In The Matter Of:

Apple
vs.
Motorola

Leonard Cimini, Ph.D.

July 13, 2011

MERRILL CORPORATION
LegaLink, Inc.
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IN THE UNITED STATES DISTRICT COURT

FOR THE WESTERN DISTRICT OF WISCONSIN

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APPLE INC. and NEXT         )
SOFTWARE, INC., (f/k/a      )
NeXT COMPUTER, INC.,        )
                            ) Civil Action No.
   Plaintiffs and           ) 10-CV-662 (BBC)
   Counterclaim-Defendants,)
                            )
 -vs-                       )
                            )
MOTOROLA, INC. and MOTOROLA)
MOBILITY, INC.,             )
                            )
   Defendants and           )
   Counterclaim-Plaintiffs.)
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Videotape deposition of LEONARD CIMINI, Ph.D. taken pursuant to notice at the law offices of Morris, Nichols, Arsht & Tunnell, 1201 Market Street, 18th Floor, Wilmington, Delaware, beginning at 11:00 a.m. on July 13, 2011, before Julianne LaBadia, Registered Diplomate Reporter and Notary Public.

APPEARANCES:

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ALSO PRESENT: Lindsay DuPhily - Discovery Video Services

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THE VIDEOGRAPHER: This is the videotape deposition of Dr. Leonard Cimini, taken by the defendant in the matter of Apple, Inc., and NeXT Software, Inc., a/k/a NeXT Computer, Inc., plaintiffs and counterclaim-defendants, versus Motorola, Inc., and MotorolaMobility, Inc., defendants and counterclaim-plaintiffs, in and for the United States District Court for the Western District of Wisconsin, case number 10-CV-662.
This deposition is being held at Morris, Nichols, Arsht & Tunnell, Wilmington, Delaware. We're going on the record on July 13, 2011, at approximately 11:00 a.m.
The court reporter is Juli LaBadia from the firm of Wilcox & Fetzer, Wilmington,

Delaware. My name is Lindsay DuPhily. I'm the videotape specialist of Discovery Video Services, in association with Wilcox & Fetzer.
Counsel will now introduce themselves, and then the court reporter will swear in the witness.
MR. WEINSTEIN: I'm Marc Weinstein of Quinn Emanuel, representing Motorola.
MR. HASLAM: Bob Haslam, Covington & Burling, representing Apple, Inc. and NeXT.
LEONARD CIMINI, Ph.D.
The witness herein, having first been duly sworn on oath, was examined and testified as follows:
DIRECT EXAMINATION
BY MR. WEINSTEIN:
Q. Okay. Thank you for coming this morning. Could you just give me your full name and the spelling.
A. Leonard Cimini. Last name, C-i-m-i-n-i.
Q. And just confirm that you understand you're under oath?
A. Yes.
Q. That this is no different than testifying

in front of a judge in a court?
A. Yes.
Q. And just to confirm, also, there's no reason that you are impaired in any way this morning in giving your testimony? There's no medication or anything that --
A. No.
Q. Okay. Have you been deposed before?
A. Yes.
Q. How many times?
A. Twice.
Q. Twice. And what were those matters related to?
A. One was a patent case, an expert witness testimony, and I -- it was -- the defendant was Syro, and I was retained by Hewlett Packard.
Q. Okay. And the other matter?
A. The other matter was a civil case, my own. I had an addition built and sued the builder.
Q. Oh. Okay. And have you ever submitted an expert declaration previously?
A. Yes.
Q. And was that also in the HP matter?
A. Yes.

Q. Any other times?
A. One time -- the first case I ever worked on, in 2004, it was Agere Broadcom, and I don't know if it was actually ever submitted. The case was settled right around the time that I wrote it.
Q. And in HP, what was the technology involved?
A. Wi-fi.
Q. And can you be more specific? Wi-fi for cellular networks? Wi-fi for --
A. No, no. Wi -- actively 802.11.
Q. 802.11?
A. Yes.
Q. Okay. Have you ever testified in court before?
A. No.
Q. And this is your first time being retained as an expert for Apple?
A. Yes.
Q. And have you previously been retained by Covington & Burling as an expert?
A. No.
Q. I guess the first, Cimini Exhibit Number 1

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is Dr. Cimini's CV.
(Cimini Exhibit 1 marked for identification)
BY MR. WEINSTEIN:
Q. So, the CV is fairly self-explanatory, but I would just like to go through a few items.
A. Okay.
Q. To have a better understanding of the things that you have researched and worked on. First, can you just tell me a little bit about your Ph.D.? What was the focus of that?
A. My Ph.D. was on, in the broad sense, detection and estimation theory. And it was specifically on robust detection and estimation. So, the gist of that is that you try to -- when you design a system, you don't actually know what the environment is like. You make a guess. And if you design your system based on your guess, you're often quite wrong, and the system degrades rapidly. So, you design it based on sort of a class of guesses.
Q. Okay.
A. And that's what my -- it was mainly on. The title, it doesn't sound like that. It's Sum

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Results and Quantization In Filtering and Detection.
Q. And your first job after getting your Ph.D. was with AT&T?
A. Yes.
Q. And please tell me the things you, in your initial role there, what are the things you worked on?
A. My -- I worked in a group that did cellular systems engineering. This is before there were cellular systems.
Q. And the timing of that was?
A. April, 1982.
Q. Okay. And what did you do for cellular systems engineering?
A. My -- my job, I worked in a forward-looking radio group. We didn't call it wireless. It was radio then.
Q. Uh-huh.
A. And my job was next generation cellular. So we didn't have a first, but mine was the next, which would be digital cellular. And my job was to determine what modulation techniques should be used. So I worked on a technology called OFDM,

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and proposed that for the next generation.
Q. Can you explain OFDM.
A. So, OFDM is what's used in Wi-fi in 802.11 today.
Q. Uh-huh.
A. And in many systems.
Q. What other systems is it used in?
A. WiMax. WiMax is sort of a smaller distance cellular type system that's popular especially in Korea. It's called WiBro there, for broadband.
Q. Uh-huh.
A. And the main problem with transmitting at higher bit rates is the fact that the signal gets to the destination by multiple paths. So when it arrives, it has spread your pulse, because they arrive at different times, these different paths.
Q. Uh-huh.
A. And so, what happens is your pulse spreads into the next pulse. This is called intersymbol interference. And that's the main limitation in transmitting at higher bit rates.
So, what OFDM does, is it's essentially the same as saying if I have a wire

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that allows me to transmit one megabit per second --
Q. Uh-huh.
A. -- if I want to transmit 10 megabits per second, I take 10 wires and I put them together. And that's what OFDM is. Except the wires are not wires. They're frequencies. They're frequency bands.
So OFDM stands for orthogonal frequency division and multiplexing. And in 1982 it couldn't be built, even at very low rates. And so, we -- we gave up on that technology, until the late '80s and early '90s, when DSP technology progressed enough that we could build it.
Q. And that's digital signal processing?
A. Yes. In 1982, digital signal processors were very, very new.
Q. Okay. And so, this was done in development throughout the early, mid, and late '80s?
A. That was from 1982 to 1985.
Q. Okay.
A. And then in 1985, I moved to the research

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area at Bell Labs, and worked on fiberoptic communications for five years.
And then in 1990, I went back to working on radio wireless systems. Both cellular -- at that point, it would be 3G systems.
Q. Uh-huh.
A. Although they weren't called that then, either. And in building systems, you know, wi-fi, 802.11 type systems. And I did that until 2002, when AT&T downsized, and I came to the University of Delaware.
Q. And in the U.S., what systems use OFDM?
A. 80 -- the initial one was 802.11A. But 802.11, the current version, 802.11G, 802.11N, and the newer systems, which will come out later, 802.11AC. They all use OFDM. And WiMax, which is 802.16. 802.16. I don't know how many WiMax systems are deployed in the United States.
Q. And is OFDM used for any other --
A. OFDM is part of the third --
Q. That's what --
A. -- generation cellular systems. But only for the downlink. So, from the base station to

the mobile units. And only in some forms of it.
Q. Okay. And then you've now been at Delaware since '92 as a professor?
A. 2002.
Q. 2002.
A. Yes.
Q. And what are the topics that you teach?
A. Mostly communications. So I teach a graduate course in digital communications. I teach an undergraduate course, senior level, in communication systems. And I teach a sophomore level course that's called signals and systems. It's the basic -- what are called linear time and variance systems.
Q. I'm familiar with that course.
A. Okay. Yeah. Everyone has to take that course.
Q. Yes.
A. It's a required course.
Q. Yes. Okay. Is there any cellular system around the world that uses OFDM?
A. Not at the present time.
Q. Okay. I'd like to introduce as Cimini Exhibit Number 2, this is -- sorry.

(Cimini Exhibit 2 marked for identification)
MR. HASLAM: I've got a copy, thanks.
MR. WEINSTEIN: Okay. You bet.
BY MR. WEINSTEIN:
Q. This is Dr. Cimini's declaration that was submitted as part of Apple's opening claim construction brief. Okay. If you would turn to page 2.
A. Yup.
Q. In paragraph 9, you said, "In preparing this declaration, I have extensively reviewed various materials, including the '559 patent and its file history." Can you tell me what other materials that you referred to?
A. For this dec -- for making this declaration?
Q. Yes.
A. Just the '559 patent and its file history.
Q. So if the -- any statement that you've made in the declaration, if it was not from the '559 patent or the file history, was it just based on your general knowledge?

A. Yes.
Q. So there were no other technical papers or books or documents that you --
A. Not in writing this declaration.
Q. Were there any discussions you had with other professors or engineers in helping to prepare the dec?
A. No.
Q. Did you, in fact, write the declaration yourself?
A. The Covington attorneys and I wrote the patent -- wrote the declaration together.
Q. Okay. In paragraph 10, you say, "The '559 patent is directed to the field of wireless telecommunication systems, and that addresses the problem of multiple cellular telephones trying to communicate with the same base station in the cellular network at the same time."
On what basis do you make that statement?
A. From the description and specification of the patent.
Q. And could you point -- oh.
A. I don't have --

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Q. Before we do that. Yes.
A. Yeah.
Q. Let me introduce as Cimini Exhibit Number 3, this is U.S. patent number 6,175,559, to Tyler Brown.
(Cimini Exhibit 3 marked for identification)
BY MR. WEINSTEIN:
A. Yeah. Thank you. Were you waiting for my answer?
Q. Yes.
A. Okay. Sorry. So, in -- in column 1, around line 15 --
Q. Uh-huh.
A. -- because multiple mobile stations may be trying to access the channel simultaneously.
Q. Okay. And just to step back a bit. In preparing for today, did you review the '559 patent again?
A. Yes.
Q. And when did you do that?
A. Yesterday, and Sunday.
Q. And were there any other materials that you used in preparing?

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A. Yes. I looked at -- I looked at several of the other patents that I had.
Q. Several other patents --
A. I can't remember all the numbers.
Q. Several other patents related to this patent?
A. Related to this one.
Q. Anything else? Any other technical documents?
A. No.
Q. Did you refer to any --
A. Oh, wait. Yes. The 3GPP. Some of the 3GPP documents.
Q. Did that include the -- I'm sorry. A 3GPP TS25.213 standard?
A. Yes.
Q. Okay. So, and the next line in paragraph 10, it says, "When a new cellular telephone enters a cell, it must notify the base station of its presence so that it can begin to send and receive data on the network. The new cellular telephone transmits a choice signal called a preamble to allow the base station to detect its presence."

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So from the time that a cell phone enters a cell to the time that it actually transmits the preamble sequence, can you explain what steps take place?
A. Not exactly. So, I can tell you in general terms.
Q. Okay.
A. So when you're -- when you have your cell phone and you're in a -- in an area, you're in Wilmington.
Q. Uh-huh.
A. You turn your phone on. Your phone immediately makes contact with the cellular system, trying to find the nearest base station. So that's all part of the initial process. Just knowing where you are, first of all.
Q. Okay.
A. But the process where now you have something to send is slightly different than -- this is more about the mobile station initiating, you know, communications with the base station.
Q. Such as making a phone call?
A. Such as making a phone call, or a text, anything.

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Q. Right.
A. And so, what you need is you need some information that needs to be exchanged with the base station, that one, allows the base station to know you're there, and to do synchronization. And that's what this short preamble is for.
So this would happen almost immediately when you have something to send. In general terms. I can't tell you exactly how --
Q. Okay.
A. -- 3G operates, or even a 2G system.
Q. Okay. So before the preamble is actually sent, are there steps, are there any other communications that occur between the mobile station and the base station?
A. I don't know how each system operates, but in the older cellular systems, so if we go back to the 2G, what happened is as soon as you were -- your phone is turned on, with nothing to transmit, there's essentially something that would be -- you can call a beacon, that allows the station to -- to know where you are, within which cell you are.
Q. So the beacon is from -- from which to

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which? From the mobile station to --
A. It would be from the base station to the mobile. Setting up sort of a handshaking, to say yes, I know you're there. But in the newer systems, that might not be necessary. I'm not sure.
Q. So in the newer system -- I'm sorry. So for 3G, it might not --
A. It might not be necessary. But I can't say.
Q. Okay. Then the last line is that "The base station then transmits to the new cellular telephone a unique identifying value that the new cellular telephone uses in future transmissions." Can you explain, what is the unique identifying value?
A. So, the unique identifying value depends on the system, right. So let's assume that it's a CDMA system. So either -- either 2G or the newer 3G.
Q. Uh-huh.
A. So what the base station would have to tell the cell -- the cell phone is how that -- how to communicate so that the base station can

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distinguish it from other users, and the mobile station is transmitting to the correct base station.
Q. Okay.
A. So this identifying value could be a code, if it's a CDMA system. And that's how 2G and 3G would operate for CDMA.
Q. Okay. And the code, is the code actually sent from the base station to the mobile station?
A. The code is actually sent from the -- okay. So I should back up. I'm not sure if the actual code is sent. It could be that the base station sends to the mobile station an index, so the mobile station has a table where the code -- say index 7 means this code.
Or it could be, actually send, if it's being done by some circuitry that's generating the code, it can tell it the -- the weights on the -- on the shift register. I don't know how it's actually done.
Q. Okay.
A. In the newer systems.
Q. Okay. Let's move on to paragraph 11.
A. Okay.

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Q. "Because many new cellular telephones often enter a cell at the same time, multiple new cellular telephones may try to transmit preambles to the base station at the same time." And what was the basis for that statement?
A. So, let me see if I can find the line. Right. So, this comes from -- you can go, the same line we read before, "because multiple mobile stations may be trying to access the channel simultaneously." Right. So that corresponds to many users -- "multiple new cellular telephones might try to transmit the preamble to the base station at the same time." So that comes from simultaneously.
Q. Uh-huh. And then the following statement, "The base station must be able to distinguish the different preambles."
A. Right. So this -- this comes from reading the patent, but basically, also general knowledge, right? So if you need to -- if you have multiple users all trying to access the channel at the same time, you need a way to separate them.
Q. Okay.

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A. Otherwise they just look like one blob of noise to the base station. So the base station needs to be able to separate these.
Q. Okay. And the '559 patent, you're saying, is directed to CDMA?
A. Yeah. That's what it says.
Q. Okay. And is it -- is the '559 patent also applicable to other forms of cellular systems?
A. No.
Q. Okay. In paragraph 12, you get into doing some background on CDMA systems. The second sentence, "CDMA allows multiple cellular telephones to use the same physical communication channel." Can you explain what that means?
A. So, the -- you need to separate users in some way. And so, you can separate them in time or frequency. So that means users use different times, so you get a turn and I get a turn. Or use different frequencies, which is the way the oldest systems operated. Or there's another way, where you can use the same time and the same frequency, but each user is assigned a different code.

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And ideally, these codes are orthogonal, so that at the destination, at the base station, each user has a different code. The base station correlates with each of these codes, and separates the users. So they're allowed to use the same frequency channel at the same time.

(Phone beeps)

MR. WEINSTEIN: Excuse me.

Q. In the last clause, it says, "Without significant interference by encoding transmitted data, using a code that is unique to that cellular telephone, and that can be distinguished from the codes of all cellular -- all other cellular telephones." Is that the same unique code you were talking about before?

A. Yes. I -- in the previous explanation, I actually answered, you know, explained the next sentence.

Q. Okay. So that's after the preamble has been sent?

A. Well, it's a combination, right? So there's two -- there's two features to a communication system, right? There's the

synchronization access, and then there's actual transmission of data.

Q. Okay.

A. So the code would be used in -- a code would be used in both cases.

Q. Okay.

A. But it's in a -- in the preamble part, you're going to separate users to start access to the channel. In the -- once you have access, then the actual data communication occurs, potentially with a different code. It depends on how the system is designed.

Q. Okay. And in the CDMA, is that the same code or different codes?

A. CDMA stands for code division multiple access.

Q. Right.

A. It simply means that each user has a different code.

Q. That would be --

A. In order to access the channel, and in order to transmit data.

Q. Right. The code used for the preamble, and then the code used for later messaging, is

that the same code or different code in CDMA?

A. It could be either. In the simplest case, it would be the same.

Q. All right.

A. But --

Q. Can you explain to me, I know you've given me some background on it, but what are the primary differences between CDMA and OFDM/FDMA?

A. Okay. So --

MR. HASLAM: I'm going to let him answer that, but I'm going to object on the relevance of that. It's not a topic that's discussed in his declaration, and that's what we're here to talk about.

MR. WEINSTEIN: Well -- okay.

Q. Please answer.

A. Okay. So, FDMA means I separate users by different -- each user uses a different frequency. So the very first cellular system, for example, which was analog, called amps, used separate frequencies. So you were given a frequency, and you kept it forever. That frequency channel was yours. That's similar to your -- when you pick up a wired telephone. You

get that wire, and that wire is yours and no one else uses it.

In -- in TDMA, we all use the same wire, but we share it. So I use it first, and then you use it. In CDMA, we all use the wire, all use it at the same time, but we all use a different code.

OFDM is not the same class. It's not an access technology. OFDM is a modulation technique that permits you to transmit at higher bit rates. So it applies to one user at a time. And it could apply to all three systems: CDMA, TDMA, or FDMA.

Q. Okay. So, I'm sorry. So OFDM can be used in CDMA?

A. Yeah, it can. There are plenty of technologies that are called multi-carrier CDMA, that look very much like OFDM.

Q. And those are used in the U.S.?

A. I don't know. The 3G technologies, some of the original 3G proposals were multi-carrier CDMA, but I don't know how much of it is actually being -- going to be deployed, or even considered in the future.

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Q. Okay. I'd like to enter as -- this is now Cimini Exhibit Number 4. And this is just a list of Dr. Cimini's publications.
(Cimini Exhibit 4 marked for identification)
BY MR. WEINSTEIN:
Q. And this is a publication list that comes from the University of Delaware's website that's linked to your bio.
A. Okay. Yeah.
Q. And this, it lists your journal articles. Also conference papers, your patents, and your books. Books is on -- I guess it's page 6.
A. Page 6.
Q. No, I'm sorry. It's not there. I'm sorry. It's on the very last page. Page 8.
A. Yes.
Q. Okay.
A. They're just book chapters.
Q. Those are just book chapters?
A. Yes.
Q. And do any of those book chapters relate to CDMA?
A. No.

Q. And in this, there are 50 journal articles listed. I guess the majority are relating to OFDM. Do any of them relate to CDMA?
A. I'm sorry. I'm trying -- I'm looking through it --
Q. Sure.
A. -- to see if there are. No. I don't -- I don't believe so.
Q. Okay. And is that also the case for the -- the conference papers?
A. I would think so.
Q. There's quite a few more.
A. Yes.
Q. And just also to confirm, also for your patents?
A. No. No CDMA.
Q. So, in -- in providing the overview of CDMA, how -- on what basis do you -- are you able to discuss it?
A. CDMA is a well-known technology, and it's -- it's well developed already in textbooks. And I've worked in cellular and wi-fi for almost 30 years, so I've developed a background where I understand these. And I've taught courses and

short courses that covered CDMA.
Q. Okay. And returning to your declaration, in paragraph 13, you said, "The basic unit of information transmitted over CDMA is called a chip." Can you explain the meaning of a chip?
A. In the -- the fundamental principle of CDMA that allows it to -- to work, is that what you do is you take a given user or information symbols from the user, information from the user, and you spread it over a very large band. And then all the users sort of pile on top of each other.
Q. Uh-huh.
A. And so, the fundamental time unit, when you spread something, means that the time interval now is much shorter. So, if a pulse was of width T before, if you spread it by a factor of N, the fundamental pulse is now T divided by N. And that fundamental pulse is called a chip, to mean part of a -- of a bit.
Q. Okay. And the next sentence you say, "A chip is binary, meaning it has a value of either 1's and 0's or plus 1 and minus 1. These are -- those are real values." Is there a difference

between a chip with a real value and one that has an imaginary or complex?
A. No. In general, a chip could be. More typically, and I don't think I've ever seen a chip in an implementation that was not real valued, and simply plus or minus 1.
Q. So in all implementations, it's -- it's a real value. Does that -- throughout the generation and transmission process of any data, it's always going to be a plus 1 or minus 1 value?
A. No. That's not true.
Q. Okay. Can you explain why that's not so?
A. Right. Because in general, the transmitted -- all information that's transmitted over the air -- air is real. All right? You can't transmit imaginary things.
Q. Uh-huh.
A. But from a mathematical implementation point of view, you think of the information that you're transmitting as complex. Which means it has a real and an imaginary part. Or from an implementation point of view, it has an in phase and quadrature part.

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Q. Can you explain that? In phase and quadrature part?
A. Simply mean that it has -- let's take an example. That we -- if we want to send a pulse, and we can modulate that pulse in many ways. So we can modulate its amplitude, or we can modulate its phase, or frequency.
If we modulate its phase, what we're doing, and you can think of it as a two-dimensional plane. So there's the real and imaginary parts. And what we're doing is we're rotating it as we change its phase. So one of the simple modulation techniques is called QPSK, and we represent that as four complex numbers. Think of it as the four -- one point in each quadrant.
Q. Right. So plus 1 minus J, plus 1 plus J, minus 1 minus J, minus 1 plus J?
A. Correct. That's correct.
Q. Okay. And what is the point of modulating by phase? What's it used for?
A. The -- it's just another way to modulate data. And it's a -- so what you do when you try to determine what modulation technique to use,

you have to consider how much band width it uses, how much power it uses, and how simple it is to implement.
And you use those three measures to determine which modulation technique to use. So for example, if you'd like to transmit higher bit rates, you need to have more amplitudes and more phases. It's the only way to pack those -- those points that we just talked about --
Q. Uh-huh.
A. -- into this two-dimensional space. Right? So that's the advantage of modulating with multiple levels in both amplitude and phase.
Phase gives you an advantage, in that the amplitude's not changing. So if you modulate the phase, the envelope of your signal is constant. And so, it has that advantage. It makes for simpler transmitter circuitry.
Q. Because it's able to determine --
A. No. It's because if you have a constant envelope --
Q. Uh-huh.
A. -- you can put it through an amplifier that's very non-linear and it doesn't bother it.

So that's why you would use phase modulation.
Q. And is that what CDMA systems use?
A. The old -- the 2G systems used QPSK and BPSK. So mainly, the original systems used plus or minus 1's only.
Q. But in the 3G system you don't know?
A. In the 3G systems, the modulation techniques go to multiple levels.
Q. Can you explain that?
A. So, they -- they -- if you take the QPSK, and you just consider more points in each quadrant, think of it in a rectangular grid, or a square grid. And that's what they use. What you'd like to do is get the highest bit rate you possibly can. And so, you want to send as many bits for each pulse that you transmit. Okay?
Q. Okay. And so then for each pulse, what?
A. They transmit as many as 6 bits, I think.
Q. And when you say 6 bits, that's six plus 1's or minus 1's?
A. Yeah. You can think of it as six plus or minus 1's.
Q. Or six 1's or 0's?
A. Yes. The way to think about it is that

there are 2 to the 6 possibilities now.
Q. Okay.
A. So there are 64 of those points in that two-dimensional space.
Q. But those are binary bits?
A. Yes. Binary bits. But the 1, 0, or plus or minus 1 is just a mapping. I just call 0 minus 1.
Q. And how does that relate back to the chips? Does that mean that one chip can have 6 bits?
A. No. No.
Q. Okay. Then --
A. So what you do is you take each of those bits, and you -- you spread them out. And so, it's easier to think of CDMA, especially the older system, it's the easiest way to think about it as just transmitting binary data. And then what you do is you spread it. And what the spreading does is it takes the pulse, and makes the pulse much narrower. The narrower pulses, they're the chips. And we call those plus or minus 1. So think of each bit being spread.
Q. So you're saying, then, it would be within

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1 pulse, you could have 6 chips?
A. No, no. No, no.
Q. Then I'm --
A. No, no. The chips and the number of bits per symbol are not related.
Q. Okay. Can you explain --
A. They're independent of each other. That's why I said, it's easier to think about this as just binary data being transmitted.
Q. Okay.
A. So I want to send a 1 or a 0 or a 1 or a minus 1. And that's all I want to send.
Q. Okay.
A. And then what I do is I take that 1, that 1 pulse, it's a positive going pulse.
Q. Uh-huh.
A. And I multiply it by another sequence, right, which is plus or minus 1's, and that serves to take that one pulse and spread it in band width, okay?
And so what I'll see is instead of one pulse which is just positive going, I'll see multiple variations, and each one of those is a width, whatever the spreading factor is I've

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divided by.
Q. Uh-huh.
A. And that we call a chip.
Q. Okay. The -- and in the last sentence of paragraph 13 you say that, "The binary chips cancel each other out when added together." Can you explain that?
A. So, the -- the purpose of the spreading is to separate users, and then unspread, right? So if the -- if you multiply all these chips together, you multiply the sequences together, and then you add them up.
Q. When you say multiply sequences together --
A. So you have this -- I said there is this spreading signal.
Q. Right.
A. Which creates the chips, right? And so it's a series of plus or minus 1's, which are a series of chips.
Q. Uh-huh.
A. And when you multiply them together at the -- so you take what you transmitted with -- at the receiver. Then -- and supposing they all

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line up. And when you add them up, the plus 1's multiply with the plus 1's.
Q. Uh-huh.
A. And the minus 1's add with the -- multiply with the minus 1's. And so, they give you all 1's. So you get -- it removes it.
Q. Okay.
A. The other feature, which is not necessary, that's what my hesitation is here, okay, is that in any of these sequences, they -- it's not necessary that you have an equal number of 1's and minus 1's. It's a desired property, but it's not true of all possible codes.
Q. Is that -- and what's the reasoning for that, that you would want relatively equal numbers of plus 1's and minus 1's?
A. So that when you have this -- you can show that if you have an equal number of plus and minus 1's, if the code -- when you correlate the code with itself, that you'll get a very -- you'll get the highest possible peak when they line up, and you'll get the smallest possible value when they don't line up. But like I said, it's not required.

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Q. Uh-huh.
A. And here it's just the fact that the plus 1's and the minus 1's will add to 0.
Q. Okay. In the next paragraph, you say that a sequence of chips, this is paragraph 14 --
A. Yes.
Q. "A sequence of chips is often called a symbol." Can you explain the difference between chips and symbols?
A. Usually, a symbol -- usually a symbol can be -- is a more general term. So it can -- it can apply -- it can refer to a collection of bits. It can refer to a collection of chips. In OFDM, it can refer to a collection of symbols.
And so, in this -- in this case, because we're talking about chips, we often call a sequence of chips a symbol.
Q. So can you give an example of what a sequence of chips would be, for -- I guess when would a chip be essentially the same as a symbol, and when would there be multiple chips to be a symbol?
A. That's going to depend on the definition of the particular codes, and the modulation

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technique that you're using. So I could have a code, I could have a code that is constructed of 8 chips.
Q. Okay.
A. So those 8 chips, I can call a code symbol. I can call them a modulation symbol, if I take those chips and multiply by the -- say a bit. Or I can call -- I can refer to the code word, which is a collection of these individual codes, I can call that a symbol.
Q. Okay. And if a chip and a symbol were -- they can also essentially be the same?
A. It's -- it's possible.
Q. And are there -- what are the advantages or disadvantages of having them be the same or having multiple chips per symbol?
A. The more standard is to have multiple chips per symbol. Because what you're trying to do is to spread -- you're trying to spread the data in frequency, in band width.
Q. Uh-huh. Do you know if CDMA uses multiple chips per symbol?
A. Again, it's a definition of symbol. What do you mean by symbol. There are -- if a bit

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comes in, that bit is multiplied, so one bit is multiplied by multiple chips, by a sequence of multiple chips. If we want to call that one symbol -- okay. We can. But the collection of bits could be called a symbol.
Q. So the multiple chips could be one symbol or it could -- each chip itself could be a symbol?
A. Each chip is -- is typically not a symbol, but it could be a symbol, yes.
Q. Okay. In paragraph 15.
A. 15. Yes.
Q. "Cellular telephone transmitters send data over the CDMA network using a sequence of chips called codes"?
A. Yes.
Q. So, is it -- a code is a sequence of chips. Is it -- how does a code relate to symbols?
A. So, for example, you -- what you might do is you might have -- we'll take the simplest -- simplest case, right. So if I take one bit and I'm going to spread it by a factor of 8, I'm multiplying it by a sequence of 8 chips. And the

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particular values of those chips is what we call a code. So that particular sequence is what we call a code.
Q. Okay. The sequence of chips used to spread the --
A. Yes. I mean we're calling it a code, but it's really a code word in a collection of values -- of sequences.
Q. And then how does that relate to symbols?
A. So, it depends again on the definition of symbols. So, symbol usually is referring to -- symbols can refer to a collection of bits, a collection of chips, a selection of another collection of symbols. So, it depends here on the parameters that are used in the design.
Q. In this -- that simple case, one bit spread by a factor of 8, so it's multiplied by a sequence of 8 chips.
A. Right.
Q. The -- and you're saying that's what becomes the code?
A. Yes. And we -- in that particular case, the one where I said 1 bit is spread by 8, we would probably call that 1 bit that's been spread

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the symbol, in that particular case.
Q. So going back to when we talked about that unique code that CDMA basically assigns to each cell phone, can you extrapolate this simple case to how that code would work, between the bit, the chips, and the symbol?
A. Depends on the code. But let's take the simple case. So you're -- you are assigned a -- there are 2 to the 8 possibilities for 8 bits.
Q. Right.
A. 8 chips.
Q. I understand.
A. Okay? Now, they are not all orthogonal.
Q. Uh-huh.
A. So you really wouldn't -- you wouldn't do it that way. But let's suppose we choose an orthogonal code. So you're given a particular 8-chip sequence. That is your code. And I am given a particular 8-chip sequence, and that's mine. Hopefully the two are orthogonal. Okay?
So all of my data, let's assume it's just bits, plus or minus 1's, or 1's and 0's, however you wanted to look at it. But plus or minus 1's makes the math work out properly.

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Q. Right.
A. So I take my plus or minus 1's, I multiply them by this chip sequence, by my code. You do the same thing. Right? I would call that transmission of the -- that's the chip sequence, I would call that the symbol. All right?
And then at the receiver, at the base station, the base station would correlate -- have two separate correlators. One for you, and one for me. Assuming everything lined up properly, you would get -- the base station would get your data and my data.
Q. Uh-huh.
A. And in this particular case, we're transmitting one bit each time.
Q. Okay. So, for each bit of my data, I am spreading it by multiplying it by the chip sequence?
A. Yes.
Q. Okay.
A. And -- in the simplest case of CDMA.
Q. Right. And that is then -- so that chip sequence of 8 bits is only going to, on the receiving end, be able to resolve 1 bit of the

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data I'm transmitting?
A. That's correct.
Q. Okay. Also in paragraph 15 you say that "Codes have properties that make them easier for the base station to recognize and differentiate when multiple cellular telephones are transmitting at the same time." Can you explain what you mean by that?
A. So, that's what I was saying about the 8 bits. So 2 to the 8 possibilities, but some of those, when you do this correlation at the receiver, will give you a large output, even though it's not the appropriate signal. It's not coming from the right user.
You -- if you can choose these codes to be orthogonal under all conditions, under all impairments, that would be the best possible thing you could do. And that means I can separate them at the receiver. So it's important how you design these codes.
Q. Is that something that's discussed in the '559 patent?
A. Can you repeat that?
Q. I'm sorry. Is that something that is

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described in the '559 patent?
A. Something -- what? Which something are you referring to? I'm --
Q. The ability to recognize and differentiate --
A. Yes.
Q. The codes having properties that make them easier for the base station to --
A. Yes. That's the target. At least that's the motivation.
Q. Okay. And can you identify where in the '559 patent it relates to that?
A. So, at the bottom of column 1, it talks about -- that paragraph, the signal generated by the preamble generator.
Q. Uh-huh.
A. Should be. So it has a list of things.
Q. Uh-huh.
A. Which has to do with timing, and complexity, or problems when you have a carrier frequency offset. And then the last allow the receiver to determine which transmission is about to begin -- transmitter is about to begin transmission.

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Q. Uh-huh.
A. So that last one is the one that allows it to separate the transmitters. And that's what's -- that's what's in 15.
Q. Okay. And the -- to determine which transmitter is about to begin transmission --
A. Yes.
Q. -- before you do that you need to send the preamble sequence?
A. Before you do what?
Q. Before you actually transmit to -- it says to allow the receiver to determine which transmitter is about to begin transmission.
A. So, do you need to send the preamble before somebody can start transmitting?
Q. Yes.
A. Yes.
Q. Okay. If a mobile station enters a cell and it's not receiving a call or you're not sending a text or not creating a call, is there any reason for it to generate a preamble sequence?
A. No. You said there's no -- it doesn't want to transmit and it doesn't want to receive?

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Q. Doesn't want to receive. Yes.
A. Yes. Okay. Make sure I'm answering the correct question.
Q. Good. Outside of CDMA, are there -- the other types of cellular systems, do they also use preamble sequences?
A. Yes. Preambles, some handshaking between the base station and the mobile station is required, to get all of the same things. To determine who is going to transmit, when, and all of the synchronization that's required.
Q. You had made a point before about the OFDM in relation to the TDMA, CDMA, and FDMA, something to the effect of that -- it was -- just give me a second -- as a modulation technique.
A. Yes.
Q. So as -- I guess what was -- what was not clear to me is the differences between those three, the TDMA, CDMA, and FDMA, and then there's a distinctive part of that system is its modulation technique?
A. That's right. Completely different.
Q. Okay. And what --
A. CDMA, TDMA, and FDMA are multiple access

techniques. So they -- they are the techniques that permit you to separate users. Okay? So that's all you really want to do. I want to separate users. I want to give you access to the channel at the same time I give someone else access to the channel.
What modulation technique I use, whether it's QPSK or 64 QAM, which are the two I mentioned before, or OFDM, doesn't matter. Right? That -- what you generate is you basically generate -- think of them as pulses. After you do all the modulation, you generate pulses.
Q. Uh-huh.
A. And then those pulses are -- there's a multiple access technique that's on top of that. In CDMA it's a spreading. In TDMA, it's each person gets a chance. So -- that's how it works.
So they are distinct. Although there is an OFDM form called OFDM-A, which is a multiple access technique, and it's used -- it's been proposed in the uplink for WiMax. It hasn't been adopted.
Q. Okay. And at this point you had said

before, also, that OFDM is primarily implemented in 802.11?
A. Yes.
Q. So what is the -- in 802.11, you also have essentially a multiple access system?
A. Right. But the multiple access technique there is -- everything is -- is packet-based and there's no voice communication. So what you do in -- in that system, there's multiple versions of how it works.
Q. Uh-huh.
A. But one looks very much like a base station. It's called an access point. And the access point determines who can transmit when. And it basically -- there's this handshaking that goes on that says you transmit and no one else is allowed to. So it looks like -- it looks like a time division system. It's not TDMA. They're not given slots, but it's -- it's one at a time.
And there are still multiple frequency channels that can be used. But basically, access points have one frequency at a time.
Q. So the -- with multiple frequency

channels, that allows more than one to transmit at the same time?
A. At the same time, right.
Q. But within each frequency channel you're basically saying, you know --
A. Yes. One user at a time.
Q. One user at a time.
A. Right. The newer versions that will come out in the next year or so allow for multiple users.
Q. And what would you say are the -- the biggest differences between this type of multi access system in wi-fi 802.11 versus the multi access in CDMA?
MR. HASLAM: I'm going to object to that question and instruct him not to answer. He's here to testify about his declaration. Anything else, he's been retained as an expert. We haven't disclosed him as a testifying expert on anything beyond what's in his dec -- his declaration, and I'd object to any questions in the line you're now going, on the grounds -- based on 26(a)(4) and the fact that you haven't sought, nor attempted to lay any foundation of

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the fact that you need to get testimony from a non-testifying expert on matters beyond that which he's been designated to testify on.

MR. WEINSTEIN: Well, I understand him to be a real true expert in OFDM, which focus on 802.11, and he's providing this declaration in relation to CDMA, so I'd like to understand what he understands is the differences between the two.

MR. HASLAM: Show me how the differences between the two relate to the '559 patent and the content and the substance of his declaration. The '559 patent says it's a method for generating preamble sequences with a code division multiple access system. Every claim is limited to a CDMA system.

I don't see any reference to the OFDM, or the relevance of the difference between OFDM and CDMA, and particularly 802.11, to this deposition.

MR. WEINSTEIN: Again, my -- he's providing a declaration on the '559 patent which relates to CDMA.

MR. HASLAM: True.

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MR. WEINSTEIN: He is representing himself as an expert. But when you look at his background, everything is focusing on OFDM, which relates to 802.11.

And I'd like to understand, if he's an expert in this area, what also would make him an expert in CDMA, and if he is truly an expert in CDMA, he would understand what the differences are between the two.

MR. HASLAM: I understand. My objection and instruction still stands.

If you want to ask him what -- and you have, but if you want to pursue what makes him feel he is qualified to respond to questions on CDMA, you can go ahead and do it. And depending on where those answers take you, you can examine him.

But you're taking him in an area which he hasn't opined on in his declaration, and that's what we're here to do.

MR. WEINSTEIN: But he's talked to how he --

MR. HASLAM: You know what, I'm just -- you can make your final statement.

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MR. WEINSTEIN: Sure.

MR. HASLAM: I won't state it. But I'm not changing my mind --

MR. WEINSTEIN: Okay.

MR. HASLAM: -- based on any arguments here today.

MR. WEINSTEIN: Okay. So you're still instructing him not to answer?

MR. HASLAM: Yes.

MR. WEINSTEIN: Okay.

MR. HASLAM: But I am not instructing him not to answer any questions you want to ask him on why he believes he's qualified to render the opinions and statements set forth in his declaration related to CDMA.

MR. WEINSTEIN: Okay.

BY MR. WEINSTEIN:

Q. As an expert in 802.11, what aspects of being an expert in 802.11 enable you to testify as an expert to CDMA?

A. So, I don't consider -- so you asked -- you asked the question, you're an expert in 802.11. That's not -- that's not correct.

Q. Okay.

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A. All right? So if I -- when I -- when I advertise myself --

Q. Uh-huh.

A. -- I advertise myself as an expert in wireless communications.

Q. Okay.

A. I've worked in wireless communications systems for 30 years. I have not worked on CDMA systems directly. But it doesn't mean that I don't understand the basics of CDMA. I've taught courses, I've taught short courses. I've taught week-long short courses at industry locations.

So, I -- and the fundamental principles of CDMA don't change. Now, the details that have to do with the differences between 802.11 access and CDMA access are -- I might not know every detail. But it -- there's -- OFDM is proposed for cellular systems, also.

Q. Uh-huh.

A. And I just happened to work for AT&T, which was a TDMA company.

Q. Right. Can you -- you say you're not sure what the difference is, but I mean are they

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profound differences?
MR. HASLAM: Between 802.11 access and CDMA access?
MR. WEINSTEIN: Right.
A. They're fundamentally different. And the reason they're fundamentally different is one system is trying to make money off of this. And you can't afford to have users interfere with each other. Right?
So there's a fundamental difference. There's a lot of safeguards. There's a base station that costs a million dollars that's controlling the mobile units. And an access point, most of us have access points in our home.
Q. Sure.
A. Okay? That cost about $100. And there's no money to be made. So there's a fundamental difference in the safeguards that prevent these systems from interfering with each other. If you're using wi-fi -- which I guess we're all using in here.
Q. Yes.
A. Okay. If you interfere with each other, it doesn't matter. You're going to resend that

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packet. If, on the other hand, you keep dropping a call --
Q. That would be annoying.
A. -- you're going to -- they're going to lose money.
Q. It happens anyway.
MR. HASLAM: Then you're on the AT&T network.
A. And of course, they're trying to get as many users as possible on the same piece of spectrum they have. That's how you make more money.
Q. Okay. Let's move on to, in paragraph 16, 17, and 18, you talk about point by point multiplication.
A. Yup.
Q. In what aspects does CDMA use point by point multiplication?
A. In -- so, in the example that I gave before, about you have an 8-chip code and I have an 8-chip code. So one way to -- let's assume that we have it completely lined up, the timing is not a problem.
Q. Uh-huh.

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A. Right? Then what I do is I take the code that I know is yours, and I multiply it by your signal bit -- you know, chip by chip. Right? And if what I do is I multiply it chip by chip, the 1's will multiply 1's to give you a 1. The minus 1 will multiply minus 1 to give you a 1. So now what happens is your bit now effectively is multiplied by a 1 straight across, and your bit comes back. Right?
If I don't get it right, the 1's and the minus 1's will not multiply properly, and I will get some subtraction, and I will get a lower signal. Ideally, because our signals are orthogonal, I will get a 0. They will get a 0 from my signal when they're trying to detect yours.
Q. Right.
A. And that's what the bit -- the chip by chip or point by point multiplication is.
Q. Okay. And that's getting more onto the following paragraphs, when you're talking about correlation and orthogonal --
A. Yeah. It's the same example.
Q. All right. So we can just move on to, in

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paragraph 19 --
A. Uh-huh.
Q. -- you say, "A base station can determine whether it has received a code from a cell phone by multiplying a received sequence by that code and calculating the sum of the resulting chips."
Before we get into explaining that, when you say "that code," what is that in reference to?
A. So, in the -- that -- "that code" refers to the code that's in the line before it.
Q. So it's received a code from a cell phone, and --
A. Right.
Q. -- the mobile station is -- the base station is using that same code?
A. Yes.
Q. Okay. And how does the -- can you explain, how did the cell phone know to use that code in the first place?
A. So, somehow this signal has been set up ahead of time. That's one way you can do this. Another way is that this is what's happening after the preamble has already set up, made this

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connection. Right? So, for example, in the base station, like I said, there's this handshaking that goes on ahead of time. You are assigned the code.
In a -- it doesn't work this way, the real system doesn't work this way, but you could be assigned a code permanently, right, so your phone could have one -- much like you have a serial number, that is your code. And the base -- all the base -- there's a big huge table, much like telephone numbers. There's a big huge table that would have this code in it. That's the simplest way. There's no -- there's no handshaking required.
Q. That would be very intensive in trying to correlate, then, if you --
A. Yeah. It could be. Right. Right.
Q. If you have --
A. Depends how many you need, how many --
Q. Right.
A. It's not done that way, right?
Q. Yeah.
A. So you know if you're in a particular base station, they give you the code that applies to

that base station, and that's what the handshaking which -- in CDMA, you need to be -- sync up fairly well, especially in the -- in the uplink, because there's some -- and the downlink, it's always synced up, but in the uplink it's very important.
Q. Uh-huh.
A. And so, you try to sync it up the best you can. So once you -- once you have that code, then the cell -- the base station is using that same code to determine that it's you.
Q. Okay.
A. And that's the example, essentially the example that's in 17 and 18.
Q. Okay. So, in general, then, the base station, whether before the preamble or after, is going to send something -- some information to the mobile station saying use this particular code, or pick from one of these codes?
A. Yes. Usually in the preamble.
Q. In the preamble?
A. Right. This is --
Q. So before the --
A. This is somehow -- so what will happen is

the -- somehow, this code is set up, and -- and once that code is set up, it could be, like I said, you have the big table which we said is impractical, or when your phone first turns on, that code is sent to your -- to your phone. There's multiple ways, and I do not know the way that it's done in the system that is -- as currently deployed.
Q. It --
A. But they all have the same end goal.
Q. Is that explained in -- in the 25.213 standard, or do you know?
A. What is --
Q. The -- the 3GPP.
A. No. What are you saying is --
Q. The --
A. We referred to a lot of things here.
Q. The manner in which the codes that are used by the mobile station to communicate with the base station.
A. I don't remember.
Q. Okay. The next line, if the chap -- sorry. "If the chips add up to a large positive or negative number, then the base station knows

that the transmitter used that code."
A. Yes.
Q. All right. Explain what that means.
A. So you do the correlation. Let's say it's point by point.
Q. Okay. Explain -- before we -- what do you mean by correlation, then?
A. So, okay. So let's suppose that the signal comes in, and what we'd like to do is to see how alike this received code is with the code that I expect from other transmitters. The base station expects.
So, what it does, this process of trying to find how alike they are is called correlation.
Q. Uh-huh.
A. Right? And so, if they're very alike, they're very correlated. Ideally, the correlation is 1. It's perfect.
Q. Uh-huh.
A. And if we're lucky, they're -- the ones that are not from the desired transmitter are very much unalike, so they're 0. The correlation is 0.

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And so, what you do is you take the -- the signal that's coming in, assume that it's synced up in time, and you multiply it point by point with, let's say, code number -- user number 1, and code for user number 2. Let's say you only think there are two users in here.

Q. Uh-huh.

A. And in code number 1, if they all line up, you'll get this 1 value out, positive 1. And that will mean that it's -- it's from transmitter 1. Right?

Hopefully, if they're orthogonal codes and they're all lined up, what you get from code number 2, when you correlate it with code number 1, is 0. And that means it's coming from code 1.

If you correlate it with code 2, then -- and code 2 is transmitting, you should get a 1 for code 2 and a 0 when you correlate it with code 1.

Q. And when you say 1 versus 0, that's doing the point by point multiplication and then adding the terms, or --

A. Yes. Point by point, and then add them.

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That's what correlation is. It's a -- I guess some people call it inner product, but it's the sum of C1 times C2.

Q. Okay. And that's just what the last line says, this process of multiplying and adding the resulting chips is called correlation.

A. Right.

Q. And you said that's sometimes called the inner product?

A. Yes.

Q. Okay. And then it's -- it's perfectly correlated if, when you -- you do the dot product -- every single product before you do the summation is a 1?

A. Yeah. It doesn't have to be 1. I mean you can -- it depends on how you're designing this, right? But it would be the sum of the chips.

Q. Right. Right.

A. Normally what you would like to do is you normalize it, because you don't like big numbers. So you normalize that to 1 by dividing by the number of chips.

Q. Uh-huh. So, but it -- let me put it

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differently. If the number of chips is 100, then -- and you did the -- the correlation --

A. Right. It was perfect.

Q. Then perfect correlation would give you a value of 100?

A. Yes. In this way.

Q. Right.

A. We were doing the correlation here.

Q. You also made a comment before about synchronized. Can you explain why -- why that's important, or how that helps to improve correlation?

A. Oh. There are certain codes that -- you would like orthogonal codes.

Q. Right.

A. That would be the best you can possibly hope for. And the problem is, the signal is coming from different distances to the base station.

Q. Right.

A. So they arrive at different times. And many codes, many particular codes are orthogonal, but if they're off in time a little bit, if the time is -- is not exactly in sync, then the

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correlation will be high between code 1 and code 2. Even though they are supposedly orthogonal. They are orthogonal, but only if they're perfectly lined up.

Q. And when --

A. So chip 1 is chip 1. Chip 2 is chip 2.

Q. Right.

A. Okay? If chip 1 and chip 2 are being multiplied together, that code might have a large correlation. So we call that the cross correlation.

Q. The cross correlation is when there's a misalignment?

A. No. The cross correlation is when you have multiple codes for different users and you correlate them. Auto correlation is when code 1 is being correlated with itself --

Q. Right.

A. -- over different time delays.

Q. Okay. And the problem is that if -- when they're aligned, you can get -- they can be perfectly orthogonal --

A. Yes.

Q. But when they're misaligned --

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A. They can be badly not orthogonal.
Q. Okay. So, in paragraph 20 we talk about the perfect correlation, and then the 0 correlation in paragraph 21, that's, again, to give the example, if I have a code of 100 chips, and I do the correlation and my sum is 0, that would be a 0 correlation?
A. Yes.
Q. So what if I do this correlation and I -- and I have 100 chips in the code, and I don't get 100, and I don't get 0. How do I know if it's orthogonal or not?
A. You're -- okay. Let's back up a little bit, because I don't understand your question.
Q. If --
A. Orthogonal means 0 correlation.
Q. Right.
A. So you can't use the word orthogonal unless it's 0 correlation.
Q. Okay. Let me ask it differently, then. How do I know -- I assume the base station doesn't always get this perfect synchronization.
A. That's right.
Q. And if it doesn't get the perfect

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synchronization, it's not -- and it does this correlation, it's not always going to get a number that matches the number of chips or a 0?
A. That's correct.
Q. So how does it decide whether or not it's intended for that base station?
A. It draws a line, and if you're above the line, it says yes.
Q. A threshold?
A. If it's below the line it says no. It's -- so for example, if I'm sending a 1 or a 0, a plus 1 or a minus 1, okay, what I do is I simply -- this is how a detector actually works. I simply draw a line at 0. If I'm above 0, I say it's a plus 1. If I'm below 0, I say it's a minus 1.
Sometimes there's noise, and there's enough noise that it makes a plus 1 look like it's below 0. So you make an error.
Q. Uh-huh.
A. The same thing occurs here. Right? So what they -- what you'd like to do is you'd like to do some processing that gives you the best chance of making a correct decision. But it's a

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statistical thing. This is digital communications. It's not always perfect.
Q. Okay. So you do some processing. Does that -- does that mean in general that the longer the code, the more likely I'm going to accurately make that determination?
A. The longer the code the more accurately -- it depends on the impairment. So it --
Q. So it's --
A. -- it depends on what's causing the problem. If what's causing the problem is the delay between the different transmitters to the base stations, so the time at which they're arriving, if that is the biggest problem, you can solve that by using a very long code.
Q. And how does it do that?
A. The very long code?
Q. Yes.
A. So -- without writing equations, but when you look at the -- the shifts in time, the off -- the peaks are -- are big. We just said it could be 100.
Q. Right.
A. But the real question is what happens

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off -- when they're misaligned.
Q. Right.
A. Right? So if it's 100 when they're aligned, right, and what is it when they're misaligned? So if, when they're misaligned, it's 85, we're in big trouble, right? Because I can't tell the difference. Right?
Q. Uh-huh.
A. But if I make it so that the code is really long, okay, so not one of these codes like Hadamard codes, but a really, really long code, and everybody uses this long code, this off-alignment value is -- is one over the length of the code.
So the bigger I make the code, the smaller that interference term becomes. Right? So, you know, and that's what's -- that's why a long code can help with the delay. You just make it -- you -- that number's really small, and by making the code really long, all the delays will come in within the length of the code.
Q. So --
A. So --
Q. So the delay becomes just a smaller and

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smaller part of the whole code?
A. Yes.
Q. Thanks.
MR. WEINSTEIN: Yeah.
THE VIDEOGRAPHER: Going off the record at approximately 12:17 p.m.
(Brief recess held)
THE VIDEOGRAPHER: We're back on the record at 12:31 p.m.
BY MR. WEINSTEIN:
Q. Okay. Let's turn to paragraph 23, on page 5 of your declaration. And in the beginning, you talk about an example of two codes, codes 1 and 2, and those having the values that were given to it in paragraph 17. And it says that when they are simultaneously transmitted, the resulting signal is the sum of code 1 and code 2. Can you explain what you mean by the sum of them? Why it's the sum?
A. I mean think about what happens when you -- when two users transmit at the same time. Their signal adds in the air, essentially. Okay?
So what -- I think what we're saying -- and all this is saying, right, is that

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if you take -- if A transmits code 1 and B transmits code 2 at the same time, then in the air they're going to add. And at the base station, what you receive is the sum of these two. Okay?
Q. Okay.
A. But I'm not -- I'm not sure -- I'm trying to remember exactly what it meant here, so you got to give me a second.
Q. Sure.
A. Okay. So I'm -- I'm a little confused as to what it meant, what I meant here. Because of the next line.
Q. "And correlates the same combined signal of code 2"? That line?
A. Yeah. So maybe I can --
Q. If you want to take a minute, that's fine.
A. No, that's okay. Let me -- yeah. Let me just go back and review. So code 1 is 1, 1, 1, 1, and code 2 -- no. 1 minus 1, 1 minus 1. And code 2 is 1, 1, 1, 1.
Q. Right.
A. So then what we're doing is we're saying these two codes sort of add in the air.

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Q. Uh-huh.
A. At least that's what this is saying. But I think there's a -- I think there's a line that's missing.
Q. If that line were magically to appear, what would it have said?
A. It would go right after 2, 0, 2, 0, right, and it should have the sum of the combined signals, or -- see, what I want -- what we want to do is we want to correlate the combined signal with code 1 and code 2. Right? So think of it as a one -- a point for point multiplication.
Q. Uh-huh.
A. So if I take 2, 0, 2, 0, and I multiply it by code number 1, you know, what do I get? I get 1 minus 1, 1 minus 1, right? Times 2, 0, 2, 0.
Q. Right. And when you add it together --
A. Right. And when you add it together you get a big number. So what -- in the two separate paths, because you would multiply by two separate codes, what you're going to get is this big correlation for both of them. So you are able to separate them.
Q. Uh-huh.

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A. That's what it would come down to.
Q. Okay. And so --
A. This has to do -- this 23 refers to 22, right? Where you're saying you're sending them at the same time.
Q. Right.
A. And to show how you don't -- you're able to separate, or at least you're able to know that they're both there. But that one shouldn't say the sum of the combined signal. It -- it -- it's okay to say combined signal, but there's no correlation, right?
Q. What -- I'm sorry. I don't understand what you mean by that.
A. So after 2, 0, 2, 0 in brackets in 23, there's a line that looks like it's missing, which says that the base station correlates with code 1, and gets the 4, just like the next line, the base station correlates the same combined signal with code 2.
Q. I see.
A. Which also yields. There could be a line just like that, instead of the sum of the combined is 2, 0, 2, 0.

Q. That's why it says this also yields?
A. Yes.
Q. Okay.
A. I don't know what happened there. Okay.
Q. And I know this is an incredibly simplified example, but this tells you that it's correlated, and therefore, the signal from each cell phone, A and B, was intended for this particular base station.
A. Right.
Q. So it's not -- it's discovered now that it's intended for it. How does it actually resolve the original, or the data that's being transmitted from that?
A. Well, you know, the code is -- this is just looking at the correlation, to say, yes, I have signal.
Q. Uh-huh.
A. From this one.
Q. Right.
A. Right? But then it needs to -- the codes are specific. So remember when I said you used that code to actually un -- despread the signal.
Q. Right.

A. That's what -- in the despreading, you would get just the individual bits that were left for code 1. And then the same thing with code 2. All you're doing here is in the very -- in the process of synchronization, there are multiple things you need to do. Is there any signal out there that's trying to get to the base station.
Q. Uh-huh.
A. When does it start, and then what is that information. So this is just saying that yes, I have some signal. This is just an example, showing that yes, I have signal from -- I guess telephone A and telephone B.
Q. Okay. And the next line is "Each time the base station comes up with a positive correlation, it has confirmed that it has received a transmission from a single cellular telephone."
A. Right. So is, in -- in the output, right, it correlated with a code 1. So think of that as you know this path in the circuitry.
Q. Right.
A. It came out with a big number. It says okay, I have something from mobile A. It gets

another one here, a big number, says yes, I have something from number -- from mobile B, and that's what this means.
Now it doesn't necessarily have to be a positive. It can be a negative, depending on how the code's constructed. But it would have to be a big number, compared to 0, in this application. In this example, I'm sorry.
Q. So when you say positive correlation, you're -- this goes back to that -- that threshold argument?
A. No, not necessarily.
Q. No?
A. This just means that when -- the words positive correlation here simply mean that when it's -- when we do this correlation, we get a positive, a big positive number. You know, in reality, there's noise added to this, so these numbers can be bigger or smaller.
Q. Uh-huh.
A. Or it can even drop below 0. Okay.
Q. And when you say get -- gets a big positive, that's an indication that the signal is intended for that particular base station?

A. Yes.
Q. And the evaluation of what makes it a big positive, that -- that does not relate to the threshold? I mean how -- how do you decide the --
A. That would relate to the threshold. In this particular case there's no noise.
Q. Right.
A. So 0 is the threshold. And as long as it's positive -- but 4 is the biggest number you could get here, also.
Q. Right.
A. So this is all perfect. Everything came out perfectly. If -- if the threshold --
Q. So it's perfectly synchronized and no noise?
A. This is assuming everything is perfect.
Q. So even if it was -- if everything is perfect, even if you had 100 chips, if you got a value of 1, that would still be an indication that it was intended for that base station?
A. In this particular case, yeah.
Q. Yes. In that idealized perfect situation.
A. Right. But the problem is that if

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they're -- in order to get a 1 you have to have a process that's going to create only a 1 rather than the 0 -- the 100. And that would mean that it's either not synchronized, or there's some other impairment. We're assuming no impairments here.
Q. Right.
A. So your -- your question only applies to the case that this doesn't apply to.
Q. Okay. So 24, then, gets into the -- the complicating factors?
A. Only the -- the misalignment.
Q. Right. Can you just explain generally what you mean by misalignment.
A. So that's, again, for example --
Q. Okay.
A. -- the signals are coming from different distances to the base station. And because they're coming at different distances, they arrive at different times. And so, they are not perfectly time aligned.
Q. Uh-huh.
A. They're not synchronized. And that's what I mean by misaligned.

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Q. Okay. And then you give an example of orthogonal codes that are -- they're only orthogonal if they're aligned perfectly.
A. Yes.
Q. So that means if you have to deal with misalignment, you cannot use those codes?
A. I don't know how to answer exactly that question. Your question was can you use these codes if they're misaligned.
Q. Well, I know physically you can use them. I guess maybe what is the reason why you don't use them?
A. Okay. So that's -- that's better. So, for example, orthogonal -- Hadamard codes are -- have very poor cross correlation properties when they're not aligned. So they all need to be lined up, and then they're perfectly orthogonal and they're wonderful codes.
Q. Uh-huh.
A. So they're used in the -- for example, in the 2G cellular, CDMA, but only in the downlink. Because the base station sends every one of those messages, they all arrive at exactly the same time, so they're all perfectly aligned. They're

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not used in the uplink, because it's almost impossible to get them to be perfectly aligned.
Q. Uh-huh.
A. Right. And so, that's an example of when this wouldn't work. But it's -- it's all -- almost always related to the -- the distance delay, because that's the bigger number, usually.
Q. Okay. And then paragraph 25 gets into the types of codes that can be used when you have misalignment issues?
A. Yes.
Q. And can you explain -- well, I guess two things: What does it mean to have imperfect orthogonality?
A. So if I just take a code, any code, and we can go back to our example of the 8 chips. So we have 2 to the 8 possibilities. Some of those codes would be not orthogonal to other codes in that set. All right? So if you were to do this correlation, you wouldn't get 0 for any two codes, you would get some possibly significant number. Okay?
So, what you do is when it's misaligned, it's -- you can't use the orthogonal

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codes, say like the Hadamard codes, so you need to use something else. So you tend to use some other pseudorandom kind of code to -- to serve this purpose.
Q. Okay. And how does it --
A. But they are not perfectly orthogonal. They don't give 0 correlation -- 0 cross correlation. That's what not perfectly orthogonal means.
Q. Okay. So, how -- how, then, can you -- well, two questions: It's not giving you the answer about whether there's a perfect orthogonality or zero orthogonality, so there's an imperfect orthogonality, but how does it -- how do these codes that have imperfect orthogonality address the misalignment issue? How does it -- you can't -- if you use Hadamard codes because of their poor cross correlation, you don't want to use that when there's misalignment. Instead you use these imperfect orthogonal codes, generally from a pseudorandom code. How does it overcome this misalignment problem?
A. Okay. So the pseudo -- the orthogonal

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codes are such that if you are misaligned, it's the structure of the code, essentially, that if they're misaligned, the cross correlation could be very large.
Q. Right.
A. A standard pseudorandom sequence has the property that the -- sometimes the cross correlation could be good, sometimes the cross correlation could be bad. Let's take as an example a code that has 24 chips. Actually, I shouldn't say 24, because I don't know what that is. Let's make it 20 chips.
Q. Okay.
A. So 2 to the 20 is 1 -- roughly 1 million.
Q. Right.
A. So there are 1 million possible sequences. So, you don't need 1 million sequences in a cell.
Q. Uh-huh.
A. And what you know is that some of those codes have really good cross correlation properties. Out of that million, there might be 50 of them that when I correlate them, even when I shift it, I get pretty decent properties, right?

That's the motivation for using other codes that are not orthogonal, is that I can have this large set, and I choose those out of that set that have good cross correlation properties.
There's a -- there are theoretical ways of bounding how much cross correlation you have, when you have a -- an offset. A time offset.
Q. And this then gets more specifically into the idea of a threshold? That it's --
A. Yes. But it -- you know, in digital communications in general there's a threshold.
Q. Right.
A. There's an optimum threshold.
Q. Right.
A. And you determine what that is, and that's how you design your system.
Q. And this type of threshold, is it generally just a -- you know, say for example in a CDMA system, is it going to be just a draw the line, if it's below this number, we're going to say it's not correlated, if it's above this number it is correlated?

A. Yes. Assuming we're -- we're transmitting these 1 -- plus or minus 1.
Q. Right.
A. You know, binary bits and things.
Q. Right. I guess my question goes to it's not set up where if it's below a certain threshold, then we say it's not correlated. If it's above some higher threshold, it is correlated. If it's somewhere in between, we don't know.
A. Okay. So there are some systems, depends on what you do. I don't believe that this is the way the second generation CDMA system would have worked, works. I believe it's just a threshold, a simple threshold. But in -- in other systems, sometime there's a gray area, and that gray area is the width of -- you know, how big it is.
Q. Uh-huh.
A. You know, depends on what you're trying to achieve. Because you can always send, for example, you can always send this information again. And that would make it more certain the second time.
Q. Okay. Can you explain what a Gold code

is.
A. A Gold code is -- a Gold code is just another kind of a -- of a spreading code, or pseudorandom code. And it's generated by using two real, true pseudorandom sequences, what are called maximal length sequences. You pick two of those. There's a process, which I don't know enough details to -- to give you those, that generates the Gold sequences.
What I do know is the Gold sequences have -- the Gold codes have a bound on this cross correlation. So that's what makes them good. And it's called -- it -- it satisfies what's called the Welsh bound. And that's this cross correlation. But it doesn't use all of the -- you don't use all of the codes that are possible.
Q. How do you end up selecting which ones?
A. Somehow you -- I don't know exactly, all right, the details.
Q. Uh-huh.
A. But you choose those, I think, you choose those that give the low cross correlation. And there's a procedure for doing that. These were invented 40 years ago or so, so -- more than 40

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probably.
Q. Probably had no idea how it would be used. Interesting.
A. Well, spread spectrum was a very well-known technique in the military. Before it became commercial.
Q. How -- how long can a Gold code be?
A. Any length.
Q. Any length. So millions? Many millions?
A. Could be.
Q. And it is correct to say it would be -- the length of the Gold code is measured in chips?
A. Yes. Assuming we're using it to spread the -- the initial pulse.
Q. Okay. So then if I'm -- if I'm using a Gold code to, as the code that I've assigned to two different mobile stations, and they are using, say, different Gold codes, or they're using different parts of the same Gold code --
A. Uh-huh.
Q. -- when the -- even if they're not synchronized, the base station can receive them. Does it -- it knows what segment of the code, or

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it knows which Gold code each one is using, it does the correlation, and then when it receives the one that's been assigned to mobile station 1, it does a correlation, it's going to give some relatively high value?
A. That's the -- that's the concept.
Q. Right. And it gives a value that would exceed its threshold?
A. Right.
Q. But when it -- if you then applied it also -- if you applied that same code to the signal received from mobile station 2, it would give you a relatively low value?
A. That's the hope, yes. So the hope is that you design this -- you've chosen your Gold codes such that you achieve the cross correlation that you want.
Q. Okay. On the top of page 6, still in paragraph 25, you say, "Consequently, the transmissions from different handsets using Gold codes would cause some small amount of interference" --
A. Right.
Q. -- "to each other." What do you mean by

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the small amount of interference?
A. That's that cross correlation that I was talk about.
Q. Okay. Let's move on to paragraph 26.
A. Uh-huh.
Q. "The '559 patent purports to describe the generation of the preamble that can be detected by the base station and can separate each cellular telephone's transmission so that each cellular telephone is uniquely identified."
In the last sentence you say, "Generally speaking, the first of the two codes, called the outer code, is used to perform signal separation, and the second, called the inner code, is used to uniquely identify the handset."
First, with respect to the outer code, what do you mean that it's used to perform signal separation?
A. That's to determine which base station -- you know, which base station you're talking to.
Q. So this is -- when you mean signal separation, you mean that the base station knows it's supposed to receive it or it's --
A. No. This doesn't have anything to do with

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whether it's supposed to receive it or not. It just has a code that's -- that identifies the -- that particular base station. So it knows it's for -- you're a base station.
Q. Right.
A. You know this is for you, as opposed to for another base station.
Q. Right. That's what I intended to say, is that --
A. Oh, okay.
Q. So the base station knows when it's receiving a signal from a mobile station --
A. That's for itself.
Q. -- it knows it's for the base station?
A. Yes. Yes.
Q. To put it again, so to tell the base station that the signal is indeed intended for it?
A. Okay.
Q. Okay. And the inner code to uniquely identify, what's the -- can you explain that?
A. Each mobile station then would have its own -- each mobile station within that base station's cell area would have its own

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identifying code.
Q. And in choosing that code, is that based on information it receives from the base station? The inner code.
A. The inner code is chosen based on -- this again gets back to that other question we talked about. Is the -- the other issue. Are these codes assigned in some way to mobile stations, or are they given to the mobile stations when they make this handshaking.
Q. Right. And that's just something you're not sure about?
A. Something I'm not sure about.
Q. Okay. So, I know you're unsure, but it's -- we were saying it's possible, then, that the base station sends information to tell a mobile station use this particular outer code, or one of these particular outer codes, and then also use one of these particular inner codes?
A. So wait. That's different from the question you just asked me a minute ago. A minute ago you asked about the inner code.
Q. Yes.
A. Right. So the inner code is specific for

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each mobile.
Q. Right.
A. So in that case, somehow the mobile must know what its code is. So, it either is embedded in the mobile unit itself, or it's sent by the base station.
The outer code is something different. The outer code is something which is common to everybody in the cell. So the base station, you know, is -- is broadcasting this all the time, for example.
Q. Uh-huh.
A. And everybody's just listening to what it is, and then it feeds it back if it hears it. Right? It's -- it's like an identifier --
Q. Right.
A. -- of that base station.
Q. And when you say common, that means that every mobile station in that cell is going to use the exact same sequence of chips?
A. For the outer code.
Q. Yes.
A. Yes.
Q. Okay. And this -- going to paragraph 27

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on the first line, "The outer code is described as known to the base station, and is shared by all transmitters." So, are you saying the same thing, that shared by all transmitters means that they're using a common outer code, and it's the same sequence of chips?
A. Yes. That's what it says in the -- that's what it says in the patent.
Q. And it says this is --
A. This is 3:45. It says the outer code is preferably common for all transmitters.
Q. Okay. And preferably common means it needs to be common?
A. No. I understand what preferably means.
Q. What?
A. I understand what preferably means. But in order for -- in order for all of the benefits to be achieved, such as simplicity, and -- and complexity, you would want this to be common for all of the -- so it's preferably here, but in -- in a non-patent sense, it's also what you would prefer; that it be common to all the transmitters.
Q. Be common to all the transmitters. Okay.

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Are there problems in distinguishing mobile stations? If they all use the same outer code, do you end up having any problems in trying to distinguish outer stations from each other?
A. Wait. You said outer stations.
Q. Let me -- let me back up. Let me rephrase that.
A. No. It's just the word you used. You said distinguish outer stations from each other. You meant mobile?
Q. I'm sorry -- mobile stations, yeah.
A. So, the outer code is used to -- to determine which base station, right --
Q. Uh-huh.
A. -- you're communicating with. But the mobile stations then are going to have their own code that distinguishes them from other mobile users.
Q. Right. Let me bring up a different point. Can you explain to me what a collision is, in -- in a cellular system.
A. So you mean a packet-based system then? Or you mean just a random access system? Which part of it are you talking about? So there's the

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part where you send data.
Q. Right.
A. In a cellular system. And there's a part where you're trying to get access to the system. So you're talking about the access part?
Q. Yes.
A. Okay. So in the access part, if you transmit the same time I transmit -- sorry. If you transmit the same time that I transmit --
Q. Right.
A. -- right, and let's say we're both exactly the same distance from the base station. Our signals are going to reach the base station at the same time on the same frequency. And those two signals will pretty much obliterate each other. Let's assume --
Q. Uh-huh.
A. -- that's true, okay? So that's why we put a code on top of them, where we separate them in time, or we separate them in frequency, to avoid these collisions. Now we typically don't talk about collisions on the data transmission.
Q. Right.
A. Because it's only on the access part.

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Q. And on the data part, it's because you've now set up maybe a different --
A. You've already set it up where there should be no collisions.
Q. Right. Because --
A. It can still happen, but it should not.
Q. But in general, at that point you can set up something to make it more clearly unique between --
A. That's correct.
Q. -- mobile stations? So, if -- if there's a closed -- and this is going to bring in the inner codes. If there's a closed set of inner codes that are available to the mobile stations that they can use, and the particular inner code that's used is chosen randomly, among whatever closed set is available, if I'm using the same outer code and I have this closed set of inner codes and I'm using one of them, there's this chance that I'm going to use the -- that two mobile stations will use the same outer code and the same inner code?
A. That's -- that can happen.
Q. Okay. And if that happens --

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A. Under your conditions.
Q. Yes.
A. Where they've chosen randomly.
Q. Yes.
A. Yes.
Q. So it can happen where they have the same outer -- well, according to this they all share the same outer code, so they all have the same outer code. But it's possible that they will randomly choose the same inner code?
A. Yes. That's possible.
Q. And if that's the case, then when -- if both mobile stations were to transmit at the same time at the same distance, then you would get a collision?
A. That's correct.
Q. So if I was to increase the number of outer codes --
A. Wait, wait.
Q. So instead of having a common outer code for all of them, I was to, say, instead have two or five or 50 outer codes that were available for my mobile station -- or for my base station, if that's the case, then I am -- by increasing the

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number of outer codes, I am decreasing the chance of a collision. Is that correct?
A. You are. But you're increasing the complexity.
Q. Sure. Sure. But if I decrease the chances of collisions, it also has a benefit, yes?
A. But you can -- you can fix that problem by not having mobiles use the same inner code.
Q. Right. If -- if I use a Hadamard code for my inner code, am I limited in the number of different inner codes I can use?
A. So let me make sure I -- so we're going to have a Hadamard code.
Q. Yes.
A. And you didn't tell me the length. The length. But you're going to have some length?
Q. Yes.
A. Yes. You're limited in the number.
Q. Okay. So again, the -- if I have that limited number, then the -- one way to improve the chance of not having a collision is to increase the number of outer codes that I use?
A. If you're limited to a small number of the

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Hadamard codes, then you could improve the -- the probability, reduce the probability of collision by increasing the number of outer codes.
Q. Okay. And in general, if -- if a base station has available a certain set of outer codes that mobile stations can use, as I decrease the number of outer codes in that set, if I start with, say, 100, and I keep on decreasing it, as I continue to decrease, the circuitry that I need in the base station will simplify?
A. As you -- oh. So let me make sure I understood, because your question went around a little bit. So, as you decrease the number of outer, possible outer codes --
Q. Uh-huh.
A. -- that a base station can use.
Q. Right.
A. The circuitry in the base station will get simpler?
Q. Yes.
A. Yes.
Q. So for example, if I have one base station that was assigned 100 codes as the outer -- as possible outer codes, and another one that was

assigned five outer codes, as possible outer codes, the one that only has five can use simpler circuitry to do the correlation process?
A. Yes.
Q. And to make it the simplest, the simplest way to do it is just to have one single outer code that all mobile stations use?
A. Yes. All mobile stations within the -- the base station's area.
Q. And that would make the circuitry the simplest possible to do the correlation with the outer code?
A. To do the correlation with the outer code, right.
Q. Right.
A. Because you need one correlator, versus many.
Q. Right. okay. In the -- the next line of paragraph 27, "A base station then uses the outer code to recognize preamble sequences that are intended for it." That means that it's doing the correlation of its assigned outer code or outer codes?
A. Uh-huh. Yes.

Q. And if a handset uses a different outer code than the one used by the base station receiver, it will not be able to decode transmissions from that handset.
A. Correct.
Q. And that -- can you explain that line a bit more? That it's not able to decode, or that it's --
A. Well, okay. So here's the -- here's the explanation. If I have different outer codes, and if I -- if I -- someone's using a different outer code for a particular base station, then when it does the correlation, it will get a low value. So it will know it's not for that particular base station.
Q. Uh-huh. Right.
A. If you are doing something similar, and you're doing the actual data transmission, right, and the codes didn't match, you wouldn't be able to decode it. So what that means is that I -- if I'm -- if I had the correct one, I would decode my -- I would be able to detect my -- if I had the one that's for me, and I know it's for me, then all of the others, I don't decode those, but

they become zero -- you know, like zero background noise to me. That's what this is intended to mean.
Q. Okay.
A. Flipped it the other way, it means I only can detect the one that's using the correct outer code.
Q. Okay. That makes sense.
A. That makes a better -- maybe a better way to say this.
Q. Right. It -- I think that sentence just kind of takes the next step leap, without --
A. It's okay.
Q. -- making it clear that it's --
A. I understand.
Q. It states it's not correlating it. Because it's not correlating it, it can't decode it correctly.
A. Right.
Q. The next line, "The '559 patent suggests to use Gold and Kasami codes to form the outer code." How does the -- well, start with the example of using a common one, where each -- where there's only one outer code for the base

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station.
A. Uh-huh.
Q. How does -- or let me -- what is in the mobile station that enables it to generate the same code as all the other mobile stations in the -- in that cell?
A. I can't tell you exactly how it's happening in 3GPP. But what I would do with a Gold code, for example, or a Kasami, because these come from actual shift -- actual length shift register sequences.
So you use the shift register to generate it. You tell the -- the only information you really need to transmit is how long the code is and -- or how many shift register -- shift registers you need. And there's also usually sort of a generator that tells them how to make the connections. And that would generate the Gold code in one transmission.
Q. What do you mean by a generator to make the connections?
A. It -- a shift register.
Q. Uh-huh.
A. Okay? So a shift register has a bunch of

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boxes, which are essentially delays.
Q. Right.
A. And then there are connections, there are feed back connections, and feed forward connections.
Q. Uh-huh.
A. And it tells them how to make these connections. Which ones are connected. So if there's four boxes, do you add the output of 1 and 2, or do you add the output of 1 and 3 or do you add the output of 1, 2, and 3? Those connections are part of what's called the generator equation for this. And that's what generates the code.
This is true for all pseudorandom sequences. There's a standard diagram, and these connections are specified. So if you simply specify the connections, and how many of these shift registers there are, you can generate any pseudorandom sequence. Any M sequence.
And then from the M sequence, you can generate the Gold sequences, by choosing them appropriately.
Q. Uh-huh. Okay.

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A. But I wouldn't do it that way. Okay?
Q. What do you mean?
A. I wouldn't do it that way, because memory's cheap.
Q. Right.
A. I would put it all in memory, and it would be an index, this is what you use. But I don't know how it's done.
Q. So each particular Gold code, then, has you know, for its first chip, would be, you know, it can go on, as we said for millions and millions of chips. When the information that's provided to -- or for the mobile station to be able to select the proper portion of the Gold code, because it's obviously not transmitting millions of chips -- and we'll just give an easy example. It's doing 100 chips. Essentially, you need to provide information to it to know like kind of the -- the offset of where to start the generation of the --
A. I assume so. Yes.
Q. Okay. Okay. In paragraph 28, you say that it's -- "The outer code is further described as periodic with period K chips, meaning that it

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consists of a series of repeating blocks of K chips, where each block has the same sequence of chips." Can you explain what you mean by "periodic."
A. Periodic simply means it repeats in time.
Q. And the period corresponds to just the --
A. How long it takes till it repeats.
Q. Yes. And here you reference the -- again, column 3.
A. Yeah.
Q. And the preferred embodiment is depicted in figure 6. Outer code 603 is periodic with period K chips.
A. Yes.
Q. And why do you want to make it periodic?
A. Why do I want to make it periodic?
Q. Well, what is -- why -- what's the point of making it periodic?
A. Well, the -- are you asking me, or do you want me to tell you what's in the --
Q. Well, both. The first one -- why -- in the '559 patent, what is the purpose of making it periodic?
A. There's several reasons for making it

periodic, I think.
Q. According to the '559 patent?
A. According to the '559 patent. Okay. And I believe it's -- I talked about this in the -- 29, but I'm not so sure. Right? So if I have a -- if I have a small sequence like this, okay, then the correlator is easier to build, because it's just a few taps.
The other reasons why the '559 wants to do it, I'm -- besides simplicity, I'm not so sure that I understand.
Q. Besides the -- this periodic aspect, and using a single outer code, is there anything in the '559 patent that provides a means for using simple circuitry in the base station?
A. That's kind of an open-ended question. So, I'm trying to figure out how to -- how to answer it.
Q. Well, before we get to that, is there -- is there anything in the '559 patent that specifically says, because we use -- you can use a periodic outer code, it makes the circuitry simpler, or simple?
A. No. But it's -- to me, and so now you're

asking me to just comment on the patent.
Q. Okay.
A. When I read the patent, I assume that he's doing this, that he wants to do this, to achieve the goals that he's set out for himself. Which is simplicity, and -- and the others. Okay.
And then I look at that, I look at the figure 6 and say, well, okay, he's using a short thing that's repeated.
Q. Right.
A. And it seems that that -- the motivation is to make the complexity of the -- the circuitry simpler.
Q. Right. Although it -- it does refer to that as a preferred embodiment. And -- I know you're the inventor of many patents, so I'm sure you've seen that terminology before.
A. Well, I -- I understand that, but based on his -- some of his -- the comment, and some of the discussion in the -- in the specification --
Q. Uh-huh.
A. -- even though it's -- it's a preferred embodiment, it's repeated several times. So it seems that it's -- you know, what I'm -- I'm an

engineer.
Q. Right.
A. I'm not a lawyer. And so, when I read these things, I read them as if I were the engineer, thinking what he's doing, and try to put myself in the same position.
Q. Uh-huh.
A. In my -- and in my opinion, the engineer wanted this to be periodic, made it clear in the second -- in the second claim, and then talks about it as a preferred embodiment.
So I, as an engineer, I read it that way. And then, with the emphasis on making the circuitry simpler, I focus on this thing being periodic, on the outer code being periodic.
Q. What other ways do you think you could make the circuitry simpler in the base station, when it comes to detecting preambles?
A. So that's another open-ended --
Q. Yes.
A. -- question. Right. If you make --
Q. For example, if I made the -- the preamble sequence shorter.
A. You can make the preamble sequence

shorter. But it has deficiencies if you make the preamble sequence shorter, right? You want the preamble sequence long enough to be able to get these cross correlations low enough, and be able to handle the delays that might happen.
And, but at the same time, you want to make it, you know, short enough so that it's -- it's simpler, right?
Q. Right. I understand. Okay. In -- in the '559, there's -- they use the term "chips" and they use the term "symbols," on the -- the side of generating the preamble. Can you explain what the difference is.
A. It's -- so again, are you asking me to answer this question -- I'm a little confused.
Q. So, if you're reading the '559 patent.
A. Right. Okay.
Q. And there's --
A. So here --
Q. For example, on column 3, it says "Both codes are preferably of length and chips where N is the total number of symbols in the preamble." Is there a difference there between chips and symbols?

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A. Not in that definition.
Q. Okay. And then, for example, it also says in that periodic part, and this is column 3, line 42 to 43, "outer code is periodic with period K chips." But then in column -- I'm sorry, in column 5, in claim 2, it says the -- and this is line 11, it says, "The period --" I'm sorry, are you -- "The period of the outer code comprises K symbols."
So in column 3 we say the period is K chips. In claim 2 we say the period comprises K symbols. So, in your view, is that the same thing again? We're talking about the same thing?
A. So, let me -- let me backtrack so I make sure I understand what you're saying. In column 3 he says both codes are of length N chips where N is the total number of symbols.
Q. Right.
A. Mathematically, that means one chip is one symbol. Right? There's no other way to interpret that line. Right? Then he talks about the outer code being periodic with K chips, right?
Q. Uh-huh.

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A. Which is consistent with figure 6.
Q. Right.
A. Okay? Because he has whatever that is, 8 chips in one of -- in -- 8 chips in -- in the code. Okay.
And then here he talks about outer code comprises K symbols. Here it's not so clear to me, with claim 2, as to what he means by K symbols. They have this -- they have this picture where he's calling these symbols, but later on he calls something else symbols.
Q. And where does he do that later on?
A. Column 5 -- 4. I'm sorry. Column 4, line 40, 41. I don't know. Somewhere in there, he talks about these M symbols. So there -- a chip isn't a symbol, but the 8 chips are a symbol.
Q. And that's -- that's happening at the base station, yes?
A. Symbols are symbols. Chips are chips.
Q. No. I'm asking what, in column 4 --
A. It's happening at the base station. But I'm not sure I understand what the difference is. So, I -- I find the confusion, for me, between column 3 and column 4, in a -- yeah.

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Q. Okay. Going back again to the commonality of the outer code. It is possible that I could say, okay, every mobile station, you're only going to use this one Gold code.
A. Yes.
Q. But, it's possible that I could say within that Gold code, which can be millions of chips long --
A. Yes.
Q. -- I want you to use, you know, mobile station 1, I want you to use this segment. Mobile station 2, I want you to use this different segment.
A. Yes.
Q. So they're using the same code, but they're using just different segments within that code?
A. That's possible.
Q. In that possibility, when you talk about having a common code, the common code -- they're still using the same Gold code, they're just using different segments?
A. It's not -- it's not my general understanding of what common code would mean.

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That would mean that everyone uses the same sequence in the base station. And then the other base stations, for example, might use the Gold code, just shifted. A different segment of it. But it's -- my understanding is it would all be the same sequence. That's my understanding of the term --
Q. Okay.
A. -- common code.
Q. Okay. And when it comes to the common code in the patent, or the -- that it's preferably common for all transmitters, it's certainly, you know, the system -- you can certainly generate preamble sequences where the -- the mobile stations are not using the same outer code? It's certainly --
A. In what he calls the -- his preferred embodiment, I don't believe that's true. I don't believe that's what he -- what was intended as the preferred embodiment.
Q. As the preferred embodiment.
A. Yes.
Q. Right. But it -- there's certainly no language here saying that unless they use a

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common code, you -- you wouldn't be able -- the system wouldn't work, or it doesn't comply with my description?
A. No. But it is -- it's consistent with his goal --
Q. Sure.
A. -- of simple circuitry.
Q. Okay. And that's the same point with the -- the periodic part.
A. Uh-huh.
Q. That it's certainly preferred. It does -- if you use periodic, it can make it, the circuitry, more simple, but there's no requirement that it be actually periodic?
A. Again, the periodic would make it simpler.
Q. Right.
A. And it seems like the only -- based on the way this is described, it's the only way you could generate these, you would generate these codes. Seems like the intention of the inventor.
Q. Okay. But it's not --
A. But not --
Q. It's not the only way?
A. Correct.

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Q. It's the preferred way, but it's not the only way you could generate it?
A. Right, but no other way --
MR. HASLAM: Object. Objection. When you say not the only way, do you mean generally, or with respect to the '559 patent?
Q. If I was reading the '559 patent, would it be understood that you could generate the outer code that's not periodic?
A. My reading of the patent, okay, would say no.
Q. That one -- you would read this and say I cannot generate an outer code unless it's periodic?
A. Based on the -- on claim 2.
Q. On claim 2. But that's not -- that's not an independent claim. That's --
A. It seems very specific, though. So at -- you asked me my reading of the '559.
Q. Right.
A. And I'm not an attorney.
Q. Right.
A. As an engineer, I would say this inventor intended for this outer code to be periodic.

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Q. But if they intended it to be periodic, wouldn't it have been in the independent claim? If they -- let me just give you a hypothetical. I have an invention, and it has three features, okay? And I say, okay, when I go to my independent claim, I say it has feature 1 and it has feature 2. And then I say in dependent claim 2, plus feature 3. Are you saying that to generate my invention, I have to do feature 3?
A. No, but I don't read this the same way.
Q. And why don't you read it the same way?
A. I -- because when I -- when I read claim 2, it seems like you're referring to claim 1, and it has to be K symbol -- periodic. I -- and like I said, I'm not -- I'm not an attorney. I don't know, you know, every detail of patent law. But I read claim 2 to be very specifically referring to the outer code in claim 1.
Q. Okay. And if -- if I interpret the outer code in claim 1 as necessarily having a period, what in claim 2 changes that? What makes it different? What is -- what is it about claim 2 that's adding something?
A. Well, again, I'm not a patent attorney,

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and I'm not claiming that -- that this is well written. Okay?
Q. I didn't draft it, either, so I'm not claiming that, as well.
A. So I'm not -- I'm not claiming that. I'm just telling you, when I read it, my interpretation.
Q. But at -- just getting back to my question, then. If --
A. There's no difference.
Q. There's no difference. Okay. Earlier today, you said in preparation for today's deposition that you did refer to the -- to the 3GPP standard?
A. Working group documents.
Q. Yes.
A. That you referred to.
Q. I'm going to make -- this is exhibit number 5?
THE VIDEOGRAPHER: 5.
MR. WEINSTEIN: 5?
(Cimini Exhibit 5 marked for identification)
A. Hopefully it's one I've looked at.

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Q. That's what I was going to ask you.
MR. WEINSTEIN: Do you need a copy?
A. I've looked at this one.
Q. So you have looked at that one?
A. Yes.
MR. HASLAM: Is this the one you looked at yesterday -- Sunday?
THE WITNESS: I said -- I said last -- yesterday and Sunday.
Q. Yes.
A. Yes.
Q. So you looked at it both days?
A. Yes.
Q. Did you look at section 4.3.3, starting on page 15?
A. Yes.
Q. Can you tell me what PRACH is?
A. That's the --
MR. HASLAM: I'm going to object to the question. You haven't laid a foundation that his review of this formed either the basis of his declaration or the basis of his preparation today to testify about his declaration.
Q. What did you look at in the -- in the

standard? What did you reference in preparation for today's deposition?
A. Section 4.3.3.
Q. And what did you look at specifically in 4.3.3?
A. The preamble code construction.
Q. And what did looking at the preamble code construction tell you in preparation for today?
A. Assuming that this is the 3GPP standard, it told me how they do the preamble.
Q. Okay. And how did that help you prepare for today?
A. It's -- trying to understand this code construction, and the code construction that's in the '559 patent.
Q. And so, you -- were you trying to understand how they were the same or different?
A. Trying to understand what's in the '559, and then trying to understand here, in the -- in the 3GPP, to see what the -- what the similarities and differences were.
Q. Okay. And what did you find to be the similarities and differences?
MR. HASLAM: I'm going to instruct

the witness not to answer on the grounds that he's not here today to testify about issues of infringement, or comparing the claims of the '559 with the standard. And as to that, it's beyond the scope of Rule 26. He's a non-testifying expert as to those issues.
MR. WEINSTEIN: Well, he's just testified that he looked at it to figure out what the differences and similarities are to understand how to prepare for today's deposition. So how -- that's informing on how he's testifying today on this deposition. I want to understand what he determined from that.
MR. HASLAM: You can try to lay a better foundation, but as of now, he basically has told -- he -- I'm not going to characterize his testimony. I don't think he said that what he did relates to understanding the construction of the '559, to the extent that that's what his declaration states.
BY MR. WEINSTEIN:
Q. So what did you compare in the '559 to the standard?
MR. HASLAM: I got the same

objection -- same instruction. He -- there's no dispute he said he compared it. There's no comparison in his declaration, and you haven't laid a foundation as to how that comparison relates to the declaration, which is the only thing he's here to testify about.
He is a -- he's been designated as an expert on things beyond the declaration. He is a consulting expert, as to which you're not entitled to discovery absent a showing, which you haven't made.
BY MR. WEINSTEIN:
Q. Okay. So how did you use this, then? How did the review of the standard inform you on understanding the '559 patent?
A. Okay. So to -- I think I should reiterate sort of what Bob's saying, right? So, I did not use it to write this declaration.
Q. But you did use it for preparing for today's deposition?
A. I used it to get a general understanding of the -- the case in general. But not for this deposition -- not for this declaration, and not for questions that I expected in this deposition.

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Q. And in your preparation for understanding what -- how CDMA works, had you previously looked at this standard to understand how preambles are generated?
A. Yes, I did.
Q. And so, when we talked before about, you know, what you had done to prepare the declaration and understanding CDMA, at that point, had you already looked at the -- this standard, in understanding --
A. Yes.
Q. Okay. So, going back to that, in addition to the '559 patent and its prosecution history, you did look at this standard to have an understanding of --
A. So that's -- that's not -- that's not the question you asked. So the question says, in preparation of this declaration.
Q. Right. That's what I'm saying.
A. Right. In this -- in preparing this declaration, you don't need anything but basic, rudimentary understanding of CDMA, and a little bit out of the '559. So you don't need anything else. So, in -- you know --

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Q. Okay. I'm --
A. It's not necessary to list everything I've ever learned about CDMA, or I've read about it --
Q. I thought you might --
A. -- for this declaration.
Q. I thought in my question that I had said that in understanding CDMA for preparation of the declaration. Maybe I didn't say it clear enough. But I --
A. Right. But that still doesn't require you to understand this (indicates).
Q. I'm not saying it does.
A. Right.
Q. I'm asking did you -- had you looked at the standard, and in preparing the declaration, to explain CDMA and explain how it applies -- how it applies to preamble sequences --
A. No. That's not the question you asked.
Q. Okay. Well, then, I'm asking it now.
A. Okay.
Q. You're saying that no, you did not look at the standard then?
A. In -- you asked the question properly. In preparation, in preparing this declaration --

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Q. Yes.
A. Did I use anything else, other than textbooks and this document (indicates). No.
Q. Okay.
A. Okay? Did I look at lots of other material related to this case? Yes.
Q. In preparing the declaration?
A. No.
Q. Just for the deposition? Preparing for the --
A. No. No. In our -- in our discussions about this case. This declaration is very specific.
Q. Right. Okay. And in column 4 of the patent --
A. Yes.
Q. -- the first line is that the -- it provides means of generating preamble sequences that can be detected with simple circuitry. It then provides --
A. Which -- sorry. Which line?
Q. I'm sorry. This is column 4, line -- starting at line 51.
A. 51.

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Q. Uh-huh.
A. Yes.
Q. So, it -- you can generate the preamble sequences that can be detected with simple circuitry, and then it lists a few other things that are advantageous.
Can you explain -- it says "In addition, for example, the first one, when the transmitter and receiver oscillator frequencies are not exactly equal, the preamble received at the base station appears very different from or highly uncorrelated with the other preambles in the set."
Can you explain how the --
A. Yes. So, when the frequency is offset, what happens is the phase, which is the integral of the frequency, will be that frequency offset times T. So, it will -- the phase will be growing. So, and since it can only be between 0 and 2 pi, it will actually be rotating --
Q. Right.
A. -- around the circle. Okay? So as this frequency offset exists, the -- the constellation, if you will, or just the plus or

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minus 1 --
Q. Okay.
A. -- will rotate. So when you do this correlation, you get something very different than you might get if you -- everybody was perfectly synchronized.
And the longer the sequence, the worse this problem will be. Because the rotation goes along longer, the phase change.
Q. Uh-huh.
A. That's the first part.
Q. Okay.
A. See what the -- well, that's -- that's it. That's all it says, right? The next part says "The preambles also allow the difference to be calculated in a straightforward manner."
Q. And just going back to this frequency offset, then, how does it -- you've just explained, I guess, the -- what it means to have this frequency offset. How is the preamble that's generated according to the patent make it appear that that preamble is different from and highly uncorrelated --
A. Well, what's most important is the highly

uncorrelated part.
Q. Right.
A. Right? So, if -- if I take a signal and it has 0 phase, and I get -- I take exactly the same chip sequence, but now I shift it by 90 degrees. When -- when I correlate those two, I get 0, when I should be getting perfect correlation.
Q. Right.
A. Because it's the same signal, it gets 0, because the inner product -- you know, is cosign a 90, so you get 0.
Q. Right.
A. And that's the problem, right? And you have no idea what this phase is. It's totally random, right, because it's just whipping around. And -- and the -- as a matter of fact, the oscillators even move, so that the difference is changing. And you need a way of correcting for that.
Q. Okay.
A. And -- and they have an algorithm for doing that.
Q. Is there anything specific in the way that

the preamble is generated that does that, or is it just this algorithm after it's received?
A. It helps that you have the -- so, if I can use the preferred embodiment in figure 6 as an example.
Q. Just this time.
A. Okay.
Q. All right.
A. By having the inner code as being these orthogonal code words --
Q. Uh-huh.
A. -- what you can do is you can correlate with each one. And then you can do this difference between one symbol and the next, if I call the whole block a symbol. A symbol and the next. And that allows, gives you an estimate of what the phase difference is between those two symbols. So it tells you how much the phase has changed from one symbol to the next.
And then what you do is you add them all up, which gives you a benefit against noise, and that gives you your estimate. All right. So the algorithm -- it's not dependent on this, but it's -- it's helped somewhat by this.

Q. Okay.
A. Their specific algorithm. There are many ways of doing frequency offset correction.
Q. And the -- the last -- that allows the difference between the transmitter and receiver oscillator frequencies to be calculated in a straightforward matter?
A. Right. That's the algorithm that I just talked about.
Q. Okay. Then I guess I'm not understanding how does the preamble generated according to the patent make it highly uncorrelated, when you have this differences between frequencies?
A. If you don't correct for the frequency, then you have a problem.
Q. Right.
A. Right? So you have to correct for it. So this -- this preamble structure, and the algorithm that they -- they made, that he invented to go along with it --
Q. Uh-huh.
A. -- allow you to fix this. And then everything lines up properly. Right? But if you don't do something to correct it, then you're

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going to have this problem.
Q. So the combination of that special algorithm and the structure --
A. Yeah, but it's --
Q. It addresses both of these last two --
A. Right. But the algorithm -- the algorithm is -- not matched, but it's -- it's designed for that structure. It's designed for having these M signals. They don't have to even be orthogonal. They can just be any M signals.
Q. Uh-huh. I've given the hypothetical before that, you know, all the mobile stations are using the same Gold sequence, but using different segments within the Gold sequence.
If I'm using the different segments, and actually, this is also addressing the point that you said in general, you would want to use just specific ones that have better orthogonal -- or cross correlation qualities.
A. Yes. Yes.
Q. So if I was just to use a segment, and then it was another segment that was offset by just one chip, so let me -- an example of 100 chips. So, I use chips 1 to 100.

A. Uh-huh.
Q. And the next segment, I use chips 2 to 101.
A. Yeah.
Q. In that case, is there any predictable way to know that that's going to create good cross correlation or not?
A. There's a -- there's a way to construct the Gold codes, which I don't know. But I think it's -- it might even -- I don't think it's specified in here. It might be.
But there's a structure -- there's an algorithm for doing this construction. And part of that algorithm will create codes, will only essentially pick those code words which have a bounded cross correlation. I'm choosing my words to be precise about this.
Q. Okay.
A. Because that's what it is. It's not a low cross correlation. It's a -- a bounded. It just means it can never be bigger than that. That's what the Gold code construction does. But I couldn't tell you, you know, how or why it does this.

Q. Right. So if it's bounded, you know where to set the threshold?
A. That's right. It can never be bigger than this. So -- and it's a function of how long the code is. So you can specify, say this is where I want my threshold to be, or I want my performance to be. You can set the length based on that. There's simple formulas for that.
Q. Okay.
MR. WEINSTEIN: Well, thank you. I have no further questions.
MR. HASLAM: I have just a couple.

CROSS-EXAMINATION

BY MR. HASLAM:
Q. I believe you testified, in response to some questions about the relationship, if any, between symbols and chips, and did I understand you to say that in -- in the typical use of the word "symbol," it relates to multiple chips?
A. Yes. I think I said that.
Q. Right. And is there anything in the '559 which is consistent with the use of symbols to mean multiple chips?
A. I think I mentioned that, too, in column

4, when he talks about this frequency offset correction technique, he refers to, you know, orthogonal -- orthogonal signals, and the orthogonal -- the correlated output as symbols. And these -- in the figure 6, for example, were multiple chips. So those symbols are now multiple chips.
Q. You were asked some questions about claim 2, and in particular, the portion of the claim 2 that states "wherein the period of the outer code comprises K symbols, wherein K is a positive integer." If "symbols" as used there means multiple chips, and if I use the preferred embodiment, a symbol could comprise 8 chips, correct?
A. 8. You said 8, right?
Q. 8, yes.
A. Yes. 8.
Q. Right. Now, if I have a symbol which comprises 8 chips, but I have an outer code which is 9 chips long, would the 9 chips be an integer number of symbols in that system?
A. Under the way you just defined it, no.
Q. So --

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A. Let me -- can I repeat it? Because I'm not sure I understood.
Q. Yes.
A. So, a symbol is defined as 8 chips.
Q. Yes.
A. And you want the outer code to be 9 chips long.
Q. Repeating at 9 chips, rather than 8 chips.
A. Right. So then you asked -- okay. The relationship between -- so it's not an integer number of symbols. Okay. Yes.
Q. In that situation, would an outer code of 9 chips fall within the scope of claim 1, but not within the scope of claim 2?
A. Yes. If claim 1 is meant to be anything, it doesn't have to have that particular period. Yes.
Q. Okay.
A. They would be different.
MR. HASLAM: I have no further questions.
THE VIDEOGRAPHER: This deposition sending at approximately 1:47 p.m.
(Deposition concluded at 1:47 p.m.)

I N D E X

E X H I B I T S

State of Delaware)
)
New Castle County)

CERTIFICATE OF REPORTER

I, Julianne LaBadia, Registered Diplomate Reporter and Notary Public, do hereby certify that there came before me on July 13, 2011, the deponent herein, LEONARD CIMINI, PH.D., who was duly sworn by me and thereafter examined by counsel for the respective parties; that the questions asked of said deponent and the answers given were taken down by me in Stenotype notes and thereafter transcribed by use of computer-aided transcription and computer printer under my direction.

I further certify that the foregoing is a true and correct transcript of the testimony given at said examination of said witness.

I further certify that reading and signing of the deposition was required by the deponent and counsel.

I further certify that I am not counsel, attorney, or relative of either party, or otherwise interested in the event of this suit.

____
Julianne LaBadia, RDR, CRR

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