Exhibit 5

[PUBLIC VERSION - REDACTED]

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8

9   UNITED STATES DISTRICT COURT

10   NORTHERN DISTRICT OF CALIFORNIA

11   OAKLAND DIVISION

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13	**THE APPLE iPOD iTUNES ANTI-TRUST LITIGATION.**	**Lead Case No. C 05-00037 YGR**
14		
15	This Document Relates To:	**[CLASS ACTION]**
16	ALL ACTIONS	
17		**EXPERT REPORT OF DR. JOHN P. J. KELLY**
18		
19		**CONFIDENTIAL ATTORNEYS EYES ONLY**
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I. Introduction

I, Dr. John P. J. Kelly, declare as follows:

1. I have been retained by counsel for Apple Inc. ("Apple"), to provide assistance in the above-captioned case. I am the principal of Kelly Computing, Inc. (d/b/a Kelly Technology Group), 830 Park Lane, Santa Barbara, CA 93108.

A. BACKGROUND

2. I previously submitted a declaration in this matter: Declaration of Dr. John P. J. Kelly In Support of Defendant's Renewed Motion For Summary Judgment (hereinafter the "Kelly Declaration"). I have described my background and qualifications in the Kelly Declaration. Attached hereto as Exhibit A is a true and correct copy of my Curriculum Vitae.

3. A listing of testimony that I have provided in the last four years and my compensation is attached hereto as Exhibit B. I am being compensated for my time spent in connection with this case. I have no financial interest in the outcome of this case.

B. ASSIGNMENT

4. Counsel for Apple asked me to examine (1) the changes made to Apple's FairPlay DRM technology introduced through iTunes 4.7, ███████████████████████ and analyze (i) whether those changes made FairPlay less susceptible to attack and (ii) why they blocked RealNetworks' Harmony technology; (2) ████████████████████████ ████████ (3) the risks that third-party applications like RealPlayer with Harmony, Winamp and others created for the proper operation of the iPod and iTunes; and (4) what it would

entail for Apple to ensure that RealPlayer with Harmony technology would continue to work in light of the changes to FairPlay including those in iTunes 4.7. In addition, counsel for Apple asked me to evaluate and respond to the opinions set forth the in the Declaration Of David F. Martin In Support Of Plaintiffs' Opposition To Apple's Motion For Summary Judgment and Expert Report of David M. Martin.

5.   I considered the following materials in preparing this declaration:

- Source code and change logs for FairPlay included in iTunes 4.5.0, 4.6.0, 4.7.0, 4.7.1, 4.8.0, 4.9.0, 5.0.0, 5.0.1;

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- Technical descriptions of FairPlay;

- Source code for iTunes 4.5.0, 4.6.0, 4.7.0, 4.7.1, 4.8.0, 4.9.0, 5.0.0, 5.0.1, 6.0.0, 6.0.1, 6.0.2, 6.0.3, 6.0.4, 6.0.5, 7.0.0, 7.0.1, 7.0.2, 7.1.0, 7.1.1, 7.2.0, 7.3.0, 7.3.1, 7.3.2, 7.4.0;

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- Source code for versions 1.1.4 and 1.1.5 of the firmware for the iPod shuffle 1st generation (Q98), versions 1.0.1, 1.0.2, 1.0.3 and 1.0.4 of the firmware for the

iPod shuffle 2nd generation (N98), and versions 1.0 and 1.0.1 of the firmware for

the iPod shuffle 3rd generation (D98);

- Declaration of Jeffrey Robbin in Support of Defendant's Motion to Dismiss or in The Alternative Motion For Summary Judgment dated February 11, 2010;

- Declaration of Jeffrey Robbin in Support of Defendant's Renewed Motion For Summary Judgment ("Robbin Decl.");

- Declaration of Augustin Farrugia in Support of Defendant's Renewed Motion For Summary Judgment ("Farrugia Decl.");

- Supplemental Declaration of Augustin Farrugia dated July 2, 2013 ("Farrugia Suppl. Decl.");

- Deposition Of Jeffrey L. Robbin On Behalf Of Apple, Inc., December 3, 2010 ("Robbin Dep. Tr."); Deposition Of David K. Heller On Behalf Of Apple, Inc., December 15, 2010 ("Heller Dep. Tr."); Deposition Of Augustin J. Farrugia On Behalf Of Apple, Inc., December 8, 2010 ("Farrugia Dep. Tr.");

- Discussion with Dave Heller on 02/17/2011;

- Discussion with Augustin Farrugia and G.P. Fasoli on 02/17/2011;

- Declaration Of David F. Martin In Support Of Plaintiffs' Opposition To Apple's Motion For Summary Judgment (hereinafter the "Martin Decl.") and the materials cited therein;

- Expert Report of David M. Martin Jr., Ph.D. dated April 8, 2013 ("Martin Report") and the materials cited therein;

- Deposition of David Martin on March 18, 2011;

- Deposition of David Martin on May 9, 2013;

- Plaintiffs' Memorandum In Opposition To Apple's Motion For Summary

Judgment and exhibits thereto;

- Documents produced by Apple in this case;

- Publicly available documents; and

- Other documents as cited in this report and its exhibits.

6. I also examined the following iPods.

Model (Name, Part Number; Code Name)	Date Introduced	Serial Number	Firmware Version[1]	Storage Size
iPod with dock connector (iPod classic 3rd generation); MM9245LL; Q14	Sept. 2003	JQ338BA3PNU	2.2	40 GB
IPod photo (iPod classic 4th generation); M9586LL; P98	Oct. 2004	JQ4513JZR5R	1.0	60 GB
iPod video (iPod classic 5th generation); MA003LL; M25	Oct. 2005	4J545EPQSZA	1.0	60 GB
iPod classic (iPod classic 6th generation); MB147LL; N25	Sept. 2007	8N748R68YMV	1.0 PC	80 GB
iPod nano 2nd generation; MA426LL; N36	Sept. 2006	SU726014V8T	1.1.3	4 GB
iPod nano 3rd generation; MA978LL; N46	Sept. 2007	7J748VLWY0P	1.0 PC	4 GB
iPod shuffle 1st generation; ; Q98	Jan. 2005	5C505H84RSA	1.1.5	1 GB
iPod shuffle 2nd generation; MA565LL; N98	Sept. 2006	5M648U35VTE	1.0.4	1 GB
iPod shuffle 2nd generation; MB813LL; N98	Sept. 2006	6V925P39437	1.0.4	1 GB
iPod shuffle 3rd generation; ; D98	March 2009	4H945RYSA78	1.1	2 GB

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[1] This is the version of the firmware that was used during testing unless otherwise specified below.

II. Technical Overview

A. THE ITUNES ECOSYSTEM

7. Apple's iTunes Store ("iTS") offers customers the ability to purchase music, videos, and other content over the Internet.[2] Customers access iTS through Apple's iTunes Software application, a free "jukebox" application that organizes and plays digital music stored on the local computer. Among other things, the iTunes Software allows users to import music stored on CDs and other sources into their music collection.[3] The iTunes Software organizes music in a library on the computer's hard drive that can be viewed and searched in multiple ways. For example, music can be viewed by reference to various categories, such as the song or artist name.[4] Users can also use the iTunes Software to transfer digital music and video to iPods. The iTunes Software saves the music to the iPod's internal storage and writes a database that organizes that music.

8. The iPod, iTunes Software ("iTunes client") and the iTS have changed as Apple has added new features for its customers. In the following paragraphs, I list a some of the features added from October 2004 to March 2009.

9. In general, iPods have become smaller even as their storage capacity was increased. In addition, several other enhancements have been added to successive generations and models of iPod, including the ability to display photos, play audio books, play videos and podcasts and play games. For example:

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[2] See, e.g., http://www.apple.com/itunes/whats-on/; http://www.apple.com/itunes/features/.

[3] See, *e.g*., http://www.apple.com/itunes/what-is/player.html.

[4] I have used the iTunes Software to purchase content from iTS, import music from CDs, manage music, and transfer music to an iPod and other Apple devices. I have used every major release of iTunes from version 1 to the current version.

- July 2002 – Apple introduced the second-generation iPod, which was compatible with Microsoft Windows and quadrupled storage space to 20gb allowing a user to store about 4,000 songs (the original iPod contained 5gb of storage for about 1,000 songs). The second-generation iPod replaced the first-generation's mechanical scroll wheel with the industry's first solid-state touch wheel allowing for increased precision, accuracy and durability;[5]

- April 2003 – Apple introduced the third-generation iPod that was thinner and doubled the storage capacity of the second-generation to 40gb and included Auto-Sync, a new feature that automatically downloads an entire digital music library into the iPod and keeps it up-to-date whenever the iPod is plugged into a Mac or Windows PC;[6]

- January 2004 – Apple introduced the iPod mini, available in five metallic colors, which provided eight hours of battery life in Apple's smallest form factor to date, constructed of an anodized aluminum body. The first-generation iPod mini was the first iPod to utilize the touch sensitive Click Wheel, containing mechanical switches beneath the wheel itself. To use any of the four included buttons, the user physically pushes the edge of the wheel inward over one of the four labels;[7]

- July 2004 – Apple introduced the fourth-generation iPod which adopted the touch sensitive Click Wheel and improved battery life to 12 hours, adding approximately

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[5] Apple Press Release, "Apple Unveils New iPods," July 17, 2012, http://www.apple.com/pr/library/2002/07/17Apple-Unveils-New-iPods.html (accessed July 16, 2013).

[6] Apple Press Release, "Apple Introduces New iPods," April 28, 2003http://www.apple.com/pr/library/2003/04/28Apple-Introduces-New-iPods.html (accessed July 16, 2013).

[7] Apple Press Release, "Apple Introduces iPod Mini," January 6, 2004 http://www.apple.com/pr/library/2004/01/06Apple-Introduces-iPod-mini html (accessed July 16, 2013).

4 hours of play time over the previous model;[8]

- October 2004 – Apple introduced the iPod photo, the first iPod to feature a color screen and slideshow photo viewing. Apple further increased battery life to 15 hours. Storage space was increased to 60gb;[9]

- January 2005 – Apple introduced the iPod shuffle, Apple's smallest music player (which was smaller and lighter than a pack of gum) and the first to feature flash-based storage;[10]

- February 2005 – Apple introduced the second-generation iPod mini, offering a richer color palette and featuring an 18-hour battery (making it the longest lasting iPod at the time);[11]

- June 2005 – Apple introduced the iPod color, doing away with the black and white screen available on non-photo models and upgrading all iPods to a full color display;[12]

- September 2005 – Apple introduced the iPod nano, the slimmest, full-featured iPod Apple had created to date – thinner than a standard #2 pencil. The iPod nano replaced the iPod mini and featured flash-based storage instead of the iPod mini's

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[8] Apple Press Release, "Apple Introduces the New iPod," July 19, 2004 http://www.apple.com/pr/library/2004/07/19Apple-Introduces-the-New-iPod.html (accessed July 16, 2013).

[9] Apple Press Release, "Apple Introduces the iPod Photo," October 26, 2004, http://www.apple.com/pr/library/2004/10/26Apple-Introduces-iPod-Photo.html (accessed July 16, 2013).

[10] Apple Press Release, "Apple Introduces iPod Shuffle," January 11, 2005 http://www.apple.com/pr/library/2005/01/11Apple-Introduces-iPod-shuffle.html (accessed July 16, 2013).

[11] Apple Press Release, "Apple Unveils New iPod Mini," February 23, 2005 http://www.apple.com/pr/library/2005/02/23Apple-Unveils-New-iPod-mini-Starting-at-Just-199 html (accessed July 16, 2013).

[12] Apple Press Release, "Apple Merges iPod-iPod Photo Lines," June 28, 2005 http://www.apple.com/pr/library/2005/06/28Apple-Merges-iPod-iPod-photo-Lines.html (accessed July 16, 2013).

microdrive;[13]

- October 2005 – Apple introduced the fifth-generation iPod, further reducing the size and weight of the unit and introducing video support. With the fifth-generation, users could play music, listen to audio books, view photos and watch videos from a single portable device with up to 20 hours of battery life;[14]

- May 2006 – Apple teamed with Nike to introduce Nike+iPod, utilizing an in-shoe sensor to help track a user's workout regime and progress on the iPod;[15]

- September 2006 – Apple introduced aluminum bodies for the iPod nano, further reducing the size of its slimmest full-featured music player while increasing battery life to 24 hours.[16] Apple also redesigned the iPod shuffle to feature an aluminum body, built-in clip, and double the storage capacity of the previous model. The new shuffle measured just half a cubic inch in volume and weighed half an ounce.[17] The fifth-generation iPod also received an increase in storage capability to 80gb, allowing the user to store up to 20,000 songs and an upgraded 2.5 inch display that was 60% brighter and designed to display TV shows and

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[13] Apple Press Release, "Apple Introduces iPod Nano," September 7, 2005
http://www.apple.com/pr/library/2005/09/07Apple-Introduces-iPod-nano html (accessed July 16, 2013).

[14] Apple Press Release, "Apple Unveils the New iPod," October 12, 2005
http://www.apple.com/pr/library/2005/10/12Apple-Unveils-the-New-iPod html (accessed July 16, 2013).

[15] Apple Press Release, "Nike and Apple Team Up to Launch Nike+iPod," May 23, 2006
http://www.apple.com/pr/library/2006/05/23Nike-and-Apple-Team-Up-to-Launch-Nike-iPod.html (accessed July 16, 2013).

[16] Apple Press Release, "Apple Introduces the New iPod Nano," September 12, 2006
http://www.apple.com/pr/library/2006/09/12Apple-Introduces-the-New-iPod-nano html (accessed July 16, 2013).

[17] Apple Press Release, "Apple Unveils the New iPod Shuffle," September 12, 2006
http://www.apple.com/pr/library/2006/09/12Apple-Unveils-the-New-iPod-shuffle html (accessed July 16, 2013).

Hollywood movies from the palm of a user's hand;[18]

- September 2007 – Apple introduced the iPod touch, featuring a Multi-Touch interface and Internet access via built-in Wi-Fi wireless networking.[19] Apple also introduced the sixth-generation iPod, dubbing it the iPod classic. The classic also featured the all aluminum construction of the shuffle and nano and featured 40 hours of battery life with 160gb of storage capacity, equivalent to 40,000 songs.[20] The iPod nano was redesigned to feature a larger display and support video playback for the first time;[21]

- September 2008 – Apple introduced the fourth-generation iPod nano, with an even larger screen to accommodate playback of widescreen videos. Apple also included a built-in accelerometer, allowing users to shake the Nano to shuffle songs on the fly. The storage capacity of the nano was increased to 16gb.[22] Apple also refreshed its iPod touch to feature chrome construction, widescreen glass display, 802.11 b/g Wi-Fi wireless networking, integrated volume control buttons, a built-in speaker, a built-in accelerometer and other advanced sensors;[23]

- September 2009 – Apple updated the iPod classic, reducing its size while adding

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[18] Apple Press Release, "Apple Introduces the New iPod," September 12, 2006 http://www.apple.com/pr/library/2006/09/12Apple-Introduces-the-New-iPod html (accessed July 16, 2013).

[19] Apple Press Release, "Apple Unveils iPod Touch," September 5, 2007 http://www.apple.com/pr/library/2007/09/05Apple-Unveils-iPod-touch html (accessed July 16, 2013).

[20] Apple Press Release, "Apple Introduces New iPod Cassic," September 5, 2007 http://www.apple.com/pr/library/2007/09/05Apple-Introduces-New-iPod-classic html (accessed July 16, 2013).

[21] Apple Press Release, "Apple Introduces All New iPod Nano," September 9, 2007 http://www.apple.com/pr/library/2007/09/05Apple-Introduces-All-New-iPod-nano.html (accessed July 16, 2013).

[22] Apple Press Release, "Apple Introduces New iPod Nano," September 9, 2008 http://www.apple.com/pr/library/2008/09/09Apple-Introduces-New-iPod-nano.html (accessed July 16, 2013).

[23] Apple Press Release, "Apple Introduces New iPod Touch," September 9, 2008 http://www.apple.com/pr/library/2008/09/09Apple-Introduces-New-iPod-touch.html (accessed July 16, 2013).

40gb of storage capacity.[24] The iPod nano also received a major update, receiving

an even larger screen, the addition of an FM radio, pedometer and built-in camera

and microphone;[25]

- September 2010 – Apple introduced its most advanced iPod touch to date,

  featuring a Retina Display, FaceTime video calling, HD video recording and a

  game center.[26] Apple also introduced a redesigned iPod nano featuring a Multi-

  Touch interface, built-in FM radio with live pause and a built-in clip for instant

  wearability.[27]

10.   New releases of the iTunes Software added support for new iPod models and also

included new features such as:

- iTunes 2.0 (Oct. 2001) included support for MP3 CD burning, enabled a 10-band

  equalizer to bring robust, receiver-style audio customization to the desktop and

  added a cross fading function that allowed for gapless playback of tracks; [28]

- iTunes 3.0 (July 2002) included support for audio books;[29]

- iTunes 4.0 (April 2003) included support for sharing music between iTunes

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[24] http://www.ign.com/articles/2010/09/03/igns-history-of-the-ipod?page=6 (accessed July 16, 2013).

[25] Apple Press Release, "Apple Introduces New iPod Nano with Built-in Video Camera," September 9, 2009 http://www.apple.com/pr/library/2009/09/09Apple-Introduces-New-iPod-nano-With-Built-in-Video-Camera.html (accessed July 16, 2013).

[26] Apple Press Release, "Apple Introduces New iPod Touch," September 1, 2010 http://www.apple.com/pr/library/2010/09/01Apple-Introduces-New-iPod-touch.html (accessed July 16, 2013).

[27] Apple Press Release, "Apple Reinvents iPod Nano with Multi-Touch Interface," September 1, 2010 http://www.apple.com/pr/library/2010/09/01Apple-Reinvents-iPod-nano-With-Multi-Touch-Interface html (accessed July 16, 2013).

[28] Apple Press Release, "Apple Announces iTunes 2," October 23, 2001 http://www.apple.com/pr/library/2001/10/23Apple-Announces-iTunes-2.html (accessed July 18, 2013).

[29] Apple Press Release, "Apple Announces iTunes 3," July 17, 2002 http://www.apple.com/pr/library/2002/07/17Apple-Announces-iTunes-3.html (accessed July 18, 2013).

users;[30]

- iTunes 4.1 (Oct. 2003) included support for On-The-Go playlists, which allows users to create playlists directly from their iPod, rather than logging into iTunes from their computer;[31]

- iTunes 4.7 (Oct. 2004) included support for copying photos to an iPod photo and showing duplicate songs in the iTunes library;[32]

- iTunes 4.8 (May 2005) included support for playing QuickTime movies, synchronizing contacts and calendar appointments with the iPod, and several new worldwide music stores;[33]

- iTunes 4.9 (June 2005) included support for browsing and subscribing to podcasts (multimedia content created exclusively for playback on iPod) from within the iTunes Music Store, and transferring podcasts to the iPod;[34]

- iTunes 5.0 (Sept. 2005) included a new more powerful instant search including the new Search Bar, the "smart shuffle" feature (which limited the repetition of the same tracks when shuffling through music), folders for organizing playlists, new

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[30] Apple Press Release, "Apple Launches the iTunes Music Store," http://www.apple.com/pr/library/2003/04/28Apple-Launches-the-iTunes-Music-Store html (accessed July 18, 2013).

[31] Apple Press Release, "Apple Updates iPod," October 16, 2003 http://www.apple.com/pr/library/2003/10/16Apple-Updates-iPod html (accessed July 18, 2013).

[32] See iTunes 4.7 help files. See also Apple Press Release, "Apple Introduces iPod Photo," October 26, 2004 http://www.apple.com/pr/library/2004/10/26Apple-Introduces-iPod-Photo html; http://www.oldapps.com/itunes.php?old_itunes=4#changelog (both accessed July 18, 2013).

[33] See iTunes 4.8 help files. See also GigaOM "iTunes 4.8 Released," May 9, 2005 http://gigaom.com/2005/05/09/itunes-48-released/ (accessed July 18, 2013).

[34] Apple Press Release, "Apple Takes Podcasting Mainstream," June 28, 2005 http://www.apple.com/pr/library/2005/06/28Apple-Takes-Podcasting-Mainstream html (accessed July 18, 2013).

Parental Controls, and allowing users the ability to enter and view song lyrics;[35]

- iTunes 6.0 (Oct. 2005) included support for previewing, buying, and downloading videos from the iTunes Music Store, synchronizing videos with the iPod video, and giving songs or other multimedia items as gifts;[36]

- iTunes 7.0 (Sept. 2006) included support for buying and downloading iPod games from the iTunes Store (allowing users to use the iPod as a mobile gaming platform), near-DVD quality video playback, gapless playback of albums, copying purchased content from the iPod to the computer, and a complete redesign of the iTunes graphical user interface, including the introduction of Cover Flow (an animated three dimensional graphical user interface integrated within iTunes to visually flip through albums, album artwork and other multimedia);[37]

- iTunes 7.1 (March 2007) included support for playing content from the iTunes library on a television using AppleTV, improved sorting and full-screen Cover Flow;[38]

- iTunes 7.2 (May 2007) included support for previewing and buying iTunes Plus (256 kbps DRM-free music), iTunes U (providing educational content from

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[35] Apple Press Release, "Apple Introduces iTunes 5," September 7, 2005 (accessed July 18, 2013).

[36] Apple Press Release, "Apple Announces iTunes 6 with 2,000 Music Videos, Pizar Short Films & Hit TV Shows," October 12, 2005 http://www.apple.com/pr/library/2005/10/12Apple-Announces-iTunes-6-With-2-000-Music-Videos-Pixar-Short-Films-Hit-TV-Shows.html (accessed July 18, 2013).

[37] Apple Press Release, "Apple Announces iTunes 7 with Amazing New Features," September 12, 2006 http://www.apple.com/pr/library/2006/09/12Apple-Announces-iTunes-7-with-Amazing-New-Features html (accessed July 18, 2013).

[38] See iTunes 7.1 help files. See also Apple Insider, "Apple Releases iTunes 7.1, QuickTime 7.1.5," March 5, 2007 http://appleinsider.com/articles/07/03/05/apple_releases_itunes_71_quicktime_715_more (accessed July 18, 2013).

leading universities, including Stanford, Yale, UC Berkeley, MIT and Oxford);[39]

- iTunes 7.3 (June 2007) included support for wirelessly streaming photos to an Apple TV;[40]

- iTunes 7.4 (September 2007) included support for iPod Touch, the sixth-generation iPod Classic and the third-generation iPod Nano. The update also provided support for watching videos at a larger size inside the iTunes window, watching video with closed captioning and rating albums;[41]

- iTunes 7.6 (Jan. 2008) included support for renting movies and copying purchased content from Apple TV to the computer;[42]

- iTunes 7.7 (July 2008) included support for the App Store;[43]

- iTunes 8.0 (Sept. 2008) included support for Genius playlists and the Genius sidebar (which automatically create playlists from a user's content and automatically recommend music based on user's preferences, respectively), and

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[39] Apple Press Release, "Apple Announces iTunes U on the iTunes Store," May 30, 2007 http://www.apple.com/pr/library/2007/05/30Apple-Announces-iTunes-U-on-the-iTunes-Store.html; Apple Press Release, "Apple Launches iTunes Plus," May 30, 2007 http://www.apple.com/pr/library/2007/05/30Apple-Launches-iTunes-Plus.html (both accessed July 18, 2013).

[40] See iTunes 7.3 help files. See also Apple Insider, "iTunes 7.3 Supports iPhone, Adds AppleTV Photo Streaming," June 29, 2007 http://appleinsider.com/articles/07/06/29/itunes_7_3_supports_iphone_adds_apple_tv_photo_streaming (accessed July 18, 2013).

[41] Apple Press Release, "Apple Unveils the iTunes Wi-Fi Music Store," September 5, 2007 http://www.apple.com/pr/library/2007/09/05Apple-Unveils-the-iTunes-Wi-Fi-Music-Store html (accessed July 18, 2013).

[42] Apple Press Release, "Apple Premieres iTunes Movie Rentals with All Major Film Studios," January 15, 2008 http://www.apple.com/pr/library/2008/01/15Apple-Premieres-iTunes-Movie-Rentals-With-All-Major-Film-Studios.html (accessed July 18, 2013).

[43] Apple Press Release, "iPhone 3G on Sale Tomorrow," July 10, 2008 http://www.apple.com/pr/library/2008/07/10iPhone-3G-on-Sale-Tomorrow html (accessed July 18, 2013).

HD-quality TV shows;[44]

- iTunes 8.1 (March 2009) included support for allowing friends to request songs for iTunes DJ, Genius sidebar for movies and TV shows and importing CDs at the same sound quality as iTunes Plus;[45]

11.   Apple also added new features and content to the iTS, including among others:

- iTunes Plus music (music at higher fidelity);

- Music videos;

- TV shows;

- Movies;

- Movie rentals;

- iPod games;

- iTunes U (which offers free content from some of the top universities around the United States);

- Pod casts;

- iOS apps;

- iMix playlists.

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[44] Apple Press Release, "Apple Announces iTunes 8," September 9, 2008 http://www.apple.com/pr/library/2008/09/09Apple-Announces-iTunes-8.html (accessed July 18, 2013).

[45] MacWorld "Apple Releases iTunes 8.1 Update," March 11, 2009 http://www.macworld.com/article/1139330/itunes.html (accessed July 18, 2013).

B.   **FAIRPLAY**

12.   Apple protected the music offered on iTS with its proprietary digital rights management (DRM) technology called FairPlay.[46] FairPlay used encryption and other tools to enforce certain usage rules, including restricting access to the keys necessary to play music purchased from iTS on a customer's computer. Encryption refers to the process of altering the song so that only someone with the right "key" can decrypt the song and thus convert it to its original, unencrypted form for playback.[47]

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[51] See, *e.g.*, Apple_AIIA_B_000096; *see also* Robbin Decl. ¶¶ 17 and Exhs. 4 and 5 thereto.

[52] See, *e.g.*, Source Code, Image File AdditionalCode_20101220.dmg, iTunes/4.7.0/MPEG/Sources/iPod/MusicStore.cp; see also Robbin Decl. at ¶¶ 10-16 and Exhibits thereto; Exhibit 29 to Deposition of David Heller.

[53] See, *e.g.*, Dep. Tr. of David Heller on December 15, 2010 at 36:23-38:2, 77:16-79:1, 80:18-81:1; Robbin Decl. at ¶¶ 10-16 and Exhibits thereto.

1. **FairPlay in iTunes 4.5.0 and 4.6.0**

18.   I examined the source code and other technical descriptions of FairPlay included in iTunes 4.5.0 and 4.6.0.

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[54] As I have used the term here, a transformation is sequence of mathematical operations performed on data. The transformation is reversible if the original data can be recovered using a second transformation which is the inverse

(continued)

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of the first transformation.

[55] See, *e.g.*, Robbin Decl. at ¶¶ 24-25, 30-33 and exhibits.

[56] See, *e.g.*, Apple_AIIA00113141-51; Robbin Decl ¶ 31 and exhibits.

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18 **2.** **FairPlay in iTunes 4.7.0**

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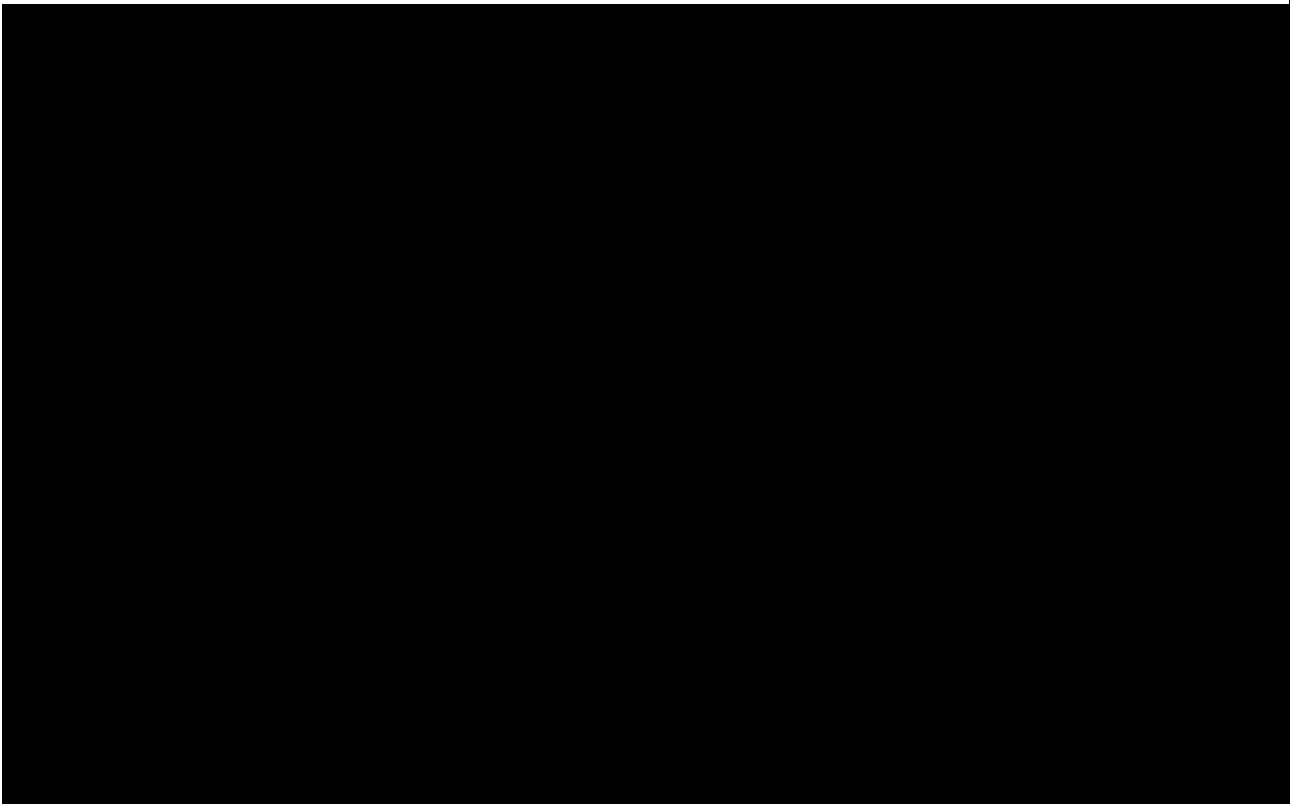
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15   **3.**   <u>**FairPlay Introduced With iTunes 7.0**</u>

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[REDACTED][59]

For example, the "chosen-ciphertext attack" where "the cryptanalyst can choose different cipher-texts to be decrypted and has access to the decrypted plaintext" exploits the attacker's ability to present arbitrary cipertext to the decryption engine. [*Applied Cryptography*, Bruce Schneier, 1996 at pp. 5, 471-472; see also *Handbook of Applied Cryptography*, Menezes et al., 1997 at pp.

[59] [REDACTED]

41, 226, 285.] The goal of the chosen-ciphertext attack is to use the cipher-text/plain-text pairs to

deduce the encryption key.

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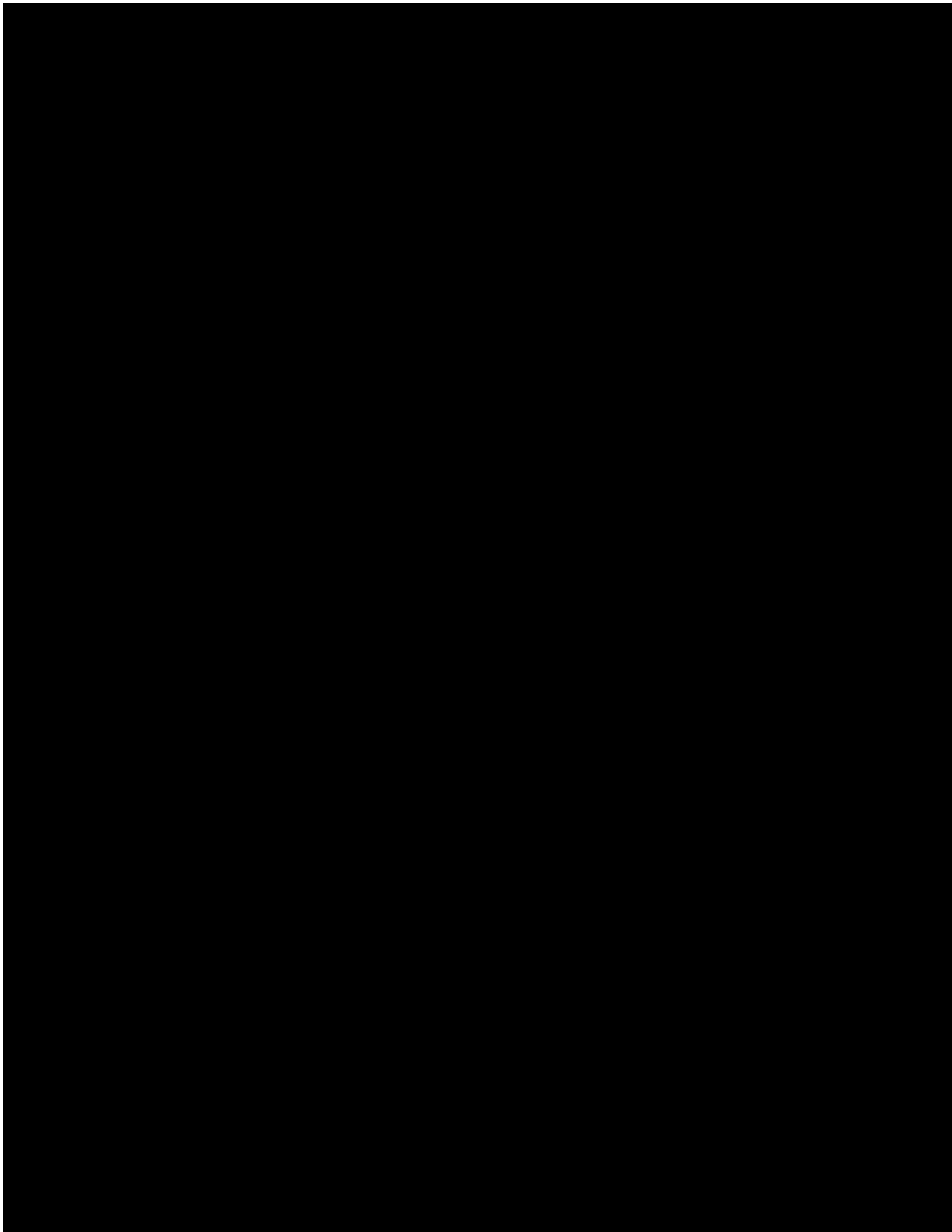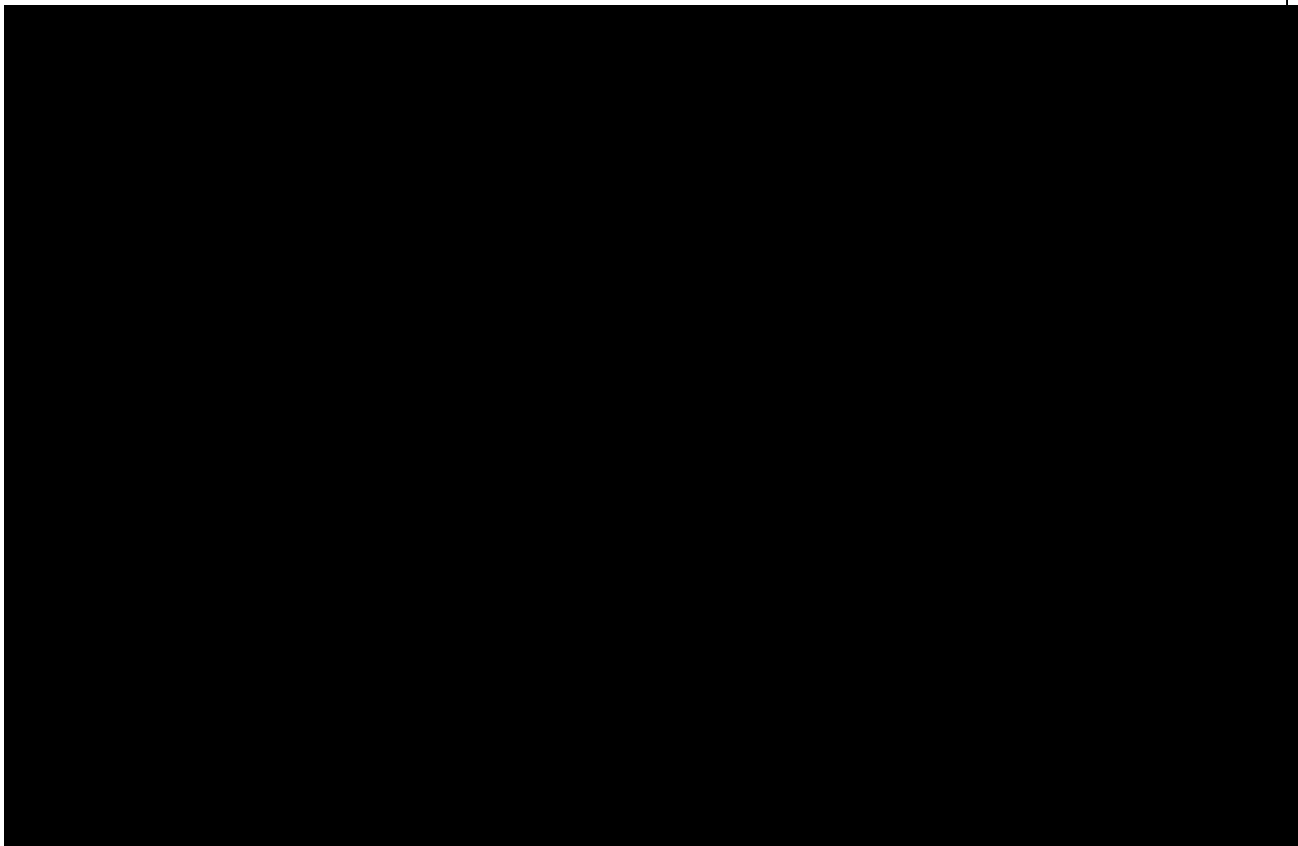██

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C. ITUNES DATABASE

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1.   __Overview of the iTunes Database__

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46.

Confidential Attorneys Eyes Only

Expert Report Of Dr. John P. J. Kelly

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6 ███████████████████████████ I will provide a few examples here.

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8 • In iTunes 4.7, the database version was changed to 1.11. ███████████████

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12 • In iTunes 4.7.1, the database version was changed to 1.12. ████████████████

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14 • In iTunes 4.9, the database version was changed to 1.13. ████████████████

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17 • In iTunes 5.0, the database version was changed to 1.14. ████████████████

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20 • In iTunes 6.0, the database version was changed to 1.15.███████████████

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23 • In iTunes 6.0.1, the database version was changed to 1.16 ███████████████

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26 • In iTunes 6.0.2, the database version was changed to 1.17.

27 • In iTunes 6.0.5, the database version was changed to 1.18. ███████████████

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5   • In iTunes 7.0, the database version was changed to 1.19. ▮▮▮▮▮▮▮▮▮▮

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9   • In iTunes 7.1, the database version was changed to 1.20. ▮▮▮▮▮▮▮▮

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15   • In iTunes 7.2, the database version was changed to 1.21.

16   • In iTunes 7.3, the database version was changed to 1.23. ▮▮▮▮▮▮▮▮

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23   • In iTunes 7.3.1, the database version was changed to 1.24.

24   • In iTunes 7.3.2, ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮

25   • In iTunes 7.4, the database version was changed to 1.25. ▮▮▮▮▮▮▮▮

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28   Several of these changes included new files and folders on the iPod. For example, a new folder

was created for the artwork database and artwork files; new database files were added for iPod shuffles; *etc.*

2. Improvements to the iTunes Database Introduced With iTunes 7.4

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[66] Checkpoint data is a plist stored on the iPod that contains information about the iPod's capabilities. Amongst other information, this can include version numbers, ID numbers, supported media types, DRM requirements, music

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database requirements, and minimum iTunes version.

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2.   **Database Verification**

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Expert Report Of Dr. John P. J. Kelly

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E.   ATTACKS ON FAIRPLAY CONTINUED AFTER ITUNES 4.7

67.   Hackers continued to attack FairPlay after the introduction of iTunes 4.7 with its improvements to FairPlay. ██

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[See, *e.g.*, Robbin Decl. at ¶¶ 41-47.] After the release of iTunes 6.0, programs like QTFairUse6 and myFairTunes7 were developed to make a copy of the decrypted audio during playback of the song. According to the documentation provided with the hacks, QTFairUse6 version 2.5[76] could circumvent the protection in FairPlay versions that corresponded with iTunes 6.0.4, 6.0.5, 7.0.0, 7.0.1 and 7.0.2; and myFairTunes7 version 7.0.2c[77] could circumvent the protection in FairPlay versions that corresponded with iTunes 6.0.5, 7.1.1.5, 7.2.0.34, 7.2.0.35, 7.3.0.54, 7.3.1.3, 7.3.2.6, 7.4.0.28, 7.4.1.2, 7.4.2.4 and 7.4.3.1. [See also, *e.g.*, Robbin Decl. at ¶ 48; Farrugia Decl. at ¶ 33.] Since hackers continued to attack all aspects of the FairPlay architecture, it was reasonable for Apple to continue improving all aspects of the FairPlay architecture.

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[76] Downloaded from http://replay.waybackmachine.org/20070208062043/http://hymn-project.org/download/QTFairUse6-2.5-src.zip; http://replay.waybackmachine.org/20070208062043/http://hymn-project.org/download/QTFairUse6-2.5.zip.

[77] Downloaded from http://www.freewarefiles.com/MyFairTunes-c_program_23754.html; http://web.archive.org/web/20080103044709/http://www.hymn-project.org/download/myFairTunes-v7.0.2c-Source.rar.

III. Harmony

68.   Harmony is what RealNetworks has described as a Digital Rights Management translation system.
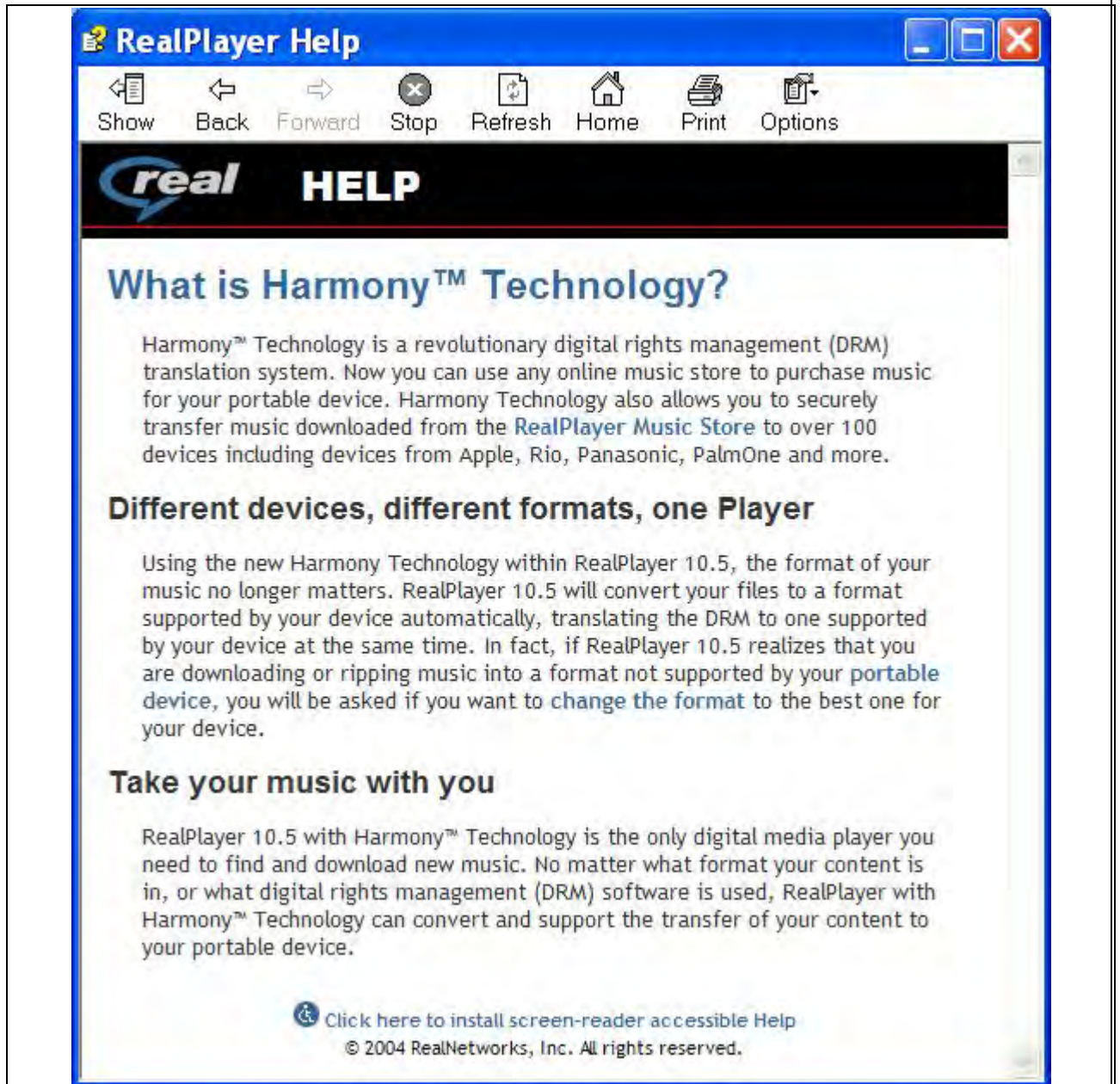

Figure 15. "What is Harmony™ Technology" help page from RealPlayer 10.5 build 6.0.12.1212 (digital signature dated 2/16/2005). See also the Martin Report at Fig. 2.

The RealPlayer help explains that Harmony would let users "use any online music store to purchase music;" would "convert your files to a format supported by your device automatically,

translating the DRM to one supported by your device;" and "[n]o matter what format your content is in, or what digital rights management (DRM) software is used, RealPlayer with Harmony™ Technology can convert and support the transfer of your content to your portable device."

69. With respect to transferring music from the RealPlayer Music Store to iPods, Harmony attempted to make songs protected by RealNetworks' DRM falsely appear to the iPod like they were files protected by FairPlay DRM. ████████████████████████

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70. However, this description of Harmony suggests that Harmony could do much more. Users could purchase music from "any online music store" and transfer the music to portable devices from "Apple, Rio, Panasonic, PalmOne and more." Harmony could accomplish this transfer because it would "translat[e] the DRM to one supported by your device." Translating the DRM means *removing* from the music file the current DRM protection, which is not supported by the music player, and then *adding* to the music file a different DRM protection, which is supported by the music player. When Dr. Martin says that he has "seen no evidence that RealPlayer and Harmony were ever intended or able to strip FairPlay encryption from any songs purchased through the iTunes Store" [Martin Report at ¶30], he is ignoring the evidence from this help page that he included in his report [see Martin Report at Fig. 2]. The help page says that Harmony was, in fact, intended to remove the DRM protection placed on a music file by "any online music store" as part of the DRM translation process. Furthermore, Dr. Martin never says that he used the Harmony technology (for example, to transfer a Helix-protected song to an iPod).

Consequently, Dr. Martin is no position to say with any certainty what Harmony could or could not do.

71.   Harmony was included as a part of the RealPlayer jukebox application. Users could use RealPlayer to transfer music, including RealNetworks' DRM-protected music, to iPods. [See Figure 16.] To load and play RealNetworks' DRM-protected music on an iPod, iPod owners had to use RealPlayer with Harmony, which "translated" the RealNetworks' DRM to FairPlay-like protection that an iPod could recognize and use to decrypt the music. I have used RealPlayer 10.5 (with Harmony) to transfer songs to an iPod. When RealPlayer transfers music to an iPod, it modifies the internal iPod ███████ ████████████████████████. In addition, RealPlayer creates a new directory on the iPod ████████████████████ and stores several files therein. [See Table 1.]
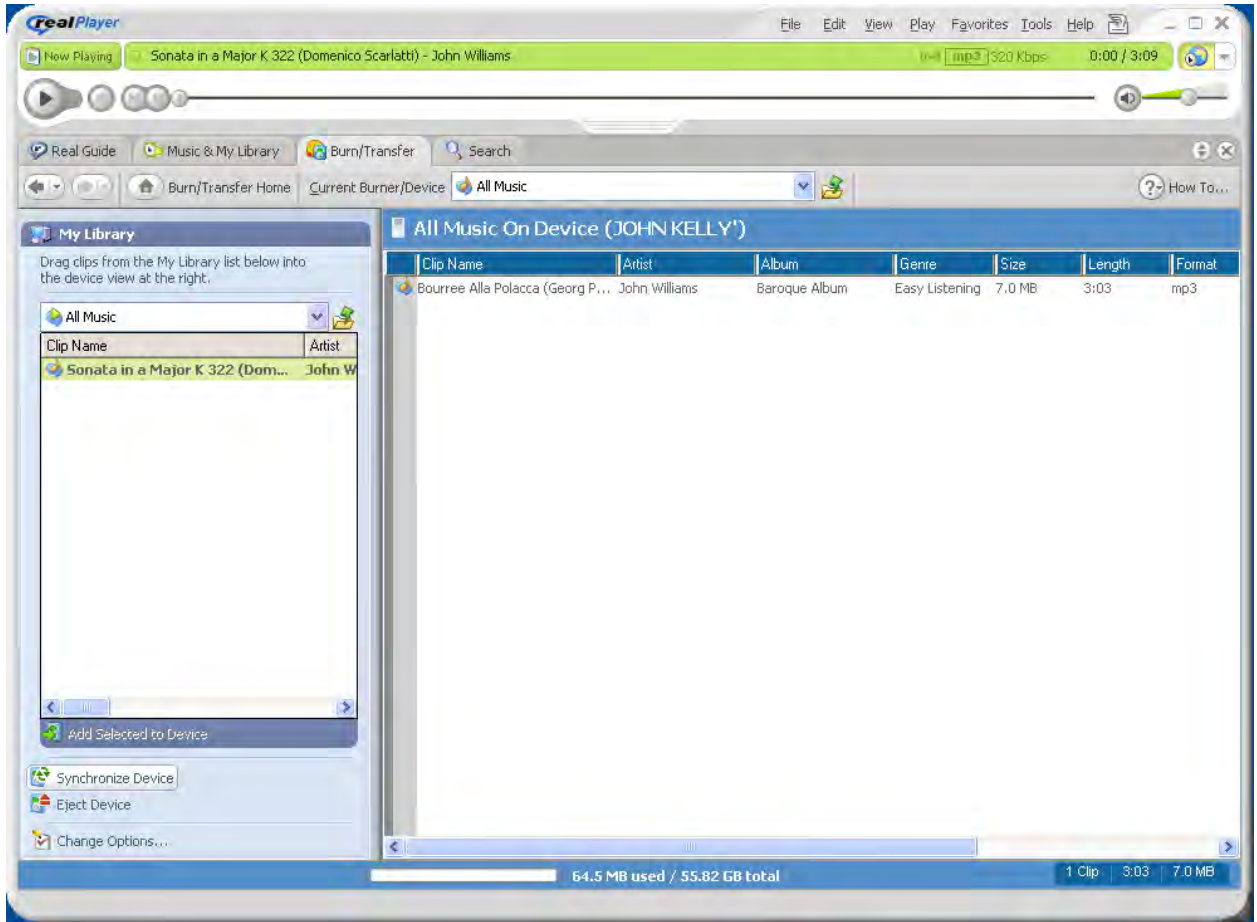
Figure 16. Screen shot of RealPlayer 10.5 running on Windows XP. An iPod is connected to the computer and the iPod's contents are shown in the right hand pane under the caption "All Music On Device (JOHN KELLY')." The one song on the iPod was copied by iTunes 4.6.0. The music in the RealPlayer library is shown in the left hand pane under the caption "My Library." Clicking the "Synchronize Device" button in the My Library pane causes RealPlayer to copy the songs in the RealPlayer library onto the iPod.

Table 1. Files added to the iPod's internal storage by RealPlayer 10.5 (with Harmony) during synchronization of a single song from the RealPlayer music library to the iPod.

iPod_Control/Music/f02/04 Sonata in a Major K 322 .mp3
iPod_Control/Music/rndb/26.dat
iPod_Control/Music/rndb/Backup/000/000002.tmd
iPod_Control/Music/rndb/cd.cdx
iPod_Control/Music/rndb/cd.dbf
iPod_Control/Music/rndb/cdtrax.cdx
iPod_Control/Music/rndb/cdtrax.dbf
iPod_Control/Music/rndb/dbdata.txt
iPod_Control/Music/rndb/playgrps.cdx
iPod_Control/Music/rndb/playgrps.dbf
iPod_Control/Music/rndb/playlist.cdx
iPod_Control/Music/rndb/playlist.dbf
iPod_Control/Music/rndb/playlist.fpt
iPod_Control/Music/rndb/playtrax.cdx
iPod_Control/Music/rndb/playtrax.dbf

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iPod  Control/Music/rndb/property.map
iPod  Control/Music/rndb/tracks.dbf
iPod  Control/Music/rndb/tracks.fpt
iPod  Control/Music/rndb/tracks2.cdx
iPod  Control/Music/rndb/trakinfo.cdx
iPod  Control/Music/rndb/trakinfo.dbf
iPod  Control/Music/rndb/version
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73.   Real Networks apparently updated RealPlayer with Harmony to ████████

████████████ perhaps as early as April 26, 2005. [See, *e.g.*,

http://news.cnet.com/RealNetworks-rekindles-iPod-tech-tussle/2100-1027_3-5685286.html;

Apple_AIIA00093862-63; Apple_AIIA00093860.]

74.   There were many changes introduced with the ██████████████ that would have

prevented Harmony, as it existed in Sept. 2006, from operating on iPods that had the new

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would continue to write an older style keybag that was no longer used by iPods with the ███████

███████. In short, Harmony would have no longer worked because it was based on an earlier

keybag format and encryption scheme that was no longer used by FairPlay.

IV. Third Party Jukebox Compatibility Problems

A. OVERVIEW OF SOFTWARE DEVELOPMENT PROCESS

75.   As a general matter, hardware refers to the physical components and

interconnections of a system such as integrated circuits, circuit boards, fans, *etc*. The

functionality of these components is fixed at the time of their manufacture and assembly. Many

electronic devices contain programmable elements – microcontroller, microprocessor, multi-chip

processors, *etc.* – to increase their flexibility. Processors are designed to read instructions and

produce results based on those instructions. Typically processors implement instructions to

perform mathematical operations (addition, subtraction, multiplication, division, *etc.*), to perform

comparisons, to change the flow of execution of instructions, to manipulate memory, and to

produce output signals for use by other components. The ultimate function performed by the

electronic device is determined by the sequence of instructions executed by the processor.

76.   Software generally refers to the programs (instructions) executed by a computer

system. Since software is stored in a storage device (*e.g.*, memory or disk drive), it can be

changed or replaced in a way that hardware cannot. For efficiency, instructions executed by a

processor are a sequence of numbers. It is not, however, efficient for humans to directly write

programs as microprocessor instructions. Instead, software is written as source code, which

refers to human readable statements written in a programming language. Source code is then

converted into instructions executable by the hardware device using another program called a

compiler.

77. Today, many hardware devices – not just computers – run software. Cars, VCRs and ovens are a just a few examples. The software (the instructions) and the data that these devices need to operate are stored in memory inside the hardware device (often inside the processor itself). Memory is a piece of hardware used to store information. It is analogous to the shelves in a library that store books (data), let a person take books off the shelves (read data from the memory) and put books onto the shelves (write data to the memory). There is a special name given to the software that operates such hardware devices and is stored in the memory inside the hardware device. It is called *firmware*. Like other types of software, firmware is written by a programmer as source code. Like other types of software, firmware source code is compiled to produce the object code actually executed by the hardware.

78. Software development is not a trivial exercise. It requires both skill and experience to produce a program that operates correctly and efficiently. Software development is not simply a matter of writing in a computer language. Software engineers have learned over the years that writing source code actually falls in the middle of the development process. The software development effort can be broadly divided into seven phases as discussed below.[78] A great deal of coordination, planning and communication is required to ensure that software development projects are conducted properly and efficiently. The degree of planning involved in developing even an update to existing software can be substantial.[79]

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[78] A few of the many references describing the software engineering process are *Software Engineering Economics* by Barry W. Boehm (1981); *Software Engineering: A Practitioner's Approach* by Roger Pressman, 2nd edition (1987); and *Rapid Development: Taming Wild Software Schedules* by Steve McConnell (1996).

[79] Apple's work on iTunes provides a good illustration. Apple's Schedule/Project Status updates are circulated repeatedly throughout the software planning and development phase, distributed first several months before the company plans to introduce the software update at issue. [See, *e.g.,* Apple_AIIA00090668 and Apple_AIIA00231215.] These schedules also demonstrate the various groups involved in developing a software update and the necessary coordination between the disparate groups to ensure efficient progress.

79.   First, specifications for the software product must be developed. This step answers the questions of what hardware platform or platforms the product will run on, what functions the product will include and, equally important, what functions the product will not include. If the product must interact with other software and hardware products, those requirements are also included.

80.   Next, the software must be designed. This is also referred to as defining the software architecture. In this step the organization of the software is defined. Modern software programs are not written as a single large unit. Instead, smaller units are defined to implement discrete functions or sub-functions. The programmers must decide how to subdivide the program and how each of the smaller units will communicate and interact.

81.   Next, the source code is written, documented and debugged. Although the individual software units have been defined in terms of function and interface, this does not mean that the source code to implement the units is defined or even obvious. Programmers use their skill, experience and creativity to write source code that balances the conflicting demands for execution speed, disk and memory use, readability, and many other factors. It is easy to understand how effective utilization of the computer's hardware resources – everyone wants their applications to run fast but use little disk or memory space and battery life – affects the eventual success of the product. It may not be obvious, however, that readability of the source code – *e.g.*, comments in the source code and good programming style – is also important to the success of a software development effort. Since commercial programming efforts will generally involve more than one programmer over the life of a project, it could be disastrous if one or more of the programmers write source code that cannot be understood by the others or is very difficult to understand. This could, for example, lead to misunderstandings that result in the incorrect behavior of the program. This could also lead to duplication of effort if a programmer decides it

is easier to write a new unit of source code rather than interface with existing units of source code. Incorporating multiple versions of a source code unit into a program increases the probability that bugs will be introduced that could interfere with the proper or intended operation of the program or device.

82.   Next, each unit of source code is tested to make sure it operates as planned. This step is called unit testing. The programmer or special test engineers may be responsible for unit testing.

83.   Next, the various units of source code must be integrated. Although the software architecture specifies how the units are to interact, the actual implementation may not behave as the architect envisioned. This is of particular concern when multiple programmers are involved. Programmers may have interpreted the interface specifications differently or may have made different assumptions when the specifications were unclear or incomplete. Again, programming style is an issue. All programmers must adhere to the same naming conventions for programming units in order for the source code to properly work together.

84.   Next, the software product as a whole must be tested. Every defined function must be operational and work as specified. All other actions should result in warning or error messages, and undesirable behavior should be prevented. Every possible action available to the user must be tested including sequences of actions that were not envisioned by the specification or software architecture. This stage is called validation testing and is usually performed by test engineers according a testing protocol.

85.   Finally, the software product is tested in real world conditions. This is often accomplished by allowing a select group of customers to begin using the new software. Alpha testing is the name given to the earliest round of field testing. Beta testing is the name given to

the subsequent round of field testing. The alpha version of the software is expected to have more problems than the beta version of the software.

86. The problems uncovered during testing may have been introduced at any stage of the development process. It may be a programming bug in a single software module, or a problem with a module specification or a problem with the software architecture. After identifying the nature of the problem, a solution must be developed and implemented. After the problem is fixed, all subsequent development stages must usually be repeated. For example, a problem with the software architecture may require repeating the design, writing, and testing stages for the affected modules. Once testing determines that the product's quality has reached an acceptable level, it is ready for sale or to be put into production.

87. Even after all of these stages of review and testing, bugs may not appear until the program is actually released and used by end users. This happens for a variety of reasons. In particular, it is generally impossible, for all but the most trivial programs, to identify and test all possible inputs to and uses of a program in the finite amount of time available for developing a product. As Dr. Martin acknowledged, most programs have bugs. [Martin 03/18/2011 Dep. Tr. at 51:22-52:3, 54:2-15, 61:13-16.]

88. Let me provide a few examples of commercial software products and services from well-established software companies that contained bugs after release to the public. First, as documents relied on by Plaintiffs' experts show, various versions of iTunes contained bugs that could interfere with the operation of iTunes or iPods. iTunes 7, for example, had bugs such as stuttering playback, problems with the automatic download of cover art, problems with gapless

playback, and stability issues.[80] This reflects that bugs may exist even where two pieces of

software (here iTunes and iPod firmware) are designed to work together and where the

developers designing and testing the programs work for the same company. As a second

example, Intuit fixed numerous bugs in Quicken Essentials for Mac from version 1.2.0 through

1.7.4, such as bugs that caused the program to unexpectedly quit, perform the incorrect "Market

Value calculation for bonds," and prevented the search feature from finding "dollar amounts that

contain more than three digits."[81] As a third example, Google recently experienced a bug in their

Gmail service. According to Google, "We released a storage software update that introduced the

unexpected bug, which caused 0.02% of Gmail users to temporarily lose access to their email."

The customer data was so thoroughly compromised on Google's servers that Google had to

restore affected accounts from backup tapes.[82] These are merely examples. I could have selected

examples from any company that provides details of the changes for each software release or has

an active online user community where product problems are discussed.

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[80] See, *e.g.*, http://pogue.blogs.nytimes.com/2006/09/18/18pogues-posts-2/;
http://appleinsider.com/articles/06/09/27/apple_looks_to_squash_bugs_with_itunes_701; see also Declaration of
Roger G. Noll on Liability And Damages dated April 3, 2013, Appendix B, references 843, 854-856, 894, 906-907,
909-926.

[81] See, *e.g.*, http://quicken.intuit.com/support/help/patching/quicken-essentials-for-mac-release-
notes/GEN82912 html.

[82] See, *e.g.*, http://www.computerworld.com/s/article/9212178/Google_still_working_to_restore_Gmail_service.

B. THERE IS OVERWHELMING EVIDENCE OF THIRD PARTY JUKEBOX BUGS

89. In the remainder of this section I will describe many errors that were present in third party jukebox programs and describe how they prevented the iPod from functioning as intended and expected.[83]

90. From 2001 (shortly after Apple introduced the iPod) to the present, various developers have released dozens of third party jukebox programs that have attempted to add and manage songs and other media to the iPod. These programs were not supported by Apple and were developed without access to Apple's source code and other confidential information regarding iPod firmware, iTunes Software, *etc*. As one would expect, these programs have not been trouble free. Many interfered with the proper operation of the iPod and/or iTunes. The documentation for some of these programs listed known or fixed problems. Users of these programs posted bug reports and sought help in forums on the program's web site or elsewhere. For example, there are reports of music disappearing from the iPod, playlists disappearing from the iPod, songs not playing or skipping, iTunes not recognizing the iTunes database, duplicate files, and artwork not displaying. These kinds of problems are very similar to the support requests that were being made to Apple. [See, *e.g.*, Table 2.] In §§ V and VI, I focus specifically on problems caused by the use of Winamp and RealPlayer. In Exhibit C, I give a sample of problem reports for other third party applications including Amarok, Anapod Explorer, EphPod,

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[83] In my declaration submitted earlier in this case, I performed a simple experiment to show how sensitive the iTunes database was. [See, *e.g.*, Kelly Declaration at ¶ 39.] Dr. Martin, however, appears to misunderstand the purpose of that experiment. [See Dr. Martin's discussion in the Martin Report at ¶¶ 64-68] As I said in my declaration, I "changed a single byte of the information added when the third song was transferred to the iPod *in order to simulate a bug* in the program that transferred the third song to the iPod." [See Kelly Declaration at ¶ 39 (emphasis added).] As I also said in the declaration, this experiment shows that "the database structure is very sensitive and all errors have the potential to prevent the iPod from functioning as intended and expected." [See Kelly Declaration at ¶ 39.]

Floola, iPod Manager for foobar2000, Media Center, MediaMonkey, MyPod, XPlay, Yamipod, Banshee, GNUpod, and gtkpod.

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92.   For the iPod to properly play songs and video, the iTunes database must be correctly formatted, contain valid data and include all of the tracks that have been copied to the iPod.

93.   Furthermore, it is not sufficient for a third party jukebox application to write a correctly formatted iTunes database and keybag in order to fully support the iPod's music and video features. It must also properly handle the other files and folders on the iPod such as the artwork database, play counts file and On-The-Go playlist files. It must format the music files properly (including tags). It must correctly handle exceptional conditions such as filling the iPod's internal storage. It must correctly interact with the Firewire or USB connection. Failures in each of these areas can be found in the problem reports of Exhibit C and Table 2. I will also illustrate some of these problems in §§ Vand VI.

94.   A third party jukebox application must also properly coordinate access to the iPod with iTunes. First, a user may want to purchase songs and videos from iTS and then use iTunes to copy the music and videos to the iPod. Second, the user may use iTunes to manage other iPod features such as photographs, contacts, calendars, notes and voice memos. Thus, a third party jukebox cannot assume that it is the only program reading and writing files on the iPod including the iTunes database and keybag. In fact, certain versions of Winamp could not initialize a freshly-formatted iPod and relied on the user using iTunes to perform this initialization. Failures to operate properly with iTunes can be found in the problem reports in the discussion of §§ V and VI.

V.   Winamp Compatibility Issues

95.   Winamp is a media player from Nullsoft that runs under Microsoft Windows. Winamp supported playback of MP3 files in its initial release and has subsequently added support for additional formats. The functionality of Winamp can be extended with Winamp plugins. Two plugins have been developed to support transferring music to the iPod.

96.   The ml_ipod plugin is an open source project hosted on Source Forge [http://mlipod.sourceforge.net/]. Version 1.0 of ml_ipod was released on 04/05/2004 [see, *e.g.*, http://mlipod.sourceforge.net/?page=changelog]. When using ml_ipod, a connected iPod is displayed under "Devices" in the Winamp Media Library window [see, *e.g.*, Figure 17].

97.   The authors of ml_ipod produced two documents listing the releases of the program: a version history[84] and a change log[85]. The date on which each version was released is

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[84] http://mlipod.sourceforge net/index.php?page=home&show=all

also provided in these documents. The version history also contains download links for many

releases of ml_ipod. The source code for ml_ipd – for both past and current releases – is

available at Source Forge.
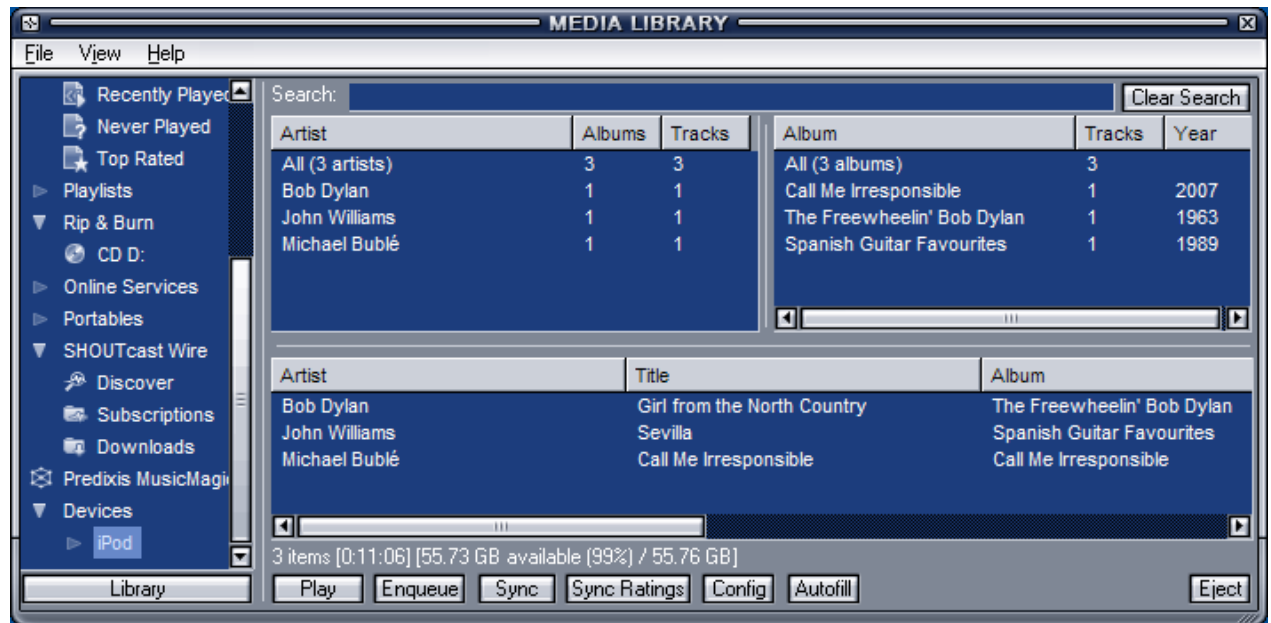
Figure 17. Screen shot of Winamp 5.2 with ml_ipod showing the contents of a connected iPod.

98.　　　The pmp_ipod plugin was written by Nullsoft and bundled with Winamp

beginning with Winamp version 5.2 in Feb. 2006. When using pmp_ipod, a connected iPod is

displayed under "Portables" in the Winamp Media Library window [see, *e.g.*, Figure 18].

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[85] http://mlipod.sourceforge net/?page=changelog

Expert Report Of Dr. John P. J. Kelly

Figure 18. Screen shot of Winamp 5.2 with pmp_ipod showing the contents of a connected iPod.

99. Both the ml_ipod and pmp_ipod plugins could interfere with the proper operation of the iPod. Some of the problems were caused by incorrect modifications to the database. Other problems were caused by other incorrect interactions between the plugin and the iPod.

A. **ML_IPOD PLUGIN**

1. **ml_ipod Plugin Overwrites iTunes Data**

100. ml_ipod would fill many fields in iTunes database with zero or some other constant value and would omit certain track and playlist objects from the database. [See Table 3.] Ml_ipod would make these changes to all tracks and playlists on the iPod including tracks and playlists that had been previously written by iTunes. ███████

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101. This bug was apparently fixed in version 1.40, which was released on 06/12/2006.
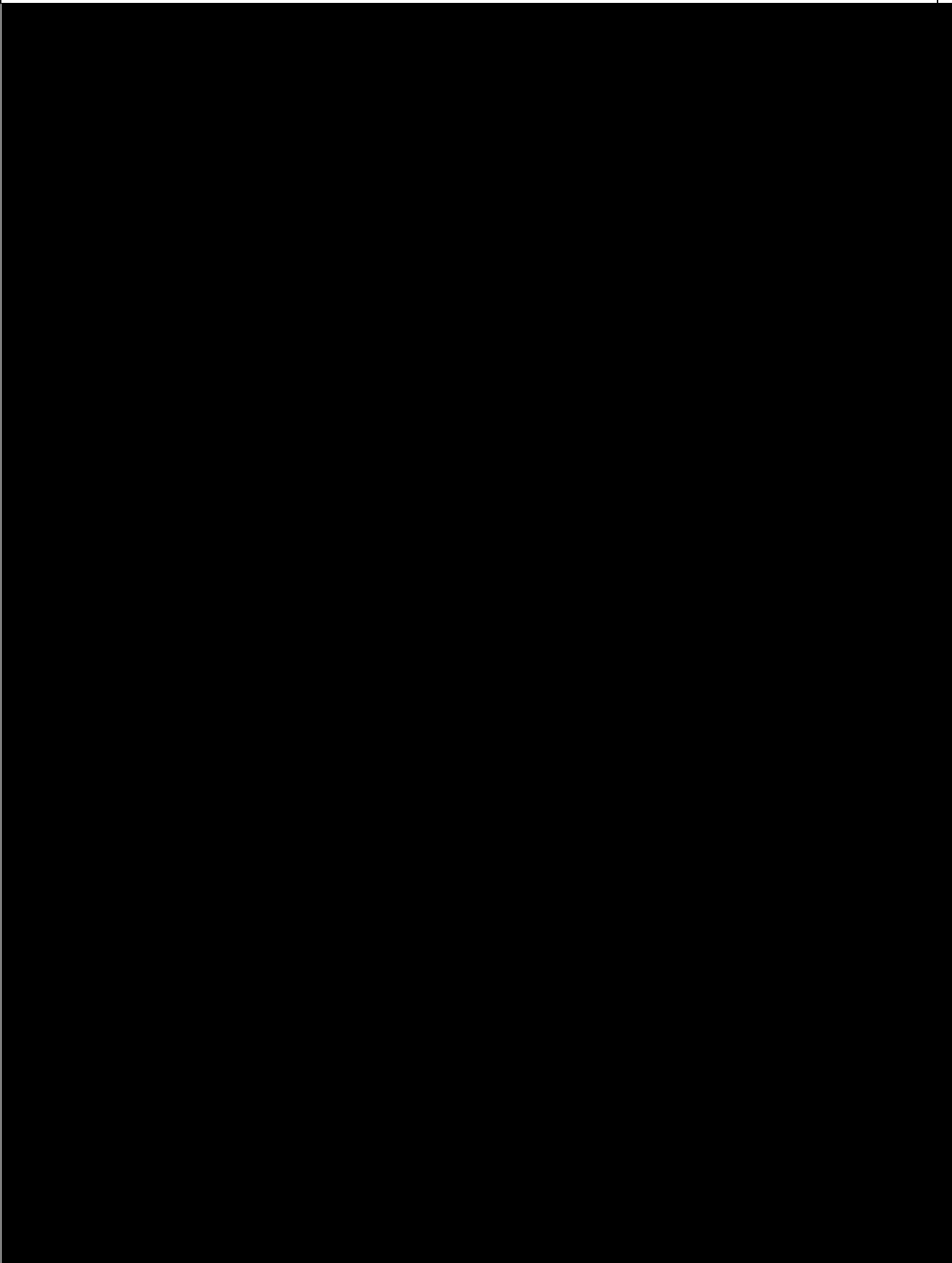
2. ml_ipod Plugin Deletes iTunes Playlists

102. ml_ipod could also delete playlists stored on the iPod by iTunes because it did not correctly interpret certain objects written to the iTunes database by iTunes.[86] When ml_ipod encountered such an object it would simply skip the object, or it would stop reading the iTunes database altogether. Then, if ml_ipod rewrote the iTunes database, it would omit the skipped information that had previously been stored by iTunes in the iTunes database.

103. To illustrate this problem, I used iTunes 4.7 to write seven songs and seven playlists (90's Music, Easy Listening, My Playlist, My Top Rated, Recently Added, Recently Played, and Top 25 Most Played) to an iPod photo running firmware version 1.0. The iPod correctly displayed all seven songs and all seven playlists. I then opened the iPod using Winamp version 5.2 with ml_ipod plugin version 1.32. Winamp showed that there were seven songs and one playlist (90's Music) on the iPod. The 90's Music playlist did not contain any songs even though iTunes placed two songs in that playlist. ml_ipod stopped reading the iTunes database when it encountered and incorrectly interpreted the SmartPlaylistInfo object associated with the 90's Music playlist. All songs in 90's Music and all playlists after 90's Music in the iTunes database were not read by ml_ipod.

104. I then transferred one additional song to the iPod. At this point Winamp showed that the iPod contained eight songs and one playlist. When the iPod was disconnected from the computer, it also showed eight songs and one playlist. The songs in the 90's Music playlist and

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six entire playlists written by iTunes were completely lost when Winamp rewrote the iTunes database. [See Figure 19.]

105.   The changelog says that bug #1501220 ("Smart playlists created in iTunes get destroyed") was fixed in version 1.40 (released 06/12/2006).
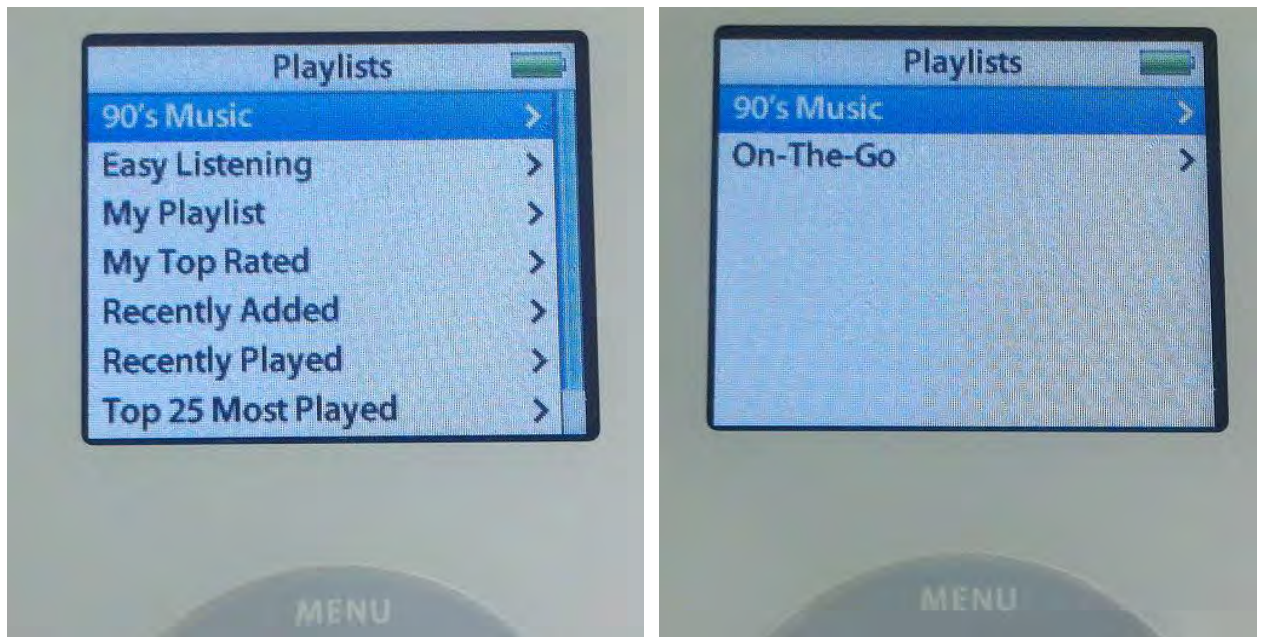
Figure 19. Playlist display on the iPod photo. The photograph on the left shows the playlists on the iPod after iTunes synchronizes songs and playlists. The photograph on the right shows the playlists on the iPod after Winamp transferred an additional song to the iPod.

3.   ml_ipod Plugin Prevents The iPod From Playing Videos

106.   Customers reported that after an iPod video was connected to Winamp using ml_ipod, the iPod would only play the audio portion of video tracks. [See http://forums.winamp.com/showthread.php?t=234701; the first post to the thread was Jan. 4, 2006.]

107.   To illustrate this problem, I used iTunes 6.0.0.18 to copy three songs and two video clips to a 60GB iPod video (*i.e.*, iPod classic 5th generation) running firmware version 1.0. The iPod displayed the three songs under the Songs menu and the video clips under the Movies

menu as shown in Figure 20. The songs and video clips played as expected. Then I ran Winamp version 5.12 with ml_ipod version 1.30 (released 9/23/2005). There were no songs or movies in the Winamp library. Winamp recognized the iPod and displayed it under Devices. I then ejected the iPod without displaying its contents, copying media to the iPod or otherwise changing its contents. Nevertheless, Winamp rewrote the iTunes database deleting an entire playlist section. As a result, the iPod video then displayed all five tracks under both the Songs menu and the Movies menu as shown in Figure 21. In addition, the iPod video will only play the audio portion of the video clips regardless of which menu is used to select the video clip.
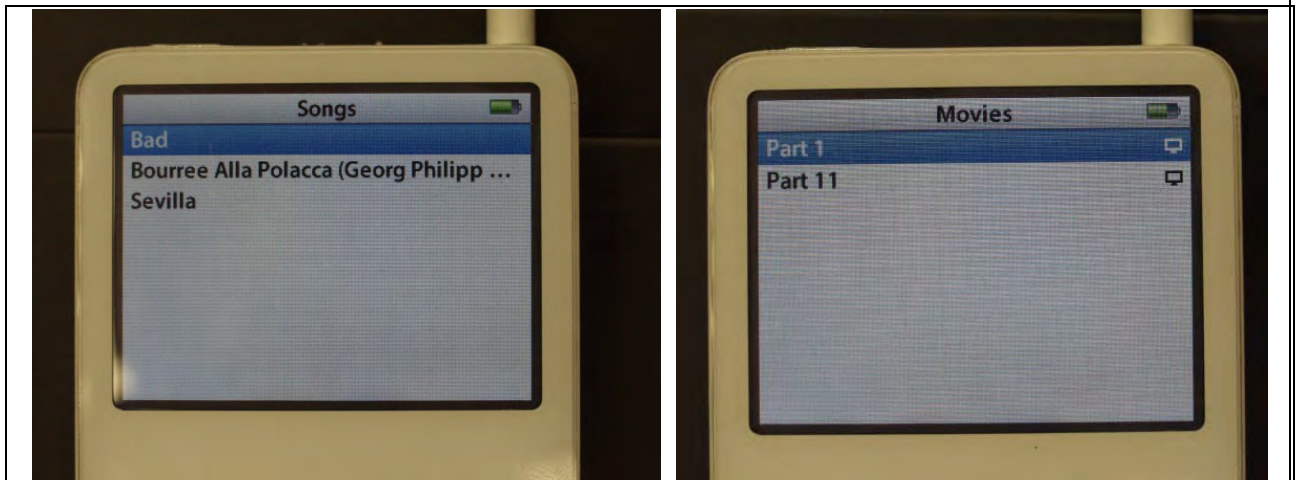
Figure 20. Contents of an iPod video after iTunes 6.0 transfers three songs and video clips.
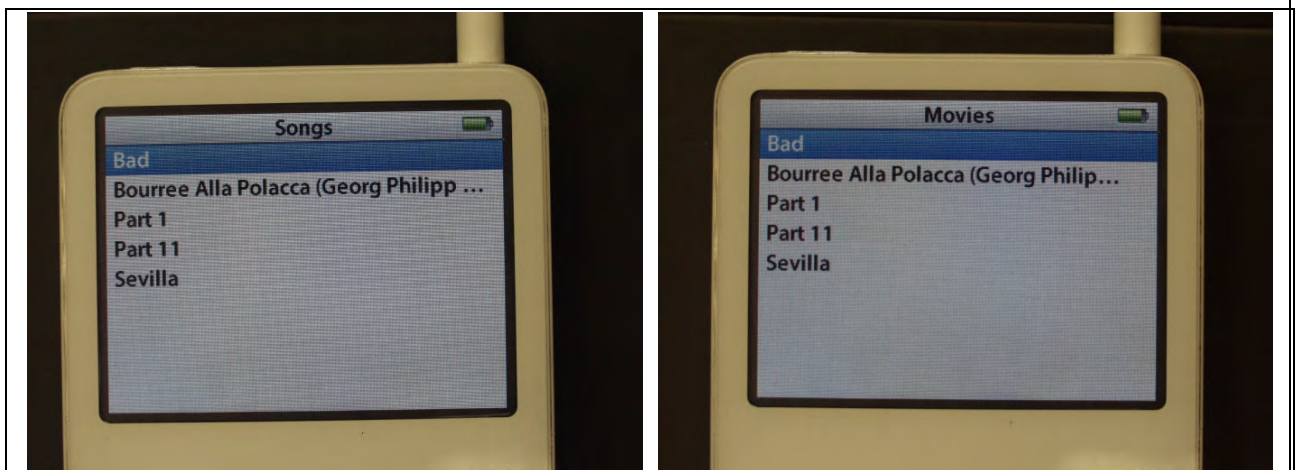
Figure 21. Contents of the iPod video after Winamp rewrites the iTunes database containing both songs and video clips.

108.   The change log for ml_ipod also mentions a problem with video files. The entry

for ml_ipod version 1.40 (released 6/12/2006) includes the following in the list of fixes:

"Handling of video files (*.mp4) for 5G iPods." [See ml_ipod changelog.]

4.   ml_ipod Plugin Deletes On-The-Go Playlists

109.   An On-The-Go playlist is a playlist that can be created and saved on the iPod,

rather than in iTunes. Until a song has been added to the On-The-Go playlist, the iPod displays

instructions for creating the playlist instead of its contents. On a click wheel iPod such as the

iPod photo, the user creates an On-The-Go playlist by selecting a song, album, artist, or playlist

and holding down the center button until the display flashes indicating that the songs have been

added to the On-The-Go playlist. [See Figure 22.] After songs have been added to the On-The-

Go playlist, the iPod displays the contents of the playlist and controls for deleting and saving the

playlist. [See Figure 22.] When the user selects "Save playlist" on the iPod, the user is prompted

to confirm their selection. [See Figure 23.] Then a new playlist with an automatically generated

name such as "New Playlist 1" is created and the On-The-Go playlist is emptied. [See Figure 23.]

The user can create additional playlists in this fashion. The iPod will delete the On-The-Go

playlists (both saved and unsaved) when the iTunes database is next updated.
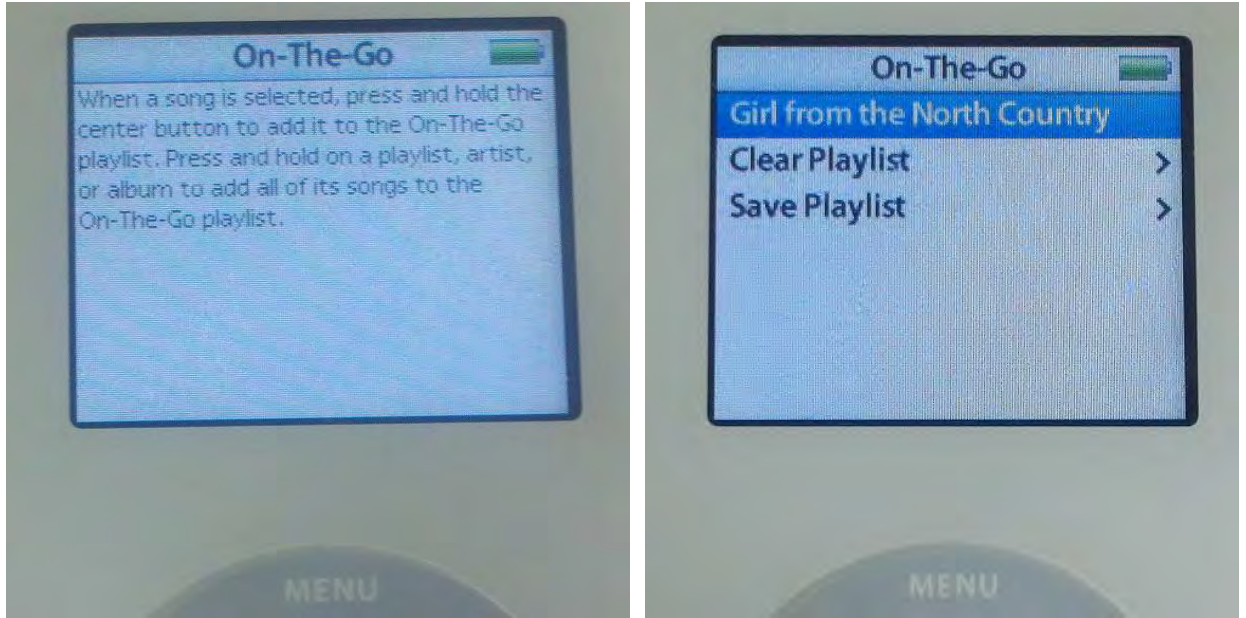
Figure 22. The photograph on the left shows the instructions for creating an On-The-Go playlist on an iPod photo. This screen is displayed when the user selects "On-The-Go" from the Playlist menu but the On-The-Go playlist is empty. The photograph on the right is the iPod photo after one song has been added to the On-The-Go playlist.
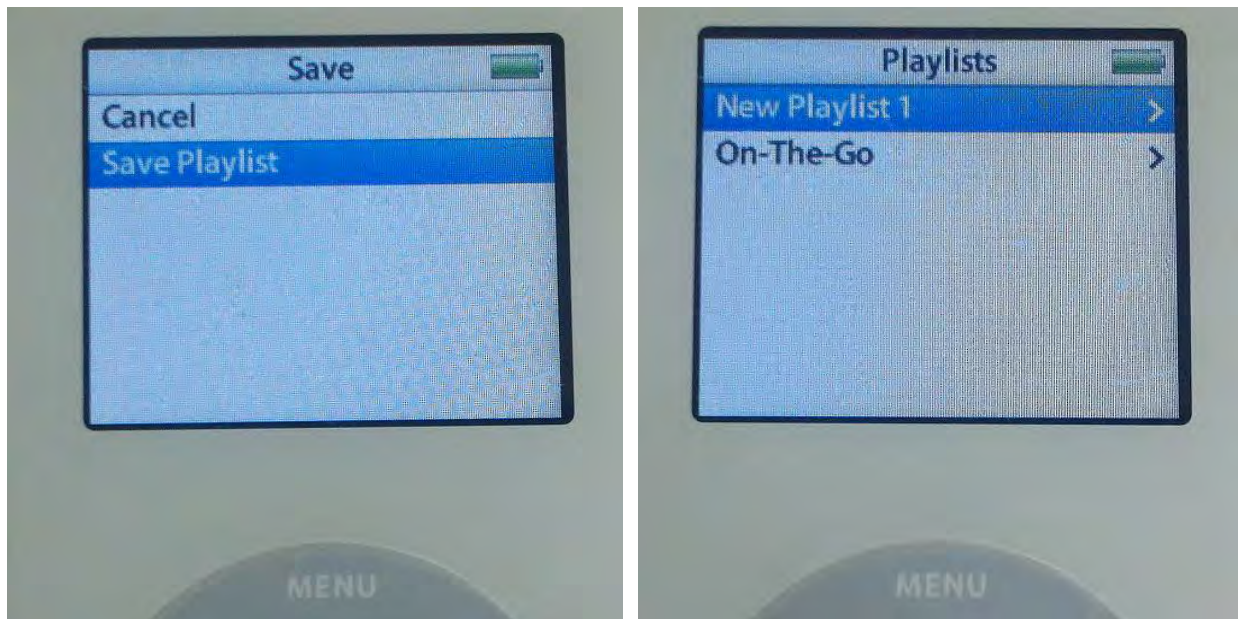
Figure 23. The photograph on the left shows the confirmation screen displayed on the iPod photo when the user chooses to save an On-The-Go playlist. [See also Figure 22.] The photograph on the right shows the Playlists menu after the user saves an On-The-Go playlist. Subsequent saved On-The-Go playlists will be named "New Playlist 2," "New Playlist 3," *etc*.

110. If iTunes is configured to automatically update the iPod, the On-The-Go playlists

(both saved and unsaved) will be copied to the iTunes library and preserved. iTunes names the

On-The-Go playlists "On-The-Go 1", "On-The-Go 2", *etc*. The user can then use iTunes to

synchronize these playlists to the iPod as desired.

111.   In contrast, Winamp with ml_ipod plugin version 1.32 displays the unsaved On-

The-Go playlist but not the saved On-The-Go playlists when the iPod is connected. In addition,

Winamp with ml_ipod plugin version 1.32 does not copy saved or unsaved On-The-Go playlists

into the Winamp library. When the iPod is ejected from Winamp, both the saved and unsaved

On-The-Go playlists disappear from the iPod. Several users complained on the Winamp forums

about the loss of On-The-Go playlists. [See, *e.g.*,

http://forums.winamp.com/showthread.php?t=195885.]

112.   Based on the changelog, the handling of On-The-Go playlists was apparently fixed

in version 1.40 (released 06/12/2006).

5.   ml_ipod Plugin Truncates The iTunes Database When The Disk Is Full

113.   Winamp with the ml_ipod plugin version 1.10 does not properly handle the iPod

database when the iPod disk is full. To illustrate this, I completely filled the iPod photo's hard

drive by using Winamp to copy over 10 GB of songs to the iPod and using Windows Explorer to

copy approximately 50 GB of data files to the root folder of the iPod. Then I connected the iPod

to Winamp and created five playlists from the existing songs on the iPod. Winamp gave no

indication of error when creating the playlists. I ejected the iPod, again with no indication of

error, but the playlist menu on the iPod shows that the iTunes database was truncated. Only one

of the playlists I created using Winamp was displayed. In addition, a playlist with a "blank"

name and no contents was also shown. [See Figure 24.]
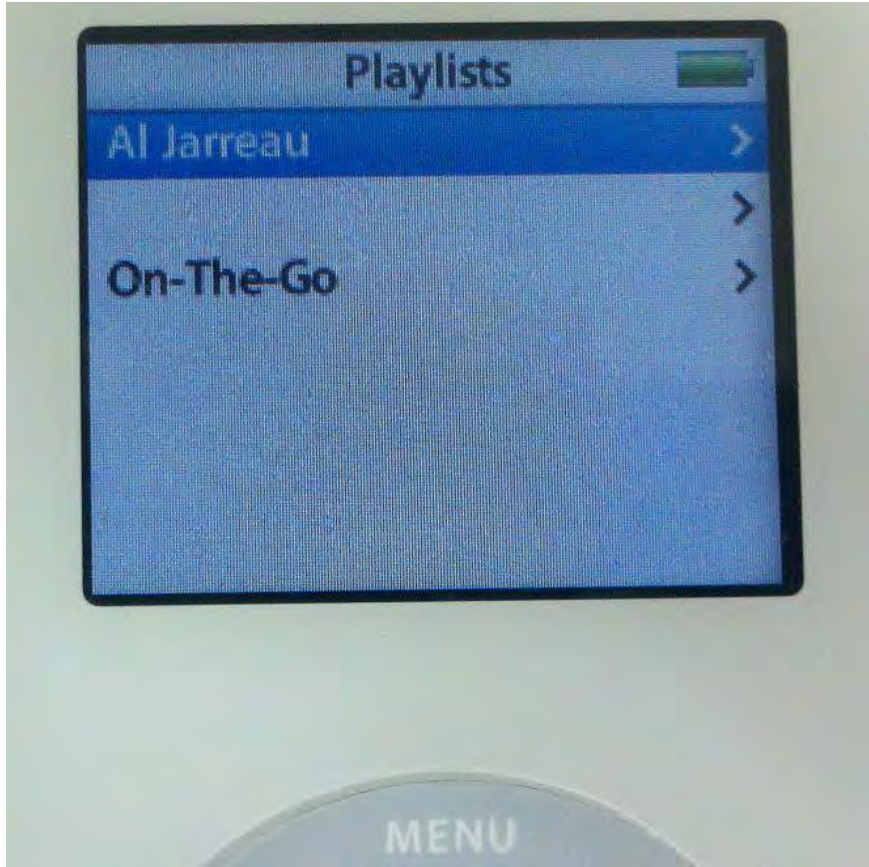
Figure 24. iPod photo showing the playlist display after ejecting the iPod.

6. Other Issues and Customer Complaints About ml_ipod

114. The ml_ipod version history and changelog summarize changes to the program, including bug fixes. In addition, users reported bugs on the SourceForge web site [http://sourceforge.net/tracker/?group_id=106528&atid=644704] and Winamp forums [http://forums.winamp.com]. I will give a few examples below.

115. A user reported that music files imported by ml_ipod with the .MP3 rather than .mp3 (uppercase vs. lower case) file extension caused his iPod nano to "crash." [See http://sourceforge.net/tracker/?func=detail&aid=1566624&group_id=106528&atid=644704.] This "bug" was assigned ID 1566624 and was reported fixed in the ml_ipod change log for version 2.00. [See ml_ipod changelog.]

116.   A user reported that deleting songs from the iPod did not work properly and that the iPod accumulated multiple copies of some songs. [See, *e.g.*, http://forums.winamp.com/showthread.php?t=175357.]

117.   Many users of the ml_ipod plugin reported problems after upgrading to Winamp 5.2, which included the pmp_ipod plugin. Although the plugins were incompatible, Winamp allowed both to be installed on the same computer and did not warn the user of the potential for problems. Symptoms included the corruption of the iTunes database and apparent loss of all the music files on the iPod. [See, *e.g.*, http://forums.winamp.com/showthread.php?threadid=239074, http://forums.winamp.com/showthread.php?threadid=238970, http://forums.winamp.com/showthread.php?t=239011.] ml_ipod version 1.40 contained the warning, "This iPod plugin can not [*sic*] coexist with pmp_ipod.dll which is found in your Winamp directory. Using both DLLs together will result in loss of your iPod music files!!!" [See, *e.g.*, warn_pmp_ipod.txt, revision 1.1.] The ml_ipod plugin was modified to prevent ml_ipod from running if pmp_ipod was also installed on the user's computer. [See, *e.g.*, function init() in view_ipod.cpp, revision 1.186.]

118.   ml_ipod could not initialize an iPod that was restored to factory condition and did not contain an iTunesDB, amongst other important files and directories, until version 2.04 (released 04/14/2007). [See change log.]

B.   PMP_IPOD PLUGIN

1.   pmp_ipod Plugin Deletes On-The-Go Playlists

119.   The pmp_ipod plugin did not correctly handle saved On-The-Go playlists. When an iPod containing a saved On-The-Go playlist is connected to Winamp version 5.2 with pmp_ipod version 0.3, Winamp displays an empty playlist named "On The Go". [See Figure 25.]

When the iPod is ejected, the On-The-Go playlist(s) on the iPod are lost. Either an empty playlist

(named "On The Go" without dashes between the words) appears on the iPod [see Figure 26.], or

the "On The Go" playlist disappears entirely [see Figure 27.].
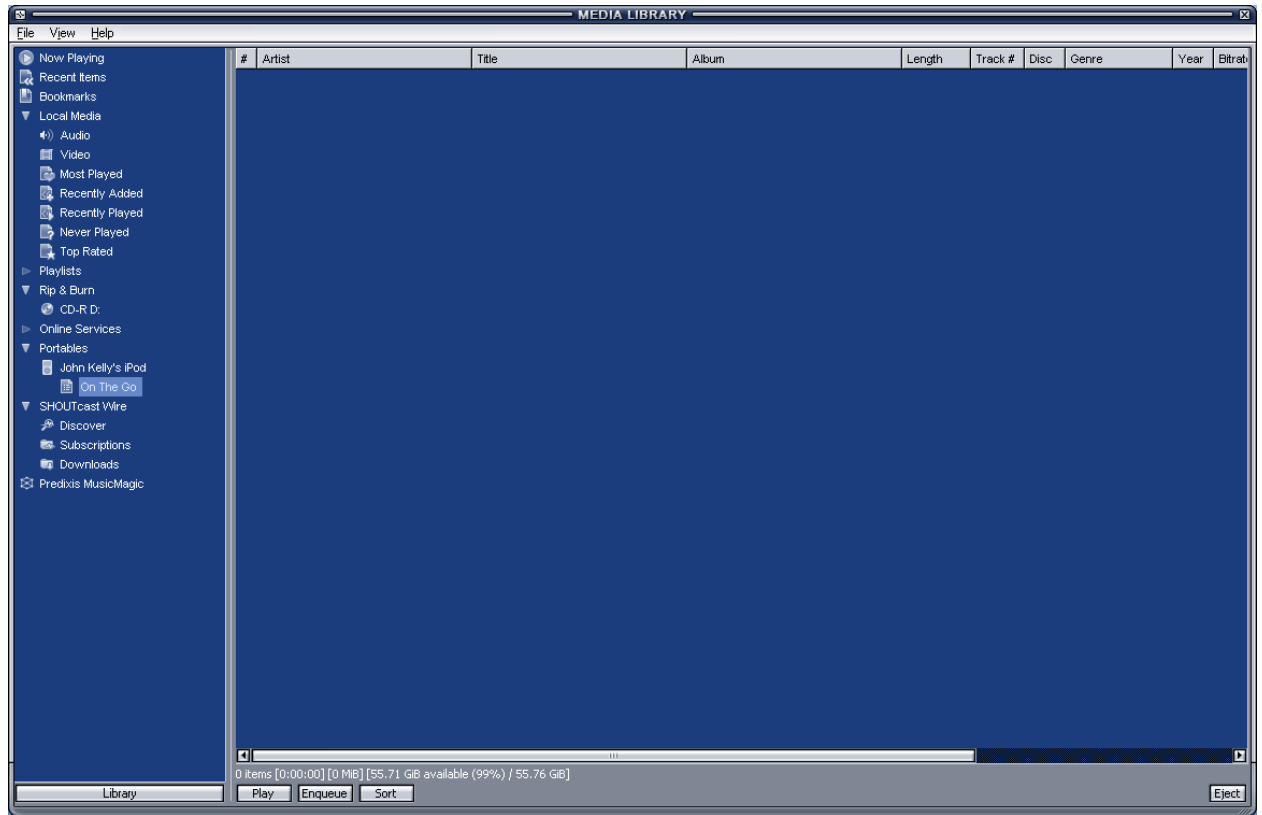
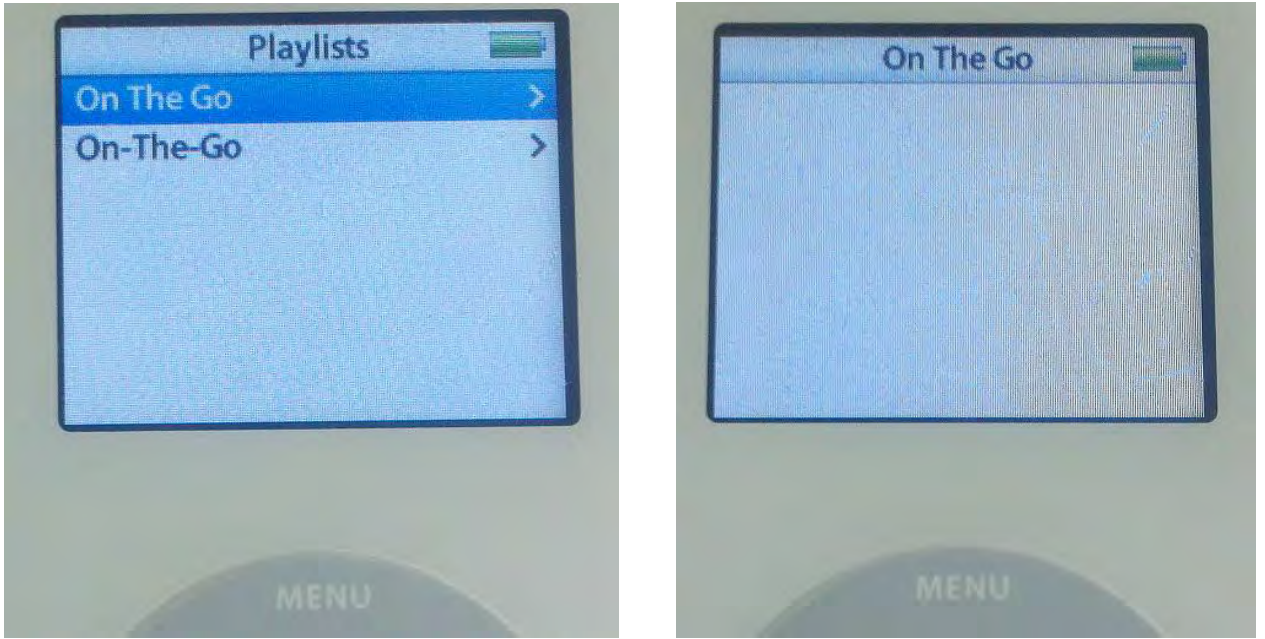**Figure 25. Screen shot of Winamp showing the contents of "On The Go" playlist.**

Figure 26. iPod photo showing the empy "On The Go" playlist created by Winamp with pmp_ipod.

Figure 27. iPod video showing that the "On The Go" (without dashes between the words) playlist is not displayed.

2. pmp_ipod Plugin May Leave The iTunes Database In An Inconsistent State

120. If the transfer of songs from a Winamp media library using pmp_ipod to a connected iPod is interrupted, for example, a power fault, the list of tracks in the iTunes database may be inconsistent with the master playlist. To simulate this, I began a transfer of fifty-four songs from Winamp 5.2 (with pmp_ipod version 0.3) to an iPod photo. I interrupted the transfer at about thirty-five songs by disconnecting the USB cable linking the iPod to the computer. The track list on the iTunes database contained thirty-three items, but the number of items in the master playlist was only thirty-two.

3. Other Issues and Customer Complaints About pmp_ipod

121. The Winamp web site provides forums where users can discuss technical problems and report bugs. [See http://forums.winamp.com/.] These forums contain many reports of problems with pmp_ipod. I will discuss a few examples below.

122. As described above, the first version of Winamp including the pmp_ipod plugin was incompatible with ml_ipod and caused corruption of the iTunes database. [See, *e.g.,* http://forums.winamp.com/showthread.php?threadid=239074, http://forums.winamp.com/showthread.php?threadid=238970, http://forums.winamp.com/showthread.php?t=239011.] According to the Winamp version history, this conflict was "fixed" in Winamp version 5.21. [See http://www.winamp.com/help/Version_History.]

123. A user reported that Winamp deleted all music from an iPod. [See http://forums.winamp.com/showthread.php?t=238764.]

124. Users also reported that the iPod shuffle would not play the tracks of an album in order. [See, *e.g.*, http://forums.winamp.com/showthread.php?t=240694&highlight=ipod.]

125.   The Winamp version history lists several additional fixes for pmp_ipod including in very recent versions.

- "Fixed: [pmp_ipod] Artist list on iPod not sorting 'The' correctly" [version 5.3];

- "Fixed: [pmp_ipod] Incompatibility with iTunes 7.1" [version 5.34];

- "Fixed: [pmp_ipod] Potential incompatability issues with latest version of iTunes" [verion 5.5];

- "Fixed: [pmp_ipod] Physical deletion of playing file" [version 5.53];

- "Fixed: [pmp_ipod] Filename length incompatibility with iPod Music Quiz v2" [version 5.53];

- "Fixed: [pmp_ipod] Various database, albumart, playback & disconnection issues" [version 5.55];

- "Fixed: [pmp_ipod] Reading of Play Count statistics" [version 5.55];

- "Fixed: [pmp_ipod] Deletion of non-existent files from database" [version 5.55];

- "Fixed: [pmp_android/ipod/usb] Issue with forward slashes in playlist paths" [version 5.6];

- "Fixed: [pmp_ipod] Compilation flag when Album Artist is 'Various Artists'" [version 5.601];

- "Fixed: [pmp_ipod] Sync and Eject issues" [version 5.601];

- "Fixed: [pmp_ipod] Nano & Shuffle 4G sync issues" [version 5.61];

- "Fixed: [pmp_ipod] Database corruption on Eject with some iPod models" [version 5.61];

126.   Versions of pmp_ipod (including Winamp 5.2 with iPod Plug-in 0.3) would not display an iPod that was restored to factory condition and did not contain an iTunesDB, amongst

other important files and directories. Thus, there was no way for pmp_ipod to initialize and manage such a factory-restored iPod.

VI. RealPlayer With Harmony Compatibility Issues

127.   RealPlayer 10.5 was the first version of RealPlayer to include Harmony Technology. RealPlayer with Harmony apparently enabled support for iPod and iTunes m4a and m4p music files. [See Figure 28.] There were multiple versions of 10.5 released over several years, each version identified by a build number. I conducted experiments using builds 6.0.12.1040 (dated 8/13/2004), 6.0.12.1235 (dated 06/30/2005), and 6.0.12.1741 (dated 10/16/2006).[87]

128.   RealPlayer 10.5 included a tab for the management of a music library stored on the local computer. [See Figure 29.] RealPlayer 10.5 also included a tab that enabled the transfer of songs to portable devices, including iPods. [See Figure 30.]

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[87] Dates are part of the digital signature included with the install program.
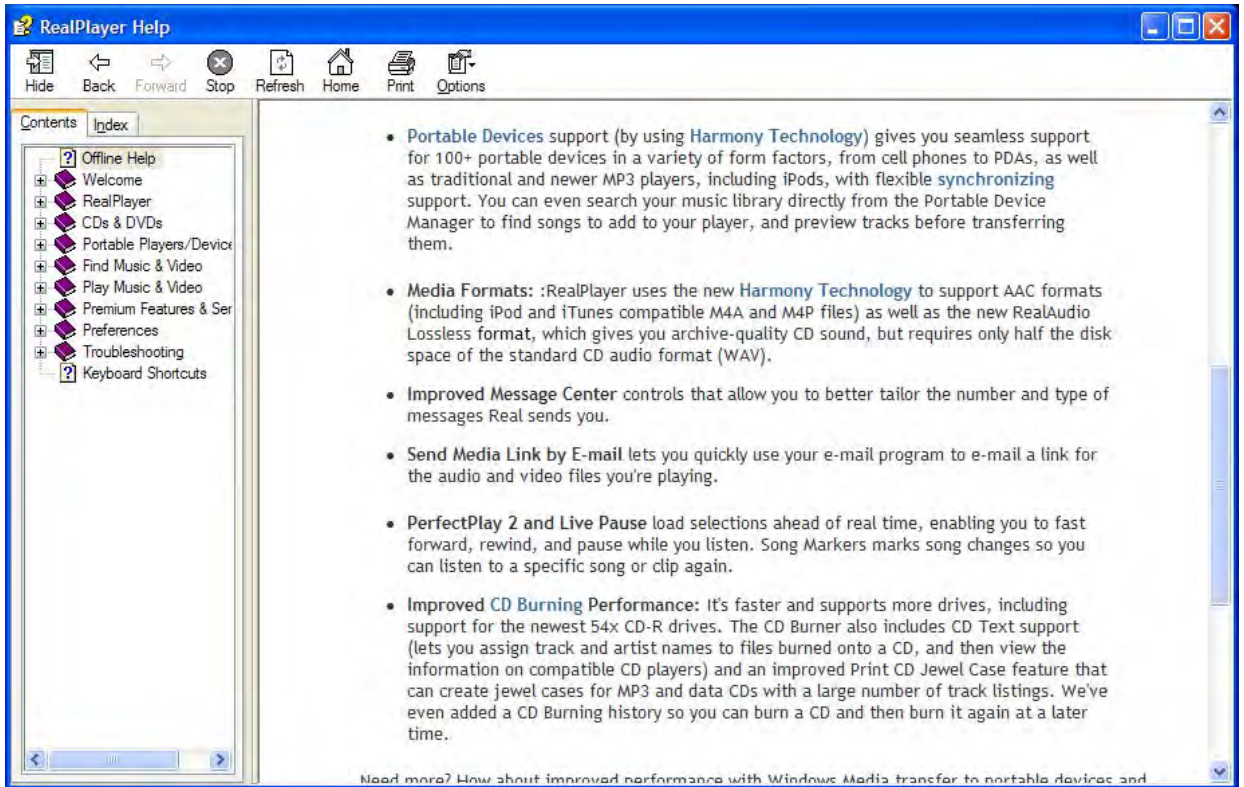
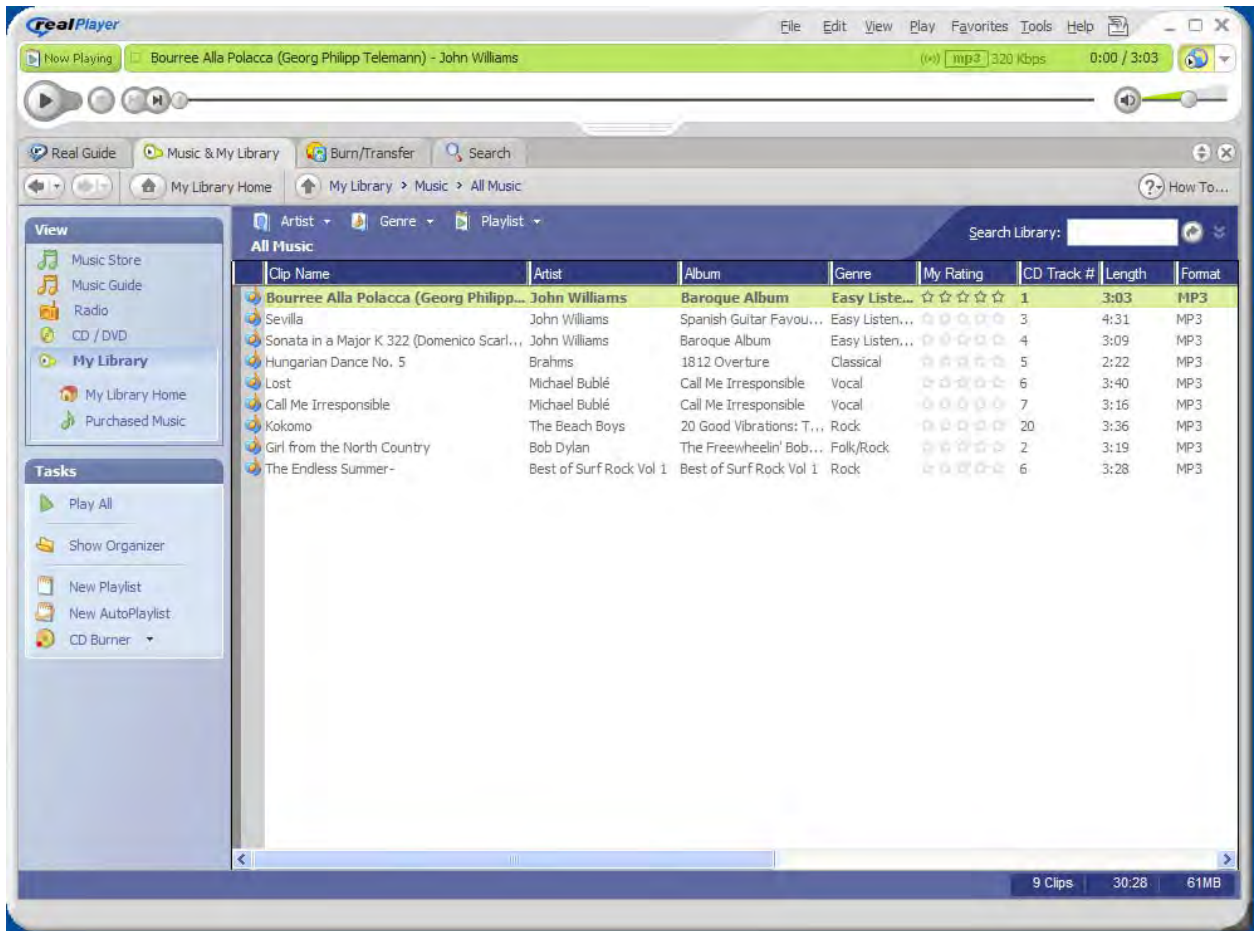**Figure 28. Screen shot of RealPlayer 10.5 Help topic discussing Harmony Technology.**

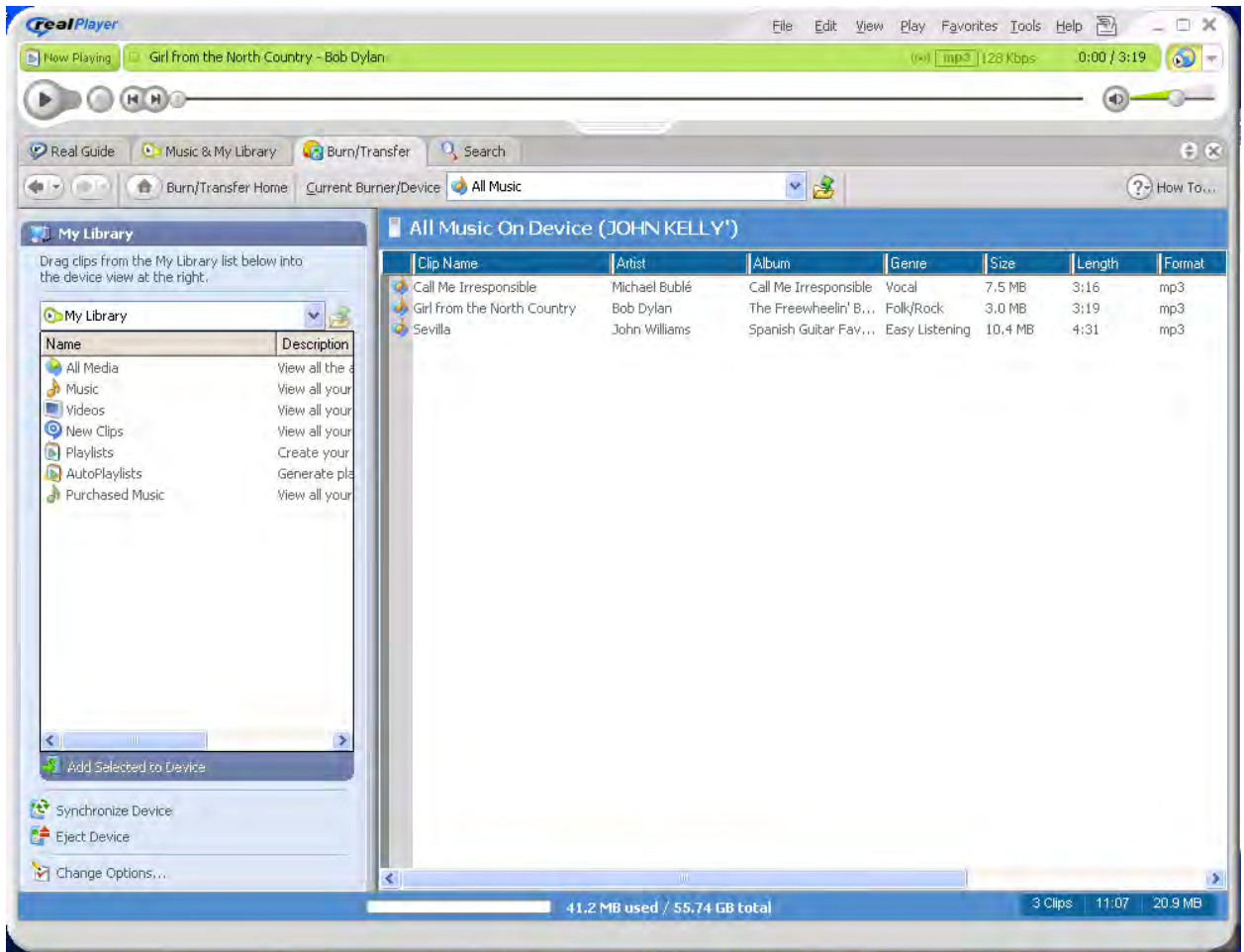**Figure 29. Screen shot of RealPlayer showing "My Library" of music tracks.**

Figure 30. Screen shot showing the Burn/Transfer tab with an iPod connected.

A. iTunes Database Contents Are Inconsistent

129. RealPlayer 10.5 (*e.g.*, Build 6.0.12.1235 and Build 6.0.12.1741) created an

inconsistent iTunes database. ██

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130. In addition, RealPlayer (*e.g.*, Build 6.0.12.1235 and Build 6.0.12.1741) fills certain fields in the iTunes database differently than iTunes does. ████████████████████████

██

██

RealPlayer 10.5, on the other hand, rounds the size of the music file down to a multiple of 1 kilobyte and uses a totalTimeInMS that may be less than, greater than or the same as the iTunes 4.6 time. In the experiments that I performed, the totalTimeInMS written by RealPlayer 10.5 differed from the value written by iTunes 4.6 by as much as 673 milliseconds (more than 0.5 seconds). ██████████████████████████████████████

██

████████████████████

131. As I discussed in the Kelly Declaration at ¶ 33, when RealPlayer transfers music to an iPod, it also creates a new directory on the iPod (iPod_Control/Music/rndb) and stores several files therein.

B. PLAYLISTS ARE CORRUPTED

132. iTunes 4.6 and RealPlayer 10.5 with Harmony did not access the iTunes database in a compatible way based on my observations. When an iPod is connected to the customer's computer, as soon as iTunes runs, it will read and update the iTunes database as needed. If

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iTunes is configured to automatically update all songs and playlists [see Figure 31], it will erase all songs on the iPod and build a new iTunes database based on the customer's iTunes Library. If iTunes is configured so that the customer can manually manage songs and playlists, iTunes may still modify the iTunes database even when it is not copying files or playlists to the iPod. If the customer also uses RealPlayer 10.5 with Harmony to add songs to the iPod, the two programs can make conflicting changes to the database. The following experiment illustrates the conflict.

- The iPod photo (firmware version 1.0) was restored to factory condition and English was chosen as the language. This deleted all files, created the base set of folders and files, and restored all settings to their default values.

- The iPod was connected to a Windows XP computer that had both iTunes 4.6 and RealPlayer 10.5 with Harmony (Build 6.0.12.1235) installed. When iTunes opened, the iPod Setup Assistant was cancelled. Then iTunes was quit.

- RealPlayer 10.5 with Harmony was then launched. Six songs were copied to the iPod.

- iTunes was launched and one song was copied to the iPod. iTunes was then quit.

- RealPlayer 10.5 with Harmony was then used to copy a playlist (named "My Playlist") containing four of the songs already on the iPod. Then the iPod was disconnected from the computer.

133. The iPod Playlists menu displays "My Playlist," a playlist without a name and On-The-Go. [See Figure 32.] Both "My Playlist" and the nameless playlist contain no songs. [See Figure 32.] The playlists section of the iTunes database was corrupted because iTunes 4.6 and RealPlayer 10.5 with Harmony did not properly coordinate their access to the database. The next time that the iPod is connected to the computer and iTunes runs, iTunes will tell the customer that the iPod is corrupted and needs to be restored. Thus, the customer will see content on the iPod

appear and disappear seemingly at random depending on how and in what order they are using

iTunes and RealPlayer 10.5 with Harmony. They may also be asked to repeatedly restore and

resync their iPod.
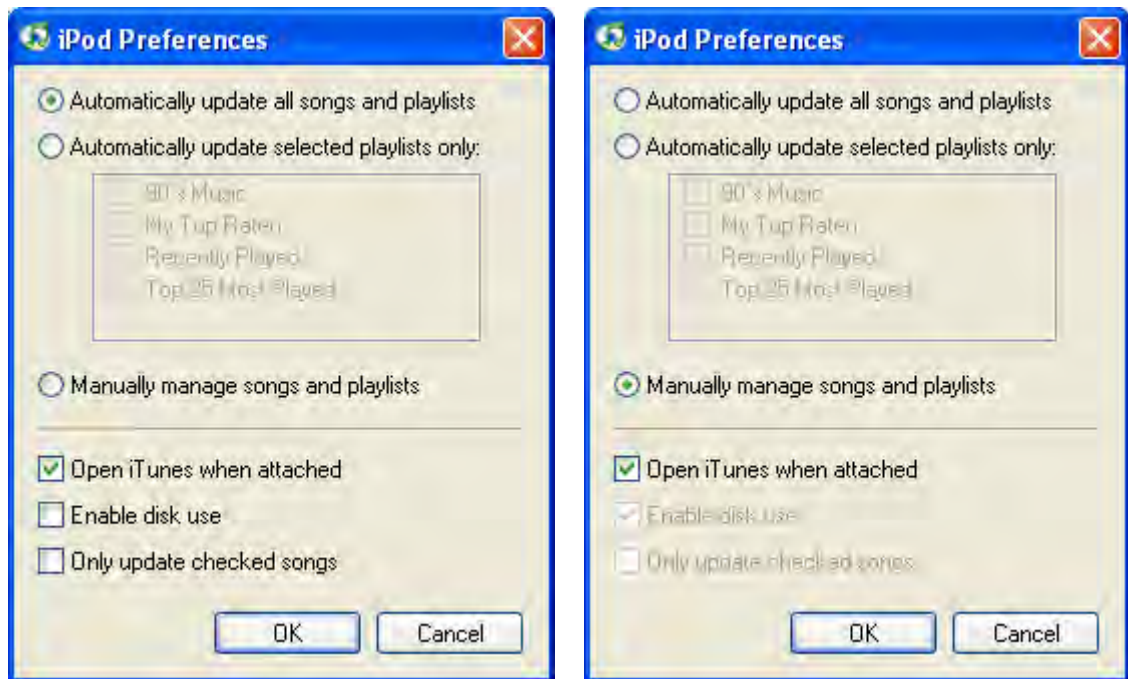
Figure 31. The left hand screen shot shows the iPod options for an iPod initialized to "Automatically update my iPod" using the iPod Setup Assistant in iTunes 4.6. The right hand screen shot shows the iPod options for an iPod initialized to not automatically update using the iPod Setup Assistant.
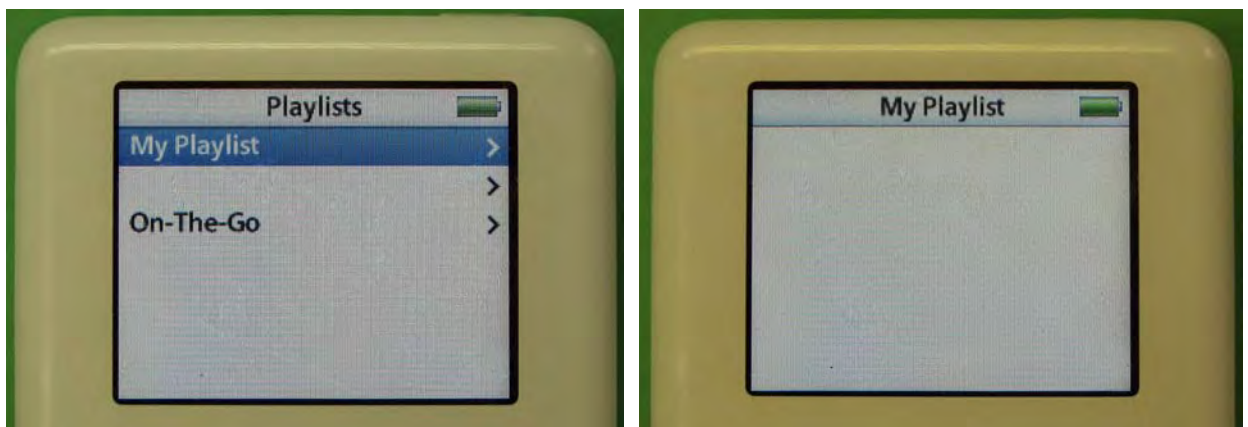
Figure 32. Photographs of the iPod photo (P98) after both iTunes and RealPlayer sync content to it as described in ¶ 132. The photograph on the left shows the Playlists menu. The photograph on the right empty shows that the "My Playlist" playlist is empty.

134.   Conflicts with iTunes Software apparently persisted. In March 2006,

RealNetworks told customers that "If you already have iTunes installed, it can cause some

conflicts with RealPlayer and your iPod. To avoid these conflicts, we recommend setting up your

iPod to be compatible with RealPlayer." It also told users to turn off automatic song and podcast

updating, noting that "every time you open iTunes with your iPod connected, non-iTunes tracks

are erased from the iPod" and that "RealPlayer can transfer the [Music Store] tracks over, but the

iPod cannot play them once iTunes synchronizes with the device." [See

http://service.real.com/musicstore/support.html?section=iPodRPinstall, which is discussed in a

March 2, 2006 email about RealPlayer with Harmony working with iPods at that time

(Apple_AIIA00093860).] Even in the Oct. 2006 release of RealPlayer with Harmony (Build

6.0.12.1741), the troubleshooting section of the help file informed customers that "iTunes can

cause issues when you attempt to use RealPlayer to download music to your iPod." [See Figure

33.]
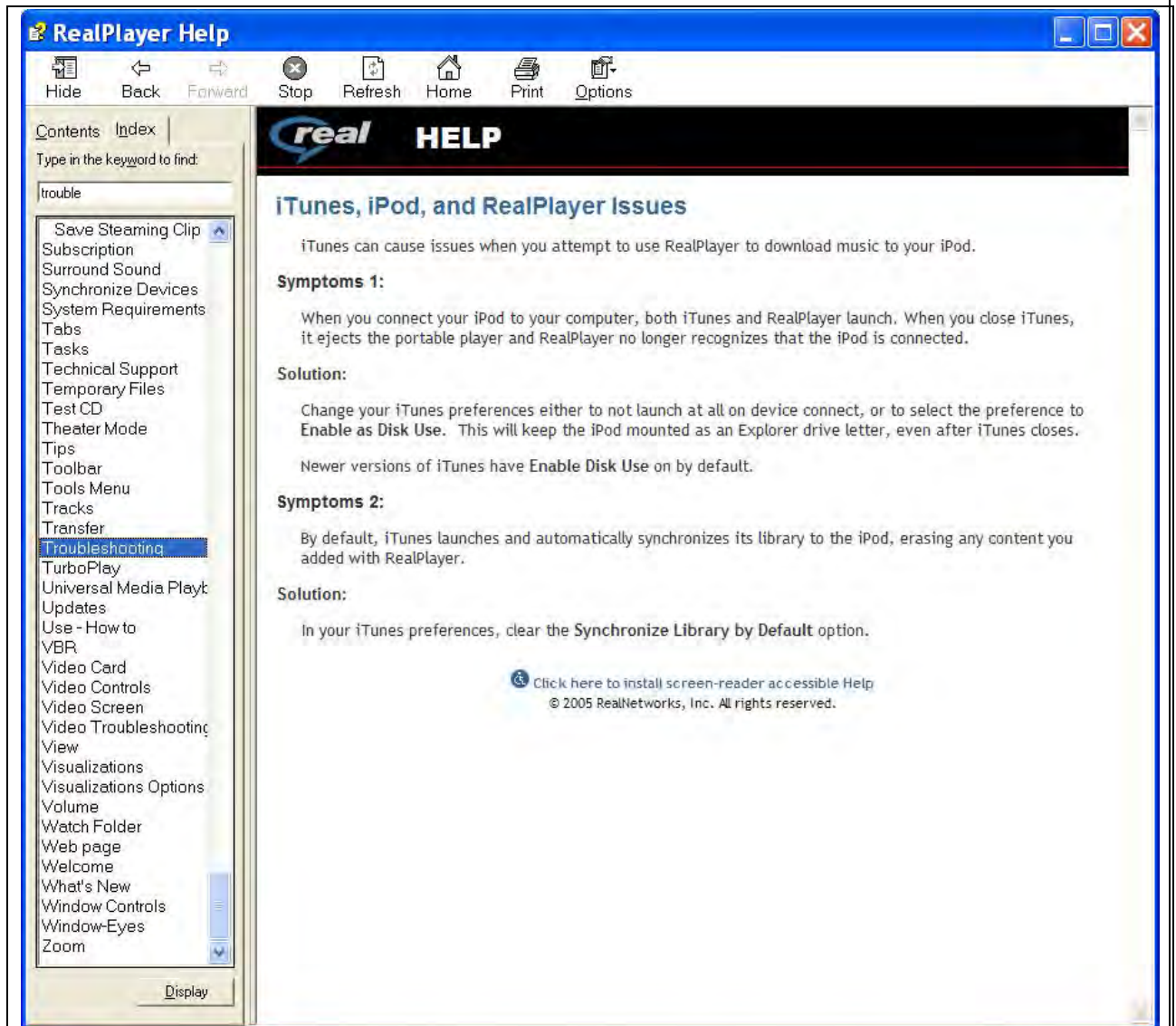
Figure 33. "iTunes, iPod, and RealPlayer Issues" page from the RealPlayer with Harmony help file installed with RealPlayer 10.5 (Build 6.0.12.1741).

C.   REALPLAYER DELETES ON-THE-GO PLAYLISTS

135.   On-the-Go playlists are improperly handled by RealPlayer with Harmony. To

illustrate this problem I used RealPlayer 10.5 build 6.0.12.1040 to restore an iPod photo (with

firmware version 1.0). [See Figure 34.] I then synchronized a library of three songs to the iPod.

Next, I ejected the iPod and created and saved an On-The-Go playlist. [See Figure 35.] When I

opened the iPod in RealPlayer the saved playlist did not appear in the "Playlists On Device"

display for the iPod. [See Figure 36.] If the user performs an action that causes RealPlayer to

update the iTunes database on the iPod – for example, rating a song [see Figure 37] – the saved

On-The-Go playlist is deleted after the iPod is ejected. RealPlayer also does not preserve

unsaved On-The-Go playlists. The unsaved On-The-Go playlist is lost from the iPod if
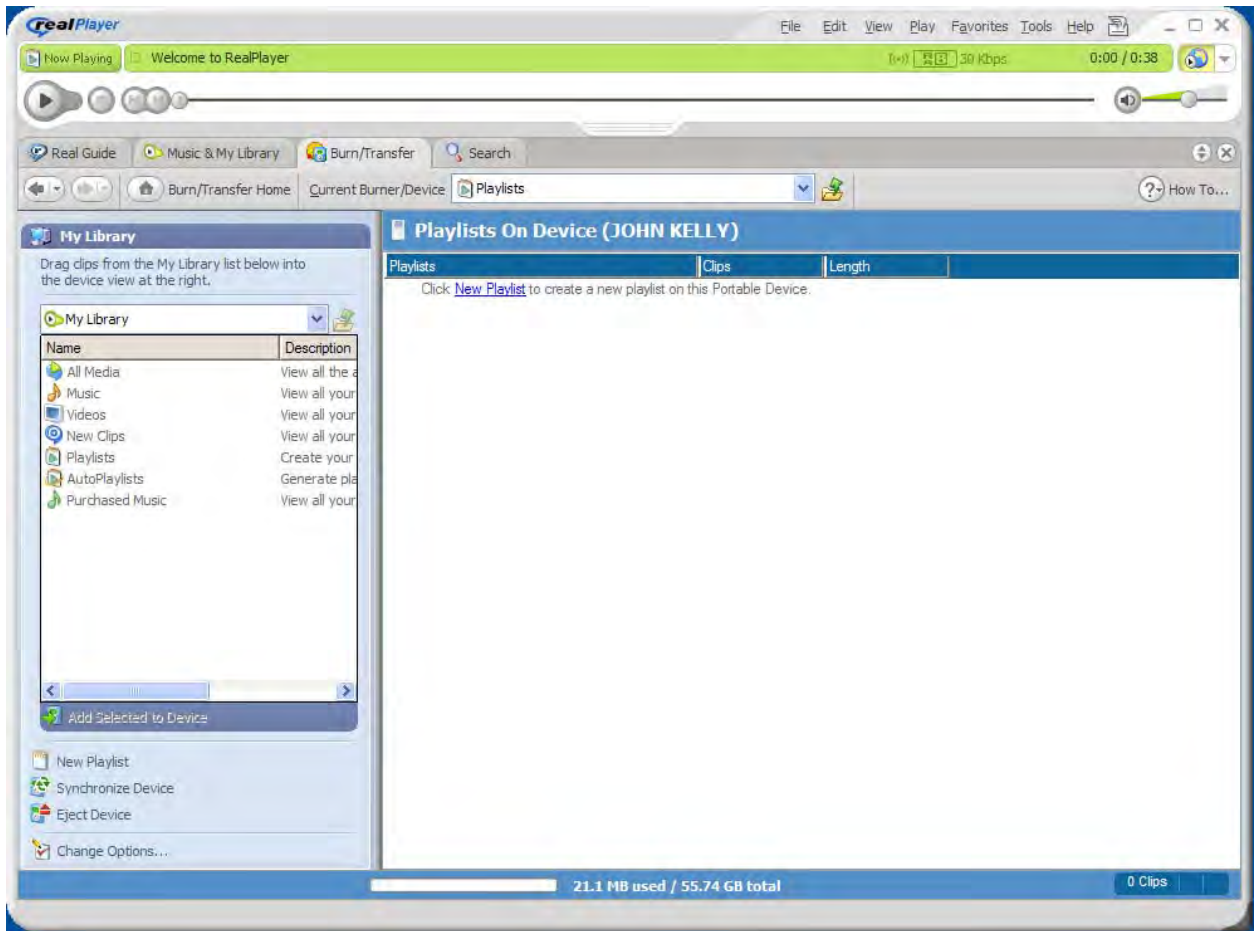
RealPlayer updates the iTunes database on the iPod.
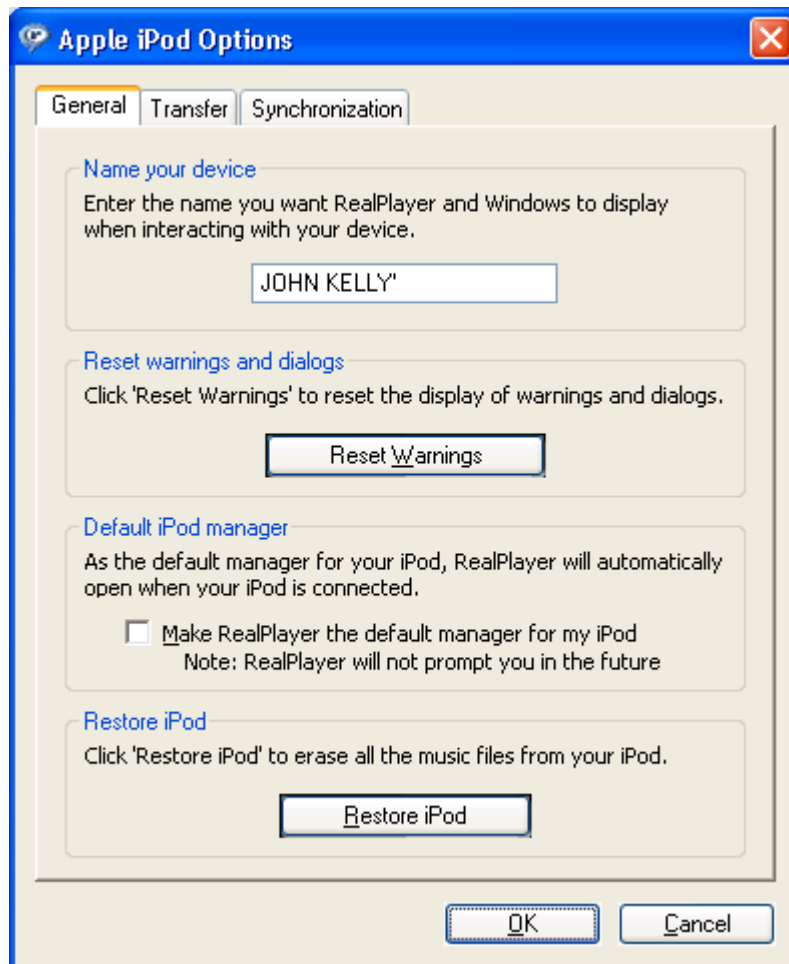
Figure 34. Screen shot showing the "Restore iPod" option available with RealPlayer 10.5.
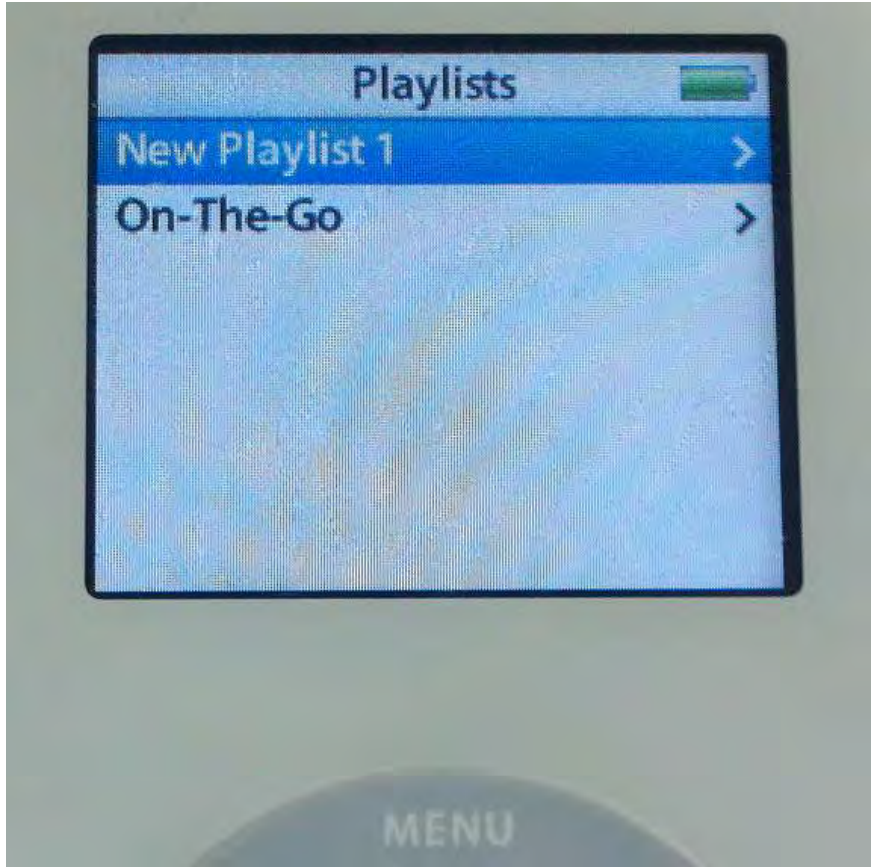
Figure 35. iPod photo showing a saved On-The-Go playlist.

Figure 36. Screen shot showing the playlists on the iPod is empty.

Figure 37. Screen shot showing the "Edit Clip Info" dialog for a song stored on the iPod.

D.   **REALPLAYER CREATES ZERO LENGTH DATABASE WHEN DISK IS FULL**

136.   RealPlayer with Harmony does not properly handle the iPod database when the

iPod disk is full.[88] To illustrate this, I completely filled the iPod photo's hard drive by using

RealPlayer to copy over 10 GB of songs (1320 tracks) to the iPod and using Windows Explorer to

copy approximately 50 GB of data files to the root folder of the iPod. I connected the iPod to

RealPlayer and created "My Playlist" and added 22 tracks from the existing songs on the iPod to

the playlist. [See Figure 38.] I created a second playlist – "Rock" – and added 391 tracks to the

device. [See Figure 39.] When I clicked "Eject Device," RealPlayer reported that I could safely

remove the device. [See Figure 40.] However, none of the 1320 tracks appeared in the song list

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[88] I performed this experiment with builds 6.0.12.1040, 6.0.12.1235 and 6.0.12.1741. All three experiments
produced identical results.

on the iPod, and it appeared that I had lost 10 GB of music. When I examined the iTunes

database on the iPod, I discovered that it was zero bytes in length. RealPlayer had given no

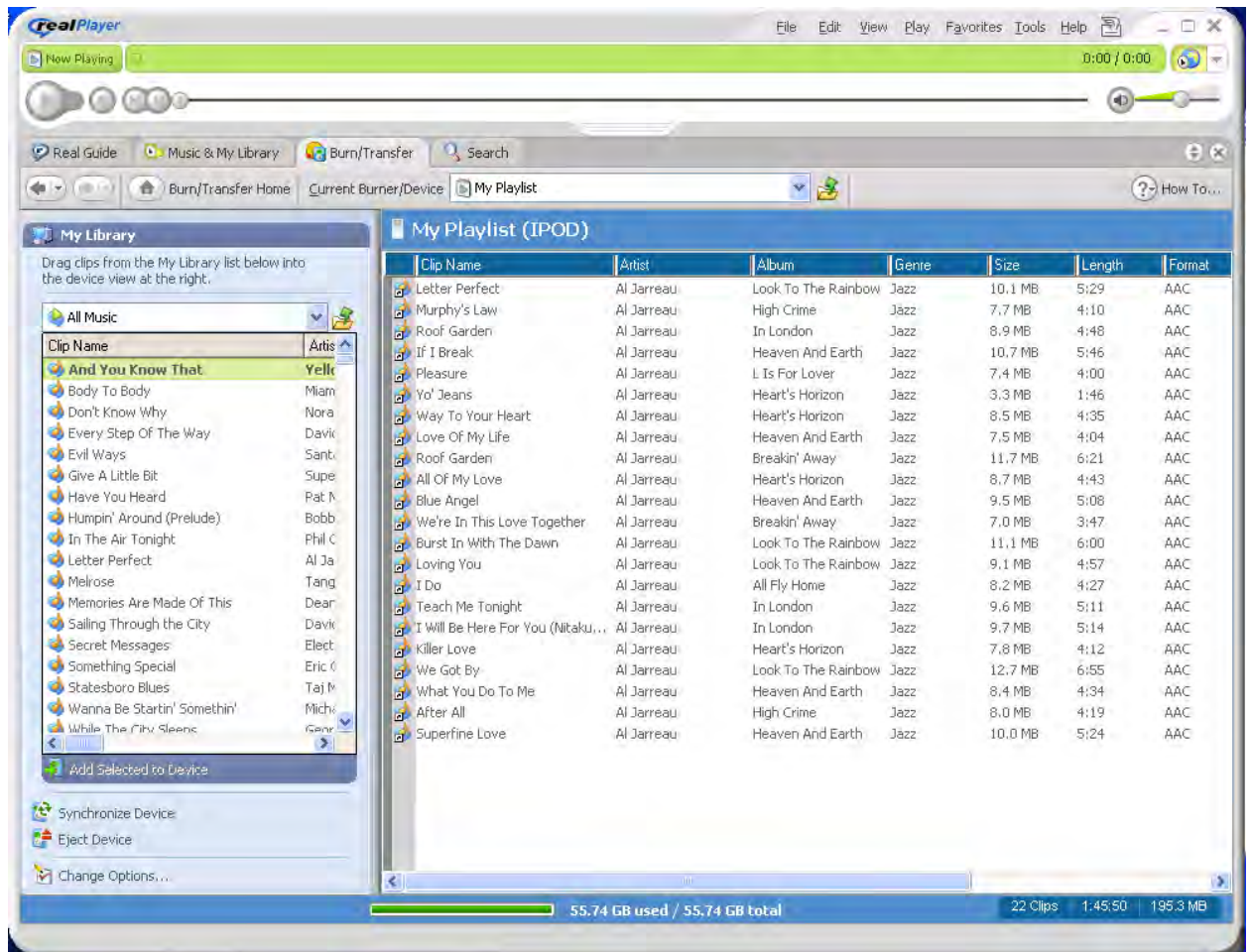indication of its failure to correctly write the iTunes database.

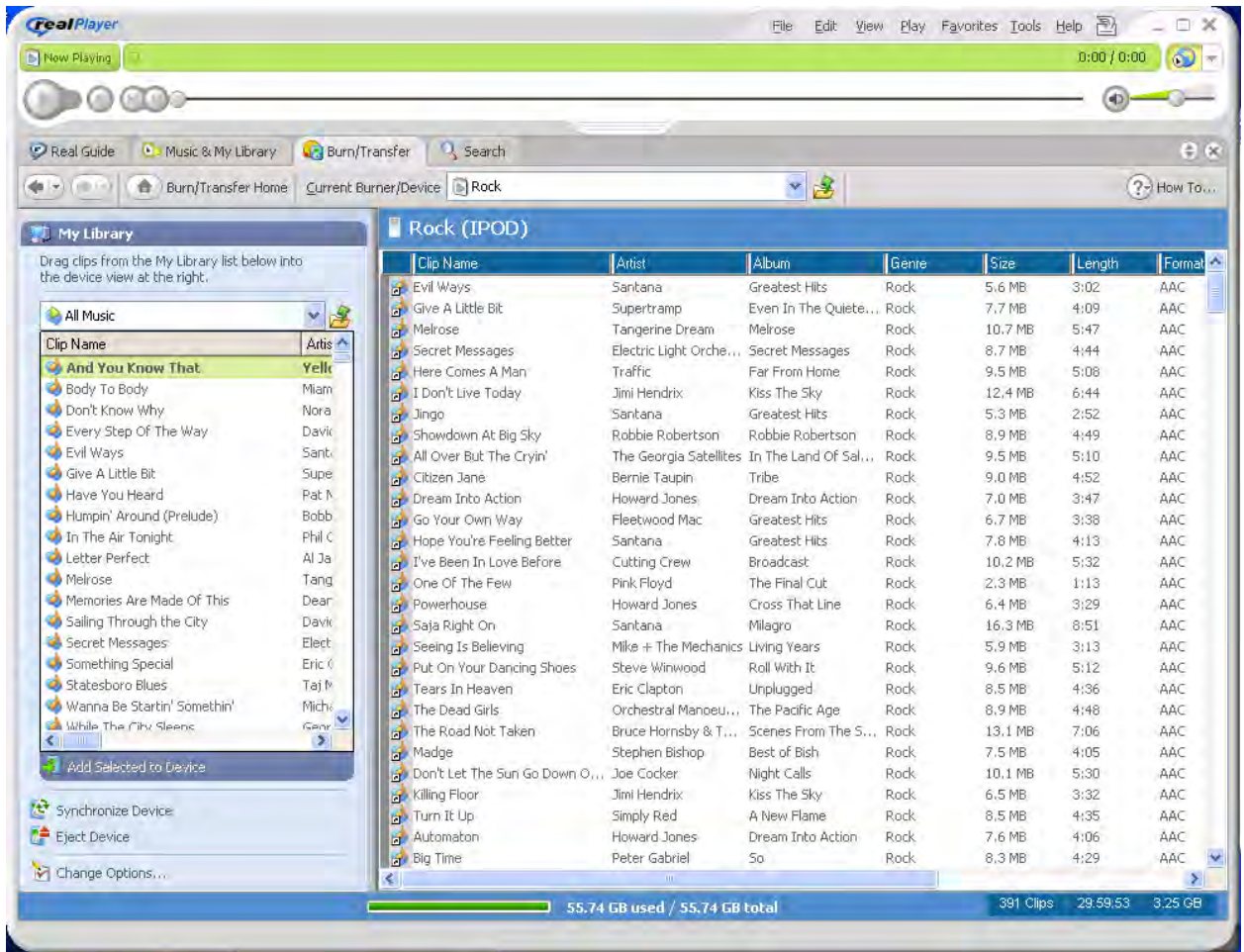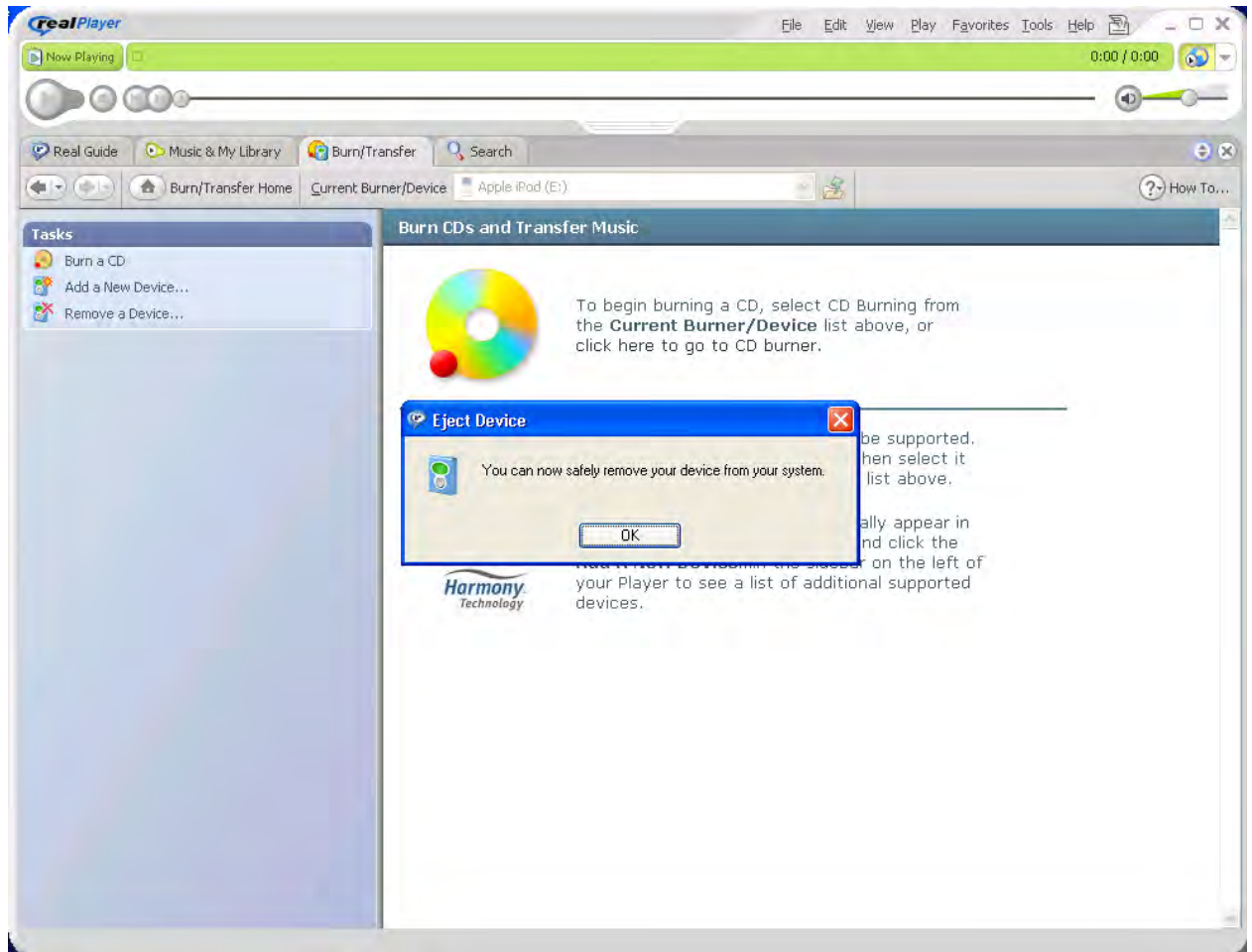**Figure 38. Screen shot of RealPlayer showing the contents of "My Playlist" on the iPod.**

Figure 39. Screen shot of RealPlayer showing the contents of "Rock" playlist on the iPod.

Figure 40. Screen shot of RealPlayer informing the user that it is safe to disconnect the iPod.

E. REALPLAYER CRASHES CAUSE MUSIC TO DISAPPEAR

137.   During the course of one experiment using RealPlayer 10.5 Build 6.0.12.1040, I

attempted to copy the RealPlayer library of 1321 songs and two autoplaylists to the iPod photo.

RealPlayer "crashed" at 99% complete. In other words, it experienced an error that caused

Microsoft Windows to immediately terminate the program. This left the iPod in a state in which

it showed that there was no music on the iPod even though the Music folder contained over 10

GB of music files.

F. **REALPLAYER DOES NOT HANDLE SPECIAL CHARACTERS IN SONG TAGS**

138.   RealPlayer improperly displays and causes the iPod to improperly display the names of songs containing multi-byte UTF-8 characters. For example, RealPlayer Build 6.0.12.1040 does not correctly display the song title "Melõdiqúe." [See Figure 41.] When RealPlayer writes this song name to the iTunes database on an iPod photo (with firmware version 1.0), it does not correctly convert the UTF-8 characters to two byte Unicode, and the song display on the iPod is also incorrect. [See Figure 42.] This song name is displayed correctly by iTunes 4.7 [see Figure 43], and is correctly displayed on the iPod when it is written to the iPod using iTunes 4.7 [see Figure 42].

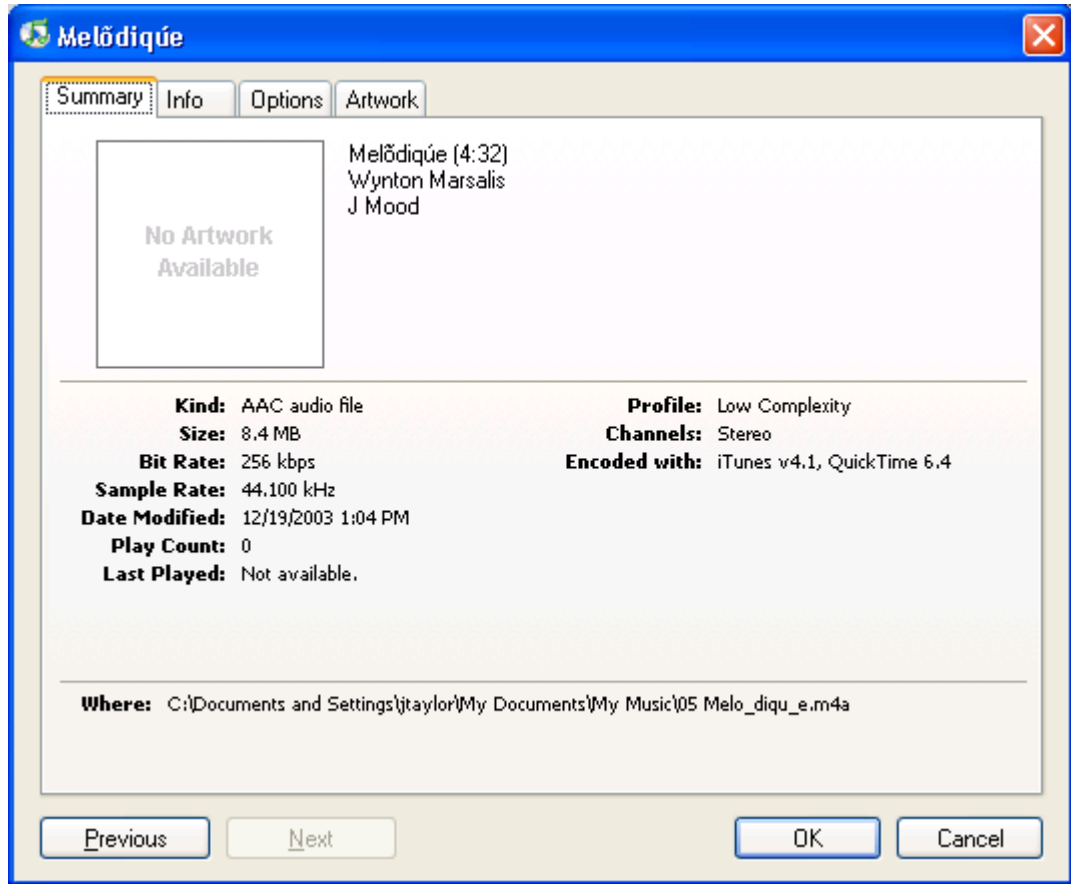**Figure 41. Screen shot showing incorrect display of song name containing multi-byte UTF-8 characters.**
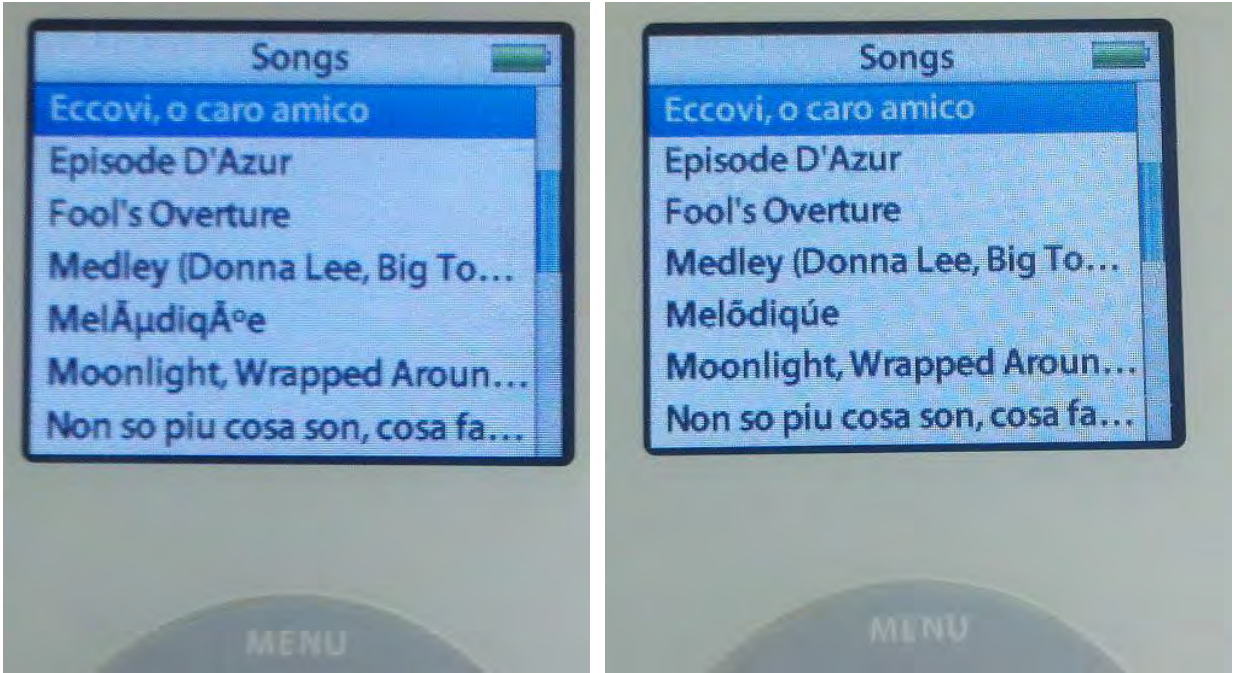
Figure 42. The photograph on the left shows a portion of the song list on the iPod photo after using RealPlayer to transfer the songs. The song "Melõdiqúe" is displayed incorrectly. The photograph on the right shows the same portion of the song list on the iPod photo after using iTunes 4.7 to transfer the songs. The song "Melõdiqúe" is displayed correctly.

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Figure 43. Screen shot showing iTunes correctly displays a song name containing multi-byte UTF-8 characters.

G. REALPLAYER LEAVES ORPHAN FILES ON THE IPOD

139. When using RealPlayer, if the transfer of songs from the media library to a connected iPod is interrupted, for example, by a power fault, the iPod may appear to be empty even though many songs have been copied to the Music folder on the iPod. To simulate this, I initiated the transfer of a group of songs from the RealPlayer Build 6.0.12.1040 library to an iPod photo, which contained no songs, but then interrupted the transfer by disconnecting the USB cable linking the iPod to the computer. I performed experiments interrupting the transfer after

about 25, 35 and 50 songs had been transferred.[89] In all three cases the song list on the iPod

display was empty.[90] The iTunes database on the iPod contained no track records. However, the

Music folder on the iPod contained the expected number of songs. When I attached the iPod to

the computer and used RealPlayer to transfer the songs again (this time allowing the transfer to

complete), there were duplicates of the music files because the songs that had been successfully

transferred but had not been added to the iTunes database were copied to the iPod a second time.

This reduces the available storage of the iPod.

H.   REALPLAYER DOES NOT SUPPORT THE iPOD VIDEO

140.   RealPlayer did not properly support the iPod video (*i.e.*, iPod classic 5th

generation) for at least two reasons. First, all songs and videos that RealPlayer copies onto the

iPod video are displayed in both the Songs and the Movies lists on the iPod video. Second,

RealPlayer converts video clips to audio clips.

141.   I performed the following experiment using RealPlayer build 6.0.12.1741 (digital

signature dated 10/16/2006) to demonstrate these problems. First, I added two songs and three

videos to the RealPlayer library. [See Figure 44.] The songs are properly recognized as MP3

audio. The MPEG-4 video clip, which is in a format that can be played by the iPod video, is

imported as a song instead of a video. The Windows Media Video and AVI video clips are

imported as videos.

142.   I then connected the iPod video (firmware version 1.0) and initialized the iPod by

clicking RealPlayer's "Restore iPod" button. Next, I copied the two songs to the iPod video and

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[89] It appears that RealPlayer writes an iTunes database to the iPod every 100 files.

[90] If the iPod already contained songs, those songs would still appear in the display, but none of the new songs would
be added to the Songs menu on the iPod.

disconnected the iPod from the computer. As shown in Figure 45, the two songs appear in both

the Songs list and the Movies list in the iPod video user interface. The songs should only appear

in Songs list. My examination of the iTunes database created by RealPlayer shows that the

database is missing information required by the iPod video. In fact, the database is missing fields

added after iTunes 4.5 (released in April 2004).

143.   Then, I connected the iPod video to the computer once again and copied the three

video clips to the iPod video. RealPlayer only copied the MPEG-4 and Windows Media Video

clips. Although RealPlayer did not copy the AVI video clip, it did not display any error or

warning messages. Finally, I disconnected the iPod video from the computer. Both the songs and

videos are displayed in the Songs list and the Movies list in the iPod video user interface. [See

Figure 46.] In addition, none of the videos are playable as videos on the iPod. The video clips

have been converted to MPEG-4 audio files by RealPlayer, again, without displaying an warning

messages.
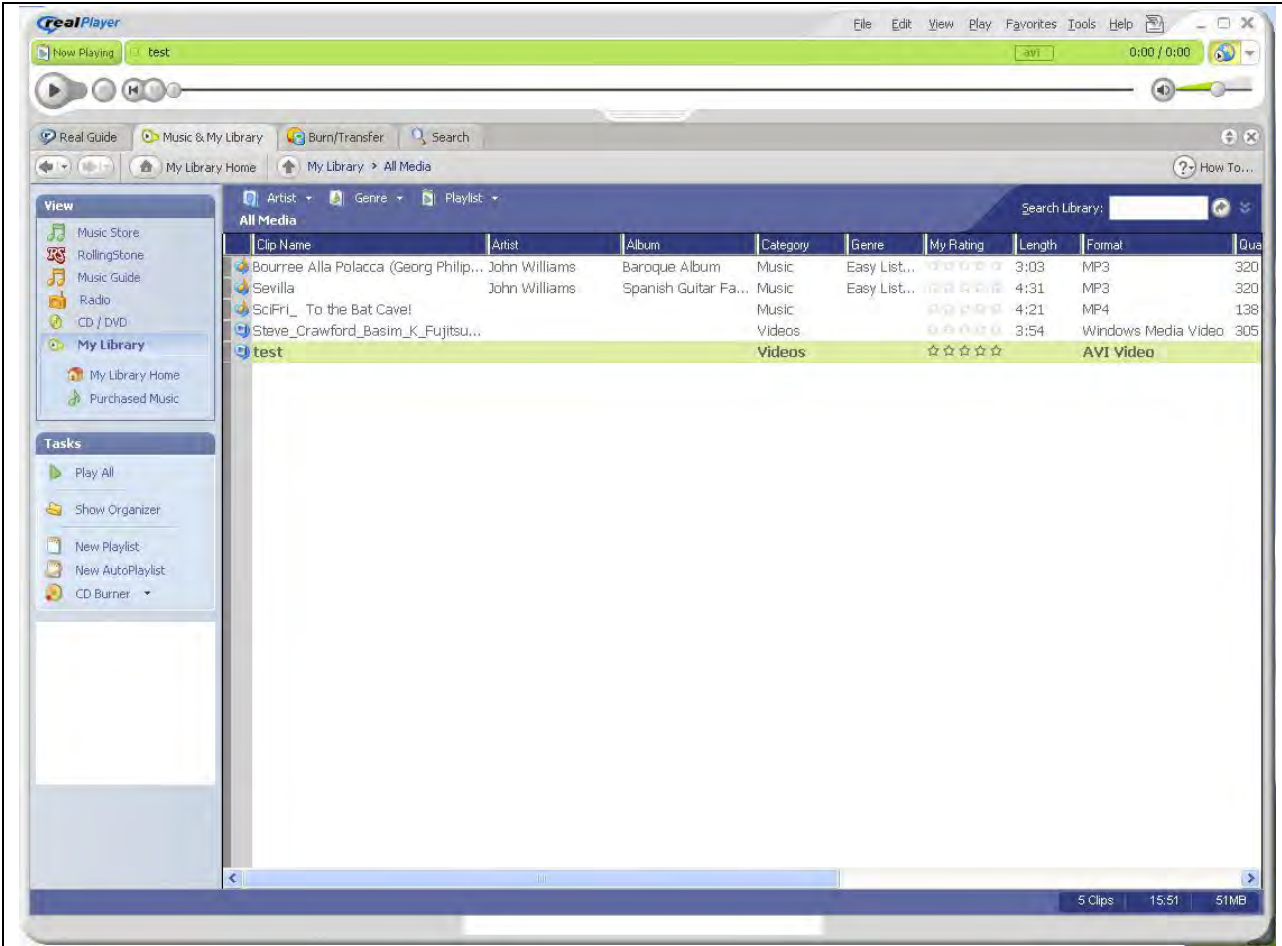
Figure 44. This RealPlayer library contains two songs in MP3 format, one video clip in MP4 format (placed in the category Music instead of Videos), one video clip in Windows Media Video format and one video clip in AVI video format.
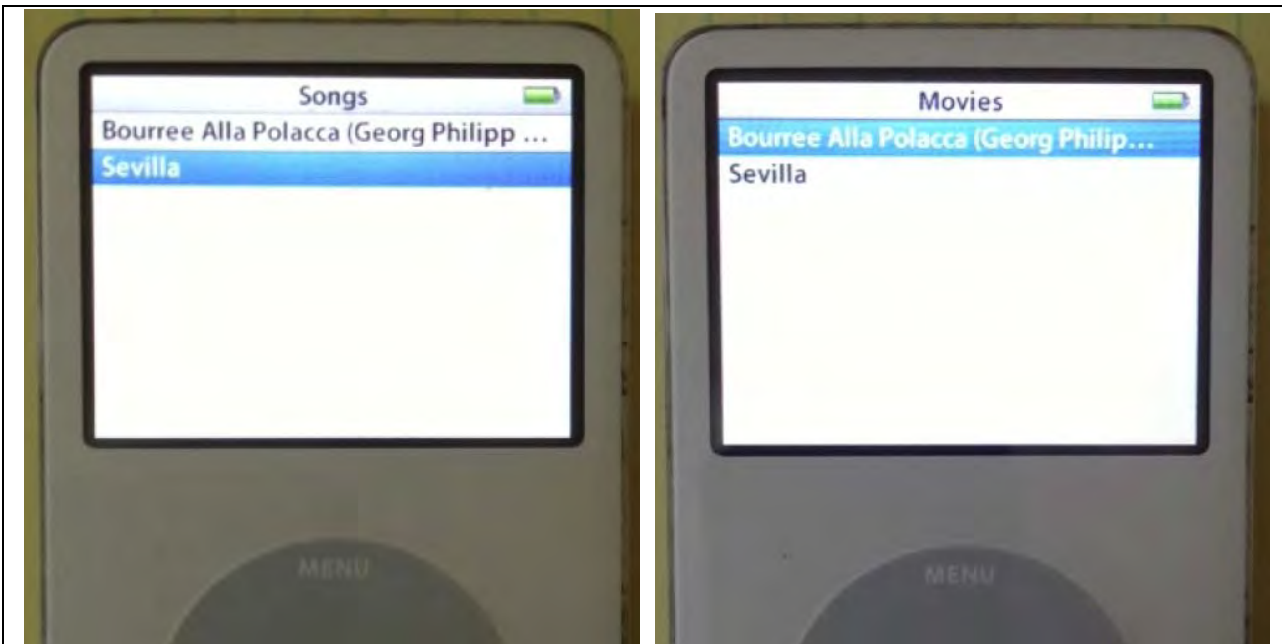
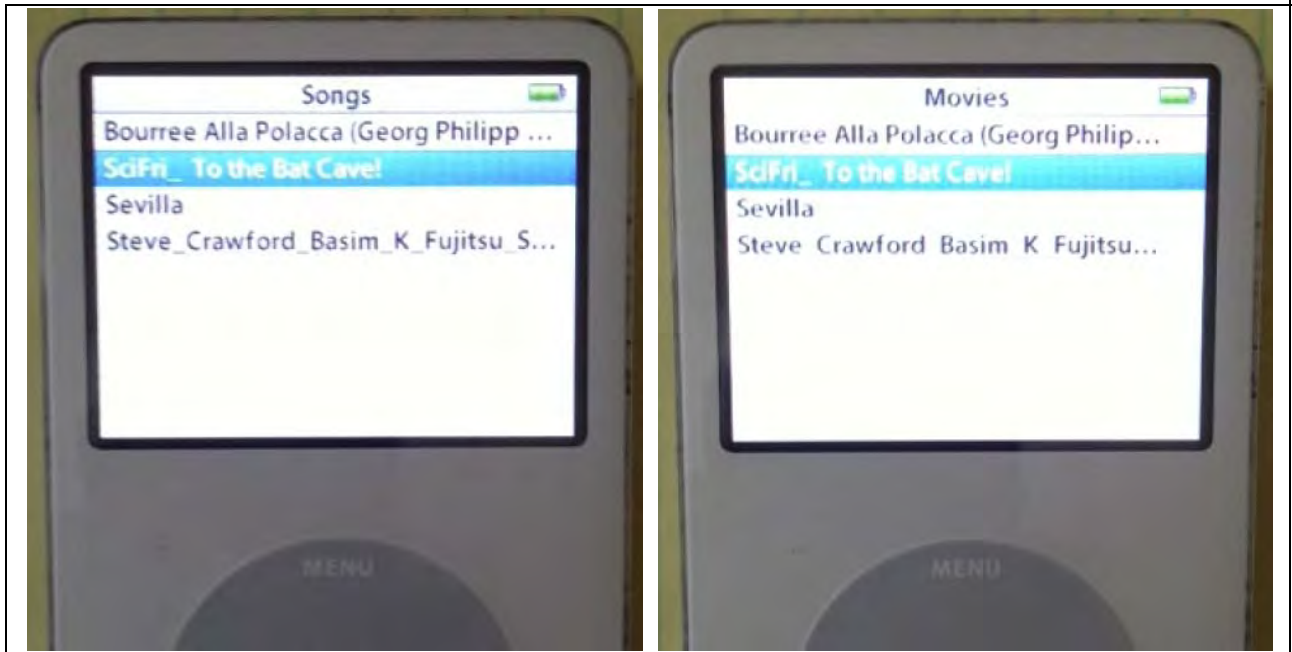**Figure 45. The two songs are listed as both songs and movies.**

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Figure 46. All of the content is listed as both songs and movies.

I. OTHER CUSTOMER COMPLAINTS

144. Some users reported that songs transferred to the iPod by RealPlayer are skipped (either entirely or after playing a portion of the song) during playback on the iPod. [See, *e.g.*, http://forums.ilounge.com/ipod-classic-legacy-ipods/110673-ipod-mini-skipping-songs.html.] One user posted on his blog instructions that he received from Real Networks for fixing this issue. [See http://johnbell.typepad.com/weblog/2006/04/real_networks_r.html.] One proposed solution was to disable optimized files. Another proposed solution was to delete the keybag files from the iPod.

145. Users have also reported that not all of the songs that Real Player says are on the iPod are displayed in the iPod menus. [See, *e.g.*, http://forums.ilounge.com/ipod-classic-legacy-ipods/160006-music-shows-pc-not-ipod.html.]

146. Users reported that RealPlayer did not copy album art to the iPod. [See, *e.g.*, http://forums.ilounge.com/ipod-classic-legacy-ipods/156128-ipod-realplayer-album-art-problem.html.]

147. Some users found that multiple entries for an artist appear in the iPod Artist menu when transferring songs using RealPlayer. [See, *e.g.*, http://forums.ilounge.com/lounge/41210-real-networks-ipod-disaster.html; http://forums.ilounge.com/third-party-software-mac-pc/113897-real-player-problem.html.]

148. Users also found that, after using RealPlayer, iTunes could not recognize the iPod and informed the user that the iPod had to be restored. [See, *e.g.*, http://forums.ilounge.com/ipod-classic-legacy-ipods/82185-ipod-music-real-music-store.html; http://forums.ilounge.com/windows-ipod-discussion-problems/44855-real-player.html.]

149. A user also reported that, after using RealPlayer, the iPod would not "play the music that I have bought from itunes." [See http://forums.ilounge.com/windows-ipod-discussion-problems/44855-real-player.html.]

150. In addition, users reported problems with RealPlayer loading music that could be played on an iPod Shuffle. Although RealPlayer appeared to copy songs onto the iPod shuffle, the iPod shuffle would not play any songs. [See, *e.g.*, http://forums.ilounge.com/windows-ipod-discussion-problems/97143-help-ipod-shuffle-major-problem.html.]

VII. Apple and Third Parties Would Have Had To Work Together

151. Allowing third party jukeboxes to load and manage music on iPods in a way that worked seamlessly without interfering with the intended operation or performance of iPods, iTunes and iTS and without interfering with FairPlay would have required close cooperation between Apple and the third party jukebox developers. Among other things, Apple would have had to share confidential information (including specifications, design information, and perhaps source code) with these third party developers. [See also Kelly Declaration at § IV.A.] And as

Dr. Martin seems to recognize, Apple would also have to modify the iPod firmware and iTunes Software to make the iPod firmware and iTunes software work seamlessly with the dozens of third-party applications – including RealPlayer and Winamp – that were available to the public. This would be an ongoing process as Apple changed iPod hardware and firmware, the iTunes software, and iTS software and content. Developing software so that it is compatible with third-party applications and then providing ongoing support to maintain that compatibility is more burdensome than developing and maintaining one's own products.

152. Dr. Martin says that "an effective way to help minimize incompatibilities or bugs in third-party applications is to publish technical documents that accurately reflect the requirements for interoperability." [Martin Report at ¶ 111.] As a threshold matter, this would require Apple to incur the costs of drafting specifications and other documents that could be read and understood by non-Apple developers. Such documents would have to be reviewed and possibly updated with each change to iTunes, iPod firmware and other programs that work with or affect iTunes or iPod firmware, including FairPlay. Aside from the burden on Apple to write and maintain such documentation and to support the developers who would use the documentation, there is no guarantee that this would lead to the requisite level of compatibility. Indeed, as discussed above, bugs that interfere with the intended operation can occur even where the software is developed internally with full information (including highly confidential proprietary information), developers have access to the relevant software and hardware as well as the respective development teams, and where a company has an incentive to reduce bugs so that customer satisfaction is enhanced. In addition, even with documentation, third-party developers still wouldn't have the same access that internal developers and engineers have. And since developers may interpret such documents in different ways, the various jukebox applications may still not produce databases and keybags that are entirely compatible. In addition, in my

experience developers sometimes ignore parts of such specifications. For example, developers

sometimes use fields that are "reserved for future expansion" to store information not contained

in existing fields. Even if this approach were effective, sharing highly confidential information –

especially related to the keybag – could reduce the security of FairPlay.

153.   Dr. Martin also believes that Apple could have written iTunes and the iPod

firmware to tolerate errors introduced by third party jukeboxes: "Another possibility would have

been for Apple to code for robustness rather than rapid failure due to the detection of third-party

software." [See Martin Report at ¶ 108.] As with documentation, this would require Apple to

spend resources developing new code and programs to interoperate with the third-party programs.

Among other things, Dr. Martin would have Apple perform a full verification analysis of the

iTunes database. This would require development effort by Apple for both the iTunes client and

the iPod. The additional processing to implement this solution could be significant on resource-

constrained devices such as the iPod and impact the responsiveness of the device, battery life, *etc*.

And it is wrong to suggest that making the device or software more "robust" would eliminate

bugs that could interfere with the operation of the iPod. As discussed above, creating a bug-free

program is nearly impossible.

154.   Dr. Martin also attempts to draw a parallel with the iPhone because Apple

provides technical documentation to developers of third-party iPhone applications. [See Martin

Report at ¶ 48.] As an initial matter, Dr. Martin's attempted analogy is too simplistic. The

developer documentation to which Dr. Martin refers is for programming interfaces to Apple

software on the iPhone, which third parties use to develop their own applications. This Apple

software was designed to be exposed to third party developers. There is no software interface for

syncing music and videos to the iPod that was designed to be exposed to third party developers.

Therefore, carrying the analogy to the iPod, Dr. Martin would have Apple provide to the third

party jukebox developers the software interface, which would consist of software on both the iPod and the user's computer to create the database and keybag, manage concurrent access by multiple jukebox applications, *etc.*, and the requisite interface documentation. All the flaws related to providing documentation and making the software more robust, as discussed above, apply equally here. There are a number of other problems with such a "solution." First, unless Apple employed techniques such as ==database and keybag verification,== third party developers would not be required to use the Apple supplied software. They could still write the database and keybag directly. Second, iPhone software runs on a relatively small collection of devices easing the cost of development, support, testing, *etc*. The portion of the proposed interface software for the user's computer would have to at least run on versions of Microsoft Windows, Mac OS X and Linux since third party jukeboxes were developed for all of these operating systems. This is a very significant challenge. Third, since such software would necessarily use FairPlay, providing this type of access would make FairPlay less secure.

VIII.   Advantages of a "Walled Garden"

155.   One of the many choices confronting the designers of a software & hardware platform is the choice between a "closed" platform (also called a "walled garden") and an "open" platform (also called an "open field"). The true walled garden approach, on the one hand, is one in which the provider controls the software, hardware, and content in the ecosystem. Users within the ecosystem cannot use non-approved or unsupported applications or content. Thus, the user of the platform must adopt the entire system as provided by the designers. The open field approach, on the other hand, allows any interested party to provide some or all of the software, some or all of the hardware, and some or all of the content. The user of the platform is free to combine software and hardware from any collection of providers in order to create the system.

Of course, a platform could be somewhere between the true walled garden and open field extremes.

156.   The Apple Macintosh is an example of a system that is closer to a walled garden than an open field. The customer must obtain the basic hardware and the operating system from Apple; however, third parties can provide certain types of expansion devices and application software. By contrast, the so-called Wintel PC is closer to an open field than a walled garden. The customer must obtain the operating system from Microsoft but can obtain the hardware (basic system and expansion devices) from any party and application software from any party.

157.   Apple's iPod/iTunes/iTunes Store is closer to a walled garden than an open field. Apple develops the hardware (iPod), the iPod firmware, the iTunes Software, and the iTS software, and optimizes each component to work together. In addition, Apple provides some of the content through iTS. By design, if the customer uses the iPod, they also use the iTunes Software to load and manage content on the iPod and the iTS to obtain content. It is not a true closed system because content (*e.g.*, DRM-free music, videos, *etc.*) can also be acquired from other parties and loaded onto an iPod using iTunes.

158.   Amazon/Kindle also has features of a walled garden. Amazon develops hardware (Kindle), software (Kindle software for computers and smartphones), and the Amazon Store. Although, as designed, the consumer purchases content from the Amazon Store and views the content using the Kindle hardware or software, it is also possible to download content from the Amazon Store to other devices.

159.   Microsoft's Xbox gaming system also has features of a walled garden. Microsoft develops hardware (Xbox consoles and accessories), software (Xbox operating system) and an

online store (Xbox Live Marketplace). Consumers must use the Xbox console and operating system from Microsoft but can purchase some accessories and some content from other parties.

160. A walled garden platform has certain perceived advantages compared to open field platform, including ease of use, security and stability. These advantages come at some cost, including potentially higher development and maintenance costs, less code portability and less API access to third party developers. In the following paragraphs I will discuss in more detail the advantages of the walled garden.

161. One important benefit of the walled garden approach is that it enhances the stability of hardware and software versions.[91] This is because there is a limited and controlled population of hardware devices that will run the software and a limited and controlled number of software applications that have to interoperate with each other. The developers, engineers and others involved face a more manageable task of tailoring the software to the specific hardware and other software with which it will interoperate. This translates to a benefit for consumers, because the consumer does not have to worry about which version out of many potential versions of the software is the correct one for a particular hardware device.

162. A walled garden provides the benefit of a better user experience. As should be apparent from the above, in a walled garden, since a company does not have to worry about compatibility and optimization with multitudes of hardware devices and software programs, the company and its developers and engineers can focus on product quality. Additionally, strict, centralized verification and testing of the product can lead to higher product quality and enhanced user experience.

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[91] For an example in the field of industrial automation, see *Walled Garden or Open Field?* by John Berra [http://www.automationworld.com/print/10058].

163.   A walled garden also provides the benefit of more easily and quickly changing the elements of the platform (*e.g.*, hardware devices and software) because a single party controls all the elements. The more diverse the hardware and software that comprise an open platform, the harder it is to devise and implement changes that are satisfactory to all stakeholders given the increased coordination that is required among the various actors. Having a single entity control the constituent parts of the platform allows walled gardens to respond more quickly to consumer demands and enables a more efficient allocation of resources when determining how to best effect changes among both the hardware and software components of a system.

164.   A walled garden platform also provides a more centralized security structure to protect end users. Since security is only as strong as the weakest link in the chain, the centralized control that is the hallmark of a walled garden platform allows a company to fully vet security risks prior to introducing new components into the system. By implementing centralized testing and verification of components supplied by third parties, which pose potential security and other risks, the company performs a gatekeeper function to protect the security of the system and end user. However, the results are only as good as the verification process.

165.   A walled garden also provides the benefit of increased convenience for customers. For example, ecosystems like Apple's provide consumers one place to find and purchase content (using iTunes to access iTS), manage and play content on the computer (using iTunes), and manage content on the iPod (using iTunes to load and mange music). Commentators have heralded the iPod's convenience and ease of use as one of its most significant achievements, stating "By exercising control over the hardware and the software, Apple has been able to construct the easiest-to-use digital music system possible. Unlike the glitch-prone systems of its

competitors, Apple's three-way combination of hardware (iPod), software (iTunes), and online

service (music store) is about as seamless as a sophisticated tech product gets."[92]

166.   Customer service is also enhanced. First, having a single customer support

organization is more convenient for the customer, who does not have to determine which of many

companies to call for support. Second, having a single customer support organization provides a

better customer experience. Since the customer support organization can service calls concerning

all elements of the platform (and interactions amongst the elements), customer support is more

likely to successfully resolve the problem. Third, the walled garden maximizes the support

resources available to the customer. As one Apple employee explained, misdirected support calls

(*i.e.*, calls due to an unsupported product or service from another company) needlessly consume

limited customer support resources.

> "We provide support to iPod customers for their hardware and iTunes as it pertains
> to iPod syncing. If a customer damages their iPod because the (*sic*) used software
> other than iTunes, then that should be outside the scope of support. For every
> dollar we spend helping one of those customers, it's one dollar less we can spend
> on supporting our customers who actually need our help."
> [Apple_AIIA01025117]

IX. Other Topics

167.   If asked or to more fully explain my opinions as expressed in this report, I reserve

the right to rely on various portions of the references that I have discussed in this report that I

have not already explicitly cited to in this report.

168.   I reserve the right to supplement my report in light of any additional fact

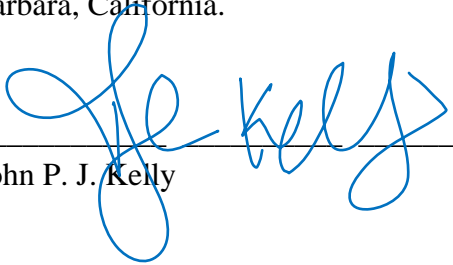discovery, opinions by Plaintiff's experts, and/or trial testimony. I also reserve the right to

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[92] *The Cult of iPod* by Leander Kahney (No Starch Press, Inc. 2005), p. 15

provide rebuttal opinions and testimony in response to Plaintiff's experts, and rebuttal testimony

in response to any of Plaintiff's fact witnesses. Further, I reserve the right to use animations,

demonstratives, enlargements of actual exhibits, and other information in order to illustrate my

opinions.

169.   I expect to continue to develop my opinions discussed in this report. I also reserve

the right to supplement my opinions based on information obtained from additional discovery or

from Plaintiff's experts, as indicated above.

170.   When called upon to do so, I will offer testimony at trial or otherwise regarding

these opinions and will offer rebuttal testimony as appropriate throughout the remainder of this

proceeding.

Executed this 19th day of July 2013 in Santa Barbara, California.

_____

John P. J. Kelly

Exhibit A

Kelly Computing, Inc.
dba Kelly Technology Group

830 Park Lane, Santa Barbara, CA 93108-1420
(805) 969-4079 • (805) 969-4629 Fax
jkelly@KellyTechnologyGroup.com

Dr. John P. J. Kelly

Citizenship: U.S. and U.K.

Formal Education

Ph.D. in Computer Science, University of California, Los Angeles, June 1982.
Regents Fellow, University of California, Los Angeles.
M.A. in Mathematics, University of Cambridge, England, June 1977.
B.A. in Mathematics, University of Cambridge, England, June 1975.

Professorial Experience

**Electrical and Computer Engineering Department,
University of California, Santa Barbara** July 1986 - December 1997.

**Computer Science Department,
University of California, Los Angeles** July 1982 - June 1986

Consulting Experience

**Kelly Computing Inc. and predecessors
Los Angeles and Santa Barbara** July 1975 - present

Representative Clients

3Com	Hitachi	Nokia
Apple	Hyundai	Piper Jaffray
Broadcom	Intel Corp.	Raytheon
Cisco Systems	LSI Logic	Rockwell
Citicorp	Matsushita	Samsung
Computer Associates	McAfee Associates	Sanyo
Creative Labs	Mentor Graphics	SAP
Dell	Microsoft	Sony Electronics
Electronic Arts	NASA	Symantec Corporation
GE	NATO	Toshiba
Hewlett Packard	Nintendo	United States Air Force

Dr. John P. J. Kelly

Selected Industrial Professional Experience

HONEYWELL INC., ARIZONA, 1996 - 1997

Expert Consultant to the Honeywell Commercial Flight Systems Group on fault tolerant computing in air transport systems in connection with the Federal Aviation Administration (FAA.)

LOS ALAMOS NATIONAL LABORATORY, NEW MEXICO, 1991 - 1995

Collaborator to the Los Alamos National Laboratory (LANL). Performing systems engineering and analysis of LANL environmental management programs including program management, DOE interactions, business practices and overall technical structure and organization. Developed computer systems and data warehouse for LANL Environmental Restoration.

AT&T GIS, NCR, SYMBIOS LOGIC, LSI LOGIC 1985 - 1998

Member of the AT&T GIS Science Advisory Committee (SAC). The SAC is a group of seven experts that evaluates AT&T's organization, technical direction and product strategy and makes recommendations to the Vice President of Technology and Development.
Expert Consultant performing systems engineering and analysis, system organization and dynamics for various AT&T GIS divisions.

UNISYS CORPORATION, ST. PAUL, MN, 1988 - 1989

Expert Consultant performed systems engineering and analysis for an Air Force program.

TELEDYNE CONTROLS 1983 -1984

Consulting Computer Scientist. Responsible for systems engineering, specification and design of a data acquisition and control system for NASA.

JET PROPULSION LABORATORY 1978 - 1983

Group Manager, System Architect. Performed systems engineering and analysis for distributed data communication networks and distributed database systems for the NASA Deep Space Network.

MARTIN LUTHER KING HOSPITAL 1977

Consulting Computer Scientist. Specified, designed and implemented a transaction oriented database management system for medical records.

Dr. John P. J. Kelly

Organization Membership

IEEE (Institute of Electrical and Electronic Engineers)
ACM (Association of Computer Machinery)
IFIP (International Federation of Information Processing) (1982-2000)

Editorial Activities

Editorial Board Member:

Springer-Verlag

Host and Local Organization Chairman:

First IFIP International Working Conference on Dependable Computing for Critical Applications, University of California, Santa Barbara, August 23-25, 1989.

Program Committee Member:

Fault Tolerant Computing Symposium 1988, 1989, 1990, 1991, 1993
Fifth Symposium on Reliability in Distributed Systems and Database Systems, 1986
Eighth Symposium on Reliable Distributed Systems, 1989
1st IFIP Int'l Working Conference on Dependable Computing for Critical Applications
3rd IFIP Int'l Working Conference on Dependable Computing for Critical Applications

Reviewer:

National Science Foundation
IEEE Transactions on Software Engineering
IEEE Transactions on Computers
IEEE Transactions on Reliability
IEEE Computer
FTCS (Fault Tolerant Computing Symposium)
SRDSDS (Symposium on Reliability in Distributed Systems and Database Systems)
VLDB (Very Large Data Base Conference)
DCCA (Dependable Computing for Critical Applications)
DCS (Distributed Computing Symposium)
California MICRO Program

Exhibit B

Prior Testimony
Prior Expert Testimony

In the past four years I have testified as an expert witness by deposition or at trial in the

following cases:

Medtronic Minimed, Inc., et. al., v. Nova Biomedical Corporation, et. al., United States
District Court for the Central District of California, Western Division, No. CV08-
00788 SJO (PJWx)

Linear Technology Corp., et. al., v. Applied Materials, Inc., et. al., Santa Clara County
Superior Court, No. 1-02-CV806004

Microprocessor Enhancement Corporation, et. al., v. Texas Instruments Incorporated,
United States District Court for the Central District of California, No. SACV 08-
1123 SVW (RNBx)

Transamerica Life Insurance Company et al. v. Lincoln National Life Insurance Company,
United States District Court for the Northern District of Iowa, Cedar Rapids
Division, No. C 06-110-MWB

ZapMedia Services, Inc., v. Apple Inc., United States District Court for the Eastern District
of Texas, Marshall Division, No. 2:08cv104

Sabre Inc. et. al., v. International Air Transport Association, et. al., Ontario Superior Court
of Justice, No. 07-CL-006825

Medtronic Sofamor Danek USA, Inc., et al., v. Nuvasive, Inc., United States District Court
Southern District of California, No. 3:08-CV-1512 MMA (AJB)

The Apple iPod iTunes Anti-Trust Litigation, United States District Court for the Northern
District of California, San Jose Division, No. C 05-00037 JW (HRL)

Affinity Labs of Texas, LLC v. Apple Inc., United States District Court for the Northern
District of California, Oakland Division, No. CV 09-4436-CW

Invesco Institutional (N.A.), Inc., v. Deutsche Investment Management Americas Inc.,
Supreme Court of the State of New York, County of New York, No. 650154/2007

DVD Copy Control Association, Inc., a Delaware corporation, v. Kaleidescape, Inc., a
Delaware corporation, Superior Court of the State of California, County of Santa
Clara, No. 104 CV 031829

In the Matter of Certain DC-DC Controllers and Products Containing Same, United States
International Trade Commission, Washington D.C., Investigation No. 337-TA-698

Bose Corporation, v. SDI Technologies, Inc., et. al., United States Didstrict Court for the
District of Massachusetts, No. 09-cv-11439-PBS

MobileMedia Ideas LLC, v. Apple Inc., United States District Court for the District of
Delaware, No. 10-258-SLR

American Broadcasting Companies, Inc., et. al., v. Aereo, Inc., and Wnet, et. al., v. Aereo,
Inc., United States District Court, Southern District of New York, Nos. 15430 (AJN)
and 1543 (AJN)

Cardsoft, Inc. et. al., v. Verifone Systems, Inc., et. al., United States District Court for the
Eastern District of Texas, Marshall Division, No. 2:08cv98

SSL Services, LLC, v. Citrix Systems, Inc. et. al, United States District Court for the
Eastern District of Texas, Marshall Division, No. 2:08-cv-158(TJW)

Ancora Technologies Inc., v. Apple Inc., United States District Court for the Central
District of California, No. 2:10-cv-10045-AG

International Air Transport Association vs. Travelport Global Distribution System BV, ICC
17129/JHN/CFG

VirnetX, Inc., v. Cisco Systems, Inc., et. al., United States District Court for the Eastern
District of Texas, Tyler Division, No. 6:10-cv-417-LED

In the Matter of Certain Electronic Devices with Graphics Data Processing Systems,
Components Thereof and Associated Software, United States International Trade
Commission, Washington, D.C., No. 337-TA-813

Sightsound Technologies, LLC, v. Apple Inc., United States District Court for the Western
District of Pennsylvania, No. 2:11-cv-01292-DWA

In the Matter of Certain Devices with Secure Communication Capabilities, Components
Thereof, and Products Containing the Same, United States International Trade
Commission, Washington D.C., No. 337-TA-858

Microunity Systems Engineering, Inc., v. Apple, Inc., et. al., United States District Court
for the Eastern District of Texas, Marshall Division, No. 02:10-cv-91-LED-RP

TAS Distributing Company, Inc., v. Cummins, Inc., United States District Court for the
Central District of Illinois, Peoria Division, No. 07-cv-1141

For my work in connection with the analysis reflected in this report and for any time I spend testifying about that study and my opinions, Kelly Computing, Inc. is being compensated at a rate of $800 per hour and I am being reimbursed for my expenses.

EXHIBIT C
Problems With 3rd Party Applications

EXHIBIT C
Problems With 3rd Party Applications

EXHIBIT C
PROBLEMS WITH 3RD PARTY APPLICATIONS

This table lists some of the problems that customers experienced through early 2007 while using 3rd party applications to manage the iPod, as reported in user forums and in software documentation.

iPod Manager	Date Introduced	iPod Problems
Amarok	2003-06-23[1]	- Orphaned files and iPod will not play songs.[2] - Artwork is not displayed.[2,3] - iPod database corruption.[2,4] - iPod Shuffle won't play.[5]
Anapod Explorer	2003-09-30[6]	- On-The-Go Playlists are deleted[7] - Duplicate files are created during sync.[8] - Only plays the audio part of a movie.[9] - Band name becomes "unknown" after sync.[10] - Corrupts database[11]
EphPod	Dec. 2001[12]	- iPod file system is corrupted.[13] - Can see songs using EphPod but not iPod.[14] - iTunes no longer recognizes the iPod.[15] - iPod database is corrupted.[16] - EphPod and Anapod, when used together, cause track numbering problems.[17]

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[1] See, *e.g.*, http://en.wikipedia.org/wiki/Amarok_%28software%29

[2] See, *e.g.*, http://amarok kde.org/wiki/Media_Device:IPod (6/16/2010); http://amarok kde.org/amarokwiki/index.php?title=Media_Device:IPod&oldid=11195 (1/26/2007)

[3] See, *e.g.*, http://ubuntuforums.org/archive/index.php/t-293406 html (11/5/2006)

[4] See, *e.g.*, http://ubuntuforums.org/showthread.php?t=181668&page=4 (5/28/2006)

[5] See, *e.g.*, http://ubuntuforums.org/showthread.php?t=204214 (6/26/2006)

[6] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/9494-new-management-software-coming-redchair html

[7] See, *e.g.*, http://forums.ilounge.com/itunes-mac-pc/149499-anapod-bug html (2/12/2006), http://forums.ilounge.com/third-party-software-mac-pc/70381-anapod-wipes-go-list html (1/21/2005)

[8] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/58982-anapod-has-been-nightmare html (11/27/2004)

[9] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/135134-dont-buy-anapod html (12/12/2005)

[10] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/54574-sync-problem-anapod html (10/28/2004)

[11] Dopisp "Fixed crash when a corrupted database from Anapod Explorer is read." [See notes on V1.0.0068 (17JAN2007), http://www mgtek.com/dopisp/changelog.aspx]

[12] See, *e.g.*, http://www.ephpod.com/info.shtml

[13] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/68645-ephpod-2-75-destroyed-my-precious-ipod html (1/13/2005), http://forums.ilounge.com/third-party-software-mac-pc/39176-very-angry html (7/14/2004)

[14] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/68713-ephpod-didnt-update-my-ipod-properly html (1/14/2005), http://forums.ilounge.com/ipod-monochrome/96348-help-i-used-ephpod-all-my-songs-got-erased.html (5/12/2005), http://forums.ilounge.com/third-party-software-mac-pc/84875-ipod-hd-not-showing-songs-need-help-one.html (3/18/2005)

[15] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/73259-ephpod-took-over-my-ipod html (2/2/2005); http://forums.ilounge.com/ipod-monochrome/70464-itunes-wont-read-my-ipod.html (1/21/2005)

[16] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/169860-ipod-db-corrupted-after-using-ephpod-try-worked-me html (7/29/2006)

[17] See, *e.g.*, http://dev forums.ilounge.com/showthread.php?t=32512 (5/18/2004)

EXHIBIT C
PROBLEMS WITH 3RD PARTY APPLICATIONS

iPod Manager	Date Introduced	iPod Problems
Floola	At least by 2006-08-14[18]	• "Even if rare it may happen that Floola messes up the item and/or artwork catalog."[19] • "shuffle add/remove problem (inconsistend [*sic*] db)"[20] • "iPod video playlist error"[20] • "iPod shuffle playlist error"[20] • "nano 2G reset bug when uploading certain files"[21] • "playlist header bug"[21] • "duplicated items: various fixes"[21]
iPod Manager for foobar2000 / aka "foo_dop"	At least by 2006-05-30[22]	• Songs are listed in DB but are not on the iPod: "I will click a song to play and it will just skip to the next track without any audio ever coming."[23] • "All files showed correct tag information, but didn't play anymore (on the iPod). First I suspected the new Nero codec 3.0.0.5 I installed in between. But in the end it was the foobar tagging that broke it."[24]
MGTEK dopisp	2006-11-22[25]	• Didn't sync ratings and play counts from iPod.[26] • Database corruption.[27] • Music stops prematurely.[28] • "To avoid having duplicate songs on your iPod, sync your iPod only with Windows Media Player."[29])
Media Center	At least by 2003-05-12[30]	• iPod database corruption[31] • "i have new ipod photo 40g, i connect it to j.river media cetner and move one mp3 file into the Ipod. now it keep restarting"[32]

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[18] See, *e.g.*, http://web.archive.org/web/20060814210143/http://www.floola.com/modules/wiwimod/ (8/14/2006)

[19] See. *e.g.*, http://www.floola.com/home/docs_bugreport/. See also
http://web.archive.org/web/20070510023642/http://www.floola.com/modules/wiwimod/index.php?page=docs_troubleshooting
(05/10/2007)

[20] See, *e.g.*, http://web.archive.org/web/20061107092300/http://www.floola.com/modules/wiwimod/ (11/7/2006)

[21] See, *e.g.*, http://web.archive.org/web/20070111122643/http://www.floola.com/modules/wiwimod/ (1/11/2007)

[22] See, *e.g.*, http://www.hydrogenaudio.org/forums/index.php?showtopic=45160 (5/30/2006)

[23] See, *e.g.*, http://www.hydrogenaudio.org/forums/index.php?showtopic=42208 (3/7/2006)

[24] See, *e.g.*, http://www.hydrogenaudio.org/forums/index.php?showtopic=32972&hl=ipod+problem (4/4/2005)

[25] See, *e.g.*, http://www.mgtek.com/dopisp/changelog.aspx

[26] "Added reverse sync of ratings and play-counts: Ratings in WMP will be updated during sync if changes were made on the iPod." [See notes for version 1.1.0124 (14FEB2007), http://www.mgtek.com/dopisp/changelog.aspx]

[27] "Fixed problem that may cause the iPod to become corrupted when songs are deleted and WMP is closed immediately." [See notes for V1.2.0252 (14APR2007), http://www.mgtek.com/dopisp/changelog.aspx]

[28] "Fixed bug that caused transcoded music to stop prematurely on certain iPods." [See notes for V2.0.0538 (01OCT2007); http://www.mgtek.com/dopisp/changelog.aspx]

[29] See, *e.g.*, http://www.mgtek.com/dopisp/manual/html/infDuplicateSongs.html

[30] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/306-media-center-9-help-jriver.html (5/12/2003)

[31] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/207523-jriver-mc-classic-vista-dont.html (10/1/2007);
http://forums.ilounge.com/ipod-monochrome/68089-songs-ipod-but-dont-show-menu-please-help.html (1/11/2005)

Exhibit C
Problems With 3rd Party Applications

iPod Manager	Date Introduced	iPod Problems
MediaMonkey	2005-06-08[33]	• iPod database corruption[34] • iTunes SmartPlaylists deleted[35] • album art disappeared[35] • Songs are not playable[36] • "Each time I re-sync it adds another version of the playlist from MM onto the iPod. I've three copies of each playlist there now."[37]
MyPod	2002-10-28[38]	• Artist displayed twice on iPod[39]
XPlay	2002-06-24[40]	• music missing from iPod[41] • "ever since i installed Xplay, when i connect the ipod to itunes, the songs are out their correct album order"[42] • iTunes cannot recognize the iPod[43] • videos play audio only[44]
Yamipod		• music missing from iPod[45] • iPod database corrupt[46]

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[32] See, *e.g.*, http://forums.ilounge.com/ipod-classic-legacy-ipods/85505-ipod-keep-restarting html (3/21/2005)

[33] Version 2.4 of MediaMonkey was available on 6/8/2005 [http://forums.ilounge.com/windows-ipod-discussion-problems/100729-mediamonkey-2-4-ipod-support html (6/8/2005)]. Alpha versions of MediaMonkey 2.4 were available for download beginning on 3/9/2005 [http://www.mediamonkey.com/forum/viewtopic.php?t=3844].

[34] See, *e.g.*, http://www mediamonkey.com/forum/viewtopic.php?f=6&t=4450&p=18352&hilit=ipod (5/18/2005); http://www mediamonkey.com/forum/viewtopic.php?f=6&t=3891&p=16267&hilit=ipod (3/13/2005)

[35] See, *e.g.*, http://www mediamonkey.com/forum/viewtopic.php?f=6&t=4550&p=18744&hilit=ipod (6/1/2005)

[36] See, *e.g.*, http://www mediamonkey.com/forum/viewtopic.php?f=1&t=4615&p=19072&hilit=ipod (6/7/2005); http://www mediamonkey.com/forum/viewtopic.php?f=6&t=3864&p=16161&hilit=ipod (3/11/2005)

[37] See, *e.g.*, http://www mediamonkey.com/forum/viewtopic.php?f=6&t=4033&p=16809&hilit=ipod (3/29/2005)

[38] See, *e.g.*, http://mypod.sourceforge.net/user%20manual/html/ch05s02 html

[39] See, *e.g.*, http://sourceforge.net/tracker/?func=detail&aid=853953&group_id=65317&atid=510535 (12/4/2003)

[40] A MeidaFour press release on 6/24/2002 announced the official release of XPlay [http://web.archive.org/web/20020803214020/http://www mediafour.com/news/releases/ipodsayhellotowindows.shtm]. A MediaFour press release on 1/8/2002 announced a projected release date for XPlay and an XPlay SDK [http://web.archive.org/web/20020203203935/http://www mediafour.com/news/releases/ipodandwindowstowed.shtm]. A pre-release version of XPlay was available at least by 12/18/2001 [http://web.archive.org/web/20011218070259/http://www mediafour.com/products/xplay/ and http://web.archive.org/web/20020205090053/http://www mediafour.com/products/xplay/preview.asp].

[41] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/88613-tracks-ipod-not-showing-using-xplay html (4/2/2005); http://forums.ilounge.com/windows-ipod-discussion-problems/114082-cant-view-songs.html (8/26/2005); http://forums.ilounge.com/ipod-monochrome/133196-help-help-all-my-mp3-gone.html (12/2/2005); http://forums.ilounge.com/third-party-software-mac-pc/160662-xplay-invalid-data-error.html (4/27/2006)

[42] See, *e.g.*, http://forums.ilounge.com/ipod-monochrome/89457-xplay-organization-problem-help html (4/5//2005)

[43] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/152304-ipod-after-xplay html (2/26/2006)

[44] See, *e.g.*, http://forums.ilounge.com/tv-videos/137005-help-video-problem html (12/23/2005)

[45] See, *e.g.*, http://forums.ilounge.com/ipod-monochrome/75545-please-help-i-may-have-lost-over-8000-songs html (2/12/2005); http://forums.ilounge.com/ipod-mini/112740-yamipod-problem html (8/16/2005)

[46] See, *e.g.*, http://forums.ilounge.com/third-party-software-mac-pc/80571-yamipod-sharepod html (3/2/2005) at post #4.

Exhibit C
Problems With 3rd Party Applications

iPod Manager	Date Introduced	iPod Problems
Banshee	2005-08[47]	• Does not import rating, play count, and last played date from iPod[48]
GNUpod	2004-06-02[49]	• Existing Audible files do not play.[50] • Problem initializing iPod.[51] • "some CD's end up having their songs sorted on the iPod alphabetically, rather than in the order of songs on the CD."[52] • Songs skip during playback.[53] • "But, when I try to hear songs through the iPod no songs appears. It looks like an empty database."[54] • Volume adjustment not applied.[55] • "When you turn on the 'compilations' option on the ipod, all albums get flagged as compilations, and disappear from the 'artists' menu."[56] • "All songs also appear in the music videos listing."[56] • Movie listing includes songs and movies only play sound track.[57] • "some songs cut off before they're supposed to end."[58]

[47] See, *e.g.*, http://en.wikipedia.org/wiki/Comparison_of_iPod_managers. Version 1.0 of Banshee was released 2008-06-05 [see http://banshee fm/download/archives/1.0.0/].
[48] See, *e.g.*, https://bugzilla.gnome.org/show_bug.cgi?id=389550 (12/25/2006)
[49] See, *e.g.*, http://download.savannah.gnu.org/releases/gnupod/
[50] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2003-11/msg00001 html (11/22/2003)
[51] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2004-06/msg00004 html (6/22/2004)
[52] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2005-01/msg00012 html (1/29/2005)
[53] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2005-01/msg00013 html (1/17/2005); https://lists.gnu.org/archive/html/bug-gnupod/2006-01/msg00005 html (1/19/2006)
[54] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2005-06/msg00000 html (5/2/2005)
[55] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2005-08/msg00001 html (8/22/2005)
[56] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2006-02/msg00000 html (2/20/2006)
[57] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2006-03/msg00005 html (3/25/2006
[58] See, *e.g.*, https://lists.gnu.org/archive/html/bug-gnupod/2006-01/msg00004 html (1/19/2006)

EXHIBIT C
PROBLEMS WITH 3RD PARTY APPLICATIONS

iPod Manager	Date Introduced	iPod Problems
gtkpod	At least by 2005-07-11[59]	• Didn't copy songs to iPod.[60] • Database is corrupted.[61] • Playlists and songs do not display on iPod.[62] • Problems with iPod Shuffle.[63] • Not syncing play counts from iPod.[64] • Tracks have incorrect play time.[65] • Movies have no audio.[66] • iPod always displays "Do Not Disconnect" message[67]

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[59] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2005-07/

[60] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2005-09/msg00002 html (9/16/2005);
http://osdir.com/ml/ipod.gtkpod.user/2005-09/msg00004 html (9/17/2005); http://osdir.com/ml/ipod.gtkpod.user/2006-06/msg00000 html (6/5/2006)

[61] See, *e.g.*, http://ubuntuforums.org/archive/index.php/t-178405 html (5/17/2006), http://osdir.com/ml/ipod.gtkpod.user/2007-08/msg00000 html (8/1/2007), http://osdir.com/ml/ipod.gtkpod.user/2006-01/msg00007.html (1/22/2006)

[62] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2006-11/msg00003 html (11/5/2006),
http://osdir.com/ml/ipod.gtkpod.user/2006-05/msg00000 html (5/6/2005); http://osdir.com/ml/ipod.gtkpod.user/2006-08/msg00117 html (8/28/2006)

[63] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2006-01/msg00001 html (1/7/2006));
http://osdir.com/ml/ipod.gtkpod.user/2006-02/msg00004 html (2/11/2006)

[64] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2006-08/msg00050 html (8/8/2006)

[65] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2006-06/msg00051 html (6/30/2006);
http://osdir.com/ml/ipod.gtkpod.user/2006-07/msg00011 html (7/3/2006)

[66] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2006-11/msg00012 html (11/14/2006)

[67] See, *e.g.*, http://osdir.com/ml/ipod.gtkpod.user/2006-08/msg00085 html (8/24/2006);
http://osdir.com/ml/ipod.gtkpod.user/2006-08/msg00094 html (8/24/2006)

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10
                  NORTHERN DISTRICT OF CALIFORNIA
11
                          OAKLAND DIVISION
12

13
   THE APPLE iPOD iTUNES ANTI-   Lead Case No. C 05 00037 YGR
14 **TRUST LITIGATION**

15   **CERTIFICATE OF SERVICE**
   This Document Related To:
16
   ALL ACTIONS
17

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PROOF OF SERVICE

I, Lillian Wong, declare:

I am a citizen of the United States and employed in San Francisco County, California. I am over the age of eighteen years and not a party to the within-entitled action. My business address is 555 California Street, 26th Floor, San Francisco, California 94104.

A copy of the **EXPERT REPORT OF JOHN KELLY was served by electronic mail at 6:19pm on July 19, 2013; the EXPERT REPORT OF ROBERT TOPEL was served by electronic mail at 12:21am on July 20, 2013; and the EXPERT REPORT OF KEVIN MURPHY was served by electronic mail at 3:21 am on July 20, 2013.**

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I declare that I am employed in the office of a member of the bar of this court at whose direction the service was made.

Executed on July 22, 2013, at San Francisco, California.

_____
Lillian Wong

Attorney or Party without Attorney:		For Court Use Only
•ROBERT A. MITTELSTAEDT, ESQ. JONES DAY 555 CALIFORNIA STREET 26TH FL SAN FRANCISCO, CA 94104 *Telephone No:* 415-626-3939		
Attorney for: , DEFENDANT	*Ref. No. or File No.:*	

Insert name of Court, and Judicial District and Branch Court:

United States District Court For The Northern District Of California Oakland Division

: THE APPLE IPOD ITUNES ANTI-TRUST LITIGATION
:

PROOF OF SERVICE	*Hearing Date:*	*Time:*	*Dept/Div:*	*Case Number:* C 05 00037 YGR

1. At the time of service I was at least 18 years of age and not a party to this action.

2. I served copies of the CERTIFICATE OF SERVICE; EXPERT REPORT OF DR.JOHN P. J. KELLY; EXPERT REPORT OF KEVIN M. MURPHY JULY 19, 2013; EXPERT REPORT OF ROBERT H. TOPEL JULY 19, 2013

3. a. Party served: BONNY E. SWEENEY, ESQ.; ROBBINS GELLER RUDMAN & DOWD

4. Address where the party was served: 655 WEST BROADWAY
STE. 1900
SAN DIEGO, CA 92101

5. I served the party:

a. **by personal service.** I personally delivered the documents listed in item 2 to the party or person authorized to receive process for the party on: Mon., Jul. 22, 2013 at: 3:33PM, to the person(s) indicated below in the manner as provided in 1011 CCP.

     BONNY SWEENEY, AUTHORIZED TO ACCEPT

(1) **(Business)** I informed him or her of the general nature of the papers.

7. Person Who Served Papers: Recoverable Cost Per CCP 1033.5(a)(4)(B)

a. Matt Caughey   d. *The Fee for Service was:*

First Legal
1111 6th Avenue, Ste. 204
San Diego, CA 92101
Telephone   (619) 231–9111
Fax   (619) 231–1361
www.firstlegalnetwork.com

e. I am: Not a Registered California Process Server

8. I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Date: Wed, Jul. 24, 2013

Matt Caughey

Judicial Council Form Rule 2.150.(a)&(b) Rev January 1, 2007	PROOF OF SERVICE	(Matt Caughey)898924 *jondasf.544502*

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10   UNITED STATES DISTRICT COURT

11   NORTHERN DISTRICT OF CALIFORNIA

12   OAKLAND DIVISION

13

14 THE APPLE iPOD iTUNES ANTI-TRUST   Case No. C 05-00037 (YGR)
    LITIGATION.
15   [CLASS ACTION]

16   **DECLARATION OF DR. JOHN P.J.
                                            KELLY**
17

18

19   I, John P.J. Kelly, Ph.D submitted my Expert Report in the above-captioned matter on

20 July 19, 2013. The report is true and correct based on my own personal knowledge.

21   I declare the forgoing is true and correct to the best of my knowledge and belief.

22   Executed this 17th day of December, 2013 in Santa Barbara, California.

23

24

25   _____
                                            John P.J. Kelly, Ph.D.
26

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