

Petition for *Inter Partes* Review of
U.S. Patent No. 7,809,996 B2

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Charter Communications, Inc.,
Petitioner

v.

Adaptive Spectrum and Signal Alignment, Inc.
Patent Owner

Case No. IPR2024-01379

U.S. Patent No. 7,809,996 B2

Filing Date: August 4, 2008
Issue Date: October 5, 2010

Title: ADAPTIVE FEC CODEWORD MANAGEMENT

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 7,809,996 B2**

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List of Exhibits

Exhibit No.	Description of Document
1001	U.S. Patent No. 7,809,996 B2 to John M. Cioffi (Application filed August 4, 2008, issued October 5, 2010) (“’996 patent”)
1002	Declaration of Dr. James Martin
1003	U.S. Patent No. 5,699,365 to Jeffrey T. Klayman, et al. (Application filed March 27, 1996, issued December 16, 1997) (“Klayman”)
1004	U.S. Patent No. 6,477,669 B1 to Anil K. Agarwal, et al. (PCT Application filed July 15, 1998, issued November 5, 2002) (“Agarwal”)
1005	U.S. Patent No. 6,546,509 B2 to Thomas J. J. Starr (Application filed June 19, 2001, issued April 8, 2003) (“Starr”)
1006	<i>Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc., et al.</i> , No. 2:24-cv-00124, Complaint (D.I. 1)
1007	’996 Patent File History
1008	<i>Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc., et al.</i> , No. 2:24-cv-00124, Docket Control Order (D.I. 20)
1009	Lex Machina – U.S. District Court for the Eastern District of Texas and District of Colorado, Patent Cases Timing, <i>available at</i> https://law.lexmachina.com/court/txed/cases?status=all&case_types-include=27&pending-from=2009-01-01&pending-to=&filters=true&tab=timing&view=analytics&cols=title%2Ccivil-number%2Ccase_type%2Ccourt%2Cfiled%2ClastDE%2Cterminate&bplots_searchlist_on=trial_date ; https://law.lexmachina.com/court/cod/cases?case_types-include=27&pending-from=2009-01-01&filters=true&tab=timing&view=analytics&cols=title%2Ccivil-

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Exhibit No.	Description of Document
	number%2Ccase_type%2Ccourt%2Cfiled%2ClastDE%2Cterminate d&bplots_searchlist_on=trial_date
1010	E.R. Berlekamp, R.E. Peile, S.P. Pope, “The Application of Error Control to Communications,” IEEE Communications Magazine, Vol. 25, No. 4, pp. 44-57 (April 1987)
1011	Claim Listing
1012	J.S. Engel, “Digital Transmission in the Presence of Impulsive Noise,” (Apr. 4, 1965), <i>available at</i> https://ieeexplore.ieee.org/abstract/document/6769876
1013	U.S. Patent No. 6,654,410 to Marcos C. Tzannes (Application filed January 16, 2002, issued November 25, 2003) (“Tzannes”)
1014	U.S. Patent No. 6,184,942 to Chandrakant B. Patel, et al. (Application filed August 16, 1999, issued February 6, 2001) (“Patel”)
1015	U.S. Patent No. 5,886,989 to Allan Evans, et al. (Application filed June 10, 1996, issued March 23, 1999) (“Evans”)
1016	U.S. Patent No. 5,659,578 to Siavash M. Alamouti, et al. (Application filed November 23, 1994, issued August 19, 1997) (“Alamouti”)
1017	U.S. Patent No. 6,016,313 to Robert B. Foster, Jr., et al. (Application filed November 7, 1996, issued January 18, 2000) (“Foster”)
1018	U.S. Patent No. 5,392,299 to Don S. Rhines, et al. (Application filed January 15, 1992, issued February 21, 1995) (“Rhines”)
1019	U.S. Patent No. 6,665,308 to Selim Shlomo Rakib, et al. (Application filed September 17, 1998, issued December 16, 2003) (“Rakib”)

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I. INTRODUCTION

Petitioner Charter Communications, Inc. respectfully submits this Petition for *Inter Partes* Review of claim 20 (the “Challenged Claim”) of U.S. Patent No. 7,809,996 (the “’996 patent”) (EX1001). Petitioner requests institution of *Inter Partes* Review (“IPR”) and a finding that the Challenged Claim is unpatentable.

II. MANDATORY NOTICES UNDER 37 CFR § 42.8(A)(1)

A. Real Parties-In-Interest under § 42.8(b)(1)

Petitioner Charter Communications, Inc. (“Petitioner”) is the real party-in-interest to this IPR petition.

B. Related Matters under § 42.8(b)(2)

The ’996 patent is asserted in pending litigation involving Petitioner and Patent Owner, *Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc., et al.*, Case No. 2:24-cv-00124 (E.D. Tex.). The complaint in the related case was first served on Petitioner on February 22, 2024. (EX1006). There are no other known related cases involving Patent Owner and the ’996 patent.

C. Lead and Back-Up Counsel under § 42.8(b)(3)

Petitioner provides the following designation of counsel.

LEAD COUNSEL	BACK-UP COUNSEL
Erik B. Milch (Reg. No. 42,887) emilch@proskauer.com Proskauer Rose LLP	Joseph Drayton <i>Pro hac vice</i> (application to be filed) jdrayton@proskauer.com

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D. Service Information under § 42.8(b)(4)

This Petition is being served by Federal Express to the attorneys of record for the '996 patent, Michael North, Chung Park, Donald Gibson, and Xin Dai at North Weber & Baugh, 3260 Hillview Ave., Palo Alto, CA 94304. Petitioner consents to electronic service at the addresses provided above for lead and back-up counsel.

III. FEE PAYMENT UNDER 37 CFR § 42.103

Petitioner requests review of one claim, with a \$41,500 payment.

IV. REQUIREMENTS UNDER 37 CFR §§ 42.104 AND 42.108

A. Grounds for Standing

Petitioner certifies the '996 patent is available for IPR and Petitioner is not barred or otherwise estopped.

B. Identification of Challenge and Statement of Precise Relief Requested

Petitioner requests the Board institute IPR of claim 20 based on:

Ground	'996 Patent Claim	Basis for Challenge (35 U.S.C. §§ 102, 103)	Application of Prior Art
1	20	§ 103	Klayman in view of Starr
2	20	§ 103	Agarwal in view of Starr

Submitted with this Petition is the Declaration of James Martin, Ph.D.

(“Martin”) (EX1002), a qualified technical expert.

C. Considerations Under 35 U.S.C. § 325(d)

This Petition does not present a situation in which “the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. § 325(d). No prior art rejections were issued during prosecution of the '996 patent. After receiving the initial application, the patent examiner issued a Non-Final Rejection on April 27, 2010, but only rejected the claims on the basis of non-statutory double patenting over U.S. Patent No. 7,428,669 (the “'669 patent”).

(EX1007, 59-64). In response, on May 7, 2020, applicant filed a terminal disclaimer to the '669 patent. (*Id.*, 44-52). On June 9, 2010, a notice of allowance was issued for claims 1-20 of the '996 application. (*Id.*, 27-33).

The prior art references identified in this Petition were never discussed nor analyzed during prosecution of the '996 patent, however, Starr—which is only used herein as a secondary reference—was disclosed to the Patent Office and cited in the '996 patent as prior art. Specifically, the '996 patent states “[a]daptive interleavers are known to those skilled in the art” citing Starr. (EX1001, 2:65-67). Neither Klayman nor Agarwal were disclosed during prosecution and are not listed on the face of the '996 patent. None of the other cited prior art references (i.e., those cited as evidence of the state of the art) were discussed or analyzed during prosecution.

D. The Board Should Not Exercise its Discretion Under 35 U.S.C. § 314(a) to Deny Institution

The Challenged Claim is presently asserted by Patent Owner in the parallel district court litigation. In *Apple v. Fintiv* (Paper 11), the Board issued precedential guidance on six non-dispositive factors to be considered when there is a co-pending district court litigation (“*Fintiv* Factors”). Taken as a whole, these factors weigh against exercising discretion to deny institution.

***Fintiv* Factor 1: Whether the court granted a stay or evidence exists that one may be granted if the proceeding is instituted.** Petitioner has not yet moved for a stay in the co-pending litigation; therefore, *Fintiv* Factor 1 is neutral. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019 (Paper 12) (PTAB Dec. 1, 2020) at 14; *Sand Revolution II, LLC v. Continental Intermodal Grp. Trucking LLC*, IPR2019-01393 (Paper 24) (PTAB June 16, 2020). As noted in *Fintiv* Factor 4 below, Petitioner stipulates it will not pursue any of the invalidity references relied on in this Petition in the co-pending litigation.

***Fintiv* Factor 2: Proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision.** The co-pending litigation is in its early stages. At the time of filing this Petition, Plaintiff has only served infringement contentions and the parties are engaging in venue discovery in connection with a motion to transfer the co-pending litigation to the District of Colorado. The parties have not yet engaged in any other written discovery, depositions, nor begun claim construction. According to the Court’s Docket Control Order, a *Markman* hearing is set for March 19, 2025 and trial is currently set for September 22, 2025. (EX1008). However, the Eastern District of Texas’ median time-to-trial for patent cases is 727 days, which would result in a trial date of February 17, 2026. (EX1009). And, if the district court litigation were to be transferred to the District of Colorado, the median time-to-trial for patent cases in

that Court is 1,125 days (resulting in an expected trial date of March 22, 2027).

(*Id.*). The projected statutory deadline for a final written decision is in mid-March 2026. Thus, given the ongoing venue discovery which may affect case deadlines and based on the Courts' median time-to-trial, this factor is neutral.

***Fintiv* Factor 3: Investment in the parallel proceedings by the court and the parties.** This factor weighs in favor of not exercising discretion to deny institution. The district court case is in its early stages as the parties have only begun venue discovery and the claim construction hearing will not occur until March 2025. (EX1008). Indeed, the most fact-intensive work (fact and expert discovery), substantive issues (e.g., claim construction), and dispositive decisions (summary judgment and trial) have not yet begun in the co-pending litigation. *See, e.g., Juniper Networks, Inc. v. Huawei Digit. Techs. (Cheng Du) Co.*, IPR2020-01130, Paper 13 at 13 (Jan. 22, 2021); *Sand Revolution II*, IPR2019-01393, Paper 24 at 11. The district court has expended minimal resources to this case.

Where, as here, “the evidence shows that the petitioner filed the petition expeditiously, such as promptly after becoming aware of the claims being asserted, this fact has weighed against exercising discretion to deny institution.” *Fintiv, Inc.*, IPR2020-00019 (Paper 11) at 10-11. Petitioner was served with infringement contentions—identifying the asserted claims—on June 28, 2024 and has filed this Petition approximately 11 weeks after that date. Thus, Petitioner was “reasonably

diligen[t]” in filing this Petition under Factor 3 which weighs against exercising discretion. *Peloton Interactive, Inc. v. iFit, Inc.*, IPR2022-00029 (Paper 13) at 45 (Apr. 22, 2022) (determining that filing a Petition within 10 weeks after Patent Owner informed petitioner of the claims being asserted “show[s] reasonable diligence that weighs against discretionary denial”).

***Fintiv* Factor 4: Overlap between issues raised in the petition and the parallel proceeding.** This factor weighs in favor of not exercising discretion to deny institution. If this Petition is instituted, Petitioner will not pursue any of the invalidity references relied on in the Petition in the district court litigation.

***Fintiv* Factor 5: Whether the petitioner and the defendant in the parallel proceedings are the same party.** Petitioner is a defendant in the parallel proceeding; however, this factor alone should not be dispositive. *See Sand Revolution II, LLC*, IPR2019-01393 (Paper 24), at 12-14, 57.

***Fintiv* Factor 6: Other circumstances that impact the Board’s discretion, including the merits.** This Petition presents a strong case for invalidity of the ’996 patent. Director Vidal’s Interim Guidance, dated June 21, 2022, indicated that the Board would not exercise discretion to deny institution where a petition presents compelling evidence of unpatentability. The claim at issue is broad and rendered obvious by the asserted grounds. Where, as here, a strong case for obviousness is presented, this factor weighs in favor of not exercising

discretion to deny institution. *See Fintiv, Inc.*, IPR2020-00019 (Paper 11), at 14-16; *Sand Revolution II, LLC*, IPR2019-01393 (Paper 24), at 12-14, 57.

Thus, *Fintiv* factors 3-4 and 6 weigh in favor of not exercising discretion to deny institution, factors 1-2 are neutral, and only factor 5 favors denying institution. Taken together, the factors weigh in favor of not exercising discretion to deny institution and the merits of this Petition warrant consideration.

V. TECHNICAL BACKGROUND AND STATE OF THE ART

During a data transmission between two nodes in a communications system, transmission errors can occur as a result of noise and/or interference on the channel. (EX1002 ¶27). If, for example, channel errors occur in a transmission from Node 1 to Node 2, Node 2 may receive a damaged link frame and determine that bit errors existed in the transmission. (*Id.*). Error correction coding was developed at least as early as the 1940s to minimize these transmission errors and correct transmissions going forward. (*Id.* ¶¶25, 28; EX1010, 44). Over time, error correction coding was adapted to be used in satellite, cable, telephony, and wireless systems. (EX1002 ¶¶24-25, 34).

A common type of error correction coding utilized in communication systems was forward error correction (“FEC”) coding, which involved adding redundancy to transmitted user data to help ensure that the data is received and to indicate to the receiver what parameters of error coding are required over a certain

communications channel. (EX1010, 44-45; EX1002 ¶¶30-31). In 1960, a new type of forward error correction coding was published—Reed-Solomon codes—which are still in use today. (EX1010, 45; EX1002 ¶30). By the 1980s, FEC coding was commonplace. (EX1002 ¶30; EX1010, 44-45). FEC coding involves an encoder which appends redundant data bits to an original transmission based on a specific coding algorithm (e.g., Reed-Solomon codes) and a decoder at the receiver determines if errors affected the transmission. (EX1002 ¶31). One benefit of FEC coding is that it is done in real-time so errors can be adaptively corrected in subsequent transmissions. (*Id.* ¶32).

Like FEC coding, data interleaving was also used by the 1980s, often along with FEC coding, to assist with error correction. (*Id.* ¶33). Data interleaving involves rearranging the order of transmitted data to ensure the most important pieces of data are not all affected by burst errors during transmission. (*Id.*). FEC coding and/or data interleaving are (and have been for decades) used in various types of transmission systems including radio, wireless, satellite, DSL, DOCSIS, digital, broadband, cable, and storage systems. (*Id.* ¶34).

VI. OVERVIEW OF THE '996 PATENT

A. Level of Ordinary Skill in the Art

A person of ordinary skill in the art as of December 7, 2003 (the presumptive alleged priority date) (“POSITA”) would have possessed at least a

bachelor's degree in electrical engineering, or a related field, with at least two years of experience in the field of DSL, cable, or wireless communication systems. (EX1002 ¶¶55-56). Additional education could compensate for less practical experience and vice versa. (*Id.* ¶56).

B. Priority Date

Patent Owner has alleged that the '996 patent claims the benefit of priority of a provisional application filed on December 7, 2003. (EX1006, 6). Petitioner uses December 7, 2003 as the priority date for the purposes of this Petition, but does not concede that the Challenged Claim is entitled to that date.

C. Specification

The '996 patent is directed to a method and transmission system utilizing adaptive forward error correction (FEC) coding. (EX1001, Abstract). Figure 4 illustrates the disclosed adaptive FEC coding method performed by the transmission system:

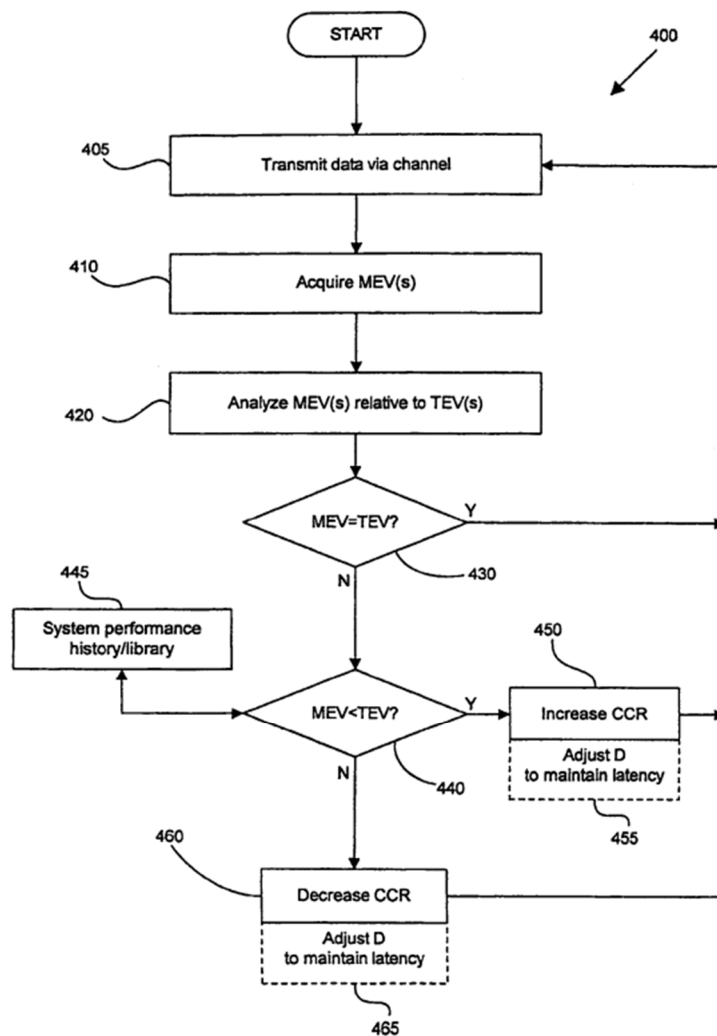


Figure 4

(*Id.*, Fig. 4). The specification teaches measuring a transmission error value, comparing it to a threshold error value, and adjusting the codeword composition ratio (“CCR”) “without affecting the latency of data transmission through the system between a transmitter and a receiver.” (*Id.*, 13:65-14:10, 5:41-44).

The disclosed system uses “adaptive programming” of FEC codewords and interleaving to overcome the purported problems in the prior art. (*Id.*, 2:41-47,

3:56-64). The '996 patent acknowledges FEC coding (including Reed-Solomon encoding) and adaptive interleaving “are known to those skilled in the art.” (*Id.*, 1:65-67, 2:65-66). However, the specification states that prior art systems “have ignored adaptive codeword generation and adjustment and, instead, have focused only on programming the D parameter alone in the interleaver.” (*Id.*, 8:10-14). According to the '996 patent, prior art methods of interleaving FEC codewords “introduces a transmission delay (or ‘latency’)”. (*Id.*, 2:48-50; *see also id.*, 3:9-17).

The specification also teaches a controller within the transmission system which “monitor[s], analyze[s] and adjust[s]” the FEC coding values. (*Id.*, 4:7-9). Specifically, the controller may adjust the CCR by adjusting certain parameters, such as the N, K, and/or R parameters in an ADSL1 system or INP or maximum interleaving delay parameters in an ADSL2 system. (*Id.*, 4:3-9). The controller is also responsible for generating signals, such as input or control signals, corresponding to the measured error values in the transmission and determined parameter adjustments. (*Id.*, 13:10-13; *see also id.*, 17:11-19 (teaching the input signal “can take many forms and be based in whole or in part on the BER, errored seconds, etc. . . . can be analog or digital and linear or non-linear . . . [or] binary such that the input signal 643 is greater than or less than one or more threshold values based upon the MEV(s).”)).

D. The Challenged Claim

This Petition challenges claim 20 of the '996 patent.

E. Claim Listing

Exhibit 1011 is a claim listing enumerating each claim element. Bracketed notations (e.g., [a], [b], etc.) are used to refer to individual elements.

VII. CLAIM CONSTRUCTION

For purposes of the prior art cited herein, no claim term requires an express construction because the prior art relied upon meet the claim terms under any reasonable interpretation. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Should the Board apply a specific construction to any claim terms of the '996 patent, Petitioner reserves the right to address those constructions and revise its arguments regarding the relevant claim limitations for the cited prior art.

VIII. THE CHALLENGED CLAIM IS INVALID

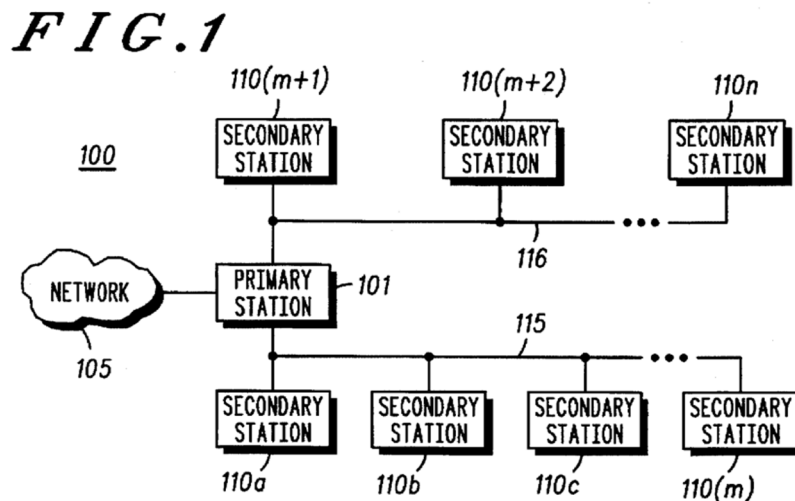
As detailed below, claim 20 of the '996 patent is obvious in view of the identified prior art.

A. Summary and Date Qualification of the Prior Art

1. Klayman (Ex. 1003)

U.S. Patent No. 5,699,365 to Jeffrey T. Klayman, et al. (“Klayman”) is a patent entitled “Apparatus and Method for Adaptive Forward Error Correction in Data Communications,” filed March 27, 1996, issued December 16, 1997, and qualifies as prior art under 35 U.S.C. §§ 102(a), (b), and (e) (pre-AIA).

Klayman teaches a communications system and method of adaptive forward error correction coding. (EX1003, Abstract).



(*Id.*, Fig. 1). As shown above, Klayman teaches primary and secondary stations, each coupled to processors and memory, that transmit data over communication channels. (*Id.*, 2:65-3:3, Figs. 2-3). Klayman discloses a method of adaptively generating an error correcting code and then detecting received errors and correcting the code accordingly:

The transmitting unit, such as the processor 150 and channel interface 160 of a secondary station 110_n, generates the error correcting code from the user data, and appends the encoded data onto the user data during transmission. The receiver unit, such as receiver 135, and processor 130_{n2} of the primary station 101, uses the encoded data to detect received errors and to correct detected errors.

(*Id.*, 5:22-28). Klayman specifically teaches monitoring parameters including bit error rates to determine the appropriate revised forward error correction parameter which is transmitted from a primary station to a secondary station. (*Id.*, 8:30-42; *see also id.*, 4:37-50).

2. Agarwal (Ex. 1004)

U.S. Patent No. 6,477,669 to Anil K. Agarwal, et al. (“Agarwal”) is a patent entitled “Method and Apparatus for Adaptive Control of Forward Error Correction Codes,” filed July 15, 1998 as a PCT application, published January 28, 1999, and issued November 5, 2002, and qualifies as prior art under 35 U.S.C. §§ 102(a), (b), and (e) (pre-AIA).

Agarwal teaches adaptive forward error correction coding in a transmission system between first and second terminals or interfaces. (EX1004, Abstract, 5:12-14). Figure 1 depicts the transmission system of Agarwal:

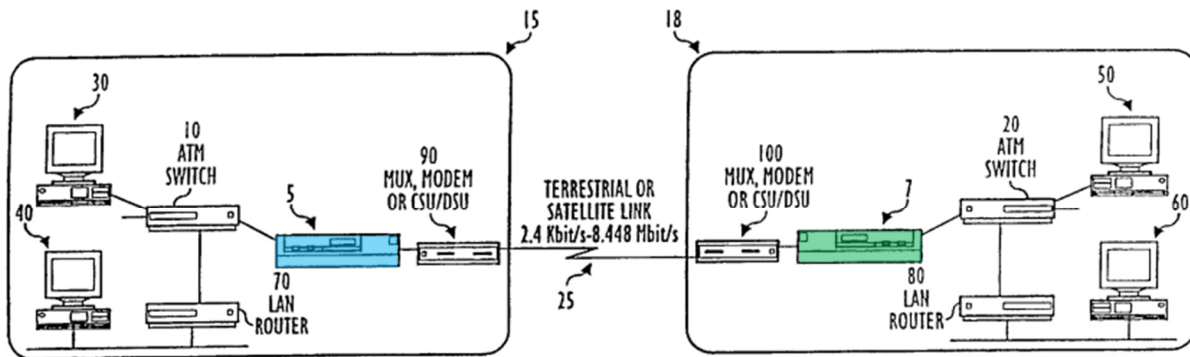


FIG. 1A

(*Id.*, Fig. 1A (annotated to indicate interfaces 5 and 7 in blue and green, respectively)). Agarwal's disclosed method includes calculating a byte error rate, determining a forward error correction code length, and transmitting a new forward error correction code length, as shown in Figure 5:

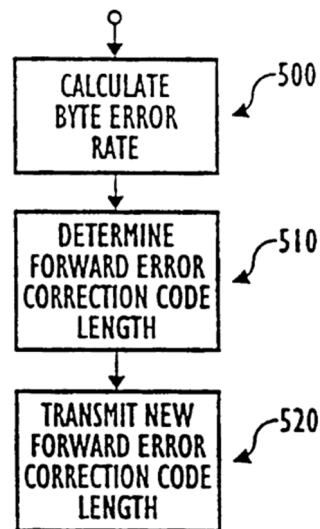


FIG. 5

(*Id.*, Fig. 5; *see also id.*, Abstract). These determinations are done “on a real-time basis.” (*Id.*, 6:1-4). Each interface includes an encoder, interleaver, decoder, and

deinterleaver to carry out the above method. (*Id.*, Fig. 1B). The first and second interfaces (remote and primary interfaces, respectively) are coupled to a microprocessor as shown in Figure 4:

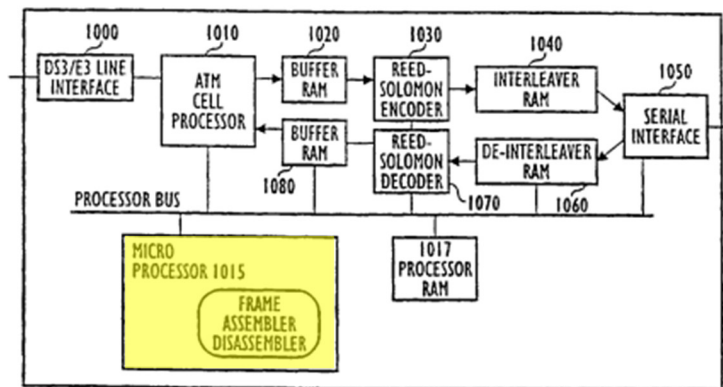


FIG. 4

(*Id.*, Fig. 4 (annotated to identify Microprocessor 1015)).

3. Starr (Ex. 1005)

U.S. Patent No. 6,546,509 to Thomas J. J. Starr (“Starr”) is a patent entitled “Method and System for Adaptive Interleaving,” filed June 19, 2001, published February 7, 2002, and issued April 8, 2003, and qualifies as prior art under 35 U.S.C. §§ 102(a), (b), and (e) (pre-AIA).

Starr discloses a communications system and method of adaptive interleaving. (EX1005, Abstract). Starr’s disclosed system monitors “performance parameters of a transmission system and control[s] the adaptive interleaver in

response to the performance parameters.” (*Id.*). Figure 3 depicts a portion of Starr’s system:

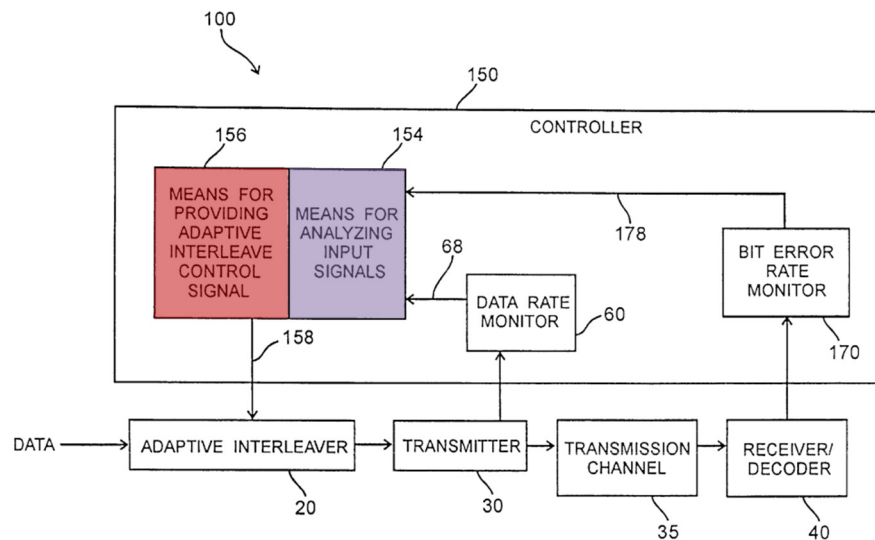


Fig. 3

(*Id.*, Fig. 3 (annotated)). As shown in Figure 3 above, Starr teaches a controller with means for providing an adaptive interleave control signal and a means for analyzing input signals. (*Id.*, Fig. 3A at 156 and 154).

B. Ground 1: Obviousness of Claim 20 Based on Klayman in View of Starr

1. Claim 20

Claim 1 is obvious over Klayman alone and/or Klayman in view of Starr.

i. Claim 20, Preamble

To the extent the preamble is limiting, it is disclosed by Klayman. The preamble recites “A transmission system comprising.” Klayman teaches “apparatus 101 for adaptive forward error correction in a data communications system 100,

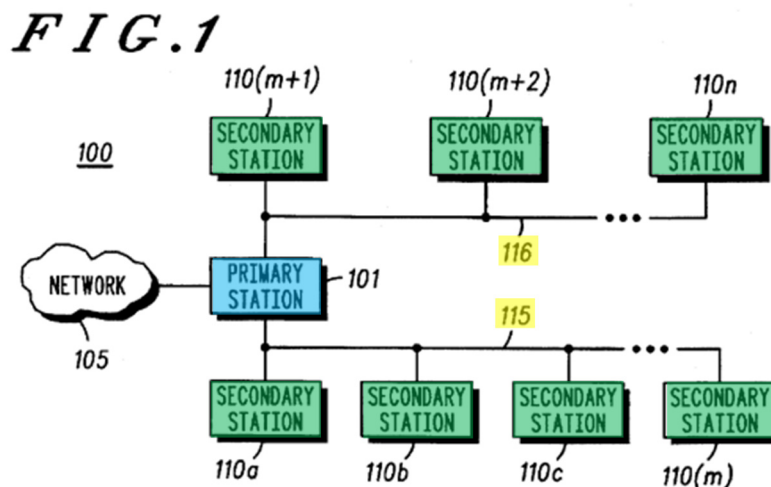
the data communications system 100 having a communication medium”

(EX1003, 10:56-59). A POSITA would have understood that Klayman’s disclosed communications system 100 is a transmission system. (EX1002 ¶111). Thus, Klayman teaches the preamble of claim 20.

ii. Element 20[a]

Klayman discloses “a transmission channel to carry data between a transmitter and a receiver/decoder, each communicatively interfaced with the transmission channel.” Klayman teaches communications channels that transmit data between primary and secondary stations (specifically, channel interface 160 of the secondary station), which correspond to a receiver/decoder and transmitter.

Klayman teaches “a plurality of communications channels” within communications medium 115 and 116. (EX1003, 10:56-59). These channels and communications media are depicted in Figure 1 below:



(*Id.*, Fig. 1 (annotated)). And, as shown in Figure 1, each communications channel is communicatively coupled with primary station 101 and secondary stations 110. (*Id.*). Klayman discloses that “primary station 101, transmits information, signals, or other data to a secondary station.” (*Id.*, 3:20-26; *see also id.*, Fig. 5 (“transmit data on a communication channel”)). As shown in Figure 1, each communication medium, comprising a transmission channel, is communicatively interfaced with the primary and secondary stations.

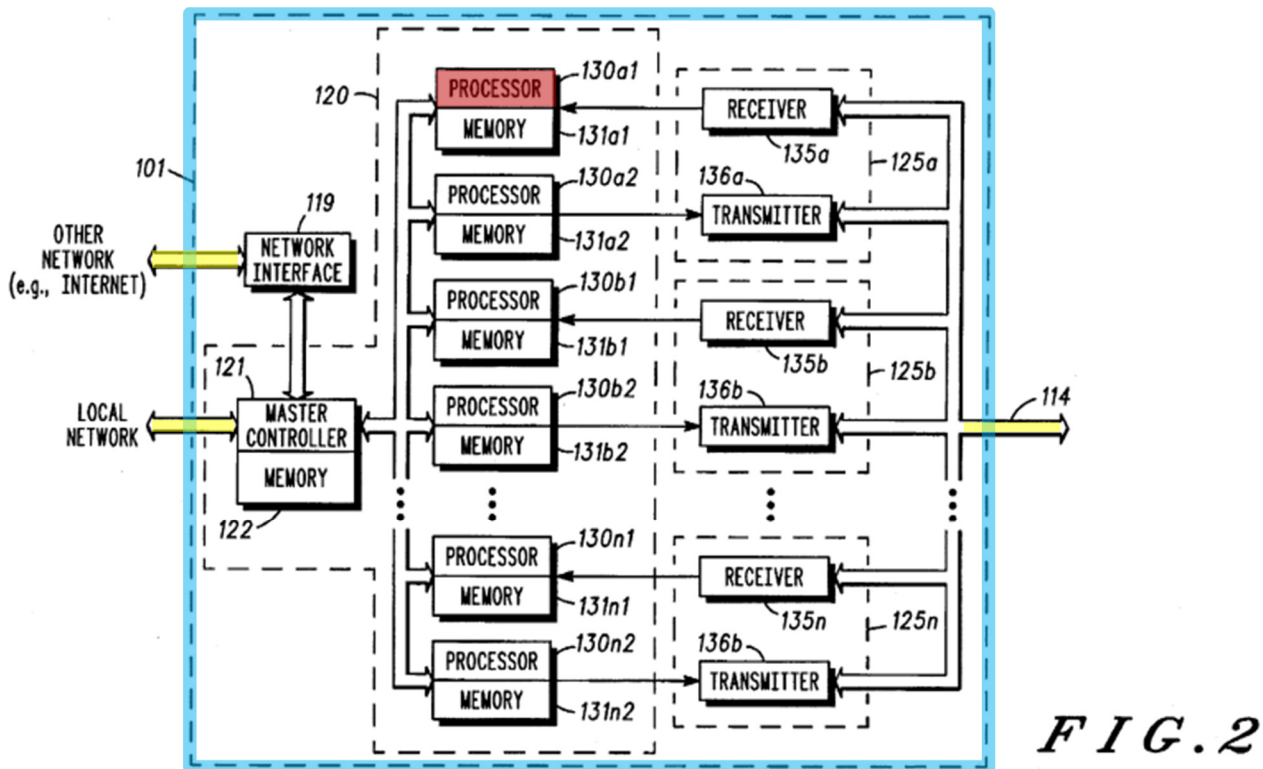
The secondary and primary stations in Klayman include the claimed transmitter and receiver/decoder, respectively. Klayman teaches the secondary station includes channel interface 160 which is a transmitter: “transmitting unit, such as processor 150 and channel interface 160 of a secondary station 110”. (*Id.*, 5:22-28 (emphasis added)). Klayman teaches that channel interface 160 of the secondary station “performs such functions as forward error correction encoding and decoding, . . . QPSK modulation (for upstream transmission), transmit level and frequency adjustment, for data and other signal reception and transmission.” (*Id.*, 4:58-5:1). Klayman further teaches the primary station is a receiver: “receiver unit, such as receiver 135 and processor 130_{n2} of the primary station”. (*Id.* (emphasis added)). With respect to the primary station (i.e., receiver), each may include a “Reed-Solomon decoder.” (*Id.*, 4:21-26 (emphasis added)). Thus, the primary station is a receiver/decoder. A POSITA would have understood

Klayman's primary station to correspond to a receiver/decoder, and channel interface 160 within Klayman's secondary station to correspond to a transmitter which transmits data over the transmission channel. (EX1002 ¶¶113-116).

Thus, Klayman teaches element 20[a].

iii. Element 20[b]

Klayman teaches "a transmission error value monitor communicatively interfaced with the receiver/decoder to periodically monitor for transmission error values indicative of impulse noise events on the transmission channel." As explained above, Klayman teaches a primary station 101 which corresponds to the claimed receiver/decoder. Klayman also teaches that each primary station 101 (i.e., receiver/decoder) includes a processor 130 as depicted in Figure 2:



(*Id.*, Fig. 2 (annotated in blue to identify primary station 101, red to identify a processor 130a1, and yellow to identify communication channels)). As shown in Figure 2 above, each processor 130 is within the primary station 101 (which includes a decoder as explained above) and communicatively coupled with the receiver.

A POSITA would have recognized that processors 130 within the primary station include a transmission error value monitor. (EX1002 ¶120). Klayman teaches that “[t]he receiving unit, such as receiver 135_n and processor 130_{n2} of the primary station 101, uses the encoded data to detect received errors.” (EX1003,

5:26-29 (emphasis added)). Specifically, as shown in Figure 4 below, processor 130 of the primary interface monitors channel parameters at step 310:

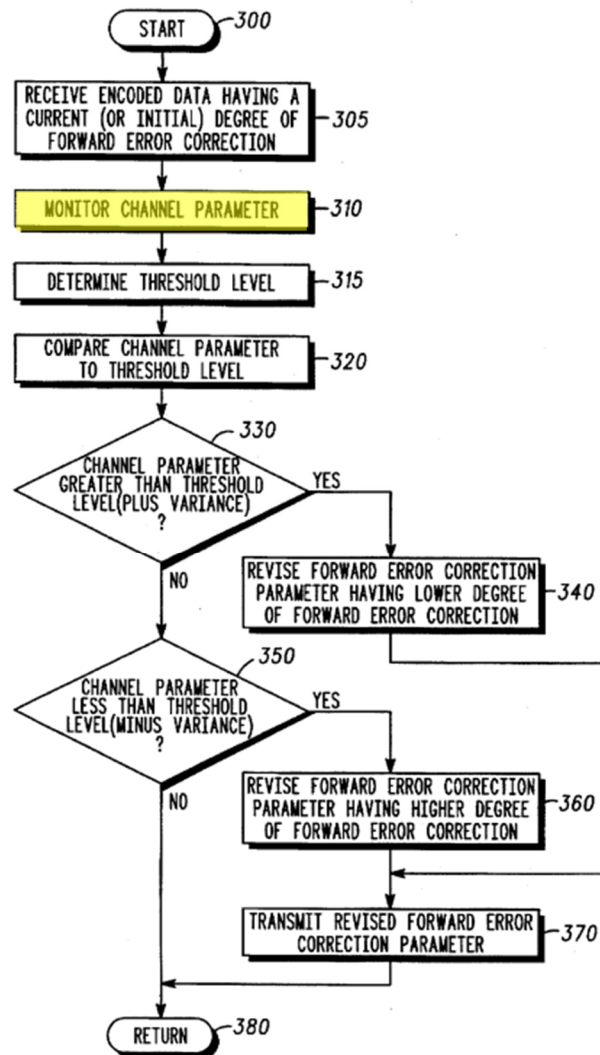


FIG. 4

(*Id.*, Fig. 4 (annotated)). Klayman explains that the processor uses program instructions “to monitor a channel parameter . . . compare the monitored parameter with a threshold level of the channel parameter; and when the monitored parameter is not within a variance (or tolerance level) of the threshold level . . . change the

first degree of forward error correction to a second degree of forward error correction.” (*Id.*, 11:2-12). Klayman thus teaches, and a POSITA would have understood it to disclose, that each processor 130 carries out the steps of Figure 4 above and includes a monitor to monitor the channel parameters. (EX1002 ¶120).

Processors 130 within the primary station “monitor a channel parameter of the second communications channel to form a monitored parameter”. (EX1003, 11:2-12). Processors 130 work in conjunction with the receiver 135 (which receives data transmissions) and memory 131 (which stores the program instructions used by processors 130) to monitor channel parameters. (*Id.*, 5:26-29, 11:2-12). A POSITA would have understood that the “detect[ed] received errors” taught by Klayman correspond to these monitored parameters which are compared to the channel parameter threshold level at step 320 (in Figure 4 above) to determine the level of variance. (EX1002 ¶119). Thus, a POSITA would have recognized that the monitor within processor 130 is a transmission error value monitor. (*Id.* ¶120). Klayman specifically teaches that one such parameter which is monitored by processor 130 is “bit error rates” (i.e., transmission error values). (EX1003, 7:37-45). Accordingly, processors 130 (each including a transmission error value monitor) monitor for bit error rates (i.e., transmission error values) on the transmission channel.

Klayman further teaches that “this process may be repeated for each secondary device and over time” and “different revised forward error correction parameters will be received by the different secondary stations and, over time, by the same secondary station.” (EX1003, 10:20-26). A POSITA would have therefore understood that processors 130 would repeatedly monitor channel parameters (i.e., transmission error values) to repeatedly transmit revised forward error correction parameters (at step 370 of Figure 4) which are received by the secondary station. (EX1002 ¶121). A POSITA would have understood Klayman’s disclosure that this process is “repeated . . . over time” to mean that this monitoring is done periodically. (*Id.* ¶¶121, 128).

Klayman discloses that the communication channels within its system are subject to noise interference:

As mentioned above, the upstream channels of the communication medium, in the preferred CableComm™ System, are in a frequency range between 5 and 42 MHz and may be susceptible to interference from typical noise sources. Forward error correction is preferably employed on the upstream channels as a way of compensating for data transmission errors which may have been caused by noise or other distortions.

(EX1003, 5:12-19 (emphasis added)). Accordingly, Klayman teaches monitoring transmission error values (also referred to in Klayman as channel parameters), such as bit error rates, which indicate a noise disruption. (*Id.*, 7:37-50; *see also id.* (specifically stating that “impulse noise” may be present on the channel)). Thus, a

POSITA would have understood that the monitored bit error rates (i.e., transmission error values) are indicative of impulse noise events on the communications channel (i.e., transmission channel). (*See also* EX1002 ¶122; *see also* EX1001, cl. 20 (reciting that “bit error rate” is a type of “transmission error value” that is “indicative of impulse noise events on the transmission channel”)).

Combination of Klayman and Starr: Additionally, Starr explicitly teaches that monitored “performance parameters are preferably chosen from the group consisting of signal to noise ratio (SNR), bit error rate (BER) and data rate.” (EX1005, 2:37-39). Thus, like Klayman, Starr teaches monitoring a bit error rate which is a transmission error value. Starr further teaches monitoring signal to noise ratio (“SNR”) which is also a transmission error value and indicative of impulse noise on the transmission channel.

Starr explicitly teaches that transmission channels can be affected by various factors including “noise present in the transmission channel” and further teaches monitoring “one or both of the SNR and BER of the system” to determine the effect of noise on the channel. (*Id.*, 3:43-54). To monitor SNR, Starr discloses a “signal to noise ratio monitor” which “comprises a monitor for determining the SNR as known to those skilled in the art.” (*Id.*, 5:10-15). “The signal to noise ratio monitor 72 determines a SNR (step 342) of the transmission system 180.” (*Id.*,

9:39-40). This determination of signal to noise ratio (shown at step 306) is shown in Figure 7 below:

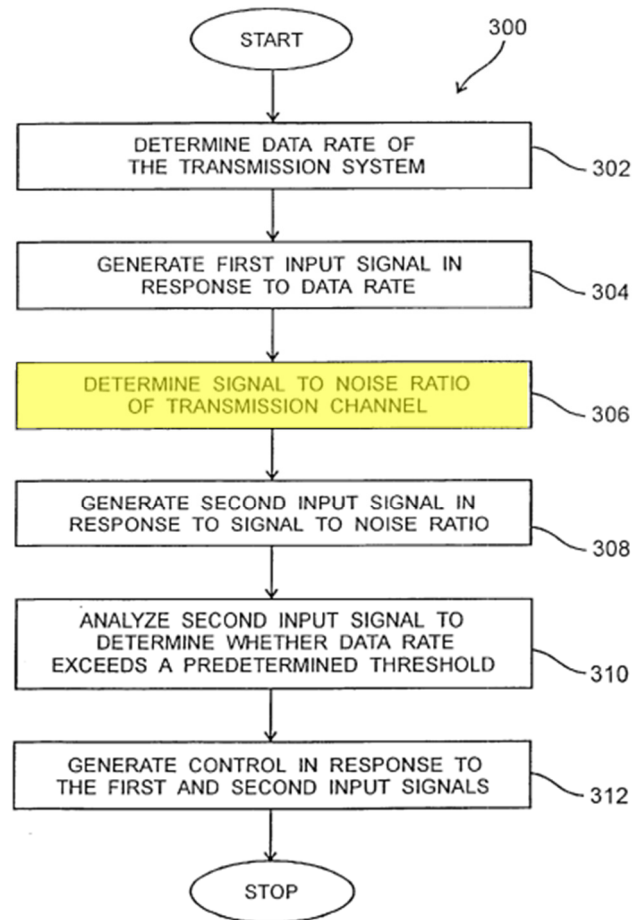


Fig. 7

(*Id.*, Fig. 7 (annotated)). A POSITA would have known that SNR is indicative of impulse noise events on the transmission channel. (EX1002 ¶125).

In the combined system of Klayman and Starr, a POSITA would have understood and found it obvious that each processor 130 of Klayman—which include a transmission error value monitor—would monitor the SNR (i.e., a

transmission error value) as taught by Starr. (*Id.* ¶124). A POSITA would have been motivated to combine the teachings of Klayman and Starr for the reasons discussed below.

Motivation to Combine Klayman and Starr: A POSITA would have been motivated to combine Klayman with Starr, predictably resulting in a transmission system that monitors both bit error rate and signal to noise ratio to determine the appropriate degree of revised forward error correction. (EX1002 ¶¶76-108).

Klayman and Starr are within the same field of adaptive error coding. (EX1003, EX1005). Klayman teaches “a method for adaptive forward error correction in a data communication system” that uses “hybrid optical fiber and coaxial cable. In other embodiments, the communications media . . . may be coaxial cable, fiber optical cable, twisted pair wires, and so on, and may also include air, atmosphere or space for wireless and satellite communication.” (EX1003, Abstract, 3:2-8). Klayman also discloses using Reed-Solomon error codes and interleaving. (*Id.*, 5:55-58, 7:20-23). Likewise, Starr (just like Klayman) teaches a system of adaptive interleaving in a transmission system that “preferably comprises twisted-pair conductive wire” but could instead “comprise coaxial cable, optical fiber, free-space laser, radio or any other type of transmission media as known to those skilled in the art.” (EX1005, 4:9-15). And, like Klayman, Starr’s system uses Reed-Solomon codes “or any other suitable error correcting decoder.”

(*Id.*, 4:24-26). Both Klayman and Starr teach a transmitter, receiver, communication channel, decoder/encoder, and a controller. (EX1003, 2:63-3:3, 4:8-38; EX1005, 2:54-57). Thus, a POSITA would have recognized Klayman and Starr teach similar communications systems, applicable across numerous systems, with common engineering designs, that utilize similar error coding correction techniques. (EX1002 ¶¶76, 80-82).

A POSITA would have also known that, prior to 2003, monitoring signal to noise ratio (“SNR”) was known in the art. (*Id.* ¶¶77, 84-85). Starr itself notes that the use of “a monitor for determining the SNR [is] known to those skilled in the art”. (EX1005, 5:10-12). For example, at least as early as 1965, it was known to measure signal-to-noise ratio to determine the performance of a transmission based on the level of noise present in the communication environment. (EX1012). Thus, a POSITA would have known that each processor 130 in Klayman’s system could include a means to monitor the SNR of incoming transmissions as one way to determine the quality of the channel. (EX1002 ¶85).

A POSITA would also have found it obvious to try implementing Starr’s teachings of monitoring SNR in Klayman’s system. (*Id.* ¶¶97-98). Klayman, for its part, explicitly teaches “monitoring . . . noise levels (such as levels of impulse noise or ingress noise)”. (EX1003, 7:40-42). While Klayman does not specifically explain the implementation of “monitoring . . . noise levels” a POSITA would have

looked to contemporaneous references, such as Starr, to arrive at various ways to monitor noise events. (EX1002 ¶98). Starr explicitly teaches monitoring SNR to indicate noise events on a channel. (EX1005, 3:41-53, 5:10-26). Thus, it would have been obvious to a POSITA to try monitoring SNR in Klayman's system. (EX1002 ¶98).

A POSITA would have expected success in the proposed combination, especially given the similar configurations of the Klayman and Starr systems. (*Id.* ¶105). Klayman teaches that processor 130 at the primary station monitors channel parameters, including bit error rates, in incoming data transmissions. (EX1003, Fig. 4 (step 310), 7:37-50). As explained above regarding element 20[b], a POSITA would have understood processor 130 to include a transmission error value monitor that monitors for bit error rates. Additionally, because Klayman also teaches monitoring "noise levels (such as levels of impulse noise . . .)," a POSITA would have also understood that the transmission error value monitor in processor 130 would include means to monitor noise levels. (EX1002 ¶105). Starr similarly teaches a specific means to monitor noise within a controller (similar to processor 130) which detects SNR as a parameter (i.e., transmission error value):

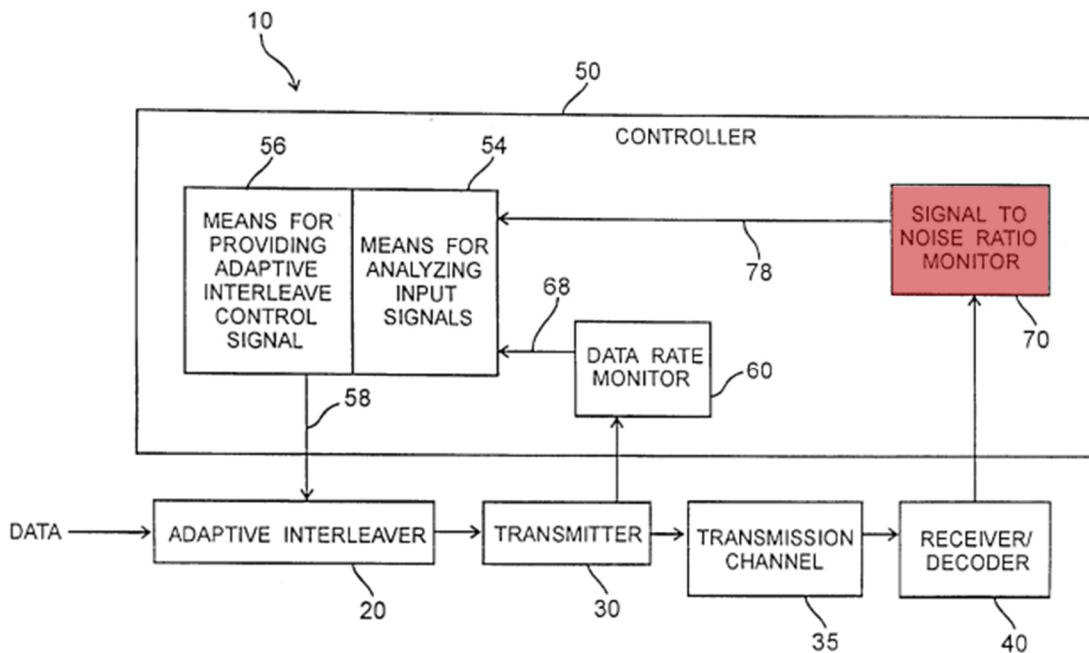


Fig. 2

(EX1005, Fig. 4 (annotated)). A POSITA would have recognized that processor 130, already configured to monitor transmission error values, including noise levels, and could specifically monitor SNR as disclosed by Starr. (EX1002 ¶105). A POSITA would have seen no technical obstacle in doing so and expected success in configuring each processor 130 to monitor SNR. (*Id.*).

Thus, Klayman alone and/or Klayman in view of Starr teaches element 20[b].

iv. Element 20[c]

Klayman discloses “wherein the transmission error values are periodically monitored after training and initialization on the receiver/decoder.” Klayman discloses that an initial registration process takes place prior to the receipt of actual

data, and thereafter data is transmitted and error values are monitored to inform error corrections. Specifically, Klayman teaches: “In the preferred embodiment, the initial degree of forward error correction may be established during an initial registration process, when a secondary station establishes a communication link with a primary station.” (EX1003, 7:23-27 (emphasis added)). Thus, the initialization process first establishes a link or synchronization between the primary and secondary stations such that data can be transmitted and error values may then be monitored. Klayman explains that “during initial set up or configuration of the communication system” the primary station (i.e., the receiver/decoder) “prior to the receipt of actual data” learns “what type of error correcting code is to be employed by the transmitting unit, for proper decoding and error correction.” (*Id.*, 5:29-36 (emphasis added)). A POSITA would have understood that transmission error values are periodically monitored in Klayman’s system after the initial set up and configuration (i.e., initialization and training) process is completed and data may be transmitted. (EX1002 ¶¶129-130).

As shown in Figure 4, monitoring of channel parameters at step 310 occurs after receiving encoded data with an initial degree of forward error correction:

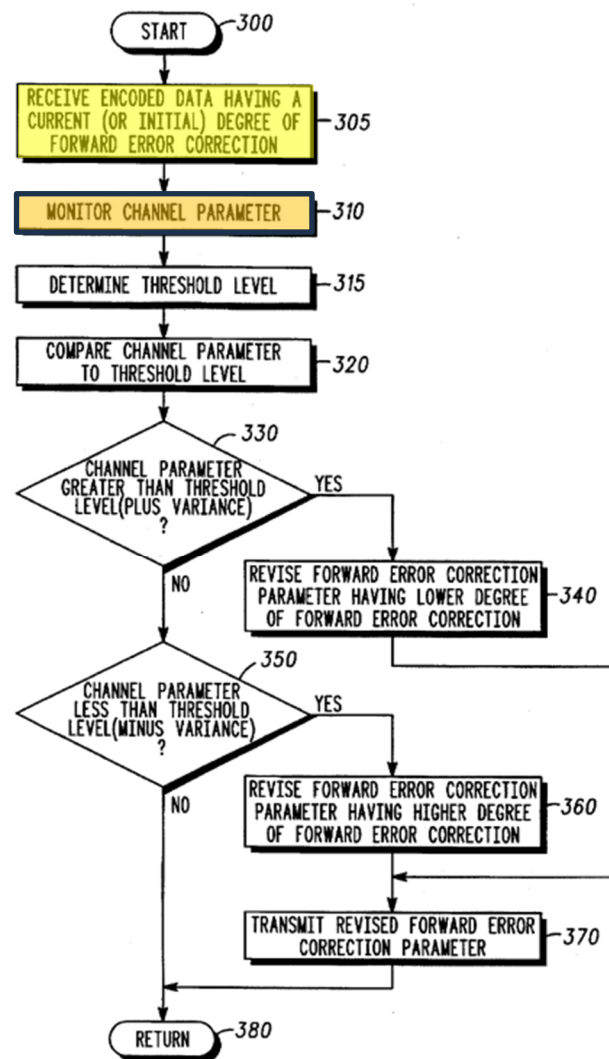


FIG. 4

(*Id.*, Fig. 4 (annotated)). A POSITA would have understood, therefore, that the periodic monitoring of transmission error values in Klayman occurs after the “initial registration process.” (EX1002 ¶130).

A POSITA would have also known that this initial registration process connecting the primary and secondary stations corresponds to training and initialization of the system, including the primary station. (*Id.* ¶¶129-130).

Klayman's description of "initial set up or configuration of the communication system" would require initialization and training of the stations so they could communicate to "establish[] the communications link." (EX1003, 5:33-36; EX1002 ¶¶129-130). For example, contemporaneous prior art explains the purpose of training and initialization in a typical ADSL communications system as: "to establish communication between the transceivers at the very onset, full initialization of the modems of the transceivers must be completed. Conventional ADSL modems will always go through an initialization procedure during which known training signals are set between the transceivers." (EX1013, 5:61-66). Thus, a POSITA reading Klayman would have understood Klayman's disclosure of an "initial registration process" to refer to the training and initialization phase (as claimed in the '996 patent) that must be completed before a communication link is established such that data can be transmitted and transmission error values may be periodically monitored. (EX1002 ¶¶129-130).

Combination of Klayman and Starr: In the combined system of Klayman and Starr, a POSITA would have understood that Klayman's processor 130 of the primary station would also periodically monitor SNR (i.e., transmission error values) after training and initialization at the primary station (i.e., receiver/decoder) for the same reasons as discussed above. (*See also* EX1002 ¶131).

Motivation to Combine Klayman and Starr: The rationale and motivation to combine Klayman and Starr is explained above regarding element 20[b], which is hereby incorporated by reference.

Thus, Klayman alone and/or Klayman in view of Starr teaches and/or renders obvious element 20[c].

v. Element 20[d]

Klayman discloses “the transmission error values being selected from a group comprising: a bit error rate, errored seconds, errored minutes, code violations over a fixed period of time, Signal-to-Noise Ratio (SNR) measured at the receiver/decoder, and Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.”

As explained above, Klayman teaches the primary station (through processors 130) monitors channel parameters, such as bit error rate, (i.e., transmission error values) at step 310 of Figure 4. Klayman states that “channel parameters are monitored in step 310, such as monitoring packet error rates, bit error rates, noise levels (such as impulse noise or ingress noise), other interference, or other parameters or factors which could be correlated with channel quality, error rates, and a desired or necessary degree of error correction capability.” (EX1003, 7:39-45 (emphasis added)). Accordingly, Klayman explicitly teaches that the

monitored channel parameters (i.e., transmission error values) include bit error rates.

Combination of Klayman and Starr: Additionally, as explained regarding element 20[b] above, Starr teaches measuring signal to noise ratio (“SNR”) which is a transmission error value. (EX1005, 2:37-39, 5:10-26). Starr also discloses that the SNR monitor is coupled to the receiver/decoder in Starr’s system:

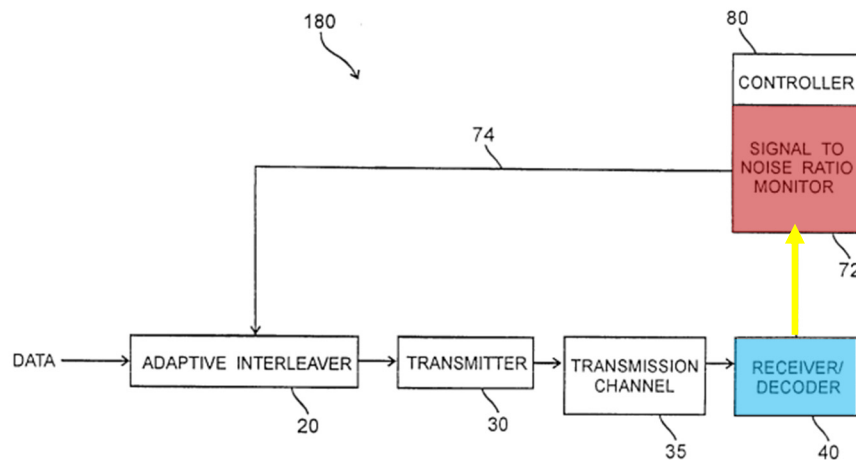


Fig. 4

(EX1005, Fig. 4 (annotated)). In the combined Klayman-Starr system, a POSITA would have recognized that SNR (as taught by Starr) is measured at the receiver/decoder. (EX1002 ¶¶135-136). As explained above regarding element 20[b], the transmission error value monitor of Klayman (i.e., a means within processor 130) is within the primary station (i.e., receiver/decoder). (EX1003, Figs. 2, 4). A POSITA would have understood that in the combined system of Klayman

and Starr, processor 130 of the primary station (i.e., receiver/decoder) would include means to measure the SNR at the receiver/decoder. (EX1002 ¶¶135-136).

Motivation to Combine Klayman and Starr: The rationale and motivation to combine Klayman and Starr is explained above regarding element 20[b], which is hereby incorporated by reference.

Thus, Klayman alone and/or Klayman in view of Starr teaches and/or renders obvious element 20[d].

vi. Element 20[e]

Klayman discloses “wherein the transmission error value monitor [] further generate[s] an input signal based on the transmission error values monitored.” As explained for element 20[b], Klayman teaches a transmission error value monitor, included within each processor 130 within the primary station, which monitors transmission error values (i.e., channel parameters such as the aforementioned “bit error rate”) at step 310 of Figure 4.

As explained above and depicted in Figure 4 below, Klayman teaches that the primary station—through processors 130—monitors channel parameters (shown in blue), compares those parameters to threshold levels (shown in green), determines whether a revised forward error correction code parameter is needed (shown in purple), revises forward error correction parameters accordingly (shown

in red), and then transmits that revised forward error correction code parameter (if needed) to the secondary station (shown in yellow):

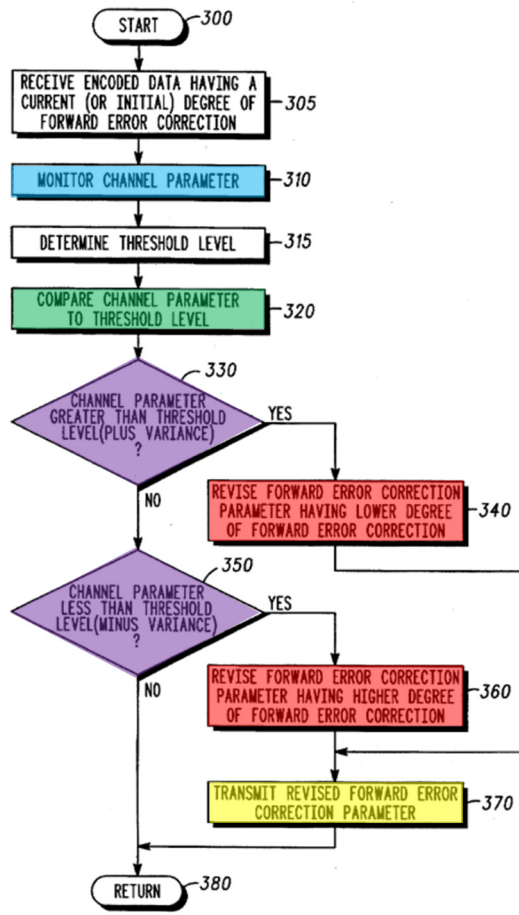


FIG. 4

(*Id.*, Fig. 4 (annotated)). As explained regarding element 20[b] above, each processor 130 performs the steps of Figure 4. (See also EX1002 ¶139). Klayman explains “[f]ollowing steps 340 and 360, the revised forward error correction parameter is transmitted, step 370, for example, to a particular secondary station.” (EX1003, 8:30-42). Accordingly, each processor 130, including a transmission

error value monitor, performs step 370, “transmit revised forward error correction parameter”. (*Id.*, Fig. 4; EX1002 ¶¶139-140).

A POSITA would have understood that, after monitoring channel parameters and comparing them to a threshold value at steps 310-350, processor 130 would then generate an input signal when transmitting the revised forward error correction parameters at step 370. (EX1002 ¶140). Klayman teaches that the forward error correction parameter is transmitted “in a link layer protocol message” and explains that “the preferred embodiment” of the invention “utilizes signaling.” (EX1003, cl. 16, 9:64-10:2; *see also id.*, 10:4-7 (“signaling may be performed at any layer in a communication protocol”); *id.*, 6:66-7:3 (“means for signaling and changing the forward error correction parameters”)). A POSITA would have recognized that processor 130 would use an input signal which is sent to and received by the transmitter. (EX1002 ¶140; *see also* EX1003, 4:58-5:6 (explaining that channel interface 160 at the secondary station (i.e., transmitter) performs “signal reception”)).

Combination of Klayman and Starr: Alternatively, Starr explicitly teaches the generation of an “input” signal. Starr discloses that “bit error rate monitor 170 preferably generates an input signal 178 that varies as a function of the BER.” (EX1005, 6:43-44). Similarly, Starr teaches “[t]he signal to noise ratio monitor 70 preferably determines the SNR and generates an input signal 78 that varies as a

function of the SNR.” (*Id.*, 5:27-29). Thus, in the combined system of Klayman and Starr, the transmission error value monitor within processor 130 of the primary station—which monitors bit error rate and SNR (i.e., transmission error values)—generates an input signal based on the monitored transmission error values (i.e., bit error rate or SNR).

Regarding the generated input signal, Starr explains:

[T]he input signal 178 can take more forms. The input signal 178 can be based in-whole or in-part on the BER. The input signal 178 can be analog or digital and linear or non-linear as known to those skilled in the art. Alternatively, the input signal 178 can be binary such that input signal 178 is greater than or less than a threshold value based upon the BER as known to those skilled in the art.

(*Id.* at 6:45-52; *compare* EX1001, 17:11-20 (the ’996 patent describes the generated “input signal” in similar terms)).

In the combined system of Klayman and Starr, a POSITA would have understood and found it obvious that step 370 of Klayman—transmission of a revised forward error correction parameter to a secondary station by processor 130—would include generating an input signal (i.e., Starr’s input signal 78 or 178) which is based on the monitored channel parameters (i.e., transmission error values such as bit error rate or SNR). (EX1002 ¶144). A POSITA would have been motivated to combine the teachings of Klayman and Starr for the reasons discussed in element 20[b] and below.

Motivation to Combine Klayman and Starr: A POSITA would have been motivated to combine Klayman with Starr, predictably resulting in a transmission system that utilizes an input signal to transmit data with a revised degree of forward error correction. (EX1002 ¶¶76, 78-108).

Klayman and Starr are within the same field of adaptive error coding. (EX1003, EX1005). Klayman teaches “a method for adaptive forward error correction in a data communication system” that uses “hybrid optical fiber and coaxial cable. In other embodiments, the communications media . . . may be coaxial cable, fiber optical cable, twisted pair wires, and so on, and may also include air, atmosphere or space for wireless and satellite communication.” (EX1003, Abstract, 3:2-8). Klayman also discloses using Reed-Solomon error codes and interleaving. (*Id.*, 5:55-58, 7:20-23). Likewise, Starr (just like Klayman) teaches a system of adaptive interleaving in a transmission system that “preferably comprises twisted-pair conductive wire” but could instead “comprise coaxial cable, optical fiber, free-space laser, radio or any other type of transmission media as known to those skilled in the art.” (EX1005, 4:9-15). And, like Klayman, Starr’s system uses Reed-Solomon codes “or any other suitable error correcting decoder.” (*Id.*, 4:24-26). Both Klayman and Starr teach a transmitter, receiver, communication channel, decoder/encoder, and a controller. (EX1003, 2:63-3:3, 4:8-38; EX1005, 2:54-57). Thus, a POSITA would have recognized Klayman and

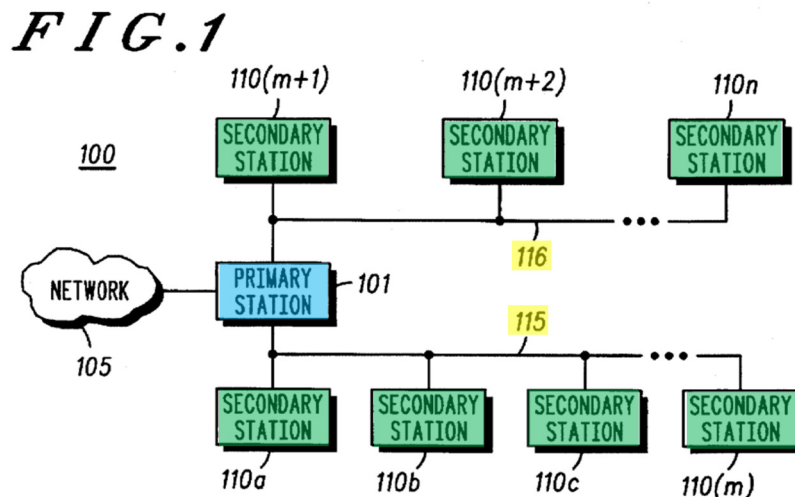
Starr teach similar communications systems, applicable across numerous systems, with common engineering designs, that utilize similar error coding correction techniques. (EX1002 ¶¶80-82, 94-96).

A POSITA would have also known that, prior to 2003, input signals were utilized to send instructions in a transmission system. (*Id.* ¶¶78, 86). It was known in the art by at least the 1990s to utilize input signals to communicate error coding parameters in transmission systems. (*See, e.g.*, EX1005, 4:63-5:5, 5:27-29, 6:43-44; EX1014, 3:25-28 (teaching supplying an input signal to a de-interleaver regarding the transmitted data); EX1015, 36:63-66 (describing using an input signal to provide data to the forward error correction decoder); EX1016, 3:5-7 (teaching an input signal which is used by an encoder)). Thus, a POSITA would have recognized utilizing the input signal of Starr in Klayman's system would have predictably resulted in transmission from the receiver to transmitter of the revised the forward error correction code parameters to be used in the next transmission. (EX1002 ¶93).

A POSITA would also have found it obvious to try implementing Starr's teachings of an input signal in Klayman's system. (*Id.* ¶¶99-100). Klayman, for its part, explicitly teaches transmitting "signals" to channel interface 160 of the secondary station (i.e., transmitter) and explains that its invention "provides a means for signaling and changing the forward error correction parameters."

(EX1003, 3:23-36, 6:65-7:3). Klayman and Starr both teach measuring transmission error values, such as bit error rate and SNR, and using those values to determine the appropriate level of necessary error correction and/or interleaving. (EX1003, Fig. 4; EX1005, Fig. 8). Thus, it would have been obvious to a POSITA to utilize specific “input” signals known in the art and well-suited for conveying this information, such as the specific “input” signals taught by Starr to accomplish this purpose. (EX1002 ¶¶93, 99-100).

A POSITA would have expected success in the proposed combination, especially given the similar configurations of the Klayman and Starr systems. (EX1002 ¶¶106-107). Klayman teaches that the primary station (i.e., receiver/decoder) with processor 130 that generates the signals is communicatively coupled to the secondary stations with channel interfaces 160 and processors 150, as shown in Figure 1:



(EX1003, Fig. 1 (annotated); *see also* Fig. 3 (depicting a secondary station)). A POSITA would have therefore recognized that the primary station is already configured to communicate, and send signals, to the secondary stations. (EX1002 ¶106). Moreover, Klayman teaches “signaling and changing the forward error correction parameters”. (EX1003, 6:65-7:1). And Klayman explains that channel interface 160 (which performs encoding within the transmitting unit) performs “signal reception”. (*Id.*, 4:64-5:1). A POSITA would have accordingly expected success in configuring the primary station, and each processor 130, to generate and transmit an input signal to the secondary stations, including channel interface 160, corresponding to a revised forward error correction coding parameter based on the monitored transmission error values. (EX1002 ¶107).

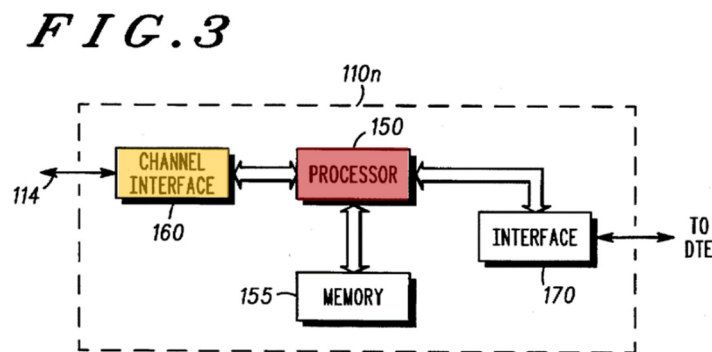
Thus, Klayman alone and/or Klayman in view of Starr renders obvious element 20[e].

vii. Element 20[f]

Klayman discloses “a controller coupled with the transmitter to receive the input signal from the transmission error value monitor and to further generate a retransmission overhead control signal of the transmitter in response to the input signal.” As explained regarding element 20[e] immediately above, Klayman teaches that processor 130 at the primary station (which a POSITA would have understood to include a transmission error value monitor) at step 370 transmits a

revised forward error correction parameter to a secondary station. Klayman also teaches that the transmitter (i.e., channel interface 160 of the secondary station) is coupled to processor 150 which receives the revised forward error correction parameter. (EX1003, Fig. 5 at step 410 (“monitor communication channel for reception of a forward error correction revision parameter”)).

As shown in Figure 3, channel interface 160 at the secondary station (i.e., transmitter) is coupled to processor 150:



(*Id.*, Fig. 3 (annotated); *see also id.*, 4:56-58 (“The processor 150 is also coupled to a channel interface 160 for communication over the communication medium 114.”) (emphasis added), 5:22-24 (“The transmitting unit, such as the processor 150 and channel interface 160 of a secondary station”)). A POSITA would have understood processor 150 to include a controller under the plain and ordinary meaning of that term. (EX1002 ¶147). As depicted in Figure 3 above, processor 150 (i.e., controller) is coupled to the channel interface 160 (i.e., transmitter) and

receives the revised forward error correction parameter from the primary station in steps 410 and 415 of Figure 5:

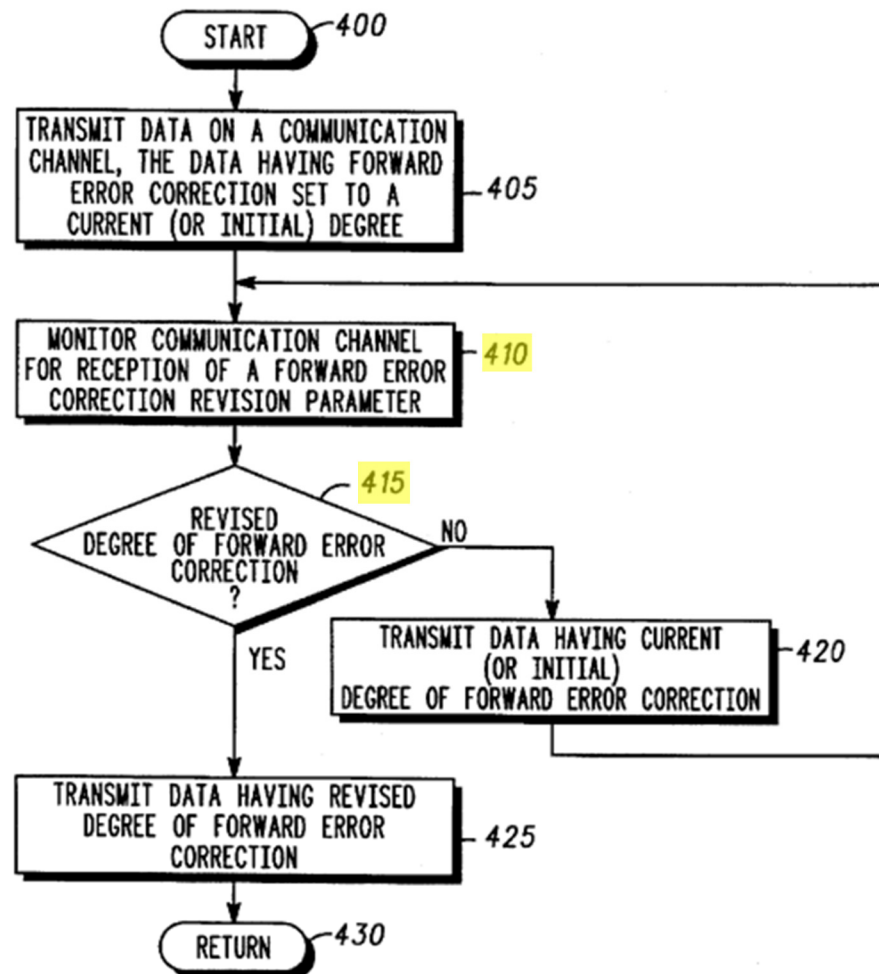


FIG. 5

(EX1003, Fig. 5 (annotated); *see also* EX1002 ¶148 (explaining that a POSITA would have understood processor 150 to carry out the steps of Figure 5)). And, as explained immediately above regarding element 20[e], transmission of the revised

forward error correction parameter—sent by the transmission error value monitor within processor 130 and received by processor 150—constitutes an input signal.

At step 415 of Figure 5, processor 150 determines whether the received input signal indicates a revised degree of forward error correction and, at step 425 of Figure 5, channel interface 160 of the secondary station “transmit[s] data having revised degree of forward error correction.” (EX1003, Fig. 5, 11:49-60; *see also id.*, 4:58-5:6 (explaining channel interface 160 “performs such functions as . . . forward error correction encoding . . . , data and other signal reception and transmission”)). Klayman explicitly teaches:

The apparatus comprises, first, a channel interface 160 coupleable to the communications medium 114 for transmission of encoded data on a first communications channel of the plurality of communications channels to form transmitted encoded data . . . ; a processor (or processor arrangement) 150 (including processor 150 with memory 155) coupled to the channel interface 160

(*Id.*, 11:33-43). A POSITA would have understood that for channel interface 160 to transmit data with the revised degree of forward error correction based on the received revision parameter, processor 150 would first generate a signal (i.e., a control signal), based on the received revised forward error correction parameter (i.e., input signal), which instructs the transmitter to send encoded data with the correct revision. (EX1002 ¶137; *see also* EX1003, 4:58-5:1 (teaching that channel interface 160 at the secondary station encodes data before transmission)).

Generation of a control signal to instruct a change in forward error correction parameters was known in the art, as is described in the '996 patent:

The FEC coder 612 preferably comprises means for receiving a multiple bit CCR adjustment control signal and means for adjusting the CCR in response to the CCR adjustment control signal, as will be known to those skilled in the art.

(EX1001, 14:62-65). Klayman also specifically teaches that its disclosed “invention provides a means for signaling and changing the forward error correction parameters” (EX1003, 6:66-7:1). Thus, a POSITA would have understood that a control signal is generated in Klayman’s system to instruct channel interface 160 (i.e., the transmitter) to adjust the forward error correction parameter.

Klayman also discloses that “a greater or higher degree of forward error correction capability is selected to decrease the overhead associated with retransmission of an entire data packet due to excessive errors”. (EX1003, 8:24-30). A POSITA would have known that the control signal sent from the primary station to processor 150 to indicate a revised forward error correction parameter is an instruction regarding the retransmission of the errored data packets. (EX1002 ¶150). Moreover, as explained by Klayman, this control signal is sent to revise the forward error correction parameter on future transmissions to lessen the amount of overhead required for retransmission. (EX1003, 8:24-30). Thus, a POSITA reading

Klayman would have understood and found it obvious that the control signal generated by processor 150 is a retransmission overhead control signal. (EX1002 ¶150).

Combination of Klayman and Starr: Alternatively, Starr discloses that the controller generates a control signal. Starr states: “The controller 50 provides an adaptive interleave control signal 58 (step 312) in response to the input signals 68, 78.” (EX1005, 8:50-52). Starr teaches a controller which includes “means for providing adaptive interleave control signal”. (*Id.*, Fig. 1). As shown in Figure 3, the controller and means for providing the control signal, are communicatively coupled to the transmitter:

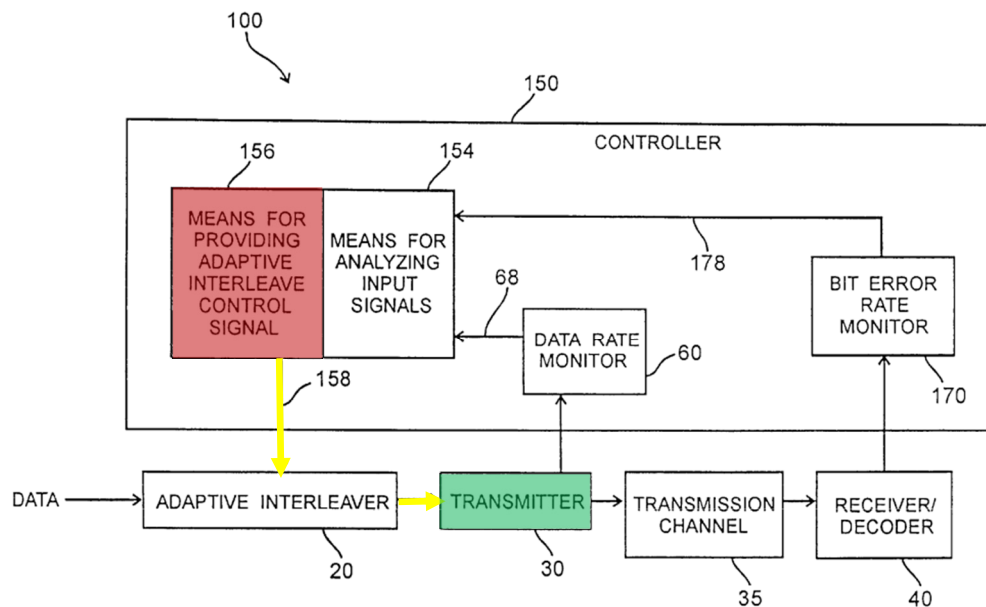


Fig. 3

(*Id.*, Fig. 3 (annotated)). Starr discloses that the generated control signal “causes the adaptive interleaver 20 to implement an interleave depth that is proportional to the SNR, BER, data rate or combination thereof.” (*Id.*, 9:18-25; *see also id.*, 7:66-8:5 (explaining the control signal “can be based in-whole or in-part on the BER”)). Starr also teaches that that “control signal 58 is preferably equivalent to the received input signal 78.” (*Id.*, 5:60-61).

As explained immediately above, POSITA would have understood that, in the combined system of Klayman and Starr, the control signal taught by Starr would be a retransmission overhead control signal based on Klayman’s teachings to select a degree of forward error correction that decreases overhead associated with retransmission of data packets. (EX1002 ¶155; EX1003, 8:24-30). A POSITA would have been motivated to combine the teachings of Klayman and Starr for the reasons discussed below.

Motivation to Combine Klayman and Starr: A POSITA would have been motivated to combine Klayman with Starr, predictably resulting in a transmission system that utilizes a control signal to instruct the transmitter to transmit data with the received revised degree of forward error correction. (EX1002 ¶¶76, 79-108).

As explained above regarding elements 20[b] and 20[e], Klayman and Starr are within the same field of adaptive error coding and teach similar forward error

correction coding communication systems that can operate over coaxial cables.

(EX1003, EX1005; *see also* EX1002 ¶¶80-82, 94-96).

A POSITA would have also known that, prior to 2003, control signals were utilized to send instructions in a transmission system. (*Id.* ¶¶78, 86). It was known in the art by at least the 1990s to utilize control signals to change error coding parameters in transmission systems. (*See, e.g.*, EX1005, 2:54-67 (teaching an adaptive interleave control signal responsive to performance parameters); EX1017, 7:36-43 (teaching sending “control information” including FEC data); EX1018, 13:40-49 (describing a control signal in an interleave system which instructs the system regarding the next sequence of code words); EX1019, 67:21-30 (teaching a control signal which instructs an encoder to add redundant bits)). The ’996 patent itself confirms the utilization of a control signal for this purpose was already known in the art:

The FEC coder 612 preferably comprises means for receiving a multiple bit CCR adjustment control signal and means for adjusting the CCR in response to the CCR adjustment control signal, as will be known to those skilled in the art.

(EX1001, 14:62-65 (emphasis added)). Thus, a POSITA would have recognized utilizing the control signal of Starr in Klayman’s system would have predictably resulted in an instruction to the transmitter to revise the forward error correction code parameters for the next transmission. (EX1002 ¶92).

A POSITA would also have found it obvious to try implementing Starr's teachings of a control signal in Klayman's system. (*Id.* ¶¶99, 101-103). A POSITA would have known there are two ways to instruct the transmitter to use the revised forward error correction parameter: (1) a control signal must be sent to the transmitter; or (2) processing of the received forward error correction parameter and encoding of the new parameter must be done entirely within the controller. (EX1002 ¶101). In the latter option, because all coding is done within the controller, the controller would not need to send a control signal to a separate encoder. (*Id.*).

As shown in Figure 3 of Klayman, Klayman teaches that the processor 150 (i.e., controller) is separate from the channel interface 160 (which encodes) and the memory 155 (which stores forward error correction coding parameters) at the secondary station. (EX1003, Fig. 3). A POSITA would have found it obvious to try different engineering configurations within Klayman's system such as keeping these elements separate from one another or incorporating them within the controller. (EX1002 ¶¶102-103; *see also* EX1003, 5:6-8 (Klayman, in fact, suggests "memory 155 may also be embodied or contained within the corresponding processor 150")). Therefore, a POSITA would have found it obvious to try sending a control signal from the controller (i.e., processor 150) of

Klayman to channel interface 160 and memory to revise and store the received forward error correction parameter. (EX1002 ¶¶101-103).

A POSITA would have expected success in the proposed combination, especially given the similar configurations of the Klayman and Starr systems. (EX1002 ¶¶106-107). Klayman teaches that processor 150 is communicatively coupled to the transmitting unit, and channel interface 160, within the secondary station. (EX1003, 4:12-15, 11:40-60, Fig. 3). A POSITA would have therefore recognized that processor 150 is already configured to communicate and send signals to the transmitting unit. (EX1002 ¶¶106-107). Moreover, Klayman teaches “signaling and changing the forward error correction parameters”. (EX1003, 6:65-7:1). And Klayman explains that channel interface 160 (which performs encoding within the transmitting unit) performs “signal reception”. (*Id.*, 4:64-5:1). A POSITA would have accordingly expected success in configuring processor 150 to send a control signal to channel interface 160 and the transmitting unit to adjust the forward error correction coding parameters. (EX1002 ¶¶106-107).

Thus, Klayman alone and/or Klayman in view of Starr renders obvious element 20[f]. In sum, Klayman alone and/or Klayman in view of Starr renders obvious claim 20.

C. Ground 2: Obviousness of Claim 20 Based on Agarwal in View of Starr

1. Claim 20

Claim 20 is obvious over Agarwal alone and/or Agarwal in view of Starr.

i. Claim 20, preamble

To the extent the preamble is limiting, it is taught by Agarwal. The preamble recites “A transmission system comprising.” Agarwal teaches a method and apparatus “for the adaptive control of a forward error correction code for transmission over a communication channel which connects the primary interface to a remote interface”. (EX1004, 3:66-4:3, 4:17-21). The transmission system of Agarwal is depicted in Figure 1A:

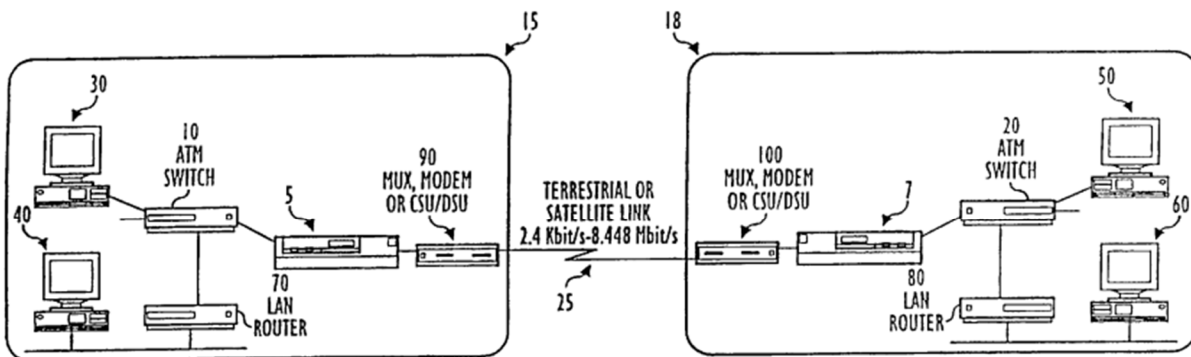


FIG. 1A

(*Id.*, Fig. 1A).

Thus, Agarwal teaches the preamble of claim 20.

ii. Element 20[a]

Agarwal discloses “a transmission channel to carry data between a transmitter and a receiver/decoder, each communicatively interfaced with the transmission channel”. Agarwal teaches forward error correction codes are sent “over a communication channel which connects the primary interface to a remote interface.” (EX1004, 4:2-3; *see also id.*, 4:14-16 (“the communication channel may be a satellite or wireless communication channel”), 5:27-31 (teaching “means of interconnecting standard ATM switches 10 and 20 over a terrestrial or satellite link 25”)). A POSITA would have recognized the disclosed communication channel to be a transmission channel. (EX1002 ¶194).

As noted above, the transmission channel of Agarwal “connects the primary interface to a remote interface.” (EX1004, 4:2-3). The primary and remote interfaces “are identical” and perform the same operations, including receiving and transmitting operations. (*Id.*, 13:22-27; *see also id.*, 8:28-30 (operations include “set[ting] the forward error correction code value of its receiver and its transmitter to a maximum value”)). Agarwal teaches that the remote interface includes a frame assembler 115, “an encoder 120 which generates a forward error correction code (i.e. block code),” and an interleaver 125 and transmits interleaved frames. (*Id.*, 5:41-49). A POSITA would have understood the remote interface to correspond to a transmitter. (EX1002 ¶¶195-196).

Agarwal teaches that the primary interface includes a deinterleaver 130, “a decoder 135 which decodes the forward error correction code of each frame in order to provide error correction for that frame,” and a frame disassembler 140 which receives interleaved frames transmitted by the remote interface. (EX1004, 5:50-58 (emphasis added)). Agarwal interchangeably refers to the primary interface as the receiving interface. (*Id.*, 7:62-8:4). A POSITA would have understood the primary/receiving interface, which includes decoder 135, to correspond to the receiver/decoder. (EX1002 ¶197).

The remote and primary interfaces (which are identical) are depicted in Figure 1B:

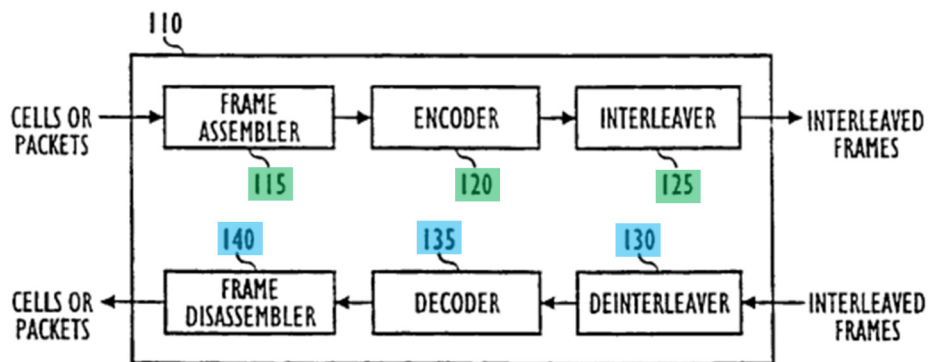


FIG. 1B

(EX1004, Fig. 1B (annotated in green to indicate the transmitter portions and in blue to indicate the receiver/decoder portions)). A POSITA would have understood that data is transmitted in the interleaved frames sent from the remote to the

primary interface over the communication channel. (EX1002 ¶199). For example, Agarwal discloses “interleaving technique rearranges the order of the bytes in the interleaved frame and transmits each byte sequentially over a WAN link.”

(EX1004, 6:24-30 (emphasis added); *see also* EX1002 ¶199 (explaining a POSITA would have known a WAN link is an exemplary communication channel)).

Additionally, Agarwal teaches a “primary incoming bit stream [is] transmitted from a remote interface” and “the receiving interface becomes synchronized with the incoming bit stream transmitted from a remote interface.” (EX1004, 7:62-8:4).

Agarwal teaches that the primary and remote interfaces are communicatively interfaced with the communication channel because the communication channel “connects the primary interface to a remote interface”. (*Id.*, 4:2-3). For example, as shown in Figure 1A, the two interfaces “may connect to the terrestrial or satellite link 25 via modems 90 and 100”. (*Id.*, 5:35-38). A POSITA would have, therefore, recognized that the primary and remote interfaces (i.e., receiver/decoder and transmitter, respectively) are communicatively interfaced with the transmission channel and transmit data over the transmission channel. (EX1002 ¶¶199-200).

Thus, Agarwal teaches element 20[a].

iii. Element 20[b]

Agarwal discloses “a transmission error value monitor communicatively interfaced with the receiver/decoder to periodically monitor for transmission error

values indicative of impulse noise events on the transmission channel”. Agarwal teaches Microprocessor 1015 which “monitors the value of the coding field of every received frame” at the primary interface and further teaches that Microprocessor 1015 “will calculate a byte error rate associated with communication signals received by the primary interface via a communication channel.” (EX1004, 12:33-36, 12:47-50). A POSITA would have understood that Microprocessor 1015 includes a transmission error value monitor to monitor the coding field values and determine the byte error rate. (EX1002 ¶¶203-204).

A POSITA would have also understood that Microprocessor 1015, including the transmission error value monitor, is communicatively interfaced with the primary station (i.e., receiver/decoder). (*Id.* ¶205). Figure 4 (shown below) is an “exemplary apparatus incorporating the adaptive coding scheme of” Agarwal’s invention. (EX1004, 4:53-54). As previously explained, the primary and remote interfaces “are identical” and, as such, Figure 4 demonstrates that Microprocessor 1015 is coupled to both the primary and remote interfaces. (*Id.*, Fig. 4). As depicted in Figure 4, Microprocessor 1015 “controls the primary interface” and is communicatively coupled to the components within the primary interface (e.g., de-interleaver RAM 1060, Reed-Solomon Decoder 1070, and buffer RAM 1080):

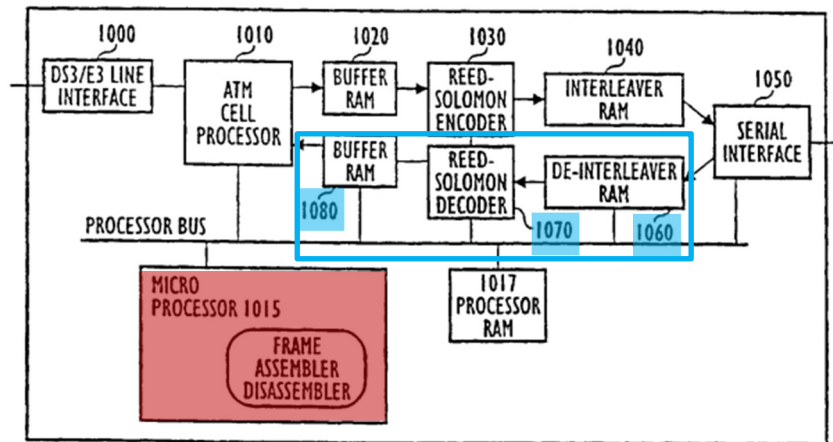


FIG. 4

(EX1004, Fig. 4 (annotated), 12:56-57).

Agarwal teaches that transmission error values (e.g., byte error rates) are “continuously measured at a receiving interface.” (*Id.*, 7:62-64). Agarwal also explains that byte error ratio is calculated based on “variable interval[s] of, for example, one second”. (*Id.*, 8:56-63). Moreover, byte error rate calculations are “performed at a predetermined interval”. (*Id.*, cl. 2). A POSITA would have understood that transmission error values are, therefore, monitored—and byte error rate is calculated—periodically during computation intervals. (EX1002 ¶206).

Agarwal explains: “The measurement of the communication link quality is based on the number of byte errors corrected by a decoder which is included in the interface.” (EX1004, 7:62-8:4). Microprocessor 1015—including a transmission error value monitor—monitors the received byte errors and performs a calculation to determine the byte error rate of that transmission (i.e., transmission error

values). (*Id.*, 8:47-55, 9:19-10:6). A POSITA reading Agarwal would also have understood that byte error rate is indicative of impulse noise events on the transmission channel which affect communication link quality. (EX1002 ¶207). In fact, Agarwal explains that channels “are inherently noisy” and measuring byte error rate to correct forward error codes is done to combat that noise. (*Id.*, 2:35-39; EX1002 ¶207). As an example, Agarwal teaches using Reed-Solomon codes and inverse byte error ratio values that include a calculated decibel margin and correspond to the amount of noise on a transmission channel. (*Id.*, 10:59-11:2). A POSITA would, therefore, have understood the byte errors and byte error rate are indicative of impulse noise events on the transmission channel. (EX1002 ¶207).

Combination of Agarwal and Starr: Additionally, as explained in Ground 1 regarding element 20[b], Starr explicitly teaches that monitored “performance parameters are preferably chosen from the group consisting of signal to noise ratio (SNR), bit error rate (BER) and data rate.” (EX1005, 2:37-39). Thus, like Agarwal, Starr teaches monitoring a bit error rate which is a transmission error value. Starr further teaches monitoring signal to noise ratio (“SNR”) which is also a transmission error value and indicative of impulse noise on the transmission channel. (*Id.*, 5:10-15 (disclosing a signal to noise monitor that measures SNR), 9:39-40 (explaining the SNR monitor determines SNR of the system), 3:43-54 (explaining the Starr system measures SNR and BER to determine what effect

“noise present in the transmission channel” may be having), Fig. 7 (showing SNR of the transmission channel is determined at step 306)). And, as explained in Ground 1 regarding element 20[b], SNR is indicative of impulse noise events on the transmission channel. (*Id.*, 3:43-54). A POSITA would have also known that SNR is indicative of impulse noise events on the transmission channel. (EX1002 ¶210).

In the combined system of Agarwal and Starr, a POSITA would have understood and found it obvious that Microprocessor 1015 of Agarwal—which include a transmission error value monitor—would monitor the SNR (i.e., a transmission error value) as taught by Starr. (*Id.*). A POSITA would have been motivated to combine the teachings of Agarwal and Starr for the reasons discussed below.

Motivation to Combine Agarwal and Starr: A POSITA would have been motivated to combine Agarwal with Starr, predictably resulting in a transmission system that monitors both byte error rate and signal to noise ratio (SNR) to determine the appropriate forward error correction parameters. (EX1002 ¶¶159, 163-187).

Agarwal and Starr are within the same field of adaptive error coding. (EX1004, EX1005). Agarwal teaches a system and “method for the adaptive control of forward error correction codes for transmission over communication

channels” that is applicable to wireless network and “equally applicable with respect to terrestrial based communications.” (EX1004, 3:56-58, 5:1-10, 6:14-15). Agarwal teaches interleaving methods in combination with forward error correction coding. (*Id.*, Fig. 1B (depicting interleavers)). And Starr discloses that its teachings are “applicable to any system that incorporates interleaving.” (EX1005, 2:50-53; *see also id.*, 3:32-34 (explaining the transmitter “can comprise any transmitter for use with any form of transmission media as known to those skilled in the art”)). As such, a POSITA would have been motivated to combine the similar systems and teachings of Agarwal and Starr. (EX1002 ¶¶164-165, 174-176).

As explained in Ground 1 regarding element 20[b], a POSITA would have also known that, well prior to 2003, monitoring signal to noise ratio (“SNR”) was known in the art. (*Id.* ¶¶161, 167-168; EX1005, 5:10-12 (“a monitor for determining the SNR [is] known to those skilled in the art”); EX1012). Thus, a POSITA would have known that Microprocessor 1015 in Agarwal’s system could include a means to monitor the SNR of incoming transmissions as one way to determine the quality of the channel. (EX1002 ¶¶168, 184).

A POSITA would also have found it obvious to try implementing Starr’s teachings of monitoring SNR in Agarwal’s system. (*Id.* ¶¶177-178). Agarwal acknowledges that signal to noise ratio is tied to transmission link quality.

(EX1004, 10:66-11:1 (“even if the link signal to noise ratio drops by 0.5 decibels, the link quality will be maintained . . .”). And Agarwal explains that a purpose of its system is to improve forward error correction where transmission channels “are inherently noisy.” (*Id.*, 2:34-39). While Agarwal teaches monitoring byte error rate and does not explicitly disclose monitoring SNR, a POSITA would have been motivated to look to contemporaneous references, such as Starr, to arrive at various ways—other than only monitoring byte error rate—to monitor noise events. (EX1002 ¶178). Starr explicitly teaches monitoring SNR to indicate noise events on a channel. (EX1005, 3:41-53, 5:10-26). Thus, it would have been obvious to a POSITA to try monitoring SNR in Agarwal’s system. (EX1002 ¶178).

A POSITA would have expected success in the proposed combination, especially given the similar configurations of the Agarwal and Starr systems. (EX1002 ¶184). Agarwal teaches that Microprocessor 1015, coupled to the primary interface (i.e., receiver/decoder) monitors byte error rates in incoming data transmissions. (EX1004, Figs. 4-5, 7:62-8:4). As explained above, a POSITA would have understood Microprocessor 1015 to include a transmission error value monitor that monitors for byte error rates. (EX1002 ¶184). Starr similarly teaches a specific means to monitor noise within a controller (similar to Microprocessor 1015) which detects SNR as a parameter:

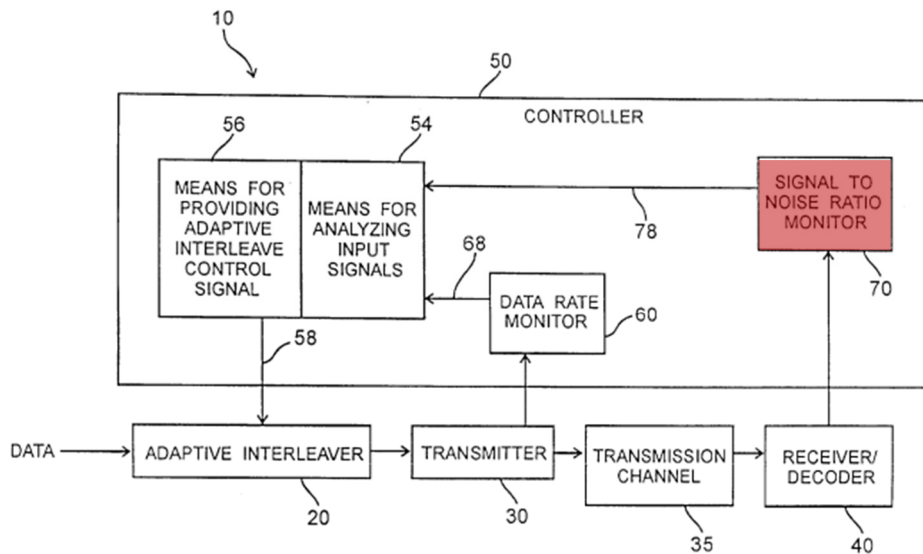


Fig. 2

(EX1005, Fig. 2 (annotated)). A POSITA would have recognized that Microprocessor 1015, already configured to “continuously measure” “the quality of the incoming communication link . . . at a receiving interface” could include means to specifically monitor SNR as disclosed by Starr. (EX1002 ¶184; EX1004, 7:62-64). A POSITA would have seen no technical obstacle in doing so and expected success in configuring Microprocessor 1015 to monitor SNR. (EX1002 ¶184).

Thus, Agarwal alone and/or Agarwal in view of Starr teaches and/or renders obvious element 20[b].

iv. Element 20[c]

Agarwal discloses “wherein the transmission error values are periodically monitored after training and initialization on the receiver/decoder.” As explained

immediately above, Agarwal teaches periodic monitoring of transmission error values at the primary/receiving interface. Agarwal also teaches that the measurement of byte errors and calculation of the byte error rate “is not made until after the receiving interface becomes synchronized with the incoming bit stream transmitted from a remote interface.” (EX1004, 7:64-8:1). Agarwal explains synchronization of the primary/receiving interface (i.e., receiver/decoder) is necessary to “ensure[] that no frames are lost during the changing of forward error correction codes.” (*Id.*, 8:22-27). And “[i]f the receiving interface is not yet synchronized to its receiving bit stream, the coding field 268 is set to a predetermined value (e.g. 0xF).” (*Id.*, 7:21-25). Therefore, transmission of data and periodic monitoring of byte errors and calculation of byte error rate at the primary/receiving interface occurs after synchronization. (*See also* EX1002 ¶¶213-214).

A POSITA would have known that the synchronization process disclosed in Agarwal is part of training and initialization of the primary/receiving interface. (EX1002 ¶214). In communication systems with a transmitter and receiver, basic initialization of the system is required before the transmitter and receiver can exchange data. (*Id.*; EX1013). As is explained in contemporaneous prior art, in a transmission system with a “standard initialization procedure . . . the steady state communication link is only established after the completion of all the initialization

steps.” (EX1013, Figs. 2-4, 6:22-27, 7:8-10). A POSITA would have also understood that at startup of the system, initialization and training includes synchronization of the transceivers. (EX1002 ¶214). Initialization, training, and synchronization must occur to successfully establish a communication link and allow data to be transmitted between the transmitter and receiver. (*Id.* ¶214; *see also* EX1013, 7:8-26 (explaining that when synchronization is lost the system must complete initialization again to then enable re-synchronization before transmitting data)). A POSITA would have also found it obvious to monitor transmission error values after training and initialization on the primary/receiving interface because data would not be transmitted, and transmission error values would not be monitored, until the transmission system went through basic initialization and training. (*Id.* ¶214; *see also* EX1013).

Combination of Agarwal and Starr: In the combined system of Agarwal and Starr, a POSITA would have understood that Agarwal’s Microprocessor 1015 coupled to the primary/receiving interface (i.e., receiver/decoder) would also periodically monitor SNR (i.e., transmission error values) after training and initialization at the primary/receiving interface (i.e., receiver/decoder) for the same reasons as discussed above. (*See also* EX1002 ¶215).

Motivation to Combine Agarwal and Starr: The rationale and motivation to combine Agarwal and Starr is explained above regarding element 20[b], which is hereby incorporated by reference.

Thus, Agarwal alone and/or Agarwal in view of Starr teaches and/or renders obvious element 20[c].

v. Element 20[d]

Agarwal discloses “the transmission error values being selected from a group comprising: a bit error rate, errored seconds, errored minutes, code violations over a fixed period of time, Signal-to-Noise Ratio (SNR) measured at the receiver/decoder, and Transmission Control Protocol and Internet Protocol (TCP/IP) throughput”. Agarwal teaches that Microprocessor 1015 monitors byte errors present in a transmission at the primary/receiving interface and calculates byte error rate. (EX1004, 8:2-4, Abstract). As shown in Figure 5 at step 500, Microprocessor 1015 calculates “byte error rate”:

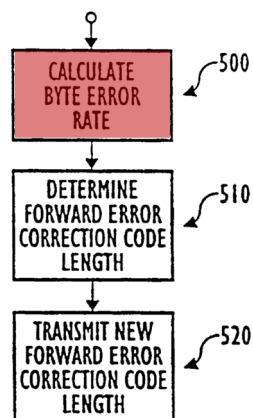


FIG. 5

(*Id.*, Fig. 5 (annotated)). Agarwal further teaches its system uses adaptive coding “to determine the proper amount of forward error-correction on a real-time basis in accordance with the number of bit errors detected in the receive link.” (*Id.*, 5:67-6:4 (emphasis added)). Agarwal thus discloses detecting bit errors and further discloses the conversion between bit and byte error ratios. (*Id.*, 8:52-53 (“bit error ratio is approximately equal to [byte error ratio] divided by eight”)). A POSITA would have also considered Agarwal’s disclosure of calculating byte error rate, and the conversion between byte and bit ratios, to render obvious monitoring bit error rate. (EX1002 ¶218). Thus, Agarwal teaches and/or renders obvious that the monitored transmission error values are bit error rates.

Combination of Agarwal and Starr: Additionally, as explained regarding element 20[b] above, Starr teaches measuring signal to noise ratio (“SNR”) which is a transmission error value. (EX1005, 2:37-39, 5:10-26). Starr also discloses that the SNR monitor is coupled to the receiver/decoder in Starr’s system:

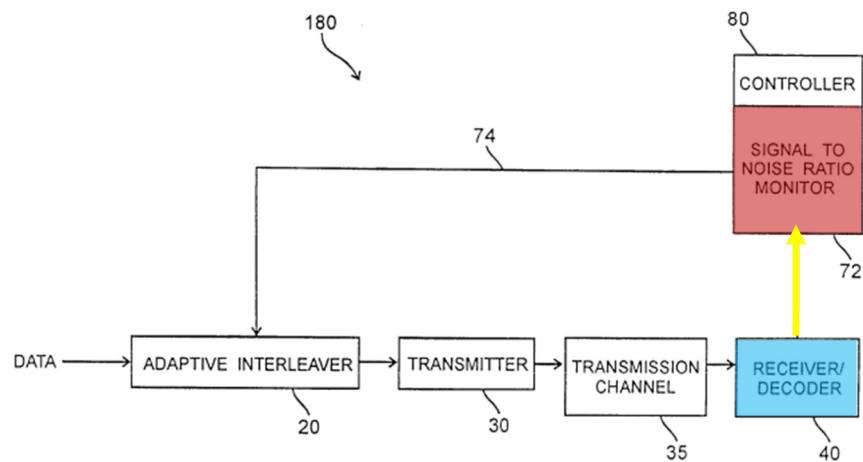


Fig. 4

(EX1005, Fig. 4 (annotated)). In the combined Agarwal-Starr system, a POSITA would have recognized that SNR (as taught by Starr) is measured at the receiver/decoder. (EX1002 ¶220). As explained above regarding element 20[b], the transmission error value monitor of Klayman (i.e., a means within Microprocessor 1015) is also coupled to the primary/receiving station (i.e., receiver/decoder), as shown below:

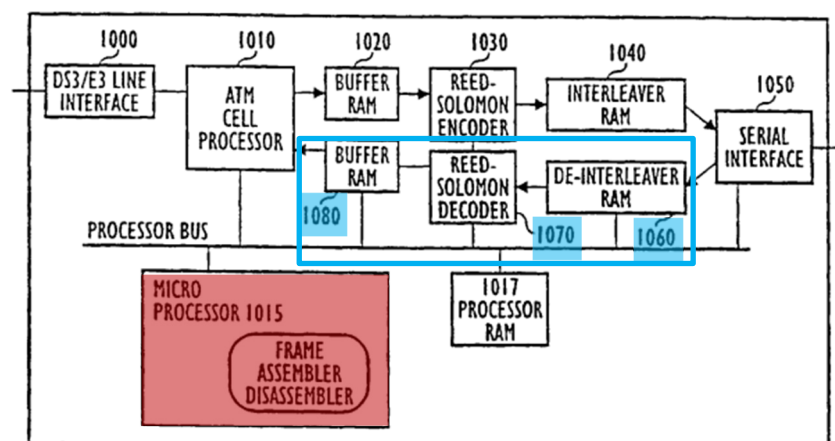


FIG. 4

(EX1004, Fig. 4 (annotated)). Moreover, Agarwal explicitly teaches that “the quality of the incoming communication link is continuously measured at the receiving interface”. (EX1004, 7:62-64 (emphasis added)). A POSITA would have thus understood that in the combined system of Agarwal and Starr, Microprocessor 1015 of the primary station (i.e., receiver/decoder) would include means to measure the SNR at the receiver/decoder. (EX1002 ¶220).

Motivation to Combine Agarwal and Starr: The rationale and motivation to combine Agarwal and Starr is explained above regarding element 20[b], which is hereby incorporated by reference.

Thus, Agarwal alone and/or Agarwal in view of Starr teaches and/or renders obvious element 20[d].

vi. Element 20[e]

Agarwal discloses “and wherein the transmission error value monitor to further generate an input signal based on the transmission error values monitored”. Agarwal teaches a “means for determining a forward error correction code length of the forward error correction code based on the byte error rate.” (EX1004, 4:25-27). After calculating the byte error rate which is used to determine the forward error correction code length, Agarwal teaches that “the primary interface stores the calculated forward error correction code and transmits this information to the remote interface.” (*Id.*, 8:5-10). The correlation between byte error rate (i.e.,

transmission error values monitored) and forward error correction code length is shown in Figure 3:

CODE TABLE		
CODE	INVERSE	REED-SOLOMON
INDEX	BER VALUE	CODE LENGTH
17	715827880	2
16	562241498	4
15	20133667	4
14	6636252	6
13	1078755	6
12	635218	8
11	219936	8
10	154438	10
9	69463	10
8	53221	12
7	29402	12
6	24125	14
5	14790	14
4	12779	16
3	8859	16
2	7841	18
1	5782	18
0	5224	20

FIG. 3

(*Id.*, Fig. 3).

As explained above, Agarwal further teaches that byte error rate is calculated by Microprocessor 1015, which includes a transmission error value monitor. Microprocessor 1015 also determines the forward error correction code length. (*Id.*, 12:47-55). Additionally, Agarwal explains Microprocessor 1015 “controls the primary interface to transmit the new forward error correction code length to the remote interface over the communication channel.” (*Id.*, 12:56-59). This step is shown in Figure 5:

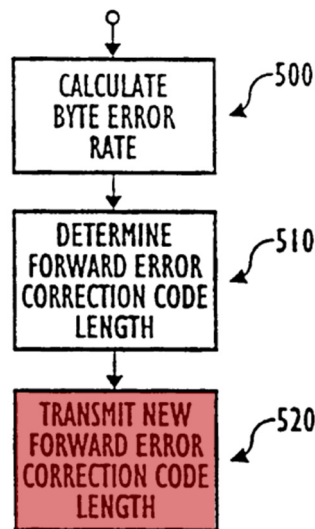


FIG. 5

(*Id.*, Fig. 5 (annotated)).

A POSITA would have recognized that transmission of the new forward error correction code length—which is based on byte error rate—includes generation of an input signal. (EX1002 ¶225). Agarwal discloses that the transmitted forward error correction code is a transmission signal. (EX1004, 8:11-14). Also, a POSITA would have understood that Microprocessor 1015, including the transmission error value monitor, generates this input signal corresponding to the new forward error correction code length based on byte error rate. (EX1002 ¶225).

Combination of Agarwal and Starr: Alternatively, Starr explicitly teaches an input signal. As explained in Ground 1 regarding element 20[e], Starr teaches

the generation of an input signal which corresponds to bit error rate or SNR. A POSITA would have been motivated to combine the teachings of Agarwal and Starr for the reasons discussed below.

Motivation to Combine Agarwal and Starr: A POSITA would have been motivated to combine Agarwal with Starr, predictably resulting in a communications system that utilizes an input signal, corresponding to monitored transmission error values (i.e., byte error rate and/or SNR), to transmit the forward error correction code length. (EX1002 ¶¶160, 163-187).

Agarwal and Starr are within the same field of adaptive error coding. (EX1004, EX1005). Agarwal teaches a system and “method for the adaptive control of forward error correction codes for transmission over communication channels” that is applicable to wireless network and “equally applicable with respect to terrestrial based communications.” (EX1004, 3:56-58, 5:1-10, 6:14-15). Agarwal teaches interleaving methods in combination with forward error correction coding. (*Id.*, Fig. 1B (depicting interleavers)). Starr discloses that its teachings are “applicable to any system that incorporates interleaving.” (EX1005, 2:50-53; *see also id.*, 3:32-34 (explaining the transmitter “can comprise any transmitter for use with any form of transmission media as known to those skilled in the art”)). As such, a POSITA would have been motivated to combine the

similar systems and teachings of Agarwal and Starr. (EX1002 ¶¶164-165, 174-176).

As explained regarding the combination of Klayman and Starr in Ground 1 above, a POSITA would also have been aware of other prior art teachings of an input signal as used in an adaptive error coding system. (*See* Part VIII.B.1.vi, *supra*; *see also* EX1005, EX1014-EX1016; EX1002 ¶¶162, 169-170). By 2003, a POSITA would have expected using an input signal in Agarwal’s transmission system to predictably result in the ability to transmit a forward error correction code length to the remote interface. (EX1002 ¶¶163, 172-173; EX1005, 5:27-29 (Starr teaches an input signal based on SNR), 6:43-45 (Starr teaches an input signal based on byte error rate)).

A POSITA would have also found using an input signal—such as the input signal taught by Starr—in Agarwal’s system obvious to try. (EX1002 ¶¶179-180). A POSITA would have found it obvious to use an input signal as a type of “communication signal” used to provide information regarding forward error correction code length as taught by Agarwal. (EX1004, Abstract, 8:11-14; EX1002 ¶180; *see also* Part VIII.B.1.vi, *supra*). Agarwal explains that Microprocessor 1015 is communicatively coupled to both the primary/receiving and remote interfaces and, as such, must send some kind of signal or instruction to the remote interface to

adjust forward error correction code length. (EX1002 ¶¶180, 185-186; EX1004, Fig. 4).

A POSITA would have also expected success in the proposed combination based on the design of the system in Agarwal. (EX1002 ¶¶185-186). For example, Agarwal teaches that Microprocessor 1015 (i.e., the controller) is communicatively coupled to both the primary and the remote interfaces and controls the Reed-Solomon Encoder to form interleaved frames based on forward error correction code lengths received from the primary/receiving interface. (EX1004, 12:12-15; EX1002 ¶185). Thus, a POSITA would have been motivated to generate an input signal to inform the remote interface of the forward error correction code length based on monitored transmission error values and expected success in doing so. (EX1002 ¶¶185-187).

Thus, Agarwal alone and/or Agarwal in view of Starr renders obvious element 20[e].

vii. Element 20[f]

Agarwal discloses “a controller coupled with the transmitter to receive the input signal from the transmission error value monitor and to further generate a retransmission overhead control signal of the transmitter in response to the input signal.” As explained above, Agarwal teaches Microprocessor 1015 which, as shown in Figure 4, is communicatively coupled with the remote interface (i.e.,

transmitter), including the interleaver RAM 1040, Reed-Solomon encoder 1030, and buffer RAM 1020:

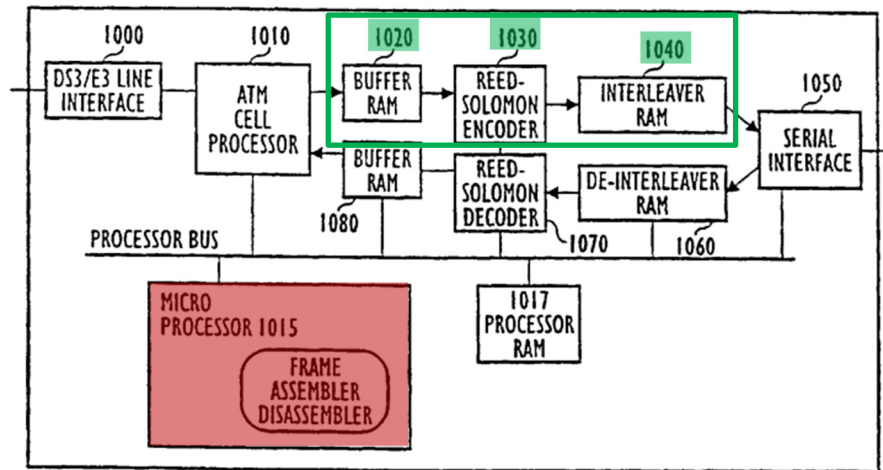


FIG. 4

(EX1004, Fig. 4 (annotated)). And, Agarwal explains that “the Reed-Solomon Encoder 1030 [is] under the control of the Microprocessor 1015.” (*Id.*, 12:13-14). Thus, because parts of the remote interface (e.g., the Reed-Solomon Encoder) are in communication with Microprocessor 1015 and are shown to be communicatively coupled with Microprocessor 1015 (*see* Fig. 4 above), the remote interface (i.e., transmitter) is coupled to Microprocessor 1015. (*See also* EX1002 ¶231). A POSITA would have also recognized that Microprocessor 1015 includes a controller. (*See also id.*).

As explained regarding element 20[e] above, the primary/receiving interface (i.e., receiver/decoder) transmits the calculated forward error correction code

length to the remote interface (i.e., transmitter) and, as Agarwal teaches, “the remote interface receives this information”. (EX1004, 8:8-11). As explained regarding element 20[e] above, a POSITA would have understood that the transmission of the calculated forward error correction code length constitutes an input signal received by the transmitter. In response to that input signal, Agarwal teaches that the remote interface “transmits signals including a forward error correction code having more or less forward error correction coding bytes in accordance with the information provided by the primary interface.” (*Id.*, 8:11-14).

In an embodiment, Agarwal explains:

An Interleaver RAM 1040 receives the output of the Reed-Solomon Encoder 1030 under the control of the Microprocessor 1015 in order to form an interleaved frame in the manner described above. Following the interleaving process, the interleaved frame is output by the Interleaver RAM 1040 to a Serial Interface 1050 for transmission to a receiving apparatus over a WAN via a modem, for example.

(*Id.*, 12:12-17).

A POSITA would have understood that Microprocessor 1015, which is communicatively coupled to the remote interface, generates a control signal to instruct the remote interface to change the forward error correction code length based on the input signal. (EX1002 ¶¶232-233). A POSITA would also have recognized the control signal to be a retransmission overhead control signal because its purpose is to instruct the remote interface to change the forward error

code correction length to minimize overhead associated with retransmission of the data. (*Id.* ¶233).

Combination of Agarwal and Starr: Alternatively, Starr teaches that the controller generates control signal as explained in Ground 1 regarding element 20[f]. A POSITA would have been motivated to combine the teachings of Agarwal and Starr for the reasons discussed below.

Motivation to Combine Agarwal and Starr: A POSITA would have been motivated to combine Agarwal with Starr, predictably resulting in a communications system that utilizes a control signal to instruct the transmitter to transmit data with the received forward error correction code length. (EX1002 ¶¶160, 163-187).

As explained above regarding element 20[e], Agarwal and Starr are within the same field of adaptive error coding. (EX1004, EX1005; *see also* EX1002 ¶¶164-165, 174-176).

As explained regarding the combination of Klayman and Starr in Ground 1 above, a POSITA would also have been aware of other prior art teachings of a control signal as used in an adaptive error coding system. (*See* Part VIII.B.1.vii, *supra*; *see also* EX1005, EX1017-EX1019; EX1002 ¶¶162, 169-172). By 2003, a POSITA would have expected using a control signal in Agarwal's transmission system to predictably result in the ability to instruct the remote interface to adjust

the forward error correction code length based on the length transmitted by the primary/receiving interface. (EX1002 ¶¶172-173, 183; EX1004, 8:11-18; EX1005, 8:13-16 (Starr similarly teaches its control signal is used to control interleave depth)).

A POSITA would have found using a control signal—such as the control signal taught by Starr—in Agarwal’s system obvious to try. (EX1002 ¶¶179, 181-182). As explained in Ground 1, a POSITA would have known there were a limited number of ways to control the transmitter to change the forward error correction code for future transmissions. (*See* Part VIII.B.1.vii, *supra*). Agarwal explains that Microprocessor 1015 is separate from the primary/receiving and remote interfaces and, as such, must send some kind of signal or instruction to the remote interface to adjust forward error correction code length. (EX1002 ¶¶181-182; EX1004, Fig. 4). A POSITA would have found it obvious to try having Microprocessor 1015 generate a retransmission overhead control signal, based on the teachings of Starr and Agarwal, to instruct the remote interface to change the forward error correction code length for the next transmission. (EX1002 ¶¶181-183).

A POSITA would have also expected success in the proposed combination based on the design of the system in Agarwal. (*Id.* ¶¶185-186). For example, Agarwal teaches that Microprocessor 1015 (i.e., the controller) is coupled to the

remote interface and controls the Reed-Solomon Encoder to form interleaved frames based on forward error correction code lengths received from the primary/receiving interface. (EX1004, 12:12-15). Agarwal further teaches using “communication signals” in the system. (*Id.*, 8:11-14). Thus, a POSITA would have been motivated to generate a control signal to instruct the remote interface to change the forward error correction code length based on information received from the primary interface and expected success in doing so. (EX1002 ¶¶185-186).

Thus, Agarwal alone and/or Agarwal in view of Starr renders obvious element 20[e]. In sum, Agarwal alone and/or Agarwal in view of Starr renders obvious claim 20.

IX. SECONDARY CONSIDERATIONS

Patent Owner has not identified any evidence of secondary indicia of non-obviousness for the '996 patent. Accordingly, there is no objective evidence of non-obviousness that might warrant a finding that the Challenged Claim is patentable. (*See also* EX1002 ¶¶241-242). Should Patent Owner identify any evidence of non-obviousness in response to this Petition, Petitioner reserves the right to respond in its Reply.

X. CONCLUSION

Petitioner respectfully requests institution of review on claim 20 and a finding that it is unpatentable.

Petition for *Inter Partes* Review of
U.S. Patent No. 7,809,996 B2

Respectfully submitted,

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Dated: September 17, 2024

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Petition for *Inter Partes* Review of
U.S. Patent No. 7,809,996 B2

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105, I hereby certify that on September 17, 2024, I caused a complete copy of this Petition for *Inter Partes* Review of U.S. Patent No. 7,809,996 and all exhibits, to be served on the Patent Owner of the subject patent as follows:

Michael V. North
North Weber & Baugh LLP
3260 Hillview Ave
Palo Alto, CA 94304

/Erik B. Milch/
Erik B. Milch (Reg. No. 42,887)

CERTIFICATE OF COMPLIANCE

Petitioner certifies:

1. This Petition complies with the type-volume limitations of 37 C.F.R. § 42.24(a)(1)(i) and contains 13,599 words, excluding the portions of the Petition exempted by 37 C.F.R. § 42.24(a)(1); and

2. This Petition complies with the typeface and style requirements of 37 C.F.R. §§ 42.6(a)(2)(ii), 42.6(a)(2)(iii) and has been prepared in proportionally spaced, 14-point Times New Roman font using Microsoft Word Version 2308 (2024).

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