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**UNITED STATES PATENT AND TRADEMARK OFFICE**

PATENT: 7,421,032

INVENTORS: HUI JIN, AAMOD KHANDEKAR, ROBERT J. MCELIECE

FILED: OCTOBER 3, 2006

ISSUED: SEPTEMBER 2, 2008

TITLE: SERIAL CONCATENATION OF INTERLEAVED  
CONVOLUTIONAL CODES FORMING TURBO-LIKE  
CODES

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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Apple Inc.  
Petitioner

v.

California Institute of Technology  
Patent Owner

Case IPR2017-00700

**PETITIONERS' UPDATED EXHIBIT LIST**

**EXHIBITS**

<b>Exhibit</b>	<b>Description</b>
1001	U.S. Patent No. 7,421,032
1002	D. J. C. MacKay, S. T. Wilson, and M. C. Davey, "Comparison of constructions of irregular Gallager codes," <i>IEEE Trans. Commun.</i> , Vol. 47, No. 10, pp. 1449-54, 1999
1003	L. Ping, W. K. Leung, N. Phamdo, "Low Density Parity Check Codes with Semi-random Parity Check Matrix." <i>Electron. Letters</i> , Vol. 35, No. 1, pp. 38-39, 1999
1004	Declaration of Professor James Davis, Ph.D. ("Davis Declaration")
1005	Gallager, R., <i>Low-Density Parity-Check Codes</i> , Monograph, M.I.T. Press, 1963
1006	Berrou <i>et al.</i> , "Near Shannon Limit Error-Correcting Coding and Decoding: Turbo-Codes," <i>ICC '93</i> , Technical Program, Conference Record 1064, Geneva 1993
1007	Benedetto, S. et al., <i>Serial Concatenation of Block and Convolutional Codes</i> , 32.10 <i>Electronics Letters</i> 887-8, 1996
1008	Luby, M. <i>et al.</i> , "Practical Loss-Resilient Codes," <i>STOC '97</i> , 1997
1009	Luby, M. <i>et al.</i> , "Analysis of Low Density Codes and Improved Designs Using Irregular Graphs," <i>STOC '98</i> , pp. 249-58, published in 1998
1010	Replacement copy of Frey, B. J. and MacKay, D. J. C., "Irregular Turbocodes," <i>Proc. 37th Allerton Conf. on Comm., Control and Computing</i> , Monticello, Illinois, published on or before March 20, 2000
1011	Final Written Decision, <i>Hughes Network Systems, LLC et al. v. Cal. Institute of Tech.</i> , IPR2015-00059, Paper 42 (PTAB Apr. 21, 2016)
1012	Certificate of Correction, U.S. Patent No. 7,421,032 (Sept. 2, 2008)

Exhibit	Description
1013	Claim Construction Order, <i>California Institute of Technology v. Hughes Communications Inc.</i> , No. 13-cv-7245 (C.D. Cal.)
1014	Decision on Institution, <i>Hughes Network Systems, LLC et al. v. Cal. Institute of Tech.</i> , IPR2015-00059, Paper 18 (PTAB Apr. 27, 2015)
1015	Expert Report of Dr. Brendan Frey (Case No. 2:13-cv-07245)
1016	MacKay, D. J. C, and Neal, R. M. "Near Shannon Limit Performance of Low Density Parity Check Codes," <i>Electronics Letters</i> , vol. 32, pp. 1645-46, 1996
1017	Replacement copy of D. Divsalar, H. Jin, and R. J. McEliece, "Coding theorems for "turbo-like" codes," <i>Proc. 36th Allerton Conf. on Comm., Control and Computing</i> , Monticello, Illinois, pp. 201-9, September 1998
1018	U.S. Patent No. 4,271,520 (1981)
1019	Declaration of Robin Fradenburgh Concerning the "Proceedings, 36th Allerton Conference on Communications, Control, and Computing" Reference
1020	Chris Heegard and Stephen B. Wicker, <i>Turbo Coding</i> , pp. 12-14, 1999
1021	George C. Clark, Jr. and J. Bibb Cain, <i>Error-Correction Coding for Digital Communications</i> , pp. 6, 229, 1938
1022	Pfister, H. and Siegel, P., "The Serial Concatenation of Rate-1 Codes Through Uniform Random Interleavers," <i>37th Allerton Conf. on Comm., Control and Computing</i> , Monticello, Illinois, published on or before September 24, 1999
1023	Replacement copy of Declaration of Paul H. Siegel ("Siegel Declaration")
1024	Kschischang, F.R., and Frey, B.J., "Iterative decoding of compound codes by probability propagation in graphical models," <i>IEEE Journal on Selected Areas in Communications</i> , vol. 16, no. 2, pp. 219-230, 1998

U.S. Patent 7,421,032  
Apple vs. California Institute of Technology

Exhibit	Description
1025	Declaration Of Richard Goldenberg In Support Of Unopposed Motions To Submit Replacement Exhibits Pursuant To 37 C.F.R. § 42.104(c)
1026	Declaration Of Jonathan Barbee In Support Of Unopposed Motions To Submit Replacement Exhibits Pursuant To 37 C.F.R. § 42.104(c)

Dated: February 28, 2017

Respectfully Submitted,

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