

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

HEWLETT PACKARD ENTERPRISE COMPANY and
CISCO SYSTEMS, INC.

Petitioner,

v.

COBBLESTONE WIRELESS LLC,
Patent Owner

IPR2024-00707

Patent 7,924,802

VIDEOCONFERENCE DEPOSITION OF
KEVIN NEGUS, Ph.D.
TAKEN ON DECEMBER 4, 2024

REPORTED BY:

PATRICIA L. HUBBARD, CSR #3400

1
2 REMOTE VIDEOCONFERENCE DEPOSITION
3 OF KEVIN NEGUS, Ph.D., who is at
4 the time of this proceeding
5 located in Granite County,
6 Montana, taken on behalf of the
7 Patent Owner, commencing at
8 9:00 A.M. (Pacific Time) on
9 December 4, 2024, before
10 PATRICIA L. HUBBARD, CSR #3400, a
11 Certified Shorthand Reporter in
12 and for the State of California,
13 pursuant to Notice.

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1 APPEARANCES OF COUNSEL:

2 For the Patent Owner:

3 LOWENSTEIN & WEATHERWAX, LLP

4 BY: PARHAM HENDIFAR, ESQ.

5 1016 Pico Boulevard

6 Santa Monica, California 90405

7 310.307.4514

8 hendifar@lowensteinweatherwax.com

9 (Present via videoconference)

10

11 For the Petitioner and the Witness:

12 DUANE MORRIS LLP

13 BY: TYLER MARANDOLA, ESQ.

14 30 South 17th Street

15 Philadelphia, Pennsylvania 19103

16 215.979.1529

17 tmarandola@duanemorris.com

18 (Present via videoconference)

19

20 Also Present:

21 Abigail Neufeld

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I N D E X

WITNESS	PAGE
KEVIN NEGUS	
(By Mr. Hendifar)	7

E X H I B I T S

	PAGE
PATENT OWNER'S DESCRIPTION	REFERENCED
Exhibit 2017 RFICs for Reduced Size, Cost	
and Power Consumption in	
Handheld Wireless Transceivers	
Exhibit 2018 ISSCC97/Session 23/Analog	
Techniques/Paper SP 23.8	
Exhibit 2019 Spectrum Options for	
Wireless Backhaul of Small	
Cells	
Exhibit 2024 Patent No. US 10,708,918 B2	
Exhibit 2025 Patent Application Publication	
US 2002/0021745 A1	

1 I N D E X (Continued)

2

3 INFORMATION REQUESTED:

4 (NONE)

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7 WITNESS INSTRUCTED NOT TO ANSWER:

8 (NONE)

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DECEMBER 4, 2024

9:00 A.M. (PACIFIC TIME)

* * *

THE REPORTER: Mr. Negus, can you tell me the city and state you are currently located in.

THE WITNESS: I'm not located in any city, but I'm in Granite County in Montana.

THE REPORTER: Okay. I am not at the same location as the witness.

Does anyone have any objection to my administering the oath to the witness remotely?

MR. HENDIFAR: No, no objection from Patent Owner.

MR. MARANDOLA: None from Petitioner -- Petitioners.

THE REPORTER: Okay. Would you please raise your right hand, Doctor.

Do you solemnly swear that the testimony you are about to give in this deposition will be the truth, the whole truth, and nothing but the truth under penalty of perjury?

THE WITNESS: Yes.

THE REPORTER: Counsel, would you make your appearances for the record, please.

1 MR. HENDIFAR: Parham Hendifar for
2 Patent Owner Cobblestone Wireless LLC. And with me
3 here is Ms. Abigail Neufeld.

4 MR. MARANDOLA: Tyler Marandola from
5 Duane Morris for the Petitioners and for the
6 witness.

7 THE REPORTER: Okay, Counsel. You're
8 good to go.

9 MR. HENDIFAR: Thank you.

10

11 KEVIN NEGUS,
12 called as a witness, having been
13 sworn, was examined and testified
14 as follows:

15

16 EXAMINATION

17 BY MR. HENDIFAR:

18 Q. Good morning, Dr. Negus. Would you
19 please spell your full name for the record.

20 A. Name is Kevin, K-e-v-i-n, Negus,
21 N-e-g-u-s.

22 Q. Do you also have a middle initial?

23 A. Yes.

24 Q. May I ask what it is?

25 A. J for James, J-a-m-e-s.

1 Q. Thank you very much.

2 And do you understand that you're
3 testifying under oath today?

4 A. Yes.

5 Q. You are not permitted by the rules to
6 speak with anybody, including your attorney, during
7 the breaks or at any other time prior to the
8 conclusion of the cross-examination regarding the
9 substance of this deposition other than issues that
10 may relate to privilege.

11 Do you understand that?

12 A. I -- I don't -- don't plan to speak with
13 counsel today.

14 Q. Sure. I still have to walk through this
15 to make sure I do my job of explaining what the
16 rules of the deposition are.

17 Your counsel will make short nonspeaking
18 objections such as, for instance, objection, form,
19 but they would not be allowed to make speaking
20 objections, such as vague or ambiguous or
21 something -- things of that nature.

22 So it is up to you to let me know if
23 there are specific aspects of a question that you
24 may not understand or that you may need more
25 information for.

1 So, if there is anything that you need
2 me -- including rephrasing the question, please let
3 me know. If you do answer my question, however, I
4 will assume that you have fully understood my
5 question.

6 Is that fair?

7 MR. MARANDOLA: Object to the form.

8 MR. HENDIFAR: I'm sorry?

9 THE WITNESS: What? Go ahead. Sorry.

10 BY MR. HENDIFAR:

11 Q. No, no, please. Go ahead.

12 Do you understand? Is that fair?

13 A. I don't know if it's fair, but I -- I
14 understand how objections work in a deposition.

15 Q. Okay. And do you understand that if you
16 answer my question, I will assume that you have
17 understood the question?

18 MR. MARANDOLA: Object to the form.

19 THE WITNESS: I don't know what to say.
20 I don't know what you -- what you will be assuming.
21 I can't read your mind.

22 BY MR. HENDIFAR:

23 Q. Okay. Can we agree that if there is any
24 part of any question I ask is vague or ambiguous to
25 you, you will ask me to clarify?

1 A. Yes.

2 Q. Okay. Other than your engagement in the
3 current IPR for which you are being deposed now, do
4 you have any current or past association with
5 Hewlett Packard Enterprise Company?

6 A. Not specifically with Hewlett Packard
7 Enterprise, if association means employment.

8 I was employed by Hewlett-Packard
9 Incorporated during the 1990's. The company split
10 after I left the company, and one of those corporate
11 entities became Hewlett-Packard Enterprise.

12 But I -- I never worked for
13 Hewlett-Packard Enterprise.

14 I have had Hewlett-Packard Enterprise as
15 a consulting client in the past on -- I don't know
16 how many occasions. Certainly more than one prior
17 occasion. But I don't recall specifically which
18 cases or when.

19 Although I would have information -- I
20 could look it up. I could find that.

21 Q. Thank you very much.

22 So when you say you've had
23 Hewlett-Packard Enterprise as a consulting client in
24 the past, is that only in the context of litigation?

25 A. That I'm not sure of.

1 Generally my consulting is primarily
2 litigation. I can't think of an instance where
3 Hewlett-Packard Enterprise, so, the post HP company,
4 hired me for a non-litigation related consulting
5 assignment. I just -- I don't one.

6 Q. Thank you.

7 Do you -- can you provide an estimate on
8 the specific time period during the '90's when you
9 were employed by HP?

10 A. Sure. It's in my resume, which I
11 believe was got to you one way or another in this
12 matter.

13 But, yeah. So, in early 1988 I joined a
14 company in Silicon Valley called Avantek. And
15 that's spelled A-v-a-n-t-e-k.

16 And that company was purchased by
17 Hewlett-Packard in November, I believe, of 1991.

18 And I continued my employment
19 effectively with Avantek but now Hewlett-Packard
20 through to somewhere in the fall of 1998 I left the
21 company.

22 Q. I realize your declaration references
23 your resume. I don't believe a resume has been
24 filed in this case on your behalf. So if I'm
25 missing it, please let me know.

1 So maybe that was an inadvertent
2 mistake, but we do not have a copy of your resume as
3 far as I can tell.

4 So, some of the questions, I apologize
5 if they may sound repetitive. Just we don't have a
6 copy of your resume.

7 Now, what was your role at Avantek prior
8 to it being acquired by H.P.

9 A. Well, I worked in research and
10 development in the commercial part of the business.

11 The company as a whole was -- the bulk
12 of the -- bulk of the sales were defense related.
13 And so they were components, RF components, and some
14 subsystems. A lot of them were with respect to
15 communications or radar systems that were deployed
16 by the Navy or the Air Force or the Army.

17 But I worked in the commercial
18 components part of the company. And our
19 customers -- at that time the fastest growing part
20 of our business was cellular telephones, both in the
21 handsets and in the base stations in it.

22 And so I worked on the development -- in
23 research and development on the development of
24 components that were going into, you know, cellular
25 telephone systems.

1 Q. Thank you very much.

2 What was your role at Avantek -- let me
3 strike that.

4 Did your role at Avantek change after it
5 was acquired by H.P.?

6 A. I mean yes in the sense that -- that
7 time moved on. And as time moved on in my career
8 and my responsibilities changed.

9 But I wouldn't -- I would not make the
10 statement that because Hewlett-Packard bought
11 Avantek, that that was the causation of the changing
12 in my responsibilities.

13 In other words, had Avantek continued to
14 thrive as an independent company, my
15 responsibilities would have changed and quite
16 possibly in the same ways.

17 Q. Understood.

18 What prompted you leaving H.P. in 1998?

19 A. I was offered a position as an executive
20 in a publicly traded company in the wireless
21 networking equipment space.

22 And so it was a promotion, if you like,
23 an opportunity for a new -- new kind of
24 responsibility. And I took advantage of that.

25 Q. Okay. What was the name of that

1 company?

2 A. That -- that was Proxim, spelled
3 P-r-o-x-i-m.

4 Q. And what was Proxim's main line of
5 business?

6 A. Wireless networking equipment.

7 Q. And how long were you at Proxim?

8 A. Formally I left Proxim around the end of
9 2002. But I had a severance package of about one
10 year. And during that time I made myself available
11 to the company whenever they wanted in a --
12 effectively an unpaid consulting role, although I
13 was being paid, of course, by this severance
14 package.

15 Q. And what prompted you leaving Proxim?

16 A. The company was sold in -- I think it
17 was March of 2002. And so -- so the name continued
18 on.

19 The company Proxim that I -- that I
20 joined disappeared when the company was sold. And
21 so a new corporate entity that was called Western
22 Multiplex bought the company, was another -- and
23 Western Multiplex was another wireless networking
24 equipment company. And so they bought the company
25 and they took the name.

1 So they continued to operate as Proxim,
2 but it was a different company.

3 I continued in the same role, which at
4 that time was the chief technology officer. As
5 chief technology officer of Proxim, the forerunner,
6 and I was the chief technology officer of the
7 combined company after the merger.

8 But the type of wireless networking
9 equipment that the new combined company was focusing
10 on was a little different, unsurprisingly, than what
11 the predecessor company I had worked for was doing.
12 And I just decided it was time for a change.

13 Q. And were you employed anywhere after
14 Proxim?

15 A. It really depends on how you define
16 "employment."

17 I've certainly worked for multiple
18 entities, including some that were companies, since
19 that time. But in a traditional full-time exclusive
20 employment sense, Proxim was the last company that I
21 had that relationship with.

22 Q. Now, I tried to look up some of the
23 articles that you have authored, and mostly they
24 seem to be prior to 2010 approximately, if I have
25 the time line correct.

1 First, is that time -- does that time
2 line sound right to you?

3 A. I'm not -- I'm not sure.

4 I mean I certainly have been an author
5 on published papers since 2010, but I -- my career
6 is not one of publishing papers. So it's just
7 really never been much of a focus, whether after
8 2010 or before it or -- or at any time, I suppose.
9 At least since I left graduate school. You know,
10 during graduate school there was an incentive if --
11 if only for the benefit of my supervisors to public
12 papers.

13 Q. Is there on the internet a copy of your
14 C.V. or publications posted on a website or web page
15 somewhere?

16 A. It's hard for me to know what's on the
17 internet.

18 Q. Hence my question. Have you posted --

19 A. Yeah. Sure. If you're saying do I
20 maintain a -- you know, a KevinNegus.com page or
21 anything like that. I certainly do not.

22 I've testify in many -- by any objective
23 measure many litigations over the years. And I do
24 believe there's a variety of expert reports or
25 declarations that have attached to them, you know,

1 then current copies of my resume in them.

2 So my guess is that if I did a few
3 keystrokes here right now on Google, I could
4 probably find a resume for me on the internet, but
5 I -- it won't be because I specifically posted it to
6 be there.

7 Q. Thank you very much.

8 Other than the current IRP for which you
9 are being deposed, do you have any current or past
10 associations with Cisco Systems Inc.?

11 A. Yes.

12 Q. Would you please elaborate what they
13 are?

14 A. I don't recall. But I've -- I've had
15 them as a consulting client in litigation-related
16 matters in the past.

17 Q. Anything else?

18 A. You know, I've had lots of business
19 engagement with them in various companies that I've
20 worked with in the past. But I was not an employee
21 or consultant to them in those relationships.

22 Q. Are you being compensated for your work
23 on this IRP by Petitioners?

24 A. I'm being paid my hourly rate. I mean
25 I'm being compensated for my time that I spend.

1 So I'm not trying to quibble with you
2 but --

3 Q. I didn't mean to imply otherwise. I was
4 just trying to understand what the rate is.

5 So it is an hourly rate?

6 A. Yeah. Sure. No problem.

7 Yeah. It's \$500 an hour. Just a
8 straight compensation for time spent no matter what
9 the time is spent on.

10 Q. I understand.

11 I was not trying to be rude or imply
12 otherwise. But I appreciate the clarification.

13 When were you first retained for this
14 case?

15 A. I don't know offhand, but it's just a
16 few key strokes away from being -- I'm sitting here
17 at my computer. I can easily find out the date that
18 I was retained at if that is important for you.

19 Q. I would appreciate that, if you would.

20 A. Okay. Hang on just a second.

21 Okay. I was on January 12th of 2024.

22 Q. And you submitted a declaration in this
23 IRP marked Exhibit 1003, correct?

24 A. I certainly submitted a declaration.
25 Exhibit 1003, that sounds right.

1 I'm just -- I don't always memorize all
2 the exhibit numbers.

3 Q. Okay. I'll represent to you that your
4 declaration in this IRP is marked as Exhibit 1003.
5 So when I refer to that exhibit, I mean your
6 declaration.

7 Does your declaration in Exhibit 1003 --
8 strike that.

9 Has any of your opinions with respect to
10 any issues addressed in your declaration in
11 Exhibit 1003 changed since you signed that
12 declaration?

13 A. Not that comes to mind. If you're
14 asking is there an error or something in it, I'm not
15 aware of anything.

16 Q. Did you draft your declaration that was
17 submitted as Exhibit 1003 in this IPR?

18 A. If by draft you mean -- you mean typed,
19 I typed everything in it.

20 Q. You did?

21 A. Yes.

22 Q. And did you choose the prior arts upon
23 which you relied upon in your declaration?

24 A. Yes.

25 Q. And did you find the prior arts upon

1 which you relied upon in your declaration?

2 MR. MARANDOLA: Objection. Form.

3 THE WITNESS: I'm not quite sure what
4 you mean by the word "find."

5 I mean I knew all of the prior art that
6 is listed in the declaration. I mean I knew it
7 before January 2024. I knew them at the time that
8 the -- these prior art references came out.

9 BY MR. HENDIFAR:

10 Q. Understood.

11 In what context did you know the Shearer
12 reference, Exhibit 1007, which is the basis of the
13 second count in your declaration prior to your
14 engagement in this IPR?

15 A. Sure. I knew it from my engagements
16 with Intersil in the past.

17 Q. So, what is Intersil?

18 A. Intersil is the -- you know, Shearer --
19 I'm not sure what the -- what the assignee name is.
20 The company changed hands several times.

21 But let me -- let me just go check to --
22 on Shearer.

23 It's not giving an assignee.

24 But at any rate, these guys were at
25 Harris Semiconductor. They're in Melbourne,

1 Florida. And I knew Mark Webster, of course, from
2 802.11 standard's work, and I knew what these guys
3 were doing.

4 And so Harris spun that off. At the
5 time that this application was made, the company was
6 called Intersil. And I had a variety of business
7 engagements.

8 I was actually the chairman of a company
9 based in Melbourne, Florida, another wireless chip
10 company, at that time.

11 And so this was published in January
12 2006. At that time I was the chairman of a company
13 based in Melbourne, Florida, which is where Mark
14 Webster was. And so I was aware of the work that
15 they were doing and aware that they -- they had a
16 variety of patents in this area.

17 Q. Okay.

18 A. I should say patent applications, I
19 guess, at that time.

20 Q. Thank you.

21 A. They made that very clear, too.

22 This -- this patent application in this
23 subject matter, they disclosed it to 802.11 back at
24 that time.

25 Q. Now, what did you do to prepare for

1 today's deposition?

2 A. Well, on Saturday I met by phone with
3 counsel for Cobblestone for, I believe, about two
4 hours. And then yesterday I reviewed some of the
5 documents in this matter.

6 MR. MARANDOLA: I think -- I think you
7 said counsel for Cobblestone, Kevin.

8 THE WITNESS: Oh, yeah. Sorry.

9 BY MR. HENDIFAR:

10 Q. Don't throw me under the bus, please.

11 A. Yeah. Yeah. Sorry. I was thinking of
12 the case was Cobblestone.

13 But, yes, I met with counsel for
14 Hewlett-Packard and Cisco. Thank you.

15 Q. Approximately how many hours have you
16 spent preparing for this deposition today?

17 A. Well, I spent, like I said, about two
18 hours on Saturday. And then yesterday, oh, I'm
19 going to guess four or five hours.

20 Q. And in preparation for today's
21 deposition have you reviewed any documents that are
22 not filed in this IPR?

23 A. I don't -- I mean I don't know. I may
24 have -- you know, the -- count -- Cobblestone has
25 asked the Board to construe one of claim terms. And

1 so I -- I've looked up a couple things associated
2 with the proposed construction, because I did not
3 have that at the time that I wrote my declaration.

4 So, if, you know, a Google search, a
5 Wikipedia page constitutes a document, then -- then,
6 yes. Otherwise, no.

7 Q. So, other than the Google search and
8 the Wikipedia -- let me rephrase that.

9 So, you performed searches in connection
10 with Patent Owner's proposed construction of center
11 frequency in this IPR, correct?

12 MR. MARANDOLA: Object to the form.

13 THE WITNESS: Well, I wouldn't say that.
14 I'd say that -- or the way I would put it -- maybe
15 it's the same thing as saying yes, is just that
16 you -- your proposed construction is that center
17 frequency should be limited to the carrier signal
18 frequency the baseband signal is up-converted to.

19 And so you've introduced words that are
20 not in the claim. They're not words that I'm not
21 familiar with in any way, shape or form, but they're
22 just not in the claim.

23 And so generally my practice is, is if a
24 Court construes a term with more technical terms,
25 then I try to give a plain and ordinary meaning to

1 those new introduced technical terms that weren't
2 otherwise already in the claim.

3 And so -- so, for example, in your
4 proposed construction, you know, the term "carrier,"
5 the term "baseband," the term "up-conversion" enters
6 into your proposed construction. And these are all
7 terms I'm very familiar with.

8 But I just wanted to have a quick check
9 to make sure that there is not anything out there on
10 a first order that might be at odds with my
11 understanding.

12 And so that -- that's all I did was just
13 take a quick check. And, sure enough, my -- my
14 understanding of those terms seems to be compatible
15 with various easily retrievable mainstream
16 discussions of them.

17 BY MR. HENDIFAR:

18 Q. Thank you very much for that
19 explanation.

20 Did you review any technical articles in
21 connection with preparing for today's deposition
22 that are not cited in your declaration?

23 A. Well, like I said, I Googled those
24 terms. I went to a Wikipedia page -- I don't know
25 whether you call a Wikipedia page a document. I

1 also don't know whether you call it a technical
2 article. It's certainly a useful piece of
3 information that -- I encourage my students to -- to
4 go to Wikipedia pages in this field.

5 So -- but I don't know whether that's --
6 meets the definition of technical article.

7 Q. Anything beyond Wikipedia?

8 A. Just -- just some stuff that came up on
9 Google searches.

10 I don't remember. You -- often when you
11 search a technical term, just type the -- type the
12 word in, you might get a dictionary definition, you
13 often get a Wikipedia page, you might get something,
14 you know, on some other website. Sometimes you get
15 a link to an IEEE paper.

16 So, you know, I looked at a few things,
17 and, again, nothing -- nothing deviant from what my
18 understanding of those terms came up for me.

19 Q. Do you have any personal experience
20 working within a standardization committee such as
21 802.11?

22 A. Yes.

23 Q. Would you please elaborate what your
24 experience is?

25 A. Well, first of all, I'm -- I'm a named

1 contributor to the 802.11 standards. I participated
2 in it many years ago.

3 And I also was the chair, technical
4 chair of another standards committee called Home RF,
5 which was a standard that was derived, actually,
6 from 802.11, as well as other standards.

7 So I -- I've got actually quite
8 extensive experience with standards committees.

9 Q. Thank you very much.

10 Are you familiar with Dr. Todor Cooklev?

11 A. No.

12 Q. What is the time frame which you were
13 involved with the 802.11 standard committee?

14 A. The time frame in which I actively
15 monitored what was going on or went to the meetings
16 or was voting member would span from about -- really
17 when it started in 1989 or '90 is when it became a
18 formal working group through to probably about 2005,
19 2006, somewhere in that time frame.

20 Q. Thank you very much.

21 I am going to introduce some new
22 exhibits. I will put them in the chat box here. If
23 there is any difficulty receiving them, I would be
24 happy to email a copy, as well, whatever you prefer.

25 So what I'm going to put in the chat box

1 now we will mark as Exhibit 2017.

2 (Whereupon the document referred
3 to was marked Exhibit 2017 and is
4 attached hereto.)

5 BY MR. HENDIFAR:

6 Q. And just take a few moments, review the
7 document, familiarize yourself with it and then let
8 me know when you are ready for me to ask my
9 questions.

10 A. Okay. Go ahead.

11 Q. And do you recognize this document?

12 A. I don't really remember writing this --
13 this -- it appears to be an IEEE publication.
14 Obviously I -- I'm the lead author. I wrote it. I
15 just --

16 Dan Millicker was my supervisor at that
17 time in 1993.

18 But I would have written this. And I
19 just don't remember. It's been quite awhile.

20 Q. But you don't dispute that this is an
21 article authored by you?

22 A. No. I do not dispute that at all.

23 Q. May I please refer you to the page with
24 the native page number at the bottom 921.

25 A. Okay.

1 Q. And please let me know when you are
2 there?

3 A. Yeah. I'm there.

4 Q. The left column, the paragraph that
5 starts with,

6 "The transmitter architecture of
7 Figure 4 uses direct conversion
8 from modulating baseband quadrature
9 inputs I and Q to the RF carrier."

10 Do you see that paragraph?

11 A. I see that sentence.

12 Q. Now, my questions are going to be
13 focused on that paragraph. So if you'd like, maybe
14 to take a moment to review that paragraph.

15 A. Okay. I've looked at that paragraph.

16 Q. Thank you.

17 Is baseband a term of art?

18 A. I'm sorry?

19 Q. Is the word "baseband" a term of art?

20 A. It -- yes. I would say that baseband is
21 a -- a common term that's used in communication
22 systems.

23 Q. So a person of ordinary skill in the art
24 would know what a baseband signal is if presented
25 with that phrase?

1 A. I think that they would -- they have an
2 understanding of what the -- of how "baseband" is
3 being used in this particular paragraph.

4 Q. What does "baseband" mean?

5 A. Baseband usually just means that it's a
6 direct representation of the information signal as
7 opposed to in a -- in a modulated format.

8 Q. Now, here it explains that the baseband
9 quadrature inputs I and Q.

10 What do the words "I" and "Q" represent
11 here?

12 A. They represent the in-phase and
13 quadrature phase. So this is -- this is with
14 respect to a baseband signal that's being described
15 by a complex format.

16 Q. But the baseband signal does not have to
17 become complex, right?

18 A. It does not have to be -- have an
19 imaginary component.

20 Anything that would be strictly real
21 is -- complex as the super set of real or imaginary.
22 So -- so in a sense, yes.

23 It doesn't need to have an imaginary
24 component, but all basebands are complex in a -- in
25 a generalized sense.

1 Q. Fair enough.

2 How is the baseband signal generated
3 from the information?

4 MR. MARANDOLA: Object to the form.

5 THE WITNESS: How is it in -- in this
6 paragraph on page 921? Is that what you're asking?
7 BY MR. HENDIFAR:

8 Q. Sure. Let's focus on this, and you can
9 explain.

10 A. Okay. Well, this -- this paragraph does
11 not explain how baseband quadrature inputs I and Q
12 are generated.

13 Q. Okay. Is there more than one way to
14 generate a baseband signal from the information?

15 A. Yes.

16 Q. Okay. Would you please provide two
17 examples of the ways to do so?

18 A. Well, one -- one would be by using a --
19 an amplitude modulation, for example, where
20 different amplitude values are related to different
21 values of the information.

22 Another one would be a phase modulation
23 for -- as a -- as a second example where the angles
24 of the complex baseband as opposed to just a
25 magnitude of amplitude is used to convey the

1 information.

2 Q. Thank you very much.

3 A. There's -- there's more examples, of
4 course, to be had, but those are two. You asked for
5 two.

6 Q. I appreciate that.

7 Now, in this article you mentioned that
8 the, quote,

9 "Direct convergence from modulating
10 baseband quadrature inputs I and Q
11 to the RF carrier."

12 What is an RF carrier?

13 A. Well, typically a carrier -- whether
14 it's RF or not, is less important. But RF is simply
15 a frequency range typically from above audio, say
16 30 kilohertz is often used as a lower bound, to
17 below optical.

18 And so you can argue where that is. But
19 certainly 30 kilohertz to 300 gigahertz is often
20 considered the RF frequency range.

21 And so a carrier is typically just an
22 unmodulated signal periodic preferably a sinusoid,
23 but it doesn't actually have to be.

24 And, yeah, so basically the -- the
25 carrier is what the modulation is surrounding, if

1 you like. The -- the carrier is what gets modulated
2 by the baseband's signal.

3 Q. Okay. And why would the baseband signal
4 be modulated on the carrier?

5 A. Why would it be?

6 That would depend on the communication
7 system.

8 Q. The paragraph in this article then
9 follows to say,

10 "The transmit LO for the modulator
11 is generated from the desired mixer
12 product of the two LOs."

13 What is LO?

14 A. LO is -- stands for local oscillator in
15 this context. It may stand for something else in
16 another field.

17 Q. Of course.

18 Going back, is the process of modulating
19 the baseband signal on the RF carrier also referred
20 to as up-conversion in this field?

21 A. It is. It's an example of up-conversion
22 in this -- I mean the up-conversion, you can see it
23 there in -- in the figure, it's simply a complex
24 rotator. It's multiplication with a complex
25 rotator.

1 Up-conversion fundamentally is a -- is a
2 frequency shift.

3 And so you can -- you can do frequency
4 shifts in different ways, but basic math is, you
5 know, that -- a shift in the frequency domain, that
6 the a convolution with an impulse. And that's
7 equivalent to a multiplication in the time domain
8 with a -- with a sinusoid.

9 And so that's typically how we do it
10 in -- in wireless communication systems.

11 And you can do it at baseband or you can
12 do it at IF or you can do it at -- at the highest
13 frequency that -- you know, the RF frequency that
14 you want to transmit at. The up-conversion can be
15 done anywhere in the chain. Or you can --

16 (A clarification was requested by
17 the reporter.)

18 THE WITNESS: Sorry. Or you can -- you
19 can do multiple up-conversions.

20 Your up-conversion can be the
21 concatenation or the convolution of multiple
22 up-conversions. And, again, that's very common in
23 actual equipment.

24 BY MR. HENDIFAR:

25 Q. Thank you very much.

1 Can up-conversion be done by a method
2 other than multipli- -- let me step back.

3 What I heard is that you mentioned
4 up-conversion can be done by multiplication.

5 But can up-conversion be done by a
6 method other than multiplication?

7 A. I believe it -- I believe it could be
8 done in the sense of how you got it done. But it
9 would always be equivalent.

10 If you do a shift in the frequency
11 domain -- it's just basic Fourier duality. Right?
12 Stuff I teach to undergrads all the time.

13 If you do a shift in the frequency
14 domain, that's a convolution in the frequency
15 domain, which is equivalent by -- by the Fourier
16 transform to a multiplication in the time domain.

17 Typically we do -- just for expediency
18 of implementing the actual communications equipment,
19 it's just simpler to do a multiplication in the time
20 domain. And so that's -- that's --

21 Now, that said, you can do that
22 multiplication in -- in different places within the
23 communications equipment block diagram, if you like.

24 You know, this one is showing a
25 multiplication. You can see the multipliers there

1 in Figure 4. It's -- it's showing that
2 multiplication being done at the RF frequency, the
3 transmit RF frequency. But it can be done, and you
4 can see a multiplication not being done at the
5 transmit RF frequency; for example, in Figure 4 in
6 the receive architecture.

7 And so you can do it -- you can do it at
8 multiple frequencies. That's what you see in the
9 receive architecture there. You can see the
10 frequency shift being done in two stages. It's very
11 common. Or it's being done in one stage in the
12 transmit side.

13 And you can also do the -- those
14 frequency shifts by multiplications, for example, in
15 what's labeled the DSP in Figure 4. You can do
16 it -- do it any way.

17 So they all end up being the -- the same
18 thing with respect to the net result.

19 Q. Thank you very much for that
20 explanation.

21 Now, what is the role of the local
22 oscillator in the process of up -- up-converting the
23 baseband signal to the carrier?

24 A. Are you asking specific to Figure 4 or
25 generally?

1 Q. Specific to Figure 4. And then I will
2 ask later if generally.

3 A. Right. So, here the -- the local
4 oscillators are shown in Figure 4. There is L01 and
5 L02. And the -- neither of those is at the RF --
6 the transmit RF frequency, those two oscillators.

7 And so the -- the role of them, the L01
8 is being used effectively to tune to a particular
9 channel in combination with the filters that are
10 shown.

11 So, like on receive, if you want to tune
12 to a particular RF channel, you would move L01, but
13 not to that channel. You would move to -- L01 to
14 that channel offset by the amount of L02.

15 L02 is fixed in Figure 4. And so the
16 combination of those two -- or either the -- you
17 could do it either as the linear addition or the
18 linear subtraction would get you to the actual RF
19 carrier that's of interest for the particular
20 communications channel that this architecture is
21 operated at.

22 Q. We are done with this exhibit.

23 I am now going to put another exhibit.
24 One moment, please.

25 So this new one we will mark as

1 Exhibit 2018.

2 (Whereupon the document referred
3 to was marked Exhibit 2018 and is
4 attached hereto.)

5 BY MR. HENDIFAR:

6 Q. And I'm going to put that in the chat
7 box.

8 And same as before, please take a moment
9 to familiarize yourself with this document. And
10 please let me know when you are ready so I can ask
11 my questions.

12 A. Okay. Yes. I think I'm ready.

13 Q. Thank you.

14 Do you recognize the document in
15 Exhibit 2018?

16 A. I vaguely remember it. So, I'm not
17 going to say I recognize it, but that's -- that's my
18 name on it. Bart Jansen, who worked for me, and Don
19 Lee, who worked for me -- Bart Jansen wrote this
20 paper, but I certainly was involved.

21 And I -- I don't recall -- you know, I
22 don't recall specifically everything that's in here,
23 but I do remember that we wrote this paper and it
24 was published by the IEEE.

25 Q. Thank you.

1 In the first column at the bottom and
2 last paragraph there is a phrase "the carrier
3 frequency of oscillation."

4 A. Where -- where is that? Oh --

5 Q. First column first page towards -- the
6 last paragraph towards the middle.

7 A. It says,

8 "Noise from the bandgap reference
9 is mixed around the carrier during
10 oscillation?"

11 Is that what you're referring to?

12 Q. No. Do you see equation one?

13 A. Oh, yeah, I see that.

14 Okay. You're saying where it says
15 "F-naught the carrier of frequency oscillation"?

16 Q. Correct.

17 A. Okay. And what's your question.

18 Q. Yes. What does "carrier frequency of
19 oscillation" mean here?

20 A. Here it's -- it's just -- that's --
21 this -- this paper was directed to a new way of
22 building a voltage-controlled oscillator. And --
23 and so that F-naught is just a frequency that that
24 voltage-controlled oscillator is operating at.

25 It could be a carrier frequency, but

1 it's -- it could not be a carrier frequency too.

2 So, I -- why -- why Bart wrote it that
3 way I -- you'd have to ask him.

4 But it's certainly not incorrect.

5 F-naught in the VCO, it certainly -- if I recall
6 right, that was our goal in this VCO was -- was to
7 have it as a VCO for a direct conversion local
8 oscillator.

9 But in -- in equation one there is no
10 requirement that F-naught be the carrier frequency
11 of oscillation. It just needs to be the frequency
12 of oscillation.

13 Q. In the example provided in this paper,
14 the frequency of the oscillator is the carrier
15 frequency, correct?

16 A. No, I don't know that. I'd have to look
17 at that.

18 It doesn't look that way to me. It
19 just -- it says -- it says 1.55 gigahertz example
20 VCO. That's -- that's not -- that's not a direct
21 conversion carrier for any system that we would have
22 been working on. And -- and what -- why is it that
23 frequency is just lost in the sense of time to me.

24 But -- but certainly when I answered the
25 question previously, the goal of this program --

1 this was a research program that was ongoing, and
2 the goal was definitely to build local oscillators
3 that could be used for direct conversion as the
4 carrier frequency.

5 Q. Okay. The goal of this program for the
6 paper 2018 was direct conversion of what to what
7 exactly?

8 A. In 2018?

9 Q. So, the goal of the program discussed in
10 Exhibit 2018, you said it was direct conversion.

11 My question is direct conversion of what
12 to what?

13 A. The goal -- in 2018 I wasn't working on
14 this -- this -- this is 1997.

15 Q. I'm sorry. My question was not clear.
16 So we have marked this document as
17 Exhibit 2018.

18 A. Oh, I'm sorry. You said in 2018 --

19 Q. Right.

20 (Indecipherable simultaneous
21 colloquy.)

22 BY MR. HENDIFAR:

23 Q. Let me rephrase the question.

24 You mentioned that in the document in
25 Exhibit 2018, the goal was direct -- I think the

1 phrase you used was "direct conversion."

2 My question is direct conversion of what
3 to what?

4 A. Oh, okay. Yeah.

5 So, in the document Exhibit 2018, I
6 don't think it says that that's the goal at all.

7 I was just telling you -- I remember
8 this program. I'm talking about at Hewlett-Packard
9 in 1997 that we -- we were trying to do what at the
10 time was the first fully monolithic voltage
11 controlled oscillators -- they're very common today.
12 Your phone has a ton of them in them. But this was
13 the first one worldwide that was ever done in
14 silicon.

15 And at that time direct conversion was
16 definitely a common architecture. And so we wanted
17 it to be capable of supporting that.

18 But I don't think this paper -- maybe it
19 says something that effect, but I -- I don't know
20 that it does.

21 I'm not trying to testify here under
22 oath that this paper is teaching use this oscillator
23 for direct conversion.

24 Q. When you say "direct conversion," what
25 are you referring to in terms of what is being

1 converted directly to what?

2 A. Right. So, carrier signal at the end of
3 the day is the -- is the unmodulated periodic
4 waveform on which the -- you know, the modulation is
5 wrapped around or it is based upon.

6 You don't -- you don't have to do an
7 up-conversion at that frequency in order to get that
8 to be the carrier signal. In other words, you can
9 do up-conversions at different frequencies or at
10 different places in the block diagram.

11 In direct conversion you do only the
12 one, you know, multiplication in the time domain as
13 a complex rotator. You do that strictly once,
14 and -- and because it's the one time, we call that
15 direct conversion.

16 And to, I suppose, distinguish -- you
17 usually don't call the others indirect conversion,
18 but -- but if you think of it as direct conversion,
19 I guess the others would be indirect.

20 Q. Okay. So, for lack of a better term, an
21 indirect conversion based on my understanding of
22 what you explained would be up-conversions from the
23 same starting point to the same ending point but
24 through different multiple stages?

25 Is that correct?

1 A. That's again getting -- I don't know
2 that I would phrase it exactly like that.

3 But you're -- you're getting to the
4 right idea, which is at the end of the day the
5 carrier -- what the carrier is really conveying is
6 if -- it's a -- from a transmit point of view, what
7 makes something a carrier is that if I'm going to
8 receive it, then I'm going to assume that it's
9 centered around that carrier.

10 Okay?

11 If it's an up-converted waveform.

12 And -- and so I need to know if I'm
13 going to receive it, how I'm going to do it.

14 So, for example, if you look at 802.11
15 for the non-HT duplicates, for example, that are in
16 the draft 2.0 standard, if you're an 802 -- a legacy
17 receiver and you're going to receive that waveform,
18 you need to know where the carrier frequency is.

19 Okay?

20 And in that waveform there's two carrier
21 frequencies. And if you don't receive it at either
22 one of those two carrier frequencies, you're just
23 going to get nonsense. If you receive it just in
24 the middle of the overall range, you'll get
25 nonsense. You have to receive it at one of those

1 two carrier frequencies.

2 So, how do you achieve those two carrier
3 frequencies? Well, you can -- you can do it with
4 direct conversion. That's one way to do it. You
5 can do it with -- you know, by shifting in the
6 baseband signal and then shifting again at RF.

7 There's -- there's -- you can do it at
8 an IF and then do another up-conversion from an IF
9 to the RF.

10 Just multiple ways of doing it.

11 Q. Can you tell by shape of a received
12 signal whether it has one or two carrier
13 frequencies?

14 A. Are we talking about something in
15 Exhibit 2018 here?

16 Q. As a general proposition, not
17 necessarily in particular in 2018.

18 A. What's the question?

19 Q. Sure. Are you able to tell whether a
20 received signal has one or two carrier frequencies
21 by just looking at the signal shape in the frequency
22 domain?

23 A. What do you mean looking at it?

24 I don't really understand.

25 Q. Is it able to determine whether a signal

1 has one or more carrier frequencies just based on
2 the shape of the signal in the frequency domain?

3 A. Again I'm not really -- I'm not
4 processing here what you're getting at.

5 I'm used to -- in wireless communication
6 sometimes we -- we know how many carrier frequencies
7 are in it. It's defined. We usually -- usually we
8 receive things that we know what's transmitted. We
9 know -- we know how the transmitter composed the
10 waveform.

11 If we don't know that, then we don't
12 know how to demodulate it. And if we don't know to
13 you to demodulate it, then we usually don't look at
14 it from an equipment point of view.

15 So I -- I think if you're -- if you're
16 asking me if I just put up an antenna outside my
17 window right now and, you know -- well, of course,
18 where I am right now, there would be nothing.

19 But if I did this in downtown Dallas and
20 I -- and there were lots of signals, could I --
21 could I tell just by looking at the spectrum
22 analyzer how many carriers were involved? If I had
23 no disclosure, no information of what was being
24 transmitted, no, I would not know how many carriers.

25 It's because I have an understanding as

1 a receiver of what is transmitted that I know, you
2 know, whether there's one carrier signal or two
3 carrier signals or ten carrier signals or, you know,
4 in case of OFDM, of course, there's hundreds or
5 thousands of carrier signals involved.

6 Q. Thank you.

7 Now, when you say that a signal may have
8 two carrier signals, what does that mean?

9 A. A signal may have -- yeah. It can have
10 two carriers if there's base -- if a baseband
11 signal -- you know, if what's being transmitted
12 has --

13 Well, again, look at the -- look at
14 equation 2061, for example, in -- in the draft 2.0
15 standard, which define the non-HT duplication.
16 That's a classic one of -- of defining two carrier
17 signals.

18 It's -- it's transmission in the upper
19 and lower halves of a 40 megahertz channel. So
20 there's an upper 20 megahertz channel, there's a
21 bottom 20 megahertz channel.

22 There's a baseband signal for the bottom
23 20 megahertz channel and there's a different
24 baseband signal for the upper 20 megahertz channel.

25 And there's an up-conversion that's

1 described for the lower 20 megahertz channel to a --
2 a lower 20 megahertz channel carrier frequency and
3 there's an up-conversion that's described of that
4 second baseband signal to an upper channel at the
5 second carrier signal frequency.

6 It's just right there in the draft 2.0
7 disclosure.

8 Q. So, you mentioned two baseband signals,
9 one of them up-converted to first carrier frequency,
10 a second one converted to a second carrier
11 frequency.

12 If the two baseband signals were
13 combined together prior to up-conversion and then
14 that combined baseband signal was up-converted once
15 to the carrier frequency, would the resulting signal
16 have one or two carrier signals?

17 MR. MARANDOLA: Object to the form.

18 THE WITNESS: So you're talking about
19 something other than non-HT duplicate transmission.

20 I mean what you're saying doesn't make
21 any sense if the context is equation 2061 and
22 draft 2.0. It's describing doing two frequency
23 shifts. And that is up-conversions as a
24 requirement.

25 I mean it's right there in the standard.

1 It's right there in my report.

2 It says, for example, go to paragraph
3 101 in my report, and it's just verbatim from the
4 draft 2.0. And it explains, it says,

5 "When transmitting in the
6 upper/lower 20 megahertz portion of
7 a 40 megahertz channel, the
8 mathematical definition of
9 transmission shall follow that of a
10 20 megahertz channel with $F_{sub C}$
11 in equation 20-1 replaced by
12 $F_{sub C}$ plus or minus ten
13 megahertz."

14 So if you're only doing upper, you
15 would -- you'd change $F_{sub C}$ to F_C plus ten
16 megahertz. If you're only doing lower, you would do
17 $F_{sub C}$ minus 10 megahertz. If you're doing both,
18 which is what the duplicate formats are, then you
19 need them both.

20 Now, how do you do that?

21 Well, that's equation 20-61. It shows a
22 first baseband signal being shifted by the negative
23 ten megahertz, that's the negative $32 \Delta_{sub F}$,
24 and then it shows a second baseband signal. Which
25 is just a 90-degree rotation in the frequency domain

1 of the first one being shifted by a different
2 frequency shift. It's -- it's plus 32 F -- or
3 delta F, pardon me, which is plus 10 megahertz.
4 It's exactly what's described.

5 Now, you're asking me if I didn't do
6 that, and then I only did one carrier up-conversion,
7 you know, well, you wouldn't be doing this. You
8 have to do this. This is the definition of the
9 non-HT duplicate is you have to end up with two
10 carrier frequencies.

11 If you don't end up with two carrier
12 frequencies, you haven't done non-HT duplicate.
13 You've done something else.

14 Q. So, I appreciate that you have
15 previously obviously prepared a response.

16 But that was not my question. So you
17 twisted my question and then you provided an answer
18 that you had obviously prepared to give?

19 So if you please focus on providing the
20 answers to my question.

21 My question is if two baseband signals
22 are combined together and that combined baseband
23 signal is up-converted once to a carrier frequency,
24 does the resulting signal have one or two carrier
25 frequencies?

1 A. That would --

2 MR. MARANDOLA: Object to form.

3 Sorry, Dr. Negus.

4 THE WITNESS: Yeah, sure. No problem.

5 Sorry. Sorry for jumping in.

6 Yeah. That would depend on what the
7 baseband -- what had already been done to the
8 baseband signal.

9 So, in -- again, in the case of equation
10 20-61, it's already had two up-conversions put into
11 it. So, adding another common up-conversion doesn't
12 change the fact that there are two up-conversions to
13 two different carrier frequencies. That's already
14 baked in to the composite complex base- -- baseband
15 waveform.

16 BY MR. HENDIFAR:

17 Q. So, you are viewing the movement of the
18 baseband signal to the right and left of center so
19 that they can both be joined together as different
20 up-conversions that result in different carrier
21 frequencies?

22 A. What do you mean by I am viewing it?
23 It's just math. It's just --

24 Q. It's your opinion --

25 A. It's just the math in the equation,

1 Counsel. It's an expo- -- it's a multiplication by
2 E to the negative $32 \Delta F$ times $J 2 \pi T$. That's
3 an up-conversion. That's the definition of an
4 up-conversion, is that multiplication in the time
5 domain by the complex sinusoidal rotator.

6 Okay?

7 And there's two of them. One is a
8 signal that's multiplied by that negative ten
9 megahertz up-conversion and the other one's
10 multiplied by a plus ten megahertz up-convergence.
11 There's two up-conversions baked into equation
12 20-61. And they correspond to the two
13 up-conversions that the draft 2.0 standard says you
14 need to have.

15 If you're going to transmit in both the
16 upper and lower 20 megahertz portions of a 40
17 megahertz channel, then the standard says you have
18 to do the up-conversions of each baseband signal by
19 respectively, it says, $F_{sub C} \pm 10$
20 megahertz. That's exactly reflected in these
21 equations.

22 Q. Okay. Is that baseband signal
23 transmitted after what you characterize as the
24 up-conversion to the $F_{sub C} \pm$?

25 A. The standard is describing that what you

1 are going to transmit -- when you transmit a non-HT
2 duplicate transmission, to use the term in the draft
3 2.0, and it's used to transmit to clause -- I'm just
4 reading from paragraph 104, but it's just verbatim
5 out of the standard --

6 "Is used to transmit to clause
7 17" -- it says "STAs" --

8 That means stations; so, receivers.

9 Clause 17 receivers are going to assume
10 a carrier frequency.

11 Okay?

12 They are never going to assume the
13 carrier frequency which is -- which is -- or they're
14 never going to assume that the carrier frequency is
15 the middle of a 40 megahertz channel. If they did,
16 they would receive garbage.

17 Okay?

18 They would never get a message.

19 The only way they are going to receive
20 is by tuning their carrier to the carrier that's
21 actually expressed by this equation, and as well in
22 combination with equation 20-1. And that is that
23 there is one carrier at F_C minus ten megahertz.

24 And so if I'm a clause 17 station and
25 I'm in the lower channel, that's the one I'm going

1 to tune to. And then I'm going to get the baseband
2 signal that's here in -- described in equation
3 20-61, the first baseband signal.

4 If I'm in the upper 20 megahertz channel
5 and I'm a clause 17 station, it just means 802.11a,
6 then I'm going to get the second baseband signal at
7 the plus ten megahertz that the -- ten megahertz
8 higher than just the middle of that 40 megahertz
9 channel.

10 And if I do it differently, if I don't
11 go through one of those two carriers, then I'm just
12 going to get garbage.

13 Q. Now, pointing to your declaration
14 paragraph 318.

15 A. Okay. I'm there.

16 Q. What do you mean by a "composite complex
17 baseband signal" in paragraph 318?

18 A. It -- yeah. That's just a reference to
19 summing -- summing -- we use different terms. A lot
20 of times we say ensemble, but composite is fine.

21 And so it's a reference in OFDM to the
22 fact that the subcarriers -- the baseband signal --
23 each -- each of those subcarriers is an
24 up-conversion.

25 Right?

1 So, but rather than refer to 64
2 different up-conversions, we refer to the sum of
3 those up-conversions as being a composite complex
4 baseband signal when -- when -- when there is a
5 modulation associated with each one of the
6 subcarriers.

7 So, for example, the first information
8 in this paragraph 318, POSITA would understand the
9 first information and the second information. And
10 it says, you know, for either HT duplicate or non-HT
11 duplicate as being within a single composite complex
12 baseband signal.

13 So that means, for example, the first
14 information being mapped to that first baseband
15 signal, it gets summed across that index K in
16 equation 20-61 for the non-HT duplicate. And that
17 would give you a single composite complex baseband
18 signal.

19 And then you've got a second
20 information, which is the 90-degree phase-rotated
21 version across the subcarriers. And it also gets
22 summed over that index K. And so that would be
23 another of -- one of these single composite complex
24 baseband signals.

25 So, effectively you end up with two of

1 them.

2 Q. Okay. And in the standard, in the
3 802.11 standard, the transmitter doesn't transmit
4 the baseband signal it outs upon converting it to
5 the frequency carrier, correct?

6 A. Well that, would -- that would depend
7 how the transmitter is implemented.

8 I mean the -- the transmitter ultimately
9 is going to transmit at the channel frequency that
10 is being signaled, you know, in the -- you know,
11 that's being signaled. For example, if it's an axis
12 point, the beacon will advertise a channel -- a
13 channel information, and then the transmission would
14 occur at that frequency.

15 I guess maybe I didn't understand your
16 question really very well.

17 (A clarification was requested by
18 the reporter.)

19 MR. HENDIFAR: I am now going to put a
20 document in the chat box which we will mark as
21 Exhibit 2019.

22 (Whereupon the document referred
23 to was marked Exhibit 2019 and is
24 attached hereto.)

25 ///

1 BY MR. HENDIFAR:

2 Q. If you'll just take a moment to review
3 this document, and then I will ask my question.

4 A. Okay. I've looked at it.

5 This is just a piece of the document, a
6 piece of what -- there were a set of slides or
7 something that -- there was a whole bunch of
8 figures. And there's a lot more that goes with
9 this.

10 Q. I only have this. I'm sorry.

11 A. Oh, I believe you that when you went to
12 download it, that this was all you got. I'm just
13 saying that this is -- this is a -- it's like an
14 abstract or -- this is a small piece of a -- yeah,
15 that's right. I remember that European conference.
16 This is not so far in the past --

17 (A clarification was requested by
18 the reporter.)

19 THE WITNESS: Yeah. It's the European
20 conference on antennas and propagation in 2014.
21 This paper was written -- written by Andrew Lea.

22 A lot of the slides he would have had
23 came from me.

24 And -- and then Hrishikesh and Badri
25 worked for me. Andrew worked for me, as well. And

1 Rodney Vaughan was a -- I think he still is a
2 professor at Simon Fraser.

3 Q. Now, what does this paper -- what
4 problem does this paper try to solve?

5 A. It's working on spectrum options for
6 wireless backhaul of small cells.

7 Q. Okay. May I please refer you to the
8 second page of this document, first paragraph, which
9 is the paragraph that connects the first and second
10 pages, last sentence of that paragraph.

11 A. So the one that starts with "with
12 non-line-of-sight links"?

13 Q. Right.

14 So let me read that for the record,
15 "With non-line-of-sight links. The
16 use of the highly directional
17 point-to-point links using high
18 frequencies is no longer
19 appropriate, and the advantages of
20 using the better non-line-of-sight
21 propagation characteristics of
22 lower carrier frequencies than tens
23 of gigahertz seems to become
24 attractive."

25 Do you see that sentence?

1 A. Yes.

2 Q. In layman term what is this sentence
3 trying to say?

4 A. It's saying that for non-line-of-sight
5 links, you're better off being at lower RF
6 frequencies than at higher -- higher frequencies
7 that -- that have certain advantages for
8 line-of-sight links.

9 So it's dis- -- it's just distinguishing
10 the preferred spectrum for non-line-of-sight links
11 versus line-of-sight for the technology available in
12 2014.

13 Q. Thank you.

14 What does "carrier frequency" mean in
15 this sentence?

16 A. Carrier frequency? I -- as I said,
17 it's -- earlier -- I gave you a response to that
18 question earlier.

19 It's basically a periodic waveform
20 that's typically unmodulated.

21 Q. Okay. Does "carrier frequency" in this
22 sentence mean the frequency of the carrier signal
23 upon which the baseband signal is modulated?

24 A. No. I think that -- I think that
25 they're really just saying -- you know, I think

1 Andrew --

2 I don't want to speak for Andrew. You
3 can -- you can depose him.

4 But I think he just means the spectrum
5 band. He just means that the characteristics of --
6 of a spectrum band that's below tens of gigahertz
7 is -- is more on -- on balance is more advantageous
8 for the non-line-of-sight, where -- where the tens
9 of gigahertz and above as a -- as an RF spectrum is
10 more advantageous in general for highly directional
11 point-to-point --

12 (A clarification was requested by
13 the reporter.)

14 THE WITNESS: -- links. And so why
15 Andrew chose the word "lower carrier frequency" as
16 opposed to just saying "spectrum bands," you'd have
17 to ask him. I can't answer that.

18 BY MR. HENDIFAR:

19 Q. This is the second article that you
20 disagree with the terminology used by your
21 co-authors.

22 A. I do not disagree with the terminology
23 being used by my co-authors here. And I did not
24 in -- in a previous one either. Just so we're
25 clear.

1 Like I said, I -- if I were writing it,
2 I would -- I wouldn't write it that way. But I
3 don't -- I don't know what -- I can't tell you what
4 Andrew had in his mind when he wrote that.

5 Q. Is it your testimony that "career
6 frequency" here just means the frequency range?

7 A. It -- no. My testimony is that this
8 sentence here is referring -- in the context of this
9 article, it's referring to the fact that for highly
10 directional point-to-point links, it's advantageous
11 to use frequencies in higher spectrum bands
12 relatively speaking compared to non-line-of-sight
13 links, you're better off being in lower spectrum
14 bands.

15 That's -- that's what this sentence
16 conveys. I totally 100 percent agree with it. And
17 why Andrew chose to write "lower carrier frequency"
18 for "spectrum band," I don't know what his reason
19 is. I'm not going to speculate.

20 Q. Okay. So you answered above what you
21 believe this sentence overall conveys, which I don't
22 disagree with.

23 I want to focus on what specifically the
24 phrase "carrier frequency" means in this sentence.
25 So --

1 A. I've already explained to you what
2 "carrier frequency" means, period.

3 Q. Right. And I want to confirm it means
4 the same in this sentence.

5 So, does "carrier frequency" in this
6 sentence in Exhibit 2019 mean the frequency of the
7 carrier signal upon which the baseband signal is
8 modulated?

9 A. It's -- it's not at odds with that.
10 It's just that that's not the point of the sentence.

11 The point of the sentence is to convey
12 what -- what spectrum options -- which is the title
13 of the paper -- are attractive for non-line-of-sight
14 links versus line-of-sight links, that that -- if
15 you pick a particular spectrum option, that you
16 would probably define your waveform as having one or
17 more carriers -- in our case if it was OFDM, it
18 would be thousands of carriers -- but that if --
19 that you would place those multiple carriers in that
20 lower spectrum versus the higher spectrum, that's --
21 that's where the point is being conveyed here.

22 Q. What is a synthesizer?

23 A. In what context, Counsel?

24 Q. In the context of RF signal.

25 A. In -- of RF what? I couldn't hear that.

1 Q. RF circuitry.

2 What is a synthesizer?

3 A. In RF circuitry, you're talking about RF
4 as in RF transceivers, for example?

5 Q. Sure.

6 A. Okay. So, typically we use the term
7 "synthesizer" as a way of generating an oscillation
8 frequency, a periodic waveform, by a reference to
9 another periodic waveform.

10 So, in other words, we -- we synthe- --
11 we start with a known periodic waveform at one
12 frequency and we synthesize another periodic
13 waveform at a different frequency that is referred
14 to the first known frequency.

15 And that's just off the cuff. I'd be
16 happy to go Google "synthesizer," you know, "in an
17 RF circuit" and see what we get, but I'm guessing it
18 will be something along that line.

19 Q. Is it similar to a mixer in terms of
20 functionality?

21 A. No. It's a different functionality than
22 a mixer.

23 A mixer is a multiplier. It's just that
24 it's -- it's not -- it's not practical in RF
25 circuits as opposed to in the digital signal

1 processing world to do a -- a linear multiplication.

2 It typically -- the mixer -- so, in the
3 mixer when we mix one frequency with a -- you know,
4 one frequency reference, often, which we usually
5 call the LO, the local oscillator input, we mix not
6 only -- or we multiply not only by that periodic
7 waveform, but we are multiplying by its harmonic.

8 So typically some of its second and
9 fourth, even harmonics, usually they're pretty
10 suppressed. But we usually have a considerable
11 harmonic mixing or modulating of the third harmonic
12 or fifth harmonic.

13 So, effectively, when we use a mixer to
14 up convert -- and this is true with direct
15 conversion, as well -- we -- we get multiple
16 carriers. We get the desired carrier, but we also
17 get the third harmonic and the fifth harmonic and
18 the seventh harmonic, and so then we have to filter
19 those off.

20 Q. Okay. I'm now going to put what we will
21 mark as Exhibit 2025 in the chat box.

22 (Whereupon the document referred
23 to was marked Exhibit 2025 and is
24 attached hereto.)

25 ///

1 BY MR. HENDIFAR:

2 Q. And please take a moment to review this
3 document and please let me know when you're ready so
4 I can ask you a question.

5 A. Okay.

6 Q. Is Exhibit 2025 the publication of a
7 patent application by you?

8 A. Appears to be.

9 Q. Do you have any reason to doubt that?

10 A. No.

11 Q. May I please refer you to paragraph one
12 of this application in Exhibit 2025.

13 A. Okay.

14 Q. And the sentence that reads as follows,
15 quote,

16 "Frequency-hopping wireless
17 communication systems are systems
18 that transmit data using a center
19 frequency with hops about a
20 relatively broad frequency
21 bandwidth. Unlike conventional
22 systems in which a fixed-frequency
23 carrier is used, in frequency
24 hopping systems the carrier
25 frequencies are approximately

1 pseudo-randomly determined."

2 Do you see that sentence?

3 A. I do see that, yes.

4 Q. What is the problem that the patent
5 application in Exhibit 2025 is trying to solve?

6 A. It's trying to disclose a solution for a
7 multi-channel bandwidth frequency-hopping system.

8 Q. And in the sentence we just read from
9 paragraph one, the application uses the phrases
10 "center frequency" and "carrier frequency"
11 interchangeably, correct?

12 A. I'm not -- I'm not sure that it -- I'm
13 not sure that it does. But -- or I'm not sure that
14 that's what it was trying to convey.

15 But I don't -- you know, I -- there --
16 there certainly are cases where the center frequency
17 and the carrier frequency can be the same thing.
18 They don't have to be.

19 Center frequency is a broader term.
20 Carrier frequency is a narrower term.

21 Can the carrier frequency be at the
22 center frequency? Sure, of course it can.

23 But it wasn't my intention here to -- to
24 use them as being interchangeable.

25 Carrier frequency is narrower than

1 center frequency. It's a narrow -- it's a narrower
2 term.

3 Q. Okay. Now, then let me rephrase my
4 question. As drafted, paragraph one of Exhibit 2025
5 uses the phrases "center frequency" and "carrier
6 frequency" interchangeably, correct?

7 A. Not on purpose.

8 Q. But it does, regardless of what your
9 purpose was, correct?

10 A. No. I -- I don't -- I don't say that
11 this uses them interchangeably. I don't -- I
12 don't -- I in no way in writing this -- I'm not
13 saying that I wrote this, but -- but certainly I
14 signed off on it.

15 In no way was I trying to say that
16 "center frequency" is interchangeable with "carrier
17 frequency."

18 I have no problem with the fact that
19 carrier frequencies are often -- don't have to be,
20 but they are often center frequencies.

21 Okay?

22 That's -- that's not a problem here.

23 But they are not -- they're -- you can
24 have a center frequency without any carrier.

25 Okay?

1 A center frequency is just the middle of
2 some kind of frequency range, the frequency in the
3 center.

4 Okay?

5 And so you don't have to have a carrier
6 in order to have a center frequency. If you do have
7 a carrier, it might well be in the center of
8 something, and it might well be a center frequency.

9 But I did not use them here to be
10 interchangeable. That was not my purpose.

11 Q. Okay. So are you saying that in
12 paragraph one of Exhibit 2025, the phrase "center
13 frequency" was intended to mean something different
14 than the phrase "carrier frequency" as those words
15 are used in that paragraph?

16 MR. MARANDOLA: Object to the form.

17 THE WITNESS: I don't recall exactly how
18 this got drafted. I don't recall whether -- whether
19 I drafted these words or whether counsel for Proxim
20 drafted these words.

21 What I'm telling you is that "center
22 frequency" and "carrier frequency" are not in
23 general interchangeable. They -- you know, one is a
24 narrower version of the other.

25 Carrier frequency can't -- can certainly

1 be a center frequency, but it doesn't have to be.
2 And a center frequency can definitely be a center
3 frequency and not a carrier frequency.

4 And so that -- that's my position.

5 I see nothing in this paragraph one
6 that's at odds with my understanding.

7 Q. And again I have to say you're repeating
8 your position unrelated to my question.

9 But if you would please focus on
10 answering the question I ask, I would appreciate
11 that. It's now becoming a repeating thing.

12 My question is not what your general
13 belief on the meaning of center frequency is. My
14 question is not what in your mind you may have
15 intended to say.

16 My question is very simple about what
17 this paragraph actually says.

18 The question is, is it your opinion that
19 in paragraph one of Exhibit 2025 the phrase "center
20 frequency" means something than the phrase "carrier
21 frequency" as those phrases are used in this
22 paragraph?

23 A. Yes. "Center frequency" means a
24 frequency in the middle of a span or the middle of a
25 range. That's what center -- that's what it means

1 in paragraph one. That's what it means not in
2 paragraph one.

3 "Carrier frequency" means that it's a
4 periodic waveform on -- on which modulation will be
5 applied. That's what it means in paragraph one.
6 That's what it means not in paragraph one.

7 There's nothing in paragraph one to
8 suggest that "center frequency" or "carrier
9 frequency" have anything other than their normal
10 plain and ordinary meanings.

11 Q. Okay. May I please refer you to
12 paragraph 15 of Exhibit 2025.

13 A. Okay.

14 Q. Paragraph 15 discusses the embodiment of
15 Figure 4, correct?

16 A. Paragraph 15 starts with,
17 "Figure 4 illustrates a transmitter
18 which is used in one embodiment of
19 the present invention."

20 Q. Yes. And what is the function of the
21 local oscillator in the embodiment of Figure 4?

22 A. In Figure 4 the local oscillator is
23 setting the -- the hopping frequency.

24 Q. Okay. Is that a carrier frequency?

25 A. Yeah. For -- for a particular hop. It

1 would be a different carrier frequency on a -- so
2 it's saying multiple carrier frequencies depending
3 on which hop you have.

4 Q. Understood.

5 So in the embodiment of Figure 4 in
6 Exhibit 2525 discussed in paragraph 15, the local
7 oscillator relates the different carrier frequencies
8 for the hopping.

9 Is that accurate?

10 A. In this particular implementation, yes,
11 I agree.

12 Q. Towards the bottom of paragraph 15 the
13 sentence that reads,

14 "An indication of whether a high or
15 low bandwidth signal is being
16 transmitted is provided to the
17 logic 60 so it can produce the
18 correct center frequency."

19 Do you see that.

20 A. Yes.

21 Q. What is the purpose of logic 60?

22 A. I believe logic 60 would basically be a
23 synthesizer. So, its purpose would be to synthesize
24 the -- the output of a local oscillator.

25 You know, so the synthesizer, you could

1 argue that 60 and 62 together are the synthesizer
2 would be fine. And it's not showing the reference
3 frequency in this figure.

4 But logic 60 would effectively be the
5 digital circuitry that's within, you know, common
6 synthesizers at that time.

7 Q. Okay. So logic 60 (inaudible comment)
8 act as in part generates the carrier frequency
9 output by local oscillator 62 or helps generate?

10 A. Well, the oscillator itself is -- is
11 just an oscillator.

12 Right?

13 And it will have a tank circuit, that's
14 t-a-n-k, and a negative resistance cell. And it
15 will -- it will naturally want to oscillate at the
16 resonance of the tank.

17 And typically there's a way to tune the
18 tank, to pull it around. And then to lock it to a
19 reference at a different frequency we generally
20 implement logic circuits. And we call that
21 combination a synthesizer.

22 So, that's what's going on there with
23 it. Whether that agrees with your question or not
24 I'm not sure.

25 Q. Are you familiar with the phrase

1 "channel frequency"?

2 A. Yes.

3 Q. What does it mean?

4 A. It -- it can mean a lot of things.

5 Unfortunately, the word "channel" I -- I always
6 apologize to my students early on for the word
7 "channel." We use it in a lot of different
8 contexts.

9 And so "channel frequency" can mean a
10 lot of different things.

11 Q. Are you familiar with the phrase
12 "channel center frequency"?

13 A. I'm familiar with -- with that set of
14 words. I'm not saying that that's a common term of
15 art, but it's not an uncommon one either.

16 Q. What does "channel center frequency"
17 mean?

18 A. It would mean -- you know, as I said
19 before center frequency is just the middle of -- of
20 a frequency range or the middle of a frequency span.

21 And so, if channel is being used in its
22 frequency domain meaning, which is -- there's many
23 different meanings for "channel."

24 But if it's being used in the frequency
25 domain meaning, then "channel center frequency"

1 means that for the frequency span of that channel,
2 you know, the center frequency is the frequency in
3 the middle of it.

4 Q. What is a radio frequency chain, RF
5 chain?

6 A. That's contextual. But typically we use
7 the word "chain" to refer to the analog side of the
8 signal processing. And where the term "chain"
9 became popular was when we had multiple chains.
10 Those are just to distinguish one chain from
11 another.

12 Back -- back in the days when we really
13 only had one chain, we didn't call it a chain. We
14 just called it the RF. But as opposed to the naught
15 RF.

16 But in beam forming or multi-carrier --
17 excuse me. Not multi-carrier -- multi-spatial
18 stream of, you know, MIMO is a popular term that's
19 used. It's more generic than the way it's usually
20 used.

21 But -- but if there's multiple spatial
22 streams or multiple spatial transmitters or
23 receivers, then we usually call the RF within a
24 particular spatial path a chain. That's the way
25 I've typically used it and -- and the way I've

1 typically even seen it.

2 Not to say that there can't be other
3 usages of it out there.

4 Q. I am now going to put a document in the
5 chat box which we will mark as Exhibit 2024.

6 (Whereupon the document referred
7 to was marked Exhibit 2024 and is
8 attached hereto.)

9 BY MR. HENDIFAR:

10 Q. Please take a moment to review and let
11 me know when you're ready.

12 A. Okay. I'm ready.

13 Q. Is Exhibit 2024 a patent issued to you?

14 A. It looks like an issued patent. And I'm
15 the first named co-inventor.

16 Q. May I --

17 A. It's not to me. I mean it was assigned
18 to someone else. I don't own this patent.

19 Q. Understood.

20 May I please refer you to column 25
21 lines 23 and 24.

22 A. Okay. Yeah. I see it.

23 Q. Does the phrase "RF carrier frequency"
24 in this sentence mean the frequency of the carrier
25 signal to which the baseband is up-converted?

1 A. I believe that it's -- it says that,
2 yeah,

3 "In some embodiments, the
4 up-conversion is a direct
5 conversion architecture where a
6 baseband in-phase and
7 quadrature-phase signal is
8 converted to an RF carrier
9 frequency such as those of the
10 60 gigahertz band. In other
11 embodiments, an IF frequency may be
12 utilized and then up-converted to
13 an RF carrier frequency."

14 So, you know, RF carrier frequency
15 ultimately refers to what is the frequency, the
16 periodic waveform upon which the modulation is
17 based -- based on or what the modulation is
18 modulating.

19 And so in the direct conversion sense,
20 yes, the RF carrier would be the carrier. But in an
21 IF architecture, the -- at least the local
22 oscillator would not be the RF carrier.

23 Q. So --

24 (Indecipherable simultaneous
25 colloquy.)

1 BY MR. HENDIFAR:

2 Q. Sorry. Please.

3 A. Yeah. I'm just saying so this -- this
4 paragraph within this is just -- it's just saying --
5 you know, it's a typical patent. It's saying I'm --
6 I'm not limiting my invention to one particular
7 implementation.

8 You know, you could do direct convert --
9 you know, you do a lot -- you could do your
10 up-conversion that results in a -- a carrier signal
11 frequency. You could do it in one step or you could
12 do it in multiple steps. Either way.

13 Q. In this IPR do you understand Patent
14 Owner's construction of center frequency as the
15 frequency of the carrier signal to which the
16 baseband signal is up-converted as requiring a
17 direct up-conversion from the baseband signal to the
18 carrier signal?

19 MR. MARANDOLA: Object to the form.

20 THE WITNESS: Yeah. I -- I understand
21 that the Patent Owner has said that center frequency
22 should mean the carrier's signal frequency, the
23 baseband signal is up-converted to, not the carrier
24 signal.

25 Q. Right. The frequency.

1 So, do you understand Patent Owner's
2 construction to require direct up-conversion from
3 baseband to carrier?

4 A. Do I understand it?

5 The words itself don't -- I mean if
6 you're saying how do I get a carrier signal
7 frequency that the baseband signal is up-converted
8 to, you do not have to do that by direct conversion.
9 That is not a requirement.

10 What does -- what Patent Owner intend,
11 you'd have to depose Patent Owner, I guess, if you
12 want to know that. I can't read anybody's mind.

13 But the words that the Patent Owner has
14 proposed should be the -- the construction as a
15 matter of law, it's clearly not the plain and
16 ordinary meaning of center frequency.

17 But if you're saying in view of the --
18 how the 802 patent uses it that way in certain
19 examples, well, there's -- there's nothing in the
20 words that you've proposed that require direct
21 conversion.

22 If you do intend that those words
23 require direct conversion, then I highly recommend
24 you propose a construction that says it has to be
25 done with direct conversion.

1 Q. Okay. All I was asking is how you
2 understood Patent Owner's proposed construction.

3 And I appreciate the response.

4 May I now, in same Exhibit 2024, refer
5 you to column 25 line 37.

6 A. Line 37 is just like in the middle of a
7 sentence.

8 I'm not -- I don't really understand
9 what you're --

10 Q. Sure. I'll ask my question. And please
11 review what you see fit.

12 In Exhibit 2024 column 25 line 37 uses
13 the phrase "local oscillator."

14 The question is in this embodiment of
15 Exhibit 2024, is the local oscillator used to
16 provide the carrier frequency for the up-conversion?

17 A. I can't tell just from these words here.
18 You can do quadrature up-conversion from
19 an IF. You don't --

20 (A clarification was requested by
21 the reporter.)

22 THE WITNESS: So you can do quadrature
23 up-conversion from an IF. There's nothing --
24 nothing wrong with that, in which case the local
25 oscillator is not at the carrier frequency. Or you

1 can do it with direct conversion.

2 And as we just discussed in the
3 paragraph above in column 25, I -- in some
4 embodiments the up-conversion is a direct conversion
5 and in other embodiments, it's a -- an IF
6 conversion.

7 So looking at, you know, line 37, this
8 local oscillator, it could be that that local
9 oscillator signal is going to be at the carrier
10 signal frequency. But it doesn't have to be. At
11 least that sentence alone isn't telling me that
12 it -- that it -- that it is.

13 BY MR. HENDIFAR:

14 Q. Okay. Reading the subsequent sentence
15 that says,

16 "The output of the up-conversion is
17 optionally filtered using optional
18 band pass filter E-10D-30 and
19 optionally amplified using optional
20 amplifier E-10D-20 and coupled to
21 transmit antenna TNX [sic]."

22 Does the fact that the output of the
23 up-conversion using the local oscillator help you
24 provide an answer to my question, which is does the
25 local oscillator in column 25 line 37 of

1 Exhibit 2024 provide the carrier frequency for the
2 up-conversion?

3 A. Well, it wouldn't if you needed the
4 optional filter. You wouldn't need the band pass
5 filter theoretically, at least, if it was a direct
6 conversion.

7 So, it says it's optionally filtering --
8 again it just goes back to the previous paragraph
9 that I'm describing that it could be done with
10 either architecture, the up-conversion could be done
11 through an IF and then through a second mixer -- or
12 it could be done through a direct conversion.

13 If you had this optional band pass
14 filter, typically you would need that because in the
15 IF conversion architecture, you're going to get two
16 versions of the frequency shift. You'll get an FLO
17 plus FIF and you'll get an FLO minus FIF.

18 And one of them will be the one you want
19 that will have the carrier signal in it. The
20 carrier signal won't be FLO or FIF, but it will be
21 one of those two options that you have.

22 And so you'll need a band pass filter to
23 get rid of the other one that you don't want.

24 Q. Understood.

25 MR. HENDIFAR: Is it a good time for a

1 break?

2 THE WITNESS: Whenever you want a break,
3 Counsel, go ahead. I don't need a break.

4 MR. HENDIFAR: Usually I need a break
5 and usually the court reporters, I don't want to
6 butcher Ms. -- I can't pronounce her last name --
7 Hubbard.

8 So let's take maybe 10 minutes?
9 15 minutes.

10 What do you prefer, Patricia?

11 THE REPORTER: Ten minutes is fine.

12 MR. HENDIFAR: Ten minutes is fine with
13 you guys?

14 Okay we'll see you at the top of the
15 hour.

16 Thank you.

17 (Brief recess.)

18 BY MR. HENDIFAR:

19 Q. So, welcome back, Dr. Negus.

20 May I please refer you to the
21 '802 Patent, which is Exhibit 1001 in this
22 proceeding.

23 Do you have a copy?

24 A. I do.

25 Q. Is it unmarked?

1 A. It's unmarked except that I have little
2 yellow highlights on the numbers 1, 2, 3, 4, 7, 8
3 and 9 on the claims. Just my way of keeping track
4 of what the asserted claims are.

5 Q. Just let me know when you have it.

6 A. Oh, I have it in front of me.

7 Q. May I please refer you to column one and
8 lines 30 to 31 -- or 29. The sentence starting on
9 line 29 says,

10 "The transmitter 100 is limited to
11 up-converting a signal to one
12 center frequency (or modulation
13 frequency) which is the LO
14 frequency."

15 What does "modulation frequency" mean
16 here?

17 MR. MARANDOLA: Object to the form.

18 THE WITNESS: You'd have to ask the
19 inventors. I can't read their minds.

20 BY MR. HENDIFAR:

21 Q. Okay. Are you able to understand this
22 sentence?

23 A. I can speculate as to what the inventors
24 mean.

25 Is that what you would like?

1 Q. I would like to understand what this
2 sentence means to a POSITA based -- or what is your
3 opinion about what this sentence means to a POSITA?

4 A. Well, let's take a look at Figure 1.

5 So, Figure 1 purports to be of the prior
6 art. It shows an input, at least in context of the
7 figure -- we don't know what that is. It shows a
8 digital to analog converter followed by a filter
9 followed by -- it's just showing a mixer. It
10 doesn't -- doesn't tell us whether it's quadrature
11 or not. And the mixer has a -- an input which is
12 the output of the filter and an input which is the
13 local oscillator. And then it's followed by no
14 other filters, a power amplifier and an antenna.

15 And so the sentence in Figure 1 in
16 that -- or, excuse me, in column one in that
17 context, that the transmitter is limited to
18 up-converting a signal to one center frequency or
19 modulation frequency, which is the LO frequency.

20 You're going to have to ask the -- the
21 inventors what they meant. Because nothing in
22 Figure 1 suggests that it's limited to up-converting
23 a signal to one center frequency or modulation
24 frequency, at least to the extent that modulation
25 frequency is meant to be a -- a carrier.

1 There's nothing about Figure 1 that
2 limits it to up-converting a signal to one carrier
3 frequency.

4 I'm not saying that that's not what the
5 inventors intend. That may be. I just can't read
6 their mind.

7 But if I look at Figure 1 and I read
8 that sentence, that sentence is incorrect.

9 Q. Okay. Did you understand -- did you
10 review the '802 Patent in preparing your
11 declaration?

12 A. Yes.

13 Q. Do you understand all of the disclosures
14 in the '802 Patent?

15 A. What do you mean by understand the
16 disclosures?

17 A lot of -- a lot of it -- like in the
18 case of this sentence where -- right here, some of
19 it is difficult to understand because it doesn't
20 seem correct.

21 But it's not a problem of understanding
22 the words, understanding the figures or the icons
23 are that in the block diagrams. I understand them.

24 Q. Okay. So, is there any part of -- or is
25 there any sentence in the '802 Patent that you do

1 not understand or you do not fully understand?

2 A. What -- what do you mean --

3 MR. MARANDOLA: Object to the form.

4 THE WITNESS: What do you mean by "fully
5 understand"?

6 Counsel, I think I -- I think I've
7 already answered your question, which is that the
8 '802 Patent has, you know, disclosures in it that --
9 that don't make sense.

10 So, I understand that they don't make
11 sense. I fully understand that they don't make
12 sense. I'm not lacking in the ability to understand
13 any of the words in the patent.

14 But where it's -- where it's vague or
15 ambiguous or incorrect, it is what it is.

16 BY MR. HENDIFAR:

17 Q. When you say that -- okay.

18 Is it the case that the portions of the
19 '802 Patent that you find potentially not
20 comprehensible, is it a case that you disagree with
21 the substance of what is said or you just don't
22 understand what the patent is trying to say?

23 A. I don't recall. It may be either one
24 depending on the specific example.

25 I don't have this patent memorized, but

1 I did read it thoroughly before I started my
2 declaration. And I do recall that there were points
3 being made in this patent that either were -- in
4 some cases were vague or in other cases appeared to
5 me to just be incorrect statements.

6 Q. So, going back to column one line 29
7 through 32 of the '802 Patent, would a POSITA know
8 what "modulation frequency" means in this sentence?

9 A. I think a POSITA would speculate that
10 that may be a reference to the carrier signal. If
11 it is a reference to the carrier signal, then either
12 this sentence is incorrect or Figure 1 fails to
13 convey the necessary circuitry that would be needed
14 in order to make this sentence correct.

15 Q. Okay. Now, if a POSITA understands
16 "modulation frequency" to mean "carrier frequency"
17 in column one lines 29 through 32, would it then
18 follow that in that sentence the patent uses the
19 phrases "center frequency" and "modulation
20 frequency" to mean the same thing?

21 MR. MARANDOLA: Object to the form.

22 THE WITNESS: No, it would not, in my
23 opinion.

24 BY MR. HENDIFAR:

25 Q. So, even though it says "center

1 frequency (or modulation frequency)" in your opinion
2 the specification does not convey that it is using
3 those two words interchangeably?

4 A. That's correct. It's certainly saying
5 that -- that the center frequency -- that the
6 modulation frequency can be a center frequency.

7 And -- and I've told you that, that if
8 modulation frequency means carrier signal frequency
9 I've told you several times that I don't have any
10 issue with the fact that a carrier signal frequency
11 may -- may well be the center frequency of a
12 particular frequency range. I don't have a problem
13 with that.

14 But I don't see that this sentence is
15 saying that the definition of "center frequency" is
16 "modulation frequency."

17 Q. In the discussion in column one starting
18 on line 12 through the end of that paragraph on line
19 40, is the output of the local oscillator the
20 carrier frequency?

21 A. In Figure 1?

22 Q. Well, my question didn't say Figure 1.

23 My question said in the '802 Patent
24 column one in the discussion starting in the
25 paragraph on line 12 through the end of that

1 paragraph on line 40, is the output of the local
2 oscillator the carrier frequency?

3 A. If -- if we read -- you know, errors
4 notwithstanding in the -- in the text, but if we
5 just read it literally and accept the errors, then I
6 think that that's what it's saying.

7 Right?

8 I think it's saying transmitter 100 is
9 limited to up-converting where this modulation
10 frequency, to the extent that's the carrier signal
11 frequency, is the LO frequency. So it's saying
12 that -- it's saying that that's what Figure 1 is in
13 the mind of the inventors' showing.

14 It's not what Figure 1 would convey to a
15 person of ordinary skill in the art, but -- but
16 that's what this sentence is saying.

17 Q. Okay. In your view, why doesn't
18 Figure 1 convey a signal with one carrier frequency?

19 A. Because it doesn't. I mean just look at
20 it. It doesn't tell us what the input is.

21 The input may already be expressed --
22 for example, if it's OFDM, there could be multiple
23 carrier frequencies already in that input in
24 digital.

25 If there was an IF conversion done in

1 digital, you know, you don't have to have a local
2 oscillator to do an IF. If there's an -- there's an
3 IF in digital, then that local oscillator that's
4 shown for mixer 130 is not going to be the carrier
5 frequency.

6 Okay?

7 So, from Figure 1 we -- we cannot come
8 to the conclusion that the -- that this has only one
9 carrier frequency and that it's the LO.

10 Now, the text in column one says that.

11 And, you know, inventors can say
12 whatever they want. They can make incorrect
13 statements if they want. And -- and that's fine.
14 If that's what -- what the inventor wants to say his
15 invention is limited to, I'm -- I don't have a
16 problem with that.

17 But Figure 1 does not convey that to a
18 person of ordinary skill in the art.

19 Q. The text of the '802 Patent in column
20 one in the paragraph starting on line 12 ending in
21 line 40, same paragraph you just reviewed, also
22 calls the output of the local oscillator the center
23 frequency, correct?

24 A. Where does it do that?

25 Q. For example, on line 31, where it says

1 "which is the LO frequency."

2 A. Okay. I see what you're saying.

3 It's saying that in this example that
4 the center frequency is the local oscillator
5 frequency. That -- that's the statement. That's
6 what I understand that comma, which is -- to mean.
7 It doesn't mean that center frequency and local
8 oscillator frequency are the same thing. Or at
9 least I don't understand that -- first of all, I
10 know they're not the same thing. But -- in all
11 cases.

12 But it's saying that for this example of
13 Figure 1, it's making this incorrect statement that
14 it's limited to this case where a center frequency
15 has a modulation frequency or carrier signal
16 frequency is the LO frequency.

17 It's making that statement. But that
18 doesn't equate center frequency with LO frequency as
19 a -- from a definitional point of view.

20 In terms of understanding what does
21 center frequency mean, one doesn't read this
22 statement and say, oh, center frequency means LO
23 frequency. That's just not -- not true at all.

24 Q. So even though it says center frequency
25 which is the LO frequency, in your opinion does not

1 mean that center frequency in the drafter's or the
2 patent's opinion was the LO frequency?

3 A. They don't say that. They say that the
4 transmitter is limited in a way that makes no sense
5 with the figure.

6 But they're -- they're saying that this
7 transmitter is limited to this case where center
8 frequency is the LO frequency. But they're not
9 saying my patent -- in my patent center frequency is
10 limited to LO frequency or center frequency is
11 interchangeable with LO frequency or whenever I say
12 center effectually I mean LO frequency.

13 There's just nothing like that in this
14 statement.

15 Q. Sure. And that was not my question.

16 Again we go back to the point that I
17 understand you have prepped for the deposition. I
18 understand experts are prepped. They're taught to
19 say certain things. They're taught not to say
20 certain things.

21 But this has become a thing where I ask
22 a question, you change my question, and then you
23 provide a memorized answer.

24 And at some level it's just how this is
25 done.

1 But this is becoming to an extreme.

2 So, I am not asking you about whether
3 the patent in this sentence says university. I am
4 define center frequency. I wasn't asking you about
5 if the patent expressly says I am saying frequency
6 instead of frequency means X. My question is very
7 specific.

8 Is the patent saying that -- in column
9 one in the paragraph starting on lines 12 through 40
10 is the patent saying that in this paragraph the
11 center frequency is the output of the local
12 oscillator which is the carrier frequency?

13 A. No. That's not the words that are
14 listed there. The word -- the words that are listed
15 are the words that are listed. They're not the
16 words that you recited.

17 Q. Right. And I'm not saying if those
18 words appear. I'm not -- well, let me then repeat
19 the question.

20 The '802 Patent column one lines 12
21 through 40, in that section, does the patent use the
22 words -- the word "center frequency" in that
23 paragraph to mean the output of the local
24 oscillator?

25 MR. MARANDOLA: Object to the form.

1 THE WITNESS: No.

2 BY MR. HENDIFAR:

3 Q. Actually the frequency -- let me correct
4 my question.

5 In the '802 Patent column one lines 12
6 through 40 does the patent use the phrase "center
7 frequency" to mean "the frequency of the local
8 oscillator"?

9 MR. MARANDOLA: Same objection.

10 THE WITNESS: No.

11 BY MR. HENDIFAR:

12 Q. So in your opinion, the sentence, quote,
13 "The transmitter 100 is limited to
14 up-converting a signal to one
15 center frequency (or modulation
16 frequency), which is the LO
17 frequency."

18 In your opinion that sentence does not
19 convey to a POSITA that center frequency is the
20 local oscillator frequency?

21 MR. MARANDOLA: Object to the form.

22 THE WITNESS: Not in a definitional
23 sense. That in no way says that the definition of
24 center frequency is LO frequency. No such statement
25 is made.

1 BY MR. HENDIFAR:

2 Q. I understand that that statement is not
3 made. But that was not my question.

4 The question --

5 A. That's what I understood your question
6 to be.

7 But perhaps you could rephrase your
8 question so that it's understandable.

9 Q. Sure.

10 Would a POSITA -- is it your opinion
11 that in the sentence, quote, "the transmitter 100 is
12 limited to up-converting a signal to one center
13 frequency (or modulation frequency), which is the LO
14 frequency" -- is it your opinion that in that
15 sentence a POSITA would not understand that in that
16 sentence "local oscillator frequency" is used -- is
17 used to mean "center frequency"?

18 MR. MARANDOLA: Object to the form.

19 THE WITNESS: You added a negative in
20 there somewhere in the middle. And I -- I can't
21 parse that. You say -- you asked first what a
22 POSITA would understand, then you said what a POSITA
23 would not understand in that question.

24 So if you could do it all in the
25 positive, I will attempt to answer this question.

1 Or all in the negative. Either way. But preferably
2 in the positive.

3 BY MR. HENDIFAR:

4 Q. Sure. Would -- well, in this --
5 restarting.

6 In the sentence, quote,

7 "The transmitter 100 is limited to
8 up-converting a signal to one
9 center frequency (or modulation
10 frequency) which is the LO
11 frequency."

12 In your opinion, in this sentence would
13 a POSITA understand that the word "center frequency"
14 is used to mean the "LO frequency" in this sentence?

15 A. No.

16 Q. Why not?

17 A. Because it's not what it says.

18 It says that the transmitter is limited.
19 It's describing what -- what's going on with the
20 transmitter.

21 It's not saying the center frequency is
22 the same as LO frequency. It's saying that in this
23 transmitter, incorrectly relative to -- it says
24 transmitter 100, which in order to understand that
25 you've got to go look at transmitter 100, which is

1 Figure 1, and there it's saying that this -- this is
2 limited to up-converting a signal to one center
3 frequency, which it's clearly not from the figure,
4 but it's yet -- but yet it's saying that it is. And
5 it's saying that that one center frequency is the LO
6 frequency.

7 But that -- that's not saying that the
8 center frequency -- that "center frequency" means
9 "LO frequency."

10 Q. May I please refer you to column 11 of
11 the '802 Patent.

12 Please let me know when you're there.

13 A. Oh, sure. I'm at column 11.

14 Q. Okay. I am going to ask you questions
15 about column 11 lines 1 through 20. And the
16 questions are as follows.

17 In the '802 Patent the up-converter 812
18 up-converts a signal to the first center frequency,
19 correct?

20 A. I'd have to look at Figure 8 here. This
21 is describing Figure 8. Let's take a look at it.

22 Okay. Let me read the text. You
23 said -- you said you want lines 1 to 20? Is that
24 it?

25 Q. I am pointing you there because I

1 believe that's where it's discussed. You're more
2 than welcome to look anywhere you'd like.

3 The question is in the '802 Patent,
4 up-converter 812 up-converts a signal to a first
5 center frequency, correct?

6 A. Let me read it, then.

7 Okay. I've -- I've read it. Would you
8 repeat your question.

9 Q. Sure. In the '802 Patent, up-converter
10 812 up-converts a signal to a first center
11 frequency, correct?

12 A. That's not what it says. But I think
13 it -- I think it means the same thing.

14 It says it up-converts the analog signal
15 to RF center frequency F -- F sub 1 or F_1 .

16 Q. I'm sorry. In what respect did you
17 disagree on this?

18 A. You said the first center frequency.
19 The word "first" does not appear. It does not say
20 "up-convert the analog signal to a first RF center
21 frequency." It says "to a RF center frequency F_1 ."

22 Q. Okay. And up-converter 813 up-converts
23 a signal to an RF center frequency F_2 , correct?

24 A. That's -- that's what the patent
25 recites.

1 Q. And the outputs of up converters 812 and
2 813 are coupled together and input to power
3 amplifier 815, correct?

4 A. Yes. That's -- that's the words it
5 recites for this exemplary embodiment.

6 Q. And the output of power amplifier 815 is
7 coupled to antenna 850 to transmit the digital data,
8 correct?

9 A. That's what it recites.

10 Q. And --

11 A. Among other things. But, yes, at least
12 that.

13 Q. And the patent in column 11 states that,
14 "The output of the power amplifier
15 815 is coupled to antenna 850 to
16 transmit the digital data
17 simultaneously as an
18 electromagnetic signal using two
19 different RF carrier frequencies."

20 Do you see that?

21 A. I do.

22 Q. Okay. Would a POSITA understand the two
23 different RF carrier frequencies in column 11 to
24 refer to the RF center frequency F1 and RF center
25 frequency F2?

1 MR. MARANDOLA: Object to the form.

2 THE WITNESS: The POSITA would have to
3 make an assumption as to what is the input into
4 Figure 8.

5 But depending upon the assumption that
6 they made, then they would -- if, for example, the
7 input to Figure 8 -- the input to the DAC 810 did
8 not already have a part of the up-conversion process
9 for one or more carriers going on.

10 So, for example, if it was not OFDM, for
11 example, then you could -- you could infer from this
12 exemplary embodiment that the way it's getting to
13 two different RF carrier frequencies is that one of
14 those RF carrier frequencies is F1 and one of those
15 RF carrier frequencies is F2.

16 Q. In this embodiment, at least, "RF
17 carrier frequency" is used as an interchangeable
18 term with "center frequency"?

19 A. In this description of the embodiment.
20 The figure itself we can't conclude that.

21 But this is -- this description is
22 limiting the Figure 8 embodiment to that case where
23 the carrier frequencies correspond to the two
24 different synthesizer frequencies.

25 Q. Is -- in your opinion, is center

1 frequency always in the center of a given frequency
2 range?

3 A. Well, that's -- that's the plain and
4 ordinary meaning.

5 Inventors can be their own
6 lexicographers. So I'm not disputing that center
7 frequency can only mean being in the center of a --
8 of a frequency span or -- or a frequency range.
9 Clearly that's the plain and ordinary meaning. And
10 that's -- the IEEE definition would tell you that.
11 You just go look at Wikipedia, you'll get that.

12 But -- but can -- can an inventor in
13 some patent, whether it's the '802 Patent or any of
14 the other, you know, 12 million patents or whatever
15 have been issued so far, can some inventor come
16 along and say, hey, my frequency is not in the
17 middle? Sure. It's a free country. You can say
18 whatever you want.

19 But that wouldn't change the main plain
20 and ordinary meaning.

21 Q. Okay. May I please refer you to claim
22 ten of the '802 Patent.

23 A. Okay.

24 Q. And specifically, the clause that starts
25 with,

1 "Up-converting the first analog
2 signal."

3 And I'm going to read that for the
4 record. Quote,

5 "Up-converting the first analog
6 signal to the first RF center
7 frequency to produce the first
8 up-converted analog signal wherein
9 the first up-converted analog
10 signal comprises the first
11 up-converted frequency range from
12 the first RF center frequency minus
13 one half the first frequency range
14 to the first RF center frequency
15 plus one half the first frequency
16 range."

17 Do you see that?

18 A. Yes.

19 Q. All right. So in your opinion, RF
20 center frequency of claim ten, just by virtue of it
21 being a center frequency, must be at the center of
22 the up-conversion frequency range, correct?

23 MR. MARANDOLA: Object to the form.

24 THE WITNESS: I'm not quite sure if I
25 follow your question.

1 I think you're asking me if the center
2 is at the center. It usually is.

3 BY MR. HENDIFAR:

4 Q. Now, the clause in that up-converting
5 limitation, the clause that starts with "wherein the
6 first up-converted analog signal" that I just read,
7 that cause says that the RF center frequency is in
8 the middle of the first frequency range.

9 Correct?

10 A. I -- I agree with that, yes.

11 Q. So, if up-converting the first analog
12 signal to the first RF center frequency already
13 requires the center frequency to be the middle
14 frequency of the range, in your opinion, based on
15 the plain and ordinary meaning, what is the import
16 of the wherein clause that follows for four lines
17 requiring the RF center frequency to be in the
18 middle of the frequency range?

19 MR. MARANDOLA: Object to the form.

20 THE WITNESS: I'm not -- you said
21 that -- I really didn't follow this question.

22 I think you're -- I think you're saying
23 that I somehow defined the first two lines,
24 "up-converting the first analog signal to a first RF
25 center frequency to produce a first up-converted

1 analog signal," and then whatever you interpreted,
2 what you've alleged me to define these two lines,
3 which I don't remember doing, to mean is -- means
4 the same as the next five lines from the wherein.

5 And what's the point of the wherein if
6 it already means that?

7 I didn't draft the claim, so, you
8 know -- first of all. I'm not saying that I ever
9 said that the first two lines meant whatever you
10 said I said.

11 But, you know, in terms of if all that
12 were true, and I'm not agreeing that it is, what's
13 the point of the next five lines?

14 I mean you have to ask whoever drafted
15 this claim what their point is. I -- I'm not a
16 claim drafter here, and I didn't draft these claims.

17 Q. Okay. So let me unpack that.

18 In claim ten limitation "up-converting
19 the first analog signal to a first RF center
20 frequency to produce a first up-converted analog
21 signal," just that portion of the claim ten, is it
22 your opinion that the recitation of RF center
23 frequency would mean that that RF center frequency
24 is the middle of the frequency range for the
25 up-conversion?

1 A. No. Not -- not necessarily.

2 Maybe you can repeat the question.

3 Maybe I misunderstood this.

4 Go --

5 Q. Sure.

6 A. Repeat it.

7 Q. In the phrase appearing in claim ten,
8 "up-converting the first analog signal to a first RF
9 frequency to produce the first up-converted analog
10 signal," does your understanding of the phrase "RF
11 center frequency" mean that the RF center frequency
12 must be in the middle of the up-converted analog
13 signal frequency range?

14 A. It means that the first RF center
15 frequency would be in the middle of the first
16 up-converted analog signal.

17 But it doesn't tell us anything about
18 where the carrier frequency is and it also doesn't
19 tell us whether there is more than one up-converting
20 analog signal.

21 The up-converter can up-convert the
22 first analog signal and have multiple signals
23 produced. I described that earlier. That's just
24 the nature of the up-conversion process. You can
25 create multiple up-converted signals in one

1 multiplication in the frequency domain.

2 Q. Okay.

3 A. Excuse me. In the time domain.

4 Q. Now, based on that understanding that
5 you just explained to me of claim ten, would the
6 following sentences -- or the clause "wherein the
7 first up-converted analog signal comprises the first
8 up-converted frequency range from the first RF
9 center frequency minus one half of the frequency
10 range to the first RF center frequency plus one half
11 of the frequency range," does that clause add
12 anything not already required by the up-converting
13 clause, the first two sentences we just discussed?

14 A. Does it add anything? It adds a whole
15 hot of words.

16 Q. Right. Any limitation -- let me
17 rephrase the question.

18 In your opinion as you explained it to
19 me -- and correct me if I'm wrong -- RF center
20 frequency of the first up-conversion in claim ten
21 already has to be in the middle of the first
22 up-converted frequency range by virtue of the term
23 "RF center frequency."

24 If that is your opinion, then is it your
25 view that the wherein clause that follows does not

1 have any role or add any substance to that
2 limitation?

3 MR. MARANDOLA: Object to the form.

4 THE WITNESS: Well, that -- that would
5 depend on the construction of the wherein cause at a
6 minimum.

7 This is the first I'm I've looked at it
8 at least in quite some time. And I'm not sure what
9 Cobblestone proposes for claim construction for the
10 terms in this claim that I haven't looked at.

11 So, I -- I can't tell you right -- right
12 here right off the top of my head without
13 understanding some claim construction positions,
14 what -- what's going on with this wherein clause.

15 Q. Are you familiar with the legal term?

16 A. Could you repeat the question, please?
17 I just didn't understand the -- the audio was bad.

18 Q. Are you familiar with the legal term
19 "claim differentiation"?

20 A. Could you repeat the question? I just
21 didn't understand. The audio was bad.

22 Q. Are you familiar with the claim term --
23 I'm sorry -- with the legal phrase "claim
24 differentiation"?

25 A. I believe that -- I'm not a lawyer, so I

1 wouldn't say am I familiar with the legal term.
2 I've worked on a lot of patent litigations that term
3 "claim differentiation" has come up in the context
4 of claim construction.

5 But ultimately claim construction is a
6 matter of law, and I'm not a lawyer.

7 Q. Are you familiar that all claim terms in
8 a claim are presumed to have meaning?

9 MR. MARANDOLA: Object to the form and
10 outside the scope.

11 THE WITNESS: I'm not sure that I've
12 heard it phrased in exactly those words.

13 I think I have an understanding of what
14 "claim differentiation" means, but I don't know that
15 I would -- if you had asked me open-ended what --
16 what that was, I don't think I would have answered
17 with what you just said.

18 BY MR. HENDIFAR:

19 Q. So let me ask you open-ended.

20 What is your understanding of the legal
21 doctrine of "claim differentiation"?

22 MR. MARANDOLA: Object to the form and
23 outside the scope.

24 THE WITNESS: Yeah. My -- my
25 understanding is that different claims in a

1 particular patent are presumed to have different
2 meanings. So in other words, claim one is a method
3 claim, for example; and claim ten is a method -- in
4 fact they're both a method of transmitting
5 information in a wireless communication channel.
6 And claim ten is a method of transmitting
7 information in a wireless communication channel.

8 So my understanding under claim
9 differentiation is it's presumed that the scope or
10 the limitations of claim one are different than the
11 limitations of claim ten.

12 That doesn't tell me what the
13 limitations are or doesn't tell me which one's
14 narrower, which one's broader.

15 It's just that there's a presumption,
16 rebuttable presumption, is my understanding, but a
17 presumption, that claim one and claim ten are not
18 the same thing.

19 BY MR. HENDIFAR:

20 Q. Okay. As a separate legal doctrine are
21 you also familiar with the legal doctrine that all
22 claim terms are presumed to have meaning in a claim?

23 MR. MARANDOLA: Object to the form and
24 outside the scope.

25 THE WITNESS: I don't know that I've

1 heard it as a claim doctrine. I'm not a lawyer, so
2 "doctrine's" not a word I use a lot.

3 But I guess just common sense is I --
4 when I'm reading -- let's forget that.

5 Here's what I do as an expert. I
6 certainly read all the words in the claim. I
7 consider all the words in the claim as part of my
8 process of -- of analyzing claims from a technology
9 point of view.

10 BY MR. HENDIFAR:

11 Q. Did you analyze claim ten in connection
12 with your understanding of claim one of the
13 '802 Patent?

14 A. Not that I can recall specifically. I
15 read the whole patent, so I would have read claim
16 ten at some point.

17 But -- but I don't recall specifically
18 analyzing claim -- claim ten. I'm not saying I
19 didn't do it. I just don't recall it.

20 Q. May I please refer you to the
21 '802 Patent column six line 25.

22 A. Column what?

23 Q. Column six, line 25.

24 A. Okay. What --

25 Q. What does "modulation signal" mean in

1 this line?

2 A. It's a reference to Figure 2. Or maybe
3 it's a reference to Figure 3.

4 Well, it's got the 200 -- it says a
5 first -- the sentence says,

6 "A first input of up-converter
7 205" -- that's in Figure 2 -- "is
8 coupled to the output of filter 203
9 to receive the first analog signal.
10 And a second input of up-converter
11 205 is coupled to synthesizer 207
12 to receive a first modulation
13 signal having a first RF center
14 frequency 303 F1 as shown in
15 Figure 3."

16 Yeah. That's completely at odds with
17 Figure 2. I mean from a point of view of a person
18 of ordinary skill in the art, they would just say
19 that sentence is nonsense. Because the figure shows
20 a synthesizer putting out not a modulation signal
21 but and -- you know, an unmodulated signal. It
22 shows it putting out a -- just a carrier signal
23 which is not modulated.

24 I mean the carrier signal gets
25 modulated. But as the carrier signal itself F1, F1

1 is not modulated. It may well be at the first RF
2 center frequency. I don't have a problem with that.
3 But it's -- it's not a modulation signal.

4 A modulation signal in the normal way
5 Figure 2 would be understood is -- would be the
6 first analog signal.

7 Q. Now, is the patent in column six line 25
8 using the phrase "modulation signal" to refer to the
9 carrier signal?

10 A. That's -- that's the only way to read it
11 that seems to square with the words in it.

12 It doesn't make a lot of sense to call
13 that. But on the other hand, as I mentioned
14 earlier, inventors can write whatever they want.
15 They can say an apple is an orange. They can say
16 the sky is green. If they say that and write it,
17 then it shall be from a -- if they say that and
18 write it and define it that way and say -- and say
19 that their patent is limited in that way.

20 But I would -- I would -- I would read
21 this as basically saying that the synthe- -- the
22 synthesizer, typically we think of that as
23 outputting a local oscillator signal.

24 And so since it's saying it's the output
25 F1 from the synthesizer 207, it's not that you can't

1 modulate through a synthesizer. You can do that.

2 That's possible, as well.

3 But -- but generally speaking, this
4 sentence doesn't make a lot of sense.

5 In order to give it meaning, I think
6 that you would assume that that modulation signal is
7 just a pure harmonic tone at F1.

8 Q. Which is the carrier signal, right?

9 A. A carrier signal. It could be a carrier
10 signal. Whether it's a carrier signal or not, we
11 would have to know what's coming into it.

12 If we don't know what the input is and
13 it's not described right here, then we don't know
14 whether that's the ultimate carrier or whether
15 there's multiple carriers. There can be multiple
16 carriers, as well.

17 It really -- you really need the
18 definition -- like, for example, you know -- I know
19 you don't want me to talk about the draft 2.0
20 equation 20-61 and 20-1, but that's the definition.
21 That's what you need in order to know where the
22 carrier signals are.

23 You don't -- you don't need just this
24 throw-away line here that doesn't think carrier
25 signal to know what -- this is ambiguous as to where

1 the carrier signal is in the frequency domain.

2 You need something specific, like, for
3 example is draft 2.0, which is specific as to where
4 your carrier signals are.

5 Q. Does a carrier signal have a frequency
6 range as opposed to a single frequency?

7 A. Well, as I mentioned earlier, in
8 generating a carrier frequency, you often end up
9 with unwanted harmonics.

10 And then in doing frequency conversions,
11 whether up-conversions or down conversions, the
12 idea -- if they're not in the analog domain, at
13 least, you know the idea is to just multiply in the
14 time domain by that complex rotator.

15 But, unfortunately, real world mixers,
16 including the ones I've designed, will generate
17 additional harmonics.

18 So -- so the idea is yes, it's just this
19 one unmodulated pure tone, periodic waveform,
20 ideally sinusoidal, but -- but in the real world
21 there's usually multiple frequency -- it usually has
22 more frequency content than just the single tone.

23 Q. So if the '802 Patent says that a
24 carrier signal has a center frequency, it is using
25 the words "center frequency" to mean the carrier

1 frequency?

2 A. No. It's -- I mean it's not saying
3 that. It -- a carrier signal -- no signal is pure.

4 Right?

5 No signal is the pure sinusoid that you,
6 you know, take in math class in high school. You
7 know, when you have a local oscillator you have a
8 resonant circuit, you know, a tank circuit and a
9 negative resistant cell, but you will have noise and
10 you will have spurious harmonics and you will have a
11 whole bunch of other things.

12 And so open hopefully you have a
13 dominant signal tone that if it's to be the carrier,
14 it would -- it would in and of itself not yet be
15 modulated if it's going to be the carrier signal.

16 Again, it's confusing because you can
17 pass modulation through synthesizers, as well. You
18 don't -- you don't have to do it. Not in the -- you
19 know, you don't have to have synthesizer only
20 produce a single tone.

21 But the way I would read this, I would
22 just say that F1, it could be the carrier frequency.
23 And it might not be. You know, but it might -- it
24 might be that something else is the carrier
25 frequency.

1 We would need to know what's going into
2 the DAC.

3 Q. I understood carrier frequency to be the
4 frequency of the carrier signal modulated
5 subsequently that actually goes out of the antenna.

6 Am I misunderstanding what a carrier
7 signal is?

8 A. You're -- where -- where did you
9 understand that from?

10 Q. Based on -- well, based on reading some
11 literature here.

12 And initially based on the articles from
13 your publications we discussed, that seems to be
14 what it means.

15 But I'm not sure at this point that you
16 believe that.

17 So let me ask you this question.

18 Is it incorrect -- is it an incorrect
19 view that a carrier signal is the -- the signal
20 that's subsequently modulated and sent out from the
21 antenna?

22 A. Well, it would depend on the system.
23 So, for example, in analog AM, you know, AM radio on
24 your dial, the carrier frequency is subsequently
25 modulated and the carrier frequency is sent out to

1 the transmitter.

2 In the case of, oh, just about every
3 digital system -- let's start with just 2G cellular,
4 for example, and, for example, IS54, U.S. -- the
5 first U.S. digital system uses QPS -- a form of QPSK
6 modulation. In that case the carrier signal is
7 modulated, but the carrier signal is suppressed.
8 The carrier signal was actually not sent out the
9 transmitter.

10 Okay?

11 The modulated signal was sent out the
12 transmitter -- or out the antenna as electromagnetic
13 radiation, but the carrier signal is suppressed and
14 not sent out.

15 So you just cannot make these generic
16 statements the way -- the way you did.

17 Q. Going to Figure 1 of the '802 patent.

18 And please let know when you are there.

19 A. I have Figure 1 in front of me.

20 Q. Sure.

21 Let us assume that the input to the
22 digital analog converter 110 is a baseband signal.

23 Fair enough?

24 A. Okay.

25 Q. And then the baseband signal is

1 up-converted to a frequency provided by the local
2 oscillator and mixed in mixer 130 and then sent out
3 after amplification of antenna 150.

4 Is --

5 A. Well, in Figure 1 what's going out 150
6 is the time domain multiplication of the local
7 oscillator and the input signal.

8 What you said is a baseband signal.
9 That doesn't tell me whether it has a carrier
10 already, that there's been a frequency shift
11 already. And there may be and there may not.

12 But no matter, what is going out the
13 antenna here is the frequency domain convolution of
14 the frequency response of the input signal, which
15 may already have a carrier present, and that
16 convolution with the local oscillator, which is
17 realized by doing a multiplication in the time
18 domain with the -- with the rotator as shown.

19 Q. So that's the thing -- I want to just
20 make a couple of points here to better understand
21 your words for a carrier signal and baseband signal
22 is.

23 In the example we discussed for Figure 1
24 of the '802 Patent, so in your view the carrier
25 signal is not necessarily the signal from the local

1 oscillator mixed in mixer 130, correct?

2 A. For sure.

3 If -- if we're looking at Figure 1, if
4 the only information in front of us is Figure 1, we
5 do not know that the transmitted waveform from
6 antenna 150 has a carrier signal which is equal to
7 LO. That would be a correct statement.

8 We need more information in order to
9 determine that.

10 The prior art, like 802.11 draft 2.0, it
11 gives us all that information. We know what -- what
12 it's describing. Here we do not know.

13 Q. And I think -- I'm trying to lay the
14 foundation of what a carrier signal is. Because I
15 think that's may be a part of where the disconnect
16 may be. So I want to understand. That's why I'm
17 asking these questions.

18 I'm not an expert in this field. My
19 layman reading of the literature suggested that the
20 mixer 130 is mixing some carrier signal with
21 whatever is coming in, essentially modulating
22 whatever is coming into the mixer on top of the
23 local oscillator carrier and sends it out.

24 Is that not a correct understanding or
25 is it not clear what the purpose of the local

1 oscillator is here?

2 A. That's a lot of question.

3 Like you said you want to understand
4 what the carrier signal is.

5 I don't think the Wikipedia page -- I've
6 got it in front of me. I don't think it's that bad.
7 It's actually the Wikipedia page for carrier wave.

8 But it says,

9 "In telecommunications a carrier
10 wave, carrier signal or just
11 carrier is a periodic waveform,
12 usually sinusoidal, that carries no
13 information, that has one or more
14 of its properties modified called
15 modulation by an information
16 bearing signal called the message
17 signal or modulation signal for the
18 purpose of conveying information."

19 There's lots of different ways you could
20 phrase it, and I'd be fine with it. But I think
21 that one is just perfectly fine.

22 So, if your goal here is to get your
23 understanding of what a carrier signal is, I highly
24 recommend you just go to Wikipedia and search for
25 "carrier wave," and I think you'll have a good

1 understanding.

2 Q. Understood.

3 So, going back -- well, I did read that.

4 So let me ask you another question.

5 In Figure 1 of the '802 Patent, is the
6 frequency of the local oscillator a carrier signal?

7 A. I can't -- I can't tell from Figure 1 in
8 and of itself.

9 It's certainly possible depending on
10 what exactly is being done at mixer 130 or at the
11 multiplier and what is coming into the input. It is
12 possible that that carrier -- that one of the
13 carrier frequencies and -- you know, and it's also
14 possible there's only one. But it's possible that
15 one of the one or more carrier frequencies that come
16 out of antenna 150 are equal to that local
17 oscillator from Figure 1 in and of itself.

18 It's also possible that none of the one
19 or more carrier frequencies to come out of 150 is at
20 the local oscillator frequency.

21 Q. Okay. Can you provide an example of
22 where what comes out of antenna 150 as no carrier
23 frequency that is at the local oscillator frequency?

24 A. Your audio was really bad there.

25 Q. I apologize.

1 You mentioned that it could be that what
2 comes out of antenna transmitter 150 has no carrier
3 frequency that is at the local oscillator frequency.

4 Did I understand that correctly?

5 A. Yes. That's -- that's what I said.

6 Q. Would you kindly provide an example of
7 that situation?

8 A. Sure. No problem.

9 An example would be 802.11 draft 2.0
10 non-HT duplicate.

11 The input signal is described by
12 equation 20-61. It's in my expert report in detail.

13 That input signal into the DAC would
14 then be filtered by filter 120, and then there would
15 be a complex rotator with a local oscillator
16 frequency that's described by equation 20-1 followed
17 by a power amplifier as shown in Figure 1 followed
18 by an antenna as shown in Figure 1.

19 And what would come out of that if -- in
20 the case if the input signal corresponded to 20 --
21 equation 20-61 in 802.11 draft 2.0 is you would get
22 two carrier frequencies coming out. So that would
23 be one example.

24 There are plenty more.

25 Q. What is the function of the local

1 oscillator in the example you just provided?

2 A. In the -- in the local -- in the example
3 meaning the draft 2.0 example that I provided?

4 Q. Well, in the one that you just
5 described.

6 A. Meaning the draft two point -- when I --
7 just, I don't know whether "just" means last
8 question or today or an hour ago.

9 You just need to be specific in your
10 questions, Counsel.

11 Q. You explained that in your opinion,
12 equation 20-61 provides -- let me step back.

13 When you were explaining our equation
14 20-61 in the 802.11 draft words, you mentioned that
15 there is a complex rotator with a local oscillator,
16 the output of which goes to a power amplifier and
17 then to an antenna.

18 Do you recall that?

19 A. Yeah. I didn't phrase it exactly that
20 way, but I said -- I said -- I said with reference
21 to equation 20-61 and equation 20-1, yeah.

22 Q. Okay. No problem.

23 Now, what is the function of the local
24 oscillator in that description that you provided?

25 A. Oh, it's part of the up-conversion. So

1 there's -- there's two up-conversions described --
2 (inaudible comment) -- a local oscillator
3 frequency --

4 (A clarification was requested by
5 the reporter.)

6 THE WITNESS: Right. I'll start again,
7 because -- so hopefully the audio doesn't freeze.

8 So, in -- in the example that I just
9 described, the up-conversion is done in a
10 combination of -- by a combination of the equations
11 that are described in 20-61, which describes two
12 up-conversions; a shift of negative ten megahertz
13 and a shift of positive ten megahertz. And the
14 up-conversion is completed by a multiplication in
15 the -- typically in the analog domain. Doesn't have
16 to be, but that's typically how we do it similar to
17 what's shown in Figure 1, where a local oscillator
18 set to the frequency $F_{\text{sub } C}$ in 20-1 is then
19 applied, and that results in an overall
20 up-conversion with two carrier frequencies that
21 would then go out antenna 150.

22 Q. Can you explain what -- what does
23 equation 20-61 do precisely?

24 A. What's -- let's get to it. Give me a
25 second.

1 Okay. So I'm referring to paragraph 104
2 in my report. And just -- and it just recites
3 verbatim from the draft 2.0.

4 And it's a reference to non-HT duplicate
5 transmission that's used to transmit to clause 17
6 stations. And it's -- the clause 17 stations, some
7 of them can be in the upper half of the 40 megahertz
8 channel, some of them be in the lower half of the
9 40 megahertz channel. And then it says that the
10 data transmission is defined in equation 20-61. And
11 I repeat that verbatim there underneath
12 paragraph 104.

13 And in it the baseband composite complex
14 waveform has multiple baseband signals within it.

15 And I'm not going to dwell on the fact
16 that there is, you know, actually 52 up-conversions
17 to 52 carriers within what I'm calling each of those
18 composite baseband signals. Those are just the
19 nature of OFDM that there are multiple
20 up-conversions.

21 But setting those aside, in order to
22 achieve this transmission to the clause 17 stations
23 that are in -- some in the upper half, some in the
24 lower half, we need to have two carrier signals.

25 Okay?

1 Otherwise this is just not going to
2 work.

3 And -- and the way that's done is it's
4 explained in section 20.3.8 of the draft 2.0
5 standard. And in my report that's at paragraph 101,
6 the excerpt, which just says that we're going to
7 replace the $F_{\text{sub } C}$ in equation 20-1 for, in the
8 case where we're transmitting to upper half or lower
9 half or in this case a duplicate to both halves,
10 we've got to replace that by F_C of -- F_C plus --
11 plus or minus ten megahertz.

12 So the way that equation 20-61 does that
13 replacement of the plus or minus 20 -- excuse me --
14 plus or minus ten megahertz is in the -- if you look
15 at the equation below paragraph 104, I have it in
16 three lines, if you like. And in the second line
17 you can see this summation of these coefficients,
18 they are D and there's subscripted K , K is for the
19 subcarrier, and then N is a subscript in the time
20 domain for an OFDM symbol number.

21 And then there is also for certain of
22 subcarriers they get a different modulation value
23 which is given by that $P_{\text{sub } N} P_{\text{sub } K}$. Those are
24 for the pilots.

25 The D 's refer to the data subcarriers.

1 And so that first one we do the
2 conventional OFDM rotate or up-convert for each sub
3 carrier. That's the $J 2 \pi K \Delta F T$ term.

4 I'm going to ignore the T offsets here
5 for the moment.

6 And then this is just high school math,
7 of course. I'm sure you know that if you have a
8 subtraction in an --in an exponential term, that's
9 the same as a multiplication in the linear.

10 So, where we have exponential $J 2 \pi K$
11 minus $32 \Delta F T$, that's the same as exponential J
12 $2 \pi K \Delta F T$, and then all times exponential $J 2$
13 π negative $32 \Delta F T$.

14 And so that 32 times ΔF -- ΔF
15 is 312.5 kilohertz. 32 times that is ten megahertz.
16 So that's where we do the frequency shift for the
17 stations in the lower half, which is negative ten
18 megahertz.

19 If we go to the third line, what we see
20 is that now we're going to rotate all of the
21 modulation values that was in the first composite
22 baseband signal on those DKN's and the PNPk's, we're
23 going to rotate them all by 90 degrees. And you see
24 that by the J . That's what that J in the -- after
25 plus J , that J just means rotate everything by

1 90 degrees.

2 And then we get the same structure --
3 I'll spare you the math. But now we're going to end
4 up with this second composite baseband signal that's
5 been rotated by 90 degrees relative to the first,
6 it's going to get all complex rotated by exponential
7 of $J 2 \pi 30$ -- plus $32 \Delta F T$, or, in other
8 words, plus ten megahertz.

9 So it's going to set up that the
10 up-conversion process, which then this whole signal
11 is going to come back to equation 20-1, which is
12 paragraph 96 in my report, and we're going to take
13 the real part of the complex rotation of the 20-61
14 signal, which expresses the two carrier signals in
15 the -- in the base -- in the composite baseband
16 waveform, and then we're going to rotate that again
17 by this $F_{sub C}$, which is set at the middle of the
18 40 megahertz channel.

19 And what that's going to give us then is
20 an upper half with a carrier frequency on the second
21 base -- baseband signal of -- of $F_{sub C}$ plus ten
22 megahertz, and it's going to give us a second
23 carrier at the lower half, which is going to be at
24 $F_{sub C}$ minus ten megahertz.

25 And if -- because we do it this way, it

1 actually works. And I know it because I've built
2 these products. It really does work. It really
3 will communicate with those clause 17 stations.

4 If you did it a different way and you
5 only had one carrier instead of two carriers, those
6 clause 17 stations would not be able to receive the
7 signal, or at least not all of them. Maybe -- maybe
8 the upper half ones would, but then the lower half
9 ones wouldn't do it.

10 In order to get both them
11 simultaneously, you have to have two carrier
12 signals. And that's exactly what draft 2.0
13 describes.

14 Q. Now, when you said you have to have two
15 carrier signals -- and I'm not trying to question
16 you. I'm just telling you what I understood when I
17 read the literature, is that you're having two
18 channels, one of them will address legacy devices
19 because they can process that channel, and then you
20 have a second channel the new devices can -- it
21 combines use of the two 20 megahertz channel.

22 Did I misunderstand how this works?

23 A. I didn't -- I mean how it works is more
24 complicated than what you just said. But what
25 you've said is in my mind a -- expressing some true

1 facts, which is that the clause 17 station channels
2 will relative to the 40 megahertz channel raster,
3 they'll either be in the upper half or in the lower
4 half, but they can only demodulate as receivers the
5 half that they're in.

6 So if you want to communicate to all of
7 the receivers that are in the upper half or the
8 lower half and. Speaking the old language, you
9 know, if the old language is French and the new
10 language is German, then what you need to do is
11 speak French in both the upper half and the lower
12 half at the same time. And since French -- upper
13 half French needs a carrier frequency and lower half
14 French needs a carrier frequency. If you're going
15 to transmit both of them at the same time, then
16 you're going to have to have two carrier signals --
17 two carrier signal frequencies. Pardon me.

18 Q. Why do two 20 megahertz channels need
19 separate carrier frequencies as opposed to being
20 combined in the baseband and being up-converted on a
21 single carrier frequency?

22 A. Because it's just by definition. I mean
23 it's -- the carrier -- the carrier frequency that is
24 modulated is F_{sub} -- I mean it just is. It's
25 directly in the standard. It says, you know, the

1 mathematical definition of the transmission is going
2 to be not $F \text{ sub } C$ in equation 20-1; it's going to be
3 $F \text{ sub } C$ plus or minus ten megahertz. That's what
4 you have to end up as. It's normative.

5 When we write standards.

6 Q. Where --

7 A. Some things are optional and some things
8 are required. This is required. And you have to
9 end up at plus or minus ten megahertz and that means
10 you have to have two carrier signals. It's as
11 simple as that.

12 If you don't do it this way, you're not
13 doing the standard.

14 Q. So where are you reading from?

15 A. I was reading from paragraph 101. But
16 it's just a straight reference out of 20.3.8 in the
17 draft 2.0 standard.

18 Q. So I am reading section 20.3.8. And it
19 says, quote,

20 "When transmitting in the
21 upper-lower 20 megahertz portion of
22 a 40 megahertz channel, the
23 mathematical definition of
24 transmission shall follow that of a
25 20 megahertz channel with FC in

1 equation 20-1 replaced by FC
2 plus/minus 10 megahertz."

3 That's what you're reading, correct?

4 A. Yes. I'm looking at the draft 2.0
5 standard at 20.3.8.

6 And you read that verbatim. And
7 that's -- and what I recited previously was also
8 verbatim.

9 Q. Okay. Is this addressing the section
10 20.3.8, is this addressing a situation where
11 transmission is done at both of the 20 megahertz
12 channel?

13 A. Yes. It's not only addressing that.
14 There are modes within draft 2.0 which are not what
15 I cited in my expert report or not what I cited with
16 respect to invalidity of the asserted claims of the
17 '802 Patent.

18 But there are other modes that are only
19 the upper 20 megahertz or only the lower. And then
20 there are modes that are both the upper and the
21 lower. And this is a reference to all of those
22 modes.

23 Q. Now, the output of equation 20-61 is a
24 baseband signal, correct?

25 A. That's -- that's one way to look at it.

1 There's two baseband signals is another
2 way to look at it. There's -- let me do math in my
3 head real quick.

4 There's 104 baseband signals if we
5 really want to be --

6 Q. That is my question.

7 A. -- truly correct. The definitionally
8 correct way to put it is there's 104 baseband
9 signals in 20-61.

10 Q. Wonderful. Now, my understanding of our
11 earlier discussion was that a baseband signal is a
12 direct representation of the information signal as
13 opposed to in a modulated form.

14 Do I recall that correctly?

15 A. That's a reasonable way to look at it.
16 So in 20-61, for example, the complex numbers DKN
17 are the baseband signal or for the pilots who would
18 be the PNPK. And it's certainly fine.

19 In that case every $J 2 \pi K$, for every
20 value of K from minus 26 to plus 26, each one of
21 those is a carrier frequency, or at least times -- K
22 times ΔF is a carrier frequency.

23 That's usually not the way we think
24 about it, but -- but definitionally if we look at
25 traditional wireless communication definition, that

1 would be the correct way to describe it.

2 Q. So, my confusion is if a baseband signal
3 is not modulated and the output of equation 20-61 is
4 a baseband signal -- one or more baseband signals,
5 then how are there carrier signals within the
6 baseband signal in equation 20-61?

7 A. Sure. Well, there's modulation inside
8 20-61. That's -- that's what I said. I don't mind
9 calling it a baseband signal, but it's modulated.

10 There's -- the modulation on carriers is
11 already in 20-61. To get to the final transmitted
12 carrier signal we need to do an additional step.
13 Okay? Which is this multiplication by the complex
14 rotator at $F_{\text{sub C}}$. That does center at the 40
15 megahertz channel.

16 But the -- is this signal a modulated
17 signal, 20-61? Absolutely, that's a modulated
18 signal. At any OFDM signal. Once you express it to
19 the subcarriers it's a modulated signal.

20 Q. You used a phrase "transmitted carrier
21 signal."

22 What does that mean?

23 A. It just means relative to the RF
24 spectrum.

25 So, this is in relationship to an IF.

1 There's two IF's in here. There's an IF at negative
2 ten megahertz and there's an IF at positive ten
3 megahertz.

4 So this is describing the modulation of
5 the negative ten megahertz IF carrier and a positive
6 ten megahertz IF carrier.

7 When we then do the complex rotation
8 multiplication that's in equation 20-1 as described
9 by draft 2.0, then we're going to end up with the FC
10 plus or minus ten megahertz as the carriers that's
11 as required by the standard.

12 Q. Is the rotation that you called it in
13 equation 20-1 also a form of modulating data on a
14 transmitted carrier signal?

15 A. It's part of the process.

16 So, equation 20-1 is not in isolation
17 with respect to the non-HT duplicate. It's the
18 concatenation -- you know, if we replace -- in 20-1,
19 you know, we have a relative -- as our stuff goes, a
20 very simple mathematical equation. And it's just
21 the real part of a complex R of T multiplied by a
22 complex rotator. That exponential of $J 2 \pi F \text{ sub CT}$.
23

24 Okay?

25 And so that R of T you just replace

1 equation 20-61, which is R to the super script I
2 subscript TX , then subscripted LEG-DUP of T . And
3 then there's off a set in there. But let's not
4 quibble on that.

5 And so when I replace that equation into
6 Figure 1 -- or excuse me -- equation 20-1, I'm going
7 to do a complex multiplication.

8 Typically we -- we certainly can do that
9 in baseband. That's -- it's absolutely possible to
10 do that by -- by math in signal processing, but it's
11 usually cheaper when we build the equipment to do
12 that in the analog domain. So usually we'll do that
13 complex rotation in the analog domain.

14 But the net result of what we get out
15 are two carrier signals; one's at FC minus ten
16 megahertz and the other's at FC plus ten megahertz.

17 And the way we got there is by doing an
18 up-conversion that produced two carrier signals,
19 which up-converters often do, and we did it by a
20 combination of equation 20-61 usually implemented in
21 the digital domain, and equation 20-1 usually
22 implemented in the analog domain.

23 Q. Is it accurate to say equation 20-1 in
24 the 802.11 standard modulates the output of equation
25 20-61 on the transmitted carrier signal which is

1 what's sent out of the antenna?

2 A. No. That would not be an accurate --
3 that would be an incomplete statement.

4 But the complete statement would be that
5 equation 20-1, if -- if we start with 20-61 as the
6 value for R of T in 20-1, then what 20-1 is doing is
7 a complex multiplication in the time domain. It's
8 applying the complex rotator of $J 2 \pi F$ -- $F \text{ sub}$
9 CT.

10 Q. I guess maybe I misunderstood you.

11 I understood you to say that's a form of
12 modulation.

13 A. It's part of the process of modulation.
14 But it's not modulation in and of itself for non-HT
15 duplicate.

16 For non-HT duplicate there's modulation
17 that occurs in equation 20-61 for each and every sub
18 carrier, all 104 across the two channels.

19 Okay?

20 Each one of them has modulation. And
21 then in grouping the -- the lower half which is
22 intended for clause 17 stations in the lower half of
23 a channel, in grouping that one we do another
24 modulation step, which is a frequency shift by an IF
25 carrier of a negative ten megahertz.

1 And then for the other 52 subcarriers in
2 the upper half intended for clause 17 stations in
3 the upper half, we do another IF frequency shift by
4 a complex rotation in the time domain,
5 multiplication in the time domain, of plus
6 megahertz.

7 And then to complete the process we add
8 an additional multiplication step with a complex
9 rotator at the frequency $F_{\text{sub } C}$, which is the
10 center of the 40 megahertz channel in which the 220
11 megahertz halves are located.

12 Q. And I'm sorry if you already answered
13 that, but would you remind me of what does -- what
14 did you mean by earlier transmitted carrier signal?

15 A. Oh, I think I've answered that multiple
16 times.

17 Q. You did. You answered it one time, I
18 know you did, and I apologize. We don't have
19 realtime. We couldn't get realtime.

20 So if you could maybe briefly just
21 mention what did you mean by transmitted carrier
22 signal?

23 A. Sure. In the context of these non-HT
24 duplicates we have two halves; we an upper half and
25 a lower half of the 40 megahertz channel. We're

1 sending this to clause 17 stations.

2 Those clause 17 stations assume a
3 carrier frequency. They assume that there's a
4 carrier frequency. If they're in the lower half,
5 they assume that their carrier frequency is in the
6 middle of that lower half. If they are in the upper
7 half, they assume that their carrier frequency is in
8 the middle of that upper half.

9 So the only way that they can both be
10 happy is if there's two carrier signals. If there's
11 only one carrier signal, both of them are very sad.
12 They will not be able to demodulate. They're done
13 for.

14 So, you have to have a carrier signal in
15 the lower half, which is $F_{sub C} - 10$
16 megahertz, and you have to have a carrier signal in
17 the upper half, which is $F_{sub C} + 10$ megahertz.

18 Q. Okay. Can the 40 megahertz channel be
19 sent on a single transmitted carrier signal in
20 middle and everybody who gets its half would
21 demodulate assuming there is a --

22 (A clarification was requested by
23 the reporter.)

24 BY MR. HENDIFAR:

25 Q. Can the transmitter send the entire 40

1 megahertz channel with a single transmitted carrier
2 signal in the middle and then each receiver would
3 receive its half of the 40 megahertz channel and the
4 receiver would treat the 20 megahertz as having a
5 carrier signal in the middle of that respective 20
6 megahertz channel?

7 MR. MARANDOLA: Object to the form.

8 THE WITNESS: Not for non-HT duplicate
9 transmission. If it -- if it does not put the two
10 carrier frequencies each respective one in the upper
11 and lower half, then the clause 17 stations will not
12 receive it.

13 It has to have the carrier -- the
14 carrier is the, you know, the periodic waveform on
15 which the modulation is applied.

16 And the standard is very clear. There's
17 no ambiguity whatsoever that -- that for non-HT
18 duplicate you're transmitting both the upper and the
19 lower halves simultaneously. You have to have a
20 carrier frequency upon which the modulation is
21 applied for the upper half and you have to have one
22 or the lower half.

23 MR. HENDIFAR: We've been going for
24 another hour and a half.

25 Is it okay if we take maybe a

1 ten-minutes or so break?

2 And that may be the last break we take.

3 THE WITNESS: If you're asking me,

4 Counsel, take a break whenever you want.

5 MR. HENDIFAR: Counsel, ten minutes.

6 MR. MARANDOLA: You said ten minutes?

7 That's fine.

8 MR. HENDIFAR: Thanks.

9 (Brief recess.)

10 BY MR. HENDIFAR:

11 Q. Welcome back, Dr. Negus.

12 Going back to equation 20-1 of the
13 802.11 standard, assuming that the baseband input
14 from equation 20-1 is equation 20-61 that we
15 discussed earlier, is it then your intention that in
16 equation 20-1 $F_{sub\ C}$ is not the carrier frequency
17 of the output signal?

18 A. I may -- that's what -- that's what it
19 says. That's what it requires. That's what 20
20 dash -- or 20.3.8 as the section requires. It
21 requires that you replace $F_{sub\ C}$ in equation
22 dash -- 20-1 with $F_{sub\ C}$ plus ten megahertz in
23 you're transmitting in the upper half or minus ten
24 megahertz in the lower half.

25 So, it's not a question of my opinion.

1 It's just a question of that's what the standard
2 requires. The standard requires that you're going
3 to have two carrier signals and they come from two
4 up-conversions.

5 There is a separate carrier signal for
6 the minus ten megahertz and there's a separate
7 carrier frequency for the plus ten megahertz and
8 there's a separate up-conversion which is that
9 multiplication by complex rotation of -- of a shift
10 of negative ten megahertz in the IF and then there's
11 one -- equivalent one for plus ten megahertz.

12 So that's just what the standard
13 requires. You don't have a choice.

14 Q. So it is your opinion -- still I'm not
15 an expert, so to me it's all your opinion.

16 So it is your opinion that when the
17 input of equation 20-1 is the baseband signal from
18 equation dash -- 20-61, equation 20-1 essential is
19 run twice; one for F sub C plus ten and one for F
20 sub C minus ten?

21 A. The result that you get would be the
22 same as that. You don't have -- you know, you can
23 implement this any way you want. The standard
24 doesn't require a particular implementation
25 methodology.

1 But the most efficient way to do this
2 would be to do the IF shift, so, plus or minus ten
3 megahertz in the -- in the digital signal
4 processing, you know, in the baseband domain, if you
5 like, baseband in the sense, you know, all -- all of
6 OFDM is up-conversions to subcarriers. But still
7 calling all of that baseband domain, then that's the
8 most efficient way to do it.

9 But what .11 does require is what comes
10 out of the antenna.

11 Right?

12 That's the whole point of having a
13 wireless standard, as you say. What comes out of
14 the antenna must be this.

15 And so in the case of non-HT duplicate,
16 you must have a carrier signal that said $F \text{ sub } C$
17 plus ten megahertz and you must have a carrier
18 signal at $F \text{ sub } C$ minus ten megahertz.

19 Q. Okay. I believe -- going to paragraph
20 208 of your declaration. Please let me know when
21 you have it.

22 A. Yeah. I'm there.

23 Q. On page 96 that's -- I guess the
24 paragraph is split -- you have the annotated version
25 of equation 20-61 from the 802.11 standard.

1 Do you see that?

2 A. I do.

3 Q. And in your annotation, as far as I can
4 understand it, is the output baseband signal of
5 equation signal 20-1 already has two frequency
6 ranges with --

7 (A clarification was requested by
8 the reporter.)

9 BY MR. HENDIFAR:

10 Q. So my understanding, and just correct me
11 if it's wrong, of course. My understanding of your
12 annotation of equation 20-61 in paragraph 280 of
13 your declaration was that the output of equation
14 20-61 already has two frequency ranges; one centered
15 around a minus some -- some frequency minus ten, the
16 other one centered around some frequency plus ten.

17 Did I misunderstand your annotation?

18 A. I don't know if you read the annotation.

19 It says it's an example disclosure. It
20 doesn't say that it equals that. It says that it
21 discloses that.

22 Clearly this is in combination with
23 equation 20-1, because that's the standard. You
24 have to apply everything in the -- in the standard.

25 And in fact, I have that just above in

1 paragraph 278. I cite to that.

2 And so what the annotations are showing
3 is an example of how these claim terms -- and at the
4 time that I wrote it I did not have your limiting
5 construction in mind. I don't think it makes any
6 difference. But I didn't have that in mind.

7 And so this is a disclosure. So for
8 example, where it says example disclosure of first
9 center frequency and that minus 32 delta F, delta F
10 is 312.5 kilohertz, so that comes out to negative
11 ten megahertz.

12 That's an example disclosure of the
13 first center frequency which is $F_{sub C} - 10$
14 megahertz. It's an example disclosure because I'm
15 not just reading this one annotation in isolation;
16 I'm reading it in terms of the -- or a person of
17 ordinary skill in the art is reading it in terms of
18 the description of non-HT duplicate in 802.11
19 draft 2.0.

20 Q. So, looking at paragraph 285 of your
21 declaration, it seems to say that the baseband
22 signal output of equation 261 already shifts the
23 baseband signal to two sections; one minus 32 delta
24 F, one plus 32 delta F.

25 So the baseband signal would already

1 have two ranges with two middle frequencies for
2 those ranges.

3 Am I mistaken?

4 A. Where -- where does the term baseband
5 signal appear in paragraph 285?

6 Q. Sure. Well, it says the output of
7 equation 261, which we already discussed it's called
8 a baseband signal.

9 A. That's your term. Not mine.

10 Q. It is your term.

11 A. No. That's not my term.

12 Q. You called it a complex baseband signal
13 somewhere. I can --

14 A. Okay. Well, you said baseband signal.
15 I didn't call it a baseband signal. It's composed
16 of multiple baseband signals.

17 The output of -- what you get from
18 equation 20-61 is a composite of many baseband
19 signals. And since it's -- you know, each
20 individual sequence of DK sub N is -- it's -- you
21 know, for a given value of K is going to be its own
22 baseband signal.

23 Okay?

24 If we compose them together using a
25 summation of complex rotators, which are the $J 2 \pi$

1 K delta F terms in equation 261 -- or at 20-61,
2 pardon me, then together we can call that a first --
3 a first baseband signal.

4 It's the baseband signal that the lower
5 half clause 17 stations are going to demodulate.
6 They're going to demodulate that in aggregate, that
7 baseband signal.

8 Then there's a second baseband signal
9 which is for the upper half ones. And it's going to
10 be 90 degree rotation of the complex numbers from
11 the first signal, and then it's going to be shifted
12 by plus ten megahertz.

13 And so I've been very consistent on
14 that. I'm not calling all of it together the
15 baseband signal with respect to your proposed
16 construction.

17 You after the fact came up with this
18 construction that the center frequency has to mean
19 the carrier signal the baseband signal is
20 up-converted to.

21 Okay?

22 I'm not using baseband signal in that
23 context in the way that this is described. And with
24 respect to paragraph 285, I'm not saying baseband
25 signal at all.

1 Q. Okay. See if I can find the
2 terminology.

3 Is it fair to say that you called the
4 output of equation 261 a complex basebands signal?
5 Would that be --

6 A. Is there somewhere you're referring to
7 in this declaration?

8 Q. I'll find it. That's fine. Give me one
9 moment.

10 Paragraph 318 of your declaration.

11 A. I'm there.

12 Q. Okay. So, doesn't paragraph 318 mean
13 that the outcome of equations 20-60 and 20-61 are
14 each a single composite complex baseband signal?

15 A. No. It's saying that the first
16 information is -- at least for the non-HT duplicate,
17 it's saying that the first information is
18 corresponding with a single complex -- excuse me --
19 a single composite -- composite means the summation
20 or -- or we often use the word "ensemble."

21 But it's saying that the first
22 information is being impressed upon a single
23 composite complex baseband signal. And then the
24 second information is being impressed upon a second
25 single composite complex baseband signal; the second

1 one having the modulation values from the first one
2 all rotated by 90 degrees across each sub --
3 subcarrier.

4 Q. So it's your contention now that in your
5 declaration when you say a complete -- complex
6 composite baseband signal, you're not referring to
7 the output of equation 20-61?

8 A. That's -- that's not my testimony at
9 all.

10 I am referring to the output of 20-61 in
11 the manner of which I just described in my previous
12 answer.

13 Q. Your previous answer says you changed
14 what your declaration says. So let me ask you
15 again.

16 In your opinion, is the output of
17 equation 20-61 a composite complex baseband signal?

18 A. 20-61 gives us two composite complex
19 baseband signals that have already been up-converted
20 to an IF; one to an IF of negative ten megahertz,
21 the other to an IF of positive megahertz.

22 Both of them have already got carrier
23 signals and -- and up-conversions expressed within
24 them. And then when convolved with the operation in
25 equation 20-1, they'll end up with the result that

1 the draft 2.0 mandates in 20.3.8.

2 Q. You testified that -- well, let me step
3 back.

4 Equation 20-61 is a summation multiplied
5 by a different summation added to some exponential,
6 correct?

7 MR. MARANDOLA: Object to the form.

8 THE WITNESS: Please point out to me
9 where in the deposition record today or my
10 declaration that I made a statement that recited the
11 words you just recited.

12 BY MR. HENDIFAR:

13 Q. I'm asking a question.

14 A. Those are not the words that I've
15 recited anywhere.

16 Q. I did not say those are the words you
17 recited.

18 The question was equation 20-61 is a
19 summation multiplied by a different summation added
20 with an exponential, correct?

21 A. No. I mean 20 -- a summation of a
22 different summation added with an exponential? I
23 didn't follow that.

24 It is what it -- what it says. It's
25 very clear.

1 So -- so, there -- there are two
2 summations, for example, in 20-61. One is in the
3 time domain. That's the subscript N, N equals zero
4 to N sin minus one. So that's saying that there are
5 multiple OFDM signals.

6 Within each OFDM symbol at a particular
7 time then there's a summation or a time range, I
8 should say, there's a summation across the sub
9 carrier in the frequency domain. And that's given
10 by the summation of K equals minus 26 to plus 26.
11 And then it recites modulation values.

12 And within that summation there are two
13 composite baseband signals that are defined; one
14 that's going to be shifted by negative ten megahertz
15 with the first up-conversion to that first frequency
16 and -- first carrier frequency and then a second one
17 which is going to have a 90-degree rotation of the
18 modulation values from the first one and a shift of
19 plus ten megahertz.

20 Okay?

21 And so that -- that's what it recites.
22 That's what I've -- what I've told you.

23 And, you know, if you want to use
24 different words, that's -- you can go ahead. But
25 that's not my words.

1 Q. The output of equation 20-61 is one
2 signal. It doesn't show two different things being
3 output separately, right?

4 A. That's totally incorrect.

5 I mean the output of 20-61, to -- to be
6 correct, is showing 104 signals.

7 Okay?

8 Q. Right. But --

9 A. Counsel, let me finish my answer.

10 The question -- the answer is that this
11 does not show one signal.

12 The composite is a composite of 104
13 modulated signals. They are grouped. There is one
14 group of 52 with them that has a frequency shift. A
15 frequency shift is another word for an
16 up-conversion. It has a frequency shift to a
17 carrier.

18 Okay?

19 And that frequency shift is negative 32
20 delta F.

21 There is another group of 52 subcarriers
22 that gets a -- all 52 get the same frequency shift,
23 which is plus 32 delta F. And that's a plus ten
24 megahertz shift.

25 And that's what's going on in equation

1 20-61.

2 Q. And all of that sum together gets the
3 signal R, which is the output of equation 61,
4 correct?

5 A. All of them summed together summed over
6 time with the windowing function and the scaling
7 function that's in 20-61, all of them together are
8 what define that signal R superscript I subscript TX
9 and then R is subscripted LEG-DUP.

10 So all of that signal is defined by all
11 of the stuff that's in there, including the two
12 carrier signals and the two up-conversions.

13 Q. Very good.

14 Now, in equation 20-1 signal R of T is
15 what input into the up-conversion or -- yeah, the
16 up-conversion equation, correct?

17 A. What -- what do you mean by
18 up-conversion equation?

19 Q. Sure. What goes into equation 20-1
20 among other things is now lower letter R of T,
21 correct?

22 A. Correct.

23 Q. And this is the same R of T when
24 equation 2061 is used that's in equation 20-61,
25 correct?

1 A. Equation for the non-HT duplicate one
2 would effectively substitute 20-61 for R of T in
3 equation 20-1.

4 Q. So as this the way it's shown in the
5 standard is the -- in your view, different baseband
6 signals are summed together in equation 20-61 to
7 output signal R, and that already summed up complex
8 composite based on signals is what's input into
9 equation 20-1, correct?

10 MR. MARANDOLA: Object to the form.

11 THE WITNESS: I couldn't follow that --
12 let me -- I couldn't follow it.

13 If you are saying is 20-61 substituted
14 for R of T in 20-1, then the answer is yes, that's
15 what it is. 20-61 is substituted. And 20-1, once
16 you've made that substitution, now you're -- you're
17 not general draft 2.0; you're only describing non-HT
18 duplicate in 2.0.

19 And in that combination what you will
20 get is an up-conversion to F sub C minus ten
21 megahertz and a second up-conversion to a second
22 carrier signal at F sub C plus ten megahertz.
23 That's what the math that's expressed by equation
24 20-1 for the specific case of non-HT duplicate,
25 that's exactly what you'll get.

1 Q. But the output of equation 20-61 is not
2 split into two and then one portion being
3 up-converted to $F \text{ sub } C \text{ minus ten}$ and then another
4 portion being up-converted to $F \text{ sub } C \text{ plus ten}$,
5 correct?

6 A. If you substitute it into equation 20-1,
7 then you will get an up-conversion of the
8 non-shifted or nonrotated modulation values to
9 $F \text{ sub } C \text{ minus ten megahertz}$ and the rotated ones
10 will go to $F \text{ sub } C \text{ plus ten megahertz}$ as a -- as a
11 second up-conversion with a second carrier signal.
12 That's exactly what you will get.

13 Q. I'm not asking you if the result will be
14 the same. I'm asking about the actual process.

15 So in this example given for equations
16 20-61 and 20-1, there is a single up-conversion done
17 in equation -1 of the already summed composite
18 complex baseband signal from equation 20-61,
19 correct?

20 A. Just so I understand that question,
21 you're asking not about the result, but you want to
22 know about the process.

23 Did I hear that correctly?

24 Q. Yes.

25 A. Okay. Draft 2.0 describes the result.

1 I have been doing wireless standards for
2 a long, long time. It is generally not the practice
3 to mandate the process the way you get to the
4 result.

5 Okay?

6 And that -- and draft 2.0 does not
7 attempt to do that. It specifies the result.

8 Your construction specifies the result,
9 not the process. It says the center frequency has
10 to mean the carrier signal frequency the baseband
11 signal is up-converted to. It does not say that the
12 carrier signal frequency that the baseband signal is
13 up-converted to must arrive by a particular process.

14 Maybe you mean it to do that. If so,
15 you should tell the Court that that's what you mean.

16 But here in -- in draft 2.0 there is no
17 process required or expressed here.

18 What -- what one can do and what norm --
19 normally one would do, because it's the most
20 efficient, is to do the minus ten megahertz
21 frequency shift and the plus ten megahertz frequency
22 shift for the two carrier signals, do those
23 up-conversions in the digital and then complete
24 those two up-conversions with another complex
25 rotation at the center of the 40 megahertz channel.

1 But direct 2.0 definitely does not
2 require you to do that.

3 Q. So if I want to send out a signal over a
4 40 megahertz channel the way 802.11 standard defines
5 it, the standard is agnostic -- or is that your
6 opinion, that the standard is agnostic as to whether
7 I sum up the baseband for each of the two 20
8 megahertz channels first and then up-convert the
9 combined baseband into the transmission carrier
10 signal or I independently up-convert each of the two
11 basebands signals for the two multi -- 20 megahertz
12 channels and then sum up the final up-converted
13 signals for the two channels.

14 In your view the standard is agnostic as
15 to which of the two is taken?

16 A. You seem to be assuming that there are
17 only two and that they must be described with the
18 words that you used, which I had a hard time
19 following.

20 The standard is agnostic as to how you
21 arrive at the transmitted signal, period. There are
22 many more than two ways to get there. It just
23 doesn't -- the standard doesn't require you to use
24 one process or methodology versus another. It does
25 require a result.

1 Okay?

2 Now, the standard does express i
3 mathematics what is a conventional way to do it,
4 which is to up convert in the baseband -- or in the
5 digital signal processing, I should say, by a
6 negative ten megahertz across what's going to be the
7 lower half of non-HT duplicate and then to frequency
8 shift or up-convert to plus ten megahertz for the
9 upper half of the non-HT duplicate and then to
10 complete those two up-conversions by a common
11 complex rotation at the center frequency of the 40
12 megahertz channel.

13 Q. May I please refer you to the -- I'm
14 going to pronounce it Shearer. I'm not sure that's
15 the correct pronunciation. S-h-e-a-r-e-r. But
16 Exhibit 1007.

17 Just let me know when you have it.

18 A. Okay. Yeah. I have the patent
19 publication in front of me.

20 Q. What is the equation -- I'm sorry.

21 What does Figure 4 in Shearer connote?

22 A. Figure 4, just looking at the figure in
23 and of itself, it's showing a 20 megahertz frequency
24 span about a center frequency. And it's showing I
25 believe -- you really would have to go look at the

1 text, but I believe the idea of each little up arrow
2 is meant to represent an amplitude value for one of
3 the multiple subcarriers.

4 But I -- so, in and of itself, Figure 4,
5 it gives you some information. But I wouldn't get
6 too definitive without reading the text that
7 describes it.

8 Q. Okay. Can you read the text so you can
9 answer precisely?

10 A. Sure. Let's see what I wrote in my
11 report.

12 Sure. As I described this in my report,
13 Figure 4 is -- is meant to be a frequency domain
14 representation, it's just -- obviously it's just a
15 magnitude response, but of a 20 megahertz
16 transmission channel for 802.11a or g for the -- or
17 to use the draft 2.0 terminology, this is a -- this
18 is a description of what a clause 17 station would
19 be expecting.

20 Q. Is the signal in Figure 4 a baseband
21 signal?

22 A. It's a -- it certainly is a
23 representation of the -- of what you would get for
24 the amplitude response around zero if you wanted to
25 see the basebands representation. But it doesn't

1 purport to be a representation of the baseband
2 signal.

3 In -- in this figure the direct
4 conversion up -- up-conversion of the baseband
5 signal would give you, in my mind, what's depicted
6 in Figure 4, that there's a center frequency at
7 baseband that would be zero at the RF transmission
8 frequency that would be the carrier frequency.

9 And so this frequency span to which this
10 magnitude response is shown is going from $F_{sub\ C}$
11 minus ten megahertz to $F_{sub\ C}$ plus ten megahertz.
12 And it's showing, as I described previously for the
13 non-HT duplicate, that for that one particular
14 composite there's 52 non-zero subcarriers, or in
15 other words, there's 52 little baseband signals,
16 each of which have been up-converted to their own
17 subcarrier frequency. And then subsequently in
18 common all of them were up-converted to $F_{sub\ C}$.

19 Q. Okay. So in your view, Shearer doesn't
20 say one way or another if Figure 4 is or is not a
21 baseband signal?

22 A. I don't see where Shearer says that this
23 in particular is a baseband signal.

24 In fact, here indicates by putting $F_{sub\ C}$
25 C at the center of Figure 4, that this is meant to

1 be at the RF transmission frequency.

2 And it says -- if you look at the start
3 of paragraph 44, it says,

4 "In an IEEE 802.11a/g design, each
5 transmission channel has a
6 bandwidth of 20 megahertz as shown
7 in Figure 4."

8 And so transmission channel is --
9 typically means at the RF. So, for example, for
10 802.11g, a channel that would be between 2400
11 megahertz and 2483.5 megahertz with a bandwidth of
12 20 megahertz.

13 Now, that said, persons have ordinary
14 skill in the art read patents. A person of ordinary
15 skill in the art looks at Figure 4 and looks at this
16 description, they know what the baseband signal
17 looks like.

18 That's -- this doesn't have to say, hey,
19 Figure 4 is a diagram with a baseband signal for a
20 person of ordinary skill in the art to look at
21 Figure 4 and go, oh, okay, now I have some
22 understanding of what's in the baseband signal.

23 Q. Okay. Paragraph 16 of Shearer says,
24 "Figure 4 is a graphical
25 representation of the frequency

1 spectrum of an input signal of
2 exemplary embodiment of an IEEE
3 802.11 system."

4 Does that in my way modify your
5 response?

6 A. No. It's the same thing. That's
7 exactly what it says.

8 It's a frequency spectrum, as I said,
9 for a transmission channel, and it's input signal in
10 the sense that it's an input into the propagation
11 channel. That's what -- that where MIMO comes from,
12 for example, multiple inputs means multiple
13 transmissions from multiple antennas.

14 So this is an example of the input
15 signal, the RF transmission channel -- excuse me --
16 RF transmission into a propagation channel.

17 So I'm fine with paragraph 16. It's
18 completely consistent with what paragraph 44
19 describes and -- and what I just told you.

20 Q. By Figure 4 you mentioned those arrows
21 are amplitudes.

22 Does that mean that the signal in
23 Figure 4 is an OFDM modulated signal?

24 A. Figure 4 in and of itself without the
25 discussion does not tell me that this is an OFDM

1 signal. And I said that it looks like an amplitude
2 response.

3 I don't want to say that those are the
4 amplitudes, because the amplitudes can be complex
5 amplitudes, in other words, that they have a phase
6 which I'm not seeing here.

7 But this is in -- we often call it the
8 magnitude response. This is just the magnitude of
9 the amplitude.

10 Now, it doesn't say that in Figure 4.
11 It's just that that's such a default for a frequency
12 domain response that in the absence of information I
13 assume that.

14 When we go to the discussion of
15 Figure 4, it's very clear that this is OFDM. And
16 it's in the very first -- or like I said, we'll take
17 it as the second sentence in paragraph 44, it says,
18 "As shown in Figure 4 in an IEEE
19 802.11a or IEEE 802.11g OFDM
20 signal."

21 So at this point we know Figure 4 is
22 disclosing an OFDM signal.

23 Q. Now, if one of the reasons I believe --
24 or if I misunderstood you, please correct me -- that
25 you said Figure 4 may be a transmitted signal, not a

1 baseband signal, was the word F sub C in the middle;
2 is that correct?

3 A. You mean Figure 4 in isolation before we
4 read its description?

5 Q. I believe you said the description
6 doesn't specify whether it's a baseband signal or
7 not.

8 Did I miss that?

9 A. The specification does not describe it
10 as a baseband signal. That's what I said. There's
11 nothing that I see in the description that says,
12 hey, look at Figure 4. That's a baseband signal.

13 If you think there is, please point it
14 out. I -- I'll be happy to look at it and consider
15 it.

16 But so far I've just looked at Figure 4,
17 paragraph 16 and paragraph 44 in answering your
18 questions here. I see nothing where Shearer or
19 Mr. Webster are -- are saying hey, Figure 4 is a --
20 a description of the baseband signal.

21 What I have said is that a person of
22 ordinary skill in the art, which is who reads
23 patents, a person of ordinary skill in the art would
24 have no trouble deducing some information about the
25 baseband signal by looking at Figure 4 in this

1 description.

2 And of course the single biggest piece
3 of information that would help them deduce that is
4 that it says it's 802.11a. And that's simple. That
5 the just clause 17. Just go look it up.

6 Q. Okay. So my question was as far as you
7 have seen, Shearer doesn't say one way or another
8 whether or not Figure 4 is a baseband signal,
9 correct?

10 A. Patents are written for persons of
11 ordinary skill in the art. Shearer says that
12 Figure 4 is a representation of the transmission
13 channel. It's the input signal into the system.

14 Okay?

15 Persons of ordinary skill in the art
16 know what that is. That's the RF signal. That's
17 what gets transmitted from the antenna. That's
18 what -- that's what Shearer's saying. And that's
19 what figure -- and Figure 4 is completely consistent
20 with that.

21 Now, in the case of IEEE 802.11a and
22 Figure 4, a person of ordinary skill in the art also
23 knows what the baseband signal is from this
24 disclosure. It can disclose both. It's not going
25 to be an either/or. It's a diagram of the

1 transmitted signal that as -- as a magnitude
2 response in the frequency domain of what should come
3 out of the antenna.

4 Q. Now, in Figure 4 who would a person of
5 ordinary skill in the art know how the baseband
6 signal would look like?

7 A. Your audio trailed off there. I
8 couldn't follow it.

9 Q. No worries.

10 In Figure 4 of Shearer how would a
11 person of ordinary skill know the shape of the
12 baseband signal based on the transmission signal
13 shown in Figure 4?

14 A. They could just go look it up in IEEE
15 802.11a and clause 17. There will be an equation
16 somewhat analogous to equation 20-61; if nothing
17 else because equation 20-61 is actually describing
18 how to compose two parallel clause 17 802.11a
19 signals.

20 So, yeah, Shearer -- Shearer is telling
21 you Figure 4, this is 802.11a.

22 Q. So is it incorrect to assume that the
23 baseband signal would look like the Figure 4
24 envelope shifted to zero?

25 A. If by envelope you mean the magnitude

1 response -- which I'm fine with using envelope, but
2 just making sure and I'm not misunderstanding -- if
3 envelope means a magnitude response, then if you
4 substituted F sub C in Figure 4 with zero, you
5 wouldn't have the accurate Figure 4 for what
6 Shearer's describing in paragraphs 16 or 44 anymore,
7 but you would have a magnitude response that's sort
8 of like .11-A.

9 I believe I actually did this one time
10 and added up -- you know, added up how many arrows
11 there are. And I think there's not the right number
12 of arrows to -- if each arrow were to mean a
13 subcarrier.

14 The other thing is that subcarriers in
15 the frequency domain, individually they don't look
16 like arrows. That's just not how they look. So
17 that's the other ambiguity, if you like.

18 But the main reason that this discloses
19 the baseband signal to a person of ordinary skill is
20 it just says it's 802.11a. So they already know
21 what it is. If they didn't know what it is, it's
22 easy to look up.

23 Q. Sure.

24 But my question was if the baseband
25 signal would have the same amplitude response as

1 Figure 4 shifted to zero.

2 A. The baseband signal of an 802.11-A
3 transmitter? Is that what you're asking?

4 Q. Sure.

5 A. Well, by saying it would have the same
6 concept of -- of a -- of a magnitude -- an
7 amplitude/magnitude response similar to what's
8 shown.

9 What it would actually have, like would
10 all the arrows be the same height, for example.
11 Well, if it was using 16 QAM modulation, for
12 example, and -- and then you have three different
13 amplitudes -- right? -- in 16 QAM and you have -- I
14 can't remember whether it was five or seven
15 different amplitudes in 64 QAM, for example, and
16 those are both modulations that are -- that are in
17 802.11a.

18 So, you know, is it representative in
19 some high level, you know, non- -- non-detailed
20 sense? Sure. Figure 4 conveys some idea of what a
21 complex baseband signal in composite might look like
22 in one view, in a view where if you're only sampling
23 the amplitude response at the specific levels shown
24 and -- and you haven't got a modulation that has
25 multiple amplitude levels.

1 Q. Now, may I please refer you to Figure 7
2 of Shearer.

3 A. Okay.

4 Q. Please feel free to read any text you
5 need.

6 What does the first axis on Figure 7,
7 the top axis, show?

8 A. Yeah. So the one that's labeled at 704
9 as opposed to 706 or 712?

10 Q. Correct.

11 A. Well, let me take a look.

12 Okay. So, just at a high level, first I
13 apologize for saying 704 as opposed to 706 or 712.
14 I should have said 700 as opposed to 706 or 712.

15 And as I pointed out in my description
16 of this in my declaration, Shearer explains that,
17 quote,

18 "Waveform 700 provides the 40
19 megahertz packets subcarrier
20 structure matching the subcarrier
21 structure of two 20 megahertz
22 802.11a/g OFDM packets wherein the
23 respective center" -- quote --
24 "center frequencies are spaced by
25 ten megahertz."

1 So that's Shearer's description and I
2 think that that is largely correct.

3 Q. Does Figure 7 axis 700 show a baseband
4 signal or a transmitted signal?

5 A. Well, it shows a number of baseband
6 signals.

7 Right?

8 I mean if it's -- it's saying that there
9 are two 20 megahertz 802.11a/g OFDM packets here.
10 So each one of those 20 megahertz ones has 52
11 baseband signals in it. It's showing effectively by
12 the way it's described here two -- two groups of
13 composite basebands; one on the left with 52
14 subcarriers and a center frequency since they're
15 spaced by ten megahertz relative -- relative to the
16 center of the 40 megahertz channel. And so that's
17 a -- the one on the left, that's effectively the
18 minus ten megahertz. And then on the right it shows
19 what's meant to represent -- and I don't think
20 there's the right number of arrows, but another 52
21 subcarriers or another 52 baseband signals grouped
22 together for a second 20 megahertz 802.11-a/g OFDM
23 packet. And that has a second center frequency also
24 spaced by ten megahertz.

25 Q. Thank you.

1 Does graph 700 in Figure 7 so baseband
2 signals or a transmitted signal?

3 A. You seem to think that it has to be one
4 or the other.

5 Q. I do.

6 A. You think they're read -- your question
7 presumes that it's either/or. And I don't accept
8 that premise.

9 You know, this -- these are read by
10 persons of ordinary skill in the art.

11 Let's go take a look. Let's go read the
12 short form. So, paragraph 19, it says,

13 "Figure 7 is a graphical
14 representation of the frequency
15 spectrum of exemplary embodiments
16 of methods for adding subcarriers
17 to an input signal of an 802.11
18 system as in Figure 5."

19 Okay? And figure five made reference
20 to, it says,

21 "The graphical representation of a
22 frequency spectrum of an input
23 signal of the exemplary embodiment
24 of Exhibit 4 without its
25 subcarriers."

1 Now we've already discussed Figure 4.

2 And it's meant to be an RF transmission signal,

3 right? It's an input signal into the system.

4 That -- that terminology is well understood.

5 So in that sense, since Figure 7 refers
6 to Figure 5 refers to Figure 4, then I would say
7 that Figure 7 is -- is an RF transmission spectrum.

8 Now, does that convey to a person of
9 ordinary skill in the art what were the baseband
10 signals that went into creating that RF spectrum?
11 Sure. It does by the description of Figure 7, by
12 the fact that each one is a 20 megahertz half that
13 corresponds to a legacy 802.11a or clause 17
14 station.

15 And so we know -- we know a lot about
16 the baseband signals that are expressed by this
17 waveform 700 in Figure 7.

18 But waveform 700 in figure 7 in and of
19 itself, that's -- that's the transmitted RF spectrum
20 representation.

21 Q. Paragraph 429 of your declaration, the
22 numerical examples that you provide, such as FC
23 being minus 18.25 megahertz, my understanding of
24 those numbers was that the 700 figure was centered
25 around zero and it was a baseband signal.

1 Did I misunderstand paragraph 429 of
2 your declaration?

3 A. Where in paragraph 429 do I say I am
4 describing Figure 7?

5 I'm not -- I'm not following the
6 Figure 7 in 429.

7 There's no question that in -- when I
8 wrote -- when I typed paragraph 429, I had certainly
9 considered all the disclosures of Shearer, including
10 Figure 7.

11 But I'm not getting the connection
12 between hey, Figure 7, hey, you know, plus or minus,
13 you know, around -- around the carrier at FC minus
14 ten megahertz, for example, here.

15 Q. Okay. Going to paragraph 421 of your
16 declaration.

17 A. Okay.

18 Q. You see discussed waveform 700?

19 A. That's correct.

20 Q. The other figure below paragraph 421,
21 right?

22 A. That's correct. Annotated figure,
23 annotated by me.

24 Q. Sure. But F sub C doesn't appear in
25 this --

1 A. F sub C? No. I added that. This was
2 annotated by me. I added F sub C based on the
3 description, which, you know, we just highlighted
4 that.

5 Figure 7 says that it's an input signal
6 like Figure 5. Figure 5 says it's an input signal
7 like Figure 4. And both are an input signal into an
8 802.11 system.

9 I know that that means, you know, an
10 input into a propagation plane is the -- is the
11 transmitted RF spectrum.

12 And in Figure 4 -- so, Figure 7 is --
13 is, you know, like Figure 5, and Figure 5 there's an
14 F sub C and in Figure 4 there's an F sub C in the
15 middle.

16 And so since Figure 7 is just like, you,
17 another representation of Figure 4 or, for that
18 matter, Figure 5, I know that that's meant -- and
19 since it's an input signal into the 802.11 or in the
20 two 20 megahertz channels within a 40 megahertz
21 channel, then I know that that center would be an
22 F sub C in 802.11 kind of nomenclature -- 40
23 megahertz, 802.11. Not 20 megahertz. 802.11
24 nomenclature.

25 Q. Going to paragraph 22 of your

1 declaration. You have also annotated Figure 8 of
2 Shearer.

3 Do you see that?

4 A. Yes.

5 Q. What is an OFDM tx kernel?

6 A. So the way -- so people can use that
7 term in different ways. Usually it's a -- kernel is
8 usually a reference to a set of code or algorithms
9 that are being used to generate baseband -- you
10 know, one or more of the baseband signals.

11 And so I would guess -- I don't want to
12 put words in Mr. Shearer or Mr. Webster's mouth, but
13 I -- from the context of this I would assume that
14 they're taking a PPDU, you know, a five protocol
15 data unit in on the left of that kernel, and
16 they're -- you know, they've got to scramble, encode
17 interleave, map and then apply an IFFT in that
18 kernel.

19 Q. So the output of kernel 320a in Shearer
20 is a baseband signal?

21 A. That would be correct. That would be a
22 composite -- effective delta of 320a would be like
23 either one of the baseband signals in equation 20-61
24 except at the 320a process -- point, at the output
25 of 320a the complex multiplication or the

1 up-conversion by minus ten megahertz has not yet
2 occurred.

3 And in -- in Figure 8 you can see,
4 though, that just as in 20-61, it does end up
5 occurring. They do an interpolation that's just so
6 that you can get your sample domain on a time domain
7 raster that's compatible with 40 megahertz and then
8 the minus ten megahertz frequency shift that's
9 described -- it's actually right above there in
10 paragraph 22 -- it says multiplying the sample by
11 E to the $J 2 \pi F$ sub shift and then T .

12 And so that's -- that's an
13 up-conversion, of course.

14 And so in that sense this is very
15 similar to one half of equation 20-61 in draft 2.0.

16 Q. And that's what I'm trying to -- I'm
17 glad we got to this point.

18 So in your opinion, when the baseband
19 signal output from kernel 320a in Shearer is
20 frequency shifted minus ten megahertz, that creates
21 a carrier signal at the frequency minus ten
22 megahertz?

23 A. Well, no. That's -- that's part of the
24 process that's going to get you there.

25 What's going to come out from -- if you

1 look at paragraph 428, for example, another
2 annotation of -- of multiple figures that I made
3 concatenated together, but what's going to come out
4 of antenna 318 is going to be two carrier signals.

5 And the first carrier signal in the
6 lower 20 megahertz channel, that's coming from the
7 negative ten megahertz frequency shift that's shown
8 in Figure 8.

9 Okay?

10 So, to get to the actual N RF carrier
11 signal or the carrier signal to which the upper 20
12 megahertz OFDM tx kernel -- think of that as a
13 baseband signal. To get to what it's up-converted
14 to, we're going to do this negative ten megahertz
15 frequency shift, and then we're going to do another
16 IF IQ modulation -- it doesn't specify the
17 frequency. I'll just make one up.

18 Let's say it's 250 -- I'm trying to
19 remember. I used to know this stuff, Intersil's
20 chipset, how it worked.

21 But I think it was around 250 megahertz.
22 So -- so that would get you to, say, 240 megahertz.
23 And then where you see the mixer 314, it doesn't
24 show the local oscillator, but there would have to
25 be one.

1 So to make the math easy, if we were
2 going to transmit that lower channel at 2440 in the
3 2.4 gigahertz band, then we would have to multiply
4 by 2200 megahertz the IQ modulation signal there.

5 And then on the other branch in what's
6 shown in figure -- excuse me -- in paragraph 428 of
7 my report, you see the -- the other transmit kernel
8 getting a plus ten megahertz shift.

9 So when that goes through the IQ
10 modulation, then that will end up at 260 megahertz
11 or -- excuse me, I take -- take that back. It's
12 going to be -- yeah, I'm sorry, that's right. It
13 will end up at 260 megahertz. And then when it gets
14 up-converted with that 20 again, you know, the next
15 piece of the up-conversion process is a
16 multiplication -- a complex rotation or a
17 multiplication by 2200 megahertz, you'll end up at
18 2460.

19 So what you'll end up with then is if
20 you look at that annotated figure is the red arrows
21 at 2440 in my example and the blue arrow is coming
22 out at 2660.

23 Each one of them is a composite baseband
24 signal which has been up-converted to the respective
25 one of those two carrier signals.

1 Q. Thank you.

2 Now, in the annotation in paragraph 428
3 of your declaration, what is the function of the box
4 titled "sum 310e"?

5 A. Yeah. Can you repeat the question? I
6 heard something about function and 310e.

7 Q. Sure.

8 In the annotation in paragraph 428 of
9 your declaration, what is the function of the box
10 named "sum" then the number is 310e, as in echo?

11 A. Yeah. That's -- that's an adder. So I
12 mean the function -- whether it's annotated or not
13 doesn't matter. It doesn't change the function of
14 that block.

15 But that is literally a sum. It's like
16 a plus sign.

17 If you go back to equation 20-61 of
18 draft 2.0, there was kind of a middle line that was
19 the first composite. And then at the -- at the
20 lower line, that third one describing the second
21 composite, you'll notice at the beginning of it
22 there was a plus sign, just a mathematical plus
23 sign.

24 Well, that mathematical plus sign is --
25 here in Shearer it's the box 310e. It's the same

1 mathematical plus sign.

2 Q. So the output of box 310e in Shearer in
3 your annotation in your paragraph 428 is essentially
4 equivalent to the output of equation 20-61 from the
5 802.11?

6 A. No. I wouldn't quite make that
7 statement.

8 I want to be careful with equivalent.
9 If I was saying that it's analogous --

10 Q. I understand.

11 A. But I just don't want to say that it's
12 exactly the same. And I'm not sure where equivalent
13 falls on that thing.

14 But the thing to remember, and why it is
15 pretty darn close if not the same, is here in
16 Shearer it's describing legacy clause 17 stations in
17 each -- you know, the upper half and the lower half.
18 And that is what's going on in 20-61. It's also
19 describing legacy clause 17 stations.

20 So I think -- I don't want to say that
21 Shearer's saying hey, I'm describing 20-61, but it's
22 very close, very analogous.

23 Q. Let me then rephrase my question in a
24 way that's acceptable to you.

25 In the annotation provided on paragraph

1 428 of your declaration, for Figures 3 and 13 of
2 Shearer, the output of the sum or 310e is analogous
3 to the output of equation 20-61 in 802.11, correct?

4 A. In 802.11 draft 2.0, yes.

5 Q. Now, what is the function of the box
6 titled "IQ modulation" and the number 312 in your
7 annotation?

8 A. Sure. In the Intersil chipset that's an
9 IF conversion. So it's a direct conversion to an IF
10 from the composite -- the two composite baseband
11 signals that have already been frequency shifted.

12 So it's going to do another frequency
13 shift.

14 And I apologize, I don't remember the --
15 it's just a fixed frequency. And I don't remember
16 what it was. But I know it was in that 200 to 300
17 megahertz range.

18 Q. So, instead of directly up-converting
19 the output of 310e to the transmission carrier
20 frequency, it does it in two stages?

21 A. Well, it's already done two stages at
22 the output of 310e. It's already had two frequency
23 shifts for the two different baseband -- composite
24 baseband signals.

25 And so if you look at just the straight

1 math that's in draft 2.0, it suggests that, hey,
2 I've only got one more frequency rotation to go.

3 Right?

4 If I take that same analogous signal, I
5 just need to rotate it one more time.

6 And that's true. That's true for
7 Shearer, as well. You only have to rotate it one
8 more time.

9 But what Shearer is showing is now I'm
10 going to break that rotation into two rotations. So
11 I'm going to do a piece of it in this block 312, I'm
12 going to get -- so if I rotate it by another -- I
13 said the example 2440 is the lower channel 2460 as
14 the center for the upper channel.

15 So it's saying instead of rotating the
16 output of 310e at 2450, instead I'll do it at, say,
17 250, and then I'm missing 2200 megahertz of
18 rotation. I'll do it -- that extra 2200 at block
19 314.

20 It's just the nature of exponents.

21 Right?

22 You know, E to the A times E to the B
23 times E to the C. It's just E to the A plus B
24 plus D.

25 Right?

1 That's just high school math.

2 And so here it's breaking the first
3 part, the minus ten megahertz and the plus ten
4 megahertz into two different rotations that are not
5 in baseband, two different up-conversions, and then
6 it's doing the remaining rotation as two separate
7 complex multiplies in the analog domain.

8 You can think of Shearer as -- as doing
9 these two up-conversions of the two baseband signals
10 to arrive at the result of these two carrier
11 signals. You can think of it as doing it in four
12 steps instead of draft 2.0 mathematically describing
13 three steps. But you could do it in any number of
14 steps and achieve the same result.

15 And that kind of gets back to what I
16 said earlier. There are so many different possible
17 ways to achieve -- you know, if you get into
18 process, there are many, many different processes
19 that you can do to end up with the same results.

20 Q. And --

21 A. Yeah. And .11, of course, like any
22 wireless standard, it just mandates a result, not a
23 process.

24 Q. I think I've understood where the
25 disconnect is. But that's fine.

1 Going back to paragraph 422 of your
2 declaration, the annotation of Figure 8 that you
3 were just trying to explain to me, is that -- so you
4 mentioned that the output of kernel 320a is one or
5 more, depending on how you look at it, baseband
6 signals.

7 Can we point in equation 20-61 in the
8 802.11 standard which component of that equation
9 would correspond to the output of kernel 320a from
10 Shearer?

11 A. I'm not sure if I can -- kernel 328,
12 which -- which figure are you referring to?

13 Q. Sure. So you have an annotation in your
14 declaration in paragraph 422. And I'm just pointing
15 to that as you already discussed that.

16 So you have an annotation of Figure 8
17 from Shearer. And we discussed that the output of
18 kernel 320a is a baseband signal that corresponds to
19 one half of what's in equation 20-61.

20 I was wondering if we can point to which
21 component in equation 20-61 would correspond to the
22 output of kernel 320a from Shearer.

23 A. Oh, I'm sorry. 320a. I swore you were
24 saying 328.

25 Okay. I was just mishearing. Okay?

1 Now I get the question.

2 Okay. So, what in 20-61 corresponds to
3 320a in Figure 8 of Shearer, again not tying it down
4 to they have to be identical, but they're at least
5 analogous.

6 And so that's a -- that's a real easy
7 question.

8 You can see it -- if you look at
9 paragraph 104, for example, of my declaration, which
10 is just verbatim 20-61, where you see the summation
11 from K equals negative 26 to 26, and then there's a
12 term which is $J D \text{ sub } K N$ and another -- you know, and
13 added with $P \text{ sub } N$, $P \text{ sub } K$, all of that summed when
14 multiplied with the exponential of $J 2 \pi K \delta F$
15 and then the T term -- okay? So, not the negative
16 32, because, remember, as we said, E to the A
17 minus -- you know, E to the A minus B is the same as
18 E to the A times E to the B .

19 So we're going to pull that term out.
20 And what would remain if we took the negative 32
21 δF term out in that middle line that if not the
22 same is very analogous to what Shearer is conveying
23 as the output of block 320a in Figure 8, the lower
24 20 megahertz OFDM tx kernel.

25 Q. Understood.

1 Now going back to equation 20-61, the
2 first summation was over number N, as in November.

3 And if I didn't misunderstand you, those
4 were the subcarriers?

5 A. No. You misunderstood. Those are the
6 symbols.

7 So there's a concept of modulation in
8 time if OFDM and a concept of modulation in
9 frequency.

10 Ultimately all we have in life is time.
11 Okay? Everything goes out the antenna and it's --
12 it's something happening versus time.

13 Frequency is a useful -- very useful
14 abstract, but, you know, ultimately you can't
15 modulate in the frequency domain. You modulate in
16 the time domain -- or you do everything in the time
17 domain.

18 So when we do the first OFDM symbol, one
19 that corresponds to N equals zero -- okay? Within
20 that symbol we're going to look at -- for the first
21 in 20-61 we're going to look at 52 subcarriers that
22 we're going to frequency shift or up-convert to
23 negative ten megahertz with the first carrier signal
24 and then we're going to look at another -- then
25 we're going to sum up another 52 which are rotated

1 by 90 degrees relative to the first 52, and
2 they're -- and those we're going to up-convert or
3 shift to a positive ten megahertz to end up with our
4 RF carrier signal in the right place.

5 So it's time is essentially what's
6 corresponding to N. And K is corresponding to
7 frequency.

8 Now, you may ask why is T in -- after
9 the summation, the second summation -- right? The K
10 summation, we still --

11 (A clarification was requested by
12 the reporter.)

13 THE WITNESS: And so there's a reason
14 why we see T in that second summation is we still
15 have to ultimately end up with time domain symbol --
16 samples. Pardon me.

17 So, for each N, N goes from zero to,
18 say, 25, just making up a number. So, for N equals
19 zero we need to end up with -- it will actually be a
20 minimum of 64 samples for each one of the symbols --
21 excuse me -- of the baseband signals.

22 But because we have two of them, we're
23 going to need double that number. So we're going to
24 need 128 time domain samples for each value of N.
25 That's what's going to come out of here at a

1 minimum. And that's -- that's what we need at a
2 minimum.

3 You can do more, and there are definite
4 advantages to doing more.

5 You also don't need to do it in the
6 digital domain. This is set up and described
7 assuming a digital domain implementation. But you
8 can actually do all of these in the analog domain.
9 You can -- you could -- there's no reason you have
10 to do any of this frequency shifting or the
11 individual subcarrier modulation, you can also do
12 that in the analog domain.

13 And in fact in the -- you know, the good
14 old days -- OFDM's been around a long, long time --
15 that's exactly how people used to do it.

16 Q. The other question is so we discussed
17 that the baseband signal is -- use your exact
18 language so there's no -- we discussed that the
19 baseband signal is a direct representation of the
20 information signal as opposed to being in a
21 modulated format.

22 So, would a baseband signal reflect the
23 fact that a system uses OFDM or not use OFDM?

24 A. So, in the context of OFDM, when the
25 disclosure is one of OFDM, the convention is to

1 consider the -- the ensemble of subcarriers together
2 that are going to be demodulated together.

3 So, in a non-HT duplicate there's two
4 such ensembles. There's one that's going to the
5 clause 17 stations in the lower half and another
6 ensemble that's going to the clause 17 stations in
7 the upper half.

8 So, the conventional way to describe
9 that is as a single composite complex waveform or
10 signal for -- one for the lower half, one for the
11 upper half.

12 It's not strictly true with
13 communications theory that that's the right way to
14 say baseband signal, but that's definitely the way
15 that -- that we usually do it.

16 Truly, truly you would say that $D_{sub K}$
17 comma N, that that's the baseband signal, just those
18 complex numbers are the basebands signal, and that
19 everything you do in this equation after that is
20 applying modulation.

21 Q. I see.

22 But in the ordinary course, the common
23 practice is that a POSITA would consider -- I think
24 you used word ensemblance or a composite --

25 A. Right. It's ensemble, e-n-s-e-m-b-l-e.

1 That's a standard term. But composite is fine, too.
2 We use both with respect to OFDM.

3 The key thing is what demodulates.

4 When we define what we're going to
5 transmit, we always do it in mind of what is going
6 to receive this signal. So, for non-HT duplicate
7 transmission, it just says it's used to transmit to
8 clause 17 stations that may be present in either the
9 upper or lower halves of the 40 megahertz channel.

10 So that says that the ones in the lower
11 half, they have to have a signal that's compatible
12 with -- they're only going to look at the lower
13 half.

14 It better have a carrier signal for that
15 lower half because they're going to apply an assumed
16 carrier signal for that lower half. And -- and they
17 get better have the ensemble of all the subcarriers
18 to convey all the information that it needs to get
19 the message in that lower half.

20 And then because it's also doing the
21 upper half simultaneously, it needs another baseband
22 signal or another ensemble or another composite
23 baseband signal that's going to duplicate that
24 information. But it's going to be up-converted to a
25 different frequency, to a different carrier signal

1 frequency, in order to fall on with what those upper
2 half clause 17 stations are expecting.

3 Q. So, in an OFDM system, a POSITA would
4 understand that ordinarily the baseband signal
5 refers to the ensemble -- ensemble of all the
6 individual baseband signals on the different RF
7 carriers, correct?

8 A. No. It would -- I mean I would say no
9 as in that what you said is always wrong. But
10 that's not the understanding.

11 The ensemble refers to what the receiver
12 is going to demodulate. So you can transmit -- we
13 refer to the ensemble with respect to what is the
14 receiver going to transmit. If you transmit two
15 ensembles, ten ensembles or one ensemble plus some
16 other stuff, that's all fine. The key thing is what
17 is it going to receive. And it's going to
18 receive -- in OFDM systems it's going to receive
19 OFDM ensembles.

20 Sometimes those ensembles are broken
21 down into subsets. For example, you know, a lot of
22 modern cellular systems will have a ensemble of --
23 might be 1,000 subcarriers. But an individual
24 handset, the one that's in your pocket right now
25 operating under OFDM, might only be looking at --

1 their often in groups of eight or in groups of 16.
2 So you might only be looking at eight of them.

3 So, from its point of view it's seeing a
4 ensemble or eight subcarriers even though the base
5 station might be transmitting right now to your
6 phone as we speak 1,000 subcarriers at once.

7 Okay?

8 So, what counts when we say, oh, here's
9 this ensemble of carriers is really how is it going
10 to be demodulated.

11 Q. Now, a baseband signal itself without an
12 up-conversion does not have a carrier frequency; is
13 that correct?

14 A. That would -- that would depend how
15 you're using the term "baseband signal."

16 I think we've gone around and around and
17 around on this already, Counsel.

18 If basebands signal means, you know,
19 that there has been no up-conversion whatsoever,
20 well, then baseband signal has no up-conversion
21 whatsoever. If baseband signal is something that's
22 going to have an up-conversion apply, well, it can
23 already have some up-conversions.

24 And that's certainly the case in OFDM
25 kind of by default. If you apply an IFFT, an IFF --

1 for example, a 64 point IFFT is basically a
2 summation of 63 up-conversions plus a direct
3 multiplication at the DC carrier.

4 So -- but here in the non-HT duplicate
5 what we have is a grouping, one grouping intended
6 for lower half clause 17 stations and -- and another
7 grouping intended for upper half clause 17 stations.
8 And so effectively we have two composite baseband
9 signals. And then each one of them, all the
10 subcarriers, no matter which one they are, they all
11 get this consistent up-conversion to the carrier
12 signal, which is negative ten megahertz off in
13 either minus or plus depending on lower or upper
14 half from the center frequency of the 40 megahertz
15 channel.

16 Q. Thank you for that. But I think my
17 question was actually complete. But let me ask it
18 again.

19 A baseband signal itself without
20 up-conversion does not have a carrier frequency,
21 correct?

22 MR. MARANDOLA: Object to the form.

23 THE WITNESS: Again, it depends -- it
24 depends -- define "baseband signal" for me.

25 ///

1 BY MR. HENDIFAR:

2 Q. Okay. A direct representation of the
3 information signal as opposed to in a modulated
4 form.

5 A. I mean if you -- if you want to define
6 "baseband signal" as it doesn't have any frequency
7 shift, then it doesn't have any frequency shift.
8 But that's not how it's defined in the context of
9 the 802.11 world.

10 Here the baseband signal is defined as a
11 composite or a complex baseband waveform. And the
12 complex baseband waveform is a summation across all
13 of the subcarriers for the intended recipient.

14 Okay?

15 Of which there's two in non-HT duplicate
16 transmission.

17 So your -- it's just a -- it's just a
18 semantics game here. It's clear what's disclosed in
19 .11 draft 2.0 and it's clear how that applies to the
20 claims of the '802 Patent.

21 But you've introduced additional words
22 in your construction. And those words, if we map
23 them to how those terms are used in 802.11 draft
24 2.0, there's no issue. You want to map them to the
25 way the terms are not used in 802.11 draft 2.0 and

1 create some disputed issue. And I -- I just -- I
2 don't accept that. I mean that's -- that's not
3 what -- the way a person of ordinary ask skill in
4 the art would read this.

5 I don't believe that a person of
6 ordinary skill in the art would come to the
7 conclusion that center frequency means carrier
8 signal frequency the baseband signal's up-converted
9 to. That's nonsensical.

10 But --

11 Q. Your opinion --

12 A. -- even if it does, what 802.describes
13 is going to, you know, render obvious the asserted
14 claims.

15 Q. Again, I asked you a question and for
16 the tenth time this has happened today you just
17 didn't answer my question. You repeated obviously a
18 prepackaged answer which was not responsive to the
19 question I asked.

20 I understand that you disagree with our
21 position. That's irrelevant to my question.

22 The question is, is it true that the
23 baseband signal that does not have any up-conversion
24 does not have a carrier signal?

25 MR. MARANDOLA: Counsel, the reality is

1 you've asked the same question 15 or 20 times and
2 you're -- you don't like the answer and so instead
3 you insult the witness.

4 (Indecipherable simultaneous
5 colloquy.)

6 MR. MARANDOLA: When the witness tries
7 to answer you --

8 (Indecipherable simultaneous
9 colloquy.)

10 MR. HENDIFAR: If you continue speaking
11 objections, I'll call the Board right now.

12 MR. MARANDOLA: It is not a speaking
13 objection. My objection is to you berating the
14 witness or insulting the witness.

15 MR. HENDIFAR: You can have objection,
16 form or objection harassment, call it what you want,
17 you can lodge your objection and move on. You don't
18 get to speak and give me a lecture here.

19 Okay?

20 MR. MARANDOLA: If you continue to
21 insult the witness we will adjourn the deposition
22 and make a motion to limit the deposition.

23 MR. HENDIFAR: You can -- you can end
24 the deposition if you want. We'll file a motion for
25 sanctions and for a second deposition.

1 Okay?

2 I've played this game before. So you
3 want to lodge an objection, make an objection.
4 That's the end of what you can do. Otherwise I will
5 call the board. If you continue this, I'll call the
6 board.

7 MR. MARANDOLA: I've been incredibly
8 generous of you while you've -- you've insulted the
9 witness.

10 MR. HENDIFAR: That's your opinion.

11 MR. MARANDOLA: And accused him of not
12 answering your question.

13 MR. HENDIFAR: That's your opinion.

14 MR. MARANDOLA: Ask your question and
15 let's finish this deposition.

16 MR. HENDIFAR: We'll finish it when the
17 deposition finishes. And the more speaking
18 objections you put, the more issues you're going to
19 create.

20 So, please do not put speaking
21 objections, as you've been doing, and answer -- and
22 I'll ask the questions. And if the witness does not
23 answer, I'll point it out.

24 Your remedy is to lodge an objection
25 that is not speaking if you have an objection.

1 That's the extent of it.

2 You want to end the deposition, go for
3 it. It's on you. We'll file a motion for sanctions
4 and for a second deposition.

5 Okay?

6 MR. MARANDOLA: Go ahead, ask your
7 questions.

8 BY MR. HENDIFAR:

9 Q. Dr. Negus, I don't believe you answered
10 this question, since I asked you and you said that's
11 not what 802.11 discloses. That's irrelevant to my
12 question.

13 My question is a baseband signal defined
14 as a direct representation of the information signal
15 that is not up-converted does not have a carrier
16 frequency, correct?

17 MR. MARANDOLA: Object to the form.

18 THE WITNESS: That would depend on the
19 baseband signal.

20 BY MR. HENDIFAR:

21 Q. How so?

22 A. Well, for example, in non-HT duplicate
23 transmission, in the draft 2.0, the normal
24 convention would be to look at the baseband signal
25 as ensembles and with respect to how it's going to

1 be received.

2 And so non-HT duplicate transmission is
3 used to transmit to clause 17 stations that may be
4 present in either the upper or lower halves of the
5 40 megahertz channel.

6 I'm just reciting verbatim from the
7 standard.

8 And so in order to do that, we are going
9 to have to end up with -- with a carrier signal for
10 the lower half and a carrier signal for the upper
11 half.

12 And we can do that a number of ways.
13 But one of the ways that we can do and is generally
14 the way we do implement these things is in the
15 digital signal processing domain, which we often
16 call baseband, then we will do a negative ten
17 megahertz frequency shift, which is just a
18 multiplication in the time domain of a complex
19 rotator, on the first ensemble baseband signal
20 that's going to the lower half clause 17 stations,
21 and then we'll do a plus ten megahertz frequency
22 shift to the second ensemble composite baseband
23 signal, the one that's been shifted by 90 degrees on
24 every subcarrier, we'll do that for the signal
25 that's going to the upper 20 megahertz.

1 So, you asked for an example and that's
2 an example.

3 Q. So in that example you're still
4 frequency shifting the original baseband signal,
5 correct?

6 A. Well, I'm frequency -- there's two
7 baseband signals. There's clause 17 stations that
8 are in the lower half, there's clause 17 stations
9 that are in the upper half. The clause 17 stations
10 in the upper half cannot demodulate a signal that's
11 sent for the lower half. They need the signal
12 that's sent for the upper half.

13 And so if I got clause 17 stations in
14 the lower half and got them in the upper half, I
15 need two signals. There's just no way around it.

16 Okay?

17 And that's exactly what 20-61 as an
18 equation is describing. It's describing a baseband
19 signal that is going to go to the lower half, and
20 which means we have to apply this negative ten
21 megahertz frequency shift or up-conversion and -- in
22 order to get to the carrier signal, and it's also
23 describing a baseband signal where we have to do a
24 positive ten megahertz frequency shift or
25 up-conversion in order to get to the right carrier

1 signal for the clause 17 stations that are in the
2 upper half of the 40 megahertz channel.

3 Q. Dr. Negus, for the fifth time I've asked
4 you a question about a baseband signal without
5 frequency shift and your response is, well, if you
6 do a frequency shift, and your response is, quote,
7 if you do a frequency shift, then your baseband
8 signal has two carrier frequencies.

9 And I don't know if that's intentional
10 or not. So maybe I'll be more clear to you.

11 Is it correct that a baseband signal
12 that does not have any frequency shifts and does not
13 have any up-conversions does not have a carrier
14 frequency?

15 MR. MARANDOLA: Object to the form.

16 THE WITNESS: So, in your question
17 you're excluding equation 20-61, which does have
18 frequency shifts and does describe how the carrier
19 signals will come about.

20 Is that -- am I understanding your
21 question is meant to exclude draft 2.0 non-HT
22 duplicate -- duplicate transmission?

23 BY MR. HENDIFAR:

24 Q. My question has nothing to do with
25 equation 20-61. It's a general question about how a

1 POSITA would understand these terms and technology.

2 The question is, is it correct that a
3 baseband signal with -- which does not have any
4 frequency shifts or up-conversions does not have a
5 carrier frequency?

6 MR. MARANDOLA: Objection to form.

7 THE WITNESS: Yeah. I'd need to -- I
8 need to take a look at it. Send me the math for
9 what you have in mind, and I'll take a look at it.
10 BY MR. HENDIFAR:

11 Q. Okay. What in the math do you need to
12 look into to determine the answer to that question?

13 A. The math that will describe what the
14 transmitted RF signal will be.

15 Q. So, in order to determine whether a
16 baseband signal has a carrier frequency or not, you
17 need to look at the up-converted RF signal that will
18 be transmitted?

19 A. I need to look at the -- if you want to
20 know whether it has a carrier signal or not, I need
21 to know what's coming out the antenna in order to
22 figure out whether it has a carrier signal or does
23 not have a carrier signal. And if it does have a
24 carrier signal, whether it has one or two or ten or
25 a hundred or a thousand, all of which are all

1 very -- they're possibles.

2 I need to know what is the math that was
3 used then to compose the signals that came to the
4 RF.

5 Your question presumes that there's a
6 baseband. You don't have to have -- you don't have
7 to apply operations in a baseband in order to end up
8 with a transmitted RF waveform.

9 Okay?

10 So, if you wanted to define something
11 and then ask me whether that's got a carrier signal
12 in the baseband, then define it all just as Shearer
13 does, as draft 2.0 does, and I'll take a look at it.
14 Email it to me, send it to me. I'll look at it for
15 you.

16 Q. Thank you.

17 So sitting here now, it is your opinion
18 that you're not able to tell me whether a baseband
19 signal that has no frequency shift or up-conversions
20 has or does not have a carrier frequency, correct?

21 MR. MARANDOLA: Object to the form.

22 THE WITNESS: My opinion is your
23 question is incomplete. And when you complete it
24 and send me the information, then I'll be happy to
25 look at it again and --and see whether it's complete

1 at that time.

2 BY MR. HENDIFAR:

3 Q. And you believe my question is
4 incomplete because you believe you need to see the
5 up-converted RF frequency that's transmitted before
6 you can answer my question, correct?

7 A. Among other things that -- that -- in
8 draft 2.0 we have a complete disclosure of the
9 result of what's going to come out the antenna. And
10 from that we can apply that to -- it's a method
11 claim. Claim one, it's a method of transmitting
12 information in a wireless communication channel.
13 It's clear that it meets it under the plain and
14 ordinary meaning.

15 You have suggested a construction that
16 says that center frequency has to mean the carrier
17 signal frequency the baseband signal's up-converted
18 to; in other words, a result.

19 You've proposed that center frequency
20 has to have this certain result.

21 Okay. When I apply that back to the
22 prior art that I looked at, no problem. That's
23 not -- I didn't do it that way in my declaration,
24 but there's no -- no issue it absolutely meets it
25 under your construction.

1 If you want to ask me questions about
2 something else, then send me what the something else
3 is, and I'll -- I'll take a look at it.

4 Q. Okay. Can you please refer to paragraph
5 422 of your declaration.

6 Please let me know when you have it.

7 A. Okay. I'm there.

8 Q. So in the annotation of Figure 8 of
9 Shearer that you've provided, does the output of box
10 320a have a carrier frequency?

11 A. It implies that there will be a carrier
12 frequency, because it's 802.11a. And there's always
13 a carrier frequency. The person of ordinary skill
14 in the art isn't going to just look at 320a.
15 They're going to look at Figure 8 and, for that
16 matter, all of Shearer.

17 And what Figure 8 is showing is that
18 the -- the carrier frequency for the lower 20
19 megahertz OFDM transmit kernel is going to end up
20 getting a negative ten megahertz frequency shift.
21 But that operation is going to happen in 310e.

22 Q. Sure.

23 So you think that the indication is that
24 there will be a carrier frequency. But that is not
25 my question.

1 My question is in Figure 8 does the
2 output of box 320a have a carrier frequency?

3 A. At 320a the composite hasn't been
4 up-converted.

5 There -- there already are carrier
6 frequencies at the output of 320a. Each
7 subcarrier -- there's 52 subcarriers at 52 different
8 carrier frequencies by definition in an OFDM
9 composite waveform, or here it says the tx kernel.

10 But they -- in ensemble form at 320a the
11 carrier has not been shifted off zero at that point.

12 Q. So it does not have a carrier frequency
13 at the point of output at box 320a, correct?

14 A. No. It's not correct. You're
15 missing -- I mean I don't understand how I tell you
16 something and then you immediately say so the
17 opposite of what -- what you just said, Dr. Negus.

18 I -- I don't know what -- you exasperate
19 me with this, Counsel.

20 Q. Well, I'm sorry you feel that way.

21 But you mentioned -- and the record is
22 clear about what you said. You said at that point
23 the frequency is not shifted yet; so, no. But
24 that's what I understood you to say.

25 So I'll ask you the question. Tell me

1 which part I'm missing.

2 So, is it your opinion that the output
3 of box 320a in Figure 8 of Shearer at the point of
4 being output from that box has a carrier frequency?

5 MR. MARANDOLA: Object to the form and
6 move to strike the editorializing before the
7 question.

8 MR. HENDIFAR: That's a speaking
9 objection. Third time.

10 BY MR. HENDIFAR:

11 Q. Please answer the question, Doctor.

12 A. Well, why don't you repeat the question
13 without the editorial.

14 Q. Sure. And that's I guess now also
15 coaching.

16 Is it your opinion that the output of
17 box 320a in Figure 8 of Shearer in ensemble form
18 have a carrier frequency?

19 A. Yes.

20 Q. What is a carrier frequency of the
21 output of box 320a in ensemble form?

22 A. In the ensemble form it has 52
23 subcarriers, each of which has its own carrier
24 frequency. As a ensemble it has a carrier frequency
25 that at that point would be zero.

1 It's just -- we call it DC.

2 That carrier frequency is going to be
3 shifted by negative ten megahertz in block 310, and
4 then it's going to get shifted twice again by the IQ
5 modulator and then eventually by the RF mixer. And
6 so you will end up with two -- as Shearer says,
7 you're going to end up with two 20 megahertz 802.11a
8 signals; one in a lower half of a 40 megahertz
9 channel and one in an upper half of a 40 megahertz
10 channel.

11 Each one will have a center frequency
12 that is a -- its own carrier signal frequency that
13 the baseband signal has been up-converted to.

14 That's the same thing I've told you
15 again and again.

16 Q. DC is zero frequency, correct?

17 A. In the -- in the -- as a 20 megahertz
18 ensemble, then prior to applying -- if you have not
19 yet applied the frequency shift, then you don't have
20 a frequency shift.

21 If you start by -- it's an arbitrary
22 reference. You can -- you can make that reference.
23 You don't have to make it zero. You can make it
24 whatever you want.

25 But if you start with the idea that it's

1 reference to zero and then apply a negative ten
2 megahertz frequency shift, then you're going to go
3 from zero to negative ten megahertz. It's no
4 different than any system.

5 You know, again, if you're going to
6 limit the claims to the center frequency must mean
7 the carrier signal frequency the baseband signal is
8 up-converted to, well then that's exactly what
9 Shearer is disclosing, and this Figure 8 is part of
10 that disclosure.

11 MR. HENDIFAR: We have no further
12 questions.

13 MR. MARANDOLA: None from me.

14 THE REPORTER: Do you want a copy,
15 counsel, of the transcript?

16 MR. MARANDOLA: Yes, please.

17 THE REPORTER: And I understand this has
18 been expedited.

19 Do you also want an expedited copy?

20 MR. MARANDOLA: What's the normal
21 delivery? Ten days?

22 THE REPORTER: Two weeks, yeah.

23 MR. MARANDOLA: That's fine. Two weeks
24 is fine.

25 ///

1 (Whereupon at 2:16 P.M. the
2 deposition proceedings were
3 concluded.)

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1 I, KEVIN NEGUS, say I have read the
2 foregoing deposition and declare under penalty of
3 perjury under the laws of the State of California:

4 That the foregoing is my deposition under
5 oath;

6 That I have read same and have made the
7 necessary corrections, additions or changes to my
8 answers that I deem necessary;

9 That my answers as indicated are true and
10 correct.

11

12 Executed at _____,
13 California, this _____ day of _____,
14 20____.

15

16

17

KEVIN NEGUS

18

19

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25

REPORTER'S CERTIFICATE

I, PATRICIA L. HUBBARD, do hereby certify:

That I am a duly qualified Certified
Shorthand Reporter in and for the State of California,
holder of Certificate Number 3400, which is in full
force and effect, and that I am authorized to
administer oaths and affirmations;

That the foregoing deposition testimony of
the herein named witness, to wit, KEVIN NEGUS, was
taken before me at the time and place herein set
forth;

That prior to being examined, KEVIN NEGUS
was duly sworn or affirmed by me to testify the truth,
the whole truth, and nothing but the truth;

That the testimony of the witness and all
objections made at the time of examination were
recorded stenographically by me and were thereafter
transcribed by me or under my direction and
supervision;

1 That the foregoing pages contain a full,
2 true and accurate record of the proceedings and
3 testimony to the best of my skill and ability;
4

5 Before completion of the deposition,
6 review of the transcript [] was [xx] was not
7 requested. If requested, any changes made by the
8 deponent (and provided to the reporter) during the
9 period allowed are appended hereto.
10

11 I further certify that I am not a relative
12 or employee or attorney or counsel of any of the
13 parties, nor am I a relative or employee of such
14 attorney or counsel, nor am I financially interested
15 in the outcome of this action.
16

17 IN WITNESS WHEREOF, I have subscribed my
18 name this 6th day of December, 2024.
19

20

21

Patricia Hubbard

PATRICIA L. HUBBARD, CSR #3400

22

23

24

25

1 ERRATA SHEET FOR THE TRANSCRIPT OF:

2 Case Name: HEWLETT PACKARD, et al., vs COBBLESTONE

3 Dep. Date: DECEMBER 4, 2024

4 Deponent: KEVIN NEGUS

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Magna Key Contacts



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Order a Transcript:

CustomerService@MagnaLS.com | 866-624-6221

General Billing Inquiries:

ARTeam@MagnaLS.com | 866-624-6221

Scheduling Operations Manager:

Patricia Gondor (E: PGondor@MagnaLS.com | C: 215-221-9566)

Customer Care:

Cari Hartley (E: CHartley@MagnaLS.com | C: 843-814-0841)

Director of Production Services:

Ron Hickman (E: RHickman@MagnaLS.com | C: 215-982-0810)

National Director of Discovery Support Services:

Carmella Mazza (E: CMazza@MagnaLS.com | C: 856-495-1920)

Billing Manager:

Maria Capetola (E: MCapetola@MagnaLS.com | C: 215-292-9603)

Director of Sales Operations:

Kristina Moukina (E: KMoukina@MagnaLS.com | C: 215-796-5028)

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