IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WISCONSIN

APPLE INC., and NEXT SOFTWARE, INC. (f/k/a NeXT COMPUTER, INC.), Plaintiffs and Counterclaim-Defendants, v. MOTOROLA, INC. and MOTOROLA MOBILITY, INC. Defendants and Counterclaim-Plaintiffs	Case No. 10-CV-662 (BBC)

DECLARATION OF DR. LEONARD J. CIMINI IN SUPPORT OF PLAINTIFFS AND COUNTERCLAIM-DEFENDANTS APPLE INC. AND NEXT SOFTWARE, INC.'S <u>CLAIM CONSTRUCTION MEMORANDUM</u>

I, Leonard J. Cimini, declare as follows:

I. Background

1. My name is Leonard J. Cimini, Ph.D. I am currently a Professor in the Department of Electrical and Computer Engineering at the University of Delaware.

2. I received Bachelor of Science, Masters of Science, and Ph.D. degrees in Electrical Engineering from the University of Pennsylvania in 1978, 1979 and 1982, respectively.

3. After receiving my Ph.D. in 1982, I worked for twenty years at AT&T Bell Laboratories and AT&T Laboratories designing and improving aspects of cellular mobile radio systems. Much of my work focused on the design of Orthogonal Frequency Division Multiplexing (OFDM) for wireless application, which remains a foundation for providing high-bit rate packet data transfers for cellular users.

4. From 1994 to 2001, I taught courses on wireless cellular systems at the University of Pennsylvania as an adjunct professor. In 2002, I joined the full-time faculty of the University of Delaware as a Professor. My research continues to focus on wireless cellular systems, including Orthogonal Frequency Division Multiplexing (OFDM) for wireless applications.

5. Attached as Exhibit A is a true and correct copy of my curriculum vitae providing additional information regarding my education and professional qualifications.

6. I have been retained as an expert in this case by Plaintiffs and Counterclaim-Defendants Apple Inc. and NeXT Software, Inc. ("Apple") and to provide this Declaration addressing issues relating to the claim construction of certain terms of U.S. Patent No. 6,175,559 ("the '559 patent").

7. I make all statements in this Declaration of my own personal knowledge, education and professional experience. While I am being compensated for my work as an expert in this case, no part of my compensation is dependent upon the particular outcome of this case or any issue in it.

8. I am over eighteen years of age and I am competent to testify as to the matters set forth herein if I am called to do so. If called as a witness, I could and would competently testify about the facts and opinions set forth herein.

II. Basis for My Opinion

9. In preparing this Declaration, I have extensively reviewed various materials, including the '559 patent and its file history.

III. Overview of the Technology

10. The '559 patent is directed to the field of wireless telecommunication systems. Specifically, the '559 patent concerns the problem of multiple cellular telephones trying to communicate with the same base station in a cellular network at the same time. For example, when a new cellular telephone enters a cell, it must notify the base station of its presence so that it can begin to send and receive data on the network. The new cellular telephone transmits a short signal, called a preamble, to allow the base station to detect its presence. The base station then transmits to the new cellular telephone a unique identifying value that the new cellular telephone uses in future transmissions.

11. Because many new cellular telephones often enter a cell at the same time, multiple new cellular telephones may try to transmit preambles to the base station at the same time. The base station must be able to distinguish the different preambles that it is receiving from different cellular telephones at the same time and determine which preamble is coming

from which cellular telephone. The ’559 patent describes the generation of a preamble in a code-division multiple access (CDMA) network that purports to have the characteristics to enable the base station to do so.

A. CDMA

12. Because the ‘559 patent concerns preamble generation in a CDMA system, I provide an overview of certain aspects of CDMA systems. CDMA allows multiple cellular telephones to use the same physical communication channel. CDMA allows multiple cellular telephones to transmit signals at the same time, within the same bandwidth, without significant interference by encoding transmitted data using a code that is unique to that cellular telephone, and that can be distinguished from the codes of all other cellular telephones.

13. The basic unit of information transmitted over CDMA is called a “chip.” A chip is binary, meaning it has a value of either 1s and 0s or +1 or -1. In CDMA, chips are described as having values of +1 or -1 because they correspond to electromagnetic waves that have the same shape but are inverted relative to each other. Binary chips cancel each other out when added together.

14. A sequence of chips is often called a “symbol.” Symbols can identify different things, such as a particular cellular telephone or a particular data value.

15. Cellular telephone transmitters send data over the CDMA network using sequences of chips, called “codes.” Codes have properties that make them easier for the base station to recognize and differentiate when multiple cellular telephones are transmitting at the same time.

16. Codes can be multiplied together in various ways. One type of multiplication is called “point-by-point” multiplication.

17. In point-by-point multiplication, each chip of the first code is multiplied by the corresponding chip of the second code. The following is exemplary:

Code 1: [1, -1, 1, -1]	Code 2: [1, 1, 1, 1]
Code 1 x Code 2	= [(1 x 1), (-1 x 1), (1 x 1), (-1 x 1)] = [1, -1, 1, -1]

18. When any code is point-by-point multiplied by itself, the resulting code has a value of 1 for every chip:

Code 1 x Code 1	= [(1 x 1), (-1 x -1), (1 x 1), (-1 x -1)] = [1, 1, 1, 1]
Code 2 x Code 2	= [(1 x 1), (1 x 1), (1 x 1), (1 x 1)] = [1, 1, 1, 1]

19. In CDMA, a base station can determine whether it has received a code from a cellular telephone by multiplying the received sequence by that code and calculating the sum of the resulting chips. If the chips add up to a large positive or negative number, then the base station knows that the transmitter used that code. This process of multiplying and adding the resulting chips is called "correlation."

20. A code is said to be perfectly correlated with itself. For example, when the Code 1, above, is multiplied by itself, the result is [1, 1, 1, 1]. The sum of the chips is 1 + 1 + 1 + 1 = 4. However, Code 1 has zero correlation with Code 2. Code 1 multiplied by Code 2 is [1, -1, 1, -1]. The sum of the chips is 1 + (-1) + 1 + (-1) = 0.

21. When two codes have a zero correlation, they are called "orthogonal" to one another.

22. In CDMA, the use of orthogonal codes allows multiple cellular telephones to transmit signals to the base station at the same time within the same physical frequency band without interference.

23. For example, if cellular telephone A transmits Code 1 and cellular telephone B simultaneously transmits Code 2, described above, to a base station, the resulting signal is the sum of Code 1 and Code 2, or [2, 0, 2 0]. The sum of the combined signal is 2 + 0 + 2 + 0 = 4. The base station then correlates the same combined signal with Code 2, which also yields 2 + 0 + 2 + 0 = 4. Each time the base station comes up with a positive correlation, it has confirmed that it has received a transmission from a single cellular telephone. The base station knows that transmissions from both cellular telephone A and cellular telephone B were received because each code individually produced a positive correlation with the combined signal

24. In this example, the base station was able to distinguish data sent by cellular telephone A from data sent by cellular telephone B because the base station received the signals from the two handsets at exactly the same time. In an actual cellular data network, the transmissions sent by multiple handsets may not arrive at a base station at the same time. If the cell phones are different distances away from the base station or send their signals at the different times, the transmissions will arrive at the base station at different times. The transmissions are said to be misaligned. Some types of orthogonal codes, such as Hadamard codes, are orthogonal only if the codes are aligned perfectly. If the two codes are misaligned, such as when the first chip of the first code overlaps in time with any chip of the second code other than the first chip, the codes are no longer orthogonal. The base station may not be able to resolve misaligned transmissions from different handsets.

25. Certain types of codes have the property that even when they are misaligned, the base station can still extract the transmissions from different handsets. Gold codes are one example of this type of code. Gold codes, however, are not perfectly orthogonal. This means that when the base station extracts one handset’s signal, it cannot eliminate completely the

effects of other handsets' transmissions. Consequently, the transmissions from different handsets using Gold codes will cause some small amount of interference to each other. This interference is not large enough to prevent the base station from resolving the misaligned transmission from different handsets.

B. The '559 Patent

26. The '559 patent purports to describe the generation of a preamble that can be detected by a base station, which can separate each cellular telephone's transmission so that each cellular telephone is uniquely identified. The purported invention of the '559 patent generates a preamble sequence that is the multiplication of two separate codes having the same number of chips. Generally speaking, the first of the two codes -- called the "outer code" -- is used to perform signal separation, and the second -- called the "inner code" -- is used to uniquely identify the handset that is transmitting.

27. The outer code is described as known to the base station, and is shared by all transmitters. '559 Patent at 3:45-46. A base station then uses the outer code to recognize preamble sequences that are intended for it. '559 Patent at 4:37-39. If a handset uses a different outer code than the one used by the base station receiver, the base station will not be able to decode transmissions from that handset. '559 Patent at 4:37-39. The '559 patent suggests the use of Gold and Kasami codes to form the outer code. '559 Patent at 3:41-45. These types of codes have imperfect orthogonality, which allows the base station to recognize each handset's preamble even if two handsets transmit preambles that overlap in time. '559 Patent at 4:53-57.

28. The outer code is further described as "periodic with period K chips," meaning that it consists of a series of repeating blocks of K chips, where each block has the same sequence of chips. '559 Patent at 3:42-43 and Fig. 6.

29. Because the outer code is common to all cellular telephone transmitters, only a single outer code is used. The use of a periodic outer code means that the base station receiver only has to generate the K chips per block in order to construct the code that it will use to remove the outer code from a received preamble. The smaller the value of K, the less complex the circuitry that is required to perform the correlation. With only one outer code and because the code is periodic, the base station may recognize it using simple correlation circuitry.

30. In contrast to the outer codes, the inner codes described in the '559 patent are "preferably different for different transmitters." '559 Patent at 3:46-47. This is so because each cellular telephone must use a different code so that the base station can uniquely identify each cellular telephone.

Executed this 17 day of June, 2011.

Leonard J. Cimini, Ph.D.