

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AT&T SERVICES INC., AND NOKIA OF AMERICA CORP.;

Petitioners

v.

ADAPTIVE SPECTRUM AND SIGNAL ALIGNMENT, INC.,

Patent Owner.

IPR2025-00395

U.S. PATENT NO. 7,428,669

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §312 AND 37 C.F.R. §42.104**

Mail Stop PATENT BOARD
Patent Trial and Appeal Board
US Patent and Trademark Office
PO Box 1450
Alexandria, Virginia 22313-1450

TABLE OF CONTENTS

I.	STANDING UNDER 37 C.F.R. §42.104(a)	1
II.	PAYMENT OF FEES	1
III.	OVERVIEW OF CHALLENGES AND RELIEF REQUESTED	1
IV.	BACKGROUND	2
	A. Technical Background	2
	B. Prosecution History	5
	C. Priority Date	5
	D. Claim Construction	5
	1. “Means for” Limitations	6
V.	PRIOR ART REFERENCES	7
	A. Cooper (Ex. 1006)	7
	B. Klayman (Ex. 1007)	7
	C. Li (Ex. 1008)	8
VI.	LEVEL OF ORDINARY SKILL IN THE ART	8
VII.	THE CHALLENGED CLAIMS ARE UNPATENTABLE	8
	A. Ground 1: Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 are rendered obvious by Cooper and Li	8
	1. Overview of Ground 1	9
	2. Motivation to Combine Cooper and Li	11
	3. Claim 14	13

4. Claim 15: The method of claim 14 wherein repeatedly acquiring the MEVs comprises at least one of the following: directly measuring a characteristic of the DSL modem; collecting a value from an element management system; or computing the MEVs from collected data. 22
5. Claim 16: The method of claim 14 wherein steps (b) through (e) are repeated. 23
6. Claim 17: The method of claim 14 wherein the method is performed by a controller.....24
7. Claim 19: The method of claim 17 wherein the controller is in a Central Office (CO).....26
8. Claim 20: The method of claim 17 wherein the controller is outside a Central Office (CO). 26
9. Claim 23: The method of claim 14 wherein the CCR is K/N , wherein K =a total number of payload bytes in the codeword and N =a total number of bytes in the codeword. 28
- 10.Claim 26: The method of claim 14 wherein the MEV is based on at least one of the following: a Bit Error Rate (BER); errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.....28
- 11.Claim 27: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in computer readable program code. 29
- 12.Claim 28: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in hardware. 29

13.Claim 29: The method of claim 14 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) system operable in compatibility with an ADSL2 standard and farther wherein adjusting the CCR comprises adjusting at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.	30
14.Claim 1	32
15.Claim 2: The controller of claim 1 wherein the MEVs are based on at least one of the following: a bit error rate; errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.....	36
16.Claim 3: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as computer readable program code.....	36
17.Claim 4: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as hardware.....	36
18.Claim 11: The controller of claim 1 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) modem operable in compatibility with an ADSL2 standard and further wherein the CCR adjustment control signal adjusts at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.....	37
B. Ground 2: Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 are rendered obvious by Klayman and Li.	37
1. Overview of Ground 2	37
2. Klayman	37
3. Motivation to combine Klayman and Li.....	39
4. Claim 14	41

5. Claim 15: The method of claim 14 wherein repeatedly acquiring the MEVs comprises at least one of the following: directly measuring a characteristic of the DSL modem; collecting a value from an element management system; or computing the MEVs from collected data. 50
6. Claim 16: The method of claim 14 wherein steps (b) through (e) are repeated. 51
7. Claim 17: The method of claim 14 wherein the method is performed by a controller.....52
8. Claim 19: The method of claim 17 wherein the controller is in a Central Office (CO).....53
9. Claim 20: The method of claim 17 wherein the controller is outside a Central Office (CO). 54
- 10.Claim 23: The method of claim 14 wherein the CCR is K/N , wherein K =a total number of payload bytes in the codeword and N =a total number of bytes in the codeword. 55
- 11.Claim 26: The method of claim 14 wherein the MEV is based on at least one of the following: a Bit Error Rate (BER); errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or ransmission Control Protocol and Internet Protocol (TCP/IP) throughput.....56
- 12.Claim 27: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in computer readable program code. 56
- 13.Claim 28: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in hardware. 57

14.Claim 29: The method of claim 14 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) system operable in compatibility with an ADSL2 standard and farther wherein adjusting the CCR comprises adjusting at least one of the following: Impuls Noise Protection (INP); or maximum interleaving delay.....	58
15.Claim 1	60
16.Claim 2: The controller of claim 1 wherein the MEVs are based on at least one of the following: a bit error rate; errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.....	64
17.Claim 3: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as computer readable program code.....	64
18.Claim 4: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as hardware.....	65
19.Claim 11: The controller of claim 1 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) modem operable in compatibility with an ADSL2 standard and further wherein the CCR adjustment control signal adjusts at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.....	65
VIII. DISCRETIONARY ISSUES.....	65
A. The Petition Does Not Present the Same References Addressed in Prosecution	65
B. The Board Should Not Deny Institution Under <i>Fintiv</i>	67
C. The Board Should Not Deny Institution Under <i>General Plastic</i>	71
IX. CONCLUSION.....	71

X.	MANDATORY NOTICES UNDER 37 C.F.R. §42.8.....	72
A.	Real Party in Interest Under 37 C.F.R. §42.8(b)(1)	72
B.	Related Matters Under 37 C.F.R. §42.8(b)(2).....	72
C.	Designation of Counsel Under 37 C.F.R. §42.8(b)(3)	73
D.	Service Information	74

TABLE OF AUTHORITIES

	Page(s)
Cases	
<i>Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH,</i> IPR2019-01469 (PTAB Feb. 13, 2020) (precedential)	65, 66
<i>Amphenol Corporation v. PPC Broadband, Inc.,</i> IPR2023-01363, Paper 9 at 30-31 (PTAB Mar. 20, 2024).....	67
<i>Apple v. Fintiv, Inc.,</i> IPR2020-00019, Paper 11 at 13-14 (PTAB Mar. 20, 2020) (precedential) 67, 69, 70	67, 69, 70
<i>Comcast Cable Commn's, LLC v. Rovi Guides, Inc.,</i> IPR2019-00231, Paper 14 at 11 (PTAB May 20, 2019)	71
<i>Dish Network v. Broadband iTV,</i> IPR2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021).....	69
<i>General Plastic Industrial Co., Ltd. v. Canon Kabushiki Kaisha,</i> IPR2016-01357, Paper 19 (PTAB Sept. 6, 2017) (precedential)	71
<i>Godbersen-Smith Constr. Co. v. Guntert & Zimmerman Const. Div., Inc.,</i> IPR2021-00050, Paper 24 at 19-21 (PTAB May 7, 2021)	66
<i>NHK Spring Co. v. Intri-Plex Techs., Inc.,</i> IPR2018-00752, Paper 8 at 19-20 (PTAB Sept. 12, 2018) (precedential)	67
<i>Oticon Med. AB v. Cochlear Ltd.,</i> IPR2019-00975, Paper 15 at 20 (PTAB Oct. 16, 2019)	67
<i>Phillips v. AWH Corp.,</i> 415 F.3d 1303 (Fed. Cir. 2005)	5
<i>Qualcomm Inc. v. Apple Inc.,</i> 24 F.4th 1367 (Fed. Cir. 2022)	30, 59
<i>Samsung Electronics America v. Prisua Engineering,</i> 948 F.3d 1342 (Fed. Cir. 2020)	7

<i>Tianma Microelectronics Co., v. Japan Display Inc.,</i> IPR2021-01058, Paper 16 at 31 (PTAB Jan. 5, 2022)	67
---	----

<i>VMWare, Inc. v. Intellectual Ventures I LLC,</i> IPR2020-00470 (PTAB Aug. 18, 2020)	68
---	----

Statutes

35 U.S.C. § 103	1, 2
35 U.S.C. § 314(a)	71
35 U.S.C. § 315(e)	76
35 U.S.C. § 325(d)	69, 71
35 U.S.C. §§ 311–319	1

Regulations

37 C.F.R. § 42.10(b)	80
37 C.F.R. § 42.104(b)(3)	6
37 C.F.R. § 42.105	2
37 C.F.R. § 42.105(b)	2
37 C.F.R. § 42.24(a)(1)(i)	1
37 C.F.R. § 42.6(e)	2
37 C.F.R. § 42.8	78
37 C.F.R. § 42.8(b)(1)	78
37 C.F.R. § 42.8(b)(2)	78
37 C.F.R. § 42.8(b)(3)	79
37 C.F.R. § 42.8(b)(4)	80
37 C.F.R. § 42	1

37 C.F.R. §42.104(a).....	1
37 C.F.R. §42.104(b)(1)–(2)	1
37 C.F.R. §42.22(a)(1).....	1

LIST OF EXHIBITS

Exhibit	Short Name	Description
Ex. 1001	'669 patent	U.S. Patent No. 7,428,669
Ex. 1002	Declaration	Declaration of Richard Gitlin
Ex. 1003	CV	<i>Curriculum Vitae</i> of Richard Gitlin
Ex. 1004	'669 File History	File History of U.S. Patent No. 7,428,669
Ex. 1005		[Reserved]
Ex. 1006	Cooper	U.S. Patent No. 6,772,388 to Cooper
Ex. 1007	Klayman	U.S. Patent No. 5,699,365 to Klayman
Ex. 1008	Li	U.S. Patent Publ. No. 2002/0140991 to Li
Ex. 1009		[Reserved]
Ex. 1010		[Reserved]
Ex. 1011	G.992.1	ITU-T Recommendation G.992.1, <i>Asymmetric digital subscriber line (ADSL) transceivers</i> (06/99)
Ex. 1012	G.992.2	ITU-T Recommendation G.992.2, <i>Splitterless asymmetric digital subscriber line (ADSL) transceivers</i> (06/99)
Ex. 1013	G.992.3	ITU-T Recommendation G.992.3, <i>Asymmetric digital subscriber line transceivers 2 (ADSL2)</i> (07/2002)
Ex. 1014	G.992.4	ITU-T Recommendation G.992.4, <i>Splitterless asymmetric digital subscriber line transceivers 2 (splitterless ADSL2)</i> (07/2002)
Ex. 1015	G.992.5	ITU-T Recommendation G.992.5, <i>Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2+)</i> (05/2003)

Exhibit	Short Name	Description
Ex. 1016	G.997.1	ITU-T Recommendation G.997.1, <i>Physical layer management for digital subscriber line (DSL) transceivers</i> (06/99)
Ex. 1017	Docket Control Order	Docket Control Order, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&T Inc., et al.</i> , Case No. 2:24-cv-00029-JRG-RSP (E.D. Tex. July 22, 2024) ECF No. 84.
Ex. 1018	Order Focusing Claims	Order Focusing Patent Claims and Prior Art to Reduce Costs, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&T Inc., et al.</i> , Case No. 2:24-cv-00029-JRG-RSP (E.D. Tex. Oct. 23, 2024), ECF No. 104.
Ex. 1019	Motion to Transfer	Defendants' Motion to Transfer Venue Based on the Parties' Contractual Forum-Selection Clause, and Alternatively, Motion to Stay Case Pending Arbitration, <i>Adaptive Spectrum and Signal Alignment, Inc. v. AT&T Inc., et al.</i> , Case No. 2:24-cv-00029-JRG-RSP (E.D. Tex. Oct. 23, 2024), ECF No. 92 (<i>Redacted</i>).
Ex. 1020	Gagnaire	Maurice Gagnaire, <i>Broadband Local Loops for High-Speed Internet Access</i> (Artech House, 2003).
Ex. 1021	DSL Advances	Thomas Starr, et al., <i>DSL Advances</i> , (Prentice Hall, 2002).
Ex. 1022	ISDN Architecture	Richard T. Roca, <i>ISDN architecture</i> (AT&T Technical Journal, 1986).
Ex. 1023	Gitlin	U.S. Patent No. 4,924,492 to Gitlin
Ex. 1024	Data Communication Principles	Richard D. Gitlin, Jeremiah F. Hayes and Stephen B. Weinstein, <i>Data Communication Principles</i> Plenum Press, 1992).
Ex. 1025	A Review of HDSL Progress	Joseph W. Lechleider, <i>High Bit Rate Digital Subscriber Lines: A Review of HDSL Progress</i> , Vol. 9, No. 6, IEEE Journal on Selected Areas in Comm. 769 (1991).

Exhibit	Short Name	Description
Ex. 1026	Haykin	Simon Haykin, Communication Systems (4 th Edition, John Wiley, 2001).
Ex. 1027	Proakis	John G. Proakis, Digital Communications (4 th Edition, McGraw Hill, 2000).
Ex. 1028	Kerpez	Kenneth J. Kerpez, et al., <i>Advanced DSL Management</i> (IEEE Communication Magazine, Sept. 2003).
Ex. 1029	Song	Kee Bong Song, et al., <i>Dynamic Spectrum Management for Next-Generation DSL Systems</i> (IEEE Communications Magazine, Oct. 2002).
Ex. 1030	Locke	U.S. Patent No. 6,598,188 to Locke
Ex. 1031	Annamalai	U.S. Patent No. 5,023,872 to Annamalai

AT&T Services Inc. (“AT&T”) and Nokia of America Corp. (“Nokia”) (“Petitioners”) petition for IPR under 35 U.S.C. §§311–319 and 37 C.F.R. §42 of Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 (“the Challenged Claims”) of U.S. Patent No. 7,428,669 (“the ’669 patent”). Petitioners request cancellation of the Challenged Claims.

I. STANDING UNDER 37 C.F.R. §42.104(a)

Petitioners certify the ’669 patent is available for IPR, and Petitioners are not barred or estopped from requesting IPR.

II. PAYMENT OF FEES

Petitioners authorize Account No. 16-0605 to be charged.

III. OVERVIEW OF CHALLENGES AND RELIEF REQUESTED

Pursuant to 37 C.F.R. §42.22(a)(1) and 42.104(b)(1)–(2), Petitioners request cancellation of the Challenged Claims pursuant to the grounds below. Additional support is provided in the Declaration of Dr. Richard Gitlin (Ex. 1002). *See* Ex. 1002, ¶¶1-62.

- **Ground 1:** Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 are unpatentable under 35 U.S.C. § 103 over U.S. Patent No. 6,772,388 (“Cooper”) and/or over Cooper in view of U.S. Patent Publication No. 2002/0140991 (“Li”).

- **Ground 2:** Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 are unpatentable under 35 U.S.C. § 103 over U.S. Patent No. 5,699,365 (“Klayman”) and/or over Klayman in view of Li.

IV. BACKGROUND

A. Technical Background

The ’669 patent describes a method for dynamically adjusting Reed-Solomon codeword parameters used for Forward Error Correction (FEC) in DSL transmissions. Ex. 1001, 1:25-31, 4:6-21; Ex. 1002, ¶¶114-115. Although the ’669 patent admits that Reed-Solomon FEC coding and adaptive interleaving were “well-known,” the ’669 patent nonetheless alleges that permitting “adjustment of a communication system to compensate for changing channel and other conditions . . . *would represent a significant advancement in the art.*” Ex. 1001, 3:6-13, 3:61-66 (emphasis added); Ex. 1002, ¶¶116-130. This is not true.

The claimed solution of the ’669 patent did nothing to advance the art. Adaptive FEC encoding techniques were well-known prior to the ’669 patent’s priority date. See Ex. 1002, ¶¶ 63-103.

*

*

*

The ’669 patent explains “Reed-Solomon encoding” is “made up of K data or information bytes (the user’s payload data) and R parity bytes, totaling N bytes in each codeword (that is, $K+R=N$).” Ex. 1001, 2:6-19; Ex. 1002, ¶116. The ’669

patent explains that “a desired error rate can be achieved by adjusting one or more of [these] FEC codeword composition parameters” (such as K, R, or N in Reed-Solomon encoding). *Id.*, 9:8-10. It goes on to define a “codeword composition ratio (CCR)” as any quantity or value that “represents the relation between the payload and parity bytes in the applicable FEC coding scheme,” and gives a specific example as the ratio of K/N. *Id.* 9:16-28; Ex. 1002, ¶122. The ’669 patent describes a method for dynamically adjusting the CCR—i.e., adjusting either K or N—with reference to Figure 4 (annotated below). Ex. 1002, ¶¶ 123-127.

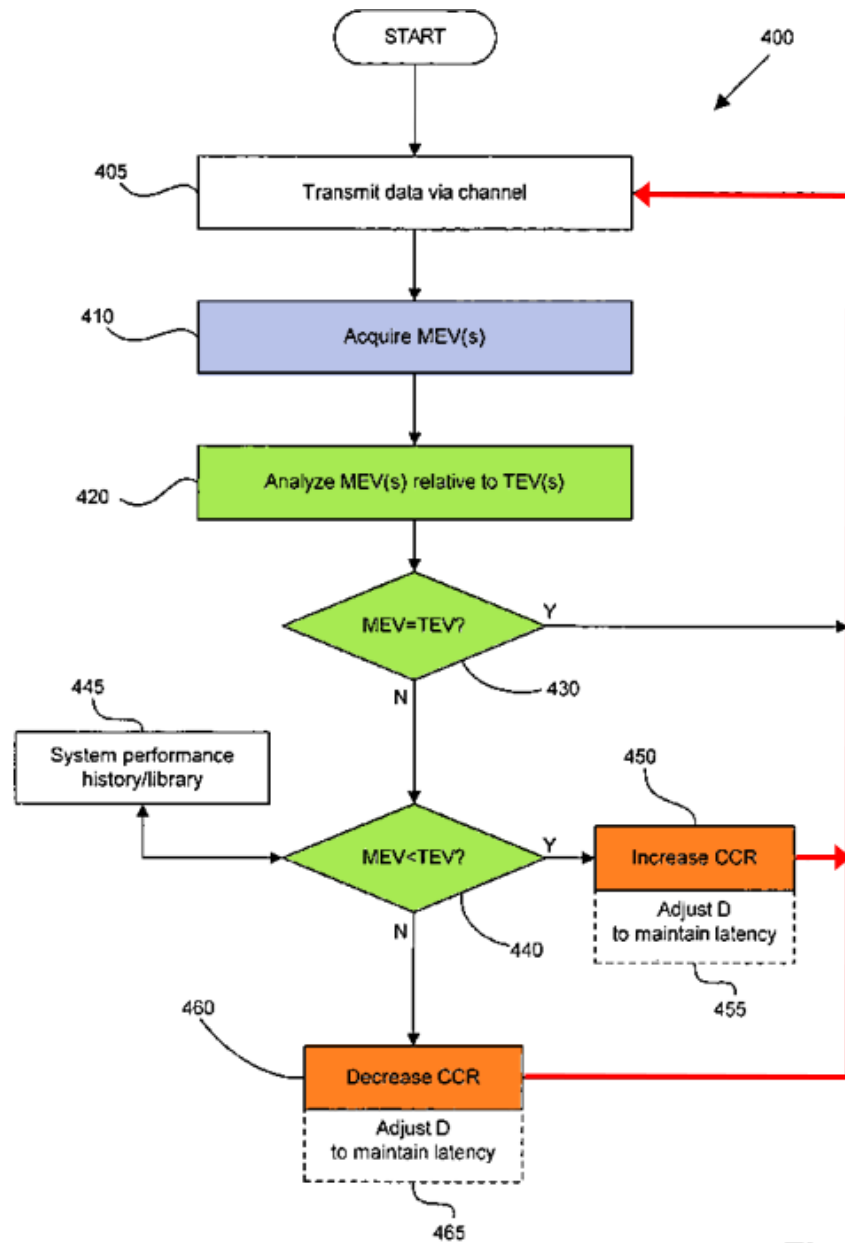


Figure 4

During data transmissions (step 405), transmission error values (e.g., Bit Error Rate (BER)) are measured (step 410). Ex. 1001, 9:12-16, 9:36-61, 13:36-43; Ex. 1002, ¶125. Those measured error values (“MEVs”) are compared against target error values (“TEVs”) (step 420). *Id.* If the MEVs equal the TEVs, then the process repeats without changing the CCR (step 430). *Id.* If, however, the MEV

does not equal the TEV, then the CCR (K/N) is adjusted (steps 450, and 460 shown in orange). *Id.* If the MEV<TEV, then the CCR is increased and if MEV>TEV, then the CCR is decreased. *Id.*, 10:1-13.

B. Prosecution History

U.S. Patent Application No. 10/795,593 (“the ’593 Application”) was filed March 8, 2004. Ex. 1004, 1-57; Ex. 1002, ¶106. During prosecution, the Applicant narrowed the claims to focus on repeatedly acquiring MEVs representing impulse noise errors detected on a channel *after* DSL modems are trained and initialized. Ex. 1004, 133-34, 187; Ex. 1002, ¶¶107-112. The Applicant also discussed the inherent necessity of using a “controller” for adjusting FEC parameters based on collected MEVs. Ex. 1004, 187; Ex. 1002, ¶112. These amendments and arguments led to allowance. Ex. 1002, ¶112.

C. Priority Date

In this Petition, Petitioners assume that the earliest priority date for the ’669 patent is December 7, 2003 based on Provisional Application No. 60/527,853. Ex. 1001; Ex. 1002, ¶113. If Patent Owner disputes the prior art status of any cited references, Petitioners reserve the right to challenge the priority date.

D. Claim Construction

Generally, the terms should receive their respective plain and ordinary meaning as understood by a person of ordinary skill in the art under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); Ex. 1002, ¶131.

1. “Means for” Limitations

Independent claim 1 recites several “means for” limitations. To comply with 37 C.F.R. § 42.104(b)(3), Petitioner identifies the following sections from Ex. 1001 that describe the structure performing the claimed function of each recited “means for” limitation. See Ex. 1002, ¶¶132-133.

Claim Term	Citation to Specification
“means for repeatedly acquiring Measured transmission Error Values (MEVs)”	“a transmission error value monitor for acquiring a transmission error value and generating a signal representative of that MEV.” <i>Id.</i> , 13:18-21, 16:63-17:30. This can be a part of a “controller 500 [that] is a computer or computer system attached to an ADSL element management system interface” that implements the “[m]onitoring, measuring, analysis, comparing, processing, evaluation, and N, R, D or INP/Maximum Interleaving Delay recommendations.” <i>Id.</i> , 13:50-59.
“means for analyzing the acquired MEVs relative to a Target transmission Error Value (TEV)”	Structure includes “software, hardware or a combination of the two.” <i>Id.</i> , 13:50-52.

“means for generating a CCR adjustment control signal”	Structure includes one of a “controller” (<i>id.</i> , 13:9-10), or “software, hardware and/or a combination of the two.” <i>Id.</i> , 14:1-3.
--	---

Even if any of these claim limitations are deemed indefinite, review is still appropriate here because a determination of unpatentability is not impossible given that the prior art references disclose at least the same structure for performing the same functions as described in the specification and claims. *Samsung Electronics America v. Prisia Engineering*, 948 F.3d 1342, 1355 (Fed. Cir. 2020); Ex. 1002, ¶¶132-133.

V. PRIOR ART REFERENCES

A. Cooper (Ex. 1006)

U.S. Patent No. 6,772,388 to Cooper *et al.*, titled “Apparatus and method for providing optimal ***adaptive forward error correction*** in data communications” (emphasis added) was filed December 6, 2000 and issued on August 3, 2004. Cooper is prior art under at least pre-AIA 35 U.S.C. § 102(e), based on its application date. *See* 35 U.S.C. §102(e); Ex. 1002, ¶¶134-151.

B. Klayman (Ex. 1007)

U.S. Patent No. 5,699,365 to Klayman, *et al.*, titled “Apparatus and method for ***adaptive forward error correction*** in data communications” (emphasis added) was filed March 27, 1996 and issued on December 16, 1997. Klayman is prior art

under at least pre-AIA 35 U.S.C. § 102(b) based on its issuance date. *See* 35 U.S.C. §102(b); Ex. 1002, ¶¶152-165.

C. Li (Ex. 1008)

U.S. Patent Application Publication No. 2002/0140991 to Li *et al.*, titled “Optimal Bit Allocation System for Reed-Solomon Coded Data,” was filed October 26, 2001 and published October 3, 2002. Ex. 1008. Li is prior art under at least pre-AIA 35 U.S.C. §102(b) based on its publication date. *See* 35 U.S.C. §102(b); Ex. 1002, ¶¶166-177.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art pertinent to the '669 patent would have had at least a Bachelor's Degree in electrical engineering, computer engineering, or similar discipline and had approximately two years of experience with electronic communication systems and familiarity with standards governing DSL systems. Ex. 1002, ¶¶57-60. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. *Id.*

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 are rendered obvious by Cooper and Li

Much like the '669 patent, Cooper is directed to an “adaptive and dynamic forward error correction scheme for a communication channel.” Ex. 1006,

Abstract. Cooper teaches all of the limitations of the challenged claims. Ex. 1002, ¶179. To the extent it is argued that any limitations are not taught by Cooper and/or such limitations are not well known to a POSITA, Cooper in view of Li teaches the limitations of the Challenged Claims and, for the reasons outlined below, the POSITA would have been motivated to combine Cooper and Li. *Id.*, ¶179.

1. Overview of Ground 1

a. Cooper

Cooper's Figure 2 shows a method for adaptive FEC during data transmissions (e.g., over twisted pair copper wires) that changes the ratio between payload and error correcting bytes within a Reed-Solomon codeword based on the number of errors detected during data transmission. Ex. 1006, 4:3-15, 6:17-28, 7:28-42; Ex. 1002, ¶¶146-151.

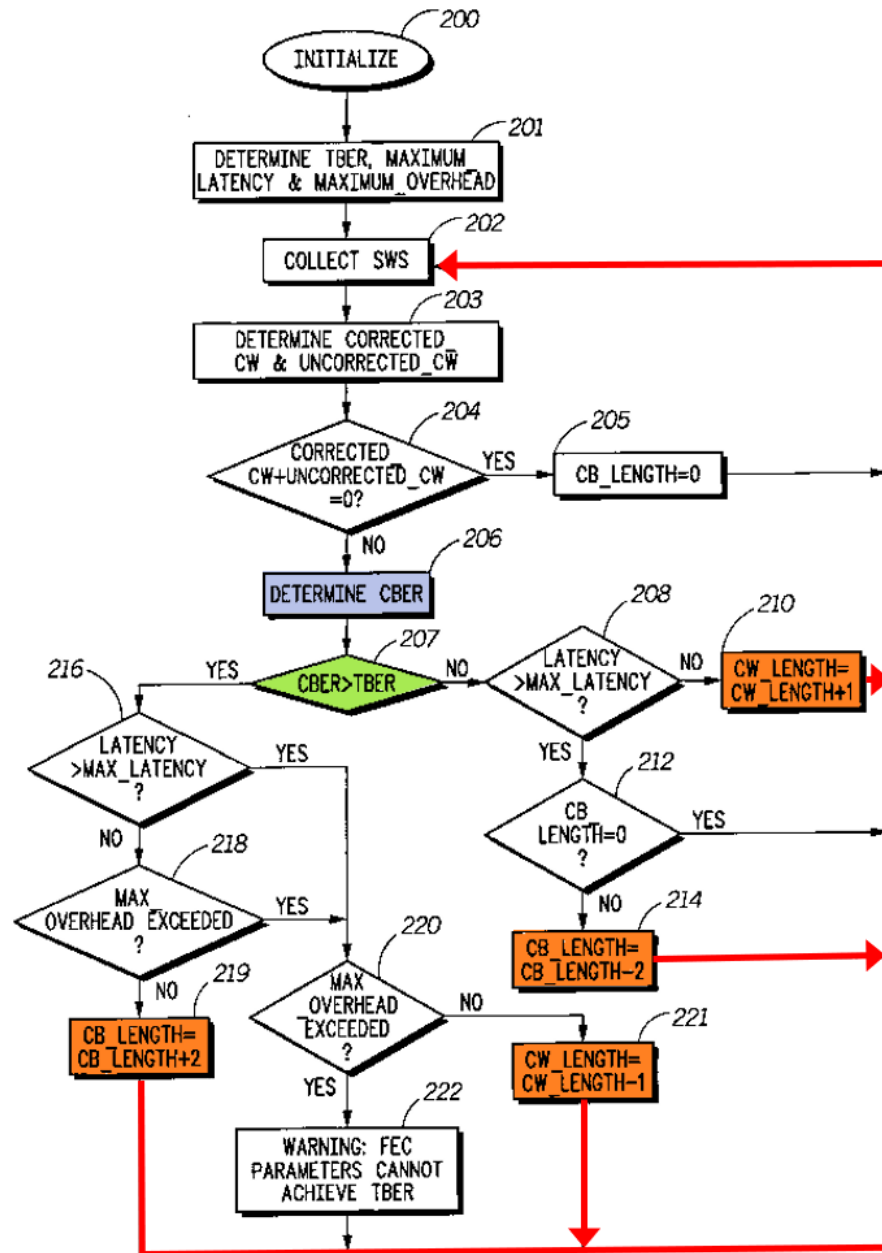


FIG. 2

Id., Figure 2 (annotated).

b. Li

Li describes an FEC scheme using Reed-Solomon codewords used by DSL modems that comply with standards such as G.992.1 and G.992.2 standards. Ex. 1008, [0001]-[0006], [0017]. Li explains that the Reed-Solomon codeword parameters can be determined based on impulse noise protection requirements. *Id.*, [0028].

2. Motivation to Combine Cooper and Li

Though Cooper discloses all of the limitations of the asserted claims, Cooper does not expressly recite a “DSL modem” used to perform FEC; instead, Cooper discloses twisted pair copper wires (which a POSITA would have known would use a DSL modem). Li, however, does disclose this DSL modem. A POSITA thus would have been motivated to modify Cooper with the teachings of Li to perform dynamic FEC coding in real-time using a DSL modem that complies with ADSL standards, including the standards disclosed in Li. Ex. 1002, ¶180.

Cooper and Li are analogous art, at least because both references discuss FEC coding for data transmitted over twisted pair wires. *See e.g.*, Ex. 1006, *Abstract*, 4:3-15; Ex. 1008, [0001]-[0006], [0017]; Ex. 1002, ¶181.

Cooper’s dynamic FEC coding scheme is usable with communications over a “twisted pair copper wire” (Ex. 1006, 4:11-15), which a POSITA would have recognized as a DSL communication medium. *See* Ex. 1008, [0002]. A POSITA

would have understood that transmitting over twisted pair copper wire at high data throughput rates would require DSL modems at the primary and secondary stations of a point-to-point network. Ex. 1002, ¶182 A POSITA would have recognized benefits of using DSL modems that are compliant with current ADSL standards, such as the G.992.1 and G.992.2 standards disclosed in Li and the more recent G.992.3/4/5 and G.997.1 standards discussed in background of the '669 Patent, with the system disclosed in Cooper. Ex. 1002, ¶¶183-184; *see also* Ex. 1001, 3:29-60; Ex. 1013; Ex. 1014; Ex. 1015; Ex. 1016.. Using modems compliant with recent standards enables reliable communication with a wide range of modems within a DSL network (i.e., between a transmitter and receiver). *Id.*, [0025], Ex. 1001, 2:39-56; *see also* Ex. 1011, Ex. 1012; Ex. 1013; Ex. 1014; Ex. 1015; Ex. 1008, [0003].

Moreover, a POSITA would have recognized that the location of a controller for determining FEC coding parameters (e.g., the controller discussed in Cooper) could be located inside or outside of a central office. *See* Ex. 1028, 1029; Ex. 1002, ¶184.

A POSITA would have had a reasonable expectation of success in combining Cooper and Li because Cooper discusses a dynamic FEC coding scheme usable for communications over twisted pair copper wires (i.e., DSL). Ex. 1006, 4:3-26; Ex. 1008, [0002]-[0006]; Ex. 1002, ¶184. A POSITA would have

recognized that DSL modems such as those described in Li would have been integrated into Cooper's DSL communication system to enable use of the twisted pair copper wires. Ex. 1002, ¶184.

3. Claim 14¹

Even a cursory comparison of the Abstract of Cooper to claim 14 of the '669 patent demonstrates the lack of inventiveness of the '669 patent (Ex. 1002, ¶186):

Claim 14, '669 Patent	Cooper Abstract
14. A method of adjusting Forward Error Correcting (FEC) coding in a Digital Subscriber Line (DSL) modem in which data is transmitted between a transmitter and a receiver on a channel, the method comprising: (a) selecting a Codeword Composition Ratio (CCR) representing a relation between payload and parity bytes in an FEC coding scheme; (b) transmitting a control signal for transmitting data from the DSL modem via the channel the control signal specifying the CCR and the FEC coding scheme; (c) repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem; (d) analyzing the acquired MEVs relative to a Target transmission Error Value (TEV); and (e) adjusting the CCR when the MEV differs sufficiently from the TEV.	An adaptive and dynamic forward error correction scheme for a communication channel is disclosed. The method and apparatus calculates the actual bit error rate for comparison with a target bit error rate. When a channel is performing better than required by the performance specifications, the forward error correction power can be reduced to provide greater throughput. If the calculated actual bit error rate is greater than the target bit error rate, then the forward error correction power is increased in an attempt to lower the calculated bit error rate. A feedback loop is employed to continually calculate revised bit error rates as the forward error correction power is increased or decreased.

¹ Claims 14-17, 19-20, 23, and 26-29 are addressed before claims 1-4, and 11 because the disclosures addressed with respect to claims 14-17, 19-20, 23, and 26-29 fully captures the scope of claims 1-4, and 11.

14[pre]: A method of adjusting Forward Error Correcting (FEC) coding in a Digital Subscriber Line (DSL) modem in which data is transmitted between a transmitter and a receiver on a channel, the method comprising:

Cooper alone or in view of Li teaches the preamble of Claim 14, to the extent it is determined to be limiting. Ex. 1002, ¶187. Cooper discloses a method of adjusting FEC coding using an “adaptive and dynamic forward error correction scheme” that “can adaptively respond to changing noise-related conditions in the communications channel *by adapting the forward error correcting power* due to those changing conditions” on a communications medium between a primary transceiver and a secondary station as a transmitter or receiver. Ex. 1006, 3:63-67, 4:3-47. The communications medium connecting the primary station and the secondary station can be “twisted pair copper wires” (*Id.*, 4:3-16), which a POSITA would have recognized as being a DSL communication channel between the primary and secondary stations. Ex. 1002, ¶188.

To the extent Cooper’s identification of twisted pair wires without express recitation of “DSL modem” leaves any doubt, Li discloses a DSL modem capable of implementing dynamically determined FEC coding parameters. Ex. 1008, [0003]-[0004], [0008]; Ex. 1002, ¶189. Moreover, a POSITA would recognize that Cooper’s adaptive and dynamic FEC scheme can be implemented using a DSL modem (disclosed in Li) in a DSL communication system transmitting over Cooper’s “twisted pair copper wire.” *Id.*

c. 14[a]: (a) selecting a Codeword Composition Ratio (CCR) representing a relation between payload and parity bytes in an FEC coding scheme;

Cooper teaches Limitation 14[a]. Ex. 1002, ¶ 190.

The crux of Cooper's invention is dynamically "adapting the forward error correcting power" (*id.*, 3:63-67) to change "the number of data errors that can be corrected" (*id.*, 2:41-45) to "balance the amount of overhead incurred by the system relative to the selected forward error correcting power." *Id.*, 2:45-47; Ex. 1002, ¶191.

Cooper teaches determining a relationship between payload and error correcting bytes (also referred to as parity bytes) in a Reed-Solomon encoding scheme (i.e., an FEC coding scheme) by selecting a "parameter pair (n, k)." Ex. 1006, 6:17-26; Ex. 1002, ¶192. Cooper defines an example relation between the payload (k) and parity (n-k) bytes in terms of "overhead"—a ratio of "n-k" bytes (parity bytes) to n bytes (total bytes) and teaches to optimize the overhead to maximize throughput while minimizing the need for retransmission. Ex. 1006, 6:67-7:3; 10:30-37; Ex. 1002, ¶¶193-194.

This follows the invention of the '669 patent, which defines a "codeword composition ratio (CCR)" as any quantity or value that "represents the relation between the payload [N] and parity [R] bytes in the applicable FEC coding scheme." *Id.*, 9:16-28. As such, the ratio between Cooper's "n" and "k,"

parameters (e.g., the overhead) is a CCR as the term is used in 14[a]. Ex. 1002, ¶194.

d. 14[b]: (b) transmitting a control signal for transmitting data from the DSL modem via the channel the control signal specifying the CCR and the FEC coding scheme;

Cooper alone or in view of Li teaches Limitation 14[b]. Ex. 1002, ¶195.

Cooper teaches a “technique for changing the forward error correction parameters in a communications channel.” *Id.*, 7:28-35. Those parameters identify the parameter pair (n, k) (which defines a CCR) and the FEC coding scheme (specifying the parameter pair refers to a Reed-Solomon FEC coding scheme) for transmitting data on a communication channel. *See id.*, 6:16-39, 7:42-62; Ex. 1002, ¶196. Cooper explains that a microcontroller in the receiver implements the method of FIG. 2 to “dynamically establish[] the forward error correction parameters” and to communicate the parameters to the transmitter so that the receiver and the transmitter are “operating with the same forward error correction parameters.” *Id.*, 7:58-61; 11:31-46. According to Cooper, both the transmitter and receiver “must know, prior to the receipt of the data [at the receiver], the type of error correcting code employed” and the FEC parameters used. Ex. 1006, 1:35-39, 4:64-66, 6:7-14.

A signal used to identify Cooper’s FEC coding scheme and parameters is a “control signal” as used in claim 14 of the ’669 patent to “adjust[] the CCR in

response to the CCR adjustment control signal.” Ex. 1001, 14:58-59; Ex. 1002, ¶197.

Cooper does not explicitly state that a “DSL modem” transmits data, but Cooper discloses “high-speed data application[s]” and that the communications medium may be a “twisted pair copper wire.” *Id.*, 4:11-15, 10:1-15. A POSITA would have known that “high-speed” data communications over “twisted pair copper wire” require DSL modems for communication. *Id.*, 4:11-15; Ex. 1002, ¶198. Therefore, a POSITA would understand that Cooper alone teaches “transmitting data from a DSL modem via the channel” as recited in 14[b]. Ex. 1002, ¶¶196-198.

If Cooper’s identification of twisted pair wires without express recitation of “DSL modem” leaves any doubt, Li discloses that a DSL modem transmits data according to the FEC coding parameters over twisted pair wire. Ex. 1008, [0039] (“The ADSL modem . . . stores various data such as the parameters G, B, n and r, and the data to be transmitted.”); Ex. 1002, ¶199. Therefore, a POSITA would have recognized that when implementing Cooper’s dynamic FEC coding scheme using twisted pair wire, the receiver and transmitter would be DSL modems, as disclosed in Li, and the FEC coding scheme and associated parameters are communicated to the transmitting DSL modem. Ex. 1002, ¶199.

e. 14[c]: (c) repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem;

Cooper teaches Limitation 14[c]. *Id.*, ¶200.

Cooper describes a process for “dynamically establishing the forward error correction parameters, in particular, the code word length (in bytes) and the check byte [error correcting] length (also in bytes).” Ex. 1006, 11:31-35. This process includes determining a calculated BER² at step 206. *Id.*, 11:66-67. Ex. 1002, ¶201.

Cooper explains that the BER or other calculated performance metrics of a transmission may be used to represent the number of measured or calculated errors, including “packet error rate, burst error rate, block error rate, or frame error rate.” Ex. 1006, 7:63-8:14; 13:65-14:6. These “calculated or measured error parameter[s]” are measured during data transmissions when impulse noise events “disrupt the channel on a random and unpredictable basis” (*Id.*, 2:66-3:3; 5:52-65), after a DSL modem is trained and initialized to communicate with other DSL modems via the communication medium. *Id.*; Ex. 1002, ¶¶202-204; *see also* Ex. 1006, 11: 31-46, FIG. 2 (calculating BER (Step 206) occurs *after* an “initialize”

² According to dependent claim 26, the MEV may be based on “a Bit Error Rate (BER),” and therefore Cooper’s disclosure of calculating a BER maps directly to a claimed embodiment of acquiring an MEV. *See infra*, Section X.A.9.

step 200 and after data samples are collected during normal data transmission (step 202)).

As reflected by the annotated red line in Cooper's FIG. 2 (below), the process is repeated over time, including step 206 for determining a calculated BER. Ex. 1002, ¶205; *see also* Ex. 1006, 12:25-30 (“[O]nce the forward error correcting power is changed . . . processing always returns to the step 202 for the collection of additional samples, a recalculation of the calculated bit error rate, and comparison with the target bit error rate.”).

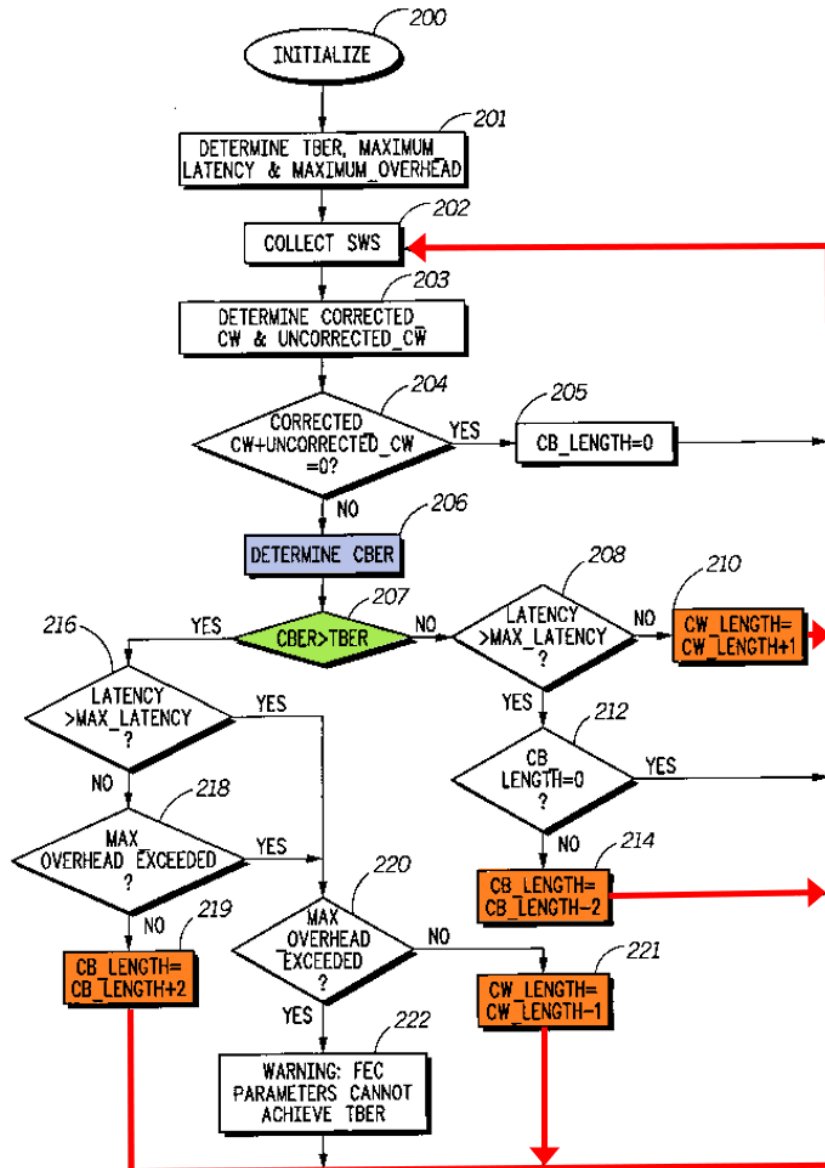


FIG. 2

Id., Figure 2 (annotated).

f. 14[d]: (d) analyzing the acquired MEVs relative to a Target transmission Error Value (TEV); and

Cooper teaches Limitation 14[d]. Ex. 1002, ¶206.

At step 207 of Cooper's FIG. 2, "the calculated bit error rate is compared with the target bit error rate" to determine whether the calculated BER is higher or lower than the target BER. Ex. 1006, 12:10-30; Ex. 1002, ¶207.

g. 14[e]: (e) adjusting the CCR when the MEV differs sufficiently from the TEV.

Cooper teaches Limitation 14[e]. Ex. 1002, ¶208.

Cooper describes "a technique for changing the forward error correction parameters in a communications channel between two or more data communications stations based on predetermined channel performance metrics including BER, FEC corrected code words, FEC uncorrectable code words, latency, and percent utilization of the communication channel." Ex. 1006, 7:28-35; Ex. 1002, ¶209. This is also illustrated in Blocks 210, 212, 214, 219, and 221 of Figure 2, shown above. *Id.*, 12:31-13:64.

Changing Cooper's "parameters" includes increasing or decreasing "the code word length or the check byte length" (also referred to by their variables *n* and *k*). *Id.*, 6:16-39, 7:43-62, 12:31-13:5, 13:6-48; Ex. 1002, ¶210.

As discussed above in reference to Limitation 14[a], Cooper's "*n*" and "*k*" constitute the content of the CCR, as defined by the '669 patent. *See* Ex. 1001, 9:8-28; Ex. 1002, ¶211. Therefore, adjusting either of Cooper's code word length or error correcting byte length would change the CCR.

4. Claim 15: The method of claim 14 wherein repeatedly acquiring the MEVs comprises at least one of the following: directly measuring a characteristic of the DSL modem; collecting a value from an element management system; or computing the MEVs from collected data.

Cooper alone or in view of Li teaches dependent claim 15. Ex. 1002, ¶212.

Cooper explains that the receiver performs the functions of FIG. 2 (including step 206 for calculating or recalculating a BER), specifically using “a dedicated microprocessor or a microprocessor with multiple functions in the receiver where the FEC process is performed.” Ex. 1006, 11:31-38, 8:36-42 (commercially available integrated circuits can provide FEC statistics, including the number of uncorrectable block errors received and the number of received blocks that were corrected). Accordingly, Cooper’s receiver directly measures characteristic of the DSL modem (the BER) using an integrated circuit (or microcontroller) that also corrects errored bytes. Ex. 1002, ¶213.

As discussed in reference to claim 14, a POSITA would have recognized that Cooper’s receiver would be embodied as a DSL modem (Ex. 1006, 4:3-15) or, in the alternative, a POSITA would have utilized a DSL modem, as discussed in Li, as the receiver of Cooper’s communication system, Ex. 1008, [0002]-[0004]; Ex. 1002, ¶214.

5. Claim 16: The method of claim 14 wherein steps (b) through (e) are repeated.

Cooper teaches dependent claim 16. As discussed in reference to Limitation 14[c], Cooper describes that the process “for dynamically establishing the forward error correction parameters” as shown in FIG. 2 is repeated. *Id.*, 11:30-35; 12:25-30. The repeated steps include communicating a change in the FEC coding scheme, codeword length and/or check byte length to the transmitter as discussed in reference to Limitation 14[b] (Ex. 1006, 6:6-16; 7:58-61); repeatedly calculating the BER as discussed in reference to Limitation 14[c] (Ex. 1006, 11:31-35; FIG. 2 (step 206)); comparing the calculated BER against a target BER, as discussed in reference to Limitation 14[d] (Ex. 1006, 12:10-30; FIG. 2 (step 207)); and adjusting the forward error correction parameters that constitute a CCR as discussed in reference to Limitation 14[e] (Ex. 1006, 12:31-13:64). Ex. 1002, ¶215. This is shown by the annotated red line in Cooper’s FIG. 2, below.

Cooper explains that the receiver, specifically a microcontroller of the receiver, performs the process of Cooper's FIG. 2 (*Id.*, 9:31-46), and further communicates changes in FEC parameters to the transmitter (*Id.*, 7:58-62). Ex. 1002, ¶217. The receiver disclosed in Cooper is thus a controller. Cooper also explains that other equipment may operate as a controller, such as "controlling, receiving and transmitting equipment," including processors, that may reside at a central location. *Id.*, 1:35-39, 4:64-66.

Alternatively, a POSITA would have found it obvious to perform the method using a controller. Ex. 1002, ¶¶218-219. A POSITA would have been motivated to use Cooper's controlling equipment separate from the transmitting and receiving modems to perform the claimed method because separate controlling equipment can include more memory and/or processing power than a DSL modem, which would enable the controller to calculate FEC coding changes in real-time. The Applicant of the '669 patent identified similar benefits to using a controller in the office action response dated March 21, 2008, stating "[u]nlike Locke's AGWN, or stationary noise, 'impulse noise events' occur as random and unpredictable events on the channel, and therefore are detected over a period of hours, days, or weeks, ***making collecting and storing such information impracticable for Locke's modems.***" Ex. 1004, 187 (*emphasis added*); Ex. 1002, ¶¶218-219.

Moreover, a POSITA would have had a reasonable expectation of success in using a controller to perform the recited method, as a controller including processors and memory are capable of controlling various functions of devices, including the devices of a primary station as disclosed in Cooper. Ex. 1006, 4:55-66; Ex. 1002, ¶219.

7. Claim 19: The method of claim 17 wherein the controller is in a Central Office (CO).

Cooper teaches dependent claim 19. Ex. 1002, ¶220.

For the same reasons as discussed in reference to claim 17, Cooper discloses the use of a controller (or it would have been obvious to a POSITA based on the disclosures of Cooper), and a POSITA would have been motivated to use a controller located in a central office. *Id.* ¶¶221-223. For example, a POSITA would have understood that Cooper’s “primary station 101” could be a DSL central office having transmitters and controllers. See Ex. 1001, 6:23-27, FIG. 7; Ex. 1011, 10 (describing a transceiver at a Central Office in the 992.1 standards).

8. Claim 20: The method of claim 17 wherein the controller is outside a Central Office (CO).

Cooper teaches dependent claim 20. Ex. 1002, ¶224.

As discussed in reference to Limitation 14[b], Cooper explains that a receiver can include a microcontroller that performs the described method. See *supra* Section X.A.2.c; Ex. 1006, 11:31-46; Ex. 1002, ¶224. The receiver (and

included microcontroller) may be located at a secondary station (e.g., in a household), and outside of the primary station that is equivalent to a Central Office. Ex. 1006, 4:3-26; *see also supra* Section X.A.5.

Alternatively, a POSITA would have been motivated to locate this controller “outside of a Central Office (CO).” Ex. 1002, ¶¶225-226 As discussed in reference to dependent claim 17, a separate controller would provide additional processing power and memory to enable real-time determination of FEC parameters, and locating the controller outside of a central office would enable the controller to be used for multiple central offices. *Id.* A POSITA would have had a reasonable expectation of success in locating the controller outside of a central office. *Id.* Internet-connected processors and memories that execute algorithms such as those discussed in Cooper, were known, and those internet-connected processors can communicate instructions to DSL modems (e.g., at Cooper’s primary station or secondary station). *See id.*; Ex. 1028, 117 (Figure 2 shows an “Advanced DSL manager” located away from equipment in a CO, with DSL modems); Ex. 1029, 103 (Figure 1 shows a spectrum management center (SMC) located outside of a central office).

9. Claim 23: The method of claim 14 wherein the CCR is K/N , wherein K =a total number of payload bytes in the codeword and N =a total number of bytes in the codeword.

Cooper teaches dependent claim 23. Ex. 1002, ¶227. As discussed for 14[a], Cooper teaches that the method includes selecting a “parameter pair (n, k), where ‘n’ is the code word size and ‘k’ is the block size (i.e., the number of information bytes).” Ex. 1006, 6:17-20; Ex. 1002, ¶¶227-228. As explained in Cooper, an “n-byte codeword therefore consists of k information bytes plus (n-k) error correcting code bytes.” Ex. 1006, 6:26-28. Comparing these two parameters (such as by calculating a ratio known as the CCR) is a description of how much of a codeword consists of payload bytes—the remainder being error correcting bytes. Ex. 1002, ¶¶227-228. Cooper describes the same relationship for balancing the amount of payload bytes (and error correcting bytes) against the total codeword length. *Id.*, 10:19-40 (Equation 2 shows a ratio between n-k and n).

10.Claim 26: The method of claim 14 wherein the MEV is based on at least one of the following: a Bit Error Rate (BER); errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.

Cooper teaches dependent claim 26. As discussed for 14[c], Cooper teaches determining a calculated BER as a measured error parameter in step 206 of FIG. 2. *Id.*, 11:66-67; Ex. 1002, ¶229.

11.Claim 27: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in computer readable program code.

Cooper teaches dependent claim 27. As discussed above with respect to claim 14, Cooper teaches each of (a) repeatedly acquiring the MEVs, (b) analyzing the repeated MEVs relative to the TEV, and (c) adjusting the CCR. Cooper also discloses that these steps can be implemented in “[a] computer program product comprising a computer-usable medium having a computer-readable code therein for providing adaptive forward error correction.” Ex. 1006, 17:17-18:37 (Claim 18, steps (a), (c), and (e)-(l)); Ex. 1002, ¶230.

12.Claim 28: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in hardware.

Cooper teaches dependent claim 28. As discussed above with respect to claim 14, Cooper teaches each of (a) repeatedly acquiring the MEVs, (b) analyzing the repeated MEVs relative to the TEV, and (c) adjusting the CCR. Moreover, Cooper states that these steps can be implemented in hardware, specifically “by a dedicated microprocessor or a microprocessor with multiple functions in the receiver where the FEC process is performed.” Ex. 1006, 11:31-46; Ex. 1002, ¶231.

13.Claim 29: The method of claim 14 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) system operable in compatibility with an ADSL2 standard and farther wherein adjusting the CCR comprises adjusting at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.

Cooper in view of Li teaches dependent claim 29. Ex. 1002, ¶232. Li discusses DSL modems and the standards applicable to DSL modems. Specifically, Li discloses an ADSL modem for dynamically determining parameters for a FEC coding scheme. Ex. 1008, [0008], [0039], FIG. 6; Ex. 1002, ¶¶233-234.

Li explains that the modems are compliant with applicable standards, such as the G.992.1 and G.992.2 standards in effect at the time of Li's filing date (October 26, 2001). *Id.*, [0025]. A POSITA reviewing Cooper and Li would have been familiar with updated ADSL standards and would have implemented the teachings of Cooper with current ADSL standards which, at the time of the '669 patent filing, encompassed G.992.3/4/5 ADSL2 standards as admitted in the background of the '669 patent, to maintain compatibility with other ADSL2 modems in existence. *See* Ex. 1001, 2:39-45; Ex. 1002, ¶¶235-237; *Qualcomm Inc. v. Apple Inc.*, 24 F.4th 1367, 1375-76 (Fed. Cir. 2022) (Applicant Admitted Prior Art can provide a factual foundation of what a POSITA would have known at the time of the invention), Ex. 1011; Ex. 1012; Ex. 1013; Ex. 1014; Ex. 1015; Ex. 1016. A POSITA would have had a reasonable expectation of success in using an ADSL2 compatible modem because G.992.3/4/5 standards define the functional

requirements for an ADSL2 compatible modem in sufficient detail to enable a POSITA to implement those standards. Ex. 1002, ¶234; *see also* Ex. 1013.

Moreover, Li discloses that adjusting FEC parameters (including Reed-Solomon parameter pairs) includes adjusting the FEC parameters based on impulse noise protection (INP) requirements and/or a delay. Ex. 1008, [0028]. As explained in Li, parameters can be adjusted based on the specified INP or delay requirements, for example, using the formula recited below. *Id.* Therefore, a POSITA would have recognized that Cooper's dynamic FEC coding scheme changes the CCR based on INP or delay requirements (e.g., using Li's formula, reproduced below) for a maximum latency of L_{max} or using other formulas specified in ADSL2 standards. *See* Ex. 1008, [0028]; Ex. 1002, ¶235.

$$x + \frac{(S - 1)}{4} + \frac{S \cdot D}{4} < L_{max}$$

where x is a constant system delay in milliseconds.

Moreover, a POSITA would have recognized that ADSL standards discuss INP and delay parameters (*see* Ex. 1008, [0026]-[0028]; *see also* Ex. 1013, 32-46 (describing that selection of FEC parameters must satisfy a requirement of meeting a minimum impulse noise protection)), and so a POSITA would have had reason to implement the dynamic FEC coding scheme of Cooper using an ADSL compatible modem that ensures compliance with INP and/or delay requirements. Ex. 1002, ¶237.

14. Claim 1

- a. 1[pre]: A controller for an adaptive Forward Error Correction (FEC) coder using a Codeword Composition Ratio (CCR), wherein the FEC coder is used in a Digital Subscriber Line (DSL) modem in which a transmitter sends data via a channel using FEC coding and interleaving according to an original transmission latency, wherein the controller comprises*

Cooper alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, limitations 14[pre], 14[a], and claim 17. Specifically, like limitation 14[pre], which claims “a method of adjusting Forward Error Correcting (FEC) coding in a Digital Subscriber Line (DSL) modem in which data is transmitted between a transmitter and a receiver on a channel,” limitation 1[pre] claims “an adaptive Forward Error Correction (FEC) coder” wherein “the FEC coder is used in a Digital Subscriber Line (DSL) modem in which a transmitter sends data via a channel.” Similarly, like limitation 14[a], which claims “a Codeword Composition Ratio (CCR),” limitation 1[pre] claims “using a Codeword Composition Ratio (CCR).” Finally, like claim 17, which claims a method “performed by a controller,” limitation 1[pre] claims “[a] controller” to enact the remainder of the limitation. Ex. 1002, ¶238.

Though none of limitations 14[pre], 14[a], or 17 expressly identifies using “FEC coding **and interleaving** according to an original transmission latency,” Li discloses this portion of 1[pre]. Li discloses considering factors such as “delay” or

“impulse noise protection” in selecting parameters, wherein one of those parameters is the “interleaver depth” (known as D). Ex. 1008, [0028]. Li explains that these parameters affect latency, and defines the relationship between the latency of the system and the FEC and interleaving parameters. *Id.* A POSITA would have known that data would be sent using FEC coding and interleaving at an original latency. Ex. 1002, ¶239.

b. 1[a]: means for repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem, wherein the means is coupled with the DSL modem;

Cooper alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, limitation 14[c]. Moreover, the '669 patent specification discusses the “means” are embodied as a “transmission error value monitor” capable of “receiving an input signal 505 that is representative of the value being sought.” Ex. 1001, 13:18-23. Cooper discloses that “the primary station 101 includes a plurality of processors, memory units, receivers and transmitters for bidirectionally communicating with each of the secondary stations 110, 112, 114, and 116 to provide differentiated signals in both the upstream and downstream directions.” Ex. 1006, 4:55-61. The bidirectional communication capability of Cooper’s primary station 101 matches the structure and functionality of the “means” discussed in the '669 patent specification. With respect to

limitation 1[a] recitation of “wherein the means is coupled with the DSL modem,” a POSITA would have understood that Cooper’s bidirectional communication capability serves to “couple” all of the processors, memory units, receivers, and transmitters (which a POSITA would recognize as a DSL modem based on Cooper alone or Cooper in view of Li, as discussed in reference to claim 14). Ex. 1002, ¶240.

c. 1[b] means for analyzing the acquired MEVs relative to a Target transmission Error Value (TEV), wherein the analyzing means is coupled with the acquiring means; and

Cooper alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, limitation 14[d]. The ’669 patent specification states that the “means for analyzing one or more MEV(s)...can comprise software, hardware or a combination of the two.” Ex. 1001, 13:50-52. As discussed in reference to claims 17 and 27, above, Cooper explains that these steps are performed by a hardware microcontroller or a computer program product, and therefore Cooper describes the same structure and functionality for analyzing MEVs as the ’669 patent. Ex. 1006, 9:31-46, 17:17-18:37. Although limitation 1[b] recites “wherein the analyzing means is coupled with the acquiring means,” as with limitation 1[a], a POSITA would have understood all the elements of the system described by Cooper to be coupled. Ex. 1006, 4:55-61; Ex. 1002, ¶241.

d. 1[c] means for generating a CCR adjustment control signal during normal operation of the DSL modem (“SHOWTIME”) responsive to the means for analyzing, and transmitting the same to the DSL modem, wherein the generating means is coupled with the analyzing means.

Cooper alone or in view of Li discloses this limitation for the same reasons explained with respect to limitations 14[b] and 14[e]. Here, limitation 1[c] recites the term “SHOWTIME”—but the claim itself makes clear that is just normal operation of the DSL modem. Moreover, the ’669 patent specification states that the means for generating a CCR (530) “can be implemented using software, hardware and/or a combination thereof.” Ex. 1001, 14:1-5. As discussed above in reference to Limitation 1[b], Cooper provides the same level of detail specifying that the recited functionality can be performed by analogous hardware or software. A POSITA would have understood the embodiments of Cooper to be in normal operation. Ex. 1002, ¶242. Although limitation 1[b] recites “wherein the generating means is coupled with the analyzing means,” as with limitation 1[a], a POSITA would have understood all the elements of the system described by Cooper to be coupled. Ex. 1006, 4:55-61; Ex. 1002, ¶242.

15.Claim 2: The controller of claim 1 wherein the MEVs are based on at least one of the following: a bit error rate; errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.

Cooper alone or in view of Li discloses this claim for the same reasons discussed with respect to claim 26, which is identical to claim 2 except that it is a “controller” rather than a method. Ex. 1002, ¶243.

16.Claim 3: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as computer readable program code.

Cooper alone or in view of Li discloses this claim for the same reasons discussed with respect to claim 27. *Id.*, ¶244. Both claims 27 and 3 recites that the method (and the correlating “means”) is “implemented” as “computer readable program code.”

17.Claim 4: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as hardware.

Cooper alone or in view of Li discloses this claim for the same reasons discussed with respect to claim 28. *Id.*, ¶245. Both claims 28 and 4 recites that the method (and the correlating “means”) is “implemented” as “hardware.”

18.Claim 11: The controller of claim 1 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) modem operable in compatibility with an ADSL2 standard and further wherein the CCR adjustment control signal adjusts at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.

Cooper in view of Li discloses this claim for the same reasons discussed with respect to claim 29, which is identical to claim 11 except that it is a “controller” rather than a method. *Id.*, ¶246.

B. Ground 2: Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 are rendered obvious by Klayman and Li.

Klayman, like the '669 patent discloses adaptive forward error correction methods. Ex. 1007, *Title*. Klayman teaches all of the limitations of the challenged claims. Ex. 1002, ¶247. To the extent it is argued that any limitations are not explicitly taught by Klayman and/or such limitations are not well known to a POSITA, Klayman in view of Li teaches the limitations of Claims 1-4, 11, 14-17, 19-20, 23, and 26-29 and, for the reasons outlined below, the POSITA would have combined Klayman and Li. Ex. 1002, ¶247.

1. Overview of Ground 2

2. Klayman

Klayman describes a dynamic error correction method that provides “error correction for accurate data reception” and provides “for overhead minimization for increased data throughput,” shown in FIG. 4 (reproduced below with annotations). Ex. 1007, 2:56-58; Ex. 1002, ¶¶153-166. The described process for

adapting FEC parameters adapts to a varying level of noise on a communication channel, such as “twisted pair wires” used for DSL communications. *Id.*, 3:3-8; 6:26-47.

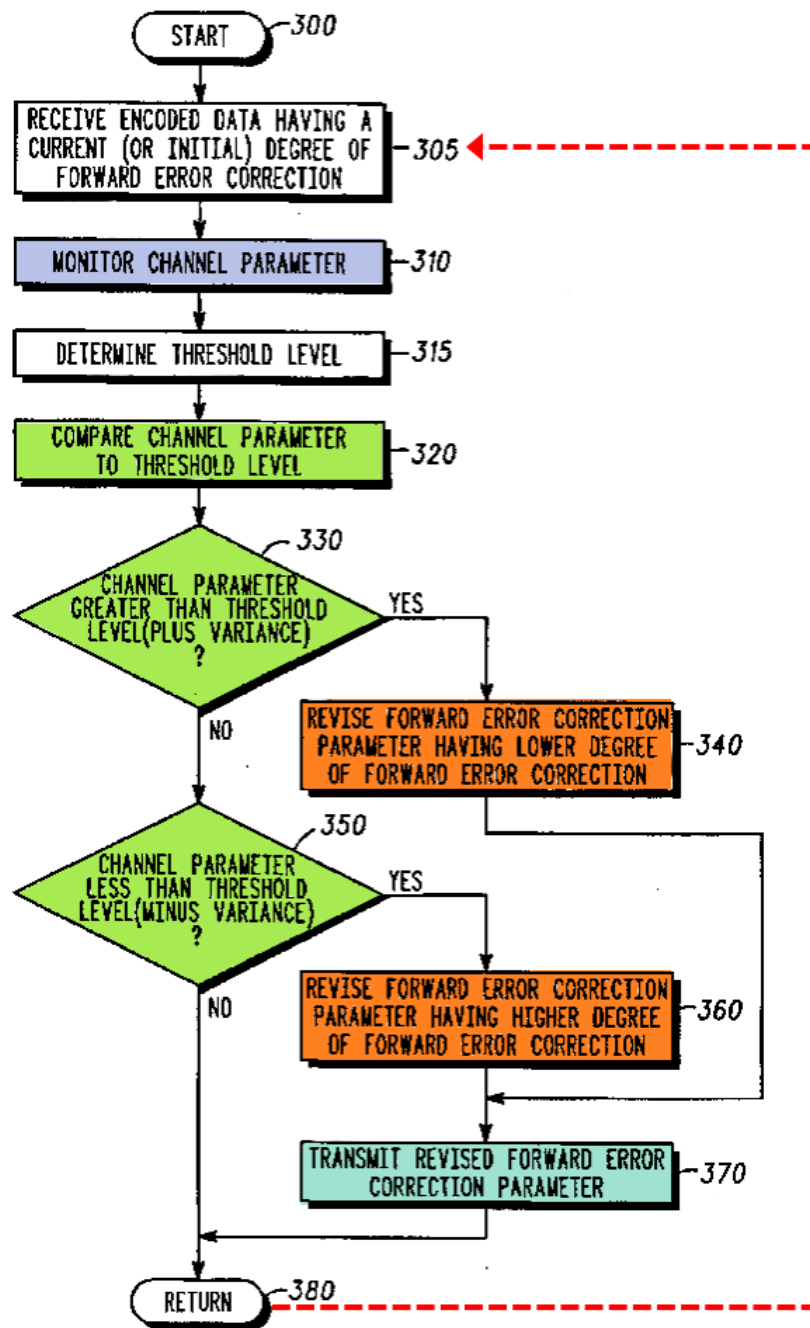


FIG. 4

Ex. 1007, Figure 4 (annotated).

3. *Motivation to combine Klayman and Li*

Though Klayman discloses all of the limitations of the asserted claims, Klayman does not expressly recite a “DSL modem” used to perform FEC; instead, like Cooper, Klayman discloses twisted pair wires (which a POSITA would have known would use a DSL modem). Li, however, does disclose this DSL modem. A POSITA would have been motivated to modify Klayman with the teachings of Li to perform dynamic FEC coding in real-time using a DSL modem that complies with ADSL standards, including the standards disclosed in Li and using the FEC parameters discussed in Li. Ex. 1002, ¶248.

Klayman and Li are analogous art, at least because both references discuss FEC coding in data transmitted over twisted pair wires. *See e.g.*, Ex. 1007, *Abstract*, 3:3-8; Ex. 1008, [0001]-[0006], [0017]; Ex. 1002, ¶249.

Klayman’s dynamic FEC coding scheme is usable with a communication system using “twisted pair wires” as a communication medium (Ex. 1007, 3:3-8), which a POSITA would have recognized as a DSL communication medium. Ex. 1002, ¶250; *see also*, Ex. 1008, [0002] (“DSL uses an infrastructure that already exists; namely, copper twisted pair lines typically used for telephone communication.”). A POSITA would have understood that transmitting over twisted pair wires of a point-to-point network would require a modem. Ex. 1002,

¶251. A POSITA would have recognized benefits of using DSL modems that are compliant with current ADSL standards, such as the G.992.1 and G.992.2 standards disclosed in Li and the more recent G.992.3/4/5 and G.997.1 standards discussed in background of the '669 patent, with the system disclosed in Klayman. *Id.*

For example, using a DSL modem compliant with current standards (as discussed in Li) at both the primary and secondary stations would enable Klayman's system to use the twisted pair wire communication medium for DSL data transmission. *Id.* ¶¶252-253. Specifically, a POSITA would have recognized that using DSL modems that are compliant with current ADSL standards would enable reliable communication with a wide range of modems within a DSL network, including between a transmitter and receiver. Ex. 1008, [0003], [0025], Ex. 1001, 2:39-56; *see also* Ex. 1011; Ex. 1012, Ex. 1013; Ex. 1014; Ex. 1015.

Moreover, a POSITA would have recognized that the location of a controller for determining FEC coding parameters (e.g., the master controller discussed in Klayman) could be located inside or outside a central office, so long as the controller can communicate FEC coding parameters to the transmitter and receiver. Ex. 1002, ¶254; *see also* Ex. 1028, 1029.

A POSITA would have had a reasonable expectation of success in combining Klayman and Li because Klayman discusses a dynamic FEC coding

scheme usable for communications over twisted pair copper wires (i.e., DSL). Ex. 1007, 3:3-8; Ex. 1008, [0002]-[0006]. A POSITA would have recognized that DSL modems such as those described in Li would have been integrated into Klayman's DSL communication system to enable use of the twisted pair copper wires that Klayman discusses as an eligible communication medium. Ex. 1002, ¶255.

4. Claim 14

Much like Cooper, Klayman's Abstract substantially overlaps with the limitations of claim 14 of the '669 patent (*id.*, ¶256):

Claim 14, '669 Patent	Klayman
14. A method of adjusting Forward Error Correcting (FEC) coding in a Digital Subscriber Line (DSL) modem in which data is transmitted between a transmitter and a receiver on a channel, the method comprising:	An apparatus (101, 110) and method for adaptive forward error correction in a data communication system (100) provides for dynamically changing forward error correction parameters based upon communication channel conditions, such as noise levels or error rates. In the method embodiment of the invention, data having a current degree of forward error correction is received (305), and a channel parameter is monitored (310), such as packet or bit error rates. A threshold level for the channel parameter is determined (315), and the monitored channel parameter is compared to the threshold level (320). When the channel parameter is not within a predetermined or adaptive variance of the threshold level, a revised forward error correction parameter having a greater or lesser degree of forward error correction capability is selected (330, 340, 350, 360), and the revised forward error correction parameter is transmitted (370). The device receiving the revised forward error correction parameter, such as a secondary station (110), then transmits data encoded utilizing the revised error correction parameter (425).
(a) selecting a Codeword Composition Ratio (CCR) representing a relation between payload and parity bytes in an FEC coding scheme;	
(b) transmitting a control signal for transmitting data from the DSL modem via the channel the control signal specifying the CCR and the FEC coding scheme;	
(c) repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem;	
(d) analyzing the acquired MEVs relative to a Target transmission Error Value (TEV); and	
(e) adjusting the CCR when the MEV differs sufficiently from the TEV.	

e. 14[pre]: A method of adjusting Forward Error Correcting (FEC) coding in a Digital Subscriber Line (DSL) modem in which data is transmitted between a transmitter and a receiver on a channel, the method comprising:

Klayman alone or in view of Li teaches the preamble of Claim 14, to the extent it is determined to be limiting. Ex. 1002, ¶257. Klayman discloses a method of “dynamically *changing forward error correction parameters* based upon

communication channel conditions, such as noise levels or error rates.” Ex. 1007, Abstract; Ex. 1002, ¶257. The described method “provid[es] sufficient error correction for accurate data reception, and also provid[es] for overhead minimization for increased data throughput.” Ex. 1007, 2:52-62. The method thereby allows FEC parameters to be adjusted to reduce the FEC error correction capability when a channel is performing with minimal error levels and to increase the FEC error correction capability when higher error levels are detected on the channel. *Id.*, 6:65-7:7, Ex. 1002, ¶257.

Klayman’s dynamic FEC protocol is applied to bidirectional communications over a communication medium between a primary station and a secondary station. *Id.*, 2:63-3:19. The communications medium connecting the primary station and secondary station can be “twisted pair wires” (*Id.*, 3:3-8), which a POSITA would have recognized as being the communications medium utilized for DSL communication between DSL modems. Ex. 1002, ¶258.

To the extent Klayman’s identification of twisted pair wires without express recitation of “DSL modem” leaves any doubt, Li discloses DSL modems that are capable of implementing dynamically-determined FEC coding parameters. Ex. 1008, [0008]. Moreover, a POSITA would recognize that Klayman’s adaptive and dynamic FEC scheme can be implemented using a DSL modem (disclosed in Li) in

a DSL communication system transmitting over Klayman's "twisted pair wires."
Ex. 1002, ¶259.

f. 14[a]: (a) selecting a Codeword Composition Ratio (CCR) representing a relation between payload and parity bytes in an FEC coding scheme;

Klayman teaches Limitation 14[a]. *Id.*, ¶260.

Klayman teaches selecting a CCR in an FEC coding scheme by selecting a parameter pair "such as (n, k) parameters" from a "Reed-Solomon" FEC coding scheme based on detected channel conditions. Ex. 1007, 5:55-65, 6:19-26. Klayman then explains that "to maximize throughput of user data over a given communications channel, the optimal error correcting methodology would utilize precisely enough error correction to compensate for the existing noise level, and no more or less." *Id.*, 6:26-30. Klayman thus teaches an optimal ratio between error correcting bytes (n-k) and payload bytes (k) is achieved by balancing the overhead (reflecting the length of the error correcting bytes in the codeword) to the amount of error correction needed. Ex. 1002, ¶¶261-263.

As explained with respect to Cooper, the '669 patent contemplates a CCR as any quantity or value that "represents the relation between the payload and parity bytes in the applicable FEC coding scheme." Ex. 1001, 9:16-28. As such, Klayman's "n" and "k" parameters (and the ratio creating a balance therebetween) define the CCR as the term is used in limitation 14[a]. Ex. 1002, ¶¶261-263.

g. 14[b]: (b) transmitting a control signal for transmitting data from the DSL modem via the channel the control signal specifying the CCR and the FEC coding scheme;

Klayman alone or in view of Li teaches Limitation 14[b]. *Id.*, ¶264.

Klayman teaches an algorithm for “changing the forward error correction parameters . . . based upon variable channel quality, such as variable noise or error levels.” Ex. 1007, 6:66-7:3. Those parameters identify the parameter pair (n, k) (which defines a CCR) and the FEC coding scheme (specifying the parameter pair refers to a Reed-Solomon FEC coding scheme) for transmitting data from a transmitter to a receiver on a communication channel. *Id.*, 5:55-65. Klayman explains that a master controller and/or other “various components” of a primary station function to perform the process of FIG. 4 for “channel monitoring and forward error correction parameter adjustment.” *Id.*, 3:44-44; 7:8-10. Regardless of the device that determines the FEC coding parameters, both the transmitter and receiver must know what FEC coding scheme is used and what parameters are used for the coding scheme so that the receiver can decode data using the same coding scheme used by the transmitter to encode the data. Ex. 1002, ¶265; *see also* Ex. 1007, 5:29-35, 7:23-27. Klayman further states that once an FEC coding parameter is determined, a forward error correction parameter and coding scheme is transmitted (step 370 in Klayman’s FIG. 4, shown below), for example, to a secondary station. Ex. 1007, 5:29-35 (transmitting an identification of a type of

FEC code to be employed when establishing a communications link), 8:39-47. A POSITA would have understood that transmitting the FEC parameter and coding scheme is equivalent to transmitting a “control signal” as recited in claim 14 of the ’669 patent to “adjust[] the CCR in response to the CCR adjustment control signal.” Ex. 1001, 14:58-59; Ex. 1002, ¶265. By transmitting the FEC parameter to a secondary station and/or a primary station, both the transmitter and receiver are informed of the FEC coding parameters used for data transmission, so the transmitter uses those FEC parameters when transmitting data and the receiver decodes transmitted data based on the same FEC parameters once the data is received.

Klayman does not explicitly state that a “DSL modem” transmits data, but Klayman states that the communications medium is capable of multimedia communications such as “real time transmission of digitally encoded video” and that the medium may be “twisted pair wires.” Ex. 1007, 1:13-17; 3:3-8. A POSITA would have understood that data communications over twisted pair wires that provide sufficient data throughput to support real-time encoded video would require a DSL modem to enable communication. Ex. 1002, ¶265.

To the extent Klayman’s identification of twisted pair wires without express recitation of “DSL modem” leaves any doubt, Li discloses that a DSL modem transmits data according to the FEC coding parameters. Ex. 1008, [0039] (“The

ADSL modem . . . stores various data such as the parameters G, B, n and r, and the data to be transmitted”). Therefore, when implementing Klayman’s dynamic FEC coding scheme using twisted pair wire, the FEC coding scheme parameters are communicated to a DSL modem (as disclosed in Li) that transmits data via the communication channel (e.g., twisted pair wires) according to the specified FEC coding scheme and associated parameters. Ex. 1002, ¶266.

h. 14[c]: (c) repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem;

Klayman teaches Limitation 14[c]. *Id.*, ¶267.

Klayman describes a process for “channel monitoring and forward error correction parameter adjustment” as illustrated in Klayman’s FIG. 4. Ex. 1007, 7:8-10. As illustrated below, this process includes monitoring a channel parameter (step 310), which Klayman describes as “monitoring packet error rates, bit error rates, noise levels (such as levels of 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.” *Id.*, 7:37-45;³ Ex. 1002, 268.

³ According to dependent claim 26, the MEV may be based “a Bit Error Rate (BER),” and therefore Klayman’s disclosure of calculating a BER (Ex. 1007, 7:37-

Moreover, Klayman explains that the BERs are monitored *after* an initial startup step reflected by step 300 in FIG. 4, and *after* “the method proceeds to receive encoded data having a first or initial degree of forward error correction,” which “may be established during an initial registration process, when a secondary station establishes a communication link with a primary station.” Ex. 1007, 7:8-36; Ex. 1002, ¶268. Klayman monitors channel parameters during a steady-state data transmission stage, occurring after the connected modems start-up and go through initialization and training steps necessary to enable the modems to communicate with one another. *See* Ex. 1007, 3:45-50.

Klayman then describes an example in which monitoring an error rate entails monitoring any of “a plurality of combinations of a bit error rate, a packet error rate, a burst error rate, a block error rate, and a frame error rate.” *Id.*, 7:45-50; Ex. 1002, ¶269.

Klayman also states that block error correcting codes (such as Reed-Solomon error correcting codes) are configured to correct “burst errors.” *Id.*, 5:37-60. These burst errors are isolated error instances, such that an interleaving technique may further improve error correction of these burst errors by spreading

50) maps directly to a claimed embodiment of acquiring an MEV. *See infra*, Section X.B.9.

the burst error out over multiple blocks so that each block code has a higher probability of correcting a small portion of a large burst error. *Id.*, 5:46-54. These errors are identical to the impulse errors discussed in the '669 patent as “isolated” errors (Ex. 1001, 10:47-53) or “time-varying intermittent noises” (Ex. 1001, 12:10-16). Therefore, Klayman’s discussion of a BER that represents burst errors satisfies Limitation 14[c]’s indication that MEVs represent impulse noise events detected on a channel. Ex. 1002, ¶270.

Klayman states that the process of FIG. 4 may be repeated over time (as conditions vary) so that different revised forward error correction parameters will be determined and transmitted over time. Ex. 1007, 8:42-47; Ex. 1002, ¶271.

i. 14[d]: (d) analyzing the acquired MEVs relative to a Target transmission Error Value (TEV); and

Klayman teaches Limitation 14[d]. Ex. 1002, ¶272; *see also supra*, §X.B.2.a.

At step 320 in Klayman’s FIG. 4, “the channel parameter (monitored in step 310) is compared to the threshold level, step 320, such that if the channel parameter is not within a predetermined or adaptive tolerance or variance of the threshold level (i.e., is not equal to the threshold level plus or minus an allowable tolerance (or variance)), then the degree of forward error correction utilized will be revised.” Ex. 1007, 7:60-66. Specifically, Klayman determines if the BER (or other monitored channel parameter) is greater than the threshold level or lower than the

target threshold level to determine whether to increase or decrease the degree of forward error correction capability. *Id.*, 8:2-38; Ex. 1002, ¶273.

j. 14[e]: (e) adjusting the CCR when the MEV differs sufficiently from the TEV.

Klayman teaches Limitation 14[e]. Ex. 1002, ¶274.

Klayman describes a method for “channel monitoring and forward error correction parameter adjustment.” Ex. 1007, 7:8-10. The steps for adjusting the forward error correction parameters are reflected in steps 340 and 360 of FIG. 4, in orange. *Id.*, 8:2-38; Ex. 1002, ¶275.

Klayman states that when a monitored channel parameter (e.g., BER) indicates that the channel has a comparatively high quality “and is causing fewer errors than are capable of being corrected by the current error correcting code, then a revised forward error correcting parameter is selected which has a lower degree of forward error correction capability.” Ex. 1007, 8:2-16. This decreases the overhead because a high error correcting capability is unnecessary, thereby increasing payload data throughput. *Id.*; Ex. 1002, ¶276.

Conversely, when a monitored channel parameter (e.g., BER) indicates that the channel has a low quality according to Klayman’s method “and is causing more errors than are capable of being corrected by the current error correcting code, then a revised forward error correcting parameter is selected which has a higher degree of forward error correction capability.” Ex. 1007, 8:16-30. This increases the error

correcting capability so that more errors can be corrected without requiring retransmission of data. *Id.*; 1002, ¶277.

As discussed above in reference to Limitation 14[a], the “forward error correcting parameters” discussed in Klayman are Reed-Solomon parameter pairs (n, k) , which represent the content of the CCR, as defined by the ’669 patent. See Ex. 1001, 9:8-28. Therefore, adjusting Klayman’s FEC parameters will result in a change in the CCR—the ratio between the payload data bytes and the total number of bytes in a codeword. Ex. 1002, ¶278.

5. Claim 15: The method of claim 14 wherein repeatedly acquiring the MEVs comprises at least one of the following: directly measuring a characteristic of the DSL modem; collecting a value from an element management system; or computing the MEVs from collected data.

Klayman teaches dependent claim 15. Ex. 1002, ¶279.

Klayman explains that a master controller of the primary station performs the process of FIG. 4, which includes monitoring BERs and/or other parameters. Ex. 1007, 4:42-44; 7:37-45. In order for the master controller of the primary station to monitor these parameters, the primary station obtains data reflecting these parameters. Ex. 1002, ¶280. For upstream communications (where the primary station is the receiver), these parameters are directly measured at the receiver (which, when the communication medium is a twisted pair wire, the receiver is a DSL modem). *Id.* For downstream communications, the master controller must

receive collected data (e.g., from the secondary station) to compute the BER or other parameters that constitute MEVs. *Id.*

As discussed in reference to claim 14, a POSITA would have recognized that Klayman's receiver would be embodied as a DSL modem. See Ex. 1007, 3:3-8. Even if Klayman is found not to teach a DSL modem, a POSITA would have utilized a DSL modem, as discussed in Li, as a receiver in Klayman's communication system when communicating over twisted pair wires. See Ex. 1008, [0002]-[0004]; Ex. 1002, ¶281.

6. Claim 16: The method of claim 14 wherein steps (b) through (e) are repeated.

Klayman teaches dependent claim 16. Ex. 1002, ¶282. As discussed in reference to Limitation 14[c], Klayman describes that the process for "channel monitoring and forward error correction parameter adjustment" is repeated over time (as conditions may vary) as different revised forward error correction parameters are determined over time. Ex. 1007, 8:42-47; Ex. 1002, ¶282.

The repeated steps include communicating a revised FEC scheme or FEC parameter to a secondary station as discussed in reference to Limitation 14[b] (Ex. 1007, 8:39-42); repeatedly calculating the BER (as shown in step 310 of Klayman's FIG. 4), as discussed in reference to Limitation 14[c] (Ex. 1007, 7:37-50); comparing the calculated BER against a threshold level as shown in step 320 of Klayman's FIG. 2, as discussed in reference to Limitation 14[d] (Ex. 1007,

7:50-8:2); and adjusting the forward error correction parameters that constitute a CCR as discussed in reference to Limitation 14[e] (Ex. 1007, 8:2-30). Ex. 1002, ¶283.

7. Claim 17: The method of claim 14 wherein the method is performed by a controller.

Klayman teaches dependent claim 17. Ex. 1002, ¶284.

As discussed in reference to Limitation 14[b], Klayman explains that a “master controller” of the primary station performs the process of FIG. 4 (which encompasses the steps recited in claim 14 of the ’669 patent). *Id.*, 3:44-57 (explaining the primary station includes a master controller); *id.*, 4:41-44 (the components of the primary station, including the master controller, performs the steps of FIG. 4); *id.*, 7:8-10 (explaining FIG. 4 illustrates a channel monitoring and forward error correction parameter adjustment method); Ex. 1002, ¶285.

Alternatively, a POSITA would have found it obvious to perform the method using a controller. A POSITA would have been motivated to use a controller, whether embodied as the master controller or a separate controller, because a controller can include more memory and/or processing power than a DSL modem, and the additional memory and/or processing power would enable the controller to calculate FEC coding changes in real-time. *Id.*, ¶286. Because Klayman’s method addresses changes in noise levels detected on the communications channel in real-time or near real-time, the additional processing

speed of a standalone controller would improve the real-time performance of the dynamic FEC coding algorithm disclosed in Klayman. *Id.* The prosecution history of the '669 patent identified similar benefits to using a controller in the office action response dated March 21, 2008, stating “‘impulse noise events’ occur as random and unpredictable events on the channel, and therefore are detected over a period of hours, days, or weeks, ***making collecting and storing such information impracticable for Locke’s modems.***” Ex. 1004, 187 (*emphasis added*).

Moreover, a POSITA would have had a reasonable expectation of success in using a controller to perform the recited method, as a controller including processors and memory are capable of controlling various functions of devices, such as the master controller that is a part of the primary station in Klayman. Ex. 1007, 3:44-4:44. To control devices, those processors execute algorithms such as FEC coding algorithms as disclosed in Klayman. Ex. 1002, ¶287.

8. Claim 19: The method of claim 17 wherein the controller is in a Central Office (CO).

Klayman teaches dependent claim 19. *Id.*, ¶288.

As discussed in reference to claim 17, Klayman explains that a primary station includes a “master controller,” which can perform the steps for FIG. 4. A POSITA would have understood that Klayman’s “primary station 101” is equivalent to a Central Office as the term is used in the '669 patent. *Id.*, ¶289. Klayman explains that the described method can be performed on a

communication medium useable for DSL communication (specifically, “twisted pair wires,” Ex. 1007, 3:3-8), which extends between a central office (“primary station 101”) and a secondary station. *Id.* Specifically, the ’669 patent explains that a DSL central office can house the transmitters and a controller. Ex. 1001, 6:23-27; *see also* Ex. 1001, FIG. 7; Ex. 1011, 10 (describing a transceiver at a Central Office in the 992.1 standards).

9. Claim 20: The method of claim 17 wherein the controller is outside a Central Office (CO).

Klayman teaches dependent claim 20. Ex. 1002, ¶290.

Klayman explains that a “secondary station” includes a processor coupled to memory, such as a part of a commercially available integrated circuit. Ex. 1007, 4:45-65. The components of the secondary station can perform functions including forward error correction encoding and decoding. *Id.* Specifically, Klayman explains that the secondary station components can perform the same functions as the master controller and other components of the primary station, including the functions that are described in detail with respect to FIG. 4 *Id.*, 5:7-10. Therefore, Klayman explains that the controller can be located at the location of a secondary station, which is outside of the central office (primary station 101). Ex. 1002, ¶291.

Alternatively, a POSITA would have been motivated to locate this controller “outside of a Central Office (CO).” As discussed in reference to dependent claim 17, a standalone controller would provide additional processing power and

memory over controllers integrated into a modem to enable real-time determination of FEC parameters, and locating the controller outside of a central office would enable the controller to be used. *Id.*, ¶292. A POSITA would have had a reasonable expectation of success in locating the controller outside of a central office. *Id.*, ¶293. Internet-connected processors and memories that execute algorithms such as those discussed in Cooper, were known, and those internet-connected processors can communicate instructions to DSL modems (e.g., at Klayman's primary station or secondary station). See Ex. 1028, 117 (Figure 2 shows an "Advanced DSL manager" located away from equipment in in a CO, with DSL modems, with a DSL database, and a network operations center); Ex. 1029, 103 (Figure 1 shows a spectrum management center (SMC) located outside of a central office).

10.Claim 23: The method of claim 14 wherein the CCR is K/N , wherein K =a total number of payload bytes in the codeword and N =a total number of bytes in the codeword.

Klayman teaches dependent claim 23. Ex. 1002, ¶294. As discussed in Limitation 14[a], Klayman teaches that the method includes revising Reed-Solomon parameters, including the n and/or k parameters in the parameter pair (n , k), where " n " is the codeword size and " k " is the block size. Ex. 1007, 5:55-65; 7:17-23. Comparing these two parameters (such as by calculating a ratio known as the CCR) is a manner of describing how much of a codeword consists of payload

bytes—the balance being error correcting bytes. Ex. 1002, ¶294. Klayman also describes a relationship for balancing the amount of payload bytes (and error correcting bytes) against the total codeword length. Ex. 1007, 6:19-26; Ex. 1002, ¶295.

11.Claim 26: The method of claim 14 wherein the MEV is based on at least one of the following: a Bit Error Rate (BER); errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.

Klayman teaches dependent claim 26. As discussed in reference to Limitation 14[c], Klayman teaches determining a calculated BER as a measured error parameter in step 310 of FIG. 4. Ex. 1007, 7:37-45; Ex. 1002, ¶296.

12.Claim 27: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in computer readable program code.

Klayman in view of Li teaches dependent claim 27. Ex. 1002, ¶297.

As discussed above with respect to claim 14, Klayman teaches each of (a) repeatedly acquiring the MEVs, (b) analyzing the repeated MEVs relative to the TEV, and (c) adjusting the CCR. *See supra*, Section X.B.2. These steps are performed by processors in communication with memory and in connection with “a computer, a workstation, or other data terminal equipment (“DTE”). Ex. 1007, 4:45-56. A POSITA would have recognized that in order to perform the method

steps of FIG. 4, the processor would execute software, specifically computer readable program code stored in the memory and/or at the connected computer, workstation, or other DTE, to instruct the processor on the steps for performance. Ex. 1002, ¶298.

Moreover, Li explains that the method for generating Reed-Solomon codes can be performed by a process “implemented as a more general device that executes a computer program, microcode, or other software in order to perform the above-described processes. *Id.*, ¶299. In such a case, the computer program may be stored in the memory 604 or on some other computer-readable medium such as a floppy disk, hard drive or CD-ROM.” Ex. 1008, [0040].

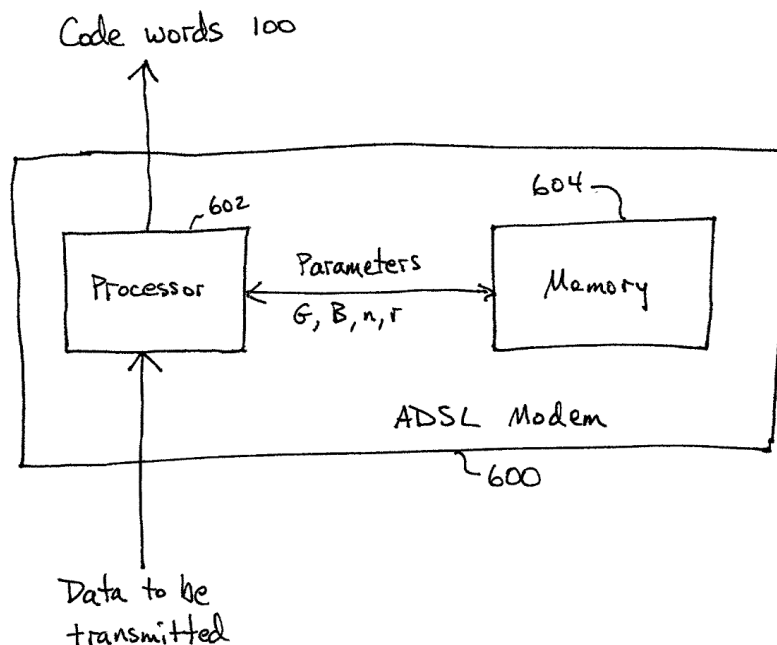
13.Claim 28: The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in hardware.

Klayman teaches dependent claim 28. As discussed above with respect to claim 14, Klayman teaches each of (a) repeatedly acquiring the MEVs, (b) analyzing the repeated MEVs relative to the TEV, and (c) adjusting the CCR. Moreover, Klayman states that these steps (which are reflected as a part of the method illustrated in FIG. 4) can be implemented in hardware, specifically by a primary station including a commercially available integrated circuit that performs such functions as forward error correction encoding and decoding. Ex. 1007, 4:45-65; Ex. 1002, ¶300.

14.Claim 29: The method of claim 14 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) system operable in compatibility with an ADSL2 standard and farther wherein adjusting the CCR comprises adjusting at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.

Klayman in view of Li teaches dependent claim 29. Ex. 1002, ¶301. As discussed above, Klayman teaches that the described dynamic FEC coding scheme can be implemented on a communication system using “twisted pair wires” as the communication medium, which is commonly known as the communication medium used with DSL systems. Ex. 1007, 3:3-8.

Moreover, Li discloses an ADSL modem (as illustrated in FIG. 6, reproduced below) for dynamically determining parameters for a FEC coding scheme. Ex. 1008, [0008], [0039]; Ex. 1002, ¶302.



Ex. 1008, FIG. 6.

Li explains that the modems may be compliant with applicable standards, such as the G.992.1 and G.992.2 standards that were in effect at the time of Li's filing date (October 26, 2001). *Id.*, [0025]. Although these standards are commonly known to refer to ADSL1 or ADSL-Lite standards (*see e.g.*, Ex. 1001, 6:60-7:8), a POSITA reviewing Klayman and Li would have been familiar with updated ADSL standards, and would have implemented the teachings of Klayman with current ADSL standards which, at the time of the '669 patent filing, encompassed G.992.3/4/5 ADSL2 standards, to maintain compatibility with other ADSL2 modems in existence. *See* Ex. 1001, 2:39-45; Ex. 1002, ¶303; *Qualcomm Inc.*, 24 F.4th 1375-76; Ex. 1011, Ex. 1012, Ex. 1013, Ex. 1014, Ex. 1015, Ex. 1016). A POSITA would have had a reasonable expectation of success in using an ADSL2 modem because G.992.3/4/5 standards define the functional requirements for an ADSL2 compatible modem, provided with sufficient detail to enable a modem designer to implement those standards in a modem design. Ex. 1002, ¶303; *see also* Ex. 1013.

Moreover, Li discloses adjusting FEC parameters (including Reed-Solomon parameter pairs) includes adjusting the FEC parameters based on impulse noise protection (INP) requirements and/or a delay. Ex. 1008, [0028]. As explained in Li, parameters (including the number of symbols or bytes per codeword, or the

number of parity bytes (referenced in Li as “redundancy” bytes) within the codeword) can be adjusted based on the specified INP or delay requirements. *Id.* The INP and delay are related to the Reed-Solomon parameters using a formula as specified in Li (and in G.992.3), and therefore a POSITA would have recognized that Cooper’s dynamic FEC coding scheme could be updated to consider INP or delay requirements using Li’s formula. Ex. 1002, ¶304; *see also* Ex. 1008, [0028]; Ex. 1013, 32.

Moreover, a POSITA would have recognized that ADSL standards (including ADSL-Lite and ADSL2) discuss INP and delay parameters (*see* Ex. 1008, [0026]-[0028]; *see also* Ex. 1013, 32-46 (describing that selection of FEC parameters must satisfy a requirement of meeting a minimum impulse noise protection)), and accordingly a POSITA would have reason to implement the dynamic FEC coding scheme of Klayman using an ADSL compatible modem that ensures compliance with INP and/or delay requirements. Ex. 1002, ¶304.

15.Claim 1

Ground 1, above, discusses the structure of the “means” limitations recited in independent claim 1. Klayman’s teachings include at least the same level of detail as the specification of the ’669 patent with respect to each recited “means” in claim 1, and those structures of Klayman are discussed in reference to claims 14, 17, and 27, above. Ex. 1002, ¶305.

a. 1[pre]: A controller for an adaptive Forward Error Correction (FEC) coder using a Codeword Composition Ratio (CCR), wherein the FEC coder is used in a Digital Subscriber Line (DSL) modem in which a transmitter sends data via a channel using FEC coding and interleaving according to an original transmission latency, wherein the controller comprises

Klayman alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, limitations 14[pre], 14[a], and claim 17. *Id.*, ¶306.

Though none of limitations 14[pre], 14[a], or 17 expressly identifies using “FEC coding **and interleaving** according to an original transmission latency,” Li discloses this portion of 1[pre]. Li discloses considering factors such as “delay” or “impulse noise protection” in selecting parameters, wherein one of those parameters is the “interleaver depth” (known as D). Ex. 1008, [0028]. Li explains that these parameters affect latency, and defines the relationship between the latency of the system and the FEC and interleaving parameters. *Id.* A POSITA would have known that data would be sent using FEC coding and interleaving at an original latency. Ex. 1002, ¶307.

b. 1[a]: means for repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem, wherein the means is coupled with the DSL modem;

Klayman alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, limitation 14[c]. *Id.*, ¶308. Klayman discloses that “the primary station includes a processor arrangement 120 which is connected to a plurality of channel interfaces, channel interface 125a through channel interface 125n, for communication over the communication medium 114.” Ex. 1007, 3:44-57. This structure for “communication” over the communication medium matches the structure and functionality of the “means” discussed in the ’669 patent specification. To the extent that limitation 1[a] recites “wherein the means is coupled with the DSL modem,” a POSITA would have understood that Klayman’s communication structure serves to “couple” the processor arrangement and channel interfaces (which a POSITA would recognize includes a DSL modem based on Klayman alone or Klay in view of Li, as discussed in reference to claim 14). Ex. 1002, ¶308.

c. 1[b] means for analyzing the acquired MEVs relative to a Target transmission Error Value (TEV), wherein the analyzing means is coupled with the acquiring means; and

Klayman alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, limitation 14[d]. *Id.*, ¶309. The '669 patent specification states that the “means for analyzing one or more MEV(s)...can comprise software, hardware or a combination of the two.” Ex. 1001, 13:50-52. As discussed in reference to claims 17 and 27, above, Klayman explains that these steps are performed by a “master controller,” and a POSITA would have recognized that the master controller executes software to instruct the master controller to perform the recited steps. Ex. 1007, 3:44-57. Although limitation 1[b] recites “wherein the analyzing means is coupled with the acquiring means,” as with limitation 1[a], a POSITA would have understood all the elements of the system described by Klayman to be coupled. Ex. 1002, ¶309; Ex. 1007, 3:43-57.

d. 1[c] means for generating a CCR adjustment control signal during normal operation of the DSL modem (“SHOWTIME”) responsive to the means for analyzing, and transmitting the same to the DSL modem, wherein the generating means is coupled with the analyzing means.

Klayman alone or in view of Li discloses this limitation for the same reasons explained with respect to claim 14, Limitations 14[b] and 14[e]. Ex. 1002, ¶310. As discussed above in reference to Limitation 1[b], Klayman provides the same

level of detail specifying that the recited functionality can be performed by analogous hardware or software. A POSITA would have understood the embodiments of Klayman to be in normal operation. Ex. 1002, ¶310. Although limitation 1[b] recites “wherein the generating means is coupled with the analyzing means,” as with limitation 1[a], a POSITA would have understood all the elements of the system described by Klayman to be coupled. Ex. 1002, ¶310; Ex. 1007, 3:43-57.

16.Claim 2: The controller of claim 1 wherein the MEVs are based on at least one of the following: a bit error rate; errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.

Klayman alone or in view of Li discloses this claim for the same reasons discussed with respect to claim 26, which is identical to claim 2 except that it is a “controller” rather than a method. Ex. 1002, ¶311.

17.Claim 3: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as computer readable program code.

Klayman alone or in view of Li discloses this claim for the same reasons discussed with respect to claim 27. Both claims 27 and 3 recites that the method (and the correlating “means”) is “implemented” as “computer readable program code.” *Id.*, ¶312.

18.Claim 4: The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as hardware.

Klayman alone or in view of Li discloses this claim for the same reasons discussed with respect to claim 28. Both claims 28 and 4 recites that the method (and the correlating “means”) is “implemented” as “hardware.” *Id.*, ¶313.

19.Claim 11: The controller of claim 1 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) modem operable in compatibility with an ADSL2 standard and further wherein the CCR adjustment control signal adjusts at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.

Klayman in view of Li discloses this claim for the same reasons discussed with respect to claim 29, which is identical to claim 11 except that it is a “controller” rather than a method. *Id.*, ¶314.

VIII. DISCRETIONARY ISSUES

A. The Petition Does Not Present the Same References Addressed in Prosecution

Institution should not be denied under §325(d). Under *Advanced Bionics*, the Board uses a two-part framework in determining whether to exercise its discretion under §325(d), specifically:

- (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and
- (2) if either condition of [the] first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential). The Board has held that the first prong of *Advanced Bionics* is not met where “neither [the combination references] nor similar prior art was before the examiner and ... the prosecution history does not include any overlapping arguments directed to this prior art.” *Godbersen-Smith Constr. Co. v. Guntert & Zimmerman Const. Div., Inc.*, IPR2021-00050, Paper 24 at 19-21 (PTAB May 7, 2021).

Under the first prong, no combination of Cooper, Klayman, and Li was before the Examiner, and the prosecution history does not include any overlapping arguments to this Petition. The only argument made during prosecution was that Locke does not disclose repeatedly acquiring MEVs representing impulse noise events **after** training and initializations on a DSL modem—i.e., during normal operation of the DSL modem. Ex. 1004, 133-34, 187. Cooper and Klayman address this alleged deficiency of Locke, disclosing “repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired **after** training and initializations on the DSL modem”—i.e., during normal operation of the DSL modem. *See Amphenol*

Corporation v. PPC Broadband, Inc., IPR2023-01363, Paper 9 at 30-31 (PTAB Mar. 20, 2024).

Accordingly, the combination of references used in this Petition cannot be cumulative of the art and/or arguments raised during prosecution as there are material differences between the grounds herein and what was previously presented. *Tianma Microelectronics Co., v. Japan Display Inc.*, IPR2021-01058, Paper 16 at 31 (PTAB Jan. 5, 2022). Because the first prong is not met, the Board need not consider the second prong. *See id.* at 21; *Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (PTAB Oct. 16, 2019).

Therefore, the Board should not deny institution under §325(d).

B. The Board Should Not Deny Institution Under *Fintiv*

The claims of the '669 patent have never been tested in view of the most relevant prior art. In view of these strong and compelling challenges, the on-going district court litigation against AT&T, and the ongoing cloud over all of Nokia's customers, institution should not be discretionarily denied under §314(a). *See NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 19-20 (PTAB Sept. 12, 2018) (precedential); *Apple v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 13-14 (PTAB Mar. 20, 2020) (precedential).

Factor 1—a potential stay of the district court litigation—is neutral because no party has requested a stay in the action against AT&T. *VMWare, Inc. v.*

Intellectual Ventures I LLC, IPR2020-00470, Paper 13 at 17 (PTAB Aug. 18, 2020) (finding in the absence of a stay motion that this factor “does not weigh for or against discretionary denial”).

Factor 2—the district court trial date and the Board’s statutory deadline—weighs against discretionary denial because of the high likelihood of transfer to another forum that will significantly push back any potential trial date. This is a complex case with a complicated relationship between the Plaintiff and the Defendant. Specifically, the Defendant has a license to patents owned by the Defendant (including the ’669 patent challenged here) where the licenses include a choice of forum clause requiring litigation to be brought in the Northern District of California rather than the Eastern District of Texas (any disagreement about this clause must be decided through arbitration). AT&T thus filed a motion to transfer the case to the Northern District of California or, in the alternative, arbitrate where the case should be brought. Given the strength of AT&T’s motion (the asserted ’669 patent is specifically licensed to AT&T), it is highly likely that trial will be pushed back (either because it is transferred or because arbitration is ordered on the issue of forum) until well after the deadline for a final written decision. Exhibit 1019. Exhibit 1019. Moreover, even if the motion is denied, because jury selection is far in the future and is not set to begin until at least September 22, 2025, with trial set to begin thereafter, discretionary denial is still not warranted. *See Dish*

Network v. Broadband iTV, IPR2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021) (“We cannot ignore the fact that the currently scheduled trial date is more than nine months away and much can change during this time”).

Altogether, this factor weighs against discretionary denial.

Factor 3—investment in the district court proceedings—weighs against discretionary denial. The district court cases are in their early stages and the district court has not issued any substantive rulings in either case with respect to the ’669 patent. Specifically, invalidity contentions were served on October 7, 2024, the claim construction hearing is not scheduled until March 19, 2025, and opening expert reports are not due until April 29, 2025 with expert discovery extending into June. Ex. 1017.

Altogether, there is much work to be done in the district court and most of the work will be well in the future. Accordingly, the district court will not invest significant resources related to the challenged patent prior to the issuance of an institution decision. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12; *DISH Network*, IPR2020-01280, Paper 17 at 18-21.

Factor 4—overlap between this proceeding and the district court proceedings—favors institution. Indeed, there will not be complete overlap between this IPR and the district court cases because there are fifteen claims challenged in this case, whereas there are eleven claims at issue in the district court

case, and that number will be reduced to six total claims before trial. Ex. 1018. This factor thus weighs against discretionary denial.

Factor 5—overlapping parties—strongly favors institution. Here, while the Petitioners include both AT&T and Nokia, currently only AT&T is a party in the underlying litigation. *Fintiv*, IPR2020-00019, Paper 11 at 13-14. As an initial matter, that means that if institution is denied and only the subset of claims raised at trial are rendered invalid at the district court, ASSIA may resort to gamesmanship and assert infringement of those claims not raised at trial (but challenged in this petition) against Nokia in a separate litigation. Additionally, in that underlying litigation, ASSIA has only accused AT&T of infringement (largely accusing Nokia products), but AT&T is just one of Nokia’s many U.S. customers using Nokia’s DSL products. Given ASSIA’s history of suing Nokia’s customers (including KPM in the Netherlands, Orange in France, and Fastweb in Italy), Nokia believes that ASSIA is likely to sue additional U.S.-based customers in the future, none of which are named in the underlying litigation.

The final *Fintiv* factor—other considerations—weighs strongly against discretionary denial. As detailed herein, the merits of the Petition are strong, with even the abstracts of the primary references (Cooper and Klayman) disclosing all of the limitations of the independent claims. More specifically, both the Cooper and Klayman references discuss dynamic FEC coding methods that perform the

same steps, in the same order, as claim 14 of the '669 patent. Ex. 1002, ¶¶186, 256. Those references discuss that the respective methods are usable for twisted pair wire communication channels that are used in DSL. *Id.*, ¶¶188-189, 258-259. Moreover, none of the grounds asserted herein were previously considered by either the Office or the district courts. *Cf. Comcast Cable Commn's, LLC v. Rovi Guides, Inc.*, IPR2019-00231, Paper 14 at 11 (PTAB May 20, 2019).

C. The Board Should Not Deny Institution Under *General Plastic*

The *General Plastic* factors do not apply because this is the first and only *inter partes review* (“IPR”) petition filed by any Petitioner with respect to the '669 patent.

IX. CONCLUSION

Petitioners request cancellation of the Challenged Claims.

X. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party in Interest Under 37 C.F.R. §42.8(b)(1)

The real parties in interest are AT&T Services Inc., AT&T Enterprises, LLC, AT&T Mobility LLC, AT&T Mobility II LLC, and Nokia of America Corp.

Out of an abundance of caution, Petitioners have identified all current defendants in the below cases, as well as additional involved parties, as potential real parties in interest only for the purpose of this proceeding and only to the extent that Patent Owner contends that these separate legal entities should be named real parties in interest in this IPR. Petitioners do so to avoid the potential expenditure of resources to resolve such a challenge. Petitioners also acknowledge that each petitioner has a number of affiliates. No unnamed entity is funding, controlling, or otherwise has an opportunity to control or direct this Petition or Petitioners' participation in any resulting IPR. Petitioners are also not aware of any affiliate that would be barred from filing this Petition under 35 U.S.C. § 315(e).

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

The '669 patent is the subject of the following litigation:

- *Adaptive Spectrum and Signal Alignment, Inc. v. AT&T Enterprises, LLC, AT&T Mobility LLC, AT&T Mobility II LLC, and AT&T Services, Inc.*, No.

2:24-cv-00029-JRG-RSP

Petitioners are not aware of any other judicial or administrative matter that would affect or be affected by a decision in this IPR.

C. Designation of Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioners provide the following designation of counsel.

Lead Counsel	Backup Counsel
M. Scott Stevens Reg. No. 54,762 ALSTON & BIRD LLP Vantage South End 1120 S. Tryon Street, Suite 300 Charlotte, NC 28203 Phone: 704.444.1000 Fax: 704.444.1111 Email: scott.stevens@alston.com	Christopher TL Douglas Reg. No. 56,950 Nicholas C. Marais Reg. No. 77,181 ALSTON & BIRD LLP Vantage South End 1120 S. Tryon Street, Suite 300 Charlotte, NC 28203 Phone: 704.444.1000 Fax: 704.444.1111 Email: christopher.douglas@alston.com Email: nic.marais@alston.com Daniel J. O'Connor Reg. No. 69,023 ALSTON & BIRD LLP 755 Page Mill Road Building C – Suite 200 Palo Alto, CA 94304 Phone: 650.838.2000 Fax: 650.838.2001 Email: dan.oconnor@alston.com

Pursuant to 37 C.F.R. § 42.8(b)(4), counsel agrees to service by mail as detailed above, and to electronic service by email as detailed above. Pursuant to 37

C.F.R §42.10(b), a Power of Attorney executed by Petitioners accompanies this Petition.

D. Service Information

Please address all correspondence and service to the addresses listed above.

Petitioners consent to electronic service at the addresses above.

Date: January 3, 2025

By: /M. Scott Stevens/

M. Scott Stevens
Reg. No. 54,762
ALSTON & BIRD LLP
Vantage South End
1120 S. Tryon Street, Suite 300
Charlotte, NC 28203
Phone: 704.444.1000
Fax: 704.444.1111
Email: scott.stevens@alston.com

CLAIMS APPENDIX

Claim	Recitation
1[pre]	A controller for an adaptive Forward Error Correction (FEC) coder using a Codeword Composition Ratio (CCR), wherein the FEC coder is used in a Digital Subscriber Line (DSL) modem in which a transmitter sends data via a channel using FEC coding and interleaving according to an original transmission latency, wherein the controller comprises:
1[a]	means for repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem, wherein the means is coupled with the DSL modem;
1[b]	means for analyzing the acquired MEVs relative to a Target transmission Error Value (TEV), wherein the analyzing means is coupled with the acquiring means; and
1[c]	means for generating a CCR adjustment control signal during normal operation of the DSL modem (“SHOWTIME”) responsive to the means for analyzing, and transmitting the same to the DSL modem, wherein the generating means is coupled with the analyzing means.
2	2. The controller of claim 1 wherein the MEVs are based on at least one of the following: a bit error rate; errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.
3	The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as computer readable program code.
4	The controller of claim 1 wherein the acquiring means, the analyzing means and the generating means are implemented as hardware.

Claim	Recitation
11	The controller of claim 1 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) modem operable in compatibility with an ADSL2 standard and further wherein the CCR adjustment control signal adjusts at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.
14[pre]	A method of adjusting Forward Error Correcting (FEC) coding in a Digital Subscriber Line (DSL) modem in which data is transmitted between a transmitter and a receiver on a channel, the method comprising:
14[a]	(a) selecting a Codeword Composition Ratio (CCR) representing a relation between payload and parity bytes in an FEC coding scheme;
14[b]	(b) transmitting a control signal for transmitting data from the DSL modem via the channel the control signal specifying the CCR and the FEC coding scheme;
14[c]	(c) repeatedly acquiring Measured transmission Error Values (MEVs) representing impulse noise events detected on the channel, the MEVs acquired after training and initializations on the DSL modem;
14[d]	(d) analyzing the acquired MEVs relative to a Target transmission Error Value (TEV); and
14[e]	(e) adjusting the CCR when the MEV differs sufficiently from the TEV.
15	The method of claim 14 wherein repeatedly acquiring the MEVs comprises at least one of the following: directly measuring a characteristic of the DSL modem; collecting a value from an element management system; or computing the MEVs from collected data.
16	The method of claim 14 wherein steps (b) through (e) are repeated.
17	The method of claim 14 wherein the method is performed by a controller.
19	The method of claim 17 wherein the controller is in a Central Office (CO).
20	The method of claim 17 wherein the controller is outside a Central Office (CO).

Claim	Recitation
23	The method of claim 14 wherein the CCR is K/N, wherein K=a total number of payload bytes in the codeword and N=a total number of bytes in the codeword.
26	The method of claim 14 wherein the MEV is based on at least one of the following: a Bit Error Rate (BER); errored seconds; errored minutes; code violations over a fixed period of time; a Signal-to-Noise Ratio (SNR) measured at the receiver; or Transmission Control Protocol and Internet Protocol (TCP/IP) throughput.
27	The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in computer readable program code.
28	The method of claim 14 wherein repeatedly acquiring the MEVs, analyzing the repeated MEVs relative to the TEV, and adjusting the CCR are implemented in hardware.
29	The method of claim 14 wherein the DSL modem is an Asymmetric Digital Subscriber Line (ADSL) system operable in compatibility with an ADSL2 standard and farther wherein adjusting the CCR comprises adjusting at least one of the following: Impulse Noise Protection (INP); or maximum interleaving delay.

CERTIFICATION UNDER 37 C.F.R. §42.24

Petitioners certify that the word count in this Petition is 13,979 words, as counted by the word-processing program (Microsoft Word for Office 365) used to generate this Petition, where such word count excludes the table of contents, table of authorities, mandatory notices, certificate of service, appendix of exhibits, and this certificate of word count. This Petition is in compliance with the 14,000-word limit set in 37 C.F.R. § 42.24(a)(1)(i).

Date: January 3, 2025

By: /M. Scott Stevens/

M. Scott Stevens
Reg. No. 54,762
ALSTON & BIRD LLP
Vantage South End
1120 S. Tryon Street, Suite 300
Charlotte, NC 28203
Phone: 704.444.1000
Fax: 704.444.1111
Email: scott.stevens@alston.com

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§42.6(e), 42.105 and in view of the agreement between the Parties under 37 C.F.R. § 42.105(b), the undersigned hereby certifies that true and correct copies of the above-captioned PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 7,428,669, all associated exhibits, and Petitioner's Power of Attorney were served in their entireties on January 3, 2025, upon the Patent Owner at the following email addresses of Patent Owner's litigation counsel:

ASSIA-ATT@caldwellcc.com

bcaldwell@caldwellcc.com

jnemunaitis@caldwellcc.com

Date: January 3, 2025

By: /M. Scott Stevens/

M. Scott Stevens
Reg. No. 54.762
ALSTON & BIRD LLP
Vantage South End
1120 S. Tryon Street, Suite 300
Charlotte, NC 28203
Phone: 704.444.1000
Fax: 704.444.1111
Email: scott.stevens@alston.com