

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LENOVO (UNITED STATES) INC.,

Petitioner,

v.

INTELLECTUAL VENTURES I, LLC,

Patent Owner.

Case No. IPR2024-01224

U.S. Patent No. 7,623,439

PATENT OWNER'S PRELIMINARY RESPONSE

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PATENT OWNER'S EXHIBIT LIST

Ex. 2001	Declaration of Dr. Gary Lomp
Ex. 2002	Resume of Dr. Gary Lomp
Ex. 2003	U.S. Patent No. 6,842,487 (Larsson)
Ex. 2004	Armin Dammann and Stefan Kaiser, "Standard conformable antenna diversity techniques for OFDM and its application to the DVB-T system," in <i>Proceedings IEEE Global Telecommunications Conference (GLOBECOM 2001)</i> , November 2001, pp. 3100–3105 (Dammann-IEEE)
Ex. 2005	Claim Construction Order dated May 28, 2024 in Case No. 6:23-cv-00307 (WD Tex.), Document 60
Ex. 2006	Memorandum In Support Of Claim Construction Order dated July 9, 2024 in Case No. 6:23-cv-00307 (WD Tex.), Document 66
Ex. 2007	Docket from Parallel Litigation, Case No. 6:23-cv-00307 (WD Tex.)
Ex. 2008	Scheduling Order dated November 11, 2023 in Case No. 6:23-cv-00307 (WD Tex.), Document 21
Ex. 2009	Defendant Lenovo's Technologies Corporation's Third Supplemental Invalidity Contentions
Ex. 2010	U.S. Provisional Application No. 60/572,481, filed on May 20, 2004

I. INTRODUCTION

The Petition (Paper #1) challenges claims 1-3, 7-11, 13-16 and 18 (“Challenged Claims”) of U.S. Patent No. 7,623,439 (“’439 Patent,” Ex. 1001) under two statutory grounds. Petition, at 5.

On the merits, the Petition is flawed for numerous reasons. First, it relies on statements from the detailed description of the ’439 Patent itself (which is not prior art) as teaching or suggesting a claim element, and to establish a motivation to combine. Second, the Petition attempts to make a case for obviousness based on an unsupported, conclusory assertion that cyclic advancement would provide “additional” diversity as compared to cyclic delay, without explaining why a person of ordinary skill would have been motivated to add further diversity to Dammann, which already had diversity. Third, with respect to its “obvious to try” argument, the Petition ignores the actual problem identified by the inventors -- i.e., that single-input, single-output (SISO) receivers did not function well with cyclic delays -- and instead relies on the fictitious (and unknown) problem of “equivalently implementing shift diversity.” Fourth, with respect to its “obvious to try” argument, the Petition fails to explain how the performance advantages achieved by the claimed invention were predictable. In this respect, the Petition fails to address the experimental results set forth in the specification, evidencing the unexpected (and unpredictable) advantages of the invention over the prior art. Fifth, the Petition fails

to establish that Dammann (the primary reference relied on for both grounds) is prior art. Other deficiencies are discussed below. Thus, the Petition should be denied on the merits.

On the issue of discretionary denial, the Petition was filed exactly one year after service of the complaint in parallel patent infringement litigation, just one day shy of the one-year deadline under 35 U.S.C. § 315(b). As a result, the parallel litigation (in which Petitioner is advancing the same prior art relied on in the Petition) has already reached an advanced stage, with a trial scheduled to occur long before any Final Written Decision would be issued in these proceedings. Based on these facts, and as explained more fully below, all of the *Fintiv* factors favor a discretionary denial of the Petition.

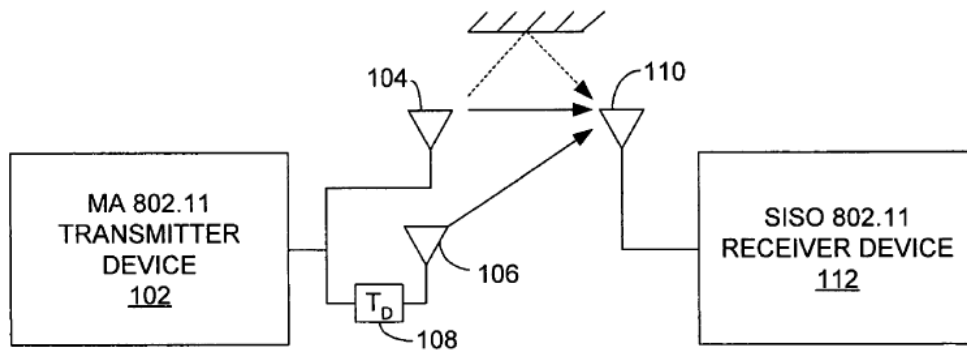
II. SPECIFICATION OF '439 PATENT

A. Background

1. The Problem Of Multi-Path When Implementing Multiple Antenna OFDM Transmitters In A Mixed Environment With Single-Input, Single Output Legacy Receivers

The '439 Patent is focused on the problem presented by multi-path signals when OFDM transmitters with multiple antennas are implemented in a mixed environment that still uses single-input, single output (SISO) legacy OFDM receivers. Ex. 1001, 1:27-32 (“there is a need to consider legacy receivers (e.g., single-input, single output (SISO), OFDM receivers) and the design challenges

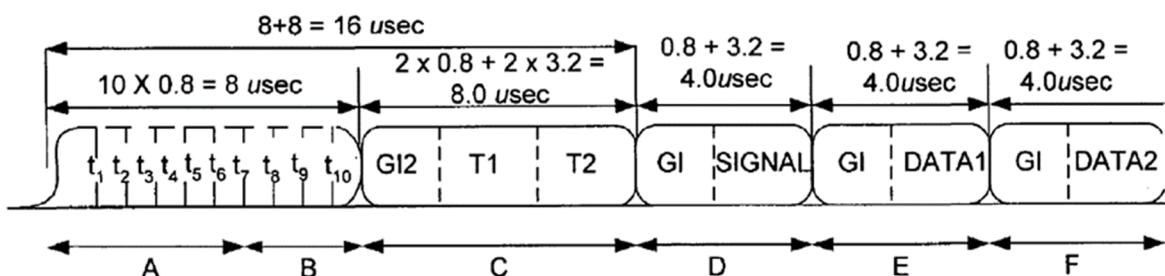
concomitant with implementing transmitters with multiple antennas in an environment that still uses legacy receivers”); Ex. 2001, ¶25. Figure 1 illustrates a mixed environment where an OFDM transmitter with multiple antennas is used with a SISO legacy receiver:



The multiple antenna (MA) transmitter device 102 includes antennas 104 and 106, while the SISO receiver device 112 includes only a single antenna 110. *Id.*, 1:38-42. “The same signals transmitted from antennas 104 and 106 may follow direct paths and multi-paths to antenna 110.” *Id.*, 1:40-42. Such multiple-path signals can result “from reflections off of objects in the environment or from multiple antennas” and can cause destructive interference of the same signals in the SISO receiver. *Id.*, 1:42-46. Figure 1 employed a technique known as “linear diversity” for mitigating “destructive interference from multi-path signals” by “equip[ing] one of the antennas 104 and 106 with a time delay element 108.” *Id.*, 1:46-56. As discussed more fully below, linear diversity was problematic because, *inter alia*, it resulted in consumption of the guard interval. *Id.*, 3:47-49; Ex. 2001, ¶26.

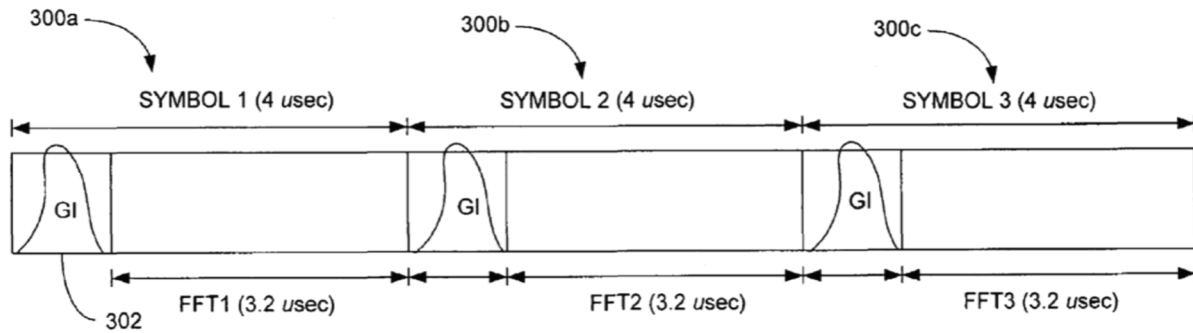
2. Existing OFDM Packet and Symbol Structures

Figure 2 of the '439 Patent depicts an OFDM packet structure used for transmission of information between MA transmitter device 102 and SISO receiver device 112. *Id.*, 1:57-60.



Section A includes short training signals that “provide signal detection, automatic gain control (AGC), and diversity selection functionality,” and Section B includes short training signals that “provide coarse frequency offset estimation and timing synchronization.” *Id.*, 1:66-2:4. With respect to Section C, “the SISO receiver device 112 determines the guard interval and symbol location (and FFT placement) through an acquisition process that includes a correlation of the known pattern corresponding to ... section C of the OFDM packet.” *Id.*, 3:22-25. Section D “contains data rate and packet length information.” *Id.*, 2:6-8. “Sections E and F are OFDM symbols.” *Id.*, 2:8-9; Ex. 2001, ¶28.

Figure 3A of the '439 Patent depicts three “exemplary OFDM symbols” in the time domain. *Id.*, 2:13-16. Each exemplary OFDM symbol corresponds, e.g., to sections E or F from Figure 2:



Each OFDM symbol includes a guard interval 302, which provides a buffer between symbols. The '439 Patent explains that “multi-path is equivalent to echoes,” and the guard intervals “comprise a zone built into an OFDM symbol” into which “echoes from a preceding OFDM symbol are positioned.” *Id.*, 2:17-21. “Such echoes cause inter-symbol interference.” *Id.*, 2:21. The guard intervals are inserted in the OFDM symbol by the MA transmitter device 102, and “are used to capture unwanted multipath-induced inter-symbol interference at the SISO receiver device 112.” *Id.*, 2:21-26; Ex. 2001, ¶30.

In the 802.11 implementation depicted in Figure 3A, each OFDM symbol is approximately 4 μsec in duration and includes 80 samples: the guard interval consumes 16 samples and the data portion comprises 64 samples. *Id.*, 2:26-30; Ex. 2001, ¶31. Processing of the OFDM signal involves placement of the FFT, and occurs as follows in the receiver:

... Fast Fourier transforms (FFT) applied at the SISO receiver device 112 (e.g., 64-point FFT) occur (or are placed) in the 3.2 (μsec) interval of each OFDM symbol 300. That is, the SISO receiver device 112 discards the 0.8 μsec duration guard interval 302 on each received 4

μsec OFDM symbol, leaving 3.2 μsec of signal (which comprises all of the information of the OFDM symbol) to FFT. No echoes are included in the 3.2 μsec interval (inter-symbol interference free). Thus, reference to “placing” or “to place” or “placement” of the FFT is understood to comprise a process or method of extracting the correct 3.2 μsec from each 4 μsec interval for implementing the FFT. *Id.*, 2:30-41 (emphasis added).

3. FFT Placement With Linear Diversity

As explained in the '439 Patent, “[l]inear delay diversity results in true delays that exhibits a behavior from a receiver perspective that is indistinguishable from true multi-path (e.g., the situation where the signal bounces off an object and arrives at the SISO receiver device 112 with a time delay due to the greater path distance traveled).” *Id.*, 3:42-47; Ex. 2001, ¶32. Figures 4A and 4B of the '439 Patent illustrate how a SISO receiver operates in this context.

Figure 4A of the '439 Patent (shown below) depicts an example of “partial packet structures 200a and 200b, each having three symbols 300 (designated as symbol 1, symbol 2, and symbol 3) comprising guard intervals 302. Packet structure 200b is a delayed version of packet structure 200a. Packet structure 200b is delayed (e.g., by delay element 108) a time delay duration designated as t_D .” *Id.*, 3:10-15; Ex. 2001, ¶33.

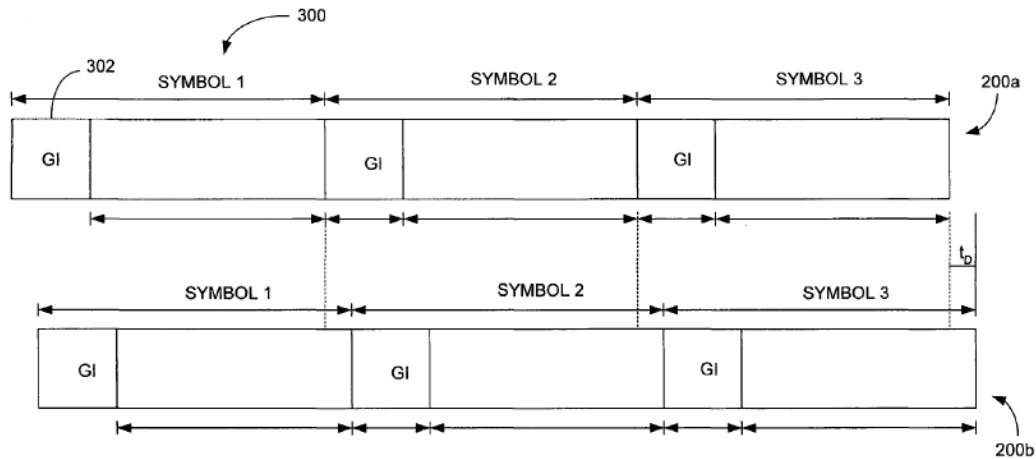


FIG. 4A (PRIOR ART)

FIG. 4B (shown below) “illustrates a single received signal (comprising the addition of the two transmit signals corresponding to packet structures 200a and 200b) output from the single receive antenna 110.” *Id.*, 3:19-22; Ex. 2001, ¶34.

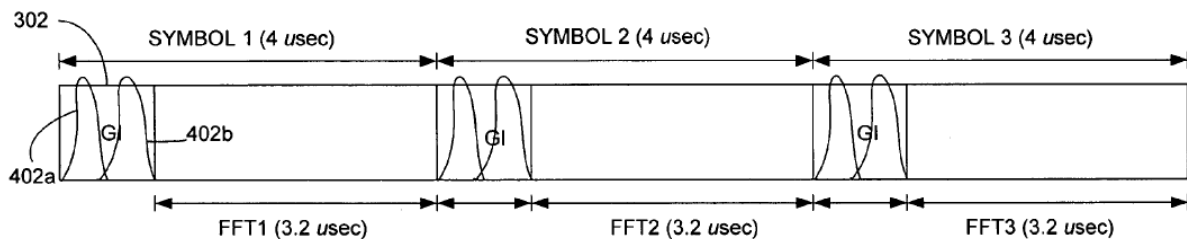


FIG. 4B (PRIOR ART)

As noted above, “[t]he SISO receiver device 112 determines the guard interval and symbol location (and FFT placement) through an acquisition process that includes a correlation of the known pattern” corresponding to the long training symbol in section C of the OFDM packet 200 (FIG. 2). *Id.*, 3:22-26; Ex. 2001, ¶35. “With the time delay (t_b) (or with multi-path), two impulse responses (402a and 402b) are detected,” and “FFT placement is accomplished by using the impulse response(s) to

center the guard interval 302 on the transients so that inter-symbol interference ISI is minimized.” *Id.*, *Id.*, 3:35-41. “[W]ith linear delay diversity, complete destructive interference is avoided, but at the expense of the consumption of the guard intervals 302.” *Id.*, 3:47-49; Ex. 2001, ¶35.

4. Use Of Small Cyclic Delays

The use of a small cyclic delay was known to somewhat improve compatibility between MA transmitters and legacy receivers. *Id.*, 3:50-52 (“With cyclic delay diversity, each tone or subcarrier is cyclically shifted (e.g., in the baseband processing portion of the MA transmitter device 102, FIG. 1) by a defined amount of samples, resulting in a circular shift of all of the samples involved”); Ex. 2001, ¶36. Figure 5 of the '439 Patent illustrates this prior technique, which employed a small cyclic delay, i.e., a delay of 1 sample:

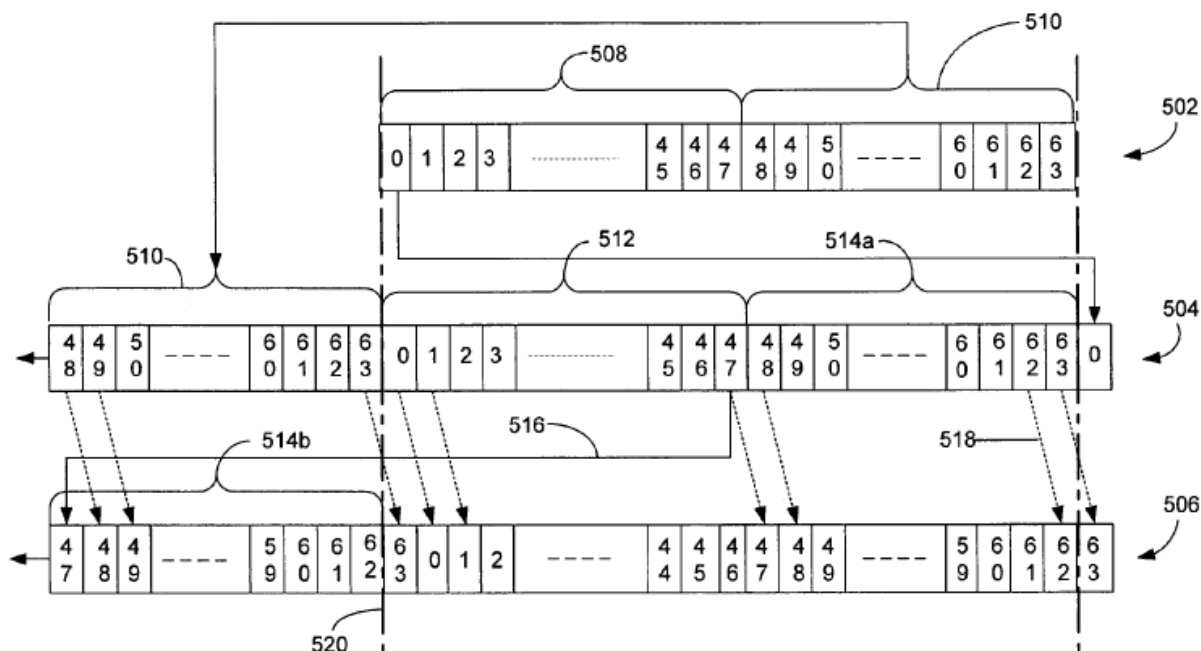


FIG. 5 (PRIOR ART)

The first tier 502 includes 80 total samples: 64 samples of symbol data 508 and 16 samples used for guard interval 510. "The second tier 504 is simply an extension of the first tier, showing the guard interval 510 corresponding to samples 510 adjacent to the next set of samples." *Id.*, 3:58-63; Ex. 2001, ¶37. "This next set of samples comprises 64 samples of symbol data 512 and 16 samples corresponding to the guard interval 514a." *Id.*, 3:63-65. The third tier 506 depicts a small *1-sample* cyclic *delay* shift, resulting in "a delay of 1 sample in the guard interval 514b preceding the 80 sample symbol in the third tier 506, starting with sample 4/7, as indicated by line 516. All of the other samples are likewise shifted as represented by the dotted arrow-head lines 518." *Id.*, 3:66-4:4; Ex. 2001, ¶37. As explained in the '439 Patent, from

“a receiver standpoint, the guard intervals 510, 514b remain aligned. ... The samples used for each guard interval are different after a cyclic shift, but the guard intervals still remain as 16 samples.” *Id.*, 4:5-10 (emphasis added); Ex. 2001, ¶37.

Significantly, the prior art techniques described by the '439 Patent in connection with Figure 5 were limited to the implementation of small cyclic delays, e.g., a 1-sample delay. Ex. 2001, ¶38.

5. Small Cyclic Delays Were Problematic Because They Resulted In “Spoofing” The Receiver

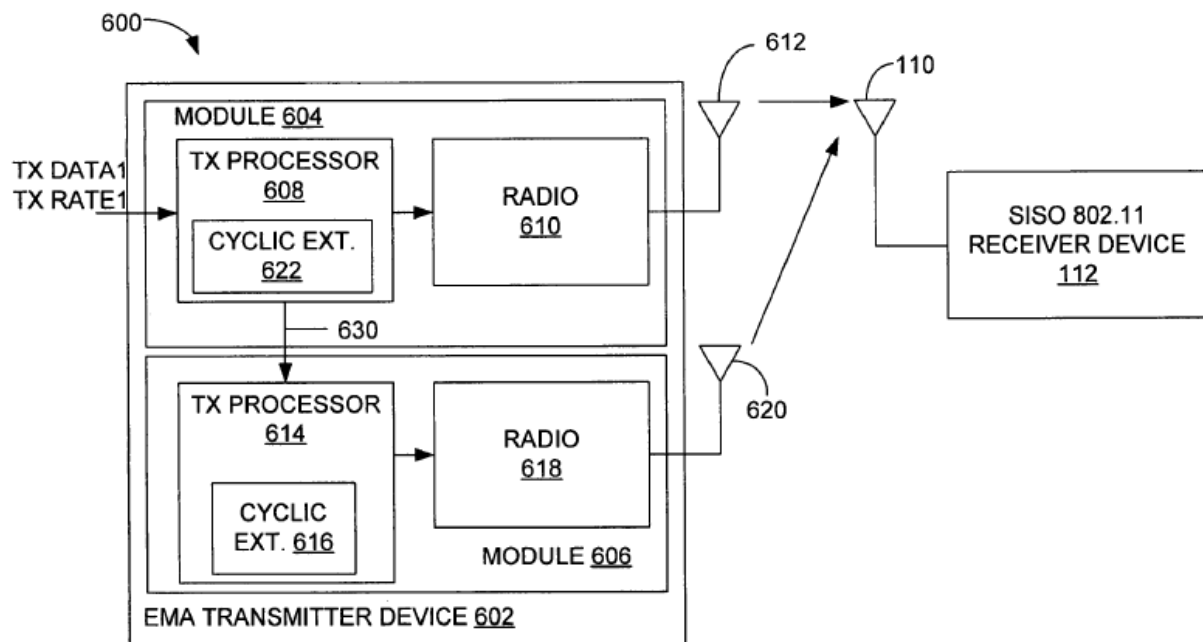
As explained in the '439 Patent, one problem with small cyclic delays involved the placement of the FFT window in the acquisition process:

... When correlation occurs at the SISO receiver device 112 (FIG. 1), the sample shifting is detected, such shifting being indistinguishable from the sample shifting that occurs in linear delay diversity. In other words, the impulse response appears to shift directly with the cyclic shift. However, the true location of the guard interval does not change because the MA transmitter device 102 (FIG. 1) is using cyclic shifts. This can spoof the SISO 20 receiver device 112 such that the FFT placement is erroneous. That is, the SISO receiver device 112 may shift the FFT over in a manner that spills over to the subsequent guard interval. *Id.*, 4:12-22 (emphasis added).

Not surprisingly, and as explained later in the '439 Patent, small cyclic delays resulted in a relatively high packet error rate. *Id.*, 8:24-41 and Fig. 9; Ex. 2001, ¶40.

B. Detailed Description

The '439 Patent discloses a novel cyclic diversity method that employs a *small* cyclic *advance*, in contrast to a *small* cyclic *delay*. Ex. 2001, ¶41. In particular, the claimed cyclic advance has a duration that is “less than [the] duration of the guard interval.” See, e.g., claim 1; Ex. 2001, ¶41. This *small* cyclic advance “enables legacy receivers to experience improved packet error rate performance when compared to conventional diversity mechanisms.” *Id.* 4:31-34 and 5:37-41; Ex. 2001, ¶41. Figure 6 illustrates an embodiment of a transmitter device for implementing the small cyclic advance diversity technique, together with the legacy receiver device 112 (described in association with Figure 1):



Module 604 includes a transmit (TX) processor 608 that performs encoding, interleaving, mapping, and OFDM symbol generation and processing. As part of symbol generation and processing, a cyclic extension module 622 implements cyclic advance diversity. *Id.*, 6:6-14; Ex. 2001, ¶42. Module 606 comprises components and functionality similar to module 604, including a transmit processor 614 and a cyclic extension module 616, which operate in a similar manner to cyclic extension module 622. *Id.*, 6:28-33; Ex. 2001, ¶42. “In operation, transmit processors 608 and 614 encode and interleave the incoming data ...[and] map the interleaved data into respective sub-carrier channels as frequency domain symbols.” *Id.*, 6:42-47. Next, “[i]nverse fast Fourier transform (IFFT) logic in baseband processing circuitry of the transmit processors 608 and 614 performs an inverse fast Fourier transformation on the frequency domain symbols to create OFDM symbols.” *Id.*, 6:47-51; Ex. 2001, ¶42.

FIG. 8 illustrates an implementation of a 4-sample cyclic advance diversity technique according to the '439 Patent:

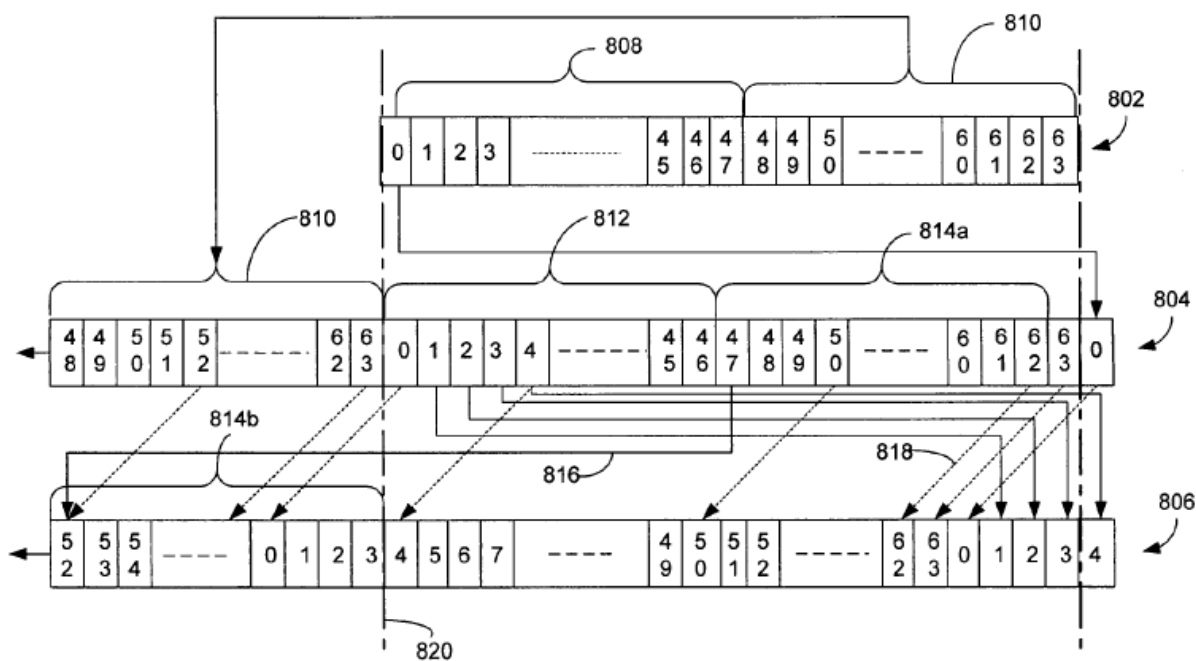


FIG. 8

The first tier 802 represents 80 total samples: 64 samples of symbol data 808 and 16 samples used for guard interval 810. “The second tier 804 is simply an extension of the first tier 802, showing the guard interval corresponding to samples 810 adjacent to the next set of samples. This next set of samples comprises 64 samples of symbol data 812 and 16 samples corresponding to the guard interval 814a.” *Id.*, 7:33-40. The third tier 806 depicts a 4-sample cyclic advance shift, resulting “in the guard interval 814b preceding the 80 sample symbol in the third tier 806 starting with sample 5/2, as represented by line 816. All of the other samples are likewise shifted as represented by the dotted arrow-head lines 818.” *Id.*, 7:40-46; Ex. 2001, ¶44. “From

a receiver standpoint, the guard intervals 810, 814b remain aligned, as represented by the dashed line 820.” *Id.*, 7:47-48; Ex. 2001, ¶44.

The small cyclic advance disclosed in the '439 Patent reduced the problem of receiver “spoofing” that plagued small cyclic delays (shown in Figure 5); Ex. 2001, ¶45. As explained in the '439 Patent:

[U]nlike cyclic delay diversity, cyclic advance diversity does not result in net shifting of the FFT. That is, the FFT placement remains substantially centered and unshifted. ...

As is shown below, small cyclic advances are preferred over small cyclic delays ...

... small cyclic advances are superior to small cyclic delays. *Id.*, 7:51-8:23 (emphasis added).

C. Experimental Data Included In Specification

The '439 Patent included experimental testing data (see Figure 9) demonstrating that a small cyclic advance of 2, 3 or 4 samples had a reduced packet error rate when compared to small cyclic delays of 1 or 2 symbols. *Id.*, 8:34-49; Ex. 2001, ¶46.

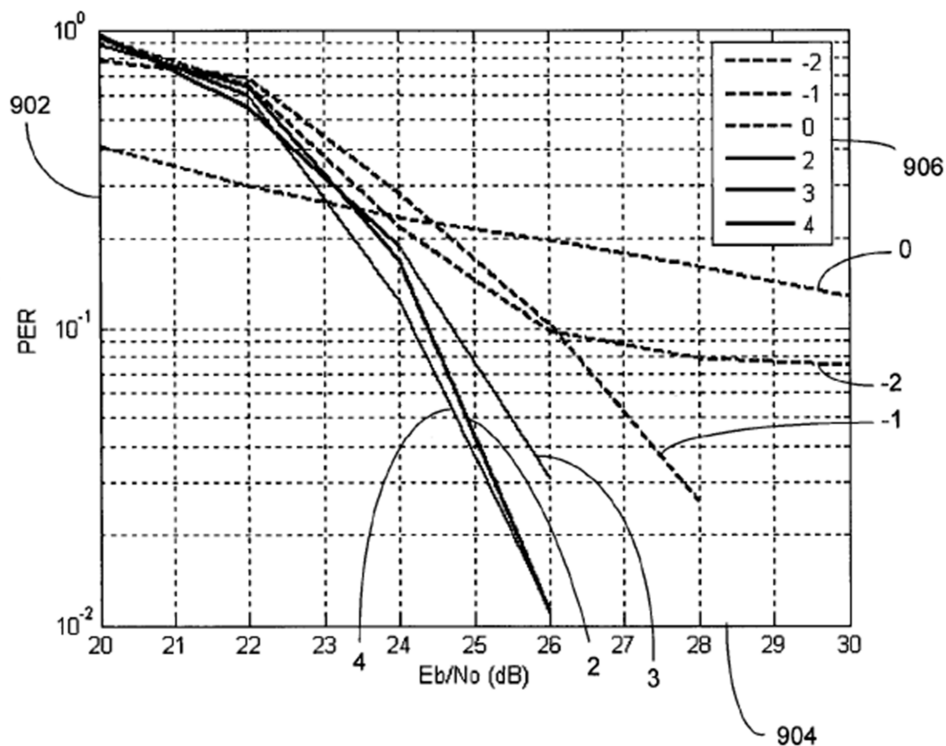


Figure 9 demonstrates the superior performance of the small cyclic advance disclosed in the '439 Patent as compared to the performance of the small cyclic delay in the prior art as illustrated in Figure 5.¹ Ex. 2001, ¶47. The Petition fails to address -- let alone dispute -- these experimental results. Although the Petition argues (incorrectly) that cyclic advances “were well known to be equivalent” to cyclic delays (e.g., Petition, 29), the Petition does not dispute that the two perform

¹ While the detailed description of the '439 Patent noted that “mathematically, a small cyclic advance of 100 nsec is identical or equivalent to a large delay of 3100 nsecs,” (*id.*, 8:6-10 (emphasis added)), the '439 Patent did not disclose that a large delay was in the prior art. The prior art labelled as Figure 5 does not include a large delay (e.g., a delay with a duration greater than the guard interval) -- rather Figure 5 shows only a small delay, e.g., a 1-sample delay. This important distinction is borne out in the prosecution history, discussed in the next section.

differently. Ex. 1001, 8:21-23 (“What has been determined experimentally is that small cyclic advances are *superior* to small cyclic delays”); and 7:51-55 (“[U]nlike cyclic delay diversity, cyclic advance diversity *does not result in net shifting of the FFT*. That is, the FFT placement remains substantially centered and unshifted.”) (emphasis added). The Petition does not dispute that the '439 Patent was the first reference to identify these performance advantages, nor does the Petition argue that these performance advantages were predictable.

III. PROSECUTION HISTORY OF '439 PATENT

The primary reference applied by the Examiner during prosecution was U.S. Patent No. 6,842,487 (Larsson) (Ex. 2003). Much like the prior art identified in Figure 5 of the '439 Patent, Larsson disclosed the use of *small* cyclic *delays* (e.g., a 1-sample delay and a 3-sample delay). Ex. 2001, ¶48. For example, Figure 8 of Larsen depicts a 1-sample delay:

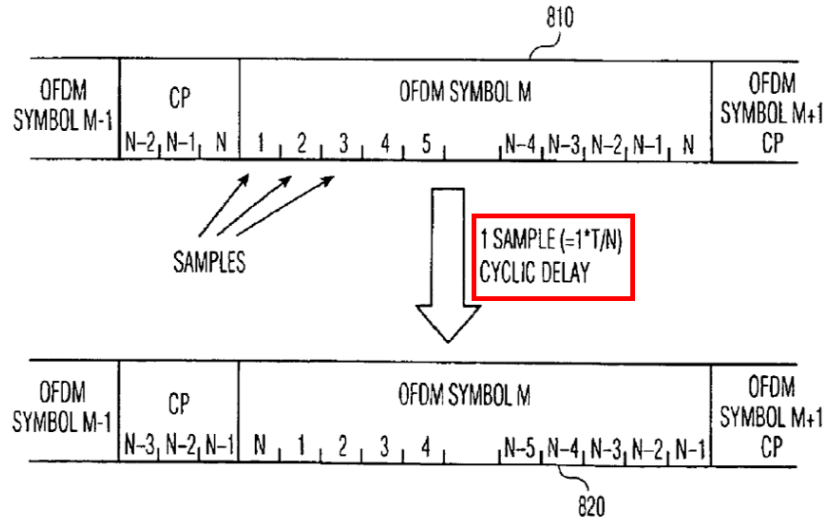


FIG. 8

Ex. 2003, Fig. 8 (red box added). In describing Figure 8, Larsson also referred to a small 3-sample delay:

FIG. 8 illustrates two OFDM symbols wherein a cyclic delay is implemented between the two symbols being transmitted in a transmission diversity scheme. Assume that OFDM symbol M 810 is transmitted over the antenna that has no cyclic delay and that OFDM symbol M 820 is transmitted over an antenna which has a cyclic delay of one sample. As can be seen by comparing OFDM symbols 810 and 820, the cyclic delay is implemented by shifting samples from the end of the OFDM symbol into the beginning of the OFDM symbol and adding a cyclic prefix by copying the last in samples of the OFDM symbol. For example, if a cyclic delay of three samples were implemented, the OFDM symbol transmitted over the third antenna would have the last three samples of the OFDM symbol shifted into the first three slots of the OFDM symbol and the remaining samples in the OFDM symbol would be shifted three places to the right. Then the last n samples of the OFDM symbol are copied and placed in the cyclic prefix, wherein n represents the number of samples in the cyclic prefix for a particular system. Ex. 2003, 6:39-58 (emphasis added).

In the First Office Action, the Examiner rejected claim 1 as anticipated by Larsson, reasoning that the claimed small cyclic advance (less than a guard interval) was met by Larsson:

Regarding claims 1, 9 and 21, Larsson teaches ... performing a periodic cyclic advancing operation on one or more sections of the OFDM packet corresponding to a second transmit antenna (performing cyclic delay operation on the same OFDM symbol corresponding to a second transmit antenna Ant 2 TX, as shown on Fig. 8 and 9 by shifting the OFDM samples, as described on 6:40-57), wherein the duration of the periodic cyclic advance operation is less than a guard interval (performing 1 sample cyclic delay operation, which is less than the cyclic prefix, identified as guard interval on 1:30-32, as the length of the cyclic prefix (CP) is three samples, as clearly shown on Fig. 8). Ex. 1002, 145-146 (emphasis added).

The applicant responded by arguing that Larsson's cyclic delay was distinguishable from the claimed cyclic advance. Ex. 1002, 136 (emphasis added). The Examiner was not persuaded, and issued a Final Office Action maintaining the rejection over Larsson. The Examiner argued that advancing inherently included delaying:

... applicant argues that Larsson does not teach "cyclically advancing" limitations of the independent claims, but teaches only "cyclically delaying", making the claims patentable over Larsson.

Examiner respectfully disagrees.

Larsson teaching is directed to delaying $n-1$, n , $n+1$ OFDM symbols for antenna ANT 2, inherently advancing $n-1$, n , $n+1$ OFDM symbols for antenna Ant 1, ... Ex. 1002, 125 (emphasis added).

The applicant next filed a Request for Continued Examination, where claim 1 was cancelled and new independent claim 24 was added. In accompanying remarks,

the applicant again articulated the distinction between a cyclic advance and a cyclic delay:

In rejecting claims 1, 9, and 21, the Examiner asserted that “advancing a portion of the signal is always relative to the other copy/duplicate of the signal, which is delayed, as advancing signal in time is physically impossible.”... As further described in specification, paragraph 0040 and Figure 8, the “cyclical advancement” set forth in the claims is accomplished by shifting the samples of the OFDM symbol in a direction opposite to that described by the prior art. Such “cyclical advancement” is imparted to the “one or more shifted versions of the OFDM packet” relative to the original OFDM packet. ...

* * *

... Larsson describes applying a “cyclic delay” to an OFDM symbol by “shifting samples from the end of the OFDM symbol into the beginning of the OFDM symbol and adding a cyclic prefix by copying the last n samples of the OFDM symbol.” See Larsson, column 6, lines 45-49 and Figure 8. Larsson, however, does not appear to suggest the “cyclical advancements” be applied to the OFDM packet as set forth in claim 24. In fact, as described in the specification, the “cyclic delay” described by Larsson would cause the legacy receiver to shift the FFT window into the subsequent symbol and thereby cause intersymbol interference since the intentional cyclic delay is “indistinguishable from the sample shifting that occurs in linear delay diversity” from the receiver standpoint. On the contrary, during the acquisition process, the cyclical advancement as set forth in claim 24 would cause the impulse responses corresponding to the shifted versions of the OFDM packet to occur before the impulse response of the unshifted OFDM packet, thereby preventing the erroneous alignment of the FFT window. Ex. 1002, 98-100 (emphasis added).

In the next Office Action, the Examiner rejected claim 24 as obvious over Larsson in view of Admitted Prior Art. The Examiner reiterated the argument that Larsson’s cyclic delay inherently included a cyclic advance:

Larsson teaches cyclical operation of shifting of a portion of the OFDM signal from the symbol end to the symbol beginning, which results in advancement of the shifted portion and in delay of the other portion of the symbol, pushed back by the advanced portion, as disclosed on 5:20-40. Therefore, applicant's emphasis on the advancing data in the cyclical shift is not a patentable feature over similar cyclical shift operation of Larsson, wherein some portion of the symbol is advanced and other portion of the symbol is delayed. Ex. 1002, 72 (emphasis added).

The applicant responded by reiterating previous arguments, including that “as described in the specification, the ‘cyclic delay’ described by Larsson would cause the legacy receiver to shift the FFT window into the subsequent symbol and thereby cause intersymbol interference.” In this regard, the applicant argued:

The Larsson reference fails to suggest or disclose every element of the claims, as amended. Larsson describes applying a “cyclic delay” to an OFDM symbol by “shifting samples from the end of the OFDM symbol into the beginning of the OFDM symbol and adding a cyclic prefix by copying the last n samples of the OFDM symbol.” See Larsson, column 6, lines 45-49 and Figure 8. Larsson, however, does not appear to suggest the “cyclical advancements” be applied to the OFDM packet as set forth in claim 24 and Fig. 8. In fact, as described in the specification, the “cyclic delay” described by Larsson would cause the legacy receiver to shift the FFT window into the subsequent symbol and thereby cause intersymbol interference since the intentional cyclic delay is “indistinguishable from the sample shifting that occurs in linear delay diversity” from the receiver standpoint.

On the contrary, during the acquisition process of the claimed invention, the cyclical advancement as set forth in claim 24 would cause the impulse responses corresponding to the shifted versions of the OFDM packet to occur before the impulse response of the unshifted OFDM packet, thereby preventing the erroneous alignment of the FFT window. This is due to the directional shift as set forth in Fig. 8, ... Ex. 1002, 52 (emphasis added).

The next Office Action included an Examiner's amendment together with a Notice of Allowance. Specifically, the Examiner's amendment (reproduced in part below) further clarified the distinction between the *small* cyclic *advance* (less than the guard interval) being claimed and Larsson's *small* cyclic *delay*:

24. (Currently Amended) A method for transmitting orthogonal frequency division multiplexing (OFDM) signals comprising: ...
cyclically advancing the first OFDM packet by shifting the samples in a first direction an amount less than a sample duration of the guard interval portion to generate a shifted version of the first OFDM packet for transmission in which at least a non-zero number of the samples from the symbol data portion of the first OFDM packet are shifted into the guard interval portion of the shifted version and a same non-zero number of samples from the guard interval portion of the first OFDM packet are shifted out of the guard interval portion of the shifted version ... Ex. 1002, 37.

In summary, the distinction between a small cyclic delay (as shown in Larsson) and the claimed small cyclic advance was *thoroughly* vetted during prosecution, and the Examiner found that this distinction (as recited in the amended claims) was patentable. Among other points, the applicant emphasized during prosecution that, “as described in the specification, the ‘cyclic delay’ described by Larsson would cause the legacy receiver to shift the FFT window into the subsequent symbol and thereby cause intersymbol interference.” Ex. 1002, 52.

IV. CLAIMS OF '439 PATENT

The claims of the '439 Patent capture the small cyclic advance invented by the applicant. Claim 1 is representative:

A method for transmitting orthogonal frequency division multiplexing (OFDM) signals comprising:

generating a first OFDM packet for transmission including a guard interval portion and a symbol data portion each comprised of a plurality of samples;

cyclically advancing the first OFDM packet by shifting the samples in a first direction an amount less than a sample duration of the guard interval portion to generate a shifted version of the first OFDM packet for transmission in which at least a non-zero number of the samples from the symbol data portion of the first OFDM packet are shifted into the guard interval portion of the shifted version and a same non-zero number of samples from the guard interval portion of the first OFDM packet are shifted out of the guard interval portion of the shifted version; and

substantially simultaneously transmitting the first OFDM packet and the shifted version of the OFDM packet (emphasis added).

Two aspects of the claim language are worthy of note. First, the claim specifies that the cyclical advance involves shifting samples from the symbol data portion of a packet into the guard interval portion of such packet.² Second, the claim specifies that the shift is small, i.e., less than the duration of the guard interval portion. Claim 8 (the other independent claim challenged in the Petition) contains analogous limitations.

² In the district court, the claim limitation that recites "cyclically advancing the first OFDM packet by shifting the samples in a first direction" was construed as "cyclically advancing the first OFDM packet by shifting the samples in the direction of transmission." Ex. 2005, 8; Ex. 2006, 25-26 (emphasis added).

V. PRIOR ART RELIED ON IN PETITION

The Petition advances a single Ground against independent Claims 1 and 8 of the '439 Patent, i.e., that such claims are obvious over “Dammann and Hervin in view of the knowledge of a POSITA.” Petition, 5.

A. Dammann

As its primary reference, the Petition relies on a technical paper by Dammann (Ex. 1005), which is alleged to have been presented at a conference in Florence, Italy, on February 27, 2002 (Dammann). Petition, 22-23. Like the Larsson reference applied during prosecution, this paper is directed to small cyclic delays. Ex. 2001, ¶60. Specifically, Dammann teaches that its cyclic delays only work when the size of the delay is small, i.e., less than the guard interval:

The cyclic extension allows different OFDM symbols to be decoded without intersymbol interference when

$$T_{Guard} \geq \delta_{max} (\geq \delta_1)$$

T_{Guard} is the period of the cyclic extension [i.e., the guard interval], and δ_{max} is the maximum multi-path delay for the channel. Ex. 1005, at 2.

Thus, Dammann requires that $T_{Guard} \geq \delta_{cy}$, i.e., cyclic delays that are smaller than the guard interval. Ex. 2001, ¶61.

Dammann begins its discussion of cyclic delay diversity (CDD) by referring back to an earlier paper by the same author that described the CDD techniques in more detail:

Below we will *briefly introduce* the application of CDD to OFDM systems as *described in detail in [8]*.

* * *

- [8] Armin Dammann and Stefan Kaiser, “Standard conformable antenna diversity techniques for OFDM and its application to the DVB-T system,” in *Proceedings IEEE Global Telecommunications Conference (GLOBECOM 2001)*, November 2001, pp. 3100–3105. Ex. 1005, 1 and 5 (emphasis added).

The Petition neglected to include Dammann’s earlier paper (Dammann - IEEE) (Ex. 2004) as an exhibit. The Dammann-IEEE paper further demonstrates that the CCD techniques being “briefly introduced” in Dammann were limited to *small* cyclic *delays*. Ex. 2001, ¶63. In this regard, Dammann-IEEE stated that the delay in samples (δ_l) was governed by the following equation:

$$\delta_\ell \leq N_g - \tau_{max}, \quad \ell = 1, \dots, M - 1,$$

Where δ_l “denotes a simple time delay in samples,” and “ N_g and τ_{max} are the guard interval and maximum channel delay in samples, respectively.” Ex. 2004, at 2. This equation plainly requires that the *delay* in samples (δ_l) be *smaller than guard interval* (N_g). After setting forth the above equation, Dammann-IEEE states that “[i]f that condition does not hold, intersymbol interference (ISI) occurs.” Ex. 2004, 2; Ex. 2001, ¶63. Since ISI must be avoided, a POSITA would have understood that the cyclic delays taught by Dammann-IEEE were necessarily small (less than the guard interval). Ex. 2001, ¶63. Since Dammann (relied on in the Petition) was only “briefly

introducing” the application of cyclic delay diversity as described in Dammann-IEEE, it is clear that Dammann is similarly directed to cyclic delays that are smaller than the guard interval. Ex. 2001, ¶63.

B. Hervin

U.S. Patent No. 5,961,575 (Hervin)(Ex. 1006) is the other reference relied on in the Petition for challenging independent Claims 1 and 8 of the '439 Patent. Hervin teaches that arithmetic shift/rotate operations can be used internally within a microprocessor to effect division and multiplication operations. Ex. 2001, ¶64. From Hervin:

The present invention generally relates to microprocessors and, more particularly, to a microprocessor having a multiple stage shifter which selectively performs preprocessing and shift/rotate/pass operations to produce improved performance of shift/rotate operations thereby.

* * *

Digital circuitry for performing arithmetic operations such as shift and/or rotate operations have long been known in the art. In a shift operation, data stored in a storage device, commonly referred to as a shift register, is moved relative to the boundaries of the device. An arithmetic shift right effects a divide by 2 operation while an arithmetic shift left effects a multiply by 2 operation. In a circular shift operation, also known as a rotate, the rightmost and leftmost positions in the shift register are treated as being adjacent during the shift. A rotate operation may be a rotate left (or “ROL”) operation in which all of the bits of an operand are shifted left by one or more positions and the most significant bits are shifted around to become the least significant bits or a rotate right (or “ROR”) operation in which all of the bits of the operand shifted right by one or more positions and the least significant bits are shifted around to become the most significant bits.

* * *

The present invention is directed to a circuit for performing arithmetic operations which both reduces the number of interconnections necessary to provide a combined shifter/rotator circuit while eliminating the need for a preconditioning unit used to pre-process byte and word sized operands to be used in shift/rotate operations performed in 32-bit architectures. Ex. 1006, 1:7-29 and 2:7-13 (emphasis added).

Hervin discloses nothing more than the use of cyclic rotations (right or left) to perform arithmetic computations within a microprocessor. Ex. 2001, ¶65. The Petition does not contend otherwise. In contrast to the '439 Patent, Hervin is not directed to OFDM (or any other wireless communication system) and therefore makes no mention of the application of diversity in such systems. Ex. 2001, ¶65. It strains the imagination that a POSITA seeking to address the problems stated in the '439 Patent -- e.g., reducing unwanted multipath-induced inter-symbol interference (Ex. 1001, 2:24-25) -- would look to Hervin's methods for internally performing arithmetic computations within a microprocessor for a solution. Ex. 2001, ¶65.

C. Knowledge of a POSITA

In addition to Dammann and Hervin, the Petition relies on what it asserts as the “knowledge of a POSITA” in its obviousness analysis. For example, the Petition predicates both its motivation to combine argument and its mapping of Element [1B] on the unsupported assertion that “it was well known in the art that cyclic delay performs the equivalent operation as a cyclic advancement,” repeating this mantra (in sum or substance) multiple times throughout the Petition. See, e.g., Petition, at

pages 29, 38-39 and 43. The Petition does not support its assertion that this proposition “was well known in the art” with any reference from the prior art. Ex. 2001, ¶66. Instead, the Petition improperly cites to teachings from the Detailed Description of the '439 Patent for this proposition. The Detailed Description of the '439 Patent is not evidence of what “was well known in the art.”

VI. THE PETITION FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD OF SUCCESS ON THE MERITS

The Petition relies on the combination of Dannmann and Hervin, in view of the knowledge of a POSITA, in challenging independent Claims 1 and 8. *See* Petition, 4. This combination is deficient, as described below.

A. The Petition Improperly Relies On The Detailed Description Of The '439 Patent As Evidence Of The Prior Art

The Petition argues that “[a] person of ordinary skill in the art would have been motivated to modify Dammann based on the disclosure of Hervin” because the Detailed Description of the '439 Patent taught that “left cyclic shifts (i.e., cyclic advances) were well known to be equivalent to right cyclic shifts (i.e., cyclic delays).” Petition, 28-29. Specifically, the Petition relies on the following passage from the Detailed Description of the '439 Patent for its argument that left cyclic shifts were “well known to be equivalent” to right cyclic shifts:

Due to the periodic nature of OFDM subcarriers, mathematically, a small cyclic advance of 100 nsec is identical or equivalent to a large delay of 3100 nsecs (the OFDM symbol waveform repeats with a period of 3.2 µsec or 3200 nsec). In other words, 3100 nsec is a periodic equivalent to

100 nsec. Likewise, a small delay of 100 nsec is identical to an advance of 3100 nsec, again due to the periodic nature of the OFDM symbol 300 (e.g., FIG. 3). Thus, a signal received by the SISO receiver device 112 (FIG. 6) having a cyclic advance of 100 nsec or a signal having a cyclic delay of 3100 nsec is processed as an identical signal from the perspective of the SISO receiver device 112, since the EMA transmitter device 602 (FIG. 6) transmits the identical signal in each case. Since a circular shift is indeed circular, the FFT placement is at the same position shifting in either direction (100 nsec advance, 3100 nsec delay).

Petition, 29, *citing* Ex. 1001 at 8:5-21.

Separately, in purporting to map element [1B] to the prior art, the Petition again asserts that “it was well known in the art that cyclic delay performs the equivalent operation as a cyclic advancement,” again repeating the identical block quote (set forth above) from the from the Detailed Description of the '439 Patent as evidence of such. Petition, 38-39, *quoting* Ex. 1001 at 8:5-21.

The detailed description of the '439 Patent is not prior art, and there is no evidence that it was “well known in the art that cyclic delay performs the equivalent operation as a cyclic advancement.”³ Petition, 29 and 38-39; Ex. 2001, ¶70. The predicate for both the motivation to combine and mapping of Element [1B] set forth in the Petition -- i.e., that left cyclic shifts were “well known to be equivalent” to right cyclic shifts -- is therefore completely unsupported. Ex. 2001, ¶70.

³ To be clear, the cited passage from the '439 Patent teaches that a small cyclic advance (100 nsec) is equivalent to a large cyclic delay (3100 nsec). The passage does not teach that a small cyclic advance (e.g., 100 nsec) is equivalent to a small cyclic delay (e.g., 100 nsec). A small cyclic advance (e.g., 100 nsec) is not equivalent to a small cyclic delay (e.g., 100 nsec). Ex. 2001, ¶70, note 3.

The Petition cites the *Updated Guidance on the Treatment of Statements of the Applicant in the Challenged Patent In Inter Partes Reviews Under §311* (June 18, 2022) as well as several Federal Circuit decisions that address the use of an Applicant's admissions as to the scope and content of the prior art in an IPR. Petition, 19-21. However, applicant's teachings in the Detailed Description of the '439 Patent are not admissions as to the scope and content of the prior art. As the Director explained in the *Updated Guidance*:

Admissions may include statements in the specification of the challenged patent such as “It is well known that . . . ,” “It is well understood that . . . ,” or “One of skill in the art would readily understand that . . . ,” or may describe technology as “prior art,” “conventional,” or “well-known.” *Updated Guidance*, at 4.

Significantly, nothing in the portion of the Detailed Description of the '439 Patent relied on in the Petition (i.e., Ex. 1001, 8:5-21) states or even suggests that the proposition being discussed was “well known,” “well understood,” “prior art,” “conventional,” or that “one of skill in the art would readily understand” it.

Furthermore, in its assertion, the Petitioner ignores key qualifiers in the quoted description. Specifically, the '439 Patent states that “mathematically, a small cyclic advance ... is identical or equivalent to a large delay.” Ex.1001, 8:5-9. Thus, notwithstanding the fact that detailed description is not prior art, contrary to Petitioner's erroneous assertion, the '439 Patent does not say or imply categorically that any left cyclic shift is equivalent to any right cyclic shift. Ex. 2001, ¶71.

B. Petitioner’s Assertion That Cyclic Advancement Would Provide “Additional” Diversity As Compared To Cyclic Delay Lacks Support And Is Conclusory

Having erroneously concluded that left cyclic shifts were “well known to be equivalent” to right cyclic shifts, the Petition argues that a POSITA would have been motivated to modify the cyclic delay in Dammann to a cyclic advancement because doing so would provide additional diversity. From the Petition:

Hervin expressly discloses cyclic advancement, and as Dr. Ding testifies, a POSITA would have been motivated to include cyclic advancement in the system described by Dammann because doing so provides additional cyclic diversity. Petition, 30, citing, Ex. 1003 at ¶61.

However, aside from this conclusory statement, Petitioner’s expert (Dr. Ding), provides *no* evidence (or reasoning) supporting his assertion that additional diversity would be achieved by modifying the cyclic delay in Dammann to a cyclic advancement. *Xerox Corp., at al v. Bytemark*, IPR2022-00624, Director Review Decision, Paper #12, February 10, 2023 (finding that “the Board was correct in giving little weight to Petitioner’s expert because the expert declaration merely offered conclusory assertions without underlying factual support.”)

Even assuming that his conclusory assertion about “additional” diversity was supported by a rational underpinning, Petitioner’s expert fails to explain why a POSITA would have been motivated to introduce further diversity in Dammann’s system. Dammann’s transmitter already implemented diversity (see, Ex. 1005, at Figure 1). Ex. 2001, ¶74. Petitioner’s expert does not explain why a POSITA would

have been motivated to add still further “additional” diversity to Dammann’s system. Ex. 2001, ¶74. For example, Petitioner’s expert fails to identify any problem (that a POSITA would have recognized) with Dammann’s transmitter that would have been addressed by adding still further diversity to the system. *Id.*

Finally, again assuming that his conclusory assertion about “additional” diversity was supported, Petitioner’s expert has provided no evidence that it was known in the art that modifying a cyclic delay to a cyclic advancement would achieve additional diversity, or that a POSITA would have recognized such to be this case. Ex. 2001, ¶75. Without knowledge or recognition by a POSITA that such “additional” diversity would be achieved, a POSITA would not have been motivated to modify the cyclic delay in Dammann as alleged. Ex. 2001, ¶75; *Leo Pharm. Prods. v. Rea*, 726 F. 3d 1346, 1353 (Fed. Cir. 2013) (“[t]he problem was not known, the possible approaches to solving the problem were not known ... Indeed ordinary artisans would not have thought to try at all because they would not have recognized the problem”); *Forest Labs., LLC v. Signmapharm Labs., LLC*, 918 F. 3d 928, 935 (Fed. Cir. 2019) (“[w]e have recognized that where a problem was not known in the art, the solution to that problem may not be obvious, because “ordinary artisans would not have thought to try at all because they would not have recognized the problem.”)

C. The Petition Fails To Demonstrate That “Implementing Cyclic Shift Diversity” Was A Problem In Search Of A Solution, Or That The Results Of The Claimed Cyclic Advancement Techniques Were Predictable

According to the Petition:

[T]here would have been a finite number of identified, predictable solutions for equivalently implementing cyclic shift diversity – indeed only two solutions: cyclical delay and cyclical advancement. Ex. 1003, at ¶61. Thus, it would have been obvious to a person of ordinary skill in the art to try cyclic advancement, in particular given that the other solution, cyclic delay, is admitted to be in the prior art by the '439 Patent. Petition, 30-31 (emphasis added).

The analysis above is severely flawed. As explained in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007), the obvious to try rationale applies only “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions.” The Petition does not identify any problem (driven by design need or market pressure) having “a finite number of identified, predictable solutions” as required by *KSR*. Ex. 2001, ¶77. Instead, the Petition alleges that there were “a finite number of identified, predictable solutions for equivalently implementing cyclic shift diversity.” Petition, 30.

However, “equivalently implementing cyclic shift diversity” is not a statement of a “problem.” Ex. 2001, ¶78. Nor was the use of cyclic advancement an identified solution to “implementing cyclic shift diversity.” *Id.* Dammann does not identify cyclic advancement for “implementing cyclic shift diversity,” and Hervin

does not mention or even address the “problem” of “implementing cyclic shift *diversity*” at all. Ex. 2001, ¶78.

Nor has the Petition carried its burden of demonstrating that the results of cyclic advancement were predictable. As noted above, the Petition does not dispute that the small cyclic advances claimed have unexpected advantages over the small cyclic delays in the prior art. 1001, 8:21-23 (“What has been determined experimentally is that small cyclic advances are superior to small cyclic delays”); and 7:51-55 (“[U]nlike cyclic delay diversity, cyclic advance diversity does not result in net shifting of the FFT. That is, the FFT placement remains substantially centered and unshifted.”) (emphasis added). The Petition does not allege that these performance advantages were “predictable” because they were not. Ex. 2001, ¶79.

D. The Petition Fails To Demonstrate That There Were A Finite Number Of Predictable Solutions For Eliminating Multi-Path Inter-Symbol Interference

As explained above, the obvious to try rationale applies only “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). The problem addressed by the '439 Patent was that SISO receivers functioned poorly when cyclic delays were used. Ex. 2001, ¶88. As discussed below, the reason for this poor performance was not known in the prior art. *Id.* Nor had the

prior art identified any predictable solutions for improving upon the poor performance of cyclic delays. *Id.*

1. The Problem Was That Cyclic Delays Did Not Work Well With SISO Receivers

The background the '439 Patent explained that “in systems utilizing multiple-antenna devices, there is a need to consider legacy receivers (e.g., single-input, single output (SISO), OFDM receivers) and the design challenges concomitant with implementing transmitters with multiple antennas in an environment that still uses legacy receivers.” Ex. 1001, 1:27-31. The '439 Patent then explained that linear delay diversity had been proposed to address these challenges but was inadequate because it (i) “results in true delays that exhibits a behavior from a receiver perspective that is indistinguishable from true multi-path” and, (ii) comes “at the expense of consumption of the guard interval.” *Id.*, 3:42-49. The '439 Patent next explained that another proposed “technique used to make MA transmitters compatible with legacy receiver devices is referred to as cyclic delay diversity.” *Id.*, 3:50-52. However, the inventors of the '439 Patent discovered a problem with this technique -- that cyclic delays did not work well with SISO receivers. Ex. 2001, ¶89; *Leo Pharm. Prods. v. Rea*, 726 F. 3d 1346, 1353 (Fed. Cir. 2013) (“[a]s an initial matter, an invention can often be the recognition of a problem itself.”); *see, Cardiac Pacemakers. Inc. v. St. Jude Med., Inc*, 381 F.3d 1371, 1377 (Fed. Cir. 2004) (“[t]here can of course arise situations wherein identification of the problem is itself the invention.”) As noted in

the '439 patent, cyclic delay techniques performed relatively poorly when used with SISO receivers. As explained the '439 Patent, this poor performance was due to suboptimal positioning of the FFT window. Ex. 2001, ¶89; *see*, Section VI(D)(2), below. Nothing in the patent specification – or in the alleged prior art cited by Petitioner – suggests that the relatively poor performance of SISO receivers or its underlying cause was known in the art at the time of the invention. Ex. 2001, ¶89.

2. The Reason That Cyclic Delays Did Not Work Well With SISO Receivers Was Discovered By The Inventors Of The '439 Patent And Not Known In The Prior Art

The prior art had not identified that cyclic delays were deficient. Ex. 2001, ¶90. Nor had the prior art identified any *reasons* why cyclic delays were deficient. *Id.* Rather, it was the inventors of the '439 Patent who discovered that the “problem with cyclic delay diversity involves the acquisition process” where “the impulse response appears to shift directly with the cyclic shift” which “can spoof the SISO receiver device 112 such that the FFT placement is erroneous.” Ex. 1001, 4:5-22. Ex. 2001, ¶90.

To the extent Petitioner were to argue that the patentee admitted that it was known in the art that the acquisition process caused cyclic delays not to work well with SISO receivers because this was discussed in the background of the '439 Patent, such an argument would be without merit. These statements in the background were the inventor’s own work. The Petition offers no evidence to the contrary. *Reading*

& Bates Construction Co. v. Baker Energy Resources Corp., 748 F.2d 645 (Fed. Cir. 1984) (holding patentee’s discussion of his own work in the specification section entitled “Summary of the Prior Art” did not constitute an admission that such constituted prior art); *Riverwood Int’ Corp. R.A. Jones & Co.*, 324 F.3d 1346 (Fed. Cir. 2003), (holding one’s own work may not be considered prior art in the absence of a statutory basis.)

3. The Petition Has Failed To Demonstrate That There Was A Finite Number Of Predictable *Identified* Solutions For Fixing The Unknown Problem That SISO Receivers Did Not Function Well With Cyclic Delays

Before something can be “obvious to try,” there must be “a finite number of identified, predictable solutions” to the problem. *KSR*, 550 U.S. 398, 421. Here, neither the problem (that SISO receivers did not work well with cyclic diversity) nor the underlying reason for that problem (errors caused by the acquisition process) were known in the art. Ex. 2001, ¶91. The Petition does not proffer evidence that any solutions had been identified for addressing the problem that SISO receivers did not work well with cyclic diversity, or for addressing the underlying reason for that problem, namely errors caused by the acquisition process. *Id.*, *Leo Pharm.*, 726 F. 3d 1346, 1353 (“[t]he problem was not known, the possible approaches to solving the problem were not known ... Indeed ordinary artisans would not have thought to try at all because they would not have recognized the problem.”)

More importantly, there is no evidence that cyclic advancement was identified in the prior art as a solution for addressing the problem that SISO receivers did not work well with cyclic diversity. Ex. 2001, ¶92. In fact, there is no evidence that cyclic advancement was identified at all in the prior art in the context of wireless systems. *Id.* For these reasons, the Petition has failed to demonstrate that the invention of the '439 Patent was “obvious to try.”

E. Dammann Would Have Discouraged A POSITA From Making The Modification Suggested By Petitioner

Dammann teaches that its cyclic delays only work when the size of the delay is small, i.e., less than the guard interval:

The cyclic extension allows different OFDM symbols to be decoded without intersymbol interference when

$$T_{Guard} \geq \delta_{max} (\geq \delta_1)$$

T_{Guard} is the period of the cyclic extension [i.e., the guard interval], and δ_{max} is the maximum multi-path delay for the channel. Ex. 1005, at 2.

Thus, Dammann requires that $T_{Guard} \geq \delta_{cy}$, i.e., cyclic delays that are smaller than the guard interval. Ex. 2001, ¶93.

Assuming for purposes of argument that the teaching in the '439 Patent that a small cyclic advance is equivalent to a large cyclic delay⁴ was known in the art (it was not), and that the converse was also known, i.e., that a large cyclic advance is equivalent to a small cyclic delay, then Dammann's requirement that its cyclic delay

⁴ Ex. 1001 at 8:5-21.

be small (smaller than the guard interval) would have translated to a requirement that any cyclic advance must be large in order to work. Ex. 2001, ¶94. The knowledge that a cyclic advance needed to be large in order to work would have actually discouraged a POSITA from trying the small cyclic advance claimed in the '439 Patent. *Id.*

Thus, in view of Dammann's explicit teachings, a POSITA would not have been motivated to try the modification proposed by Petitioner. *Id.*

F. Petitioner Has Failed To Demonstrate That Hervin Is Analogous Art

In an IPR, the “patent challenger has the burden of producing evidence to support a conclusion of unpatentability.” *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375-76 (Fed. Cir. 2016). This burden includes evidencing establishing that a prior art reference is analogous because “[w]hether a reference is analogous art is an issue of fact.” *Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020).

“Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.” *Sanofi-Aventis Deutschland GmbH v. Mylan Pharm. Inc.*, 66 F.4th 1373, 1377 (Fed. Cir. 2023). In the present case, the Petitioner has not even

attempted to show that Hervin satisfies either test, which represents a fundamental deficiency in the Petition. Moreover, as explained below, it is clear that Hervin fails to meet either test for analogous prior art. Ex. 2001, ¶95.

With respect to the first test, the '439 Patent and Hervin are from different fields of endeavor. Ex. 2001, ¶96. More particularly, the '439 Patent is directed to the field of multi-path effects in OFDM wireless systems (Ex. 1001, e.g., 1:28-31), while Hervin is directed to the field of arithmetic computations within a 32-bit microprocessor architecture. Ex. 2001, ¶96; Ex. 1006, 2:7-13 (“The present invention is directed to a circuit for performing arithmetic operations which both reduces the number of interconnections necessary to provide a combined shifter/io rotator circuit while eliminating the need for a preconditioning unit used to pre-process byte and word sized operands to be used in shift/rotate operations performed in 32-bit architectures.”) These are clearly different fields of endeavor. Ex. 2001, ¶96. The Petition does not contend otherwise.

With respect to the second test, Hervin is not reasonably pertinent to the particular problems addressed by the '439 Patent, e.g., that cyclic delays did not work well with SISO receivers. Ex. 2001, ¶97. “A ‘reasonably pertinent’ reference is one that an ordinarily skilled artisan would reasonably have consulted in seeking a solution to the problem that the inventor was attempting to solve.” *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1382 (Fed. Cir. 2019). Accordingly, “a reference is

reasonably pertinent if . . . it is one which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem." *Sci. Plastic Prods. v. Biotage AB*, 766 F.3d 1355, 1359 (Fed. Cir. 2014). To determine if the reference would have commended itself to an inventor's attention, "[t]he problems to which the claimed invention and reference at issue relate must be identified and compared from the perspective of a person having ordinary skill in the art." *Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1360 (Fed. Cir. 2020).

Hervin would not have logically commended itself to an inventor's attention in considering the problem that cyclic delays did not work well with SISO receivers. Ex. 2001, ¶98. Hervin is not directed to directed to OFDM (or any other wireless communication system). *Id.* Hervin does not mention multi-path effects or inter-symbol interference; nor does Hervin address the application of diversity in such systems. *Id.* Accordingly, a POSITA seeking to address the problem addressed by the '439 Patent would not have looked to Hervin's methods for internally performing arithmetic computations within a microprocessor for the solution. *Id.* Again, the Petition does not contend otherwise.

G. THE PETITION IS DEFICIENT BECAUSE IT FAILS TO ADDRESS THE EXPERIMENTAL RESULTS IN THE SPECIFICATION

The Petition is also deficient because it fails to address -- let alone dispute -- the experimental results in the specification demonstrating the superior performance of the claimed cyclic advances over the small cyclic delays in the prior art. The Petition utterly “fails to grapple persuasively with developed, and well-known evidence of unexpected results” and provides no “rebuttal to the actual results exhibited with the claimed combination as evidenced in, at minimum, the specification’s examples.” *Gilead Sciences, Inc. v. United States of America Represented By the Dept. Of Health And Human Services*, IPR2019-01455, Paper #16, at 50 (PTAB February 5, 2020)(denying institution)(non-precedential). The Petition’s failure to address the unexpected results in the specification of the '439 Patent constitutes a fundamental deficiency. *See Coalition for Affordable Drugs V LLC, v. Hoffman La-Roche Inc.*, IPR2015-01792, Paper #14, at 17–18 (PTAB Mar. 11, 2016) (denying institution due, in part, to Petitioner not addressing the objective indicia of nonobviousness) (non-precedential); *Merial Limited v. Virbac*, IPR2014-01279, Paper 13 at 27 (PTAB Jan. 22, 2015) (concluding petitioner “was aware of the unexpected results ... [and Petitioner] should have addressed the unexpected results in the first instance.”) (non-precedential).

The Petition relies on *Tristar Products, Inc. v. Choon's Design, LLC*, IPR2015-01883, Paper No. 6 at 26 (PTAB Mar. 9, 2016) to excuse its failure to address the experimental results set forth in the '439 Patent specification. The facts in *Tristar Products* bear no resemblance to those of this case. In *Tristar Products*, the Patent Owner acknowledged in the Patent Owner Preliminary Response that “Patentee cannot supply any declaration evidence at this point” and alluded to there being evidence (not yet of record in the proceedings) of commercial success, industry praise and copying. IPR2015-01883, Paper No. 5 at 35. *Tristar Products* does not support excusing the failure of the present Petitioner to address in the first instance experimental results that were part of the '439 Patent specification.

VII. THE PETITION FAILS TO DEMONSTRATE THAT DAMMANN IS PRIOR ART

The Petition alleges that Dammann is prior art “under at least Section 102(b)” because it was presented at a “European Wireless 2002 conference” in Florence, Italy on February 27, 2002, and “accepted” for “publication in the proceedings.” Petition, 20-21. Section 102(b) (Pre-AIA) provided as follows:

A person shall be entitled to a patent unless — ... (b) the invention was patented or described in a printed publication in this or a foreign country_or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States. (emphasis added).⁵

⁵ The Petition does not argue that Dammann qualifies as prior art under Section 102(a) (Pre-AIA). Under that section, information that “was known or used by others in this country” before the invention date qualifies as prior art. Even if the Dammann was

The Petition lacks the evidence required to demonstrate that Dammann was a “printed publication” before the priority date of the '439 Patent. We begin by summarizing the evidence presented in the Petition, and then explain why it is deficient.

A. Exhibits Relied On To Demonstrate Public Accessibility

The Petition relies on Exhibits 1014-1016 to support its allegation that Dammann is prior art. Each of these exhibits is discussed below:

1. Exhibit 1014

Exhibit 1014 purports to be a page archived from the website “docenti.ing.unipi.it” (see blue box below added by Patent Owner) on October 28, 2002 (see red box below added by Patent Owner). This exhibit does not mention the Dammann paper:

orally "presented" at a conference in *Italy* in 2002, such a presentation would not qualify as prior art under Section 102(a) (Pre-AIA) because the activity did not take place "in this country."

European Wireless 2002

Next Generation Wireless Networks:
Technologies, Protocols, Services and Applications
February 25-28, 2002 - Florence, Italy

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The conference will bring together researchers and practitioners presenting the most up-to-date results and achievements primarily in the following fields: advancement in physical layers and MAC protocols for indoor/cellular narrowband networks and broadband radio access systems; architectures and related protocols for the interworking of fixed and wireless (terrestrial and satellite) networks; Quality of Service (QoS) in wireless networks and/or in the internetworking environment; Personal Communication Systems beyond the third generation.

Important Dates:

Paper Submissions Due	September 15, 2001 (*)
Notification of Acceptance	November 15, 2001 (**)
Camera-Ready Versions Due	December 15, 2001
Conference Dates	February 26-28, 2002

(*) Due to the many requests received the paper submission deadline has been extended to **September 22, 2001**.

(**) Due to the many papers received the notification of acceptance will be delayed of approximately 10 days.

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Email cw2002@ing.unipi.it with any questions or comments about the conference or for more information.

2. Exhibit 1015

Exhibit 1015 (reproduced below) purports to be another page archived from the website “docenti.ing.unipi.it” (blue box) on May 23, 2002 (red box). Again, this exhibit *does not mention the Dammann paper*:

EW2002 Summary

EW2002 in numbers

- Though named "European", the EW2002 conference has received attention from all over the world. **221 papers**, from **25 different countries in 5 continents**, have been submitted.
- **152** papers have been accepted for presentation in the conference and publication in the [proceedings](#). Among these, **18** have been selected for [journal publication](#).
- **246 participants** have been welcomed to EW2002.

Best Student Paper Awards

Among many worthy competitors, the following two students have been selected for the Best Student Paper Awards:

Daniela Tuninetti, for the paper *"The long-term average capacity region per unit energy with application to protocols for sensor networks"*, by D. Tuninetti, G. Caire, Institut Eurécom, France

Rami Mukhtar, for the paper *"Packet Latency for Type-II Hybrid ARQ Transmissions over a Correlated Error Channel"*, by R. Mukhtar, M. Zukerman, F. Cameron, The University of Melbourne, Australia

Journal Publications

As announced, papers of particular merit are proposed for publication in the *AEI European Transactions on Telecommunications* and *ACM/Kluwer Wireless Networks* journals. Following is the list of the selected papers:

- Selected list of papers that will compete for publication on a special issue of **ACM/Kluwer Wireless Networks** reserved to European Wireless 2002.

1. *Hiperlan/2 Public Access Interworking with 3G Cellular Systems*
S. McCann, and H. Flygare
2. *Characteristics of WAP Traffic*
I.C.Y. Ma, and J. Irvine
3. *Packet Latency for Type-II Hybrid ARQ Transmissions over a Correlated Error Channel*
R. Mukhtar, M. Zukerman, and F. Cameron
4. *Local and Global QoS-aware Token Bucket Parameters Determination for Traffic Conditioning in 3rd Generation Wireless Networks*
Frank Yong Li
5. *Adaptive Core Multicast Routing Protocol*
S. Park, and D. Park
6. *Study of the TCP Dynamics over Wireless Networks with Micromobility Support Using the ns Simulator*
L. Cerdà, F. Vena, and O. Casals
7. *Bluetooth/802.11 Protocol Adaptation for RFID Tags*
R. Bridgelall
8. *Distributed power control for power-aware energy-efficient routing in ad-hoc networks*
P. Bergamo, D. Maniezzo, A. Giovanardi, G. Mazzini, and M. Zorzi

- Selected list of papers that will compete for publication on a special issue of **AEI European Transactions on Telecommunications** reserved to European Wireless 2002 (scheduled as the first issue of 2003).

1. *The long-term average capacity region per unit energy with application to protocols for sensor networks*

- D. Tuninetti and G. Caire
2. *Performance Evaluation of Frequency Spread Coding and Frequency Interleaving for OFDM Systems Using Adaptive Co-Channel Interference Canceller*
M. Shibahara, T. Fujii, T. Saba, I. Sasase
3. *Joint Coded-Precoded OFDM with Low-Complexity Turbo-decoding*
Z. Wang, S. Zhou, G.B. Giannakis
4. *A New Unified Approach to Adaptive Blind Equalization for Multicarrier CDMA Systems with Receiver Diversity*
D. Chen and K. Yao
5. *Acquisition of Orthogonal Modulated Signals in Rayleigh-Fading Channels*
P. Xiao, E. Strom
6. *Dynamic Code Assignment in Hybrid MC-CDMA/TDMA System*
C.-L. Yang, J.-F. Chang
7. *Advanced Ray-Optical Propagation Modeling for Indoor Environments Including Wideband Properties*
R. Hoppe, G. Woelfle, P. Wertz, F.M. Landstorfer
8. *Performance of Space-Combining Transmission Diversity with OFDM for Broadband Wireless Access System*
M. Nobuaki, Y. Asai, O. Kagami, H. Hojo
9. *Reduction of Co-Channel Interference in GSM by Joint Channel and Data Estimation*
M. Loncar, C. F. Mecklenbrauker, R. Muller
10. *A Priority MAC Protocol to Support Real-time Multimedia Traffic in Ad Hoc Networks*
J.-P. Sheu, C.-H. Liu, S.-L. Wu, Y.-C. Tseng

3. Exhibit 1016

Exhibit 1016 (reproduced in part below) purports to be another page archived from the website “docenti.ing.unipi.it” (blue box) on November 23, 2004 (red box) -- which is after the priority date⁶ of the '439 Patent:

⁶ The '439 Patent claims priority to U.S. Provisional Application No. 60/572,481, which was filed on May 20, 2004. As explained in Section VII(C), *supra*, the Challenged Claims are entitled to the benefit of the filing date of the provisional application.

Wednesday, February 27, 2002			
	<u>Monday 25</u>	<u>Tuesday 26</u>	<u>Wednesday 27</u>
Time	Track A	Track B	Track C
9.00	<u>Ad Hoc Wireless Networks I</u>	<u>Capacity of Wireless Networks</u>	<u>Signal Equalization and Channel Estimation</u>
9.15			
9.30			
9.45			
10.00			
10.15			
10.30	Coffee Break		
10.45			
11.00	<u>QoS in Wireless</u>	<u>QoS and Services in Mobile Internet</u>	<u>Modulation and Signal Synchronization</u>
11.15			
11.30			
11.45			
12.00			
12.15			
12.30	Lunch		
12.45			
13.00			
13.15			
13.30			
13.45			
14.00	<u>Energy Efficient Computation</u>	<u>Advanced Wireless System and Services</u>	<u>Space-Time Signal Processing for Wireless Systems</u>
14.15			
14.30			
14.45			
15.00			
15.15			
15.30	Coffee Break		

Exhibit 1016 indicates a 1 hour period (from 14:00-15:00 on “Thursday 28”) entitled “Space-Time Signal Processing for Wireless Systems.” See, green box above (added by Patent Owner). Page 6 of Exhibit 1016 has a section (reproduced below) with the same title, which makes mention of Dammann.

Space-Time Signal Processing for Wireless Systems

Chair: Sergio Barbarossa, University of Rome "La Sapienza", Italy

- On the equivalence of Space-Time Block Coding with Multipath Propagation and/or Cyclic Delay Diversity in OFDM

A. Dammann¹, P. Lusina², M. Bossert²,

¹ German Aerospace Center (DLR) - ² University of Ulm, Germany

- Enhancement of Hiperlan/2 System using Space-Time Coding

M. Gidlund

Royal Institute of Technology, Stockholm, Sweden

- Optimized Design and Performance of Multiple-Antenna 4th Generation WLANs for Partially Coherent Decoding

E. Baccarelli, M. Biagi, A. Fasano

Università di Roma 1, Italy

- Space-time UMTS uplink system for future generation mobile radio communication system

S.L. Ling, M.F. Siyau, R.F. Ormondroyd

Cranfield University, RMCS, Swindon, UK

- Reflections on Smart Antennas for MAC Protocols in Multihop Ad Hoc Networks

H. Koubaa

LORIA INRIA, Vandoeuvre-Les-Nancy, France

B. Exhibits 1014-1016 Fail To Demonstrate That Dammann Was A Printed Publication Under Pre-AIA Section 102(b)

In order to demonstrate that Dammann was a printed publication under Section 102(b), the Petition needed to show that the reference was sufficiently accessible to the public interested in the art; dissemination and public accessibility are the keys to the legal determination of whether the prior art reference was published. *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989); see also *In re Hall*, 781 F.2d 897, 899 (Fed. Cir. 1986) ; *SRI v. Internet Security Systems*, 511 F.3d 1186, 1197 (Fed. Cir. 2008); see *Synopsys, Inc. v. Mentor Graphics Corp.*, IPR2014-00042, Paper No. 16 at 36, (PTAB Feb. 22, 2013) (finding no evidence as to the publication or public accessibility of the alleged prior art reference).

Exhibits 1014-1016 fail to demonstrate that Dammann was disseminated in any way before the effective filing date of the '439 Patent. While Exhibit 1015 refers to certain unnamed papers being “accepted” for “publication in the proceedings” -- there is no evidence that any of the “proceedings” were in fact published at the time of the conference. For example, Petitioner has failed to show that there was a physical publication that included “accepted” papers that was provided to conference participants. Nor has Petitioner shown that, at the time of the conference, there was a website from which conference participants (or members of the public) could access a copy of Dammann. Significantly, Exhibit 1016 (the only archived web page that even mentions Dammann) is dated November 23, 2004 -- which is two years after the conference, and after the priority date of the '439 Patent (May 20, 2004). See, Section VII(C) (demonstrating that the Challenged Claims are entitled to the benefit of the filing date of the provisional application dated May 20, 2004).

Furthermore, Exhibits 1014-1016 are archived pages from a website called “docenti.ing.unipi.it.” The Petition fails to explain what relationship existed -- if any -- between “docenti.ing.unipi.it” and the “Wireless Conference 2002.” Given the complete absence of information about the “docenti.ing.unipi.it” website, there is no evidence that a POSITA would have known to even look at “docenti.ing.unipi.it” for relevant information. See, *Blue Calypso v. Groupon*, 815 F.3d 1331, 1048 (Fed. Cir. 2016), citing, *Kyocera Wireless Corp. v. Int'l Trade Comm'n*, 545 F.3d 1340, 1350

(Fed. Cir. 2008) (a reference will be considered publicly accessible if it was “disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it”) (emphasis added); *SRI*, 511 F. 3d 1186 at 1197 (a finding that “an anonymous user skilled in the art” would not have been able to find a document militates against a finding of public accessibility); *In re Cronyn*, 890 F.2d 1158, 1160 (to qualify as a printed publication, a reference “must have been sufficiently accessible to the public interested in the art.”) Thus, even if Exhibit 1016 was dated before the priority date of the '439 Patent, it still would fail to demonstrate that Dammann met the standard for public accessibility required under Section 102(b) (Pre-AIA), because the Petition contains no evidence that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, could have located Dammann.

In *Blue Calypso*, Groupon asserted that the Ratsimor reference (a report co-authored by Ratsimor who, at that time, was a graduate student) was available via a hyperlink located on a personal webpage created by the graduate student before the critical date. In affirming a decision of the Board that the reference was not publicly available, the Federal Circuit stated:

In the present case, the Board found that Groupon had failed to carry its burden of establishing that an interested party exercising reasonable diligence would have located Ratsimor. We agree. ... Even if we assume that Ratsimor was available online on Dr. Ratsimor’s

personal page before the critical date, Groupon does not point to any evidence indicating that Ratsimor was viewed or downloaded. Further, in contrast to *Voter Verified*, the present case lacks any testimonial evidence that a person interested in e-commerce and peer-to-peer marketing would be independently aware of the web address for Dr. Ratsimor's personal page. In other words, there was no evidence that the ordinarily skilled artisan would know of Dr. Ratsimor's personal webpage or its web address. Instead, Groupon argues that an internet search engine would have been able to locate the report. But that argument does not allow us to automatically infer that Dr. Ratsimor's webpage was "indexed . . . (through search engines or otherwise)" and thus locatable by a search engine. . . . The record is devoid of any evidence that a query of a search engine before the critical date, using any combination of search words, would have led to Ratsimor appearing in the search results. *Blue Calypso v. Groupon*, 815 F.3d 1331, 1048-1049 (emphasis added, citations omitted).

As in *Groupon*, there is no evidence in this case that a person interested in wireless diversity would have been independently aware of the "docenti.ing.unipi.it" website.

Groupon also argued that the Ratsimor reference was publicly accessible because "an article that Dr. Ratsimor and several of the same co-authors published . . . would have directed interested researchers to [the] Ratsimor [reference]." *Id.* In rejecting that argument, the Court reasoned:

We have previously recognized that the presence of a "research aid" can also establish public accessibility. . . . For example, in *Bruckelmyer*, we concluded that the presence of an issued foreign patent put an interested researcher on notice of that patent's application. *Id.* ("[I]t does not matter whether the '119 application was catalogued or indexed in a meaningful way because the '119 patent was indexed and could serve as a research aid."). The Board acknowledged that the published article was publicly accessible and that it related to the same research presented in Ratsimor. The Board

nevertheless found the article insufficient because it did not include any citation to Ratsimor. Moreover, even if the published article would have led a reader to the UMBC Department website, there is no evidence that it would have led a reader to Dr. Ratsimor's personal website, which arguably housed the link to Ratsimor. For example, there is no evidence that UMBC Department's website provided a link to Dr. Ratsimor's webpage.

We agree with the Board. The published article does not provide a skilled artisan with a sufficiently definite roadmap leading to Ratsimor. An adequate roadmap need not give turn-by-turn directions, but should at least provide enough details from which we can determine that an interested party is reasonably certain to arrive at the destination: the potentially invalidating reference. ...

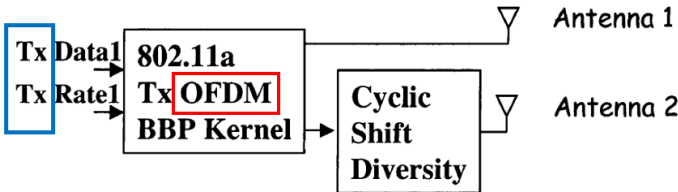
Id. (emphasis added, citations omitted). Again, as in *Groupon*, Petitioner has presented no evidence that would have led a POSITA to the “docenti.ing.unipi.it” website, or to a page on that website containing a link to Dammann.

In summary, Petitioner has failed to show that Dammann was disseminated in any way before the effective filing date of the '439 Patent. In addition, to the extent that a link to Dammann was available on the “docenti.ing.unipi.it” website, Petitioner failed to present evidence that a person interested in wireless diversity would have been aware of the web address for “docenti.ing.unipi.it,” or known to look there for relevant information.

C. The Challenged Claims Are Supported By The Provisional Application Filed May 20, 2004

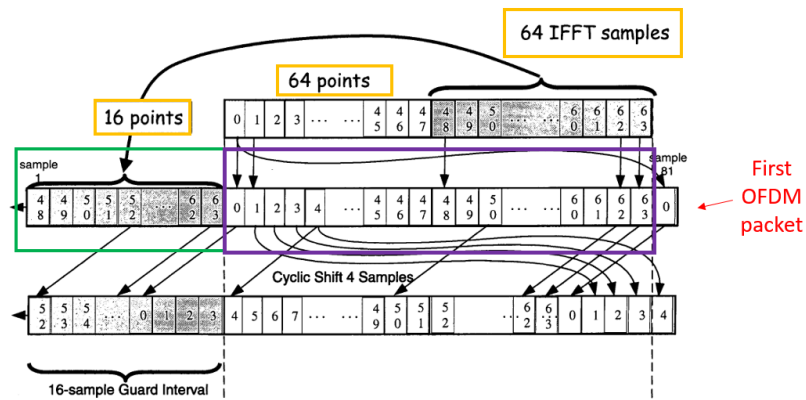
Even if Petitioner had been able to demonstrate that a person interested in wireless diversity would have been aware of the “docenti.ing.unipi.it” website or known to look there for relevant information, the Petition would have still failed to

demonstrate that Dammann was prior art. As mentioned above, the only exhibit even mentioning Dammann (Ex. 1016) bears an archive date of November 23, 2004. -- which is after the effective filing date of the Challenged Claims on May 20, 2004. See, Section VI(A)(3), *supra*. As detailed in the color-coded claim charts below, all of the challenged claims of the '439 Patent are supported by U.S. Provisional Application No. 60/572,481, filed on May 20, 2004. Ex. 2001, ¶99 (mapping the Challenged Claims to the disclosure from the Provisional Application (Ex. 2008)).

Claim Element	Support in Provisional Application
1. A method for transmitting orthogonal frequency division multiplexing (OFDM) signals comprising:	Two Antenna Tx Diversity • BBP: Baseband Processor • The radio would like to transmit the signal using two antennas • However, the two signals can destructive collide at the receive • The trick to avoid this is to use cyclic shift diversity on the 2nd antenna – Each OFDM symbol is cyclically shifted  Ex. 2010, Provisional App., at Slide 4.

generating a **first OFDM packet** for transmission including a **guard interval** portion and a **symbol data portion** each comprised of a plurality of samples;

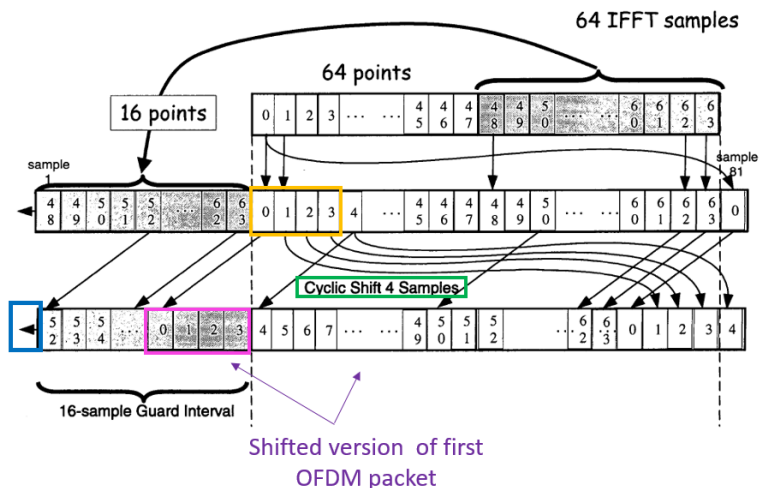
Example of Cyclic Advance Diversity: 4-sample CAD



Ex. 2010, Provisional App., at Slide 8.

cyclically advancing the first OFDM packet by **shifting** the samples in a first direction an amount less than a sample duration of the guard interval portion to generate a shifted version of the first OFDM packet for transmission in which at least a **non-zero number** of the samples from the symbol data portion of the first OFDM packet are **shifted into** the guard interval portion of the shifted version

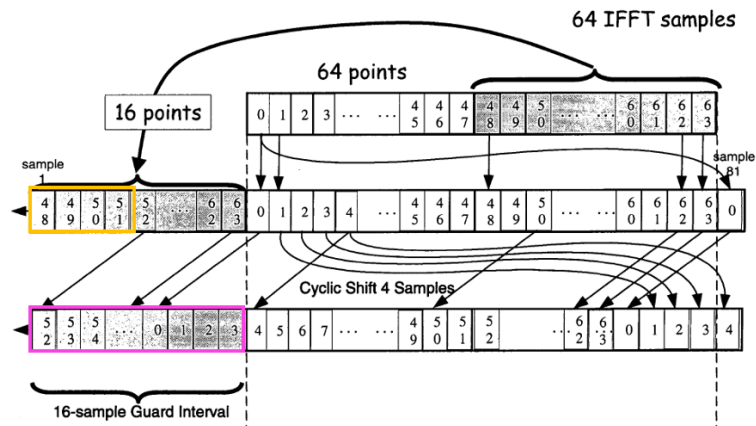
Example of Cyclic Advance Diversity: 4-sample CAD



Ex. 2010, Provisional App., at Slide 8.

and a same non-zero number of samples from the guard interval portion of the first OFDM packet are shifted out of the guard interval portion of the shifted version; and

Example of Cyclic Advance Diversity: 4-sample CAD

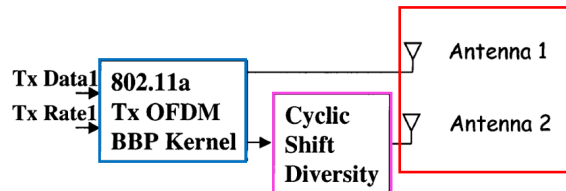


Ex. 2010, Provisional App., at Slide 8.

substantially simultaneously transmitting the first OFDM packet and the shifted version of the OFDM packet.

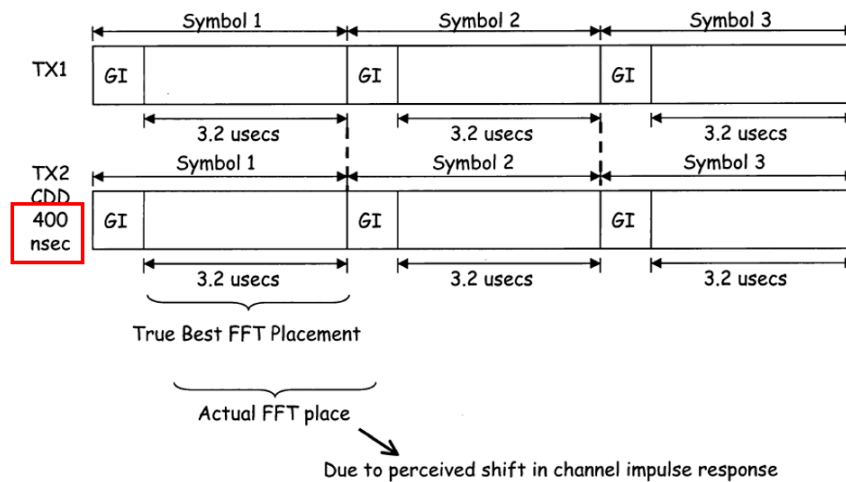
Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructively collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted



Ex. 2010, Provisional App., at Slide 4.

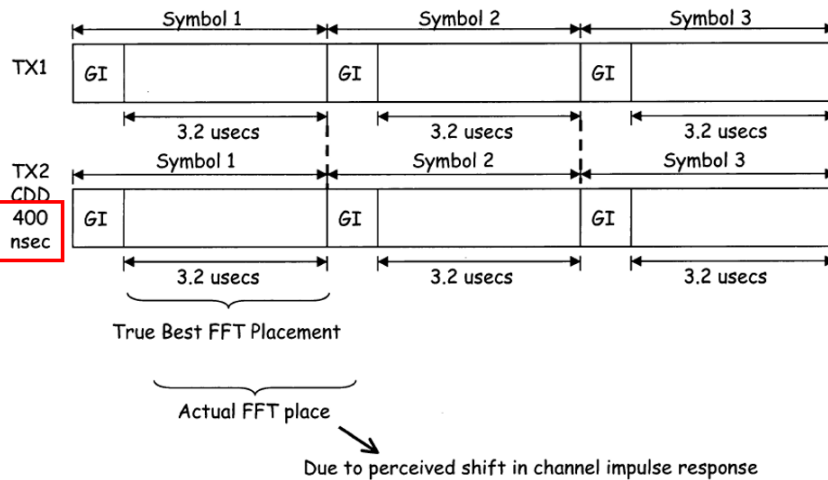
Legacy Radios and Cyclic Shift Diversity



Ex. 2010, Provisional App., at Slide 11.

2. The method of claim 1, further comprising cyclically advancing the OFDM packet for a duration of less than approximately 800 nanoseconds.

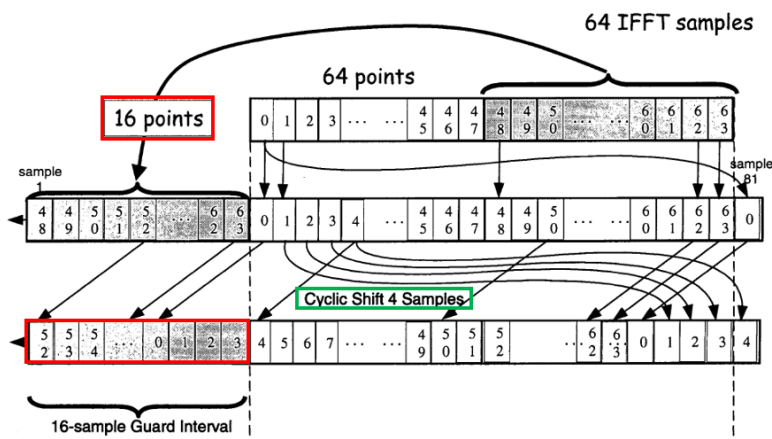
Legacy Radios and Cyclic Shift Diversity



Ex. 2010, Provisional App., at Slide 11.

3. The method of claim 1, further comprising cyclically advancing the OFDM packet for a duration of less than one half of the sample duration of the guard interval portion.

Example of Cyclic Advance Diversity: 4-sample CAD

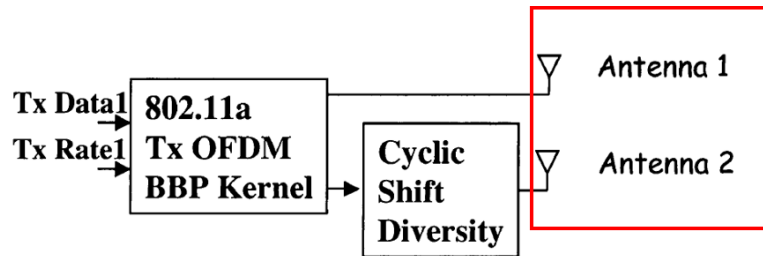


Ex. 2010, Provisional App., at Slide 8.

7. The method of claim 1, further comprising transmitting the first OFDM packet and the shifted version of the OFDM packet from a multiple-antenna transmitter device.

Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructive collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted

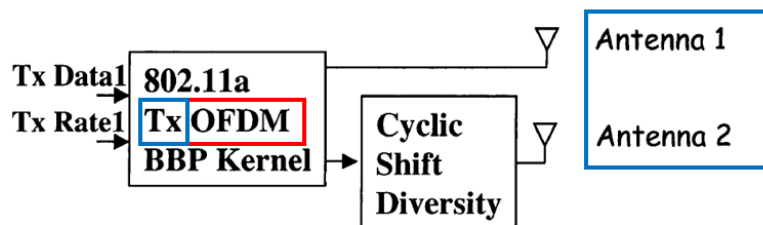


Ex. 2010, Provisional App., at Slide 4.

8. A signal transmitting system for transmitting orthogonal frequency division multiplexing (OFDM) signals comprising:

Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructive collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted

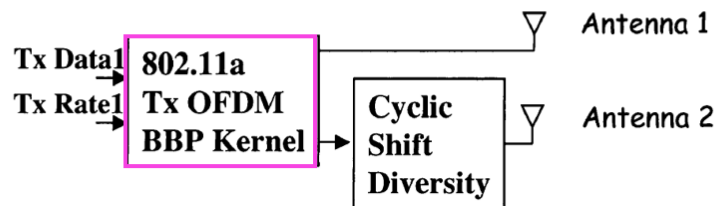


Ex. 2010, Provisional App., at Slide 4.

a first transmit processor for generating a first OFDM packet for transmission including a guard interval portion and a symbol data portion each comprised of a plurality of samples;

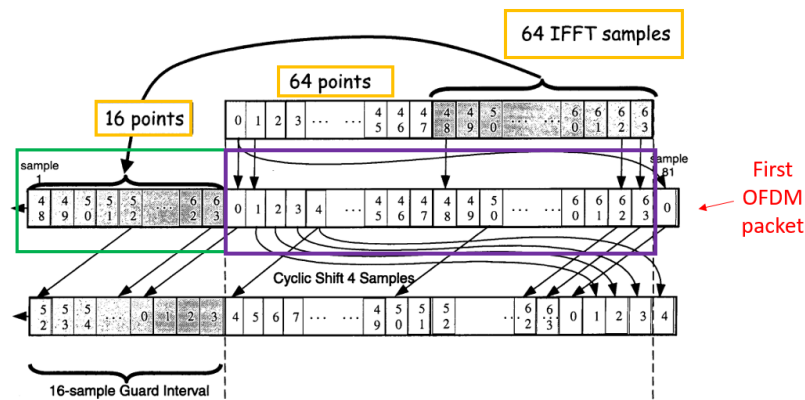
Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructively collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted



Ex. 2010, Provisional App., at Slide 4.

Example of Cyclic Advance Diversity: 4-sample CAD

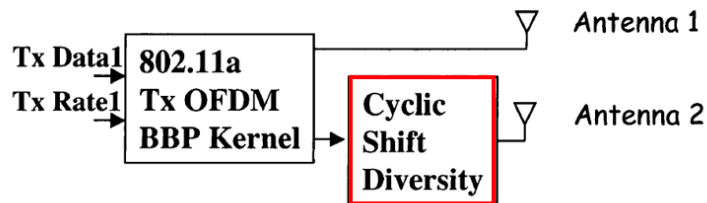


Ex. 2010, Provisional App., at Slide 8.

a second transmit processor for cyclically advancing the first OFDM packet by shifting the samples in a first direction an amount less than a sample duration of the guard interval portion to generate a shifted version of the first OFDM packet for transmission in which at least a non-zero number of the samples from the symbol data portion of the first OFDM packet are shifted into the guard interval portion of the shifted version and

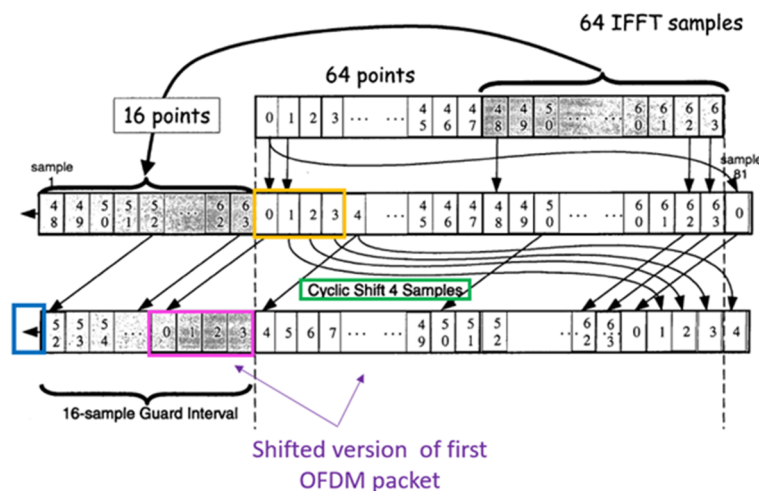
Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructively collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenn
 - Each OFDM symbol is cyclically shifted



Ex. 2010, Provisional App., at Slide 4.

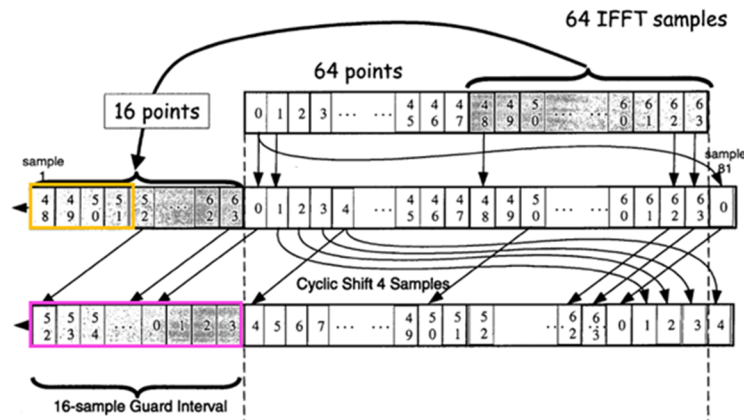
Example of Cyclic Advance Diversity: 4-sample CAD



Ex. 2010, Provisional App., at Slide 8.

a same non-zero number of samples from the guard interval portion of the first OFDM packet are shifted out of the guard interval portion of the shifted version;

Example of Cyclic Advance Diversity: 4-sample CAD

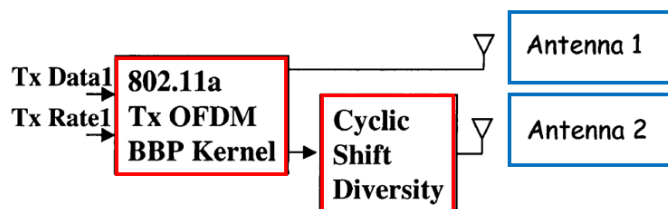


Ex. 2010, Provisional App., at Slide 8.

a plurality of radio transmitters for converting the OFDM packet and the shifted version of the OFDM packet to corresponding radio signals; and a plurality of radio antennas correspondingly coupled to the plurality of radio transmitters for transmitting the radio signals;

Two Antenna Tx-Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructive collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted

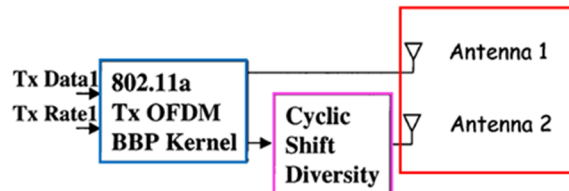


Ex. 2010, Provisional App., at Slide 4.

wherein the first transmit processor and the second transmit processor are configured to substantially simultaneously cause the transmission of the first OFDM packet and the shifted version of the OFDM packet via corresponding transmitters and antennas.

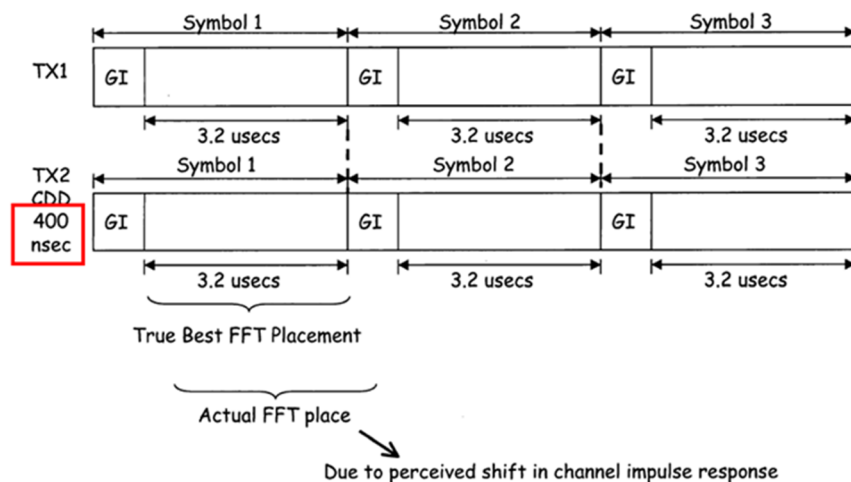
Two Antenna Tx-Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructively collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted

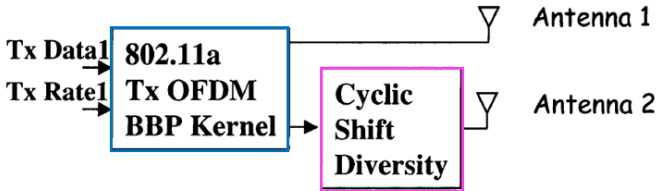


Ex. 2010, Provisional App., at Slide 4.

Legacy Radios and Cyclic Shift Diversity



Ex. 2010, Provisional App., at Slide 11.

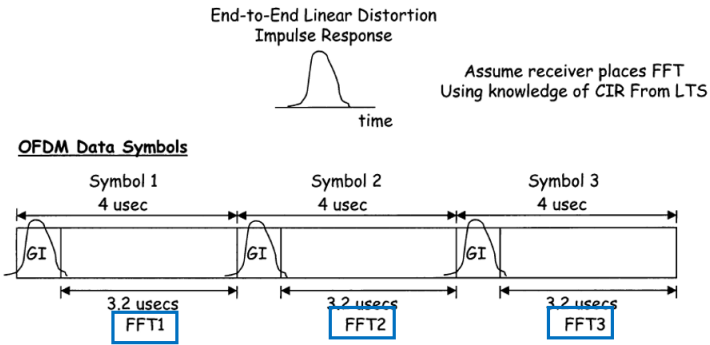
9. The system of claim 8, wherein each of the first and second transmit processors includes a cyclic extension module for performing cyclical advancements.	Two Antenna Tx Diversity • BBP: Baseband Processor • The radio would like to transmit the signal using two antennas • However, the two signals can destructive collide at the receive • The trick to avoid this is to use cyclic shift diversity on the 2nd antenna – Each OFDM symbol is cyclically shifted  Ex. 2010, Provisional App., at Slide 4.
10. The system of claim 9, wherein each of the cyclic extension modules is configured to cyclically advance the OFDM packet for a duration of less than one half of sample duration of the guard interval.	See, Claim 3.

13. The system of claim 8, wherein each of the plurality of transmit processors further includes an Inverse Fast Fourier (IFFT) module for generating OFDM symbols from incoming data.

Legacy Radios and Optimal FFT Placement



- Optimal FFT placement minimizes intersymbol interference
 - Decay transient from previous symbol
 - Start-up transient due to next symbol

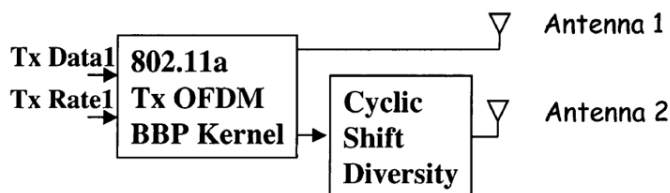


Ex. 2010, Provisional App., at Slide 5.

14. The system of claim 8, wherein the first and second transmit processors perform the cyclical advancements on baseband signals.

Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructive collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted

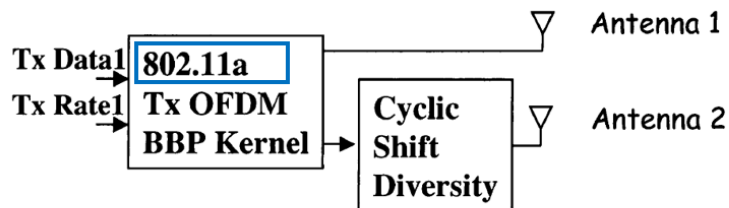


Ex. 2010, Provisional App., at Slide 4.

16. The system of claim 8, wherein the transmitter is an 802.11 compliant device.

Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructive collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted

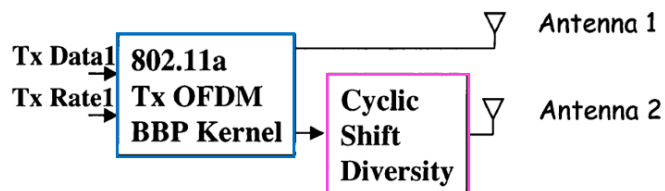


Ex. 2010, Provisional App., at Slide 4.

18. The system of claim 8, wherein the first and second transmit processors include firmware stored in a memory device and executed by a suitable instruction execution system.

Two Antenna Tx Diversity

- BBP: Baseband Processor
- The radio would like to transmit the signal using two antennas
- However, the two signals can destructive collide at the receive
- The trick to avoid this is to use cyclic shift diversity on the 2nd antenna
 - Each OFDM symbol is cyclically shifted



Ex. 2010, Provisional App., at Slide 4.

VIII. SUMMARY OF ARGUMENTS ON THE MERITS

With respect to Ground 1, for the reasons explained above, the Petition has failed to demonstrate a reasonable likelihood of success of establishing that independent claims 1 and 8 are unpatentable. With respect to the other claims challenged in Ground 1 (i.e., dependent claims 3, 7, 9-10, 13-14 and 16), the Petition has failed to demonstrate a reasonable likelihood of success of establishing the unpatentability of these dependent claims, because the Petition has failed to demonstrate a reasonable likelihood of success of establishing that the independent claims (i.e., claims 1 and 8) from which these dependent claims depend are unpatentable. Similarly, with respect to Ground 2, the Petition has failed to demonstrate a reasonable likelihood of success of establishing the unpatentability of dependent claims 2, 11, 15 and 18, because the Petition has failed to demonstrate a reasonable likelihood of success of establishing that the independent claims (i.e., claims 1 and 8) from which these dependent claims depend are unpatentable.

IX. INSTITUTION SHOULD BE DENIED UNDER THE *FINTIV* FACTORS

On August 3, 2023, Petitioner was served with a Complaint filed by Patent Owner alleging infringement of the '439 Patent in *Intellectual Ventures I LLC et al v. Lenovo Group Ltd.*, WDTX-6-23-cv-00307 (the “Parallel Litigation.”) Ex. 2007. Petitioner waited until August 2, 2024 -- a single day shy of the 1-year deadline -- to file the present IPR. As a result, the Parallel Litigation has already reached an advanced stage, with the Court denying Petitioner’s Motion To Transfer on May 21, 2024 (Ex. 2007), and issuing a Claim Construction Order on May 28, 2024. Ex. 2005. Fact discovery closed on November 5, 2024, and the parties served Opening Expert Reports on November 12, 2024. Ex. 2008. By the anticipated date of the Institution Decision in this matter (February 19, 2025), expert discovery will be closed (December 31, 2024), and the parties will be about 8 weeks away from Trial, which is scheduled for April 8, 2025. Ex. 2008. Thus, the Trial is scheduled to occur more than 10 months before the statutory deadline for issuing a Final Written Decision in this matter on February 19, 2026.

The precedential order in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (“*Fintiv*”) identifies six factors for the Board to consider in deciding whether to exercise discretion to deny institution based on parallel proceedings involving the same patent. As discussed below, application of the

present facts to these factors demonstrates that there are strong reasons for exercising discretion to deny institution here.

A. Factor 1 Weighs Against Institution Because A Stay Has Not Been Granted In The Parallel Litigation And There Is No Evidence That A Stay Would Be Granted If This IPR Was Instituted

No stay has even been requested in the Parallel Litigation. In addition, even if this IPR was instituted (which would not occur until on or around February 19, 2025) it is unlikely that the Court (Judge Albright) would grant a stay, particularly given the very advanced stage that the Parallel Litigation will be in at that point and the proximity to the trial date on April 8, 2025. *See, generally, Continental Intermodal Grp. v. Sand Revolution LLC*, No. 7:18-cv-00147 (W.D. Tex. July 22, 2020) (Judge Albright) *Multimedia Content Mgmt. LLC v. Dish Network*, No. 6:18-CV-00207-ADA, 2019 U.S. Dist. LEXIS (W.D. Tex. May 30, 2018) (Judge Albright) (denying stay).

Thus, the first factor weighs against institution.

B. Factor 2 Weighs Against Institution Because The Parallel Litigation Has A Trial Date Scheduled Well Before The Projected Statutory Deadline For The Board's Final Written Decision

As noted above, the trial is scheduled in the Parallel Litigation for April 8, 2025 (Ex. 2008), *more than 10 months before the statutory deadline for issuing a Final Written Decision* in this matter on February 19, 2026.

Looking at the median time from filing to case disposition statistics yields a similar result. The median time from filing to case disposition in the Western District of Texas (where the Parallel Litigation is pending) is 28.3 months (Ex. 1013, 27). Given that the Parallel Litigation was filed on April 26, 2023 (Ex. 2007), the 28.3 month median time to disposition indicates a disposition of the Parallel Litigation by the beginning of September, 2025 -- about six months before the statutory deadline for issuing a Final Written Decision in this matter on February 19, 2026.

Thus, the second factor weighs against institution.

C. Factor 3 weighs against institution because the parties will have invested significant effort in the Parallel Litigation by the time the Board's institution decision is due.

Factor 3 relates to investment in the Parallel Litigation by the court and the parties. *Fintiv*, Paper 11 at 9. This factor is judged from the date of the institution decision, which is expected to be no later than February 19, 2025. *Id.*

In the Parallel Litigation, the Court denied Petitioner's Motion To Transfer on May 21, 2024 (Ex. 2007), and issued a Claim Construction Order on May 28, 2024. Ex. 2005. Fact discovery closed on November 5, 2024, and the parties served Opening Expert Reports on November 12, 2024. Ex. 2008. By the anticipated date of the Institution Decision in this matter (February 19, 2025), expert discovery will be closed (December 31, 2024), and the parties will be about 8 weeks away from Trial, which is scheduled for April 8, 2025. Ex. 2008.

The parties and the Court have made a substantial investment in the Parallel Litigation, which will grow even larger by the expected date of the institution decision on February 19, 2025.

Below is an abbreviated version of the Scheduling Order (Ex. 2008) issued in the Parallel Litigation. Patent Owner has added the red text to illustrate the extent to which the schedule will have been completed by the expected date of the institution decision:

<u>Deadline</u>	<u>Item</u>
10/24/23	Deadline for Plaintiff to serve preliminary infringement contentions.
11/14/23	Parties shall file a motion to enter an agreed Scheduling Order.
11/21/23	Deadline to file a motion for inter-district transfer.
1/5/24	Deadline for Defendant to serve preliminary invalidity contentions.
1/15/24	Parties exchange claim terms for construction.
1/19/24	Parties exchange proposed claim constructions.
1/23/24	Parties disclose extrinsic evidence.
1/30/24	Deadline to meet and confer to narrow terms in dispute and exchange revised list of terms/constructions.
2/6/24	Defendant files Opening claim construction brief.
2/27/24	Plaintiff files Responsive claim construction brief.
3/12/24	Defendant files Reply claim construction brief.
3/26/24	Plaintiff files a Sur-Reply claim construction brief.
3/29/24	Parties submit Joint Claim Construction Statement.
4/2/24	Parties submit optional technical tutorials.
4/9/24	<i>Markman</i> Hearing
4/10/24	Fact Discovery opens
5/21/24	Deadline to add parties.
6/4/24	Deadline to serve Final Infringement and Invalidity Contentions.
7/30/24	Deadline to amend pleadings.
10/8/24	Deadline for the first meet and confer to discuss narrowing the number of claims asserted and prior art references at issue.
11/5/24	Close of Fact Discovery.
11/12/24	Opening Expert Reports.

12/10/24	Rebuttal Expert Reports.
12/31/24	Close of Expert Discovery
1/7/25	Deadline for the second meet and confer to discuss narrowing the number of claims asserted and prior art references at issue.
1/14/25	Dispositive motion deadline and <i>Daubert</i> motion deadline.
1/28/25	Serve Pretrial Disclosures.
1/11/25	Serve objections to pretrial disclosures/rebuttal disclosures.
1/18/25	Serve objections to rebuttal disclosures; file Motions <i>in limine</i> .
February 19, 2025 -- Deadline for Institution Decision	
2/25/25	File Joint Pretrial Order and oppositions to motions <i>in limine</i>
3/4/25	Deadline to file replies to motions <i>in limine</i> .
3/11/25	Meet and confer regarding objections/disputes on motions <i>in limine</i> .
3/15/25	File notice identifying objections/disputes on motions <i>in limine</i> .
3/18/25	Final Pretrial Conference.
4/8/25	Jury Selection / Trial.

As illustrated above, more of the Parallel Litigation will lie behind than ahead at the time of the institution decision.

Thus, the third factor weighs against institution.

D. Factor 4 weighs against institution because there is substantial overlap between the Parallel Litigation and this IPR

In Invalidity Contentions in the Parallel Litigation, Petitioner relies not only on Dammann, Hervin and Kannan, and other references such as Larsson that are cumulative thereof. *See*, Ex. 2009, at 10-11 and 18-23. Rather than offer a full *Sotera*⁷ stipulation that would have barred Petitioner from pursuing any ground

⁷ *Sotera Wireless, Inc. v. Masimo Corporation*, IPR2020-01019, Paper 12, at 18-19 (P.T.A.B. December 1, 2020)(stipulating "that, if IPR is instituted, [Petitioner] will not pursue in the District Court Litigation any ground raised or that could have been reasonably raised in an IPR.")

raised *or that could have been reasonably raised in this IPR*" if this IPR is instituted, Petitioners offered a much more limited *Sand*⁸ stipulation stating that, if this IPR is instituted "Petitioners will not pursue in the Texas Litigation *the same grounds* asserted in the Petition." Pet., at 74. Under the present facts, this stipulation is so narrow as to be meaningless. To gain two bites at the apple, Petitioners have laid the groundwork to advance cumulative prior art and virtually identical arguments in the Parallel Proceedings as advanced in these proceedings, by rearranging the combinations to technically get around the narrow *Sand* stipulation. See, e.g., Ex. 2009, at 10 (identifying, *inter alia*, Dammann, Hervin, Kannan and Larsson), and at 20 ("the references identified above render one or more Asserted Claims obvious when the references are read in combination with each other.") Thus, the *Sand* stipulation will permit Petitioners to advance a combination cumulative to the Grounds asserted herein by simply substituting Larsson's teaching of a small cyclic delay for that in Dammann, and otherwise making the same arguments in the district court advanced herein based on Hervin and Kannan.

Because the *Sand* stipulation will essentially allow Petitioners to advance substantially the arguments made here in the district court, the stipulation does little to mitigate the duplication of efforts that will occur in the PTAB and the district

⁸ *Sand Revolution II, LLC v. Continental Intermodal Group—Trucking LLC*, IPR2019-01393, Paper 24 at 11-12 (P.T.A.B. June 16, 2020).

court should this IPR be instituted. While the Board in *Sand* found such a limited stipulation carried only "marginal" weight, the stipulation should carry even less weight here given Petitioner's plan to advance rearranged versions of the same prior art combinations in the district court. *Sand Revolution*, IPR2019-01393, Paper 24 at 11. Because the limited *Sand* stipulation offered by Petitioners does not mitigate the potential for significant overlap between this IPR and the Parallel Litigation, there are particularly strong “concerns of inefficiency and the possibility of conflicting decision” if this IPR is instituted. *Fintiv*, Paper 11 at 12.

Thus, the fourth factor weighs against institution.

E. Factor 5 weighs against institution because the patent owner is the same and the Petitioner are the same parties as in the Parallel Litigation

Patent Owner and Petitioner are the same parties as in the Parallel Litigation.

Thus, the fifth factor weighs against institution.

F. Factor 6 weighs against institution because there are no other circumstances that favor institution, and the merits of Petitioner’s challenge is weak

As discussed above, Petitioner’s challenge is weak. Petitioner erroneously relies on teachings in the detailed description of the '439 patent (rather than prior art) in its arguments, and attempts to support its case for obviousness with an unsupported, conclusory assertion that cyclic advancement would provide “additional” diversity as compared to cyclic delay. The Petition also fails to

demonstrate that “implementing cyclic shift diversity” was a problem in search of a solution, or that the results of the claimed cyclic advancement techniques were predictable. Petitioner does not dispute that the claimed cyclic advances have unexpected advantages over the small cyclic delays in the prior art, and fails to address -- let alone rebut -- the experimental results evidencing such advantages included in the '439 Patent specification. Accordingly, the Petition not only fails to meet the “reasonable likelihood” standard under 35 U.S.C. § 314(a) but fails to meet the higher “compelling merits” standard under Factor 6. *See, CommScope Technologies LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 23 at 4-5 (P.T.A.B. Feb. 27, 2023) (precedential).

Thus, the sixth factor weighs against institution.

All *Fintiv* factors weigh against institution of the IPR. Under §314(a) and, based on the totality of the *Fintiv* factors, institution should be denied.

X. CONCLUSION

For the above reasons, Patent Owner respectfully requests that the Board deny institution of the Petition.

Respectfully submitted,

Dated: November 18, 2024

By: /Daniel H. Golub/
Daniel H. Golub
Registration No. 33,701
Counsel for Patent Owner
Intellectual Ventures I LLC

CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this Patent Owner Preliminary Response complies with the type-volume limits of 37 C.F.R. § 42.24(b)(1) because it contains 13,954 words, excluding the parts of this Patent Owner's Preliminary Response that are exempted by 37 C.F.R. § 42.24(a), according to the word processing system used to prepare this Patent Owner's Preliminary Response.

Respectfully submitted,

Dated: November 18, 2024

By: /Daniel H. Golub/
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Registration No. 33,701
Counsel for Patent Owner
Intellectual Ventures I LLC

CERTIFICATE OF SERVICE

The undersigned certifies that pursuant to 37 C.F.R. § 42.6(e), a copy of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE** was served via email (as consented to by counsel) on November 18, 2024 to lead and backup counsel of record for Petitioners as follows:

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