United States Court of Appeals for the Federal Circuit

SISVEL INTERNATIONAL S.A.,
Appellant

v.

SIERRA WIRELESS, INC., TELIT CINTERION DEUTSCHLAND GMBH, F/D/B/A THALES DIS AIS DEUTSCHLAND GMBH
Cross-Appellants

2022-1493, 2022-1547

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2020-01099.

Decided: October 6, 2023

ROBERT J. GAJARSA, Devlin Law Firm LLC, Wilmington, DE, argued for appellant. Also represented by TIMOTHY DEVLIN, NEIL A. BENCHELL.

KOURTNEY MUELLER MERRILL, Perkins Coie LLP, Denver, CO, argued for all cross-appellants. Cross-appellant Sierra Wireless, Inc. also represented by AMANDA TESSAR.

GUY YONAY, Pearl Cohen Zedek Latzer Baratz LLP,

New York, NY, for cross-appellant Telit Cinterion Deutschland GmbH. Also represented by KYLE AUTERI, I.

Before MOORE, *Chief Judge*, CLEVENGER and CHEN, *Circuit Judges*.

CHEN, *Circuit Judge*.

The Patent Trial and Appeal Board (Board) determined claims 1–3 and 9 of U.S. Patent No. 6,529,561 ('561 patent) were unpatentable, but upheld claims 4–8 and 10. *Cradlepoint, Inc. v. Sisvel Int'l S.A.*, No. IPR2020-01099, 2021 WL 6655659, at *27 (P.T.A.B. Jan. 18, 2021) (*Decision*). Sisvel International S.A. (Sisvel) appeals the Board's unpatentability determination of claims 1–3 and 9; Sierra Wireless, Inc. and Telit Cinterion Deutschland GmbH (collectively, Cross-Appellants) appeal the Board's upholding of claims 4–8 and 10. As to the appeal, we *affirm*. As to the cross-appeal, we *affirm-in-part*, *vacate-in-part*, and *remand*.

BACKGROUND

I

The '561 patent relates to methods of channel coding when transmitting data in radio systems. '561 patent col. 1 ll. 10–15, col. 4 ll. 19–30. Channel coding is a technique that adds redundant information to a data block, thereby creating a coded data block. To account for problems from noise and interference during data transmission, the redundant data allows a receiver to more accurately detect and correct errors in the transmitted data, but at the cost of requiring more bandwidth and network resource usage.

The '561 patent uses techniques called "link adaptation" and "incremental redundancy," which it asserts improves prior channel coding techniques. *Id.* col. 3 ll. 2–5, col. 4 ll. 19–30. Link adaptation occurs on the

transmission side and refers to changing the code rate[1] of the transmitted data blocks. *Id.* col. 1 ll. 39–41. A data block is first coded to add redundant data bits,[2] and then "punctured" to remove a certain number of coded data bits. *Id.* col. 7 ll. 21–46. In link adaptation, the code rate can be adjusted between successive data blocks to optimize radio resources based on channel conditions. *Id.* col. 1 ll. 39–50.

Incremental redundancy occurs on the receiver side. *Id.* col. 2 ll. 25–27. When a receiver receives a coded data block with too many errors to accurately decode, it will store that coded data block in memory and request retransmission of the data block. *See id.* col. 2 ll. 25–29. After receiving the retransmitted data block, the receiver combines the stored and the retransmitted coded data blocks. *Id.* col. 2 ll. 27–29. Because the combined coded data block has more overall data bits and increased redundancy, it can more feasibly be decoded by the receiver. *Id.* col. 2 ll. 29–33.

The claims recite coding a data block and then puncturing it with a first puncturing pattern to remove some data bits from the coded data block. The punctured, coded data block is then transmitted to a receiver. The receiver, however, may not be able to decode the data and requests retransmission. When the transmitter resends the coded data block, it performs link adaptation by changing the

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[1] The code rate refers to "the ratio of the number of user data bits to the coded data bits of a channel." *Id.* col. 1 ll. 50–51. As an example, if 100 data bits are converted into 200 coded data bits to be transmitted over the channel, the code rate is 100/200 = $1/2$. *Id.* col. 1 ll. 51–55.

[2] The '561 patent appears to refer to the terms "bits" and "symbols" interchangeably. '561 patent col. 8 ll. 10–13 ("[T]he second puncturing pattern 406 comprises bits 100100100, i.e. only the first and the third symbol thereafter are retained, while other symbols are removed.").

number of bits removed when puncturing the coded data block using a second puncturing pattern. *Id.* col. 1 ll. 39–41, col. 9 ll. 60–67. The second puncturing pattern removes more bits than the first puncturing pattern, such that the retransmitted coded data block transmits fewer bits. When the receiver receives the retransmitted coded data block, it performs incremental redundancy by combining the original and retransmitted coded data blocks and decoding the combined data block. *Id.* col. 9 ll. 65–67.

Independent claim 1 of the '561 patent recites:

> 1. A method of transmitting data in a radio system from a transmitter to a receiver, the method comprising:
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> channel coding a data block into a coded data block by using a selected channel coding;
>
> puncturing the coded data block by using a first puncturing pattern;
>
> transmitting the coded data block punctured by the first puncturing pattern to the receiver;
>
> detecting a need for retransmission of the received coded data block;
>
> transmitting a retransmission request of the coded data block to the transmitter;
>
> increasing the code rate of the coded data block to be retransmitted by puncturing the coded data block coded by the channel coding of the original transmission using *a second puncturing pattern* including fewer symbols to be transmitted than the first puncturing pattern;
>
> transmitting the coded data block punctured by the second puncturing pattern to the receiver;
>
> *combining the received coded data block punctured by the first puncturing pattern and the received*

> *coded data block punctured by the second puncturing pattern*; and
>
> decoding the channel coding of the combined coded data block.

Id. at claim 1 (emphasis added).

Claim 5 is similar to claim 1, but is directed to a radio system and further recites a "means for detecting" limitation[3]:

> 5. A radio system comprising:
>
> a transmitter and a receiver having a radio connection to the transmitter;
>
> the transmitter comprising a channel coder for channel coding a data block into a coded data block by using a selected channel coding and for puncturing the coded data block by using a first puncturing pattern, and transmission means for transmitting the coded data block punctured by the first puncturing pattern to the receiver; and
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> the receiver comprising a channel decoder for decoding the received coded data block, *means for detecting a need for retransmission of the received coded data block*, and means for transmitting a retransmission request of the coded data block to the transmitter; wherein:
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> the channel coder increases the code rate of the coded data block to be retransmitted by puncturing the coded data block coded by the channel coding of the original transmission by using a second

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[3] Claim 10 recites the identical limitation "means for detecting a need for retransmission of the received coded data block." We treat claim 5 as representative.

> puncturing pattern comprising fewer symbols to be transmitted than the first puncturing pattern;
>
> the transmission means transmit the coded data block punctured by the second puncturing pattern to the receiver;
>
> the receiver comprises means for combining a received coded data block punctured by the first puncturing pattern and a received coded data block punctured by the second puncturing pattern; and
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> the channel decoder decodes the channel coding of the combined coded data block.

Id. at claim 5 (emphasis added).

II

Cross-Appellants filed a petition for *inter partes* review of claims 1–10 of the '561 patent. *Decision*, 2021 WL 6655659, at *1; J.A. 180. Relevant here, Cross-Appellants challenged claims 1–3, 5–7, 9, and 10 as unpatentable under 35 U.S.C. § 103 over Chen,[4] as well as claims 1–10 as unpatentable under § 103 over Chen and Eriksson[5] or

[4] World Intellectual Property Organization ("WIPO") Patent Application No. PCT/US98/24155, filed Nov. 12, 1998, Publication No. WO 99/26371, published May 27, 1999, to Tao Chen et al.

[5] S. Eriksson et al., "Comparison of Link Quality Control Strategies for Packet Data Services in EDGE," 1999 IEEE 49th Vehicular Technology Conference, May 16–20, 1999.

Chen and GSM 03.64[6].[7] J.A. 186. The Board determined that Chen rendered claims 1–3 and 9 obvious, but upheld claims 4–8 and 10. *Decision*, 2021 WL 6655659, at *27.

First addressing claim 5's "means for detecting" limitation, the Board construed it as a means-plus-function limitation but determined there was "insufficient algorithmic structure identified" by Cross-Appellants in its petition. *Id.* at *5–6. The Board acknowledged Cross-Appellants' assertion that the "means for detecting" corresponded to various protocols mentioned by name in the '561 patent, such as forward error correction (FEC), Automatic Repeat Request (ARQ), and hybrid ARQ, and also acknowledged the related testimony from Cross-Appellants' expert, Dr. Kakaes. *Id.* at *3, *5–7. Dr. Kakaes testified that a skilled artisan would be familiar with "well-known and commonly used error detection codes, such as the" cyclic redundancy check (CRC) and "[ARQ] protocol and hybrid ARQ," and "would have known from the '561 specification how to program a processor or hardware to achieve the claimed function of 'detecting a need for retransmission of the received coded data block.'" *Id.* at *7. The Board, however, found that this testimony could not remedy the insufficient structure disclosed in the specification itself. *Id.* According to the Board, Cross-Appellants "ha[d] not shown that the '561 patent presents an algorithm for how the error detection code detects an error, nor explained the circumstances

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[6] Special Mobile Group ("SMG") of the European Telecommunications Standards Institute ("ETSI"), Global System for Mobile Communications (GSM) Technical Specification (TS) 101 350 V8.0.0 (1999-07), "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2," GSM 03.64, Version 8.0.0, Release 1999.

[7] We collectively refer to Eriksson and GSM 03.64 as the "GSM references."

under which the error correcting code cannot correct errors and what constitutes 'sufficient certainty.'" *Id.* at *8.

Turning to Cross-Appellants' prior art challenges, the Board found that claims 1–3 and 9 would have been obvious in view of Chen. Relevant here, the Board found that Chen discloses both the "second puncturing pattern" and "combining" limitations of claim 1. *Id.* at *10–12, *15–18. The Board did not evaluate unpatentability of claims 5–7 and 10 because it was "unable to conclude what structure is encompassed" by the "means for detecting" limitation. *Id.* at *19.

As for the grounds based on Chen with GSM references, the Board found that Cross-Appellants' many offered reasons to combine the references "[did] not suffice as an articulated reason with a rational underpinning to combine the respective teachings of the references." *Id.* at *24–27. The Board also found that many of Cross-Appellants' reasons to combine Chen and the GSM references lacked clarity. *Id.* at *25–27. And as with its analysis based on Chen alone, the Board again did not reach claims 5–8 and 10 because it was unable to conclude what structure is encompassed by the "means for detecting" limitation. *Id.* at *27.

Thus, the Board ultimately determined claims 1–3 and 9 were unpatentable under § 103 based on Chen, but upheld claims 4–8 and 10. *Id.*

Sisvel and Cross-Appellants each timely appealed the Board's final written decision. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A) and 35 U.S.C. § 141(c).

STANDARD OF REVIEW

We review decisions by the Board under the standards set forth in the Administrative Procedure Act (APA). 5 U.S.C. § 706; *Pride Mobility Prods. Corp. v. Permobil, Inc.*, 818 F.3d 1307, 1313 (Fed. Cir. 2016). We set aside the Board's actions if they are "arbitrary, capricious, an abuse

of discretion, or otherwise not in accordance with law" or "unsupported by substantial evidence." 5 U.S.C. § 706(2)(A), (E). The Board's "[d]eterminations about governing legal standards and about intrinsic evidence are reviewed de novo, and any factual findings about extrinsic evidence relevant to the question, such as evidence about knowledge of those skilled in the art, are reviewed for" substantial evidence. *BASF Corp. v. Johnson Matthey Inc.*, 875 F.3d 1360, 1365 (Fed. Cir. 2017); *ACCO Brands Corp. v. Fellowes, Inc.*, 813 F.3d 1361, 1365 (Fed. Cir. 2016).

Obviousness is a question of law based on underlying findings of fact. *In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000). Relevant underlying factual questions here include the scope and content of the prior art, the differences between the prior art and the claimed invention, whether the prior art reference teaches away, and the presence or absence of a motivation to combine. *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1364 (Fed. Cir. 2015); *Gen. Elec. Co. v. Raytheon Techs. Corp.*, 983 F.3d 1334, 1345 (Fed. Cir. 2020).[8]

DISCUSSION

I. Appeal

On appeal, Sisvel argues that (1) Chen fails to disclose a second puncturing pattern, Appellant's Opening Br. 12–15; and (2) the Board did not provide a sufficiently detailed explanation to support its finding that Chen discloses the "combining" limitation, and ignored its rebuttal arguments, Appellant's Opening Br. 16–19. We disagree with Sisvel on both counts.

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[8] The Board applied pre-AIA law, which the parties do not dispute. *Decision*, 2021 WL 6655659, at *3 n.1. We therefore discuss the pre-AIA versions of all relevant patentability statutes.

A. Second Puncturing Pattern

Substantial evidence supports the Board's finding that Chen discloses the claimed "second puncturing pattern." *Decision*, 2021 WL 6655659, at *10–12, *15. Claim 1 requires a "first puncturing pattern" and a "second puncturing pattern." '561 patent at claim 1. To teach the first and second puncturing pattern, the Board relied on Chen's embodiment that has an "original transmission" and a "retransmission." J.A. 1214 ll. 38–39, 1215 ll. 4–37. To create the original transmission and the retransmission, Chen discloses a convolutional encoder with, for example, four generators (g0, g1, g2, and g3) that each output code symbols. J.A. 1214 l. 38–1215 l. 37. For the original transmission, only the code symbols from generators g0 and g1 are sent. J.A. 1215 ll. 4–33. When an error occurs in receiving the originally transmitted packet, a "retransmitted packet" can be sent that includes "code symbols from other generators which have not been transmitted previously," such as code symbols from generators g2 and/or g3. J.A. 1215 ll. 6–8. Chen expressly describes that its coded transmissions are "generated by using punctured codes" and that "[p]uncturing reduces the number of code symbols to be retransmitted." J.A. 1215 ll. 25–37. Cross-Appellants' expert, Dr. Kakaes, explained that a skilled artisan would have understood Chen's selective transmission of selected code symbols from certain generators to refer to puncturing, such that the original transmission with only code symbols from generators g0 and g1 correspond to a "first puncturing pattern" and the retransmitted packet with additional code symbols (e.g., g2) corresponds to a "second puncturing pattern." J.A. 2481–88 ¶¶ 31–41. Despite Sisvel's arguments to the contrary, Appellant's Opening Br. 13–15, Chen's disclosure and Dr. Kakaes's testimony are substantial

evidence supporting the Board's finding that Chen teaches the "second puncturing pattern" limitation.[9]

Sisvel also contends that Chen teaches away from using a second puncturing pattern. Appellant's Opening Br. 15; Appellant's Reply Br. 4–7. Substantial evidence supports the Board's finding that Chen teaches a second puncturing pattern. Although Chen states that puncturing "reduces the error correcting capability of the convolutional code," J.A. 1215 ll. 35–37, Chen expressly states that "other code rates can also be generated using punctured codes and are within the scope of the present invention." J.A. 1215 ll. 25–26. The latter statement refutes any suggestion of teaching away, as it expressly contemplates "using punctured codes." *See DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) ("A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." (citations omitted)).

B. Combining

Turning to the "combining" limitation, the Board's analysis is sufficiently detailed and did not ignore Sisvel's arguments. The Board found that Chen's disclosure of "accumulating the code symbols from the transmitted and retransmitted coded data blocks," also referred to in Chen as "interleaving," teaches the "combining" limitation. *Decision*, 2021 WL 6655659, at *12. The Board rejected Sisvel's

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[9] The Board reasonably found that Chen discloses the limitation "a second puncturing pattern including fewer symbols to be transmitted than the first puncturing pattern" through Chen's retransmission of only the code symbols from generator g2. *Decision*, 2021 WL 6655659, at *11–12; J.A. 1215 ll. 16–22.

argument that Chen's "interleaving" is different than the '561 patent's "combining" limitation, finding them to be the same. *Decision*, 2021 WL 6655659, at *17 ("Petitioner further contends, and we agree, that "'combining" in the '561 patent and "interleaving" in the second embodiment of Chen are the exact same thing . . . ."'). In fact, the Board expressly stated that it considered Sisvel's arguments in the Patent Owner Response and Sur-Reply and testimony from Sisvel's expert Mr. Bates, but it found Sisvel's arguments "unavailing" because "the record does not support the finding that 'combining' as recited in claim 1 excludes interleaving as taught by Chen." *Id.* at *17. Moreover, the Board acknowledged Sisvel's argument that Chen includes a statement that "retransmitted packets are interleaved (not combined)." J.A. 483, 571–72 (both quoting J.A. 1215 ll. 9–10). But the Board found this argument unpersuasive in light of Chen's other teachings of accumulating and combining packets. *Decision*, 2021 WL 6655659, at *16–17 ("[A]lthough Chen distinguishes interleaving from combining in one instance, it also discloses accumulating packets and combining packets.").

Sisvel also asserts that it rebutted the Board's reliance on Chen's disclosure of the "accumulation of packet energy" for the "combining" limitation. Appellant's Opening Br. 17–18 (citing J.A. 484). The Board, however, relied on Chen's alternative embodiment describing a method of accumulating *code symbols*, which is different than accumulating *packet energy*. *Decision*, 2021 WL 6655659, at *12, *17–18 (citing J.A. 1215 ll. 9–13, 17–24, 33–35). The Board agreed with Cross-Appellants that Chen's accumulation of *code symbols* through "interleaving" is the same as the '561 patent's "combining" because "[b]oth involve the same concept: collecting together different coded symbols from the transmission and retransmission to be decoded together at a lower code rate." *Id.* at *17.

Accordingly, the Board's analysis of the "combining" limitation is sufficiently detailed, adequately addresses

Sisvel's related arguments, and is supported by substantial evidence.

II. Cross-Appeal

Cross-Appellants argue that (1) the Board's finding that a skilled artisan would not have been motivated to combine Chen and the GSM references is not supported by substantial evidence, Cross-Appellants' Opening Br. 33–52; and (2) the Board erroneously found insufficient corresponding structure in the specification for the term "means for detecting," Cross-Appellants' Opening Br. 52–61. We hold substantial evidence supports the Board's finding of a lack of motivation to combine Chen and the GSM references, but that the Board erred in analyzing the "means for detecting" limitation.

A. Motivation to Combine

The Board found that each of Cross-Appellants' ten reasons for combining Chen and GSM "[did] not suffice as an articulated reason with a rational underpinning to combine the respective teachings of the references." *Decision*, 2021 WL 6655659, at *24–27. That finding was more than reasonable in this case, where Cross-Appellants' proposed combinations and rationales were expressed at such a non-specific, high level of generality, they never made clear to the Board what portions of the references were being combined and why a skilled artisan would identify those particular elements for a combination.

We agree with the Board that Cross-Appellants' first, second, and third reasons to combine were merely assertions that the references were analogous art, which, without more, is an insufficient articulation for motivation to combine. *Id.* at *24; J.A. 250–251. We further agree with the Board that Cross-Appellants' remaining rationales were too conclusory, lacked clarity, or suffered from both problems. *Decision*, 2021 WL 6655659, at *24–27; *see, e.g.*, *id.* at *26 ("[T]he record . . . lacks clarity as to how

Petitioner contends Chen is modified and/or improved by [the GSM references] or how Chen itself modifies and/or improves [the GSM references], respectively, despite Petitioner having had the opportunity, post-institution, to address this deficiency."); *id.* at *27 ("[I]t is not clear that the second [modulation coding scheme (MCS)] is that of Chen or [the GSM references]."). For example, the Petition does not explain what reference is the primary versus secondary reference, what elements are missing from the primary reference, what elements should be added from the secondary reference to reach the claimed invention, or why those particular elements would be obvious to add. J.A. 252–262. Moreover, Cross-Appellants are inconsistent as to how Chen and the GSM references should be combined. In some instances, Cross-Appellants allege that a skilled artisan would improve Chen with the GSM references. *See, e.g.*, J.A. 252 ("Applying [the GSM references' teachings] to Chen would have been applying known techniques to improve the similar incremental redundancy techniques already taught by Chen in the same manner."); J.A. 259 (asserting that a skilled artisan would be "applying [the GSM references] to Chen . . ."). In other instances, Cross-Appellants allege the converse—that a skilled artisan would improve the GSM references with Chen. *See*, *e.g.*, J.A. 542–44 (discussing applying Chen to the GSM standards described in the GSM references); *see also* Cross-Appellants' Opening Br. 50 ("Cross-Appellants' argument has always been that a [skilled artisan] would take Chen's disclosed incremental redundancy retransmission method and apply it to the mandatory GSM protocols and MCSs to arrive at the claimed invention."). Under the circumstances, we cannot fault the Board for being at a loss in trying to decipher Cross-Appellants kitchen-sink of unclear and confusing motivation-to-combine arguments.

B. Means for Detecting

1. Proceedings Before the Board

The Board found that Cross-Appellants "fail[ed] to identify sufficient algorithmic structure" in the specification corresponding to claim 5's "means for detecting a need for retransmission of the received coded data block." *Decision*, 2021 WL 6655659, at *8. Under the familiar analysis from this Court's decision in *Noah Systems, Inc. v. Intuit Inc.*, "our case law regarding special purpose computer-implemented means-plus-functions claims is divided into two distinct groups: First, cases in which the specification discloses no algorithm; and second, cases in which the specification does disclose an algorithm but a [party] contends that disclosure is inadequate." 675 F.3d 1302, 1313 (Fed. Cir. 2012). Where the specification discloses no algorithm, the knowledge of a skilled artisan is irrelevant. *Id.* (citing *Aristocrat Techs. Austl. Pty Ltd. v. Int'l Game Tech.*, 521 F.3d 1328, 1337 (Fed. Cir. 2008)). But where the specification discloses *some* arguable algorithm, even if a party contends that the algorithm is inadequate, the sufficiency of the purportedly-adequate structure disclosed in the specification must be evaluated in light of the knowledge possessed by a skilled artisan. *Id.* (citing *Aristocrat*, 521 F.3d at 1337; and then *AllVoice Computing PLC v. Nuance Commc'ns, Inc.*, 504 F.3d 1236, 1245 (Fed. Cir. 2007)).

Before the Board, Cross-Appellants relied on certain software protocols mentioned by name in the specification as examples of the corresponding structure, such as "ARQ" (Automatic Repeat Request) and "hybrid FEC/ARQ (Forward Error Correction/Automatic Repeat Request" (hybrid ARQ). '561 patent FIG. 2, col. 2 ll. 33–37, col. 10 ll. 41–42; J.A. 84. Cross-Appellants further relied on the agreement between both parties' experts that these software protocols were well-understood and well-known to a person of ordinary skill. *See, e.g.*, Cross-Appellants' Br. 54 ("These protocols were not only known in the art, but were included in

GSM's mandatory technical specifications."); J.A. 523 (patentee's expert testifying that "a [skilled artisan] would well understand what Forward Error Correction is and where it's conducted and would also understand what ARQ is."). Before the Board and before us, Cross-Appellants argue that these references to the names of software protocols are sufficient to bring the case out of *Noah* group one (absolutely no disclosure) and into *Noah* group two (some disclosure). Cross-Appellants assert that it is not always necessary to set forth in the specification the protocol steps themselves, as long as the protocol name is sufficient to connote specific structure to a skilled artisan. We agree with Cross-Appellants that the Board should have evaluated the protocols disclosed in the specification in light of the knowledge of a skilled artisan and conducted an analysis appropriate to *Noah* group two.

The Board disregarded the expert testimony offered by Cross-Appellants because it appeared to classify this case as falling within the "no algorithm" group of the *Noah* framework, where evidence of a skilled artisan's knowledge is irrelevant. For example, the Board rejected Dr. Kakaes's apparently undisputed testimony that a skilled artisan would be familiar with "well-known and commonly used error detection codes" such as CRC, as well as ARQ and hybrid ARQ, and "would have known from the '561 specification how to program a processor or hardware to achieve the claimed function of 'detecting a need for retransmission of the received coded data block.'" *Decision*, 2021 WL 6655659, at *7. The Board relied on our cases stating that "the testimony of one of ordinary skill in the art cannot supplant the total absence of structure from the specification" because § 112 requires that "the specification itself adequately disclose the corresponding structure." *Id.* (quoting *Default Proof Credit Card Sys., Inc. v. Home Depot U.S.A., Inc.*, 412 F.3d 1291, 1302 (Fed. Cir. 2005); and then *Noah*, 675 F.3d at 1312). Thus, the Board asserted that even if a skilled artisan "would have known of FEC, CRC,

ARQ, and hybrid ARQ," the Board refused to consider that knowledge because the specification itself contained no "algorithm for performing any one or more of these protocols." *Id.* at 7 (citing the portion of *Noah* discussing the "total absence of structure from the specification").

2. Our Precedents on Noah *Group One*

Patents falling into the first *Noah* group involve "the *total* absence of structure from the specification." *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1354 (Fed. Cir. 2015) (emphasis added). Where there is no arguable disclosure of structure, "the testimony of one of ordinary skill in the art" "cannot create structure where *none* otherwise exists." *Id.* (emphasis added); *accord Noah*, 675 F.3d at 1313 (explaining that group one cases involve "a total omission of structure" from the specification).

Some *Noah* group one cases arise when the patentee concedes that the patent discloses no structure, but attempts to defend its claims by arguing that structure is not needed. *Robert Bosch, LLC v. Snap-On Inc.*, 769 F.3d 1094, 1101 (Fed. Cir. 2014) (noting that the patentee conceded there was no structure in the specification but attempted to defend the claims by arguing the claims were not subject to § 112, ¶ 6 at all); *EON Corp. IP Holdings LLC v. AT & T Mobility LLC*, 785 F.3d 616, 621, 624 (Fed. Cir. 2015) (explaining that "[t]he parties agree that the [asserted] patent's specification discloses no algorithms, so this case falls in the first category" of *Noah*, but noting that the patentee attempted to rely on the "*Katz* exception"[10] to defend the lack of structure).

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[10] The *Katz* exception arises from this Court's decision in *In re Katz Interactive Call Processing Patent Litigation*, which held that a microprocessor alone, without an algorithm, was sufficient disclosure for claims whose

Other cases finding a "total absence" of structure arise when we determine that a claim has two (or more) functions, but we find that the disclosed structure applies only to one of the functions. *See, e.g.*, *Tomita Techs. USA, LLC v. Nintendo Co.*, 594 F. App'x 657, 662 (Fed. Cir. 2014) (non-precedential) (holding that a claim involved the functions of "offsetting and displaying," but omitted any structure for displaying, and thus fell into *Noah* group one). *Noah* itself was such a case. There, we explained that when there is disclosed structure for "less than all" of the functions in a claim, "we must analyze the disclosures as we do when no algorithm is disclosed." *Noah*, 675 F.3d at 1318.

A related line of cases arises when a patentee attempts to "rewrite the patent's specification" by using an expert to retroactively import structure that is totally absent from the patent. *Default Proof*, 412 F.3d at 1302; *accord Noah*, 675 F.3d at 1313 (citing *Default Proof*, 412 F.3d at 1301). For example, the patentee in *Function Media L.L.C. v. Google, Inc.* sought to excuse its lack of "any disclosure of the structure" by trying to "rely on the knowledge of one skilled in the art to fill the gaps" in the specification. 708 F.3d 1310, 1319 (Fed. Cir. 2013). The *Function Media* patentee asserted that it would be "unnecessary and extraneous" to require a specification to disclose structure that was within the background knowledge of a skilled artisan,

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functions are so fundamentally basic that they can be "achieved by any general purpose computer without special programming." 639 F.3d 1303, 1316 (Fed. Cir. 2011) (finding a general-purpose microprocessor sufficient structure for otherwise-unspecified functions of "processing," "receiving," and "storing"). But we immediately characterized *In re Katz* as a "narrow exception" to the "default rule" that an algorithm is required. *Ergo Licensing, LLC v. CareFusion 303, Inc.*, 673 F.3d 1361, 1364–65 (Fed. Cir. 2012).

citing our decision in *Typhoon Touch Technologies, Inc. v. Dell, Inc.* for support. *Id.* at 1318–19 (citing 659 F.3d 1376, 1385 (Fed. Cir. 2011)). We disagreed with the patentee. We distinguished *Typhoon* because that case involved explicit, though brief, disclosures in the specification. *Id.* at 1319. Unlike *Typhoon*'s brief-but-adequately-disclosed algorithm, *Function Media* involved no disclosure whatsoever, and thus appropriately fell into *Noah*'s first group. *Id.* at 1318.

Function Media's holding fits squarely within a long line of cases recognizing that expert testimony can "shed light on" the meaning of a specification's disclosure without being tantamount to a "rewrite" of the specification, but only when some actual disclosure exists in the specification. *Default Proof*, 412 F.3d at 1302 (quoting *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1332 (Fed. Cir. 2003)); *Function Media*, 708 F.3d at 1318 (quoting *Default Proof*, 412 F.3d at 1302).

Finally, we have considered cases that involve specification disclosures that are so generic and vague that they do not qualify as structure as a matter of law. For example, we rejected a disclosure of a "standard microprocessor" with "appropriate programming" because such a disclosure effectively "imposes no limitation whatever, as any general purpose computer must be programmed." *Aristocrat*, 521 F.3d at 1334; *accord Function Media*, 708 F.3d at 1318 (holding that a specification's mere disclosure of "a computer program that transmits" is not structure as a matter of law because it is merely a non-limiting "abstraction that simply describes the function"). For similar reasons, we have also rejected the "bare statement" that any "known techniques or methods can be used" as structure. *Biomedino, LLC v. Waters Techs. Corp.*, 490 F.3d 946, 953 (Fed. Cir. 2007). *Noah* itself rejected a general reference to "off the shelf software" as a basis for the patentee to retroactively "fill the gaps in its specification." *Noah*, 675 F.3d at 1317. Analogizing to our cases that rejected disclosures of

"any computer-related device" as insufficient, *Noah* concluded that an otherwise-unspecified reference to all "off the shelf software" was too generic, and therefore "does not disclose an algorithm" as a matter of law. *Id.* (citing *Blackboard, Inc. v. Desire2Learn, Inc.*, 574 F.3d 1371, 1383 (Fed. Cir. 2009)).

3. Our Precedents on Noah *Group Two*

If there is *some* disclosure of structure in the specification for performing the claimed function, the question of whether the specification discloses sufficient structure must be viewed in light of the knowledge of a skilled artisan. For example, in *Atmel Corp. v. Information Storage Devices, Inc*, we considered whether a specification's reference to the title of a scientific article could serve as sufficient structure for a means-plus function limitation. 198 F.3d 1374, 1377 (Fed. Cir. 1999) (claiming a "*high voltage generating means* disposed on said semiconductor circuit for generating a high voltage from a lower voltage power supply" (emphasis added)). We determined that while the content of referenced scientific article may not be incorporated by reference—because the article was not itself part of the specification—we could consider the title of the article, which did appear in the specification. *Id.* at 1382–83.

Our inquiry, then, turned on what a skilled artisan would understand from the title of the article itself, which referenced a particular type of integrated circuit (i.e., on-chip NMOS integrated circuits) and a particular approach to generating voltage (i.e., voltage multiplication). *Id.* at 1377. We noted that the patentee's expert offered undisputed testimony that the title of the article *alone* was sufficient to indicate the precise structure to a skilled artisan. *Id.* at 1382 ("Atmel's expert, Callahan, testified that this title alone was sufficient to indicate to one skilled in the art the precise structure of the means recited in the specification. The record indicates that that testimony was essentially unrebutted."). Thus, while we did not reach outside

of the specification to evaluate portions of the article "that do[] not appear in the specification," we also took account of what "the specification plainly states"—i.e., the title of the article—and all that it disclosed to a person of ordinary skill. *Id.*; *accord S3 Inc. v. NVIDIA Corp.*, 259 F.3d 1364, 1370–71 (Fed. Cir. 2001) (approving structure where the details of the structure were not described in the specification, but it was a "well known electronic structure and performs a common electronic function, and is readily implemented from the description in the specification").

We have applied this skilled artisan perspective for means-plus-function limitations in the context of software. In *AllVoice Computing PLC v. Nuance Communications, Inc.*, we held that "[i]n software cases . . . algorithms in the specification need only disclose adequate defining structure to render the bounds of the claim understandable to one of ordinary skill in the art." 504 F.3d at 1245 (citing *Med. Instrumentation & Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1214 (Fed. Cir. 2003)). There, we relied on a specification's reference to "the dynamic data exchange (DDE) protocol in the Windows operating system" as an algorithm. *Id.* at 1241–42. Though the specification did not detail what steps corresponded to the Windows version of the DDE protocol, we determined that "the reference to DDE in the specification" was sufficient to require consideration of expert testimony. *Id.* at 1242. Relying on the patentee's expert testimony that implementation of the DDE protocol "would be a trivial matter" for a skilled artisan, we found the claims sufficiently definite. *Id.*

Thus, for a means-plus-function limitation where the corresponding structure is an algorithm, the specification need not disclose all the details of the algorithm to satisfy the definiteness requirement of § 112 ¶ 2 so long as what is disclosed would be sufficiently definite to a skilled artisan. *See Finisar Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323, 1340 (Fed. Cir. 2008) (explaining that a patentee may disclose algorithmic structure "in any understandable

terms including as a mathematical formula, in prose . . . or as a flow chart, *or in any other manner that provides sufficient structure*" (emphasis added)).

The line demarking *Noah* group one from group two is thus clear: while an expert's testimony may "not create or infer the structure" that is totally absent from the specification, our cases allow "[e]xpert testimony . . . to show what" the disclosures that actually appear in the specification "would convey to one skilled in the art." *Biomedino*, 490 F.3d at 952. Cases where structure is "totally absent" fall in *Noah* group one, while cases with even "arguably" adequate disclosure fall into *Noah* group two. *Noah*, 675 F.3d at 1318–19; *EON Corp.*, 785 F.3d at 624 ("Where the specification discloses an algorithm that the accused infringer contends is inadequate, we judge the disclosure's sufficiency based on the skilled artisan's perspective." (citing *Noah*, 675 F.3d at 1313)).

4. Our Precedents Dictate That This is a Noah *Group Two Case, Requiring Consideration of Expert Testimony*

With these principles in mind, the question presented by this case is whether the specification's explicit reference to protocol names—which no party disputes refer to protocols known in the art—is sufficient to bring this case into *Noah* group two. We hold that it is. As such, the Board should have considered the knowledge of a skilled artisan to assess whether the protocol name sufficiently discloses an understood algorithm corresponding to the means-plus-function limitation. Contrary to the Board's view, that remains true even though the steps corresponding to the protocols are not expressly set out in the specification. Like in *Noah*, the Board thus erred when it "classified this case as a case involving no disclosed algorithm, and, because of this error, also improperly refused to allow [Cross-Appellants] to present expert testimony regarding the sufficiency of the purportedly disclosed algorithm." *Noah*, 675 F.3d at 1313.

This case does not resemble our precedents on *Noah* group one. This is not a case, akin to *Default Proof*, where there is a "total absence" of disclosure in the specification, with a party relying on an expert to "rewrite" the specification to retroactively insert certain protocols into the patent—the '561 patent itself identifies by name the relevant software protocols in the specification. Nor is this a case, like *Biomedino*, involving a vague catch-all phrase, like reciting all "known techniques" and leaving the reader to guess which allegedly known techniques are claimed. The '561 patent gives a concrete answer by disclosing to a skilled artisan a discrete, limited, and specific set of software protocols: FEC, ARQ, and hybrid ARQ.

The '561 patent's disclosures resemble our prior precedents which have permitted reliance on expert testimony, most particularly *Atmel* and *AllVoice*. Because the protocol names are stated within the '561 patent's specification, this case is indistinguishable from *Atmel*, where the specification's reference to an article title "alone" was sufficient to permit consideration of expert testimony on its meaning. *Atmel*, 198 F.3d at 1382. Here, Cross-Appellants levy an identical contention: that the reference to the names of specific protocols would connote a particular set of steps—an algorithm—to a skilled artisan. Like the name of the article in *Atmel*, the names of the protocols in the '561 patent must be considered for all they disclose to a skilled artisan. *Id.* And like the reference to the DDE protocol in *AllVoice*, 504 F.3d at 1242, the '561 patent's reference to protocol names is enough to require the Board to consider the import of those names in light of the knowledge of a skilled artisan.

Given the protocols identified in the specification, the Board should have considered expert testimony to "shed light on" these disclosures. *Default Proof*, 412 F.3d at 1302. That does not allow an expert to create new structure or imply structure from background knowledge—instead, it only reads the existing disclosures in the specification for

all they "would convey to one skilled in the art." *Biomedino*, 490 F.3d at 952.[11]

As should be clear, we do not reach the merits of the factual question of whether the protocols identified in the '561 patent's specification disclose sufficient structure to satisfy § 112 ¶ 2. We instead leave that question for the Board. On remand, the Board must conduct the analysis appropriate for *Noah* group two, including whether any of the protocols are clearly linked or associated with "the

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[11] We are quick to emphasize that we do not hold reference to a protocol name will *always* be sufficient structure. For example, it would not be enough to merely reference the name of a protocol that is unknown in the art, because the name of an unknown protocol, alone, would not inform a skilled artisan of the relevant steps that allegedly constitute an algorithm. Moreover, even references to the name of a known protocol may not always be enough in all cases. It may be the case that, as a factual matter, a name is merely a generic umbrella term that encompasses a vast and inchoate set of methods; or a name may connote a meaning that is so vague, varied, or ill-understood that a skilled artisan would not understand any algorithmic structure from the name of the protocol alone.

At the same time, the mere fact that a protocol (or other disclosure) is amenable to more than one implementation does not, by itself, make it insufficient structure. *AllVoice*, 504 F.3d at 1245 (approving algorithm as sufficient where there were "several straightforward ways that [it] could be implemented by one skilled in the art using well-known features of the Windows operating system"). Some variability in implementation of the corresponding structure or algorithm is permissible, so long as a skilled artisan can identify "adequate defining structure to render the bounds of the claim understandable." *Id.*

function recited in the claim,"[12] and whether they are "adequate structure for performing this function."[13] We express no view on those foregoing questions.

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[12] It is not clear from the Board's decision whether it ever settled on which of the protocols named in the specification (e.g., ARQ, hybrid ARQ, etc.) are "clearly linked" to the "means for detecting" limitation. While the determination of "what structure, if any . . . corresponds to the claimed function" is a "question[] of law, reviewed de novo," we think it prudent to allow the Board to address the question in the first instance. *Egenera, Inc. v. Cisco Sys., Inc.*, 972 F.3d 1367, 1373 (Fed. Cir. 2020).

[13] At one point in the Board's analysis, it appeared to implicitly require the "means for detecting" to include an additional function: "detecting the need for retransmission by an error detection code or *by the fact that an error correcting code cannot correct errors occurring on the channel with sufficient certainty*." *Decision*, 2021 WL 6655659, at *8 (cleaned up) (emphasis added). This articulation differed from the Board's express construction, *id.* at *5–6, which included none of the additional language italicized in the preceding sentence. *See Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 448 F.3d 1324, 1334 (Fed. Cir. 2006) ("A court errs when it improperly imports unclaimed functions into a means-plus-function claim limitation."). If the Board intended to modify its construction of the function to include the additional language, the Board must offer a reasoned analysis that "fully and particularly set[s] out the bases upon which it" relied, with sufficient specificity to allow "effective judicial review." *Provisur Techs., Inc. v. Weber, Inc.*, 50 F.4th 117, 123 (Fed. Cir. 2022). The Board must also consider whether the specification associates that additional function with any of the protocols (such as ARQ). *Cf.* '561 patent FIG. 2, col. 10 l. 41 – col. 11 l. 4.

C. Impossibility

If the Board finds that the specification lacks a sufficiently disclosed algorithm, the Board should state as much in its decision. It must then proceed to follow the guidance in our opinion in *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801 (Fed. Cir. 2021).

Intel held that when faced with a means-plus-function limitation with possibly insufficient corresponding structure in the specification, the Board must either (1) determine whether the claim is indefinite and then whether such indefiniteness renders it impossible to adjudicate a prior-art challenge on the merits, or (2) resolve the prior-art challenge to the patentability of the claims despite the potential indefiniteness of the means-plus-function term. *Id.* at 804, 814. The Board must also "clearly state that the final written decision does not include a determination of patentability of any claim that falls within the impossibility category." *Id.* at 813.

Accordingly, we vacate and remand the Board's decision as to the "means for detecting" limitation.

CONCLUSION

We have considered the parties' remaining arguments and do not find them persuasive. For the foregoing reasons, the Board's decision is affirmed-in-part, vacated-in-part, and remanded for further proceedings consistent with this opinion.

AFFIRMED-IN-PART, VACATED-IN-PART, AND REMANDED

COSTS

No costs.