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In re Patent of: Xiaobo Zhang
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Title: METHOD AND DEVICE FOR MULTI-ANTENNA
TRANSMISSION IN UE AND BASE STATION

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 10,951,271 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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LIST OF EXHIBITS

EX1001	U.S. Patent No. 10,951,271 B2
EX1002	U.S. Patent No. 10,951,271 File History
EX1003	Declaration of Dr. Robert Akl
EX1004	U.S. Patent Application Publication No. 2015/0036612 to Kim (“Kim”)
EX1005	International Publication WO2015/131494 to Chen
EX1006	Certified English translation of International Publication WO2015/131494 to Chen (“Chen”)
EX1007	RESERVED
EX1008	Farhana Afroz et al., <i>SINR, RSRP, RSSI and RSRQ Measurements in Long Term Evolution Networks</i> , International Journal of Wireless & Mobile Networks (IJWMN), Vol. 7, No. 4, pp. 113-123 (Aug. 2015) (“Afroz”)
EX1009	International Publication WO2016/126099 A1 to Park et al.
EX1010	Certified English translation of International Publication WO2016/126099 A1 to Park et al. (“Park”)
EX1011	International Publication WO2016/015307 A1 to Liu et al.
EX1012	Certified English translation of International Publication WO2016/015307 A1 to Liu et al. (“Liu”)

- EX1013 Excerpts from Stefania Sesia et al., *LTE – The UMTS Long Term Evolution from Theory to Practice* (John Wiley & Sons, Ltd. 2d ed. 2011) (“Sesia LTE”)
- EX1014 US Patent Application Publication No. 20160218778A1 to Ng et al (“Ng”)
- EX1015 3GPP TS 36.133 v13.2.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management (Release 13)”) (Jan. 2016)
- EX1016 U.S. Patent Application Publication No. 2013/0308608 A1 to Hu et al. (“Hu”)
- EX1017 U.S. Patent Application Publication No. 2011/0038330 A1 to Luo et al. (“Luo”)
- EX1018 U.S. Patent Application Publication No. 2011/0176519 A1 to Vitthaladevuni et al. (“Vitthaladevuni”)
- EX1019 3GPP TS 36.211 v13.0.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (Release 13)”) (January 2016)
- EX1020 3GPP TS 36.212 v13.0.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding (Release 13)”) (January 2016)
- EX1021 3GPP TS 36.213 v13.0.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 13)”) (May 2016)
- EX1022 3GPP TS 36.214 v13.0.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements (Release 13)”) (Dec. 2015)

- EX1023 3GPP TS 36.331 v13.0.0 (“Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 13)”) (Dec. 2015)
- EX1024 US Patent Application Publication No. US 2016/0142189A1 to Shin et al (“Shin”)
- EX1025 3GPP Declaration of Friedhelm Rodermund
- EX1026 Original complaint filed in *Apex Beam Technologies LLC v. Apple Inc.*, Case No. 6-24-cv-00223 (WDTX) (April 29, 2024)
- EX1027 Amended Complaint filed in *Apex Beam Technologies LLC v. Apple Inc.*, Case No. 6-24-cv-00223-ADA-DIG (WDTX) (May 2, 2024)
- EX1028 Proof of Service of Amended Complaint in Apex Beam Technologies LLC v. Apple Inc., Case No. 6-24-cv-00223-ADA-DIG (WDTX) (May 14, 2024).
- EX1029 IPR2023-00571, Paper 10 (Institution Decision)
- EX1030 IPR2023-00747, Paper 10 (Institution Decision)

LISTING OF CLAIMS

Claim 1	
1.pre	A method for multi-antenna transmission in a user equipment (UE), comprising:
1.a	receiving, by the UE, a first signaling originating from a base station;
1.b	receiving, by the UE, a first wireless signal originating from the base station; and
1.c	transmitting, by the UE, first information to the base station;
1.d1	wherein, K antenna port groups of the base station are used to transmit the first wireless signal;
1.d2	the first signaling is used by the UE to determine the K antenna port groups transmitting the first wireless signal received by the UE; the K is a positive integer greater than 1;
1.d3	the K antenna port groups respectively correspond to K channel quality values; the K channel quality values are K non-negative real numbers; the K channel quality values are Reference Signal Received Powers (RSRPs) or a Signal to Interference plus Noise Ratios (SINRs);
1.d4	K1 antenna port groups of the K antenna port groups correspond to K1 channel quality values of the K channel quality values; the K1 is a positive integer less than or equal to the K;
1.d5	a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values;
1.d6	the first information is used to determine the K1 antenna port groups and the first proportional sequence;
1.d7	the first signaling is used to determine a target threshold; the target threshold is a non-negative real number;

1.d8	a first channel quality is a best channel quality value among the K1 channel quality values; a second channel quality is a worse channel quality value among the K1 channel quality values;
1.d9	a ratio between the second channel quality and the first channel quality is greater than or equal to the target threshold
Claim 2	
2.	The method according to claim 1, wherein the K channel quality values are broadband channel quality values; or the first proportional sequence comprises K1 positive real numbers less than or equal to 1, and the first proportional sequence comprises at least one 1; or the first proportional sequence comprises quantized values corresponding to K1 positive real numbers; or the first proportional sequence comprises K1-1 positive real number(s), and the K1-1 positive real number(s) is(are) a ratio(ratios) between a channel quality value(s) other than the best channel quality value among the K1 channel quality values and the best channel quality value; or the first proportional sequence comprises quantized values corresponding to K1-1 positive real number(s).
Claim 3	
3.pre	The method according to claim 1,
3.a	wherein K2 antenna port groups in the K antenna port groups correspond to K2 channel quality values in the K channel quality values; the K2 is a positive integer less than or equal to the K;
3.b	a second proportional sequence corresponds to a ratio(ratios) among the K2 channel quality values;
3.c	a first receiving beamforming vector is used to receive signals transmitted through the K1 antenna port groups; a second receiving beamforming vector is used to receive signals transmitted through the K2 antenna port groups; the first receiving beamforming vector and the second receive beamforming vector are different;
3.d	the first information is further used to determine the K2 antenna port groups and the second proportional sequence.

Claim 4	
4.	The method according to claim 3, wherein any two antenna ports in the K1 antenna port groups are co-located or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL); or any two antenna ports in the K1 antenna port groups are on a same carrier, and any two antenna ports in the K2 antenna port groups are on a same carrier; or the first signaling is further used to determine at least the last one of the K1, the K2 and the target threshold, a third channel quality is a best channel quality value among the K2 channel quality values, a fourth channel quality is a worse channel quality value among the K2 channel quality values, a ratio between the fourth channel quality and the third channel quality is greater than or equal to the target threshold, and the first information is further used to determine at least one of the first channel quality and the third channel quality.
Claim 5	
5	The method according to claim 3, further comprising: receiving a second wireless signal; wherein a target antenna port group is used to transmit the second wireless signal; the target antenna port group is associated with the K1 antenna port groups and the first proportional sequence, or the target antenna port group is associated with the K2 antenna port groups and the second proportional sequence.
Claim 6	
6.pre	A method for multi-antenna transmission in a base station, comprising:
6.a	transmitting, by the base station, a first signaling to a user equipment (UE);
6.b	transmitting, by the base station, a first wireless signal to the UE; and
6.c	receiving, by the base station, first information from the UE;
6.d1	wherein, K antenna port groups of the base station are used to transmit the first wireless signal;

6.d2	the first signaling is used by the UE to determine the K antenna port groups transmitting the first wireless signal received by the UE; the K is a positive integer greater than 1;
6.d3	the K antenna port groups respectively correspond to K channel quality values; the K channel quality values are K non-negative real numbers; the K channel quality values are Reference Signal Received Powers (RSRPs) or Signal to Interference plus Noise Ratios (SINRs);
6.d4	K1 antenna port groups of the K antenna port groups correspond to K1 channel quality values of the K channel quality values; the K1 is a positive integer less than or equal to the K;
6.d5	a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values;
6.d6	the first information is used to determine the K1 antenna port groups and the first proportional sequence;
6.d7	the first signaling is used to determine a target threshold; the target threshold is a non-negative real number;
6.d8	a first channel quality is a best channel quality value among the K1 channel quality values; a second channel quality is a worse channel quality value among the K1 channel quality values;
6.d9	a ratio between the second channel quality and the first channel quality is greater than or equal to the target threshold.

Claim 7	
7.	The method according to claim 6, wherein the K channel quality values are broadband channel quality values; or the first proportional sequence comprises K1 positive real numbers less than or equal to 1, and the first proportional sequence comprises at least one 1; or the first proportional sequence comprises quantized values corresponding to K1 positive real numbers; or the first proportional sequence comprises K1-1 positive real number(s), and the K1-1 positive real number(s) is(are) a ratio(ratios) between a channel quality value(s) other than the best channel quality value among the K1 channel quality values and the best channel quality value; or the first proportional sequence comprises quantized values corresponding to K1-1 positive real number(s).
Claim 8	
8.	The method according to claim 6, wherein K2 antenna port groups in the K antenna port groups correspond to K2 channel quality values in the K channel quality values; the K2 is a positive integer less than or equal to the K; a second proportional sequence corresponds to a ratio(ratios) among the K2 channel quality values; a first receiving beamforming vector is used to receive signals transmitted through the K1 antenna port groups; a second receiving beamforming vector is used to receive signals transmitted through the K2 antenna port groups; the first receiving beamforming vector and the second receiving beamforming vector are different; the first information is further used to determine the K2 antenna port groups and the second proportional sequence.

Claim 9	
9.	The method according to claim 8, wherein any two antenna ports in the K1 antenna port groups are co-located or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL); or any two antenna ports in the K1 antenna port groups are on a same carrier, and any two antenna ports in the K2 antenna port groups are on a same carrier; or the first signaling is further used to determine at least the last one of the K1, the K2 and the target threshold, a third channel quality is a best channel quality value among the K2 channel quality values, a fourth channel quality is a worse channel quality value among the K2 channel quality values, a ratio between the fourth channel quality and the third channel quality is greater than or equal to the target threshold, and the first information is further used to determine at least one of the first channel quality and the third channel quality.
9.	The method according to claim 8, wherein any two antenna ports in the K1 antenna port groups are co-located or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL); or any two antenna ports in the K1 antenna port groups are on a same carrier, and any two antenna ports in the K2 antenna port groups are on a same carrier; or the first signaling is further used to determine at least the last one of the K1, the K2 and the target threshold, a third channel quality is a best channel quality value among the K2 channel quality values, a fourth channel quality is a worse channel quality value among the K2 channel quality values, a ratio between the fourth channel quality and the third channel quality is greater than or equal to the target threshold, and the first information is further used to determine at least one of the first channel quality and the third channel quality.

Claim 10	
10.	The method according to claim 8, further comprising: transmitting a second wireless signal; wherein a target antenna port group is used to transmit the second wireless signal; the target antenna port group is associated with the K1 antenna port groups and the first proportional sequence, or the target antenna port group is associated with the K2 antenna port groups and the second proportional sequence.
Claim 11	
11.pre	A user equipment (UE) for multi-antenna transmission comprising:
11.a	a first receiver at the UE, receiving a first signaling originating from a base station;
11.b	a second receiver at the UE, receiving a first wireless signal originating from the base station; and
11.c	a third transmitter at the UE, transmitting first information to the base station;
11.d1	wherein, K antenna port groups of the base station are used to transmit the first wireless signal;
11.d2	the first signaling is used by the UE to determine the K antenna port groups transmitting the first wireless signal received by the UE; the K is a positive integer greater than 1;
11.d3	the K antenna port groups respectively correspond to K channel quality values; the K channel quality values are K non-negative real numbers; the K channel quality values are Reference Signal Received Powers (RSRPs) or Signal to Interference plus Noise Ratios (SINRs);
11.d4	K1 antenna port groups of the K antenna port groups correspond to K1 channel quality values of the K channel quality values; the K1 is a positive integer less than or equal to the K;
11.d5	a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values;

11.d6	the first information is used to determine the K1 antenna port groups and the first proportional sequence;
11.d7	the first signaling is used to determine a target threshold; the target threshold is a non-negative real number;
11.d8	a first channel quality is a best channel quality value among the K1 channel quality values; a second channel quality is a worse channel quality value among the K1 channel quality values;
11.d9	a ratio between the second channel quality and the first channel quality is greater than or equal to the target threshold.
Claim 12	
12.	The user equipment to claim 11, wherein the K channel quality values are broadband channel quality values; or the first proportional sequence comprises K1 positive real numbers less than or equal to 1, and the first proportional sequence comprises at least one 1; or the first proportional sequence comprises quantized values corresponding to K1 positive real numbers; or the first proportional sequence comprises K1-1 positive real number(s), and the K1-1 positive real number(s) is(are) a ratio(ratios) between a channel quality value(s) other than the best channel quality value among the K1 channel quality values and the best channel quality value; or the first proportional sequence comprises quantized values corresponding to K1-1 positive real number(s).

Claim 13	
13.	The user equipment to claim 11, wherein K2 antenna port groups in the K antenna port groups correspond to K2 channel quality values in the K channel quality values; the K2 is a positive integer less than or equal to the K; a second proportional sequence corresponds to a ratio(ratios) among the K2 channel quality values; a first receiving beamforming vector is used to receive signals transmitted through the K1 antenna port groups; a second receiving beamforming vector is used to receive signals transmitted through the K2 antenna port groups; the first receiving beamforming vector and the second receiving beamforming vector are different; the first information is further used to determine the K2 antenna port groups and the second proportional sequence.
Claim 14	
14.	The user equipment to claim 13, wherein any two antenna ports in the K1 antenna port groups are co-located or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL); or any two antenna ports in the K1 antenna port groups are on a same carrier, and any two antenna ports in the K2 antenna port groups are on a same carrier; or the first signaling is further used to determine at least the last one of the K1, the K2 and the target threshold, a third channel quality is a best channel quality value among the K2 channel quality values, a fourth channel quality is a worse channel quality value among the K2 channel quality values, a ratio between the fourth channel quality and the third channel quality is greater than or equal to the target threshold, and the first information is further used to determine at least one of the first channel quality and the third channel quality.

Claim 15	
15.	The user equipment to claim 13, wherein any two antenna ports in the K1 antenna port groups are co-located or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL); or any two antenna ports in the K1 antenna port groups are on a same carrier, and any two antenna ports in the K2 antenna port groups are on a same carrier; or the first signaling is further used to determine at least the last one of the K1, the K2 and the target threshold, a third channel quality is a best channel quality value among the K2 channel quality values, a fourth channel quality is a worse channel quality value among the K2 channel quality values, a ratio between the fourth channel quality and the third channel quality is greater than or equal to the target threshold, and the first information is further used to determine at least one of the first channel quality and the third channel quality.
Claim 16	
16.pre	A base station for multi-antenna transmission comprising:
16.a	a first transmitter at the base station, transmitting a first signaling to a user equipment (UE);
16.b	a second transmitter at the base station, transmitting a first radio signal to the UE; and
16.c	a third receiver at the base station, receiving first information from the UE;
16.d1	wherein, K antenna port groups of the base station are used to transmit the first wireless signal;
16.d2	the first signaling is used by the UE to determine the K antenna port groups transmitting the first wireless signal received by the UE; the K is a positive integer greater than 1;

16.d3	the K antenna port groups respectively correspond to K channel quality values; the K channel quality values are K non-negative real numbers; the K channel quality values are Reference Signal Received Powers (RSRPs) or Signal to Interference plus Noise Ratios (SINRs);
16.d4	K1 antenna port groups of the K antenna port groups correspond to K1 channel quality values of the K channel quality values; the K1 is a positive integer less than or equal to the K;
16.d5	a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values;
16.d6	the first information is used to determine the K1 antenna port groups and the first proportional sequence;
16.d7	the first signaling is used to determine a target threshold; the target threshold is a non-negative real number;
16.d8	a first channel quality is a best channel quality value among the K1 channel quality values; a second channel quality is a worse channel quality value among the K1 channel quality values;
16.d9	a ratio between the second channel quality and the first channel quality is greater than or equal to the target threshold.
Claim 17	
17.	The base station to claim 16, wherein the K channel quality values are broadband channel quality values; or the first proportional sequence comprises K1 positive real numbers less than or equal to 1, and the first proportional sequence comprises at least one 1; or the first proportional sequence comprises quantized values corresponding to K1 positive real numbers; or the first proportional sequence comprises K1-1 positive real number(s), and the K1-1 positive real number(s) is(are) a ratio(ratios) between a channel quality value(s) other than the best channel quality value among the K1 channel quality values and the best channel quality value; or the first proportional sequence comprises quantized values corresponding to K1-1 positive real number(s).

Claim 18	
18.	The base station to claim 16, wherein K2 antenna port groups in the K antenna port groups correspond to K2 channel quality values in the K channel quality values; the K2 is a positive integer less than or equal to the K; a second proportional sequence corresponds to a ratio(ratios) among the K2 channel quality values; a first receiving beamforming vector is used to receive signals transmitted through the K1 antenna port groups; a second receiving beamforming vector is used to receive signals transmitted through the K2 antenna port groups; the first receiving beamforming vector and the second receiving beamforming vector are different; the first information is further used to determine the K2 antenna port groups and the second proportional sequence.
Claim 19	
19.	The base station to claim 18, wherein any two antenna ports in the K1 antenna port groups are co-located or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL); or any two antenna ports in the K1 antenna port groups are on a same carrier, and any two antenna ports in the K2 antenna port groups are on a same carrier; or the first signaling is further used to determine at least the last one of the K1, the K2 and the target threshold, a third channel quality is a best channel quality value among the K2 channel quality values, a fourth channel quality is a worse channel quality value among the K2 channel quality values, a ratio between the fourth channel quality and the third channel quality is greater than or equal to the target threshold, and the first information is further used to determine at least one of the first channel quality and the third channel quality.

Claim 20	
20.	The base station to claim 18, wherein the second transmitter further transmits a second wireless signal; wherein a target antenna port group is used to transmit the second wireless signal; the target antenna port group is associated with the K1 antenna port groups and the first proportional sequence, or the target antenna port group is associated with the K2 antenna port groups and the second proportional sequence.

I. INTRODUCTION

Apple Inc. (“Apple” or “Petitioner”) petitions for IPR of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 10,951,271 (“the ’271 patent”).

II. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Apple Inc. certifies that the ’271 Patent is available for IPR. The present petition is being filed within one year of service of a complaint against Apple. Apple is not barred or estopped from requesting this review. EX1026-28.

B. Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested

Petitioner requests IPR of the Challenged Claims on the below grounds. Dr. Robert Akl provides supporting explanations in an expert declaration (EX1003) cited throughout this Petition. EX1003, ¶¶1-190.

Ground	’271 Patent Claims	Basis for §103 Rejection
1	1-20	Liu and Park

Each reference predates December 28, 2016, the ’271 Patent’s earliest claimed priority date, and thus qualifies as prior art, as shown by the table below.

Reference	Prior Art Date	Status
Liu	Published on Feb. 4, 2016	AIA §102(a)(1) & (2)
Park	Published on August 11, 2016	AIA §102(a)(1) & (2)

III. SUMMARY OF THE '271 PATENT

A. Brief Description

The '271 patent describes a technique for “improving transmission quality” in which a base station obtains “a proportional relationship among reception qualities corresponding to multiple beams” and generates “a more accurate serving beam for the UE according to the proportional relationship.” EX1001, 2:17-22; EX1003, §V (describing background knowledge by citing, among others, EX1015, EX1019, EX1020, EX1021, EX1022, EX1023). To achieve these features, the '271 patent describes a method that includes “receiving a first signaling; receiving a first wireless signal; and transmitting first information.” *Id.*, Abstract. In particular, the '271 patent purports to teach, “K antenna port groups are used to transmit the first wireless signal,” and “the first signaling is used to determine the K antenna port groups.” *Id.*, 1:64-67. “[T]he K antenna port groups respectively correspond to K channel quality values,” which are “Reference Signal Received Power[s] (RSRP[s]).” *Id.*, 1:67-2:2, 3:63-65. “K1 antenna port groups” correspond to “K1 channel quality values of the K channel quality values,” where K1 is “less than or equal to the K.” *Id.*, 2:2-5. Moreover, “a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values,” and “the first information is used to determine []the K1 antenna port groups[and] the first proportional sequence[.]” *Id.*, 2:5-9. The “K1 channel quality values” include “a

first channel quality [that] is a best channel quality value” and “a second channel quality [that] is a worse channel quality value,” and “a ratio between the second channel quality and the first channel quality [being] greater than or equal to [a] target threshold” determined from the first signaling. *Id.*, 2:9-16. The ’271 patent further explains that an “antenna port group” may be “composed of one antenna port.” *Id.*, 2:47-48, 13:64-65. Notably, the claims recite transmitting or receiving “first information,” which “is *used to determine...*the first proportional sequence,” but without requiring the proportional sequence to be sent as part of the recited first information. *Id.*, 27:20-21, 27:37-39 (emphasis added); EX1003, ¶¶54-55.

B. Prosecution History

Applicant argued that prior art (e.g., US9,520,973 (“Kim-973”)) teaches parameters that “**do not depend on the results of channel measurement nor do they include channel quality information such as RSRP or SINR**” whereas “the first proportional sequence of the claims is calculated based on the results of channel measurements indicated by channel quality values of RSRP or SINR.” EX1002, 464 (emphasis original). Applicant further argued that Kim-973 teaches “a threshold of **delay spread or Doppler**,” rather than “a threshold of a ratio between two channel qualities such as **RSRP and SINR**.” *Id.*, 464-65 (emphasis original). The Examiner subsequently allowed the claims, stating: “prior art of record...appears to fail or fairly show or suggest...novel and unobvious limitations

of [1.d], as recited in group claims 1-5 and 11-15; and [6.d], as recited in group claims 6-10 and 16-20.” *Id.*, 479-485 (Notice of Allowance).

But as demonstrated by this Petition, all of the recited features were known in the art. EX1003, ¶¶56-57. If the Examiner had considered more pertinent prior art, such as Kim, Chen, Liu, or Park, the ’271 claims would not have issued in their current form. *Id.*

IV. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art at the time of the ’271 patent (“POSITA”) would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or a similar field, along with two years of experience designing or developing wireless networks, including long-term evolution LTE/4G or 5G new radio (NR) cellular technology. EX1003, ¶¶29-32; ¶¶10, 16. Additional years of experience could substitute for an advanced-level degree (and vice versa). *Id.*

V. CLAIM CONSTRUCTION

All claim terms should be construed according to the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. §42.100. Especially in view of the similarity between the ’271 patent specifications examples and the prior art (e.g., Liu and Park), the prior art renders the challenged claims obvious under any reasonable construction consistent with the specification,

as explained *infra* §VI.A.4.[1.d1] (e.g., Liu’s base station transmits the first wireless signal using the M (K) antenna port groups (*transmitting the first wireless signal* under Element [1.d1]), just like the ’271 patent description), and [1.d5] (e.g., Park compares the RSRP of each measured antenna port group to the maximum RSRP “as an RSRP ratio,” (EX1010, [0370-373]), thereby providing the recited “*proportional sequence that corresponds to a ratio (ratios)*”). EX1003, ¶¶25, 87, 108. Accordingly, no formal constructions are necessary in this proceeding, because “claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011)¹. Patent Owner proposed construction of Elements [1.d1] and [1.d5] in an earlier proceeding. IPR2023-00571, Paper 14, 11-13). Although a construction is not deemed necessary to resolve invalidity in view of the similarity to the prior art, and because the plain and ordinary meaning would have been readily understood by a POSITA, Petitioner provides further analysis of the construction of these terms in the element-by-element analysis below, to the extent

¹ Petitioner is not conceding that each claim satisfies all statutory requirements, nor waiving any arguments concerning claim scope or grounds that can only be raised in district court.

construction is deemed necessary.²

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. GROUND 1 – Claims 1-20 Rendered Obvious by Liu and Park

1. Liu (EX1012)

Like the '271 patent, Liu teaches a “signal transmission method and an associated device” for performing “more effective antenna selection.” EX1012, Abstract. Specifically, Liu teaches that, “when an antenna configuration is performed, a second network device transmits configuration information of M antenna ports... and transmits signals of the M antenna ports to [a] first network device,” which first network device receives, “based on the configuration information, the signals of the M antenna ports transmitted by the second network device....” *Id.*, 21. “[T]he first network device may be user equipment (UE), and the second network device may be a base station....” *Id.*

Liu teaches that the M antenna ports may be individual ports, where the UE measures and selects the optimal ports, which it reports back to the base station: “The first network device needs to select N antenna ports from among M antenna

² Petitioner is not conceding that each claim satisfies all statutory requirements, nor waiving any arguments concerning claim scope or grounds that can only be raised in district court.

ports according to a certain criterion, and notify the second network device of first information of the selected N antenna ports [wherein] the first information is channel state information (CSI) corresponding to the N antenna ports....” EX1012, 22.

Liu also teaches dividing the M ports into groups having multiple antenna ports per group:

For example, M=10 corresponds to five cells, and each cell has two antennas...;

the UE measures the five groups of antenna ports respectively corresponding to the five cells, and finds that port 0 and port 1 corresponding to cell 1 have the strongest received signal power. For example, $RSRP_1 > RSRP_2 > RSRP_3 > RSRP_4 > RSRP_5$, $RSRP_1$ represents the received signal power corresponding to cell 1, $RSRP_2$ represents a received signal power corresponding to cell 2, and $RSRP_n$ represents a received signal power corresponding to cell n.

EX1012, 23. The base station uses the reported information to transmit data to the UE using the selected antenna port groups: “the second network device is notified of the CSI corresponding to the N antenna ports or the index information corresponding to the N antenna ports, so that the second network device transmits data to the first network device through the N antenna ports.” *Id.*, 24.

Liu is analogous art to the '271 patent because Liu, like the '271 patent, is directed to the “field of telecommunications technology and in particular to a signal transmission method” that uses “multiple-input multiple-output (MIMO) wireless systems” and describes “a signal transmission method and an associated device” for performing “more effective antenna selection” from the multiple antennas. EX1012, 4-5; EX1001, 1:18-19; EX1003, ¶¶58-62.

2. Park (EX1010)

Like the '271 patent, Park relates to a “radio communication system” and discloses an antenna selection method by “feeding back CSI based on reference signals.” EX1010, [0001]. Park’s UE measures the signal strength of the transmitting antenna ports, including measuring the reference signal receive power (RSRP). *Id.*, [0292]. After measuring each antenna port’s RSRP, Park determines and reports the antenna ports that are “strongly received.” *Id.*, [0371], FIG. 12. Park’s UE report[s] RSRPs of ports “that fall within a certain range compared to the max (RSRP (r, m)).” by determining an RSRP ratio by comparing each antenna port’s RSRP to the maximum RSRP. *Id.*, [0372-373]. The signals are “strongly received” when an RSRP difference is “higher than the threshold in terms of the RSRP ratio or dB scale” using the equation $RSRP(r,m) - \max(RSRP(r,m)) > \text{Threshold}$. *Id.* While Park’s RSRP can be a ratio, it can also use the decibel (dB) scale, which describes a ratio in power (Watts) of each

antenna port's RSRP value divided by the maximum antenna port RSRP value. EX1003, ¶63. Thus, Park teaches determining an RSRP-to-max(RSRP) ratio and selecting those antennas that satisfy the ratio comparison threshold. EX1010, [0371-378].

Park is analogous art to the '271 patent because Park, like the '271 patent, is directed to a wireless communication system that provides for feeding back CSI from a terminal based on a reference signal for selecting from multiple antennas in multiple antenna (MIMO and massive MIMO) systems. EX1010, [0001], [0092-97], [0341-356]; EX1001, 1:18-19; EX1003, ¶64.

3. Predictable Combination

A POSITA would have found it obvious to apply Park's "RSRP ratio" of the RSRP powers (proportional sequence) in Liu's system to determine the "strongly received" antenna port groups based on Park's relative comparison to achieve known benefits. EX1010, [0371-373], [0378], FIG. 12; EX1003, ¶65. As further explained below, multiple reasons would have prompted a POSITA to combine Liu and Park. *Id.*

A POSITA would have been motivated to calculate Park's RSRP-to-max(RSRP) ratio by dividing the raw RSRP values using Liu's K1 measured RSRP channel quality values because doing so would allow the system to

determine the relative strength of the received signals and select only those within a threshold range (e.g., 50% or higher—or 5 dB, about 31.62%—of the maximum power in Watts). EX1010, [0371-373], [0378], FIG. 12. EX1003, ¶66; EX1004, [0135-136], [0149]. By considering Park’s RSRP ratios (e.g., rather than Liu’s ordinal rankings (e.g., 1st, 2nd, 3rd strongest signal)), a POSITA would have recognized that the system would select only signals having comparable strength to the strongest signal, which improves transmission and data transfer because the data transfer over a particular transmission beam (e.g., antenna port group beam) is proportional to the received signal strength. EX1003, ¶66; *see* EX1008 (“Afroz”), 115, 118, 120, 122, FIG. 7. 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. EX1003, ¶66; *see* EX1012, 10-11 (“selecting...N antenna ports” that meet threshold criteria), 31, 38. Park confirms this, explaining that MIMO systems “collecting multiple data pieces received through multiple antennas,” which describes transmitting the wireless signal using multiple base station antenna signals such that the received signal is divided across multiple transmissions, and received by multiple antennas, which improves the overall

integrity and reliability of the system, such as in Liu. EX1010, [0093-94], [405]; EX1003, ¶66.

If the selection criteria were merely a cut-off value (e.g., all signals above a certain dB value), the system may select signals with very disparate powers if some of the received signals are much stronger than others, resulting in a wider disparity in signal strength and transmission rates, which could affect system performance. EX1003, ¶67. Similarly, if the system were to select the three or four strongest signals to provide multiple transmission paths, EX1010, [0093-94], the third or fourth signals may be much weaker, which could be disadvantageous to system performance because of the disparity in signal strength. EX1003, ¶67. A POSITA would have recognized that this could be avoided by using Park's ratios. *Id.*

A POSITA would have had a reasonable expectation of success in implementing Park's proportional sequence selection criteria using an RSRP ratio in Liu's system. EX1003, ¶68. Park's proportional RSRP ratio determination performs a basic, well-known, and conventional calculation (division of power values or, as argued by Patent Owner as sufficient, subtraction of respective dB scale values) of the RSRP values measured by Liu's system. *Id.*; EX1004, [0135-136], [0149]. Park compares the ratio to a threshold value and selects the antenna

port groups satisfying the threshold. EX1010, [0372-373], [378]; EX1003, ¶68. Liu performs a similar threshold comparison to select a subset, e.g., N, of the M or X antenna port groups. EX1012, 10, 31, 38; EX1003, ¶68. Using RSRP ratio comparison, in accordance with Park, to determine a set of acceptable antenna port groups (e.g., beams for transmission) would have been a straightforward selection condition that applies only known, conventional calculations (determining each RSRP ratio and comparing it to a threshold) used according to their known functions to yield predictable results (selecting antenna port group(s) based on the threshold comparison). *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007); *Slot Speaker Techs., Inc. v. Apple Inc.*, 680 F. App'x 932, 943-44 (Fed. Cir. 2017).

4. Application to Challenged Claims

[1.pre]: A method for multi-antenna transmission in a user equipment (UE), comprising:

To the extent the preamble is limiting, the Liu-Park combination performs a method for multi-antenna transmission in a user equipment (“UE”). EX1003, ¶69. Liu discloses multi-antenna transmission (e.g., multiple-input multiple-output (“MIMO”) or massive MIMO transmission) between a base station (“BS”) and UE to “perform more effective antenna selection” by the UE. EX1012, 2, 18, , 20, 29-30, FIGS. 1, 5. FIG. 1 is “a flowchart of a signal transmission method” in which a first network device receives “signals of M antenna ports transmitted by a second

network device,” the “first network device” being a “user equipment (UE)” and the “second network device” being a “base station.” *Id.*, 21, FIG. 1. The UE identifies the preferred N antenna ports for transmission and the base station “transmits data to the first network device through the N antenna ports [UE].” *Id.*, 21; EX1003, ¶69.

[1.a]: receiving, by the UE, a first signaling originating from a base station

The Liu-Park combination performs [1.a] when Liu’s first network device (i.e., the claim *UE*) receives, from the second network device (i.e., the claimed *base station*), *a first signaling* to provide configuration information such as codebook information (e.g., pre-coding matrices), M antenna ports assignment, and criteria and threshold requirements. EX1012, 18, 20, 23, 25-26; EX1003, ¶70 (noting conventional use of RRC signaling to provide, e.g., CSI-RS (Channel State Information-Reference Signal) configuration information by citing EX1004, [0142], [0146], [0148] (antenna port for transmitting CSI-RSs); EX1022, [0009] (same); and EX1014 (“Ng”) at [0152] (threshold for received CSI-RSs)).

“[W]hen an antenna configuration is performed,” the base station of the Liu-Park combination “transmits configuration information of M antenna ports to a first network device [UE],” which receives, “based on the configuration information, the signals of the M antenna ports transmitted by the second network

device....” EX1012, 18. “The user equipment calculates the SNR based on the configured codebook [(e.g., configuration information)] set and feeds back the SNR to a base station device.” *Id.*, 25, 26 (“feeding back... first information of N antenna ports in the M antenna ports according to a first criterion” that results in “optimal best information transmission performance”), 33 (“The configuration information of the M antenna ports includes a pattern of the antenna ports, that is, information such as a location of a time-frequency resource of the antenna ports, a transmitting cycle of the signals of the antenna ports, and a power.”), 34 (“the first information is channel state information (CSI) corresponding to the N antenna ports or index information corresponding to the N antenna ports”).

In the Liu-Park combination, the UE receives the first signaling based on which it selects antenna port groups, as revealed in Liu in two examples. First, the base station sends “configuration information of the M antenna ports includ[ing] a pattern of the antenna ports” where “[t]he configuration information is the configuration information of the M antenna ports.” EX1012, 33. This example is consistent with portions of the specification of the ’271 patent explaining that an antenna port group may comprise only one antenna port. EX1001, 2:45-46, 13:64-65.

Second, Liu teaches, alternatively, “the M antenna ports are divided into a plurality of groups, and are transmitted to the first network device in the form of a

plurality of pieces of configuration information, with each piece of configuration information corresponding to the configuration.” EX1012, 33 (“Each piece of configuration information corresponds to a configuration of one of antenna port groups”). For example, when $M=10$, the 10 antenna ports may be divided into “five cells, [where] each cell has two antennas.” *Id.*, 34 (“Cell 1 corresponds to port 0 and port 1, cell 1 [sic:2] corresponds to port 2 and port 3, cell 1 [sic: 3] corresponds to port 4 and port 5,” etc., where the “UE measures the five groups of antenna ports respectively corresponding to the five cells....” EX1012, 34. For multiple cells, the first signaling includes multiple pieces of configuration information, where each piece of configuration information corresponds to the configuration of one of the antenna port groups, *id.*, 33, and the broadcasting and signal notifications include various criteria and threshold information. *Id.*, 31-34; EX1003, ¶¶71-73.

As noted by Dr. Akl, Liu’s description of RRM [radio resource management] measurement refers to conventional signaling commonly used to convey configuration information and generate measurement reports for beam selection. EX1012, 28-29; EX1003, ¶¶74-75 (citing EX1004 (Kim), [0078-81], [0106], [0110-111], [0119], [0135-136], [0146], [0148-149] (describing base station configuring antenna ports for radio resource management (RRM, like Liu) measurements and signaling to UE which antenna ports should be measured to

determine channel qualities); EX1022 (Shin), [0009] (RRC signaling to indicate antenna port for transmitting CSI-RSs)).

[1.b]: receiving, by the UE, a first wireless signal originating from the base station; and

In the Liu-Park combination, the UE receives from the base station, ***a first wireless signal*** of the M antenna ports. As Liu explains, the “second network device [BS]...transmits signals of the M antenna ports to the first network device [UE]” and the UE “receives, based on the configuration information, the signals of the M antenna ports transmitted by the second network device” EX1012, 21, FIG. 1 (S101); *see also* 1 (background of beamforming/precoding for reception “in multiple-input multiple-output (MIMO) wireless systems”), 38-39 (determining transmission performance using the corresponding first codebook information which refers to information containing multiple precoding matrices).

Thus, in Liu’s disclosure, a “***first wireless signal***” is sent between the base station and UE using the base station’s antenna port groups because the signal is broadcast in different directions from different antenna ports. EX1003, ¶¶76-77. As Dr. Akl observes, Liu teaches that the measured signals are used during antenna port selection—or “RRM,” radio resource management—by virtue of using conventional reference signals that were well-known wireless signals in prior art systems, as evidenced in Park. *See e.g.*, EX1010, [0206-210] (noting “a reference

signal” for “detecting channel information” where “a reference signal associated with feedback of channel-state information (CSI) may be defined as CSI-RS”); EX1003, ¶77 (further citing, e.g., EX1004, [0051-53], [0063], [0070] (describing reference signals transmitted by base station antenna ports to perform channel measurements, e.g., RSRP)).

This is just like the '271 Patent, which 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; EX1003, ¶¶78-79.

[1.c]: transmitting, by the UE, first information to the base station;

In the Liu-Park combination, the UE transmits ***first information*** about the received wireless signal back ***to the base station*** after measuring each port signal, including “channel state information (CSI),” such as RSRP, or “index information” corresponding to antenna port or port groups selected by the UE. EX1012, 22; EX1010, [0001] (“feeding back CSI from a terminal based on a reference signal”); EX1003, ¶81.

The first information may be obtained and sent for individual antenna ports in the M antenna ports (e.g., N antenna port groups having one port per group) or for different antenna port groups from the X port groups (e.g., Cell 1, comprising ports 0,1), or other antenna port groups (e.g., antenna port groups N1, N2, or N3). EX1012, 22-23; EX1003, ¶82. The “CSI corresponding to these N antenna ports” is provided as a notification to the second network device “so that the second network device transmits data to the first network device through the N antenna ports.”. EX1012, 23-24.

Moreover, when the M ports are divided into five (X) port groups, “the UE measures the five groups of antenna ports respectively corresponding to the five cells....” EX1012, 34. The UE then “feed[s] back...first information of N antenna ports in the M antenna ports according to the first criterion,” such as signal strength, “to select a best antenna configuration and feeds back first information to the base station,” “including an antenna index and or CSI [RSRP].” EX1012, 25, 28; EX1003, ¶83. When the UE feeds back CSI information, such as RSRP, to the base station, the UE provides the well-known measurement report, which, as observed by Dr. Akl, was commonly performed in prior art systems. EX1003, ¶83 (citing EX1012, 31; EX1010, [0367-378] (UE reports RSRP of antenna ports); EX1004, [0106], [0135-137], [0139], [0148-149] (UE measures RSRP and RSRP-

to-max(RSRP) ratio and reports measured RSRP and ratio to base station in measurement report)).

[1.d]/ [1.d1]: wherein, K antenna port groups of the base station are used to transmit the first wireless signal;

The Liu-Park combination provides [1.d1]. EX1003, ¶84. Liu's base station transmits the first wireless signal using M individual antenna ports, which correspond to K antenna port groups having one port per group, for example. *Id.* (noting similarity to the '271 patent by citing EX1001, 13:64-65 (stating that antenna port group may include only one port), 2:45-46). Alternatively, the base station transmits the first wireless signal using X groups (cells) of antenna ports, corresponding to K antenna port groups, e.g., having two ports per cell, for example. *Id.*

Liu's base station transmits signals of the M antenna ports to the UE, which "receives the signals of the M antenna ports. EX1012, 21; *see also*, 26, 30, 38, FIG. 1 (S101), FIG. 3 (S201), FIG. 3 (S301). In this example, by "transmit[ting] signals of the M antenna ports," the base station transmits the first wireless signal using the M (K) antenna port groups where each group corresponds to one port. EX1003, ¶85.

Moreover, when the M antenna ports are divided into X cells, where X corresponds to K antenna port groups having groups of two antenna ports per cell,

each cell has an antenna configuration the base station uses to transmit the wireless signal that is received by the UE. EX1003, ¶86. When “the M antenna ports are divided into X groups,” Liu explains that “base station separately configures a codebook set for each group of antenna ports,” suggesting the base station transmitting the wireless signal for each of the X (K) antenna port groups because the 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. EX1012, 28; EX1003, ¶86. Liu specifically explains that “a first group of antenna ports corresponds to an antenna configuration 1 and includes antenna ports port 0 and port 1,” and “the base station configures a codebook set C1 for antenna configuration 1.” EX1012, 28. Liu’s UE “measures the five groups of antenna ports respectively corresponding to the five cells” and records the received signal power (RSRP) for each cell’s wireless signal, thus confirming the fact that each group of antenna ports (e.g., cell) is used to transmit a corresponding wireless signal. EX1012 34; EX1003, ¶86; *supra* [1.b].

Liu’s description is just like the disclosure of the ’271 patent, which explains that each “antenna port group includes only one antenna port,” (EX1001, 13:64-65), each “antenna port corresponds to a reference signal,” (*id.*, 2:56-57), and each “reference signal is a Channel State Information Reference Signal (CSI-RS),” (*id.*, 3:3-4). EX1003, ¶87. According to the ’271 patent, “the first wireless signal is

composed of K beam-formed CSI-RSs” using “K different analog beamforming vectors,” where the K beamformed CSI-RSs respectively “correspond[] to [the] K antenna port groups.” EX1001, 14:7-8, 13:61-62; *see also id.*, 3:3-4, 3:23-26, 13:62-67. The ’271 patent also explains “the first wireless signal is an *CSI-RS burst*” and “is composed of the *K reference signal groups*” that “are *respectively* transmitted through the K antenna port groups,” where each “reference signal group” may include “only one reference signal.” *Id.*, 3:16-17, 3:22-26, 13:66-67 (emphases added); *see also id.*, claim 5. In fact, it was conventional to transmit multiple CSI-RSs each emanating from the corresponding antenna ports. EX1003, ¶¶87-88 (citing EX1004 (“Kim”) at e.g. FIG. 6, [0076] (“each...CSI-RS is mapped to each antenna port”)).

To be clear, the plain and ordinary meaning of [1.d1] was readily understandable to a POSITA, and thus construction is not believed necessary. *Supra*, §V (Claim Construction). Alternatively, if construed, Liu-Park likewise renders obvious [1.d1] for the reasons described herein, as construction of [1.d1] must take account of the context of the claim language and the specification. For example, as set forth in the ’271 specification, a first wireless signal includes one or more sub-components, of which CSI-RSs are provided as an express example. *See* EX1001, 14:7-8 (“the first wireless signal is composed of K beam-formed CSI-RSs” using “K different analog beamforming vectors,” where the K beamformed

CSI-RSs respectively “correspond[] to [the] K antenna port groups.” EX1001, 14:7-8, 13:61-62; *see also*, 3:3-4, 3:23-26, 13:62-67 (“antenna port group includes only one antenna port”). Thus, the Liu-Park combination likewise renders obvious [1.d1] construed consistent with the specification, for the same reasons described above. EX1003, ¶87.

[1.d2]:

The Liu-Park combination renders obvious Element [1.d2] when Liu reveals that “M is a positive integer” and “X is a positive integer,” each corresponding to K antenna port groups being a positive integer greater than 1.” EX1012, 21, 30, 38; *supra* §VI.A.4 ([1.d1]). Liu also depicts “a configuration diagram of a plurality of [greater than one] antennas in an exemplary active antenna array.” EX1012, 20, FIG. 2; EX1003, ¶89.

Liu’s UE uses the configuration information as well as broadcasting and signal notifications sent from the base station (“first signaling,” *supra* §VI.A.4 ([1a])) to determine the M, or alternatively X, antenna port groups transmitting the first wireless signal received by the UE, as known in the art. EX1003, ¶90 (citing EX1004, [0078-80], [0106], [0111], [0119], [0135-136]). Liu’s configuration information and broadcasting and signal notification includes “the configuration information of M antenna ports, or the M antenna ports are divided into a plurality

of [X] groups” where “[e]ach piece of configuration information corresponding to the configuration of one of the antenna port groups.” EX1012, 22, 29, 31, 38. The UE uses this configuration information and broadcasting and signal notifications (“first signaling”) to determine the M or X antenna port groups because, as observed by Dr. Akl, the configuration information specifies the antenna port groups and includes “a pattern of the antenna ports” and “[c]odebook information [that] refers to information that includes a plurality of precoding matrices” of the antenna port groups. EX1012, 22, 27; EX1003, ¶90. The UE uses this information to determine and measure the antenna port groups, such as “calculat[ing]” RSRP or SNR of each antenna port group “based on the codebook set.” EX1012, 22, 28. The codebook information in the configuration information and broadcasting and signal notifications specifies the K antenna port groups and is used by the UE to identify and measure the first wireless signal because, as confirmed by Liu, for “a first group of antenna ports correspond[ing] to an antenna configuration 1 [that] includes antenna ports port 0 and port 1; the base station configures codebook set C1 for antenna configuration 1, and the precoding matrix” for the first port group, and, “[b]ased on corresponding ports of each antenna configuration,” the UE provides “an optimal rank, PMI(i), and SNR(i) in a codebook set Ci corresponding to each antenna configuration” as feedback. EX1012, 28. Once the UE has determined and measured each antenna port group,

the UE “select[s] a best antenna configuration, and feeds back first information to the base station.” *Id.* (“the first information includes antenna indices and or CSI fed back to the base station”); EX1003, ¶¶90-91.

[1.d3]:

The Liu-Park combination renders obvious Element [1.d3] where each of the M or X antenna port groups (corresponding to K antenna port groups, *supra* §VI.A.4 ([1d1])), as provided in Liu, has channel state information (“CSI”) including a channel quality value, such as RSRP, as evidenced in both Liu and Park. EX1012, 28; EX1010, [0001] (“feeding back CSI from a terminal based on a reference signal”). The CSI measurements include RSRP, which is a non-negative real number, because RSRP is the received power in Watts of the wireless signal. EX1012, 28; EX1003, ¶92 (noting power, as measured in Watts, would be a non-negative real number).

Liu explains that “[w]hen the user equipment performs RRM [radio resource management] measurement[s],” the UE “performs random beamforming...in the codebook set...to calculate and report an average reference signal receiving power (RSRP)” of the antenna port groups. EX1012, 29. As one example, the UE “performs random beamforming on all codebooks in C1 based on a pilot of the antenna configuration 1 to obtain an RSRP 1” of the first antenna port group, and

performs similar RSRP measurements for each other antenna configurations of the other antenna port groups. EX1012, 29-30; EX1003, ¶93. Similarly, “the UE measures the five groups of antenna ports” and determines RSRP1-RSRP5 for each port group, finding that “port 0 and port 1 corresponding to cell 1 have the strongest received signal power” and $RSRP1 > RSRP2 > RSRP3 > RSRP4 > RSRP5$. EX1012, 34. Such RSRP measurements were well known in the prior art. *Id.*, 34; EX1003, ¶94. Liu’s UE uses the codebook set to measure the RSRP (channel quality values) corresponding to the M or X antenna port groups (K antenna port groups, *supra* §VI.A.4 ([1.d1])), as part of the conventional beamforming/precoding process. EX1012, 1 (background beamforming/precoding in MIMO systems), 22-24, 34, 38; EX1003, ¶¶94-95.

[1.d4]:

As explained *supra* [1.d3], in the Liu-Park combination, Liu’s UE measures K channel quality values (RSRP) for each of the M or X antenna port groups (K antenna port groups). Element [1.d4] states that K1 is some or all of the K antenna port groups and, therefore, K1 channel quality values are some or all of the K channel quality values discussed for [1.d1]-[1.d3]. EX1003, ¶96.

Liu’s UE determines the channel quality values (RSRP) for a subset, N, of the M antenna ports transmitting the wireless signal with “N being an integer less

than or equal to M.” EX1012, Abstract, 22, FIG. 1 (step S102); EX1003, ¶97. The UE selects N (K1) antenna port groups and sends the channel quality value information (RSRP) back to the base station as first information, for example, using a “feeding back” for “selecting...from the M antenna ports, N antenna ports that obtain optimal best information transmission performance.” EX1012, 8, 12; EX1003, ¶97. Liu’s N corresponds to the claimed “K1,” which is a positive integer less than or equal to M or X (respectively, K), because N contains at least one antenna port or port group cell comprising an antenna port group being reported back but is not larger than the complete set of M ports or X port groups (respectively, K antenna port groups). EX1003, ¶97. The CSI information (e.g., RSRP) is then “obtained” and the base station “is notified of the CSI corresponding to the N antenna ports or the index information corresponding to the N antenna ports, so that the [base station] transmits data to the [UE] through the N antenna ports.” EX1012, 24; EX1010, [0372-0373] (determining “an RSRP ratio” and reporting when “greater than a certain threshold value”); EX1003, ¶¶97-98.

[1.d5]:

The Liu-Park combination renders obvious *a first proportional sequence corresponds to a ratio(ratios) among the K1 channel quality values*. EX1003, ¶99. Liu discloses determining a reference signal receiving quality (RSRQ), which

a POSITA would have recognized is a ratio of RSRP over the received signal strength indicator (RSSI). EX1012, 28, 36-39, 22, 32 (discussing RSRP, RSSI, RSRQ). The RSRQ for the N antenna port groups (K1 antenna port groups, *supra* §VI.A.4 ([1.d4])) of the M or X antenna port groups together form a proportional sequence of RSRP and RSSI ratios. *See* EX1010, [0295]; EX1013 (“Sesia LTE”), 514; EX1003, ¶99.

To the extent that Patent Owner argues, or the Board finds, that Liu did not disclose (which Liu does) a ratio that includes at least a ratio of different channel quality values (*infra* §§VI.A.4 ([1.d8]-[1.d9])), Park renders this ratio obvious because Park compares the RSRP of each measured antenna port group to the maximum RSRP as an “RSRP ratio or dB scale.” EX1010, [0370-373], [0376-378] (emphasis added), FIG. 12; EX1003, ¶100.

In more detail, Park teaches that the UE “reports the RSRP of L antennas that were strongly received” during RRM-RS³, which “composed of multiple antenna ports, and it would be possible for the UE to measure the RSRP for each transmission beam by setting the beam-forming differently for each antenna port..” EX1010, [0359]; EX1003, ¶101 (Park describes similar configuration information and broadcasting and signal notifications (“first signaling”) to Liu for an antenna

³ Radio Resource Management Reference Signal

port group's wireless signal). To determine the "strongly received" antenna port signals, Park aligns each measured RSRP and "reporting is limited to the RSRP of the selected antenna ports, namely the RSRP of the ports that fall within a certain range compared to the max (RSRP (r, m))." EX1010, [0371-373]. Park's UE reports the antenna ports having "wherein the RSRP difference is higher than the threshold in terms of the RSRP ratio or dB scale." EX1010, [0371-373] (emphasis added); EX1003, ¶102.

In the above context, a POSITA would have recognized that an "RSRP ratio" describes the power ratio $\text{RSRP}(r,m)/\text{max}(\text{RSRP}(r,m))$. EX1003, ¶103. As explained above, the power, P , in Watts is a non-negative real number. *Supra* §VI.A.4 ([1.d3]). Park's FIG. 12 confirms the comparison of each measured RSRP to the max(RSRP), which forms a proportional sequence of RSRP ratios. EX1010, [0376-378], FIG. 12; EX1003, ¶103. The RSRP ratio can be compared for individual antenna ports or "an antenna port group," where the "the base station could determine the group and then notify," which teaches comparing the RSRP ratio(s) for single-antenna port groups (e.g., Liu's M antenna ports) or multiple-antenna port groups (e.g., Liu's X antenna port groups). EX1010, [0385]; EX1003, ¶103.

During prosecution of the '271 patent, the applicant argued 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.” EX1002, 472. To the extent Patent Owner argues that this requires the “proportional sequence” to include—and the UE to report—all of the RSRP values above a certain threshold, Park discloses this interpretation, as explained above. EX1003, ¶104.

While Park discloses that a group of antenna ports is selected when the antenna ports exceed a particular threshold, Park provides an example where the UE has been configured to report the RSRP of an antenna port having an RSRP within 5 dB of the antenna port with the greatest RSRP. EX1010, [0378], FIG. 12. A POSITA would have recognized from Park’s disclosure of an “RSRP ratio” that the ratio could be calculated, rather than the difference, in dB. EX1010, [0373], [0378]; EX1003, ¶105. As explained *supra* §VI.A.2, a POSITA would have been motivated to use the power “RSRP ratio” because it determines the power threshold as a representation of a maximum power difference (Watts) compared to the maximum RSRP. EX1003, ¶105. It would have been obvious to a POSITA to compare the power ratios (in Watts), rather than converting to dB representations, because standard ratios would have been simpler for more conventional ratios, such as 50% or 75%. EX1003, ¶105 (noting well-known feature by citing EX1004,

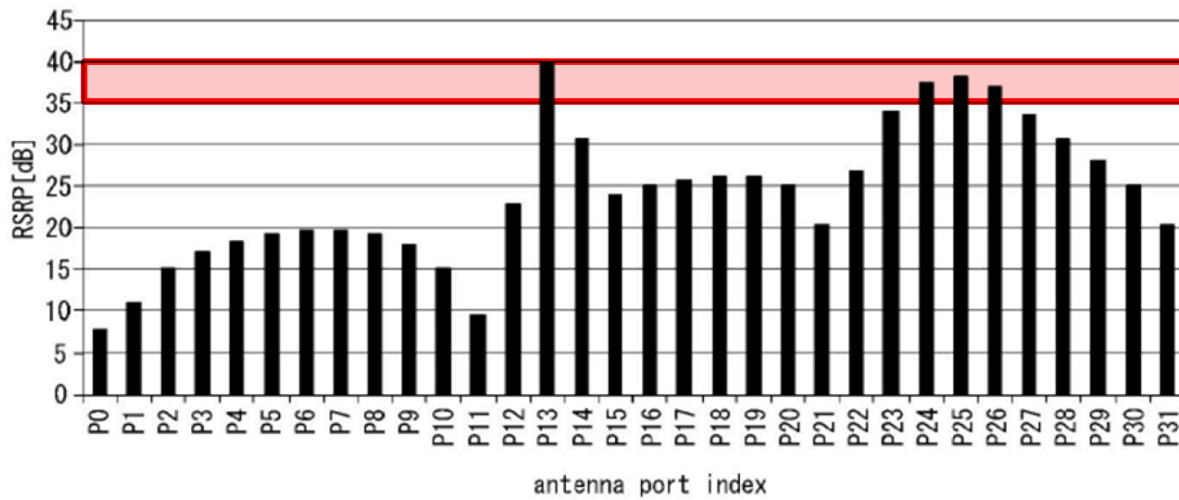
[0135-136], [0149] (comparing RSRP-to-max(RSRP) ratio in Watts to threshold); EX1006, 14-15).

To the extent Patent Owner alleges that the “ratio(s)” and “proportional sequence” in elements [1d5]-[1d9] can be satisfied by subtracting dB values, Park teaches and renders obvious that interpretation too. For example, *Park* discloses, as an alternative to using the “RSRP ratio,” using Equation 13:

$$\text{RSRP}(r,m) - \max(\text{RSRP}(r,m)) > \text{Threshold}$$

EX1010, [0372-373]; EX1003, ¶106. Park applies this equation to consider whether the dB difference of the received RSRP values in FIG. 12 is greater than 5 dB. EX1010, [0376-378], FIG. 12. “since antenna port 13 has the maximum RSRP of 40dB as shown in Figure 12,” the UE compares each of the other antenna ports’ RSRP values to antenna port 13 and the UE reports “those antenna ports with the RSRP exceeding 35dB.” *Id.*, [0378]. The “RSRPs of the antenna ports 24, 25, and 26 including antenna port 13 are reported to the base station,” as shown by the red band in annotated FIG. 12 below. EX1010, [0376-378], FIG. 12.

[FIG. 12]



EX1003, ¶107 (citing EX1010, FIG. 12 (annotated)).

In sum, a POSITA would have found it obvious to use Park’s “RSRP ratio” of the RSRP powers (proportional sequence), or the dB difference, to the extent argued by Patent Owner, in Liu’s system to determine the “received strongly” antenna port groups using Park’s relative comparison because it allows each UE to make the best use of the available transmitted wireless signal. *Supra* §VI.A.3; EX1003, ¶¶108-109.

To be clear, the Liu-Park combination renders obvious [1.d5] based on its plain and ordinary meaning, which was readily understandable to a POSITA, and thus construction is not necessary. *Supra*, §V (Claim Construction). Alternatively, even if construction were considered necessary, Liu-Park likewise renders obvious [1.d5] for the same reasons described above. Here again, construction of [1.d5]

must take account of the context of the claim language and the specification, including dependent claims that further inform the meaning, which confirm that the sequence can have a number other than exactly $K1$ values, and describe examples that the “first proportional sequence comprises quantized values corresponding to $[K1/K1-1]$ positive real numbers.” See EX1001, 27:35-28:8, 29:12-27, 30:32-47, 31:50-32:16. Thus, the Liu-Park combination likewise renders obvious [1.d5] construed consistent with the specification, for the same reasons described above. EX1003, ¶

[1.d6]:

In the Liu-Park combination, *the first information is used to determine the $K1$ antenna port groups and the first proportional sequence* because the Liu-Park combination uses the channel state information (CSI), such as RSRP (“first information”) to determine the first proportional sequence and to select the N (i.e. the claimed “ $K1$ ”) antenna port groups of the M or X (i.e., the claimed “ K ”) antenna port groups. §VI.A.4 ([1.c] (“first information”), [1.d5]).

The Liu-Park combination applies Park’s “UE reports antenna ports with an RSRP” ratio or difference from the $\max(\text{RSRP})$ over a desired threshold to determine the selected port groups (e.g., Liu’s N or $K1$ antenna port groups). EX1010, [0378]; EX1012, 28, 38, 22-24 (noting the UE sends

“the first information [which] includes an antenna index and or a CSI,” identifying selected antenna port group(s) and the corresponding CSI (e.g., RSRP) values to the base station); EX1003, ¶110-111. The first information includes antenna ports where the signal strength (e.g., RSRP ratio) “is higher than” a threshold so that the “UE compares [the signal strengths] to select a best antenna configuration and feeds back first information corresponding to the best antenna configuration to the base station.” EX1012, 28, 37-38; EX1003, ¶111. “[T]he CSI [e.g., RSRP]... or the index information corresponding to these N antenna ports” is provided as a notification to the base station so that the base station “transmits data” to the UE “through the N antenna ports.” EX1012, 24.

A POSITA would have found it obvious to use Liu’s RSRP values to create the proportional sequence of [1.d5], as revealed in Park, which would, in turn, be used to select Liu’s N (K1) antenna port groups that the base station “transmits data” to the UE “through the N antenna ports.” EX1012, 24; EX1003, ¶112. Park, like Liu, explains that “the UE has been configured to report the RSRP of an antenna port” group that meets the threshold criteria (K1 port groups, like Liu’s N port groups) to transmit data to the UE. EX1010, [0378], [0382-383]; EX1003, ¶112; *supra* §VI.A.4 ([1.d5]). To the extent Patent Owner argues that the proportional sequence and the K1 antenna port

groups are determined by those antenna ports that meet the threshold criteria, *see* EX1002, 472, the Liu-Park combination of renders this obvious for at least the reasons explained for [1d5]. *Supra* §VI.A.4 ([1.d5]).

A POSITA would have found it obvious to combine Liu and Park to use Park's proportional sequence, and would have a reasonable expectation of success at doing so, for the reasons set forth for [1.d5]. *Supra* §VI.A.3; EX1003, ¶113. The predictable result would have been using the first information to determine the K1 antenna port groups and the first proportional sequence. *Id.*

[1.d7]:

The Liu-Park combination renders obvious that ***the first signaling is used to determine a target threshold and the target threshold is a non-negative real number.*** EX1003, ¶114.

Liu discloses the UE using a “first criterion” or threshold, such as an SNR threshold, throughput threshold, or codebook information, to determine the selected (N or K1) antenna ports, and that the threshold “may be predefined” or provided through “a base station broadcast.” EX1012, 24; EX1003, ¶114. For example, “the first criterion, the first threshold, the second threshold, the third threshold, and the fourth threshold are configured by the second network device by

using broadcast information, high higher layer signaling, or dynamic signaling.” EX1012, 20, 30-31.27, 38. By configuring these criteria and thresholds through configuration information and broadcasting and signal notifications (“first signaling”), Liu teaches sending the threshold and criteria requirements to the UE in the first signaling. *Supra* §VI.A.4 ([1a]); EX1003, ¶114.

Liu describes the first signaling including a power threshold, such as signal-to-noise ratio (“SNR”) threshold, to select N antenna ports from among M antenna ports. EX1012, 6, 11, 15, 20 (“more effective antenna selection”), 22-23, 24-25, 28-29; EX1003, ¶115. As explained *supra* §VI.A.3 and [1.d5], a POSITA would have it obvious to and been motivated to send Park’s power ratio threshold through the same broadcast signaling as other threshold values to allow the base station to configure the UE according to the system requirements because Liu explains that “antenna selection is carried out more effectively” using thresholds. EX1012, 20; EX1003, ¶115. A POSITA would have a reasonable expectation of success in transmitting the threshold with the first signaling because transmitting thresholds to the UE by the base station represented only the ordinary and expected use of transmitting information, as taught by Liu. EX1003, ¶115; EX1012, 6, 11, 15, 20, 21-25, 28-29.

In the Liu-Park combination, Park provides measured-RSRP-to-max(RSRP) ratio threshold that is a non-negative real number because, as explained *supra* [1.d5], the ratio of two RSRP values in Watts, which are non-negative values (or a negative dB difference), corresponds to a non-negative power ratio that is less than or equal to one. EX1003, ¶116; EX1010, [0372-378], FIG. 12. Moreover, a POSITA would have recognized that using a straight RSRP ratio of the power in Watts would be a non-negative real number, such as 0.3162 or about 31.62% of the strongest signal, as explained *supra* [1.d5]. EX1003, ¶¶116-117.

[1.d8]:

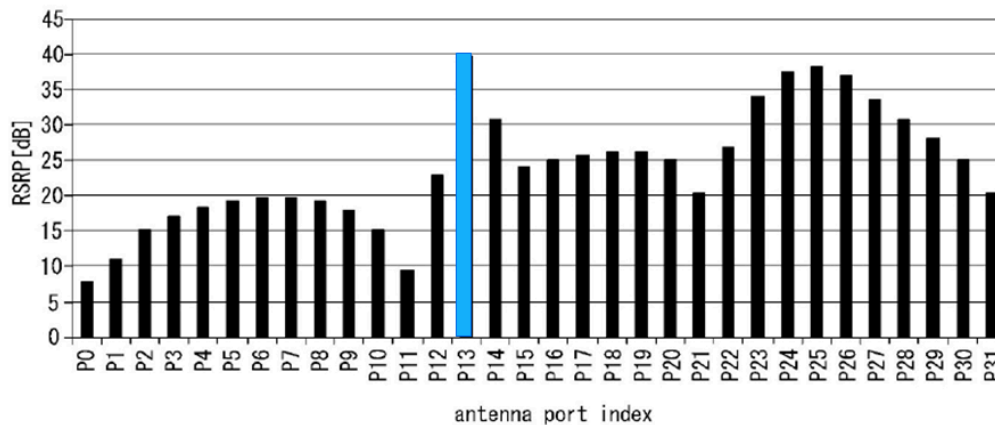
The Liu-Park combination renders obvious Element [1.d8]. EX1003, ¶118.

Liu discloses calculating the RSRP (“channel quality value”) for each of the N (K1) antenna port groups within the M or X antenna port groups, where the RSRP values are compared and ranked from best (maximum value) to worse (less than the maximum value). EX1003, ¶118. Liu’s “UE measures the five groups of antenna ports respectively corresponding to the five cells, and finds that port 0 and port 1 corresponding to cell 1 have the strongest received signal power. For example, $RSRP_1 > RSRP_2 > RSRP_3 > RSRP_4 > RSRP_5$,” and “ $RSRP_n$ represents a received signal power corresponding to cell n.” EX1012, 23, 34. In this example, $RSRP_1$ is the “best channel quality value” or maximum RSRP while $RSRP_2$,

RSRP3, RSRP4, and RSRP5 are “worse channel quality value(s)” or lesser RSRPs.
EX1003, ¶118.

Park confirms that the channel quality values include a maximum or “best” RSRP channel quality value, $\max(\text{RSRP}(r,m))$, and “worse” RSRP channel quality values that have a lesser RSRP. EX1010, [0367-378], FIG. 12; EX1003, ¶119. Park’s FIG. 12, annotated below, shows antenna port 13 having the “best” channel quality. value. (blue bar) with “the maximum RSRP of 40 dB” and the remaining antenna ports (black bars) having a “worse” channel quality value less than 40 dB. EX1010, [0378], FIG. 12.

[FIG. 12]



EX1003, ¶¶119-120 (citing EX1010, FIG. 12).

[1.d9]:

The Liu-Park combination renders obvious that a ratio between the second [worse] channel quality and the first [best] channel quality is greater than or equal to the target threshold. EX1003, ¶121.

Liu discloses that the criterion or threshold for selecting antenna port groups may rely on a power ratio calculation that is “greater than or equal to” a particular threshold, including power ratios, such as signal-to-noise (SNR) ratios. EX1012, 6, 11, 16, 24-27, 35-37, 44-45, 51; EX1003, ¶121.

As explained *supra* [1.d5], Park teaches determining a proportional sequence comprising a ratio(ratios) of the RSRP channel quality values for the received antenna port groups and selecting the antenna port groups that “have an RSRP difference greater than a certain threshold value expressed as an *RSRP ratio*,” or alternatively dB difference, to the extent argued by Patent Owner. EX1010, [0372-373] (emphasis added), [378]; EX1003, ¶122. Thus, Liu and Park both teach determining power ratio measurements (e.g., SNR or RSRP ratio) for antenna port groups and comparing the power ratio to a threshold value. *Supra* §VI.A.4 ([1d5]); EX1010, [0385]; EX1003, ¶123. Park’s threshold represents an RSRP power ratio in Watts of about 0.3162 or 31.62% of the maximum RSRP (alternatively, 5 dB difference), as explained above. Using Park’s FIG. 12 as an example, this is determined by looking for antenna ports with an RSRP-to-max(RSRP) ratio greater

than about 31.62% (alternatively -5 dB). For example, Park's Port24 has an RSRP of about 37 dB, representing an RSRP power ratio in Watts of about 0.5012, or about 50% (or about -3 dB). EX1010, [0378], FIG. 12; EX1003, ¶123. Park's Port20, however, has an RSRP of about 25 dB, representing an RSRP power ratio in Watts of about 0.0316, or about 3% of Port13 (or about -15 dB). EX1010, FIG. 12. A POSITA would have found it obvious to calculate these ratios either by taking the ratio of powers in Watts—"RSRP ratio"—or a "dB scale" difference, according to Patent Owner's assertion, as explained in Park. EX1010, [0372]; EX1003, ¶123; *supra* §VI.A.4 ([1.d5]), EX1004, [0135-136], [0149]; EX1006, 14-15. Park therefore selects Port24, but not Port20. EX1003, ¶123.

Park and Liu both disclose that the power ratio is greater than a threshold value, *supra* §VI.A.4 ([1d5]), which satisfies the claim language that "a ratio between the second channel quality and the first channel quality is greater than or equal to the target threshold." EX1010, [0372-373] (Equation 13); EX1003, ¶124.

To the extent Patent Owner argues that this limitation strictly requires "greater than or equal" (which it does not), a POSITA would have found it obvious to determine whether Park's "RSRP ratio" is greater than or equal to a threshold value, as taught by Liu. EX1003, ¶125; *supra* §§VI.A.4 ([1d5]), VI.A.4 ([1d7]); EX1010, [0371-373], [0378] (UE "report[s] the RSRP of an antenna port having an RSRP within 5 dB of the antenna port with the greatest RSRP"), FIG. 12.

While Element [1.d8] recites only a “worse” channel quality value (e.g., any channel quality value that is not the “best” channel quality value), such as Park’s Port24 explained above, to the extent Patent Owner argues that, based on the prosecution history, the threshold for [1.d9] requires the “worst” channel quality value to be above the target threshold, Park discloses and renders obvious the UE restricting and reporting the K1 channel quality values to only those values above the threshold value, as explained above for [1.d5]-[1.d6]. *Supra* §§VI.A.4 ([1.d5]-[1.d6]); EX1010, [0378], FIG. 12; EX1002, 472. In particular, Park’s Port27 represents the “worst” selected and reported antenna port above Park’s 31.62% ratio (or 5 dB difference) threshold within the reported antenna port set criteria in Park. EX1010, FIG. 12; EX1003, ¶126.

As explained *supra* §VI.A.3, a POSITA would have found it obvious to use Park’s RSRP ratio and determine whether it is “greater than or equal to” a threshold value (as described in Liu) to select strongly received antenna ports and provide for better data transfer by selecting those port groups that have strength in an acceptable range as compared to the strongest received signal. EX1003, ¶127. A POSITA would have been motivated to implement Park’s RSRP-to-max(RSRP) ratio comparison between the worse (second) channel quality and the best (first) channel quality being greater than the target threshold. *Supra* §§VI.A.4 ([1d5], [1d8]). As explained above, both Liu and Park disclose threshold comparisons that

require the power ratio to be “greater than” or “greater than or equal to” the threshold value. EX1003, ¶127. Moreover, using a “greater than” or “greater than or equal to” determination would have also been a matter of design choice to a POSITA and would have represented two known options for selecting values greater than a particular threshold that were considered interchangeable options. EX1003, ¶127; *KSR*, 550 U.S. at 416-417, 421; *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1338-41 (Fed. Cir. 2020).

As explained *supra* [1.d5] and [1.d8], a POSITA would have had a reasonable expectation of success in implementing Park’s RSRP-to-max(RSRP) ratio comparison between the worse (second) channel quality and the best (first) channel quality being greater than the target threshold. *Supra* §§VI.A.4 ([1.d5], [1.d8]); EX1003, ¶128.

If this element is construed to require a “greater than or equal to” comparison, rather than being satisfied by “greater than,” a POSITA also would have had a reasonable expectation of success in implementing this comparison for Park’s threshold value because “greater than” and “greater than or equal to” were considered interchangeable to a POSITA. EX1003, ¶129. Moreover, the difference in implementing these comparisons in a particular system would have been a trivial matter in the implementation software that would not have affected the operation of the other processes because both comparators were well known for operating

within the same comparison formulas for nearly all available processing systems described in Liu and Park. *Id.* As such, using Liu’s “greater than or equal to” comparison in Park’s RSRP-to-max(RSRP) ratio equation would have been a straightforward selection condition that applies only known, conventional calculations (“greater than” versus “greater than or equal to”) used according to their known functions to yield predictable results (selecting a particular antenna port group based on the threshold). *Id.*

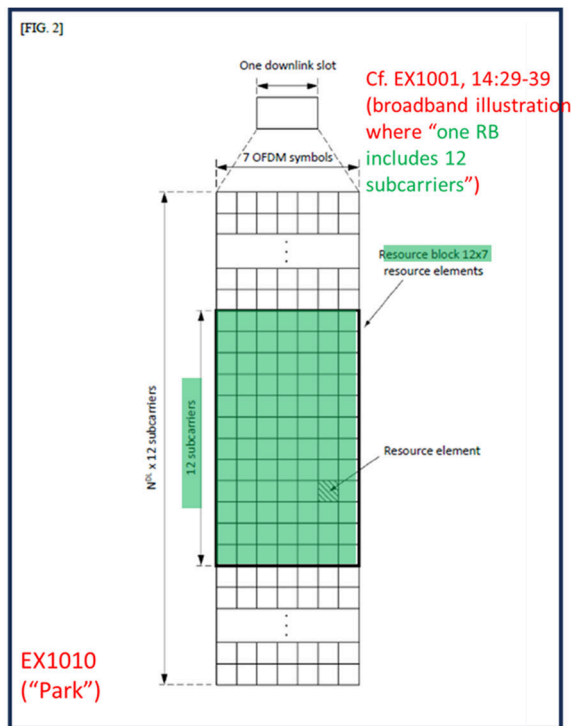
For the foregoing reasons, the Liu-Park combination renders obvious claim 1. EX1003, ¶130.

Claim 2.

Claim 2 recites five alternative options in disjunctive. Satisfying any one of these options satisfies the requirements of claim 2. *Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001).

In the Liu-Park combination, Park teaches ***the K channel quality values are broadband channel quality values***. Park teaches reference signals (RSs) “for the purpose of acquiring channel information.” EX1010, [0208]. “Since the purpose of the former is for the UE to acquire downlink channel information, transmission must be carried out with via broadband, and even if the UE does not receive downlink data from a specific sub-frame, it must be able to receive and measure

the RS.” *Id.* In FIG. 2 (below), Park shows an example of “a resource grid” in which “single downlink slot includes 7 OFDM symbols, and that a single resource block includes 12 sub-carrier waves in the frequency domain.” *Id.* For the record, Park shares FIG. 2 (annotated below) with Kim (EX1004), who is a co-inventor with Park. Park’s description parallels the descriptions of the ’271 patent. *See e.g.*, EX1001, 14:29-39 (“the broadband is composed of a plurality of sub-bands, and the sub-bands are composed of one or more Resource Blocks (RBs)” and “one RB includes 12 subcarriers”).



EX1003, ¶132 (EX1010, FIG. 2)

The Liu-Park combination render obvious *the first proportional sequence comprising K1 ratios of positive real numbers less than or equal to 1, and the first proportional sequence comprising at least one 1.*

As explained for Elements [1.d5]-[1.d7] and [1.d9], the Liu-Park combination determines, in Liu's system, a proportional sequence of K1 RSRP-to-max(RSRP) ratios results in values that are positive real numbers less than or equal to 1 and a value of 1 by virtue of comparing the measured RSRP to the max(RSRP), as revealed in Park. *Supra* §§VI.A.4 ([1d5]-[1d9]). For example, when Park calculates the RSRP ratio for antenna 13, the RSRP is the same and the power ratio, $P_{\text{antenna13}}/P_{\text{antenna13}}=1$ (difference is 0 dB). EX1003, ¶133. Similarly, for lesser RSRP values (e.g., antennas 24, 25, 26), the power ratios, $P_x/P_{\text{antenna13}}$, are positive real numbers less than 1 (dB difference is less than 0). *Id.* The same holds true when calculating Liu's RSRP values. *Id.*

Moreover, if the ratio RSRP(r,m)-to-max(RSRP(r,m)) is a direct division based on Park's disclosure of an "RSRP ratio," EX1010, [0378]; *supra* §VI.A.4 ([1d5]), then the ratio will be 1 for max(RSRP(r,m))/max(RSRP(r,m)), and between 0 and 1 for all other RSRP(r,m)/max(RSRP(r,m)). EX1003, ¶¶134-135.

Claim 3

[3.pre]:

In the context of claim 1, the Liu-Park combination also renders obvious claim 3, as explained below. EX1003, ¶136.

[3.a]:

In the Liu-Park combination, Liu discloses ***wherein K2 antenna port groups in the K antenna port groups correspond to K2 channel quality values in the K channel quality values; the K2 is a positive integer less than or equal to the K.*** EX1003, ¶137.

Liu teaches that, within M or X antenna port groups (K antenna port groups), the UE may select two different subgroups, such as N1 and N2 groups, for different purposes. EX1003, ¶138. Liu's UE may select N1 antenna port groups from the M or X port groups (e.g., Cell 1), representing K1, and also N2 antenna port groups from the M or X port groups (e.g., Cell 2), representing K2. Because each of N1/Cell 1 (K1) and N2/Cell 2 (K2) includes one or more of the M antenna port groups, the N2/Cell 2 (K2) antenna port groups is a positive integer less than or equal to M (K). *Id.*

For example, a first group of antenna ports, N1, that is optimal for transmit diversity transmission may be selected and the first information of the N1 antenna ports (e.g., RSRP and antenna indices) reported to the base station for selection, while a second group of antenna ports, N2, that is optimal for beamforming transmission may

be selected and the first information of the N2 antenna ports (e.g., RSRP and antenna indices) provided to the base station. EX1012, 17, 27; *also* EX1012, 25-26, 38; EX1003, ¶139. Liu explains why multiple, different antenna ports groups may be selected: “a SU [single user] may select cross polarization antennas, and correlation between the antennas is small, which facilitates spatial multiplexing,” and when “MUs are paired, it is better for each user to select a co-polar antenna, to facilitate beamforming for each user” which a POSITA would have recognized as selecting two beamformed groups, based on the RSRP values discussed above to ensure sufficient power of the transmission, and possibly other factors, such as SU or MU requirements, as described in Liu. EX1012, 35, 24; EX1003, ¶139.

To the extent that Patent Owner argues, or the Board finds, that Liu does not disclose (which Liu does) the K2 antenna port groups, it would have been obvious to a POSITA to select two sets of antenna port groups, K1 and K2, for example, because the carriers or frequency bands of each of the antenna port groups are different and, thus, each carrier or frequency band requires a different selection of antenna port groups to optimize the transmission from the base station to the UE. EX1003, ¶140. Similarly, a POSITA would have found it obvious to select the K2 antenna port groups during a second measurement report using the first information, such as a predetermined interval or occurrence of a triggering condition. *Id.*; EX1004, [0148]; EX1013 (Sesia LTE), 75.

A POSITA would have found it obvious to select different sets of antenna port groups based on the purpose of the group (e.g., single-user or multi-user transmission), based on the frequency band(s), or in a second measurement report to optimize the transmission of each transmission. EX1003, ¶141. A POSITA would have been motivated to select the K2 antenna port groups because doing so would have allowed the UE to further optimize the selection, such as for antenna correlation, single- or multi-user transmission, or a particular frequency band, by applying additional criteria to give comprehensive consideration to signal power and other criteria to select the optimal transmission signals. EX1012, 23-24, 35; EX1003, ¶141.

A POSITA would enjoyed a reasonable expectation of success in selecting the K2 antenna port group signals having channel quality values because such subset comprises a subset of the K channel quality values (RSRP) determined for every received signal, as explained *supra* [1.d3] and [1.d4]. The K2 subset would have been a straightforward determination of those already-measured channel quality values that meet criteria already described in Liu, and therefore applies only known, conventional calculations used according to their known functions to yield predictable results. EX1003, ¶142.

[3.b]:

The Liu-Park combination renders obvious *a second proportional sequence corresponds to a ratio(ratios) among the K2 channel quality values*. While the K2 antenna port groups described in [3.a] are part of the set of M or X antenna port groups, the UE prepares a second proportional sequence that corresponds to the RSRP-to-max(RSRP) ratio among the K2 RSRP values (channel quality values) because K2 is a subset of the K values already calculated when measuring the RSRP ratios, as explained in claim 1. *Supra* §VI.A.4 ([1.d5]-[1.d9]); EX1003, ¶143. A POSITA also would have found it obvious to determine the proportional sequence among the K2 antenna port groups because each ratio among the K2 antenna port groups would be determined when the UE performs the RSRQ or RSRP-to-max(RSRP) ratio comparison, as explained *supra* [1.d5] (referring to K1). EX1010, [0370-373]; EX1003, ¶143.

[3.c]:

The Liu-Park combination also renders obvious “*a first receiving beamforming vector is used to receive signals transmitted through the K1 antenna port groups, a second receiving beamforming vector is used to receive signals transmitted through the K2 antenna port groups, and that the first*

receiving beamforming vector and the second receive beamforming vector are different.” EX1003, ¶144.

As explained *supra* [1.d6], and *infra* [3.d], Liu teaches that the selected K1 and K2 antenna port groups cause the second network device to transmit data on these N antenna ports to the first network device. EX1012, 24; EX1003, ¶144. A POSITA would have understood that each beam requires a beamforming vector for the respective antenna group, as explained by Liu. *Id.* In the background section, Liu explains that “[b]y means of combination of transmit beamforming (Beam Forming, BF)/precoding and receiving, multiple-input multiple-output (Multiple-Input Multiple-Output, MIMO) wireless system can achieve diversity and array gains.” EX1012, 1. A “typical system using BF [beamforming] or precoding generally may be represented as:

$$\mathbf{y} = \mathbf{H}\mathbf{V}\mathbf{s} + \mathbf{n}$$

$\mathbf{y}$ is a receive signal vector, $\mathbf{H}$ is a channel matrix, $\mathbf{V}$ is a precoding matrix, [and] $\mathbf{s}$ is a transmitted symbol vector.” *Id.* A POSITA would have known that each column of the “precoding matrix” is a beamforming vector, and beamforming is achieved by multiplying the precoding matrix by the transmitted symbol vector. EX1003, ¶144. Liu’s UE knows the “precoding matrix,” because the UE “traverses all precoding matrices” when selecting antenna ports. EX1012, 27-28,

36-37, 38-39. A POSITA would have recognized that the UE would use each precoding matrix vector (receiving beamforming vector) to receive the signals transmitted through the antenna port groups in order to calculate the channel distortion of the reference signals (first wireless signals), which would allow the UE to tell the base station how to perform beamforming for an upcoming transmission. EX1003, ¶144.

In the same context of MIMO systems, Park teaches that the UE “measure the RSRP for each transmission beam by setting the beam-forming differently for each antenna port.” EX1010, [0359]; *see also* EX1018 (“Vitthaladevuni”), [0005]. In other words, Park confirms Liu’s description that each port group (e.g., K1 and K2) would have its own different receiving beamforming vectors (and corresponding matrices) to account for the differences in the antenna port beams. EX1003, ¶145.

[3.d]:

As explained *supra* [1.d6] and [3.b], in the Liu-Park combination, the first information is used ***to determine the K2 antenna port groups and the second proportional sequence***, e.g., when the UE reports the K2 antenna port groups. EX1010, [0371-373]; EX1003, ¶146.

Park's UE reports antenna ports with an RSRP over the desired threshold to select "strongly received" antenna port groups. EX1010, [0371-373], [0378]; *supra* §§VI.A.4 ([1.d5]-[1.d6]), VI.A.4 ([3b]); EX1003, ¶147. Liu provides the CSI [e.g., RSRP] or the index information corresponding to these N antenna ports... as a notification to the base station so that the base station "transmits data to the first network device through the N antenna ports.." EX1012, 24, 23, 27-28; EX1003, ¶147. Park's UE similarly reports the RSRP of an antenna port group that meets the threshold criteria for selection. EX1010, [0378], [0382-383] (measuring RSRP for antenna port groups); EX1003, ¶147. In the Liu-Park combination, the RSRP values (e.g., at least portions of the "first information") are used to generate the proportional sequence (e.g., *supra* [1.d5]) and determine the antenna port groups above the desired threshold to select the N, N2, or Cell 2 antenna ports (K2 antenna port groups) and the corresponding beam or cell transmission associated with the port groups to transmit subsequent data. EX1003, ¶147.

Claim 4

Claim 4, which depends from claim 3, recites three alternative options in disjunctive form. Satisfying any one of these options satisfies the requirements of claim 4. *Brown*, 265 F.3d at 1351. The Liu-Park combination at least renders obvious that ***any two antenna ports in the K1 antenna port groups are co-located***

or quasi-co-located (QCL), and any two antenna ports in the K2 antenna port groups are co-located or quasi-co-located (QCL). EX1003, ¶149.

Liu teaches that each of the M ports is located at a “second network device” “base station.” EX1012, 20-22; EX1003, ¶150. Liu’s “base station configures M antenna ports for UE,” EX1012, 24-25, which suggests that the M antenna ports are co-located or quasi-co-located at the base station where the antenna ports are being configured. EX1003, ¶150. This is because Liu’s “UE traverses all the antennas and selects an antenna in a manner in which the antenna optimizes the performance of the UE” and reports the selected antennas back to the base station, which would have been understood as a single base station, meaning that the antennas are co-located or quasi-co-located at the base station. EX1012, 25-26; EX1003, ¶150.

This co-location or quasi-co-location condition is maintained when the M antenna ports are single antenna port groups or X antenna port groups of multiple ports because Liu describes each antenna port as being part of the second network device. EX1003, ¶151. Park confirms the POSITA’s understanding of Liu, explaining that quasi-co-located includes when antenna ports “may be assumed to be transmitting at the same location (co-location) (for example, a terminal may

assume antenna ports are transmitting from the same transmission point),” such as the single base station described in Liu. EX1010, [0311]; EX1003, ¶151.

Because the K1 and K2 antenna port groups are subsets of the K antenna port groups, *see* Elements [1.d4], [3.a], and the K antenna port groups are co-located or quasi-co-located at *Liu*’s base station, the K1 and K2 antenna port groups are also co-located or quasi-co-located at *Liu*’s base station. EX1003, ¶152.

A POSITA also would have found it obvious that *any two antenna ports in the K1 antenna port groups are on a same carrier and any two antenna ports in the K2 antenna port groups are on a same carrier*. For example, Park discloses each of the reference signals (K wireless signals, which includes K1 and K2) on the same subcarrier k' . EX1010, [0231-236]. Park confirms that management resources “could be set up identically for all RRM-RSs with the same carrier wave frequency, namely those that have been set up at the same component carrier.” EX1010, [0417]. This simplifies the system configuration when allowing the UE to perform measurement reports and antenna port selection. EX1003, ¶153. A POSITA would have been motivated to have any two ports of the K1 antenna port group on the same carrier and any two ports of the K2 antenna port group to “obviate[] the need for a separate carrier frequency to offer mobile broadcast services” or mitigate the need for a frequency-specific offset value during the measurement. EX1013 (Sesia LTE), 505, 506 (UE identifies cells on same carrier

as serving cell); EX1004, [0170]; EX1003, ¶¶153-154. Placing ports of the K1 and K2 antenna port groups on the same carrier was well-known and represents nothing more than known transmission processes operating according to their ordinary and expected functions to yield predictable results of sending signals on the same carrier. *Id.*

Claim 5.

In the context of claim 3, the Liu-Park combination further renders obvious claim 5. EX1003, ¶155. As an initial matter, claim 5 does not require the “***target antenna group***” be different from the K1 or K2 antenna port groups, or that the “***second wireless signal***” be associated with both the K1 and K2 port groups or proportional sequences, but instead only “***associated with***” one of those groups and proportional sequences. EX1003, ¶155.

Liu explains that the CSI [e.g., RSRP] or the index information corresponding to these N antenna ports is provided as a notification to the base station “so that the second network 30 device transmits data to the first network device through the N antenna ports.” EX1012, 52, 35. A POSITA would have understood this data transmission to be a second wireless signal that is transmitted using the selected antenna port group(s) and received by the UE. EX1003, ¶156. This second wireless signal (data transmission) is different from the first wireless

signal at least because it is transmitted in a second report than the first wireless signal and it carries a signal directed to the UE, rather than being the broadcast wireless signal used to measure and select the transmitting port group(s). *Id.*; EX1012, 25, 35.

Liu's system sends a data transmission ("second wireless signal") received by the UE using the selected N, N1, or Cell 1 port groups (K1 antenna port groups). *Supra* §VI.A.4 ([1d5]-[1d9]). The selected port group comprises a "target antenna port group" because it is the selected and desired antenna port group for transmitting data to the UE, given the selection criteria. EX1003, ¶157. The selected N, N1, or Cell 1 port groups are associated with the K1 antenna port groups because the selected N, N1, or Cell 1 port groups are identified by their corresponding index and RSRP value, and associated with the first proportional sequence because they are selected based on the threshold comparison of the first proportional sequence, as explained for [1.d5] and [1.d8]-[1.d9]. *Supra* §VI.A.4 ([1.d5] and [1.d8]-[1.d9]); EX1003, ¶¶157-158; EX1012, 24 ("channel state information (CHannel State Signal, CSI) corresponding to the N antenna ports or index information corresponding to the N antenna ports" is sent to base station, which "transmits data to the first network device through the N antenna ports" to UE), 25-34, 24-28 ("UE traverses all the antennas and selects an antenna in a

manner in which the antenna optimizes the performance of the UE”), 37-41(UE feeds back CSI (e.g., RSRP and port index) to base station); EX1010, [0371-373], [378].

Claim 6

Claim 6 is substantively identical to claim 1, except for reciting the base station transmitting and receiving, rather than the UE receiving and transmitting, information. *Compare* [6.pre] *with* [1.pre]. As shown below, each element of claim 6 is met by the Liu-Park combination at least for the same reasons as articulated *supra* §VI.A.4(a) (claim 1). EX1003, ¶159.

[6.pre]:

To the extent the preamble is limiting, the Liu-Park combination discloses [6.pre] at least for the same reasons as articulated *supra* §VI.A.4 (Element [1.pre]). EX1003, ¶160.

[6.a], [6.b], [6.c]:

The Liu-Park combination renders obvious Elements [6.a]-[6.c] at least for the same reasons as articulated *supra* §VI.A.4 (Elements [1.a]-[1.c]). EX1003, ¶161.

[6.d]/ [6.d1]-[6.d9]:

The Liu-Park combination renders obvious Elements [6.d1]-[6.d9], which are substantively identical to elements [1.d1]-[1.d9]. *Supra* §§VI.A.4 (Elements [1.d1]-[1.d9]); EX1003, ¶¶162-163.

Claims 7-10

Claims 7-8 depend from claim 6, which, as discussed above, is met by the Liu-Park combination. Claims 7-8 are substantively identical to claims 2-3, and likewise met by the Liu-Park combination, at least for the same reasons as articulated *supra* §§VI.A.4 (claims 2-3). Claims 9-10 depend from claim 8, and are substantively identical to claims 4-5. Claims 9-10 are met by the Liu-Park combination, at least for the same reasons as articulated *supra* §§VI.A.4 (claims 4-5). EX1003, ¶¶164-165.

Claim 11

Claim 11 is substantively similar to claim 1, with Elements [11a]-[11c] reciting a “first receiver,” “second receiver,” and “third transmitter” performing functions substantially identical to the method recited by Elements [1.a]-[1.c]. EX1003, ¶166. The elements of claim 11 are met by the Liu-Park combination for reasons articulated *supra* §VI.A.4 (claim 1) and further discussed below (with respect to additionally recited “receiver[s]” and “transmitter”). *Id.*

[11.pre]:

To the extent the preamble is limiting, the Liu-Park combination provides [11.pre] at least for the same reasons as articulated *supra* §VI.A.4 (Element [1.pre]). EX1003, ¶167.

[11.a]

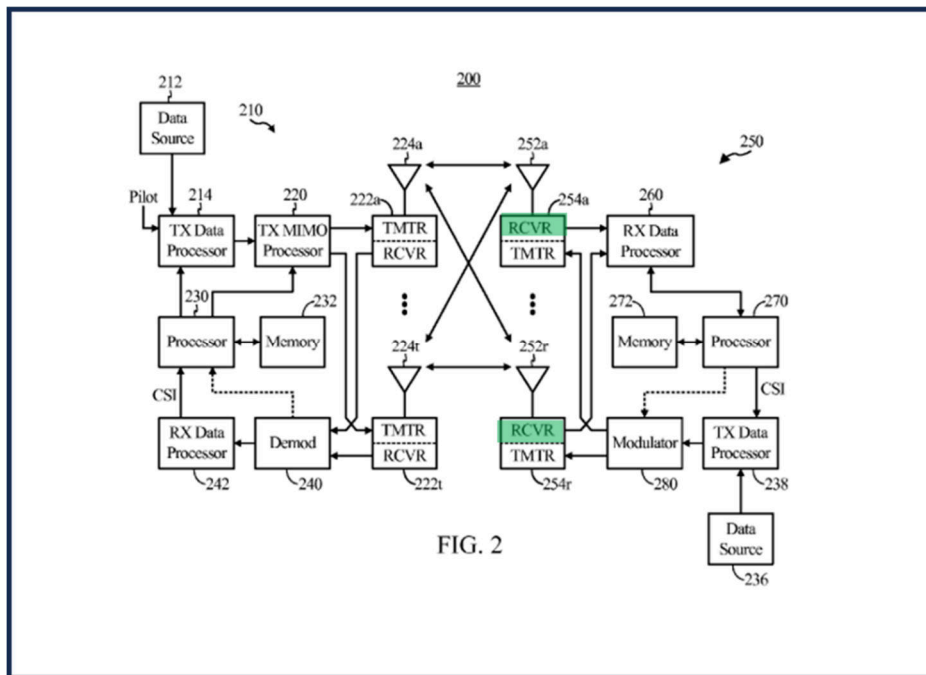
Liu discloses Element [11.a] for the reasons discussed *supra* §VI.A.4 ([1.a]). EX1003, ¶168. Liu's UE has "a receiving unit 11" (FIG. 5) or "receiver 41" (FIG. 8) configured to receive signals of M antenna ports transmitted by a second network device, where M is a positive integer," which a POSITA would have understood describes a receiver receiving first signaling and wireless signals from the transmitting base station, as described *supra* §VI.A.4 ([1a]-[1b]). EX1012, 33, 44 FIGS. 5, 8; EX1003, ¶168.

[11.b]

Liu discloses Element [11.b] for the reasons discussed *supra* §VI.A.4 ([1.b]). EX1003, ¶169. Liu discloses a receiver or receiving unit for MIMO systems, as explained *supra* [3.c] and §VI.A.1, EX1012, 1, which a POSITA would have understood includes more than one receiver because it requires "multiple output," indicating that UE has at least two receivers each receive the first signaling and the first wireless signal. EX1003, ¶169. To the extent Patent Owner argues, or the

Board finds, that Liu does not disclose or suggest a second receiver, Liu and Park render obvious the “second receiver” recited in [11.b], as further explained below.

Park explains using “use multiple transmission antennas and multiple reception antennas in order to improve data transmission and reception efficiency.” EX1010, [0207]. A POSITA would have found it obvious to include two receivers to receive the first signaling and the first wireless signal because the broadcast transmission from the base station being received at multiple receivers would have allowed the UE to process the received signal at each receiving antenna more efficiently, and the use of MIMO systems in which a base station transmits signaling and wireless signals from multiple antenna ports and the UE receives the transmitted signaling and wireless signals at multiple antennas was routine and conventional years before the '271 patent was filed. *See* EX1010, [0093-94]; EX1003, ¶¶170-171; EX1017 (Luo), FIG. 2, [0037]; EX1016 (Hu), FIG. 12 (showing one receiver at each antenna); EX1018 (Vitthaladevuni), FIG. 10. Specifically, Luo explains that “transmitted modulated signals are received by NR antennas 252a through 252r and the received signal from each antenna 252 is provided to a [respective receiver \(RCVR\) 254a through 254r](#)” at the UE, as depicted in FIG. 2 (below). EX1017 (“Luo”), [0037].



EX1003, ¶171 (noting EX1017 (“Luo”) at FIG. 2 (above) generally matches FIG. 4 of the ’271 patent, both showing one receiver per antenna).

A POSITA would have been motivated to include two receivers, as claimed, because it would have enabled the MIMO operation disclosed in Liu and Park and facilitated greater throughput and increased the channel reliability because data transfer is generally proportional to the number of receiving and transmitting antennas. This would have enhanced processing at the UE by dividing the processing amongst multiple receivers. EX1003, ¶172. A POSITA would have known that using two receivers, each complimenting the other by receiving the signaling and wireless signals from the base station, was conventional in MIMO

systems. EX1003, ¶172. The multi-receiver and multi-transmitter configuration was a well-known design choice to a POSITA. *Id.*

A POSITA would have reasonably expected success in providing two receivers, each receiving the first signaling and the first wireless signal, in Liu's UE because multiple receivers receiving this information was conventional and routine in the MIMO antennas described in Liu and Park. *Id.* MIMO technologies were well established by the earliest priority date of the '271 patent, and the use of multiple receivers, as claimed, would have required only the implementation of that well-established technology operating in its expected operation. The combination thus represents only known components operating according to their ordinary and expected functions to yield predictable results (receiving transmitted signals). *Id.* For example, FIG. 4 of the '271 patent merely shows each antenna coupled to a receiver (or transceiver), which, as demonstrated above, was general knowledge because the configuration was ubiquitous by the time of the purported invention. EX1003, ¶173 (noting Applicant never relied on FIG. 4 during prosecution and the Notice of Allowance never mentioned FIG. 4 as reason for allowance).

[11.c]:

Liu discloses Element [11.c] for the reasons discussed *supra* §VI.A.4 ([1.c]). Liu discloses that the UE includes a “transmitter 42” for feeding back first information of N antenna ports to the base station and a “feedback unit 12” to transmit and “feed back first information of N antenna ports in the M antenna ports according to a first criterion,” to the second network device (base station). EX1012, 33, 44, FIGS. 5, 8; EX1003, ¶174.

[11d] [11d1]-[11d9]

The Liu-Park combination meets elements [11.d1]-[11.d9], which are substantively identical to elements [1.d10]-[1.d9], respectively. *Supra* §§VI.A.4 (Elements [1.d1]-[1.d9]); EX1003, ¶¶175-176.

Claims 12-15

Claims 12-13, and 15 depend from claim 11, which, as discussed above, is met by the Liu-Park combination. Claims 12-13, and 15 are substantively identical to claims 2-3, and 5, respectively, and likewise are met by the Liu-Park combination at least for the same reasons as articulated *supra* §§VI.A.4 (claims 2-3, 5). EX1003, ¶177.

Claim 14 depends from claim 13, which, as discussed above, is met by the Liu-Park combination. Claims 14 is substantively identical to claim 4, and

likewise is met by the Liu-Park combination, for the same reasons as articulated *supra* §VI.A.4 (claim 4). EX1003, ¶¶177-178.

Claim 16

Claim 16 is substantively identical to claim 6, with Elements [16a]-[16c] reciting a “first transmitter,” “second transmitter,” and “third receiver” performing functions substantially identical to the method recited by Elements [6.a]-[6.c]. EX1003, ¶179. The elements of claim 16 are met by the Liu-Park combination for reasons articulated *supra* §VI.A.4 (claims 1 and 6) and further discussed below (with respect to additionally recited “transmitter[s]” and “receiver”). *Id.*

[16.pre]:

To the extent the preamble is limiting, the Liu-Park combination provides [16.pre] at least for the same reasons as articulated *supra* §VI.A.4 (Element [1.pre]/[6.pre]). EX1003, ¶180.

[16.a]:

Liu discloses Element [16.a] for the reasons discussed *supra* §VI.A.4 ([1.a], [6.a]). EX1003, ¶181. Liu’s base station has “a transmitting unit 21” (FIG. 6), “transmitting unit 31” (FIG. 7), “transmitter 51” (FIG. 9), or “transmitter 61” (FIG. 10) “configured to transmit signals of M antenna ports to a first network device, where M is a positive integer,” which a POSITA would have understood describes

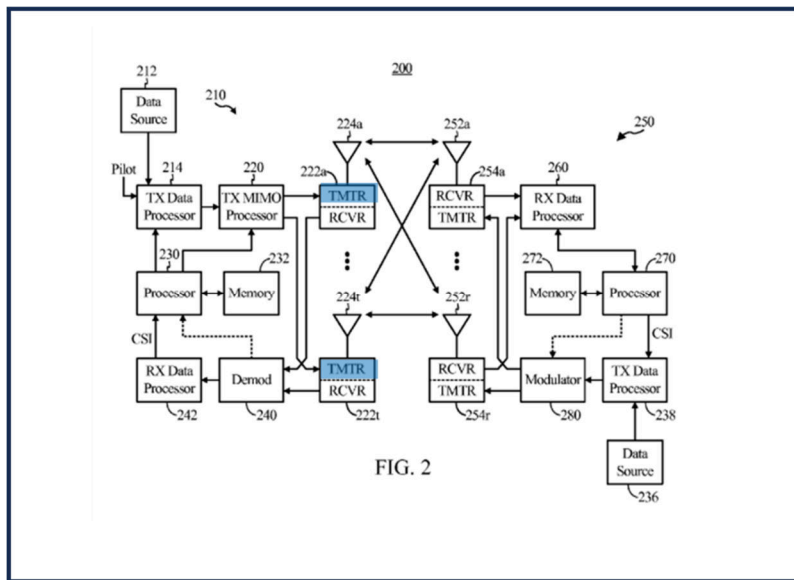
a transmitter for transmitting first signaling and wireless signals to the UE. EX1012, 41, 42, 46, FIGS. 6, 7, 9, 10; EX1003, ¶181.

[16.b]:

Liu discloses Element [16.b] for the reasons discussed *supra* §VI.A.4 ([1.b], [6.b]). EX1003, ¶182. Liu’s base station has multiple transmitters or transmitting units in the form of transmitting antenna port groups transmitting wireless radio signals to the UE for MIMO systems, as explained *supra* [3c] and §VI.A.1, EX1012, 1; EX1003, ¶182. To the extent Patent Owner argues, or the Board finds, that Liu does not disclose or suggest a second transmitter, Liu and Park render obvious the “second transmitter” recited in [16b].

Park explains using “multiple transmission antennas and multiple reception antennas in order to improve data transmission and reception efficiency.” EX1010, [0207]. A POSITA would have found it obvious to include two transmitters to transmit the first signaling and the first wireless signal respectively because the broadcast transmission from the base station being transmitted at multiple transmitters, *see* EX1010, [0093-94], FIG. 5, would have allowed the base station to transmit signaling and wireless signals from multiple antenna ports, as explained for [11b], which was routine and conventional years before the ’271 patent was filed. EX1003, ¶183; EX1017 (Luo), FIG. 2, [0036]; EX1016 (Hu), FIG. 12;

EX1018 (Vitthaladevuni), FIG. 10. Specifically, Luo explains that “[e]ach transmitter [(“TMTR”)] 222 receives and processes a respective symbol stream,” and “NT modulated signals from transmitters 222a through 222t are then transmitted from NT antennas 224a through 224t, respectively” at the base station, as depicted in FIG. 2 (below). EX1017 (“Luo”), [0036].



EX1003, ¶183 (noting Luo’s FIG. 2 (above) generally matches FIG. 4 of the ’271 patent, both showing one transmitter per antenna).

A POSITA would have been motivated to include two transmitters, as claimed, to enable the MIMO operation disclosed in Liu and Park and facilitate greater throughput and increased the channel reliability because data transfer to the UE is generally proportional to the number of receiving and transmitting antennas. This would have enhanced base station transmission processing by dividing the processing amongst multiple transmitters. EX1003, ¶184.

A POSITA would have reasonably expected to succeed in providing two transmitters, each transmitting the first signaling and the first wireless signal, in Liu's base station because multiple transmitters transmitting this information was conventional and routine in the MIMO antennas described in Liu and Park. EX1003, ¶185. MIMO technologies were well established by the earliest priority date of the '271 patent and the use of multiple transmitters, as claimed, would have required only the implementation of that well-established technology operating in its expected operation. The combination thus represents only known components operating according to their ordinary and expected functions to yield predictable results (transmitting signals). EX1003, ¶185.

[16.c]:

Liu discloses Element [16.c] for the reasons discussed *supra* §VI.A.4 ([1.c], [6.c]). EX1003, ¶186. Liu's base station includes "receiving unit 22" (FIG. 6), "receiving unit 32" (FIG. 7), "receiver 52" (FIG. 9), or "receiver 62" (FIG. 10) for "configured to receive first information of N antenna ports in the M antenna ports that is fed back by the first network device according to a first criterion," which a POSITA would have understood describes a receiver for receiving the

transmitted first information, such as antenna indices and RSRP values from the UE. EX1012, 41, 42, 46; FIGS. 6, 7, 9, 10; EX1003, ¶186.

[16.d]/ [16.d1]-[16.d9]:

The Liu-Park combination meets elements [16.d1]-[16.d9], which are substantively identical to elements [6.d1]-[6.d9], respectively. *Supra* §§VI.A.4 (Elements [6.d1]-[6.d9]); EX1003, ¶187-188.

Claims 17-20

Claims 17-19 depend from claim 16, which, as discussed above, is met by the Liu-Park combination. Claims 17-19 are substantively identical to claims 2-4 and 7-9, and likewise are met by the Liu-Park combination at least for the same reasons as articulated *supra* §§VI.A.4 (claims 2-4, 7-9). EX1003, ¶189.

Claim 20 depends from claim 18, which, as discussed above, is met by the Liu-Park combination. Claims 20 is substantively identical to claims 5, 10, and 15, and likewise is met by the Liu-Park combination at least for the same reasons as articulated *supra* §§VI.A.4 (claims 5, 10, 15). EX1003, ¶189.

VII. DISCRETIONARY CONSIDERATIONS

Petitioner believes that discretionary denial is unwarranted, and yet, Petitioner intends to utilize the bifurcated briefing process contemplated by the March 26, 2025, Stewart Memorandum to rebut contentions if offered by Patent

Owner to the contrary. *See, e.g. Learn about the new interim processes relating to institution in AIA proceedings* (available at <https://www.uspto.gov/about-us/events/learn-about-new-interim-processes-relating-institution-aia-proceedings>, April 24, 2025); <https://uspto.cosocloud.com/p9xpz6s4jn75/> (Video).

VIII. PAYMENT OF FEES – 37 C.F.R. § 42.103

Petitioner authorizes the Patent and Trademark Office to charge any fees to Deposit Account No. 06-1050.

IX. CONCLUSION

Petitioner respectfully requests institution of an IPR for those claims of the '271 patent for each of the grounds presented herein.

X. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Apple Inc. is the petitioner and the real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates or petitions for inter partes review for the '271 Patent. The '271 patent is the subject of a number of civil actions including: *Apex Beam Technologies LLC v. Apple Inc*, 6-24-cv-00223 (WDTX), filed April 29, 2024; *Samsung Electronics Co., Ltd. et al. v. Apex Beam Technologies LLC*, IPR2023-00571 (PTAB), filed March 29, 2023; *Samsung Electronics Co., Ltd. et al v. Apex Beam Technologies LLC*, IPR2023-

00747 (PTAB), filed March 29, 2023; *Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd. et al*, 2-22-cv-00188 (EDTX), filed June 1, 2022; *Apex Beam Technologies LLC v. ZTE Corporation*, 2-22-cv-00031 (EDTX), filed February 1, 2022; *Apex Beam Technologies LLC v. OnePlus Technology (Shenzhen) Co., Ltd.*, 2-22-cv-00032 (EDTX), filed February 1, 2022; *Apex Beam Technologies LLC v. TCT Mobile International Limited et al*, 2-21-cv-00438 (EDTX), filed November 30, 2021. The '271 patent is the subject of IPR2025-00898, filed concurrently herewith. The '904 patent, a family member of the '271 patent, is the subject of IPR2025-00904 and IPR2025-00923, filed concurrently herewith.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR50095-0229IP2@fr.com.

Respectfully submitted,

Dated: May 1, 2025

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,710 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: May 1, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on May 1, 2025, a complete and entire copy of this Petition for *Inter Partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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