

Petitioner's Demonstratives

Samsung Electronics Co., Ltd., and Samsung
Electronics America, Inc.,

Petitioner

v.

Apex Beam Technologies LLC,
Patent Owner

IPR2023-00599

Patent No. 10,912,081

Samsung Exhibit 1026

Samsung v. Apex - IPR2023-00599

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Topics

- Instituted grounds
- High-level summary of '081 patent and prior art
- Disputed issues in *Lee* Ground
- Disputed issues in *Chen/Lee* Ground
- Expert qualifications

Topics

- Instituted grounds
- High-level summary of '081 patent and prior art
- Disputed issues in *Lee* Ground
- Disputed issues in *Chen/Lee* Ground
- Expert qualifications

Instituted Grounds

- All claims of the '081 patent are challenged:
 - Claims 1-4: user equipment method
 - Claims 5-8: base station method
 - Claims 9-10: user equipment apparatus
 - Claims 11-12: base station apparatus

	Challenged Claims	Basis	Prior Art
Ground 1	1-12	§ 102	<i>Lee</i>
Ground 2	1-12	§ 103	<i>Chen</i> in view of <i>Lee</i>

Topics

- Instituted grounds
- High-level summary of '081 patent and prior art
- Disputed issues in *Lee* Ground
- Disputed issues in *Chen/Lee* Ground
- Expert qualifications

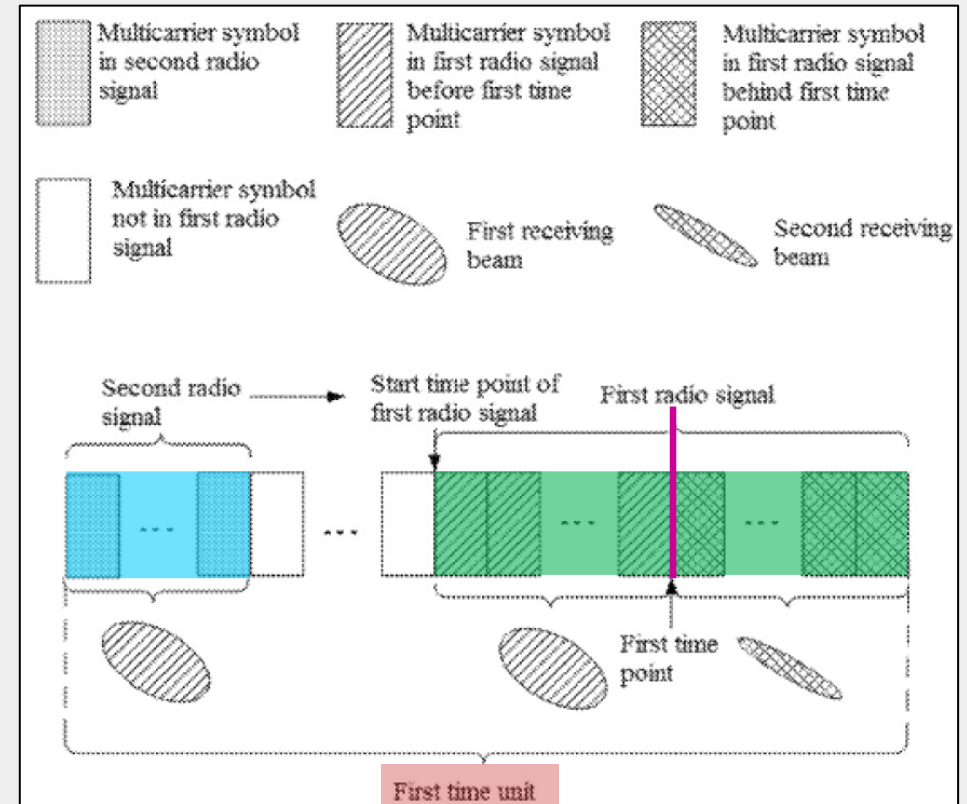
Exemplary '081 Claim: Beam Switching Procedure

1. A method in a User Equipment (UE) for wireless communication, comprising:

receiving a **second radio signal**;

receiving a **first radio signal**;

wherein the **first radio signal** is transmitted within a **first time unit**, a **first bit block** is used for generating the **first radio signal**, and the **first radio signal** comprises **G multicarrier symbols**; the **second radio signal** is transmitted within the **first time unit**, and the **second radio signal** is used for determining a time-domain resource occupied by the **G multicarrier symbols**; as for any one given multicarrier symbol of the **G multicarrier symbols**, the multi-antenna related receiving for the given multicarrier symbol is related to the relative position of a time-domain resource occupied by the given multicarrier symbol with respect to a **first time point** in time domain; when the time-domain resource occupied by the given multicarrier symbol is behind the **first time point**, the **second radio signal** is used for determining the multi-antenna related receiving for the given multicarrier symbol; and when the time-domain resource occupied by the given multicarrier symbol is before the **first time point**, the multi-antenna related receiving for the given multicarrier symbol is related to the multi-antenna related receiving for the **second radio signal**; the **first time point** is one time point within the **first time unit**; and G is a positive integer.



(’081 patent, FIG. 7.)

(’081 patent, 2:39-40.)

In one embodiment, the **first bit block** is a transmission block.

(’081 patent, 2:64-65.)

In one embodiment, the **G multicarrier symbols** are G consecutive multicarrier symbols.

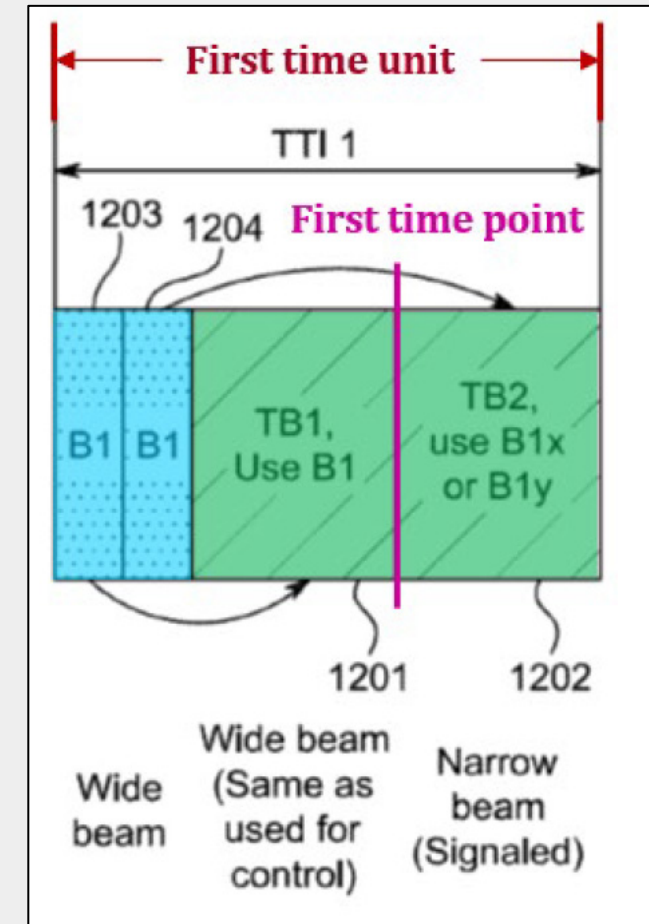
Lee's Beam Switching Procedure

1. A method in a User Equipment (UE) for wireless communication, comprising:

receiving a second radio signal;

receiving a first radio signal;

wherein the first radio signal is transmitted within a first time unit, a first bit block is used for generating the first radio signal, and the first radio signal comprises G multicarrier symbols; the second radio signal is transmitted within the first time unit, and the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols; as for any one given multicarrier symbol of the G multicarrier symbols, the multi-antenna related receiving for the given multicarrier symbol is related to the relative position of a time-domain resource occupied by the given multicarrier symbol with respect to a first time point in time domain; when the time-domain resource occupied by the given multicarrier symbol is behind the first time point, the second radio signal is used for determining the multi-antenna related receiving for the given multicarrier symbol; and when the time-domain resource occupied by the given multicarrier symbol is before the first time point, the multi-antenna related receiving for the given multicarrier symbol is related to the multi-antenna related receiving for the given multicarrier symbol is related to the multi-antenna related receiving for the given multicarrier symbol; the first time point is one time point within the first time unit; and G is a positive integer.



(Lee, FIG. 12.)

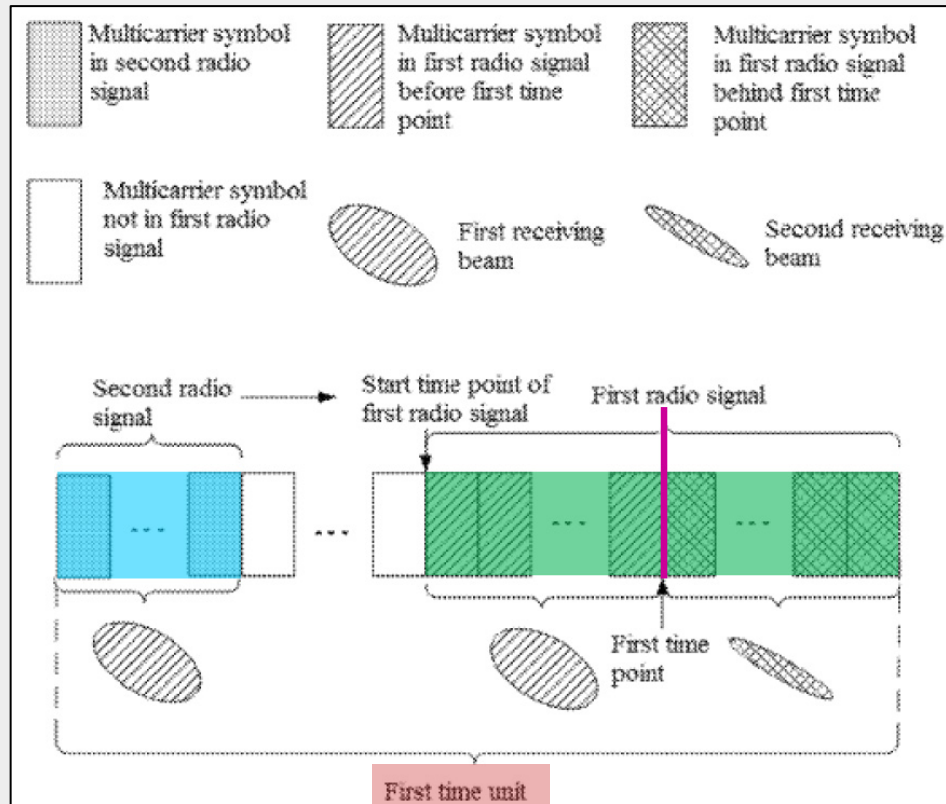
(Lee, [0110].)

(Lee, [0079].)

[0110] A physical downlink data channel may carry payload information in the form of Medium Access Control (MAC) Protocol Data Unit (PDU) from the MAC layer. The resource allocation of this channel may be carried in the

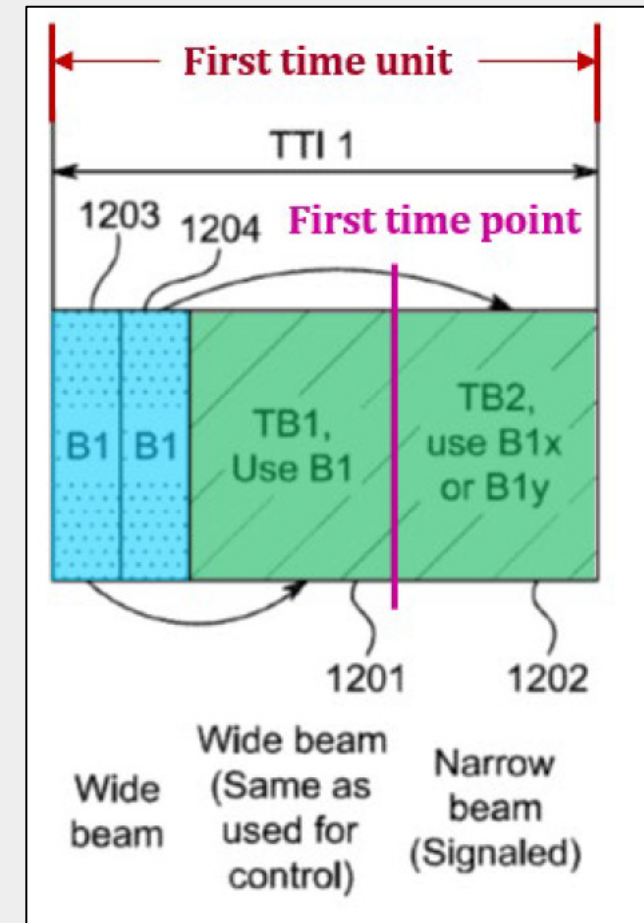
[0079] A "data region" may be part of the scheduling interval in time domain, which may be referred to in units of OFDM symbols, used for the transmission of all data channel beams in that scheduling interval.

'081 Patent's Procedure vs. *Lee*'s Procedure



(’081 patent, FIG. 7.)

’081 Patent



Lee

(*Lee*, FIG. 12.)

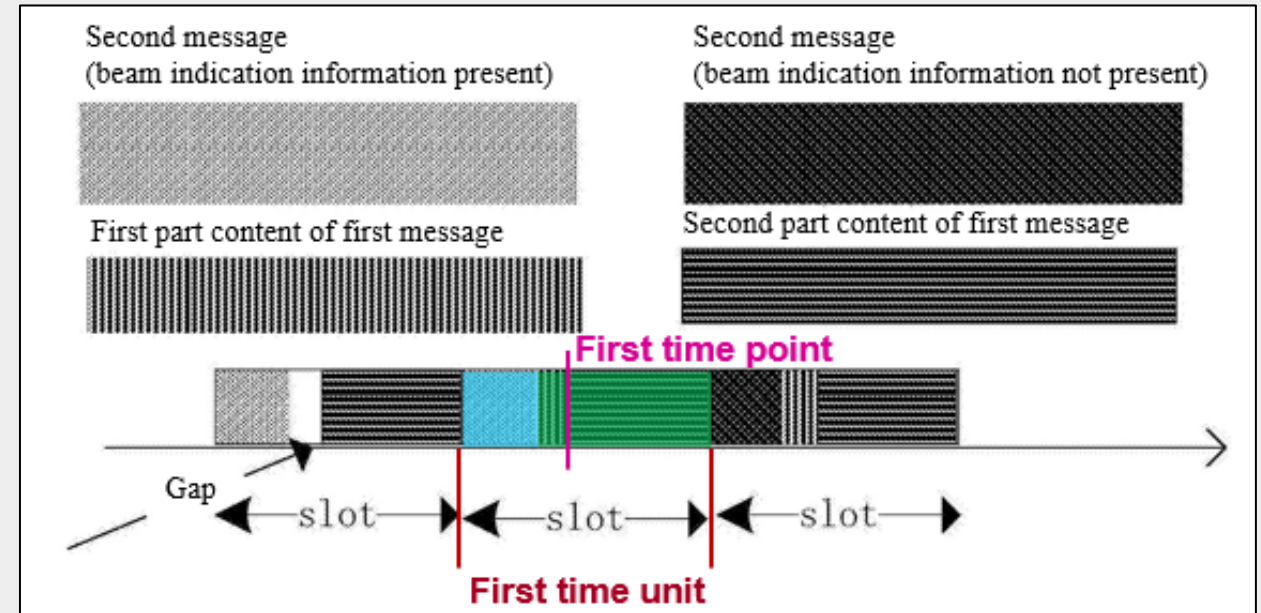
Chen's Beam Switching Procedure in View of Lee

1. A method in a User Equipment (UE) for wireless communication, comprising:

receiving a **second radio signal**;

receiving a **first radio signal**;

wherein the **first radio signal** is transmitted within a **first time unit**, a **first bit block** is used for generating the **first radio signal**, and the **first radio signal** comprises **G multicarrier symbols**; the **second radio signal** is transmitted within the **first time unit**, and the **second radio signal** is used for determining a time-domain resource occupied by the **G multicarrier symbols**; as for any one given multicarrier symbol of the **G multicarrier symbols**, the multi-antenna related receiving for the given multicarrier symbol is related to the relative position of a time-domain resource occupied by the given multicarrier symbol with respect to a **first time point** in time domain; when the time-domain resource occupied by the given multicarrier symbol is behind the **first time point**, the **second radio signal** is used for determining the multi-antenna related receiving for the given multicarrier symbol; and when the time-domain resource occupied by the given multicarrier symbol is before the **first time point**, the multi-antenna related receiving for the given multicarrier symbol is related to the multi-antenna related receiving for the **second radio signal**; the **first time point** is one time point within the **first time unit**; and G is a positive integer.



(Chen, FIG. 4.)

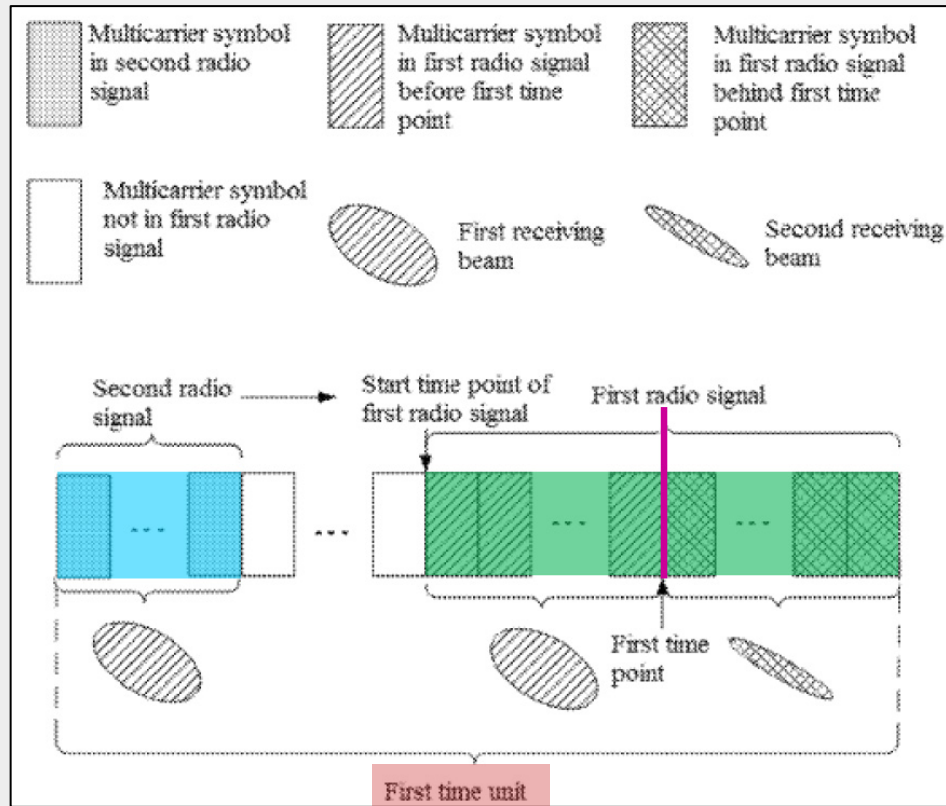
(Lee, [0110].)

[0110] A physical downlink data channel may carry payload information in the form of **Medium Access Control (MAC) Protocol Data Unit (PDU)** from the MAC layer. The resource allocation of this channel may be carried in the

(Lee, [0079].)

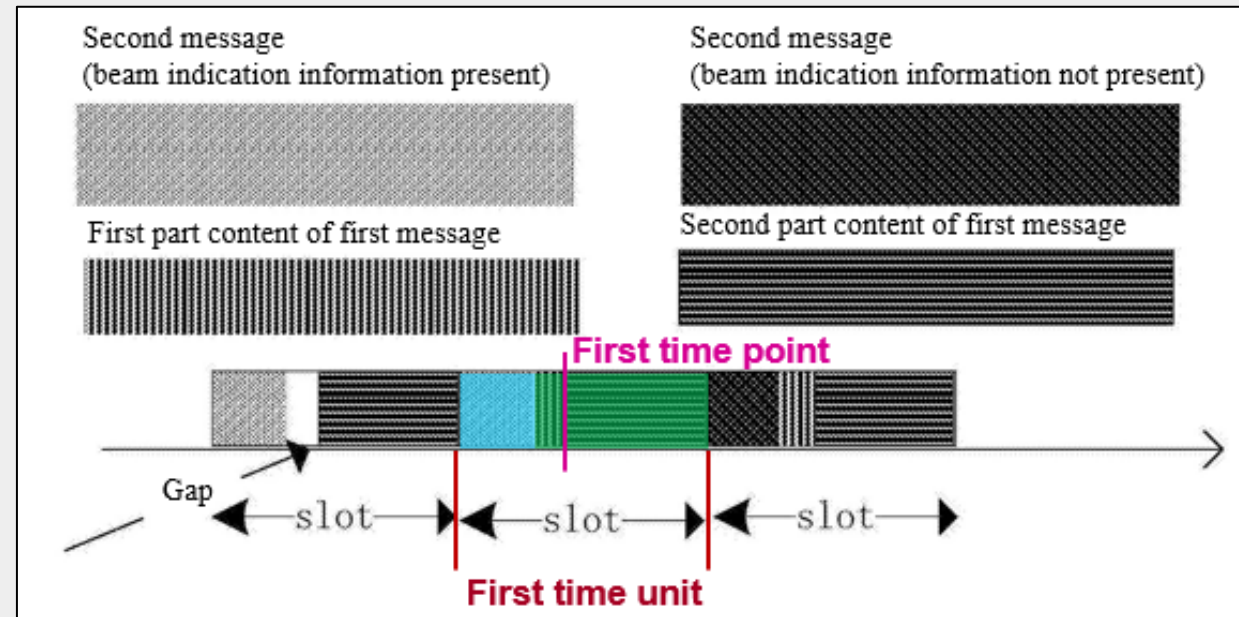
[0079] A "data region" may be part of the scheduling interval in time domain, which may be referred to in units of **OFDM symbols**, used for the transmission of all data channel beams in that scheduling interval.

'081 Patent's Procedure vs. *Chen/Lee*'s Procedure



('081 patent, FIG. 7.)

'081 Patent



(*Chen*, FIG. 4.)

Chen

Topics

- Instituted grounds
- High-level summary of '081 patent and prior art
- Disputed issues in *Lee* Ground
- Disputed issues in *Chen/Lee* Ground
- Expert qualifications

Disputed Issues in *Lee* Ground

- “radio signal” (claim 1)
 - Claim construction of “radio signal”
 - Comparison to prior art
- “the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols” (claim 1)
 - Claim construction of this limitation
 - Comparison to prior art

Disputed Issues in *Lee* Ground

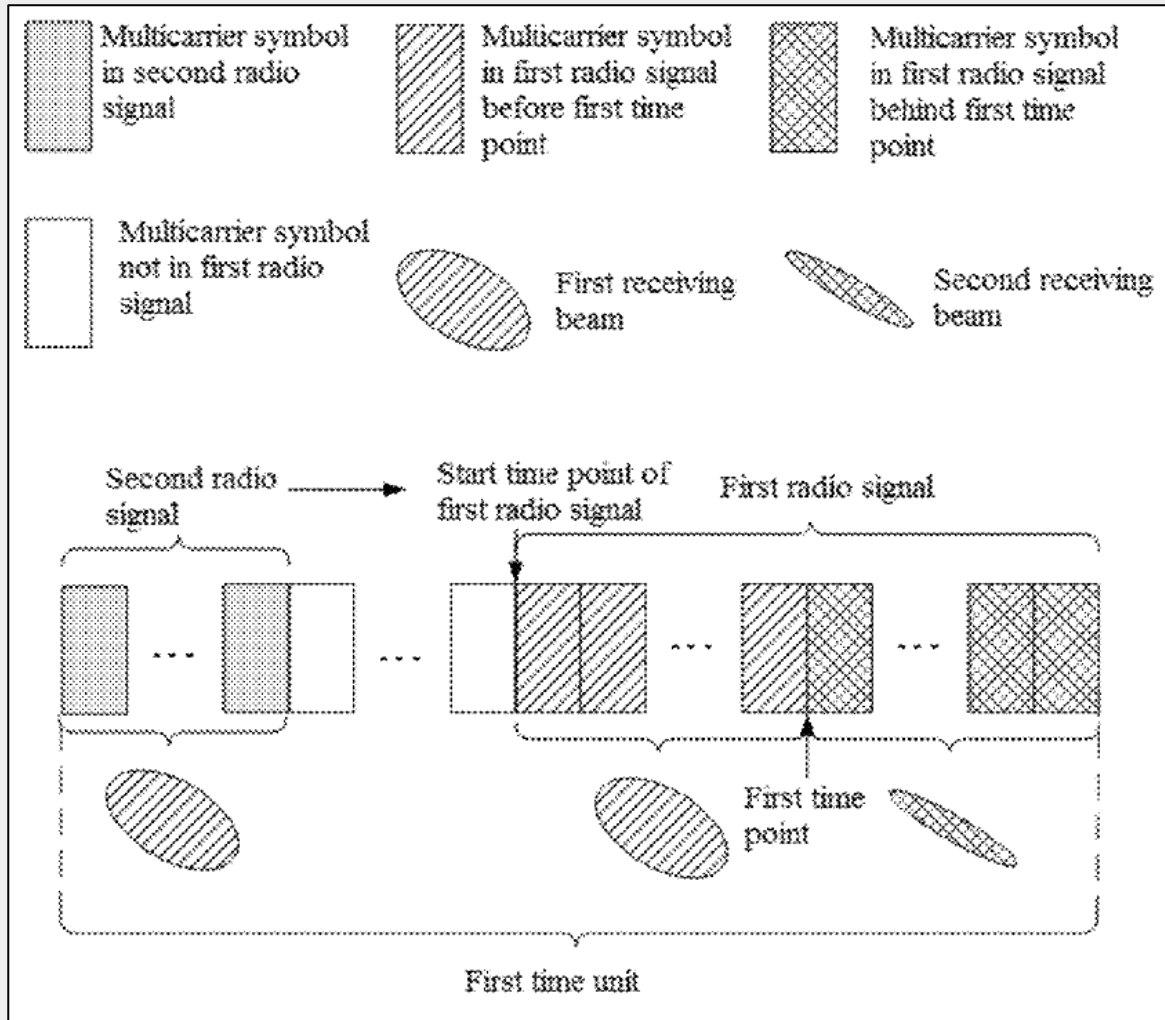
- “radio signal” (claim 1)
 - Claim construction of “radio signal”
 - Comparison to prior art
- “the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols” (claim 1)
 - Claim construction of this limitation
 - Comparison to prior art

Construction of “Radio Signal”

Claim Term	Samsung’s Construction	Apex’s POPR	Apex’s POR
“radio signal”	plain and ordinary meaning	not disputed	“signal that transmits particular radio information”

****Apex did not offer a construction for “radio signal” in the related district court case.**

The '081 Patent Uses the Term “Radio Signal” Broadly



(’081 patent, FIG. 7.)

Embodiment 7 illustrates an example of a second radio signal and a first radio signal, as shown in FIG. 7. Grey rectangles represent multicarrier symbols in the second radio signal, rectangles filled by oblique lines represent multicarrier symbols in the first radio signal before the first time point, rectangles filled by cross lines represent multicarrier symbols in the first radio signal behind the first time point, blank rectangles represent multicarrier symbols not in the first radio signal, a wide oval filled by oblique lines represents a first receiving beam, and a narrow oval filled by cross lines represents a second receiving beam.

(’081 patent, 17:57-67.)

In one embodiment, the first radio signal is a consecutive data transmission block in time domain.

In one embodiment, the first radio signal is G consecutive multicarrier symbols in time domain.

(’081 patent, 2:20-23.)

In one subembodiment, the second radio signal is a PDCCH, and the first radio signal is a PDSCH.

In one subembodiment, the second radio signal is a DCI that is used for indicating downlink assignment, and the first radio signal is a PDSCH transmitted on the downlink resource indicated by the second radio signal.

(’081 patent, 18:19-24.)

Apex's Own Purported Evidence Contradicts Its Proposed Construction

Wiley Electrical and Electronics Engineering Dictionary confirms that the content of a signal defines the signal. For example, a signal that transmits control information is a control signal:

control signal:

2. In telecommunications, a signal that transmits control information.

Ex. 2004, ¶ 30 (citing Steven M. Kaplan, Wiley Electrical and Electronics

(POR 17.)

Claim Term	Apex's Construction
"radio signal"	"signal that transmits ~~particular~~ radio information"



37 CFR § 42.63 - Form of evidence.

(a) Exhibits required. Evidence consists of affidavits, transcripts of depositions, documents, and things. All evidence must be filed in the form of an exhibit.

Apex's Construction is Vague

Q. What do you mean by "particular radio information"?

A. Well, it depends on the content.

If the content is changing, the information itself is changing. Then it's a different radio signal.

Q. You'd agree that "particular radio information" can include multiple pieces of radio information, right?

A. Well, then you're redefining the word "information."

The -- radio information is a consistent and a one type of one transmission. So it's a signal that transmits a particular radio information. So it would be the content of that radio information.

(Ex. 1024 (Gomez Tr.), 12:7-22.)

Apex's Construction is Vague

In an attempt to misrepresent the claimed requirements, Petitioner contends that “[t]he ’081 patent does not preclude the ‘second radio signal’ from having multiple portions.” Pet. at 16 (citations omitted); Ex. 2004, ¶ 38. As noted in Section V.A., having different particular information corresponds to different signals in the context of the ’081 Patent, not portions of the same signal. *Id.*

(POR 25.)

In an attempt to misrepresent the claimed requirements, as for the claimed “second radio signal,” Petitioner contends that “[t]he ’081 patent does not preclude the ‘first radio signal’ from having multiple portions.” Pet. at 18; Ex. 2004, ¶ 43. As noted in Section V.A., having different particular information corresponds to different signals in the context of the ’081 Patent, not portions of the same signal.

(POR 28.)

Q. Is downlink control information particular radio information?

A. It can be, yes.

(Ex. 1024 (Gomez Tr.), 12:23-25.)

Q. Does DCI include beam-switching information?

THE WITNESS: Again, it's -- I haven't memorized the entire specification. I'd have to go back and look.

But my understanding of DCI, from what I've -- how I've used it is that it's -- it includes resource information and modulation information.

(Ex. 1024 (Gomez Tr.), 15:15-16:1.)

“A patent may not, like a ‘nose of wax,’ be twisted one way to avoid anticipation and another to find infringement.”

Amazon.com, Inc. v. Barnesandnoble.com, Inc., 239 F.3d 1343, 1351 (Fed. Cir. 2001)



Apex's Interpretation Would Read Out the Claimed Embodiment

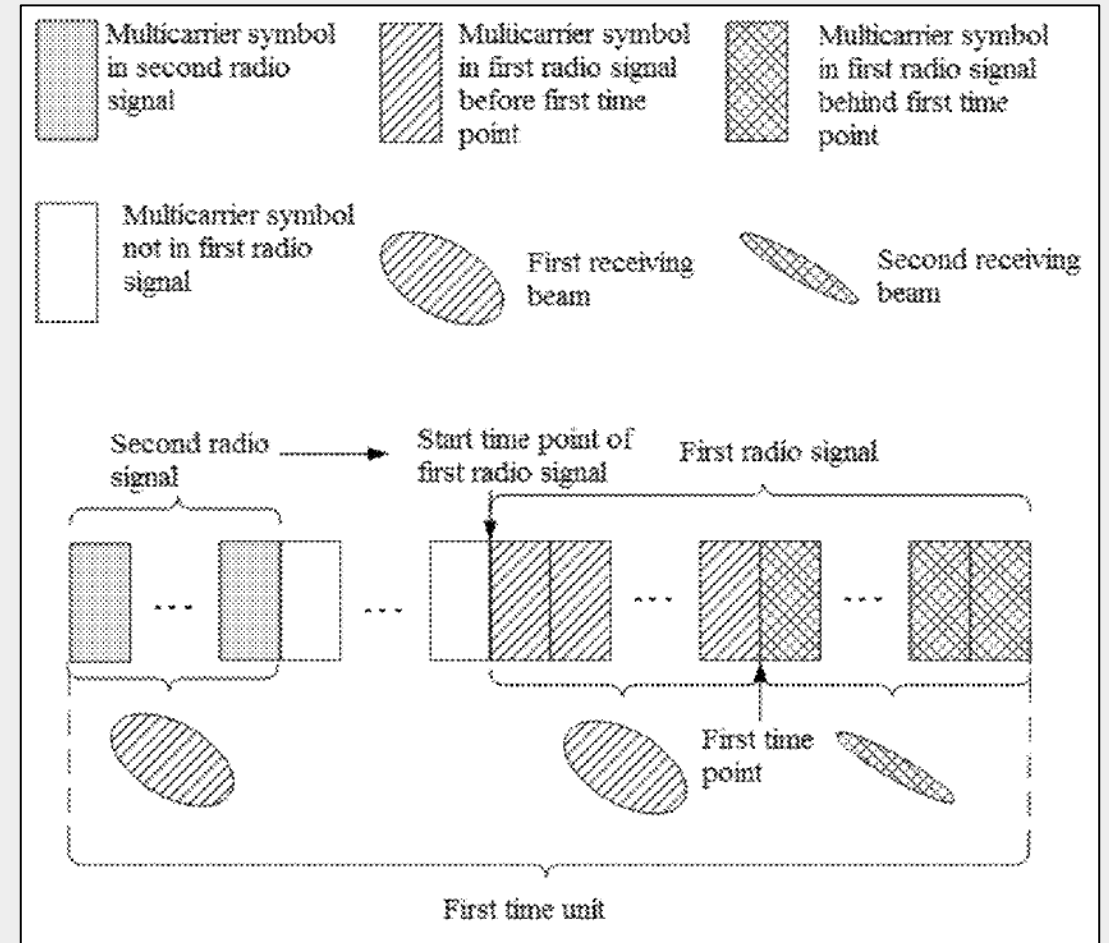
Q. Would different places on the time frequency resources and using different beams make two TBs different radio signals?

A. It can, definitely.

(Ex. 1024 (Gomez Tr.), 8:6-9.)

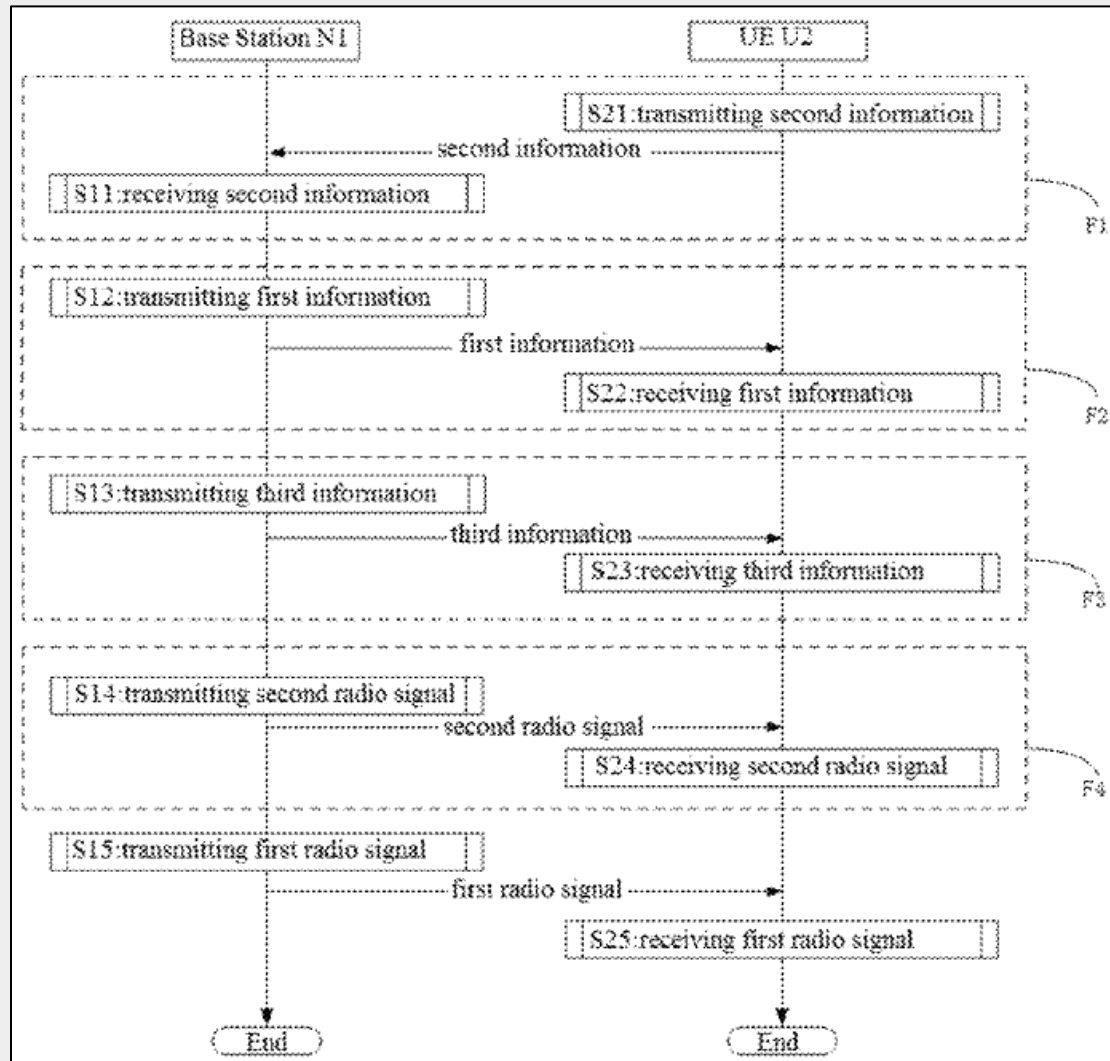
Fig. 7 of the '081 Patent is representative of how the invention seeks to provide the aforementioned benefit. Fig. 7 and its accompanying description in the '081 Patent specification shows (i) that the first radio signal can comprise different multi-carrier symbols and (ii) that the multi-carrier symbols can change at a “first time point” between a first receiving beam, which is the same beam that the second radio signal is sent under, and second receiving beam.

(POR 5.)



('081 patent, FIG. 7.)

Apex's Interpretation is Inconsistent with the '081 Patent



('081 patent, FIG. 5.)

Q. So there's two radio signals in Figure 5?

A. That's what the diagram says.

Cross

(Ex. 1024 (Gomez Tr.), 16:15-17.)

Q. How many signals are there in total in Figure 5?

A. Well, there's first radio signal, second radio signal, third information, first information, and second information.

Q. And the second information signal is different than the first information signal, correct?

A. That's correct.

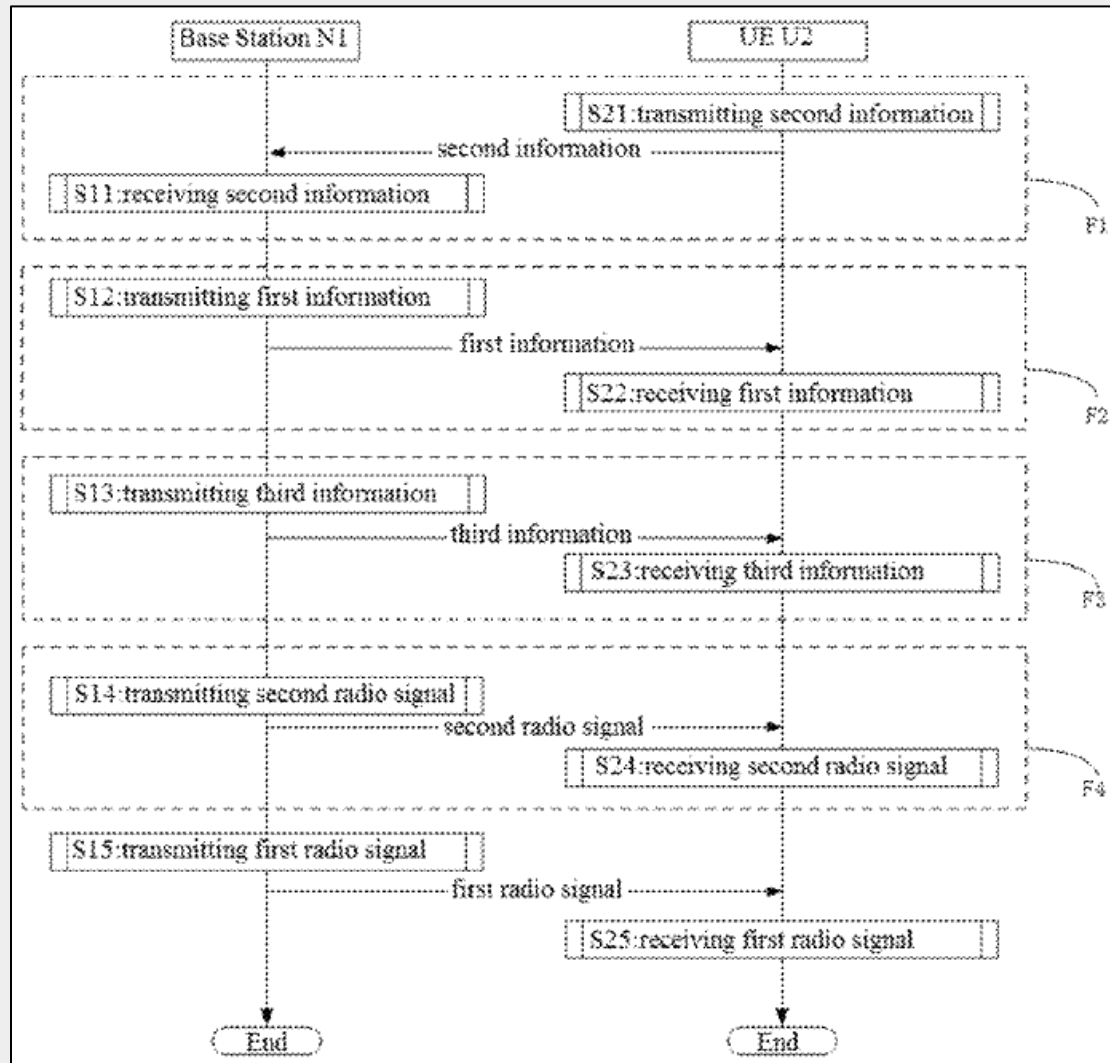
Q. And the first information signal is different than the third information signal, correct?

A. Yes, it is.

Redirect

(Ex. 1024 (Gomez Tr.), 31:19-32:6.)

Apex's Interpretation is Inconsistent with the '081 Patent



In one embodiment, the third information is carried in the second radio signal.

('081 patent, 6:41-42.)

In one embodiment, the second radio signal is a PDCCH.

('081 patent, 3:59.)

In one embodiment, the second radio signal is a DCI carrying downlink assignment.

('081 patent, 4:1-2.)

In one embodiment, the third information is a DCI.
In one embodiment, the third information is transmitted on the PDCCH.

('081 patent, 6:38-40.)

('081 patent, FIG. 5.)

Apex's Expert Admits That "Particular Radio Information" Can Include Multiple Pieces of Information

Q. Is downlink control information particular radio information?

A. It can be, yes.

(Ex. 1024 (Gomez Tr.), 12:23-25.)

Q. Does DCI include beam-switching information?

THE WITNESS: Again, it's -- I haven't memorized the entire specification. I'd have to go back and look.

But my understanding of DCI, from what I've -- how I've used it is that it's -- it includes resource information and modulation information.

(Ex. 1024 (Gomez Tr.), 15:15-16:1.)

Figure 7 shows a first radio signal with consecutive symbols in the time domain, right?

A. It shows a first radio signal consecutive -- consecutive of times and then a first time point.

Q. Okay. So just to clarify the record.

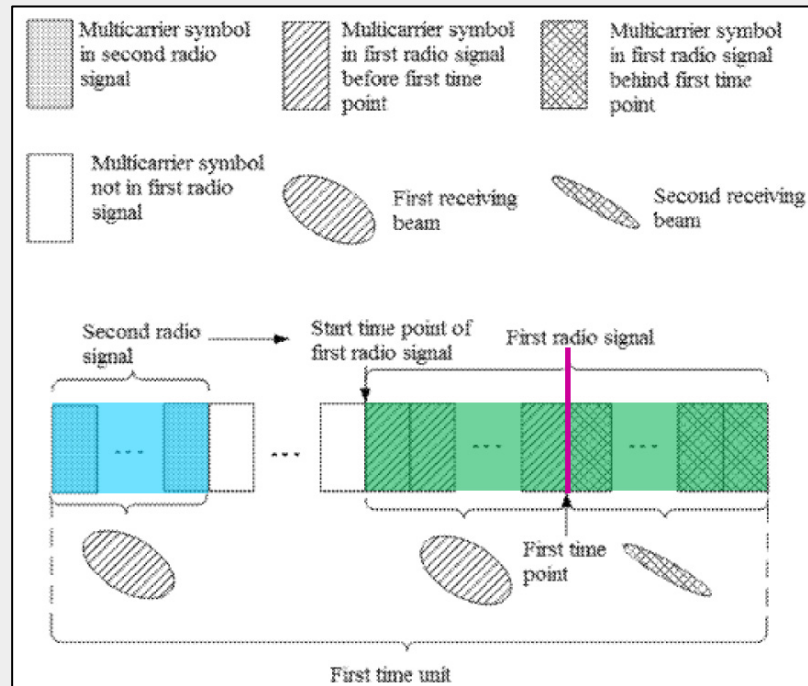
You agree that it shows a first radio signal with consecutive symbols in the time domain, right?

A. Yes, it does.

(Ex. 1024 (Gomez Tr.), 16:20-17:5.)

Lee Discloses “Second Radio Signal”, Regardless of Whether Apex’s Construction is Applied

’081 Patent



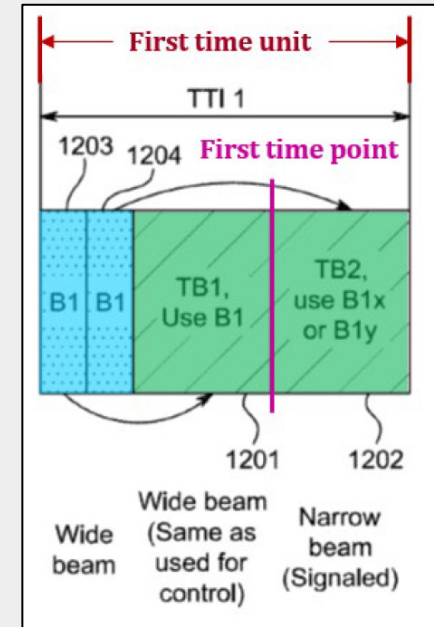
(’081 patent, FIG. 7.)

In one embodiment, the second radio signal is a DCI carrying downlink assignment.

(’081 patent, 4:1-2.)

In one embodiment, the second radio signal is a PDCCH.

(’081 patent, 3:59.)



Lee

(Lee, FIG. 12.)

[0168] In particular, as shown in FIG. 12, a first TB (TB1) may use the same wide beam or the same beam ID as the control channel, and a second TB (TB2) may use a narrow beam or a beam ID that is different from the beam ID used by the control channel. The beam ID for TB2 may be signal in a DCI transmitted in control data B1 that is associated with TB2. In addition, the dual

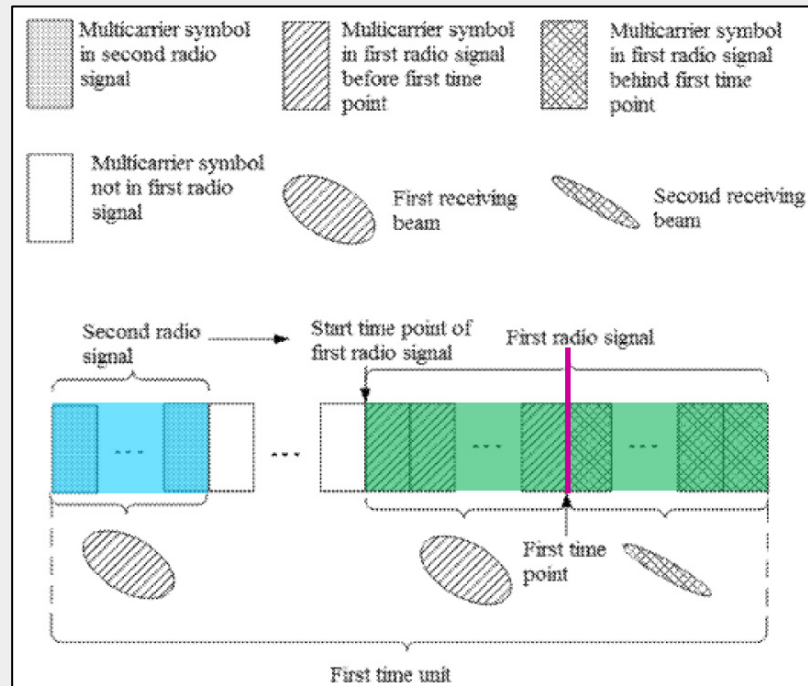
(Lee, [0168].)

interchangeably. The terms control channel, control channel beam, PDCCH, mPDCCH, mmW PDCCH, mmW control channel, directional PDCCH, beamformed control channel, spatial control channel, control channel slice, high frequency control channel may be used interchangeably. The terms data channel,

(Lee, [0086].)

Lee Discloses “First Radio Signal”, Regardless of Whether Apex’s Construction is Applied

’081 Patent



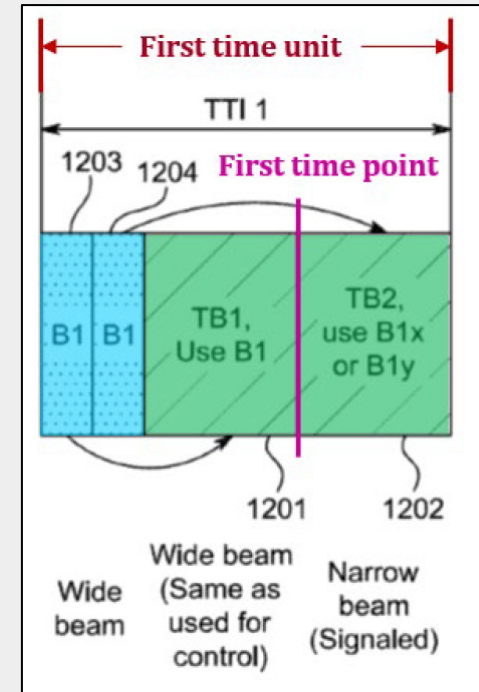
(’081 patent, FIG. 7.)

In one embodiment, the first radio signal is a PDSCH.

In one embodiment, the first radio signal is a consecutive data transmission block in time domain.

In one embodiment, the first radio signal is G consecutive multicarrier symbols in time domain.

(’081 patent, 2:19-23.)



Lee

(Lee, FIG. 12.)

data carried by TB1 may be a subset of the data carried by TB2, and TB1 may use a lower modulation and coding scheme (MCS) value than TB2.

(Lee, [0168].)

frequency control channel may be used interchangeably. The terms data channel, data channel beam, PDSCH, mPDSCH, mmW PDSCH, mmW data channel, directional PDSCH, beamformed data channel, spatial data channel, data channel slice, and high frequency data channel may be used interchangeably.

(Lee, [0086].)

Apex's Construction Does Not Require Only a "Single" Second/First Radio Signal

Claim Term	Samsung's Construction	Apex's POPR	Apex's POR
"radio signal"	plain and ordinary meaning	not disputed	"signal that transmits particular radio information"

Patent Owner proposes that the Board construe "radio signal" to be a "signal that transmits particular radio information." Ex. 2004, ¶ 27. This construction addresses at least two critical disputes: (1) the signal must be one, single signal, and (2) the one signal must include and carry particular (rather than different contents or types) of radio information. In addition to the POR evidence supporting this

(PO Sur-Reply 1.)

Petitioner's Reply confirms that Lee fails to disclose a single second radio signal (*i.e., receiving a second radio signal*). This point is supported by Petitioner's attempt to map the teachings of multiple separate signals carrying different sets of information to meet the requirements of a single radio signal.

(PO Sur-Reply 9.)

Petitioner's Reply confirms that Lee fails to disclose "receiving a first radio signal." Petitioner does not identify a single radio signal with particular information as the one incoming "first radio signal." *Id.*, ¶ 41. Petitioner argues that two

(PO Sur-Reply 10.)

Disputed Issues in *Lee* Ground

- “radio signal” (claim 1)
 - Claim construction of “radio signal”
 - Comparison to prior art
- “the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols” (claim 1)
 - Claim construction of this limitation
 - Comparison to prior art

Construction of the “Symbol” Limitations

Claim Term	Samsung’s Construction	Apex’s POPR	Apex’s POR
“the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols”	plain and ordinary meaning	not disputed	“the second radio signal is used for determining a time-domain resource occupied by <u>each of</u> the G multicarrier symbols”

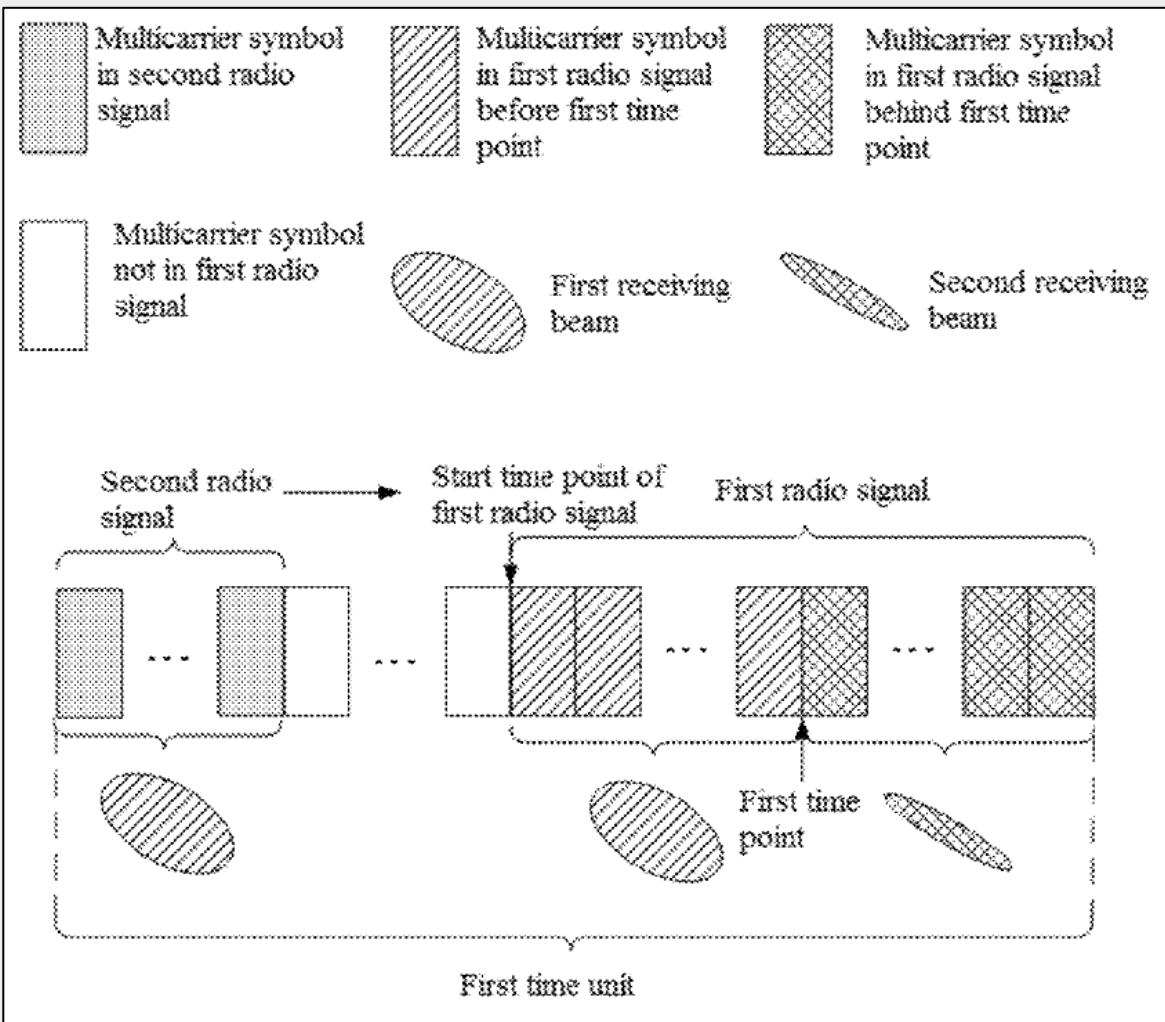
****Apex did not offer a construction for this term in the related district court case.**



“Instead of looking to the words themselves, [patent owner] added language without support from the specification or prosecution history, altering otherwise unambiguous claim language, a practice this court has repeatedly rejected.”

Source Vagabond Sys. Ltd. v. Hydrapak, Inc., 753 F.3d 1291, 1299 (Fed. Cir. 2014).

The '081 Patent Does Not Contemplate a Symbol Level Analysis



('081 patent, FIG. 7.)

In Embodiment 7, both the first radio signal and the second radio signal are transmitted within the first time unit, the multicarrier symbols occupied by the second radio signal are before the multicarrier symbols occupied by the first radio signal in time domain, the first receiving beam is used for receiving the second radio signal, the second radio signal indicates the start time point of the first radio signal in the first time unit, and the start time point is used for determining the time domain resource occupied by the first radio signal in the first time unit. The first time point is one time point within the first time unit behind the multicarrier symbols occupied by the second radio signal.

('081 patent, 18:1-12.)

Apex's Cited Evidence Does Not Support Its Construction

1. A method in a User Equipment (UE) for wireless communication, comprising:
receiving a second radio signal;
receiving a first radio signal;
wherein the first radio signal is transmitted within a first time unit, a first bit block is used for generating the first radio signal, and the first radio signal comprises G multicarrier symbols; the second radio signal is transmitted within the first time unit, and the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols; **as for any one given multicarrier symbol of the G multicarrier symbols, the multi-antenna related receiving for the given multicarrier symbol is related to the relative position of a time-domain resource occupied by the given multicarrier symbol with respect to a first time point in time domain; when the time-domain resource occupied by the given multicarrier symbol is behind the first time point, the second radio signal is used for determining the multi-antenna related receiving for the given multicarrier symbol; and when the time-domain resource occupied by the given multicarrier symbol is before the first time point, the multi-antenna related receiving for the given multicarrier symbol is related to the multi-antenna related receiving for the second radio signal; the first time point is one time point within the first time unit; and G is a positive integer.**

('081 patent, claim 1.)

'081 Patent, Claim 1. In my opinion, a person of ordinary skill in the art would readily understand that the time domain resource occupied by *each one* of the G multicarrier symbols must be determined by the second radio signal. **Otherwise, a person of ordinary skill in the art would not have found it possible to determine, in the subsequent limitations, whether the time domain resource occupied by each one of the multicarrier symbols is before or behind the first time point.**

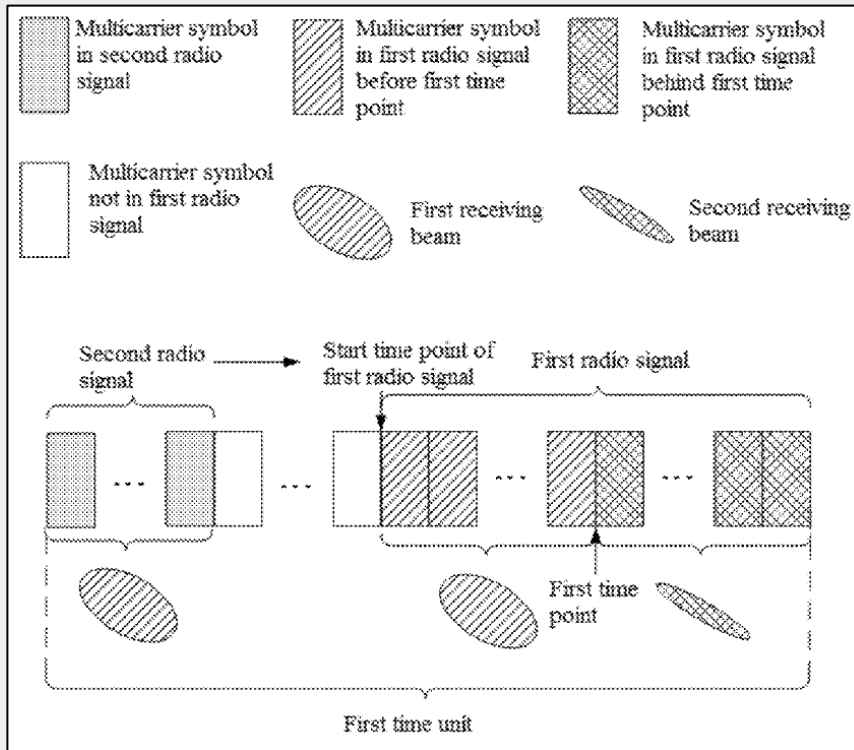
(Ex. 2004 (Gomez), ¶33.)

Apex's Cited Evidence Does Not Support Its Construction

Q. Each symbol occupies a specific length of time, right?

A. Symbols do have specific lengths of time, correct.

(Ex. 1024 (Gomez Tr.), 18:12-15.)



('081 patent, FIG 7.)

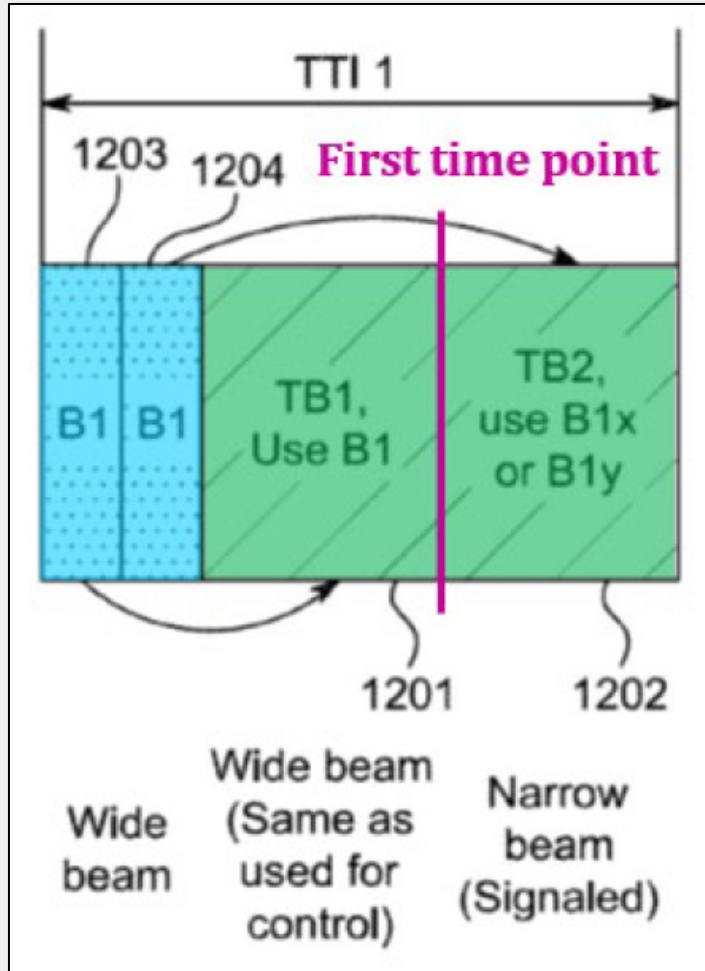
"QUESTION: So within a given numerology, if you know the start time of the first symbol -- of the first radio signal depicted in Figure 7, you would also know the start time of the second symbol of the first radio signal depicted in Figure 7, right?"

THE WITNESS: Again, this is just one embodiment where the slots -- or the symbols are consecutive and ignoring any other ones.

The second symbol would follow the first symbol, and that would be a known time.

(Ex. 1024 (Gomez Tr.), 21:3-20.)

Lee Discloses the “Symbol” Limitations, Regardless of Whether Apex’s Construction is Applied



(Lee, FIG. 12.)

[0109] A physical downlink control channel may carry data related control information to identify, demodulate and decode the associated data channel properly.

(Lee, [0109].)

[0110] A physical downlink data channel may carry payload information in the form of Medium Access Control (MAC) Protocol Data Unit (PDU) from the MAC layer. The resource allocation of this channel may be carried in the scheduling information in the physical downlink control channel.

(Lee, [0110].)

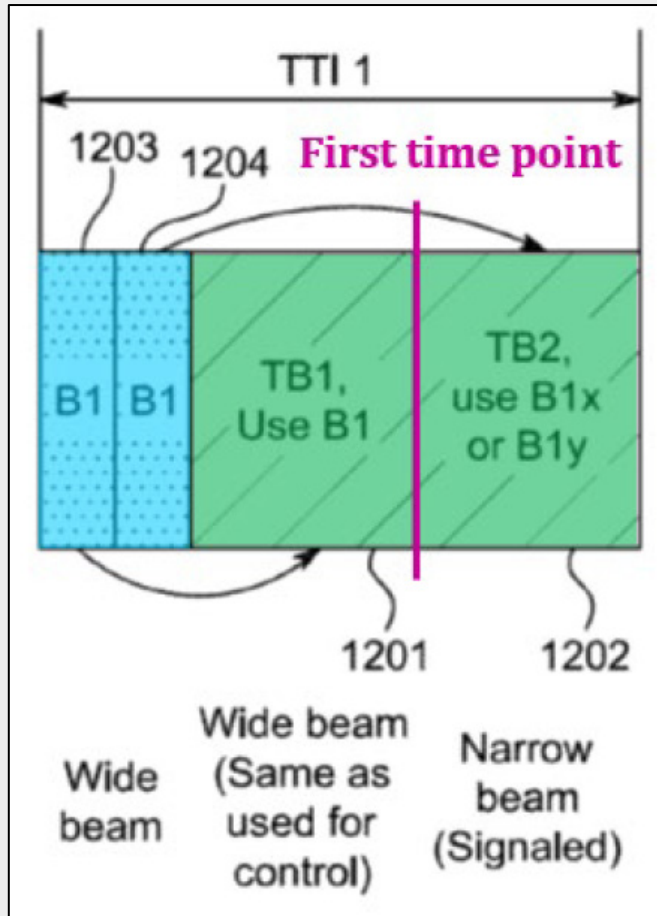
[0148] A transmission scheme may use explicit beam association between control channel and the associated data channel, where the transmit beam for the control channel and the associated data channel may be determined independently (or separately). The transmit beam used for the data channel may be explicitly indicated from the corresponding control channel. The transmit beam described herein may include one or more of following parameters: Tx or Rx beam width (e.g., beam subgroup), Tx or Rx beam direction (e.g., beam index) within the beam width, and a time-frequency resource associated with the beam. The beam index may be indicated as antenna port or reference signal sequence.

(Lee, [0148].)

1204. The first transport block may be mapped on to a first codeword provided in the control Tx beam 1203 and the second transport block may be mapped on to a second codeword provided in control Tx beam 1204. The codeword may be associated with: a specific beam or beam ID, a BRS, and/or a time/frequency location. As used herein, a codeword represents user data before it is formatted

(Lee, [0169].)

Lee Discloses the “Symbol” Limitations, Regardless of Whether Apex’s Construction is Applied



(Lee, FIG. 12.)

[0167] Referring now to FIG. 12, FIG. 12 shows a diagram for a dual TB transmission scheme. Two or more transport blocks may be transmitted with a same beam as the control channel, or may be transmitted with different beams. For example, FIG. 12 illustrates two transport blocks 1201 and 1202 transmitted (multiplexed) in a TDM fashion within a single TTI (e.g., TTI1). The transmission of the individual transport blocks may use the same beam as the control channel (e.g., transport block 1201 which uses a wide beam), or may use a different beam (e.g., transport block 1202 which uses a narrow beam). In the latter case, the narrow beam ID may need to be signaled in the control region of the TTI.

(Lee, [0167].)

[0168] In particular, as shown in FIG. 12, a first TB (TB1) may use the same wide beam or the same beam ID as the control channel, and a second TB (TB2) may use a narrow beam or a beam ID that is different from the beam ID used by the control channel. The beam ID for TB2 may be signaled in a DCI transmitted in control data B1 that is associated with TB2. In addition, the dual TB transmission scheme shown in FIG. 12 may be used to carry out a fallback transmission, to be described in more detail below. As a fallback mechanism, data carried by TB1 may be a subset of the data carried by TB2, and TB1 may use a lower modulation and coding scheme (MCS) value than TB2.

(Lee, [0168].)

Topics

- Instituted grounds
- High-level summary of '081 patent and prior art
- Disputed issues in *Lee* Ground
- Disputed issues in *Chen/Lee* Ground
- Expert qualifications

Disputed Issues in *Chen/Lee* Ground

- “a first bit block is used for generating the first radio signal” (claim 1)
- “the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols” (claim 1)
 - Claim construction of this limitation
 - Comparison to prior art

Disputed Issues in *Chen/Lee* Ground

- “a first bit block is used for generating the first radio signal” (claim 1)
- “the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols” (claim 1)
 - Claim construction of this limitation
 - Comparison to prior art

Apex Improperly Attacks *Lee* and *Chen* Individually

Petitioner cannot and does not rely on Chen to disclose “a first bit block [] used for generating the first radio signal” and, instead, only relies on “*Lee*’s teachings of a data message generated by a bit block (*e.g.*, MAC PDU)” that Petitioner alleges could be implemented into Chen’s method. Pet. at 55-58; Ex. 2004, ¶ 62.

However, Lee’s MAC PDU does not generate a first radio signal. *Id.*, ¶ 63. As described in Section VII.A.4., Lee’s alleged first bit block (MAC PDU) generates two different signals (*i.e.*, TB1 and TB2) associated with two different code words (CW), instead of generating one radio signal. *Id.*

(POR 35-36.)

Obviousness cannot be overcome “by attacking references individually where the [ground] is based upon the teachings of a combination of references.”

Bradium Techs. LLC v. Iancu, 923 F.3d 1032, 1050 (Fed. Cir. 2019).



The Petition Shows That the Claimed “First Bit Block” Would Have Been Obvious to a POSITA

195. As discussed above for claim [1b], *Chen*’s transmitting end device (base station) transmits a first message, which can be a “data” message, to the receiving end device (UE). See Section XI.B.1.c; *Chen*, 12; *Chen Priority*, [0123]. *Chen* teaches that “the first part content and the second part content belong to the same message.” *Chen* 17; *Chen Priority* 152. A POSITA would understand that a block of bits is used to generate both the “first part content of the first message” and the “second part content of the first message”, i.e., of the claimed “first radio signal.”

(Ex. 1002 (Kakaes), ¶195.)

196. Further, it was well known to a POSITA that a data message may be generated using a bit block, which is a group of bits. Ex. 1020 (*TS-36.212*), 10 (describing a bit block having “B bits,” and if B is no more than “Z” (which is defined to be 6144), the “number of code blocks C is determined” to be “C = 1” (36.212, 10)). The bits of each code word are further processed and transmitted in a set of OFDM signals over a set of antenna ports. Ex. 1019 (*TS-36.211*), 66 (“the block of bits” transmitted on the “physical channel in one subframe, shall be scrambled prior to modulation, resulting in a block of scrambled bits”), Fig. 6.3-1.

(Ex. 1002 (Kakaes), ¶196.)

The Petition Shows That the Claimed “First Bit Block” Would Have Been Obvious to a POSITA

206. A POSITA would have been motivated to implement *Lee*’s teachings of a data message generated by a bit block (e.g., MAC PDU) and using multicarrier symbols (e.g., OFDM symbols) into *Chen*’s method. Both *Chen* and *Lee* disclose wireless communication systems where a base station transmits control and data messages to the UE within a single time slot. See e.g., *Chen*, FIG. 4; *Chen Priority*, FIG. 4; *Lee*, FIG. 12. Both *Chen* and *Lee* disclose that the data includes multiple symbols in the time domain. *Chen*, 17; *Chen Priority*, [0152]; *Lee*, [0079]. *Lee* further discloses that the data is generated using a bit block, and the multiple symbols are a positive integer number of multicarrier symbols. *Lee*, [0079], [0091], [0095], [0110], [0224]-[0230], FIGS. 2, 13-14.

(Ex. 1002
(Kakaes), ¶206.)

208. A POSITA would have been motivated to implement *Lee*’s bit block and multicarrier symbols in *Chen*’s method because of the well-known benefits of bit block and multicarrier symbol transmission methods, for example, increased bandwidth efficiency, increased speed, and low sensitivity to channel fading. Thus, a POSITA would have been motivated to implement *Lee*’s bit block and multicarrier symbols because of these well-known advantages provided by *Lee*’s method. Further, a POSITA would have been motivated to look to *Lee* to understand how to generate and modulate *Chen*’s data message.

(Ex. 1002
(Kakaes), ¶208.)

207. A POSITA would therefore have found it obvious to combine *Chen* and *Lee* by implementing *Lee*’s use of a bit block and multicarrier symbols in *Chen*’s method, because this was a well-known, conventional procedure, as taught by *Lee*. See also Ex. 1020 (*TS-36.212*), 10, 63, 87; Ex. 1019 (*TS-36.211*), 18-19, 59-62, 66; Ex. 1008 (*TS-36.321*), 49; Ex. 1006 (*TR 25.892*), 18. A POSITA would have understood that *Lee*’s disclosure simply provides additional details and explanation about how *Chen*’s data message is generated and modulated in time and frequency domains, and, thus, would have found it obvious to look to the conventional procedure described in *Lee* to understand and implement the details not expressly described in *Chen*’s method.

(Ex. 1002
(Kakaes), ¶207.)

Disputed Issues in *Chen/Lee* Ground

- “first bit block” (claim 1)
- “the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols” (claim 1)
 - Claim construction of this limitation
 - Comparison to prior art

Construction of the “Symbol” Limitations

Claim Term	Samsung’s Construction	Apex’s POPR	Apex’s POR
“the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols”	plain and ordinary meaning	not disputed	“the second radio signal is used for determining a time-domain resource occupied by <u>each of</u> the G multicarrier symbols”

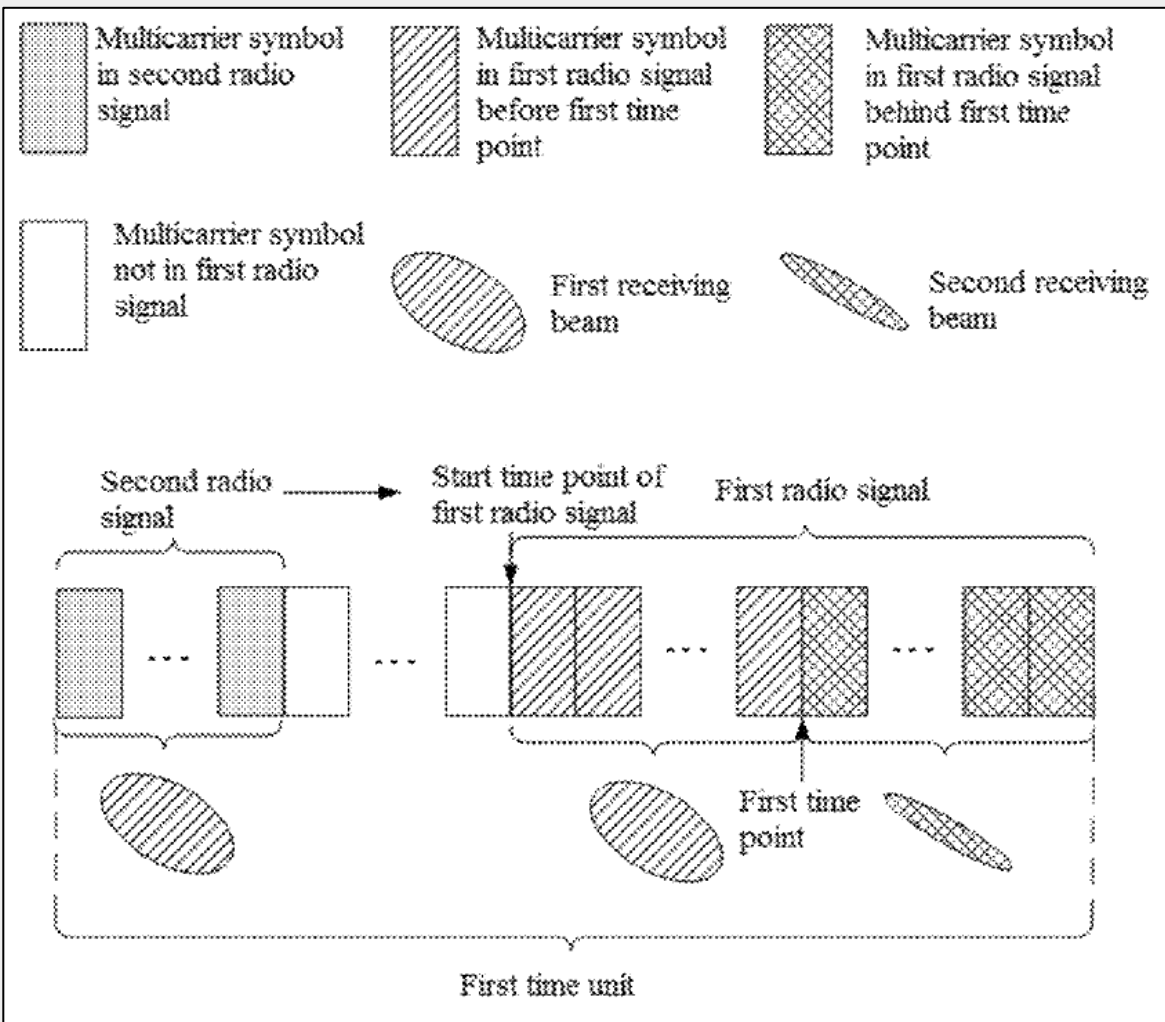
****Apex did not offer a construction for this term in the related district court case.**



“Instead of looking to the words themselves, [patent owner] added language without support from the specification or prosecution history, altering otherwise unambiguous claim language, a practice this court has repeatedly rejected.”

Source Vagabond Sys. Ltd. v. Hydrapak, Inc., 753 F.3d 1291, 1299 (Fed. Cir. 2014).

The '081 Patent Does Not Contemplate a Symbol Level Analysis



('081 patent, FIG. 7.)

In Embodiment 7, both the first radio signal and the second radio signal are transmitted within the first time unit, the multicarrier symbols occupied by the second radio signal are before the multicarrier symbols occupied by the first radio signal in time domain, the first receiving beam is used for receiving the second radio signal, the second radio signal indicates the start time point of the first radio signal in the first time unit, and the start time point is used for determining the time domain resource occupied by the first radio signal in the first time unit. The first time point is one time point within the first time unit behind the multicarrier symbols occupied by the second radio signal.

('081 patent, 18:1-12.)

Apex's Cited Evidence Does Not Support Its Construction

1. A method in a User Equipment (UE) for wireless communication, comprising:
receiving a second radio signal;
receiving a first radio signal;
wherein the first radio signal is transmitted within a first time unit, a first bit block is used for generating the first radio signal, and the first radio signal comprises G multicarrier symbols; the second radio signal is transmitted within the first time unit, and the second radio signal is used for determining a time-domain resource occupied by the G multicarrier symbols; **as for any one given multicarrier symbol of the G multicarrier symbols, the multi-antenna related receiving for the given multicarrier symbol is related to the relative position of a time-domain resource occupied by the given multicarrier symbol with respect to a first time point in time domain; when the time-domain resource occupied by the given multicarrier symbol is behind the first time point, the second radio signal is used for determining the multi-antenna related receiving for the given multicarrier symbol; and when the time-domain resource occupied by the given multicarrier symbol is before the first time point, the multi-antenna related receiving for the given multicarrier symbol is related to the multi-antenna related receiving for the second radio signal; the first time point is one time point within the first time unit; and G is a positive integer.**

('081 patent, claim 1.)

'081 Patent, Claim 1. In my opinion, a person of ordinary skill in the art would readily understand that the time domain resource occupied by *each one* of the G multicarrier symbols must be determined by the second radio signal. **Otherwise, a person of ordinary skill in the art would not have found it possible to determine, in the subsequent limitations, whether the time domain resource occupied by each one of the multicarrier symbols is before or behind the first time point.**

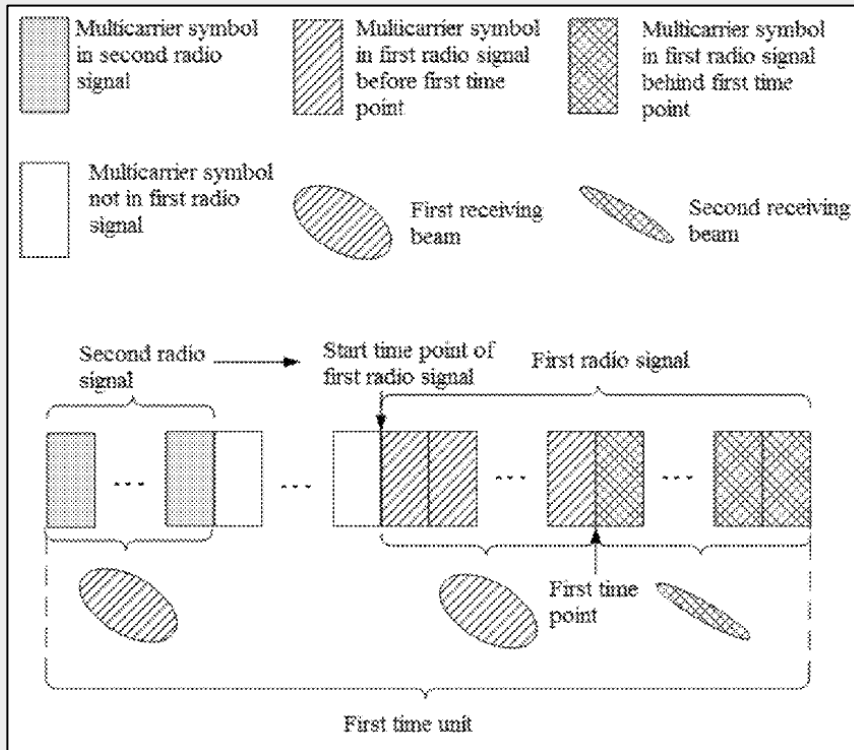
(Ex. 2004 (Gomez), ¶33.)

Apex's Cited Evidence Does Not Support Its Construction

Q. Each symbol occupies a specific length of time, right?

A. Symbols do have specific lengths of time, correct.

(Ex. 1024 (Gomez Tr.), 18:12-15.)



('081 patent, FIG 7.)

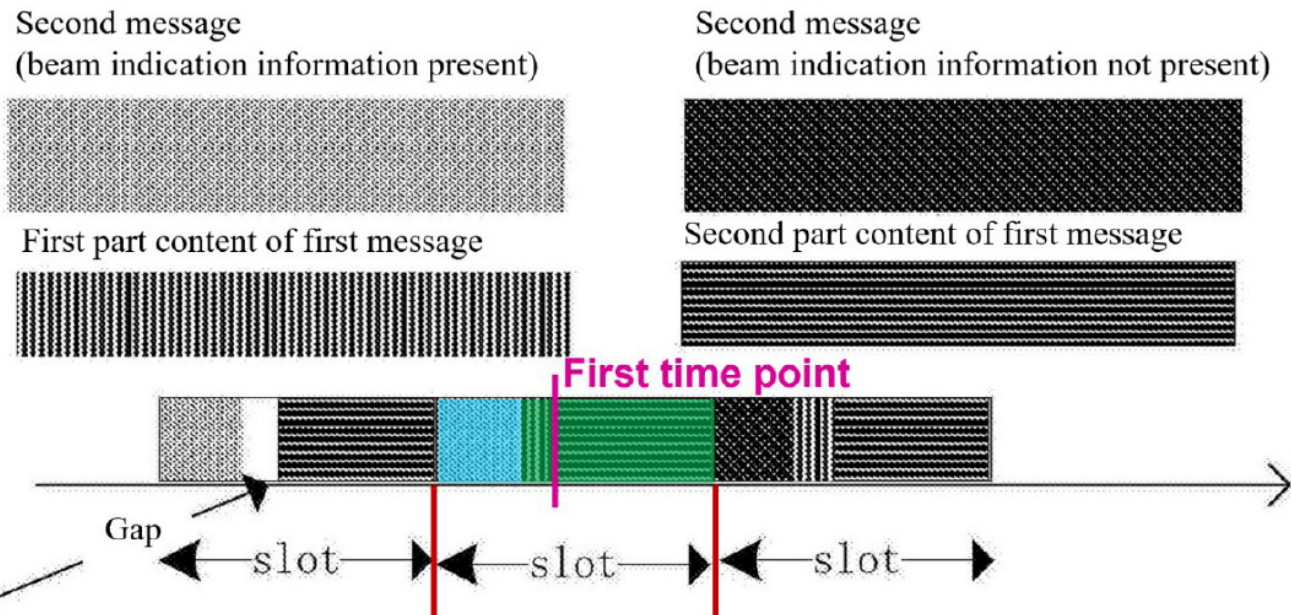
"QUESTION: So within a given numerology, if you know the start time of the first symbol -- of the first radio signal depicted in Figure 7, you would also know the start time of the second symbol of the first radio signal depicted in Figure 7, right?"

THE WITNESS: Again, this is just one embodiment where the slots -- or the symbols are consecutive and ignoring any other ones.

The second symbol would follow the first symbol, and that would be a known time.

(Ex. 1024 (Gomez Tr.), 21:3-20.)

Chen/Lee Renders Obvious the “Symbol” Limitations, Regardless of Whether Apex’s Construction is Applied



(Chen, FIG. 4.)

message may be a downlink signal. In addition, in an embodiment of the present disclosure, the first message may be defined as msg1. And said second message may be understood as a message for notifying the receiving end device of a receiver reference, e.g., a control message or a scheduling message. In addition, the second message in an embodiment of the present disclosure may be defined as msg2.

(Chen, 12.)

212. It was well known that a control message provides, among other things, control information associated with a data message. As the name “control” implies, the purpose of the control information is to provide instructions for receiving the data. Further, it was well known that the control information includes, among other things, scheduling information and time-domain resource information for determining time-domain resources of symbols in data transmission schemes such as Chen’s. Indeed, Chen specifically states that the second message may be a “scheduling message” for the first message. Chen, 12; Chen Priority, [0123]. Thus, a POSITA would have understood that Chen’s control message and/or scheduling message includes information indicating a time-domain resource occupied by Chen’s data message (“first message”).

(Ex. 1002 (Kakaes), ¶212.)

Chen/Lee Renders Obvious the “Symbol” Limitations, Regardless of Whether Apex’s Construction is Applied

213. Further, as discussed above in Section XI.A.1.h, *Lee* discloses a similar “control” message. For example, *Lee* discloses that “[a] physical downlink control channel may carry data related control information to identify, demodulate and decode the associated data channel properly.” *Lee*, [0109]; *Lee Provisional*, [0100]. As an example, *Lee* discloses that the control channel may carry scheduling information for the data channel. *Lee*, [0110]; *Lee Provisional*, [0101]. As another example, *Lee* discloses that the control channel may indicate the “transmit beam” used for the data channel, where the transmit beam “may include one or more of following parameters: Tx or Rx beam width (e.g., beam subgroup), Tx or Rx beam direction (e.g., beam index) within the beam width, and a time-frequency resource associated with the beam.” *Lee*, [0148]; *Lee*

(Ex. 1002 (Kakaes), ¶213.)

214. Further, because *Chen/Lee*’s data message includes multicarrier symbols, the scheduling information and time/frequency resource allocation information would have included the scheduling and time/frequency resource allocation of the symbols. Thus, as was well known in the art at the time, a POSITA would have understood that *Chen*’s control/scheduling message to include scheduling information and time/frequency information for the multicarrier symbols in the data message.

(Ex. 1002 (Kakaes), ¶214.)

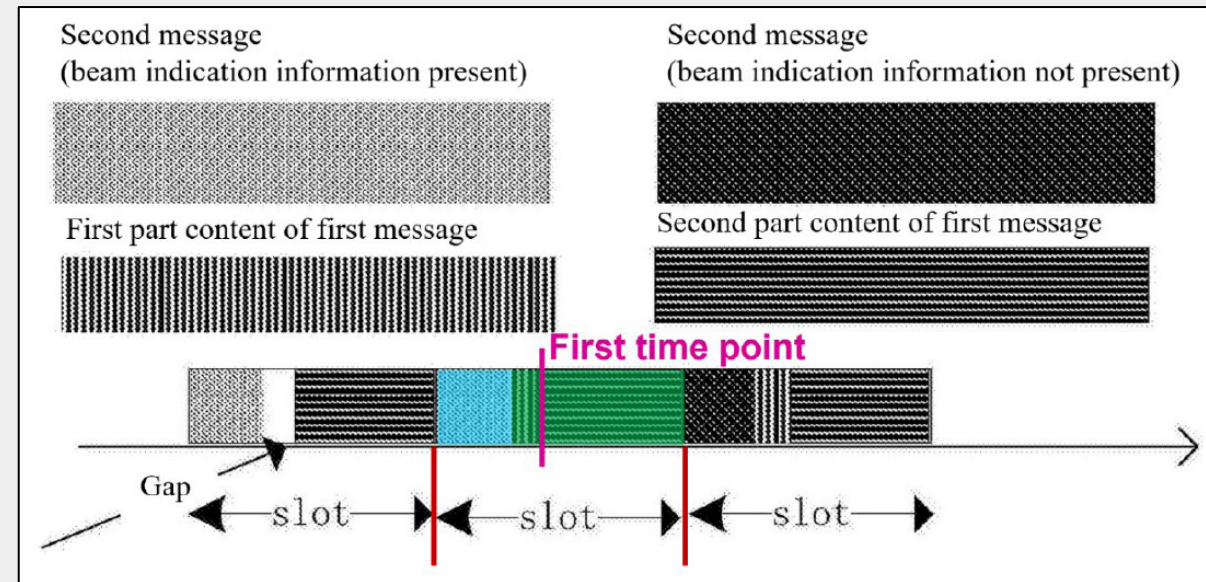
Chen/Lee Renders Obvious the “Symbol” Limitations, Regardless of Whether Apex’s Construction is Applied

In this implementation, said second message may include or not include the parameter indication information; if it does include it, then the receiver parameter indicated by the parameter indication information serves as said target receiver parameter. Therein, a reception beam indicated by the parameter indication information may be a receiver parameter different from the receiver parameter currently used by the receiving end device; at this time, the receiving end device needs to switch the receiver parameter. It is not necessary to switch if the default receiver parameter is used; for example, the default receiver parameter may be the receiver parameter currently used by the receiving end device for rapid decoding of the message transmitted by the transmitting end device. In addition, in embodiments of the present disclosure, the parameter indication information in the second message may be a parameter indication field in the second message, i.e., the second message may have or not have this parameter indication field.

(Chen, 13.)

without having to switch the beam receiver parameter. In addition, the target receiver parameter may be a relevant parameter of a receiver in the receiving end device, e.g., at least one of parameters such as reception beam, equalizer, and reception filter, concerning which the present disclosure imposes no restrictions. To take a target reception beam as an example of a target

(Chen, 12.)



(Chen, FIG. 4.)

Topics

- Instituted grounds
- High-level summary of '081 patent and prior art
- Disputed issues in *Lee* Ground
- Disputed issues in *Chen/Lee* Ground
- Expert qualifications

Law Regarding Experts



“To offer expert testimony from the perspective of a skilled artisan in a patent case—like for claim construction, validity, or infringement—a witness must at least have ordinary skill in the art. Without that skill, the witness’ opinions are neither relevant nor reliable.”

Kyocera Senco Indus. Tools Inc. v. Int’l Trade Comm’n, 22 F.4th 1369, 1376-77 (Fed. Cir. 2022).

Disputed Level of Ordinary Skill

Samsung's Definition

V. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) would have had at least a master’s degree in electrical engineering or a similar field and at least two years of experience working with telecommunications systems, including multiple-input multiple-output (MIMO) technology. Additional relevant work experience can compensate for less education, and *vice versa*. Kakaes, Section IX.

(Petition 13.)

Apex's Definition

at 11-12; Ex. 2004, ¶ 20. In view of the Board’s guidance, Patent Owner proposes that a POSITA would have had either (i) at least a master’s degree in electrical engineering or a similar field and at least two years of experience working with telecommunications systems; or (ii) at least a bachelor’s degree in electrical engineering or a similar field and at least five years of experience working with telecommunications systems. Ex. 2004, ¶ 20.

(POR 12.)

For purposes of this Decision on Institution, we adopt Petitioner’s definition of the level of skill for one of ordinary skill in the art, except we decline to adopt the recitals of “at least” as that language is vague and open-ended. Pet. 13. We also decline to adopt Petitioner’s assertion concerning “[a]dditional relevant work experience,” as it also is vague and open-ended. As adopted, we view the definition for the level of ordinary

(Institution Decision, 11-12.)

Mr. Gomez (Apex) Fails to Meet Samsung's Definition of a POSITA

Gomez (Apex) ❌

- No master's degree
- No MIMO experience.

2. I received my Bachelor's degree in Electrical Engineering from Yale University in 1983.

(Ex. 2004 (Gomez), ¶2.)

Curriculum Vitae of Miguel Gomez

2178 Sirah Ct., Livermore CA 94550
miguel@rockslideanalytics.com
ph. 415.793.4103

Education

Year	College or University	Degree
1983	Yale University	BSEE

(Ex. 2004 (Gomez), Ex. A, 2.)

10 Q. Are you familiar with multiple-input/
11 multiple-output technologies? 10:14
12 A. MIMO, yes.
13 Q. What's your understanding of MIMO?
14 A. MIMO is a way to provide various
15 different services, including diversity, as well 10:14
16 as beamforming so that, you know, you can get
17 either -- you can get a more reliable signal to
18 the receiver that you're intending to target.
19 Q. Which of the engineering experiences
20 listed on your CV involved MIMO? 10:15
21 A. Well, I have a fair amount of
22 experience developing antenna systems in general
23 and, you know, I'm very familiar with all of the
24 technologies involved in MIMO, mostly on the
25 receiver side when I was looking at building a 10:15

1 phased array antenna. But I haven't actually
2 specifically built a product related to those
3 technologies.

(Ex. 1025 (Gomez Tr.), 51:10-52:3.)

Mr. Gomez (Apex) Lacks Relevant Experience

Gomez (Apex) ❌

17 Which of those engineering
18 experiences involved wireless networking?
19 A. There was quite a few that involved
20 wireless networking. The Philips environment
21 required wireless local area networking, as well
22 as working with Microsoft, to understand their
23 early smartphone implementations that they were
24 coming out with on CE.
25 Also the ActSolar required
1 transmission of data from the rooftops down to
2 the -- down to the receivers. And so we were
3 using a protocol called Zigbee. I think it was
4 802.11.15 was the underlying technology to that
5 -- to that -- to Zigbee. And so, you know, I
6 built a number of radio systems over the years
7 related to transmitting various types of data.
8 Q. Are there any others besides those
9 that you just called out?
10 A. Those are the two primary ones that I
11 -- that I recall.

(Ex. 1025 (Gomez Tr.), 47:17-48:11.)

2 Q. Did any of the engineering
3 experiences listed on your CV involve 4G
4 cellular network communications?
5 A. From the engineering experiences,
6 most of the work was done either on the -- on
7 the 2G or the local area network protocols like
8 802.11a and some of the other protocols that had
9 to do with technology similar to 4G.
10 Q. But none of them directly involved
11 4G?
12 A. (Witness indicating.)
13 MR. PYMENTO: Objection.
14 THE STENOGRAPHER: I didn't get an
15 answer. I'm sorry.
16 THE WITNESS: Like I said, the
17 technologies included some of the same
18 elements of the 4G, like, you know, the
19 OFDM -- OF -- the orthogonal
20 frequency-division multiplexing.
21 (Stenographer clarification.)
22 THE WITNESS: Orthogonal
23 frequency-division multiplexing.
24 Some of the same technologies.

1 BY MR. HIGH:
2 Q. But none of them directly involved
3 4G?
4 MR. PYMENTO: Objection.
5 THE WITNESS: No.
6 BY MR. HIGH:
7 Q. Did any of the engineering
8 experiences involve 5G?
9 A. No.

(Ex. 1025 (Gomez Tr.), 50:2-51:9.)

Mr. Gomez (Apex) Lacks Relevant Experience

Gomez (Apex) ❌

Q. And does DCI include beam ID information?

THE WITNESS: I don't believe it does. I'd have to go back and look at that. I haven't memorized the entire specification.

(Ex. 1024 (Gomez Tr.), 13:24-14:6.)

Q. Does DCI include candidate scheme information?

ATTORNEY PYMENTO: Objection to form.

THE WITNESS: I don't believe it does, but I'd have to go back and look.

(Ex. 1024 (Gomez Tr.), 15:8-13.)

Q. Does DCI include antenna configuration information?

THE WITNESS: It certainly includes modulation types.

I don't believe it includes antenna information, but I'd have to go back and look at that.

(Ex. 1024 (Gomez Tr.), 14:23-15:6.)

Q. Does DCI include beam-switching information?

THE WITNESS: Again, it's -- I haven't memorized the entire specification. I'd have to go back and look.

But my understanding of DCI, from what I've -- how I've used it is that it's -- it includes resource information and modulation information.

(Ex. 1024 (Gomez Tr.), 15:15-16:1.)

Dr. Kakaes (Samsung) Satisfies Either Party's Definition of a POSITA

Kakaes (Samsung) ✓

13. I am an expert in the field of communication engineering and specifically, among others, the field of wireless communications. I have over 40 years of experience in electrical engineering and computer science and in fixed and mobile communications networks. I attended the University of Colorado from 1974 to 1980, during which I earned a Bachelor of Science (B.S.) and a Master of Science (M.S.) in applied mathematics with a minor in electrical engineering. I attended the Polytechnic Institute of New York between 1982 and 1988, during which I earned a Doctor of Philosophy (Ph.D.) in electrical engineering, with a minor in applied mathematics. My Ph.D. thesis was titled “Topological Properties and Design of Multihop Packet Radio Networks.” While pursuing my Ph.D.

(Ex. 1002 (Kakaes), ¶13.)

- AREAS OF EXPERTISE**
- All aspects of fixed and mobile communications. Over the years, my emphasis has been both in breadth and in depth, originally in fixed communications networks and then in mobile communications. Specific areas of in-depth expertise include:
- NR/5G, LTE/LTE-Advanced and evolution issues of 3G to 4G and 5G
 - UMTS, including FDD, TDD, HSDPA/HSUPA, HSPA+, both air interface (UTRA) and Radio Access Network (RAN) as well as Core Network (CN) technologies
 - GSM, GPRS, EDGE (EGPRS) and related evolutionary problems and solutions
 - cdma2000 family from IS-95, through its evolution to 1x, 3x, 1xEV-DO (HDR), 1xEV-DV (all aspects of the evolution to “3G” and beyond)
 - Wired and Wireless Local Area Networks (LAN) including all variants of IEEE 802.11 (WiFi)
 - Metropolitan Area Networks (MAN), and Personal Area Networks (PAN) technologies, Paging networks, Ad hoc networks, including IEEE 802.16 (WiMAX), HIPERLAN, Bluetooth, Near Field Communications, IrDA (Infrared Data Association) operating with any of the available access technologies
 - North American TDMA and IS-54/IS-136
 - IMS, SIP, and VoIP (Voice over IP), including VoIP over LTE
 - TETRA
 - iDEN™
 - Core Network technologies, IS-41, SS7, ATM, MAP, SAE, etc.
 - Design and implementation of voice and data networking (circuit switching as well as all the evolving all IP-based technologies)
 - Traffic engineering and network design; both air interface aspects (including resource allocation, QoS, MAC protocol, etc.) and design of core network, both user plane and control plane

(Ex. 1002 (Kakaes), App. A.)