

Declaration of William H. Beckmann, Ph.D., in Support of  
Petitions for Covered Business Method (CBM) Review

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Facebook, Inc., Instagram LLC  
Petitioners

v.

Skky, LLC  
Patent Owner

U.S. Patent No. 9,203,870

U.S. Patent No. 9,203,956

U.S. Patent No. 9,215,310

U.S. Patent No. 9,219,810

Title: MEDIA DELIVERY PLATFORM

**DECLARATION OF WILLIAM H. BECKMANN, PH.D. IN SUPPORT OF  
PETITIONS FOR COVERED BUSINESS METHOD (CBM) REVIEW**

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I, William Beckmann Ph.D., declare as follows:

1. I have personal knowledge of the facts stated in this declaration, and could and would testify to these facts under oath if called upon to do so.

2. I have been retained by counsel for Facebook, Inc. and Instagram, LLC (Petitioners) in this case as an expert in the relevant art.

3. I have been asked to provide my opinions relating to the claims of four patents to John Mikkelsen et al., which I understand are assigned to Skky, LLC (“Patent Owner” or “Skky”): U.S. Patent No. 9,203,870 (“’870”), 9,203,956 (“’956”), 9,215,310 (“’310”) and 9,219,810 (“’810”). I will refer to these patents collectively as the “Skky patents.”

**I. BRIEF SUMMARY OF MY OPINIONS**

4. The claims of the four Skky patents listed above, all entitled “Media Delivery Platform,” purport to disclose techniques for storing digital media files or electronic content and providing or distributing it to a user operating a cellular phone. As explained in detail in **Section VI**, the supposedly technological features in these claims recite no inventive concept. They instead recite well-understood, routine, and conventional activities that were known to persons of ordinary skill in the art. In addition, as explained in detail in **Sections VII** and **VIII**, the claims of these patents do not recite what the inventor regarded as the invention, and are not adequately supported by the written description.

## **II. INTRODUCTION AND QUALIFICATIONS**

### **A. Qualifications and Experience**

5. I am currently President and Co-Founder of Network Computing Associates, a consulting firm that provides expertise to companies and organizations in making or executing decisions that involve network and information technologies and their integration into the company's business processes. I have more than 35 years of technical experience in the telecommunications field. For example, I have designed, developed, tested, maintained, marketed and sold telecommunications networks including POTS (plain old telephone service) networks, access networks (including ISDN and DSL), wireless networks (both cellular and WiFi), IP (including TCP/IP and UDP/IP, wide area and LAN) networks, metallic/fiber/microwave facility backbone infrastructure networks, wireless broadcast networks (primarily for television broadcast) and satellite networks (including DirecTV in the U.S. and BSkyB in the U.K.).

6. I have dealt with information technology ("IT") systems for even longer. My first major programming effort (while I was a graduate student at Cornell) was for the Cornell School of Hotel Administration regarding an IBM System 370 database system. The programming tools in that matter included RJE, Fortran, and a beta version of IBM's DB2 relational database system. When I

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joined Bell Labs (BTL) in 1980, I became one of the first Unix “hackers,” helping BTL develop Unix system security and system access methods.

7. At Bellcore (Bell Communications Research) in the mid-1980s, I worked with start-up companies in Silicon Valley developing techniques and products in MPEG encoding and decoding. Because of my extensive work with MPEG (both at Bellcore and later at IBM, when my organization, working with IBM Research, was responsible for the design and development of the IBM Video Server), I am quite familiar with encoding and decoding techniques, such as JPEG (because the I-frames in an MPEG stream use essentially the same encoding/decoding techniques as JPEG). I also worked with MIT in its “Project Athena” that developed a campus-wide distribution network and databases that included personnel (i.e., students, faculty, etc.) records that included text, image, audio, and video.

8. I have worked extensively with database systems, primarily IBM and Oracle, and am familiar with their structure, their programming and their administration. One of the largest database system projects undertaken in the U.S. in the early 1990s was the project I led at Ameritech. I have worked with and am familiar with the Windows FAT and NTFS database systems.

9. I am also familiar with processing in the smart phone environment. Two of my current cases are involved with the Android system; and, as you may

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know, Android is based on a Linux kernel (Linux is essentially a version of Unix, from a technical point of view).

10. Furthermore, I have provided technical expertise to a major smartphone manufacturer regarding the formatting, processing and communication of image and video in the smart phone environment.

11. I am familiar with the use of orthogonal frequency-division multiplexing (OFDM) in communication systems. In the 1980s to early 1990s I worked on and assessed ADSL (Asymmetric Digital Subscriber Line) technologies that employed discrete multitone modulation, an adaptive OFDM modulation used to increase the data transport capacity of standard telephone copper lines. In the early 2000s I consulted for the Federal Communications Commission (FCC) on the use of digital modulation techniques, such as quadrature amplitude modulation (QAM), and the use of fast Fourier transform (FFT) and inverse fast Fourier transform (IFFT) techniques with OFDM systems. In the mid-2000s, I consulted for British Telecom on employing OFDM with various modulation methods for access to data communications networks such as the Internet. Most recently, from 2012 to 2016, I have headed a technology group for the International Consortium on Cybersecurity in International Financial Transactions. In this role, I have examined protocols for providing secure communications over wireless and wireline OFDM channels.

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12. I have an M.S. and Ph.D. in Mathematics, both from Cornell University. I obtained a B.S., summa cum laude, in Mathematics from Davidson College. Among other academic appointments, I have been an Assistant Professor of Mathematics and Computer Science at Middlebury College and an Adjunct Professor of Electrical Engineering at Rensselaer Polytechnic Institute. I am a member of a number of professional affiliations, including the Association of Computing Machinery (“ACM”) and the Institute of Electrical and Electronics Engineers (“IEEE”).

13. Additional details of my background are set forth in my curriculum vitae, attached as **Exhibit A** to this Declaration, which provides a more complete description of my educational background and work experience, and lists the presentations, articles and other publications I have authored or to which I have contributed.

14. I am being compensated for the time I have spent on this matter at the rate of \$500 per hour. My compensation does not depend in any way upon the outcome of this proceeding.

**B. Materials Considered**

15. The analysis that I provide in this Declaration is based on my education and experience in the telecommunications and information technology industries, as well as the documents I have considered including the '870, '956,



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'810 and '310 patents, which all claim priority to a series of earlier applications, the earliest being a provisional application filed on June 27, 2001. I have therefore assumed a June 27, 2001 date of invention with respect to the '870, '956, '310 and '810 patents.<sup>1</sup> I also reviewed the file histories for these patents.

16. This Declaration cites the following documents for various purposes, as explained below, including describing the relevant technology and the relevant state of the art at the time of the alleged invention of the Skky patents:

Ex. No.	Description of Document
1004	Excerpts from John Hedtke, <i>MP3 and the Digital Music Revolution: Turn your PC into a CD-Quality Digital Jukebox!</i> (1999)
1005	U.S. Patent No. 6,714,797 to Heikki Rautila, entitled "System and Method for the Transfer of Digital Data to a Mobile Device"
1006	Excerpts from Scot Hacker, <i>MP3: The Definitive Guide</i> (2000)
1007	EP 1033894 A2 to Masatoshi Saito, entitled "Portable Telephone Terminal Apparatus for Receiving Data and Data Receiving Method"
1008	Excerpts from Setrag Khoshafian, <i>Multimedia and Imaging Databases</i> (1995)

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<sup>1</sup> Because the June 27, 2001 provisional is the earliest application to which the '870, '956, '810, and '310 patents could claim priority, I have assumed that date for purposes of my Declaration. I have not provided an opinion as to whether the claims are adequately disclosed and supported by the June 27, 2001 provisional.

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Ex. No.	Description of Document
<b>1009</b>	U.S. Patent No. 6,423,892 to Muralidharan Ramaswamy, entitled “Method, Wireless MP3 Player and System for Downloading MP3 Files from the Internet”
<b>1010</b>	U.S. Patent No. 7,065,342 to Devon A. Rolf, entitled “System and Mobile Cellular Telephone Device for Playing Recorded Music”
<b>1011</b>	Alan Gatherer et al., <i>DSP-Based Architectures for Mobile Communications: Past, Present and Future</i> , IEEE Communications, pp. 84-90 (Jan. 2000)
<b>1012</b>	Excerpts from Richard Van Nee et al., <i>OFDM for Wireless Multimedia Communications</i> (2000)
<b>1013</b>	U.S. Patent No. 3,488,445, entitled “Orthogonal Frequency Multiplex Transmission System”
<b>1014</b>	Excerpts from Ahmad R.S. Bahai et al., <i>Multi-Carrier Digital Communications</i> (1999)
<b>1015</b>	L. Cimini, <i>Analysis and Simulation of a Digital Mobile Channel Using Orthogonal Frequency Division Multiplexing</i> , IEEE Trans. Commun., Vol. 33, No. 7, pp. 665-675 (July 1985)
<b>1016</b>	E.F. Casas, <i>OFDM for Data Communication Over Mobile Radio FM-Channels-Part I: Analysis and Experimental Results</i> , IEEE Trans. Commun., Vol. 39, No. 5, pp. 783-793 (May 1991)
<b>1017</b>	William D. Warner, <i>OFDM/FM Frame Synchronization for Mobile Radio Data Communication</i> , IEEE Trans. on Veh. Tech., Vol. 42, No. 3, pp. 302-313 (Aug. 1993)
<b>1018</b>	William Y. Zou and Yiyan Wu, <i>COFDM: An Overview</i> , IEEE Transactions on Broadcasting, Vol. 41, pp. 1-8 (Mar. 1995)
<b>1019</b>	W.A.C. Fernando and R.M.A.P. Rajatheva, <i>Performance of COFDM for LEO Satellite Channels in Global Mobile Communications</i> , Vehicular Technology Conference, 1998. VTC 98. 48th IEEE Vol. 2, 1503-1507 (1998)

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<b>Ex. No.</b>	<b>Description of Document</b>
<b>1020</b>	Justin Chuang et al., <i>High-Speed Wireless Data Access Based on Combining EDGE with Wideband OFDM</i> , IEEE Comms., Vol. 37, No. 11, pp. 92-98 (Nov. 1999)
<b>1021</b>	U.S. Patent No. 5,726,978 to Carl Frodigh et al., entitled “Adaptive Channel Allocation in a Frequency Division Multiplexed System”
<b>1022</b>	U.S. Patent No. 5,828,650 to Esa Malkamaki, entitled “Combined Modulation—and Multiple Access Method for Radio Signals”
<b>1023</b>	EP 0786890 A2 to Mitsuhiro Suzuki, entitled “Resource Allocation in a Multi-User, Multicarrier Mobile Radio System”
<b>1024</b>	WO 1997030531 A1 to Roger Larsson, entitled “Improvements in or Relating to OFDM Systems”
<b>1025</b>	U.S. Patent No. 4,843,562 to Stephen C. Kenyon et al., entitled “Broadcast Information Classification System and Method”
<b>1026</b>	Tom McCourt et al., <i>SoundScan and the Consolidation of Control in the Popular Music Industry</i> , Media, Culture & Society (1997)
<b>1027</b>	“How You Get Paid at ASCAP” (attached to the Affidavit of Christopher Butler, Internet Archive)
<b>1028</b>	EMusic.com, Inc. 10-K Report for the Fiscal Year Ended June 30, 2000
<b>1029</b>	WO 2000/043905 A1 to Bernard Fritsch, entitled “Distribution of Musical Products over the Internet”
<b>1030</b>	Underhill & Gertler, <i>The Complete Idiot’s Guide to MP3: Music on the Internet</i> (2000)
<b>1031</b>	Robert W. Chang, <i>Synthesis of Band-Limited Orthogonal Signals for Multichannel Data Transmission</i> , Bell System Technical Journal, Volume 45, Issue 10, pp. 1775–1796 (Dec. 1966)
<b>1032</b>	U.S. App. Pub. No. 2002/0168082 to Ravi Razdan, entitled “Real-

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Ex. No.	Description of Document
	Time, Distributed, Transactional, Hybrid Watermarking Method to Provide Trace-Ability and Copyright Protection of Digital Content in Peer-to-Peer Networks”
<b>1033</b>	Declaration of Robert Freidson under 37 C.F.R. § 1.132, August 8, 2008, filed in U.S. Patent Appl. No. 10/183,756
<b>1034</b>	Amendment and Response, August 5, 2008, filed in U.S. Patent Appl. No. 10/183,756
<b>1035</b>	IPR2014-01236, Ex. 2021 (Declaration of Professor Kevin C. Almeroth)
<b>1036</b>	Excerpts from IEEE Std 801-11a-1999, <i>Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band</i>
<b>1037</b>	U.S. Patent No. 6,711,622 to Michael J. Fuller, entitled “Video and Audio Streaming for Multiple Users”
<b>1038</b>	U.S. Patent No. 5,533,019 to Jay P. Jayapalan, entitled “Packet Data in an Analog Cellular Radiotelephone System”
<b>1039</b>	U.S. Patent No. 7,187,947 to Russell W. White, entitled “System and Method for Communicating Selected Information to an Electronic Device”

### III. PERSON OF ORDINARY SKILL IN THE ART

17. I understand that an assessment of claims of the Skky patents should be undertaken from the perspective of a person of ordinary skill in the art as of the earliest claimed priority date, which I understand is June 27, 2001.

18. In my opinion, a person of ordinary skill in the art as of June 2001 would have possessed at least a bachelor’s degree in computer science, computer

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engineering, or electrical engineering (or equivalent degree or experience) with at least four years of experience with wireless communications systems and at least two years of experience with the communication of digital media.

19. My opinions regarding the level of ordinary skill in the art are based on, among other things, my over 35 years of experience in the field of network communications, computer science and engineering, my understanding of the basic qualifications that would be relevant to an engineer or scientist tasked with investigating methods and systems in the relevant area, and my familiarity with the backgrounds of colleagues, co-workers, and employees, both past and present.

20. Although my qualifications and experience exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the Skky patents have been based on the perspective of a person of ordinary skill in the art as of June 2001.

**IV. BACKGROUND ON RELEVANT TECHNOLOGIES AT THE TIME OF THE ALLEGED INVENTION**

21. The Skky patents, which are all entitled “Media Delivery Platform,” generally disclose a system and method for delivering digital media files to an electronic device. In this section, I provide a brief background discussion on pertinent technologies prior to June 2001.

**A. Electronic Storage and Retrieval of Digital Media Files**

22. The idea of storing a library of media (e.g., audio or video) content and making it available based on user request is a longstanding practice not limited to any particular type of technology. For example, long before the Skky patents, a person could visit a local library to physically “check out” such materials.

23. With the advent of telecommunications networks, media no longer needed to be physically delivered to the user. Instead, media could be delivered electronically via a network that connected the user to the media source. One well-known example of such a network was the Internet. By the late 1990s, the Internet was used by millions worldwide to send and receive communications over the World Wide Web (WWW). And by the time of the alleged invention, as the Skky patents acknowledge, “[t]he general concept for delivery of sound recordings or clips and visual recordings or clips by way of the Internet [was] known . . . .” (’870, 1:25-27.)<sup>2</sup> In other words, it was well-known that media could be stored

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<sup>2</sup> When citing to portions of the written description of the Skky patents, my Declaration cites to the ’870 patent (the earliest-issued of the four patents). Because the ’870, ’956, ’810 and ’310 patents share the same written description, except as otherwise noted, any citation to or discussion of the ’870 patent should be understood as also applying to the ’956, ’310 and ’810 patents.

electronically on a computing device connected to the Internet, and delivered to a user device via the Internet. For example, the patent acknowledges the existence of prior art websites such as “Amazon.com” that maintain a library of digital music samples to which users can listen. (’870, 1:31-33.)

24. It was also well-known that media could be stored electronically in compressed digital form. Compression techniques enabled media files to be stored at a fraction of their original size, which provided advantages by allowing for more efficient use of storage mediums (e.g., computer hard drives) and network bandwidth. Indeed, the Skky patents acknowledge the existence of “MP3” (’870, 1:38, 24:1, 29:63), which is a standardized technique for compressing digital audio. (John Hedtke, *MP3 and the Digital Music Revolution* (1999), Ex. 1004, at p.1.) By 1999, MP3 had already become “enormously popular for distributing and exchanging songs and music.” (*Id.*) “The most popular way of finding MP3 files [was] through MP3 web sites. There [were] hundreds of MP3 web sites in existence that distribute MP3 files, software, news bulletins about MP3, and provide a forum for discussions by MP3 users.” (*Id.* at p.37 (under “Getting MP3 Files from Web Sites”).)

## **B. Cellular Phones**

25. Cellular phones (also commonly known as “cell phones”) were well-known prior to June 2001. The Skky patents recognize the existence of

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“commercially available cellular phone[s].” (’870, 14:27-38.) Cell phones included transmitters and receivers for transmitting and receiving over-the-air signals (e.g., radio frequency waves), which allowed cell phones to communicate wirelessly.

26. Early cell phones, which were commonly known as “1G” or “first generation” devices, transmitted and received analog signals and were generally designed only for voice communications. In the 1990s, cell phones adopted more advanced technologies such as GSM (1991) and CDMA (1995) that used digital signals for communication. Because they allowed transmission and reception of digital signals, cell phones could more easily send and receive communications other than voice such as text, pictures, and other types of data. Although digital cellular phones were in wide use by 2001, cellular carriers in the United States were required to continue supporting analog cellular services until 2008.

27. Although analog cell phones were originally only designed for voice, techniques were nevertheless developed to allow them to transmit and receive digital data. These techniques evolved from techniques developed for landline telephones and generally involved converting digital data into a series of audible sounds or tones that could be transmitted through the analog cellular network in the same manner as ordinary voice communications. The receiving device, in turn, received these audible sounds or tones and converted them back into the original



digital data. Examples of such an approach are described in the Background section of Motorola's U.S. Patent No. 5,533,019 [**Ex. 1038**], filed in 1994. As I will explain in more detail below, the Skky patents describe a similar technique for sending and receiving digital data over the voice channel of an analog cell phone.

28. It was known that, in addition to providing traditional voice communication capabilities, cell phones could download and play back digital music content. For example, the Background Art section of the Skky patents acknowledges the existence of cell phones that can play music in a compressed format such as MP3. ('870, 1:34-40.) Prior art patents describing cell phones with music download and playback features include EP 1033894 A2 [**Ex. 1007**] and U.S. Patent No. 6,423,892 [**Ex. 1009**], which I discuss in **Section VI.B**.

29. It was well-known that cell phones can include one or more processors for performing a variety of functions. One type of processor that was commonly used in cell phones was the digital signal processor, or "DSP." As explained in Alan Gatherer, *DSP-Based Architectures for Mobile Communications: Past, Present and Future*, IEEE Communications (Jan. 2000) [**Ex. 1011**], "[p]rogrammable digital signal processors (DSPs) [were] pervasive in the wireless handset market for digital cellular telephony" (*id.* at p. 84), and a known and increasingly compelling option for implementing a "multimedia processor in the handset." (*Id.* at p. 87; *see also id.* Fig. 7.)

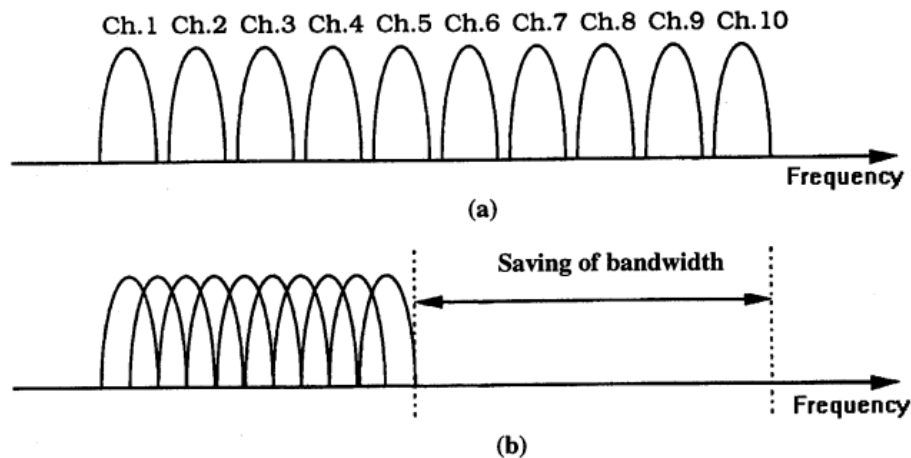
**C. OFDM**

30. Orthogonal frequency-division multiplexing, or “OFDM,” is a particular type of frequency-division multiplexing (“FDM”), which refers to a technique in which discrete signals can be combined within a shared frequency band of a communications medium. Such a shared frequency band can be, for example, the voice band (approximately 300 Hz to 3-4 kHz) or any portion of the radio spectrum used for wireless communication (approximately 3 Hz to 3 THz). The communications medium can be physical (e.g., copper wirelines for traditional telephone connections) or wireless (e.g., electromagnetic spectrum for over-the-air connections).

31. The basic concept of FDM can be explained using the familiar concept of FM radio, in which a user turns a radio receiver to a particular frequency (e.g., 97.1 MHz) to listen to a radio broadcast. FDM divides up an available frequency band (characterized by a particular “bandwidth”) into a number of frequency “sub-bands,” sometimes referred to as “sub-channels.” To reduce interference, these sub-bands usually do not overlap. To use the FM radio example, FM radio stations use a frequency band that ranges from 87.5 to 108 MHz of the radio spectrum. By dividing the available bandwidth into sub-bands, FDM allows multiple signals to be transmitted simultaneously because each sub-band can carry a distinct signal. This is essentially how “frequency division

multiplexing” gets its name. FDM was used with the telegraph more than a century ago and continues to be used in numerous applications including, as noted, radio signals broadcast over the air.

32. OFDM is a more advanced variant of FDM. In broad overview, OFDM differs from ordinary FDM in that OFDM uses frequency sub-bands that overlap, but are centered at precise intervals and as such, gives rise to the “orthogonal” nature of OFDM, where the relative shapes of the electromagnetic waves reduce interference with each other. The basic differences are illustrated in Figure 1.10 of Richard Van Nee et al., *OFDM for Wireless Multimedia Communications* (2000) [Ex. 1012] (“Van Nee”):



**Figure 1.10** Concept of OFDM signal: (a) Conventional multicarrier technique, and (b) orthogonal multicarrier modulation technique.

(Van Nee, Fig. 1.10, at p. 22.) The top portion (a) of Figure 1.10 shows a conventional FDM arrangement in which each signal channel occupies a distinct frequency sub-band. The sub-bands in this example do not overlap, and each sub-

band is separated by what is known as a “guard band,” an unused portion of the bandwidth designed to reduce interference between neighboring channels.

33. The bottom portion (b) of Figure 1.10 shows an OFDM arrangement. As shown, OFDM eliminates the need for a guard band and allows frequency sub-bands to overlap, thus making for a more efficient use of the available bandwidth. The spacing between the center frequency of each sub-band is precisely chosen to create the “orthogonal” nature of OFDM, a characteristic that reduces interchannel interference notwithstanding the overlapping nature of the sub-bands.

34. Because the sub-bands overlap in OFDM, a mathematical method known as the fast Fourier transform (“FFT”) is performed at the receiver to “demodulate” the OFDM signal to recover the individual signals carried within each sub-band. (Van Nee, Ex. 1012, at p. 47 (“[T]he basic OFDM signal is formed using the IFFT, adding a cyclic extension and performing windowing to get a steeper spectral rolloff. . . . In the receiver, the subcarriers are demodulated by an FFT, which performs the reverse operation of an IFFT.”).)

35. OFDM was known long before June 2001. For example, patents on OFDM date back almost 50 years to U.S. Patent No. 3,488,445 entitled “Orthogonal Frequency Multiplex Data Transmission System,” filed in 1966 and issuing in 1970 [Ex. 1013]. OFDM was also deployed in a number of known wireless applications. I discuss known applications of OFDM in **Section VI.D**

below.

**D. Audio Channels vs. Data Channels Used in Communications**

36. The concept of an audio channel is familiar to anyone who has used a telephone. Audio channels generally enable the transmission of human speech. Since the majority of the sounds in human speech have frequencies ranging between 300 Hz and 3-4 kHz, audio channels were designed to support this frequency band. Accordingly, the 300 Hz to 3-4 kHz frequency band became known as the “voice band.”

37. The term “data channel,” as its name implies, refers to a channel designed to support the transmission of data. Although a data channel can be used to transmit human speech (for example, in digital form), a data channel can also transmit other types of information. As such, frequency bands used by data channels were not limited to the voice band. Data channels can include much higher frequencies, and could have bandwidths much wider than that of the voice band. For example, a frequency band used by the wireless LAN technology commercially known as “WiFi” used a frequency band in the 5 GHz range, orders of magnitude above the voice band. (IEEE Std 802-11a-1999, *Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band* [Ex. 1036], at p. 3 (“The radio frequency LAN system is initially aimed for the 5.15–5.25, 5.25–5.35 and 5.725–

5.825 GHz unlicensed national information structure (U-NII) bands, . . .”).)

38. Moreover, audio channels typically supported communication between one party and another party. As such, a party at one end of the audio connection could transmit and receive voice communications (*i.e.*, talk and listen) using the entire bandwidth of the voice band. Indeed, it would be difficult to carry a conversation were one limited to talking and/or listening through only sounds of a particular sub-band of frequencies of the voice band.

39. On the other hand, as I noted above, the transmission of data need not occur at any particular frequency. As such, unlike the voice band of an audio channel, bandwidth allocated to data channels could be more easily shared among multiple users. In other words, multiple users could simultaneously access the shared bandwidth to transmit and/or receive data. This concept is known as “multiple access.” For example, the TIA/EIA IS-95A standard, which was published in 1995 and served as the basis for many commercial 2G cellular systems, allowed for multiple access by using a technique known as Code Division Multiple Access (CDMA).

## **V. THE SKKY PATENT’S TECHNIQUE FOR DELIVERING DIGITAL MEDIA**

### **A. The Specification**

40. As I mentioned above, the Skky patents, all entitled “Media Delivery

Platform,” generally describe a system and method for delivering digital media files to an electronic device. ('870, Abstract.) All four of the patents share a common written description, which will be briefly summarized here.

41. One embodiment, shown in Figure 2, describes a server (206) for storing digital media files. ('870, 15:6-7; *see also id.*, 12:65-66 (describing a similar server 106).)

The server can receive requests from a telephone ('870, 12:56-13:3), “which may be given through user voice commands or

commands using the phone keys.” ('870, 12:56-59.) If the user requests to download a particular digital media file, the server allows for the file to be transmitted over a cellular network to the cell phone (202) for storage and playback. ('870, 12:65-13:15, 13:41-45, 14:55-15:3, 15:27-39.) This is shown in Figure 2, reproduced at above right.

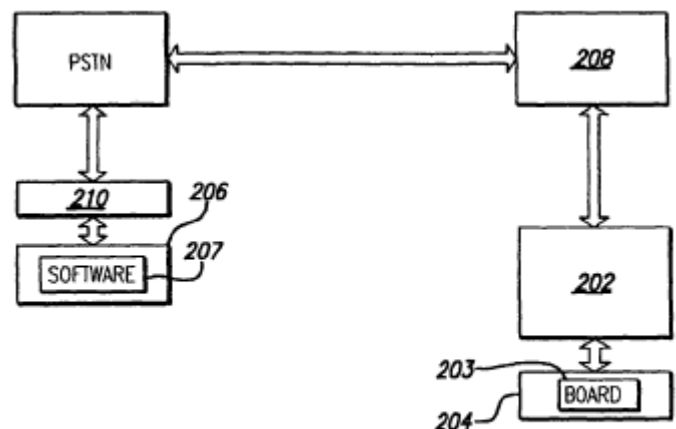


FIG. 2

42. The Skky patents explain that the cell phone may be “an analogue (voice-only) system or a digital system.” ('870, 13:30-34 & 14:13-19.) When the file is transmitted over an *analogue (audio)* channel, “a special method and algorithm to map digits to sounds is used.” ('870, 16:23-25.) As the patents

explain, this special method uses “[a]n orthogonal frequency-division multiplex (OFDM) modulation scheme” for data transmission. (’870, 16:57-58.) This method using OFDM (**500**) is illustrated in Figure 5. (16:31-34.)

43. As shown in Fig. 5, the OFDM signal is transmitted over a phone line to the receiving telephone, “much like voice sounds are transferred during a normal phone conversation” (’870, 18:35-36), and the telephone processes the signal to recover the original data (shown on the right beginning at step **512**). (’870, 16:41-46.) The Skky patents refer to the recovery of original data (e.g., music encoded in MP3) from the OFDM signal as “demodulation,” and teaches a digital signal processor (DSP) **300** for performing this task. (’870, 18:36-42.)

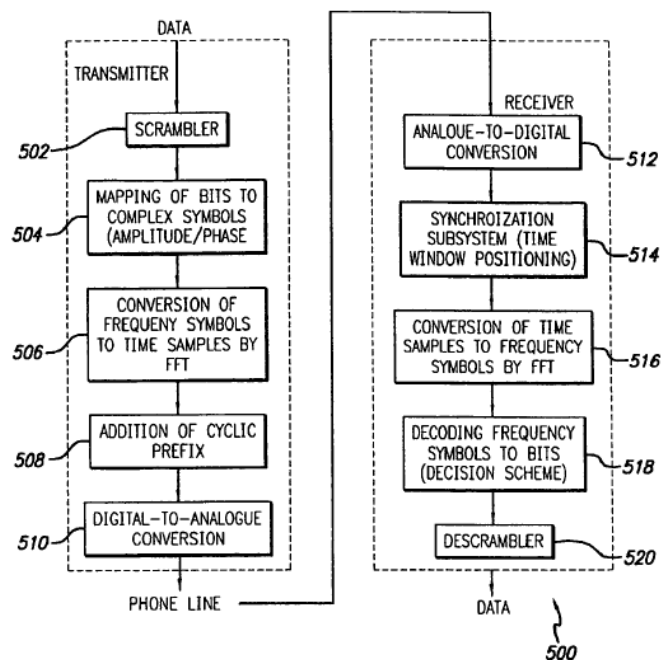


FIG. 5

44. The Skky patents also explain that when the file is transmitted over a *digital data* channel to the cell phone, “no [de]modulation<sup>3</sup> is required on the

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<sup>3</sup> One of ordinary skill in the art would have understood the “modulation” on the mobile phone side to be a typo for “demodulation,” which is used in the patent to



mobile phone side.” (’870, 19:55-61.) Because OFDM demodulation is not used for receiving data signals sent over a cellular data channel, one of ordinary skill in the art would have understood that signals transmitted over a digital data channel, unlike those transmitted over an analogue audio channel, are not “modulated” using OFDM.

**B. The Freidson Declaration**

45. The Skky patents all claim priority to U.S. Patent Application No. 10/183,756, filed on June 26, 2002, issuing as U.S. Patent No. 7,548,875. During prosecution of the ’875 patent, on August 5, 2008, inventor Robert Freidson submitted a declaration under 37 C.F.R. § 1.132 (“Freidson Declaration”) explaining why he believed his alleged invention was patentable:

In one aspect, my inventive method employed OFDM teachings as a method for data transmission over an **audio channel of a wireless cell phone**. In another aspect, I have developed a method for rich media delivery over a **data channel of a wireless phone that doesn’t employ OFDM**.

(Freidson Decl., Ex. 1033, at ¶ 7 (emphasis added).) The applicant’s remarks filed alongside this declaration similarly state:

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describe recovery of original data from an OFDM signal at the receiver. (See ’870, 18:38-42.)

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[I]n one aspect, Freidson's inventive method employs OFDM in data transmission over an **audio channel of a wireless cellular device, e.g. a cell phone**, and in another aspect there is also the delivery of rich media content wherein **OFDM is not employed, such as over a data channel**[.]

(08/05/2008 Amendment and Response, Ex. 1034, at p. 5 (emphasis added).)

46. I understand that the Freidson Declaration was cited and quoted by the applicants in the prosecution files for each of the '870, '810, '956, and '310 patents. With respect to the '870 patent, I am informed that the Freidson Declaration was specifically cited in an Office Action response filed by the applicants on August 22, 2014. With respect to the '810 patent, I am informed that the Freidson Declaration was specifically cited in an Office Action response filed by the applicants on November 13, 2014. With respect to the '956 patent, I am informed that the Freidson Declaration was specifically cited in an Office Action response filed by the applicants on September 5, 2014. With respect to the '310 patent, I am informed that the Freidson Declaration was specifically cited in an Office Action response filed by the applicants on September 9, 2014.

**C. Claim Construction**

47. I have been informed by counsel that a claim in an unexpired patent subject to Covered Business Method review must be given its "broadest reasonable construction in light of the specification of the patent in which it appears," which is

different from the manner in which the scope of a claim is determined in litigation.

48. Each of the Skky patents recites the transmission and/or receipt of files using orthogonal frequency-division multiplex (OFDM) modulation. I am informed by counsel that the claims of the Skky patents under their broadest reasonable construction are not limited to use of OFDM for transmission over an audio channel, and cover use of OFDM for cellular data channels. I have applied this construction in my analysis below.

## **VI. OPINIONS REGARDING PATENT-ELIGIBLE SUBJECT MATTER**

49. I am informed by counsel that patent claims that cover an “abstract idea” are not eligible for patent protection. I am informed by counsel that to determine if an alleged invention of a claim is an ineligible abstract idea, two inquiries must be performed. First, it must be determined if the claim is directed to an abstract idea. This entails a legal exercise in which the concepts embodied in the claim be characterized or defined. Second, if it is determined that the claim is directed to an abstract idea, it must be determined if the elements of the claim as a whole contain an inventive concept or meaningful limitation sufficient to transform the claimed abstract idea into a patent-eligible invention. I am further informed that claim limitations that merely recite generic computer components or technology do not add sufficiently meaningful limitations that distinguish the claim from the abstract idea itself.

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50. My opinions in this Declaration will focus on the second step of the analysis, and more specifically, whether the following techniques and/or technologies recited in the claims of the Skky patents recite any inventive concept: (a) providing a library for compressed audio and/or visual files (such as MP3 files), (b) delivery of digital content to wireless devices such as cell phones upon request, (c) “receiver” and “digital signal processor” components of a cell phone, (d) use of orthogonal frequency-division multiplexing (OFDM), (e) streaming digital content (such as audio files) to a cell phone, (f) computerized rights management, and (g) optimizing digital files. As I explain below, these technologies were well-understood, routine, conventional activities previously known to persons of ordinary skill in the art.

**A. Storage of and Transmission of Compressed Digital Content**

51. The Background Art section of the Skky patents concedes that “[t]he general concept for delivery of sound recordings or clips and visual recordings or clips by way of the Internet is known and described in various U.S. patent applications.” (’870, 1:25-27.) The patent acknowledges the existence of prior art websites such as “Amazon.com” that provide a library of digital music samples to which users can listen. (’870, 1:30-33.)

52. Storage of compressed digital audio and visual files was also routine and conventional. The Skky patents explain that the MPEG Audio Layer 3 (MP3)

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compression algorithm may be used for storage of digital audio files. ('870, 24:1-2.) MP3 was already well-known in the art. As explained in John Hedtke, *MP3 and the Digital Music Revolution* (1999), MP3 was a standardized technique for compressing digital audio. (*Id.*, Ex. 1004, at p. 1.)

53. In fact, Hedtke observes that, by 1999 – two years before the filing of the earliest application for the Skky patents – MP3 had already become “enormously popular for distributing and exchanging songs and music.” (*Id.*) “The most popular way of finding MP3 files is through MP3 web sites. There are hundreds of MP3 web sites in existence that distribute MP3 files, software, news bulletins about MP3, and provide a forum for discussions by MP3 users.” (*Id.* at p. 37 (under “Getting MP3 Files from Web Sites”).)

54. Another example of prior art storage and transmission of digital files is provided in the “Background” section of Nokia’s U.S. Patent No. 6,714,797 (the “Nokia patent”) [**Ex. 1005**], filed more than a year before the earliest application to which the Skky patent can claim priority:

The user would [] log onto a web site and view the products or services available for sale. . . . In the case where the item ordered is digital in format, such as software, graphics, text, video, or music, the item ordered maybe downloaded into the user’s PC, server, lap top, palm computer or other processor-based system.

(*Id.*, 1:16-41 (emphasis added).)

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55. Server and database techniques used for storage and transmission of digital files (e.g., over the Internet) were also well-known. As explained in Scot Hacker, *MP3: The Definitive Guide* (2000) (“Hacker”) [Ex. 1006]:

[Y]ou can store all of your songs in a database such as MySQL and interface with it through a web server extension such as Perl or PHP. Myriad Perl modules are available so you won't have to create everything from scratch. . . . Once configured, you'll be able to bookmark a web page in a browser on another machine in the house, see available playlists, and select songs on your stereo just by clicking on them in your browser.

(*Id.* at p. 258.) Moreover, the application of these known techniques was not limited to music files. As noted in Setrag Khoshafian, *Multimedia and Imaging Databases* (1995) (“Khoshafian”) [Ex. 1008], “multimedia database applications” started “gain[ing] popularity” as early as 1995, more than five years before the alleged invention. (*Id.* at p. 2 (emphasis added).) Khoshafian – published in 1995 – also described in detail known techniques for implementing “servers involved in the multimedia database applications.” (*Id.* at p. 14; *see also id.* at pp. 215-262 (Chapter entitled “Client/Server Architectures and Multimedia Databases).)

56. It was also known that delivery of digital audio content did not require users to download an entire digital audio file; users could receive and thus listen to

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a portion of the content delivered over the Internet. For example, it was known to provide the ability for a user to receive a sample or preview containing a portion of an audio recording. (*See* Ex. 1030, at pp.62-63 (showing the ability for users to sample audio tracks by clicking on clickable speaker icons); and Ex. 1029, at p.3:13-18 (“For instance, a consumer may browse through artists, tracks or albums, pre-listen to a portion of the song and purchase the selected song either by downloading the digital data to her computer hard drive or by placing a mail order for a compact disk (CD).”) (emphasis added).) Accordingly, storage of compressed digital files on a server, and distribution of those files (in whole or in part) over the Internet, were well-understood, routine, conventional activities previously known to persons of ordinary skill in the art.

**B. Wireless Devices and Digital Content Delivery**

57. As noted previously, Hedtke confirms that by no later than 1999, there were “hundreds of MP3 web sites in existence that distribute MP3 files” (Ex. 1004, at p. 37), so delivery of data files and digital media files over the Internet and using web sites was already well-known. Allowing the selection and delivery to occur using a “cellular phone” does not provide any inventive concept.

58. As explained in my technology background discussion in **Part IV.B** above, cell phones were well-known prior to the Skky patents. The Skky patents themselves confirm that a cellular phone for use with the alleged invention “may

be any commercially available cellular phone” having standardized capabilities for handling dialing, command, and caller ID features. (’870, 14:27-38.) The Background Art section of the Skky patents acknowledges the existence of cellular phones that can play music in a digital format such as MP3. (’870, 1:36-40.)

59. At least four prior art references further demonstrate that delivering digital content to cellular phones was already known. To take one example, the Nokia patent, filed in May 2000, discloses an “Internet capable cellular phone” capable of ordering and downloading digital products. (Ex. 1005, 1:8-12.) These digital products can include “software, graphics, text, video, or music.” (*Id.*, 1:38-39.) The Nokia patent also discloses a server that provides a menu of digital products available for purchase, and downloading those digital products from the server using the cell phone. (*Id.*, 4:41-45.)

60. To take another example, Sony’s EP 1033894 A2 to Masatoshi Saito (“Saito”) [**Ex. 1007**], published before the earliest application on the face of the Skky patents, explains that cell phones “have been widely used as terminal apparatuses for transmitting and receiving audio information services,” and could be used to select and download music titles from a server and play them back. (Saito, ¶¶ 0002, 0003, 0023, 0025, 0026.) Saito discloses a cell phone that allows a user to select digital music titles that are wirelessly delivered from a server. (*Id.* ¶¶ 0015, 0016, 0022, 0028.)



61. A similar technique is disclosed in U.S. Patent No. 6,423,892 to Muralidharan Ramaswamy, filed on January 29, 2001 (“Ramaswamy”) [Ex. 1009]. Ramaswamy discloses a handheld wireless device that combines a wireless MP3 player with cellular phone features. (Ramaswamy, 2:26-31.) The user can select MP3 files from a list provided by a music server, which transmits the selected files to the wireless device for storage and playback. (*Id.*, 1:32-2:2.) U.S. Patent No. 7,065,342 to Devon A. Rolf [Ex. 1010], filed on November 22, 2000, likewise discloses a cell phone for wirelessly downloading MP3 files for storage and playback. (*Id.*, 1:28-51.)

62. Accordingly, requesting or selecting digital content from a cellular phone, and having the selected content transmitted to the cell phone, recite no inventive technological features. These features were well-understood, routine, conventional activities previously known to persons of ordinary skill in the art.

### **C. Wireless Device Processors and Receivers**

63. The terms “receiver” and “digital signal processor” refer to well-known and standard components of cell phones. Generally speaking, the term “receiver” refers to a component or circuit that receives the wireless signals that were sent to the phone. Saito, for example, discloses a receiver (“receiving circuit 10”) for receiving the digital music downloaded from the server and delivering it to other components of the phone. (Saito, Ex. 1007, ¶¶ 0019, 0022.)

64. The term “digital signal processing” refers to a broad range of techniques for analyzing or manipulating the information in a signal. Digital signal processors (DSPs) were standard components of prior art cell phones, and off-the-shelf DSPs suitable for cellular phones were available from a number of manufacturers such as Texas Instruments. In the embodiment disclosed in the written description of the Skky patents, the digital signal processor (DSP) 300 shown in Figure 3 is the same processor 300 that performs a number of other functions including monitoring keypresses by the user, receiving sound clips, unpacking and playing back sound clips through a built-in speaker, controlling a voice-driven user interface, “and performance of other auxiliary functions.” (’870, 14:51-63.) As explained in Alan Gatherer, *DSP-Based Architectures for Mobile Communications: Past, Present and Future*, IEEE Communications (Jan. 2000) [Ex. 1011], “[p]rogrammable digital signal processors (DSPs) [were] pervasive in the wireless handset market for digital cellular telephony” (*id.* at p. 84), and a known and increasingly compelling option for implementing a “multimedia processor in the handset.” (*Id.* at p. 87; *see also id.* Fig. 7.)

#### **D. OFDM**

65. The claims of the Skky patents recite the transmission and receipt of data by orthogonal frequency-division multiplex (OFDM). These limitations likewise provide no inventive concept. OFDM refers to a technique for

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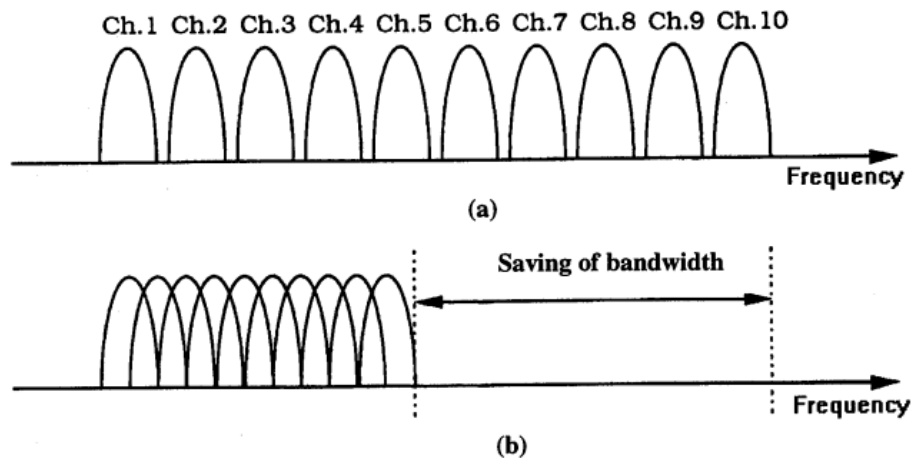
transmitting data that dates back fifty years, long before the Skky patents.

66. OFDM is a particular type of frequency-division multiplexing (“FDM”), which refers to a technique in which discrete signals can be combined within a shared frequency band of a communications medium. Such a shared frequency band can be, for example, the voice band (approximately 300 Hz to 3-4 kHz) or any portion of the radio spectrum used for wireless communication (approximately 3 Hz to 3 THz). The communications medium can be physical (e.g., copper wirelines for traditional telephone connections) or wireless (e.g., electromagnetic spectrum for over-the-air connections).

67. Anyone who has ever tuned into an FM radio station by turning a radio receiver to a particular frequency (e.g. 97.1 MHz) has been exposed to the basic concept of FDM. FDM divides up an available frequency band (characterized by a particular “bandwidth”) into a number of frequency “sub-bands,” sometimes referred to as “sub-channels.” To reduce interference, these sub-bands usually do not overlap. To use the FM radio example above, FM radio stations use a frequency band that ranges from 87.5 to 108 MHz of the radio spectrum. By dividing the available bandwidth into sub-bands, FDM allows multiple signals to be transmitted simultaneously because each sub-band can carry a distinct signal. This is essentially how “frequency division multiplexing” gets its name. FDM was used with the telegraph more than a century ago and continues to

be used in numerous applications including, as noted, radio signals broadcast over the air.

68. OFDM is a more advanced variant of FDM. Because the claims of the Skky patents specify no technical details about OFDM or any OFDM implementation, only a short summary is warranted. In broad overview, OFDM differs from ordinary FDM in that OFDM uses frequency sub-bands that overlap, but are centered at precise intervals and as such, gives rise to the “orthogonal” nature of OFDM. The basic differences are illustrated in Figure 1.10 of Richard Van Nee et al., *OFDM for Wireless Multimedia Communications* (2000) [Ex. 1012] (“Van Nee”):



**Figure 1.10** Concept of OFDM signal: (a) Conventional multicarrier technique, and (b) orthogonal multicarrier modulation technique.

(Van Nee, Fig. 1.10, at 22.) The top portion (a) of Figure 1.10 shows a conventional FDM arrangement in which each signal channel occupies a distinct frequency sub-band. The sub-bands in this example do not overlap, and each sub-

band is separated by what is known as a “guard band,” an unused portion of the bandwidth designed to reduce interference between neighboring channels.

69. The bottom portion (b) of Figure 1.10 shows an OFDM arrangement. As shown, OFDM eliminates the need for a guard band and allows frequency sub-bands to overlap, thus making for a more efficient use of the available bandwidth. The spacing between the center frequency of each sub-band is precisely chosen to create “orthogonality,” a characteristic that reduces interchannel interference notwithstanding the overlapping nature of the sub-bands.

70. OFDM was certainly not an invention of the Skky patents and provides no inventive concept. Patents on OFDM date back almost 50 years to U.S. Patent No. 3,488,445 entitled “Orthogonal Frequency Multiplex Transmission System,” filed in 1966 and issuing in 1970 [**Ex. 1013**]. (*See also* Ex. 1033 (technical paper by the inventor).) OFDM was also deployed in a number of known wireless applications before the applications for the Skky patents were filed. The ubiquitous wireless LAN technology commercially known as “WiFi” used OFDM, which was specified in 1999 for use in the IEEE 802.11a standard. (IEEE Std 802-11a-1999, *Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band* [**Ex. 1036**], at 4 (“This subclause describes the PHY services provided to the IEEE 802.11 wireless LAN MAC by the 5 GHz (bands) OFDM system.”).) As

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explained in Ahmad R.S. Bahai et al., *Multi-Carrier Digital Communications* (1999) [Ex. 1014]: “OFDM has been particularly successful in numerous wireless applications, where its superior performance in multi-path environments is desirable.” (*Id.* at p.14.) Some of the earlier prior art references describing the use of OFDM to wirelessly transmit information include:

- In 1985, the use of OFDM in cellular systems was proposed by L. Cimini in the paper entitled, *Analysis and Simulation of a Digital Mobile Channel Using Orthogonal Frequency Division Multiplexing*, IEEE Trans. Commun., Vol. 33, No. 7, pp. 665-675 (July, 1985) [Ex. 1015].
- In 1991, a similar application of OFDM in a mobile system was proposed by E.F. Casas, *OFDM for Data Communication Over Mobile Radio FM-Channels-Part I: Analysis and Experimental Results*, IEEE Trans. Commun., Vol. 39, No. 5, pp. 783-793 (May 1991) [Ex. 1016].
- In 1993, another wireless OFDM technique was proposed by William D. Warner in *OFDM/FM Frame Synchronization for Mobile Radio Data Communication*, IEEE Transactions on Vehicular Technology, Vol. 42, No. 3, pp. 302-313 (Aug. 1993) [Ex. 1017]. Warner specifically noted that his OFDM technique was attractive because “it can be implemented simply and inexpensively by retrofitting existing FM communication systems.” (*Id.* at p.302.)

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- In 1995, the history of research and development of OFDM and coded OFDM (COFDM) was discussed in William Y. Zou and Yiyan Wu, *COFDM: An Overview*, IEEE Transactions on Broadcasting, Vol. 41, pp. 1-8 (Mar. 1995) [Ex. 1018]. The authors specifically noted that “[a]fter more than thirty years of research and development, orthogonal frequency division multiplexing (OFDM) has been widely implemented in high speed digital communications.” (*Id.* at p. 1.)
- In 1998, the use of OFDM was proposed for satellite communications by W.A.C. Fernando and R.M.A.P. Rajatheva in *Performance of COFDM for LEO Satellite Channels in Global Mobile Communications*, Vehicular Technology Conference, 1998. VTC 98. 48th IEEE Vol. 2, 1503-1507 (1998) [Ex. 1019].
- In 1999, Justin Chuang proposed another OFDM wireless technique in *High-Speed Wireless Data Access Based on Combining EDGE with Wideband OFDM*, IEEE Communications, Vol. 37, No. 11, pp. 92-98 (Nov. 1999) [Ex. 1020], describing a technique in which wireless devices could transmit data using existing EDGE technology, but receive data using wideband OFDM (WOFDM). (*Id.* at pp.93-94.)

71. By the mid-1990s, cell phone companies such as Ericsson, Nokia and Sony were publishing technologies and filing patent applications on ways to use

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OFDM to wirelessly send data over cellular networks. For example:

- Ericsson’s U.S. Patent No. 5,726,978, filed in June 1995 and issuing in March 1998 [**Ex. 1021**], describes use of OFDM in a cellular system. It explains that “OFDM offers several advantages that are desirable in a cellular system.” (*Id.*, 2:38-39.)
- Nokia’s U.S. Patent No. 5,828,650, filed in July 1996 and issuing in October 1998 [**Ex. 1022**], similarly describes the use of OFDM in a cellular system. This patent discloses a technique in which “the signal processing principle based upon orthogonal frequency-division multiplexing (OFDM) may be applied to data transfer between the base station and a terminal device in a cellular network.” (*Id.*, 4:27-30.)
- Sony’s EP 0786890 A2, filed in January 1997 and published in July 1997 [**Ex. 1023**], also describes a technique for using OFDM to wirelessly send and receive data. (*Id.*, at p. 4:7-9, p. 5:28-29.) Sony called this technique “BDMA” and explained that it could “be applied to cellular phones which will be substituted for conventional GSM, PCS, PHS or the like.” (*Id.* at p. 3:20-21, p. 5:28-29.)
- Telia’s WO 1997030531 A1, filed in January 1997 and published in August 1997 [**Ex. 1024**], describes “[t]he use of variable duration guard spaces in OFDM systems” that “has particular application in mobile



telephony, in which a plurality of base stations transmit data to a plurality of mobile stations.” (*Id.* at p. 3:18-19, p. 9:15-17.) Telia specifically noted that “[t]he design and implementation of OFDM systems [were] well known to those skilled in the art of telecommunications.” (*Id.* at p. 9:27-29.)

72. These are just a few examples of prior art references that described use of OFDM for wireless applications. The feature of transmitting digital audio or visual files to a cell phone using OFDM provides no inventive concept.

#### **E. Streaming Digital Content**

73. Certain claims of the Skky patents also recite the step of providing a “streaming” transmission of digital content to a cell phone. This feature likewise provides no inventive concept.

74. The term “streaming” generally refers to a process in which digital content is presented to a user as it is being received by the device. If “streamed” digital content is an audio recording, for example, the audio content could be played for the user as is being received by the device. Streaming is generally distinguishable from other techniques in which the delivery must be completed before playback of the content may commence.

75. Streaming was certainly not an invention of the Skky patents, and was common by the late 1990s. For example, as explained in the Background section

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of U.S. Patent No. 6,711,622 to Michael J. Fuller et al. (“Fuller”) [Ex. 1037], filed  
on December 31, 1997:

Streaming audio and video, as a subset of all the types of audio and  
video that can be transmitted over the Internet, allow people to  
broadcast long and/or live video and audio transmissions across the  
Internet. Streaming video and audio is video and audio digital data  
that is transmitted on a continuous basis. A client can access the data  
stream and regenerate the video images and audio signal as they are  
being transmitted.

(*Id.*, 1:48-55.) Fuller identifies a number of then-existing streaming technologies  
including RealNetworks and MBone. (*Id.*, 1:61-2:33.)

76. It was also known that streaming content could be delivered to  
wireless devices such as cell phones. For example, U.S. Patent No. 7,065,342  
(“Rolf”), entitled “System and Mobile Cellular Telephone Device for Playing  
Recorded Music,” expressly teaches use of streaming technology in a cellular  
network to transmit encoded music. Rolf explains that “a user of the cellular  
telephone (for example) may use the telephone to establish a wireless  
communications link ..., and then wirelessly download one or more selected music  
recordings for storage in a memory of the cellular telephone. In particular, the  
selected music recording(s) is/are transmitted via a wireless data communications  
link to the cellular telephone.” (Rolf, Ex. 1010, at 1:28-35.) Rolf also explains

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that the compressed music recording “need not be fully stored” within the cell phone, but rather could be “streamed” to the cell phone via the communications link. (*Id.* at 6:20-26.)

77. As another example, U.S. Patent No. 7,187,947 to Russell W. White (“White”) [Ex. 1039], filed on March 28, 2000, discloses a system and method for transmitting selected digital content to a wireless device. Like Rolf discussed above, White explains that selected audio information can be streamed wirelessly to an electronic device such as a cell phone. (White, 8:32-36 (“The information may include audio information such as MP3’s, streaming audio, streaming, Internet broadcasts, etc. selectable by a user and operable to be wirelessly communicated to an electronic device.”).) Streaming transmission of digital audio or visual files was therefore not an inventive concept.

**F. Computerized Rights Management**

78. Certain claims of the Skky patents recite limitations relating to recording data about digital media files downloaded to the cellular phone, and providing rights data for determination of royalty payments. These claims do not appear to recite any particular technology or approach for recording downloads or data or providing rights management data.

79. It was a long-standing practice to monitor broadcasting content to facilitate the payment of royalties to copyright owners such as musical artists. As

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explained in the Background section of U.S. Patent No. 4,843,562 to Stephen C. Kenyon et al. (“Kenyon”) [Ex. 1025], published more than 10 years before the alleged invention, “[i]t is known that broadcast stations (television and radio) are regularly monitored to determine when and how often certain information is broadcast. For example, artists may be paid a royalty rate depending upon how often their particular work is broadcast.” (*Id.*, 1:12-16.) Kenyon explains that although such monitoring was traditionally performed manually (*id.*, 1:29-33), by the time of its filing in 1987 “several techniques and systems [had] been developed which electronically monitor broadcast signals and provide information relative to the content and timing of the program monitored.” (*Id.*, 1:47-50.) One well-known computerized service for tracking radio and television broadcasts was called Broadcast Data Systems (BDS). As explained in Tom McCourt et al., *SoundScan and the Consolidation of Control in the Popular Music Industry*, Media, Culture & Society (1997) (“Mccourt”) [Ex. 1026]:

This system scrap[ped] *Billboard’s* traditional method of determining overall airplay by placing weekly calls to selected stations. Instead, records and commercials are played into the system’s computer, which creates a digital ‘fingerprint’ of each selection. These are downloaded to BDS electronic monitors in each market, which log the ‘fingerprint’ when the recording or commercial is aired on a monitored station.

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(*Id.*, at p. 206.) By 1997, the BDS system was used to “monitor[] 800 radio and 515 television stations in 85 markets across the country, as well as 50 radio and music television stations in Great Britain.” (*Id.*) Data recorded by BDS was also being provided to performance-rights organizations such as ASCAP for determination of royalty payments. (How You Get Paid at ASCAP [Ex. 1027], at p. 2 (“ASCAP uses more BDS information than any other performing rights organization”).)

80. In addition to broadcasts, computer technologies were widely used to track sales of copyrighted materials. McCourt describes one such technology known as “SoundScan,” which “employs computerized point-of-purchase technology that has proved successful for tracking sales in the clothing and grocery industries. Whenever a customer makes a purchase at a store equipped with SoundScan, the sales clerk scans the bar code on the album, CD or cassette. Information about the purchase is entered automatically into a database accessible to SoundScan headquarters.” (Mccourt, Ex. 1026, at p. 203.) By the time of McCourt’s publication in 1997, “[c]omputerized point-of-sale information [] account[ted] for all of *Billboard’s* charts, and point-of-sale information [was] used to track both albums and singles in virtually every musical genre.” (*Id.*, at p. 208.)

81. By the time of the alleged invention, the use of computerized tracking techniques by music websites was also conventional. To take one example,

EMusic.com – one of the “top five music content websites as measured by unique visitors in June 2000” – employed a “database management system that indexes, retrieves and manipulates [its] growing multimedia content,” and thus allows EMusic to “track user preferences to enable effective marketing programs and maintain an efficient royalty accounting program.” (EMusic.com, Inc. 10-K Report for the Fiscal Year Ended June 30, 2000 [Ex. 1028], at pp. 2, 5.)

82. A similar “sales sub-system” was disclosed in WO 2000/043904 A1 to Bernard Fritsch (“Fritsch”) [Ex. 1029], published in July 2000. (*Id.*, p.8, ln. 21.) Fritsch explains that the sales sub-system “maintains a record on a computer database (or the like) of all the purchases ever made by the user. . . . The sub-system permits the rights holders to access the web page of the computer system and determine what royalties they have generated.” (*Id.*, p. 8, ll. 21-26.) Accordingly, the recitation of rights management using computer technologies does not provide any inventive concept.

#### **G. Optimization of Digital Content Files**

83. Claims 3 and 6 of the '956 patent recite an additional step of “optimizing the digital audio and/or visual file according to an optimization scheme.” These claims do not recite a particular type of optimization, nor do they specify any details about how the optimization is to be achieved. These features, as with the other features addressed above, borrow from the existing technologies.

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84. It was well-known to persons of ordinary skill in the art that digital content can be optimized to enhance their perceived quality in the face of real-world constraints. For example, an audio file containing a musical song may include defects that hamper the quality of the audio as perceived by the listener. As explained in U.S. Patent No. 6,560,577 to Jay G. Gilbert et al. (filed Mar. 2000) (“Gilbert”) [Ex. 1055], “[s]uch defects may arise from the reproduction of the information on the analog medium and may include scratch noises, clicks, pops, hissing, etc.” (*Id.*, 4:15-18.) Gilbert explains that “techniques to identify and compensate for certain defects” were “well known in the art” (*id.*, 4:18-20):

These techniques include searching for certain values of the digital audio information that are beyond a normal range to identify and correct specific audio defects. Other techniques include: applying high-pass filters to remove low frequency noise, normalizing extreme or inconsistent volume levels to an average value, adjusting the playback pitch, and comparing adjacent data to adjust inconsistent values (i.e., removing blips by averaging the values of adjacent data in a linear fashion).

(*Id.*, 4:20-29.)

85. Similarly, compression can create a tension between (a) reducing the amount of storage or bandwidth required to store or transmit audio content, and (b) the quality of the compressed audio content as perceived by the user. Generally speaking, increasing the reduction achieved by audio compression can reduce the

quality of the audio signals. One of the key considerations in any system that handles digital audio, therefore, is to apply optimization techniques to achieve a desirable balance between performance and audio quality.

86. The Hacker reference discussed above specifically discusses optimization techniques in the context of compression. (*See* Ex. 1006 at p.161 (“Pre-encoding optimizations”).) Hacker explains how to “optimize the quality” of compressed MP3 files (*id.*), and further explains particular techniques and tools for achieving such optimization including normalization, sampling, resampling, bitrates, etc. (*Id.* at pp.163-170.) There is simply nothing about optimizing digital audio and/or visual files that provides an inventive concept.

## **H. Conclusion**

87. As my foregoing discussion illustrates, the features described above, individually and in combination, provide no inventive concept. These features instead describe activities and technologies that were well-understood, routine, and conventional to persons of ordinary skill in the art. As I explained above, storage and transmission of digital media files, cellular phones and delivery of digital content to cell phones, receivers and DSPs, the use of OFDM for wireless data delivery, streaming, computerized rights management, and optimization of digital audio files, were all known and in the prior art well before the date of the alleged invention in the Skky patents. The claims simply recite the use of such techniques



to facilitate digital content storage, selection, and delivery.

## **VII. OPINIONS REGARDING WHAT THE INVENTOR “REGARDS” AS THE INVENTION**

88. The independent claims in the Skky patents generally recite the ability to transmit digital media files using OFDM. (*E.g.*, '870, claim 1 (“the transmission of the digital media files over the cellular network by orthogonal frequency-division multiplex modulation to the cellular phone”), '956, claim 1 (“cell phone including a receiver and digital signal processor configured for receiving and processing files transmitted by orthogonal frequency-division multiplex modulation”), '310, claim 1 (“said cellular phone including a receiver and a digital signal processor configured for receiving and processing data files transmitted by orthogonal frequency-division multiplex modulation”), '810, claim 1 (“the wireless device including a digital signal processor and a receiver configured for the handling of digital media transmitted by orthogonal frequency-division multiplex modulation”) (underlining added).) I have also been asked to provide my opinion, with respect to the OFDM limitations in the Skky patents, whether the claims reflect what the inventor regarded as his invention. In my opinion, the answer to this question is “no.”

89. I am informed by counsel that a patent specification must conclude with one or more claims particularly pointing out and distinctly claiming the

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subject matter which the inventor regards as the invention. I am informed that where it would be apparent to one of skill in the art that the invention set forth in a claim is not what the patentee regarded as his invention, the claim is invalid. I am informed by counsel that this determination can be made based on the specification and statements made by the applicants during prosecution of the patent.

90. As I explained in **Section V.C** above, I am informed by counsel that the claims of the Skky patents under their broadest reasonable construction are not limited to use of OFDM for transmission over an audio channel, and cover use of OFDM for cellular data channels. But during the prosecution of the Skky patents, as I noted in **Section V.B**, inventor Robert Freidson submitted a declaration under 37 C.F.R. § 1.132 (“Freidson Declaration”) [**Ex. 1033**] explaining why he believed his alleged invention to be patentable over the prior art. In that Declaration, Mr. Freidson made clear what he regarded as his alleged invention:

In one aspect, my inventive method employed OFDM teachings as a method for data transmission over an audio channel of a wireless cell phone. In another aspect, I have developed a method for rich media delivery over a data channel of a wireless phone that doesn’t employ OFDM.

(Freidson Decl. ¶ 7 (emphasis added); *see also* 08/05/2008 Amendment and Response, Ex. 1034, at 5 (applicants’ remarks mirroring Freidson’s declaration).)

91. Mr. Freidson’s declaration goes on to describe efforts to develop

OFDM for wireless delivery over an *audio* channel, but never suggests that those techniques were intended for use with a *data* channel or a digital cellular connection. (Freidson Decl. ¶¶ 8-14.) The applicants clearly regarded their invention as using OFDM for conversion of data into audio signals for transmission over an audio channel, *i.e.*, not a cellular data channel.

92. The clear dichotomy between the “audio channel” and “data channel” of a wireless phone, and the use of OFDM only with the audio channel, is also reflected in the written description. The discussion of OFDM appears entirely in a section entitled, “Method for Data Transmission Over an Audio Channel

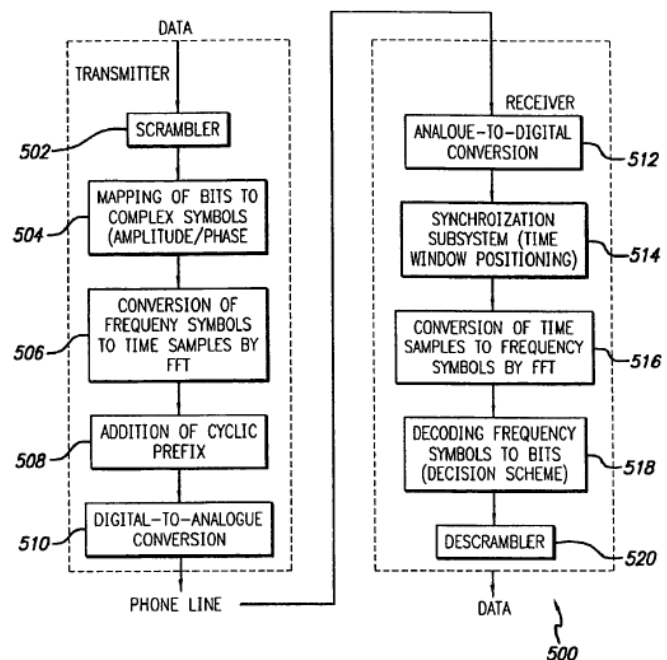


FIG. 5

of a Wireless Telephone.” (’870, 16:29-30.) That section describes a “data transmission method **500**” using OFDM. (’870, 16:31-34, 16:57-58.) As shown in Fig. 5 (reproduced above), the OFDM signal is transmitted over a phone line to the receiving telephone, which processes the signal to recover the original data (beginning at step **512**). (’870, 16:37-46.) The Skky patents refer to the recovery of original data (e.g., music encoded in MP3) from the OFDM signal as

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“demodulation,” and teaches a digital signal processor (DSP) **300** for performing this task. ('870, 18:38-42.)

93. But the specification also makes clear that this method of using OFDM (**500**) is for transferring data “based on a voice mode connection,” which is explicitly distinguished from a “data mode.” ('870, 16:31-33 (emphasis added).) In fact, the specification prefaces the discussion of OFDM by calling it a “special method and algorithm to map digits to sounds.” ('870, 16:23-25 (emphasis added).) The disclosed OFDM technique, in other words, is employed to convert digital data into a “special sequence of sounds modulates” ('870, 18:28-30) used to generate “actual sounds” ('870, 18:30-33), which are sent over the cell phone’s audio channel “much like voice sounds are transferred during a normal phone conversation.” ('870, 18:33-36.) Because a voice channel is used, the patent expressly recognizes that the disclosed OFDM method (**500**) could also be implemented using an ordinary landline. ('870, 16:34-36; *see also id.* 16:25-28.)

94. In stark contrast, the specification nowhere describes the use of OFDM with data channels. For example, the specification explains in detail how the supported voice bandwidth of an audio channel can be divided into multiple sub-channels according to OFDM techniques ('870, 17:1-16), but fails to mention how such techniques can be applied to a different bandwidth allocated to data channels in a cellular system. The specification also never suggests that OFDM

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can be used as a multiple-access scheme, an essential feature of modern digital cellular networks, including LTE, that allows bandwidth allocated to data channels to be shared among multiple users. For example, the specification does not explain the minimum or maximum bandwidth assigned to each user and how to allocate particular sub-channels to individual users. More fundamentally, the specification does not describe a cellular system capable of determining how and when a cell phone is allowed access to the shared data bandwidth. This is because the disclosed OFDM techniques divide up the *voice band of an audio channel* established by existing cellular and wireline networks for connecting a single user to the media source. Based on the lack of explanation for how OFDM is to be applied in the context of cellular data channels notwithstanding the technical differences between data channels and audio channels, it would have been apparent to one of ordinary skill in the art that the inventors did not regard the use of OFDM with cellular data channels as their invention.

95. Indeed, a later section of the patent, entitled “Example Using Digital Cellular Network and Cellular Telephone,” makes clear that the disclosed OFDM technique is not used with cellular data channels. Specifically, when describing data transmission “in the context of digital (capable of providing a dedicated data transmission channel) cellular network,” the specification states: “Since in this case a digital channel is used for sound clip data transmission, no modulation [sic] is

required on the mobile phone side.” (’870, 19:51-58 (emphasis added).) One of ordinary skill in the art would have understood the “modulation” on the mobile phone side to be a typo for “demodulation,” which, as discussed above, is used in the patent to describe recovery of original data from an OFDM signal at the receiver. (See ’870, 18:36-42.) In any event, because OFDM demodulation is not used for receiving data signals sent over a cellular data channel, it follows that those signals were never “modulated” using OFDM in the first instance.

96. In fact, a person of ordinary skill in the art would have understood that it makes no sense whatsoever to apply the OFDM technique as used to “map digits to sounds” in the patent to a *data* channel. (’870, 16:23-25, 19:55-58.) Because a wireless data channel can transmit and receive data in digital form, employing OFDM in converting digital information into audio (analog) signals as described in the patent serves no purpose.

97. The written description of the Skky patents and the Freidson Declaration also reject the use of OFDM with a cellular data channel. (’870, 19:51-58; Freidson Decl., Ex. 1033, ¶ 7.) I have been informed by counsel that it may be argued that these statements were not intended to be limiting with respect to the scope of the invention, and accordingly, would not demonstrate to persons of ordinary skill in the art that the inventors regarded the use of OFDM with a cellular data channel to be categorically outside the scope of their invention. But in my

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opinion, this argument relies on a strained interpretation of those statements. It would be odd, to say the least, that an inventor would declare “employ[ing] OFDM teachings as a method for data transmission over an *audio channel* of a wireless cell phone,” and in the very next sentence, specifically call out “delivery over a *data channel* of a wireless phone that doesn’t employ OFDM” as aspects of his invention if the inventor regarded the use of OFDM with a cellular data channel to be a part of the overall invention. (Freidson Decl. ¶ 7 (emphasis added).) This also cannot be squared with the specification stating that OFDM is not required “since” a data channel is used, and instead teaching the use of “a modulation protocol compatible with the protocol supported by the cellular network provider” (’870, 19:51-60 (emphasis added)), when, as previously alleged by Patent Owner’s own expert, “OFDM was not implemented in a mobile cellular network until December 2008—7 years after the [’870] invention” (Ex. 1035, ¶ 105). Accordingly, these statements from the specification and the Freidson Declaration, viewed in light of the technical differences between OFDM used with audio channels and OFDM used with data channels, would have left no doubt in the mind of a person of ordinary skill in the art that the inventors regarded as their invention the use of OFDM with an audio channel and not the use of OFDM with a cellular data channel.

98. For these reasons, it would have been apparent to a person of ordinary

skill in the art that the inventors regarded as their invention the use of OFDM with an audio channel and not the use of OFDM with a cellular data channel.

### **VIII. OPINIONS REGARDING WHETHER THE INVENTOR HAD POSSESSION OF THE INVENTION**

99. I have also been asked to provide my opinion as to whether claims 1-14 are adequately supported by the written description. In my opinion, the answer to this question is “no.”

100. I am informed that a patent claim is invalid if the patent fails to provide adequate written description. I am informed by counsel that to satisfy the written description requirement, the disclosure of the specification must sufficiently describe an invention understandable to a person of ordinary skill in the art and show that, as of the filing date sought, the inventor was in possession of *the invention*. I am informed by counsel that *the invention* is, for purposes of the written description inquiry, whatever is claimed. I am further informed by counsel that the description must do more than merely disclose what would render the claimed invention obvious. As explained below, in my opinion, the '870 specification does not meet this requirement because it does not show that the inventors actually invented the broadly claimed use of OFDM.

101. As I explained in **Section V.C** above, I am informed by counsel that the Skky patents under their broadest reasonable construction are not limited to use



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of OFDM for transmission over an audio channel, and cover use of OFDM for cellular data channels. That is, the claims under their broadest reasonable construction refer to OFDM generically and cover its use with or without an audio channel, notwithstanding that the specification describes only the use of OFDM with an audio channel. As I discussed in detail in **Section VII** above, the specification never mentions applying OFDM techniques to bandwidth allocated to cellular data channels or using OFDM as a multiple-access scheme, notwithstanding the technical differences between data channels and audio channels. (*See Section IV.D.*) In fact, the written description of the Skky patents affirmatively states that OFDM modulation is not used where transmission occurs over a data channel rather than an audio channel. ('870, 19:53-61 (“[I]n the context of digital (capable of providing a dedicated data transmission channel) cellular network. Since in this case a digital channel is used for sound clip data transmission, no modulation [sic] is required on the mobile phone side.”).)

102. Under these circumstances, a person of ordinary skill would not reasonably read the written description as describing a larger invention, of which the use of OFDM with an audio channel was merely a preferred embodiment. And one of ordinary skill in the art would not understand that the inventor had possession of the full scope of the claimed subject matter at the time of filing. Thus, one of ordinary skill in the art would not understand that the inventor had

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possession of the claimed subject matter, which includes the use of OFDM with data channels, at the time of filing.

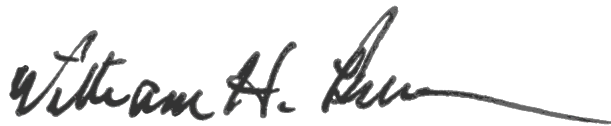
**IX. CONCLUSION**

103. In signing this Declaration, I recognize that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in this proceeding. If required, I will appear for cross-examination at the appropriate time. I reserve the right to offer opinions relevant to the invalidity of the Skky patent claims at issue and/or offer testimony in support of this Declaration.

104. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.

Dated: October 13, 2016

Respectfully submitted,

A handwritten signature in black ink, appearing to read "William H. Beckmann", with a long horizontal flourish extending to the right.

William H. Beckmann, Ph.D.

# EXHIBIT A

# William H. Beckmann, Ph.D.

## Curriculum Vitae

### Professional Summary

Dr. Beckmann has over thirty-five years of academic and industry experience focused in the fields of communications networks and information technology. He has been responsible for managing and solving business and technical issues in these fields. Dr. Beckmann is an expert in all aspects of broadband network and software technologies and their implementation into advanced communications networks (wireline and wireless). He has had experience in strategic planning, marketing, business development, technical development, deployment, and management of these technologies and networks.

### Expertise

- Advanced Intelligent Networks
- Broadband Communications
- Digital Networking Technologies
- Digital Video Systems
- Distributed Processing Systems
- Messaging Systems (Wireless & Wireline)
- Public Networks, VPNs, Operations/Control
- Software Design & Architecture

### Education

<u>Year</u>	<u>College or University</u>	<u>Degree</u>
1977	Cornell University	Ph.D., Mathematics
1974	Cornell University	M.S., Mathematics
1972	Davidson College	B.S., <i>Summa cum Laude</i> , Mathematics

### Professional Experience

From: 1999  
To: Present  
Organization: Networking Computing Associates  
Title: President and Co-Founder  
Summary: Network Computing Associates (NCA) is a consulting firm that provides expertise to companies and organizations in making or executing decisions that involve network and information technologies and their integration into the company's business processes. NCA Clientele includes:

- Bain Capital, Boston, MA

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- Big Think, New York, NY
- Burst.com, San Francisco, CA
- Deutsche Bank, New York, NY
- Federal Communications Commission, Washington, DC
- General Electric, Fairfield, CT
- Heckler & O'Keefe, CPAs, Armonk, NY
- IBM, Somers, NY
- Lucent Technologies, Inc., Murray Hill, NJ
- Sorceron, New York, NY
- Zoologic, New York, NY

From: 1995

To: 1999

Organization: IBM Corporation

Title: Global Vice President

Summary: Dr. Beckmann was responsible for broadband digital solutions and marketing, sales, deployment and development of digital video systems. In 1997, he headed the team that constructed the IBM corporate strategy for digital broadband systems and services. Accomplishments include:

- Took a digital video development level project into a global sales & distribution project known as Video Enabled Solutions (VES), with sales teams and support groups throughout the world. VES tied together teams in IBM Global Services, IBM's Systems Integration Division with the IBM Telecommunications & Media sales division. This project included development and sales of the IBM Media Streamer, a Unix-based server that could concurrently stream hundreds of digital broadband channels over cable or DSL transmission systems; and implementation and deployment of this server into a full digital network infrastructure, including operational and management support systems and integration of those systems with other similar systems that the customer may have already installed. A digital messaging system (wireline version of today's SMS system) was integrated into the broadband network. Total new revenues for IBM from 1996 to 1998 exceeded \$120M.
- The Digital Broadband Strategy, presented to IBM's Chief Technology Council in 1997, addressed how every one of IBM's product, sales, and development groups should approach and assess arising broadband opportunities, and what those opportunities were likely to be. The strategy proposed what alliances IBM should seek and what new lines of business IBM should consider pursuing. The strategy covered all of IBM's technologies, from microelectronics through servers, software, and database and storage systems.

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From: 1989  
To: 1995  
Organization: Ameritech  
Title: Manager and Director in Corporate Strategy  
Summary: Dr. Beckmann had responsibilities in development and deployment of advanced information technologies and multimedia systems. He was the lead in corporate strategy for the merger of five information, accounting, and billing systems of Ameritech's Bell Operating Companies into a single networked system. This effort consolidated Ameritech's various databases, CSR systems, and billing system that were spread out over the five Bell Operating Companies that comprised Ameritech, into a single comprehensive, integrated system. This involved geographical consolidation as well as software & IT consolidation for systems that were mission-critical and 24/7.

To achieve this required:

- Creation of a hot standby system that fully duplicated the data in the existing system in real time.
- Implementation of a high-speed network architecture linking the dispersed systems: the geographical consolidation was initially virtually enabled by this high-speed networking. This network also fed the standby system.
- Development of an intermediate layer of software that allowed the legacy system software to run as always and permitted insertion of a new interface software layer that made CSR and other agent system interactions consistent and uniform throughout the RBOC service area. This software layer was object-oriented and represented the largest OO software deployment in the country at that time (1989/1990).

As an enhancement to its voice and data transport services, Ameritech considered moving into application transport services that required higher bandwidth: these applications were multimedia in nature. In particular, Ameritech was interested in services that could successfully compete with cable services. This required identification of potential sources of these services: broadcast services, such as those carried by cable, were not legally permitted for the RBOCs. To identify and attract such sources as well as to specify the requirements for the digital content, from a source perspective as well as from a consumer perspective, necessitated execution of the following technical program:

- Analysis of network transmission capabilities applied to actual subscriber loop data (1991 - 1992)
- Mapping of MPEG requirements to ADSL-based and SONET-based benchmarks (1990 – 1992)
- Design of network management systems for support and management of

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broadband services

- Trial and Comparison of Fiber-to-the-Home and ADSL delivery of Video-on-Demand and Interactive Video Applications (Geneva Lakes WI, 1992)

From: 1984  
To: 1989  
Organization: Bell Communications Research (Bellcore)  
Title: Manager  
Summary: Dr. Beckmann was responsible for integration architectures of ISDN and Advanced Intelligent Networks (AIN) and for design of multimedia network systems (including broadband networks). This work encompassed technology, service, and business issues. Special areas of focus included: (1) remote management, operations, and programming of network nodes (switches, digital cross-connect systems, and data base management systems), software languages and interfaces for such remote systems, and uniform operational and management interfaces to multi-vendor environments; and (2) assessment and, where appropriate, migration of AIN design templates to ISDN and BISDN configurations.

Dr. Beckmann also served as the Bellcore graduate school recruiter in electrical engineering and computer science at the University of Southern California.

From: 1980  
To: 1984  
Organization: Bell Telephone Laboratories (BTL)  
Title: Manager (1983-1984) and Member of Technical Staff (1980-1983)  
Summary: During his time at Bell Labs, Dr. Beckmann was responsible for:

- Queuing theoretical analysis and algorithmic development for automatic call distribution systems, including operator services systems
- System design and development (as the lead systems engineer) of a Fast Packet Switching system that digitized and packetized voice and multiplexed and switched voice and data traffic (predecessor of ATM technology)
- Creation and management of a group responsible for systems integration of packet-switched data networks with voice networks

From: 1982  
To: 1982  
Organization: Rensselaer Polytechnic Institute  
Title: Adjunct Professor of Electrical Engineering

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**Curriculum Vitae**

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From: 1979  
To: 1980  
Organization: Middlebury College  
Title: Assistant Professor of Mathematics and Computer Science and Mellon Fellow

From: 1977  
To: 1979  
Organization: Middlebury College  
Title: Assistant Professor and Mellon Fellow

From: 1978  
To: 1979  
Organization: Harvard School of Public Health/Harvard Medical School  
Title: Adjunct Professor of Mathematics in the Medical Sciences

From: 1976  
To: 1977  
Organization: Cornell University  
Title: Instructor in Mathematics

From: 1972  
To: 1976  
Organization: Cornell University  
Title: National Science Foundation Graduate Fellow

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**Consulting Experience**

From: 2012  
To: 2016  
Organization: International Consortium on Cybersecurity in International Financial Transactions  
Summary: Headed technology group on employing TLS with coded TCP over OFDM channels (both RF and wireline). Examined techniques for utilizing time-dependent modified modulation per subcarrier to enhance security.

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From: 2005  
To: 2006  
Organization: British Telecom  
Summary: Business and technical consulting on engineering and deployment for high-speed access to data communications networks (including Internet access) and integration with wireless access methods, especially employing OFDM with various modulation methods.

From: 2006  
To: 2006  
Organization: Steptoe & Johnson  
Summary: Provided technical consulting in Vonage v. Verizon

From: 2001  
To: 2003  
Organization: Federal Communications Commission  
Summary: Technology consulting and tutorials on digital modulation techniques including QAM with OFDM, and support tools (e.g., FFT and IFFT)

From: 1999  
To: 2000  
Organization: Federal Communications Commission  
Summary: Technology and Business consulting on Broadband and Wireless systems

From: 1995  
To: 1996  
Organization: British Telecom  
Summary: Business and technical consulting on engineering and deployment of ADSL and fiber systems, including switching and transmission facilities and information technology, and the underlying network management infrastructure

From: 1992  
To: 1993  
Organization: Ameritech Development Corporation  
Summary: Provided technical and business due diligence analysis and report regarding ADSL and Amati Communications

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**Curriculum Vitae**

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### **Professional Affiliations**

- Member, AAAS (American Association for the Advancement of Science)
- Member, ACM (Association of Computing Machinery)
- Member, AMS (American Mathematical Society)
- Member, IEEE (Institute of Electrical and Electronics Engineers)
- Member, MAA (Mathematical Association of America)

### **Patents & Publications**

<u>Patent</u>	<u>Date Issued</u>	<u>Description</u>
6,675,388	01/06/2004	Data distribution system using coordinated analog and digital streams
7,769,662	08/03/2010	Tax deduction revaluation system
7,788,212	08/31/2010	System and method for personalization implemented on multiple networks and multiple interfaces

### **Presentations**

#### **Related to Broadband Wireline and xDSL Technologies**

1. Panel Member, IEEE Conference on Digital Subscriber Line (DSL) Technologies, San Jose (1992)
2. "Asymmetric Switching Requirements in Digital Switching Systems Generated by ADSL Deployment," invited address at AT&T Conference on Advanced Switching System Technologies, Chicago (1991)
3. "Issues in Preparing for ADSL and HDSL Implementation," talk presented to Regional Bell Operating Company (RBOC) engineers, Chicago (September 1989)
4. "Impact of Digital Processing Requirements for ADSL Deployment in the Intelligent Network," talk presented to Bellcore (September 1988)

#### **Related to General Broadband Technologies and Voice/Data Integration Technologies**

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1. "Comparison of High Definition Video Alternatives within IP Networks," Joint presentation with Dr. Michael Haley to IETF reviewing Internet-2 (1997)
  2. "Management and Operations in a Network Supporting Voice, Data, and Video," Presentation to STET and Telecom Italia, Rome (1996)
  3. "FDDI and ATM Network Comparisons and Interfaces," Invited Presentation to Digital Equipment Corporation, Boston (1990)
  4. Keynote Address on Digital communications systems and applications at the IEEE International Conference on Digital Communications, Stuttgart (1988)
  5. Presentation on "Digital Broadband Networks and Multimedia Applications" at International ISDN Conference in London (1987)
  6. "Recommendation for Protocol Headers in Voice Packets," Presentation to Study Group XVIII, CCITT, Geneva (September 1983)
  7. "Transport of Voice Streams in an X.25 Network," Presentation to JWG (Study Group VII/XI), CCITT, Washington (June 1983)

#### Articles and Memoranda

1. "Business and Technical Analysis of Proposed Ethernet Network and IEEE 802.6 Extensions through a WAN," consulting memo for Lucent Technologies (November 1999)
  2. "Decisions, Decisions: Digital data broadcasting can provide new revenue streams for telcos, cable companies and DBS service providers," *Telephony* (October 1997)
  3. "Online Data Base Systems Using Broadband Networks to Displace Storage Devices," Joint technical memorandum (IBM) with Dr. Ahmed Tantawy (1996)
  4. "Stochastic Comparison of Trellis Encoding Parameters," Technical Memorandum (written at Bell Labs, published in Bellcore) (1985)
  5. "Performance Analysis of Alternatives in Interconnection of Optical Core Switching Matrices," Technical Memorandum, Bell Telephone Laboratories (1983)
  6. "Modifying Banyan Switches to Emulate StarLite Switching Functionality," Technical Memorandum, Bell Telephone Laboratories (1982)
  7. "High Density Wave Division Multiplexing in Optical Fiber Transmission and Switching Systems: A Mathematical Model," Technical Memorandum, Bell Telephone Laboratories (1982)
  8. "Burst Switching and Jitter in Packetized Voice," Technical Memorandum, Bell Telephone Laboratories (1982)
  9. "A Mathematical Model for Discrete Embedding and Extraction of Waveforms," Technical Memorandum (Bell Telephone Laboratories), 1982
  10. "Buffer Caching Requirements in a Packetized Voice Network," Technical Memorandum, Bell Telephone Laboratories (1981)
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11. "Synchronizing Packet Streams over a Multi-Routing Packet Network," Technical Memorandum, Bell Telephone Laboratories (1981)

Other

1. Co-host, IEEE Globecom "Communications for the Information Age," Hollywood, FL (1988)