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

NOKIA CORPORATION, Plaintiff, v. APPLE INC., Defendant.	
APPLE INC., Counterclaim-Plaintiff, v. NOKIA CORPORATION and NOKIA INC., Counterclaim-Defendants.	CIVIL ACTION NO. 10-CV-249

DECLARATION OF DANIEL F. SIEVENPIPER

1. My name is Dr. Daniel F. Sievenpiper. I have personal knowledge of the information set forth herein, and I could and would competently testify thereto if called as a witness.

2. I have been retained by the law firm of Wilmer Cutler Pickering Hale and Dorr LLP as an expert on behalf of Apple Inc. ("Apple") in this action for patent infringement brought by Nokia Corporation against Apple.

3. I understand that in this action, Nokia has accused Apple of infringing U.S. Patent No. 6,348,894, entitled "Radio Frequency Antenna" (the "'894 patent"), U.S. Patent No. 6,603,431, entitled "Mobile Station and Antenna Arrangement in Mobile Station" (the "'431 patent"), and U.S. Patent No. 6,317,083, entitled "Antenna Having a Feed and a Shorting Post

Connected Between Reference Plane and Planar Conductor Interacting to Form a Transmission Line" (the "'083 patent"). Specifically, I understand that Nokia has accused Apple of infringement of claims 1, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, and 23 of the '894 patent, claims 1, 2, 4, 5, 6, and 7 of the '431 patent, and claims 1, 2, 6, 7, 8, 9, 10, 12, 16, 18, 20, 22, and 24 of the '083 patent.

4. I have worked in the field of antenna technology since 1994, holding various positions such as senior research staff engineer, program development manager, director, and professor of electrical engineering. My industry experience includes working for HRL Laboratories for over eleven years.

5. I hold a Bachelor of Science degree in electrical engineering (1994) and a Ph.D. degree in electrical engineering (1999). I obtained each of my degrees from the University of California, Los Angeles. I am an Associate Editor for the Institute of Electrical and Electronics Engineers (IEEE) Antennas and Wireless Propagation Letters, a member of the IEEE Antennas and Propagation Society Administrative Committee, and a member of the Antennas and Propagation Society AdCom on New Technology Directions.

6. I became a Fellow of the IEEE in 2009.

7. I have done work with all aspects of antenna technology during my career.

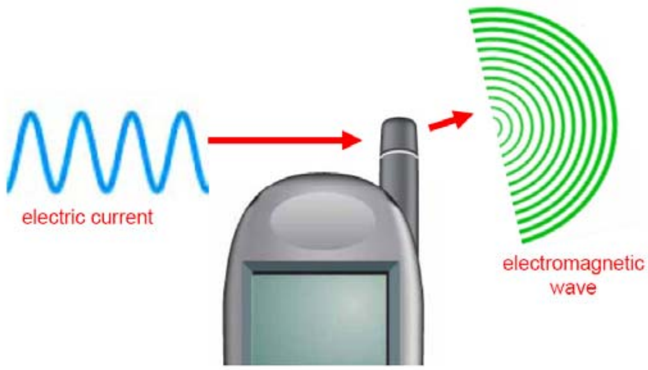
8. A copy of my current curriculum vitae is attached hereto as Exhibit A.

9. Based on my experience in the field of antenna technology, my extensive professional background and my professional honors and activities, I am very familiar with the antenna technology, including the technology described in the '894, '431, and '083 patents.

10. In the preparation of this declaration I reviewed the '894, '431, and '083 patents.

I. BACKGROUND ON ANTENNA TECHNOLOGY

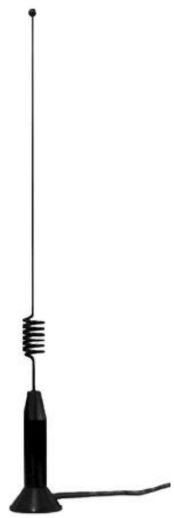
11. When two devices are connected by a wire, an electric current can pass signals back and forth between them, allowing the devices to communicate. However, devices cannot communicate wirelessly using electric current, because current generally cannot travel through the air. Before a signal can be sent wirelessly, it must be transformed from a current into an electromagnetic wave, which can travel through the air.



12. An antenna is a device that converts current into electromagnetic waves to send signals, and converts electromagnetic waves into current to receive signals. Based on a concept known as reciprocity, antennas work the same way regardless of whether they are transmitting or receiving.

13. Generally, any alternating electric current that is not contained within a cable or "waveguide" will generate electromagnetic waves as radiation. A cable or "waveguide" acts as a transmission line to transport the signal from the source to an antenna, where the signal can be released. To generate electromagnetic waves that will carry a signal through the air, the signal travels through the cable or waveguide to the antenna structure in the form of alternating electric current, where the signal is released—or "radiated"—by the antenna structure in into the air in the form of electromagnetic waves. The shape, size, and configuration of the antenna structure determine the frequencies at which the antenna is capable of radiating.

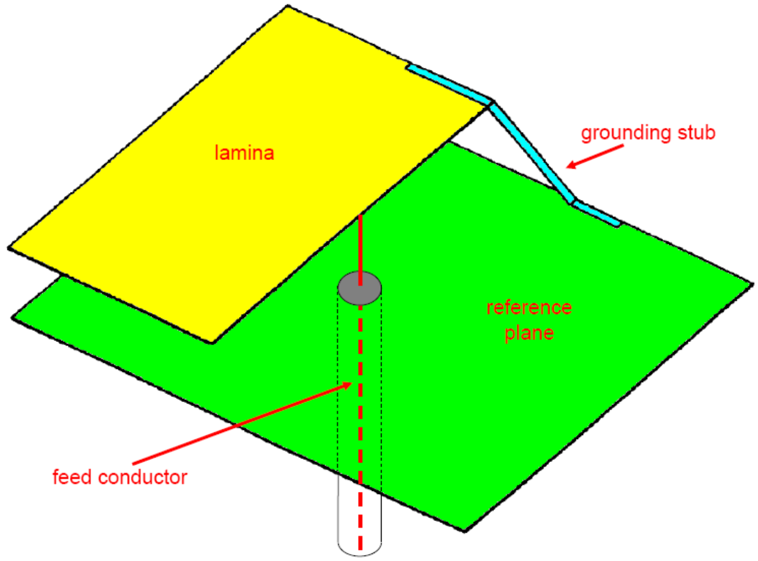
14. Antennas come in many different forms. One well-known structure is the “whip” antenna, illustrated below, which is common on automobiles and older mobile phones.



15. When mobile devices (such as mobile phones) use whip antennas, these antennas are typically external to the device.

16. A whip antenna includes a stiff (often retractable) vertical wire. In addition to the wire, a whip antenna also includes a “ground plane.” A “ground plane”—sometimes called a “reference plane”—is a structure that interacts with the wire antenna to allow for the release of a signal from the antenna.

17. Not all antennas use stiff vertical wires. Another type of antenna common in mobile phones is often described as a planar antenna, one example of which (a planar inverted-F antenna or “PIFA”) is illustrated below:



18. Instead of a wire, a planar antenna includes a plate of metal (lamina) suspended over the reference plane. This metal plate goes by many different names, including "lamina," "resonating region," "resonator," or "radiating sheet." In other contexts (including in the '431 patent), the metal plate is itself referred to as the "antenna," while other terms such as "antenna assembly" are used to describe the overall antenna structure, including the lamina ("antenna"), ground plane, and other components.

II. THE '894 PATENT

19. There are several recognized frequency bands which have been set by standards setting organizations for the operation of different modes of wireless communication. In 2000, the year the '894 patent was filed, the standards set by these bodies generally directed wireless cellular telephone communications to occur in frequency ranges between 824-1990 MHz. Also in 2000, the standards set by these bodies generally directed frequency ranges for local area networks such as Bluetooth and WLAN to operate in ranges between 2.4-5.875 GHz. The '894 patent confirms these frequency ranges for Bluetooth and WLAN local area networks. (Dkt. No. 43-4, '894 patent, cols. 1:13-15, 5:20-22.)

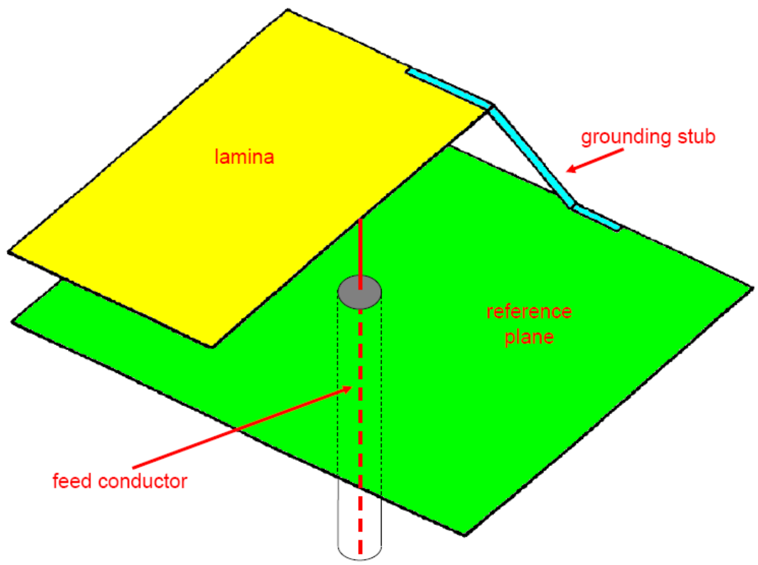
20. The ’894 patent points out the relationship between frequency bands and physical size of the antennas. (*See, e.g.*, *id.* at col. 3:49-52.) This relationship is due to the fact that higher frequency bands have shorter wavelengths, and therefore require smaller antennas to operate at these wavelengths. For this reason, Bluetooth and WLAN antennas are generally much smaller than antennas designed for cellular telephone communications.

III. THE ’083 PATENT

21. The ’083 patent concerns using transmission or feed lines between a reference plane and a lamina.

22. In the prior art disclosed in the ’083 patent, described as “PIFA” or “planar inverted-F antennas”, the antenna structure includes a “flat conductive sheet” (lamina), a reference or “ground” plane, a “grounding stub” between the lamina and the reference plane, and a “feed” conductor which extends up to the reference plane contained in coaxial cable, and then proceeds unshielded between the lamina and the reference plane. (Dkt. No. 43-3, ’083 patent, col. 1:33-51.)

23. The following diagram reflects a prior art PIFA antenna structure fitting the narrative description set forth in the ’083 patent:

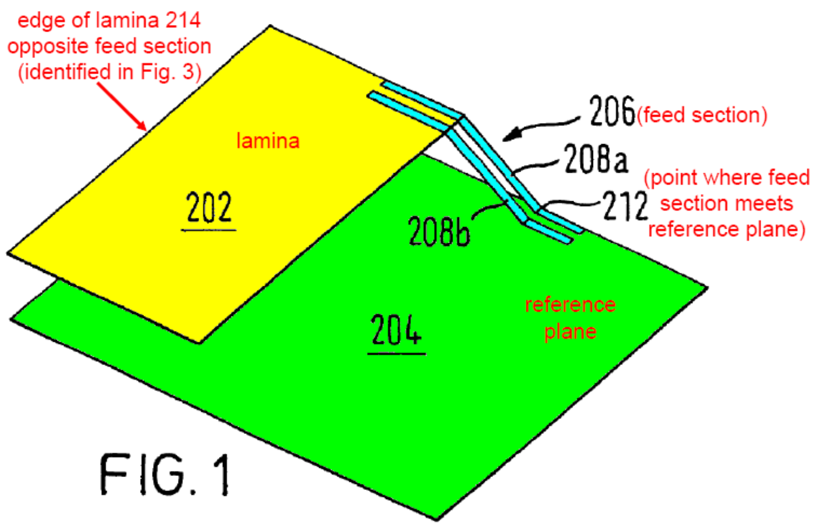


24. The broadcast strategy utilized in these prior art PIFA antennas is to intentionally release the signal into the gap between the reference plane and the lamina (resonant chamber), by allowing the feed conductor to extend without shielding between the ground plane and the lamina. This initial release of signal energy then resonates within the resonant chamber, allowing it to be efficiently radiated out into space. The process is similar to an acoustic guitar, where the initial vibration of the guitar string is released into the guitar's acoustic chamber, at which point it then resonates and radiates into free space as harmonic sound.

25. The '083 specification describes two advantageous electrical properties achieved when the feed signal is contained within the two-conductor transmission line all the way to the lamina—properties that cannot be achieved unless both conductors each extend this full distance. The first electrical property claimed by the '083 patent is that the "feed section generally has a graded impedance characteristic [that] advantageously varies along the length of the feed section in a uniform manner." (*Id.* at col. 2:30-35.) If there were a break in either of the conductors before they reached the lamina, this would result in a radical impedance change at the point of

the break—not a "graded" impedance that varies in a "uniform" manner as touted in the '083 patent to be an advantage of the invention.

26. The second advantageous electrical property claimed by the '083 patent is that a "resonant circuit" is formed from the feed section conductors and the lamina, which allows for an increased "electrical length" of the antenna. (*Id.* at col. 1:52-61.) In the claimed structure, this "electrical length of the resonant circuit [] extends from the open circuit on an edge 214 of the antenna sheet [lamina] 202, along the feed section 206 and to the point 212 at which the feed section meets the ground plane [204]." (*Id.* at col. 3:51-57)



(*Id.* at fig. 1 (color shading and annotations added).)

27. To achieve this advantage, the feed section conductors must extend all the way to the lamina; if there were a break in electrical contact within the span from 214 through 206 to point 212, the "electrical length" would terminate at the point of the break, and would no longer extend from edge 214 to point 212 as claimed in the '083 patent.

28. I understand Nokia's proposed construction of the '083 claim term "feed section extending from the reference plane to the lamina and coupled to the reference plane and the

lamina" to be "feed section extending from the reference plane to the lamina and with an electromagnetic interaction to the reference plane and the lamina."

29. At some level every piece of metal within a structure such as a mobile phone has an "electromagnetic interaction" with every other piece of metal within that structure. It is possible to attempt to shield a metallic structure from electromagnetic interaction with other metallic structures in such devices, but unless a metallic structure is completely surrounded by a conducting shell it will have some level of electromagnetic interaction with the other metallic structures within that device.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge and belief.

Executed on December 17, 2010 in San Diego, California.

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Daniel F. Sievenpiper, Ph.D.