UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

CALIFORNIA INSTITUTE OF TECHNOLOGY,
Patent Owner.

IPR2017-00210 and IPR2017-00219
Patent No. 7,116,710

DECLARATION OF DR. DARIUSH DIVSALAR

I, Dariush Divsalar, declare as follows:

I. ENGAGEMENT

1. I have been asked by counsel for the California Institute of Technology to be a witness in the above-captioned proceeding. I have been asked to address certain aspects of error correction coding technology during the time of the invention of U.S. Patent No. 7,116,710 (the "'710 patent"), specifically with regard to certain references cited and relied on in connection with cases IPR2017-00210 and IPR2017-00219. In particular, I offer my opinions regarding the following reference, and potential combinations: Dariush Divsalar, Hui Jin, and Robert McEliece, "Coding Theorems for 'Turbo-Like' Codes" (Exs. 1003/1203, "Divsalar").

II. QUALIFICATIONS

2. I received my MSEE in 1975, my Engineer Degree in 1977, and my Ph.D. in 1978, all from the University of California in Los Angeles. I majored in Communication Systems (Department of Electrical Engineering) and double-minored in Computer System Modeling and Analysis (Department of Computer Science) and Applied Mathematics (Department of Mathematics).

3. In 1996 (as a report), and later in 1998 (published in IEEE Trans. on Info. Theory) along with S. Benedetto, G. Montorsi, and F. Pollara, I published a paper entitled, "Serial Concatenation of Interleaved Codes: Performance Analysis,

Design, and Iterative Decoding." In this paper, we proposed a subclass of serial concatenated codes, serial concatenated convolutional codes (SCCCs). Combined with the iterative message-passing decoding algorithm of turbo codes, we demonstrated that these SCCCs outperformed parallel concatenated turbo codes. This paper was highly cited—according to Google Scholar it has been cited more than 1500 times on the same title, and it has been cited more than 450 times in IEEE publications. This paper is considered instrumental in progressing the field's understanding of error correcting codes.

4. In 1988 I won the IEEE Best Paper of the Year award for my work on Trellis coded DPSK for satellite communications.

5. In 1999 I was promoted to my role as a senior research scientist at JPL/Caltech. The selection of senior research scientist requires a recommendation from the section division and also six to eight references from outside JPL; one of my recommenders was Dr. Andrew J. Viterbi, the inventor of the Viterbi algorithm, co-founder of Qualcomm, and one of the most prominent information theorists of all time.

6. More recently, in 2008 I won the Joint Paper award of the IEEE Information Theory and IEEE Communication Theory societies for my paper,

"Accumulate Repeat Accumulate Codes". My paper on Accumulate-Repeat-Accumulate (ARA) codes cites the inventors' IRA paper.

7. I have summarized in this section my educational background and relevant experience. My full *curriculum vitae* is attached as Exhibit 2032 to this declaration.

III. COMPENSATION AND PRIOR TESTIMONY

8. Other than my ordinary salary, I am not being compensated for the time I spend in connection with this case. My compensation is in no way linked to the outcome of this case. Furthermore, I am not listed on any of the patents-in-suit and have no financial interest in the outcome of this litigation.

IV. SUMMARY OF OPINIONS

9. I am the author of the paper, "Coding Theorems for 'Turbo-Like' Codes" identified by Petitioners as the "Divsalar" prior art. I was not involved in the development or research that led to IRA codes, and I made no contribution to the development of the IRA codes. I do not believe it would have been trivial or obvious to modify RA codes by making them "irregular" in order to arrive at IRA codes, nor would a person of ordinary skill in the art be motivated to make such a modification.

10. It was completely untrue that people of ordinary skill in the art at the time of invention thought that irregularity could be used to improve ***any*** code. It's

not even clear what that phrase means for the vast majority of codes. Furthermore, it would not have been obvious to modify my RA codes to include an irregular repeat—there would be no motivation to do so and no expectation that such a modification would improve performance. The contemporaneous technical literature on "irregular codes" was directed to specific types of irregularity that had no meaningful application to RA codes. For example, research on irregular low-density parity check (LDPC) codes was concerned with modifying traditional Gallager codes, a specific class of LDPC codes with a structure different from RA and IRA codes, to use irregular parity check matrices. A person of ordinary skill in the art would have no motivation to apply such a teaching to RA codes, because they were not described in terms of a low-density parity check matrix. In addition, even if such a person derived the parity check matrix for an RA code, that matrix is *already* irregular.

11. There is no disclosure in my RA paper ("Divsalar") of a systematic code. I did not consider making RA codes systematic during my research. There was no point in making RA codes systematic, and a person of ordinary skill in the art would not have made RA codes systematic.

V. LEVEL OF ORDINARY SKILL

12. I understand that the '710 patent claims a priority date of no later than May 18, 2000 for their invention. In my opinion the typical qualifications of a

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