

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., AND
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioner,

v.

APEX BEAM TECHNOLOGIES LLC,

Patent Owner.

Case No. IPR2023-00571
U.S. Patent No. 10,951,271

PETITIONER'S REPLY

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I. Introduction

Patent Owner Apex's Response, Paper 14 ("POR"), substantively disputes only two limitations of claim 1 of the '271 Patent: "wherein, K antenna port groups of the base station are used to transmit the first wireless signal" ([1d1]),¹ POR 20-24, and "a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values" ([1d5]), POR 27-29. Both disputes rely on Apex's improper claim constructions, POR 11-18, which are unduly narrow and contradicted by the '271 Patent.

Once Apex's improper constructions are rejected, it proffers no other rebuttals to the Petition's showing that claims 1-20 are obvious based on *Liu* and *Park*. Apex's remaining disputes merely refer back to its arguments for [1d1] and [1d5], and thus fail for the same reasons. *See* POR 25-27, 29-30 (claim 1), 30-31 (claims 2-20).

Notwithstanding Apex's incorrect positions, the Board does not need to construe either [1d1] or [1d5] because the prior art teaches the examples described in the '271 Patent. Furthermore, no construction is necessary because *Liu* and *Park* disclose or render obvious Apex's constructions.

¹ Petitioner maintains the Petition's element numbering for ease of reference. Paper 10, Decision on Institution, 19 n.12 ("D.I.").

The Board should hold unpatentable and cancel claims 1-20.

II. Claim Construction

Apex's constructions should be rejected because they are contrary to the claim language and the '271 Patent's disclosure.

A. **"K antenna port groups of the base station are used to transmit the first wireless signal" ([1d1])**

Apex proposes construing [1d1] to mean "K groups of antenna ports of the base station are used to collectively transmit the first wireless signal." POR 11 (citation omitted). The construction is wrong and alters the claim language in two ways. First, it rearranges "K antenna port groups" to "K groups of antenna ports," requiring more than one group *and* more than one port per group, which is contrary to the specification's disclosure that an "antenna port group[]" may have only one antenna port. Second, it adds "collectively," which does not clarify the claim language and instead adds confusion.

The POR fails to explain why [1d1] requires construction and does not point to specification support, except where it merely repeats the claim language, which does not support either construing the term or Apex's construction. *See* POR 13-14. Apex instead uses extrinsic dictionary definitions (Ex. 2006) to allege a "plain language" construction that contradicts the specification's disclosure, which is improper. *Eon Corp. IP Holdings v. Silver Spring Networks, Inc.*, 815 F.3d 1314,

1320-21 (Fed. Cir. 2016); *Profectus Tech. LLC v. Huawei Techs. Co.*, 823 F.3d 1375, 1380 (Fed. Cir. 2016) (extrinsic evidence may not be used to contradict intrinsic record); *Seabed Geosols. (US) Inc. v. Magseis FF LLC*, 8 F.4th 1285, 1287 (Fed. Cir. 2021) (same).

Apex uses this dictionary to allege that a “group” must be a “*collection*” and that “antenna port groups are ‘more than one antenna port group.’” POR 12 (quoting Ex. 2006, 325). Apex’s construction makes *both* “groups” and “ports” plural, contrary to the claim language where “antenna port groups” has one *single* plural noun (“groups”), meaning more than one group. *Id.*² Apex’s construction is also contradicted by the ’271 Patent, which states that “[i]n one embodiment, the antenna port group is composed of *one antenna port*.” Ex. 1001, 2:45-46, 13:64-65 (emphasis added).³

Apex’s construction also adds “collectively,” which injects ambiguity and is not supported by the specification. Apex argues that “[s]ince the claimed ‘first

² Apex asserts that “[c]laim 1 requires at least 2 antenna port groups,” POR 12-13, but that is undisputed because “K is ... greater than 1.” Ex. 1001, 27:26-27.

³ Apex does not address the specification’s “one antenna port” language, as requested by the Board. D.I. 14-15, 15 n.10 (quoting Ex. 1001, 13:64-65); *see* POR 11-14.

wireless signal’ is transmitted by at least 2 groups of antennas, a [POSITA] would understand that the claimed first wireless signal is not transmitted by each group separately, but rather transmitted by the K groups collectively.” POR 13. But Apex does not cite support from the specification or explain what “collectively” means. *See generally* POR.

Apex’s extrinsic evidence also does not support adding “collectively.” The dictionary definitions, at most, define “group” outside of the context of the ’271 Patent, but say nothing about whether a “group” must “collectively” perform an action. Apex’s citation to Petitioner’s expert, POR 12-13 (citation omitted), relates only to the number of port groups, not whether the first wireless signal must be “collectively” transmitted by them. Apex’s own expert’s testimony is conclusory and does not explain or justify adding “collectively” because it relies solely on the same deficient evidence.

“Collectively” also injects ambiguity and confusion into the claim, making it improper. *See O2 Micro Int’l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1360 (Fed. Cir. 2008) (claim construction should provide clarity, not confusion). Apex’s own expert could not explain what “collectively” means. In IPR2023-00603, Apex’s expert stated that “collectively” means “[t]ogether.” Ex. 1037, 30:5-6. He then contradicted himself, first saying that “collectively” or “together” means “simultaneously” or “at the same time,” but then that it can be “*similar to* at the

same time”; “treated” or “sent collectively as a unit” (which is circular); or “in the ordinary sense of the word ‘together,’” none of which he could explain. *Id.*, 8:11-20, 32:11-18, 30:7-18 (emphasis added). This testimony confirms that “collectively” would introduce confusion and ambiguity, rendering the construction improper.

Apex’s construction should be rejected. No construction is necessary because [1d1] is readily understandable from its language. *See Hill–Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1374 (Fed. Cir. 2014). Moreover, the Board does not need to construe [1d1] because, as explained below, *Liu* teaches the disclosed embodiments from the ’271 Patent and Apex’s construction. Paper 1, Petition (“Pet.”), 4; *infra* § III.A.3.

B. “proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values” ([1d5])

Apex proposes construing [1d5] to mean “a sequence of K1 proportions, where each of the K1 proportions is a ratio between one channel quality value to itself or to another of the K1 channel quality values.” POR 14. Apex’s construction should be rejected.

Apex’s construction requires “a sequence of K1 proportions,” limiting the sequence to exactly “K1” values. *Id.* This cannot be correct because the claim language does not recite how many proportions the “first proportional sequence”

has. The claim language only says that it “corresponds to a ratio(ratios)” that are “among the K1 channel quality values,” leaving open the possibility that the “first proportional sequence” could also correspond to ratios other than ratios among the K1 channel quality values. Ex. 1001, 27:35-37. In addition, focusing on the number of “K1” values makes no sense because K1 itself can vary so long as it is “a positive integer less than or equal to ... K.” *Id.*, 27:34-35.

Regardless, Apex’s construction also cannot be correct because the claims and specification explain that (1) the sequence can have a number other than exactly K1 values, and (2) the values do not need to be the proportions themselves. Dependent claims 2, 7, 12, and 17 and the specification recite that “the first proportional sequence *comprises* K1 positive real numbers ...” *or* “the first proportional sequence *comprises* K1-1 positive real number(s)” *Id.*, 27:50-52, 27:54-55, 29:1-3, 29:5-6, 30:19-21, 30:23-24, 31:36-39, 31:42-43 (emphases added); *see also id.*, 5:34-58, 5:65-67, 8:60-9:17, 10:38-62, 11:51-63. Because the “first proportional sequence” in the dependent claims may include “K1” or “K1-1” values, Apex’s construction requiring exactly K1 values cannot be correct. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314-15 (Fed. Cir. 2005) (en banc) (“[T]he presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim.”). Furthermore, “‘comprising[.]’ ... is well understood in patent law to mean

‘including but not limited to’ and allows for additional elements or values not expressly recited in the claims. *Exergen Corp. v. Wal-Mart Stores, Inc.*, 575 F.3d 1312, 1319 (Fed. Cir. 2009) (citation omitted). Thus, the claimed “first proportional sequence” “compris[ing]” K1 or K1-1 values may include additional or fewer than K1 values, as long as it includes values that “correspond[] to a ratio(ratios) among the K1 channel quality values.” Ex. 1001, 27:35-37.

Apex’s construction is also incorrect because it requires the first proportional sequence to include a specific “ratio between one channel quality value to itself or to another of the K1 channel quality values,” although this is not recited in the claims. POR 14, 17-18. To the contrary, dependent claims 2, 7, 12, and 17 and the specification state that the “first proportional sequence comprises *quantized values* corresponding to [K1/K1-1] positive real numbers,” not the proportions (ratios) themselves. Ex. 1001, 27:52-61, 29:3-12, 30:21-30, 31:39-32:5 (emphasis added); *see also id.*, 4:34-36, 4:44-46, 5:37-38, 5:43-45, 8:63-64, 9:2-4, 10:40-42, 10:47-49, 14:50-52.

Embodiment 9 of the ’271 Patent, POR 16-17 (citing Ex. 1001, 24:10-31), does not change this because it is exemplary and does not limit the claims. *Phillips*, 415 F.3d at 1323 (citations omitted).

Apex’s use of extrinsic dictionary definitions to contradict the claim language and specification is also improper.^{4,5} *Eon*, 815 F.3d at 1320-21; *Profectus*, 823 F.3d at 1380; *Seabed*, 8 F.4th at 1287.

Regardless, the Board does not need to construe [1d5] because both parties agree [1d5] *includes* the “first proportional sequence” being a sequence of ratios of the K1 RSRP values divided by the max(RSRP) value, which *Liu* and *Park* render obvious. *See* Pet. 22-29; *infra* § III.B.3.

III. *Liu* and *Park* Render Obvious Claim 1

A. *Liu* discloses “K antenna port groups of the base station are used to transmit the first wireless signal” (element [1d1])

Apex’s arguments against [1d1] are based solely on its improper construction. *See* POR 20-24. Once Apex’s construction is rejected, Apex offers no rebuttal to the Petition’s showing that *Liu* discloses [1d1].

⁴ The POR never identifies which of the multiple definitions for each term it relies on, which also shows the incorrectness of Apex’s analysis. *See* POR 15-16.

⁵ None of the four definitions of “sequence” is discussed in the POR’s claim construction section. Apex therefore waived any ability to argue that these definitions change the outcome.

1. *Liu* discloses transmitting the same “first wireless signal” as the ’271 Patent

Apex argues that *Liu*’s base station sending M signals using M antenna ports is not “collectively” transmitting a “first wireless signal” using the M antenna ports because “*Liu* discloses only a singular antenna port for transmitting each singular signal (*i.e.*, a one-to-one mapping of ports to signals).” POR 20-22 (alleging the claim requires “there are still at least 2 antenna port groups or 2 antenna ports that collectively transmit the claimed first wireless signal, which *Liu* still does not disclose” (citing Ex. 2004 (Gomez Decl.); Ex. 2005 (Kakaes Dep. Tr.))). This is wrong.

Apex’s argument first wrongly assumes that the “first wireless signal” cannot comprise multiple signals. But the ’271 Patent discloses exactly that: K antenna port groups respectively transmit the “first wireless signal” by sending K separate reference signals (e.g., Channel State Information Resource Signals (“CSI-RSs”))—the same as *Liu*. For example, the ’271 Patent explains that “[t]he first wireless signal is composed of the *K* reference signal groups” that “are *respectively* transmitted through the K antenna port groups,” and each “reference signal group” may be “only one reference signal.” Ex. 1001, 3:23-26, 13:62-63, 13:66-67, 14:5-8 (emphases added); *see also id.*, 3:27-29 (“K different analog beamforming vectors” are used to send the wireless signal), 2:56-58, 3:3-4, 14:3

(each “antenna port corresponds to a reference signal” and each “reference signal is a Channel State Information Reference Signal (CSI-RS)”). Similarly, the ’271 Patent explains that “the first wireless signal is composed of K beam-formed CSI-RSs,” where the K CSI-RSs respectively “correspond[] to [the] K antenna port groups.” *Id.*, 14:5-8; *see also id.*, 3:3-4, 3:23-26, 13:62-63, 13:66-67. These are also described as a “CSI-RS burst,” and the “first wireless signal” may be a “CSI-RS burst.” *Id.*, 3:3-4, 3:16-17; *see also* Ex. 2005, 23:7-42:7 (Dr. Kakaes explaining that *Liu* and the ’271 Patent both disclose a CSI-RS burst as the first wireless signal by sending K CSI-RSs using K antenna port groups). Apex does not address any of these disclosures. The POR, however, describes *Liu* the same way—with each antenna port group respectively transmitting a corresponding reference signal. POR 20-21. The Petition explains that these transmitted signals, together, comprise the first wireless signal, the same as the ’271 Patent. *See* Pet. 16-17 (citing Ex. 1003 (“Kakaes”), ¶¶109-112); *see also* Ex. 2005, 23:7-42:7. Apex does not identify any meaningful difference between these two disclosures, let alone one that rebuts the Petition’s showing that *Liu* discloses [1d1].

During his deposition (Ex. 2005), Petitioner’s expert, Dr. Kakaes, explained that using M (in *Liu*) or K (in the ’271 Patent) antenna port groups to send M or K reference signals, respectively, describes a “CSI[-]RS burst,” which is described in the Petition, his declaration, and the ’271 Patent. For example, a “[CSI-RS] burst is

a channel state information reference signal burst, meaning it consists of several [CSI-RSs], and that's what the M wireless signals form together [in *Liu*], a burst, which is the first wireless signal consistent with the teachings of the '271 Patent." Ex. 2005, 21:21-22:19. He repeatedly explained that, "in the context of *Liu*, the transmitting the M wireless signals *collectively form* what the '271 Patent call[s] a burst, and the '271 Patent said that that burst can be the first wireless signal.... So [the] M wireless signals that I'm discussing, paragraph 111 [of *Kakaes*], *together form* what the '271 Patent calls a burst and identifies that as an example of what a first wireless signal can be." *Id.*, 23:7-24 (emphases added); *see also id.*, 24:5-17 ("[R]eading *Liu* in the context of *Liu*, those wireless signals are [CSI-RSs] ... and those reference signals viewed in their totality consistent with what *Liu* teaches and consistent with the '271 Patent teaches, form the first wireless signal ... of claim 1 of the '271 Patent."), 24:18-25:3 ("[T]he limitation of the first wireless signal is met by the collection of those reference signals transmitted by each of the M antenna ports."), 25:4-26:13, 26:14-16, 30:22-31:13 ("Q[:] Does your declaration describe a [CSI-RS] burst in *Liu*? A[:] Yes, it does."), 32:5-22, 33:6-10 ("A channel state information reference signal [CSI-RS] burst is a collection of reference signal reception -- transmissions and receptions and that's what the RSRP of each antenna port group of *Liu* is."), 35:7-21 ("[W]hen one reads *Liu*, *Liu*'s disclosure in its full context ... means that that collection of RSRP of each

antenna port group was [a] burst, to use the language of the '271 Patent, and therefore it meets that limitation.”), 36:7-16 (“Liu discloses what the '271 Patent required to be disclosed.”), 37:12-38:2 (“[T]he concept of a burst as discussed in the '271 Patent is certainly disclosed in Liu, even though the word burst ... does not appear.”), 39:17-40:2 (“[T]he concept of what the '271 Patent calls a burst is discussed at length in my declaration.”), 40:17-41:7 (“[C]ertainly the fact that the first wireless signal is in [sic] [CSI-RS] burst is part of the '271 Patent and that that first wireless signal is met by the prior art I’ve cited to, including Liu”), 41:8-42:7 (“And that’s [sic] a [POSITA] would understand those reference signals to constitute the claimed first wireless signal originating from the base station, which is again consistent with the disclosure of the '271 Patent of an example of what that first signal could be.”).

Apex does not rebut Dr. Kakaes’s testimony that *Liu* and the '271 Patent describe the same thing. *See* POR 20-24. Rather, Apex argues that “during [his] deposition, ... Petitioner’s expert could not point to any mentions of ‘bursts,’ collection[s] of reference[] signals, or citations to the portion of the '271 Patent describing bursts, either in Liu, the Petition,^[6] or in his own declaration.” POR 22

⁶ Dr. Kakaes was not asked about the Petition during his deposition. *See generally* Ex. 2005.

(citing Ex. 2005, 36:4-42:7). This is wrong. The issue is not whether *Liu*, the '271 Patent, and Dr. Kakaes use the same *word*, but whether they describe what is claimed. Dr. Kakaes repeatedly explained that *Liu* and his declaration describe the collection of *Liu*'s M CSI-RSs as the "first wireless signal," which describes a CSI-RS burst or K port groups transmitting K wireless signals comprising the first wireless signal, as shown in the citations above.

Apex labels Dr. Kakaes's testimony as "tortured" and "brand new," POR 22, but it is neither. Far from being "tortured," Dr. Kakaes testified that the '271 Patent and *Liu* (including Apex's own description of how *Liu* operates) describe the same thing, which Apex has not addressed. Apex's failure to address these disclosures and inability to identify any meaningful difference between *Liu* and the '271 Patent's examples shows the incorrectness of Apex's argument. The testimony is not "new" because Dr. Kakaes repeatedly explained that this argument appears in his declaration, providing citations, to which Apex's only response is that he did not use the *word* "burst," which is unavailing because it does not address the *substance*, which is the same. Dr. Kakaes explained that Apex's position is contradicted by the '271 Patent's disclosure and that the unpatentability theory set forth in his declaration is the same as the '271 Patent's disclosure and examples of the "first wireless signal." Ex. 2005, 21:21-22:19, 23:7-24, 24:5-17, 24:18-25:3, 25:4-26:13, 26:14-16, 30:22-31:13, 32:5-22, 33:3-10, 35:7-21, 36:7-16, 37:12-

38:2, 39:17-40:2, 40:17-41:7, 41:8-42:7. Dr. Kakaes testifying about his declaration and comparing his opinions to the '271 Patent's disclosure is not a new argument, especially because the basis for unpatentability remains the same.

Ericsson Inc. v. Intell. Ventures I LLC, 901 F.3d 1374, 1379-80 (Fed. Cir. 2018) (not new argument to use teachings of challenged patent to support and further explain arguments made in petition); *Chamberlain Grp., Inc. v. One World Techs., Inc.*, 944 F.3d 919, 925 (Fed. Cir. 2019) ("Parties are not barred from elaborating on their arguments on issues previously raised."); *Axionics, Inc. v. Medtronic, Inc.*, 75 F.4th 1374, 1382 (Fed. Cir. 2023).

Liu therefore discloses [1d1].

2. Apex fails to rebut the Petition's argument regarding *Liu*'s codebooks

Apex's next argument that "Petitioner's alternate argument that codebook sets are indicative of meeting this claim limitation is also flawed" also fails because it relies solely on Apex's improper construction. POR 22-23; *see also id.*, 23 ("Liu teaches transmitting a wireless signal for each of its X antenna port groups instead of transmitting one wireless signal for multiple antenna port groups since Liu's codebook information is keyed to each antenna port group.").

Apex's position that the codebook "***configuration*** is not a base station ***transmission*** of a first wireless signal," *id.*, is misplaced because the Petition (and

Dr. Kakaes’s testimony) does not rely on the codebook being the “first wireless signal.” Rather, the *X transmitted* signals from the X antenna port groups are the “first wireless signal”; the codebooks merely describe the signals, which permit the user’s device to measure the signals. *See* Pet. 16-17 (“[T]he codebook information for each group corresponds to the matrix that *describes the beam pattern transmitted by the base station* and received by the UE for that port group.” (emphasis added)).

Apex’s argument that “beamforming is also not the same as transmitting the claimed first wireless signal *from the base station*,” POR 24, is similarly misplaced. *Liu*’s codebooks tell the UE what to measure and how to perform the RSRP measurement by describing the “antenna configuration” for forming the beams being transmitted by the X antenna port groups (e.g., describing the transmitted signals of the X antenna port groups forming the first wireless signal). *See* Pet. 16-17 (quoting *Liu*, 21). These signals described by the codebooks form the “first wireless signal.” *See id.*

Liu therefore discloses [1d1] under this alternative argument.

3. The Board does not need to construe [1d1] because *Liu* discloses the embodiments disclosed in the ’271 Patent and Apex’s construction of [1d1]

Liu discloses Apex’s proposed construction of [1d1]. Apex does not dispute that *Liu*’s teaching that “the M antenna ports are divided into X groups” of 2 ports

per group discloses “K groups of antenna ports,” but instead disputes whether those groups “collectively” transmit the first wireless signal (which fails for the reasons discussed in Sections III.A.1-III.A.2). POR 20-24; *see* Pet. 16-17 (quoting *Liu*, 21). And, whatever transmitting “collectively” in Apex’s construction means, it must cover the examples disclosed in the ’271 Patent, which *Liu*’s disclosed wireless signals are the same as. *Supra* §§ II.A, III.A.1, III.A.2.

Therefore, *Liu* discloses [1d1].

B. *Liu* discloses, or *Liu* and *Park* render obvious, the “first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values” (element [1d5])

The POR’s arguments related to [1d5] are based solely on Apex’s improper construction. *See* POR 27-29. Once Apex’s construction is rejected, Apex offers no rebuttal to the Petition’s showing that *Liu* discloses, or *Liu* and *Park* render obvious, [1d5].

1. *Liu*’s RSRQ discloses [1d5]

Apex argues that *Liu*’s⁷ RSRQ (defined as RSRP/RSSI, *see* Pet. 22) is not the claimed “first proportional sequence” because it does not use two RSRP values

⁷ The D.I. asks Petitioner to “clarify during trial whether it truly relies on *Liu* alone” for RSRQ. D.I. 20. Petitioner does. RSRQ is a term of art defined as RSRP/RSSI. *See* Pet. 22. A POSITA would know this definition, but the Petition’s

in the ratios. POR 27-28. Other than disputing whether RSRQ can be the “ratio,” Apex raises no other disputes related to the Petition’s RSRQ showing that RSRQ meets [1d5]. But [1d5] does not require that the “first proportional sequence” be the ratio of one of the K1 RSRP values to itself or another of the K1 RSRP values because the ’271 Patent discloses the “first proportional sequence” being other values. *Supra* § II.B. The Petition shows that the RSRP value in the RSRQ ratio is one of the K1 channel quality values (RSRP), Pet. 22, which Apex does not rebut. *Liu*’s RSRQ therefore discloses [1d5].

2. *Liu* and *Park* disclose and render obvious [1d5]

Apex’s arguments related to *Park* fail to rebut the Petition’s showing that *Liu* and *Park* render obvious [1d5] because they misunderstand the prior art and the claims.

Apex argues that *Park* “does not disclose the claimed ‘sequence’” because “Park computes each of the differentials between the max(RSRP) and individual RSRPs and if a differential is greater than the threshold, then, and only then, will the UE report such antenna ports.” POR 28. Apex’s argument is misplaced.

citations to *Park* and *Sesia LTE* provide it for convenience. *See id.* (citing *Park*, [295]; *Sesia LTE*, 514; Kakaes, ¶126).

Even if one embodiment of *Park* calculates a difference of RSRP values by subtraction (differential), *Park* also discloses calculating an “RSRP ratio” (division) of one RSRP value to the maximum RSRP value that the Petition relies on for unpatentability. Pet. 22-29; *Park*, [372]-[373]. And, if the “first proportional sequence” must include a ratio, *Liu* discloses, or *Liu* and *Park* render obvious, the “first proportional sequence” including a ratio (e.g., RSRQ in *Liu* or RSRP-to-max(RSRP) in the combination of *Liu* and *Park*).

Nothing in the claim precludes the K1 values in the first proportional sequence from being those above the target threshold or using the RSRP-ratio-to-threshold comparisons to determine the K1 antenna port groups, as in *Park*. See Ex. 1001, claim 1. To the contrary, the Applicant argued during prosecution that “the purpose of the target threshold in the present application and claims is a restriction of channel quality report, i.e., to restrict the difference between the largest and smallest channel qualities in a UE report,” as in *Park*. Ex. 1002, 472; see also Pet. 26, 31. The Petition explains that the RSRP ratios and threshold in the combination of *Liu* and *Park* perform the same function. See, e.g., Pet. 28 (“Knowing the proportional strength of each received antenna port group’s signal would have allowed for determining which of the received signals (e.g., N or K1 antenna port group signals within the M or X antenna port groups) has sufficient strength to support transmit diversity over multiple beams.”), 30-31 (*Liu* and *Park*

“us[e] ... RSRP (‘first information’)[] to determine the first proportional sequence and to select the N (e.g., K1) antenna port groups of the M or X (K) antenna port groups”).

The POR does not challenge the Petition’s showing that when *Park* “aligns” each measured RSRP for the antenna ports as shown in *Park*’s Figure 12, and then calculates the “RSRP ratio” for each port’s “aligned” RSRP value to the max(RSRP) to determine which ports to report, this forms a sequence based on the RSRP-to-max(RSRP) ratios. *Park*, [372]-[373]; Pet. 23-24.

In POR Section VII.A.6, Apex argues that, “as noted above [for [1d5],] ... *Park* only ‘reports antenna ports’ and not a sequence of all K1 channel quality ratios: ‘[B]ecause antenna port 13 has the greatest RSRP of 40 dB,’ the UE compares each of the other antenna ports’ RSRP values to antenna port 13 and ‘the UE reports antenna ports with an RSRP over 35 dB.’” POR 30 (alteration in original) (quoting Pet. 25). This too fails because the claim does not require reporting “a sequence of all K1 channel quality values” or that the first proportional sequence contains only and exactly the K1 values. *Supra* § II.B. Rather, the claim states that “first information” is used to “determine” the first proportional sequence, which *Park* does by “align[ing]” each RSRP value and taking the RSRP-to-max(RSRP) ratio for each RSRP and selecting the antenna port

groups having an RSRP-to-max(RSRP) ratio above the threshold value. Pet. 22-31; *see also* Ex. 2005, 59:7-61:9.

Apex incorrectly argues that *Park* reporting the indices of the antenna port groups for the K1 ports that exceed the threshold is not sufficient. POR 28-30. First, the Petition also relies on *Liu* for reporting the RSRP values. Pet. 14-15. Second, *Park* also reports RSRP values. Pet. 23 (“*Park* teaches that the UE ‘reports the RSRP of L antenna ports chosen from among these that are strongly received’” (emphasis added) (quoting *Park*, [371])). Third, the reported “first information” can be port indices, because it does not have to be the RSRP values. Pet. 14-15. The reported indices and RSRP values correspond to *Liu*’s N (or K1) antenna ports, including the max(RSRP) and other RSRP values corresponding to the K1 channel quality values and the first proportional sequence of the combination. *See, e.g.*, Pet. 27-29. Thus, *Liu* and *Park* render obvious the “first proportional sequence” having the K1 proportions (the ratios greater than the threshold value comprising the K1 antenna port groups) where each of the proportions is a ratio (“RSRP ratio”) between one channel quality value (reported RSRP of each K1 port) to itself or another of the K1 channel quality values (max(RSRP) of the reported K1 ports). *See* Pet. 22-29.

Apex’s argument that “a subsequent limitation recites that the UE transmits first information used to determine the first proportional sequence (i.e., the full

sequence of K1 ratios regardless of any threshold)” is irrelevant. POR 29. Nothing in the claim requires the “first information” to be the ratios themselves. Instead, the ’271 Patent explains that “first information” can include different things, such as “explicitly indicat[ing] the K1 antenna port groups,” being “transmitted in a CSI report,” being “used to determine ... the first channel quality,” being “used to determine ... the first proportional sequence” (meaning it is not the proportional sequence itself), or being “Uplink Control Information (UCI),” among other things. *E.g.*, Ex. 1001, 4:1-2, 4:5-8, 4:13-14, 7:8-10, 7:20-26, 14:37-39, 14:62-63. This can include the port indices or RSRP values, as explained in the Petition. *See* Pet. 14-15.

Apex thus fails to rebut the Petition’s showing that *Liu* and *Park* render obvious [1d5].

3. The Board does not need to construe [1d5] because the prior art teaches the examples in the ’271 Patent and Apex’s construction

Although the D.I. “invite[s] the parties to construe limitation [1d5] during trial,” D.I. 23, no construction is necessary because the prior art teaches at least the ’271 Patent’s examples of [1d5].

As explained above, *Park* discloses determining RSRP-to-max(RSRP) ratios where each of the RSRP value and the max(RSRP) value correspond to one of the reported antenna port groups that are the K1 antenna port groups. *Supra* § III.B.2;

Pet. 22-29. These are determined by “align[ing]” each port’s RSRP value and taking the ratio of each RSRP to the maximum RSRP value. Pet. 22-29.

The Board also does not need to determine the scope of “corresponds” or whether “‘proportional’ imposes an additional, as yet unspecified, requirement,” *see* D.I. 23, because *Park* teaches that the “first proportional sequence” is a sequence of RSRP-to-max(RSRP) ratios including each of the K1 antenna port groups, which also meets Apex’s construction of the claim term. *Supra* § III.B.2; Pet. 22-29.

Thus, no construction is needed because the combination of *Liu* and *Park* render obvious [1d5]. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

C. Apex’s other arguments regarding “K antenna port groups” and the “first wireless signal” fail

The arguments in POR Sections VII.A.2-VII.A.4 refer back to the “K antenna port groups” and “first wireless signal” arguments discussed for [1d1], POR 25-27, and fail for similar reasons to those discussed above.

D. Apex’s other “proportional sequence” arguments fail

The arguments in POR Section VII.A.6 refer back to the “proportional sequence” arguments discussed above for [1d5], POR 29-30, and fail for similar reasons to those discussed above.

IV. *Liu and Park* Render Obvious Claims 2-20

Apex does not separately argue the patentability of claims 2-20.

Apex's arguments for dependent claims 2-5 rely on the same "proportional sequence" arguments of POR Sections VII.A.5-VII.A.6, POR 30, and fail for the reasons discussed above.

Apex's arguments for claims 6-20 merely refer back to claims 1-5, POR 30-31, and fail for the same reasons as claims 1-5.

V. The Board Should Give Mr. Gomez's Declaration No Weight

The Petition identifies a POSITA as "[having] 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." Pet. 9. The D.I. found this definition reasonable, but omitted that work experience could compensate for education or vice versa as vague. D.I. 9-10. The Board's modified definition is acceptable to Petitioner.

Apex proposes a different definition that omits the requirement for experience with MIMO technology, requiring only general "telecommunications systems" experience, and adds an alternative based on a B.S. degree and five years' experience. POR 10-11. Mr. Gomez does not meet either party's definition.

Petitioner's definition should be accepted because it is consistent with the '271 Patent and the asserted prior art. The '271 Patent is directed to solving

problems in MIMO systems. Ex. 1001, 1:18-31. “MIMO” is a specialized area in telecommunications systems and refers to multi-antenna technology used to improve communication quality and increase throughput. *Id.*, 1:18-36. There is no dispute that the claimed invention relates to MIMO systems and that the claimed “antenna port groups,” “first wireless signal,” and “beamforming vector[s]” are techniques intrinsically linked to MIMO systems. *See id.*, 1:18-31.

The asserted prior art also describes MIMO technology. *Liu*, 1; *Park*, [3].

The sole named inventor of the '271 Patent—Xiaobo Zhang—had a master’s degree in electrical engineering and published multiple conference papers on MIMO technology before the filing date of the '271 Patent, further supporting Petitioner’s definition. *See* Ex. 1033, 1-2; Ex. 1034; Ex. 1035.

Apex does not provide any explanation for omitting MIMO experience, making it unsupported. Regardless, the choice of POSITA does not change the outcome of obviousness.

Apex’s expert does not meet Petitioner’s definition. Mr. Gomez does not have a master’s degree and he lacks MIMO technology work experience under Petitioner’s definition. His CV does not list any MIMO experience and he could not point to anything when asked. Ex. 1036, 51:10-52:3 (admitting that “[he hasn’t] actually specifically built a product related to those [MIMO] technologies”).

Even applying Apex's incorrect definition, Mr. Gomez is not qualified as a POSITA. Because he does not have a master's degree, he would be required to have had at least five years' experience working with telecommunications systems. He has not identified such experience. He admitted that any such experience he has is not in the 4G or 5G telecommunications system relevant to the '271 Patent. *Id.*, 50:2-51:9. Only two of his work experiences involved wireless networking: his work for Philips (February 1997-December 1999) and ActSolar (August 2006-March 2009). *Id.*, 47:14-48:11; Ex. 2004 (Ex. A, 3, 5). He testified that this work, at most, only tangentially involved wireless networking, and not necessarily telecommunications systems. *See* Ex. 1036, 33:4-35:23, 38:17-39:25. His Philips work involved 2G cellular network communications and "local-area-network-type technologies," and his ActSolar work involved "transmission of data from the rooftops down to" nearby receivers "using a protocol called Zigbee" (which is not the telecommunications of the '271 Patent). *Id.*, 47:14-48:22. Mr. Gomez's lack of relevant experience highlights his lack of credentials. His only potentially practical experience involving telecommunications (Philips) ended nearly two decades before the claimed priority date of the '271 Patent.

Unlike Mr. Gomez, Petitioner's expert, Dr. Kakaes, meets either party's definition. *See* Kakaes, ¶¶17-22; Ex. 1004. Dr. Kakaes's testimony is thus more credible and should be given more weight.

VI. Conclusion

For these reasons and those in the Petition, the challenged claims should be canceled.

Date: April 30, 2024

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CERTIFICATION OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, Petitioner certifies that the word count of **Petitioner's Reply** (exclusive of any table of contents, table of authorities, mandatory notices under § 42.8, certificates of service and word count, and list of exhibits or claim listing) as measured by Microsoft Word is 5,594.

Dated: April 30, 2024

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing **Petitioner's**
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