IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GODO KAISHA IP BRIDGE 1,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Civ. No. 15-634-SLR
	)	
TCL COMMUNICATION TECHNOLOGY HOLDINGS LIMITED, a Chinese Corporation, TCT MOBILE LIMITED, a Hong Kong Corporation, TCT MOBILE (US), INC., a Delaware Corporation and TCT MOBILE, INC., a Delaware Corporation,	)	
	)	
Defendants.	)	

MEMORANDUM ORDER

At Wilmington this 19th day of April, 2017, having heard argument on, and having reviewed the papers submitted in connection with, the parties' proposed claim construction;

IT IS ORDERED that the disputed claim language of U.S. Patent Nos. 7,373,295 ("the '295 patent"), 8,351,538 ("the '538 patent"), and 8,385,239 ("the '239 patent") shall be construed consistent with the tenets of claim construction set forth by the United States Court of Appeals for the Federal Circuit in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005), as follows:

1. **"Pulse vector:"**[1] "A sequence of electrical pulses." The specification explains that the pulse vector generator generates "[pulse] vectors . . . each having a signed unit pulse[2] [] provided to one element on a vector axis." ('295 patent, 6:28-30) With reference to table 1, the specification describes a rule for generating pulse vectors with pulses located according to a position vector.[3] (*Id.*, 6:46-49, table 1)

2. **"Pulse vector generator:"**[4] § 112, ¶ 6 applies. Indefinite. When claim language does not employ the word "means," the presumption is that § 112, ¶ 6 does not apply. *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015). However, "the presumption can be overcome and § 112, ¶ 6 will apply if the challenger demonstrates that the claim term fails to recite sufficiently definite structure or else

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[1] Found in '295 patent, claims 1-4.

[2] The specification recites a "unit pulse," but does not explain what it is, or what units of measure are used to define it. The specification does not clarify whether the "unit pulse" refers to the magnitude of the vector or to the magnitude of an individual number in the n-tuple of the vector. Plaintiff argued that the equation (col 7:15-38) defines "a pulse vector as having a single pulse." (D.I. 109 at 5) The declaration of plaintiff's expert, Paul Min, PhD ("Dr. Min"), at ¶ 50 as cited does not support this assertion. (D.I. 111, ¶ 50) The parties agreed that the pulse vector represents a sequence of electrical pulses.

[3] Plaintiff proposed "a vector with at least one pulse" and argued that there only needs to be a single pulse in a pulse vector. However, Dr. Min explained that the pulse vector generator "outputs pulse vectors in accordance with a rule for specifying the pulse positions and whether those pulses are positive or negative." (D.I. 111, ¶ 53) Figure 3 shows the pulse vectors as having either positive or negative values at each "pulse position candidate," so according to the specification and Dr. Min's explanation, the pulse vector cannot have zero values at any of the specified pulse positions. Plaintiff did not explain how Dr. Min's opinion reconciles with plaintiff's proposed construction.

[4] Found in '295 patent, claims 1-4.

recites function without reciting sufficient structure for performing that function." *Id.* (citations omitted) (internal quotation marks omitted). Claim 1 recites:

> A dispersed pulse vector generator used for a speech coder/decoder, comprising:
>
> a pulse vector generator configured to generate a pulse vector having a signed unit pulse;
>
> a dispersion pattern storage configured to store a plurality of fixed dispersion patterns;
>
> a dispersion pattern selector configured to determine a selected dispersion pattern of the plurality of fixed dispersion patterns with reference to an adaptive codebook gain; and
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> a dispersed pulse vector generator configured to generate a dispersed pulse vector by convoluting the pulse vector and the selected dispersion pattern;
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> the dispersion pattern selector comprising;
>
> a first selector that pre-selects dispersion patterns of the plurality of fixed dispersion patterns; and
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> a second selector that determines the selected dispersion pattern, of the pre-selected dispersion patterns, to be convoluted with the pulse vector.

('295 patent, 28:16-34) The "dispersed pulse vector generator" comprises (among other things) "a pulse vector generator" and "a dispersed pulse vector generator;" therefore, the "pulse vector generator" term is central to the construction of claim 1. Plaintiff argued that no construction is necessary for "pulse vector generator," because "the prefix 'pulse vector' imparts [sufficiently definite] structure to the term 'generator'" and that § 112, ¶ 6 does not apply. (D.I. 109 at 5) Plaintiff contended that "the specification describes a pulse vector generator's structure by 'describing the claim limitation's operation, such as its input, output, or connections.'" (*Id.*, citing *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1299 (Fed. Cir. 2014)) Defendants' expert, Nikil Jayant, PhD ("Dr. Jayant"), opined that § 112, ¶ 6 applies, because the specification "does not disclose any type of structure, neither physical component nor a software algorithm, for generating a pulse vector." (D.I. 131, ¶ 52)

3. The specification discloses that the "pulse vector generator" generates pulse vectors. (*See, e.g.*, '295 patent, 6:26-30; 6:46-49; 7:6-9; figure 3, box 101; figure 4, box 216; figure 5, box 312; figure 6, box 416; and figure 7, box 516) Tables 1 and 2 identify the "pulse position candidates" for various channels. For example, table 1 shows channel 1 as having pulse position candidates in the form of an eight-tuple; however, the pulse position candidates for channels 2 and 3 are shown as a matrix having two rows and eight columns. ('295 patent, 6:51-62) The court notes that, aside from general boxes in "functional block diagram[s]," the specification does not identify any physical structure associated with the "pulse vector generator," nor does the specification discuss software, processors, or computers of any kind.[5] Plaintiff contended that *Apple v. Motorola* applies, but Dr. Min did not express an opinion whether the '295 patent discloses a computer implemented invention or whether a "pulse vector generator" would be implemented in software in the first place. The Federal Circuit has explained that:

> "Structure" to a person of ordinary skill in the art of computer-implemented inventions may differ from more traditional, mechanical structure. . . . the "structure" of computer software is understood through, for example, an outline of an algorithm, a flowchart, or a specific set of instructions or rules. . . . Structure may also be provided by describing the claim limitation's operation, such as its input, output, or connections. The limitation's operation is more than just its function; it is how the function is achieved in the context of the invention.

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[5] Plaintiff did not argue that a physical structure was identified. The specification does mention "memory" and "switches" with reference to the "dispersion pattern storage and selection" functional box. ('295 patent, figure 3, item 102) While plaintiff's expert explained that these are computer memory and (ostensibly) electrical switches, nothing in the specification says one way or another.

Apple, 757 F.3d at 1298-99.[6] Plaintiff argued the latter, relying on Dr. Min's opinion that the structure of the "pulse vector generator" is found in its "input, output, or connections." (D.I. 111 at ¶ 53) In response, Dr. Jayant pointed out that:

> For example, tables 1 and 2 show that the positions of pulses within the pulse vectors may be reflective of an algebraic codebook table. ('295 Patent, 6:50-63, 27:38-47) However, the specification does not disclose **how** those pulse vectors are generated, nor does it disclose **what**, other than the amorphous "pulse vector generator," generates those pulse vectors. For example, the specification does not disclose whether a pulse vector generator outputs stored pulse vectors in response to various inputs, or whether a pulse vector generator synthesizes and outputs pulse vectors in real-time.

(D.I. 131 at ¶ 53 (emphasis in original)) The specification explains "operation of the . . . excitation vector generator," but the explanation of the operation of the "pulse vector generator" is conclusory: "the pulse vector generator 101 algebraically generates the signed pulse vectors corresponding to the number of channels (three in this embodiment) in accordance with the rule described in table 1." ('295 patent, 7:6-9; *see also id.*, 6:46-49; 9:3-8)

4. Table 1, as discussed above, shows where the pulses may be placed in a given vector or matrix, but the specification does not explain the "algebraic" process by which the pulse vector is generated.[7] Column 7 of the specification discusses various

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[6] The applicability of many of the cases cited by plaintiff depends on this critical (but unestablished) fact. If this invention is implemented on a computer, and the "pulse vector generator" is a function defined primarily in software, then the case law provides an avenue for establishing the applicability of § 112, ¶ 6, determining whether sufficient corresponding structure has been identified, and for evaluating definiteness under § 112, ¶ 2. It is worth noting, however, that if a person having ordinary skill in the art would expect the pulse vector generator to be implemented in hardware (e.g. electronic circuitry), then such structures would need to be identified.

[7] At oral argument, plaintiff's counsel displayed a slide and explained that:

> The next portion of the table [1] says, you need to indicate where the pulse position is, and it indicates here, for example, Channel 1, the pulse position candidates are 0, 10, 20, 30, and up to 70. One of ordinary skill in the art can

relationships involved in generating the excitation vector in the first embodiment, including a vector di, which is the "signed pulse vector for channel i." (*Id.*, 7:32) In the first embodiment, the vector di may be a potential output from the pulse vector generator as identified by a mathematical relationship: "$di = \pm\delta(n - pi),\ n = 0 - L - 1$" where an input, "$pi$ [, is the] signed pulse vector candidate for channel i." (*Id.* at 7:32-34) The specification does not explain whether this is an algebraic relationship employed by the pulse vector generator. (*Id.* at 7:10-57) Plaintiff's expert, Dr. Min, explained that $\pm\delta$ "is the pulse polarity" and that "pi is the pulse position candidate for channel i . . . as shown in table 1."[8] (D.I. 138 at ¶ 8) Drawing upon the second embodiment, which discloses "a CELP speech coder,"[9] Dr. Min opined that the "combination index for pulse vectors"[10] is the input for the pulse vector generator. (D.I. 138 at ¶ 5 (citing '295 patent, 10:1-5; 8:58-59)) The second embodiment builds on the first, "this embodiment applies the excitation vector generator explained in the first embodiment to the random codebook of the CELP speech encoder of [figure] 1." ('295

> understand that you can convert that position and interpret it in bit format. You see on the right-hand side her[e], it's very simple. Position 0 could be converted into 000. Position 10 could be converted into 0001. And so this, your Honor, is the algorithm.

(D.I. 233 at 31 (citing plaintiff's demonstrative slide 13)) These materials do not reflect the intrinsic record or Dr. Min's opinion. The court declines to consider them.

[8] The specification does not draw this connection between pi and table 1. The court notes that table 1 uses a different notation: "P^1," "P^2," and "P^3," and that P^2 and P^3 refer to matrices and not vectors. Dr. Min does not discuss these differences in either of his reports.

[9] The first embodiment discloses an "excitation vector generator." ('295 patent, 6:16-18) The second embodiment discloses "a CELP speech coder." (*Id.*, 8:37-39) Dr. Min does not explain why these two disclosures should be read together to explain the algebraic function that defines how the pulse vector generator operates in the first embodiment.

[10] This "input" is also described as the "combination index for pulse positions and pulse polarities." ('295 patent, 8:58-59) By definition, the combination index may be related to pi as articulated in the first embodiment.

patent, 8:40-43) However, nothing in the specification suggests that the applicant intended the second embodiment to be read into the first to explain the operation of the example in the first embodiment so as to impart structure to the "pulse vector generator" in the first embodiment. The parties agreed that the specification discloses a pulse vector, but the inputs, outputs, and connections associated with the pulse vector generator are described at a high level without sufficient detail to explain how the pulse vector generator "interacts with other components . . . in a way that might inform the structural character of the limitation-in-question or otherwise impart structure" to the pulse vector generator.[11] *Williamson*, 792 F.3d at 1351. For these reasons, the court concludes that defendants have rebutted the presumption against means-plus-function claiming. Therefore, "pulse vector generator" is governed by § 112, ¶ 6.

5. When § 112, ¶ 6 applies, a "claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112, ¶ 6. "A patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014). Construing a claim under § 112, ¶ 6 "is a two-step process. The court must first identify the claimed function. Then, the court must determine what structure, if any, disclosed in the specification corresponds to the claimed function." *Williamson*, 792 F.3d at 1351. Means-plus-function claim language is indefinite "if a person of ordinary skill in the art

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[11] At best, the specification and Dr. Min provide insight into the mathematical relationships between some of the (possible) inputs into the "pulse vector generator" and some of the (possible) outputs, but none of this information relates to the structure of the "pulse vector generator" itself.

would be unable to recognize the structure in the specification and associate it with the corresponding function in the claim." *Id.* at 1352 (citation omitted).

6. The parties agree that the pulse vector generator performs the function of "generat[ing] a pulse vector having a signed unit pulse." ('295 patent, 28:18-19; D.I. 130 at 7; *see also* D.I. 109 at 6) Dr. Min explained that "a person skilled in the art would associate the[] pulse generation rules [as in tables 1 and 2 and elsewhere in the specification] as the structures corresponding to the recited function." (D.I. 111, ¶ 56) Dr. Jayant opined that "the specification does not disclose corresponding structure for performing . . . [the] function," and that tables 1 and 2 merely "show that the positions of pulses within the pulse vectors may be reflective of an algebraic codebook table" without disclosing how to generate pulse vectors. (D.I. 131, ¶¶ 52-53) In the first embodiment, "the pulse vector generator 101 algebraically generates [three] pulse vectors in accordance with the rule described in table 1." ('295 patent, 6:46-48; *see also id.*, 7:6-9) The specification refers to table 1 as "a pulse generation rule." (*Id.*, 8:22-28; 9:3-8; 9:25; 9:39) The seventh embodiment discloses another set of candidate positions for the pulses: "[t]he five signed unit pulses constituting the random vector have pulses each selected from the candidate positions defined for each of zero to fourth groups shown in table 2." ('295 patent, 27:28-30) Taken together, tables 1 and 2 are rules for where, in vector space, individual pulses may be located; however, neither table 1 nor table 2 describes an algorithm[12] governing the operation of the pulse vector generator.

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[12] The specification discloses algorithms. (*See, e.g.*, '295 patent, 16:46-48, figure 9 ("vector quantization algorithm")) Table 1 is identified as a "rule" and nothing in the record suggests that the applicant intended for the "rule" of table 1 or the "pulse position candidates" of table 2 to disclose an algorithm.

7. Plaintiff argued that "the prefix 'pulse vector' imparts structure to the term 'generator.'" (D.I. 109 at 5) Defendants responded that "[t]he prefix 'pulse vector' does nothing more than restate the specified function of the 'generator.'" (D.I. 143 at 1) "Pulse vector" cannot impart corresponding structure to "generator," because "purely functional language, which simply restates the function associated with the means-plus-function limitation, is insufficient to provide the required corresponding structure." *Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1317 (Fed. Cir. 2012) (citations omitted). Plaintiff responded that "the term is not indefinite because the specification discloses 'a specific set of instructions or rules' for generating pulse vectors."[13] (D.I. 137 at 3, quoting *Apple*, 757 F.3d at 1298) Plaintiff contended that "the specification 'disclose[s] adequate defining structure to render the bounds of the claim understandable to one of ordinary skill in the art.'" (D.I. 137 at 4, quoting *AllVoice Computing PLC v. Nuance Commc'ns, Inc.*, 504 F.3d 1236, 1245 (Fed. Cir. 2007)) *AllVoice Computing* is inapposite, because the specification in *AllVoice* included an algorithm described in a flow chart in figure 8A, and the patentee's expert "set forth several straightforward ways that the algorithm represented in figure 8A could be implemented by one skilled in the art using well-known features of the Windows operating system."[14] *AllVoice Computing*, 504 F.3d at 1345. Plaintiff argued that "a person of ordinary skill in the art[15] would have been

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[13] This citation to *Apple* relates to the question of whether § 112, ¶ 6 applies and not to whether "a specific set of instructions or rules" can provide sufficient corresponding structure to avoid indefiniteness.

[14] It is not clear that the invention of the '295 patent is implemented in software. In its reply brief, plaintiff argued (by analogy to *Apple*, 757 F.3d 1286) that "a 'pulse vector generator' is a [computer software] algorithm." (D.I. 137 at 2) However, the specification does not mention computers, processors, or software. Dr. Min opined that "memory" is computer memory and that "switch" is either an electrical component or something implemented in software. (D.I. 111, ¶¶ 64-74) Dr. Jayant disagreed. (D.I. 131, ¶ 66)

[15] The parties agreed that a person having ordinary skill in the art "would have had at least the equivalent of a master's degree in electrical engineering or related discipline,

familiar with algebraic codebook tables, such as the ones in tables 1 and 2, and understood how a pulse vector generator inserts a non-zero number representing a pulse into at least one of the pulse position candidates shown in the tables." (D.I. 137 at 3 (citing D.I. 138, ¶¶ 6-9)) Defendants argued that plaintiff cannot "rely on the knowledge of one of skill in the art to compensate for the lack of disclosure in the '295 patent itself." (D.I. 143 at 3 & n.2, citing *Function Media, LLC v. Google, Inc.*, 708 F.3d 1310, 1319 (Fed. Cir. 2013); *Aristocrat Techs. Australia Pty Ltd. v. Int'l Game Tech.*, 521 F.3d 1328, 1336-37 (Fed. Cir. 2008)) The Court in *Aristocrat* distinguished *AllVoice Computing* and explained that "[t]he question [] is not whether the algorithm that was disclosed was described with sufficient specificity, but whether an algorithm was disclosed at all." *Aristocrat*, 521 F.3d at 1337. The *Aristocrat* court explained that

> the proper inquiry for purposes of § 112, ¶ 6 analysis is to look at the disclosure of the patent and determine if one of skill in the art would have understood that disclosure to encompass software to perform the function and been able to implement such a program, not simply whether one of skill in the art would have been able to write such a software program.

Id. (citations and quotations omitted). Dr. Min did not explain that the '295 patent discloses software, nor did he express the opinion that a person having ordinary skill in the art would recognize tables 1 and 2 as disclosing computer-implemented algorithms. Instead, Dr. Min opined that "the term 'pulse vector generator' connotes an algorithm," and that "a person of ordinary skill would understand [mathematically] how a pulse vector generator generates pulse vectors."[16] (D.I. 111, ¶ 54; D.I. 138, ¶ 5) In light of

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or at least [three] years of practical or research experience in the field of digital signal processing for speech or audio applications." (D.I. 131, ¶ 36; D.I. 111, ¶ 46)

[16] *See Blackboard, Inc. v. Desire2Learn, Inc.*, 574 F.3d 1371, 1385 (Fed. Cir. 2009) ("A patentee cannot avoid providing specificity as to structure simply because someone of ordinary skill in the art would be able to devise a means to perform the claimed function. To allow that form of claiming under § 112, ¶ 6, would allow the patentee to claim all possible means of achieving a function.").

Aristocrat, the distinction here is between understanding the mathematical operation involved in calculating a pulse vector and understanding the patent specification as describing software to perform the function (and being able to program a computer to perform the function) associated with the pulse vector generator. Based upon the extrinsic record at hand, Dr. Min has established the former and not the latter.[17] Under § 112, ¶ 6, the term "pulse vector generator" lacks sufficient disclosure of structure and, therefore, is indefinite under § 112, ¶ 2, because it "fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus*, 134 S. Ct. at 2124.

8. **"Dispersion pattern storage:"**[18] "Memory for storing dispersion patterns." Section 112, ¶ 6 does not apply.[19] Not indefinite. The specification discloses that "[a] memory stores at least one type of dispersion pattern for each of the channels."[20] ('295 patent, abstract; figure 3, items 102, M1, M2, and M3)

9. **"Dispersion pattern selector:"**[21] "Switch for selecting a dispersion pattern." Section 112, ¶ 6 does not apply.[22] Not indefinite. The specification recites sufficiently definite structure. For example, figure 3 discloses "a dispersion pattern storing and

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[17] There is no evidence in the record that a person having ordinary skill in the art would also be able to program the software necessary to create a computer-implemented "pulse vector generator," if such a structure were implemented on computer.

[18] Found in '295 patent, claims 1 and 3.

[19] In order to rebut the presumption that § 112, ¶ 6 does not apply, defendants carry the burden to demonstrate "that the claim term fails to 'recite sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Williamson*, 792 F.3d at 1349 (citations omitted). Defendants failed to rebut the presumption.

[20] Dr. Min explained that a person having ordinary skill in the art would recognize "dispersion pattern storage" as "memory." (D.I. 111, ¶¶ 60-63)

[21] Found in '295 patent, claim 1.

[22] *See supra* note 19.

selecting section 102 having dispersion pattern storing sections and switches." ('295 patent, 6:20-22; *see also* figure 3, items 102, SW1, SW2, and SW3; 6:31-37; 6:66-7:5; 8:66-9:3; 11:31-41; 11:50-57; and 12:44-13:2) **Extrinsic evidence:** Dr. Min explained that figure 3 "graphically represents a switch that selects a dispersion pattern from multiple dispersion patterns" and that a person of ordinary skill in the art would recognize that the selector is a switch. (D.I. 111, ¶ 64-66)

10. **"A first selector:"**[23] Section 112, ¶ 6 does not apply.[24] Not indefinite. Claim 1 recites "a first selector that pre-selects dispersion patterns of the plurality of fixed dispersion patterns." ('295 patent, 28:30-31) Figure 3 discloses "a dispersion pattern storing and selecting section 102 having dispersion pattern storing sections and switches." ('295 patent, 6:20-22; *see also* figure 3, items 102, SW1, SW2, and SW3) The "switches SW1 to SW2 [are] for selecting one kind of dispersion pattern from M kinds of dispersion patterns stored in the respective storing sections M1 to M3." ('295 patent, 6:34-37) Moreover, "in the CELP speech coder using the excitation vector generator of the first embodiment in the random codebook, a **pre-selection** for dispersion patterns stored in the dispersion pattern storing and selecting section is carried out . . . before searching the index of random codebook." ('295 patent, 11:52-57 (emphasis added)) While the specification does not identify which specific switch is the first selector, the specification discloses an algorithm for the operation of the first selector:

> [W]hen the adaptive codebook gain is larger than the threshold value as a result of the comparison, the control signal provides an instruction to

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[23] Found in '295 patent, claim 1.

[24] Dr. Min opined that "a first selector" would be understood by a person having ordinary skill in the art as "a first switch." (D.I. 111, ¶ 64) Dr. Jayant explained "that the terms "dispersion pattern selector," "a first selector," and "a second selector" (i.e., "the 'selector' elements") are not understood by persons of ordinary skill in the art to have sufficiently definite meanings as the names for structure." (D.I. 131, ¶ 63)

> select the dispersion pattern obtained by the pre-training to reduce the quantization distortion in vector quantization processing for random excitations. Also, when the adaptive code gain is not larger than the threshold value as a result of the comparison, the control signal provides an instruction to carry out the pre-selection for the dispersion pattern different from the dispersion pattern obtained from the result of the pretraining.

('295 patent, 12:49-59) For these reasons, § 112, ¶ 6 does not apply. *See Williamson*, 792 F.3d at 1349.

11. **"A second selector:"**[25] Section 112, ¶ 6 applies. Indefinite. Claim 1 recites "a second selector that determines the selected dispersion pattern, of the pre-selected dispersion patterns, to be convoluted with the pulse vector." ('295 patent, 28:32-34) The specification explains that "[t]he pulse vector dispersion section 103 performs convolution of the pulse vectors output from the pulse vector generator and the dispersion patterns output from the dispersion pattern storing and selecting section 102 in every channel so as to generate N dispersed vectors." ('295 patent, 6:38-43) The specification does not mention "a second selector," and the specification contains no algorithms describing the operation of "a second selector."[26] Therefore, § 112, ¶ 6 applies. *See Williamson*, 792 F.3d at 1349.

12. Construing a claim under § 112, ¶ 6 "is a two-step process. The court must first identify the claimed function. Then, the court must determine what structure, if any, disclosed in the specification corresponds to the claimed function." *Williamson*, 792 F.3d at 1351. Means-plus-function claim language is indefinite "if a person of ordinary

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[25] Found in '295 patent, claim 1.

[26] Plaintiff argued that the specification "describes that each switch in figure 3 can be replaced with two switches—a first switch for pre-selecting one group of dispersion patterns, and a second switch for selecting from the pre-selected group a dispersion pattern with a certain index." (D.I. 109 at 11-12 (citing '295 patent, 11:50-57)) The cited passage does not identify any structures, nor does it discuss the function associated with "a second selector" as described in the claims.

skill in the art would be unable to recognize the structure in the specification and associate it with the corresponding function in the claim." *Id.* at 1352 (citation omitted). The function of "a second selector," under § 112, ¶ 6, is "determin[ing] the selected dispersion pattern, of the pre-selected dispersion patterns, to be convoluted with the pulse vector." The structural relationships are described as follows:

> The pulse vector dispersion section 103 performs convolution of the pulse vectors output from the pulse vector generator 101 and the dispersion patterns output from the dispersion pattern storing and selecting section 102 in every channel so as to generate N dispersed vectors.

('295 patent, 6:38-42) A "second selector" is located somewhere within the "dispersion pattern storing and selecting section 102" in the functional block diagram, figure 3. However, the specification does not identify a structure corresponding to "a second selector" within the dispersion pattern storing and selecting section. Plaintiff did not identify how "a second selector" "determines the selected dispersion pattern," and Dr. Min's declarations provided no additional insight. (D.I. 111, ¶¶ 64-74; D.I. 138, ¶¶ 14-15) For these reasons, "a second selector" as construed under § 112, ¶ 6 is indefinite under § 112, ¶ 2.

13. **"An arranging unit:"**[27] "Circuitry or a combination of circuitry and software that operates to insert signals into symbols of a CQI transmission slot." Section 112, ¶ 6 does not apply.[28] Not indefinite. Claim 9 recites:

> A radio communication apparatus comprising:
>
> . . . .
>
> an arranging unit configured to arrange two reference signals (RS), which are produced by multiplying two reference signal sequences with values having opposite phases from each other, in the Nth symbol and the Mth symbol of a CQI signals transmission slot, and to arrange channel quality indicator (CQI)

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[27] Found in '538 patent, claims 9 and 14.

[28] *See supra* note 19.

> signals in symbols of the CQI signals transmission slot other than the Nth symbol and the Mth symbol, . . .

('538 patent, 18:60-19:17) The claim language itself provides sufficiently definite structure for "an arranging unit" "by describing the claim limitation's operation, such as its input, output, or connections." *Apple*, 757 F.3d at 1299. The specification, with reference to figures 5 and 8-11, also demonstrates the input, output, or connections associated with the "arranging unit." Defendants have failed to rebut the presumption that § 112, ¶ 6 does not apply.[29]

14. **"Format for transmitting an ACK/NACK signal:"**[30] "A first slot structure for transmitting an ACK/NACK signal." Claim 10 depends on claim 9, which recites:

> A radio communication apparatus comprising:
>
> . . . .
>
> a transmitting unit configured to transmit the spread ACK/NACK signal in the ACK/NACK signal transmission slot;
>
> an arranging unit configured to arrange two reference signals (RS), which are produced by multiplying two reference signal sequences with values having opposite phases from each other, in the Nth symbol and the Mth symbol of a CQI signals transmission slot, and to arrange channel quality indicator (CQI) signals in symbols of the CQI signals transmission slot other than the Nth symbol and the Mth symbol, . . .

('538 patent, 18:60-19:15) The slot structure associated with the ACK/NACK signal is disclosed in claim 9 and in the specification. ('538 patent, 19:5-6; figures 1, 8, 9, 10, and 11) Claims 9 and 10 are not limited to the transmission of a reference signal in the ACK/NACK signal transmission slot.[31] For example, claim 10 distinguishes between

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[29] Defendants relied solely on the application of § 112, ¶ 6 as their basis for indefiniteness. (*See* D.I. 130 at 21-23; D.I. 143 at 11)

[30] Found in '538 patent, claim 10.

[31] The parties argued the construction of claims 10 and 15 together. Plaintiff had proposed "a slot structure for transmitting an ACK/NACK signal and a reference signal." (D.I. 102 at 7) Neither party addressed the differences between these two claims as it relates to the inclusion of a reference signal in the ACK/NACK signal. Plaintiff

"the spread ACK/NACK signal in the ACK/NACK signal transmission slot" and "the reference signals (RS) and the CQI signals arranged in the CQI signals transmission slot." ('538 patent, 19:21-24)

15. **"Format for transmitting an ACK/NACK signal:"**[32] "A first slot structure for transmitting an ACK/NACK signal and a reference signal." Claim 15 depends on claim 14, which recites:

> A radio communication apparatus comprising:
>
> . . . .
>
> an arranging unit configured to arrange the spread ACK/NACK signal in the 1st, 2nd, 6th and 7th symbols of the ACK/NACK signal transmission slot and to arrange first reference signals (1st RS) in 3rd, 4th and 5th symbols of the ACK/NACK signal transmission slot; and
>
> a transmitting unit configured to transmit the ACK/NACK signal and the first reference signals (1st RS) arranged in the ACK/NACK signal transmission slot, . . .

('538 patent, 20:1-21) This specific slot structure associated with the ACK/NACK signal is disclosed in claim 14 and in the specification. ('538 patent, 20:14-18; figures 1, 8, 9, 10, and 11) Claim 14 includes the limitation that the ACK/NACK signal transmission slot includes symbol positions for a reference signal. Claim 15 recites:

> The radio communication apparatus according to claim 14, wherein
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> the transmitting unit transmits the ACK/NACK signal and the first reference signals (1st RS) arranged in the ACK/NACK signal

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contended that the specification explicitly includes "'reference signal[s]' in the ACK/NACK and CQI formats." (D.I. 109 at 24) Plaintiff clarified that "**all** of the embodiments of the '538 patent discuss the reference signals, as their positions are critical to the claimed invention." (D.I. 137 at 12 (emphasis in original)) Defendants responded that the intrinsic record provides "no evidence of a 'clear intention' to include . . . [the reference signal] limitations in the meaning of 'format'" and that it is improper to import the "slot structure" limitation into the claims. (D.I. 130 at 24-25) As discussed herein, the differing limitations of claims 10 and 15 support different constructions of the relevant terms.

[32] Found in '538 patent, claim 15.

> transmission slot or the second reference signals (2nd RS) and the CQI signals arranged in the CQI signals transmission slot using a physical resource that supports a mixture of a format for transmitting an ACK/NACK signal and a format for transmitting CQI signals.

('538 patent, 20:32-41) Claim 15 includes the limitation that the ACK/NACK signal is transmitted with the first reference signals.

16. **"Format for transmitting CQI signals:"**[33] "A second slot structure for transmitting the CQI signals and the reference signals." ***"Format for transmitting CQI signals:"***[34] "A second slot structure for transmitting the CQI signal and the second reference signals." A slot structure is described in the claims and the specification. ('538 patent, 19:10-14; 19:23-24; 20:22-32; 20:37-38; figures 5, 8, 9, 10, 11, and 16) In claim 10, reference signals and CQI signals are arranged and transmitted in the "CQI signals transmission slot." ('538 patent, 19:15-17; 19:23-24) Claim 15 (including the second reference signals) is similarly limited. ('538 patent, 20:22-29; 20:36-38)

17. **"A physical resource that supports a mixture of a format for transmitting an ACK/NACK signal and a format for transmitting CQI signals:"**[35] "A physical resource that supports transmitting, at the same time, a first slot structure for transmitting the spread ACK/NACK signal, and a second slot structure for transmitting the CQI signals and the reference signals." **"A physical resource that supports a mixture of a format for transmitting an ACK/NACK signal and a format for transmitting CQI signals:"**[36] "A physical resource that supports transmitting, at the same time, a first slot structure for transmitting an ACK/NACK signal and the first

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[33] Found in '538 patent, claim 10.

[34] Found in '538 patent, claim 15.

[35] Found in '538 patent, claim 10.

[36] Found in '538 patent, claim 15.

reference signals, and a second slot structure for transmitting the CQI signals and the second reference signals." The ACK/NACK signal transmission slot and the CQI signals transmission slot are transmitted at the same time. Plaintiff argued that the construction of "mixture" "incorporates the limitation that the formats must be sent 'at the same time.'" (D.I. 109 at 24) Defendants' expert, Dr. Stephen B. Wicker ("Dr. Wicker"), opined that "[r]esource blocks are made up of multiple resource elements, not all of which are transmitted simultaneously. Each symbol within a single slot is transmitted consecutively. Two signals can be transmitted in those symbols within the same resource block, but sent consecutively, rather than simultaneously." (D.I.133, ¶ 65) Based upon this explanation, defendants contended that the ACK/NACK signal and the CQI signals can be sent "at different times." (D.I. 130 at 25)

18. The specification discusses the background art in which the "ACK/NACK signal is transmitted to the base station using an uplink control channel such as a PUCCH ('Physical Uplink Control Channel')." ('538 patent, 1:22-24) It is possible "to "code-multiplex ACK/NACK signals from a plurality of mobile stations by spreading using ZC (Zadoff-Chu) sequences and Walsh sequences."[37] ('538 patent, 1:46-49) The specification identifies the problem to be solved as: "in a PUCCH of [the] 3GPP LTE [specification], not only the above-described ACK/NACK signals but also CQI (Channel Quality Indicator) signals are multiplexed." ('538 patent, 3:24-26) However, "Walsh sequences are not applicable to CQI signals and therefore the Walsh sequences cannot be used to separate an ACK/NACK signal and CQI signal," but it is possible to separate these signals with "little inter-code interference" by using ZC sequences to despread an ACK/NACK signal and CQI signal spread using ZC sequences associated with different cyclic shifts." ('538 patent, 3:32-40) The specification explains that, "when despreading

[37] The court notes that code-division multiplexing is a method of multiplexing signals that are sent at the same time.

is performed using ZC sequences to separate a CQI signal from an ACK/NACK signal, a little inter-code interference from the ACK/NACK signal remains." ('538 patent, 3:47-50) Specifically, with respect to reference signals ("RS"):

> As shown from FIG. 1 and FIG. 5, an ACK/NACK signal and CQI signal employ different signal formats and their RSs are defined in different positions (that is, the positions of these RS are optimized independently in case where only an ACK/NACK signal is received and in case where only a CQI signal is received). Therefore, there is a problem that the amount of interference from an ACK/NACK signal to RSs of a CQI signal varies depending on the content of data of the ACK/NACK signal or the phases of W 1 and W 2 used for the ACK/NACK signal. That is to say, even though RSs are important portions for receiving a CQI signal, there is a possibility that the amount of interference in these RSs cannot be predicted, thereby deteriorating CQI receiving performance.

('538 patent, 3:50-63) This interference is the result of transmitting the two signals (ACK/NACK and CQI) at the same time. According to the specification, the solution to this interference involves "add[ing] a phase according to part of the orthogonal sequence [used to spread the ACK/NACK signal], to a reference signal of a channel quality indicator signal including the reference signal to which the phase is added." ('538 patent, 4:11-17) In claims 9 and 14, the "arranging unit" adds this phase to the reference signals transmitted in the CQI signals transmission slot. ('538 patent, 19:7-14; 20:14-18; 20:22-29) Nothing in the specification or the claims suggests that, within the scope of claims 10 and 15, the ACK/NACK signal transmission slot and the CQI signals transmission slot are transmitted sequentially or at different times.[38]

19. **"Multiplexing the aperiodic channel quality indicator report, with data:"**[39] "Multiplexing the aperiodic channel quality indicator report with user data."

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[38] The specification mentions that there are situations where the ACK/NACK signal and the CQI signals are transmitted at different times, but the problem the '538 patent seeks to solve is what happens when these two signals are transmitted at the same time.

[39] Found in '239 patent, claim 8.

"Without multiplexing the aperiodic channel quality indicator report with data:"[40] "Without multiplexing the aperiodic channel quality indicator report with user data." The mobile station ("MS") or user equipment ("UE") transmits a "channel quality indicator" ("CQI") report to the base station. ('239 patent, 1:20-21; 9:30-32) Based upon the quality of channel, the aperiodic CQI may be transmitted from the UE to the base station with or "without multiplexing with user data."[41] ('239 patent, 10:56-61)

20. The court has provided a construction in quotes for the claim limitations at issue. The parties are expected to present the claim construction consistently with any explanation or clarification herein provided by the court, even if such language is not included within the quotes.

Senior United States District Judge

[40] Found in '239 patent, claim 8.

[41] The specification states that "in case a data buffer at the UE is non-empty, **user data** and CQI are multiplexed with each other." ('239 patent, 8:43-44 (emphasis added)) "It is desirable to define a control signaling scheme . . . , wherein the [aperiodic CQI] report only contains CQI information, i.e. without multiplexing the CQI information with Uplink Shared Channel data." ('239 patent, 9:30-34) "One main aspect of the invention is to use a selected transport format for CQI report in a predetermined reporting mode just in selected conditions. More generally, a control channel signal from a base station to a terminal is defined, which comprises a selected transport format, which is to be used by the terminal for **user data** transmission to the base station." ('239 patent, 9:49-54 (emphasis added))