

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.;
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

EMPIRE TECHNOLOGY DEVELOPMENT, LLC,
Patent Owner.

Case No. IPR2024-00896
U.S. Patent No. 8,798,120

**REPLY IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,798,120**

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Ex-1003	Curriculum Vitae of Dr. Matthew C. Valenti
Ex-1004	Prosecution History of the ’120 Patent (Application No. 12/727,049)
Ex-1005	U.S. Patent Publication No. 2006/0067263 (“Li”)
Ex-1006	Mohammad Z. Siam et al., <i>Adaptive Multi-antenna Power Control in Wireless Networks</i> , International Conference on Wireless Communications and Mobile Computing 875-880 (2006) (“Siam”)
Ex-1007	Shuguang Cui et al., <i>Modulation Optimization Under Energy Constraints</i> , 4 Institute of Electrical and Electronic Engineers International Conference on Communications 2805-2811 (2003) (“Cui-2003”)
Ex-1008	Esa Tirola and Juha Ylitalo, <i>Performance of a UMTS Uplink MIMO Scheme</i> , 1 Institute of Electrical and Electronic Engineers 58th Vehicular Technology Conference 657-661 (2003) (“Tirola”)
Ex-1009	U.S. Patent Publication No. 2007/0171808 (“Wu”)
Ex-1010	INTENTIONALLY LEFT BLANK
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¹ Four-digit pin citations that begin with 0 are to the branded numbers added by Samsung in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, or line numbers.

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Ex-1025	Shuguang Cui et al., <i>Energy-Constrained Modulation Optimization</i> , 4 Institute of Electrical and Electronic Engineers Transactions of Wireless Communications 2349-2360 (Sept. 2005) (“Cui-2005”)
Ex-1026	Shuguang Cui et al., <i>Energy-Efficiency of MIMO and Cooperative MIMO Techniques in Sensor Networks</i> , 22 Institute of Electrical and Electronic Engineers Selected Areas in Communications 1089-1098 (Aug. 2004) (“Cui-2004”)
Ex-1027	INTENTIONALLY LEFT BLANK
Ex-1028	U.S. Patent Publication No. 2008/0095263 (“Xu”)

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Ex-1029	Adam J. Tenenbaum et al., <i>Improved Sum-Rate Optimization in the Multiuser MIMO Downlink</i> , IEEE 984 (2008) (“Tenenbaum”)
Ex-1030	Runhua Chen et al., <i>Uplink Power Control in Multi-Cell Spatial Multiplexing Wireless Systems</i> , 6 IEEE Transactions of Wireless Communications 2700 (July 2007) (“Chen”)
Ex-1031	U.S. Patent Publication No. 2005/0250452 (“Walton”)
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Ex-1033	Bruno Bougard et al., <i>SmartMIMO: An Energy-Aware Adaptive MIMO-OFDM Radio Link Control for Next-Generation Wireless Local Area Networks</i> , EURASIP Journal on Wireless Communications and Networking (2007) (“Bougard”)
Ex-1034	Andreas F. Molisch et al., <i>MIMO Systems with Antenna Selection</i> , IEEE Microwave Magazine 46 (2004) (“Molisch”)
Ex-1035	Chan-Byoung Chae et al., <i>Adaptive Spatial Modulation for MIMO-OFDM</i> , IEEE Communications Society 87 (2004) (“Chae”)
Ex-1036	Kyeongjun Ko et al., <i>Low Complexity Multiuser MIMO Scheduling with Chordal Distance</i> , IEEE 80 (2008) (“Ko”)
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Ex-1040	Shuguang Cui et al., <i>Cross-Layer Energy and Delay Optimization in Small-Scale Sensor Networks</i> , 6 IEEE Transactions on Wireless Communications 3688 (2007) (“Cui-2007”)
Ex-1041	U.S. Patent No. 8,315,346 (“Kim”)
Ex-1042	Karama Hamdi et al., <i>Low-Complexity Antenna Selection and User</i>

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Ex-1045	Theodore S. Rappaport, <i>Wireless Communication, Principles and Practice</i> , Ch. 1, 1-24 (2nd ed., 2001)
Ex-1046	Defendants Samsung’s Elecs. Co., Ltd. and Samsung Elecs. Am., Inc.’s Stipulation Regarding Invalidity Challenges in <i>Empire Technology LLC v. Samsung Elecs. Co., Ltd. et al.</i> , Case No. 2:23-cv-00427-JRG (E.D. Tex.) (Dkt. 44)
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Ex-1051	Steven M. Kaplan, Wiley Electrical and Electronics Engineering Dictionary 415, 797 (2004)
Ex-1052	Transcript of the deposition of Robert Akl, D.Sc., dated May 28, 2025

I. INTRODUCTION AND BACKGROUND

A. Related District Court Litigation

Patent Owner (“PO”) sued Samsung in 2:23-cv-00427 (E.D. Tex. Sept. 18, 2023). The district court’s March 31, 2025 Markman (Ex-1050) is consistent with the Board’s preliminary construction and Petitioner’s application of the prior art to the challenged claims in this IPR.

II. CLAIM CONSTRUCTION

A. “An idle power consumption of the mobile station”

The district court’s final construction, the intrinsic evidence, and even PO’s expert’s admissions at deposition show that the Board’s preliminary construction is correct that the recited “idle power consumption of the mobile station” does not require that the first and second circuitry be powered on.

1. The district court’s *final* construction aligns with the Board’s preliminary construction

PO relies heavily on the district court’s *preliminary* claim construction to challenge the Board’s preliminary construction: specifically, “whether the transceiver is on or off.” POR 11, 15-16. But, significantly, the district court’s *final* construction accords with the Board’s preliminary construction:

Board Preliminary Construction	District Court Final Construction
“Power consumption during which the transceiver may be waiting to send data, <i>whether the transceiver is on or off.</i> ” Paper 15, 25. ²	“A power consumed by the mobile station when the mobile station is powered on and waiting to send.” Ex-1050, 12. “The Court agrees with [PO] that a fully powered-off mobile station does not have ‘idle power consumption’ within the meaning of the claims. <i>Nor must all the circuitry of the mobile station be turned on for it to be ‘idle.’</i> ” <i>Id.</i>

The district court’s final construction removed the preliminary requirement “power consumed by the *first and second circuitry* when the mobile station is powered on” that, according to PO, required the first and second circuitry to be powered on. POR, 15-18; Ex-2011, 1. The district court’s final construction focuses properly on “power consumed by the *mobile station*,” which is what the claim says. At his deposition in this IPR, PO’s expert, Dr. Akl, agreed the district court’s final construction “makes more sense when you plug it into the claim itself,” as compared to its preliminary construction. Ex-1052, 82:10-19.

Petitioner agrees with PO that the Board should take into consideration the district court’s construction (POR, 15 (citing 37 C.F.R. §42.100(b))) and, here, the district court’s final construction and reasoning is correct. As discussed below, whether it’s the Board’s preliminary or the district court’s final construction, the

² Emphases have been added throughout unless otherwise noted.

bottom line is that ***nothing*** in the claims or specification ***requires*** “idle power consumption” to mean the “first and second circuitry are powered on.” POR, 17.

2. Intrinsic evidence supports the Board’s preliminary construction

Claim construction begins with the ordinary meaning of the claim language in the context of the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314-15 (Fed. Cir. 2005) (en banc). Claim 25 recites “wherein the control signal is based ... at least in part, on an idle power consumption ***of the mobile station***”—not the “first and second circuitry.” Ex-1001, cl. 25. Indeed, claim 25 recites that a “control signal is based, at least in part” on two things: (1) “a ***power consumption*** of the ***first and second circuitry***” and (2) “an ***idle power consumption*** of the ***mobile station***.” *Id.* The different language selected by patentee to differentiate “power consumption” from “idle power consumption” should be given effect such that “idle power consumption” refers to the idle power consumption of the entire ***mobile station***³ and does not impose any particular requirement on the idle power consumption of the first and second circuitry.

³ The mobile station includes all of mobile station 410, including both transmit chains 454 and 460, any receiver portions including decoder 477 and those portions not shown, controller 475, and other mobile phone circuits. Ex-1001, 7:17-41, Fig. 4. A transceiver is a single transmitter-receiver pair. Ex-1051, 797.

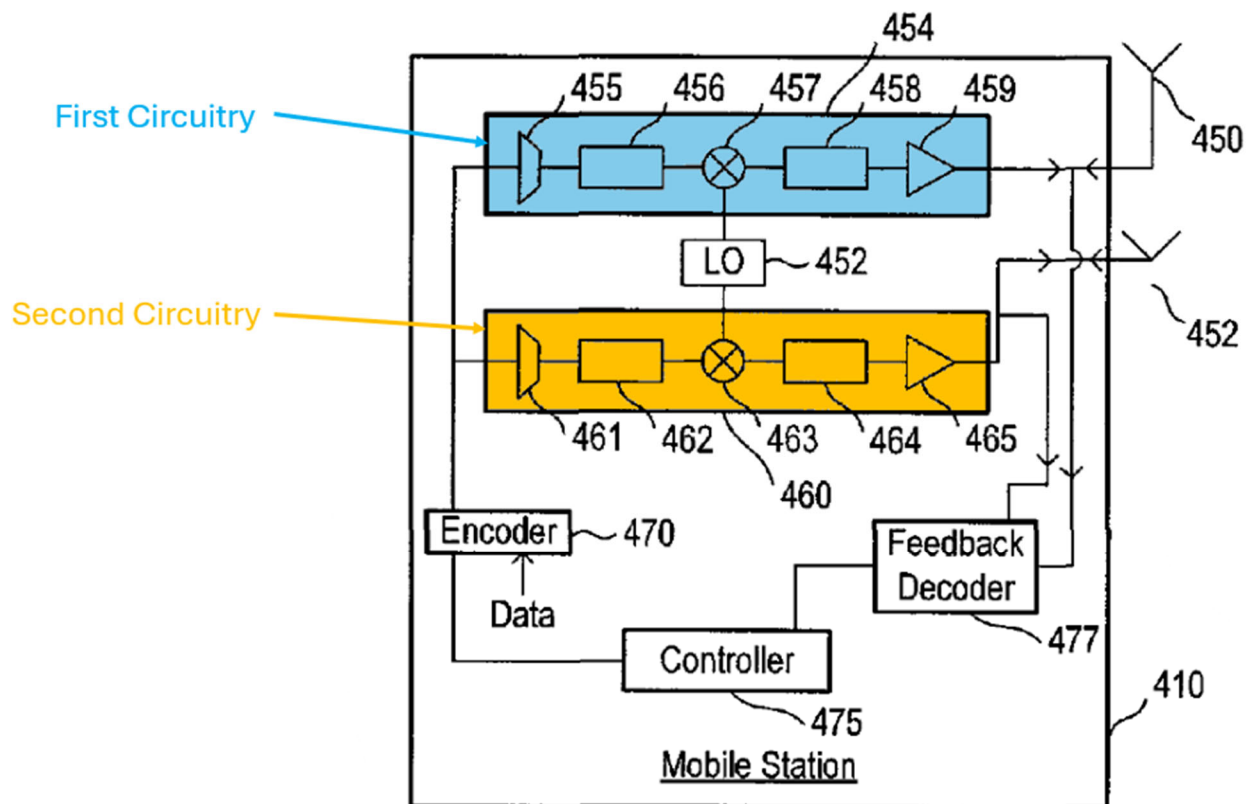
The specification informs what an “idle power consumption of the mobile station” includes. “[T]he idle time may include times during which the mobile station 410 is waiting to send data over the communications channel, such as waiting for a scheduled time to begin transmission.” Ex-1001, 8:55-58. Further:

[I]f the transmission rate is too slow, a greater number of transceivers may ***become idle, waiting to send transmissions*** over the communications channel. Even if the idling transceivers ***turn off*** their transmission chains, some ***idle power may be consumed*** due to leakage current or other effects.

Id., 3:5-7. Thus, power consumed by transceivers’ transmission chains that have been “turn[ed] off” while the transceivers are “waiting to send transmissions” would fall within the scope of “idle power consumption.” *See, e.g.*, Ex-2013, 41:12-43:16 (Petitioner’s expert: “here it is saying that there is still some power, or idle power being used through leakage current”). Even PO’s expert concedes that “idle power consumption” is satisfied whether the transceivers have their transmission chains turned on or off. Ex-2022 ¶52 (agreeing that the specification “*confirms* that idle power consumption refers to times where the transceivers are idling and thus powered on (in contrast to their transmission chains, ***which could be powered off***)” (first emphasis in original)).

The ’120 Patent depicts examples of transmission chains in the mobile station. Figure 4, excerpted and annotated below, illustrates “first circuitry” 454, comprising

a chain of circuitry in the signal transmission path to the first antenna 450 including “digital-to-analog converter 455, a filter 456, a mixer 457, a filter 458, and a power amplifier 459.” Ex-1001, 7:18-22. “Second circuitry” 460 is described similarly, comprising the circuits in the transmission path to the second antenna 452. *Id.*, 7:23-27.



PO’s expert agrees that first circuitry 454 could be an example of a “transmission chain.” Ex-1052, 28:14-22 (“And so an example of a first circuitry could be a transmission chain.”), 30:7-12 (“I have not provided a definition of transmission chain. I’ve stated that that term appears once in the patent, and I stated that the *first*

circuitry can be an example of a transmission chain at least in an embodiment of figure 4.”). Thus, in admitting the transmission chain in figure 4 can be considered the recited “first circuitry,” and, because the specification allows for transmission chains to be turned off, PO cannot credibly dispute that first (or second) circuitry may be turned off while the mobile station is idle. Thus, the intrinsic record demonstrates that the Board’s preliminary construction is correct: “idle power consumption of the mobile station” means “power consumption during which the transceiver may be waiting to send data, whether the transceiver is on or off.”⁴

3. Patent Owner’s other evidence cannot change the plain and ordinary meaning in light of the specification

The intrinsic evidence PO cites confirms that an idling mobile station is “waiting to send”—a limitation no one disputes—and, as described above, contradicts its argument that both first and second circuitry must be powered on. POR, 13-16. In addition, PO’s prosecution history argument (POR, 16-17) is at best a tenuous inference built on unsupportable assumptions. The fact that Cui-2005 (related to Cui-2003, applied here by Petitioner) was listed on the face of the patent but not used to reject the claims and was never discussed by the Examiner cannot be

⁴ Alternatively, “whether the transceiver is on or off” could be rephrased as “whether the transmission chain is on or off” to align even more precisely with the specification, but this would not change how the prior art, including Cui-2003, is applied to claim 25 because, for example, Cui-2003 also turns off its transmission chain (“circuits in the signal path”) in sleep mode, as discussed below.

used to infer a claim construction, given the prosecution history’s complete silence on that reference. *See Malvern Panalytical Inc. v. TA Instruments-Waters LLC*, 85 F.4th 1365, 1375 (Fed. Cir. 2023) (vacating and remanding district court construction, which relied heavily on reference cited in IDS during prosecution because the “bare listing of [prior art] in the IDS ... did not amount to an admission that [it] is material (or controlling) in construing” the term-at-issue and “cannot limit” its scope). And it cannot be taken as a rejection of Petitioner’s invalidity position where Petitioner relies on the **combination** of Li, Siam, and Cui-2003, none of which was ever before the Examiner.

PO also relies on extrinsic evidence including dictionary definitions and arguing by analogy that a POSITA would understand an idling car is “powered on but not actively working.” POR, 13, 17. PO’s expert, Dr. Akl, explained at deposition that “when you’re in your car and you’re at a stoplight, for example, your car is idling, it is on, but it is not moving. You’re **waiting to go** once the light turns green.” Ex-1052, 41:4-7. PO’s car analogy is inapt and underscores why the Federal Circuit requires a claim term’s plain and ordinary meaning to flow from the specification as would be understood by a POSITA. *Phillips*, 415 F.3d at 1314-15, 1318-19 (extrinsic evidence such as dictionaries and expert testimony are “less reliable” than intrinsic evidence). The requirements for “idle” are context dependent.

Despite his admissions that first and second circuitry are examples of transmission chains, PO's expert later argued that when the transceivers turn off their transmission chains, they nevertheless keep the circuitry in the transmission path powered on:

Q. Okay. And in your view, the circuitry that's included in the transmission chain has to be on in order for the transceiver to be consuming idle power?

A. I'm saying the hardware is on. What's off is the *sending*. That's how a POSITA would read that phrase.

Ex-1052, 64:1-7. Dr. Akl further explains, "Your transmission chains are powered off because they're not actively sending. But the circuitry, it's powered on and it is consuming idle power." *Id.*, 66:2-5. This non-credible explanation is belied by the '120 Patent's statement that when the transmission chain is turned off, "some idle power may be consumed *due to leakage current* or other effects." Ex-1001, 3:5-7; *see Phillips*, 415 F.3d at 1318 ("conclusory, unsupported assertions by experts ... are not useful" and should be "discount[ed]" when "clearly at odds with the claim construction mandated by the ... written record of the patent"). It is well known that leakage current refers to current that flows when electronic assemblies are in a standby, disabled, or sleep mode.⁵ Thus, it is *circuitry* that is *turned off* that

⁵ Ex-1051, 415 (defining "leakage current" as "[c]urrent which flows through a component, circuit, or device which is in the off state").

consumes leakage current. Thus, the Board’s preliminary construction is correct, with the understanding that turning off transmission chains of the transceivers includes turning off the claimed first or second circuitry.

III. CLAIMS 25-29 ARE UNPATENTABLE AS OBVIOUS UNDER 35 U.S.C. § 103

A. Ground 1: Claims 25, 27, and 28 Are Obvious Over Li-Siam

1. Petitioner demonstrates motivation to combine Li-Siam

The Petition (Petition, 24-27) and extensive expert testimony (Ex-1002 ¶¶85-92), explain that Li articulates the problem of idle power consumption in MIMO mode and discloses the mechanics of mode switching to a SIMO (or other) mode to reduce energy consumption, as PO admits. POR, 18-19 (citing Ex-1005 ¶¶18-19, 24); *id.*, 33; Ex-1002 ¶¶85-86. But Li does not disclose when to make such a mode switch to optimize *total* power consumption (both when transmitting and not transmitting). Siam presents a protocol for optimizing power while transmitting, which demonstrates that considering transmitted power together with circuit power may allow energy consumption per bit to be optimized, which aligns with Li’s goal of using more of its “battery energy for communicating actual traffic.” Ex-1005 ¶18; Petition, 24-26; Ex-1002 ¶¶87-91. Thus, a POSITA would have been motivated to combine Li-Siam to optimize total power consumption. Petition, 26; Ex-1002 ¶¶85-92. The Board agreed, as a preliminary matter. Paper 15, 29-30.

PO argues that Li has no need for Siam because right after Li explains the problem of idle power consumption (Ex-1005 ¶18),

Li expressly states that its disclosed embodiments *solve* the power consumption problem. Ex-1005, [0019]. For example, Li states that by switching “STA 120 and STA 150 to a SIMO or MIMO operating mode” the “power consumption for STA 120 and STA 150 may be reduced.”

POR, 33. Thus, PO *admits* that Li’s SIMO/MIMO mode switching signal is based (at least in part) on consideration of idle power consumption of the mobile station. PO argues that because Li already solves that problem, there is no need to combine it with Siam. Ex-1052, 104:20-21 (“[I]t’s my opinion that the problem identified by Li is solved by Li.”). Although Li addresses *idle* power consumption, a POSITA would have recognized that Siam’s E-BASIC protocol teaches optimization of *total* power consumption per transmitted bit by also considering *circuit power consumption*, which promotes Li’s overall goal to maximize use of the battery for actual data transmission. Ex-1005 ¶18; Petition, 24-26; Ex-1002 ¶¶87-91. Just because Li alone already addresses one issue (idle power consumption) does not mean it could not be improved to address another (total bit energy efficiency by also considering circuit power consumption while transmitting). *See Honeywell Int’l Inc. v. 3G Licensing, S.A.*, 124 F.4th 1345, 1353-54 (Fed. Cir. 2025) (“[T]he problem motivating the patentee may be *only one of many* addressed by the patent’s subject matter’ and [] accordingly, ‘*any need or problem* known in the field of endeavor at

the time of invention and addressed by the patent can provide a reason for combining.’” (emphases in original) (quoting *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007))). PO’s argument that Siam does not suggest a need to improve Siam’s mode selection system fails for the same reasons. POR, 33.

And PO cites no authority for its puzzling argument that Siam cannot be combined with Li because Li is a patent publication and Siam describes simulations of communication system performance and was never implemented as a physical realization. POR, 28. There is no requirement that printed publications must describe physically realized systems in order to teach a POSITA to modify a primary reference like Li. *See, e.g., In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”); *KSR*, 550 U.S. at 421 (“A person of ordinary skill is also a person of ordinary creativity, not an automaton.”); Ex-2013, 75:11-77:6 (Siam’s “physical apparatus would be inherent to the systems that it is describing. And I think a person of ordinary skill would understand what those apparatuses would be [I]t is disclosing the components of what you would expect from a wireless link between two physical devices.”).

2. Li-Siam discloses claim 25’s “idle power consumption” limitation

The Petition explains that Siam’s E-BASIC protocol optimizes mode switching by considering both radiated power and circuit power consumption. Petition, 25-26 (citing Ex-1006, 875-76). Because Li recognizes the problem of circuit power consumption while the transceiver is *idle* (Ex-1005 ¶18) and addresses it with a signal that switches transmission modes (*id.*, ¶19), the Li-Siam *combination* teaches considering circuit power while idle in selecting a transmission mode. Petition, 40-43; Ex-1002 ¶¶119-124. PO’s attempts to distinguish the references individually (POR, 35-37) instead of as a combination are legally improper. *Keller*, 642 F.2d at 425. Likewise, PO’s argument that Li does not disclose “inputs or variables” (POR, 35-36) fails to account for Siam’s disclosure of how much power is consumed in circuitry (whether idle or transmitting). Ex-1006, 876-77 (equations for transmitted and circuit power).

PO’s argument that Siam considers transmitter-receiver distance *instead* of circuit power variations (POR, 37) is simply wrong. Larger distance affects the amount of *transmitted* (radiated) power received by the receiver, and Siam’s model considers “total power consumption [which] consists of transmission *and circuit powers.*” Petition, 15 (quoting Ex-1006, 876). The fact that Siam considers the

effect of *distance* on transmitted power in no way suggests it does not consider circuit power.

Moreover, PO admits Li recognizes idle power consumption is a problem. POR, 35 (quoting Ex-1005 ¶18). It admits Li discloses receiving a signal from the base station instructing the mobile station to switch its mode. *Id.*, 36 (quoting Ex-1005 ¶24). It admits “[r]educd power consumption may be a result of the mode selection.” *Id.*, 35 (citing Ex-1005 ¶¶19, 35, 43). And PO admits Li “expressly states that its *disclosed embodiments solve the power consumption problem*” that Li describes in paragraph 18. *Id.*, 33 (citing Ex-1005 ¶19). Thus, PO admits Li addresses idle power consumption using a control signal to switch to a MIMO or SIMO mode to reduce idle power consumption. Thus, as the Petition shows, Li-Siam teaches the idle power consumption limitation. Ex-1002 ¶¶85-92, 109-124.

PO raises no independent reasons that claims 27-28 would not be obvious over Li-Siam. POR, 38.

B. Ground 2: Claims 25, 27, and 28 Are Obvious over Li-Siam-Cui-2003

1. Petitioner demonstrates motivation to combine Li-Siam-Cui-2003

Cui-2003 discloses methods for selecting “the best modulation strategy to minimize total energy consumption” and discloses a “multi-mode operation” that considers power consumption in active mode, sleep mode, and during transitions

back to active mode to enable significant energy savings. Petition, 45-46; Ex-1002 ¶133; Ex-1007, 2805-806. Cui-2003 further improves Li-Siam's system by expanding Siam's total energy equation (which includes RF power and circuit power consumption when transmitting) to also include the power consumed when the system is "working in a sleep mode" "when there is no signal to transmit," i.e., when it is idling. Ex-1007, 2806; Petition, 45-47; Ex-1002 ¶¶133-34.

PO repeats its arguments against the combinability of Li and Siam (POR, 39-40), and attacks Cui-2003 in isolation instead of in combination (*id.*, 29-30) which are wrong for the same reasons described above. PO then argues that because Cui-2003 discloses that "circuits in the signal path are shut down for energy saving," a POSITA would have considered the power expended in sleep mode to be irrelevant to transmission mode selection. POR, 41. But Cui-2003's "sleep" mode is no different from the '120 Patent's disclosure that "if the idling transceivers turn off their transmission chains, some idle power may be consumed due to leakage current or other effects." Ex-1001, 3:5-7. In Cui-2003's sleep mode, the circuitry is ***working*** and ready to send:

We assume that the transceiver circuitry works on a multimode basis: when there is a signal to transmit all circuits work in active mode, when there is no signal to transmit ***they work in sleep mode***, and when switching from sleep mode to active mode there is a transient mode.

Ex-1007, 2806; Petition, 46; Ex-1002 ¶¶56, 134; Ex-2013, 90:15-22. And Cui-2003’s “total energy consumption E required to send L bits” that it seeks to optimize includes P_{sp} , the power consumed during sleep mode:

$$E = P_{on}T_{on} + P_{sp}T_{sp} + P_{tr}T_{tr}$$

Ex-1007, 2806; Petition, 51; Ex-1002 ¶¶56, 147. The “leaking current I_l of the switching transistors,” responsible for transceiver power consumption in sleep mode, is small, and if the circuitry is properly designed and employs CMOS technology, P_{sp} may be approximated as zero. Ex-1007, 2806. However, “our analysis can be easily modified to incorporate $P_{sp} \neq 0$.” *Id.*; Ex-2013, 93:18-94:10 (Petitioner’s expert: “Cui does allow for it to be non-zero. ... You could use it set to zero or not.”). Thus, Cui-2003’s analytical framework could accommodate higher sleep-mode power consumption, even the 60% disclosed in Li. Ex-1005 ¶18; Petition, 51-52; Ex-1002 ¶147. Thus, a POSITA would not have rejected Cui-2003’s sleep mode as irrelevant, as PO claims, but would have viewed Cui-2003’s energy equations as a way to improve upon Siam’s, which considers transmitted power and circuit power consumption but not idle power expressly. Ex-1002 ¶¶134, 147. Considering power consumption both while transmitting and while idling provides a more complete energy estimate that would improve the optimization of energy consumption per bit in selecting a transmission mode. *Id.*; Petition, 49-52; Ex-1007, 2805 (“[I]n order to find the optimal transmission scheme, the overall energy

consumption including both transmission and circuit energy consumption needs to be considered.”); Ex-2013, 85:13-86:2. A POSITA would, therefore, have been motivated to combine Li-Siam-Cui-2003. Ex-1002 ¶¶130-136.

2. Li-Siam-Cui-2003 discloses claim 25’s “idle power consumption” limitation

Cui-2003 expressly takes into account power consumption of the transceiver in sleep mode (P_{sp}) when the mobile device is not transmitting:

$$\begin{aligned} E &= P_{on}T_{on} + P_{sp}T_{sp} + P_{tr}T_{tr} \\ &= (P_t + P_{c0})T_{on} + P_{sp}T_{sp} + P_{tr}T_{tr}, \end{aligned} \quad (1)$$

“where P_{on} , P_{sp} , and P_{tr} are power consumption values for the active mode, the sleep mode, and the transient mode, respectively.” Petition, 51 (quoting Ex-1007, 2806). PO’s four reasons that power consumption during “sleep mode” does not meet claim 25’s “idle power consumption” limitation are wrong.

First, PO argues that because Cui-2003 discloses “all the circuits in the signal path are shut down for energy saving” during sleep mode, the mobile device cannot be considered to be in idle mode. POR, 43. But Cui-2003 describes the mobile device as “*work[ing]* in sleep mode” when “there is no signal to transmit” (Ex-1007, 2806), emphasizing that this is a low-power state in which the transmitter is *waiting to send*. See Ex-2013, 89:6-13 (“it is in a low power mode”); 90:15-22 (“[W]ork’ implies usage of energy. In fact power is a unit of work. So I think if you work in

sleep mode, that sort of implies there is still some energy being used.”). And the power consumption of the shut-down circuitry during sleep mode is “dominated by the leaking current $[I_l]$ of the switching transistors if the circuitry is properly designed” (*id.*, 91:9-15), just like the “idling transceivers” of the ’120 Patent that “turn off their transmission chains” yet still consume idle power “due to leakage current or other effects.” Ex-1001, 3:5-7. PO argues that the power consumption of Cui-2003’s sleep mode may be lower than that of the ’120 Patent’s idle mode (POR, 43), but nothing in claim 25 places any quantitative bounds on the magnitude of idle power consumption to be considered, nor does the ’120 Patent disclose any idle power consumption other than that due to “leakage current or other effects.” Ex-1001, 3:7. And Cui-2003 expressly accounts for it in its energy equations. Petition, 50-52; Ex-1002 ¶¶134, 147 n.11; Ex-2013, 91:3-8.

Moreover, Cui-2003’s sleep mode is a state in which it is “waiting to send”—it describes a time period T during which it must send L bits: “[w]e assume a node has L bits to transmit with a deadline T . The transceiver spends time $T_{on} < T$ to communicate these bits ... and then *returns* to sleep mode where all the circuits in the signal path are shut down for energy saving.” Ex-1007, 2806. PO’s expert admitted “[w]hen there’s no signal to transmit, they work in sleep mode. And they switch ... back and forth between active mode and sleep mode. So they can be on, transmitting; or they can be in sleep mode, not transmitting.” Ex-1052, 129:21-25.

In other words, the system transitions to “sleep” mode between periods of communicating L bits, emphasizing that sleep mode is a state in which the transceiver is waiting to send. *See* Ex-2013, 85:3-86:18.

Second, PO’s argument that the unrelated Walton reference’s defining an “idle” state distinct from a “sleep” state shows that Cui-2003 does not disclose an “idle” state (POR, 45-46) necessarily assumes that an “idle” state is a defined term of art, contradicting PO’s argument that “‘idle power consumption’ has its plain and ordinary meaning.” POR, 12. Just because Cui-2003 names a state a “sleep” state, the ’120 Patent names it an “idle” state, and Walton describes both “sleep” and “idle” states does not mean Cui-2003’s sleep state does not render the ’120 Patent’s idle state obvious, especially when the characteristics of Cui-2003’s sleep state match the ’120 Patent’s descriptions of its idle state.

Third, PO argues that Petitioner’s expert has published papers describing sleep mode differently from “listening to idle channels.” POR, 46-47. These arguments fail, as explained above. In addition, Petitioner’s expert explained an “idle channel is not ... the same thing as idle mode” because an “[i]dle channel is a channel with no activity on it,” meaning “no transmissions or reception” but “[i]t is listening ... for signals.” Ex-2013, 104:7-105:15. Likewise, “camping on a cell” refers to advanced power-saving behaviors of *receivers listening* for incoming signals that must wake up periodically and not to *transmitters* that can enter a low-

power state (sleep or idle) when they do not have data to transmit (as claim 25 contemplates). Ex-2013, 111:21-112:15.

And fourth, PO argues that because Cui-2005, a paper sharing common authors with Cui-2003, was listed on the face of the '120 Patent (though never discussed during prosecution), the Board should require Petitioner to overcome a heightened bar to demonstrate obviousness. POR, 47-48. PO's cited case makes clear that the heightened standard applies "[w]hen *no prior art* other than that which was considered by the PTO examiner is relied on by the attacker." POR, 48 (citing *Ultra-Tex Surfaces v. Hill Bros. Chem. Co.*, 204 F.3d 1360, 1367 (Fed. Cir 2000)). Here, neither Li, Siam, nor Cui-2003 (nor their combination) was considered by the examiner, and this principle does not even apply. Regardless, Cui-2003's sleep mode disclosure is indistinguishable from the '120 Patent's idle mode embodiment in which transceivers turn off their transmission chains, which even PO does not argue should be excluded from the scope of "idle power consumption." Petitioner, thus, would meet even a heightened bar of showing that claim 25 is rendered obvious.

PO raises no independent reasons that claims 27-28 would not be obvious over Li-Siam-Cui-2003. POR, 50.

C. Grounds 3 and 4: Claim 26 Is Obvious Over Li-Siam-Wu or Over Li-Siam-Cui-2003-Wu

PO raises no independent reasons that claim 26 would not have been obvious over the asserted grounds. POR, 50-51.

D. Ground 5: Claim 29 Is Obvious Over Li-Siam-Tirola

1. Petitioner demonstrates motivation to combine Li-Siam-Tirola

PO incorrectly concludes that Tirola disparages MIMO generally because it states that MIMO is not feasible for improving UMTS. POR, 51. But Petitioner's expert explains this statement is narrowly focused on whether it is more efficient to double the number of receive antennas (to use 4) than add a second uplink antenna. Ex-2013, 138:16-139:11 (quoting Ex-1008, Abstract). And Tirola states "MIMO transmissions *will provide some benefit (up to 2 dB)* for UL coverage and *UE battery consumption.*" Ex-1008, Abstract. Li-Siam is focused on improving battery consumption, so a POSITA would have recognized MIMO may save power and would not have seen Tirola as teaching away from Li-Siam. See Ex-1002 ¶163.

Tirola presents estimates of the noise increase based on the number of users for various antenna configurations including 1x2 (SIMO) and 2x2 (MIMO). Ex-1002 ¶164 (citing Ex-1008, 658-61, Fig. 4). PO incorrectly argues that because 1x2 SIMO has a larger noise rise than 2x2 MIMO as a function of the number of users under only one set of conditions, while 2x2 MIMO has the larger noise rise in the

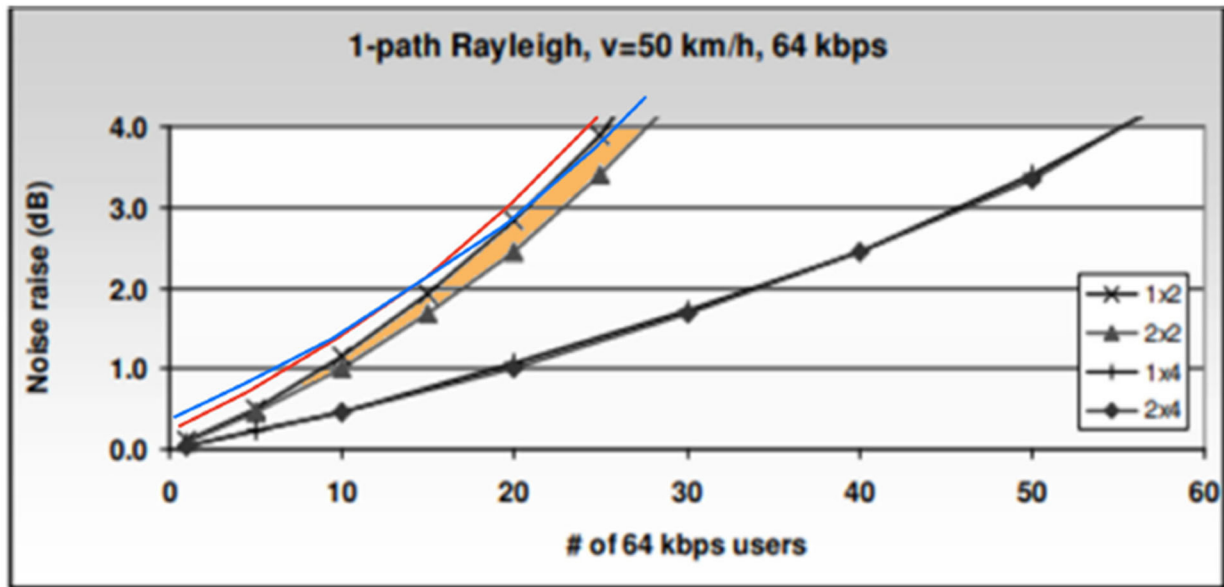
majority of cases, a POSITA would have concluded that Tirola as a whole shows that MIMO performs worse than SIMO for a larger number of users and would not have been motivated to combine Li-Siam-Tirola. POR, 54-55. But PO misses the point. The fact that Tirola shows that the number of users has *any* effect (positive or negative) on the selection of SIMO or MIMO mode under *any* conditions is what would have motivated a POSITA to consider the number of users in determining whether to switch between SIMO and MIMO. *See, e.g.*, Ex-2013, 146:7-148:16; Ex-1002 ¶¶54-55, 57-58, 165-166. The Petition simply presents an exemplary case in which considerations of RF link power and circuit power consumption might favor SIMO but noise rise due to number of users might favor MIMO (per Tirola's Figure 4(b)), thus changing the mode-switching cross-over point at which the most energy-efficient transmission would take place. Petition, 66-68; Ex-1002 ¶¶179-81. But if other channel conditions suggested that MIMO had the larger noise increase with number of users (e.g., Tirola Fig. 4(d)), that would also affect the cross-over point by expanding the conditions under which SIMO would remain the proper choice to achieve the most energy-efficient transmission. Ex-2013, 146:7-148:16; Ex-1002 ¶¶179-81. Moreover, even if Tirola showed a change in performance between SIMO and MIMO as a function of the number of users under only a single set of channel conditions, there is no reason to conclude a POSITA would not have considered Tirola's teachings for at least those channel conditions. *See, e.g., Recor*

Med., Inc. v. Medtronic Ireland Mfg. Unlimited Co., No. 2023-2251, 2025 WL 944511, at *2 (Fed. Cir. Mar. 27, 2025) (vacating and remanding because “the Board was required to consider [the prior art] ‘for everything that it teaches’” and failed to do so when it “disregarded” certain disclosures “simply because [the reference] has a preferred embodiment” (quoting *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1076 (Fed. Cir. 2015)). PO’s suggestion that a POSITA would have considered Tirola only if it concluded that SIMO *always* exhibited a noise rise greater than that of MIMO, regardless of channel condition, is simply wrong. *Id.*

2. Li-Siam-Tirola discloses claim 29’s “number of users” limitation

Li-Siam-Tirola teaches or suggests that Siam’s energy equation, which is optimized to determine which transmission mode provides the lowest energy per bit, should also include consideration of the noise rise as a function of the number of users for those transmission modes because a larger noise increase will require more transmit energy to achieve the same signal-to-noise performance. Ex-1002 ¶179 (“[W]hen accounting for total power, a POSITA would need to consider not only the *noise rise, which determines the amount of transmitted power*, but also ... the circuit power of the SIMO or MIMO mode used.”). Because the noise rise of SIMO mode as a function of the number of users may differ from the noise rise of MIMO mode as a function of the number of users (e.g., Ex-1008, Fig. 4), the number of

users may change the point at which it is optimal to switch from SIMO to MIMO or vice-versa. Ex-1002 ¶180. An example of this is illustrated in the annotated version of Figure 4(b) below, from Ex-1002 ¶180.



By shifting Tirola's 2x2 (MIMO) curve up by a larger amount (blue) than the 1x2 (SIMO) curve (red) to account for the larger circuit power consumption of MIMO over SIMO, it can be seen that "in this example, the cross is at 2dB noise raise, which corresponds to approximately 14 users. This would imply that if circuit power is taken into account, there would be some crossover point, i.e., number of users, below which the SIMO system would outperform the MIMO system." Ex-1002 ¶180; Petition, 67. This is an exemplary case, but for any case in which the noise rise in SIMO differs from that in MIMO as a function of the number of users, consideration of the number of users will change the amount of power needed in SIMO and/or

MIMO mode and will change the optimal point for selecting between them. Ex-1002 ¶¶178-79. Though PO’s expert, Dr. Akl, argues there could be other ways to compensate for increased channel noise, he acknowledges that increasing signal power is one way to do so:

Q. Raising a signal power is one way to compensate for increased noise in the channel; is that right?

A. It is one way, yes. There’s many ways a POSITA would—would think of. It is one way.

Ex-1052, 140:3-6. Thus, Li-Siam-Tiirola teaches that the control signal for switching between MIMO and SIMO is based on a number of users of the communication system. Ex-1002 ¶¶163-167, 174-182.⁶

⁶ PO’s argument that “Tiirola merely describes a simulation” (POR, 57) is irrelevant, as explained above for Siam. *Keller*, 642 F.2d at 425; *KSR*, 550 U.S. at 421. And PO’s argument that “Tiirola does not teach a control signal” and “has no application with respect to transmission mode selection in a mobile device” (POR, 30) considers Tiirola in isolation instead of in combination with Li-Siam, which is legally improper. *Keller*, 642 F.2d at 425.

IV. CONCLUSION

For the foregoing reasons, claims 25-29 should be cancelled as obvious over the prior art presented in this IPR.

Respectfully Submitted,

/s/ William M. Fink

William M. Fink (Reg. No. 72,332)

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Petitioner certifies that this reply includes 5,344 words, as measured by Microsoft Word, exclusive of the table of contents, table of authorities, mandatory notices under §42.8, certificates of service, word count, and exhibits.

CERTIFICATE OF SERVICE (37 C.F.R. §42.6(e)(1))

I hereby certify that on June 10, 2025, I caused a true and correct copy of the foregoing REPLY IN SUPPORT OF SAMSUNG’S PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,798,120 to be served electronically on counsel for Patent Owner at the following addresses:

Nathaniel Browand
Milbank LLP
55 Hudson Yards
New York, NY 10001
Email: nbrowand@milbank.com

Christopher Gaspar
Milbank LLP
55 Hudson Yards
New York, NY 10001
Email: cgaspar@milbank.com

Dated: June 10, 2025

Respectfully submitted,

/s/ William M. Fink

William M. Fink (Reg. No. 72,332)
O’Melveny & Myers LLP
1625 Eye Street, NW
Washington, DC 20006
Telephone: (202) 383-5300
Fax: (202) 383-5414
Email: tfink@omm.com
Attorney for Petitioner