

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

EMPIRE TECHNOLOGY DEVELOPMENT LLC,
Patent Owner.

Case No. IPR2024-00897
U.S. Patent No. 8,565,331

PATENT OWNER'S PRELIMINARY RESPONSE

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LIST OF EXHIBITS

Exhibit Number	Description
Ex-2001	Master License Agreement
Ex-2002	Assignment and Assumption Agreement
Ex-2003	Patent List – Wireless Portfolio
Ex-2004	Excerpt from Merriam-Webster's Collegiate Dictionary (11th ed. 2008)
Ex-2005	Excerpt from The American Heritage Dictionary of the English Language (4th ed. 2006)
Ex-2006	Excerpt of Random House Webster's College Dictionary (3rd ed. 2005)
Ex-2007	Excerpt of Bloomsbury English Dictionary (2nd ed. 2004)
Ex-2008	Excerpt of Longman Dictionary of American English (4th ed. 2008)
Ex-2009	Excerpt of Shorter Oxford English Dictionary (6th ed. 2007)
Ex-2010	Disclaimer in a Patent Under 37 C.F.R. 1.321(a), Patent No. 8,565,331, Docket No. APA-US-800279-02-US-NAT (Oct. 15, 2024)

I. INTRODUCTION

Patent Owner Empire Technology Development, LLC submits this Preliminary Response to Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.'s Petition challenging claims 1-8 of U.S. Patent No. 8,565,331 (the "'331 Patent"). The Board should deny institution of this Petition because Petitioners have not established a reasonable likelihood that they will prevail on any of the three grounds.

The Petition's Ground 1 fails for at least three reasons. *First*, the Petition fails to establish that Haustein discloses the steps of claim 1 that require decoding replicated data and generating an updated estimate of the channel. The Petition relies on Haustein's disclosure of a first transmission of pilot signals and data and a retransmission for these limitations. But the retransmission in Haustein only occurs if decoding the first transmission is unsuccessful—there is no suggestion that the channel estimate will ever be updated after either the first transmission or retransmission are decoded successfully. *Second*, Haustein also fails to disclose replicated data from multiple data streams because the method disclosed therein applies only a redundancy of data over a single data stream. *Third*, Petitioners also fail to show that Haustein discloses decoding subsequently received signals using the updated channel matrix estimate.

Ground 2 of the Petition fails for three reasons. *First*, the Petition fails to establish that a person of ordinary skill in the art (“POSITA”) would have been motivated to combine Ban and Wang without resorting to hindsight as it only identifies one conclusory, hindsight-based reason for modifying Ban’s communication system with Wang’s transmitter and receiver. *Second*, the Petition fails to show that the combination of Ban and Wang discloses generating an updated estimate of the channel matrix because Ban does not suggest transmitting multiple pilot blocks for purposes of updating the channel matrix estimate. *Third*, Petitioners also fail to show that the combination of Ban and Wang discloses decoding subsequently received signals using the updated channel matrix estimate, as the Petition does not cite any support in either reference for this claim limitation.

The Petition’s Ground 3 relies on an erroneous interpretation of “replicated data” that is inconsistent with Petitioners’ own interpretation in the Petition and therefore, fails because Tang does not disclose replicated data or receiving replicated data from multiple data streams. In addition, Petitioners also fail to show that Tang discloses decoding subsequently received signals using the updated channel matrix estimate. Therefore, the Board should deny institution of the Petition.

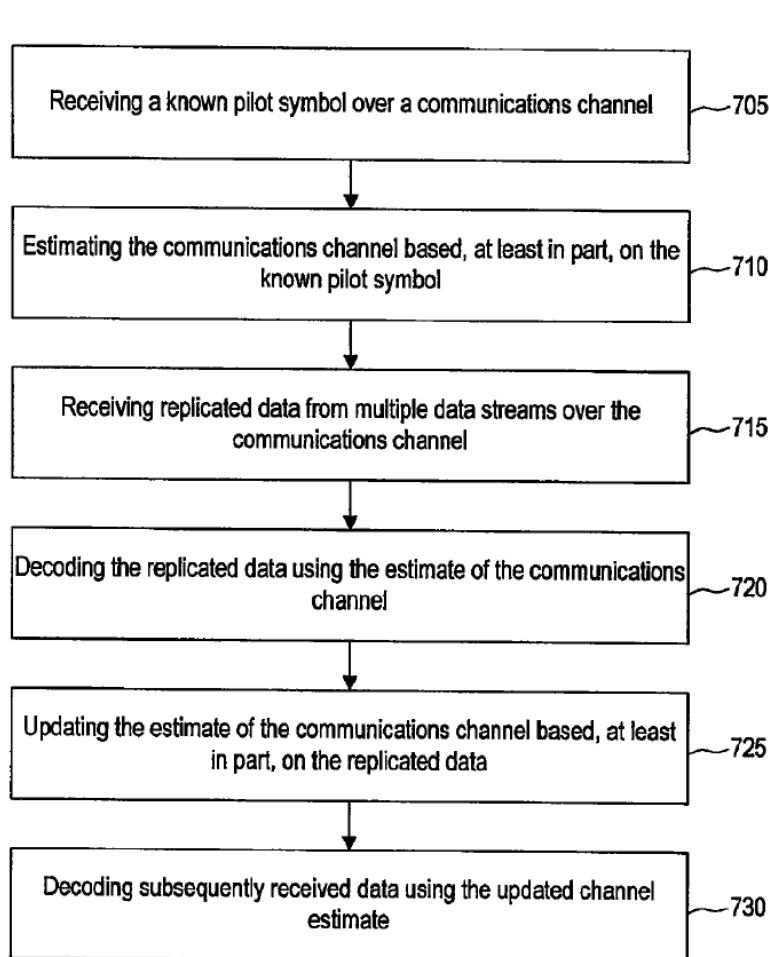
II. BACKGROUND

A. Overview of the '331 Patent

The '331 Patent is directed to “methods, systems, devices, and/or apparatus generally related to use of replicated data as a pilot symbol in a communications system.” Ex-1001 at 4:3-5. Wireless communications rely on communication channels that “may introduce a variety of non-idealities to a transmitted signal . . . [s]uch as may be caused by multipath interference, reflections, motion of one or more mobile stations, or other properties of a communications channel.” *Id.* at 1:27-31. “One way to measure properties of the communications channel is to insert pilot symbols into the transmitted data streams.” *Id.* at 1:66-2:1. “The pilot symbols may be known to the receiver and the known pilot symbols may be compared with the received signals to generate an estimate of one or more properties of the communications channel.” *Id.* at 2:1-4. Use of replicated data symbols as pilot symbols “may advantageously improve the data rate of the communications system” and “improve estimates of a channel matrix associated with a communications channel.” *Id.* at 5:55-57, 9:21-22.

The '331 Patent describes a method for receiving signals over a communication channel using replicated data. In one embodiment, Figure 7 below shows a method of receiving a known pilot symbol over a communication channel in step 705, estimating the communications channel based, at least in part, on the

known pilot symbol in step 710, receiving replicated data from multiple data streams over the communications channel in step 715, decoding the replicated data using the estimate of the communications channel in step 720, updating the estimate of the communications channel based, at least in part, on the replicated data in step 725, and decoding subsequently received data using the updated channel estimate in step 730. *Id.* at 9:43-64.

**Figure 7**

The '331 Patent explains that by using replicated data symbols as pilot symbols, the “accuracy of the resultant channel estimates may in some examples

approach the accuracy of an example where the effective number of inserted pilot symbols is equal to a sum of the number of pilot symbols plus the number of inserted replicated data symbols.” *Id.* at 10:56-60. In addition, using replicated data symbols may not impact the “overall data rate” as much as using more pilot symbols because “the replicated data symbols also transmit data.” *Id.* at 10:60-64.

Figure 5 illustrates an embodiment where the transmission of two data streams using replicated data symbols appears in a space-frequency block coding format. *Id.* at 7:62-8:9. Using input symbol stream 505 consisting of data symbols s1, s2, s3, s4, s5, s6, s7, s8, s9, s10, s11..., pilot symbols 520-525 have been inserted amongst data symbols 530-539 in data stream 510. *Id.* at 8:13-15. As indicated by the ovals and the arrow, data symbols 530 and 531 have been replicated in pairs from one frequency to another and inserted at a location between pilot symbols 523 and 524.¹ *Id.* at 8:15-18. A second data stream 515 is generated for transmission from a second location in accordance with the Alamouti space-frequency coding technique. *Id.* at 8:8-10.

¹ Patent Owner does not dispute Petitioners’ position that Figure 5 contains a typographical error, as S4 in first stream 510 should be -S4* and S3 in second stream 515 should be S3* to be consistent with Alamouti space frequency coding applied to all of the other data and pilot symbols shown. See Pet. at 5 n.2.

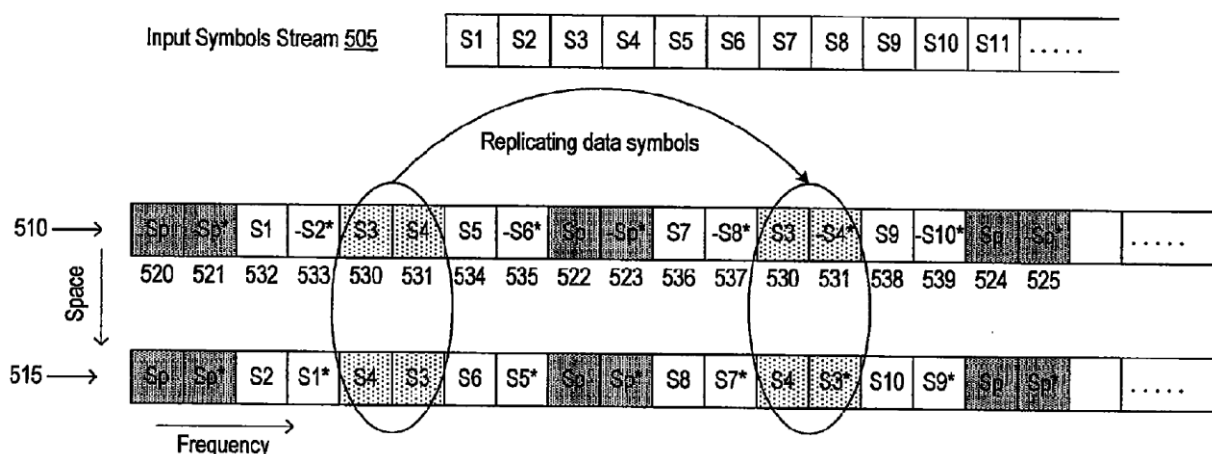


Figure 5

Figure 3 below illustrates another embodiment comprising signals S1 302 and S2 303 having pilot symbols 310 and 314 and data symbols 311-313 and 315-321 in which data symbols 312 and 316 are replicated from signal S1 302 to signal S2 303. *Id.* at 6:45-7:4. In this example, the signals are encoded using the Alamouti space-time block coding technique. *Id.* at 6:49-51.

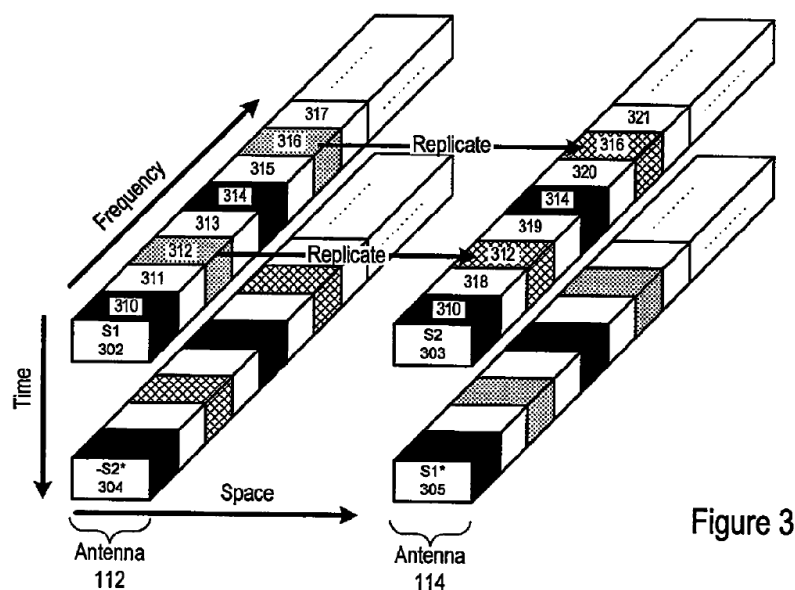


Figure 3

B. Prosecution History of the '331 Patent

On December 19, 2012, the PTO issued an office action that rejected the pending claims over U.S. Patent Publication No. 2010/0202559 to Luo. Ex-1004 at 230-35.

On March 18, 2013, applicant traversed the rejection by arguing that *inter alia* Luo does not disclose (i) “generating an updated estimate of the channel matrix based, at least in part, on the replicated data,” as recited in claim 8 (issued claim 1) or (ii) “a channel estimator coupled to the decoder and the receiver, wherein the channel estimator is configured to receive the received signals and the decoded at least one data symbol, wherein the channel estimator is configured to estimate a channel matrix of the communications channel based, at least in part, on the decoded at least one data symbol” as recited in claim 18 (issued claim 6). *Id.* at 253-54.

On May 8, 2013, the PTO issued a final rejection that *inter alia* (i) maintained the rejection to claim 8 over Luo because the limitation of “an updated estimate of the channel matrix” was “not given any patentable weight” since it “is not used by any other method step” and (ii) indicated claim 18 “would be allowable if rewritten or amended to overcome” a formal objection. *Id.* at 266.

On June 27, 2013, applicant filed a response that *inter alia* (i) amended claim 8 to include the limitation of “decoding subsequently received signals over the

communications channel using the updated estimate of the channel matrix” and (ii) addressed the formal objection to claim 18. *Id.* at 274-78.

On July 9, 2013, the PTO issued a notice of allowance. *Id.* at 282-87.

C. Related District Court Litigation

District court litigation is pending between Petitioners and Patent Owner in the Eastern District of Texas in the matter captioned *Empire Tech. Dev. LLC v. Samsung Elecs. Co.*, 2:23-cv-00427 (E.D. Tex. Sept. 18, 2023). In that action, Patent Owner contends that Petitioners infringe at least claims 1 and 5 of the '331 Patent under 35 U.S.C. § 271.

III. LEVEL OF ORDINARY SKILL IN THE ART

Petitioners offer a definition of a POSITA at the relevant time as one who would have had “a bachelor’s degree in electrical engineering, computer science, computer engineering, or a related field, and two-three years of experience in the research, design, development, or testing of wireless data communication systems at the physical layer, with additional education substituting for experience and vice versa.” Pet. at 8. For purposes of this proceeding, Patent Owner does not challenge this definition.

IV. CLAIM CONSTRUCTION

A. “Replicated data”

The term “replicated data” has its plain and ordinary meaning of “duplicated data,” *i.e.*, repeating the same data symbol more than once in a transmission. Although Petitioners do not provide a construction of the term, Petitioners appear to apply inconsistent meaning to the term throughout their Petition. In Grounds 1 and 2, Petitioners apply an understanding similar to Patent Owner's. But in connection with Ground 3, Petitioners assert that replicated data includes not only duplicated data but also coding or other mathematical representations of the same data that are not duplicates. *Cf. id.* at 84-85 (“[A] POSITA would have understood that d_i and its complex conjugate, d_i^* , correspond to two representations of the same underlying data symbol.”). Petitioners' understanding of “replicated data” in connection with Ground 3 is incorrect and contrary to the intrinsic record.

The claims support the interpretation that replicated data means duplicated data. The term “replicated data” appears three times in claim 1 and in each of claims 2-5. *First*, in claim 1, replicated data is (i) received from multiple streams, (ii) decoded using the estimated channel matrix, and (iii) part of the basis for generating an updated estimate of the channel matrix. Ex-1001 at 15:46-16:4. There is no language in claim 1 to suggest that replicated data would include representations of the same data in different ways using coding techniques.

Second, claim 5 recites that “the replicated data includes same data symbols in multiple data streams.” *Id.* at 16:15-16. By further limiting claim 1, claim 5 requires that the replicated data in a stream is also duplicated into multiple streams so that the same data symbols appear in both the same stream and in multiple streams. If replicated data were broad enough to cover mathematical representations of the same data that are not identical copies, replicated data would not necessarily include the “same data symbols” as required by claim 5. Thus, Petitioners’ broad interpretation of claim 5 is inconsistent with a plain reading of claim 5.

Third, claims 2-4 describe using particular techniques to decode replicated data. If replicated data in claim 1 already included mathematical representations of the same data that are not identical copies, as used in various coding techniques, the “decoding the replicated data” step of claim 1 would necessarily require using one of the specific decoding techniques identified in claims 2-4. In other words, if replicated data were defined to include coded data, the limitations of claims 2-4 would be superfluous and would not further limit the “decoding the replicated data” step of claim 1. *See Curtiss-Wright Flow Control Corp. v. Velan, Inc.*, 438 F.3d 1374, 1380 (Fed. Cir. 2006) (“Indeed the statute stresses that a dependent claim must add a limitation to those recited in the independent claim.”) (quoting 35 U.S.C. § 112(d) (“a claim in dependent form shall contain a reference to a claim previously set forth and then specify **a further limitation of the subject matter claimed**”))

(emphasis added)). Petitioners' interpretation conflates coding techniques, which involve multiple representations of data, with the replicated data itself in a manner that is inconsistent with the claim language because it would require adding a limitation from a dependent claim (*e.g.*, claims 2-4) into independent claim 1. *See Bancorp Servs., L.L.C. v. Hartford Life Ins. Co.*, 359 F.3d 1367, 1373 (Fed. Cir. 2004) (“[T]he use of both terms in close proximity in the same claim gives rise to an inference that a different meaning should be assigned to each.”).

The specification is clear that replicated data is duplicated data. For example, with reference to Figure 5, the specification states:

Data symbols 530 and 531 have been replicated from one frequency to another frequency in the data streams 510 and 515. The ***replicated data*** symbols have been inserted at a location between the pilot symbols 523 and 524. As generally described above, any number or positioning of ***replicated data*** symbols may generally be used. In the example shown in FIG. 5, ***data symbols have been replicated in pairs***.

Ex-1001 at 8:15-21 (emphases added). This passage shows that replicated data refers to the same data symbols that have been duplicated in pairs from one frequency to another.

The specification also distinguishes between replicated data and coding techniques, such as Alamouti coding, that involve multiple representations of the same data. For instance, the '331 Patent states as follows:

Following modulation, pilot insertion, ***data replication, and coding in accordance with a space-frequency coding technique***, one signal stream 510 may be generated for transmission from a first location, such as the antenna 112 of FIG. 1, and a second signal stream 515 may be generated for transmission from a second location, such as the antenna 114 of FIG. 1.

Id. at 8:1-7 (emphasis added). As another example of the differentiation between replicated data and techniques for coding different representations of the same data, the specification explains that “[r]eplicating a pair of data symbols may be ***advantageous*** in some examples ***for consistency with the coding technique employed*** to code the data stream.” *Id.* at 8:22-24 (emphases added).

The distinction between data replication and coding representations in the specification is even apparent at a hardware level. Specifically, “replicator 162 may be configured to replicate at least a portion of data” while “encoder 158 may be configured to receive one or more data streams generated by the modulator 164 and which may have been modified by the replicator 162.” *Id.* at 4:52-53, 4:57-59. The specification states that “encoder 158 may be configured to encode the data streams in accordance with a block encoding technique, such as space-time or space-frequency block coding, including in some examples Alamouti space-time or Alamouti space-frequency block coding.” *Id.* at 4:59-63; *see id.* at Figs. 1 and 2. Thus, the specification establishes that data replication is distinct from data

encoding, these two functions are performed by different hardware components, and therefore, replicated data is not just two representations of the same underlying data.

In addition, annotated Figure 5 below shows several examples of data symbols (red) where multiple representations of the same underlying data appear in Alamouti block-coded format, but none of these data symbols are referred to as being replicated data. *Id.* at Fig. 5. For example, data symbols s_1 and $-s_2^*$ in data stream 510 and s_2 and s_1^* in data stream 515 are not identified as replicated data. *Id.* Rather, the only data symbols identified as replicated data in this figure are the duplicated data symbols 530 and 531. *Id.* at 8:15-18 (“Data symbols 530 and 531 have been replicated from one frequency to another frequency in the data streams 510 and 515. The replicated data symbols have been inserted at a location between the pilot symbols 523 and 524.”).

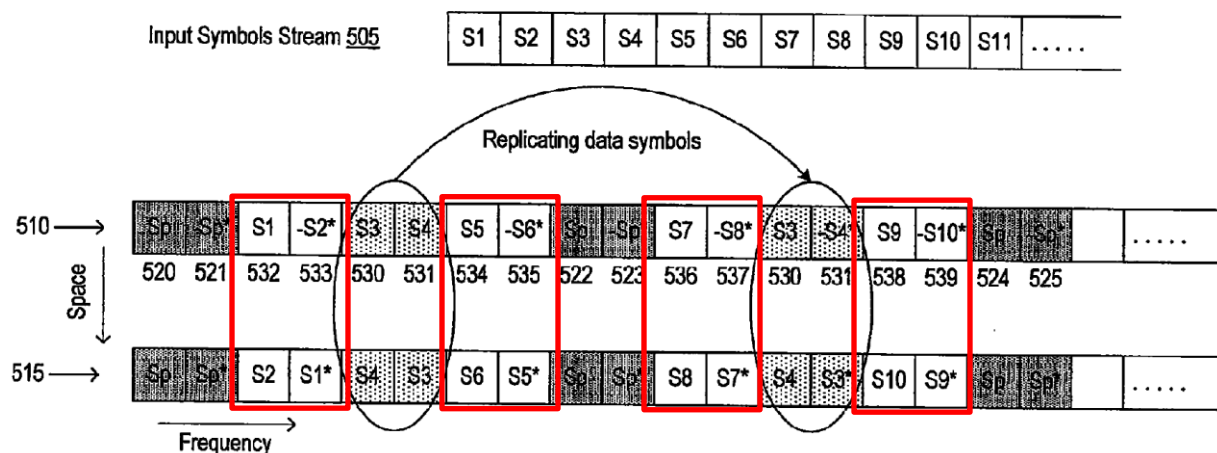


Figure 5

The intrinsic record consistently uses the term “replicated data” to refer to data that has been duplicated. The term replicated data does not have a special meaning in the field of wireless communications. In the absence of such a special meaning or disavowal of claim scope, the words of a claim are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art when read in the context of the specification and prosecution history. *Thorner v. Sony Comput. Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). As described above, the intrinsic record is clear that the word “replicated” is used in its ordinary sense. Dictionary definitions confirm that the word “replicate” means to repeat, duplicate, or make an exact copy of. Ex-2004 (Merriam-Webster's); Ex-2005 (American Heritage); Ex-2006 (Random House); Ex-2007 (Bloomsbury); Ex-2008 (Longman); Ex-2009 (Shorter Oxford). This understanding supports Patent Owner's interpretation of the intrinsic record.

Petitioners know that their interpretation of “replicated data” in connection with Ground 3 is incorrect because they applied Patent Owner's understanding that “replicated data” has its plain and ordinary meaning of “duplicated data” in Grounds 1 and 2. In fact, Petitioners explicitly distinguish between “replicated data” and different representations of the same data applied by Alamouti coding. For example, in Ground 1, Petitioners assert that “redundant payload data 203” in a single data stream teaches or suggests “replicated data” while the “entire data stream (already

including replicated data)” is then processed “using Alamouti block coding” for purposes of being transmitted “in two separate streams.” Pet. at 20-21. As another example, in Ground 2, Petitioners contend that “Ban-Wang teaches or suggests the claimed ‘replicated data’ by copying data within a data stream Ban-Wang then teaches applying Alamouti coding to the data stream (already including replicated data) to transmit two separate, spatially-diverse streams over the communication channel.” *Id.* at 52-53. These examples show that Petitioners would not have identified duplicated data in a single stream for the “replicated data” limitation if they actually thought applying Alamouti coding to transmit multiple streams was sufficient to disclose “replicated data.” Accordingly, Petitioners’ interpretation of replicated data in connection with Ground 3 is incorrect.

Thus, “replicated data” should be interpreted to have its plain and ordinary meaning of “duplicated data.”

V. OVERVIEW OF THE APPLIED REFERENCES

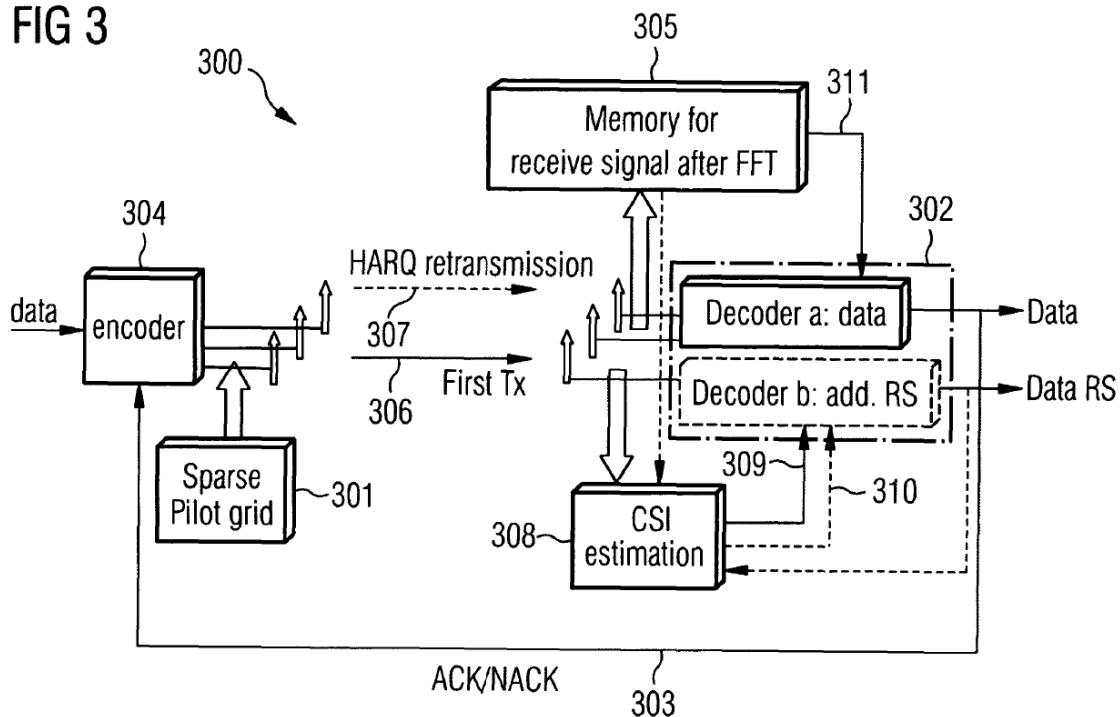
A. Haustein

Haustein discloses a method and system of transmitting data in a communication network. Ex-1005, Abstract. The method comprises transmitting a data packet comprising a first plurality of pilot data and a second plurality of payload data a first time, receiving an indication signal indicating whether the data packet is decodable on the receiving side, and, if the indication signal indicates that the data

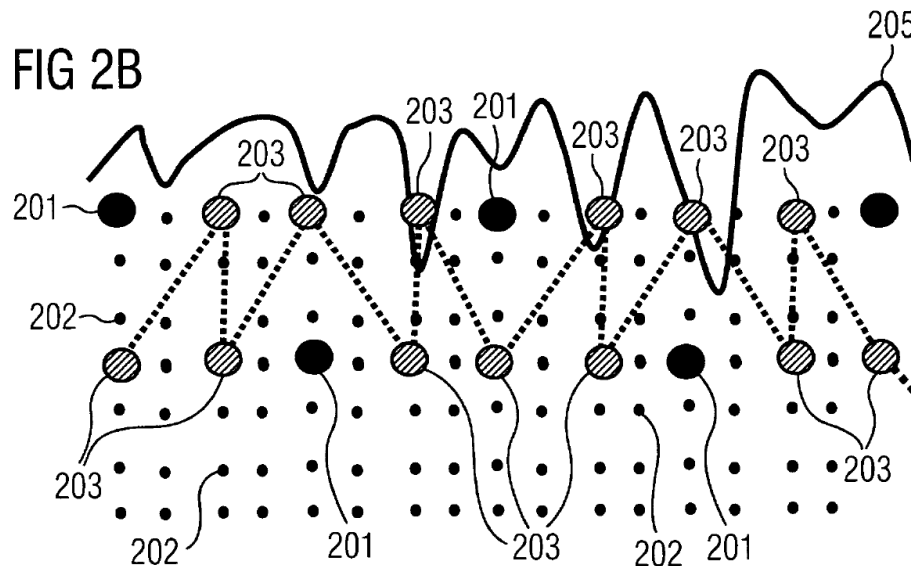
packet is not decodable, initiating a retransmission of the data packet comprising more pilot signals, wherein some of them are formed by converted payload data of the second plurality of payload data. *Id.*

With reference to Figure 3 below, sparse pilot grid 301 is sent in first transmission 306 and the pilot symbols are used for estimation of a Channel State Information (CSI) 308. *Id.* ¶¶ 49-50. If the payload data of first transmission 306 can be decoded at the receiver or decoder 302 using the sparse pilot grid 301, an ACK (acknowledge) message 303 is fed back to the transmitter or encoder 304. *Id.* If the data is not decodable, the receiver 302 sends back a NACK (no-acknowledge) message together with the request for a denser pilot grid, so that a retransmission 307 may be initiated. *Id.* ¶ 49.

FIG 3



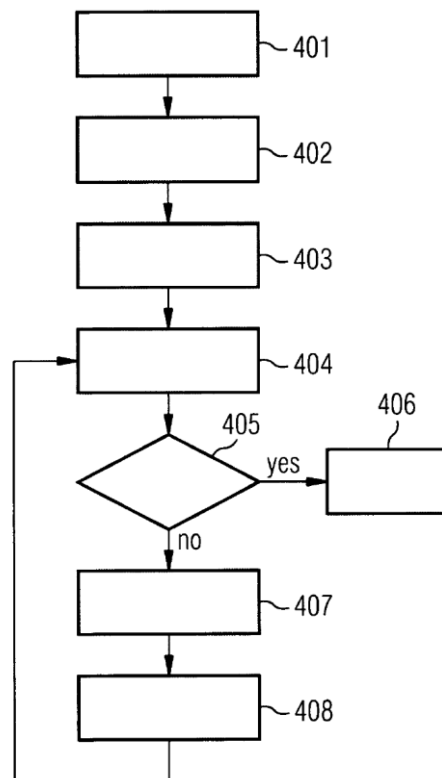
The denser pilot grid includes certain payload data from the first transmission that “can be used as pseudo reference signals in a potential retransmission.” *Id.* ¶¶ 48, 51. Figure 2B shows a transmission grid for an antenna where pilot signals 201, payload data 202, and pseudo pilot signals 203 are transmitted. *Id.* ¶ 48, Fig 2B. Haustein teaches that where the payload data in the first transmission “could be decoded, only the sparse pilot grid is used” for channel estimation, “while in the case of the retransmission the pilots of the original sparse pilot grid and the pseudo pilot signals are used” in channel estimation. *Id.* ¶ 50.



Haustein also describes a flowchart of the disclosed method. Figure 4 below shows first step 401, in which “data signals of a data packet are determined which are intended to represent pseudo pilot signals and additionally redundancy is added to the . . . data signals.” *Id.* ¶ 59. In step 402, the encoded data packet is transmitted comprising a sparse pilot grid, normal data signals, and pseudo pilot signals. *Id.* In

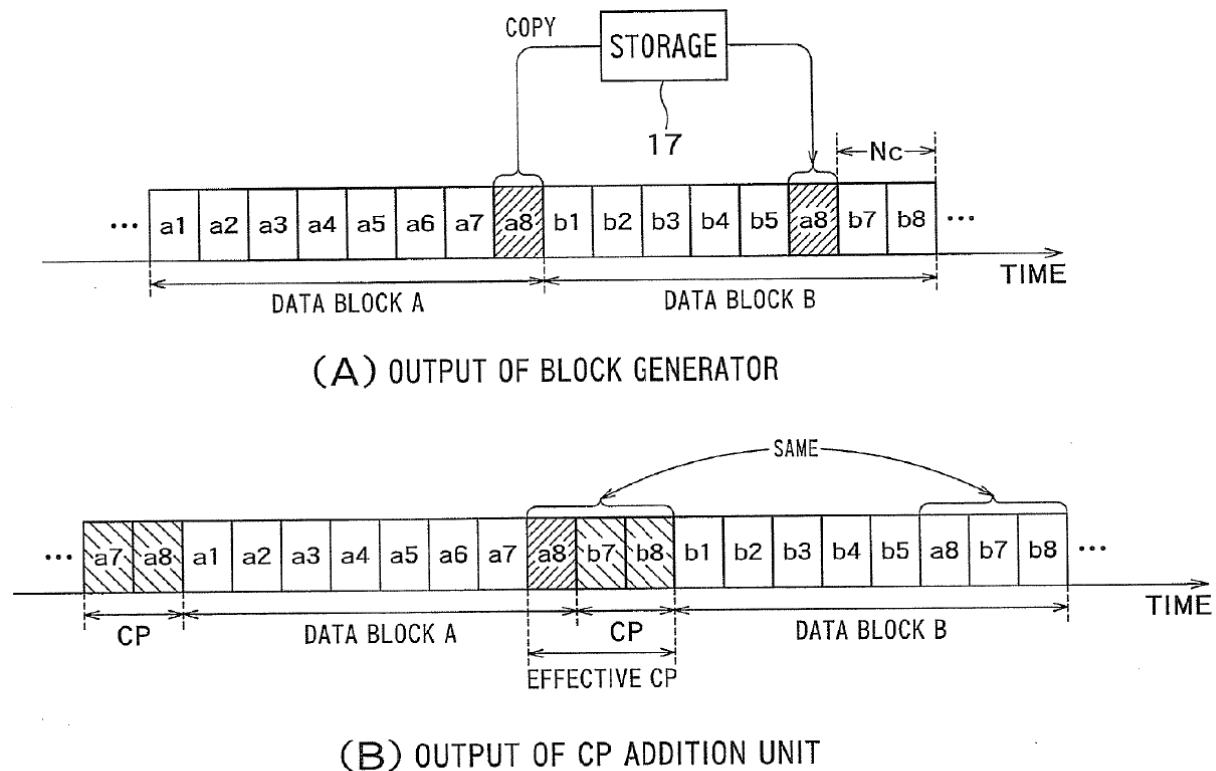
step 403, the encoded data packet is received at the receiving side, and channel estimation is performed in step 404. *Id.* In step 405, a decision is made as to whether decoding can be performed or not. *Id.* In step 406 where decoding can be performed, the data are decoded, and an output and an ACK message are sent back to the transmitting side. *Id.* In step 407 where decoding cannot be performed, a NACK message is sent back to the transmitting side. *Id.* In step 408, a retransmission is performed in which the pseudo pilot signals are used as pilot signals and a channel estimation for the retransmitted data is performed on the receiving side using the original pilot signals and the pseudo pilot signals. *Id.*

FIG 4



B. Ban

Ban discloses a transmitter and a receiver for single carrier communication using a cyclic prefix (CP). Ex-1006 ¶ 3. Ban describes techniques for extending the size or length of CPs by copying one or more data symbols from a prior data block to precede a portion of the end of the data block that is copied to the head of that data block as a CP. *Id.* ¶ 93. As illustrated in Figure 2A, a copy of data symbol a8 at the end of data block A is added before the last two data symbols in data block B. *Id.* As shown in Figure 2B, the last two data symbols in data blocks A and B are added as CPs to the head of data blocks A and B, respectively, so that the CP of data block B is effectively extended to three data symbols. *Id.* ¶ 95.

**FIG. 2**

C. Wang

Wang discloses a base station transmitting device comprising a first and a second antenna spaced apart from each other and a mobile terminal receiving device with a single antenna in a wireless orthogonal frequency division multiplex (OFDM) communication system with space time transmit diversity (STTD). Ex-1007 ¶¶ 1, 8, 22. Figures 1 and 2 below are schematic illustrations of the base station and mobile terminal, respectively.

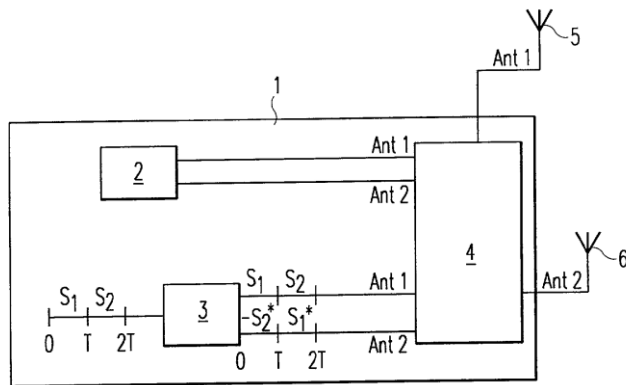


Fig. 1

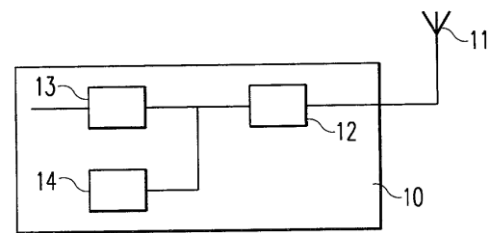


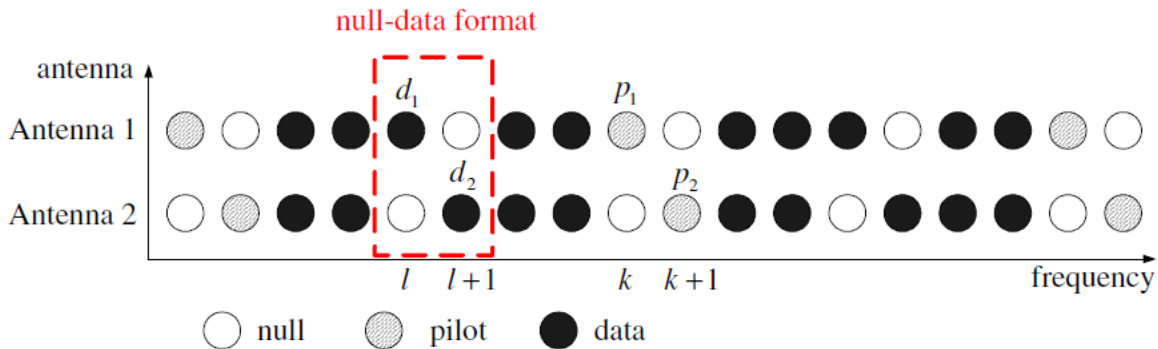
Fig. 2

As illustrated in Figure 1, Wang states that “[a]lthough generally the same data content is transmitted by each of the two antennas, ***the signals transmitted by the two antennas are not absolutely identical***, but data symbols to be transmitted are mapped or coded slightly differently on the signals transmitted by each of the antennas.” *Id.* ¶ 4 (emphasis added). Wang teaches that employing a space-time coding technique avoids cross-interference because it allows a receiving device “with only a single antenna to distinguish and separate signals coming from one of

the transmitting antennas from signals coming from the other of the transmitting antennas.” *Id.*

D. Tang

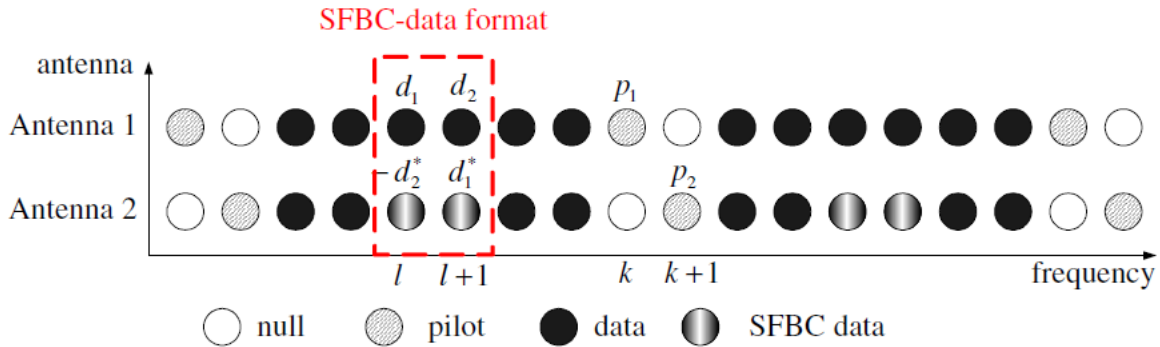
Tang discloses a “joint pilot-aided and blind decision-directed channel estimation scheme” with “two alternative orthogonal data formats” for use in a MIMO-OFDM system. Ex-1008 at 1. The first alternative is a null-data format where at a first frequency antenna 2 is idle and data symbol d_1 is transmitted on antenna 1, and at a second frequency antenna 1 is idle and data symbol d_2 is transmitted on antenna 2. *Id.* at 2-3. Figure 4 below shows the disclosed scheme with the null-data format. *Id.* at 3.



The second alternative uses the Alamouti space-frequency block code (SFBC) format. *Id.* at 1 (citing S.M. Alamouti, “A simple transmitter diversity scheme for wireless communications,” *IEEE J. Select. Areas Commun.*, vol. 16, pp. 1451-58, Oct. 1998). Figure 5 below illustrates the SFBC format in which at a first frequency d_1 is transmitted on antenna 1 and $-d_2^*$ is transmitted on antenna 2 and at a second

frequency d_2 is transmitted on antenna 1 and d_1^* is transmitted on antenna 2. *Id.* at

3.



VI. CLAIMS 6-8 HAVE BEEN DISCLAIMED AND ARE NOT SUBJECT TO *INTER PARTES* REVIEW.

Patent Owner has filed a statutory disclaimer of claims 6-8 pursuant to 37 C.F.R. § 1.321(a). Ex-2010. As a consequence of the disclaimer, the Board cannot base its determination on whether to institute a trial on claims 6-8. *See* 37 C.F.R. § 42.107(e) (“No *inter partes* review will be instituted based on disclaimed claims.”); *see also Guinn v. Kopf*, 96 F.3d 1419, 1422 (Fed. Cir. 1996) (“A statutory disclaimer under 35 U.S.C. § 253 has the effect of canceling the claims from the patent and the patent is viewed as though the disclaimed claims had never existed in the patent.”); *Raytheon Techs. Corp. v. Gen. Elec. Co.*, 993 F.3d 1374, 1379 n.4 (Fed. Cir. 2021) (“Disclaimed claims are treated as if they never existed.”). Thus, the Board may consider only claims 1-5 of the ’331 Patent for purposes of institution.

VII. PETITIONERS HAVE NOT ESTABLISHED THAT THE PRIOR ART RENDERS OBVIOUS CLAIMS 1-5 OF THE '331 PATENT.

A. Ground 1: Claims 1-5 Would Not Have Been Obvious to a POSITA in View of Haustein.

- i. *Haustein does not disclose or suggest both “decoding the replicated data using the estimate channel matrix” and “generating an updated estimate of the channel matrix based, at least in part, on the replicated data.”*

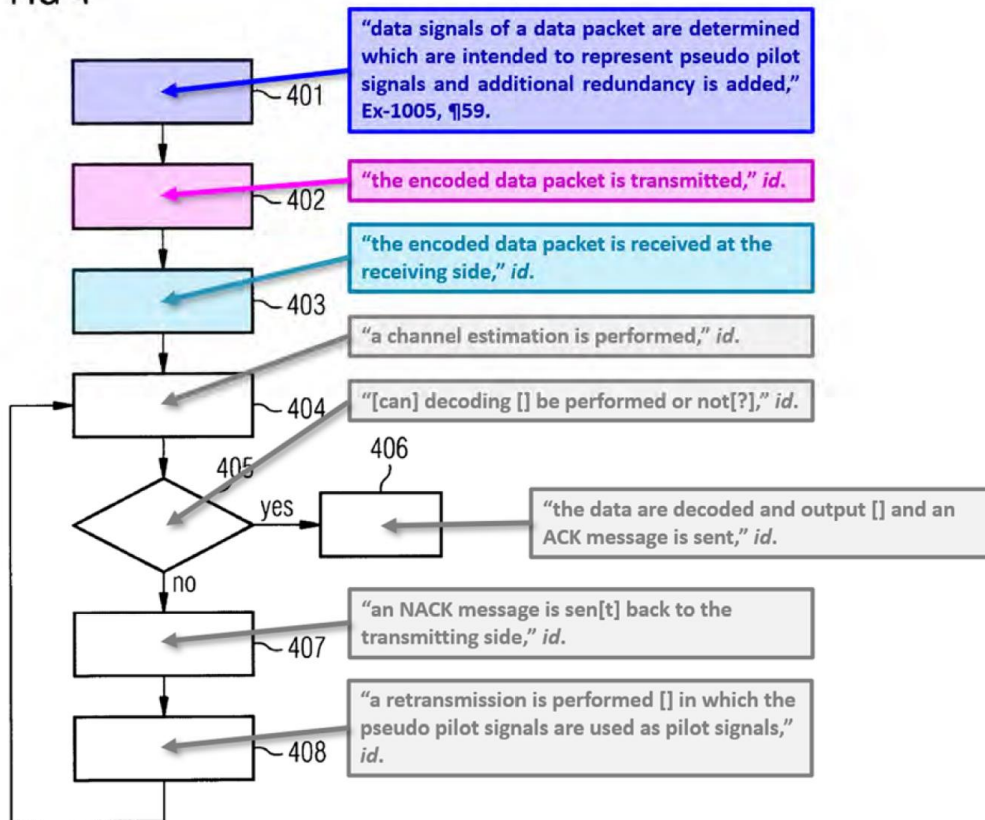
Haustein does not disclose claim elements 1[d] and 1[e]. Petitioners rely on the first transmission of Haustein for the step of “decoding the replicated data using the estimated channel matrix” and Haustein’s disclosure of a retransmission for the step of “generating an updated estimate of the channel matrix based, at least in part, on the replicated data.” Pet. at 25-28. Specifically, the Petition states that for claim element 1[d], “pilot signals received in first transmission 306 ‘are used for an estimation of a Channel State Information (CSI) 308,’” *id.* at 25 (quoting Ex-1005 ¶ 50), and for claim element 1[e], ““the data block is retransmitted using additional pilot signals which are formed by payload data of the original transmission,”” *id.* at 26-27 (quoting Ex-1005 ¶ 22).

But Haustein does not disclose decoding during the first transmission **and** sending a retransmission on which the updated estimate of the channel matrix is generated. Rather, Haustein teaches sending a retransmission only if decoding of the first transmission cannot be performed. Ex-1005 ¶ 22 (“In case it is determined that

the data packet could not be decoded on the receiving side the data block is retransmitted....” (emphasis added)).

In fact, Figure 4 establishes that the sequence relied upon by Petitioners never occurs and is not contemplated by Haustein. *Compare id.* ¶ 59, Fig. 4, with Pet. at 26-27. Petitioners’ annotated Figure 4, reproduced below, confirms that step 405 represents the decision point of whether “decoding can be performed or not” and either there is decoding of the first transmission in step 406, or a retransmission and channel estimation of the retransmitted data in step 408, but not both: “***In case a decoding can be performed the data are decoded*** and output 406 and an ACK message is sen[t] back to the transmitting side. ***In case the decoding cannot be performed*** an NACK message is sen[t] back to the transmitting side 407 and ***a retransmission is performed*** 408.” Ex-1005 ¶ 59 (emphases added). In other words, Petitioners rely on step 406 of Figure 4 for claim element 1[d] and step 408 for claim element 1[e], but Haustein does not disclose performing step 406 followed by step 408.

FIG 4



Petitioners recognize this problem and seek to have their expert recast Haustein by arguing that a “POSITA would have understood Haustein’s statement that ‘decoding cannot be performed,’ to mean that error(s) were present such that **some** of the received data was not properly decoded.” Pet. at 27 (citing Ex-1002 ¶¶ 109-12). But Petitioners’ expert should not be credited because that testimony contradicts a plain reading of Haustein, which repeatedly discloses that decoding of the first transmission and retransmission are mutually exclusive events:

receiving an indication signal indicating whether the data packet is decodable on the receiving side, and, ***in case that the indication signal***

indicates that it is determined that the data packet is not decodable, initiating a retransmission of the data packet...

Ex-1005 ¶ 8 (emphasis added); *see also id.* at Abstract.

a so-called No-Acknowledge (NACK) message of a HARQ protocol ***may be sent in case the original payload data are not decodable.***

Id. ¶ 9 (emphases added).

determining whether the data packet is decodable on the receiving side and ***in case that it is determined that the data packet is not decodable sending an indication signal to a sending side initiating a retransmission*** of the data packet...

Id. ¶ 10 (emphasis added); *see also id.* ¶¶ 11, 13.

In case it is determined that the data packet could not be decoded on the receiving side ***the data block is retransmitted*** using additional pilot signals which are formed by payload data of the original transmission.

Id. ¶ 22 (emphases added). No reasonable POSITA would have interpreted Haustein to disclose decoding data during the first transmission and then additionally sending a retransmission because Haustein says the exact opposite.

Petitioners' assertion that the teachings of "not decodable" and "decoding cannot be performed" mean that "some of the received data was not properly decoded" or that redundant data 203 "is likely to have been properly decoded" is not supported by the record evidence. *See Pet.* at 27. *First*, Haustein does not say

anything like this, nor does the reference support Petitioners' unsupported speculation about "some" of the data. Petitioners concede that a "decoding cannot be performed" message means "error(s) were present," Pet. at 27; Ex-1002 ¶ 110, but there is simply no way to determine whether any of the data was properly decoded in any particular transmission deemed not decodable, let alone surmising which of the data may have been decoded. Additionally, Petitioners have no support for interpreting Haustein's NACK (no-acknowledge) message of a HARQ protocol as an indication that some data was properly decoded.

Second, Petitioners' reliance on conclusory expert testimony fails to establish that Haustein satisfies this limitation. Petitioners' expert cites passages from another reference Fei, but Fei states that "if the decoding is not successful ... the decoder generates data bit hypotheses." Ex-1002 ¶ 63 (citing Ex-1033 ¶¶ 15-17). "[G]enerating data bit hypotheses" does not mean that any data was decoded, and even if Haustein's method of transmitting data performed a similar step (which Petitioners have not established and is not apparent from Haustein), a POSITA would not understand such a teaching as decoding data as required by claim 1. In short, generating data bit hypotheses does not disclose decoding replicated data.

Furthermore, Petitioners do not suggest that a POSITA would have been motivated to modify Haustein to arrive at a method that involved both decoding the first transmission and, after a successful decoding, performing a retransmission. Nor

is there any expert testimony to support modifying Haustein in this manner. This is not surprising because there is no suggestion or teaching in Haustein that decoding the first transmission and performing a retransmission would ever be desirable or worth considering.

- ii. *Haustein does not disclose or suggest “receiving replicated data from multiple data streams transmitted over the communication channel” as recited in independent claim 1.*

Haustein does not disclose or suggest claim element 1[c], “receiving replicated data from multiple data streams transmitted over the communication channel” for two reasons—each of which is fatal to Ground 1 of the Petition. *First*, Haustein does not disclose receiving replicated over multiple data streams because the disclosed data transmission method is for a single antenna with a single data stream. *Second*, Haustein recognizes that further work would be necessary to adapt the disclosed data transmission method to “systems using more than one antenna element” with multiple data streams. Ex-1005 ¶ 55. The inability to resolve or suggest a solution to this problem demonstrates the insufficiency of Haustein. Each of these reasons is discussed in detail below.

Petitioners claim that Haustein discloses the transmission of redundant data in multiple data streams based on a brief reference to Alamouti processing. Pet. at 23-24. But Haustein’s general mention of Alamouti processing does not show whether or how the disclosed transmission would be possible over multiple data streams

because the disclosed transmission is a single data stream over a single antenna. Haustein never suggests that the symbol grids in Figures 1 and 2 represent anything other than a single transmission. Ex-1005 ¶ 47 (“With reference to Fig. 1 overhead per antenna for different radio channels when using a conventional transmission method will be described.”), ¶ 48 (“With reference to Fig. 2 overhead per antenna for different radio channels when using a transmission method according to an exemplary embodiment of the invention will be described.”). Since Figures 1 and 2 of Haustein only disclose single antenna transmissions, it is incorrect for Petitioners to interpret Haustein’s symbol grids as being “sent using Alamouti space-time block coding using two antennas.” Pet. at 33.

Identifying Alamouti block coding does not suggest whether or how Haustein’s transmission method would be possible over multiple data streams. Even assuming arguendo that a POSITA would have understood that Alamouti processing is a type of space-time or space-frequency block coding, Haustein is silent on whether or how Alamouti processing would be incorporated into the disclosed transmission method.

Haustein acknowledges that the disclosed transmission method either does not work or would require further development for use in multiple antenna systems. Ex-1005 ¶ 55. Specifically, Haustein appreciates the problems that would be encountered by applying the disclosed method to multiple data streams over multiple

antennas: “*For systems using more than one antenna element further considerations may be considered*, but the scheme may be applicable in principle. *The main issue is that*, if both or all antenna elements transmit data simultaneously *it ... may be difficult to separate the pilot signals for each antenna element.*” *Id.* (emphases added). Without a solution to the problem, Haustein concedes that it may be necessary to turn off the multiple antennas and transmit through one antenna element at a time: “If average residual cross correlation between data signals is still too high *one might switch off in advance data transmission on one or more antenna elements* for the intended future pseudo RSs.” *Id.* ¶ 58 (emphasis added). Petitioners’ expert provides figures that purport to illustrate Alamouti space-time block coding in Haustein, Pet. at 24, but these illustrations are insufficient to overcome Haustein’s express identification of problems with transmitting in multiple streams.

- iii. *Haustein does not disclose or suggest “decoding subsequently received signals over the communications channel using the updated estimate of the channel matrix.”*

Haustein does not disclose claim element 1[f]. Petitioners make two attempts to show that Haustein satisfies this claim limitation, both of which are insufficient.

First, Petitioners contend that decoding HARQ retransmission 307 satisfies this limitation. Pet. at 29; *see also* Ex-1002 ¶ 115. But decoding HARQ

retransmission 307 does not constitute decoding subsequently received signals at least because it is only a single signal.

Moreover, retransmission 307 is not a ***subsequently received*** signal. Haustein explains that the pseudo pilot symbols in the retransmission are used to update the channel estimate:

By retransmitting the converted payload data, i.e. the payload data of the second plurality of payload data of the original transmission which are intended to be used as additional pilot data in the retransmission ... ***it may be possible to ensure that the converted payload data or additional pilot data are correctly received on the receiving side, so that the channel may be correctly estimated*** leading to the fact that the payload data may be decodable on the receiving side.”

Ex-1005 ¶ 29 (emphases added).

In case the decoding cannot be performed an NACK message is send back to the transmitting side 407 and a retransmission is performed 408² in which the pseudo pilot signals are used as pilot signals. Then again ***a channel estimation for the retransmitted data*** is performed on the receiving side using the original pilot signals as well as the pseudo pilot signals.

² Retransmission 307 shown in the system of Figure 3 corresponds to retransmission 408 in the flowchart of Figure 4. See Ex-1005 ¶¶ 49, 59, 61.

Ex-1005 ¶ 59 (emphasis added).

In fact, Petitioners acknowledge that “the updated estimate of the channel matrix [is] **determined using the pilot symbols and pseudo pilot symbols in retransmission 307.**” Pet. at 31 (emphasis added). Therefore, retransmission 307 itself is used in creating an updated channel estimate, and decoding retransmission 307 does not constitute decoding **subsequently received** signals.

Petitioners also quote Haustein's statement that using “pseudo reference signals” provides an “improved channel estimation, which in turn will increase the decoding probability of the rest of the data bins significantly.” *Id.* at 29 (quoting Ex-1005 ¶ 51). But Petitioners take this quote out of context as it does not support Petitioners' position. Instead, Haustein explains that in the retransmission, the receiver “decod[es] the data bins intended as ‘pseudo reference signals’” to improve the channel estimation so that “**the rest of** the data bins” in the retransmission may be decoded. Ex-1005 ¶ 51 (emphasis added). Again, this quote only refers to the retransmission and does not disclose or suggest decoding subsequently received signals using the updated channel estimate.

Second, Petitioners recognize the inadequacy of their first argument by claiming that “Haustein also teaches or suggests using the updated channel estimate to decode additional subsequently received signals,” though Petitioners try to have it both ways by asserting that this is “not required by the claim.” Pet. at 30; *see* Ex-

1002 ¶ 115. According to Petitioners, “a POSITA would have recognized that the updated estimate of the channel matrix determined using the pilot symbols and pseudo pilot symbols in retransmission 307 will be used not only to decode retransmission 307, but also subsequently received signals during the coherence time.” Pet. at 31.

Petitioners' problem is that neither showing is sufficient, individually or collectively. Petitioners' argument rests on the assumption that subsequently received signals are decoded during a “coherence time.” *Id.* But Haustein does not support this assumption, and its single mention of “coherence time” in the Art Background section says nothing about subsequently received signals. See Ex-1005 ¶ 3 (“The required number of pilot or reference signals however depends on the coherence time as well as coherence bandwidth.”). Instead, Petitioners rely only on their expert for the conclusory statement that the “channel matrix is used to decode subsequently received data symbols for the duration of the coherence time.” Pet. at 31 (citing Ex-1002 ¶¶ 116-17). But the “*ipse dixit* declaration” of Petitioners' expert is inadequate and does not show that Haustein teaches or suggests using an updated channel estimate to decode subsequently received signals. See *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1360-62 (Fed. Cir. 2019) (reversing obviousness determination because “expert's ‘conclusory statements and unspecific expert testimony’ did not qualify as substantial evidence that could support the Board's

conclusions regarding obviousness” (quoting *DSS Tech. Mgmt., Inc. v. Apple Inc.*, 885 F.3d 1367, 1376 (Fed. Cir. 2018))); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”).

B. Ground 2: Claims 1-5 Would Not Have Been Obvious to a POSITA in View of Ban and Wang.

- i. A POSITA would not have been motivated to combine Ban and Wang without resorting to hindsight.*

A POSITA would not have been motivated to modify Ban to transmit over multiple antennas with the space-time block coding of Wang. Rather than indicating any specific or rational basis as to why a POSITA would be motivated to combine the cited references, the Petition appeals broadly to general desires and problems known in telecommunication systems, and incorrectly alleges that it would be obvious to combine Ban and Wang as analogous art relating to transmitting OFDM symbols and using pilot symbols. They are not analogous, at least because they do not both include multiple transmit antennas. And adding multiple transmit antennas to Ban (a one-transmitter, one-receiver system) would have created significant problems, none of which are addressed by Petitioners. Such problems confirm that a POSITA would not have made such a combination in the absence of a reason for doing so.

“[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. When combining teachings from different references, a petitioner must explain (1) how a POSITA would combine the elements to reach the claimed invention and (2) why a POSITA would have been motivated to do so. *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1066 (Fed. Cir. 2016) (“[T]he Board must still be careful not to allow hindsight reconstruction of references ... without any explanation as to how or why the references would be combined to produce the claimed invention.” (citing *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1368 (Fed. Cir. 2012))). Here, Petitioners merely pluck features from two different references in an attempt to construct the claimed invention.

The Petition broadly alleges a POSITA would have been motivated to arrive at the proposed combination because the proposed combination would improve decoding reliability. The Petition's reliance on broad, generic problems or objectives in the field to reconstruct the claimed invention is impermissible. In *Securus Techs., Inc. v. Global Tel*Link Corp.*, the Federal Circuit held that the Board correctly found that the proposed rationale to combine the asserted art was “simply too conclusory.” 701 F. App'x 971, 976 (Fed. Cir. 2017). This holding was based on Securus “assert[ing], without more, that because [the references] were drawn from the same general field of art, the skilled artisan would have turned to them to solve the

problems identified” in the challenged patent. *Id.* at 976-77 (citing *Microsoft Corp. v. Enfish, LLC*, 662 F. App'x 981, 990 (Fed. Cir. 2016)). The Federal Circuit criticized relying solely on the same field of “telecommunications monitoring and control,” stating “[s]uch short-cut logic would lead to the conclusion that any and all combinations of elements known in this broad field would automatically be obvious, without the need for any further analysis. *Id.* at 977. “The Board, therefore, properly rejected Securus’ assertion of obviousness.” *Id.*

Here, Petitioners claim that a “POSITA would have been motivated to combine the teachings of Ban and Wang ... because both relate to transmitting OFDM symbols and using pilot symbols for channel estimation.” Pet. at 45 (citations omitted). Although the use of OFDM and pilot symbols have been ubiquitous in telecommunications for decades, the Petition summarily concludes that in the combination “system performance would be improved.” *Id.* at 46. But system performance is such a universal problem that it was incumbent upon the Petitioners to explain why Wang—as opposed to thousands of other OFDM references—would be combined with Ban. *See Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1373 (Fed. Cir. 2008) (“[K]nowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references to reach the particular claimed method.”). Any number of apparatuses or techniques may be used to improve performance in a telecommunications system. The Petition provides no

other motivation for why a POSITA would implement the substantially different multi-transmitter system of Wang to improve general telecommunication performance (not at all tied to the cyclic prefix issues that Ban is directed to).

Petitioners' expert offers no further analysis on alleged motivation to combine and simply parrots the language of the Petition. *Compare* Pet. at 45 ("A POSITA seeking to implement Ban's system to increase decoding reliability would have been motivated to search for additional techniques to further improve decoding reliability."), *with* Ex-1002 ¶ 155 ("A POSITA seeking to implement Ban's system for the purpose of increasing the reliability of decoding would have been motivated to search for additional techniques to further improve the reliability of the decoding."). Petitioners' expert also refers to "transmission quality," Ex-1002 ¶ 156 (quoting Ex-1007 ¶ 2), but this generic testimony is insufficient because it "fails to explain why a person of ordinary skill in the art would have combined elements from specific references *in the way the claimed invention does*," *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012).

The Petition also avoids many issues that would have to be addressed in the proffered combination. Ban is a one-transmitter to one-receiver system. Ex-1006 at Figs. 1, 12. Ban is focused on extending cyclic prefixes for separating data blocks and reducing interference in a data stream. *Id.* ¶ 81. Ban's solution involves effectively extending the cyclic prefix without reducing the data block size by

copying select data symbols multiple times so that the same data symbols appear in multiple data blocks. *Id.* at Fig. 3, ¶ 97. There is not a concern about interference from other transmitters, because there are no other transmitters. It is not clear why a POSITA would have looked to incorporate an additional transmitter and an orthogonal coding method in Ban's single transmitter and single receiver focused on cyclic prefix length.

The fact that Wang disclosed a well-known coding method that could "improve decoding reliability" in a multiple antenna system does not explain why a POSITA would have been motivated to modify Ban into a multiple antenna system in the first place. In short, Petitioners never explain why a POSITA would have decided to modify Ban into a multiple antenna system, beyond general, conclusory statements. *See Samsung Elecs. Co. v. Dynamics Inc.*, IPR2020-00499, Paper 63 at 34 (P.T.A.B. Aug. 10, 2021) (finding insufficient petitioner's proffered motivation that a POSITA would have modified a prior art reference "to improve the functionality [of the primary reference] and make it more commercially convenient").

The Petition's conclusory arguments illustrate an apparent and high degree of reliance on hindsight and the '331 Patent to reconstruct the claimed invention. Given these flawed arguments, a POSITA would not have been motivated to combine the cited references.

- ii. *Neither Ban nor Wang discloses “generating an updated estimate of the channel matrix based, at least in part, on the replicated data.”*

The combination of Ban and Wang does not disclose claim element 1[e], generating an updated estimate of the channel matrix based, at least in part, on replicated data.

Neither Ban nor Wang ever suggests using “known data” cited by Petitioners to update an estimate of the channel matrix as required by claim 1. Petitioners rely on the passage in Ban that “if some of the pilot symbols in the data block are replaced with data symbols of the preceding block ... data symbols in the data block are handled as known data.” Ex-1006 ¶ 147. But Ban only states that “since all the pilot symbols and data symbols in the data block can be regarded as known data, the channel can be estimated using the entire data block.” *Id.* The cited passage simply fails to disclose the limitation of “generating an **updated** estimate of the channel matrix based, at least in part, on the replicated data.”

The '331 Patent is clear that estimating the channel is different from generating an updated estimate of the channel. *First*, claim limitation 1[b] requires “**estimating a channel matrix** of the communication channel based, at least in part, on the pilot symbol” while claim limitation 1[e] recites “**generating an updated estimate of the channel matrix** based, at least in part, on the replicated data.” Ex-1001 at 15:45-16:4 (emphases added). *Second*, the '331 Patent expressly states that

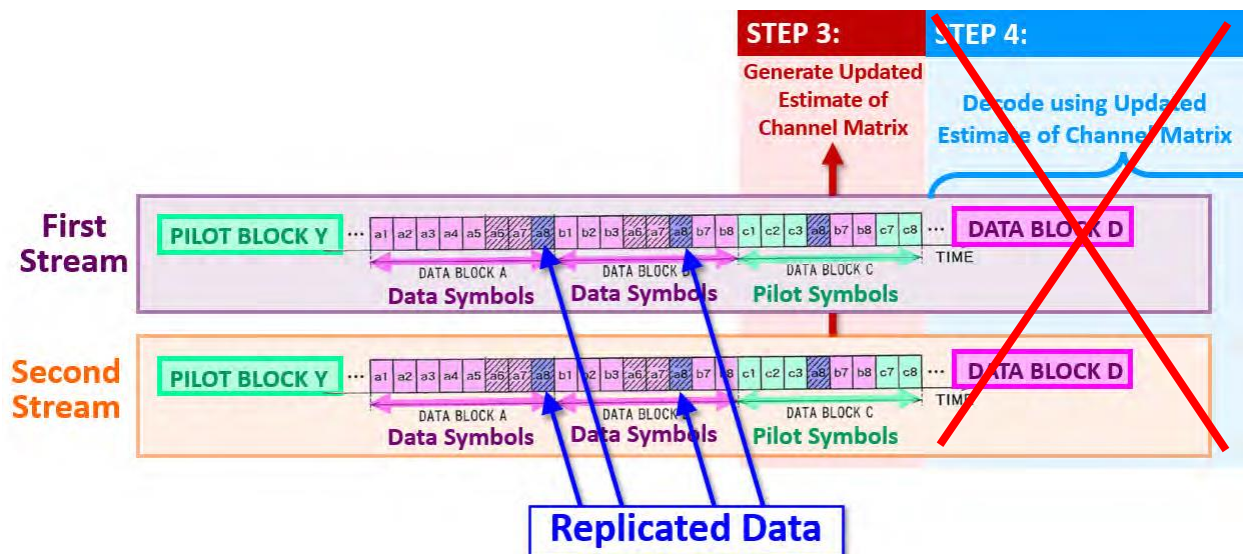
“replicated data symbols may be used by the channel estimator to estimate all or part of the channel matrix, or to update an estimate of the channel matrix,” further confirming that estimating the channel and updating an estimate of the channel matrix are different. *Id.* at 7:44-46.

Petitioners' argument further presupposes a prior pilot block that is neither disclosed nor suggested in Ban or Wang. The Petition claims that “Step 1” involves estimating a channel matrix based in part on “Pilot Block Y” that occurs before a subsequent “Step 3” in which pilot symbols are received in “Data Block C.” Pet. at 61. But neither Ban nor Wang teaches or suggests a “Pilot Block Y” before “Data Block A.” Petitioners and their expert simply add “Pilot Block Y” to a heavily annotated figure in an effort to map subsequent “Step 3” onto the claim language of “***generating an updated estimate of the channel matrix***” where there is no evidence to support the assertion of a “first estimated channel matrix.” *Id.*; Ex-1002 ¶ 185; *see also* Pet. at 59 (offering the conclusory assumption that “Ban-Wang’s receiver would receive pilot symbols of block Y”). Petitioners’ contention is insufficient and nothing more than a “hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention.” *See ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 546 (Fed. Cir. 1998).

- iii. *Neither Ban nor Wang discloses “decoding subsequently received signals over the communications channel using the updated estimate of the channel matrix.”*

Ban and Wang are completely lacking any disclosure of claim limitation 1[f], and Ground 2 must fail on this basis alone. Petitioners contend that an “updated estimate of the channel matrix is used in the decoding process (step 4, below) to decode subsequently received blocks of data symbols (e.g., data block D, below).” Pet. at 62.

But Ban does not disclose a “data block D” and neither does Wang. There is no support for a “step 4” in either Ban or Wang. Petitioners simply add to the discussion of Ban and Wang without any suggestion or hint in Ban or Wang justifying Petitioners’ extrapolation.



Pet. at 63 (annotated).

In fact, *Petitioners' analysis for claim limitation 1[f] does not cite any support from either Ban or Wang*. Petitioners' discussion of Ban and Wang with respect to claim limitation 1[f] is pure supposition. Without any support in Ban or Wang, Petitioners rely only on the conclusory statement of their expert whose entire opinion for this limitation is identical to the language of the Petition. *Compare* Pet. at 62, *with* Ex-1002 ¶ 187. And with only a one-sentence conclusory expert opinion for this entire claim limitation, Petitioners' allegations are insufficient as a matter of law. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380-81 (Fed. Cir. 2016) ("To satisfy its burden of proving obviousness, a petitioner cannot employ merely conclusory statements."); *see also* *DSS Tech.*, 885 F.3d at 1374 (reversing determination of obviousness where "the Board relied on a gap-filler ... to supply a missing claim limitation").

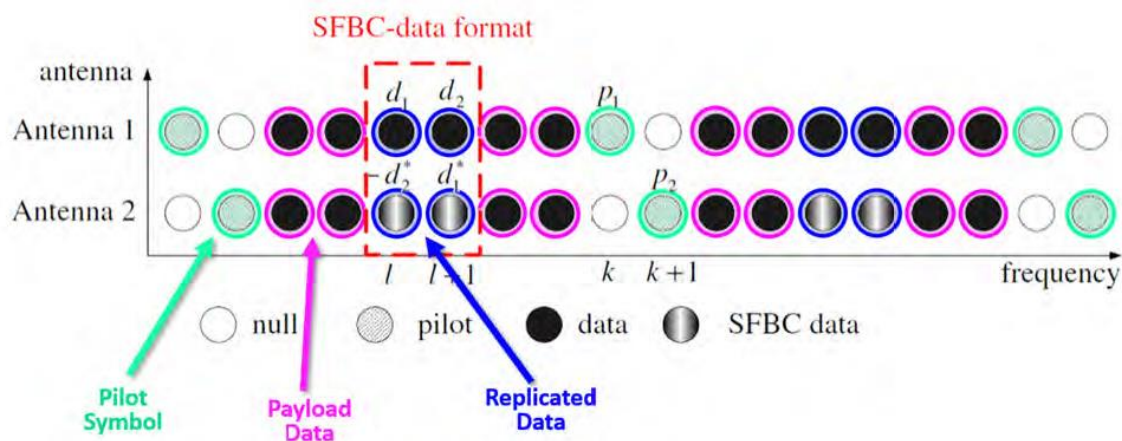
C. Ground 3: Claims 1-5 Would Not Have Been Obvious to a POSITA in View of Tang.

- i. *Tang does not disclose "receiving replicated data from multiple data streams transmitted over the communications channel."*

Tang does not disclose limitation 1[c], "receiving replicated data from multiple data streams transmitted over the communications channel." Petitioners contend that Tang discloses a method that receives replicated data because data is transmitted using SFBC-data format over two antennas. Pet. at 84-85. But the '331 Patent is clear that data in SFBC format alone does not constitute replicated data.

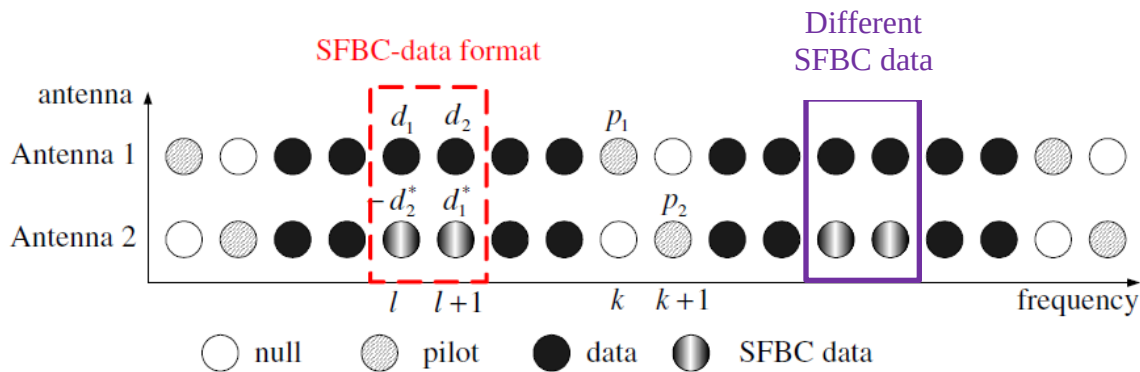
Under the correct claim construction, as described *supra* Section IV, replicated data is duplicated data, and Tang does not teach receiving duplicated data from multiple data streams.

Petitioners assert that data in SFBC format satisfies the requirement of “replicated data” because d_1 and d_1^* and d_2 and $-d_2^*$ are the “same data” as shown in Petitioners’ annotated figure below. *Id.* at 84. Specifically, Petitioners recognize that “complex conjugates of d_1 and d_2 are transmitted by the second antenna” but seek to dismiss this distinction by arguing that they are “two representations of the same underlying data symbol.” *Id.* (citing Ex-1002 ¶ 237).



Tang does not disclose repeating the same data symbol in a transmission stream, and Petitioners never claim that it does. Although Petitioners misleadingly suggest with their annotations that there is some connection between the pairs of data symbols in blue transmitted over each antenna, there is in fact no connection at all. In fact, the only fair reading of Tang is that each of the data symbols represent

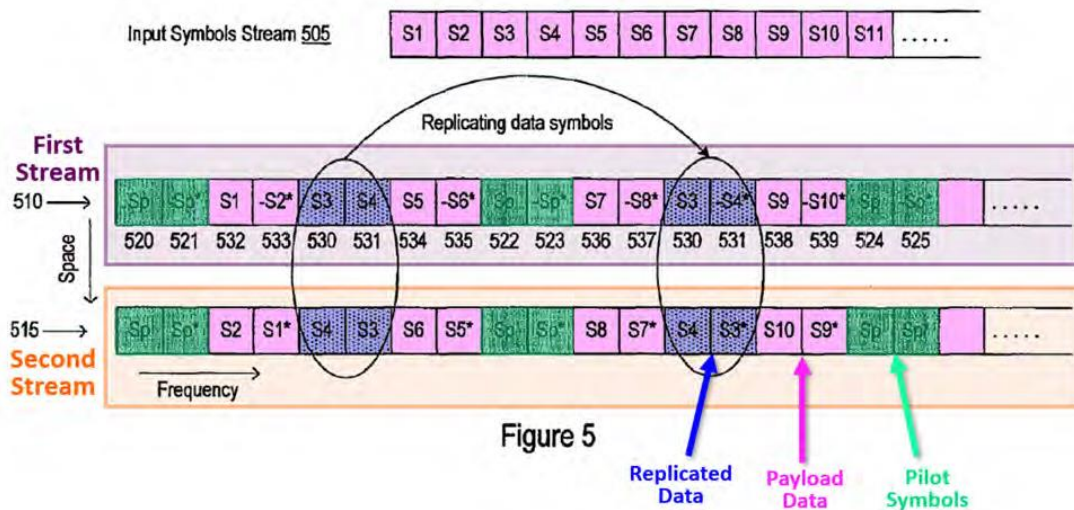
different items of payload data—otherwise the labels d_1 and d_2 would not have been used—and the “SFBC data” transmitted over antenna 2 is the SFBC-encoded data from antenna 1 at that frequency. A proper understanding of Tang’s teachings is shown in the annotated figure below. Petitioners fully recognize this deficiency in Tang and use deceptive annotations to suggest that Tang could satisfy the “replicated data” limitation.



Ex-1008 at 3 (annotated).

In addition, Petitioners should be aware that their assertion with respect to Tang is incorrect because it is inconsistent with their own description of the '331 Patent. In describing the '331 Patent, Petitioners recognize that data in SFBC format alone is not replicated data. Pet. at 5. As Petitioners indicate in their annotated Figure 5 below, the only replicated data are the duplicated data symbols shown in blue. Although other data symbols shown in pink appear in SFBC format over two antennas, Petitioners never describe these “two representations of the same underlying” payload data in SFBC format as replicated data because the '331 Patent

also distinguishes between data in SFBC format and replicated data. See Ex-1001 at Fig. 5, 8:1-24. In short, data in SFBC format alone do not constitute replicated data because it is not duplicated data.



Pet. at 5.

Thus, because data in SFBC format alone does not constitute “replicated data” as required by claim 1, Tang does not disclose “receiving replicated data from multiple data streams transmitted over the communications channel.”

- ii. *Tang does not disclose or suggest both “decoding the replicated data using the estimate channel matrix” and “generating an updated estimate of the channel matrix based, at least in part, on the replicated data.”*

Tang does not disclose receiving “replicated data” for the reasons discussed above in Section VII.C.i. Thus, Tang also cannot disclose “decoding the replicated data” or “generating an updated estimate of the channel matrix based, at least in part,

on the replicated data” since it does not teach receiving any “replicated data” in the first place.

- iii. *Tang does not disclose or suggest “decoding subsequently received signals over the communications channel using the updated estimate of the channel matrix.”*

Tang does not disclose claim element 1[f].

Petitioners’ argument with respect to this limitation simply copies the position taken in Ground 1 based on Haustein and only shows that neither reference teaches nor suggests this limitation. As with Haustein, Petitioners assume with respect to Tang that “POSITA would have understood that, following receipt of the pilot symbols and replicated data symbols that are used to generate the final estimated channel frequency response $H_{ij}(n)$, Tang’s receiver would use $H_{ij}(n)$ to decode subsequently received signals $r_j(n)$ over a coherence time over which the channel is assumed not to be varying.” Pet. at 91.

Again, Petitioners’ argument rests on the assumption that subsequently received signals are decoded during a “coherence time,” a concept not even mentioned in Tang. *See id.* Importantly, Tang does not provide any support for Petitioners’ assumption and $r_j(n)$ are not subsequently received signals but rather described in Tang as “the signal demodulated by a fast Fourier transform.” Ex-1008 at 2. In fact, ***Petitioners do not have any support from Tang for claim limitation 1[f]***. The single citation in the Petition to Tang for this limitation concerns the

general observation that “pilot overhead” diminishes system spectrum efficiency and has nothing to do with decoding subsequently received signals using the updated channel matrix estimate. *Cf.* Pet. at 92.

Like Grounds 1 and 2, Petitioners rely only on their expert to show that Tang teaches or suggests using an updated channel estimate to decode subsequently received signals. Pet. at 91-92 (citing Ex-1002 ¶¶ 148-49). But again, an allegation supported only by conclusory expert opinion is insufficient as a matter of law. *See In re Magnum Oil Tools*, 829 F.3d at 1380-81; *TQ Delta, LLC*, 942 F.3d at 1360-62.

VIII. CONCLUSION

For any or all of the independently sufficient reasons discussed above, the Board should deny institution.

Dated: October 18, 2024

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the present paper contains 9,364 words as counted by the word-processing program used to generate the brief. This total does not include the tables of contents and authorities, the caption page, table of exhibits, certificate of service, or this certificate of word count.

Dated: October 18, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that, on October 18, 2024, true and correct copies of Patent Owner's Preliminary Response and Exhibits 2004 – 2010 were served via electronic mail upon the following counsel of record:

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