

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. IPR2023-00747
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 26-28. Both disputes rely on Apex's improper claim constructions, POR 11-17, 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 *Kim* and *Chen*. Apex's remaining disputes merely refer back to its arguments for [1d1] and [1d5], and thus fail for the same reasons. *See* POR 24-26, 28-29 (claim 1), 29-30 (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 *Kim* and *Chen* disclose or render obvious Apex's constructions.

¹ Petitioner maintains the Petition's element numbering for ease of reference. Paper 10, Decision on Institution, 22 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. 16-17, 17 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, *Kim* teaches, or the combination of *Kim* and *Chen* renders obvious, the disclosed embodiments from the ’271 Patent and Apex’s construction. Paper 1, Petition (“Pet.”), 3; *infra* § III.A.2.

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.* (citation omitted). 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) (holding that prior art reference anticipated a claim even though it detected and used “radiation from the heated probe, in addition to detecting the peak radiation from multiple areas of the biological tissue” recited in the claim). 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 (citation omitted). 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 *Kim* discloses. *See* Pet. 28-29; *see also id.*, 26-28, 29-30; *infra* § III.B.2.

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 14-15.

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.

III. *Kim* and *Chen* Render Obvious Claim 1

A. *Kim* discloses, or *Kim* and *Chen* render obvious, “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 *Kim* discloses, or *Kim* and *Chen* render obvious, [1d1].

1. *Kim* discloses, or *Kim* and *Chen* render obvious, transmitting the same “first wireless signal” as the ’271 Patent

Apex argues that *Kim*’s base station sending the set of Channel State Information Resource Signals (“CSI-RSs”) is not “collectively” transmitting a “first wireless signal” using antenna ports because “Kim 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 Kim still does not disclose” (citing Ex. 2004 (Gomez Decl.); Ex. 2005 (Kakaes Dep. Tr.))). This is wrong.

Apex 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., CSI-RSs)—the same as *Kim*. 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, 48:3-17 (Dr. Kakaes explaining that *Liu* (Ex. 1006) 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, and *Kim*’s disclosure is similar to *Liu*). Apex does not address any of these disclosures. The POR, however, describes *Kim* the same way—with each antenna port group respectively transmitting a corresponding reference signal. POR 20-22. The Petition explains that these transmitted CSI-RSs, together, comprise the first wireless signal, the same as the '271 Patent. *See* Pet. 12-15 (citing Ex. 1003

(“Kakaes”), ¶¶104-108), 16-18 (citing Kakaes, ¶¶112-116); *see also* Ex. 2005, 23:7-42:7, 48:3-17. Apex does not identify any meaningful difference between these two disclosures, let alone one that rebuts the Petition’s showing that *Kim* discloses [1d1].

During his deposition (Ex. 2005), Petitioner’s expert, Dr. Kakaes, explained—in the context of *Liu* in IPR2023-00571 for which Apex makes the same arguments as it does against *Kim*—*see* Ex. 2005, 21:21-42:7, 48:3-17; *compare* POR 20-24, with IPR2023-00571, Paper 14, Apex’s Patent Owner’s Response, 20-24—that using M antenna port groups (or K in the ’271 Patent, and the N management set in *Kim*) to send M or K reference signals 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 Ex. 1003 in IPR2023-00571], *together form* what the ’271 Patent calls a burst and identifies that as an example of what a first wireless

signal can be.” Ex. 2005, 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.”). Dr. Kakaes explained that *Kim*’s disclosure for [1d1] is similar. *See id.*, 48:3-17.

Apex does not rebut Dr. Kakaes’s testimony that *Kim* and the ’271 Patent describe the same thing. *See* POR 20-24. Indeed, the POR characterizes *Kim* the same way as the ’271 Patent’s disclosures describing a “CSI-RS burst” and describing sending K CSI-RS wireless signals from K respective antenna ports as the first wireless signal (e.g., on a per-port basis). *Compare* POR 20 (“Kim discloses only a singular antenna port for transmitting each singular signal (*i.e.*, a one-to-one mapping of ports to signals)...”), 21 (“Is it your understanding that each CSI RS in Kim is mapped to each antenna port in Kim?” (citation omitted)), *with* Ex. 1001, 2:56-58, 3:3-4, 3:23-29, 13:62-63, 13:66-67, 14:3-8 (explaining 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 that each “antenna port corresponds to a reference signal” and “the reference signal is a Channel State Information Reference Signal (CSI-RS)” (emphasis added)). Apex’s failure to address these disclosures and inability to identify any meaningful

difference between *Kim* and the '271 Patent's examples shows the incorrectness of Apex's argument.

Apex next argues that *Chen* does not teach Apex's construction of [1d1] because "Chen uses M pilot ports to transmit the same M amount of pilot signals, meaning that Chen discloses one pilot signal per pilot port." POR 22-23. This is the same incorrect argument Apex made for *Kim* (and *Liu* in corresponding IPR2023-00571, Paper 14, Patent Owner's Response, 20-24) and fails for the reasons discussed above. *See* POR 22-24.

Thus, *Kim* discloses, or the combination of *Kim* and *Chen* renders obvious, [1d1].

2. The Board does not need to construe [1d1] because *Kim* discloses, or the combination of *Kim* and *Chen* renders obvious, the embodiments disclosed in the '271 Patent and Apex's construction of [1d1]

Kim, or the combination of *Kim* and *Chen*, discloses Apex's proposed construction of [1d1]. Apex does not dispute that the Petition's alternative argument that *Kim*'s teaching that each "CSI-RS configuration" mapping an "antenna port pair" to the Resource Elements (RE) 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 Section III.A.1). POR 22; *see* Pet. 11, 16-18 (quoting *Kim*, [0142]) (citing *Kim*, [0076], [0141]). And,

whatever transmitting “collectively” in Apex’s construction means, it must cover the examples disclosed in the ’271 Patent, which *Kim*’s disclosed wireless signals are the same as. *Supra* §§ II.A, III.A.1.

Therefore, *Kim* discloses, or the combination of *Kim* and *Chen* renders obvious, [1d1].

B. *Kim* discloses 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 26-28. Once Apex’s construction is rejected, Apex offers no rebuttal to the Petition’s showing that *Kim* discloses [1d5].

1. *Kim* discloses [1d5]

Apex’s arguments, POR 26-28, fail to rebut the Petition’s showing that *Kim* discloses [1d5] because they misunderstand the prior art and the claims.

Apex argues that *Kim* “does not disclose the claimed ‘sequence’” because “Kim’s measurement report value corresponds to either (i) a ratio (‘the ratio of the n-th CSI-RS average Rx power level to the best CSI-RS average Rx power level’), which is a ratio of the averages instead of a ratio between two specific channel quality values (which each corresponds to an antenna port group); or (ii) a ‘maximum of M’ ratios that meet the threshold instead of the full sequence of K1

ratios, regardless of any threshold.” POR 27 (emphases added). Apex’s arguments are misplaced.

Apex’s “average Rx power level[s]” argument misunderstands *Kim*. *Id.* The Petition, supported by Dr. Kakaes and *Kim*, explains that the “CSI-RS average Rx power level” *is* an RSRP value and, therefore, a “channel quality value[]” recited in claim 1. Pet. 28-29. The claims do not recite a particular method for calculating RSRP and thus do not exclude *Kim*’s RSRP.

Kim explains that “RSRP *is defined as the linear average over the power contributions of REs*” that carry transmitted signals. *Kim*, [0107] (emphasis added). The Petition, supported by Dr. Kakaes’s testimony, explains that “[a] POSITA ... would have understood ‘*average Rx power level*’ *is the RSRP value* because ‘RSRP is defined as the linear average ... power contributions of REs that carry downlink’ CSI-RS signals, and ‘linear average ... power contributions of REs’ would have been known to mean *the received power for a particular transmitting antenna port*.” Pet. 6, 28-29 (emphases added) (quoting *Kim*, [0107], [0136]) (citing *Kim*, [0148]-[0149]; Kakaes, ¶132). The Petition also explains that the RSRP channel quality values in claim 1 are the RSRP described in *Kim*, such as max(RSRP_i) or the “maximum or best CSI-RS average Rx power level.” Pet. 35 (citing *Kim*, [0136], [0149]). Apex does not show any error in this analysis and, therefore, its first argument related to [1d5] fails.

Kim also discloses that the “first proportional sequence” includes a ratio of these RSRP values. *Kim*’s paragraphs [0148]-[0149], relied on in the Petition, disclose that the UE reports M CSI-RSs that satisfy “the RSRP ratio ($\text{RSRP}_n/\max(\text{RSRP}_i)$)” that is “higher than a predetermined threshold value” or “ $\text{RSRP}_n/\max(\text{RSRP}_i) > \text{Threshold}$.” *Kim*, [0148]-[0149]; Pet. 28-29 (citing *Kim*, [0148]-[0149]). The claim specifically says that RSRP is a “channel quality value” and *Kim* discloses using an RSRP value in the ratio of RSRP-to-max(RSRP). Pet. 28-29; *Kim*, [0136], [0149]. Thus, *Kim* expressly discloses a ratio using the RSRP values recited in the claims. *Kim*, [0148]-[0149]; Pet. 28-29 (citing *Kim*, [0148]-[0149]).

Apex’s second argument that *Kim* reports “a ‘maximum of M’ ratios that meet the threshold instead of the full sequence of K1 ratios, regardless of any threshold,” also fails. POR 27. As explained in the Petition, *Kim* reports a set of antenna port groups (up to M antenna port groups) that *are* the K1 ratios (e.g., reported set=K1 antenna port groups). See Pet. 26-28, 19 n.7. *Kim* uses the RSRP-to-max(RSRP) ratios and threshold to determine the K1 antenna port groups being reported. Pet. 28-29; *see also* Ex. 1001, 27:37-39. “M” is just the largest number that K1 can be in *Kim*, but it is always less than or equal to the N or K set transmitted from the base station. See Pet. 26-28, 19 n.7. The Petition explains this: “because all M reported ports all have RSRP ratio values that satisfy the RSRP

ratio threshold of Equation 4,” then “[i]n such cases[,] K1 has the same value as *Kim*’s M.” Pet. 29 (citing *Kim*, [0148]-[0149], [0136], [0146]; Kakaes, ¶133).

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 *Kim*. 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 *Kim*. Ex. 1002, 472; see also Pet. 29. The Petition explains that *Kim*’s RSRP ratios and threshold perform the same function. See Pet. 29 (“To the extent Patent Owner argues that the ‘proportional sequence’ includes—and the UE must report—only K1 RSRP ratio values above a certain threshold, *Kim* discloses this interpretation, as explained above, because all M reported ports all have RSRP ratio values that satisfy the RSRP ratio threshold of Equation 4. In such cases[,] K1 has the same value as *Kim*’s M.” (citing *Kim*, [0148]-[0149], [0136], [0146]; Kakaes, ¶133)).

Apex’s argument that “[t]he differentiation between separate calculations of ratios present in *Kim* versus the claimed amalgamation of K1 ratios into a sequence is important because Claim 1’s 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 28; Ex. 2004, ¶53. Nothing in the claim requires the “first information” to be the ratios themselves. *See, 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. The first information can include the port indices or RSRP values, as explained in the Petition. *See* Pet. 15-16. Regardless, *Kim does send the K1 ratios* of the first proportional sequence to the base station. Pet. 28-30; *see also id.*, 15 (“The UE may perform RSRP measurements on the CRS and CSI-RS signals transmitted by the base station and report the RSRP values *and RSRP-to-max(RSRP) ratios* back to the base station as first information in the measurement report.” (emphasis added) (citing *Kim*, [0113], [0136], [0148]-[0149]; Kakaes ¶110)). “The measurement report value may include ‘the ratio of the n-th CSI-RS average Rx power level to the best CSI-RS average Rx power level,’” which describes the RSRP-to-max(RSRP) ratios determined using *Kim*’s Equation 4 for the various received RSRP values, and only an amalgamated set that satisfies the threshold value is sent. Pet. 28-30 (quoting *Kim*, [0136]) (citing *Kim*, [0148]-[149]; Kakaes, ¶¶132-135); *see also* Pet. 15.

Apex also fails to explain why *Kim*’s ratio determination is not a sequence, especially when the Petition explains that “[a] POSITA would have understood that, because each of the RSRP values of the reported antenna ports (K1 antenna ports) satisfies Equation 4’s threshold ratio, the corresponding ratios comprise a

first proportional sequence among the reported (K1) channel quality RSRP values.” Pet. 28. These ratios are used “to determine which are above the threshold requirement to determine ‘a maximum of M’ [K1 values] to be reported, *thus creating a sequence.*” *Id.* (emphasis added) (quoting Kakaes ¶132). The “first information” may include the transmitted M (K1) RSRP-to-max(RSRP) ratios that the POR says would meet its construction of “first proportional sequence.” *Compare* POR 16, *with* Pet. 15, 28-29; *Kim*, [0136], [0149]; Ex. 1001, 4:5-8.

In POR Section VII.A.6, Apex argues that, “as noted above [for [1d5]], ... Kim only reports a ‘maximum of M’ ratios that have already met a threshold and not a sequence of all K1 channel quality ratios.” POR 29. 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, III.B.1. Regardless, *Kim* does describe reporting the sequence of K1 RSRP-to-max(RSRP) ratios corresponding to the K1 antenna port groups as part of the measurement report. Pet. 26-28; *see also* Pet. 15, 29-30; *Kim*, [0136], [0146], [0148]-[0149].

Apex thus fails to rebut the Petition’s showing that *Kim* discloses [1d5].

2. 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. 25, no construction is necessary because the prior art teaches at least the '271 Patent's examples of [1d5].

As explained above, *Kim* determines and reports the sequence of 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 in *Kim*. *Supra* § III.B.1; Pet. 15, 26-30, 19 n.7. These are determined by taking each RSRP and comparing it to the max(RSRP), then sending the sequence of ratios that are above the threshold value and forming the K1 ratios of the sequence. Pet. 15, 26-30.

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. 24-25, because *Kim* teaches that the “first proportional sequence” can be 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.1; Pet. 26-30.

Thus, no construction is needed because *Kim* discloses [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 24-26, 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 28-29, and fail for similar reasons to those discussed above.

IV. *Kim* and *Chen* 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 29, and fail for the reasons discussed above.

Apex’s arguments for claims 6-20 merely refer back to claims 1-5, POR 29-30, 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. 8. The D.I. found this definition reasonable, but omitted that work experience could compensate for education or vice versa as vague. D.I. 11. 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. 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. *Kim*, [0091], [0174], [0177], FIG. 12; *Chen*, 1.

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 5,464.

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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