

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

ERICSSON INC.
NOKIA OF AMERICA CORPORATION
Petitioner,

v.

XR COMMUNICATIONS LLC
Patent Owner

IPR2024-00613
Patent 10,715,235

DEPONENT: DR. MARK P. MAHON

TAKEN: JANUARY 7, 2025

REPORTER: DANNIELLE COPELAND
REGISTERED DIPLOMATE REPORTER
CERTIFIED REALTIME REPORTER
CALIFORNIA CSR 14444

STENOGRAPHICALLY REPORTED REMOTELY VIA ZOOM
VIDEOCONFERENCE

JOB NUMBER 107320

First Legal Depositions - Calendar@firstlegal.com
855.348.4997

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

I N D E X

EXAMINATION:	PAGE
BY ATTORNEY WANG	4
BY ATTORNEY ANDERSON	118
BY ATTORNEY WANG	119
CERTIFICATE	123

E X H I B I T S

NONE MARKED

1 THE DEPOSITION OF DR. MARK P. MAHON, TAKEN
2 PURSUANT TO NOTICE HERETOFORE FILED, VIA ZOOM
3 VIDEOCONFERENCE, ON JANUARY 7, 2025, AT APPROXIMATELY
4 7:58 A.M., PACIFIC TIME, UPON ORAL EXAMINATION, AND TO
5 BE USED IN ACCORDANCE WITH ALL APPLICABLE RULES OF
6 CIVIL PROCEDURE.

7
8 *** **

9 APPEARANCES
10 VIA ZOOM VIDEOCONFERENCE

11
12 FOR THE PETITIONER:
13 MATT YUNGWIRTH, ESQ.
14 KEVIN ANDERSON, ESQ.
15 DUANE MORRIS LLP
16 1075 PEACHTREE STREET NE, SUITE 1700
17 ATLANTA, GEORGIA 30309-3929
18 MSYUNGWIRTH@DUANEMORRIS.COM
19 KPANDERSON@DUANEMORRIS.COM

20
21 FOR THE PATENT OWNER:
22 PHILIP X. WANG, ESQ.
23 RUSS, AUGUST & KABAT
24 12424 WILSHIRE BOULEVARD, 12TH FLOOR
25 LOS ANGELES, CALIFORNIA 90025
PWANG@RAKLAW.COM

ALSO PRESENT:
JAKE DIBBLE, TECH

1 DR. MARK P. MAHON, AFTER BEING FIRST DULY
2 SWORN, WAS EXAMINED AND DEPOSED AS FOLLOWS:

3

4 EXAMINATION

5

6 BY ATTORNEY WANG:

7 Q. Good morning, Doctor.

8 Could you please state your name?

9 A. Yes. My name is Mark Mahon.

10 Q. Good morning, Dr. Mahon. My name is Philip
11 Wang, and I represent Patent Owner XR Communications or
12 Vivato in this case, in this IPR proceeding.

13 Do you understand that you are under oath today?

14 A. Yes, I do.

15 Q. Have you testified under oath before?

16 A. Yes, I have.

17 Q. How many times?

18 A. I've been deposed around a dozen times or
19 so, and I've testified at trial.

20 Q. How many times have you testified at trial?

21 A. I believe it's a total of four times,
22 including an ITC case.

23 Q. One ITC case and three district court
24 cases?

25 A. Yes. Yes.

1 Q. So you're well familiar with depositions?

2 A. I am.

3 Q. Do you understand that even though we're on
4 Zoom today, that the testimony you give under oath is
5 subject to the same penalty of perjury as if you were
6 testifying in a court of law?

7 A. Yes, I do.

8 Q. Okay. I'm going to assume that you
9 understand the questions I ask unless you tell me that
10 you don't understand them.

11 Is that fair?

12 A. Yes, it is.

13 Q. Okay. And if anything is unclear, feel
14 free to ask me to clarify.

15 A. I will.

16 Q. Is there anything that would prevent you
17 from thinking clearly and testifying truthfully today?

18 A. No, there isn't.

19 Q. How many depositions have you had via Zoom
20 or remotely?

21 A. I would say seven or eight, somewhere in
22 that neighborhood.

23 Q. And then you -- you mentioned that you
24 testified at trial four times.

25 So in each of those instances you testified in --

1 in deposition as part of that case?

2 A. Correct.

3 Q. And then you said there were about eight
4 other proceedings where you testified in deposition but
5 you did not -- the case did not go to trial or you did
6 not testify at trial, correct?

7 A. That's correct. And while you were
8 speaking I did recall one more trial testimony, so
9 actually there were five times at trial I testified.

10 Q. Okay. And it is still about a dozen
11 proceedings where you gave a deposition, give or take?

12 A. That sounds about right. I'm not sure the
13 exact number.

14 Q. The cases where you testified at trial,
15 were you testifying on behalf of the defendant or
16 accused infringer?

17 A. I have testified at trial on behalf of both
18 the plaintiff and the defendant.

19 Q. How many times at trial on behalf of the
20 plaintiff or the patent owner?

21 A. Three times in district case for the
22 plaintiff, one time for the defendant. And at the ITC
23 one time for the plaintiff.

24 Oh, I'm sorry. I just remembered another ITC
25 case. So twice for the plaintiff in the ITC.

1 Q. And for the dozen-or-so proceedings where
2 you've given a deposition, has that been more for the
3 plaintiff or patent owner or more for the defendant and
4 accused infringer?

5 A. It's about 50/50.

6 Q. Okay. You submitted a declaration in this
7 case, correct?

8 A. That is correct.

9 Q. And do you recall when -- when that was
10 submitted?

11 A. That was submitted this spring -- last
12 spring.

13 Q. Do you remember what month?

14 A. I'd have to look at my declaration. I'm
15 guessing it was in March. I don't remember.

16 Q. I think that that's right. That's the date
17 I have marked.

18 Do you remember when you were retained to work on
19 this IPR?

20 A. I believe it was in December of '23.

21 Q. Who wrote your declaration?

22 A. I provided the first draft, and I worked
23 with counsel to complete the -- my declaration.

24 Q. Did you provide the first draft of the
25 entirety of your declaration?

1 A. I provided the first draft. I don't recall
2 the particular sections. That was a while ago.

3 Q. Approximately how many hours or how much
4 time did you spend preparing your declaration?

5 A. Again, I don't recall exact number. I'm
6 going to guess it was somewhere around 20 hours.

7 Q. Does your declaration contain a complete
8 statement of your opinions in this IPR?

9 A. To the best of my recollection, yes.

10 Q. Sitting here, do you have any corrections
11 to your declaration?

12 A. None -- none that come to mind, no.

13 Q. Sitting here, do you have any additional
14 opinions beyond your declaration?

15 A. With respect to the IPR associated with
16 '235, not that I can think of.

17 Q. Yes, I'm sure you have many other opinions
18 about other issues.

19 I meant to ask: Do you have any opinions to offer
20 in this proceeding or relevant to the issues in this
21 proceeding?

22 A. Understood.

23 And I do not -- can't think of anything else
24 that's not contained in my declaration at this time.

25 Q. What did you do to prepare for this

1 deposition?

2 **A. I read -- re-read through my declaration,**
3 **the petition, the IPR documents, basically the**
4 **documents that I have been presented associated with**
5 **this case.**

6 Q. Did you have any -- conduct any meetings in
7 preparation for this deposition?

8 **A. Yes. I met with counsel yesterday.**

9 Q. Without revealing your discussions, was
10 that Mr. Anderson?

11 **A. Yes, it was.**

12 Q. Did you meet anyone -- meet with anyone
13 else?

14 **A. I did not.**

15 Q. How long was your meeting with
16 Mr. Anderson?

17 **A. Between three and four hours.**

18 Q. And that was the only meeting you
19 conducted?

20 **A. That is correct.**

21 Q. I want to go back to the -- the documents
22 that you reviewed to prepare for -- for this
23 deposition.

24 You testified that you re-read through your
25 declaration, correct?

1 A. **That is correct.**

2 Q. Oh, let me also ask about: How many hours
3 did you spend preparing for this deposition?

4 A. **Somewhere around ten hours.**

5 Q. And then you said you -- you re-read
6 through the petition, correct?

7 A. **That is correct.**

8 Q. And then you said the IPR documents,
9 basically the documents that you have been presented
10 associated with this case.

11 Can you clarify what those were?

12 A. **They were mainly the documents I referenced**
13 **in my declaration. So I would go back and I would look**
14 **at the references that I had made and generally scanned**
15 **through those documents. So that would include any**
16 **documents associated with -- that I list in my exhibits**
17 **associated with my declaration.**

18 Q. Okay. So you're referring to the exhibits
19 referenced in your declaration and in the table at the
20 end of your declaration?

21 A. **Yes.**

22 Q. And that would include the -- the
23 challenged '235 patent, correct?

24 A. **That is correct.**

25 Q. And that would include the prior art

1 references you rely on?

2 A. That is correct.

3 Q. Apart from what we've discussed, have you
4 reviewed any other documents in this proceeding?

5 A. Not that I can recall right now. Maybe if
6 I looked through my declaration, I can come up with
7 something I looked at that I -- I can't recall right
8 now, but nothing comes to mind.

9 Q. Okay. So your declaration was submitted in
10 March of last year, right; so March of 2024, correct?

11 A. That is correct.

12 Q. And so it would have cited documents that
13 existed by then, right?

14 A. I'm sorry. I didn't hear the last --

15 Q. I said it would have -- this is maybe a
16 silly question, but you agree that it would -- that
17 the documents it cites would have existed at that time?

18 A. Oh, I see what your question is. Yes.

19 And I did since that time review a claim
20 construction order that came down from the district
21 court in November.

22 Q. Yeah. You anticipated my question, which
23 is: Have you reviewed any documents that were created
24 or came about after the time that you submitted your
25 declaration, and you identified the -- the claim

1 construction order.

2 Is that the claim construction order in the
3 underlying district court case in the Eastern District
4 of Texas?

5 A. Yes. I believe it is, yes.

6 Q. Did -- did that affect your opinions in --
7 in this IPR?

8 A. No, it did not.

9 Q. Have you reviewed any other documents that
10 were created after the time of your declaration?

11 A. Not that I recall, no.

12 Q. Have you reviewed patent owner's
13 preliminary response submitted in this IPR?

14 A. Yes, I have.

15 Q. Okay. That would be created after your
16 declaration, right?

17 A. Now that you point that out, yes, that is
18 true.

19 Q. Have you reviewed the board's institution
20 decision in this IPR?

21 A. Yes, I did.

22 Q. Okay. And did you review those recently,
23 in -- in preparation for your deposition, or at the
24 time that they were issued?

25 A. Well, I believe it might have been both. I

1 went through a lot of documents in the last few days,
2 but I believe that I reviewed the institution decision
3 prior to that.

4 Q. Okay. Did reviewing patent owner's
5 preliminary response affect your opinions in this IPR?

6 A. No, it did not.

7 Q. Did reviewing the institution decision by
8 the board affect your opinions in this IPR?

9 A. It doesn't change my opinions.

10 Q. So I -- I want to just clarify, you know,
11 if you would, the universe of documents you've reviewed
12 for this IPR or for your deposition.

13 So we have your declaration, the petition, and all
14 of the exhibits attached to your declaration,
15 correct --

16 A. Correct.

17 Q. -- or -- or cited in your declaration?

18 A. Correct.

19 Q. And then we've identified three documents
20 that were created after: the claim construction order,
21 the patent owner preliminary response, and the board's
22 institution decision.

23 Correct?

24 A. That is correct.

25 Q. Can you think of any other documents that

1 you've reviewed in this IPR?

2 **A. Nothing is coming to mind.**

3 Q. If any come to mind today, will you let me
4 know?

5 **A. Yes, I will.**

6 Q. Do you have any documents with you,
7 Dr. Mahon?

8 **A. I have no hardcopies -- documents.**

9 Q. Okay. And on -- on your computer screen,
10 do you have any applications open or any -- any --
11 anything on your desktop?

12 **A. I have the Zoom link, I have my mail**
13 **browser so I can find the Zoom link, and I have an**
14 **Explorer window open for the -- a copy, a digital copy,**
15 **of my declaration and the petition in this case.**

16 Q. And are -- are those the only documents
17 that -- that you have available, if you will, or
18 readily available?

19 **A. Yes.**

20 Q. Okay. Let's start with your declaration.
21 Could you open that?

22 And I just want to confirm that we're looking at
23 the same copy.

24 **A. Okay.**

25 Q. Do you have any markings on annotations on

1 the documents?

2 A. No, I do not.

3 Q. So the declaration, is that identified as
4 Exhibit -- Petitioner's Exhibit 1003?

5 A. That is correct.

6 Q. And is it 286 pages?

7 A. Yes, it is.

8 Q. And then could you open the -- the
9 petition?

10 Does it say "Petition For Inter Partes Review of
11 U.S. Patent Number 10,715,235" on the first page?

12 A. Yes, it does.

13 Q. And IPR number IPR 2024-00613?

14 A. Yes, it does.

15 Q. And is your document 105 pages?

16 A. Yes, it is.

17 Q. Could you turn to page 161 of your
18 declaration, or paragraph 354?

19 A. Thank you.

20 Okay. I'm there.

21 Q. All right. Do you see here this -- it's a
22 short section, but it's entitled "Claim Construction"?

23 A. Yes, I do.

24 Q. Okay. And you say that you've been
25 instructed for purposes of this IPR that each term is

1 given its plain and ordinary meaning and that no
2 specific construction of any claim term is required?

3 A. That is correct.

4 Q. So you were informed that no specific
5 construction of any claim term is required, or is that
6 your opinion?

7 A. It's -- I've been informed and it is my
8 opinion that the plain and ordinary meaning is -- of
9 the claim terms or all the terms associated with this
10 IPR are -- is the construction, plain and ordinary
11 meaning.

12 Q. Does that remain your opinion?

13 A. Yes, it does.

14 Q. Do you perform any claim construction
15 analysis or offer any claim construction opinions in
16 this case?

17 A. Other than my descriptions associated with
18 the plain and ordinary meaning of the terms that I
19 discuss.

20 Q. Do you -- are you familiar with
21 "disclaimer" in the context of claim construction?

22 A. I've heard the term. I couldn't give you a
23 specific definition associated with that.

24 Q. What's -- what's your understanding of that
25 term?

1 A. That there are -- a disclaimer would be
2 something that comes into play associated with the item
3 at hand. In this case, it would be a construction of a
4 term.

5 Q. Are you familiar with "lexicography" in the
6 context of claim construction?

7 A. In general my understanding is that that
8 would be when the inventor defines a specific term for
9 use in the specification of the patent.

10 Q. Do you offer any opinions about
11 "lexicography" or "disclaimer" in this case?

12 A. I do not.

13 Q. Is it your opinion that each term of the
14 challenged claims in this case carry their plain and
15 ordinary meaning?

16 A. Yes. As I state in my declaration, that
17 the plain and ordinary meaning for the claim terms is
18 sufficient in that the prior art related -- or relied
19 on, that I relied on in this case meets that definition
20 under any reasonable construction associated with the
21 terms.

22 Q. Okay. Do you offer any opinion that the
23 meaning of any claim term of the '235 patent is
24 narrower than its plain and ordinary meaning?

25 A. I -- I just used the term under its -- a

1 person of skill in the art would understand how a term
2 is used in the context of either the claim or the
3 specification or the prior art, so I do not try to
4 narrow anything specifically.

5 Q. Do you offer any opinion that the meaning
6 of any claim term of the 3 -- '235 patent is broader
7 than its plain and ordinary meaning?

8 A. Again, I would give a similar answer that
9 for all the terms associated with this IPR and the
10 relevant documents, I just take a plain and ordinary
11 meaning to the person of ordinary skill in the art and
12 do not try to broaden any definitions.

13 Q. What prior art do you rely on in this IPR?

14 A. I rely on patent -- let me just look at the
15 patent number. The Agee and the Butler patents. And
16 the Agee patent is Number 7,248,841, and then the
17 Butler patent is 3,255,450.

18 Q. And your opinions -- your invalidity
19 opinions in this case relate to obviousness, right?

20 A. That is correct.

21 Q. Can you -- to help guide our discussion,
22 could you please turn to page 162 of your declaration,
23 or paragraph 355?

24 A. Okay. I'm there.

25 Q. So here you say -- the first heading is

1 about "The Motivation to Combine Agee With Butler With
2 the Reasonable Expectation of Success."

3 Do you see that?

4 **A. Yes, I do.**

5 Q. So we discussed your opinions relating to
6 obviousness or that your opinions do relate to
7 obviousness.

8 Is your theory based on an obviousness combination
9 of Butler -- or an obviousness combination with Agee
10 and Butler?

11 **A. Yes. As I state in my declaration, that**
12 **it's -- in my opinion, the '235 patent is obvious over**
13 **Agee or Agee in combination with Butler.**

14 **So in either case it's, in my opinion, obvious**
15 **based on those -- the single prior art or the**
16 **combination.**

17 Q. Okay. So for all of the challenged claims,
18 you have to present two theories: one obviousness
19 based on Agee alone, and one based on a combination of
20 Agee with Butler?

21 **A. Well, throughout my narrative I discuss how**
22 **Agee discloses all the asserted claims of the '235, and**
23 **then I also address the Butler patent as basically an**
24 **additional support for if there's any doubt about what**
25 **I'm discussing within Agee with respect to the**

1 obviousness analysis that I'm performing.

2 I don't know that I've taken a specific approach
3 where I just do a -- an obviousness alone and then a
4 combination analysis. It's more interwoven.

5 Q. Okay. For all challenged claims, you do
6 have an obviousness opinion, correct?

7 A. That is correct.

8 Q. Okay. Is it your opinion that for all of
9 the claims it is not necessary to combine Agee with
10 Butler in that Agee alone renders them obvious?

11 A. I -- it is my opinion that Agee alone
12 renders the claims obvious, but also in the combination
13 with Butler the same obviousness would -- analysis
14 would be applicable, and I point to specific elements
15 within Butler that would provide additional support if
16 anything is -- in my analysis is not clear associated
17 with Agee alone.

18 Q. What would Butler provide additional
19 support for?

20 A. Well, the use of the Butler matrix within
21 the Agee reference and how it's used and what it's used
22 for from the perspective of a person of ordinary skill
23 in the art.

24 Q. Do you recall how many times Agee mentions
25 the Butler matrix?

1 A. I do not. I would have to do a search.

2 Q. And do you recall if he uses that term,
3 "Butler matrix"?

4 A. So we have the -- in Agee, the Butler mode
5 form is the term that's used.

6 Q. And is it your opinion that that refers to
7 Butler matrix?

8 A. Yes, it is.

9 Q. You testified earlier that in your opinion
10 Agee discloses each claim of the '235 patent?

11 A. It renders it obvious, yes.

12 Q. Okay. I -- I believe you said "disclosed"
13 before.

14 What did you mean by that?

15 A. In the analysis of the claim terms in
16 this -- for this '235, that Agee addresses and
17 discloses within the specification and the claims of
18 that patent, it discloses the elements -- the asserted
19 claim elements associated with the '235 patent.

20 Q. Okay. What -- what do you mean by
21 "addresses" and "discloses"?

22 A. Well, the Agee patent is very long and it
23 has a very technical, detailed discussion of how the
24 inventive system works for Agee, and as part of that
25 discussion it goes through step-by-step analysis of how

1 the system works, and with that context and also
2 associated with the particular figures and also
3 comparing that to the asserted claims of the '235
4 patent, saying that Agee makes that -- those asserted
5 claims obvious to a person of ordinary skill in the
6 art.

7 Q. Okay. So when you say "disclose," you mean
8 renders obvious?

9 A. In that context, yes.

10 Q. Can you turn to paragraph 24 of your
11 declaration?

12 A. 24?

13 Q. Yes, the Section 4, entitled "Legal
14 Standards."

15 A. Okay. I'm there.

16 Q. Do you see that the legal standards section
17 continues for a few pages, until page 19?

18 A. Yes, I do.

19 Q. Returning back to paragraph 24, do you see
20 that in the first sentence you say that you are not an
21 attorney and offer no legal opinions?

22 A. Yes, I do.

23 Q. That's true, correct; you're not an
24 attorney?

25 A. It is true, yes.

1 Q. Good. Good for you.

2 So were you provided these legal standards by
3 counsel?

4 A. I believe that is correct, yes.

5 Q. But you were previously familiar with these
6 legal standards, correct; for example, from your work
7 in other cases?

8 A. That is correct.

9 Q. Okay. And were these the legal standards
10 that you applied in offering your opinions in -- in
11 this declaration?

12 A. Yes, they are.

13 Q. Did you apply any legal standards beyond
14 what's stated here?

15 A. Not that I can recall, no.

16 Q. Would you turn to paragraph 33?

17 A. I am there.

18 Q. Do you see that here you talk about the
19 Phillips standard of claim construction?

20 A. Yes, I do.

21 Q. And is this the understanding of claim
22 construction you applied in your opinions?

23 A. Yes. This is the -- basically, a procedure
24 that I followed in rendering my opinions.

25 Q. Okay. And you don't discuss disclaimer or

1 lexicography here, correct?

2 A. Certainly not in paragraph 33, and I don't
3 believe I address lexicography in this section at all
4 or any part of my declaration.

5 Q. What about a disclaimer?

6 A. Same for disclaimer, correct.

7 Q. Are you familiar with the difference
8 between anticipation and obviousness?

9 A. Yes.

10 Q. Here in your legal standards you have
11 several paragraphs that discuss obviousness, correct?

12 A. That is correct.

13 Q. Do you have any opinions that discuss
14 anticipation?

15 A. In paragraph 25, in my first sentence, I
16 discuss that a patent claim may be deemed unpatentable
17 as anticipated, et cetera. So I do discuss that in
18 paragraph 25.

19 Q. Okay. Let's discuss paragraph 25.

20 You say that, "A patent claim may be deemed
21 unpatentable as anticipated if it is shown by a
22 preponderance of the evidence that each and every
23 feature of the claim is found in a single prior art
24 reference or rendered obvious if in view of the prior
25 art reference or a combination of prior art references

1 it would have been obvious to a person of skill in the
2 art, taking into account four factors."

3 Do you see that?

4 **A. Yes, I do.**

5 Q. Is that your understanding of the
6 difference between anticipation and obviousness?

7 **A. Yes.**

8 Q. You don't offer any anticipation opinions
9 in this case, correct?

10 **A. That is correct.**

11 Q. Have you considered whether Agee
12 anticipates any claim of the '235 patent?

13 **A. I've only performed an obviousness analysis**
14 **for Agee and, obviously, the Butler patent coming into**
15 **play.**

16 Q. Okay. So it says here that, "A patent
17 claim may be anticipated if it's shown by preponderance
18 that each and every feature of the claim is found in a
19 prior art reference."

20 Do you see that?

21 **A. Yes, I do.**

22 Q. So do you agree that each and every feature
23 of the claims of the '235 patent is not found in Agee?

24 **A. My opinion is that Agee provides the --**
25 **renders obvious the asserted claims of the '235 patent.**

1 In terms of the anticipation, which would be an
2 analysis showing that every feature of the claims found
3 plus that it's disclosed in the same -- exactly as
4 within the claim elements, I did not make that
5 analysis.

6 Q. You said "disclosed in the same -- exactly
7 as within the claim elements."

8 What do you mean by that?

9 A. My understanding to show anticipation, you
10 also have to do an analysis that shows that not only
11 are the -- the details associated with the prior art
12 reference, that they not only render obvious to a
13 person of ordinary skill in the art, but they are
14 disclosed in the same -- exact same fashion as in the
15 patent you're analyzing, and I have not made that
16 analysis. I have made the analysis of obviousness for
17 Agee and in combination with Butler also.

18 Q. When you say disclosed in the same fashion,
19 do you mean like disclosed in the same order?

20 A. Yes, that's part of it.

21 So in terms of if there is a claim term that
22 required things to be done in a certain order, I
23 haven't done that analysis, but that would be part of
24 the anticipatory analysis.

25 Q. As part of your work in this proceeding,

1 you've analyzed the Agee reference, correct?

2 **A. That is correct.**

3 Q. Is Agee directed to multiple embodiments or
4 does it disclose multiple embodiments?

5 **A. Yes, it does.**

6 Q. Do you know how many embodiments it
7 discloses?

8 **A. I don't recall.**

9 Q. Have you analyzed the different embodiments
10 as part of your opinions?

11 **A. I have analyzed the entire Agee reference,**
12 **so it would include all the embodiments.**

13 Q. Do you -- do you discuss the embodiments or
14 address that -- that issue?

15 **A. I discuss the specifics associated with the**
16 **Agee reference which include specific embodiments,**
17 **preferred embodiments and otherwise in that -- in that**
18 **patent, and I make those references throughout my**
19 **declaration.**

20 Q. So when we were talking about the -- the
21 test for anticipation, you mentioned two aspects: one,
22 disclosing of the elements; and then two, disclosing
23 them in the same fashion or order, correct?

24 **A. In my discussion I did -- I did mention**
25 **that, yes.**

1 Q. So is it your opinion that Agee discloses
2 all of the elements of the '235 patent but may not
3 disclose them in the same fashion or -- or order?

4 A. No. What I meant to say and was trying to
5 articulate is that in doing an obviousness analysis
6 you're looking at the asserted claims and seeing if the
7 prior art reference renders those claims obviousness --
8 obvious by what's disclosed in that -- that patent. To
9 me that's a slightly different approach than if you're
10 trying to prove anticipation. And that's also a -- my
11 understanding has a different level of proof with
12 respect to that.

13 Q. What do you mean by "a different level of
14 proof"?

15 A. Well, I would have to go back to, again, a
16 more robust definition of anticipation to provide you
17 with a more informed analysis, but what I'm saying is
18 that I took just an obviousness approach with respect
19 to the Agee patent and not an -- I didn't do an
20 anticipation analysis with respect to Agee.

21 Q. Are you familiar with single-reference
22 obviousness?

23 A. Yes.

24 Q. What's your understanding of
25 single-reference obviousness?

1 A. Well, that it's -- renders the patent
2 obvious -- or the asserted claims obvious in view of
3 that single reference if a person of ordinary skill in
4 the art would consider those claim -- asserted claims
5 to be obvious based on scope, the differences in the
6 prior art under the claim construction, the level of
7 ordinary skill in the art, and any secondary references
8 as I have disclosed in the -- or as I state in the
9 paragraph 25 there for obviousness.

10 Q. You said or any secondary references.
11 I think you meant to say secondary considerations?

12 A. Secondary evidence bearing on obviousness,
13 yes. So that would be as you stated.

14 Q. Secondary considerations of nonobviousness?

15 A. Correct.

16 Q. When we talk about obviousness based on two
17 references, do you understand that the law requires
18 motivation to combine the two references?

19 A. Motivation to combine is an element for the
20 analysis, and I have addressed that in my declaration.

21 Q. And you addressed that for the Agee and
22 Butler references?

23 A. Correct.

24 Q. Can we turn to paragraph 355 of your
25 declaration?

1 A. **Okay. I'm there.**

2 Q. So in paragraph 356 you say that, "In my
3 opinion, a POSITA as of the priority date would have
4 known about the Butler matrix technology described in
5 the Butler patent."

6 Do you see that?

7 A. **Yes, I do.**

8 Q. And then you would have -- you say, "A
9 POSITA would have known the basic functionality and
10 operation of a Butler matrix without needing to refer
11 to a source reference such as the Butler patent"?

12 A. **That's correct.**

13 Q. So specifically what part of the Butler
14 patent are you relying on or helps your -- your
15 obviousness opinion?

16 A. **Well, I reference the Butler patent
17 throughout my declaration, so I can go to those
18 specific references, but in general it's the entire
19 Butler patent that I reference for my obviousness
20 analysis.**

21 Q. Okay. In paragraph 361, do you see how you
22 talk about improvements in electronic circuitry between
23 1960 and 2000?

24 A. **Yes, I do.**

25 Q. And then you say, "The combination uses the

1 functionality of the Butler disclosure and would not
2 necessarily use the exact electrical components
3 identified in Butler's patents"?

4 A. Yes, I do.

5 Q. So what electrical components would be
6 used?

7 When you say "would not exactly use the exact
8 electrical components," what do you have in mind?

9 A. Well, in terms of the understanding of a
10 person of ordinary skill in the art, what a Butler
11 matrix does at the time of the invention and what was
12 originally disclosed in the Butler patent, that person
13 would understand that in implementing a Butler matrix
14 there's multiple ways to do that, and the technology,
15 such as even microstrip technology, changed between
16 that time and the time of the invention.

17 So materials changed, options for implementing how
18 the connections are coming out of a feed have changed.
19 So any of those particulars associated with the actual
20 construction and implementation of the Butler matrix
21 itself, but the concept of the Butler matrix and what
22 it does and how it does it, the passive beamforming
23 would have been well understood to a person of ordinary
24 skill in the art at the time.

25 Q. Do you believe that the Butler matrix as

1 disclosed in the Butler reference in 1960 would be
2 incompatible with the Agee reference in 2000?

3 A. No, not necessarily. It's -- it could
4 be -- you could use the technology of the 1960s to
5 implement it, if you wanted to.

6 Q. To implement what?

7 A. The Butler matrix.

8 Q. And would that work with the system in
9 2000?

10 A. Certainly.

11 Q. So this section, it's entitled, "The
12 Motivation to Combine Agee With Butler," correct, or it
13 begins with that?

14 A. Yes, that is correct.

15 Q. Okay. Do you discuss any motivation to
16 modify Agee by itself?

17 A. The only reference I make to that is in
18 paragraph 360 where I'm addressing the knowledge of a
19 person of ordinary skill in the art with respect to a
20 Butler matrix and that that knowledge combined with
21 Agee's express reference would have motivated that
22 person to combine that long-known functionality in
23 Butler's patent with Agee's disclosure. But other than
24 that, that's the only, really, reference I make to
25 that.

1 Q. We discussed you also have the opinion that
2 Agee alone renders the '235 claims obvious, correct?

3 A. Yes. As we've discussed, the
4 implementation of a Butler matrix was well known, and,
5 therefore, since it's contained in Agee, Agee would be
6 able to render -- in my analysis, render the '235
7 obvious.

8 Q. And so I see here that you have a section
9 on motivation to combine Agee with Butler with the
10 reasonable expectation of success.

11 My question is: Do you discuss any modifications
12 of Agee alone; for example, changes one would make to
13 Agee to -- to render the '235 claims obvious?

14 A. I'm not sure I understand your question.

15 Q. Let me ask you a different way.

16 Do you -- do you discuss in your opinions any
17 modifications or changes to Agee?

18 A. No. My opinion is that Agee renders
19 obvious the asserted claims based on the knowledge of a
20 person of ordinary skill in the art at the time of the
21 invention, and that alone is sufficient.

22 Q. So do you believe that any changes or
23 modifications to Agee are -- are necessary?

24 A. Not outside of the scope of anything I've
25 discussed in my declaration from the perspective of a

1 person of ordinary skill in the art, and I don't recall
2 anything right now that's coming to mind that I -- I
3 discussed.

4 Q. Let's turn back to the legal standards
5 section of your declaration.

6 Do you see -- can you turn to paragraph 25?

7 A. Paragraph -- sorry. Paragraph 25. Yes.

8 Q. And do you see here four items at the end
9 of the paragraph, or four issues?

10 A. Yes, I do.

11 Q. Are those the Graham factors or have you
12 heard of the Graham factors?

13 A. Yes, I've heard that term previously.

14 Q. Do you know if these are what's referred to
15 as the Graham factors?

16 A. That seems correct. I -- I would have to
17 look back at another document to see specifically what
18 the Graham factors are, but that seems consistent with
19 my understanding.

20 Q. Or -- or to become a lawyer.

21 Do you see the second item that says, "The
22 differences between the prior art and the claim under
23 consideration"?

24 A. Yes, I do.

25 Q. And so that would be something you have to

1 consider to -- to offer your -- your obviousness
2 opinion, right?

3 A. Yes, it would.

4 Q. So what are the differences between Agee
5 and the claims of the '235 patent or Claim 1 of the
6 '235 patent?

7 A. In my analysis, there's very little
8 daylight between the two. I can't think of anything
9 specific in terms of differences between the Agee
10 reference and the '235 patent.

11 Q. Why didn't you offer any opinion that Agee
12 anticipates Claim 1 of the '235 patent?

13 A. I -- I don't have a specific answer to
14 that. It's -- based on my analysis of Agee, it was --
15 it rendered the claims obvious, and that's the analysis
16 I performed.

17 Q. Is it because you were instructed to offer
18 an obviousness opinion and not anticipation?

19 A. Well, the -- the analysis certainly was
20 done from an obviousness perspective. That's the
21 avenue I chose to take. I can't really give a better
22 answer than that.

23 Q. If in performing your analysis you
24 concluded that Agee anticipates Claim 1 of the '235
25 patent, you would have offered that opinion, right?

1 A. I don't recall the discussions I've had
2 with counsel with respect to my analysis, so I can't
3 really provide an answer to that question.

4 ATTORNEY WANG: Let's go off the record.
5 (RECESS TAKEN.)

6 BY ATTORNEY WANG:

7 Q. Welcome back, Dr. Mahon.

8 A. Thank you.

9 Q. Did you have any discussions with counsel
10 over the break?

11 A. I did not.

12 Q. Can you please turn to paragraph 422 of
13 your declaration?

14 A. Yes.

15 Okay. I'm there.

16 Q. Do you see right below that paragraph you
17 have the -- the claim language of the '235 patent that
18 you've identified as Element 1.3?

19 A. Yes, I do.

20 Q. And in the next paragraph, 423, you say
21 that Agee discloses this -- the element?

22 A. Yes, I do.

23 Q. And then you have a Footnote 16.
24 Do you see that?

25 A. I do see that.

1 Q. All right. And the footnote's
2 blank, right?

3 A. It sure is.

4 Q. Was that intended to be footnotes you've
5 had elsewhere, to -- to repeat the same footnote?

6 A. I don't recall exactly what I was intending
7 there.

8 Q. It may -- may help, I can turn your
9 attention to page 165 or paragraph 370.

10 A. Okay. 370. I have a long excerpt.

11 Q. Right. But take a look at the Footnote 15
12 at the bottom of the page.

13 Do you see Footnote 15 says, "As used throughout
14 this declaration, 'discloses' encompasses what a
15 reference would teach, suggest, or render obvious to a
16 POSITA"?

17 A. Yes, I do see that.

18 Q. And it does say "as used throughout this
19 declaration."

20 So do you stand by that, that that's what you mean
21 by discloses -- quote, discloses?

22 A. Yes.

23 Q. Okay. And do you think that's what you
24 meant in that sentence with paragraph 16?

25 A. Yes.

1 Q. Paragraph 423?

2 A. Yes.

3 Q. And that's probably what you intended to
4 include as Footnote 16?

5 A. I believe that is -- yes. I'm sorry. I
6 believe that is correct, yes.

7 Q. All right. Let's turn back to the claim
8 language of Element 1.3 that we looked at that was in
9 bold.

10 Do you see that -- that claim language?

11 A. Yes, I do.

12 Q. What is the remote station in Agee?

13 A. It's used directed to mobile communication
14 systems. So remote station in Agee is basically any
15 elements in Agee that would be either another base
16 station or a mobile station.

17 Q. And that's what you're mapping to for
18 the -- a remote station claim term?

19 A. Yes.

20 Q. And you said that it could be either
21 another base station or a mobile station.

22 Are you mapping it to -- to both?

23 A. Well, Agee addresses beamforming in the
24 context of forming a beam for direct communication
25 specifically with base stations, but it could be with

1 respect to, for example, mobile too.

2 Q. But are -- are you relying, then, on Agee's
3 discussion of base stations to be the claimed remote
4 station?

5 A. Well, certainly Agee discloses the beamform
6 with respect to the base stations, and that's what I
7 present in my declaration with respect to that
8 analysis, so therefore the remote station certainly is
9 encompassed by Agee's discussion with respect to the
10 base station communications and links.

11 Q. What is the first signal transmissioned in
12 Agee?

13 A. So based on my analysis, as I present in my
14 declaration with respect to three things, the file
15 history, the IPR analysis, and the patent owner's
16 responses, for example, in paragraph 214 of my
17 declaration I discuss the patent owner's perspective
18 with respect to the first signal transmission, and the
19 patent owner at that time argued that it was disclosed
20 by the passages from Littlejoe, and specifically that
21 the Butler matrix, which includes an array of --
22 antenna array, explicitly discloses the first signal
23 transmission element as well as other elements with
24 respect to the determining first signal information,
25 for example.

1 So the Agee patent also has a Butler matrix and an
2 array associated with that matrix, obviously, and to a
3 person of ordinary skill in the art that array would be
4 receiving the first signal transmission from a remote
5 station.

6 Q. So you referenced paragraph 214 of your
7 declaration where you discussed patent owner's
8 perspective with respect to the first signal
9 transmission; is that correct?

10 A. That section, including 214, but the
11 paragraphs preceding that also with respect to
12 overcoming the Crilly reference and referencing
13 Littlejoe and that Littlejoe contains the Butler matrix
14 for overcoming that, assuming that section, yes, and
15 including paragraph 214.

16 Q. Okay. And I did notice there's many parts
17 where you reference your view of patent owner's
18 position or perspective or arguments.

19 That's something you discuss in your declaration,
20 correct?

21 A. Correct.

22 Q. Okay. Do you agree with your understanding
23 of patent owner's position or perspective or arguments?

24 A. I address those in my declaration where
25 from my analysis that they certainly align with a

1 person of ordinary skill in the art's understanding of
2 the claim terms, and this is one example.

3 Q. Okay. I'm trying to understand to what
4 extent those are your opinions or to what extent are
5 you agnostic or maybe disagree with those opinions but
6 you're applying them.

7 Can you shed light on that?

8 A. Sure. I'm not -- anything that I discuss
9 with respect to bringing in the patent owner's opinions
10 or the prosecution history is to bolster my analysis in
11 terms of from the person -- from the perspective of a
12 person of ordinary skill in the art what my analysis
13 concluded, and I am bringing in the additional evidence
14 as I cite based on the patent owner's statements and
15 disclosure -- or statements to also say that's
16 consistent with what the patent owner said previously
17 or asserted previously.

18 And so to me, based on my analysis, my independent
19 analysis, my conclusions, what's disclosed in --
20 obviously in this specification in the prior art and
21 the patent owner's statements, that it's all consistent
22 from the perspective of a person of ordinary skill in
23 the art for the terms that I address in my declaration.

24 Q. Okay. So do you agree with the patent
25 owner's statements in various proceedings or various

1 statements that -- that you discuss in your
2 declaration?

3 A. To the extent that I -- I present them in
4 my declaration and specifically reference them, unless
5 I state that this is an example of where they were
6 incorrect, yes.

7 Q. So if you just somewhere in your
8 declaration referenced like a statement that patent
9 owner made, should I or the reader understand you to be
10 agreeing with this statement?

11 A. What you should be understanding should be
12 gleaned from the context of my declaration of what I'm
13 saying at that part of the declaration and how I'm
14 using the specific quotation or reference or excerpt
15 within that context should be -- make it clear what my
16 reason for referencing that is and how that aligned
17 with my original fundamental opinion associated with my
18 analysis of obviousness with respect to the prior art
19 from the perspective of a POSITA.

20 Q. Suppose hypothetically the patent owner's
21 statements that you cite in your declaration don't
22 exist, that those proceedings did not happen; would --
23 would your opinions be affected or changed?

24 A. I would have to look at every specific
25 instance to make a clear statement about that, but my

1 opinions stand on their own and then I'm using other
2 references to support them.

3 Q. Okay. So -- and I think you testified
4 before that you used them to bolster your opinions,
5 right?

6 A. To show that my opinions are consistent
7 from the perspective of a person of ordinary skill in
8 the art. For example, if the patent owner is making
9 essentially the same argument or the same point, my
10 analysis seems to be cogent.

11 Q. So if the statements didn't exist, it may
12 be the case that maybe certain of your opinions would
13 have different or less support, but the opinions would
14 still be yours and the conclusions would be the same?

15 A. Well, in terms of support itself, it's
16 obviously -- to me it's -- it's important to call out
17 the fact that the patent owner essentially agrees with
18 me, and based on their past statements or documents
19 that they've filed, but I -- I believe my analysis has
20 plenty of support. I'm just saying, oh, by the way,
21 also, the patent owner in this case also agrees with
22 me.

23 So if you take that away, I don't think that
24 changes the domain, necessarily, of my support. Sure,
25 it's not there anymore, but I feel that all references

1 that I've made within the documents provide sufficient
2 support for my opinions of obviousness.

3 Q. So in that sense would you agree that your
4 opinions don't depend on -- on the patent owner
5 statements or documents that you cite?

6 A. Well, you know, some of my cites were
7 within context and kind of interwoven, for example, how
8 they overcame Crilly and what -- the statements they
9 had made, and so that -- that history also comes into
10 play to provide context or texture for my presentation
11 within my declaration.

12 I would have to look at each instance to say -- to
13 give you a -- an analysis and think about it to say
14 whether that changes or makes my analysis weaker from
15 the perspective -- I don't -- I don't believe it does.
16 I stand behind all my analysis from the skilled
17 person's perspective.

18 THE REPORTER: I apologize. I know we just
19 took a break, but can I have two minutes?

20 ATTORNEY WANG: Let's go off the record.

21 (RECESS TAKEN.)

22 BY ATTORNEY WANG:

23 Q. Welcome back, Doctor.

24 A. Thank you.

25 Q. So before the break you testified that the

1 Agee patent also has a Butler matrix and an -- and an
2 array associated with that matrix, and to a person of
3 ordinary skill in the art that array would be receiving
4 the first signal transmission from a remote station.

5 Do you recall that?

6 A. That sounds correct, yes.

7 Q. So what is the -- what specifically is the
8 first signal transmission from a remote station in
9 Agee?

10 A. It's the signal that's being received at
11 the array elements, which both in, you know, for
12 example, Littlejoe and other references describe that,
13 which is -- what a person of ordinary skill in the art
14 would understand is a vector sum of signals arriving --
15 could be from multi -- many paths or a single path, and
16 so that signal hitting the array and showing up in the
17 output would be a -- for example, a first -- an example
18 of a first signal transmission.

19 Q. Okay. And so would that be one signal
20 or -- or multiple signals?

21 A. Again, we can look at the specific claim
22 element that you're referencing, but the -- there's no
23 doubt the array is receiving a signal. It has multiple
24 antennas. If it was just a single source arriving at
25 the array and it -- it's going across the array, you

1 would have a -- certainly a first instance of that
2 signal being received at one antenna and another
3 instance receiving another antenna, so it would be that
4 phase front coming across the array and then it being
5 received by the antenna array.

6 Q. But so before you talked about a vector sum
7 of signals.

8 What do you mean by that?

9 A. That's how a person of ordinary skill in
10 the art would understand the phase and amplitude of the
11 arriving signal and our array and how it's being formed
12 together. You typically look at that as a vector sum
13 of those signals arriving, and whether it's one signal
14 or many signals, it's the same concept.

15 Q. Okay. And then you -- you talked about a
16 single source arriving at the array.

17 Do you recall that?

18 A. Yes.

19 Q. So in that example when you say a single
20 source, do you mean a single signal?

21 A. What I'm saying is a phase front coming
22 across the array, is what I'm saying.

23 Q. What's a phase front?

24 A. It's the phase of the leading edge of the
25 wave, and you need to pick a reference point in terms

1 of doing a phase and amplitude analysis of a signal,
2 and so we use the concept the phrase front to describe
3 how a signal is propagating, for example.

4 And in my declaration I go to great lengths to
5 discuss how an array or a beamformer, how that phase
6 front is arriving at the array and what happens as it
7 arrives and in the context of my analysis of how that
8 plays into the determination that Agee, for example, in
9 its disclosures of beamforming render obvious the first
10 signal transmission and the second signal transmission.

11 Q. So can a signal be represented as a wave,
12 like a waveform?

13 A. Well, the term "signal" is very broad.
14 Certainly in a given context if you're talking about a
15 signal frequency source or -- I'm sorry, a signal
16 frequency, yes, sure, a sine wave, a cosine wave, or
17 any other complex wave you could look as a -- a signal.
18 It just depends on context.

19 Q. Okay. And when you refer to the phase
20 front or when you use that term, how does that relate
21 to like a waveform?

22 Would that be the -- a part of the waveform or the
23 front part of it?

24 A. Any reference you wish you can pick as an
25 engineer to represent the phase front. And typically

1 in, for example, signal propagation you use that phase
2 front to basically draw out an angle or a
3 directionality for that signal, if you're doing that
4 kind of analysis. So in that context you're using the
5 phase front to say the signal is going in this
6 direction.

7 In the context that I disclose in my declaration,
8 we have a beamformer, and as I'm providing essentially
9 a tutorial on how those work and how it's understood
10 from a perspective of a person of ordinary skill in the
11 art, when you see a line drawn showing that the signal
12 is impinging on the array, that's a phase front.
13 That's some reference point in that signal. It could
14 be any particular phase value within that signal as
15 it's propagating.

16 Q. And before you talked about a first
17 instance of a signal being received at one antenna and
18 another instance being received at another antenna.

19 Do you recall that?

20 A. Yes, I do recall talking about that -- that
21 signal arriving at the array and propagating across the
22 array.

23 Q. So what do you mean by a first instance of
24 a signal and another instance of a signal?

25 A. What I was referring to there is, again, my

1 analysis where you have a -- a beamformer with multiple
2 antennas and you have a signal propagating across that,
3 every antenna is going to basically sample or measure
4 that -- that signal coming across it. So each one of
5 those antennas has a phase and amplitude measurement,
6 essentially, and it's going to be feeding that back to
7 the system for processing, so it's sampling that signal
8 at some point in time.

9 And in terms of the disclosures of the '235 and
10 with respect to the references to the beamforming and
11 the multiantenna array analysis -- antenna element
12 array analysis, that the first signal transmission
13 certainly meets that -- meets that analysis with
14 respect to that signal being sampled by the multiple
15 antennas as it's propagating across the array.

16 Q. Okay. You testified I believe regarding
17 the array that each antenna is going to sample or
18 measure that -- that signal coming across it, right?

19 A. At any given instant in any system, array
20 system, from the prospective of a POSITA, someone
21 skilled in the art, is going to know that you're going
22 to -- whether it's the electromagnetic signal exciting
23 the antennas to cause a flow of electrons to go back to
24 the system in whatever fashion, or if it's a waveguide,
25 for example, even if you have RF feed horns out on the

1 antenna and that analog signal is being fed through
2 those horns, at some instant you're sampling that
3 signal, and it's done at the same time across the
4 array.

5 You're sampling that wave propagating or that
6 signal propagating across the array, and all of those
7 antennas are taking samples simultaneously.

8 Q. And so the -- and you've been talking about
9 antennas.

10 Are you referring to antenna elements?

11 A. Yes. You can look at a beamformer from a
12 collection of individual antennas or a collection of
13 elements within a given antenna for doing beamforming.
14 It just depends upon your actual implementation of
15 beamforming.

16 Q. And what -- what were you looking at in --
17 in this case, between those two examples?

18 Were you looking at a collection of individual
19 antennas or a collection of elements within a given
20 antenna?

21 A. Well, to keep my analysis simple, I was
22 looking at each antenna, essentially, as a separate
23 element within it. So that just makes it a little
24 easier because you don't have to worry about
25 directionality associated with each single antenna in

1 an array. You just assume they all have the same
2 directionality, for example, response. So from that
3 analysis it's just simpler to discuss each individual
4 antenna as an antenna element.

5 Q. I think you talked about sampling of -- of
6 each antenna being different.

7 And is that because each antenna would be in a --
8 at least a slightly different location?

9 A. Well, again, depends upon your array
10 implementation. You could have a bunch of elements
11 clustered close together and then it's referenced with
12 respect to the frequency, center of frequency of the
13 signal, whether -- how different those samples are
14 going to be, if you're talking about difference in
15 sampling, certainly each element in any array is going
16 to have a slightly different sample of the signal.

17 And typically your antennas are fixed positions,
18 they typically don't move, so if that's what you're
19 referring to, I'm talking in my analysis about fixed
20 antenna positions.

21 Q. But the fact that they're two different
22 elements means that they would be at least in slightly
23 different locations, right; they could be next to each
24 other or they could be at opposite ends of an array,
25 but their location would be different, right?

1 A. Well, the antenna spacing has to be defined
2 for your array, and that antenna spacing would indicate
3 the difference in -- differential in distance between
4 the antenna elements or the antennas, depending upon
5 the case.

6 Q. Okay. And then when we were talking about
7 a signal hitting each antenna or each antenna sampling
8 the signal, were you talking about the same signal or
9 one signal?

10 A. Just in general.

11 Q. Would that apply to one signal or the same
12 signal?

13 A. I'm not sure what your question is.

14 Q. Give me a minute. Let me look back to what
15 we were discussing. Okay.

16 So you testified earlier that if it was just a
17 single source arriving at the array and it's going
18 across the array, you would have a first instance of
19 that signal being received at one antenna and another
20 instance received at another antenna, so it would be
21 that phase coming across the array and then it being
22 received by the antenna array.

23 Do you recall that?

24 A. Yes. I was speaking to that phase front
25 propagating across the array.

1 Q. And so when you were talking about a first
2 instance of that signal being received at one antenna
3 and another instance received at another antenna, were
4 you referring to the -- the same signal or one signal?

5 A. It's true in any -- either context whether
6 it's multiple signals or a single signal, as that -- as
7 those -- that signal or signals are arriving at the
8 array, you're sampling that -- those arriving signals
9 or signal via the array at the same time, and I was --
10 so it's applicable to either -- either case.

11 Q. What did you mean by an instance, that
12 word, "instance"?

13 A. I meant -- just, again, from my
14 perspective, you -- typically you reference where
15 your -- your signal or signals -- your signal is or
16 your signals are with respect to the array when you're
17 doing an analysis based on that phase front, and if I
18 look at putting that phase front at some point with
19 respect to that array, really I'm saying, okay, this
20 phase front references here across the array, so we're
21 sampling that -- that signal that's arriving at the
22 array across all the array elements, and that's what I
23 was talking about.

24 And so I guess I would say what I really was
25 referring to there is the claim instance of wherever

1 that phase front is, the array sampling signal or
2 signals coming across it, and then another time
3 certainly you could -- you could reference it that way,
4 but what I was really saying is you have a sample when
5 that signal is impinging on the array, you have each
6 one of those antennas taking a sample, and that could
7 be -- again, you could look at that as a -- a sample, a
8 first sample, second sample, et cetera, samples of that
9 signal as it's coming across the array, is really what
10 I was saying.

11 Q. If it were one signal, would it be arriving
12 at the antenna elements at different times?

13 A. No. You -- again, when you have -- do an
14 analysis of beamforming or signal processing with
15 respect to beamforming, you design your system to be
16 responsive in a given direction, for example.

17 So you then picture geometrically that signal
18 coming across the array, and that's, again, where this
19 phase front analysis comes from, and you say, okay,
20 based on this instance, what's my response of my array
21 to this direction.

22 And that is completely independent of -- of the
23 directionality in terms of the sampling, meaning you're
24 sampling -- again, there's a clock that's sampling
25 your -- your antenna signals, it's happening at the

1 same time across all of those elements of the array,
2 and that signal is present at the array, you know,
3 within that context.

4 Q. Let's return to the paragraph that we were
5 looking at with the language of Element 1.3. It was
6 paragraph 422.

7 A. Give me one second, please.

8 Okay. Paragraph 422, right before Element 1.3.

9 Q. Right.

10 And so in Element 1.3, do you see the claim
11 language includes a first antenna element and a second
12 antenna element?

13 A. Yes.

14 Q. And for -- for those two elements are you
15 mapping that to antennas in the Butler array of Agee?

16 A. The antenna elements in this claim element,
17 I am mapping those to the antenna elements in the Agee
18 reference.

19 Q. And what are the antenna elements in the
20 Agee reference?

21 A. Agee does disclose a Butler matrix, so it's
22 the antennas attached to that Butler matrix -- antenna
23 elements attached to that Butler matrix.

24 Q. Anything else that you're mapping to Agee
25 as the claimed first antenna element and second antenna

1 element?

2 A. From the perspective of a person of
3 ordinary skill in the art, I think that's pretty clear.
4 I don't -- I don't recall mentioning anything else, no.

5 Q. We discussed this before, and I just want
6 to ask again, but what's the difference between an
7 antenna and an antenna element, or do you think they're
8 interchangeable?

9 A. They're two separate things. The question
10 is -- well, the context of the question was with
11 respect to beamforming, and in beamforming you can do
12 it multiple ways.

13 And what I was stating previously is in
14 beamforming you can use a collection, for example, of
15 Yagi antennas, and each one of those has a
16 directionality, but you can beamform with those.

17 However, modern-day electronics, typically that's
18 way too much space, they're too big, you don't want
19 your phone being five-foot-by-five-foot, right, or your
20 base station to be really huge, so we are using
21 electronic elements now to make up an array.

22 So when you say "element," you're speaking about
23 one particular receive, basically, point in that array,
24 or that antenna itself. So if I have an antenna array
25 that's made up of 64-by-64 elements, then every single

1 one of those 64-by-64 elements is receiving the signal
2 as it's hitting and impinging on that antenna.

3 Q. It sounds like if you have multiple
4 antennas, that they may have different directionality
5 or different directions?

6 A. You can certainly do that if you wanted to,
7 but typically today you don't -- you don't do that.
8 There may be a reason to do it. I can't think of one
9 in terms of implementation in the context we're
10 discussing. You could certainly do it, but it doesn't
11 make much sense.

12 Q. So I -- I -- I recall you saying that
13 thinking that one way would be simplified, and is it
14 that the -- the antenna elements would all have the
15 same -- same direction, and so that was what was being
16 simplified?

17 A. No. Really, what was being simplified was
18 the depiction of what happens when a signal and its
19 phase front arrives at an array, is really what --
20 that's what I was referring to.

21 Q. So would having multiple antenna elements
22 versus having multiple antennas imply a change in -- in
23 the directionality of the antennas or antenna elements?

24 A. Well, in either instance you have to phase
25 those together in a particular way to get a -- a

1 directional response, whether the antenna itself is
2 directional and you're grouping a bunch of antennas,
3 those antennas together to create a beamformer, or
4 whether you have a bunch of antennas with exactly the
5 same isotropic behavior, which is what you typically
6 design an antenna array element to have, so you have --
7 let's say here's 256 elements in your array, you
8 typically want each one of those things to have the
9 exact same isotropic behavior, and that's what
10 manufacturers typically strive for.

11 Q. What do you mean by "isotropic behavior"?

12 A. Same sensitivity in all directions.

13 Q. I'm sorry. Did you say "feigned
14 sensitivity"?

15 A. Same, S-A-M-E.

16 Q. Same. Same sensitivity. Okay.

17 And to do that would they be pointed in exactly
18 the same -- same way?

19 A. Well, that depends upon geometry. Your
20 geometry of your array, even if they are isotropic,
21 will determine the overall response characteristics of
22 the array. So you have to take that into account when
23 you're doing the signal processing to determine the
24 directionality or the sensitivity of the overall,
25 meaning the array, that's made up of those antenna

1 elements, so spacing, how many, your aperture, those
2 kind of things, what frequency you're operating at.

3 Q. Okay. Returning to the language of
4 Claim 1.3, do you see that it includes the terms "a
5 first signal transmission" and "a second signal
6 transmission"?

7 A. Yes.

8 Q. And those are coming from the same remote
9 station, per the claim language, right?

10 A. Well, it does say "the remote station," in
11 the first case it says "a remote station," so it would
12 lead a person of ordinary skill in the art to say that
13 it's coming from the same remote station.

14 Q. And so what are you pointing to as a first
15 signal transmission and the second signal transmission
16 in Agee?

17 A. Well, again, I'm pointing to the -- the
18 received signal across the array, first antenna
19 element, for example, second signal element would be
20 the first signal transmission from the remote station
21 via the first antenna element, and the second signal
22 transmission from the remote station via the second
23 antenna element simultaneously.

24 Q. You said a couple of times, Doctor, that it
25 could be -- what we're talking about, it could be one

1 signal or multiple signals.

2 Do you recall that?

3 A. I said in the analysis that I was
4 discussing, that it's -- it didn't -- it was not
5 material to the understanding of how the beamformer
6 operates, correct.

7 Q. And so in the example of receiving one
8 signal, just one signal total, would that meet a first
9 signal transmission and a second signal transmission as
10 claimed by Element 1.3?

11 A. In my declaration I do go through the
12 analysis to show that, yes, it would be met, as well as
13 I do a different -- well, I do also the case of the
14 fact that Agee is disclosed to OFDM systems, and if
15 your remote station was transmitting on multiple
16 subcarriers, obviously you're going to be receiving, if
17 you want to look at it that way, multiple signals where
18 each subcarrier is a signal.

19 But to answer your question in short, yes, Agee
20 meets that limitation based upon that single signal
21 coming across the array.

22 Q. So it's your view that one signal coming
23 across the array could be considered a first signal
24 transmission and a second signal transmission?

25 A. My analysis is that the claim term

1 that's -- the claim elements of 1.3 that's talking
2 about a first signal transmission via the first antenna
3 element and a second signal transmission via the second
4 antenna element is met by a -- a signal coming across
5 that array and that array sampling that signal via
6 multiple antennas simultaneously. That's my analysis.

7 Q. Okay. And your theory for that -- how that
8 can be met by more than one signal or multiple signals
9 depends on what you were talking about with the
10 subcarriers?

11 A. Well, you can look at it from two
12 perspectives. If I just have one -- or if I have a
13 remote station that's sending out a signal and you have
14 multipath, you're going to have multiple versions of
15 that signal arriving.

16 So beyond what I've just discussed, multipath
17 would also present a case where you have multiple
18 versions of that signal arriving at the array, and also
19 in the case that if you have OFDM, you have these Agee
20 calls and tones but these subcarriers, you have
21 multiple subcarriers arriving at the array to each one
22 of those antenna elements, and each one of those would
23 represent a first signal transmission and second signal
24 transmission at the respective elements.

25 Q. What is OFDM?

1 A. Orthogonal frequency division multiplexing.

2 THE REPORTER: One more time a little
3 slower, please, Doctor.

4 THE WITNESS: Yes. I'm sorry.

5 Orthogonal frequency division multiplexing.

6 BY ATTORNEY WANG:

7 Q. And your opinions for OFDM for this claim
8 element don't depend on the Butler matrix?

9 A. Well, I've done my analysis with respect to
10 Agee's disclosure of the Butler matrix, and as I
11 discuss in my declaration, I've done that analysis
12 based on that.

13 I could go back and -- and kind of think about it
14 some more with respect to a single antenna element, but
15 I haven't done that at this point.

16 Q. How does OFDM relate to the -- a Butler
17 matrix, or...

18 A. OFDM is a multiplexing technique. It's
19 what Agee is disclosed towards, and that's why I
20 reference it.

21 Q. So I'm trying to understand if this is a
22 different theory or the same theory and if it relies on
23 your opinion of Agee disclosing a Butler matrix.

24 Are you -- when you look at OFDM, is it part of
25 the Butler matrix or a -- a different part of the

1 system?

2 A. Oh, I see what you're -- you're asking.

3 No.

4 OFDM is a technique for sharing resources in a
5 communication system. Agee just happens to be oriented
6 towards an OFDM system in a TD -- TDD implementation,
7 and each one of these analyses on their own provides
8 support for Agee rendering obvious this claim element
9 in my analysis. You can take away the OFDM, you can
10 leave it. Either way, Agee, in my opinion, renders
11 this obvious.

12 Q. Can you take away the Butler matrix and
13 would your opinion be that Agee renders the claim
14 obvious?

15 A. You have a -- an array in Agee, and the
16 Butler matrix is a way of having passive beamforming.
17 Whether it's active or passive beamforming, you have
18 essentially the same thing occur. And so if he was
19 using active beamforming, he would be, again, receiving
20 a first signal transmission and a second signal
21 transmission and sampling those simultaneously.

22 Q. Okay. So if it were active beamforming, it
23 would not rely on a Butler matrix?

24 A. Well, there's hybrid implementations. And
25 actually, Agee is actually directed to that.

1 So if you wanted to, you could have the Butler
2 matrix in there for doing your beamforming. You don't
3 have to. Today especially. Back in the preceding 40
4 years before the invention, Butler matrices were
5 important because they were exactly -- they were
6 passive. You didn't have to implement and spend a lot
7 of money to implement an active beamforming system if a
8 passive system was sufficient, and so there was a
9 transition and there are still implementations of
10 Butler matrices for doing beamforming now.

11 So to a person of ordinary skill in the art,
12 that's not going to make a difference in terms of when
13 the signals are arriving, when they're sampled, and the
14 signal processing that's involved other than you have
15 to take the front end into account when you're doing
16 your directional analysis, sensitivity analysis.

17 Q. So you could have implementations of active
18 beamforming that do not use a Butler matrix?

19 A. Well, certainly beamforming can be
20 implemented in many ways. Sonar arrays, for example,
21 they don't -- they don't have a Butler matrix in front
22 of them. Yes, you can do active beamforming without a
23 Butler matrix.

24 Q. So is it your opinion that one could take
25 away the Butler matrix from Agee and would your opinion

1 still be that Agee renders the claim obvious, Claim 1
2 of the '235 patent?

3 A. Well, I didn't do that analysis. Certainly
4 if you want me to consider it, I can do that and go
5 back through it and get back to you, but my analysis is
6 based on what's disclosed in the prior art reference,
7 what was stated by the patent owners in their -- their
8 disclosures to the board, as well as the file histories
9 which referenced Littlejoe and -- and the Butler
10 matrix, Agee happens to fit that very tightly, and I --
11 I haven't performed a separate analysis of that.

12 Q. You've referenced patent owner's arguments
13 about Littlejoe a few times.

14 Do you recall that?

15 A. Yes.

16 Q. And what is Littlejoe, just to confirm?

17 A. Littlejoe is basically -- it was used by
18 the patent owner to get the approval of the patent
19 board beyond the Crilly reference, and Littlejoe
20 includes a Butler matrix for sampling an array and
21 doing some beamforming in a -- I believe it's a WAN
22 system. I would have to -- I have to look at it again,
23 but I believe it's a WAN system.

24 Q. So do you believe that Littlejoe provides
25 written description for the -- the independent claims

1 of the '235 patent?

2 A. Well, the patent owner pointed to that, and
3 all I'm doing is I'm saying -- I'm not making an
4 opinion of whether there's a written description.

5 I'm saying that the patent owner pointed to that,
6 and given that the patent owner pointed to that, as
7 well as my analysis, we are consistent from the
8 perspective of a person of ordinary skill in the art.
9 That's -- I don't have -- I haven't done a written
10 description analysis.

11 Q. Do you offer any opinions about the
12 priority date of the '235 patent?

13 A. So in paragraph 178 I discuss the priority
14 date and my knowledge with respect to the priority
15 date, and specifically here I address the fact that the
16 Jones patent assumed priority date is November 4th,
17 2002, which is the filing date of the provisional. And
18 I'm also aware that the patent owner has asserted that
19 the priority date could be as early as February 1st,
20 2002, in prior IR -- IPR proceedings, and I reference
21 the IPR there.

22 Let's see here. I think that's the extent, but
23 let me just take a quick look to see if I address it
24 elsewhere.

25 Elsewhere, in paragraph 183, I do discuss the fact

1 that the weight calculations being added at a prior --
2 a later date, in 2017. I dis- -- I do discuss the
3 prosecution history with respect to priority in
4 section -- I don't know what the subsection -- or what
5 the master section is in -- beginning in paragraph 187.

6 And then I go through what I just referenced,
7 is -- which is the discussion of Littlejoe with respect
8 to Crilly and predating Crilly in -- beginning in
9 paragraph 204.

10 So I don't specifically have a discussion beyond
11 what I just said with respect to the priority date in
12 my declaration.

13 Q. Okay. Yeah. I think it's helpful to look
14 at paragraph 178.

15 A. Okay. One second, please.

16 Q. Let's turn back to that.

17 And so you identify here, like, two possible
18 priority dates: One in November 2002, and one in
19 February 2002, correct?

20 A. Correct.

21 Q. And you're -- you're assuming for purposes
22 of this declaration, without stating one way or the
23 other, that -- you're assuming the priority date is
24 November of 2002?

25 A. Correct.

1 Q. And you say it wouldn't affect your
2 opinions for either of the two possible dates?

3 A. Correct. In paragraph 179 I do say my
4 analysis herein would not change for either of those
5 two possible dates.

6 Q. And that's because both are after the
7 Butler reference, correct, by quite a few years?

8 A. Yes. They are after the reference, and my
9 analysis is based on what the understanding of the
10 person of ordinary skill in the art was at the time, as
11 well as the prior art I'm pointing to.

12 Q. And are -- are both dates after the date of
13 the Agee reference?

14 A. Agee was June 10th, 2001.

15 Q. And you -- you assume that Agee qualifies
16 as prior art under 102 (a) and (e)?

17 A. I would have to look at those paragraphs
18 again, but yes, it's prior art under the obviousness
19 analysis.

20 Q. Okay. Let's turn back to paragraph 178.

21 A. Okay.

22 Q. So in paragraph 178 you say that you're
23 aware that the PO has asserted the priority date could
24 be as early as February 2002 in prior IPR proceedings,
25 and then you cite patent owner's preliminary response?

1 A. Correct.

2 Q. Did you review the board's institution
3 decision in that IPR proceeding?

4 A. I did review it way back in the beginning
5 of last year.

6 Q. Do you know if that's in your materials
7 considered?

8 A. I will to take a look.

9 Yes, it is. Exhibit 1010.

10 Q. Right.

11 So that -- that's the preliminary response, patent
12 owner's document, right?

13 A. Correct.

14 Q. But then we were talking about the
15 institution decision in that proceeding.

16 A. I don't see it listed here, but I -- my
17 memory tells me I did review it.

18 Q. Okay. Going back to 178, paragraph 178.

19 So do you know if the -- the board adopted patent
20 owner's arguments or found that -- do you recall, or
21 found that the claims were entitled to a priority date
22 as early as February 2002?

23 A. I do address the chronology here, so let me
24 take a look.

25 In paragraph 259 I mention that in the process of

1 the prosecution of that IPR, that the patent owner
2 settled with petitioners, and for that IPR, 20 --
3 2022-00367, along with other joined IPRs, they were all
4 dismissed without the board having ruled on these
5 arguments.

6 Q. All right. So there was no final written
7 decision in that IPR, but I'm asking about the
8 institution decision.

9 And do you recall one way or the other if the
10 patent board agreed whether it adopted patent owner's
11 arguments regarding the priority date?

12 A. I don't seem to have addressed it in my
13 declaration, and I can't seem to recall exactly if and
14 what the board said in the institution decision.

15 Q. For Claim 1.3, when we were talking about
16 the first signal transmission and the second signal
17 transmission, do you recall that?

18 A. Yes.

19 Q. And your opinion is that those signal
20 transmissions are received simultaneously?

21 A. Yes.

22 Q. And is that because the -- I think you
23 explained that the -- the sampling by the antennas or
24 antenna elements would be at the same time, or that you
25 take that at one point in time?

1 A. My opinion is that's how a person of
2 ordinary skill in the art would understand that
3 occurring, and since simultaneously in the claim
4 elements it is modifying receive, that is coherent; and
5 therefore, yes, that -- those antennas are sampling, at
6 the same time, whatever is impinging on that array.

7 Q. Would the signals arrive at the different
8 antenna elements or the antennas at different times?

9 A. When you're sampling, you're sampling the
10 RF environment, whatever is there at that given
11 instant. And so a signal does propagate, and in the
12 context of a person of ordinary skill in the art doing
13 beamforming, you're looking at it from the perspective
14 of that signal is impinging across the array, and
15 you're sampling that signal at that instant time.

16 So again, from the perspective of a person of
17 ordinary skill in the art, if you want to discuss when
18 the phase front first arrives at the first element
19 depending on directionality versus how long it takes to
20 propagate across the array to whatever the sample rate
21 is to when you do the sampling, that's immaterial from
22 the perspective -- reasonable perspective of the person
23 of ordinary skill in the art analyzing these claim
24 elements and the array with respect to these claim
25 elements.

1 Q. So in -- in your view the -- the
2 simultaneous claim element doesn't mean much, right --

3 ATTORNEY ANDERSON: Objection.

4 BY ATTORNEY WANG:

5 Q. -- as long as you -- as long as you pick a
6 point in time, that -- that would meet it?

7 ATTORNEY ANDERSON: Objection to form.

8 THE WITNESS: I'm not sure I understand
9 your question, if you can maybe clarify for me a little
10 bit with respect to my opinions, I could give you a
11 more refined analysis.

12 BY ATTORNEY WANG:

13 Q. Maybe it was just a poorly formed question.
14 We can come back to that.

15 I want to ask you about the -- Claim 1.4.

16 A. 1. -- excuse me. I have to get to that.
17 One second.

18 Q. Yeah. And I'll -- I'll find it as well.

19 A. Okay.

20 Q. Okay. So it's below paragraph 514.

21 A. Okay. I'm there.

22 Q. Notice the pattern of these claim
23 limitations appearing at the bottom of the pages.

24 A. It's poorly spaced, is that what you're
25 saying?

1 Q. No. No. It's fine. It's just a
2 coincidence.

3 So do you see the claim limitation 1.4, it says,
4 "Determine first signal information for the first
5 signal transmission"?

6 A. Correct. Yes, I do.

7 Q. And just to remind me, when we're talking
8 about the first signal transmission, how would you
9 identify that concisely?

10 A. Well, I go through analysis of signal
11 transmission throughout my declaration with respect to
12 the claim elements in my analysis -- claim elements in
13 my analysis, and if we go to -- one second -- 1.3, a
14 claim element where we're -- first we see this --
15 receive a first signal transmission from a remote
16 station via the first antenna element.

17 That's where it first shows up in the claim
18 elements, and then in my background discussion I go
19 through great length with discussing signal
20 transmissions with respect to the disclosures of
21 arrays.

22 I then also include a discussion of the received
23 first signal transmission based on the patent owner's
24 arguments in -- as I mentioned before, in those
25 paragraphs 204 through 214 or 215 or so.

1 I go through the analysis of the preliminary
2 response -- patent owner's preliminary response and how
3 they discuss the claim elements specifically with
4 respect to the Butler matrix that's disclosed, and in
5 paragraph 230 I discuss how the petitioner only --
6 well, the statement, Exhibit 1010, "Petitioner only
7 disputes the portion of this element requiring
8 simultaneous receipt of a first and second signal
9 transmission," and then -- and as the petitioner notes,
10 the searcher comprises this Butler matrix and points to
11 the Butler matrix with respect to that.

12 In Exhibit 1011, again discussing the reception of
13 the signal transmission, I discuss how in the IPR
14 prosecution for 2022-01155, when the board declined to
15 institute a review, that the board accepted the patent
16 owner's arguments that the prior art for that IPR did
17 not disclose two simultaneous signal transmissions and
18 the board -- what was pointing to there was a single
19 antenna element.

20 Beginning in paragraph 330, I start to discuss
21 signal transmissions with respect to, again, arrays,
22 before I get into discussing Claim Element 1.3 which I
23 mentioned is the first time I discuss -- or the claim
24 element associated with the term "first signal
25 transmission" comes into play, and therefore I'm

1 relying on the fact that we're -- and pointing to the
2 fact that a person of ordinary skill in the art would
3 understand that that array is receiving a first signal
4 transmission via that first antenna element. Whatever
5 that signal is, whatever that transmission is, that
6 first signal transmission is at a first antenna, and
7 that second signal transmission is at that second
8 antenna.

9 Q. Okay. So the -- the first signal
10 transmission is whatever the first antenna element
11 receives, the sampling that we were talking about?

12 A. Within the context of the claim element, as
13 disclosed in that claim element to the person of skill
14 in the art, they would understand that what's being
15 received at the first antenna element of that claim is
16 the first signal transmission and what's being received
17 at that second element is the second signal
18 transmission, and that element discusses those being
19 received simultaneously.

20 Q. Okay. What is -- what, then, is the first
21 signal information for the first signal transmission?

22 A. Beginning with my development in my
23 declaration in paragraph 217 where I discuss the first
24 signal information and second signal information, I'm
25 pointing to, again, support that's consistent with my

1 analysis from the perspective of the person of ordinary
2 skill in the art where the patent owner pointed to
3 the -- for the element determine first signal
4 information for the first signal transmission, that
5 first signal information cites Document C-4 where the
6 beamforming application using -- uses the signal
7 strength information derived from the packet receptions
8 by the searcher receivers, and that the second signal
9 information for the second signal transmission, it
10 recites to the same C-4 reference where the beamforming
11 application uses the signal strength information
12 derived from the packet receptions by the searcher
13 receivers.

14 I then go on to continue to discuss the
15 representation of LittleJoe's Butler matrix receiving
16 the signal information. Specifically, I cite to the
17 patent owner's response in paragraph 257 where they
18 state that determining second signal information for
19 the second signal transmission cites to the rest of the
20 claim language, and it's referencing I guess Burke
21 here.

22 In paragraph 264 I make the explicit reference
23 that the claim language regarding signal informations
24 includes signal strengths on the different antennas,
25 and based on my analysis of the IPR I cite to that for

1 2022-01155 as additional support beyond what the
2 perspective of the person of ordinary skill in the art
3 would understand.

4 Q. Can I point out, Doctor, just that -- do
5 you see in Term 1.4, Claim Limitation 1.4, it says,
6 "Determine the first signal information," that claim
7 term?

8 A. Yes, I do.

9 Q. And I believe that that's the first time it
10 appears in Claim 1, "first signal information"?

11 A. Correct.

12 Q. So my -- my question is just: What are you
13 identifying as the first signal information?

14 And so I would expect that to be part of your
15 opinions for -- for this claim, Claim Term 1.4, and
16 I -- I believe you were discussing or summarizing your
17 opinions for -- for earlier terms.

18 A. Well, I was trying to say that my analysis
19 leading up to this is consistent, and specifically in
20 the subsequent paragraphs to the paragraph containing
21 1.4 elements -- or listing 1.4 elements, I say that
22 Agee -- Agee discloses these elements in several ways;
23 for example, by using the signal strength. So signal
24 strength information associated with the -- the
25 received signal would be an example of signal -- first

1 **signal information, for example.**

2 Q. The signal strength for the first signal
3 transmission would be an example of the first signal
4 information?

5 A. **Correct.**

6 Q. Okay. What -- what other examples or
7 what -- what other opinion -- opinions do you offer as
8 the first signal information?

9 A. So in paragraph 527 I point to, beyond the
10 signal strength, Agee's disclosures correspond to other
11 forms of signal information that are also identified in
12 the '235 patent. These include data induced on each
13 antenna.

14 And Agee provides antenna pointing direction
15 information, null/zero location information, peak
16 location information, frequency information, and timing
17 information, which are forms of signal information.

18 Q. Sorry. I got mixed up. Can you hear me,
19 Doctor?

20 A. **Yes. I can hear you now.**

21 Q. Okay. I -- I think my volume went down for
22 a second, but I see this in the realtime.

23 Do you see in paragraph 5 -- 519, you say that a
24 POSITA would recognize the transmit power level as
25 measured at the receiver as the signal strength?

1 A. I do.

2 Q. Okay. So those two terms would be
3 synonymous, right, or have the same information, in
4 your view, "transmit power level" and "signal
5 strength"?

6 A. Well, that's one example. So there's
7 various proxies for signal strength. Power level is
8 one.

9 Q. What would be another?

10 A. Amplitude. Intensity.

11 Q. But in your view, they would all be --
12 constitute signal strength?

13 A. They could. Typically to a person of
14 ordinary skill in the art, for example -- I remember
15 some cell phones that actually used amplitude as signal
16 strength, and obviously power is -- can be used as
17 signal strength, and intensity can be used as signal
18 strength. So those are all proxies to mean the same
19 thing. You would just have to look at the context of
20 what the person or the engineer is analyzing and what
21 they're conveying.

22 Q. Okay. Do you see in -- in paragraph 533,
23 you say that in Agee's Butler matrix, signal
24 information, signal strengths from multiple antennas
25 are combined on each Butler combiner output?

1 A. Yes, I do.

2 Q. Do you have the opinion that that -- the
3 other examples of signal information from other
4 multiple antennas are combined on each Butler combined
5 output?

6 A. I'm sorry. Could you ask that question
7 again?

8 Q. Sure.

9 Do you have the opinion that the other examples of
10 signal information you mentioned, apart from signal
11 strength, are combined on each Butler combiner output?

12 A. So what I'm pointing to here is that -- a
13 person of ordinary skill in the art understanding
14 Agee's system that has the Butler matrix in it, that
15 the signal infor- -- the signals being received at the
16 Butler matrix are going to be combined in a particular
17 way.

18 We mentioned previously that -- that vector sum
19 addition of the phasing amplitudes is consistent with
20 the understanding of an artisan and that they're going
21 to come out of the Butler matrix feeds, the outputs,
22 and that's a combination of all those received signals
23 and -- or that received information, and that if you
24 look at that -- again, it's reasonable for a person of
25 ordinary skill in the art to understand that's -- each

1 one of those feeds is a combination of the antenna
2 elements and that the combined output could also be a
3 first signal information. And I say specifically --
4 for example, from the first antenna signal is adding in
5 there. Right? So that is contained in that
6 information.

7 So whether you're looking at and tracing down how
8 that information arrives through one antenna or if
9 you're looking at the multiple antennas receiving
10 information and looking at the outputs, you have that
11 information being transmitted through the Butler matrix
12 to the outputs, is what I'm addressing here in this
13 paragraph.

14 Q. So what -- what is the signal information;
15 is it the signal strength or is it the output of the
16 Butler matrix?

17 A. Well, the first -- I'm pointing to the
18 signal strength as the first signal information, so --
19 as well as the other things that I pointed out in the
20 previous paragraph, 5 -- 527, I think it was, could be
21 used to determine that first signal information.

22 Q. When you say "could be used to determine,"
23 do you mean used to determine or can be --

24 A. Can be.

25 Q. Can be. Okay. Okay.

1 So my question, then, was -- again, I was asking
2 about paragraph 533. You say that in Agee's Butler
3 matrix, signal information -- signal strengths, (signal
4 strengths), for multiple antennas are combined on each
5 Butler combiner output.

6 Do you see that?

7 **A. Yes, correct.**

8 Q. And this specific sentence seems to be
9 about signal strengths, based on the -- the
10 parentheses?

11 **A. I am referencing signal strengths here**
12 **because that's primarily where I, you know, present my**
13 **analysis because it's consistent with what the patent**
14 **owner previously pointed to, but I could have pointed**
15 **to the others.**

16 Q. Okay. And would -- in your opinion, would
17 the same be true of others, other examples of signal
18 information, that you would say that multiple antennas
19 are combined on each Butler combiner output?

20 **A. Yes. That's how the Butler matrix works.**
21 **It combines all of those together. So the answer is**
22 **yes.**

23 Q. It -- it combines everything, all -- all
24 information received from an antenna together?

25 **A. From the array to each one of the outputs.**

1 Q. Focusing on signal strengths, how are they
2 combined on each Butler combiner output?

3 Are they just added together?

4 A. The -- the signals -- if you look at a
5 Butler matrix, you see that the signals have signal
6 paths. And so you have splitters, you have summers,
7 and you have delay elements in there, and so they go
8 through those paths and are combined in that fashion to
9 show up at a particular output of the Butler matrix as
10 I present in my detailed analysis -- or discussion, I
11 should say, in my declaration of how a Butler matrix
12 works.

13 Q. And so it's more complicated than just
14 adding them; it's -- it seems like it involves
15 different possibilities or formulas, right?

16 I mean, you talked about paths and delay elements
17 and so forth?

18 A. Yeah, no, that's all part of the summation
19 process. So those signals are -- right? To a person
20 of ordinary skill in the art, those signals are
21 combined together. That combining -- again, you're
22 assuming linearly, and that combining is the equivalent
23 of summing or adding.

24 Q. Okay. You say then -- in that same
25 paragraph, you say, "Each individual Butler combiner

1 output by itself is a determination of a first signal
2 information and second signal information as claimed."

3 Do you see that?

4 A. Yes.

5 Q. And so you used the word "determination."

6 Is your opinion that the determination occurs
7 after the combiner output, or before?

8 A. Well, as I state in this section, that
9 we're -- and we are -- you know, we are analyzing a
10 Butler matrix here, and with respect to rendering
11 obvious the claim element of determining or determine
12 the first signal information and determine second
13 signal information, with respect to that, I am stating
14 that -- let me just get back to it here.

15 The operation of the Butler matrix where the
16 outputs are combined, where I state that they
17 constitute a determination of different signal
18 informations, what I'm saying is that signal
19 information is showing up at each one of those outputs;
20 and therefore, given the Butler matrix is there, that's
21 a determination of the signal informations.

22 Q. Okay. I mean, here we have the noun of
23 "each Butler combiner," right, in paragraph 533?

24 A. Correct.

25 Q. And so each Butler combiner would have one

1 or more inputs and one or more outputs, right?

2 ATTORNEY ANDERSON: Objection to form.

3 But go ahead.

4 THE WITNESS: The Butler matrix, as I have
5 presented above, will take the array input and it feeds
6 specific outputs, and there's a signal path for each
7 one of those. And each one of those, depending upon
8 where you're transmitting and receiving, whatever is
9 showing up at, for example, the input antenna, one of
10 the input antennas, is going to show up on one of the
11 or several of the or maybe all of the antenna Butler
12 outputs.

13 But that's -- again, it's that -- that
14 signal that's being received or that information that's
15 being received that one antenna is showing up at the
16 output, and same is true for the other antenna.

17 So what I'm -- what I reference here in
18 that paragraph is that each individual Butler combiner
19 output by itself is a determination of first signal
20 information because of the fact that that information
21 is showing up on that output. It's a -- it's showing
22 up, and that is a determination.

23 BY ATTORNEY WANG:

24 Q. Okay. So the -- each Butler combiner, the
25 way I understand it is it's part of the overall Butler

1 matrix, correct?

2 A. I'm saying that the -- the Butler matrix is
3 receiving the -- the energy, it's going through the
4 Butler matrix, and it's showing up on the outputs. So
5 you have several outputs of the Butler matrix, and
6 whatever is being impinged upon that array is showing
7 up in -- again, in some form of those Butler outputs,
8 and what is showing up? Well, various signal
9 information is showing up at any point in those
10 outputs.

11 Q. I'm asking about specifically the Butler
12 combiner, that -- that noun, or "each Butler combiner."

13 Are -- are you say- -- is that part of the entire
14 Butler array -- or the entire Butler array -- I
15 understood it to be part of it?

16 ATTORNEY ANDERSON: Objection to form.

17 Go ahead.

18 THE WITNESS: In paragraph 448 I reference
19 that Agee uses the term "combiner output" to reference
20 the Butler matrix output which consists of combined
21 different signals received on multiple antennas and
22 output on RF feeds and which is used to calculate the
23 weights.

24 I will also say that Agee does discuss or
25 use the -- the words together "output combiner" with

1 respect to the application of the weights in the
2 least-squares error algorithm. In this context -- I am
3 getting back to that paragraph.

4 Either way, actually, at the output of the Butler
5 matrix, which are the signals that are combined, or
6 whether you trace that through the signal processing
7 chain where the weights are being applied and it's
8 referring to the combiner output as part of that
9 process, the same is true, that the signal strength
10 would still be signal informations.

11 BY ATTORNEY WANG:

12 Q. Okay. So before -- and I think in that
13 paragraph we were referencing you talk about the output
14 being a determination of signal information, correct,
15 the output of the Butler combiner?

16 A. Output of the Butler combiner by itself is
17 a determination of a first signal information. I do
18 say that, yes.

19 Q. And so does the determination occur within
20 the Butler combiner or right before its output or after
21 its output?

22 A. It is a determination in terms of at the
23 output if you also trace that through the signal
24 processing chain and look at the combiner -- Butler
25 combiner output with respect to applying the weights

1 for the least -- least-squares error algorithm, that's
2 also a determination. It's the same information that's
3 processed, differently, but that doesn't change the
4 fact that it's a determination -- it's determined.

5 Q. Okay. So at the point the information is
6 input into the Butler combiner, do you have the opinion
7 that a determination has occurred?

8 ATTORNEY ANDERSON: Objection to form.
9 Go ahead.

10 THE WITNESS: My opinion is that the energy
11 that's impinging on the array, the signal or signals,
12 is being fed through a signal processing chain that
13 includes a Butler matrix up front, and from the
14 perspective of a person of ordinary skill in the art,
15 the question is, is does that contain signal
16 information, and the answer is yes, such as signal
17 strength.

18 Can that signal strength exist throughout
19 the processing chain to a person of ordinary skill in
20 the art? The answer is yes.

21 So you can point to several points along
22 that processing chain where the signal information
23 exists and that you're using it in various ways and a
24 person of ordinary skill in the art would understand
25 that depending upon how you're using it in that signal

1 processing chain, you can discuss the signal strength
2 based on the signal or signals arriving at the array,
3 and that would still meet the determination language of
4 the claim.

5 BY ATTORNEY WANG:

6 Q. And the first point that you point to is
7 the output of the Butler combiner?

8 A. I point to the combiner output, is what I
9 state there, and I'm following up on the discussion
10 here of the Butler matrix coming into -- receiving
11 the -- the signal or signals.

12 Q. Right.

13 And when you say that you can point to several
14 points along the processing chain, would the first
15 point along the processing chain that you point to be
16 the output of the Butler combiner?

17 A. It's the output of the combination of those
18 signals, so that combination is happening within the
19 Butler ma- -- design -- based on the design of the
20 Butler matrix, and that at the output it is a
21 determination of that signal information, that signal
22 information is there. So it exists there. It also
23 exists throughout several stages of the signal
24 processing chain.

25 ATTORNEY WANG: Let's go off the record.

1 ATTORNEY ANDERSON: Off the record.

2 (RECESS TAKEN.)

3 BY ATTORNEY WANG:

4 Q. Welcome back, Doctor.

5 Did you have any discussions with counsel during
6 the lunch break?

7 A. I did not.

8 Q. Could I turn your attention to paragraph
9 536, and I want to ask you about Limitation 1.6.

10 A. Okay. I'm at 536.

11 Q. And do you see the claim language for
12 Limitation 1.6 that says, "Determine a set of weighting
13 values based on the first signal information and the
14 second signal information"?

15 A. I do, yes.

16 Q. So I see that your opinions for this
17 limitation go from paragraph 537 through 572.

18 A. That seems to be correct, yes.

19 Q. About 18 pages, right, or thereabouts?

20 A. Roughly, yes.

21 Q. And in these pages you have a lot of
22 formulas and block quotes from the Agee reference?

23 A. I certainly do, yes.

24 Q. All right. Turning back to the claim
25 language of 1.6.

1 So my question is generally why you needed so many
2 pages or formulas and how does that relate to your
3 opinions that the limitation is met?

4 **A. Agee --**

5 ATTORNEY ANDERSON: Objection to form.
6 Go ahead.

7 **THE WITNESS: I'm sorry.**

8 The Agee reference is very lengthy and it
9 has a lot of good information, quite frankly, from an
10 engineer standpoint -- engineering standpoint, and I
11 just presented the detail here to make sure I had both
12 encompassed the support from that reference -- again,
13 it's a very long section, and it talks about all of
14 this information in great detail. So basically, I
15 would say I just didn't limit myself to a page count.

16 BY ATTORNEY WANG:

17 Q. But if the claim just says "Determine a set
18 of weighting values based on the first signal
19 information and the second signal information," are the
20 details or the formulas or flow charts or block quotes,
21 how -- how do they relate to your opinion or are they
22 necessary to your opinion that the limitation is met?

23 **A. They support my opinion.**

24 Q. Are the details of any of the flow charts
25 or figures or formulas relevant?

1 A. Yes, they are relevant. They're not
2 superfluous, if that's what you mean.

3 Q. And how are they relevant?

4 A. The Agee reference discusses the whole
5 signal processing chain. And if you go through the
6 reference in great detail, you will see that Agee
7 references other sections going through specific
8 additional technical details, and so I just wanted to
9 make sure there was a coherent presentation pulling
10 that out of Agee to show basically how the weights are
11 calculated in the Agee embodiments.

12 Q. When you say "Agee embodiments," do you
13 know how many embodiments you're relying on?

14 A. I didn't count them, no.

15 Q. But you are discussing multiple
16 embodiments?

17 A. I would have to go back and reference the
18 sections that I present here. I did my analysis from
19 the perspective of tracing through to show how the
20 weights are calculated, and if it happens to be from a
21 given section and a given embodiment, I just didn't
22 take note of it, so I -- I can't answer that question.

23 Q. Can you concisely identify what you point
24 to as the claimed set of weighting values?

25 A. It's the weights that are calculated in

1 Agree. And you see those displayed, as I have, in --
2 through this section in various excerpts as well as
3 figures and diagrams that I point to. That W that you
4 see there stands for weights. So any time I'm
5 referencing that W, you're looking at the weights that
6 Agree is -- is calculating based upon the received
7 signal information.

8 Q. And so -- that's -- so you point to the W
9 as the set of weighting values?

10 A. Well, that's what they represent. I point
11 to the entire information in there to show you that,
12 indeed, they are calculating the weight values as
13 claimed in the claim element.

14 Q. We talked for the previous limitation about
15 the output of the Butler combiner.

16 Do you recall -- do you recall that?

17 A. Yes.

18 Q. Okay. And your opinion was that the output
19 includes or is a determination of the first signal
20 information and the second signal information, right?

21 A. It indeed includes it, yes.

22 Q. Okay. The output of the Butler combiner,
23 what -- what form is the output?

24 Is it bits?

25 Is it a number?

1 What -- what form is the output in?

2 A. Agee doesn't specifically limit -- Agee
3 goes through the signal processing chain, so obviously
4 you have ADDs listed there at some point, you go from
5 analog/digital signal, and so you have sampling. It's
6 going to be represented as bits.

7 You just have to point me to where in the signal
8 processing chain you're talking about, whether it's
9 analog, it's digital, and on the reverse side whether
10 it's digital or analog, RF, and whether it's baseband
11 or it's converted.

12 Q. But it -- it's still just one thing, right;
13 it's not -- it's not multiple things, it's one output,
14 like a stream of bits or a stream of bytes, data?

15 ATTORNEY ANDERSON: Objection to form, I
16 think.

17 THE WITNESS: Yeah, I'm not sure I
18 understand where you're -- what specifically you're
19 asking.

20 So the Agee reference, as I've discussed
21 and as Agee obviously represents, is using a Butler
22 matrix for doing beamforming, he has this detailed
23 signal processing chain, and a person of ordinary skill
24 in the art is going to understand what is going on
25 along that processing chain, signal processing chain.

1 So when you say the question -- or when you
2 ask that question, I'm just confused by exactly what
3 you mean.

4 BY ATTORNEY WANG:

5 Q. I mean, we're talking about the output of a
6 Butler combiner, right?

7 And so I -- I was trying to understand if there's
8 one output or multiple outputs or what form that that
9 would be in.

10 A. So the Butler matrix has multiple outputs,
11 and then again, as I pointed out and pointed to various
12 figures throughout Agee, those outputs go through
13 signal processing, including the multilink adaption
14 algorithm, but also amplifiers, ADDs, FFTs, inverse
15 FFTs, et cetera, et cetera.

16 So those outputs are connected to the rest of the
17 system that -- if we're just focusing on the Butler
18 matrix itself, and I actually -- if you go to Figure --
19 let's see here. I know I have it here. It's just
20 figuring out what page it's on.

21 One representation is on page 190 -- I'm pointing
22 to Figure 25 -- that shows and discusses Agee's
23 disclosure of the Butler mode form, the Butler matrix,
24 and how it's connected into the transceiver in the
25 system. And specifically I believe it's in the Columns

1 45 and 46, he goes through this and says how that is
2 embodied within the disclosed MIMO transceiver.

3 Q. Okay. And if we were to look at Figure 25,
4 so the -- the Butler matrix is Item 380, right?

5 A. The Butler mode form, yes, would be that
6 which is contained in 380, and then Agee also discloses
7 other processing elements that are necessary --
8 typically necessary for performing the -- starting to
9 perform the signal processing associated with the
10 outputs of each -- each one of those outputs coming off
11 the Butler mode form 380.

12 Q. And when it says -- or when you say that
13 Figure 25 discloses the Butler mode form which is
14 connected to the antennas and the antenna arrays, is
15 that the -- the upsidedown triangle, the antennas?

16 A. That's one antenna depicted, and a person
17 of ordinary skill in the art would understand that
18 there would be an antenna connected to each one of the
19 inputs on the Butler mode form shown in 380.

20 Q. And the inputs would be on the left side,
21 or all of them -- or both the left and the right?

22 A. No, it would be on the left side, and it
23 could be reacting as a transmit antenna or receive
24 antenna.

25 Q. And then what are the lines on the right

1 side of the Butler mode form?

2 A. Those are the outputs of the mode form, the
3 Butler matrix, and that goes through a bandpass filter,
4 transmit and receive switches, low-noise amplifiers,
5 et cetera, up conversion, down conversion.

6 Q. But it just shows one line to the BPF 382,
7 right?

8 A. A person of ordinary skill in the art would
9 understand that each one of those outputs would go
10 through the same signal processing chain, and I
11 reference that in my declaration.

12 Q. And they -- so they all go to 382, just
13 like the input would all come from the antenna?

14 A. There would be multiple antennas, and there
15 would be multiple -- typically multiple bandpass
16 filters, and one connected, for example, to each one of
17 those outputs. So you look at that figure and you
18 duplicate that circuitry across each one of those
19 outputs.

20 Q. Okay. Returning to the language of Claim
21 Limitation 1.6, when we were talking about the output
22 of the Butler combiner -- well, first, sorry, let me
23 ask you this.

24 For the paragraph -- or for the figure we were
25 looking at, 25, that -- find the paragraph number

1 again.

2 On page 190 of your declaration, can you -- what
3 would be the Butler combiner in this figure?

4 A. Well, the Butler -- the -- the combiner is
5 interior -- the Butler combiner, that is the summer, is
6 inside the Butler mode form. That's where those --
7 again, signals coming in from the antennas, they go
8 through those elements within the Butler matrix,
9 they're combined, they're summed in various ways, and
10 then they're output.

11 So that's -- I mentioned previously that the
12 Butler matrix itself has a combiner in it as well as
13 the Agee reference talks about a combiner output. It
14 has a combiner that's attached to the signal processing
15 chain coming out of the outputs of the Butler matrix.

16 Q. Okay. So when you're referring to the
17 Butler combiner, how would that correspond to
18 Figure 25?

19 Would that be internal to the Butler mode form, or
20 external to it?

21 A. For 1.6, I am pointing to the specification
22 in Agee that is talking about the calculation of the
23 weights and specifically referring to the output of the
24 multilink adaption algorithm, and that is listed as the
25 combiner output.

1 Q. Okay.

2 A. In the Agee reference.

3 Q. Would that correspond to Figure 25?

4 A. The Figure 25 shows how Agee is proposing
5 to integrate the Butler matrix into the disclosed
6 system in Agee and the necessary signal processing
7 elements that have to come into play, and then that's
8 flowing to what would be next in the signal processing
9 chain, for example, the disclosures in Figure 24 which
10 show the multilink adaption algorithm, for example.

11 Q. Okay. So are you able to say whether the
12 Butler combiner would be within the Butler mode form,
13 Item 380 in Figure 25, or external to it?

14 A. I did answer that question.

15 The Butler matrix inherently includes a combiner,
16 and that -- for addressing 1.6 claim elements, in terms
17 of the weight calculations, I am going to, as part of
18 that, the signal -- the multilink adaption algorithm
19 which uses the term "combiner output," so I am using
20 combiner output in that section to specifically talk to
21 the output of that combiner which I could point to if I
22 find a figure -- I will tell you, which I think it's in
23 the 30s, it is -- maybe not. Maybe it's earlier. Oh,
24 okay. Figure 30.

25 Q. Okay. So I do understand the Butler

1 combiner is an adder or a summer, correct?

2 A. That's essentially what it does to the
3 understanding of a -- from the understanding of a
4 skilled artisan.

5 Q. Okay. And to give a simplistic example,
6 you could have a summer and adder that adds the numbers
7 two and five and you would get an output of seven,
8 right?

9 A. Essentially, that's what a summer does. It
10 takes two things, combines them together, and depending
11 upon their characteristics gives you an output
12 associated with the two inputs. And it's a linear
13 process, which is the important part of it.

14 Q. Okay. So in my example, if you just look
15 at the output, the output of seven, you're not able to
16 determine the -- the inputs, right, that it was -- that
17 the inputs were two and five?

18 A. Well, certainly that if you're just giving
19 an abstract example, a particular value when you're
20 saying what's the possible combinations that create
21 this value, you can come up with an infinite number of
22 solutions.

23 But in the disclosure of Agee it's quite clear,
24 and also to the perspective of a person of ordinary
25 skill in the art, if you're asking them on a given

1 output that is a combination of two antenna inputs or
2 multiple antenna outputs is that output representative
3 of what's coming in and does it contain, for example,
4 the signal information on each one of those in a
5 combined fashion, the answer is yes. It's -- it's in
6 there.

7 Q. Sure. I think you may be ahead of me. I'm
8 a very simple-minded person, and I'm just talking about
9 the number seven.

10 If you looked at the number seven, you wouldn't
11 know if the inputs were two and five or three and four
12 or one and six, right?

13 A. Well, again, in the abstract if you're just
14 giving me some integer value and asking me what
15 combinations can create that, you can come up with, as
16 I said, an infinite number of answers.

17 Q. Okay. So then in our example when we're
18 looking at the output of the Butler combiner, are you
19 able to, just looking at the output, determine what the
20 inputs or the input information were by looking at the
21 output?

22 A. You can -- the output contains the
23 information. The question is, is how are you going to
24 use it, and that's what Agee discloses. So while the
25 signal information is there, it just depends upon how

1 you want to use it in the signal processing chain.

2 Q. Okay. So would you say the same thing
3 about my example of the output being a seven and the
4 inputs being a two and five, you would say that the --
5 the information is there, just in the number seven?

6 A. There's apples and oranges you're comparing
7 there, particularly from an engineering system.
8 Certainly you have the combination and depending upon
9 what else you're doing in the system, you would make a
10 determination of what information is in that output
11 that you're abstractly defining, and that's where the
12 signal processing chain has to come into play.

13 A person of ordinary skill in the art understands
14 that in terms of receiving signals and calculating
15 weights, for example, you have to make a description of
16 both the environments, the signals, and the signal
17 processing chain to be able to come up with a
18 calculation of valid weights.

19 And in the case of Agee, he discloses several
20 techniques -- the QRD composition, the singular-value
21 decomposition techniques -- for calculating these
22 weights, which are -- all have rigorous mathematical
23 background for supporting their use in making a
24 determination of signal characteristics and/or weight
25 values for implementing a particular beamforming, in

1 this case, system.

2 Q. Right. And I -- I'm just trying to
3 understand how this system works and what the output of
4 the Butler combiner is.

5 Is it like my example with the -- the numbers
6 where you just get the output, or does it contain
7 additional information that allows you to know what the
8 input signal information is?

9 A. Well, based on your simple example, an
10 engineer designing that system, essentially, if you
11 want to go that simple, looking at the output would say
12 that the output contains input one, plus input two,
13 plus input three, plus input four, and it would use
14 that mathematical representation for doing analysis in
15 how the rest of the signal processing chain is going to
16 work, and I can't give you a better answer than that.

17 That's -- it's there, it can be represented
18 mathematically, and it can be used in the rest of the
19 signal processing chain.

20 Q. Sure.

21 But in my example you would agree with that just
22 knowing the output does not tell you the input, so you
23 might have a range of -- of possibilities or know it
24 adds up to the output, but you wouldn't be able to
25 recreate the output if you're just given the number

1 seven and you know it's an adder?

2 A. No, I disagree with that. Your context is
3 outside of the context of the realm of what we're
4 talking about here with respect to a signal processing
5 system. You are collapsing information in your
6 representation.

7 So for example, you can take any representation at
8 any point in time, and you could reduce the
9 dimensionality of the representation and say, well,
10 there's -- the dimensions aren't there because I'm just
11 looking at a scale or value.

12 Well, if you're forcing that, you're inducing the
13 collapse of information content to make that case. I
14 disagree with what with respect to what's going on here
15 with the disclosed system in Agee.

16 Q. I'm just trying to understand that -- the
17 signal chain, and I -- I understand your opinions, but
18 I just -- I'm asking a specific question.

19 If you were looking at the output, do you agree
20 that you could not -- you would not know the specific
21 inputs that -- that led to the -- the output?

22 It may be that you don't care, but I'm just trying
23 to understand if you agree with that statement.

24 A. No, I don't.

25 Q. You don't.

1 So your opinion is that you can create the --
2 recreate the specific inputs from by just looking at
3 the output?

4 **A. From the disclosed system, yes.**

5 Q. And that's why I started this discussion
6 with -- with asking the -- the form of the output. I
7 was trying to understand that -- you know, if it was
8 something like just a number, like seven, or if it had
9 more information that would allow you to -- to recreate
10 the inputs.

11 So is your opinion the -- the latter, that it has
12 more information?

13 **A. No. My opinion is that your example is not**
14 **germane to the discussion of the disclosed system, is**
15 **what I'm saying.**

16 Q. Okay. In Limitation 1.6, how is
17 determining the set of weighting values, the W in Agee,
18 based on the first signal information and the second
19 signal information?

20 **A. So throughout this section I go through**
21 **the -- how Agee discloses his system and specifically**
22 **that he's taking the outputs that are being fed through**
23 **that Butler matrix and going through that initial**
24 **signal processing chain, going into the multilink**
25 **adaption algorithm, and in several parts he goes**

1 through, again, in great detail, for pulling out
2 information associated with the receive -- received
3 signals.

4 Part of that is, again, calculating weights for
5 doing an optimization analysis of the received signal,
6 and particularly the FFT base least-squares algorithm,
7 and what I point to throughout the paragraphs in this
8 section -- and as you pointed out, it's lengthy,
9 because there's many ways to do this, and he's
10 disclosing a particular way to do this to provide an
11 optimum solution for his system.

12 And so the answer to your question is -- I can --
13 I can go through this paragraph by paragraph, but
14 essentially you're taking that received signal
15 informations, it's going through the signal processing
16 chain, it's going into the adaption algorithm, and so
17 that information, that signal information is being used
18 to calculate the weights, to optimize the performance
19 of the system. So you're basically steering the beam
20 in the system in a given direction that will minimize
21 your mean squared error, is what's going on here.

22 Q. Sorry.

23 You say that he goes through -- by "he," you mean
24 Agee, goes through in great detail for pulling out
25 information associated with the received signals,

1 correct?

2 A. I think the word that I said -- I phrased
3 it that way, and what I was speaking to is the process
4 for calculating the weights and the algorithms
5 disclosed in Figures 35 and 37, as well as the other
6 excerpts I have listed here in the -- in this section.

7 Q. Does Agee specifically pull out the first
8 signal information?

9 A. Agee uses the first signal information to
10 do the weight calculation.

11 Q. So when you say pulling out information
12 associated with the received signals, what -- what are
13 you specifically referring to?

14 What -- what specific information is pulled out?

15 A. The optimized weights for minimizing the
16 mean squared error.

17 Q. Okay. And so when you say "pulled out," I
18 mean, that -- that sounds like that's the goal or
19 the -- the output of the algorithm, right?

20 A. The weights -- the point of the
21 algorithm -- the goal of the algorithm is to minimize
22 mean squared error, and the weight calculation is part
23 of that. And what the weight calculations are based
24 upon is the received signal information, and that
25 includes the first signal information and the second

1 **signal information.**

2 Q. Okay. But I read the -- the pulling out
3 differently.

4 I mean, when you said "pull out," it sounded to me
5 like you were talking about taking out specific things
6 from -- from the input, but it's really just generating
7 like an output calculation?

8 A. The characteristics of what it's operating
9 on -- and those characteristics would include the first
10 and second signal information -- determine --
11 ultimately determine the output in conjunction with
12 whatever optimization or algorithm you're implementing
13 to manipulate that received information.

14 So the answer to that is you're calculating
15 weights in the end, and that weights provide you with
16 an optimum mean squared error solution.

17 Q. Can you look at paragraph 568?

18 A. **568.**

19 Q. Okay.

20 A. **Okay.**

21 Q. Do you see here you say that "Agee
22 expressly confirms that the Butler matrix output is the
23 input to the algorithms described in Figure 30"?

24 A. **Yes.**

25 Q. And the algorithm described in Figure 30,

1 that's what you're relying on for this limitation,
2 right, Limitation 1.6?

3 **A. It's part of what I'm relying on. I go**
4 **through -- again, I go through many excerpts within the**
5 **documents. Here I am explicitly pointing to that**
6 **algorithm as an example.**

7 Q. In paragraph 572, do you see this -- can
8 you turn to paragraph 572?

9 **A. Yes.**

10 Q. You say that "Agee uses the different
11 signal informations, the signal strengths received, to
12 calculate weights used for receive and transmit
13 beamforming"?

14 **A. Yes, I do.**

15 Q. So in this paragraph you're relying on
16 signal strengths as -- as the information, right,
17 that's why you have it in the parentheses?

18 **A. I point to that as an example of the signal**
19 **information, yes.**

20 Q. You're not discussing other forms of
21 information in this paragraph, right?

22 **A. I only point to signal strengths in this**
23 **paragraph.**

24 Q. Since we're here, let's look at Limitation
25 1.7.

1 A. Okay.

2 Q. When it says "this set of weighting
3 values," for that are you referring to the output of
4 the algorithms described in Figure 30?

5 A. Figure 30 shows the implementation of those
6 weight -- calculated weight values. I have other
7 references to how the weights are calculated through
8 other references to Agee, and here I'm discussing how
9 those weights are used in the system which is to be
10 applied, and that application would be on the --
11 constructing the beams on the outputs, and that would
12 actually be better shown in a different figure in Agee
13 where those weights come into play, and I think that's
14 Figure 24.

15 Q. In paragraph 573 you talk about combiner
16 weights and distribution weights.

17 Do you see that?

18 A. Yes, I do.

19 Q. So 1.7, when you say wherein the
20 limitation's set of weighting values used by the
21 transceiver to construct transmission signals -- so
22 would that be what you -- what you call distribution
23 weights (transmit weights)?

24 A. Yes. The distribution weights are the
25 transmit weights which you use for creating a signal to

1 be transmitted. So that would be the beamform
2 transmission signals, yes.

3 Q. And it would not be the combiner weights
4 (receiver weights)?

5 A. You have a set of weights that are used for
6 combining the inputs, and that's correct, that's also
7 referred to as receiver weights, and then a separate
8 set of weights for calculating the outputs. And Agee
9 discloses a reciprocity system, so there's actually a
10 relationship between those two.

11 Q. So again, your opinions for Limitation 1.7
12 go on for several pages, and -- trying to understand if
13 that's relevant or necessary for the claim language or
14 if there's something important in your -- the material
15 that you quote or block quote.

16 A. I wouldn't have -- again, I don't include
17 it to be superfluous. I included it because I thought
18 it was germane, and I think it's just a fulsome
19 presentation of my opinion. I could have added more
20 there, if that's what you're asking. I, again, didn't
21 limit myself to a specific amount of word count or page
22 number.

23 Q. And did you say that you think -- you
24 referenced a figure in Agee. What was -- was that
25 Figure 24?

1 A. You mean when I was previously discussing
2 where the weights are used in the system?

3 Q. Yeah. I -- I thought that we -- we were
4 talking about the previous figure, but then in 1.7 you
5 said that that was shown in another figure.

6 And do you recall what figure you mentioned?

7 A. Yeah. I was pointing to Figure 24.

8 Q. Do you recall where Figure 24 is in your
9 declaration, offhand?

10 A. I can find it.

11 Yes, on page 127 of my declaration.

12 Q. Okay. And so could -- with us looking at
13 Figure 24, can you maybe explain what -- why you're
14 referencing it and what we should be looking at?

15 A. Well, I'm saying that within the context of
16 our conversation with respect to the weights being used
17 in the system for receiving and transmitting, in Block
18 136 you see the multilink receive weight adaption
19 algorithm, so that's where the weights are adapted to
20 provide that optimum solution, and then you see in
21 Block 138 the multilink diversity combining, the
22 received weights, the Ws there, that's where they're
23 being applied to the combination.

24 And then in 152 you see the multilink diversity
25 distribution, and you can see the weights, the

1 conjugate values of the weights are being used there
2 for the transmission signal processing chain.

3 Q. Can we turn to page 255 of your
4 declaration?

5 A. Okay. I'm there.

6 Q. Do you see the -- the claim language of
7 1.8?

8 It says, "Cause the transceiver" to receive -- "to
9 transmit a third signal to the remote station via the
10 antenna, the third signal comprising content based on
11 the set of weighting values"?

12 A. I do.

13 Q. In Agee, what is the transceiver that
14 transmits a third signal to the remote station via the
15 antenna?

16 A. Agee discloses the MIMO transceiver, and as
17 part of that you'll see the -- the weights being used
18 as part of that transceiving process.

19 Q. And so you're pointing to the MIMO
20 transceiver in Agee as the claimed transceiver?

21 A. He does disclose a transceiver, and he does
22 say it's a MIMO transceiver, yes.

23 Q. What about via the antenna; what is the
24 antenna in Element 1.8?

25 A. That's the output -- the signal going out

1 of those antennas we looked at earlier with respect
2 to -- attached to Agee's system on the left of that
3 Block 380 that we referenced previously.

4 Q. And is that one signal or multiple signals?

5 A. You have the signal coming through the
6 system to be transmitted in a beamform fashion. So
7 that energy coming out, so the -- the signal going to
8 the antennas, from the perspective of a person of
9 ordinary skill in the art, would understand that as
10 a -- essentially a composite signal of whatever is
11 going to be transmitted, and that could be made up of
12 multiple subsignals, if you have data that you want to
13 send, for example.

14 But you can consider that, from a signal
15 processing perspective, to be a single signal that's
16 being sent through the signal processing chain, that
17 multilink diversity distribution where the weights are
18 applied, to form the proper directionality of that
19 signal once it goes through the Butler matrix to be
20 transmitted to the receiver.

21 So the answer to that question is, yes, it's a --
22 would be considered a third signal essentially going
23 out.

24 Q. And for -- for this claim element, in
25 paragraph 594, you say that during prosecution it was

1 asserted that this, quote, content based on the set of
2 weighting values, end quote, was merely the application
3 of the computed beamforming weights.

4 Do you see that?

5 A. Yes.

6 Q. And that's the understanding that you
7 applied in this IPR?

8 A. What I'm saying is that the applicant
9 specifically stated that, and that is within the
10 perspective of the understanding of a person of
11 ordinary skill in the art in terms of what it means to
12 be the third -- third single comprising content based
13 on the set of weighting values that's consistent with
14 that. It doesn't mean I'm limiting it to that, but
15 that's consistent, and I'm pointing to that here.

16 Q. What does "content" mean?

17 A. Again, it's a broad term, and in this case
18 applying the weights to something. So you're basically
19 shaping that signal in a given way, so basically
20 you're creating content based on the application of
21 those weights. It could be the internals of the
22 signal, it could be specific externals. Again, it
23 depends on context, but certainly this evidence that
24 I'm pointing to falls well within that context with
25 respect to the understanding of a skilled artisan.

1 Q. Okay. So in paragraph 598 you -- you
2 discuss kind of an alternate understanding, right,
3 where you -- you say that -- you talk about the concept
4 of actual weights being transmitted between devices.

5 Do you see that?

6 A. Yes, I do.

7 Q. And you don't believe to a person of
8 ordinary skill that that's required by the limitation?

9 A. I'm stating that the '235 patent does not
10 disclose that, and so I'm just making that -- that
11 flat-out fact statement that there's nothing that I saw
12 in my analysis of the '235 patent that it discloses the
13 requirement of transmitting weights.

14 Q. It says the actual weights.

15 So what -- what do you mean by "actual weights,"
16 or what does that mean?

17 A. The calculated weight values.

18 Q. Okay. Would Agee disclose that,
19 transmitting the calculated weight values between
20 devices?

21 A. With respect to paragraph 598 in my
22 reference, that you're actually sending the weights
23 within the signal, I don't recall Agee discussing that.

24 Q. Okay. Is 599 a good summary of your
25 opinion for Agee for this limitation in that it

1 discloses Limitation 1.8 for the same reason as cited
2 for Littlejoe above and for the same reason it's
3 disclosed in the '235 patent to the extent it is?

4 A. Well, it's certainly a concise statement of
5 my opinion that it is disclosed for those same reasons.
6 I'm not making a -- I'm not limiting my analysis beyond
7 that, but it's certainly -- I'm pointing to the fact
8 that since it's -- the same reasons cited for Littlejoe
9 and the same reasons that it's disclosed or found to be
10 disclosed in the '235, it's also disclosed in Agee.

11 Q. What -- what other way is it disclosed, if
12 you say that it's not -- your opinion is not limited to
13 that?

14 A. Well, there's more of a fulsome discussion
15 here in terms of my presentation. I wouldn't -- what
16 I'm saying is I wouldn't limit my analysis to be so
17 narrow because I discuss what's actually going on in
18 Agee's disclosed system and why it supports this
19 analysis, so I'm -- comprehensive within this section
20 that I discuss in 1.8, I would include all that
21 material.

22 ATTORNEY WANG: Let's take a short break
23 and -- and go off the record.

24 ATTORNEY ANDERSON: Okay.

25 (RECESS TAKEN.)

1 ATTORNEY WANG: Thank you, Dr. Mahon. I
2 checked my notes, and I have no further questions, so I
3 will pass the witness.

4 Thank you for your time today.

5 **THE WITNESS: Thank you.**

6

7

EXAMINATION

8

9 BY ATTORNEY ANDERSON:

10 Q. Doctor, I just have a couple questions.

11 In your analysis for Elements 1.3, 1.4, 1.5, does
12 that analysis apply to only one particular form of data
13 that's received in Agee, or does that analysis apply
14 to -- to all the data?

15 A. Well, as I discussed today, that -- that
16 would apply to all forms of signal information, which
17 in this case I mentioned previously that there's a list
18 of potential signal information, so it would be
19 applicable to all those.

20 Q. Okay. And for the data being received by
21 the Agee, does that processing that applies to the data
22 in Elements 1.3, 1.4, 1.5, does that apply to the pilot
23 signals that you discuss in Element 1.6?

24 A. Yes. I specifically call out the pilot
25 data as an example; and yes, so therefore it is

1 applicable to that.

2 ATTORNEY ANDERSON: Okay. I'll pass the
3 witness.

4

5 EXAMINATION

6

7 BY ATTORNEY WANG:

8 Q. Just a couple of questions.

9 Your -- your counsel asked, Doctor, if -- well,
10 first your -- your counsel asked you several questions
11 about data.

12 What -- what understanding were you applying to
13 data?

14 A. The -- the signal that's being transmitted
15 typically carries data, right, and one of the data it
16 carries is pilot data, in this -- Agee's disclosures.

17 Q. Okay. So today we -- we discussed the
18 signal and then we discussed certain information about
19 the signal such as signal strength.

20 And so when you use "data," are you referring to
21 something different than signal information or signal
22 information that we discussed?

23 A. Well, the signal strength is -- would be
24 inherently coupled to the signal that you're receiving,
25 and that signal that you're receiving, as disclosed in

1 Agee, has pilot data and it has just regular data,
2 plain, vanilla data, so it's part and parcel of that.

3 Now, Agee discloses that how you make some of the
4 measurements are based off of the known pilot data
5 sequence, and so that is disclosed in Agee for doing
6 some of the -- or performing some of the calculations,
7 and that's what you see in the algorithm flows in
8 the -- some of the later sections that we discussed
9 today. So that algorithm talks about pilot signals,
10 for example, and that's part of the process.

11 Q. Okay. And then your counsel asked you
12 about -- said -- referred to the pilot signals that you
13 discuss in Element 1.6.

14 Do you -- do you recall that?

15 A. Yes.

16 Q. Okay. Do you know if you explicitly
17 mention pilot signals in Elements 1.3, 1.4, or 1.5?

18 A. I'm going through my declaration.

19 I obviously talk about the pilot signals, the
20 tones, pilot tones, in my background section of Agee,
21 to my discussion of Agee, specifically associated with
22 the weight calculations.

23 Then if I go -- continue to go down -- let's see
24 here.

25 I -- I mention the pilot data many, many times in

1 the discussion of the development of Agee and how it's
2 integrated with all the calculations before I even get
3 to the discussion of the limitations. And I'm trying
4 to get there. I'm calculating timing offsets, for
5 example.

6 So I do have an excerpt that includes, in
7 paragraph 435, talking about the pilot data. So that's
8 part of 1.3. I do mention the pilot signals in
9 paragraph 446, 470, 471. So yes, I do discuss it as
10 part of those elements.

11 Q. I'm sorry.

12 To just help me understand, what's the difference
13 between pilot data and a pilot signal?

14 A. The -- as used here and as used in Agee,
15 the pilot signal is carrying pilot data, and they can
16 be used synonymously to a person of ordinary skill in
17 the art because you know what and how a pilot -- how
18 pilot data is used and how a pilot signal is used.

19 And in the disclosures in Agee with respect to,
20 again, the signal processing that's disclosed, the Agee
21 references pilot data. And let me see if -- Agee also
22 uses the term "pilot signal."

23 So to a person of ordinary skill in the art, for
24 example, within a given section of Agee they would
25 understand the context of the difference between

1 talking about the signal itself, which is carrying all
2 the pilot data, and then maybe, for example, a specific
3 example of when you're using the pilot data, the
4 contents of that pilot signal, for doing the
5 calculations. And it just depends upon which section
6 of Agee you're looking at or which algorithm flow
7 you're looking at, and even where in the algorithm flow
8 you're looking.

9 Q. Okay.

10 ATTORNEY WANG: All right. Thank you,
11 Doctor.

12 I have nothing further.

13 ATTORNEY ANDERSON: Nor do I.

14 Off the record.

15 (CONCLUDED AT 12:39 P.M.)
16
17
18
19
20
21
22
23
24
25

1 STATE OF _____)

2) SS.

3 COUNTY OF _____)

4

5 I, THE UNDERSIGNED, DECLARE UNDER PENALTY OF

6 PERJURY THAT I HAVE READ THE FOREGOING TRANSCRIPT, AND

7 I HAVE MADE ANY CORRECTIONS, ADDITIONS, OR DELETIONS

8 THAT I WAS DESIROUS OF MAKING; THAT THE FOREGOING IS A

9 TRUE AND CORRECT TRANSCRIPT OF MY TESTIMONY CONTAINED

10 THEREIN.

11 EXECUTED THIS _____ DAY OF _____,

12 20_____, AT _____, _____.

13 (CITY)

(STATE)

14

15

16

17 DR. MARK P. MAHON

18

19 SUBSCRIBED AND SWORN TO BEFORE ME

20 THIS _____ DAY OF _____, 2025.

21

22

23 NOTARY PUBLIC IN AND FOR SAID

24 COUNTY AND STATE

25

1 REPORTER'S CERTIFICATE

2
3 I, DANNIELLE COPELAND, RDR, CRR, DO HEREBY CERTIFY
4 THAT THE FOREGOING DEPOSITION OF DR. MARK P. MAHON
5 WAS TAKEN VIA ZOOM BEFORE ME AT 7:58 A.M. FOR THE
6 PURPOSE IN THE CAPTION STATED; THAT THE WITNESS WAS
7 FIRST DULY SWORN TO TELL THE TRUTH, THE WHOLE TRUTH,
8 AND NOTHING BUT THE TRUTH; THAT THE DEPOSITION WAS
9 TAKEN BEFORE ME STENOGRAPHICALLY AND AFTERWARDS
10 TRANSCRIBED UNDER MY DIRECTION; THAT THE FOREGOING IS A
11 FULL, TRUE, AND CORRECT TRANSCRIPT OF THE SAID
12 DEPOSITION SO GIVEN; THAT THERE WAS A REQUEST THAT THE
13 WITNESS READ AND SIGN THE TRANSCRIPT; THAT THE
14 APPEARANCES WERE AS STATED IN THE CAPTION.

15 I FURTHER CERTIFY THAT I AM NEITHER OF COUNSEL NOR
16 OF KIN TO ANY OF THE PARTIES TO THIS ACTION, AND AM IN
17 NO WAY INTERESTED IN THE OUTCOME OF SAID ACTION.

18 WITNESS MY SIGNATURE ON JANUARY 21, 2025.
19
20

21 *Dannielle Copeland*

22 _____
23 DANNIELLE COPELAND, RDR, CRR
24 CALIFORNIA CSR 14444
25 TENNESSEE LICENSE 807
WASHINGTON CSR 22000824

1 Errata Sheet

2

3 NAME OF CASE: ERICSON INC. vs XR COMMUNICATION LLC

4 DATE OF DEPOSITION: 01/07/2025

5 NAME OF WITNESS: MARK P. MAHON, M.D.

6 Reason Codes:

7 1. To clarify the record.

8 2. To conform to the facts.

9 3. To correct transcription errors.

10 Page _____ Line _____ Reason _____

11 From _____ to _____

12 Page _____ Line _____ Reason _____

13 From _____ to _____

14 Page _____ Line _____ Reason _____

15 From _____ to _____

16 Page _____ Line _____ Reason _____

17 From _____ to _____

18 Page _____ Line _____ Reason _____

19 From _____ to _____

20 Page _____ Line _____ Reason _____

21 From _____ to _____

22 Page _____ Line _____ Reason _____

23 From _____ to _____

24

25 _____

(	1.8 113:7,24 117:1,20	165 37:9	2017 67:2	111:25 112:7, 8,13
(a) 68:16	10,715,235 15:11	178 66:13 67:14 68:20,22 69:18	2022-00367 70:3	25 24:15,18,19 29:9 34:6,7 95:22 96:3,13 97:25 98:18 99:3,4,13
(e) 68:16	1003 15:4	179 68:3	2022-01155 74:14 77:1	
1	1010 69:9 74:6	18 90:19	2024 11:10	255 113:3
1 35:5,12,24 65:1 72:16 77:10	1011 74:12	183 66:25	2024-00613 15:13	256 58:7
1.3 36:18 38:8 55:5,8,10 59:4 60:10 61:1 70:15 73:13 74:22 118:11,22 120:17 121:8	102 68:16	187 67:5	204 67:9 73:25	257 76:17
1.4 72:15 73:3 77:5,15,21 118:11,22 120:17	105 15:15	19 22:17	214 39:16 40:6, 10,15 73:25	259 69:25
1.5 118:11,22 120:17	10th 68:14	190 95:21 98:2	215 73:25	264 76:22
1.6 90:9,12,25 97:21 98:21 99:16 105:16 109:2 118:23 120:13	127 112:11	1960 30:23 32:1	217 75:23	286 15:6
1.7 109:25 110:19 111:11 112:4	12:39 122:15	1960s 32:4	23 7:20	3
	136 112:18	1st 66:19	230 74:5	3 18:6
	138 112:21	2	235 8:16 10:23 17:23 18:6 19:12,22 21:10,16,19 22:3 25:12, 23,25 28:2 33:2,6,13 35:5,6,10,12, 24 36:17 49:9 65:2 66:1,12 78:12 116:9, 12 117:3,10	3,255,450 18:17
	15 37:11,13	20 8:6 70:2	24 22:10,12,19 99:9 110:14	30 99:24 108:23, 25 110:4,5
	152 112:24	2000 30:23 32:2,9		30s 99:23
	16 36:23 37:24 38:4	2001 68:14		33 23:16 24:2
	161 15:17	2002 66:17,20 67:18,19,24 68:24 69:22		330 74:20
	162 18:22			35 107:5

354 15:18	96:1	598 116:1,21	99:10,18	68:1
355 18:23 29:24	46 96:1	599 116:24	105:25	affected 42:23
356 30:2	470 121:9		106:16	Agee 18:15,16
360 32:18	471 121:9	6	added 67:1 83:3 111:19	19:1,9,13,19, 20,22,25
361 30:21	4th 66:16	64-by-64 56:25 57:1	adder 100:1,6 104:1	20:9,10,11, 17,21,24
37 107:5	5	7	adding 81:4 83:14,23	21:4,10,16, 22,24 22:4
370 37:9,10	5 78:23 81:20	7,248,841 18:16	addition 80:19	25:11,14,23, 24 26:17
380 96:4,6,11,19 99:13 114:3	50/50 7:5	A	additional 8:13 19:24 20:15,18 41:13 77:1 92:8 103:7	27:1,3,11,16 28:1,19,20 29:21 32:2, 12,16 33:2,5, 9,12,13,17, 18,23 35:4,9, 11,14,24
382 97:6,12	514 72:20	abstract 100:19 101:13	address 19:23 24:3 27:14 40:24 41:23 66:15, 23 69:23	36:21 38:12, 14,15,23 39:5,12 40:1 45:1,9 47:8 55:15,17,20, 21,24 59:16
4	519 78:23	abstractly 102:11	addressed 29:20,21 70:12	60:14,19 61:19 62:19, 23 63:5,8,10, 13,15,25
4 22:13	527 78:9 81:20	accepted 74:15	addresses 21:16,21 38:23	64:25 65:1,10 68:13,14,15 77:22 78:14
40 64:3	533 79:22 82:2 84:23	account 25:2 58:22 64:15	addressing 32:18 81:12 99:16	86:19,24 90:22 91:4,8 92:4,6,10,11, 12 93:1,6
422 36:12 55:6,8	536 90:9,10	accused 6:16 7:4	adds 94:4 95:14 100:6 103:24	94:2,20,21 95:12 96:6 98:13,22 99:2,4,6
423 36:20 38:1	537 90:17	active 63:17,19,22 64:7,17,22	adopted 69:19 70:10	100:23 101:24
435 121:7	568 108:17,18	actual 31:19 50:14 116:4,14,15	affect 12:6 13:5,8	
446 121:9	572 90:17 109:7,8	adapted 112:19		
448 86:18	573 110:15	adaption 95:13 98:24		
45	594 114:25			

102:19	algorithm	23,24 28:5,	119:2 122:13	52:4 54:6
104:15	87:2 88:1	17,20 29:20	angle	55:15,22
105:17,21	95:14 98:24	30:20 33:6	48:2	56:15 57:4,
106:24 107:7,	99:10,18	35:7,14,15,	annotations	22,23 58:2,3,
9 108:21	105:25 106:6,	19,23 36:2	14:25	4 61:6 70:23
109:10 110:8,	16 107:19,21	39:8,13,15	answers	71:5,8 76:24
12 111:8,24	108:12,25	40:25 41:10,	101:16	79:24 80:4
113:13,16,20	109:6 112:19	12,18,19	antenna	81:9 82:4,18
116:18,23,25	120:7,9	42:18 43:10,	39:22 46:2,3,	85:10 86:21
117:10	122:6,7	19 44:13,14,	5 48:17,18	96:14,15
118:13,21	algorithms	16 47:1,7	49:3,11,17	97:14 98:7
120:1,3,5,20,	107:4 108:23	48:4 49:1,11,	50:1,10,13,	114:1,8
21 121:1,14,	110:4	12,13 50:21	20,22,25	anticipated
19,20,21,24	align	51:3,19 53:17	51:4,6,7,20	11:22 24:17,
122:6	40:25	54:14,19	52:1,2,4,7,19,	21 25:17
Agee's	aligned	60:3,12,25	20,22 53:2,3	anticipates
32:21,23	42:16	61:6 62:9,11	54:12,25	25:12 35:12,
39:2,9 62:10	alternate	63:9 64:16	55:11,12,16,	24
78:10 79:23	116:2	65:3,5,11	17,19,22,25	anticipation
80:14 82:2	amount	66:7,10 68:4,	56:7,24 57:2,	24:8,14 25:6,
95:22 114:2	111:21	9,19 72:11	14,21,23	8 26:1,9
117:18	amplifiers	73:10,12,13	58:1,6,25	27:21 28:10,
119:16	95:14 97:4	74:1 76:1,25	59:18,21,23	16,20 35:18
agnostic	amplitude	77:18 82:13	61:2,4,22	anticipatory
41:5	46:10 47:1	83:10 92:18	62:14 70:24	26:24
agree	49:5 79:10,15	103:14 106:5	71:8 73:16	anymore
11:16 25:22	amplitudes	116:12 117:6,	74:19 75:4,6,	43:25
40:22 41:24	80:19	16,19 118:11,	8,10,15	aperture
44:3 103:21	analog	12,13	78:13,14	59:1
104:19,23	50:1 94:9,10	analyzed	81:1,4,8	apologize
agreed	analog/digital	27:1,9,11	82:24 85:9,	44:18
70:10	94:5	analyzing	11,15,16	appearing
agreeing	analyses	26:15 71:23	96:14,16,18,	72:23
42:10	63:7	79:20 84:9	23,24 97:13	appears
agrees	analysis	and/or	101:1,2	77:10
43:17,21	16:15 20:1,4,	102:24	113:10,15,23,	apples
ahead	13,16 21:15,	Anderson	24	102:6
85:3 86:17	25 25:13	9:10,16 72:3,	antennas	applicable
88:9 91:6	26:2,5,10,16,	7 85:2 86:16	45:24 49:2,5,	20:14 53:10
101:7		88:8 90:1	15,23 50:7,9,	
		91:5 94:15	12,19 51:17	
		117:24 118:9		

118:19 119:1	70:5,11 73:24	21 54:11	27:21	
applicant	74:16	61:15,18,21	asserted	B
115:8	array	64:13 89:2	19:22 21:18	back
application	39:21,22	art	22:3,4 25:25	9:21 10:13
76:6,11 87:1	40:2,3 45:2,3,	10:25 17:18	28:6 29:2,4	22:19 28:15
110:10 115:2,	11,16,23,25	18:1,3,11,13	33:19 41:17	34:4,17 36:7
20	46:4,5,11,16,	19:15 20:23	66:18 68:23	38:7 44:23
applications	22 47:5,6	22:6 24:23,25	115:1	49:6,23 52:14
14:10	48:12,21,22	25:2,19	assume	62:13 64:3
applied	49:11,12,15,	26:11,13 28:7	5:8 51:1	65:5 67:16
23:10,22 87:7	17,19 50:4,6	29:4,6,7	68:15	68:20 69:4,18
110:10	51:1,9,15,24	31:10,24	assumed	72:14 84:14
112:23	52:2,17,18,	32:19 33:20	66:16	87:3 90:4,24
114:18 115:7	21,22,25	34:1,22 40:3	assuming	92:17
applies	53:8,9,16,19,	41:12,20,23	40:14 67:21,	background
118:21	20,22 54:1,5,	42:18 43:8	23 83:22	73:18 102:23
apply	9,18,20 55:1,	45:3,13 46:10	attached	120:20
23:13 52:11	2,15 56:21,	48:11 49:21	13:14 55:22,	bandpass
118:12,13,16,	23,24 57:19	56:3 59:12	23 98:14	97:3,15
22	58:6,7,20,22,	64:11 65:6	114:2	base
applying	25 59:18	66:8 68:10,	attention	38:15,21,25
41:6 87:25	60:21,23	11,16,18	37:9 90:8	39:3,6,10
115:18	61:5,18,21	71:2,12,17,23	attorney	56:20 106:6
119:12	63:15 65:20	74:16 75:2,14	4:6 22:21,24	baseband
approach	71:6,14,20,24	76:2 77:2	36:4,6 44:20,	94:10
20:2 28:9,18	75:3 82:25	79:14 80:13,	22 62:6 72:3,	based
approval	85:5 86:6,14	25 83:20	4,7,12 85:2,	19:8,15,19
65:18	88:11 89:2	88:14,20,24	23 86:16	29:5,16 33:19
Approximatel	arrays	94:24 96:17	87:11 88:8	35:14 39:13
y	64:20 73:21	97:8 100:25	89:5,25 90:1,	41:14,18
8:3	74:21 96:14	102:13 114:9	3 91:5,16	43:18 53:17
argued	arrive	115:11	94:15 95:4	54:20 60:20
39:19	71:7	121:17,23	117:22,24	62:12 65:6
argument	arrives	art's	118:1,9	68:9 73:23
43:9	47:7 57:19	41:1	119:2,7	76:25 82:9
arguments	71:18 81:8	articulate	122:10,13	89:2,19 90:13
40:18,23	arriving	28:5	avenue	91:18 93:6
65:12 69:20	45:14,24	artisan	35:21	103:9 105:18
	46:11,13,16	80:20 100:4	aware	107:23
	47:6 48:21	115:25	66:18 68:23	113:10 115:1,
	52:17 53:7,8,	aspects		12,20 120:4

basic 30:9	begins 32:13	117:22	16,21 81:11, 16 82:2,5,19, 20 83:2,5,9, 11,25 84:10, 15,20,23,25 85:4,11,18, 24,25 86:2,4, 5,7,11,12,14, 20 87:4,15, 16,20,24 88:6,13 89:7, 10,16,19,20 93:15,22 94:21 95:6, 10,17,23 96:4,5,11,13, 19 97:1,3,22 98:3,4,5,6,8, 12,15,17,19 99:5,12,15,25 101:18 103:4 105:23 108:22 114:19	93:6,12 102:14,21 106:4 107:4 108:14 111:8 121:4
basically 9:3 10:9 19:23 23:23 38:14 48:2 49:3 56:23 65:17 91:14 92:10 106:19 115:18,19	behalf 6:15,17,19	bringing 41:9,13		calculation 98:22 102:18 107:10,22 108:7
beam 38:24 106:19	behavior 58:5,9,11	broad 47:13 115:17		calculations 67:1 99:17 107:23 120:6, 22 121:2 122:5
beamform 39:5 56:16 111:1 114:6	big 56:18	broaden 18:12		call 43:16 110:22 118:24
beamformer 47:5 48:8 49:1 50:11 58:3 60:5	bit 72:10	broaden 18:6		calls 61:20
beamforming 31:22 38:23 47:9 49:10 50:13,15 54:14,15 56:11,14 63:16,17,19, 22 64:2,7,10, 18,19,22 65:21 71:13 76:6,10 94:22 102:25 109:13 115:3	bits 93:24 94:6,14	brower 14:13		care 104:22
	blank 37:2	bunch 51:10 58:2,4		carries 119:15,16
	block 90:22 91:20 111:15 112:17,21 114:3	Burke 76:20		carry 17:14
	board 13:8 65:8,19 69:19 70:4, 10,14 74:14, 15,18	Butler 18:15,17 19:1,9,10,13, 20,23 20:10, 13,15,18,20, 25 21:3,4,7 25:14 26:17 29:22 30:4,5, 10,11,13,16, 19 31:1,10, 12,13,20,21, 25 32:1,7,12, 20 33:4,9 39:21 40:1,13 45:1 55:15, 21,22,23 62:8,10,16, 23,25 63:12, 16,23 64:1,4, 10,18,21,23, 25 65:9,20 68:7 74:4,10, 11 76:15 79:23,25 80:4,11,14,	Butler's 31:3 32:23	carrying 121:15 122:1
	board's 12:19 13:21 69:2		bytes 94:14	case 4:12,22,23 6:1,5,21,25 7:7 9:5 10:10 12:3 14:15 16:16 17:3, 11,14,19 18:19 19:14 25:9 43:12,21 50:17 52:5 53:10 59:11 60:13 61:17, 19 102:19
	bold 38:9		C	
	bolster 41:10 43:4		C-4 76:5,10	
beams 110:11	bottom 37:12 72:23		calculate 86:22 106:18 109:12	
bearing 29:12	BPF 97:6		calculated 92:11,20,25 110:6,7 116:17,19	
beginning 67:5,8 69:4 74:20 75:22	break 36:10 44:19, 25 90:6		calculating	

103:1 104:13 115:17 118:17 cases 4:24 6:14 23:7 cell 79:15 center 51:12 cetera 24:17 54:8 95:15 97:5 chain 87:7,24 88:12,19,22 89:1,14,15,24 92:5 94:3,8, 23,25 97:10 98:15 99:9 102:1,12,17 103:15,19 104:17 105:24 106:16 113:2 114:16 challenged 10:23 17:14 19:17 20:5 change 13:9 57:22 68:4 88:3 changed 31:15,17,18 42:23 characteristic s 58:21 100:11 102:24 108:8, 9	charts 91:20,24 checked 118:2 chose 35:21 chronology 69:23 circuitry 30:22 97:18 cite 41:14 42:21 44:5 68:25 76:16,25 cited 11:12 13:17 117:1,8 cites 11:17 44:6 76:5,19 claim 11:19,25 12:2 13:20 15:22 16:2,5,9,14, 15,21 17:6, 17,23 18:2,6 21:10,15,19 23:19,21 24:16,20,23 25:12,17,18 26:4,7,21 29:4,6 34:22 35:5,12,24 36:17 38:7, 10,18 41:2 45:21 53:25 55:10,16 59:4,9 60:25 61:1 62:7 63:8,13 65:1	70:15 71:3, 23,24 72:2, 15,22 73:3, 12,14,17 74:3,22,23 75:12,13,15 76:20,23 77:5,6,10,15 84:11 89:4 90:11,24 91:17 93:13 97:20 99:16 111:13 113:6 114:24 claimed 39:3 55:25 60:10 84:2 92:24 93:13 113:20 claims 17:14 19:17, 22 20:5,9,12 21:17 22:3,5 25:23,25 26:2 28:6,7 29:2,4 33:2,13,19 35:5,15 65:25 69:21 clarify 5:14 10:11 13:10 72:9 clear 20:16 42:15, 25 56:3 100:23 clock 54:24 close 51:11 clustered 51:11	cogent 43:10 coherent 71:4 92:9 coincidence 73:2 collapse 104:13 collapsing 104:5 collection 50:12,18,19 56:14 Columns 95:25 combination 19:8,9,13,16, 19 20:4,12 24:25 26:17 30:25 80:22 81:1 89:17,18 101:1 102:8 112:23 combinations 100:20 101:15 combine 19:1 20:9 29:18,19 32:12,22 33:9 combined 32:20 79:25 80:4,11,16 81:2 82:4,19 83:2,8,21 84:16 86:20 87:5 98:9 101:5 combiner	79:25 80:11 82:5,19 83:2, 25 84:7,23,25 85:18,24 86:12,19,25 87:8,15,16, 20,24,25 88:6 89:7,8,16 93:15,22 95:6 97:22 98:3,4, 5,12,13,14, 17,25 99:12, 15,19,20,21 100:1 101:18 103:4 110:15 111:3 combines 82:21,23 100:10 combining 83:21,22 111:6 112:21 communicati on 38:13,24 63:5 communicati ons 4:11 39:10 comparing 22:3 102:6 complete 7:23 8:7 completely 54:22 complex 47:17 complicated 83:13 components
---	---	--	--	---

31:2,5,8 composite 114:10 composition 102:20 comprehensive 117:19 comprises 74:10 comprising 113:10 115:12 computed 115:3 computer 14:9 concept 31:21 46:14 47:2 116:3 concise 117:4 concisely 73:9 92:23 concluded 35:24 41:13 122:15 conclusions 41:19 43:14 conduct 9:6 conducted 9:19 confirm 14:22 65:16 confirms 108:22	confused 95:2 conjugate 113:1 conjunction 108:11 connected 95:16,24 96:14,18 97:16 connections 31:18 consideration 34:23 considerations 29:11,14 considered 25:11 60:23 69:7 114:22 consistent 34:18 41:16, 21 43:6 66:7 75:25 77:19 80:19 82:13 115:13,15 consists 86:20 constitute 79:12 84:17 construct 110:21 constructing 110:11 construction 11:20 12:1,2 13:20 15:22 16:2,5,10,14,	15,21 17:3,6, 20 23:19,22 29:6 31:20 contained 8:24 33:5 81:5 96:6 content 104:13 113:10 115:1, 12,16,20 contents 122:4 context 16:21 17:6 18:2 22:1,9 38:24 42:12, 15 44:7,10 47:7,14,18 48:4,7 53:5 55:3 56:10 57:9 71:12 75:12 79:19 87:2 104:2,3 112:15 115:23,24 121:25 continue 76:14 120:23 continues 22:17 conversation 112:16 conversion 97:5 converted 94:11 conveying 79:21 copy	14:14,23 correct 6:2,6,7 7:7,8 9:20,25 10:1, 6,7,23,24 11:2,10,11 13:15,16,18, 23,24 15:5 16:3 18:20 20:6,7 22:23 23:4,6,8 24:1, 6,11,12 25:9, 10 27:1,2,23 29:15,23 30:12 32:12, 14 33:2 34:16 38:6 40:9,20, 21 45:6 60:6 67:19,20,25 68:3,7 69:1, 13 73:6 77:11 78:5 82:7 84:24 86:1 87:14 90:18 100:1 107:1 111:6 corrections 8:10 correspond 78:10 98:17 99:3 cosine 47:16 counsel 7:23 9:8 23:3 36:2,9 90:5 119:9,10 120:11 count 91:15 92:14 111:21	couple 59:24 118:10 119:8 coupled 119:24 court 4:23 5:6 11:21 12:3 create 58:3 100:20 101:15 105:1 created 11:23 12:10, 15 13:20 creating 110:25 115:20 Crilly 40:12 44:8 65:19 67:8 D data 78:12 94:14 114:12 118:12,14,20, 21,25 119:11, 13,15,16,20 120:1,2,4,25 121:7,13,15, 18,21 122:2,3 date 7:16 30:3 66:12,14,15, 16,17,19 67:2,11,23 68:12,23 69:21 70:11 dates
--	---	--	---	--

67:18 68:2,5, 12	declined 74:14	deposed 4:2,18	7 89:3,21 93:19 102:10, 24	dimensionalit y 104:9
daylight 35:8	decompositio n 102:21	deposition 6:1,4,11 7:2 9:1,7,23 10:3 12:23 13:12	determine 58:21,23 73:4 76:3 77:6 81:21,22,23 84:11,12 90:12 91:17 100:16 101:19 108:10,11	dimensions 104:10
days 13:1	deemed 24:16,20	depositions 5:1,19		direct 38:24
December 7:20	defendant 6:15,18,22 7:3	derived 76:7,12		directed 27:3 38:13 63:25
decision 12:20 13:2,7, 22 69:3,15 70:7,8,14	defined 52:1	describe 45:12 47:2	determined 88:4	direction 48:6 54:16,21 57:15 78:14 106:20
declaration 7:6,14,21,23, 25 8:4,7,11, 14,24 9:2,25 10:13,17,19, 20 11:6,9,25 12:10,16 13:13,14,17 14:15,20 15:3,18 17:16 18:22 19:11 22:11 23:11 24:4 27:19 29:20,25 30:17 33:25 34:5 36:13 37:14,19 39:7,14,17 40:7,19,24 41:23 42:2,4, 8,12,13,21 44:11 47:4 48:7 60:11 62:11 67:12, 22 70:13 73:11 75:23 83:11 97:11 98:2 112:9,11 113:4 120:18	defines 17:8	description 65:25 66:4,10 102:15	determining 39:24 76:18 84:11 105:17	directional 58:1,2 64:16
	defining 102:11	descriptions 16:17	development 75:22 121:1	directionality 48:3 50:25 51:2 54:23 56:16 57:4,23 58:24 71:19 114:18
	definition 16:23 17:19 28:16	design 54:15 58:6 89:19	devices 116:4,20	
	definitions 18:12	designing 103:10	diagrams 93:3	directions 57:5 58:12
	delay 83:7,16	desktop 14:11	difference 24:7 25:6 51:14 52:3 56:6 64:12 121:12,25	dis- 67:2
	depend 44:4 62:8	detail 91:11,14 92:6 106:1,24		disagree 41:5 104:2,14
	depending 52:4 71:19 85:7 88:25 100:10 102:8	detailed 21:23 83:10 94:22	differences 29:5 34:22 35:4,9	disclaimer 16:21 17:1,11 23:25 24:5,6
	depends 47:18 50:14 51:9 58:19 61:9 101:25 115:23 122:5	details 26:11 91:20, 24 92:8	differential 52:3	disclose 22:7 27:4 28:3 48:7 55:21 74:17 113:21 116:10,18
	depicted 96:16	determination 47:8 84:1,5,6, 17,21 85:19, 22 87:14,17, 19,22 88:2,4,	differently 88:3 108:3	
	depiction 57:18		digital 14:14 94:9,10	disclosed 21:12 26:3,6,

14,18,19 28:8 29:8 31:12 32:1 39:19 41:19 60:14 62:19 65:6 74:4 75:13 96:2 99:5 104:15 105:4, 14 107:5 117:3,5,9,10, 11,18 119:25 120:5 121:20	13,16,17,19 27:13,15 32:15 33:11, 16 39:17 40:19 41:8 42:1 47:5 51:3 62:11 66:13,25 67:2 71:17 74:3,5, 13,20,23 75:23 76:14 86:24 89:1 116:2 117:17, 20 118:23 120:13 121:9	120:21 121:1, 3 discussions 9:9 36:1,9 90:5 dismissed 70:4 displayed 93:1 disputes 74:7 distance 52:3 distribution 110:16,22,24 112:25 114:17 district 4:23 6:21 11:20 12:3 diversity 112:21,24 114:17 division 62:1,5 Doctor 4:7 44:23 59:24 62:3 77:4 78:19 90:4 118:10 119:9 122:11 document 15:15 34:17 69:12 76:5 documents 9:3,4,21 10:8, 9,12,15,16 11:4,12,17,23 12:9 13:1,11,	19,25 14:6,8, 16 15:1 18:10 43:18 44:1,5 109:5 domain 43:24 doubt 19:24 45:23 dozen 4:18 6:10 dozen-or-so 7:1 draft 7:22,24 8:1 draw 48:2 drawn 48:11 DULY 4:1 duplicate 97:18	electrical 31:2,5,8 electromagne tic 49:22 electronic 30:22 56:21 electronics 56:17 electrons 49:23 element 29:19 36:18, 21 38:8 39:23 45:22 49:11 50:23 51:4,15 55:5,8,10,11, 12,16,25 56:1,7,22 58:6 59:19, 21,23 60:10 61:3,4 62:8, 14 63:8 71:18 72:2 73:14,16 74:7,19,22,24 75:4,10,12, 13,15,17,18 76:3 84:11 93:13 113:24 114:24 118:23 120:13 elements 20:14 21:18, 19 26:4,7 27:22 28:2 38:15 39:23 45:11 50:10, 13,19 51:10, 22 52:4 53:22 54:12 55:1,
discloses 19:22 21:10, 17,18,21 27:7 28:1 36:21 37:14,21 39:5,22 77:22 96:6,13 101:24 102:19 105:21 111:9 113:16 116:12 117:1 120:3 disclosing 27:22 62:23 106:10 disclosure 31:1 32:23 41:15 62:10 95:23 100:23 disclosures 47:9 49:9 65:8 73:20 78:10 99:9 119:16 121:19 discuss 16:19 19:21 23:25 24:11,	discussed 11:3 19:5 33:1,3,25 34:3 40:7 56:5 61:16 94:20 118:15 119:17,18,22 120:8 discusses 75:18 92:4 95:22 discussing 19:25 52:15 57:10 60:4 73:19 74:12, 22 77:16 92:15 109:20 110:8 112:1 116:23 discussion 18:21 21:23, 25 27:24 39:3,9 67:7, 10 73:18,22 83:10 89:9 105:5,14 117:14	discussed 11:3 19:5 33:1,3,25 34:3 40:7 56:5 61:16 94:20 118:15 119:17,18,22 120:8 discusses 75:18 92:4 95:22 discussing 19:25 52:15 57:10 60:4 73:19 74:12, 22 77:16 92:15 109:20 110:8 112:1 116:23 discussion 18:21 21:23, 25 27:24 39:3,9 67:7, 10 73:18,22 83:10 89:9 105:5,14 117:14	discussed 11:3 19:5 33:1,3,25 34:3 40:7 56:5 61:16 94:20 118:15 119:17,18,22 120:8 discusses 75:18 92:4 95:22 discussing 19:25 52:15 57:10 60:4 73:19 74:12, 22 77:16 92:15 109:20 110:8 112:1 116:23 discussion 18:21 21:23, 25 27:24 39:3,9 67:7, 10 73:18,22 83:10 89:9 105:5,14 117:14	discussed 11:3 19:5 33:1,3,25 34:3 40:7 56:5 61:16 94:20 118:15 119:17,18,22 120:8 discusses 75:18 92:4 95:22 discussing 19:25 52:15 57:10 60:4 73:19 74:12, 22 77:16 92:15 109:20 110:8 112:1 116:23 discussion 18:21 21:23, 25 27:24 39:3,9 67:7, 10 73:18,22 83:10 89:9 105:5,14 117:14

14,16,17,19, 23 56:21,25 57:1,14,21,23 58:7 59:1 61:1,22,24 70:24 71:4,8, 24,25 73:12, 18 74:3 77:21,22 81:2 83:7,16 96:7 98:8 99:7,16 118:11,22 120:17 121:10	engineering 91:10 102:7 entire 27:11 30:18 86:13,14 93:11 entirety 7:25 entitled 15:22 22:13 32:11 69:21 environment 71:10 environments 102:16 equivalent 83:22 error 87:2 88:1 106:21 107:16,22 108:16 essentially 43:9,17 48:8 49:6 50:22 63:18 100:2,9 103:10 106:14 114:10,22 evidence 24:22 29:12 41:13 115:23 exact 6:13 8:5 26:14 31:2,7 58:9 EXAMINATIO N 4:4 118:7	119:5 EXAMINED 4:2 examples 50:17 78:6 80:3,9 82:17 excerpt 37:10 42:14 121:6 excerpts 93:2 107:6 109:4 exciting 49:22 excuse 72:16 Exhibit 15:4 69:9 74:6,12 exhibits 10:16,18 13:14 exist 42:22 43:11 88:18 existed 11:13,17 exists 88:23 89:22, 23 expect 77:14 expectation 19:2 33:10 explain 112:13 explained	70:23 explicit 76:22 explicitly 39:22 109:5 120:16 Explorer 14:14 express 32:21 expressly 108:22 extent 41:4 42:3 66:22 117:3 external 98:20 99:13 externals 115:22 F fact 43:17 51:21 60:14 66:15, 25 75:1,2 85:20 88:4 116:11 117:7 factors 25:2 34:11, 12,15,18 fair 5:11 falls 115:24 familiar 5:1 16:20 17:5 23:5	24:7 28:21 fashion 26:14,18 27:23 28:3 49:24 83:8 101:5 114:6 feature 24:23 25:18, 22 26:2 February 66:19 67:19 68:24 69:22 fed 50:1 88:12 105:22 feed 31:18 49:25 feeding 49:6 feeds 80:21 81:1 85:5 86:22 feel 5:13 43:25 feigned 58:13 FFT 106:6 FFTS 95:14,15 figure 95:18,22 96:3,13 97:17,24 98:3,18 99:3, 4,9,13,22,24 108:23,25 110:4,5,12,14 111:24,25
---	--	---	--	---

112:4,5,6,7,8, 13	24 122:6,7	found 24:23 25:18, 23 26:2 69:20,21 117:9	generating 108:6	guessing 7:15
figures 22:2 91:25 93:3 95:12 107:5	flowing 99:8		geometrically 54:17	guide 18:21
figuring 95:20	flows 120:7		geometry 58:19,20	H
file 39:14 65:8	focusing 83:1 95:17	frankly 91:9	germane 105:14 111:18	hand 17:3
filed 43:19	footnote 36:23 37:5, 11,13 38:4	free 5:14	give 5:4 6:11 16:22 18:8 35:21 44:13 52:14 55:7 72:10 100:5 103:16	happen 42:22
filing 66:17	footnote's 37:1	frequency 47:15,16 51:12 59:2 62:1,5 78:16		happening 54:25 89:18
filter 97:3	footnotes 37:4	front 46:4,21,23 47:2,6,20,23, 25 48:2,5,12 52:24 53:17, 18,20 54:1,19 57:19 64:15, 21 71:18 88:13	giving 100:18 101:14	hardcopies 14:8
filters 97:16	forcing 104:12		gleaned 42:12	heading 18:25
final 70:6	form 21:5 72:7 85:2 86:7,16 88:8 91:5 93:23 94:1,15 95:8,23 96:5, 11,13,19 97:1,2 98:6, 19 99:12 105:6 114:18 118:12	fulsome 111:18 117:14	goal 107:18,21	hear 11:14 78:18, 20
find 14:13 72:18 97:25 99:22 112:10		functionality 30:9 31:1 32:22	good 4:7,10 23:1 91:9 116:24	heard 16:22 34:12, 13
fine 73:1	formed 46:11 72:13	fundamental 42:17	Graham 34:11,12,15, 18	helpful 67:13
fit 65:10	forming 38:24	G	great 47:4 73:19 91:14 92:6 106:1,24	helps 30:14
five-foot-by-five-foot 56:19	forms 78:11,17 109:20 118:16	gave 6:11	grouping 58:2	histories 65:8
fixed 51:17,19	formulas 83:15 90:22 91:2,20,25	general 17:7 30:18 52:10	guess 8:6 53:24 76:20	history 39:15 41:10 44:9 67:3
flat-out 116:11		generally 10:14 91:1		hitting 45:16 52:7 57:2
flow 49:23 91:20,				horns 49:25 50:2

hours 8:3,6 9:17 10:2,4	implementations 63:24 64:9,17	42:6	105:9,12,18, 19 106:2,17, 25 107:8,9, 11,14,24,25 108:1,10,13 109:16,19,21 118:16,18 119:18,21,22	52:18,20 53:2,3,11,12, 25 54:20 57:24
huge 56:20	implemented 64:20	independent 41:18 54:22 65:25		instances 5:25
hybrid 63:24	implementing 31:13,17 102:25 108:12	individual 50:12,18 51:3 83:25 85:18		instant 49:19 50:2 71:11,15
hypothetically 42:20	imply 57:22	induced 78:12	informations 76:23 84:18, 21 87:10 106:15 109:11	institute 74:15
I	important 43:16 64:5 100:13 111:14	inducing 104:12	informed 16:4,7 28:17	institution 12:19 13:2,7, 22 69:2,15 70:8,14
identified 11:25 13:19 15:3 31:3 36:18 78:11	improvements 30:22	infinite 100:21 101:16	infringer 6:16 7:4	instructed 15:25 35:17
identify 67:17 73:9 92:23	include 10:15,22,25 27:12,16 38:4 73:22 78:12 108:9 111:16 117:20	information 39:24 73:4 75:21,24 76:4,5,7,9,11, 16,18 77:6, 10,13,24 78:1,4,8,11, 15,16,17 79:3,24 80:3, 10,23 81:3,6, 8,10,11,14, 18,21 82:3, 18,24 84:2, 12,13,19 85:14,20 86:9 87:14,17 88:2,5,16,22 89:21,22 90:13,14 91:9,14,19 93:7,11,20 101:4,20,23, 25 102:5,10 103:7,8 104:5,13	inherently 99:15 119:24	integer 101:14
identifying 77:13			initial 105:23	integrate 99:5
immaterial 71:21			input 85:5,9,10 88:6 97:13 101:20 103:8, 12,13,22 108:6,23	integrated 121:2
impinged 86:6	included 111:17		inputs 85:1 96:19,20 100:12,16,17 101:1,11,20 102:4 104:21 105:2,10 111:6	intended 37:4 38:3
impinging 48:12 54:5 57:2 71:6,14 88:11	includes 39:21 55:11 59:4 65:20 76:24 88:13 93:19,21 99:15 107:25 121:6			intending 37:6
implement 32:5,6 64:6,7	including 4:22 40:10,15 95:13		instance 42:25 44:12 46:1,3 48:17, 18,23,24	intensity 79:10,17
implementation 31:20 33:4 50:14 51:10 57:9 63:6 110:5	incompatible 32:2		inside 98:6	Inter 15:10
	incorrect			interchangeable 56:8
				interior 98:5
				internal

98:19	issue	36:17 38:8,10	lexicography	listed
internals	27:14	55:5,11 59:3,	17:5,11 24:1,	69:16 94:4
115:21	issued	9 76:20,23	3	98:24 107:6
interwoven	12:24	89:3 90:11,25	light	listing
20:4 44:7	issues	97:20 111:13	41:7	77:21
invalidity	8:18,20 34:9	113:6	limit	Littlejoe
18:18	ITC	law	91:15 94:2	39:20 40:13
invention	4:22,23 6:22,	5:6 29:17	111:21	45:12 65:9,
31:11,16	24,25	lawyer	117:16	13,16,17,19,
33:21 64:4	item	34:20	limitation	24 67:7
inventive	17:2 34:21	lead	60:20 73:3	117:2,8
21:24	96:4 99:13	59:12	77:5 90:9,12,	Littlejoe's
inventor	items	leading	17 91:3,22	76:15
17:8	34:8	46:24 77:19	93:14 97:21	location
inverse	J	least-squares	105:16 109:1,	51:8,25
95:14		87:2 88:1	2,24 111:11	78:15,16
involved	joined	106:6	116:8,25	locations
64:14	70:3	leave	117:1	51:23
involves	Jones	63:10	limitation's	long
83:14	66:16	led	110:20	9:15 21:22
IPR	June	104:21	limitations	37:10 71:19
4:12 7:19 8:8,	68:14	left	72:23 121:3	72:5 91:13
15 9:3 10:8	K	96:20,21,22	limited	long-known
12:7,13,20		114:2	117:12	32:22
13:5,8,12	kind	legal	limiting	looked
14:1 15:13,25	44:7 48:4	22:13,16,21	115:14 117:6	11:6,7 38:8
16:10 18:9,13	59:2 62:13	23:2,6,9,13	linear	101:10 114:1
39:15 66:20,	116:2	24:10 34:4	100:12	lot
21 68:24 69:3	knowing	length	linearly	13:1 64:6
70:1,2,7	103:22	73:19	83:22	90:21 91:9
74:13,16	knowledge	lengths	lines	low-noise
76:25 115:7	32:18,20	47:4	96:25	97:4
IPRS	33:19 66:14	lengthy	link	lunch
70:3	L	91:8 106:8	14:12,13	90:6
IR		level	links	M
66:20	language	28:11,13 29:6	39:10	
isotropic		78:24 79:4,7	list	ma-
58:5,9,11,20			10:16 118:17	89:19

made 10:14 26:15, 16 42:9 44:1, 9 56:25 58:25 114:11	7:17 markings 14:25 master 67:5 material 60:5 111:14 117:21 materials 31:17 69:6 mathematical 102:22 103:14 mathematicall y 103:18 matrices 64:4,10 matrix 20:20,25 21:3,7 30:4, 10 31:11,13, 20,21,25 32:7,20 33:4 39:21 40:1,2, 13 45:1,2 55:21,22,23 62:8,10,17, 23,25 63:12, 16,23 64:2, 18,21,23,25 65:10,20 74:4,10,11 76:15 79:23 80:14,16,21 81:11,16 82:3,20 83:5, 9,11 84:10, 15,20 85:4 86:1,2,4,5,20	87:5 88:13 89:10,20 94:22 95:10, 18,23 96:4 97:3 98:8,12, 15 99:5,15 105:23 108:22 114:19 meaning 16:1,8,11,18 17:15,17,23, 24 18:5,7,11 54:23 58:25 means 51:22 115:11 meant 8:19 28:4 29:11 37:24 53:13 measure 49:3,18 measured 78:25 measurement 49:5 measurement s 120:4 meet 9:12 60:8 72:6 89:3 meeting 9:15,18 meetings 9:6 meets 17:19 49:13 60:20	memory 69:17 mention 27:24 69:25 120:17,25 121:8 mentioned 5:23 27:21 73:24 74:23 80:10,18 98:11 112:6 118:17 mentioning 56:4 mentions 20:24 met 9:8 60:12 61:4,8 91:3, 22 microstrip 31:15 MIMO 96:2 113:16, 19,22 mind 8:12 11:8 14:2,3 31:8 34:2 minimize 106:20 107:21 minimizing 107:15 minute 52:14 minutes 44:19	mixed 78:18 mobile 38:13,16,21 39:1 mode 21:4 95:23 96:5,11,13,19 97:1,2 98:6, 19 99:12 modern-day 56:17 modifications 33:11,17,23 modify 32:16 modifying 71:4 money 64:7 month 7:13 morning 4:7,10 motivated 32:21 motivation 19:1 29:18,19 32:12,15 33:9 move 51:18 multi 45:15 multiantenna 49:11 multilink 95:13 98:24
---	--	---	---	--

99:10,18 105:24 112:18,21,24 114:17 multipath 61:14,16 multiple 27:3,4 31:14 45:20,23 49:1,14 53:6 56:12 57:3, 21,22 60:1, 15,17 61:6,8, 14,17,21 79:24 80:4 81:9 82:4,18 86:21 92:15 94:13 95:8,10 97:14,15 101:2 114:4, 12 multiplexing 62:1,5,18 N narrative 19:21 narrow 18:4 117:17 narrower 17:24 necessarily 31:2 32:3 43:24 needed 91:1 needing 30:10	neighborhood 5:22 nonobviousness 29:14 note 92:22 notes 74:9 118:2 notice 40:16 72:22 noun 84:22 86:12 November 11:21 66:16 67:18,24 null/zero 78:15 number 6:13 8:5 15:11,13 18:15,16 93:25 97:25 100:21 101:9, 10,16 102:5 103:25 105:8 111:22 numbers 100:6 103:5 O oath 4:13,15 5:4 Objection 72:3,7 85:2 86:16 88:8 91:5 94:15	obvious 19:12,14 20:10,12 21:11 22:5,8 24:24 25:1,25 26:12 28:8 29:2,5 33:2,7, 13,19 35:15 37:15 47:9 63:8,11,14 65:1 84:11 obviousness 18:19 19:6,7, 8,9,18 20:1,3, 6,13 24:8,11 25:6,13 26:16 28:5,7,18,22, 25 29:9,12,16 30:15,19 35:1,18,20 42:18 44:2 68:18 occur 63:18 87:19 occurred 88:7 occurring 71:3 occurs 84:6 OFDM 60:14 61:19, 25 62:7,16, 18,24 63:4,6, 9 offer 8:19 16:15 17:10,22 18:5 22:21 25:8 35:1,11,17 66:11 78:7	offered 35:25 offering 23:10 offhand 112:9 offsets 121:4 open 14:10,14,21 15:8 operates 60:6 operating 59:2 108:8 operation 30:10 84:15 opinion 16:6,8,12 17:13,22 18:5 19:12,14 20:6,8,11 21:6,9 25:24 28:1 30:3,15 33:1,18 35:2, 11,18,25 42:17 62:23 63:10,13 64:24,25 66:4 70:19 71:1 78:7 80:2,9 82:16 84:6 88:6,10 91:21,22,23 93:18 105:1, 11,13 111:19 116:25 117:5, 12 opinions 8:8,14,17,19	12:6 13:5,8,9 16:15 17:10 18:18,19 19:5,6 22:21 23:10,22,24 24:13 25:8 27:10 33:16 41:4,5,9 42:23 43:1,4, 6,12,13 44:2, 4 62:7 66:11 68:2 72:10 77:15,17 78:7 90:16 91:3 104:17 111:11 opposite 51:24 optimization 106:5 108:12 optimize 106:18 optimized 107:15 optimum 106:11 108:16 112:20 options 31:17 oranges 102:6 order 11:20 12:1,2 13:20 26:19, 22 27:23 28:3 ordinary 16:1,8,10,18 17:15,17,24 18:7,10,11
--	---	---	--	--

20:22 22:5 26:13 29:3,7 31:10,23 32:19 33:20 34:1 40:3 41:1,12,22 43:7 45:3,13 46:9 48:10 56:3 59:12 64:11 66:8 68:10 71:2, 12,17,23 75:2 76:1 77:2 79:14 80:13, 25 83:20 88:14,19,24 94:23 96:17 97:8 100:24 102:13 114:9 115:11 116:8 121:16,23	23 94:1,13 95:5,8 97:21 98:10,13,23, 25 99:19,20, 21 100:7,11, 15 101:1,2, 18,19,21,22 102:3,10 103:3,6,11, 12,22,24,25 104:19,21 105:3,6 107:19 108:7, 11,22 110:3 113:25	39:15,17 40:7,17,23 41:9,14,21,25 42:20 65:12 68:25 69:12, 20 70:10 73:23 74:2,16 76:17	81:13,20 82:2 83:25 84:23 85:18 86:18 87:3,13 90:8, 17 97:24,25 106:13 108:17 109:7, 8,15,21,23 110:15 114:25 116:1, 21 121:7,9	pass 118:3 119:2
oriented 63:5	outputs 80:21 81:10, 12 82:25 84:16,19 85:1,6,12 86:4,5,7,10 95:8,10,12,16 96:10 97:2,9, 17,19 98:15 101:2 105:22 110:11 111:8	owners 65:7		passages 39:20
original 42:17				passive 31:22 63:16, 17 64:6,8
originally 31:12	overcame 44:8			past 43:18
Orthogonal 62:1,5	overcoming 40:12,14			patent 4:11 6:20 7:3 10:23 12:12 13:4,21 15:11 17:9,23 18:6, 14,15,16,17 19:12,23 21:10,18,19, 22 22:4 24:16,20 25:12,14,16, 23,25 26:15 27:18 28:2,8, 19 29:1 30:5, 11,14,16,19 31:12 32:23 35:5,6,10,12, 25 36:17 39:15,17,19 40:1,7,17,23 41:9,14,16, 21,24 42:8,20 43:8,17,21 44:4 45:1 65:2,7,12,18 66:1,2,5,6,12, 16,18 68:25 69:11,19 70:1,10 73:23 74:2,15 76:2, 17 78:12 82:13 116:9, 12 117:3
output 45:17 79:25 80:5,11 81:2, 15 82:5,19 83:2,9 84:1,7 85:16,19,21 86:19,20,22, 25 87:4,8,13, 15,16,20,21, 23,25 89:7,8, 16,17,20 93:15,18,22,	owner 4:11 6:20 7:3 13:21 39:19 41:16 42:9 43:8,17,21 44:4 65:18 66:2,5,6,18 70:1 76:2 82:14	owners 65:7	paragraphs 24:11 40:11 68:17 73:25 77:20 106:7	
	owner's 12:12 13:4	P	paragraphs 24:11 40:11 68:17 73:25 77:20 106:7	
		P.M. 122:15	part 6:1 21:24 24:4 26:20, 23,25 27:10 30:13 42:13 47:22,23 62:24,25 77:14 83:18 85:25 86:13, 15 87:8 99:17 100:13 106:4 107:22 109:3 113:17,18 120:2,10 121:8,10	
		packet 76:7,12	parcel 120:2	
		pages 15:6,15 22:17 72:23 90:19, 21 91:2 111:12	parentheses 82:10 109:17	
		paragraph 15:18 18:23 22:10,19 23:16 24:2, 15,18,19 29:9,24 30:2, 21 32:18 34:6,7,9 36:12,16,20 37:9,24 38:1 39:16 40:6,15 55:4,6,8 66:13,25 67:5,9,14 68:3,20,22 69:18,25 72:20 74:5,20 75:23 76:17, 22 77:20 78:9,23 79:22	part 6:1 21:24 24:4 26:20, 23,25 27:10 30:13 42:13 47:22,23 62:24,25 77:14 83:18 85:25 86:13, 15 87:8 99:17 100:13 106:4 107:22 109:3 113:17,18 120:2,10 121:8,10	
			Partes 15:10	
			particulars 31:19	
			parts 40:16 105:25	

patents 18:15 31:3	75:2,13 76:1 77:2 79:13,20 80:13,24	23,24 47:1,5, 19,25 48:1,5, 12,14 49:5	plaintiff 6:18,20,22, 23,25 7:3	113:19 115:15,24 117:7
path 45:15 85:6	83:19 88:14, 19,24 94:23	52:21,24 53:17,18,20	play 17:2 25:15 44:10 74:25 99:7 102:12 110:13	points 74:10 88:21 89:14
paths 45:15 83:6,8, 16	96:16 97:8 100:24 101:8 102:13 114:8 115:10 116:7 121:16,23	54:1,19 57:19,24 71:18		poorly 72:13,24
pattern 72:22		phasing 80:19	plays 47:8	portion 74:7
peak 78:15	person's 44:17	Philip 4:10	plenty 43:20	POSITA 30:3,9 37:16 42:19 49:20 78:24
penalty 5:5	perspective 20:22 33:25 35:20 39:17 40:8,18,23 41:11,22 42:19 43:7 44:15,17 48:10 53:14 56:2 66:8 71:13,16,22 76:1 77:2 88:14 92:19 100:24 114:8, 15 115:10	Phillips 23:19	PO 68:23	position 40:18,23
perform 16:14 96:9		phone 56:19	point 12:17 20:14 43:9 46:25 48:13 49:8 53:18 56:23 62:15 70:25 72:6 77:4 78:9 86:9 88:5,21 89:6, 8,13,15 92:23 93:3,8,10 94:4,7 99:21 104:8 106:7 107:20 109:18,22	positions 51:17,20
performance 106:18		phones 79:15		possibilities 83:15 103:23
performed 25:13 35:16 65:11		phrase 47:2		potential 118:18
performing 20:1 35:23 96:8 120:6		phrased 107:2		power 78:24 79:4,7, 16
perjury 5:5	perspectives 61:12	pick 46:25 47:24 72:5		preceding 40:11 64:3
person 18:1,11 20:22 22:5 25:1 26:13 29:3 31:10,12,23 32:19,22 33:20 34:1 40:3 41:1,11, 12,22 43:7 45:2,13 46:9 48:10 56:2 59:12 64:11 66:8 68:10 71:1,12,16,22	petition 9:3 10:6 13:13 14:15 15:9,10	picture 54:17	pointed 58:17 66:2,5, 6 76:2 81:19 82:14 95:11 106:8	predating 67:8
	petitioner 74:5,6,9	pilot 118:22,24 119:16 120:1, 4,9,12,17,19, 20,25 121:7, 8,13,15,17, 18,21,22 122:2,3,4		preferred 27:17
	Petitioner's 15:4	plain 16:1,8,10,18 17:14,17,24 18:7,10 120:2	pointing 59:14,17 68:11 74:18 75:1,25 78:14 80:12 81:17 95:21 98:21 109:5 112:7	preliminary 12:13 13:5,21 68:25 69:11 74:1,2
	petitioners 70:2			preparation 9:7 12:23
	phase 46:4,10,21,			

prepare 8:25 9:22	24,25 25:19 26:11 28:7	102:1,12,17 103:15,19	providing 48:8	119:8,10
preparing 8:4 10:3	29:6 34:22 41:20 42:18	104:4 105:24 106:15 113:2	provisional 66:17	quick 66:23
preponderance 24:22 25:17	65:6 66:20 67:1 68:11, 16,18,24 74:16	114:15,16 118:21 121:20	proxies 79:7,18	quotation 42:14
present 19:18 39:7,13 42:3 55:2 61:17 82:12 83:10 92:18	priority 30:3 66:12, 13,14,16,19 67:3,11,18,23 68:23 69:21 70:11	proof 28:11,14	pull 107:7 108:4	quote 37:21 111:15 115:1,2
presentation 44:10 92:9 111:19 117:15	procedure 23:23	propagate 71:11,20	pulled 107:14,17	quotes 90:22 91:20
presented 9:4 10:9 85:5 91:11	proceeding 4:12 8:20,21 11:4 26:25 69:3,15	propagating 47:3 48:15,21 49:2,15 50:5, 6 52:25	pulling 92:9 106:1,24 107:11 108:2	R
pretty 56:3	proceedings 6:4,11 7:1 41:25 42:22 66:20 68:24	propagation 48:1	purposes 15:25 67:21	range 103:23
prevent 5:16	process 69:25 83:19 87:9 100:13 107:3 113:18 120:10	proper 114:18	putting 53:18	rate 71:20
previous 81:20 93:14 112:4	processed 88:3	proposing 99:4	Q	re-read 9:2,24 10:5
previously 23:5 34:13 41:16,17 56:13 80:18 82:14 98:11 112:1 114:3 118:17	processing 49:7 54:14 58:23 64:14 87:6,24 88:12,19,22 89:1,14,15,24 92:5 94:3,8, 23,25 95:13 96:7,9 97:10 98:14 99:6,8	prosecution 41:10 67:3 70:1 74:14 114:25	QRD 102:20	reacting 96:23
primarily 82:12		prospective 49:20	qualifies 68:15	read 9:2 108:2
prior 10:25 13:3 17:18 18:3,13 19:15 24:23,		prove 28:10	question 11:16,18,22 33:11,14 36:3 52:13 56:9,10 60:19 72:9,13 77:12 80:6 82:1 88:15 91:1 92:22 95:1,2 99:14 101:23 104:18 106:12 114:21	reader 42:9
		provided 7:22 8:1 23:2	questions 5:9 118:2,10	readily 14:18
				realm 104:3
				realtime 78:22
				reason 42:16 57:8 117:1,2
				reasonable 17:20 19:2 33:10 71:22

80:24	112:22	89:25 90:1	29:7,10,17,	91:25 92:1,3
reasons	118:13,20	117:23	18,22 30:18	111:13
117:5,8,9	receiver	122:14	43:2,25 45:12	relied
recall	78:25 111:4,7	recreate	49:10 53:20	17:18,19
6:8 7:9 8:1,5	114:20	103:25 105:2,	92:7 110:7,8	relies
11:5,7 12:11	receivers	9	121:21	62:22
20:24 21:2	76:8,13	reduce	referencing	rely
23:15 27:8	receives	104:8	40:12 42:16	11:1 18:13,14
34:1 36:1	75:11	refer	45:22 76:20	63:23
37:6 45:5	receiving	30:10 47:19	82:11 87:13	relying
46:17 48:19,	40:4 45:3,23	reference	93:5 112:14	30:14 39:2
20 52:23 56:4	46:3 57:1	20:21 24:24,	referred	75:1 92:13
57:12 60:2	60:7,16 63:19	25 25:19	34:14 111:7	109:1,3,15
65:14 69:20	75:3 76:15	26:12 27:1,	120:12	remain
70:9,13,17	81:9 85:8	11,16 28:7	referring	16:12
93:16 112:6,8	86:3 89:10	29:3 30:11,	10:18 48:25	remember
116:23	102:14	16,19 32:1,2,	50:10 51:19	7:13,15,18
120:14	112:17	17,21,24	53:4,25 57:20	79:14
receipt	119:24,25	35:10 37:15	87:8 98:16,23	remembered
74:8	recently	40:12,17	107:13 110:3	6:24
receive	12:22	42:4,14 46:25	119:20	remind
56:23 71:4	reception	47:24 48:13	refers	73:7
73:15 96:23	74:12	53:14 54:3	21:6	remote
97:4 106:2	receptions	55:18,20	refined	38:12,14,18
109:12	76:7,12	62:20 65:6,19	72:11	39:3,8 40:4
112:18 113:8	RECESS	66:20 68:7,8,	regular	45:4,8 59:8,
received	36:5 44:21	13 76:10,22	120:1	10,11,13,20,
45:10 46:2,5	90:2 117:25	85:17 86:18,	relate	22 60:15
48:17,18	reciprocity	19 90:22	18:19 19:6	61:13 73:15
52:19,20,22	111:9	91:8,12 92:4,	47:20 62:16	113:9,14
53:2,3 59:18	recites	6,17 94:20	91:2,21	remotely
70:20 73:22	76:10	97:11 98:13	related	5:20
75:15,16,19	recognize	99:2 116:22	17:18	render
77:25 80:15,	78:24	referenced	relating	26:12 33:6,13
22,23 82:24	recollection	10:12,19 40:6	19:5	37:15 47:9
85:14,15	8:9	42:8 51:11	relationship	rendered
86:21 93:6	record	65:9,12 67:6	111:10	24:24 35:15
106:2,5,14,25	36:4 44:20	111:24 114:3	relevant	rendering
107:12,24		references	8:20 18:10	
108:13		10:14 11:1		
109:11		24:25 27:18		

23:24 63:8 84:10	63:4	return 55:4	71:20	93:2 99:20
renders 20:10,12 21:11 22:8 25:25 28:7 29:1 33:2,18 63:10,13 65:1	respect 8:15 19:25 28:12,18,20 32:19 36:2 39:1,6,7,9,14, 18,24 40:8,11 41:9 42:18 49:10,14 51:12 53:16, 19 54:15 56:11 62:9,14 66:14 67:3,7, 11 71:24 72:10 73:11, 20 74:4,11,21 84:10,13 87:1,25 104:4,14 112:16 114:1 115:25 116:21 121:19	Returning 22:19 59:3 97:20	sampld 49:14 64:13	105:20 106:8 107:6 117:19 120:20 121:24 122:5
repeat 37:5		revealing 9:9	samples 50:7 51:13 54:8	sections 8:2 92:7,18 120:8
REPORTER 44:18 62:2		reverse 94:9	sampling 49:7 50:2,5 51:5,15 52:7 53:8,21 54:1, 23,24 61:5 63:21 65:20 70:23 71:5,9, 15,21 75:11 94:5	send 114:13
represent 4:11 47:25 61:23 93:10		review 11:19 12:22 15:10 69:2,4, 17 74:15		sending 61:13 116:22
representatio n 76:15 95:21 103:14 104:6, 7,9		reviewed 9:22 11:4,23 12:9,12,19 13:2,11 14:1	say- 86:13	sense 44:3 57:11
representativ e 101:2		reviewing 13:4,7	scale 104:11	sensitivity 58:12,14,16, 24 64:16
represented 47:11 94:6 103:17	respective 61:24	RF 49:25 71:10 86:22 94:10	scanned 10:14	sentence 22:20 24:15 37:24 82:8
represents 94:21	response 12:13 13:5,21 51:2 54:20 58:1,21 68:25 69:11 74:2 76:17	rigorous 102:22	scope 29:5 33:24	separate 50:22 56:9 65:11 111:7
required 16:2,5 26:22 116:8	responses 39:16	robust 28:16	screen 14:9	sequence 120:5
requirement 116:13	responsive 54:16	Roughly 90:20	search 21:1	set 90:12 91:17 92:24 93:9 105:17 110:2, 20 111:5,8 113:11 115:1, 13
requires 29:17	rest 76:19 95:16 103:15,18	ruled 70:4	searcher 74:10 76:8,12	settled 70:2
requiring 74:7	retained 7:18	S	secondary 29:7,10,11, 12,14	shaping 115:19
resources		S-A-M-E 58:15	section 15:22 22:13, 16 24:3 32:11 33:8 34:5 40:10,14 67:4,5 84:8 91:13 92:21	sharing 63:4

shed 41:7	52:7,8,9,11, 12,19 53:2,4, 6,7,9,15,21	25 95:13 96:9 97:10 98:14 99:6,8,18	silly 11:16	singular- value 102:20
short 15:22 60:19 117:22	54:1,5,9,11, 14,17 55:2 57:1,18 58:23	101:4,25 102:1,12,16, 24 103:8,15, 19 104:4,17	similar 18:8	Sitting 8:10,13
show 26:9 43:6 60:12 83:9 85:10 92:10, 19 93:11 99:10	59:5,15,18, 19,20,21 60:1,8,9,18, 20,22,23,24 61:2,3,4,5,8, 13,15,18,23 63:20 64:14 70:16,19	105:18,19,24 106:5,14,15, 17 107:8,9, 24,25 108:1, 10 109:11,16, 18,22 110:25 113:2,9,10, 14,25 114:4, 5,7,10,14,15, 16,19,22 115:19,22 116:23	simple 50:21 103:9, 11	skill 18:1,11 20:22 22:5 25:1 26:13 29:3,7 31:10,24 32:19 33:20 34:1 40:3 41:1,12,22 43:7 45:3,13 46:9 48:10 56:3 59:12 64:11 66:8 68:10 71:2, 12,17,23 75:2,13 76:2 77:2 79:14 80:13,25 83:20 88:14, 19,24 94:23 96:17 97:8 100:25 102:13 114:9 115:11 116:8 121:16,23
showing 26:2 45:16 48:11 84:19 85:9,15,21 86:4,6,8,9	71:11,14,15 73:4,5,8,10, 15,19,23 74:8,13,17, 21,24 75:3,5, 6,7,9,16,17, 21,24 76:3,4, 5,6,8,9,11,16, 18,19,23,24 77:6,10,13, 23,25 78:1,2, 3,8,10,11,17, 25 79:4,7,12, 15,17,23,24 80:3,10,15 81:3,4,14,15, 18,21 82:3,9, 11,17 83:1,5 84:1,2,12,13, 17,18,21 85:6,14,19 86:8 87:6,9, 10,14,17,23 88:11,12,15, 16,18,22,25 89:1,2,11,21, 23 90:13,14 91:18,19 92:5 93:7,19,20 94:3,5,7,23,	118:16,18 119:14,18,19, 21,23,24,25 121:13,15,18, 20,22 122:1,4	simple- minded 101:8	
shown 24:21 25:17 96:19 110:12 112:5			simpler 51:3	
shows 26:10 73:17 95:22 97:6 99:4 110:5			simplified 57:13,16,17	
side 94:9 96:20,22 97:1			simplistic 100:5	
signal 39:11,18,22, 24 40:4,8 45:4,8,10,16, 18,19,23 46:2,11,13,20 47:1,3,10,11, 13,15,17 48:1,3,5,11, 13,14,17,21, 24 49:2,4,7, 12,14,18,22 50:1,3,6 51:13,16		signals 45:14,20 46:7,13,14 53:6,7,8,15, 16 54:2,25 60:1,17 61:8 64:13 71:7 80:15,22 83:4,5,19,20 86:21 87:5 88:11 89:2, 11,18 98:7 102:14,16 106:3,25 107:12 110:21 111:2 114:4 118:23 120:9,12,17, 19 121:8	simultaneous 72:2 74:8,17	
			simultaneous ly 50:7 59:23 61:6 63:21 70:20 71:3 75:19	
			sine 47:16	
			single 19:15 24:23 29:3 45:15,24 46:16,19,20 50:25 52:17 53:6 56:25 60:20 62:14 74:18 114:15 115:12	skilled 44:16 49:21 100:4 115:25
			single- reference 28:21,25	slightly 28:9 51:8,16, 22
				slower 62:3
				solution 106:11 108:16 112:20

solutions 100:22	67:10 74:3 76:16 77:19 81:3 86:11 94:2,18 95:25 98:23 99:20 105:21 107:7, 13 115:9 118:24 120:21	stands 93:4	38:25 39:3,6	114:12
Sonar 64:20		start 14:20 74:20	steering 106:19	success 19:2 33:10
sounded 108:4		started 105:5	step-by-step 21:25	sufficient 17:18 33:21 44:1 64:8
sounds 6:12 45:6 57:3 107:18	specification 17:9 18:3 21:17 41:20 98:21	starting 96:8	stream 94:14	suggest 37:15
source 30:11 45:24 46:16,20 47:15 52:17	specifics 27:15	state 4:8 17:16 19:11 29:8 42:5 76:18 84:8,16 89:9	strength 76:7,11 77:23,24 78:2,10,25 79:5,7,12,16, 17,18 80:11 81:15,18 87:9 88:17,18 89:1 119:19,23	sum 45:14 46:6,12 80:18
space 56:18	spend 8:4 10:3 64:6	stated 23:14 29:13 65:7 115:9	strengths 76:24 79:24 82:3,4,9,11 83:1 109:11, 16,22	summarizing 77:16
spaced 72:24	splitters 83:6	statement 8:8 42:8,10, 25 74:6 104:23 116:11 117:4		summary 116:24
spacing 52:1,2 59:1	spring 7:11,12	statements 41:14,15,21, 25 42:1,21 43:11,18 44:5,8	strive 58:10	summation 83:18
speaking 6:8 52:24 56:22 107:3	squared 106:21 107:16,22 108:16	stating 56:13 67:22 84:13 116:9	subcarrier 60:18	summed 98:9
specific 16:2,4,23 17:8 20:2,14 27:16 30:18 35:9,13 42:14,24 45:21 82:8 85:6 92:7 104:18,20 105:2 107:14 108:5 111:21 115:22 122:2	stages 89:23	station 38:12,14,16, 18,21 39:4,8, 10 40:5 45:4, 8 56:20 59:9, 10,11,13,20, 22 60:15 61:13 73:16 113:9,14	subcarriers 60:16 61:10, 20,21	summer 98:5 100:1,6, 9
specifically 18:4 30:13 34:17 38:25 39:20 42:4 45:7 66:15	stand 37:20 43:1 44:16	stations	subject 5:5	summers 83:6
	standard 23:19		submitted 7:6,10,11 11:9,24 12:13	summing 83:23
	standards 22:14,16 23:2,6,9,13 24:10 34:4		subsection 67:4	superfluous 92:2 111:17
	standpoint 91:10		subsequent 77:20	support 19:24 20:15, 19 43:2,13, 15,20,24 44:2 63:8 75:25 77:1 91:12,23
			subsignals	supporting 102:23
				supports

117:18	54:6 105:22	102:20,21	44:25 49:16	31:11,16,24
Suppose	106:14 108:5	technology	52:16	33:20 39:19
42:20	talk	30:4 31:14,15	testify	49:8 50:3
switches	23:18 29:16	32:4	6:6	53:9 54:2
97:4	30:22 87:13	tells	testifying	55:1 62:2
SWORN	99:20 110:15	69:17	5:6,17 6:15	68:10 70:24,
4:2	116:3 120:19	ten	testimony	25 71:6,15
synonymous	talked	10:4	5:4 6:8	72:6 74:23
79:3	46:6,15 48:16	term	Texas	77:9 93:4
synonymousl	51:5 83:16	15:25 16:2,5,	12:4	104:8 118:4
y	93:14	22,25 17:4,8,	texture	times
121:16	talking	13,23,25	44:10	4:17,18,20,21
system	27:20 47:14	18:1,6 21:2,5	theories	5:24 6:9,19,
21:24 22:1	48:20 50:8	26:21 34:13	19:18	21 20:24
32:8 49:7,19,	51:14,19	38:18 47:13,	theory	54:12 59:24
20,24 54:15	52:6,8 53:1,	20 60:25	19:8 61:7	65:13 71:8
63:1,5,6 64:7,	23 59:25	74:24 77:5,7,	62:22	120:25
8 65:22,23	61:1,9 69:14	15 86:19	thereabouts	timing
80:14 95:17,	70:15 73:7	99:19 115:17	90:19	78:16 121:4
25 99:6	75:11 94:8	121:22	thing	today
102:7,9	95:5 97:21	terms	63:18 79:19	4:13 5:4,17
103:1,3,10	98:22 101:8	16:9,18	94:12 102:2	14:3 57:7
104:5,15	104:4 108:5	17:17,21 18:9	things	64:3 118:4,15
105:4,14,21	112:4 121:7	21:15 26:1,21	26:22 39:14	119:17 120:9
106:11,19,20	122:1	31:9 35:9	56:9 58:8	tones
110:9 111:9	talks	41:2,11,23	59:2 81:19	61:20 120:20
112:2,17	91:13 98:13	43:15 46:25	94:13 100:10	total
114:2,6	120:9	49:9 54:23	108:5	4:21 60:8
117:18	TD	57:9 59:4	thinking	trace
systems	63:6	64:12 77:17	5:17 57:13	87:6,23
38:14 60:14	TDD	79:2 87:22	thought	tracing
	63:6	99:16 102:14	111:17 112:3	81:7 92:19
T	teach	115:11	tightly	transceiver
	37:15	117:15	65:10	95:24 96:2
table	technical	test	time	110:21 113:8,
10:19	21:23 92:8	27:21	6:22,23 8:4,	13,16,20,21,
takes	technique	testified	24 11:17,19,	22
71:19 100:10	62:18 63:4	4:15,19,20	24 12:10,24	transceiving
taking	techniques	5:24,25 6:4,9,		113:18
25:2 50:7		14,17 9:24		
		21:9 43:3		

transition 64:9	116:13,19	unclear 5:13	unpatentable 24:16,21	Wang 4:6,11 36:4,6 44:20,22 62:6 72:4,12 85:23 87:11 89:5,25 90:3 91:16 95:4 117:22 118:1 119:7 122:10
transmission 39:18,23 40:4,9 45:4,8, 18 47:10 49:12 59:5,6, 15,20,22 60:9,24 61:2, 3,23,24 63:20,21 70:16,17 73:5,8,11,15, 23 74:9,13,25 75:4,5,6,7,10, 16,18,21 76:4,9,19 78:3 110:21 111:2 113:2	trial 4:19,20 5:24 6:5,6,8,9,14, 17,19 triangle 96:15 true 12:18 22:23, 25 53:5 82:17 85:16 87:9 truthfully 5:17 turn 15:17 18:22 22:10 23:16 29:24 34:4,6 36:12 37:8 38:7 67:16 68:20 90:8 109:8 113:3	underlying 12:3 understand 4:13 5:3,9,10 18:1 29:17 31:13 33:14 41:3 42:9 45:14 46:10 62:21 71:2 72:8 75:3,14 77:3 80:25 85:25 88:24 94:18,24 95:7 96:17 97:9 99:25 103:3 104:16,17,23 105:7 111:12 114:9 121:12, 25	upside down 96:15 V valid 102:18 values 90:13 91:18 92:24 93:9,12 102:25 105:17 110:3, 6,20 113:1,11 115:2,13 116:17,19 vanilla 120:2 vector 45:14 46:6,12 80:18 versions 61:14,18 versus 57:22 71:19 view 24:24 29:2 40:17 60:22 72:1 79:4,11 Vivato 4:12 volume 78:21 W WAN 65:21,23	wanted 32:5 57:6 64:1 92:8 wave 46:25 47:11, 16,17 50:5 waveform 47:12,21,22 waveguide 49:24 ways 31:14 56:12 64:20 77:22 88:23 98:9 106:9 weaker 44:14 weight 67:1 93:12 99:17 102:24 107:10,22,23 110:6 112:18 116:17,19 120:22 weighting 90:12 91:18 92:24 93:9 105:17 110:2, 20 113:11 115:2,13
transmission ed 39:11	Turning 90:24 tutorial 48:9 typically 46:12 47:25 51:17,18 53:14 56:17 57:7 58:5,8, 10 79:13 96:8 97:15 119:15	understandin g 16:24 17:7 23:21 25:5 26:9 28:11,24 31:9 34:19 40:22 41:1 42:11 60:5 68:9 80:13,20 100:3 115:6, 10,25 116:2 119:12 understands 102:13 understood 8:22 31:23 48:9 86:15 universe 13:11		
transmission s 70:20 73:20 74:17,21	U U.S. 15:11 ultimately 108:11			
transmit 78:24 79:4 96:23 97:4 109:12 110:23,25 113:9				
transmits 113:14				
transmitted 81:11 111:1 114:6,11,20 116:4 119:14				
transmitting 60:15 85:8 112:17				

weights 86:23 87:1,7, 25 92:10,20, 25 93:4,5 98:23 102:15, 18,22 106:4, 18 107:4,15, 20 108:15 109:12 110:7, 9,13,16,23, 24,25 111:3, 4,5,7,8 112:2, 16,19,22,25 113:1,17 114:17 115:3, 18,21 116:4, 13,14,15,22	wrote 7:21 Ws 112:22 X XR 4:11 Y Yagi 56:15 year 11:10 69:5 years 64:4 68:7 yesterday 9:8 Z Zoom 5:4,19 14:12, 13	
window 14:14		
word 53:12 84:5 107:2 111:21		
words 86:25		
work 7:18 23:6 26:25 32:8 48:9 103:16		
worked 7:22		
works 21:24 22:1 82:20 83:12 103:3		
worry 50:24		
written 65:25 66:4,9 70:6		