exactly what it does. It takes every single bit,	11:29:27
13	repeats it Q times.	11:29:30
14	BY MR. DOWD:	11:29:34
15	Q. Okay.	11:29:34
16	A. That's what a repeater does.	11:29:32
17	Q. All right. And then those qN repeated	11:29:34
18	bits are input to the interleaver P, right?	11:29:37
19	A. The stream of information that's coming in	11:29:40
20	with the permuted bits is then being interleaved;	11:29:42
21	that's correct.	11:29:48
22	Q. Okay. And what happens in the interleaver	11:29:49
23	P is that you change the order of the bits, right?	11:29:53
24	MR. GLASS: Same objections.	11:29:57
25	THE WITNESS: That's correct.	11:29:58

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1	BY MR. DOWD:	11:29:59
2	Q. Then the qN repeated bits are output from	11:30:00
3	the interleaver and input to the accumulator block,	11:30:08
4	right?	11:30:13
5	A. You take the stream off bits that come out	11:30:13
6	of the interleaver and you put it through an	11:30:17
7	accumulator, yes.	11:30:21
8	Q. And that's shown in the figure as the qN	11:30:21
9	bits going into the rate-1 accumulator, right?	11:30:24
10	A. I see a symbol qN appearing and an error	11:30:27
11	that goes into the rate-1 one plus one over D block.	11:30:30
12	THE REPORTER: Wait.	11:30:30
13	"Going to the rate" --	11:30:30
14	Start there, please.	11:30:34
15	THE WITNESS: I'm -- I'm seeing a symbol	11:30:34
16	called qN which goes into a rate-1 one plus one over	11:30:38
17	D block.	11:30:44
18	BY MR. DOWD:	11:30:48
19	Q. And if we go back to the same sentence	11:30:48
20	that I was pointing at before, it says:	11:30:50
21	"An information block of length N is	11:30:52
22	repeated Q times, scrambled by an	11:30:55
23	interleaver of size qN , and then encoded	11:30:59
24	by a rate-1 accumulator."	11:31:02
25	Right?	11:31:05

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1 A. I see the sentence. 11:31:05
2 Q. And that is what is shown in Figure 3, 11:31:08
3 right? 11:31:19
4 A. That's one possible interpretation, yes. 11:31:19
5 Q. Now, what happens in the accumulation step 11:31:25
6 is shown in the paper in the formula here, Figure -- 11:31:32
7 I'm sorry, Formula 5.1, right? 11:31:36
8 MR. GLASS: Objection. Outside the scope. 11:31:41
9 THE WITNESS: It was not my task to 11:31:49
10 examine in detail the paper in here. So this might 11:31:51
11 very well be correct, but I have not done an 11:31:55
12 in-depth analysis of this particular paper. 11:31:58
13 BY MR. DOWD: 11:32:00
14 Q. I'll tell you what, take a moment and read 11:32:00
15 the fourth sentence of the paragraph right above the 11:32:03
16 figure, the one that says: 11:32:07
17 "The accumulator can be viewed." 11:32:08
18 Do you see that there? 11:32:11
19 A. Yes, I see that. 11:32:12
20 Q. Read that down to the end of Formula 11:32:14
21 5.1 and let me know when you're read it. 11:32:20
22 A. I've read it. 11:32:52
23 Q. Okay. And let me start with, prior to 11:32:54
24 today, had you read the description of Figure 3 in 11:32:58
25 Divsalar? 11:33:03

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1	A.	I've read that paper certainly sometime,	11:33:03
2		yes.	11:33:07
3	Q.	Okay. For the purposes of preparing your	11:33:07
4		report, did you perform an analysis of the Divsalar	11:33:09
5		disclosure and how the components of Figure 3 work?	11:33:13
6	A.	I did not look at the particular claims	11:33:16
7		and try to match them up or in any way analyze them	11:33:20
8		with respect to this particular paper.	11:33:24
9	Q.	And I'm -- I'm not asking about that. I'm	11:33:26
10		asking, did you perform any analysis of how the	11:33:28
11		individual components disclosed here in Figure 3 are	11:33:31
12		described to work by the Divsalar paper?	11:33:35
13	A.	You're talking about how the component is	11:33:40
14		disclosed in the patent relating to what's written	11:33:44
15		here in this particular paper?	11:33:46
16	Q.	No. So let me ask my question, again.	11:33:48
17	A.	Okay.	11:33:51
18	Q.	My question is, we've got the repeater;	11:33:51
19		we've got the permuter; we've got the accumulator	11:33:55
20		shown in Figure 3 of Divsalar.	11:34:00
21	A.	Sure.	11:34:02
22	Q.	And my question is, in preparing your	11:34:03
23		opinions in this case, did you perform any analysis	11:34:05
24		of how Divsalar explains those components operating?	11:34:08
25	A.	Could you explain a little bit more what	11:34:16

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1 you mean with "analysis". 11:34:19

2 Q. Did you do anything to understand 11:34:20

3 Divsalar's disclosure of how Figure 3 operates? 11:34:23

4 A. "Disclosure" here means the paper? 11:34:26

5 Q. Means the paper Divsalar that you have 11:34:29

6 marked in front of you as Exhibit 6 that -- 11:34:32

7 (Overlapping speakers.) 11:34:32

8 THE WITNESS: If that's the paper, if 11:34:35

9 that's what you mean, yes, I've read the paper. 11:34:36

10 BY MR. DOWD: 11:34:36

11 Q. Okay. So let's focus on the accumulator 11:34:39

12 and focus on how it works, okay? 11:34:40

13 Do you have that in mind? 11:34:43

14 A. I see the accumulator, yes. 11:34:46

15 Q. The accumulator in Figure 3 operates 11:34:51

16 according to the formula 5.1, right? 11:34:54

17 MR. GLASS: Objection. Outside the scope. 11:34:58

18 THE WITNESS: As I said, I did not prepare 11:35:00

19 an in-depth analysis how that might relate to 11:35:01

20 various components disclosed in the patent. I feel 11:35:04

21 uncomfortable having to do this on the spot. 11:35:06

22 BY MR. DOWD: 11:35:09

23 Q. I'm not asking you about the patent; I'm 11:35:09

24 asking you about what Divsalar discloses. 11:35:11

25 A. Okay. I -- this is a publication. I've 11:35:14

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1	read the publication. I understand what the	11:35:15
2	publication says.	11:35:17
3	Q. All right. So am I correct that the	11:35:19
4	accumulator of Figure 3 in Divsalar operates	11:35:21
5	according to the Formula 5.1 in Divsalar immediately	11:35:25
6	above the figure?	11:35:29
7	MR. GLASS: Same objections. Outside the	11:35:30
8	scope.	11:35:32
9	THE WITNESS: It is written here that this	11:35:32
10	formula exactly -- it is written here that this	11:35:35
11	formula represents some accumulation.	11:35:38
12	BY MR. DOWD:	11:35:38
13	Q. All right. So let's walk through how the	11:35:42
14	accumulation of the formula in Figure 5.1 operates.	11:35:44
15	Now, you see in the text it says:	11:35:52
16	"The accumulator can be viewed as a	11:35:54
17	truncated rate-1 recursive convolutional	11:35:56
18	encoder with transfer function one over	11:36:00
19	one plus D, but we prefer to think of it	11:36:03
20	as a block code whose input block, X sub	11:36:06
21	one through X sub N, and output block, Y	11:36:10
22	sub one through Y sub N, are related by	11:36:14
23	the formula..."	11:36:16
24	And then it gives the formula, right?	11:36:18
25	A. Correct.	11:36:20

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1 Q. So the input to the accumulation is the 11:36:20
2 block X sub one through X sub N, right? 11:36:23
3 MR. GLASS: Objection. Outside the scope. 11:36:27
4 THE WITNESS: He has here an input of X to 11:36:28
5 X1. I'll remark that whether or not you are 11:36:32
6 thinking of it as a block -- 11:36:32
7 THE REPORTER: Wait. Wait. Hold on. 11:36:32
8 Start that part over. I didn't catch it. 11:36:38
9 THE WITNESS: Whether or not you're 11:36:38
10 thinking of this as a block or you consider this a 11:36:40
11 block or an infinite stream, it would be exactly the 11:36:44
12 same formula. 11:36:48
13 BY MR. DOWD: 11:36:49
14 Q. Okay. But what Divsalar actually says is 11:36:49
15 that it's an input block X sub one through X sub N, 11:36:52
16 right? 11:36:56
17 MR. GLASS: Same objections. 11:36:56
18 THE WITNESS: If you say so, yes. 11:36:57
19 BY MR. DOWD: 11:36:59
20 Q. I mean, am I reading that incorrectly? 11:36:59
21 A. As I said, I did not do an in-depth 11:37:02
22 analysis and I prefer not to do so now on this spot. 11:37:04
23 Q. I -- really, you know, my question doesn't 11:37:09
24 get at what you'd prefer to do or what you wouldn't. 11:37:11
25 My question is, is it correct that the 11:37:14

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1	input to the accumulator, as taught in Divsalar, is	11:37:17
2	an input block X sub one through X sub N ?	11:37:20
3	MR. GLASS: Same objections.	11:37:24
4	THE WITNESS: The sequence of bits --	11:37:24
5	THE REPORTER: Wait. Wait. You didn't	11:37:24
6	allow him to give his objection. It's very	11:37:24
7	important.	11:37:24
8	Can you give your answer over, please.	11:37:32
9	THE WITNESS: As I said, such a code works	11:37:32
10	by taking a sequence of bits, putting it into the	11:37:34
11	sequence -- into the sequence of blocks that you	11:37:38
12	have and you get a sequence of bits out. That's my	11:37:40
13	understanding of RA codes and that's my definition	11:37:43
14	that I would like to use.	11:37:48
15	BY MR. DOWD:	11:37:50
16	Q. Okay. So when Divsalar says that the	11:37:50
17	input to the accumulator is, quote: "Input block X	11:37:53
18	sub one through X sub N ," can you tell me "yes,"	11:37:56
19	"no," "I don't know," that's the input to the	11:38:00
20	accumulator?	11:38:02
21	A. I see a sentence in which it says there's	11:38:04
22	a block whose input is X_1 up to X_N . That's what I	11:38:07
23	see.	11:38:12
24	Q. Okay. And then it continues that the	11:38:12
25	output block is Y sub one through Y sub N , right?	11:38:14

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1	A.	I'm -- all I'm doing is here reading that	11:38:17
2		there's an output block Y1 to YN. I'm not forming	11:38:19
3		any opinion on that.	11:38:23
4	Q.	Okay. And let's talk about the	11:38:24
5		relationship between those blocks described by the	11:38:27
6		Formula 5.1.	11:38:30
7		Do you see that there?	11:38:31
8	A.	I see the Formula 5.1; that's correct.	11:38:32
9	Q.	Now, X1 through XN, those are the qN	11:38:37
10		repeated bits, right?	11:38:43
11		MR. GLASS: Outside the scope.	11:38:46
12		THE WITNESS: According to his definition	11:38:47
13		here, there is some bits called X1 and they are	11:38:51
14		accumulated, yes.	11:38:56
15		BY MR. DOWD:	11:38:58
16	Q.	Okay. And the accumulator performs XOR	11:38:58
17		sums on subsets of those bits, right?	11:39:03
18		MR. GLASS: Same objections. Outside the	11:39:05
19		scope.	11:39:07
20		THE WITNESS: The accumulator does what an	11:39:07
21		accumulator does; it exactly sums up the sequence of	11:39:09
22		bits.	11:39:12
23		BY MR. DOWD:	11:39:12
24	Q.	Using an XOR summing, right?	11:39:13
25		MR. GLASS: Same objection.	11:39:15

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1	THE WITNESS: It -- it's a summation; it's	11:39:15
2	a mathematical operation; it's a sum.	11:39:18
3	BY MR. DOWD:	11:39:18
4	Q. And when you perform a mathematical	11:39:22
5	summing operation on bits, you're using either mod 2	11:39:24
6	or exclusive OR mathematics, right?	11:39:28
7	MR. GLASS: Same objection.	11:39:31
8	THE WITNESS: Now we're talking about --	
9	MR. GLASS: Outside the scope.	
10	THE REPORTER: Wait. Wait. You've got to	
11	allow a pause for him to get in an objection,	
12	please; otherwise, I hear two people speaking at the	
13	same time and I can't take it down.	
14	THE WITNESS: I apologize.	
15	MR. GLASS: I was just going to say	
16	outside the scope.	
17	THE REPORTER: Thank you. I appreciate	
18	it.	
19	MR. GLASS: Go ahead.	11:39:45
20	THE WITNESS: To me, it's a plus that's	11:39:45
21	well-defined in mathematics. There might be many	11:39:47
22	ways of representing it -- it's a plus, okay?	11:39:51
23	BY MR. DOWD:	11:39:53
24	Q. Okay. And is there something about --	11:39:53
25	withdrawn.	11:39:53

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1 That plus sign represents an exclusive OR 11:39:56
2 operation, correct? 11:40:00
3 A. Perhaps you can think of this. It is 11:40:01
4 simply a sum of elements in the field of GF(2). 11:40:04
5 Q. In the field GF(2)? 11:40:08
6 A. Yes, that's what it's called. 11:40:11
7 Q. Well, if I have two bits and I'm adding 11:40:14
8 those two bits together and I show you the two bits 11:40:18
9 with a plus side between them, you would know that 11:40:22
10 you could perform an XOR operation to do the 11:40:25
11 summation, right? 11:40:29
12 A. There might be -- 11:40:30
13 MR. GLASS: Same objection. 11:40:30
14 THE WITNESS: There might be -- 11:40:30
15 MR. GLASS: Outside the scope. 11:40:31
16 Go ahead. 11:40:32
17 THE WITNESS: Sorry. There might be many 11:40:32
18 ways of doing it. This is not what my expert report 11:40:34
19 is about. My expert report is about the general 11:40:37
20 definition. To me this is a plus -- it's a plus in 11:40:40
21 GF(2); that's what it is mathematically. There 11:40:44
22 might be many other ways of representing it. That's 11:40:47
23 not my -- that's not what my expert report is about. 11:40:50
24 BY MR. DOWD: 11:40:52
25 Q. Okay. My question is, if I tell you to 11:40:52

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1	add a 1 and a 0, two bits, and I show that with a	11:40:56
2	plus sign, you would understand that one way to do	11:41:02
3	that is through an exclusive OR operation; "yes" or	11:41:07
4	"no"?	11:41:10
5	A. There might be a way of doing this.	11:41:10
6	Q. I'm not asking you if there might be other	11:41:12
7	ways; I'm asking, do you know that one way to do it	11:41:14
8	is an exclusive OR operation, right?	11:41:17
9	A. This might very well be true, yes.	11:41:19
10	Q. Okay. So when Dr. Divsalar testified in	11:41:23
11	this case that this performs an XOR operation, you	11:41:29
12	have no basis to disagree with him, do you?	11:41:33
13	A. If he says so, I believe him.	11:41:36
14	Q. Okay. So let's look at how each of the Y1	11:41:41
15	through YN subsets is calculated, okay?	11:41:46
16	Y1 is comprised of the subset X1, right?	11:41:54
17	MR. GLASS: Outside the scope.	11:41:57
18	THE WITNESS: Y1 simply takes the first	11:41:59
19	element and computes the sum.	11:42:02
20	BY MR. DOWD:	11:42:03
21	Q. Okay. Y2 is comprised of the subset X1	11:42:04
22	plus X2, right?	11:42:08
23	MR. GLASS: Same objection.	11:42:11
24	THE WITNESS: What this box does, it's an	11:42:13
25	accumulated and it computes mathematically whatever	11:42:16

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1 an accumulator does. That's what it is. That's 11:42:19
2 what I can say. 11:42:20
3 BY MR. DOWD: 11:42:25
4 Q. Okay. Let me maybe come at this a 11:42:26
5 different way. 11:42:29
6 Take -- turn back to the '781 patent, 11:42:29
7 Exhibit 3, and turn to Column 3. And I'd like you 11:42:50
8 to read to yourself Lines 5 down to Line 24. Let me 11:42:59
9 know when you're done. 11:43:11
10 A. Are we talking about page -- Column 3? 11:43:12
11 Q. Column 3 from Line 5 where it begins: 11:43:16
12 "The accumulator" -- "accumulator may be a truncated 11:43:19
13 rate-1 recursive convolutional coder," all the way 11:43:23
14 down past the formula to Line 24. 11:43:28
15 A. I'm done. 11:44:27
16 Q. Okay. So this describes an accumulator, 11:44:29
17 right? 11:44:33
18 MR. GLASS: Objection. Outside the scope. 11:44:33
19 THE WITNESS: I have not -- you know, I 11:44:34
20 have not read this patent and tried to make an 11:44:36
21 analysis of it. I feel uncomfortable now making 11:44:38
22 on-the-spot judgment. 11:44:41
23 BY MR. DOWD: 11:44:41
24 Q. So when it says: "The encoder is an 11:44:43
25 accumulator," you don't know whether it's an 11:44:45

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1	accumulator?	11:44:48
2	MR. GLASS: Same objections. Calls for a	11:44:48
3	legal conclusion.	11:44:50
4	THE WITNESS: Whatever is written here, I	11:44:50
5	don't doubt it, but I have not, you know, looked in	11:44:56
6	details about this thing. There is one thing to	11:44:59
7	think about what technically a word means. There's	11:45:02
8	another one legal means. I have no -- no idea, you	11:45:05
9	know, what exactly that would be defined and what	11:45:07
10	exactly that would mean in a legal way and there's	11:45:11
11	no way for me now on the spot to -- to answer this	11:45:14
12	question.	11:45:17
13	BY MR. DOWD:	11:45:19
14	Q. So in performing the analysis that you	11:45:19
15	have performed for this case, you have -- nothing	11:45:22
16	that you did allowed you to form an opinion about	11:45:28
17	whether the intercoder 206 in the '781 patent is an	11:45:31
18	accumulator?	11:45:36
19	A. I was not asked --	11:45:36
20	MR. GLASS: Same -- same objections. Go	11:45:36
21	ahead.	11:45:39
22	THE WITNESS: I was not asked to perform	11:45:39
23	an opinion on that.	11:45:41
24	BY MR. DOWD:	11:45:43
25	Q. Okay. So let me just ask you this. Do	11:45:43