

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TCL ELECTRONICS HOLDINGS LTD. and TCL INDUSTRIES HOLDINGS
CO., LTD.,

Petitioners,

v.

INTELLECTUAL VENTURES I, LLC,

Patent Owner.

Case No. IPR2024-01244

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	Armin Dammann and Stefan Kaiser, “Standard conformable antenna diversity techniques for OFDM and its application to the DVB-T system,” Accepted for Publication in Proceedings IEEE Global Telecommunications Conference (GLOBECOM 2001), San Antonio, Texas, USA, November 2001 (Dammann)
Ex. 2004	Docket from Parallel Litigation, Case No. 6:23-cv-00307 (WD Tex.)
Ex. 2005	Claim Construction Order and Memorandum dated September 10, 2024 in Case No. 6:23-cv-00309 (WD Tex.), Document 44
Ex. 2006	Scheduling Order dated March 5, 2024 in Case No. 6:23-cv-00309 (WD Tex.), Document 26
Ex. 2007	United States District Courts — National Judicial Caseload Profile, Dec. 2023 Edition
Ex. 2008	Defendants’ Final Invalidity Contentions in in Case No. 6:23-cv-00309 (WD Tex.), Dated September 23, 2024
Ex. 2009	Provisional Application

I. INTRODUCTION

The Petition (Paper #1) challenges claims 1-21 (“Challenged Claims”) of U.S. Patent No. 7,623,439 (“’439 Patent”) under two statutory grounds. Pet., at 3.

The Petition does not dispute that the small cyclic advance recited in the Challenged Claims (as shown, e.g., in Figure 8 of the ’439 Patent below) is different from the small cyclic delay that was identified as prior art in Figure 5 of the ’439 Patent (below):

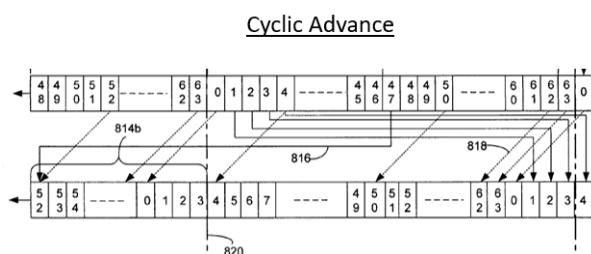


FIG. 8

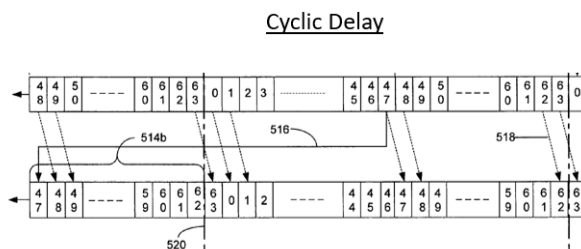


FIG. 5 (PRIOR ART)

In the claimed advance, a small number of sample(s) are cyclically advanced in time, whereas in the prior art, a small number of sample(s) are cyclically delayed in time.

The merits of the Petition are severely flawed because neither Larsson nor Bauch discloses the small cyclic advance recited in the Challenged Claims. Larsson and Bauch are singularly directed to small cyclic delays, and the passages in those references where “samples from the beginning of the OFDM symbol are shifted into the end of the symbol” (Ex. 1005, 9:41-47 (Larsson)) or a “means 522 for introducing the delay” is “operative to perform a right-shift” (Ex. 1007, 22:30-23:1 (Bauch)) disclose alternate ways to implement the small cyclic delays that are the focus of those references -- rather than the small cyclic advance that is the subject

of the '439 patent. The small cyclic delay disclosed in Larsson was thoroughly vetted during prosecution, and Bauch's small cyclic delay is cumulative of that shown in Larsson which was overcome during prosecution.

The testing data in the '439 Patent, showing a dramatically reduced packet error rate for the claimed small cyclic advance as compared to the prior art small cyclic delay, stands uncontradicted. See, e.g., Ex 1001, FIG. 9. The Petition offers no data to the contrary. Instead, the Petition attempts to divert attention by faulting the experimental data for failing to compare the claimed small cyclic advances with large cyclic delays. Pet., at 71-72. However, in contrast to the small cyclic delay labeled as "Prior Art" in FIG. 5 of the '439 Patent, a large cyclic delay has not been shown to have existed in the prior art. The purpose of FIG. 9 was to demonstrate that the small cyclic advance recited in the Challenged Claims performed better than the known prior art, i.e., a small cyclic delay. Those performance advantages have been demonstrated and stand uncontradicted.

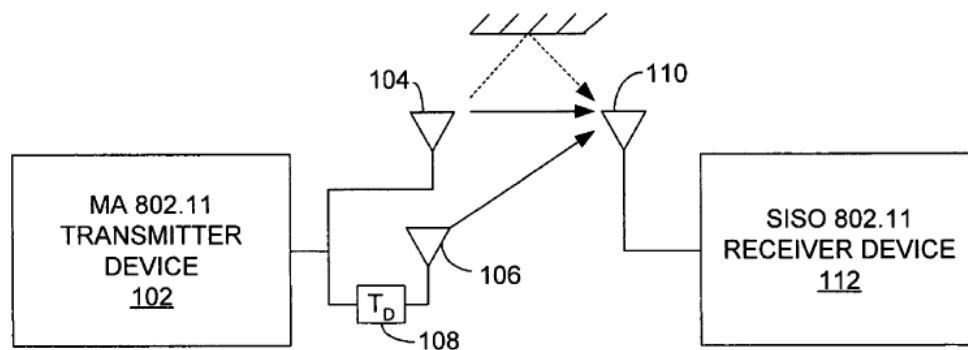
On the issue of discretionary denial, the Petition should be denied because parallel district court litigation has already reached an advanced stage, with a trial scheduled to occur long before any Final Written Decision would be issued in these proceedings. Based on these facts, and as explained more 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, ¶26. Figure 1 illustrates a mixed environment where an OFDM transmitter with multiple antennas is used with a SISO legacy receiver:

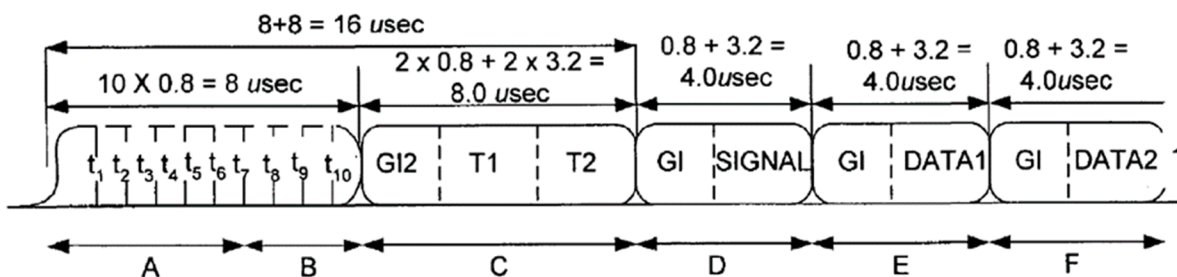


The multiple antenna (MA) transmitter device 102 includes antennas 104 and 106, while the SISO receiver device 112 includes only a single antenna 110. *Id.*, 1:38-42.

“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, ¶27.

2. Existing OFDM Packet and Symbol Structures

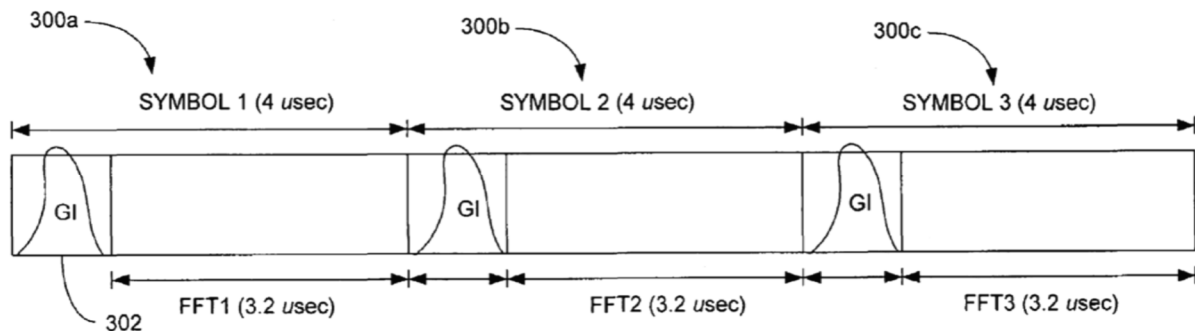
Figure 2 of the '439 Patent depicts an OFDM packet structure used for the transmission of information between MA transmitter device 102 and SISO receiver device 112. *Id.*, 1:57-60.



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, ¶29.

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, ¶31.

In the 802.11 implementation depicted in Figure 3A, each OFDM symbol is approximately 4 μ sec 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, ¶32. 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 (μ sec) interval of each OFDM symbol 300. That is, the SISO receiver device 112 discards the 0.8 μ sec duration guard interval 302 on each received 4 μ sec OFDM symbol, leaving 3.2 μ sec of signal (which comprises all of the information of the OFDM symbol) to FFT. No echoes are included in the 3.2 μ sec 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 μ sec from each 4 μ sec 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 exhibit 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, ¶33. 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, ¶34.

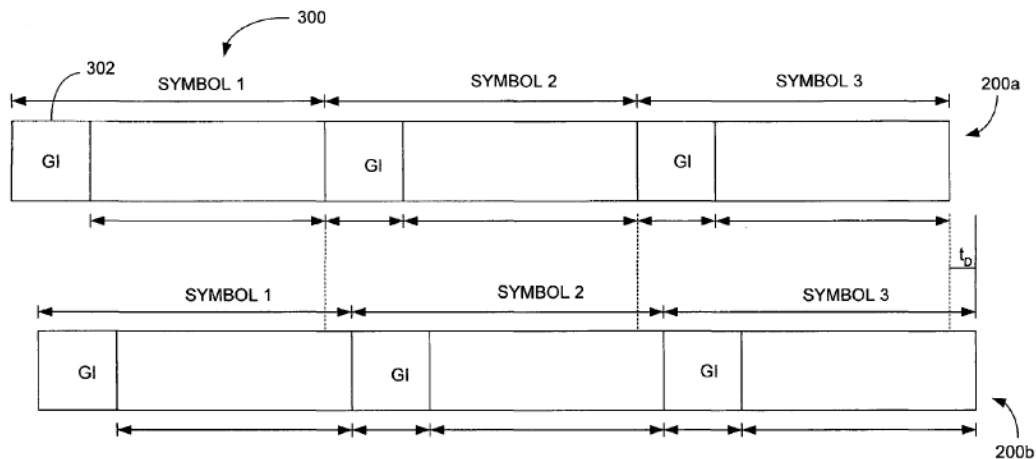


FIG. 4A (PRIOR ART)

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, ¶35.

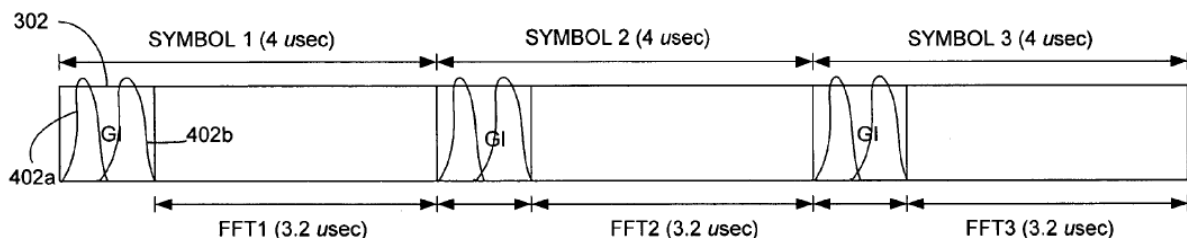


FIG. 4B (PRIOR ART)

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, ¶36. “With the time delay (t_D) (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, ¶36.

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, ¶37. Figure 5 of the '439 Patent illustrates this prior technique, which employed a small cyclic delay, i.e., a delay of 1 sample:

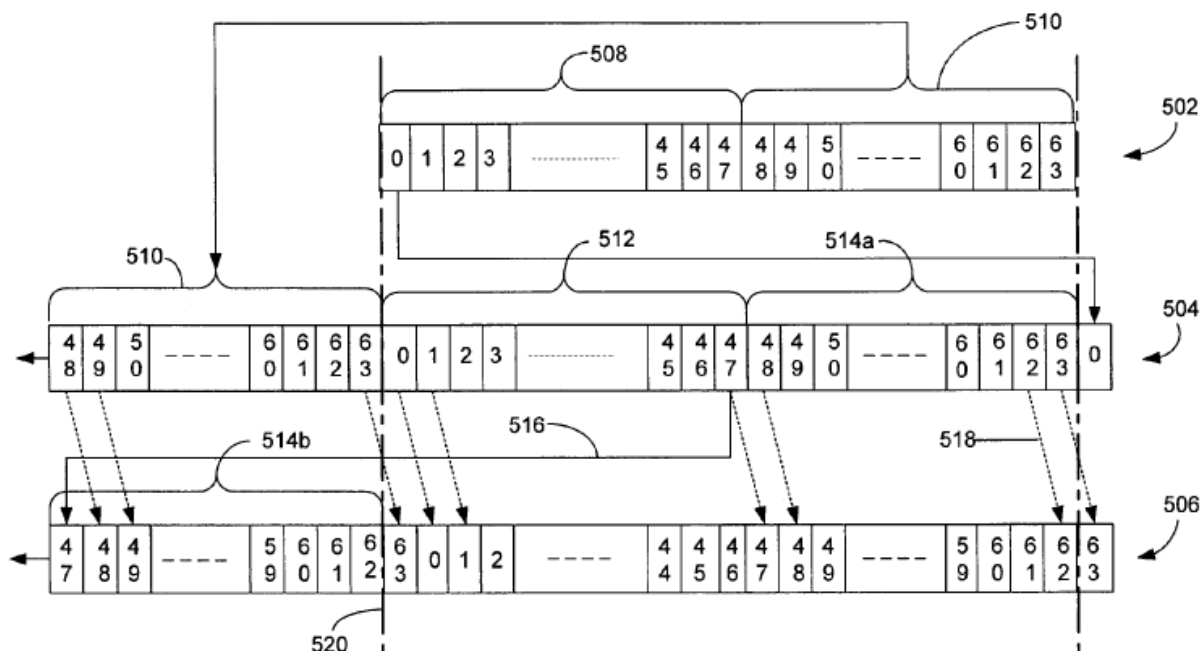


FIG. 5 (PRIOR ART)

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, ¶38. "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, ¶38. 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, ¶38.

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, ¶39.

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).

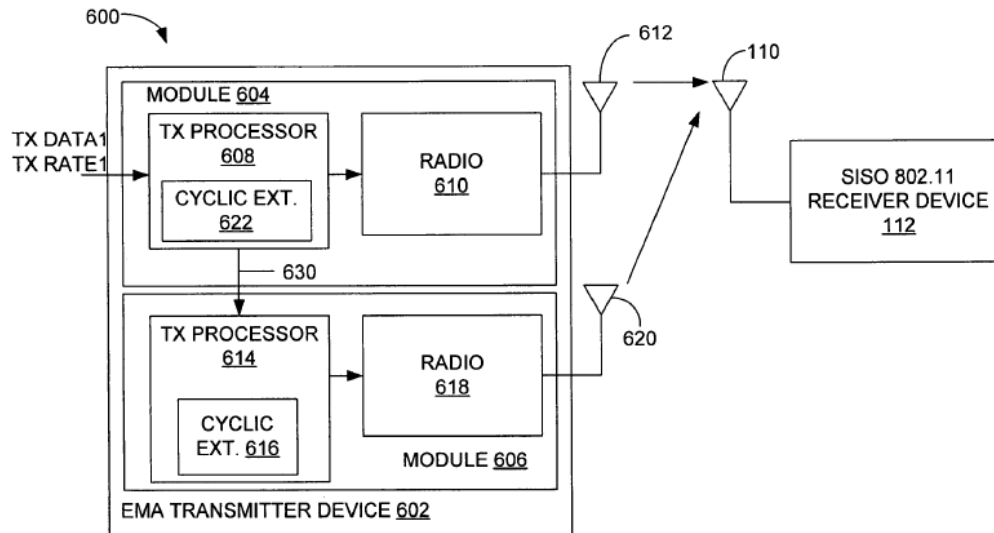
Not surprisingly, and as explained later in the '439 Patent, small cyclic delays resulted in a relatively high packet error rate. *Id.*, 8:24-41 and Fig. 9; Ex. 2001, ¶41.

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, ¶42. In particular, the

claimed cyclic advance has a duration that is less than the duration of the guard interval.¹ See, e.g., claim 1 (“... 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 ... in which ... samples from the symbol data portion of the first OFDM packet are shifted into the guard interval ...”); Ex. 2001, ¶42. 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, ¶42. 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):

¹ The Petition states that “the shift's magnitude is irrelevant here.” Pet., at 6, note 4 (emphasis). To the extent the Petition is suggesting that the magnitude of the claimed cyclic advance is irrelevant to these proceedings, it could not be more wrong. An important aspect of the Challenged Claims is the recitation requiring that the cyclic advance have a “magnitude” that is less than the duration of the guard interval -- a feature which Patent Owner refers to elsewhere in this response as a small cyclic advance. Ex. 2001, ¶42.



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, ¶43. 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, ¶43. “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, ¶43.

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

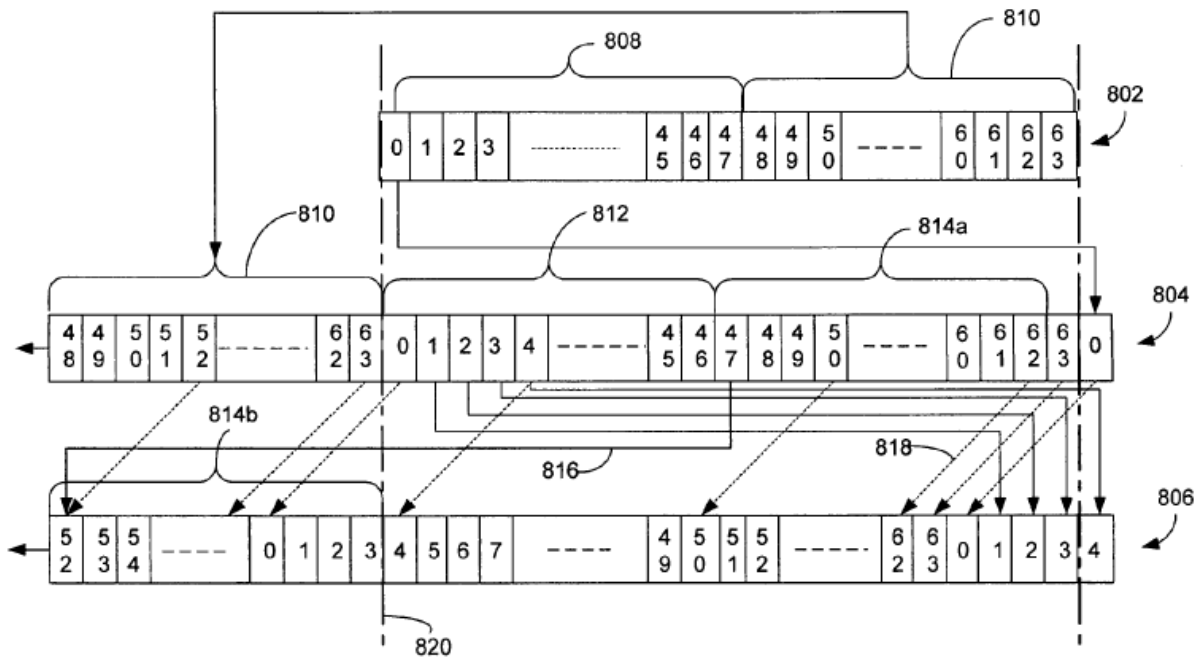


FIG. 8

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, ¶45.

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, ¶46. 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 demonstrating that a small cyclic advance of 2, 3 or 4 samples had a dramatically reduced packet error rate when compared to small cyclic delays of 1 or 2 symbols. *Id.*, 8:34-49; Ex. 2001, ¶47. In Figure 9 (reproduced below), the lines labeled “-1” and “-2” in the legend (red box - added by Patent Owner) correspond to 1 and 2 symbol cyclic delays, respectively; and the lines labeled “2”, “3” and “4” correspond to 2, 3 and 4 symbol cyclic advances, respectively. Ex. 1001, 8:34-43; Ex. 2001, ¶48.

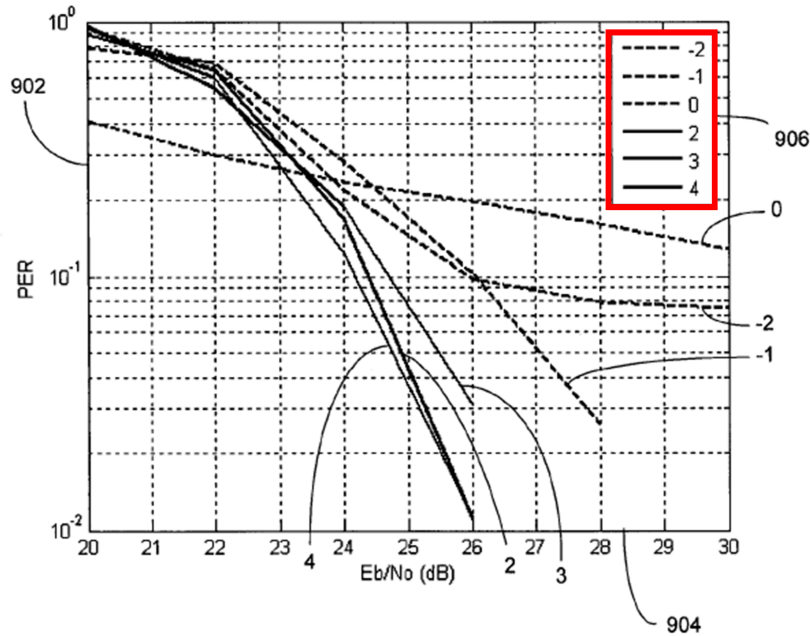
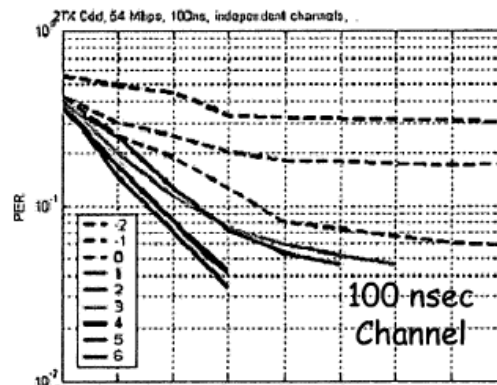
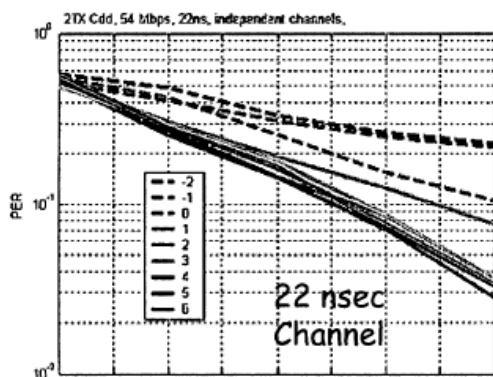


Figure 9 unquestionably demonstrates the superior performance of the small cyclic advance disclosed in the '439 Patent as compared to the performance of the small cyclic delay in the prior art, as illustrated in Figure 5. Ex. 2001, ¶49. As explained in the '439 Patent:

... As shown in the plot 900 of FIG. 9, the lower the curve, the better the PER performance for a particular SNR. The cyclic advance diversity, such as shown in curves 2-4 works well and indeed is generally superior in PER performance to cyclic delay diversity. Additional performance curves may be found in the provisional application referenced in the cross-reference to related applications section of this disclosure. Ex. 1001, 8:44-51.

The additional performance curves from the provisional application are reproduced below, and also show superior performance with small cyclic advances (i.e., advances of 1, 2, 3, 4, 5 or 6 symbols) as compared to small cyclic delays (i.e., delays of 1 or 2 symbols):



Ex. 2009, at XX (stating “Performance is robust with cyclic advances. Poor with delays”);² Ex. 2001, ¶50.

The Petition criticizes Figure 9 for failing to compare *small* cyclic advances with *large* cyclic delays. This reflects Petitioner’s misunderstanding of the invention and the prior art. Ex. 2001, ¶51. The Petition reasoned:

Critically, however, Figure 9 is *not* an apples-to-apples comparison of advances and delays. ... But what is “identical or equivalent” are small cyclic advances with their correspondingly large cyclic delays, which is the opposite of what is shown in Figure 9. *See id.* at 8:5-9. Figure 9 therefore does not illustrate “[e]xperimental testing [of] *small advancements* (e.g., 100 nsec) as opposed to *large delays*,” rather it compares *small delays* and *small-but-slightly larger advancements*. *See id.* at 8:24-26. Had the testing been an apples-to-apples comparison of small advancements with correspondingly large delays, a POSITA would have instead found “identical or equivalent” results ... Pet., at 71-72 (emphasis in original).

² The Petition incorrectly asserts that the claim of “significant performance gains” in the '439 Patent is “unsupported and unreliable.” Pet., at 72. However, the data shown in Figure 9 of the '439 Patent, together with that shown in the additional performance curves in the referenced provisional application, provide ample support for the significant performance gains described in the '439 Patent.

However, the purpose of Figure 9 was not to compare small cyclic advances with large cyclic delays (which the Petition argues are mathematically identical) -- rather, the purpose was to demonstrate the superior performance of the small cyclic advance disclosed (and claimed) in the '439 Patent as compared to the performance of the small cyclic delay in the prior art as illustrated in Figure 5. Ex. 2001, ¶52.

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 cyclic delay of 3100 nsecs,” (*id.*, 8:6-10 (emphasis added)), the '439 Patent did not disclose that a large cyclic delay was in the prior art. The prior art labelled as Figure 5 does not include a large cyclic delay (e.g., a delay with a duration greater than the guard interval) -- rather Figure 5 shows only a small cyclic delay, e.g., a 1-sample delay, and none of the references relied on in the Petition disclose a large cyclic delay. Ex. 2001, ¶53. In fact, as explained more fully below, the work of Dammann and that of his co-author Kaiser referenced in the background of Bausch (Ex. 1007, at 4) expressly discouraged the use of any delay larger than the guard interval.³ Ex. 2001,

³ See, Sections V(C) and V(D), *infra*, which discusses: Ex. 2003, 2 (reciting equation requiring that the delay in samples be smaller than guard interval and stating that “[i]f that condition does not hold, intersymbol interference (ISI) occurs”); Ex. 1006, at 5-6 (reporting that while small cyclic delays that were a fraction of the guard in duration provided some benefits, longer cyclic delays provided no additional benefits); and Ex. 1007, at 2-3 (discussing work of Dammann and Kaiser and stating that “a delay is introduced in a cyclic manner such that the guard interval is not exceeded.”)

¶53. Thus, the purpose of Figure 9 was not to compare small cyclic advances with large cyclic delays⁴ -- but to demonstrate that the small cyclic advance disclosed in the '439 Patent performed better than the small cyclic delay in the prior art. Ex. 2001, ¶53.

Significantly, the Petition does not dispute the small cyclic advance disclosed and claimed in the '439 Patent performs dramatically better than the small cyclic delay in the prior art, as illustrated in Figure 5, and offers no data to the contrary. The Petition also does not dispute that the '439 Patent was the first reference to identify these performance advantages. Finally, the Petition does not claim that these performance advantages were predictable -- they were not. Ex. 2001, ¶54.

⁴ The Petition appears to base its criticism of Figure 9 on a statement in the '439 Patent comparing small advancements and large delays. Pet., at 71, citing Ex. 1001, 8:24-27 (describing a large delay that may “span an almost an entire FFT”). In light of the specification of the '439 Patent, it is clear that “span an almost an entire FFT” means spanning almost the entire duration of FFT placement, as noted in the preceding paragraph and throughout the specification. See, Ex. 1001, 8:18-21; see also, *id.*, 2:30-41, 3:22-26, 7:47-54, In light of the sentence immediately preceding the one that Petitioner cites, it is undisputable that Figure 9 compares small cyclic advances to small cyclic delays (rather than large cyclic delays). See *id.*, 8:21-23 (“What has been determined experimentally is that small cyclic advances are superior to small cyclic delays.”). Ex. 2001, ¶53.

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. 1005). Much like the prior art identified in Figure 5 of the '439 Patent, Larsson disclosed only⁵ the use of small cyclic delays (e.g., a 1-sample delay and a 3-sample delay). Ex. 2001, ¶55. For example, Figure 8 of Larsen depicts a 1-sample delay:

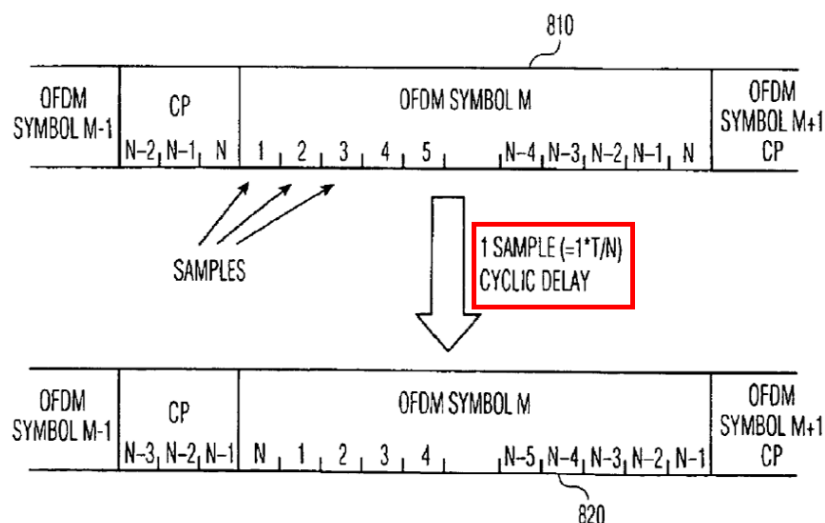


FIG. 8

Ex. 1005, 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

⁵ As explained in further detail in Section V(A), *infra*, nothing in Larsson discloses or suggests a small cyclic advance as claimed.

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 n 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. 1005, 6:39-58 (emphasis added).

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

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, 965-966 (emphasis added).

The applicant responded by arguing that Larsson's cyclic delay was distinguishable from the claimed cyclic advance. Ex. 1002, 985 (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, 998 (emphasis added).

The applicant next filed a Request for Continued Examination, where claim 1 was canceled 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, 1012-1014 (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, 1054 (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, 1073 (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, 1090.

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, 1012-1014; Ex. 2001, ¶62.

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.⁶ Second, the claim specifies

⁶ The district court construed temporal aspects of “generating a first OFDM packet...,” “cyclically advancing the first OFDM packet ... to generate a shifted version of the first OFDM packet,” and “substantially simultaneously transmitting the first OFDM packet” / “substantially simultaneously cause the transmission of the first OFDM packet.” Ex. 2006, 18-24.

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. Ex. 2001, ¶64.

V. PRIOR ART RELIED ON IN THE PETITION

A. Larsson

The primary reference relied on for Ground 1 is Larsson, the same reference applied during prosecution and found wanting. Larsson’s disclosure was limited to small cyclic delays (e.g., a 1-sample delay and a 3-sample delay). Ex. 2001, ¶65. The fact that Larsson was singularly focused on cyclic *delays* is evident from both the title of Larsson (“Cyclic *Delay* Diversity for ...”) and the first sentence of the “Detailed Description” of Larsson:

DETAILED DESCRIPTION

The *present invention is directed to* transmission diversity, and more specifically to mitigating ISI *by employing a cyclic delay* in a transmission diversity system. Ex. 1005, 6:25-28 (emphasis added).

Ex. 1005, 6:25-28 (emphasis added). The figures and text of Larsson recite the term “cyclic *delay*” 73 times, in connection with *every* embodiment. Ex. 1005, 6:39-50 (“FIG. 8 illustrates two OFDM symbols wherein a cyclic *delay* is implemented ... the cyclic *delay* is implemented by shifting samples from the end of the OFDM symbol into the beginning ... For example, if a cyclic *delay* of three samples were implemented ...”); 7:8-9 (“Each subsequent antenna path performs the cyclic *delay* on the symbol”); 7: 23-24 (“the cyclic *delay* is converted into a phase factor”); 7:28-

31 (“FIG. 9 illustrates a cyclic delay for a transmit diversity scheme, it can be seen that the cyclic delay is not limited by the size of the cyclic prefix”); 7:34-36 (“a system which uses a cyclic delay is only limited to using a number of antennas equal to the number of samples in the OFDM symbol. Further, by using a cyclic delay ...”); 7:39-42 (“Curve 1010 illustrates the power carrier density function for the transmission using a cyclic delay of ... As illustrated in FIG. 10, the implementation of a cyclic delay results in ...”); 7:48-50 (“FIG. 11 illustrates the subcarrier covariance matrix for a transmission diversity system which employs 32 cyclic delays”); 7:57-58 (“FIG. 12 illustrates an exemplary method for employing cyclic delay in accordance with the present invention”); and 9:4-5 (“As can be seen from FIGS. 13B and 13C, the cyclic delays t_1 , t_2 and t_3 are chosen such ...”). Ex. 2001, ¶66.

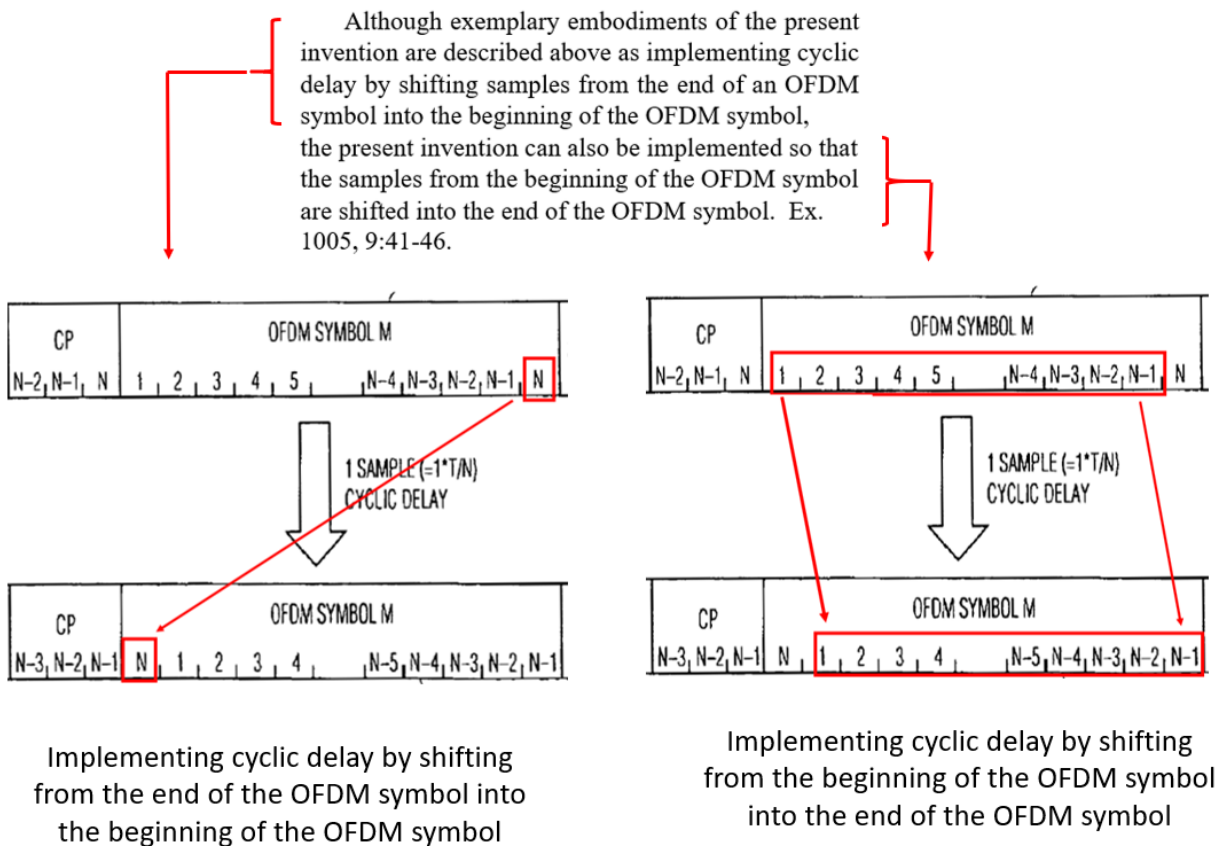
Having characterized the “present invention”⁷ as “employing a cyclic delay in a transmit diversity system” (*id.*, 6:25-28), and explained the operation of the disclosed embodiments, which were limited to cyclic delays, the specification identified two alternatives for implementing such cyclic delays:

Although exemplary embodiments of the present invention are described above as implementing cyclic delay by shifting samples from the end of an OFDM symbol into the beginning of the OFDM symbol, the present invention can also be implemented so that the samples from

⁷ See, e.g., *Pacing Techs., LLC v. Garmin Int'l, Inc.*, 778 F.3d 1021 (Fed. Cir. 2015) (“When a patentee “describes the features of the ‘present invention’ as a whole,” he alerts the reader that “this description limits the scope of the invention”).

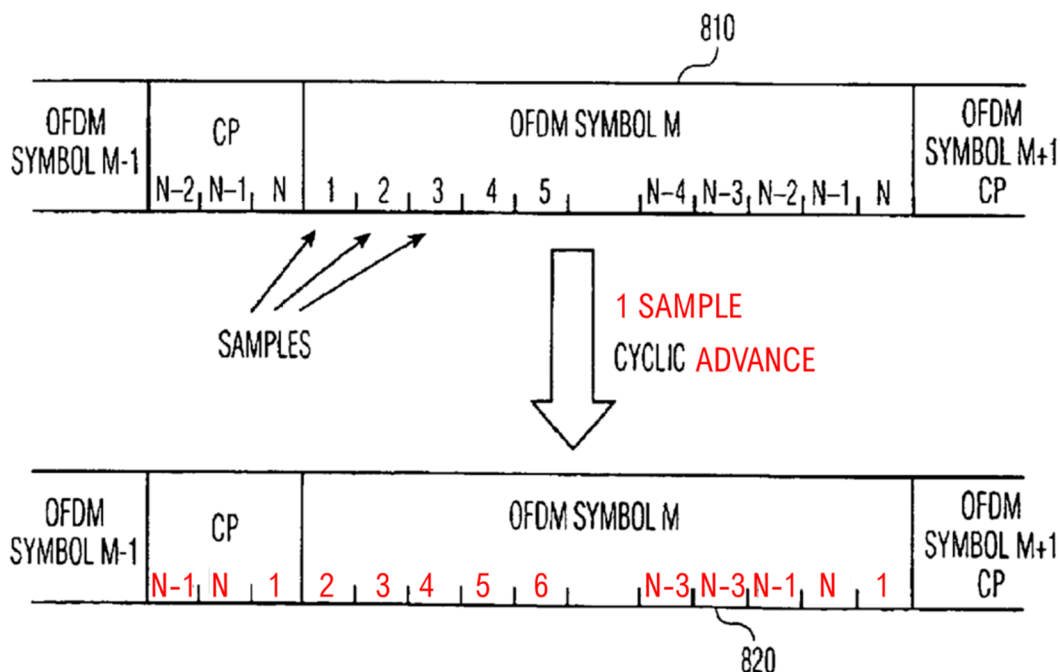
the beginning of the OFDM symbol are shifted into the end of the OFDM symbol. ... Ex. 1005, 9:41-47 (emphasis added).

This passage is stating that there are two ways to implement the cyclic delay employed in the present invention: one way of implementing the cyclic delay (described in connection with, e.g., FIG. 8) is to shift samples from the end of an OFDM symbol into the beginning of the OFDM symbol, and the second way of implementing the cyclic delay is by shifting “samples from the beginning of the OFDM symbol ... into the end of the OFDM symbol.” Ex. 2001, ¶67. Set forth below is an illustration created by Patent Owner graphically illustrating these two alternatives for implementing Larsson’s cyclic delay.



Ex. 2001, ¶67.

In stark contrast to Larsson's disclosure of the two ways of providing a cyclic *delay*, if a cyclic *advance*, e.g., of 1 sample, were to be applied to Larsson's OFDM symbol, the resulting OFDM symbol and the corresponding cyclic prefix would be as shown below:



As seen in the figures above, an OFDM symbol that is cyclically advanced by one sample is entirely different from that cyclically delayed by one sample. Thus, contrary to the Petition, Larsson did not disclose (or even suggest) the small cyclic advance claimed in the '439 Patent. Ex. 2001, ¶68. The Examiner did not “overlook” the subject passage from Larsson (Ex. 1005, 9:41-47), because that passage disclosed nothing more than an alternate way to implement the same cyclic *delay* disclosed earlier in the reference. Ex. 2001, ¶68. Rather than reading the subject

passage of Larsson in connection with Larsson *as a whole* (which makes clear that the “present invention” is limited to cyclic delays), the Petition improperly reads the subject passage of Larsson both *in isolation* and *through lens of the teachings of the '439 Patent* in order to erroneously suggest that Larsson discloses the small cyclic advance claimed in the '439 Patent. Ex. 2001, ¶68.

B. IEEE

The second reference relied on for Ground 1 is a supplement to IEEE Standard 802.11-1999, referred to in the Petition as “IEEE.” Ex. 1008. The Petition does not contend that IEEE teaches or suggests the small cyclic advance claimed in the '439 Patent. Ex. 2001, ¶69.

C. Kaiser

Ground 2 of the Petition relies on a paper by Armin Dammann and Stefan Kaiser entitled “Low Complex Standard Conformable Antenna Diversity Techniques for OFDM Systems and its Application to the DVB-T System.” Ex. 1006. Even though Dammann is the lead author of the article, the Petition refers to this paper based on the name of the second author, “Kaiser.” The work of Dammann and Kaiser is at issue in IPR2024-00883, and referred to generally in the References section of Kaiser (see, e.g., Ex. 1006, at 6, references [8] and [10]), as well as in the Bauch reference discussed below. See, e.g., Ex. 1007, at 4. This section of the Patent

Owner Preliminary Response discusses the specifics of Kaiser reference, as well as the work of Dammann and Kaiser more generally.

Like Larsson, Kaiser is limited to “Cyclic Delay Diversity,” abbreviated “CDD” in Kaiser - where the middle “D” stands for delay. Ex. 1006, 2 (heading, “Cyclic Delay Diversity”); (“The OFDM symbols of the CDD signal can be generated ... Fig. 4 shows the block diagram of an N-transmitter-antenna OFDM system with CDD. ... because of linearity CDD can be implemented at the receiver. Fig. 5 shows the principle block diagram of a CDD receiver ... these techniques are implementable with only slight additional complexity as long as the delays ... are multiples of the system sampling time.”) Ex. 2001, ¶71.

Kaiser reported that while small cyclic delays provided some benefits, longer cyclic delays provided no additional benefits. Ex. 1006, 5-6. Specifically, Kaiser simulated a “2k-mode” and “8k-mode with symbol durations of 224 and 896 μ s, respectively, each having a guard interval of 28 μ s. For the 2k-mode, the guard interval was 1/8th of the symbol duration and for the 8k-mode, the guard interval was 1/32nd of the symbol duration. Ex. 1006, 5; Ex. 2001, ¶72. In connection with these simulations, Kaiser reported:

As the results, showed in Fig. 11(a) and 11(b), signify, there is a saturation effect in terms of cyclic delay diversity. It can be observed, that a cyclic delay of $\delta > 1.5 \mu$ s results in no further improvement. Ex. 1006, at 6 (emphasis added).

Thus, in the context of systems having a guard interval of $28\ \mu\text{s}$, Kaiser reported that there was a saturation effect that occurred for cyclic delays longer than roughly 5% of the duration of the guard interval (or $1.5\ \mu\text{s}$). This teaching would have discouraged a POSITA from trying longer delays (which the Petition argues are mathematically equivalent to the small cyclic advances claimed in the '439 Patent.) Ex. 2001, ¶73.

Kaiser also stated that “simulation results on further 2k system can be found in” reference [10] to the paper:

- [10] Armin Dammann and Stefan Kaiser, “Standard conformable antenna diversity techniques for OFDM and its application to the DVB-T system,” Accepted for Publication in Proceedings IEEE Global Telecommunications Conference (GLOBECOM 2001), San Antonio, Texas, USA, November 2001. Ex. 1006, 6.

The Petition neglected to include this earlier paper (Dammann, Ex. 2003) from the same authors (Dammann and Kaiser) as an exhibit. Dammann⁸ further demonstrates that the cyclic delay diversity techniques being explored by Dammann and Kaiser were limited to small cyclic delays. Ex. 2001, ¶75. In this regard, Dammann stated that the delay in samples (δ_l) was governed by the following equation:

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

⁸ Dammann is also cited in the Bauch reference (Ex. 1007, at 4), as discussed in Section V(D), *infra*.

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. 2003, at 2. This equation plainly requires that the delay in samples (δ_l) be smaller than the guard interval (N_g); Ex. 2001, ¶75. After setting forth the above equation, Dammann states that “[i]f that condition does not hold, intersymbol interference (ISI) occurs.” Ex. 2003, 2; Ex. 2001, ¶75. Since ISI must be avoided, a POSITA would have understood that the cyclic delays of Dammann and Kaiser were necessarily small (less than the guard interval), and would have been discouraged from trying longer cyclic delays. Ex. 2001, ¶75.

D. Bauch

Ground 2 of the Petition also relies on a WIPO International Publication titled “Apparatus and Method for Cyclic Delay Diversity.” Ex. 1007 at Cover (emphasis added). Bauch begins by discussing the prior work of Dammann and Kaiser which, as noted above, was limited to small cyclic delays (less than the duration of the guard interval):

An increased frequency selectivity without exceeding the guard interval can be achieved introducing a cyclic delay diversity, as described in: A. Dammann and S. Kaiser, “Standard conformable antenna diversity techniques for OFDM systems and its application to the DVB-T system”, IEEE Globecom, pages 3100-3105, November 2001, in: A. Dammann and S. Kaiser, “Low complex standard conformable antenna diversity techniques for OFDM systems and its application to the DVB-T system”, 4th International ITG Conference on Source and Channel Coding, pages 253-259, January 2002, and in: A. Dammann, R. Raulefs, and S. Kaiser, “Beamforming in combination

with space-time diversity for broadband OFDM systems”, IEEE Conference on Communications (ICC), pages 165-171, April 2002. In accordance with the teachings of the above documents, a delay is introduced in a cyclic manner such that the guard interval is not exceeded. Ex. 1007, 2-3 (emphasis added).

The Petition interprets the above passage as “Bauch expressly teach[ing] that its disclosure should be applied to Kaiser’s system” -- which in turn was limited to small cyclic delays that were less than the guard interval. Pet., at 46; Ex. 2001, ¶77.

Like Larsson, Bauch makes clear that the “present invention” and every embodiment are limited to the implementation of cyclic delays:

The present application is based on the finding, that ... In particular, it has been found that the spatial diversity can fully be exploited, when, at the transmitter or at the receiver, cyclic delay diversity scheme is used, wherein the cyclic delays are determined by a number of users. Ex. 1007, 7-8 (emphasis added).

* * *

In accordance with the present invention, the cyclic delay is chosen such that sub-carriers associated with subsequent user signal values are uncorrelated. ... *Id.*, at 8 (emphasis added).

It is a further advantage of the present invention, that the inventive cyclic delay diversity concept is simple, ... Ex. 1007, 7-8 (emphasis added). *Id.*, at 8 (emphasis added).

* * *

Fig. 2 shows a correlation function for the inventive cyclic delay diversity scheme ...

Fig. 4 demonstrates cyclic delay diversity in a ...

Fig. 5 demonstrates cyclic delay diversity in a ...

Fig. 6b shows the channel of Fig. 6a transformed by the cyclic delay diversity ... *Id.*, at 9-10 (emphasis added).

* * *

In accordance with the present invention, the cyclic delay can be used in an already existing, standardized system ... *Id.*, at 11 (emphasis added).

* * *

The inventive cyclic diversity scheme is based on an efficient exploitation of general correlation properties. To be more specific, the inventive delays (shifts) are chosen such that, ... In particular for the case of an OFDM transmission scenario, an efficient choice of cyclic delay may ... In accordance with the present invention, the cyclic delays are chosen such that ... *Id.*, at 14-15 (emphasis added).

* * *

Fig. 2 shows a correlation function for an inventive cyclic delay diversity with two transmit antennas and a cyclic delay ... The cyclic delays (cyclic shifts) are chosen according to U where U is the number of users ...

The inventive choice cyclic delay guarantees that ... *Id.*, at 15 (emphasis added).

* * *

It is to be noted that the inventive cyclic shift operation introduces a cyclic delay having an influence on ... *Id.*, at 19 (emphasis added).

* * *

... After influencing the phase of each value, the resulting frequency domain signals are then transformed back to time domain, so that delayed versions of the respective receive signals are obtained. *Id.*, at 20 (emphasis added).

* * *

... Each antenna introduces a different cyclic delay ... *Id.*, at 23 (emphasis added).

* * *

... the cyclic delay diversity transforms the multi-ple-input-multiple-output (MIMO) channel to a single-input-multiple-output (SIMO) channel having ... In Fig. 6b, the transformation introduced by the cyclic delay diversity is demonstrated. *Id.*, at 24-25 (emphasis added).

Ex. 2001, ¶78.

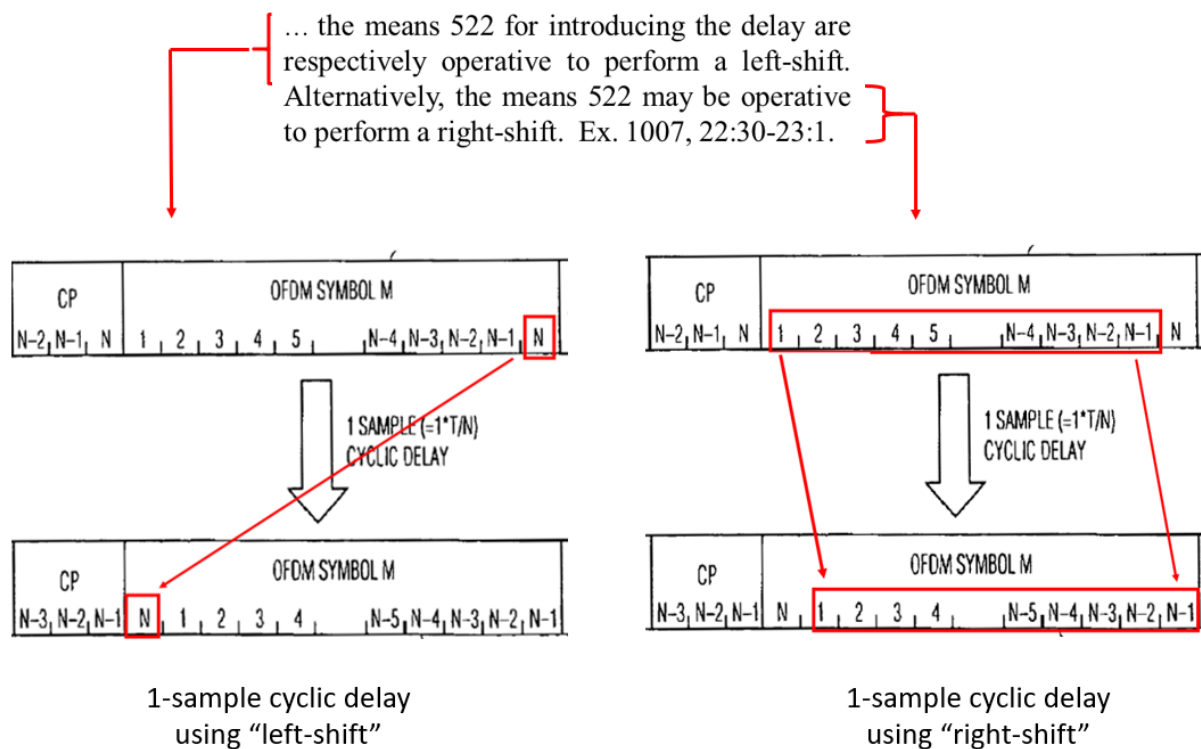
Bauch also makes clear in several places that, when it refers to a cyclic shift, it means a cyclic delay. *Id.*, at 14 (“the inventive delays (shifts) are chosen such that, ...”); 15 (“The cyclic delays (cyclic shifts) are chosen ...”); 19 (“the inventive cyclic shift operation introduces a cyclic delay ...”). Ex. 2001, ¶79.

The Petition (at 45) focuses on the passage at 22:30-23:1 of Bauch, which states:

... the means 522 for introducing the delay are respectively operative to perform a left-shift. Alternatively, the means 522 may be operative to perform a right-shift. (emphasis added).

The stated function of means 522 is “for introducing the delay.” Similar to the passage in Larsson discussed above, this passage in Bauch is stating that there are two ways for means 522 to introduce the cyclic delay: one way that means 522 can introduce the cyclic delay is to shift samples from the end of an OFDM symbol into the beginning of the OFDM symbol (the so-called “left-shift”), and the second way that means 522 can introduce the cyclic delay is by shifting samples from the beginning of the OFDM symbol into the end of the OFDM symbol (the so-called “right-shift”). Ex. 2001, ¶80. Reproduced below is the same illustration created by Patent Owner based on the figures from Larsson shown previously, but modified to

graphically illustrate implementation of a 1-sample cyclic delay using either the “left-shift” or “right-shift” described in Bauch:



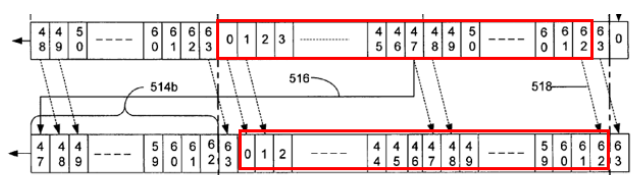
Ex. 2001, ¶80. Contrary to the Petition, Bauch did not disclose (or even suggest) the small cyclic advance claimed in the '439 Patent. Ex. 2001, ¶81. Rather than reading the subject passage of Bauch in connection with Bauch *as a whole* (which makes clear that the “present invention” is limited to cyclic delays), the Petition improperly reads the subject passage of Bauch both *in isolation* and *through lens of the teachings of the '439 Patent* in order to argue that Bauch discloses the small cyclic advance claimed in the '439 Patent. Ex. 2001, ¶81.

Reading the subject passage of Bauch as being directed to the small cyclic advance claimed in the '439 Patent is also inconsistent with Bauch's recognition that, according to earlier work of Dammann and Kaiser, the duration of a cyclic delay must be small - i.e., less than guard interval. Ex. 2001, ¶82; see, e.g., Ex. 1007, 3 ("In accordance with the teachings of the above documents, a delay is introduced in a cyclic manner such that the guard interval is not exceeded"); and Pet., at 46 ("Bauch expressly teaches that its disclosure should be applied to Kaiser's system.") If, as the Petition argues, the small cyclic advance claimed in the '439 Patent is mathematically equivalent to a large cyclic delay, it would be nonsensical to read the subject passage of Bauch as being directed to such a large cyclic delay (equivalent to a small cyclic advance) given Bauch's acknowledgment (based on Dammann and Kaiser's work) that any cyclic delay must be small. Ex. 2001, ¶82.

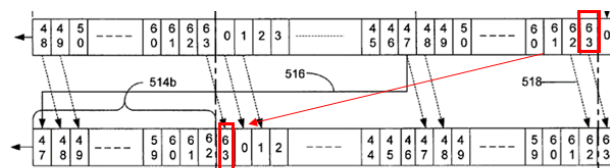
VI. THE PRIOR ART RELIED ON IN THE PETITION IS CUMULATIVE OF THAT ADVANCED BY THE EXAMINER AND OVERCOME DURING PROSECUTION

As set forth in Section III, *supra*, the small cyclic delay disclosed in Larsson was thoroughly vetted and overcome during prosecution. Besides Larsson, the Examiner also applied Figure 5 of the '439 Patent (labelled "Prior Art") in making rejections during prosecution. See, e.g., Office Action dated March 9, 2009 (rejecting claims as being unpatentable over Larsson in view of Admitted Prior Art including Figs. 1-5 and pages 1-7)(Ex. 1002, at 1048-1050). The Prior Art shown in

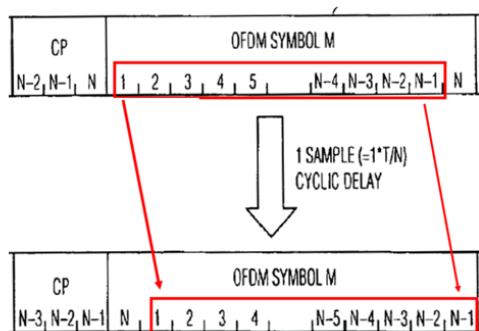
Figure 5 of the '439 Patent (top figures in diagram below) depicted the same small cyclic delay disclosed in Larsson and Bauch, and in the terminology of Bauch, could have been implemented using either a “right-shift” or a “left-shift,” as graphically depicted below (diagram created by Patent Owner):



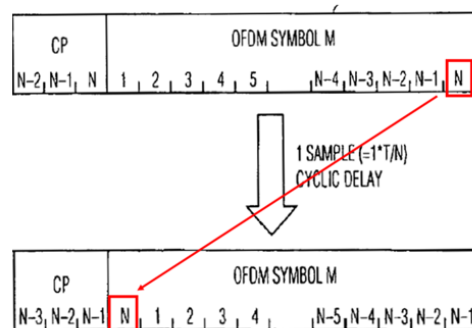
1-sample cyclic delay labelled “Prior Art” from FIG. 5 of ‘439 Patent (implemented using “right-shift”)



1-sample cyclic delay labelled “Prior Art” from FIG. 5 of ‘439 Patent (implemented using “left-shift”)



Implementing cyclic delay by shifting from the beginning of the OFDM symbol into the end of the OFDM symbol (Larsson) or performing a “right-shift” (Bauch)



Implementing cyclic delay by shifting from the end of the OFDM symbol into the beginning of the OFDM symbol (Larsson) or performing a “left-shift” (Bauch)

Ex. 2001, ¶83. Simply put, regardless of whether the small cyclic delay from the prior art was implemented by shifting from the beginning of the OFDM symbol into the end of the OFDM symbol or shifting from the end of the OFDM symbol into the beginning of the OFDM symbol (as phrased in Larsson) or by performing a “right-shift” or a “left-shift” (as phrased in Bauch), the result is the same as shown in the

Prior Art identified in FIG. 5 of the '439 Patent -- namely, a small cyclic delay. Ex. 2001, ¶84.

In other words, the direction of the shift -- left or right -- by itself, does not determine whether there is a cyclic delay or cyclical advance. Ex. 2001, ¶85. When a 1-sample cyclic delay is introduced, sample 1 through N-1 are delayed relative to their original position or time index, regardless of whether left or right shift is used to implement the cyclic delay, as shown above using annotated FIG. 8 of Larsson. In contrast, when a 4-sample cyclic advance is introduced, samples 4 through N-1 (where N=64) are advanced relative to their original position or time index, as shown in FIG. 8 of the '439 Patent. Ex. 2001, ¶85. The references relied on in the Petition are clearly cumulative of the art considered and overcome during prosecution. Ex. 2001, ¶86.

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

Returning to the language of Claim 1 of the '439 Patent, Claim 1 recites in pertinent part:

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 ...⁹

The Larsson and Bauch references (relied on in Grounds 1 and 2, respectively) fail to disclose the claimed *small* (less than the duration of the guard interval) cyclic *advance* (shifting samples in a first direction from the symbol data portion into guard interval portion) as shown, for example, in Figure 8 of the '439 Patent (reproduced in part below):

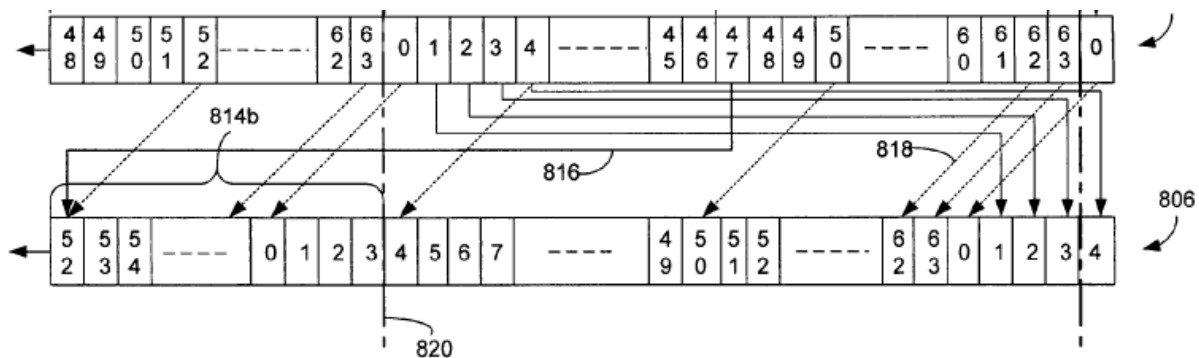


FIG. 8

Ex. 2001, ¶88.

⁹ The highlighted claim language corresponds to the claim elements identified as 1[b][i] - 1[b][iii] by the Petition. Pet., at 82.

A. Ground 1 Is Deficient Because Larsson Fails To Teach The Small Cyclic Advanced Recited In All Challenged Claims

In Ground 1, the Petition relies on Larsson as meeting the claim elements 1[b][i] - 1[b][iii] corresponding to the small cyclic advance recited in Claim 1 of the '439 Patent. Specifically, the Petition argues:

... Larsson teaches shifting in *either* direction:

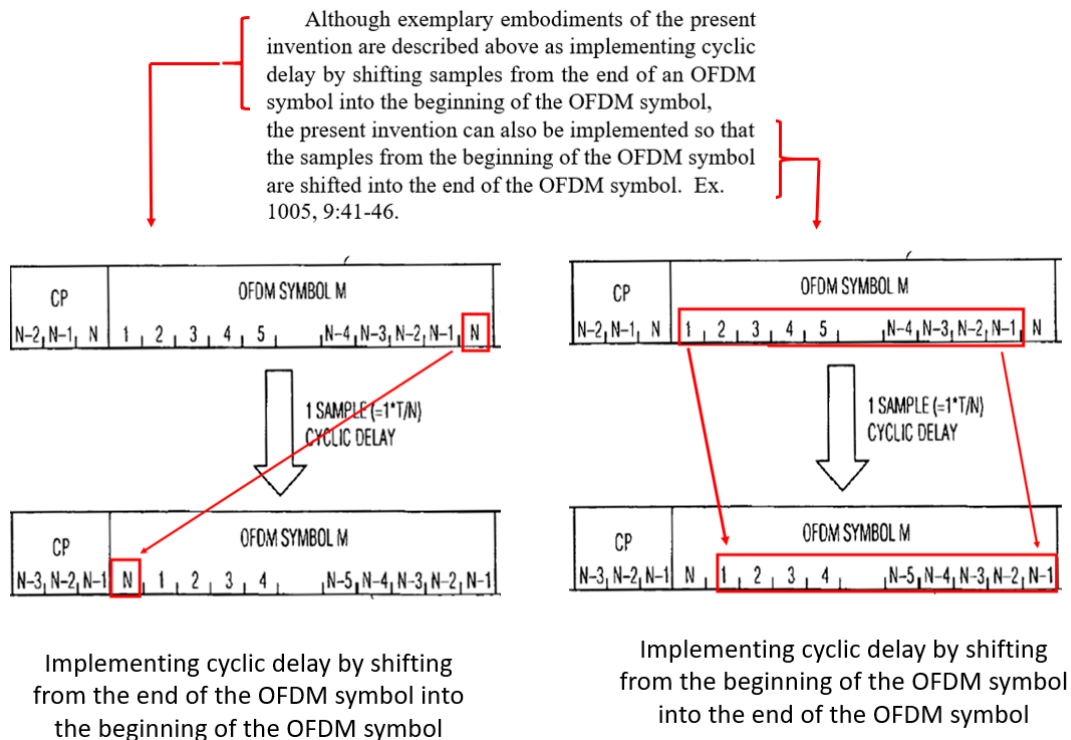
Although exemplary embodiments of the present invention are described above as implementing cyclic delay by shifting samples from the end of an OFDM symbol into the beginning of the OFDM symbol, *the present invention can also be implemented so that the samples from the beginning of the OFDM symbol are shifted into the end of the OFDM symbol.*

See EX1005 at 9:41–47. Larsson refers to a shift in the first direction described above as a cyclic delay, so a POSITA would recognize that a shift in the opposite direction is a cyclical advance. See EX1003 ¶82. A POSITA would understand that a cyclic delay is a shift in the opposite direction as the signal transmission direction (which is what makes it a delay), so a cyclic advance is necessarily a shift in the direction of signal transmission. See *id.* ¶¶35, 82. Pet., at 16 (emphasis in original).

The quoted passage from Larson does not say “shift in the first direction” or “shift in the opposite direction.” In fact, neither the term “direction” or “advance” are mentioned in the quote from Larsson. The words in Larsson say that the present invention (defined earlier in Larsson as a cyclic *delay*)¹⁰ can be implemented “so

¹⁰ See generally, Section V(A), *supra*; see also Ex. 1005, 6:25-28 (“The *present invention is directed to* transmission diversity, and more specifically to mitigating ISI *by employing a cyclic delay* ...”).

that the samples from the beginning of the OFDM symbol are shifted into the end of the OFDM symbol.” Ex. 2001, ¶90. The meaning of the relied on passage is depicted graphically in the diagram shown in Section V(A) and reproduced again below:



Ex. 2001, ¶90. As seen above, when a 1-sample cyclic delay is performed, regardless of the direction of the shift, samples 1 through $N-1$, are *delayed* relative to their respective original positions. Ex. 2001, ¶91. By contrast, nothing in Larsson teaches or suggests the claimed small cyclic advance depicted in one example in Figure 8 of the '439 Patent:

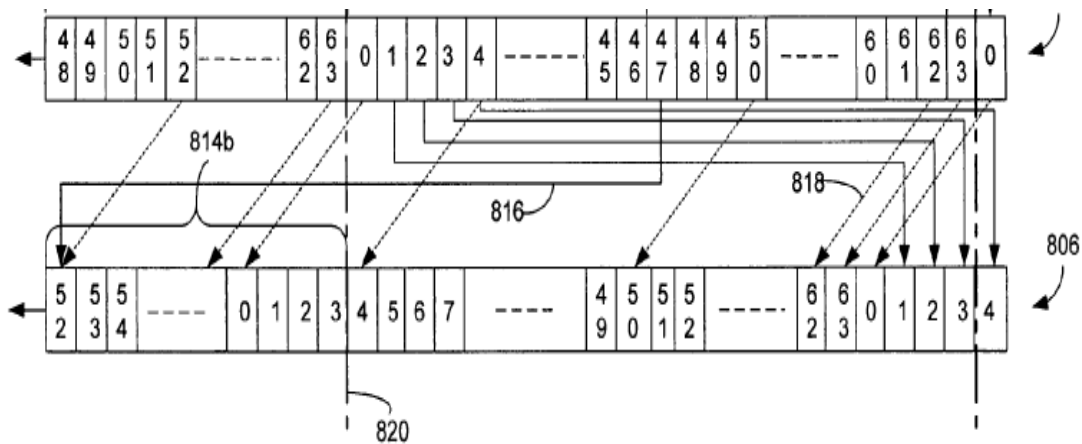


FIG. 8

Ex. 2001, ¶91. It can be seen above that when a 4-sample cyclic *advance* is performed, samples 4 through N-1 (where N=64), are *advanced* in the shifted version relative to their respective original positions. Ex. 2001, ¶91. For at least this reason, the references relied on in Ground 1 fail to meet the claim elements 1[b][i] - 1[b][iii] corresponding to the small cyclic advance recited in independent Claim 1 of the '439 Patent. Ex. 2001, ¶91. For substantially the same reason, the references relied on in Ground 1 also fail to meet the claim elements 8[b] and 19[b] corresponding to the small cyclic advance recited in the other independent claims (i.e., Claims 8 and 19) of the '439 Patent. Ex. 2001, ¶91.

B. Ground 2 Is Deficient Because Bauch Fails To Teach The Small Cyclic Advanced Recited In All Challenged Claims

In Ground 2, the Petition relies on Bauch as meeting the claim elements 1[b][i] - 1[b][iii] corresponding to the small cyclic advance recited in Claim 1 of the '439

Patent. With respect to these elements, the Petition (at 45) focuses on the passage at 22:30-23:1 of Bauch, which states:

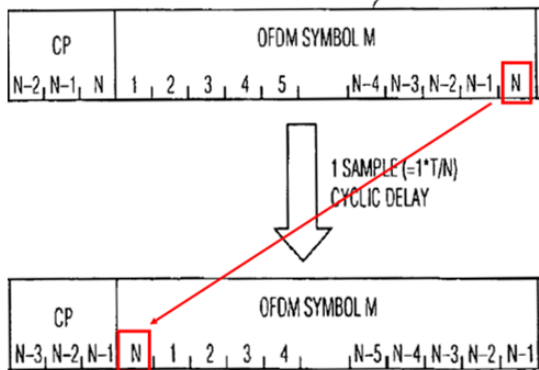
... the means 522 for introducing the delay are respectively operative to perform a left-shift. Alternatively, the means 522 may be operative to perform a right-shift. (emphasis added).

With respect to this passage from Bauch, the Petition argues:

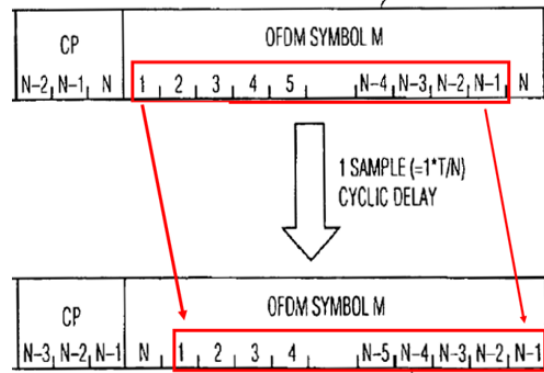
... Bauch refers to this shift as “a left-shift.” *See id.* at 22:30–32. Critically, however, Bauch then teaches: “Alternatively, the means 522 may be operative to perform a **right-shift**.” *See id.* at 22:30–23:1. As a POSITA would have recognized, a “left-shift” in Bauch is a cyclic delay, and shifting in the opposite direction, a “right-shift,” is a cyclic advance. *See id.* at 22:30–23:1; EX1003 ¶153. Pet., at 45 (emphasis in original).

However, the quoted passage from Bauch does not say “shifting in the opposite direction” and does not use the term “cyclic advance.” Ex. 2001, ¶93. Focusing on the actual words of Bauch at 22:30-23:1, the stated function of means 522 is “for introducing the delay.” Bauch states that the means 522 for implementing the delay “may be operative to perform a right-shift.” This passage is teaching the implementation of a cyclic delay using a right-shift, as depicted graphically in the diagram shown in Section V(D) and reproduced again below:

... the means 522 for introducing the delay are respectively operative to perform a left-shift. Alternatively, the means 522 may be operative to perform a right-shift. Ex. 1007, 22:30-23:1.



1-sample cyclic delay using "left-shift"



1-sample cyclic delay using "right-shift"

Ex. 2001, ¶93. By contrast, nothing in Larsson teaches or suggests the claimed small cyclic advance depicted in one example by Figure 8 of the '439 Patent:

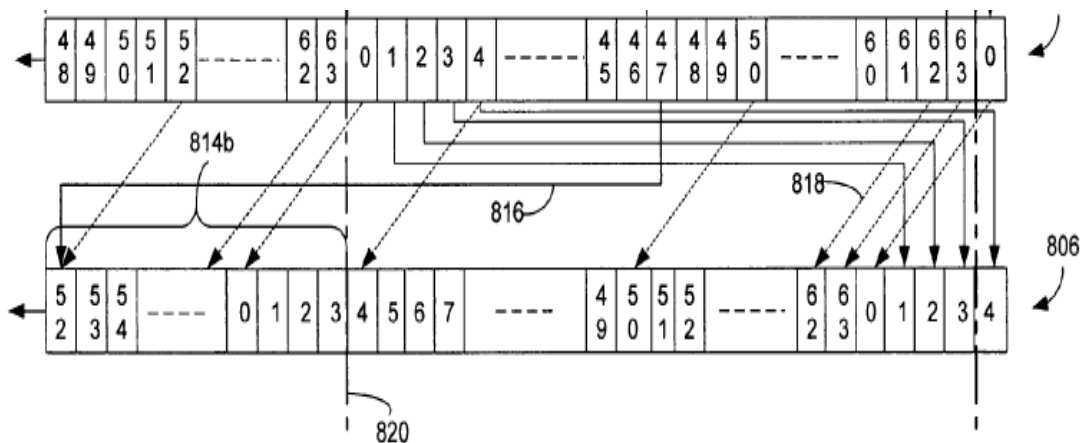


FIG. 8

Ex. 2001, ¶94. For at least this reason, the references relied on in Ground 2 fail to meet the claim elements 1[b][i] - 1[b][iii] corresponding to the small cyclic advance recited in independent Claim 1 of the '439 Patent. For substantially the same reason, the references relied on in Ground 2 also fail to meet the claim elements 8[b] and 19[b] corresponding to the small cyclic advance recited in the other independent claims (i.e., Claims 8 and 19) of the '439 Patent. Ex. 2001, ¶95.

Moreover, it would not have been obvious to combine Kaiser and Bauch as alleged in Ground 2. As explained in Section V(C), *supra*, Kaiser reported that there was a saturation effect that occurred for cyclic delays longer than roughly 5% of the duration of the guard interval, and Dammann (Ex. 2003) -- which was referenced in both Kaiser and Bauch -- disclosed that the cyclic delay needed to be smaller than the guard interval to avoid intersymbol interference. These teachings would have discouraged a POSITA from trying longer delays (which the Petition argues are mathematically equivalent to the small cyclic advances claimed in the '439 Patent.) Ex. 2001, ¶96 . For at least this further reason, the references relied on in Ground 2 fail to render the Challenged Claims obvious.

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

As detailed in Section II(C), *supra*, the '439 Patent included experimental testing data demonstrating that a small cyclic advance of 2, 3, or 4 samples had a

dramatically reduced packet error rate when compared to small cyclic delays of 1 or 2 symbols. Ex. 1001, 8:34-49, and FIG. 9; Ex. 2009, at 21; and Ex. 2001, ¶97.

Unable to grapple with this evidence on the merits, the Petition attempts to divert attention by faulting the data shown in Figure 9 of the '439 Patent for failing to compare small cyclic advances with large cyclic delays. Pet., at 71-72. As explained in Section II(C), *supra*, this criticism reflects a fundamental misunderstanding of the invention and the prior art. The purpose of the data in Figure 9 of the '439 Patent was not to compare small cyclic advances with large cyclic delays which, as stated in the Petition, are mathematically identical -- rather, the purpose was to demonstrate that the superior performance of the small cyclic advance disclosed, e.g., in Figure 8 of the '439 Patent, as compared to the performance of the small cyclic delay in the prior art as illustrated, e.g., in Figure 5 of the '439 Patent (as well as Larsson and Bauch.) Ex. 2001, ¶98.

Importantly, the Petition does not dispute that the small cyclic advance disclosed and claimed in the '439 Patent performs dramatically better than the small cyclic delay in the prior art, as illustrated in Figure 5 (and Larsson and Bauch), and offers no data to the contrary. Ex. 2001, ¶99. In this respect, 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).

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 in establishing that independent claims 1, 8, and 19 are unpatentable. See Sections VII(A) and (C), *supra*. With respect to the other claims challenged in Ground 1 (i.e., dependent claims 2-7, 9-18, and 20-21), the Petition has failed to demonstrate a reasonable likelihood of success in 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, 8 and 19) 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 that that independent claims 1, 8 and 19 are unpatentable. See Sections VII(B) and (C), *supra*. With respect to the other claims challenged in Ground 1 (i.e., dependent claims 2-7, 9-18 and 20-21), 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, 8 and 19) 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 v. TCL Electronics Holdings Ltd. et al.*, WDTX-6-23-cv-00309 (the “Parallel Litigation.”) Ex. 2004, at 7, #16. Petitioner waited until July 21, 2024 -- over 11 months after being served with the Complaint -- to file the present IPR. As a result, the Parallel Litigation has already reached an advanced stage, with the court issuing a claim construction order on September 10, 2024, and the parties having served their final

infringement and invalidity contentions on September 23, 2024. Ex. 2005 (Claim Construction Order) and Ex. 2006 (Scheduling Order). The case is so advanced that fact discovery is scheduled to be closed on February 24, 2025 -- a few days after the anticipated date of the institution decision in this IPR on February 15, 2025. The trial is scheduled for July 28, 2025 (Ex. 2006), nearly 7 months before the statutory deadline for issuing a Final Written Decision on February 24, 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, the 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 November 22, 2024) it is unlikely that the Court (Judge Albright) would grant a stay, particularly given the very advanced stage of the Parallel Litigation at that point and the proximity to the trial date. *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).

Petitioner has not established that Judge Albright “routinely stays cases after an IPR is instituted.” Pet., at 73. The two decisions cited by Petitioner for that proposition are inapposite. In *Lone Star SCM Sys., Ltd. v Zebra Techs. Corp.*, Case No. 6:21-cv-00842-ADA, Dkt. 85 at 1 (W.D. Tex. July 31, 2023), IPRs were instituted five months before the Markman hearing was even scheduled to take place, and the stay was granted at a time when fact discovery had just opened. By contrast, in this case, the Markman hearing and ruling have taken place, and fact discovery will close within a few days of the scheduled institution decision. Similarly, in *Pedersen v. Oracle Corp.*, Case No. 6:22-cv-00410-ADA, Dkt. 42 at 5 (W.D. Tex. Aug. 24, 2023), at the time of institution, “[d]iscovery ha[d] not commenced, the Court ha[d] not yet held a *Markman* hearing, and the parties ha[d] not filed any *Markman* briefs.” The facts of *Pedersen* are a far cry from the present facts where the Markman hearing and ruling have taken place, and fact discovery will close within a few days of the scheduled institution decision.

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 in the Parallel Litigation is scheduled for July 28, 2025 (Ex. 2006), nearly 7 months before the statutory deadline for issuing a Final Written Decision in this matter on February 24, 2026.

With respect to factor 2, the Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022) directs the Board to consider the median time from filing to case disposition statistics. 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. 2007, 27). Given that the Parallel Litigation was filed on April 26, 2023 (Ex. 2004 at 6, #1), the 28.3 month median time to disposition indicates 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 24, 2026.¹¹

Thus, the second factor weighs against institution.

¹¹ The Petition (at 73-74) cites the Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022) ("Interim Procedure") for the proposition that "scheduled trial dates are unreliable and often change." However, the Petition neglected to perform the timing analysis based on trial statistics mandated by the Interim Procedure, at 3 ("when considering the proximity of the district court's trial date to the date when the PTAB final written decision will be due, the PTAB will consider the median time from filing to disposition of the civil trial for the district in which the parallel litigation resides.")

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 15, 2025. *Id.*

In the Parallel Litigation, Patent Owner served Preliminary Infringement contentions (February 12, 2024), Petitioner (Defendant) served Preliminary Invalidity Contentions (April 8, 2024), the parties exchanged claim terms for construction (April 22, 2024), the parties exchanged proposed claim constructions (May 6, 2024), the parties completed claim construction briefing with Petitioner filing an Opening Claim Construction Brief (May 27, 2024), Plaintiff filing a responsive Claim Construction Brief (May 27, 2024), Petitioner (Defendant) filing a Reply Claim Construction Brief (July 1, 2024) and Plaintiff filing a Sur-Reply Claim Construction Brief (July 15, 2024). Ex. 2006, at 2. In addition, the Court held a Claim Construction Hearing on August 8, 2024, and issued its Claim Construction Order (Ex. 2005) on September 10, 2024. Ex. 2004, at 10, #44.

The parties and the Court have already made a substantial investment in the Parallel Litigation, which will grow even larger by the expected date of the institution decision on February 15, 2025. By that time, the parties will be only days

away from the scheduled close of fact discovery on February 24, 2025. Ex. 2006, at 3..

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 on Larsson, IEEE, Dammann (which is cumulative of Kaiser), and Bauch in the Parallel Litigation. Rather than offer a full *Sotera*¹² stipulation that would have barred Petitioner from pursuing any ground raised *or that could have been reasonably raised in this IPR*” if this IPR is instituted, Petitioners offered a much more limited *Sand*¹³ 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 the identical (or cumulative) prior art and virtually identical arguments in the Parallel Proceedings as advanced in these proceedings, by rearranging the combinations to technically get

¹² *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.")

¹³ *Sand Revolution II, LLC v. Continental Intermodal Group—Trucking LLC*, IPR2019-01393, Paper 24 at 11-12 (P.T.A.B. June 16, 2020).

around the narrow *Sand* stipulation. Below are portions of Petitioner’s invalidity contentions in the Parallel Litigation. The Ground in the red box corresponds to Ground 1 in this IPR, while the Grounds in the blue boxes are outside the scope of the *Sands* stipulation, but will nonetheless permit Petitioners to advance the identical (or cumulative¹⁴) prior art and virtually identical arguments in the Parallel Proceedings as advanced here:

‘439 Patent Claims	Ground
1, 2, 3, 7, 8, 9, 10, 11, 13, 14, 15, 16, 18	Obvious over Larsson ’487 in view of IEEE*
1, 2, 3, 7, 8, 9, 10, 11, 13, 14, 15, 16, 18	Obvious over Dammann in view of Bauch and IEEE*
1, 2, 3, 7, 8, 9, 10, 11, 13, 14, 15, 16, 18	Obvious over Bauch in view of Larsson ’487

Ex. 2008, at 19.

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 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

¹⁴ For example, Dammann (Ex. 2003) is cumulative of Kaiser.

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; *see Eclinicalworks, LLC et al. v. Decapolic LLC*, IPR2022-00229, 2022 Pat. App. LEXIS 2274, Paper 10 at *13 (PTAB Apr. 13, 2022) (finding factor 4 weighs strongly in favor of denial where the ground in the Petition was included in the preliminary invalidity contentions in parallel case).

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 Petitioners 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, Petitioners’ challenge is weak. Neither Larsson nor Bauch disclose the small cyclic advance recited in the Challenged Claims, and the Petition fails to offer evidence contradicting the testing data in the '439 Patent

showing a dramatically reduced packet error rate for the claimed small cyclic advance as compared to the prior art small cyclic. 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 15, 2024

By: /Daniel H. Golub/
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Registration No. 33,701
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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 12,321 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 15, 2024

By: /Daniel H. Golub/
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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 15, 2024 to lead and backup counsel of record for Petitioners as follows:

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