UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF CALIFORNIA
BEFORE HONORABLE CATHY ANN BENCIVENGO, JUDGE PRESIDING

BELL NORTHERN RESEARCH, LLC,, Plaintiff, vs. COOLPAD TECHNOLOGIES, INC. AND YULONG COMPUTER COMMUNICATIONS, Defendants.	CASE NO. 18CV1783-CAB-BLM SAN DIEGO, CALIFORNIA THURSDAY, JUNE 20, 2019
BELL NORTHERN RESEARCH, LLC, Plaintiff, vs. HUAWEI TECHNOLOGIES Co., LTD., HUAWEI DEVICE (HONG KONG) CO., LTD., and HUAWEI DEVICE USA, INC., Defendants.	CASE NO. 18CV1784-CAB-BLM
BELL NORTHERN RESEARCH, LLC., Plaintiff, vs. KYOCERA CORPORATION and KYOCERA INTERNATIONAL INC., Defendants.	CASE NO. 18CV1785-CAB-BLM

BELL NORTHERN RESEARCH, LLC., Plaintiff, vs. ZTE CORPORATION, ZTE (USA) INC. ZTE (TX) INC. Defendants.	)	CASE NO. 18CV1786-CAB-BLM
BELL NORTHERN RESEARCH, LLC,, Plaintiff, vs. LG ELECTRONICS, INC., LG ELECTRONICS U.S.A. INC., and LG ELECTRONICS MOBILE RESEARCH U.S.A., LLC, Defendants.	)	CASE NO. 18CV2864-CAB-BLM

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ALSO PRESENT:

San Diego, California; Thursday, June 20, 2019; 9:00 a.m.

(Cases called)

MS. ABDULLAH: Sadaf Abdullah on behalf of plaintiff, Bell Northern Research.

MR. HARTSELL: Steven Hartsell on behalf of Bell Northern Research.

THE COURT: Thank you.

MR. SKIERMONT: Good morning your Honor. Paul Skiermont on behalf of Bell Northern Research.

MS. ZHANG: Good morning, your Honor. Jiaxiao Zhang from McDermott Will & Emery on behalf of ZTE. With me is Amol Parikh and Thomas DaMario.

MS. FULLER: Good morning. Joanna Fuller on behalf of Huawei with Fish & Richardson, and with me is Jason Wolff and Ethan Rubin.

MR. MILLIKEN: Good morning, your Honor. Tom Milliken from Perkins Coie on behalf of Coolpad and Yulong. With me is James Hurt.

THE COURT: Thank you. All right. We're back. So let's get started on the '842.

MR. HARTSELL: Your Honor, may I approach?

THE COURT: Yes. Go ahead.

MR. HARTSELL: Good morning, your Honor. Again this is Steven Hartsell on behalf of Bell Northern Research. The '842 patent was developed by engineers at Broadcom and filed in

January of 2010. The '842 patent is a continuation of U.S. Patent Number 7,646,703 which claims priority to at least July 2004. The '842 patent is directed to long training sequences with minimum peak-to-average power ratios, and today I would like to provide some background and a few common steps that I hope the Court would find useful in today's discussion.

The '842 patent is taught against the backdrop of the 802.11 WiFi standard which is promulgated by IEEE, which is the Institute for Electrical and Electronic Engineers. This standard governs how different wireless devices are designed and how they communicate with one another. Now as technology evolves, the 802.11 standard has been amended periodically to add additional capabilities, usually resulting in faster speeds and better coverage.

As you can see on our slide, in 1999, the 802.11 standard was amended to implement OFDM, which stands for orthogonal frequency-division multiplexing, to increase data throughput. I'm going to show you what that means on slide 5. At the top, you can see this is how data was transmitted OFDM. Basically we have single carriers that are separated. When OFDM is implemented, the carrier waves are essentially smushed together allowing you to send more data found within the given bandwidth. As you can see on the OFDM, there's an overlap in the subcarriers which is necessary to achieve high data rates.

In slide 6, each colored peak is a subcarrier which carries data essentially, for example, the data you might need to load your website. The carriers are designed to be orthogonal which allows them to occupy the same bandwidth without interfering with which other.

Now as with many things while OFDM provides throughput improvements and other advantages, it also brings certain disadvantages. And one of the disadvantages to using OFDM systems is they are known to have high peak-to0average power ratio, in other words, PAPR, when compared to single carrier systems. PAPR is the ratio of peak power to the average power signal.

Now due to the presence of large numbers of independently modulated subcarriers in an OFDM system, the peak value of a system can be very high as compared to the average of the system as a whole. This is a problem -- PAPR is a problem because it reduces the power efficiency of radio frequency amplifiers, and this results essentially in high power consumption battery drain.

Therefore, the RF amplifiers are operated usually with a certain safety margin called a power back-off. Increasing the power back-off can result in lower amplifier efficiency and higher overall power consumption.

Another concept that may come up today is BPSK. BPSK stands for binary phase shift keying which is a digital modulation process by changing or modulating a phase of a constant frequency reference signal. The patent explains at column 2, lines 29 to 34 that in the 802.11a and 802.11g, versions of the standard when data packets are inserted, they include a preamble, and that preamble contains a short training sequence followed by a long training sequence which are used to synchronize -- which are used for synchronization between the sender and receiver devices.

Now the long training sequence uses BPSK and, therefore, each subcarrier in the training sequence consists of either a +1 or a -1. That's just an artifact of using BPSK. So there are very few symbols that are actually available behind using BPSK coding, making it very important to be able fine tune the timing so that data in the packet is accurately read and and interpreted.

In slide 10, this is a three-dimensional representation of an OFDM channel. At the top left in the kind greenish-gray area, you can see these are the short training fields. To the right, the blue squares represent the long training fields, and the gray blocks further to the right represent the data that is actually being transmitted. And as you can see in OFDM, there a lot of overlapping data occurring at the same time.

Now with higher data throughputs, the patentees recognized the need to create longer training sequences to ensure proper synchronization between sending and receiving wireless devices especially since we were going to start compacting more data than we were before. The solution that the inventors devised built upon the existing training sequences by adding subcarriers which are selected in a manner to minimize PAPR. You can see in the last slide essentially they took the existing long training sequences and they add subcarriers to either side. And there's a couple of examples in the patent. And they select these subcarriers such that the PAPR is minimal.

And as we saw on the previous slide, these preambles are sent with every data packet so they're constantly being sent, so it's desirable to minimize the PAPR as much as possible.

And unless the Court has any questions, I would hand it over to defendants' counsel.

THE COURT: I'm sure I will, but go ahead.

MR. HURT: Good morning, your Honor. James Hurt from Perkins Coie on behalf of the defendants.

THE COURT: Thank you.

MR. HURT: So today for you, I am going to present a tutorial. The roadmap, I have four basic modules. Those four modules are going to be wireless basics, then switching to frequency and time domain, then talk a little bit about orthogonal frequency-division multiplexing or OFDM.

(Court reporter interruption)

MR. HURT: Oh, I'm sorry.

And then we'll talk a little about the 802.11 standards themselves. So what is wireless digital communications? Fundamentally this is getting bits from the transmitting apparatus to the receiving apparatus. It involves the movement of information from the transmitter to the receiver. All it is moving, information from point A to point B.

But that information needs to go to something called "the channel." What is the channel? I like to think of the channel like a hose. It's just a pipe that connects the transmitting device to the receiving device. The more bandwidth you use, the fatter the hose is going to be. So in 802.11n, we're using a 20 megahertz channel. There are other technologies out there such as like CDMA that only use the 1.25 megahertz channel.

(Court reporter interruption)

MR. HURT: I'm sorry. The channel, the wireless channel bandwidth affected the more data you can get through. But to get that information through, you must pass through that channel and that channel impairs and degrades the signal.

So let's look at a typical WiFi environment. Here assuming your home office, you have a transmitter device called an AP going to your client. The signals are going to travel through that space. You might have a direct line path that goes from the transmitting device to the receiving device. You may have a path that bounces off the wall or you may have a path that bounces off your couch. Those three paths combine at the receiver. This is known as a multipath environment. It is the multipath environment that is one source of channel degradation. The signals bounce around the environment, they arrive at the receiver with different replicas at different times.

Another impairment is what's known as signal fading or variation in received signal power. You can see, as you might expect, the further away you move from the transmitting device, your received signal gets lower. Here we have an example of the actual received signal. You see that the signal is moving up and down and doesn't follow that straight line path. Where does that come from? That comes from what's called small scale interference. This possible small scale interference is a result of the multipath environment, the signals bouncing across the different objects in the environment and then combining at the receiver either constructively or destructively.

Channel estimation. This is an important concept particularly to the '842 patent. For a receiver to actually receive the information from the transmitter, it needs to know what the channel did to the signal. To do so, the receiver needs to know in advance what the transmitter is actually going to be transmitting. The '842 patent is about training sequences. As an example, we take the transmitter. It sends the signal through the channel. We see that the channel degrades the signal. It does something to it. The receiver gets that signal and it needs to look at it. It says hey, what did I receive from the channel? Oh. I see something that's distorted from the known signal that I'm expecting to receive. Once it sees that signal, it can correct for it. It makes that correction and says okay. Now I know what the channel is going to do to my signal.

So moving on to the second part of the tutorial, frequency and time domain. I like to use an analogy for frequency and time domain. Here on the left, you see music notes on a scale. To the right, you see a speaker. The notes on a staff represent the frequency domain. These are the frequencies that you want to hear. But you don't actually hear those. What you hear is the time domain sequence or the sound. Something in between was transformed, the frequency into time. What does that? In this case, it's the piano. It's the transformer. It's the device that converts frequency, notes, to sound, time.

Here's a visual demonstration. You can see as I take the frequency to the left, the period of the wave form increases. This corresponds to the low note on the scale. As we increase the frequency, the period of the wave form decreases. That will correspond to the high note on the scale. A signal can be described in both time or the frequency domain. They're effectively equivalent representations of the same signal, but they're described differently. One is saying here is what you look like in time, the other is saying here's what you look like in frequency.

So here's an example. Here's a cosign of 128 hertz. This is saying I'm a cosign and the one sample is 128, that's what I want to transmit. You take the Inverse Fourier Transformer, this signal, you end up with an actual cosign wave in the time domain at 128 hertz. Similarly you take a 256 hertz cosign wave. You have a single sample saying, I want 256. Take the Inverse Fourier Transform of that, you end up with a cosign 256 hertz.

So you might ask yourself, what happens if I combine them? What is this going to look like? So we put on the left both 128 and 256, take that Inverse Fourier Transformer. What do we have? We have something that doesn't look like a cosign wave anymore because the signals have combined and now we have the combined representation of both 128 and 256. We know that the time domain signal on the right was synthesized or created from the frequency domain signal on the left.

Moving briefly into OFDM or Orghogonal Frequency Division Multiplexing. I want to explain exactly what OFDM is compared to some other techniques and talk a little bit more about subcarriers. So before we get specifically into OFDM, I want to talk a little bit more about wireless spectrum.

I'm sure, as your Honor knows, back in the 80's, back in the 90's, we had radio bands. Oftentimes we would have to scan our FM radios to figure out what music channel we wanted to listen to. Here you can see as we scan the FM radio band, the frequency or peak of what channel we want to tune to increases. Once we see that specific channel, we go ahead and tune back to there. And we see, boom, here's the signal that we want, here's the frequency at which it was present.

The point being here is, a signal may be transmitted at different frequencies, as if using different channels of a FM radio without changing the information content. What this means is that you can have the same song playing on 88.3 as 91.1. They're on two different frequency channels, but it's the same information content. It's the ability to send that information on separate frequencies at the same time. That's the basis of OFDM.

So going back, what is OFDM? Here is an analogy I like to think of. Going back to the hose or that fat pipe, you have a single fat pipe of water. That's your bandwidth in a single carrier system. We're going to take that pipe of water and we're going to divide into multiple independent parallel streams, like from a showerhead. That's the picture to your right.

So why would we use OFDM? OFDM is more efficient. Here is a spectrum comparison for the same data rate transmission, if we use multi-carrier, multiple faucets or like an FM radio we have to have guard bands in between each station, but we're able to go ahead and use every channel on that FM radio band to transmit data, or we can decide to try to glop all that data together and do something called "single carrier."

Now single carrier when you spread the data rate, it causes bandwidth to expand. That's the basis for a technology called CDMA, which was actually invented here in San Diego by a company called Qualcomm. A similar technology called frequency hopping spread spectrum was actually invented in the '40s by Austrian-born actress Hedy Lamarr. She, during the 1940s, worked with our allies to help the Allies defeat the Germans by coming up with a system that would hop frequencies to overcome the German jamming of the Allied torpedoes.

Similarly though when you take away from a single carrier, we can crunch even more. We can get down to OFDM because we're able to overlap these subcarriers and these signals in a very special way. This is a very similar slide to what co-counsel has shown you before.

I want to point out a couple key things about this one. When you look at the peak of the red signal, you'll see that all of the other colors go to zero. That's what it means to be orthogonal in the context of the '842. The '842 is saying use all these different signals, use them in a non-interfering way to bring the data across all subcarriers.

The subcarriers spacing is an important feature in OFDM. They need to be spaced at certain regular spacing so they maintain orthogonal. In this case, we call that Delta F. And the K or the index value is just a number how far away from the center.

So in 802.11a, there are 52 subcarriers. They range from -26 to +26. In 802.11n, the technology used today, we go from -28 to +28. You've added four subcarriers that we're using. But to be clear, those subcarriers were already there. There are 64 defined subcarriers in the system. The question is not were they added: Were they used. That's the primary difference between 802.11a and 802.11n.

The patentee did not invent subcarriers. They were present. They were simply not used before. In fact, none of the stuff I discussed today so far was invented by the patentee. All this was known technology, known techniques.

So moving quickly into the 802.11 family of standards. I know this is a busy slide. I just want to point out a couple of things. In 1999, 802.11a was introduced, using 20 megahertz of bandwidth channel. It was based on OFDM. It's max data rate was 54 megabits per second. Ten years later in 2009, 802.11n was introduced. It also has an option or capability to use 20 megahertz channels, also based on OFDM technology, but its max data rate goes to 600 megabits per seconds. WiFi has evolved both in the technology used and the max data rate that it supports.

The key thing about 802.11 though was is it was designed to be backwards compatible. That meant the older devices and newer devices need to be able interoperate together, but more fundamentally, it put constraints on newer standards. The standards cannot go and change things that the older devices are expecting to see. So during training sequences, the values that the receiver is going to use to determine what the channel did to its signal already defined the value. The BPSK value for that subcarrier, it cannot be changed.

The '842 patent was about determining those four values that they're going to use on the two extra subcarriers on the left and the two extra subcarriers on the right. That's the invention. That's what they're claiming, this inventive sequence that's four defined values for subcarriers on the left and the right.

Here it is. This is the actual 802.11a training sequence. Again, 64 subcarriers already there, existed the entire time. Only 52 were active and it has a -26 to a 26 with dc with a zero index not being used. This training sequence was already defined in 802.11.

The sequence itself is on the bottom. 53 subcarriers is OFDM training symbol, modulated by a sequence of L. Those L sequence values are all +1 or -1s BPSK. You can think of a training sequence just like the notes on a scale. The receiver knows what the transmitter is going to be sending during this training sequence. It's used so the receiver can figure out what did the channel do to my signal.

So 802.11n came along. What do we want? What do we always want? We want better, faster, cheaper. 802.11n increased the data rate from a 54 megabits per second to 600 megabits per second. Many different ways for the system designers to achieve that goal. One of the ways they achieved that goal was to increase the used subcarriers.

So again, only have 64. Using 52 in 802.11a. 802.11n, all right, let's use four more. What enabled that was improved digital filtering technology. Technology not invented by the patentee here.

So now instead of having six subcarriers on the left and five on the right, we can decrease it, use those extra subcarriers to carry more data. To do that, you have to define values for those subcarriers during the training sequence, so you can determine what did the channel do to that specific subcarrier.

So the actual patent itself was a patent application filed by Broadcom during the 802.11n standardization process.

The specification disclosed the exact same training sequence as specified in the eventual standard. Again, you were required to start with 802.11a. They didn't invent the entire sequence. It was already there for them. Here it is again, the 802.11a training sequence.

Now I want to talk a little bit about peak-to-average power ratios as counsel discussed as well. Here's the sequence on the left. You take the Inverse Fourier Transform with this the sequence, you end up with this sequence on the right. The sequence to the right is the power sequence that you actually will get out when you take the Inverse Fourier Transform.

I have shown the solid red line, the average value. And the dotted green line is the peak value. As counsel indicated, depending upon the ratio of the peak to the average, it's going to matter how much variability you have going into your power amplifier. The more variability, the more back-off you need. So he's right, minimizing peak-to-average power ratio is an important aspect of OFDM's system.

But one thing I want to know, if you look at the left sequence, the one in frequency domain, it consists of only +1s and -1s. If you take the power of that sequence, its peak power and its average power are identical. They are both 1. Because when you take a 1 or a -1 and you square it or multiply it by itself, 1 x 1, 1, -1 x -1, 1. So it's the peak in the average in the frequency domain where a sequence is defined by

BPSK is 1. It has no peak-to-average because they're exactly the same thing which means in the context of the '842 patent, peak-to-average power ratio is a time domain property. There is no peak-to-average power ratio for a frequency domain signal.

Here is the '842 patent and the 802.11n training sequence. The four red dots, that's the supposedly inventive sequence of the '842 patent. Again, those subcarriers already existed. They were already there. What the patentee had to figure out was what do I want to put on these four subcarriers? Do I want to put a +1 or do I want to put a -1 because there were only four additional subcarriers and we were restricted to +1s and -1s, there are only 16 possibilities the patentee could have chosen from. It turns out that this selection, 1 out of 16, this is the one that gives you the minimal peak-to-average power ratio when converted to time domain.

That property of the peak-to-average power ratio in the time domain is an inherent characteristic of the frequency domain sequence that you selected. Had you changed any one of these red dots from a +1 to a -1 or take a -1 to a +1, the corresponding peak-to-average power ratio will go up.

Let's go ahead and do that. I take the Inverse Fourier Transformer, the extended long training sequence defined in the '842 patent and, again, we get to the right a power domain sequence. And you'll notice the peak-to-average power ratio from 8011a to 802.11n went up just a little bit. It went from 3.2 dB to 3.6 dB. dB is a relative scale that engineers like to use. Approximately 3 dB is a factor of 2. From .2 to .6 is just a smidgen more. Not a big deal. But the patentee and BNR are correct, you do want to try to minimize this. But you only had four values to mess with to figure out how you wanted to do this. Thank you, your Honor.

THE COURT: Okay. All right. Do you want to start with the first term that's at issue here?

MR. HARTSELL: I understood that the defendants would be presenting first since they're the ones who put this term up for construction.

MR. HURT: I'm happy to present first, your Honor.

THE COURT: Okay. Go ahead.

MR. HURT: Do you mind if I do a have a quick swig of water?

THE COURT: No, go right ahead.

MR. HURT: All right. So we're here back to talk about the proper construction of the Inverse Fourier Transformer. Here is the claim language:

Wherein the Inverse Fourier Transformer processes the extended long training sequence, which we've discussed quite a bit before, from the signal generator and provides what? An optimal extended long training sequence with a minimal peak-to-average ratio.

On the bottom left, I've shown again, here is the extended long training sequence of the '842. Take the Inverse Fourier Transform, you end up with this. It has peak-to-average power ratio of 3.6 dB.

Let's look at the proposed constructions. Defendants propose: A circuit and/or software that performs a defined mathematical function that transforms a series of values from the frequency domain into the time domain.

BNR proposes: Plain and ordinary meaning, or alternatively, circuit and/or software that at least performs Inverse Fourier Transform.

Let's talk about the first, plain and ordinary meaning.

THE COURT: This is a fundamentally, perhaps, stupid question, but why does it bounce back and forth from Inverse Fourier Transform to Inverse Fourier Transformer?

MR. HURT: So the transform is the actual defined mathematical formula or the function. The transformer is just something that implements that function.

THE COURT: And this is clearly something that people who do this stuff would recognize. I mean, it's written in the patent in initial caps. So while I'm not exactly sure what it is, I would suspect you certainly would know, people who would practice this sort of technology are going to recognize this, and I think in both the briefing, it was recognized that this is a mathematical function that an electrical engineer is going to recognize. They're going to know what this is.

MR. HURT: Yes. Absolutely agree with your Honor.

THE COURT: So why do I have to do anything more with it when it says that it's there, it's operatively coupled with the signal generator, and it's going to process this extended long training sequence from the signal generator and provide an optimal extended long training sequence with a minimal peak-to-average ratio? Isn't it just doing what the formula does?

MR. HURT: Yes, your Honor. But two reasons why you should construe this term. One is to provide -- resolve the dispute between the parties as to the exact scope of this claim term. Second, provide clarity and guidance to the finder of fact. Going back to the first, we have a fundamental dispute with respect to what defendants believe the Inverse Fourier Transformer of the '842 is doing relative to what BNR proposes that an Inverse Fourier Transformer in the abstract can do.

BNR has already proposed and argued that the Inverse Fourier Transformer can be multi-dimensional, can operate between multiple domains. Defendants do not dispute that mathematical concept in the abstract. What defendants -- our concerns are is that even when we get to expert reports, if we have a fundamental dispute, the arguments are not going to be joined. We're going to be talking about the '842 Inverse

Fourier Transformer, the one that takes frequency domain signals into time domain. BNR will be talking about this amorphous transform that can -- according to them, can do anything. It can take any number of dimensions, go anywhere to any space to any other space. Yet the '842 patent never talks about anything else other than frequency in time.

THE COURT: So fundamentally, it's not this mathematical functionality but rather that this claim is directed as a wireless communication device that comprises this transformer?

MR. HURT: Absolutely, your Honor.

THE COURT: In the context of the claim language itself that says this is a transformer that is comprised in a wireless communications device, your argument is how it operates that mathematical principle is limited?

MR. HURT: Absolutely.

THE COURT: And limited to this frequency into time domain?

MR. HURT: Yes, your Honor. That's exactly correct.

THE COURT: Okay. And now help me find out other than beyond the fact that it says that it's a wireless communications device, why would someone recognize that?

MR. HURT: Absolutely. Happy to do that. So plaintiffs and defendants agree that this can be a circuit and/or software. No dispute there.

But let's look at the difference between the defendants' construction and the plaintiff's construction. The plaintiff's construction is a nonconstruction. Again, it simply parrots back the terms of the very term we're trying to construe. Defendants' construction provides both clarity and definition. It tells you exactly what the mathematical function will be operating on. It will transform a signal one into a one-dimensional series of time domain values. That's what's described in the '842.

Where are we going to find support for this? Defendants find support in the claim, the specification, and the expert. BNR's supposed support? They have no support in the claims. They have no support in the specification, and they have no support from an expert looking at the claim language itself.

What do we see? Inverse Fourier Transformer is carried by what? Subcarriers. We're operating in what? An orthogonal frequency division multiplexing system, clearly indicating that the input of Inverse Fourier Transformer is what? A frequency domain signal. What comes out? An optimal extended long training sequence with what? A peak-to-average ratio.

The frequency domain signal had no peak-to-average ratio, so what must we be talking about here? The time domain sequence, the sequences between the '842 and 802.11n specification, the technology accused here today, are identical. They're defined by subcarriers in the specification, they're defined as subcarriers in the patent. The two new things are the +1s at -28 and -27 and -1 and -1 at subcarriers 27 to 28. The specification itself says "using subcarriers." Again, the difference between the sequences, four red dots.

The specification supports defendants' construction. The specification says that the extended long training sequence is a frequency domain signal. Here are three cites from the '842 patent itself: Column 2, lines 34 through 36 describes the sequence, the subcarriers. Again at column 2, lines 37 through 39, more subcarriers. '842 column 4, 50 through 64 always refers to subcarriers, either 56 and 63. Fundamentally, the patent specification itself tells us that input is a frequency domain signal and the output is a time domain signal. '842, column 4, lines 50 through 64 under the red highlighted text: The Inverse Frequency Transform processes the long training sequence from the signal generating circuit and thereafter produces and optimal expanded long training sequence. With what? A minimal peak-to-average ratio.

But the specification goes on. It talks about block 208 and it tells you that the input to block 208 takes as its input the output from block 206, block 206 being the IFT. Serial to parallel module 208 converts the serial time domain signals into parallel time domain signals. What did it get at its input? A time domain signal. Where did that come from? The IFT.

Here at the receiver side and here in this case, the signal flows from the right to the left because we're starting with our antennas. Again, the specification, column 5, lines 1 through 9 tells us that the fast wave transformer, which is just another version of the Fourier Transform on the receiver side, must convert the serial time domain signals, which are the input, into 306 going from right to left into an output which is a frequency domain signal. The FFT at the receiver must be doing the inverse or the opposite of what the transmitter did. If the receiver is going frequency -- time to frequency, the receiver must have been doing the opposite. It was going frequency to time.

In fact, the '842 patent tells us that in column 4 lines 50 through 64, again with the highlighted -- sorry underlined red text that the inverse Fourier Transformer 206 may be an Inverse Fast Fourier Transformer. So if the Fast Fourier Transformer went from time to frequency, the inverse should be going from frequency to time.

THE COURT: Okay. Without pretending I'm getting even 10 percent of what you're talking about, looking at this, I anticipate their argument is going to be that the section that you've underlined where it talks about this transformer converting the serial time domain signals into frequency domain signals is an example, one way of doing it, not limited. Why is it limiting? Why should the Court read this description, which is consistent throughout. It talks about this transformer is getting a signal in one way, in frequency and coming out as time, or coming in as time and coming out as frequency. I'm not seeing a lot of examples that haven't been pointed out to me of other ways those frequencies can go in and out because, again, the context here is in a wireless communications device.

I'm anticipating their argument is going to be, that's just an example, you would be reading a limitation from the claim -- from the specification into the claim. Why is that not the case? Why can't there be -- I mean, there are other ways, I understand, of doing these changes. It's not necessarily frequency to time and time to frequency.

MR. HURT: So fundamentally, the question is if you're starting with the frequency domain signal, which is the basis of OFDM, you need to get to time because you need to transmit something out your antenna. You're not going be able to transmit 256. Antenna is not going to know what to do with that. You need to actually give it a wave form that looks like 256 hertz.

So if you want to transmit off an antenna in a wireless communication system, you need to have time domain signal. Nowhere in the patent are two-dimensional Fourier Transforms discussed because you don't use two-dimensional Fourier Transformers for signal generation. You may use a two-dimensional Fourier Transform for analysis, you may use it to take the two-dimensional Fourier Transform of an image, but the data itself, it's just the one-dimensional values of the frequencies that you want to transmit.

Fundamentally, OFDM is about frequency to time. There is nothing else that you can do if you want to use it in an OFDM system. We're not importing any limitations from the specification into a claim. We're simply clarifying in the context of the '842 for wireless OFDM signal generation what does the IFT do? It takes modulated frequency domain subcarriers. What value do you want me to impart on that subcarrier? You do the corresponding time domain sequence so you can actually transmit that. I offer a challenge to BNR: Show me a wireless system based on OFDM that uses a two-dimensional Fourier Transform to produce the time sequence to transform.

THE COURT: It is relevant then or important to your analysis that when this transformer processes the extended long training sequence from the signal generator and provides the optimal extended long training sequence with a minimal peak-to-average ratio that that's done for configuration for an OFDM scheme, and that's why it has to be frequency to time and time to frequency?

MR. HURT: That is correct, your Honor.

THE COURT: That is an element of the claim. So you can't kind of read that out. You're doing it for that orthogonal frequency division multiplexing scheme?

MR. HURT: That's correct. I can go back to that real quick. So it tells you it's an orthogonal frequency divulged in the multiplexing scheme. OFDM, the very basis, start with frequency, modulate, give me the data you want me to transmit, I will take the transform, I will transmit it out the antenna for you.

THE COURT: Okay. All right. Thank you.

MR. HURT: Thank you, your Honor.

MR. HARTSELL: Your Honor, I think you were right. Initially, the Fourier Transforms are well known mathematical functions. We have said that, defendants have said that, their expert has said that. We agree with you, any expert would recognize what a Fourier Transform is.

So when we were providing some context about the circuit or software that can perform the function you think that would be useful, but as you realize, the specification -- what the defendants are trying to do is import limitations from the specification, which the Federal Circuit consistently says that even if there is only one embodiment taught, it's improper to import limitations from the specifications into the claims unless the patentee -- unless it's absolutely required.

Now I find it interesting that the patent as counsel talked about, there are examples of "frequency" and "time domain," those terms being used in the patent. However, that shows that the patentees actually understood those concepts. The patentees when they went to claim, they did not put any restrictions on the Inverse Fourier Transformer. They didn't say it had to go from frequency to time or time to frequency or frequency to space or any other variety.

That's important because while the invention is taught against the background of the 802.11 specification, the patent says that it is not actually limited to 802.11 specification. And we have provided in our brief examples of extrinsic evidence showing, for example, your slide 20, this was example Exhibit U to our brief. This comes from a textbook showing the mathematical formula for a Fourier Transform and Inverse Fourier Transformer showing. There is no inherent limitation it has to be frequency to time or space or any other variable. It's a very broad concept.

Likewise, we presented a dictionary definition showing that a Fourier Transform is just a mapping function from one domain to another. So while we admit that the Inverse Fourier Transform in some context, it may be used to go from frequency to time, it is not limited to that. It is a very broad function that has a lot of applications and capability. And so essentially at the end of the day, the defendants are just attempting to import limitations from the specification into the claims.

MR. HURT: A couple comments, your Honor?

THE COURT: Yes.

MR. HURT: So first, talking about the embodiments of the invention. Referring to the different embodiments of the invention, the embodiments of the invention are two, 56 subcarriers or 63 subcarriers. It's not about hey, let's do this with a two-dimensional Fourier Transform; hey, let's do this by going straight to wave vector. Not in the patent. The two embodiments, 56 to 63.

BNR has shown no way to actually perform this claim without frequency domain. It's in the claim language itself. It says: Orthogonal frequency division multiplexing. You must start with a frequency domain signal that you can multiplex the data on. It says it right there, OFDM. BNR simply wants to ignore and pretend the claim language says Inverse Fourier Transform by itself with none of the claim language around it that tells you what it's taking in, what it's putting out in the context of the system that it operates in.

THE COURT: Well, sometimes I feel we've parsed the words in the claim to get what the claim language ultimately requires into the definition of the term when it first appears, and that may be just a redundancy that's not necessary.

You need in this claim a wireless communication device that has a signal generator and an Inverse Fourier Transformer. That is this transformer that is going to do this mapping function, and it's just sort of what it is. But then it talks about how that transformer is going to process this extended sequence and provide the sequence with the minimal to peak average ratio. So what I feel like you're focused on is not necessarily the definition of the transformer but this processing portion of the claim that says how that happens is it's got to be frequency to time and time to frequency; otherwise, it won't be doing this.

MR. HURT: I'm not sure I quite understand the question, your Honor.

THE COURT: I'm not sure I need to download into the definition beyond what you both agree to, that this transformer is a circuit and/or software that performs a defined mathematical function, and then that what that function, though, is driven by the rest of the language of the claim because what it has to achieve is taking the sequence from the generator and providing the optimal extended long training sequence that with a minimal peak-to-average ratio over this certain number of subcarriers. And as I understand what you're saying is, in the context of a wireless communications device, that processing step of this transformer is going to require that it do it with time to frequency or frequency to time.

MR. HURT: That's correct, your Honor. In the context of '842 for a wireless communication system when you're starting with a frequency domain signal, it will go through the IFT, it will produce that time domain sequence. But I think that's not the fundamental dispute here. The fundamental dispute is what is the scope of the claim language itself.

The defendants are saying in the context of the '842, the IFT needs to go from A to B. BNR has said no, no, no, no, it's very broad, it can do all these things. It hasn't tied that to the specification, which means that defendants don't know the claim scope. Where do we infringe?

If we decide to implement this with not in IFT but say a parallel bank of filters, is BNR going to come back and say well, that's close enough to our amorphous IFT description? I don't know what their IFT description is. They haven't provided one.

THE COURT: Well, they have. They've provided what's a recognized definition of the Fourier Transform, that it's something that defines a signal in one domain that could be, for example, space or time into another domain such as wavelength or frequency. You're limiting it to the time and frequency switches, and they're saying no, it doesn't have to be because someone would understand that this transformer could operate -- it could be going from space to wavelength. I don't know how it does that. That would be a combination of the same four things. And in the context of a wireless device, you're saying no, that wouldn't be the way it would operate.

MR. HURT: That wouldn't be the way. But let me just respond to that argument briefly. So if you want to actually have a two-dimensional Fourier Transform, it actually requires a double summation. Even the extrinsic evidence that they pointed to is a single-dimensional Fourier Transform and it happens to be in continuous time, which by the way, is not the system that we operate. It's a discrete time digital signal processing system that actually takes an Inverse Fourier Transform based on a digital discrete time system.

Their extrinsic evidence is wholly inapplicable to a DSP based system, first of all. You'll notice that the integral goes from negative infinity to positive. Great. We're going to be here forever when we're doing it their way.

In the context of '842, it tells you we're going from frequency into time because we're a wireless OFDM system. The fact that BNR wants to make that broader tells me that they want to be able to accuse anything that we do, right? The intrinsic evidence supports our construction. Their extrinsic evidence, in fact, contradicts the intrinsic evidence. They want to take a dictionary definition that talks about an integral that's not discussed anywhere in the intrinsic evidence. The patent itself clearly says we're operating in OFDM, we use subcarriers, we get to time.

THE COURT: Okay. Thank you.

MR. HARTSELL: Your Honor.

THE COURT: Yes.

MR. HARTSELL: If I may, your Honor, just very briefly. I think your Honor hit the nail on the head, and I think counsel solved his own problem because, like he said, the rest of the claim language provides additional restraints and limitations to the claim language itself. There is no need to import those other limitations into the definition of Fourier Transform. Whatever other limitations exist, they exist elsewhere in the claims. We don't think that it's necessary to define well-known mathematical concepts of claim construction.

THE COURT: If the argument is that the only way this IFT operates in this context is the example set forth in the specification which only talks about converting time into frequency, is there somewhere in here where it provides or says or you could do it this way? Just out of curiosity.

MR. HARTSELL: No, I don't believe there is an additional example. But, again, that is what the Federal Circuit has said that even if your patent specification only provides one example, you're not limited to that one example when the claim language you used is broader. And in this case, like I said, the patentees in one part of the specification obviously understood that there are concepts such as frequency domain and time domain, yet when they went to claim it, they didn't say that the Fourier Transformer has to be from frequency to time or time to frequency or anything else. They didn't place any restrictions as it relates to Inverse Fourier Transform. To the extent there are other restrictions given the fact that it works in OFDM system, those come in -- those are other aspects of the claim and are limited in that nature. So it's not proper to import other limitations from different parts of the claim.

THE COURT: All right. Thank you. I feel like we're going to revisit this. Well, we're not done with this because we still need to figure out what the extended training sequence is and how that is different from the standard wireless network or the legacy wireless networks. So that might add further constraints on this claim anyway. Let's leave this for now. I'm inclined to not -- although I think as a practical matter the way it operates, I'm not inclined to read it into the claim because, at least, my fairly superficial understanding of this is as a practical matter, it needs to operate time to frequency and frequency to time to do the processing part of the claim. And so maybe as we continue to discuss other aspects of this claim that might help me a little bit more to understand where the openings are for this to be something broader than what you've described to the Court, the defendants.

So let's go back to "long training sequences."

Hello.

MS. FULLER: Hi. My name is Joanna Fuller on behalf of the defendants. So we're going to start with the term of "standard wireless navigating configuration for long training sequences."

THE COURT: And this may be just, again, for my state of mind here so you can help me move from something very superficial to why it doesn't work this way. But in trying to read this whole patent overall and what you have already talked about this morning at the time the patent was filed, the standard wireless network configuration or the legacy wireless local area network device configurations here were using less than 52 subcarriers, or 52 subcarriers, and the patent addresses using more. Now I understand from what you said those subcarriers existed, but they weren't being used. And this patent says we're going to use more than 52 subcarriers now. So isn't that what is meant by this longer than the long term training sequence used by legacy or greater than the number of subcarriers than the standard wireless configuration is that it uses more than 52 subcarriers to do this process?

MS. FULLER: So the dependent claims refer to both more than 52, and another one refers to more than 56, I believe.

THE COURT: The dependent claims all talk about being more than 56.

MS. FULLER: So the patent talks about --

THE COURT: Or at least.

MS. FULLER: Okay. Let me get to where you are. So the patent talks about more than 52, more than 56, and more than 63. And those paragraphs that discuss that are essentially identical, so they don't really say when it needs to be more than 52 or when it needs to be more than 56 or when it needs to be more than 63 subcarriers. The dependent claims, I think that -- here. So the dependent claims refer to at least 56, and claim 5 is at least 63. So there's just a lot of different directions and it doesn't seem to be bounded in scope or time or anything.

THE COURT: I'm sorry. But I'm looking at column 2 and it's saying in the 802.11a through 11g compliant devices, only 52 of the 64 active subcarriers are used, and the rest of the patent goes on to explain how you're going to use more than the 52 of the 64. You might use 56, you might use 63, but that what you're talking about here in this claim where it says that you have this sequence is carried by a greater number of subcarriers than the standard, it identifies the standard. The standard was 52. So I don't know that it has to say how many more. It certainly teaches how many more. But it simply has to be more than the 52.

MS. FULLER: So defendants -- or sorry. Plaintiff is not limiting it to that at all. Plaintiff's construction suggests that it can be any standard issued by any standard setting organization, not even limited to 802.11, that uses an OFDM scheme.

THE COURT: I don't agree with that. I think the plain language of the patent says what was a compliant device at the time in the existing prior art in the background of the invention was that you were using 52 of 64 active subcarriers and then goes on to teach a way of formatting this thing so that you're using more than 52 but not exceeding the 64. You could use somewhere -- I guess there are limitations mathematically, but you're within that range between 53 and 63. And it explains how to do that. So I don't think this is overly broad. Their proposed construction may be overly broad, but within the confines of the patent, I think it's defined, that what the standard was 52 and you're exceeding that, and it's teaching 56 or 63.

MS. FULLER: So we still think it's overly broad even if it's limited that way because there are like multiple standards that could fit in there. But certainly that helps constrain it. But, again, I don't see that in the claim itself. So the claim itself is written in such a way that it's indefinite because it's not limited that way.

THE COURT: But what I would be trying to make clear, as you said, is the portion of the claim that talks about these training sequences being carried by a greater number of subcarriers than the standard wireless networking configuration. And the patent says that the standard was 52 of 64 at the time this patent was filed. So that's the standard. It has to be greater than that. And that would seem to apply equally to referencing the legacy devices. That that was the legacy. Those were the wireless network devices. In accordance with legacy wireless networking protocol. What was -- the networking protocol at the time the patent was filed was using 52 of 64 active devices. So as long as what you're doing is exceeding that 52, I think that's what the limitation of the claim is.

MS. FULLER: So the concern we have with that if the optimal extended long training sequence is exceeding the 52, it doesn't seem to be bounded in time because as the technology gets more sophisticated, the number of subcarriers are just squeezed into the same range, right? And as the technology gets more sophisticated, the number of subcarriers has been increased and increased.

THE COURT: But it's going to bounded by what was the standard at the time this patent was filed. They don't get a moving target to say the standard now is 64 and we're moving out to 85 or something. Their standard at the time they filed this patent they have identified in the patent which, therefore, identifies the terminology of the claim is 52 of 64. And so they don't get to keep moving the standard forward into the future. The Court doesn't see it that way.

MS. FULLER: So just so we're on the same page, so where this is leading that I think that we should discuss is we have extended long training sequence and the optimal extended long training sequence. Those have essentially the same number of carriers and those are both said to be greater than this standard one. So with the bounds you're talking about, I think what you're saying is those extended long training sequences and the optimal long training sequences would also be bound to the point in time that the patentee filed this because those are what the longer one is relative to the standard wireless networking configuration. Is that consistent with what you're saying?

THE COURT: Yes. Again, in trying to read the patent and understand what was identified as the existing art at the time, what they were improving on was that training sequence used less than 52 subcarriers or used 52 subcarriers. So an extended long training sequence has to use more than 52 subcarriers to be extended pursuant to this patent, and optimal may be the examples they gave of 56 and 63, but that's what they were saying they did that was different than the standard at the time, and I don't think it becomes an open-ended so the standard now may be 63 and you're using 84. They don't get to claim that because they didn't teach that.

MS. FULLER: So we definitely agree that the optimal extended long training sequence and the extended long training sequence are also limited, right, to what would have been known or anticipated at the time of the patent. So definitely we agree that the standard wireless networking configuration to the extent you say it's a standard is limited but so are the length of the one that's carrier/subcarriers for the same reason because it would have to be known or anticipated at the time of the patent, and that's reflected in the patent, as my colleague was mentioning earlier. So they both said which the greater number of subcarrier standard was as well as the one that it's comparing to.

THE COURT: Well, if the Court construes the standard wireless networking configuration for an orthogonal frequency division multiplexing scheme and a legacy wireless local area networking device in accordance with a legacy wireless networking protocol standard as the use of more than 52 subcarriers because that was the standard at the time, then that would be the way I understand what the standard was. The standard was that identified 802.11a through g compliant device were only 52 of 64 active subcarriers were used. That was the standard. That is what they identified as the standard. I don't see the configuration for either the way it's defined in claim 1 or claim 14 to be really any different. It's the standard compliant wireless device.

MS. FULLER: And then we would say -- I mean, using that same rationale if we were to accept that, would be that the optimal extended long training sequence would be limited to 802.11n.

Correct, Mr. Hurt?

THE COURT: Well, I don't know that they called it 11n anywhere in the patent. They just said that you're using more than the 52 active subcarriers which I guess is n, but there is no discussion in the patent. There it is. 802n, a new extension is being developed. Anyway.

So let's do this a little bit at a time. So your argument with my interpretation of what the standard was at the time which I think is called out in the patent, otherwise, it's kind of vague.

MR. HARTSELL: Well, your Honor, the issue with these terms is not really the construction. The reason these are at issue today is because the defendants have said that they are indefinite, and so what we have proposed in our briefing is how somebody of ordinary skill in the art would understand these terms to show that they would understand them with reasonable certainty. So we're not necessarily arguing for a specific construction. The defendants haven't argued for a specific construction, nor have they proposed a construction of their own. The issue here today is whether somebody of ordinary skill in the art would understand this term with reasonable certainty.

And I think as your Honor has noted in the specification, 802.11 is how the -- it's taught against the backdrop of the 802.11 standard. It's not necessarily limited to the 802.11 standard. The patent needs to say that and --

THE COURT: Yes. But if you want the standard to simply be oh, a standard set by a standard setting committee, that doesn't tell me anything. The patent does very specifically go into what the standard was, and there has to be some scope to what that standard was. And it is defined and recognized in the patent as to what the standard was relevant to these claims was using the 52 of 64 subcarriers to do this process.

MR. HARTSELL: Yes. And I would agree that yes, back at the time, yes, that was what was known. And the inventive aspect, of course, is adding on and making longer training sequences with low PAPR. And we have provided a couple of examples in the patent. We're not limited, of course, to just the two examples in the patent because those are embodiments.

THE COURT: But if you just make it vague, vaguely saying whatever the standard is at the time you're reading this patent, then how would someone know what standard you're applying? There has to be some context and it has to be at the time the patent was filed.

MR. HARTSELL: Yes, I would agree it's the standard at the time the patent was filed, but I would submit that a person of ordinary skill in the art would understand these terms with reasonable certainty. And one of the ways we know this is because of Huawei. Last week Huawei filed IPRs against the '842 patent. And they relied on Dr. Wells' testimony, the same expert who submitted a declaration that said they're a little uncertain in some respects here. In his IPR declaration, he had no problem applying these terms to prior art references.

And in the *Sonics* case, which we've cited in our briefing, the Federal Circuit reversed a district court's finding of indefiniteness. And one of the reasons they did so is because the patent at issue there had been subject to -- not inter partes review but a reexamination proceeding, and the Federal Circuit noted that the requester and all the individuals there were able to apply the term at issue to the prior art references which they said served as objective evidence that a person of ordinary skill in the art would understand this term with reasonable certainty and, therefore, it is not indefinite.

THE COURT: I am not finding the standard of wireless networking configuration or the standard that something that's in accordance with the legacy wireless networking protocol standard to be indefinite because I think the patent describes those things, what they are, what the standard was. But what the Court is advocating for here in my own claim construction of this term is to make it not indefinite -- not just some nebulous there's a standard out there that exists in the industry -- is that the standard that's described in the patent is the standard that applies, that whatever you're doing here with your extended training sequence has to be beyond what the standard was at the time the patent was filed, and it identifies what the standard was. And I don't think they disagree with that.

MS. FULLER: We agree that it talks about the 802.11. It talks about a couple of standards.

MR. HARTSELL: The patentee said that it's not limited to just 802.11. It's the backdrop of it. There can be other OFDM standards that this patent might potentially apply to that's not necessarily at issue in this case.

THE COURT: Then it becomes indefinite. If your argument is I can just say what I am doing is different than the standard, the standard today, fine. The standard ten years from now? I don't know what that standard is. But you can measure it against it when the patent is still valid, then I don't think you have set a standard, then I don't think you have put anybody on notice as to what the standard is that you're saying that you're different from. The patent specifically teaches an existing standard and says this is different than that. And I think you need to be limited to that.

MR. HARTSELL: I would submit that the standard should be the OFDM standards that existed at the time, of which 802.11

is one.

THE COURT: Okay. And so the device is implementing the 802.11a and 11d standard using the OFDM encoding scheme, use only the 52 of the 64 active subcarriers. You haven't changed anything, in my opinion, by saying you want to limit it to that. You're still limited to those standards the 802.11a and g using 52 of the 64 subcarriers. That was the existing standard for the OFDM or the legacy wireless networking protocol at the time. I see your client is going yes.

MR. HARTSELL: We would be fine with that, your Honor.

THE COURT: So I'm not going to find those references to this being compared to a standard configuration at the time to be indefinite. I'm going to limit it to what the patent describes is the standard at the time which I have now repeated six times, so I'm not going to say it again.

But let's talk about what it means to be an extended long training sequence. The defendants, again, have argued that's indefinite, and the plaintiffs have said it's a sequence that uses more active subcarriers than an earlier version of the same standard, which again gets me back to it's a training sequence that uses more than 52 of the 64 active subcarriers because that's what the patent describes.

MS. FULLER: The problem here is similar to the problem of the last one that we were just talking about is that if it's extended, again, it's not limited to the number of subcarriers known or anticipated at the time of the patent. BNR is trying to argue that it can be extended to 63, it can be extended to 2048, it can be extended beyond whatever, as long as it's more than some baseline number. So that has the same issue going forward, that there's this attempt -- there's vague language in BNR's construction as well, attempts capture extended long training sequences way, way out in the future.

THE COURT: Well, if an extended training sequence is based on the state of the art at the time, a sequence that is more than 52 of the 64 subcarriers, the patent specifically teaches using 56 or 63 of those carriers. Your point is what? The patent won't teach using 2000 subcarriers. It doesn't enable that. It doesn't explain how you would do that.

MS. FULLER: Right. That would make it indefinite.

THE COURT: Not enabled. I don't know that it would be indefinite. They're different concepts, but, okay.

Yes.

MR. HARTSELL: Your Honor, I would say if we're -- based on your prior comments, if we're going from the baseline 52, anything more than 52 qualifies as extended long training sequence. And the Federal Circuit *SuperGuide* case specifically states that claims can capture after rising technology. And this wasn't in our briefing, but I would cite you to *Brandywine Communications Techs. v CenturyTel Broadband Services*. This is 2013 U.S. District Lexis 187334 from the Middle District of

Florida, April 17, 2013. This is right before *Nautilus*. But that Court was presented with a very similar circumstance involving standards, and the Court looked at the Federal Circuit's jurisprudence with respect to *SuperGuide* and its progeny and noted that the Federal Circuit specifically said that under the *SuperGuide* case law that claims can capture later revisions of a standard. So as long as the extended long training sequence is longer than the 52 that was known at the time, it qualifies. That was the invention.

MS. FULLER: So like he said, they didn't cite that in their brief. On the contrary case --

THE COURT: Well, they did say that the training sequence that uses more active subcarriers than the earlier version. The Court has now defined the earlier version to be 52 active subcarriers. So taking my interpretation of what limits the earlier version and importing that to their construction, I think that that is the construction, that it's "a training sequence that uses more than 52 active subcarriers." Now you're into a long training sequence. And, yes, there are optimal ones provided for in the patent that use 56 or 63, but those are optimal. I have no idea if you could do less than 56 or 63 or some combination. Presumably you could. Those would give you best peak to whatever ratio, I guess. But, again, what's going on here is at the time it used 52 and now they're saying you're using more.

MS. FULLER: But even the patent doesn't say you can use an infinite number. So there's this concern, right? So the patent at the time, only a certain number of subcarriers were considered. So now you can see here WiMAX has carrier configurations up to 2048 subcarriers. One variation has 256 subcarriers. These types of configurations were not known or anticipated at the time of the patent.

THE COURT: Okay. The patent talks about 52 of 64, so you have a cap at the other end for the standard. The standard at the time was there were 64 potential subcarriers. They were only using 52, and the patent certainly teaches using something more than 52 but less than 64. It doesn't teach anything about the standard at the time being more than 64 subcarriers. So if your argument is now we use more than 64, that wasn't an improvement on the standard at the time. That's a different standard.

MS. FULLER: Right. In our opinion, that wouldn't be captured by even the extended long training sequence, right? Because it can only be extended as far as the patent has extended it.

And also just to address this case law, I direct you to *Extreme Networks v Enterasys Networks* -- again, we didn't cite this in our brief because they didn't have any contrary testimony -- so 2007 Westlaw 5601497 at star 16 to star 17 from the Western District of Wisconsin, also regards standards and says like *Phillips* what's known or anticipated at the time of the patent.

THE COURT: Okay. Anything else?

MS. FULLER: I would like to quickly distinguish *SuperGuide* that they've cited in their slides. In that case, what it's talking about is signals, and it's merely saying that after a rising technology other kinds of signals would be covered. Here it is talking about a standard. A standard is something that goes through a whole process, it's defined and then it's a standard, and so deciding that other standards could somehow be that standard is like a different -- it's not applicable in that way.

Did you want to talk about any of the other terms?

THE COURT: Actually I wanted him to...

MR. HARTSELL: I would disagree with counsel's characterization of *SuperGuide*. *SuperGuide* was about television signals that didn't exist at the time that the patent was claimed, and the Federal Circuit said that yes, because of the way the claims were drafted and they were drafted broadly enough, they could capture, I believe, it was digital television signals technology that came into being after the patent was drafted. So I think the Federal Circuit law is clear that as technology evolves if your claims were properly drafted, it can encompass that technology at least in certain situations.

THE COURT: Okay. I'm ready to move on. I didn't have anything else in this patent.

MS. FULLER: There's nothing else. These four terms are all related.

MR. HARTSELL: Again, yes, these are all terms the defendants put up under a motion for summary judgment of indefiniteness. Like I said, we would also submit because it is a motion for summary judgment, the defendants have not met their burden showing clear and convincing evidence that any of these terms are indefinite, especially given the statutory presumption.

THE COURT: I don't find the terms indefinite. I do find them limited, though, by the specification, as the Court has already indicated. And you'll get my constructions on this term. So the motion for summary judgment on indefiniteness as to the various terms of this patent is denied.

MR. HARTSELL: Thank you, your Honor.

THE COURT: Okay. All right. And the '450 and/or '862.

MS. ABDULLAH: May I approach to hand out slides?

THE COURT: Absolutely.

MS. ABDULLAH: Good morning, your Honor. Sadaf Abdullah for BNR.

THE COURT: Thank you.

MS. ABDULLAH: So the '450 patent and the '862 patent are, again, asserted in just two of the cases in Huawei's and ZTE. And I'm going to cover them together beginning at the tutorial because although they're not directly related and they're not continuations of each other, they are related in technology, and they're related in a couple of other ways.

So one of the ways that they're related is that there are a couple of common inventors. They also arose from some of the work Broadcom was doing again on the 802.11 standard similar to what we were talking about this morning, and so some of those concepts are going to come back up, but these come a little bit later. So the '450 patent claims priority to December 14th, 2004 and the '862 dates back to April 21st, 2005.

And as your Honor is probably aware, Broadcom is heavily involved in standard setting and so many of the innovations surrounding 802.11 came up as related to this work.

So the concept that we need to begin with is "beamforming." And so that's the concept that comes up throughout these patents. And so to start kind of with an overview of how exactly beamforming works and what is beamforming, I'm going to use some animations as well as some excerpts from both of the patents to get that concept clear.

So the first concept we want to begin with is you have a wireless router, let's say, in a laptop and you're at home, and that router is what's going on emit the waves that essentially are your WiFi signal, and they emit in a way that's circularly outward. And the patent -- the '450 patent talks about one of the issues that arises with that kind of formation of radiating outwards. It's signal fading, and Mr. Hurt explained a little bit about that as well. It's a significant problem because it leads to temporary loss of communications at mobile terminals.

So what beamforming is about is essentially multiple antenna systems, so multiple input and multiple output systems, MIMO systems. And the reason you have to have multiple ones is because you have different antennas sending out different waves. And so what happens is you have lots of waves out there and whenever the peaks of the waves overlap like shown here, they create constructive interference which results in large power at that location. And the word "interference" usually implies something not good. In this case it is good because you've got extra signal, extra power into the signal right at where those waves are overlapping.

So the location of that area where that constructive interference occurs is what we're going to call the beam here. And so we have drawn a line in this demonstrative to show the beam aligned with that peak formation. What beamforming does is it redirects that beam to -- from wherever it's going to the laptop to take advantage of that extra power that's created by the constructive interference. So the way you do that redirection is by altering the relative aspects of the waves between the two antennas at the sending device as well as the receiver.

The patents talk about that concept specifically. So the '450 tells us the process of optimizing the pattern of radiation is sometimes referred to as "beamforming." And it uses linear array mathematical operations to increase the average signal to noise ratio by focusing energy in desired directions. Here is where the math comes in because we're going to be dealing with a lot of linear algebra in order to do this kind of redirection or calibration.

So with that overview of beamforming in mind, we should talk a little bit about the RF channel. So Mr. Hurt described the channel this morning as something like a hose. I'm not sure I completely agree with that because a hose kind of implies that there is outer bounds or limits. Here we have, you know, more dispersion. And he did describe a little bit about how there is -- aspects of the channel will impair and degrade signals as things bounce around in there.

But the way that we accomplish beamforming is that the laptop, the host device, or the "beamformee," as we call it, sometimes is going to estimate what's going on in the channel. It's going to receive a signal, it's going to take that signal and based on that signal, it's going to do some math on it to figure out what's going on in the channel, what does it look like. And based on that, it's going to decompose some information and send that back to the router, and the router receives that information and based on that information knows that I can adjust the way I'm transmitting a little bit so that beam is going to hit the host device a little bit better. And so a lot of what we're going to be talking about is this channel estimation, what we do with that, and how we're sending back information to the router.

The patents, beginning with the '540, they talk about various limitations and disadvantages of approaches of beamforming. So the '450, I haven't called out everything, but it extensively discusses all these prior art ways to deal with the signal fading issues. From columns 335 to 550, it's all about the different limitations, and then the patentee concludes with that statement that there are further limitations and disadvantages with conventional and traditional approaches.

So what does the '450 patent want to do in order to solve that problem? Here we see a brief description of the solution: The feedback information can be derived from mathematical matrix decomposition of the channel estimates.

What does that mean? So for starters, this is going to a figure from the '862 patent, but it demonstrates the concept.

Here, this is a depiction of kind of the same graphic we were looking at before. And so in this graphic, in the system shown here, V refers to the matrix that tries to optimize transmission from the router. That's why I've labeled it "beamformer." That labeling is mine and not the patent's.

THE COURT: I like "beamformee."

MS. ABDULLAH: And beamformee then is the receiving device. That's labeled with a U because there's a matrix associated with that that tries to optimize how those signals are received by the laptop. That H in the middle there is going to very important because that essentially represents what's happening to the signal as it's traveling between the space. H is a mathematical function, and it accounts for both V and U, as well as some other aspects such as noise.

So when the beamformee, the laptop, is sending back that feedback information which you can see on the top there labeled as 160, what it is trying to do is tell the transmitting device hey, if you modify your V a little, the laptop will receive a better signal with less noise and other signal loss issues. And so through this process, the beam forms between the two devices.

Now in order to be able to tell the router how it should adjust its V, the laptop needs to be able to represent what that channel looks like, and that is where H comes in. And so the '450 patent tells us that a communications medium such as an RF channel between a transmitting mobile terminal and a receiving mobile terminal may be represented by a transfer system function H.

Now turning to claim 1, this kind of brings it home for the '450 patent exactly what's going on here. The first thing we do is we compute: Computing a plurality of channel estimate matrices based on signals received by a mobile terminal from a base station via one or more downlink RF channels.

"Downlink" just means it's what's coming from the transmitting device to the receiving device.

Now "channel estimate matrices" is a term of dispute we're going to cover later. But the one thing we are agreed on is that it is in some ways estimating what's going on in the channel.

The next step is going be to take the channel estimate matrices and essentially decomposing them using a known mathematical method called "singular value matrix decomposition," or SVD. So what that does is that derives certain coefficients, for example, V and U, which we talked about earlier, and basically breaks apart the signal in a way that it's going to be smaller pieces and easier to transmit.

And so on the note of transmitting, the final part of this is you transmit those coefficients back as feedback information to the base station via an uplink RF channel, so that means going from the receiving device back. And that is what allows the transmitter to refine its signal.

So just briefly, I want to pause for a second and talk about what SVD is, because that is a concept that came up here and it's going to come up later in the '862 as well. And essentially in very simple terms, it's taking a matrix and factorizing, or factoring it rather. So factorization means taking a mathematical object and breaking it apart into a product of several factors.

So for example, just using generic terminology here, SVD of Multi-Frequency A is a factorization into the product of three matrices, U, D and V(t). Where the columns of U and V are orthonormal and matrix D is diagonal with positive real entries. So that's a whole bunch of mathematical description of what those are. Not very, very relevant here but just so you know that it's a well-known mathematical principle that a person of ordinary skill would understand.

And in the next slide, I've just basically put in numbers where some of that would occur. But I'm not going to really go through the exact calculations.

So that kind of brings us to what the '450 is about.

Now let's look at the '862 patent. So the '862 patent sort of starts where we left off with the '450. What we have here -- and this part of the spec talks about it. It says sort of halfway through this paragraph: One approach for sending back from the receiver to the transmitter is for the receiver to determine the channel response H and to provide it as the feedback.

THE COURT: You're going to have to slow down.

MS. ABDULLAH: Sorry.

THE COURT: There is no way she's keeping up.

MS. ABDULLAH: Whenever I read it's... I've got to remind myself.

Is for the receiver to determine the channel response H and to provide it as the feedback information.

So that's what we've just talked about with H and decomposing it and sending it back.

Now what '862 points out is an issue with this approach is the size of the feedback packet, which may be so large during the time it takes to send the transmitter, the response of the channel has changed. So if it's so big it's taking a long time to get back, in the meantime, the properties of the channel are changing, it's kind of not useful to have that information any more.

And here is a further explanation in the patent of the size required. This talks about different 4-bit expressions and basically what it requires to send those. So just reading that last highlighted bit there: With 4-bit expressions, essentially the number of bits required is 1,728 per tone, and that requires overhead for a packet exchange that is too large for practical applications. And there are further examples in the patent surrounding that.

So how does the '862 solve that problem? It teaches us essentially how to reduce the size of that feedback information so it can get back more efficiently before it becomes obsolete. So claim 9 tells us that the first thing you have is a plurality of RF components that receive the signal and convert it to a baseband signal. That baseband signal is then fed into the baseband processing module which then operates to perform a number of different functions. And those are: It receives a preamble sequence carried by the baseband signal.

So preamble sequence we talked a little bit about this morning. So it gets that. Based on that, it estimates a channel response, and then from that channel response, it determines an estimated transmitter beamforming unitary matrix V based on that channel response and a receiver beamforming unitary matrix. And essentially this is the SVD type stuff that we talked about with the '450 patent.

Now here is where we get into some more information. The next step is to decompose the estimated transmitter beamforming unitary matrix V. So that was the V that we got that we wanted to send back. It's further being decomposed here to produce the transmitter beamforming information.

And in the final step: A baseband signal is formed that wirelessly sends the transmitter beamforming information back to the transmitting wireless device.

So we're basically breaking apart and breaking apart more to really reduce the size of what we are sending back. And the breaking apart is all done through mathematical operations, a variety of which are covered in the patent specifically.

Figure 8 of the '862 patent is one embodiment, and the reason I wanted to highlight this is it recites many of the same things we looked at in the claim we were looking at. But here we see in step '806 that the decomposition, the second one, is being done by using the Givens Rotation to yield feedback component; i.e., the transmitter beamforming information. And so Givens Rotation is another thing that's going to come up later today, and that's one way the decomposition happens. It is not the only way, it is one.

And 32 simply describes that figure and clarifies that once you have matrix V you're going to do the Givens Rotation to produce the transmitter beamforming information.

And finally for the '862 patent, here is a figure that kind of gives an overview of the various pieces and structures that are involved in processing and receiving on the host device. And we'll probably revisit some of these later today as well.

So unless your Honor has any questions, I can turn it over to defendants.

THE COURT: No. Go ahead.

MS. ABDULLAH: Okay.

MR. DaMARIO: Good morning, your Honor. Tom DaMario from McDermott on behalf of the defendants. Much of this information has already been covered by various counsel, so I'm going to try to keep it high level. But again, we're going to be talking about the '450 and '862 patents which are very similar and they cover beamforming information, which has already been discussed, but we're going to go through it once again.

Before we get into beamforming, we need to set up a little bit of terminology. Many of these concepts should be familiar. Again, it was discussed by counsel. But on slide 4, we see a typical setup with the transmitting apparatus and the receiving apparatus. The receiving apparatus is typically going to be the cell phone, the transmitting apparatus is typically going to be what's called the base station.

Notably the background of the '450 patent describes a communications medium between the two devices. The communications medium in this instance is the RF channel between the two devices, and this communications medium can be referenced by the transfer function H, which incorporates all the properties of the communications medium. The changes are based on a variety of factors including the RF channel frequency and any objects between the two devices. So we're going to label the communications medium H, and we also note that there are other devices that could be present in this communications medium or in this setup that may introduce some noise. Other devices could be operating on our frequencies that are close by. There could be other cell phones present, things like that that may interrupt. So I want to account for that noise as well, and we're going to denote noise as N.

And then looking at the next slide, slide 6, we come up with an equation for what is received at the cell phone based off of what is sent by the transmitting apparatus or the base station. And this is described in the '450 patent background, and it's defined as equation 1.

And so what we see here is that the signal that is received at the cell phone is a combination of the communications medium or the transfer system function H, any noise that's present in the system and a signal that was sent by the transmitting apparatus.

Something to keep in mind is that all of these variables will change over time. So H could change based on a number of factors including any interference that may be present in the system, changes in frequency, the noise could change, the cell phone could go in and out of the room that is not part of the transmitting or receiving apparatuses. So the long story short, these things change over time and we need to adjust for that.

Some of the challenges inherent in wireless communications are "fading." And the '450 background talks about a number of different types of fading. And this will be important because beamforming is a system that is used to combat some of these types of fading, so I think it's important background that we talk about fading a little bit.

So your typical type of fading is "path loss fading," and a classic example of this is if you're playing music on a Bluetooth headset or something like that and you walk out of the room, the music is going to go off because your cell phone is too far away from the Bluetooth headset. There's not enough power being delivered to the Bluetooth headset.

Another type of fading is called "multipath fading." As was discussed earlier, these antennas are not transmitting a signal in one direction, they're transmitting a nondirectional signal, so it's going out in different directions. That means the signal could -- or versions could go directly from the transmitter to the receiver, but other versions of that signal could bounce off of other objects.

So in this example that we see on slide 10, the yellow signal which is coming, again, from the transmitting apparatus. It goes directly to the receiving apparatus. Whereas, the blue signal bounces off a couple of objects before it hits the receiving apparatus. Importantly these two signals while the same and operating on the same frequency are going to arrive at different times. This could lead to errors in the system. Because there is constructive and destructive interference, certain values may be lost.

Another type of fading is called "fast fading." When transmitting on a mobile terminal or receiving on a mobile terminal if that terminal is in motion -- so if your cell phone is in motion -- that's going to affect the signal that is being received. A classic example of this is called the "Doppler effect," and you experience it when an ambulance goes by. You'll notice that the sound when the ambulance is coming towards you is higher pitched than when the ambulance is going away from you. That is because the sound wave is being compressed as the ambulance is coming toward you and it expands as it is going away from you, so that may affect the signal received at the receiving apparatus as well.

One way to combat some of these things is included in "multiple antenna systems." So we want to add multiple antennas, and this allows to incorporate what is called "beamforming."

If we go to the next slide, we can see an example. Slide 13, an example of beamforming. A simplified example. But the advantages to using a multiple antenna system is beamforming can be implemented. And beamforming is really just the process of optimizing the pattern of radiation emitted by the transmitting antennas such that it's focused in a specific area. Obviously we want to focus that on the receiving apparatus.

Not to get too heavy into the math, but we do need to talk about matrices a little bit. When we have multiple antennas, we do introduce matrices just because there are multiple signals being sent. All this slide is meant to demonstrate is that each of those variables that were shown in equation 1 can be represented as either matrices or vectors. And each of those values in the matrix would be representative of one of those antennas or a combination of those antennas.

So now that we have the ability to implement beamforming, it's important to remember that the communications medium and all of this can change over time. So we need to be able to adjust our beamform in order to account for that change in the communications medium. To do that, we send -- we take the information that is sent from the transmitting apparatus, the receiving apparatus performs a calculation and sends back feedback to the transmitting apparatus which tells the transmitting apparatus how the H value of the communication medium has changed so transmitting apparatus can adjust accordingly.

One of the disadvantages is that that information could be very large. So in order to compress that feedback information, we conduct what is called "a singular value decomposition" which breaks apart that matrix into a series of smaller values which can then be transmitted over or back to the transmitting apparatus which the transmitting apparatus can then reconstruct H from.

One other concept that's going to be important for the '862 is the distinction or the relationship between Cartesian coordinates and Polar coordinates. Cartesian coordinates identify a particular point according to a chart on an X, Y plot. So we can see that the point P here is represented by X and Y values. The only thing that we're trying to get across with this particular slide is that that can also be represented by a line R which would be the radius and an angle data.

With that, unless there are any questions, we can move on to the first term.

THE COURT: Go ahead.

MR. DaMARIO: So the first term for construction is "Channel Estimate Matrices." This appears in the '450 patent at claims 2, 3, 11, 12, 13, 21 and 22. The first thing I would like to note is that in between briefing, the defendant -- or excuse me, BNR's construction changed a little bit. So we have actually modified our construction to make the issues a little bit more clear for the Court to reduce the issues and kind of clarify things. So our new construction is the Matrix H_{est} for tones of different frequencies. We did remove a portion which indicated -- I guess our previous construction was matrix H_{est} for tones of different frequencies where H_{est} contains estimates of the true values of H(t). We have drafted that portion of our construction just to simplify things.

So that being said, we believe there are only two other issues between the two parties. That is the inclusion of H_{est} and the inclusion of tones of different frequencies.

So the '450 patent describes multiple versions of H, and that's described throughout the specification. One of those versions is H_{est}. So keeping that in mind, I would like to walk through the claim language a little bit.

The first thing we want to look at is that in claim 1 which is not asserted but the dependent claim 2 is, we note that this is a method for communication. A method comprising: Computing a plurality of channel estimate matrices based on signals received by a mobile terminal from a base station. So right now, we know that the signals are generated at the base station and received by the mobile terminal.

Next I'd like to point to the fact that the mobile terminal then -- excuse me. So signals are received by a mobile terminal from a base station via one or more downlink RF channels wherein said plurality of channel estimate matrices comprise coefficients derived from performing a singular value matrix decomposition (SVD) on said receiver signals.

So right now, we know that the channel estimate matrices are generated by the mobile terminal and not the base station.

THE COURT: Wait, wait.

MR. DaMARIO: Sorry.

THE COURT: '450 patent, column 4, lines 19 to 21: To the extent that H(t) which may be referred to as the channel estimate matrix. Why is H(t) not -- why is that not the definition of what the channel estimate matrix is? And, therefore, one or more of those is the matrices. where did the est thing come from?

MR. DaMARIO: So Hest is a specific version of the H(t) and it comes from equation 2 in the patent which is shown in -- first shown in column 8 around line 55. And there's a reason we're foration on H_{est}. There a couple other versions of H(t) that are described in the patent. H_{up} is one of them and H_{down} is another one.

We've discussed earlier that claim 1 requires computing a channel -- a plurality of channel estimate matrices based on signals received by a mobile terminal from a base station. So right there, we're talking about signals that are sent from the base station to the mobile terminal. Hup is defined in the patent as a reverse channel estimate matrix which provides an H measurement based on signals received by the base station from a mobile terminal. So right there, H_{up} is almost the opposite of what claim 1 is talking about. So it's excluded by the claim. It's not covered. That particular embodiment of the specification is not covered by claim 1.

Next we look at H_{down} which is another version of H that is described in the patent specification. We note that again the claim 1 describes computing a plurality of channel estimate matrices. The channel estimate matrices comprise coefficients and then transmitting those coefficients as feedback information to the base station. That implies that the channel estimate matrices are generated at the cell phone at the receiving terminal and then sent to the base station. H_{down} is computed at the base station. That's described in the specification at column 5, lines 4 to 10. So right there, H_{down} is an embodiment of H that is described in the specification but is not part of claim 1.

H_{est} is the only other version of H that is described in the specification that is specifically described as a channel estimate matrix in equation 2. That exists in the specification. So we are focusing on H_{est} because it is the only version of H that is described in the specification that also comports with the claim language.

THE COURT: I'm not sure I followed any of that. I've got a channel matrix which is defined in the patent at H(t) and the method of claim 1 says I'm going to compute that plurality of those matrices based on signals received by the mobile terminal from the base station. So how does the fact that the signal that is coming from the base station is not relevant to this method? You just said that that doesn't count.

MR. DaMARIO: I said that doesn't count for a specific version of H. There are multiple versions of H described in the patent. One of them is H_{up}, the other one is H_{down}. For the reasons we discussed earlier H_{up} and H_{down} are not included in claim 1 of the patent. The only version of H that is included in claim 1 of the patent is H_{est}. And, again, the patentee chose to describe H_{est} as a full channel estimate matrix. These are the patentee's words specifically, again, at just above equation 2, column 8, lines 49 to 57.

THE COURT: Okay.

MR. DaMARIO: Again the patent describes H_{est}. We want to make sure we're talking about the version of H(t) that we're talking about is the version that's claimed and not the version that's not claimed.

THE COURT: So the particular versions of H that are these channel estimate matrices based on the method claim of claim 1 have to be based on signals received from the mobile terminal, and your position is the only disclosed H that receives those is H_{est}.

MR. DaMARIO: Correct. So moving on --

THE COURT: Don't move on yet.

MR. DaMARIO: Sorry.

THE COURT: I'm still trying to figure out what's wrong with that.

MS. ABDULLAH: Well, what's wrong with is it's not true. I'm going to read you a portion of defendants' opening claim construction brief. This is at page 16. They write: H_{down} is for a channel where signals are received by a mobile terminal from a base station. So right there, we already have an example of H that is not H_{est}.

And I think your Honor got right to the place where the patentee described what the channel estimate matrix is. If you could go to slide 37, please. It says: To the extent that H(t) may be referred to as the channel estimate matrix. And then it goes on to describe more. But it very clearly says that's what we refer to it as.

If we can go to the next slide. What the defendants are using here H_{est}, equation 2, it begins with the words "with one embodiment." And we have one other version of H, H_{down}, that's in the spec that's not H_{est}. And so for the simple reason that you can't import limitations, you can't limit it to one embodiment. You know, it's not appropriate for defendants to limit it to H_{est}.

If I can go back to slide 35, please. This is where we put together the different constructions. And this is a little bit different from what defendants put out because as they just noted, they dropped part of their proposed construction. And this was the first time I had learned of it so I still had this up on my slide. But what this makes clear is up until five minutes ago, they at least agreed that it reflected estimates of true values of H(t). And that part is not any significantly different than what BNR proposes as the plain and ordinary meaning. Essentially they are just trying to limit, bring in H_{est} and then bring in the tones language, none of which is in the claim and is limiting in a way which would be improper under the case law.

MR. DaMARIO: If I may respond, your Honor? H_{down} is a version that is not covered by claim 1, not because it is sent from the base station to the transmitting device but because H_{down} is actually computed at the base station. Claim 1 makes clear H is computed at the receiving device, so that is the reason that H_{down} is not included in claim 1. And I don't believe we've gotten to the "tones of different frequencies" yet, but I'm happy to address that.

THE COURT: Okay. I don't even understand what H_{est} is compared to H(t). I've got a patent that says these matrices are H(t) and a whole bunch of language here that defines how these particular channel estimate matrices are determined. They're based on signals that are received by the terminal from the base station by one or more RF downlink channels and wherein the plurality of those matrices are comprised coefficients that are derived from performing these matrix decompositions on said received signals. And I don't know where the "up" and the "down" and the "est" fits in this. It looks like there's a lot of information here that says what's going to happen in this step, and I don't know -- frankly, I'm sorry, I don't understand any of this stuff. It's very complicated. You went through a lot of material, but I feel like the patent has already told me what these channel matrices are. They're H(t), which is I can't even tell you back what that is.

This is one of those times I feel like putting these things in front of a judge to decide what it means is so stupid because I'm not a mathematician, I'm not an engineer, and you're asking me to write something into this definition that seems different than what the patent says it is; yet there are all these steps here determining how you compute these pluralities of these matrices that are driven by the language of the claim and I don't know why I should do this -- what is it an H_{est}? What does that mean?

MR. HURT: It means the H estimate.

THE COURT: But isn't that what you're getting to? The channel estimate is not -- the channel estimate is H(t). That's what the patent says the channel estimate is, H(t).

MR. HURT: If I may, your Honor? So H(t) is the actual channel. It's the thing that we don't actually know. H_{est} is what the receiver estimates based on the training signal that was sent. So H_{est} represents the estimate of the true channel H that we don't know.

THE COURT: Well, then why does the patent say you can refer to H(t) as the channel estimate matrix?

MS. ABDULLAH: That would be the estimate that the device is creating of H(t). And that's why the part we had agreed upon was that it's the estimates of the values of H(t). So we do all recognize that it's the device's estimate, but that doesn't change the fact that it's H(t). That's the function we're talking about.

And if Mr. DaMario just said that H_{est} is essentially channel estimate matrix, well, if that's the case, we don't need a construction if that's so understandable. And that is BNR's starting position, that channel estimate matrix is clear based on the spec to a person of ordinary skill in the art. But, again, if the Court wishes to adopt a construction, the one that's clearly laid out in the patent certainly trumps a statement that says in one embodiment, especially where there are other versions disclosed.

And Mr. DaMario also talked about the directionality. And as your Honor pointed out, the claim makes it clear that it's signals received by a mobile terminal from a base station. And so to the extent, that's their concern, that's in there.

MR. DaMARIO: Your Honor, we're trying to make clear that the --

THE COURT: (laughing) Sorry. Go ahead.

MR. DaMARIO: That the embodiments described in the specification or the -- that the embodiments claimed are --

we're talking about the same H that is claimed, let me put it that way. So H_{est} we believe is the only version of H that is claimed.

MS. ABDULLAH: The patentee could have claimed H_{est}. That's not what the claim language says.

THE COURT: Maybe I'm not reading this properly. So the computations which are performed at the receiving mobile terminal may constitute an estimate of the true values of H(t) and may be known as channel estimates. So are what you saying in that context is that that's the estimates are the true values of H(t)?

MR. DaMARIO: The true values of H(t) are what the actual channel is.

THE COURT: Right.

MR. DaMARIO: You don't have any way of knowing exactly what "channel" is. That's why we provide estimates.

THE COURT: Okay. Where is there a reference in here to this H_{est} that would help me understand why I should pick that as the meaning of "a channel matrix"?

MS. ABDULLAH: Your Honor, it's up on the screen. It's that equation right there that's described as one embodiment.

THE COURT: Just preceding that, again, the paragraph that is right before that in the same area of the specification, it again says that the channel estimate matrix

H(t). This is at lines 36, 37 of column 8, which in the paragraph preceding this, you've got this discussion about that in fast-fading RF channels, however, the channel estimate matrix H(t) may change rapidly. Why is that not what the channel estimate matrix is? It's H(t). Why is it something different than that?

MR. DaMARIO: Because, your Honor, H(t) is a more general version of the channel estimate matrix. The only version that is claimed is H_{est}.

MS. ABDULLAH: I disagree with that. What is claimed as a channel estimate matrix which is here and in other places defined as H(t). We agree it's the estimates of H(t), but it is a representation of H(t) and not any particular embodiment.

THE COURT: Right. And so in this step for a method of communication, the method comprises computing a plurality of these H(t) matrices based on these signals that are then coefficients derived from all this stuff. Those are the steps that get you to the math you're trying to do, right?

MR. DaMARIO: I'm sorry. I didn't quite follow.

THE COURT: Yes, I don't blame you. But, again, I feel like I would be writing something that is just so contrary to the plain language of the patent that explains what this is, that this channel estimate matrix is H(t) and not something else. And if H(t) could be different things, then the rest of the language of the method of this claim tells you which version of H(t) you're going to get to and use. But I don't have to write that at the top of the definition of what a channel estimate matrix is.

MR. DaMARIO: Your Honor, we're just trying to make it clear that claim 1 is not including other versions of H(t) like H_{up} and H_{down}. It's only covering the version of H(t) that is described in the method.

THE COURT: Of course it is only covering what's described in the method of --

MR. DaMARIO: We're --

THE COURT: -- the method steps of this claim. So am I just taking all the rest of what's described as to how you're going to get this matrix because it's based on these signals and say in light of all of these steps, that means it can only be this particular H?

MR. DaMARIO: That's right, your Honor. We're trying to clarify that.

THE COURT: I don't feel the need to clarify that. I think the patent itself clarifies that. The steps that are set forth that I, frankly, don't understand but somebody in the would understand -- you just told me somebody in the art would read this method step and say so clearly it cannot be H_{up} or $_{down}$, or whichever was the one you said it couldn't be because it's not flowing in that direction. Okay. Then if that's what you're doing, it's not covered by this method of doing this.

But I don't think I have to define the channel estimate matrices beyond what the plaintiffs have offered, that it's one or more matrices that are -- that is or are an estimate of the values of H(t), and then the rest of steps of this claim are going to tell you which value of H(t) it is.

MR. DaMARIO: I understand, your Honor.

THE COURT: Good. I feel a little like I used to do stuff to Judge Brewster and finally he said, I don't get it, but okay. That's why he's there on the wall. Anyway. Go ahead.

MR. DaMARIO: What I was going to say, that is in this case, we're not importing limitations from the specification, we're merely clarifying that this is the version of H(t) that we're talking about. In *DuPont v Phillips*, they say that it's entirely proper to use the specification to interpret what the patentee meant. In this case, we're not adding anything extraneous, we're simply clarifying that this is the version of H(t) that we're talking about.

MS. ABDULLAH: And if I may briefly respond to that point? The clearest articulation in the specification is where it's called "H(t)."

THE COURT: Okay. The Court is going to stick with what the patent defines the channel estimate matrix to be which is H(t), and the steps of this particular method claim provide all of the rest of the information as to which values of H(t) you're going to end up to do this. But I'm not going to rewrite what the meaning of "channel estimate matrices" is to be specific to this claim because it has to be consistent over two patents, and maybe this method limits it to H_{est}, but I don't know that other method steps are limited to that.

And if I redefine channel estimate matrices to mean just that particular computation, then it would have be to consistent throughout. And that doesn't make sense to me if the broadest definition of "channel estimate matrices" supported by the patent is H(t) and all the other steps here how you define that, narrow it to a particular version of H, then fine, but if I define "channel estimate matrices" in this claim to be only H_{est}, then is H_{up} and H_{down} never a channel estimate?

I think you're creating a definition that would carry throughout both the '450 and presumably the '862 of this particular mathematical whatever it is that would be too limited because it would be inconsistent if it's the steps of this method to say you're going to end up with H_{est} but maybe not in some other method step in the patent.

MR. DaMARIO: Your Honor, our construction would only apply to the '450 patent and specifically all of the asserted claims. I'm happy to walk through those claims as well.

THE COURT: Again, it may only apply to this, but are there other claims in the patent that use this language that it wouldn't apply to? I can't write the language of the claim to mean certain things in claim 1 and 14 but not be appropriate in claims 8 and 9, even if they're not asserted against you. It has to be consistent throughout.

And you've both already represented to me that these patents are related subject matter, so it seems to me that something that is kind of generally known, to people who work in this field, what channel estimate matrices are -- can be in their totality can't be limited in a definition in one particular claim, unless the claim itself said that. And you're saying the rest of the steps of this claim drive that conclusion, well, then fine, this particular method of practicing it will do that, but I'm not going to define the term that narrowly throughout. I just don't think that makes sense.

And I'm freely admitting on a very high and superficial level at any patent when there is a term that is consistently used throughout claims, the term has to be identified and construed the same way consistently throughout the patent. There may be other limitations of a claim of that patent that will constrain the way that term is used, but you don't say well, in claim 1, it means this but in claim 5, it's going to be mean something different. That's not just solid claim construction.

And since the patent has defined this term, I'm not going to narrow it beyond that and trust that the rest of the description in this patent as to how these pluralities of matrices are computed based on the rest of the steps here supports what you want those matrices ultimately to be for this particular claim, but not defined that those matrices just narrowly in every instance to be what the rest of this claim would narrow it to. And if that didn't make sense to you, I'm sorry, but that's the best I can do. This is complicated stuff.

MR. DaMARIO: I understand, your Honor.

MS. ABDULLAH: Thank you, your Honor.

THE COURT: And if you think I'm confused, wait until you try to explain all this to a jury. Okay. We'll go for another half-hour and leave early for lunch if we're not done.

There's a lot of channel estimate matrices here, but the next term in this that I've got is "the coefficients derived from performing a single value matrix decomposition." Is that right?

MR. DaMARIO: Yes, your Honor. Would you permit us a moment to confer with our cocounsel?

THE COURT: Sure.

MR. DaMARIO: Thank you.

(Defense attorney discussion off the record)

MR. DaMARIO: Your Honor, given the construction for "channel estimate matrices," our construction for the following term was based off of that. So in this case, we can agree to the plain and ordinary meaning.

THE COURT: Great. Thank you.

MR. DaMARIO: Thank you.

THE COURT: And those were all the issues raised in the '450, so we can move to the '862.

MS. ABDULLAH: So the term for construction here which defendants have proposed is: Decompose the estimated transmitter beamforming unitary matrix V to produce the transmitter beamforming information.

So if you remember when we were walking through this claim, we had SVD as the prior step, and this step is further breaking apart what we're getting out of these mathematical calculations.

Now the first thing I want to note is if we look at our proposed constructions, and, of course, to begin, we do not think that a construction is necessary given that the words of the claim make it clear exactly what is meant there; and, in fact, defendants agree with most of that because as you can see here, the first part of that decomposed term, we essentially agree to the definition. It is: Factor the estimated transmitter beamforming unitary matrix V to produce a reduced something, right? So it's the "something" we are disagreeing on.

If you look at the claim language, that "something" is essentially the transmitter beamforming information. So our proposal to the defendants was, let's have that term construed. They declined. And there's a reason for that. It's because transmitter beamforming information comes up again later in the claim, and when it later comes up, it says that that transmitter beamforming information is being wirelessly sent. Now why is that significant? It's significant because when it's wirelessly being sent, it had to be quantized. And that's something that Dr. Min, defendants' expert, has admitted.

So, of course, we don't really know what defendants were thinking, but we suspect that they recognize that in that step transmitter beamforming information has to be quantized, but they're proposing a different definition for that earlier instance.

So to take a step back and actually just talk about what these definitions are. In the '862 patent, we know that the coefficients of Givens Rotation and phase matrix coefficients serve as the transmitter beamforming information that is sent from the receiving wireless communication device to the transmitting wireless communication device. So again here, we have nicer articulation of what it is. What is the transmitter beamforming information? It's the coefficients of these mathematical operations. Dr. Min agrees with that. He said the result of the Givens Rotation is two matrices. And he agrees also that the values of the matrices are called coefficients. So that is where the coefficients part of our proposal comes from.

Now to talk about the quantized part. Again, I highlighted the last part where it says "to wirelessly send the transmitter beamforming information." And that's significant because it requires quantization. And what is quantization? So it's a method of producing a discrete set of values that represents a continuous quantity. And in Dr. Min's words, it refers to the transformation of data into integer values.

I think an example here would be useful. It looks a little bit mathy, but I think it can be simplified a little bit to just describe an angle. So an angle in radians is an example of a continuous quantity. You are probably familiar with angles and degrees, 90 degrees, so on and so forth. But radians, as mathematicians like to call it, is a more elegant representation of what an angle is. And what it uses is basically the unit circle, which we have depicted here. And this unit circle basically shows a 90-degree angle. And expressed in radians, it's pi over 2.

Now pi over 2, as you can see, and as you might know, pi has an infinite number of digits. It never ends. So because you basically have this continuous quantity that basically continues on forever, what you have to do in order to practically use that information is quantize it.

And the patent talks about angles, right? Those Greek symbols are basically angles and it talks about them in the context of bits and bytes. Okay, what does that mean? That means you have to somehow limit that continuous going on forever angle to bit and bytes so you can actually transfer it. And that's the quantization step.

And so throughout the patent where we see angles described, it's talking about quantized information. Otherwise, you could never send it in a bit or byte. So there are multiple examples in the patent where it talks about these bits and bytes in that context.

In this example, there are 12 angles. The beamforming module may regenerate V as 3 x 3 with 4 bits for expression of the angles, a 54-tone signal may have feedback information of 324 bytes.

There's another example of where the patent talks about what you're doing with the estimated transmitter beamforming matrix is it's a set of angles fed back to the transmitting device, but going on, it says: Operation continues with the receiving wireless device wirelessly sending that transmitter beamforming information to the transmitting wireless device, and that necessarily involves quantization. Quantization isn't going to be specifically called out because it's one of those operations that's just done to transmit the signal.

And Dr. Min agrees with us on that. This is from

Dr. Min's deposition. He tells us: In any formable digital communications, you would have to fix the -- what we call the precision of the number. And that essentially is quantization. Sometimes you use 8 bits, 16 bits, 32 bits, sometimes even 64 bits. That's just to indicate a floating number of any kind.

He also explains: If you want to transmit a true valuable angle, then you would need infinite bits.

That's exactly what I was just talking about the radians and pi going on forever.

We asked him very specifically: Now under your construction for the "decompose" term, in what format are the angles transmitted to the transmitting wireless device?

He answered: So what the patent specification says is you do a unitary matrix V, then decompose it using Givens. Actually, you do it multiple times as necessary, and then after that, the actual data sent back to the transmitter is quantized information, under Dr. Min's proposed.

So unless your Honor has any questions, we propose that the Court adopt our construction of this term.

THE COURT: Okay. Thank you.

MR. WOLFF: I can't imagine what it's like for you to listen to this.

THE COURT: Well, this one because there's a reference later on that we're going to transmit this information. And I think counsel is right, what we're trying to define here based on your proposed constructions is what the transmitter beamforming information is. I don't understand how you transmit an angle, other than it's a representation of a bunch of numbers.

MR. WOLFF: Sure.

THE COURT: You're not sending a diagram. You're sending a set of numbers, and those numbers have been reduced to be able to direct the router to move the signal, to optimize how it's being received, right?

MR. WOLFF: Yes, yes. And, I mean, the bits and the bytes and the quantization and the forming of the angles or forming the beam and transmitting the beam, this is misdirection here. What we're focused on is the claim limitation "decompose the estimated transmitter beamforming unitary matrix V to produce the transmitter beamforming information." That's what the dispute is about.

They're talking about what you're actually going to do to form the baseband signal and doing a bunch of quantization and other stuff to get that information out. Yes, there can be -- you can do stuff to that data that you decomposed in the earlier step to get it out. Nobody is saying you can't do that. We're just saying this quantization stuff is just like misdirection.

THE COURT: Right. But, again, their point is in the entire context of the claim and the part that you all seem to disagree on that you've got this -- you're producing, you say "a reduced set of angles" and they say "a reduced number of quantized coefficients." If I were to define the transmitter beamforming information which is what is produced as a reduced set of angles, that reduced set of angles has to then be sent to the transmitting wireless device. How is that done? What is that? I mean, a reduced set of angles to me is still going to be some mathematical configuration, isn't it?

MR. WOLFF: I'll get to that. I'll get to that. Yes, it would be an angle. It would be a reduced set of angles. And that's what the Givens Rotation does.

Let me take us back to what the objective of the patent was. And this was in slides 20 and 21, I think, of plaintiff's deck. They had an excerpt from the patent. I've got it kind of up here in the pink highlighting. It's about 3:22 through 25 of the patent.

And counsel talked, when she did the tutorial, about the problem with the prior art. The problem we're trying to solve here is when we're trying to estimate what that beamforming information was. What happened to make that beam get out of phase in some way that it got distorted based on that training sequence. They're saying that look, in the prior art, the problem is that when they go back through here and they compute that information, it's just so large that by the time you computed it and send it back, the channel has changed.

Something else has interfered with this process. And so the idea is we want to come up with a better process.

So what do they do? They talk about this other example that counsel also put up there talking about using Cartesian coordinates. The problem with doing that is look at how big the overhead is. This is the orange highlighting back towards the bottom about line 3:47 through 48. It says "which requires overhead for a packet exchange that is too large for practical applications." And they're saying look, the problem we're trying to solve is that we need to shrink down this beamforming information, so how are we going to do it?

And that's what they summarized right there in the last sentence of the background. "Therefore, a need exists for a method and apparatus for reducing beam feedback information for wireless communications." The idea is we need to take this information and come up with a better way, a different way of doing this than what the prior art was doing. The prior art is taking too long using these Cartesian coordinates. It just became a great big mess which was defeating the purpose for calculating that channel because it could change by the time they got this information.

If I could get back to our slides. So what the patent says -- and just to be clear, our construction isn't limited to a Givens Rotation. Even though that's the example on this limitation, we're not saying that's the only way you can do this. The patent at figure 7 has a step that loosely reflects the claim language, and we want to look at what the input to that process is. The input to that process is you have taken this beam or this information you've had and you turn it from Cartesian coordinates into Polar coordinates.

And the specification. If we go back and look at the specification, it talks about generally how you're going to do this estimated beamforming information is with a QR decomposition operation. I had to look that up myself. I did not know what it was. That's a linear algebra process known in the art. There are different ways to do a QR decomposition. Gram-Schmidt is a way, the Givens Rotation. These are just guys who came up with special ways to do it.

And what was special about the Givens Rotation is that the Givens Rotation allowed us to reduce that information that we had when we looked at the beamforming information. I'm at slide 37 now of our slides. And it -- the patent recognizes this at 13:65 through 14:3: The Givens Rotation relies upon the observation that with the condition, and it's got these two matrices you multiply together with some math, some of the angles of Givens Rotation are redundant. And that's because you have taken this signal from polar representation of angles and you have rotated it some ways to zero out some of the stuff you don't need because the angles are going to be redundant.

And because you have done this process, because you have eliminated and reduced the number of angles using this Givens Rotation, the set of angles fed back to the transmitting wireless device are reduced. So this is how I've achieved what the patent said. I said, look, I'm going to do this mathematical process. This mathematical process is going to reduce my number of angles. And by reducing the number of angles, I don't have to mess with the great big jumble of bits and bytes. I don't have to worry about that right now. I've got less information. I can take that less information. I can drop it onto my signal, and I can transmit it out.

So slide 38. Again, it's the same -- same description. At element 806, it says the same thing. Just decompose the estimated beamforming matrix using the Givens Rotation to yield the feedback components. And then it says in parenthesis "the transmitter beamforming information." And then it says at column 14, lines 31 through 36 that the products of the Givens Rotation are the transmitter beamforming information.

This is, again, in keeping with what the objective was for the invention. I needed to make that set of beamforming information smaller and easier so I could get it back fast enough so I could make a difference with my receiving device.

THE COURT: I'm not seeing a disparity here that we're reducing information, that there's information that's being analyzed here whether it's through this Givens Rotation or some other mathematical formula, and the information is conceptually angled. But they're just -- so you've both got a reduced number or reduced set of something. But you're stopping at angles. But I don't know angles are then transmitted back. Angles seems to be the sort of physical manifestation of this math, but I don't -- but how would angles get transmitted? Don't they have to be reduced to some kind of number?

MR. WOLFF: Some sort of angles are numbers, yes.

THE COURT: Right. But reduced set of numbers, at least to my mind, doesn't suggest that you're talking about -- what does that mean "a reduced set of angles"? You've produced a reduced set of angles, and I don't think they disagree with that. What you're doing is narrowing how many different angles of beam you want to get to the optimal ones. But then it has to be transferred back. That's where I'm kind of lost, that this is the information, what's described as the beamforming information, and that that's what has to be transmitted back to the wireless device. And why is not that not quantized coefficient? Why is this not that? What's the difference?

MR. WOLFF: The quantized stuff and the transmitting it back, that's a separate step. Now that you have decomposed this matrix and its reduced set of angles, now I take that information and I create my beam with it or my feedback information that I'm going to send back to the transmitter to say this is what we've got on our end so you can change the stuff with the next signal to shape the beam.

Yes, you're going to have to do some other stuff when you form that beam. You're going to have to take those angles-- that reduced set of information you have as angles and you're going to have to do something with them. It doesn't matter whether it's 8 bits or 12 bits or 32 or I don't know how many bits they care about or that it has to be quantized. Yes, you're going to have to do that if you're transmitting. That's why all this depo testimony from Min is totally irrelevant.

THE COURT: Okay. But let's say I substitute the language of the claim with your proposed construction, then I'm going to decompose the estimated transmitter beamforming unitary matrix to produce a reduced set of angles and form a baseband signal employed by a plurality of RF components to wirelessly send a reduced set of angles to the transmitting wireless device.

MR. WOLFF: Right.

THE COURT: That makes sense?

MR. WOLFF: It makes sense to me because I know that when I put that information into the signal, that reduced information that I modified the signal with, that the receiving device can extract out what that reduced set of angles were.

THE COURT: And you're sending a reduced set of angles. Someone is going to understand what that means to send a reduced set of angles?

MR. WOLFF: You have to put -- you have to take the beam and you have to form the beam with those reduced set of angles, and by doing that, I am telling the transmitter when it's going to get this information back, what that reduced set of angles are. They're going to go through the reverse process and decompose that and say okay, what were those reduced set of angles we need to do to use? Yes, there's going to be modification of bits, there's going to be some multiplication, there's going to be other things that have to happen over that carrier when you've made that signal. We're not dealing with that. That's the next step in the claim.

THE COURT: Well, it's the term in the claim that, again, based just on the Court's understanding of claim construction, the term has to be consistent throughout. The transmitter beamforming information that is produced is the same transmitter beamforming information in that claim that is transmitted. You've certainly pointed to places in the specification where it says that a Givens Rotation produces the transmitter beamforming information and that the products of that rotation are the beamforming information, and that, according to you, is a reduced set of angles.

The plaintiff's position is that's just one example?

MS. ABDULLAH: Yes. That's exactly right, your Honor. And I think Mr. Wolff just said that an additional reason, that if you're limiting it to angles -- and their entire basis for that is a description of what results from the Givens Rotation is another reason not to limit it to a reduced set of angles. Coefficients, that term is general enough that it would cover Givens Rotation results and it would cover other QR decomposition techniques, but, you know, limiting it that way is an additional reason.

And if I may make one other point based on what Mr. Wolff said. I just want to point out that part of what it seems that they're saying is that you do the Givens Rotation and you have angles. But that's not even true. If you look at their brief, the top of page 23. Let me start at the bottom. It says from -- this is Givens Rotation example: From this exemplary matrix, the Givens Rotation produces just two angles, and it has the Greek representation, as the transmitter beamforming information. But then at the top of the next page. This is the result of the Givens Rotation.

That's not just the angles. In order to extract those angles, you still have to perform an additional step. Now you don't necessarily have to talk about that, because just like quantization, that's something that you would have to do in order to extract the angles. And it's kind of, you know, that is the operation you would have to perform. But that doesn't mean there's nothing you have to do further. So already if they're faulting us for saying there's additional processing, their interpretation also requires additional processing.

THE COURT: Well, I have clear examples that the defendants have pointed to in the patent in defining what the transmitter beamforming information is, that in this example it's the feedback components from the Givens Rotation, that it's the products of those rotations, and they're saying that that is a reduced set of angles. Is there another example in the patent as to what transmitter beamforming information is?

MS. ABDULLAH: Yes, your Honor. Let me see if I can find that slide. On slide 53 that says that: As the reader will appreciate, the coefficients of the Givens Rotation and the phase matrix coefficients serve as the transmitter beamforming information.

So even that articulates -- even though it mentions Givens Rotation, we're also talking about phase matrix coefficients together forming the transmitter beamforming information. So what we know from that is, that is certainly coefficients, and then to the extent there's angles, they have to be quantized in order to be consistently applied throughout the claim language.

THE COURT: Okay. We're going to break, and we'll come back and hopefully wrap this up. 1:30. Thank you.

MR. SKIERMONT: Thank you, your Honor.

(Lunch recess at 11:45 a.m.)

(Call to order of the court at 1:30 p.m.)

THE COURT: Okay. Ooh, we're missing someone. Is he watching the soccer game? No.

MS. ABDULLAH: Your Honor, Mr. Skiermont had to leave to attend to an urgent matter.

THE COURT: That's fine. All right. We were going to move on.

MR. WOLFF: Were we?

THE COURT: I think. What else do you want to tell me about angles or quantized coefficients?

MS. ABDULLAH: I do have a few things to add that I was looking at during the break. If I may, I would like to use the Elmo for this. I think we have been looking at a few different snippets from the patent, and I kind of want to put it all in context. I think it flows a certain way and makes things a little bit more clear.

So I'm beginning at the bottom of column 13 with this "according to one embodiment." And this is the part that the defendants have relied on for their interpretation. And so going on to the top of column 14, this is where the set of angles fed back language appears. One thing to note here though, this is in the context of that Givens Rotation. And the next paragraph says "operation continues," and that's where the wirelessly sending occurs, and that's where the transmitter beamforming information term actually appears. It's not up here. In any case, the specification continues then to describe this Givens Rotation. It has the mathematical constructs there. It talks about applying it here at the bottom of column 14.

And then turning to the top of column 15, it actually talks about the angles and mentions that we're talking about quantized angles. And this is consistent with what I was talking about before where, you know, you have to transmit over bits and bytes. And so here's where kind of the -- I mean, this is heavy math in here and it's talking for what stands for what and what function means what. Essentially the point is, the patent itself contemplates quantization. We didn't pull it out of thin air.

And then, finally, this whole discussion of Givens Rotation kind of concludes here with -- this is the portion that we've relied on where it says "as the reader will appreciate, the coefficients of the Givens Rotation and the phase matrix coefficients serve as the transmitter beamforming information." So essentially here, even in the parts that the defendants rely on, if you look at it all in context, we have quantization and the transmitter beamforming information is in the form of coefficients.

And the last thing I would like to say is, our position is still, to begin with, that, you know, if you just look at -- if we can go to slide 49. If you just look at the claim language, the claim term for construction, plain and ordinary meaning here is sufficient. It says: Decompose the estimated transmitter beamforming unitary matrix V, which we know what that is, to produce the transmitter beamforming information. And later in the claim, we find out that that's what's sent back.

And we all agree that decomposing, right, could be a number of different QR techniques. It doesn't have to be Givens Rotation. So really the transmitter beamforming information, in the context of the patent, it's clear what that is, it's the information being sent back. And while we have proposed a construction that is essentially how the specification describes it, our position is still that construction is not needed.

THE COURT: Okay.

MR. WOLFF: Counsel was trying to import the embodiment from the spec in here talking about quantized angles. We're dealing with "digital signal processing system." The numbers have to be represented somehow. Nobody is saying that numbers can't be represented with radians as degrees.

THE COURT: You guys are bringing in angles. They're not.

MR. WOLFF: They're bringing in quantization.

THE COURT: They're bringing in coefficients.

MR. WOLFF: Right. And where does that come from?

THE COURT: You read me the language. You said the coefficients will serve as the beamforming information.

MR. WOLFF: For a matrix. For the matrix you've produced after finding out what the decomposed angles were.

THE COURT: So again, but -- the transmitter beamforming information isn't just angles then?

MR. WOLFF: The decomposition is doing the Givens Rotation or something like it to get a reduced set of angles. Where this quantization comes from, I don't know. Yes, they can point to something where you take the result from the Givens Rotation or some other process and apply it to a matrix to come up with another matrix that has more coefficients. And, of course, you're going to have to send that over a wire, which is the last step here: Forming a baseband signal employed by the plurality of RF components to wirelessly send transmitter beamforming information to the wireless -- to the transmitting wireless device.

Nobody is saying you don't have to send data that's -- nobody is saying how many bits you need or anything here. They want to say oh, because you have to do it with bits or because it has to be a certain number of -- it has to have a certain number of precision, that's dealt with. That's not what's being addressed in the patent.

Dr. Min addressed these issues in his declaration. He explains why it is somebody of ordinary skill in the art would understand this to be this reduced set of angles. That's unrebutted testimony. That's at 675 at 80, paragraph 176 of his declaration. He walks through the example, the paragraph 178 of his declaration.

THE COURT: Wait. When you decompose the estimated transmitter beamforming unitary matrix, what do you get?

MR. WOLFF: Some angles.

THE COURT: Anything else? Is there another way to do it beyond just some angles?

MR. WOLFF: The only thing in the patent is by getting angles.

THE COURT: That isn't what I asked you.

MR. WOLFF: The only thing I understand you would get would be angles. It could radian -- it's got to be a number, right? You've got to represent it in a computer. Nobody is saying it has to be 45 degrees or 2 pi over r or it has to be 4 bits or 8 bits or 12 bits.

THE COURT: So somebody who knows what they're doing here and reads this would know if I'm going to start decomposing estimated transmitter beamforming unitary matrix, it's going to produce something, then I know what that is, it's going to be angles or numbers. Do I really need to construe this more specifically because it's not clear what it is? It's ambiguous to someone of skill in the art? Is it?

Again, we're not doing it so the jury will understand it. We're doing it so somebody of ordinary skill in the art who is reading this entire process would get to the beamforming unitary matrix and would not understand that the product of that is something that they would know what it would be, and I need to tell them what that is.

MR. WOLFF: And the problem with plaintiff's proposed--

THE COURT: I wouldn't do anything. I would just leave it as it is. They know what it is. It's going be what it is, and it's going to get transmitted back.

MR. WOLFF: And our position here is that clarity would be useful to the trier of fact and to whoever has to decide how these claims are going to be applied to the --

THE COURT: Clarity to the trier of fact is not a claim construction issue. That's a matter of your expert explaining it on the stand as to what it is. The concern I would have is if two people of ordinary skill in the art would be reading what seems to be a necessary, you're going to do this decomposition and you're going to get this product, this information, and they would not understand, or somehow in the prosecution of this patent, they limit it among the normal things it would result in to a specific thing what that is. And nobody has talked about the prosecution history causing any limitation here.

There's examples in the patent of what that decomposition does. I don't know that I need to limit it to that, or that wouldn't be clear to somebody who knows how to do this, that they would know that the product of this decomposition is now your transmitter beamforming information.

MR. WOLFF: And I think that the problem we have here is we're going to end up with two sets of experts coming in and saying what the term means, and it's going to be two ships crossing in the night. The jury is going to be sitting there left trying to figure out what does this term mean.

Our view of this is like the *02 Micro* situation where the jury is not supposed to decide what the claim means, not to resolve whether one expert is right or the other expert is wrong or however it is. We're just asking for a construction that's consistent with the specification that's consistent with what the proposed invention was.

I mean, we started with this process with another patent where your Honor said, anybody knows looking at the patent, these claims, they're going to know it's limited to the standard, the standard that was talked about in the background. And now we're in a --

THE COURT: This is a little different because that was sort of just a statement of a standard that exists. This is -- to me, the way I'm understanding this, this is a mathematical concept that you're going to have this information going in and you're going to do this decomposition, and some mathematical result is going to happen that's going to reduce the information that gets transmitted back so it can happen quickly enough for the antennas to respond and function properly. And I'm just not sure it's necessary for the Court to define what transmitter beamforming information is to the extent that somebody who would know how to do this would need that clarification to go oh, that's what you mean by this. Isn't it just the practical result of the decomposition?

MR. WOLFF: And, again, my point is you're going to have two experts come in and tell you two different things. That's the concern we have, and that's why we're asking for a construction. I understand your position. And maybe the best thing to do is move on to the next terms, and we'll see what your order says.

THE COURT: I can always revisit a claim construction. But I'm not convinced that at the end of the day, fighting over this any longer other than to say it says what it says and someone of skill in the art will understand it, and if another expert comes in with an opinion that you just think is so off-base, and I'm sure I'll hear about it in a summary judgment motion, we can talk about it again then.

Claim construction can always be revisited. I'm just not convinced given what's going on in the whole context of this claim, I need to limit what that information is. It seems to me that somebody who knows what they're talking about here will know that's what the result of the decomposition is the information you're going to transmit.

MR. WOLFF: It might be moot.

THE COURT: It might be. There's always that hope. Okay. Let's move on then. Assume the Court will not construe that claim any further, that that language of "transmitter beamforming information" is what it is and that a person of skill in the art would understand that is the result of the decomposition of the estimated transmitter beamforming matrix. And there we go. So now where are we? We're going to decompose it. Uh-huh. Okay.

MR. WOLFF: Now we have some more 112, 6 arguments. So I'm only going to address two of these issues on the slide here, the estimated channel response based on the preamble sequence and forming a baseband signal. I'm just going to address those two. Let me start with the threshold question, and that's whether in claim 9, a baseband processing module operable to convey a means-plus-function. Defendants' position is it does. Plaintiff's is it does not.

Baseband is a thing, it is a thing designed to do something, and the thing -- the functions that it's supposed to achieve are recited in the method-like steps that are throughout the claim.

I'm not going to rehash *Williamson*. We talked about it yesterday.

If we go back to the specification and look at -- 8:1 through 9 of the specification describes that the baseband processing modules may be implemented using one or more processing devices and it lists a whole bunch of generic computer components, and it says that this is implemented based on operational instructions. So that's what we know about how the baseband processing module is implemented.

Dr. Min in his declaration at 65-9 at 87 through 88, at paragraph 189. Actually 184 -- paragraphs 184 through 190 of his declaration at 84:25 talk about this issue, whether this term is a means-plus-function limitation. And, again, this goes back to *Williamson* and its use of "module." It's really no different than if they just said "means." It doesn't convey any specific structure. Some cases -- these are in the briefs too.

The issue with this particular patent is, again, you are taking some core generic thing and you're turning it into a special machine, and that are those codes are defined by those operational instructions, as they have mentioned, but not explain in the specification. And plaintiff's position: Baseband processing module is described as a well-known piece of hardware and software. We get that is what the specification is basically saying, that people of skill in the art would know that. But if you are in means-plus-function land, you need to do more than that. That was part of the bargain for exchange we talked about yesterday when Congress enacted 112 and said that you need do more when you talk about

112, 6 limitations.

Plaintiffs brief mentions that -- or they cite to the portion of the specification that says: Most of the these functions are performed by the operational instructions possibly implemented in the baseband processing module. But, again, these operational instructions that they point to for their structure for this don't have any structure to them. They just say they're operational instructions.

The correct inquiry is to look at the disclosure of the patent. And one of skill in the art would have understood the disclosure to encompass software for digital-to-digital conversion. Your Honor is familiar with the cases. We've talked about those yesterday too.

Dr. Min offered a declaration. He explains what a person of ordinary skill would understand with respect to these terms. They're just not described in the patent. They're just referring to off-the-shelf components that you could somehow get somewhere. But, again, this is a special process. This is supposed to have changed the way that you look at these signals coming in and create this beamforming information to send back to help improve that transmitter signal.

This is not just taking the prior art and doing it. You had to do something with that prior art and make it better. You had to disclose the algorithms for doing it. And that's just not what happens in the specification here.

Baseband processing module is one of the two specific functions recited in the claim for this -- I'm sorry.

THE COURT: Well, let's slow down a little bit on this one because we don't need to really factor them all out. Whatever this module is, it's got to operate to do all of these things. It's got to receive, it's got to estimate, it's got to determine, it's got to decompose, and it's got to form. The way I read this, this is all happening at this baseband processing module. The fact that the patent lists the module 100 as being one or more processing devices, I'm not necessarily at this point disagreeing with the defendants that the fact that you identify a number of ways -- of devices that such a processing device could be this list of things to do all of those functions, that device has to be able to do all of that. And so I'm not sure that all these things you've listed here, individually or together, which of them can do these things.

Because is it really sufficient to just tell me I've got a module in this device that I'm claiming that is going to be operable to do five different steps that are the heart and soul of this whole patent? And it might solve some of their problems of what happens in those steps because if, in fact, for those steps to happen, we have to look at what structure the patent puts together to go, this is the structure to do this, that can receive the sequence, that can estimate the response, that can determine the estimated matrix, that can decompose it and produce the transmitter beam and then send it back.

MS. ABDULLAH: Your Honor, I think where we start is this is not 112, 6 because it is clear from this record based on expert testimony, the patent itself, as well as additional extrinsic evidence, that a baseband processor or processing module -- I don't think the word "module" changes processor to something else -- essentially was well known in the art and its actual operation was well known.

So what I have on the screen here, this is Dr. Min again, defendants' expert. He said at his deposition in this case, baseband processor is a term of art. Okay. That's that common parlance language that we see all throughout the Federal Circuit case law. And he said multiple different kinds might exist, but the overall scope and general context were well known.

So then we asked him: Well, what do you mean?

And he said: A person of ordinary skill in the art would use the baseband processor without having to define it, and they know what that is.

And so then we went further and asked him: Okay. So what is it? What is that baseband processor?

And he says: It is something that works on digital signals to perform whatever is necessary for the protocol aspect at the baseband.

So what we have here -- yes, we did not invent baseband processing modules. That's clear from the patent. What we have here is an improvement on that module. The question from 112, 6 is when you read that claim term does is it connote sufficient structure? And here it does. We don't even get into match up structure to function unless we're already in 112, 6 land. But given this record, you know, Dr. Min is clear. He says I know exactly what that is.

If we go to the next slide, this is just case law citing -- the slide after this.

This is an industry paper from around the same time period where, again, it describes the baseband processing module -- here it actually uses that term -- provides user interface support and retains the software which defines the protocol to be used in the RF channel, RF packets, structure, algorithms of interaction between the notes of the network. This is basically the module that is handling that communication aspect, and it's described in a way that everybody knows what it means.

In the patent, this is a portion that we've cited: Most of the operations, meaning the steps that are essentially the invention, are typically performed by a baseband processing module. That invokes something that people know what that is. Again, it might be implemented using one or more processing devices.

If the claim term was "processing device," then maybe we would have a different conversation. But here, it's actually saying this functional thing, the structure that we know what it does is being implemented using a processor. It would be superfluous if a processor is being implemented using a processor. We're not talking about a general processor here by any means.

And then I just wanted to speak to Mr. Wolff's characterization of *Williamson*. *Williamson* does not stand for the proposition if module is in there, it's automatically 112, 6. *Williamson* went through the analysis of okay, given that it has "module," there's still the presumption -- it's a weakened presumption, but there's still the presumption that it's not means-plus-function. So we look at, well, okay. In this context, in this particular claim having read this specification, would a person of ordinary skill in the art see this and think -- you know, essentially would it connote structure to that person? That's the question here. And on this record, it seems very difficult to say that there is not a structure that everybody is thinking of when they say that.

A couple of cases I wanted to draw the Court's attention to. In the *En Ocean GMBH v Face International* case that's 742 F.3d 955, the Federal Circuit considered whether a term like -- I believe it was a signal receiver for receiving and then went on to describe different things that that receiver did. The Federal Circuit heard that -- I'm sorry, held that after there was evidence on the record demonstrating that "receiver," just that term by itself, conveys known structure including scientific literature and expert testimony, that that term was not 112, 6. And the Court specifically said just because the disputed term is not limited to a single structure does not disqualify it. There is other case law that says that a broad class of structures would still be okay as long as it was structure.

Another Federal Circuit case, *Tex Tech*, which we've cited extensively in our brief. There the question was system memory. And, again, the function was storing data. And the Court held, based on the context of that claim, you've got terms that mean something to a person of ordinary skill in the art.

And I think given that Dr. Min very specifically told us exactly what it means, something that works on digital signals to perform whatever is necessary for the protocol aspect at the baseband, all of these functions are related to that, right? We've got things sent out and received and processed, and that's what a baseband processor does.

THE COURT: Okay.

MR. WOLFF: The caveat on that testimony is what it says at the bottom: It's something that works on digital signals to perform whatever is necessary for the protocol aspect of the baseband. And that's what we're saying is all these functions described in the patent.

Counsel also put up a portion of the specification. This is the patent at 7:57 through 8:1. This is where the portion of the spec comes from. I think one of their slides that they just put up. What does it say? It says the baseband processing module in combination with operational instructions stored in memory executes digital receiver functions and digital transmitter functions respectively. Well, what are those digital receiver and transmitter functions? Those are the steps in the claim. Those are all those things that come after it. And what is that baseband processor module? It's some generic piece of hardware that they're saying has been specially programmed with these operational instructions.

THE COURT: But if it is a piece of hardware that someone of skill in the art would recognize it is a thing. It's not a not a thing. It is a thing. Your own expert said that there are multiple different kinds of baseband processors, so a baseband processor is a something. It is structure. It's not a functional word. It's a thing.

MR. WOLFF: It needs to be a processor configured to do the specific thing that's recited in the claim. Are they willing to stipulate that all the stuff in the claim was performed by prior art baseband processors?

THE COURT: No. I --

MR. WOLFF: I guess they're not.

THE COURT: -- I think she's saying for a baseband processor to be a means as opposed to a structure, it would have no known structure to someone in the art. It has to be operable to do those things, fine. But that doesn't make the processor some unknown, undefined blank slate. It is a thing. It's a processor. It has to be combined with operational instructions, and to do these things. Okay, but that doesn't make the processor itself equivalent to a means.

MR. WOLFF: And what we're pointing to is that if you just say "baseband processing module," you don't convey enough structure. You haven't said what the extra special hardware is that is supposed to implement all the functions that are recited in the claim. You could say that about any software claim. I don't think the limitation they're proposing here is it's software or hardware. It doesn't have to be hardware.

THE COURT: I don't know that they're proposing anything. You all raised the issue that this processing module is subject to 112, 6, and they're saying it's not. They're saying it is a thing, and people of skill in the art know what a baseband processor is, and it has to be operable to do these things.

Now I think we're arguing a different issue about whether the patent teaches how you do those things with this baseband processor, but I don't think it makes the baseband processor some unknown, undefined entity. It is what it is, and that's the combination of all the other processors that become the module that's described in the patent.

Your own expert did not go I have no idea what that is, I don't know what that means. He very specifically said that it's a term of art, and there are multiple different kinds of these processors. That means it's something that exists. So it can't be 112, 6. It has to do these functions, and the patent has to teach you how to do these functions, and it's claiming that the processor can do these functions. And are you saying there's no place in the patent that teaches how this module performs these functions?

MR. WOLFF: Yes, yes. That's what we're saying.

THE COURT: Well, that's not 112, 6.

MR. WOLFF: Well, if it's subject to 112, 6, it is a 112, 6 issue.

THE COURT: But it's not. Let's forget that. I don't see this as a 112, 6 issue. This is a known processing baseband processing module. There's something that -- your own expert recognized as something that would be known to someone of skill in the art what that constitutes.

Now that this particular module of the baseband processing has to accomplish these goals may be a different argument for a different day whether this patent teaches a processor that does all these things, but I don't think that you get to define the processor by what it has to accomplish because otherwise, it's an unknown structure or that there is no structure. There is structure. There is clearly structure described in the patent.

MR. WOLFF: I'll only just refer a last comment because this ends the hearing, I guess. But *Williamson* also involved a general purpose processor which is generally known to be structure too.

THE COURT: You know, in all of these cases, when you use words like "module" and "processor," they're very case specific to how they're being employed. You have a problem trying to get past your own expert who did not say, I don't know what this. He said, I know what this is.

MR. WOLFF: And he said in that qualifying language that you are implementing something -- when you created this thing that implements the standard, it would be a baseband processor, and he says you didn't teach how to do this thing.

THE COURT: I don't see that in here. Maybe he said that elsewhere in his deposition, but for purposes of where they've cited to it, he's saying he understands what it is and that it works on digital signals to perform what's necessary to do these steps. And he didn't say he couldn't figure out what that was and that it somehow was not something that existed in the art or was limited to what was disclosed in the patent.

MR. WOLFF: That was his declaration testimony. But we understand your position. I guess we're done for today.

MS. ABDULLAH: Are we?

MR. WOLFF: We can argue some more if you want?

MS. ABDULLAH: No, no, we're good with that.

THE COURT: Normally when I do claim construction and things aren't quite as complex as this, I give my constructions, final constructions, and then you go along. I gave you a lot of indications as to what my constructions would be. Some of them I was more specific; some of them, I wasn't. I'll get the transcript from Mauralee. It will be a rough, but I'll work off of that and my notes and get you my written claim constructions.

There's a good chance that there's going to be a motion for clarification when you get them because you're going to be like I didn't understand that that's what you said. And while I'm not inviting motions for clarification, I also don't want you proceeding further in the case with a disagreement where you think my construction ultimately says one thing and you're thinking it says something else.

So when you get it, whether or not you agree with it isn't the issue, it's just whether or not you both understand it to mean the same thing. If there is an honest dispute that you think in reading it I meant one thing and you're understanding it to mean something else, I would like to come back and have that conversation.

It's not a chance for you to go, we know what you said, we don't like what you said, but rather she said this, see that's what it says, and you honestly go, no, that's not what I'm reading this to say. Because this is complicated stuff and I don't want to have you both proceeding thinking okay, here's her claim construction and then have your expert later be challenged for exclusion saying you didn't apply my construction, and I'll be going no, you didn't, but you honestly didn't understand it to be what you thought I said it was. So with that, how are we -- now these are back in IPR?

MR. WOLFF: Yes.

THE COURT: Which ones?

MR. WOLFF: I think it was in our notice. It's not all of them. I think it's like five.

THE COURT: My law clerk mentioned the notice got filed but he said, They didn't ask for a stay and I knew you were busy, so I didn't bring it to your attention.

MR. WOLFF: We just asked for the notice, so.

THE COURT: Okay. Have any of the IPRs been instituted or are they back for consideration?

MR. WOLFF: They were just filed. So you had noticed us to tell you when they were filed, so we told you when they were filed.

THE COURT: Keep me informed if any get instituted.

Even though we have done claim construction, I'm rather loathe to go on parallel tracks with the Patent Office. Because things happen in IPR, even if the patents come back, sometimes there's clarifications about scope and meaning that might require I reconsider my claim construction. And I think we're, both the Patent Office and the district courts, playing on the same standards these days, and so it's much more persuasive to me to hear what people, who actually know what this stuff means, think about it. So if they get instituted, let me know and we'll keep that in mind. Otherwise, we will just keep going. And I will try to get you a construction quickly, because this isn't going to get any more clear to me in a week.

MS. ABDULLAH: Just two kind of housekeeping things. One, I have a USB with our animations if you would like this. So I'll just hand it up.

THE COURT: Although our IT department always tells us don't plug those things in. God knows what's on them. You'll bring down the whole district court system.

MS. ABDULLAH: The other thing I wanted to ask about is, I know that the rest of the case schedule still has to be set, so how does the Court want us to --

THE COURT: As soon as I issue the claim construction order, then we'll make sure you get your schedule. You should continue just doing discovery and then we'll set the rest of the dates moving forward. And as I said, I will work on this immediately because it won't get better in a week or two. I'll try to get it done first thing next week. All right.

MS. ABDULLAH: Thank you.

MS. ZHANG: Thank you.

MR. HARTSELL: Thank you, your Honor.

MR. WOLFF: Thank you, your Honor.

(Court in recess at 2:10 p.m.)

**** End of requested transcript ****

CERTIFICATE OF OFFICIAL REPORTER

I, Mauralee Ramirez, Federal official Court Reporter, in and for the United States District Court for the Southern District of California, do hereby certify that pursuant to Section 753, Title 28, United States Code that the foregoing is a true and correct transcript of the stenographically reported proceedings held in the above-entitled matter and that the transcript page format is in conformance with the regulations of the Judicial Conference of the United States.

Dated this 28th day of June 2019.

/S/ Mauralee Ramirez
Mauralee Ramirez, CSR No. 11674, RPR
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