KeyLabs™

Test Final Report

RealNetworks RealVideo 10 Comparison Test

Project ID: 312012

December 24, 2003

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1.0 INTRODUCTION

In December of 2003, RealNetworks, Inc. contracted KeyLabs to conduct viewer preference testing of RealNetworks RealVideo 10 (RV 10) to Windows Media Video 9 (WMV 9) clips and MPEG-4 ASP clips. The objective of this effort was to conduct viewer preference testing of RV 10 to WMV 9 and MPEG-4 at the same bit rates and at higher bit rates.

KeyLabs was selected due to its expertise in test methodologies with the goal of conducting the tests in a fair and equal manner to provide a set of independent data results. The survey was conducted at the KeyLabs test facilities in Lindon, Utah.

2.0 EXECUTIVE SUMMARY

2.1 Overview and Results

The survey required each participant to evaluate up to four video clips on the basis of the following criteria:

- Smoothness of Motion
- Image Clarity
- Overall Preference

Clips were viewed via RealOne Player and Windows Media Player 9. The clips were not shown to all viewers in the same order. Four test groups were predefined with a designated set of tests administered for each group. Test groups were named as follows: Y1, Y2, Z1, Z2 (See Appendix B – Test Groups for further details.)

Each participant was given a video survey form upon entering the test facility. Participants completed the personal information section of the form and were then seated between 24" and 72" from a monitor. Participants then watched each pair of clips twice. For example, participants were shown Clip A, Clip B, then Clip A again, and finally Clip B. At the conclusion of the video clip pairings, each viewer indicated their preferences on the survey form. The viewing experience for all viewers included no audio. A total of 103 people participated in this test, and the resulting data was compiled for this report. The complete test results are provided in Section 6.0 Test Results of this report.

2.2 Analysis & Observations

KeyLabs found that even when RealVideo 10 was encoded at a thirty percent (30%) lower bitrate than Windows Media 9, that as many as 83% but no fewer than 77% of test participants either preferred RealVideo 10 over Windows Media Video 9 or had No Preference between the two codecs. In addition, more than 60% of the test participants preferred RealVideo 10 for Smoothness of Motion to Windows Media Video 9. When compared specifically to Windows Media Video 9, viewers preferred RealVideo 10 at 300 kbps instead of Windows Media Video 9 at 450 kbps by a margin of greater than three to one.

In addition, the viewer preferences indicated that the RealVideo 10 clips were preferred by over 66% of the viewers for Overall Preference when compared to Windows Media Video 9 and MPEG-4 ASP at the same video bitrate. Overall responses indicate a two to one preference of RealVideo 10 versus Windows Media 9 and MPEG-4 at the same bitrates.

The viewer preferences are reflected in the following tables and graphs:

Table 1: Same Bitrate Video Comparison Percentages

RV 10 vs. WMV 9/MPEG-4 Same Bitrate Video Comparison						
Overall Percentages						
	RealVideo 10		**Competitor**		**No Preference**	
Motion	49.51%		26.70%		23.79%	
Clarity	71.84%		16.99%		11.17%	
Overall	66.02%		21.36%		12.62%	
	500 Kbps / 500 Kbps			**500 Kbps / 500 Kbps**		
	RV 10	**WMV 9**	**No Preference**	**RV 10**	**MPEG-4**	**No Preference**
Motion	40.00%	30.00%	30.00%	46.00%	28.00%	26.00%
Clarity	60.00%	26.00%	14.00%	74.00%	18.00%	8.00%
Overall	58.00%	24.00%	18.00%	62.00%	26.00%	12.00%
	300 Kbps / 300 Kbps			**32 Kbps / 32 Kbps**		
	RV 10	**WMV 9**	**No Preference**	**RV 10**	**WMV 9**	**No Preference**
Motion	52.83%	15.09%	32.08%	58.49%	33.96%	7.55%
Clarity	71.70%	13.21%	15.09%	81.13%	11.32%	7.55%
Overall	69.81%	16.98%	13.21%	73.58%	18.87%	7.55%

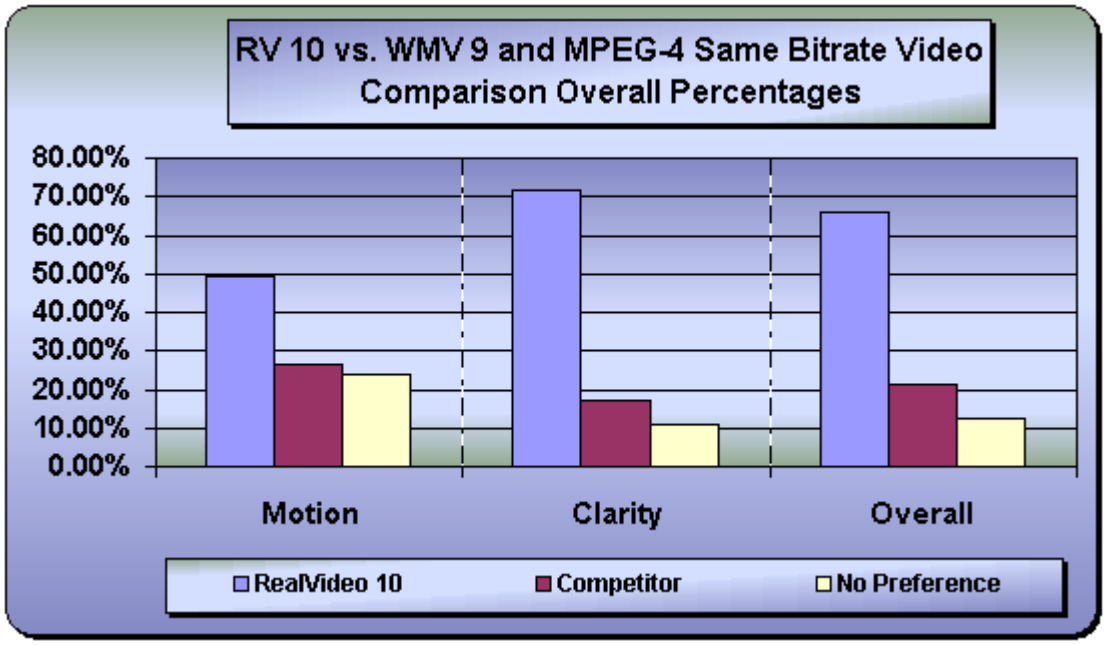

Figure 1: RV 10 vs. WMV 9 and MPEG-4 @ Same Bitrate Overall Percentages

Table 2: RV 10 at 30% Lower Bitrate Video Comparison Percentages

RV 10 vs. WMV 9 At 30% Lower Bitrate Video Comparison						
Overall Percentages						
	RealVideo 10	**Competitor**	**No Preference**			
Motion	62.26%	20.75%	16.98%			
Clarity	39.62%	38.68%	21.70%			
Overall	58.49%	19.81%	21.70%			
	300 Kbps / 450 Kbps			**32 Kbps / 48 Kbps**		
	RV 10	**WMV 9**	**No Preference**	**RV 10**	**WMV 9**	**No Preference**
Motion	32.08%	37.74%	30.19%	47.17%	39.62%	13.21%
Clarity	60.38%	18.87%	20.75%	64.15%	22.64%	13.21%
Overall	54.72%	16.98%	28.30%	62.26%	22.64%	15.09%

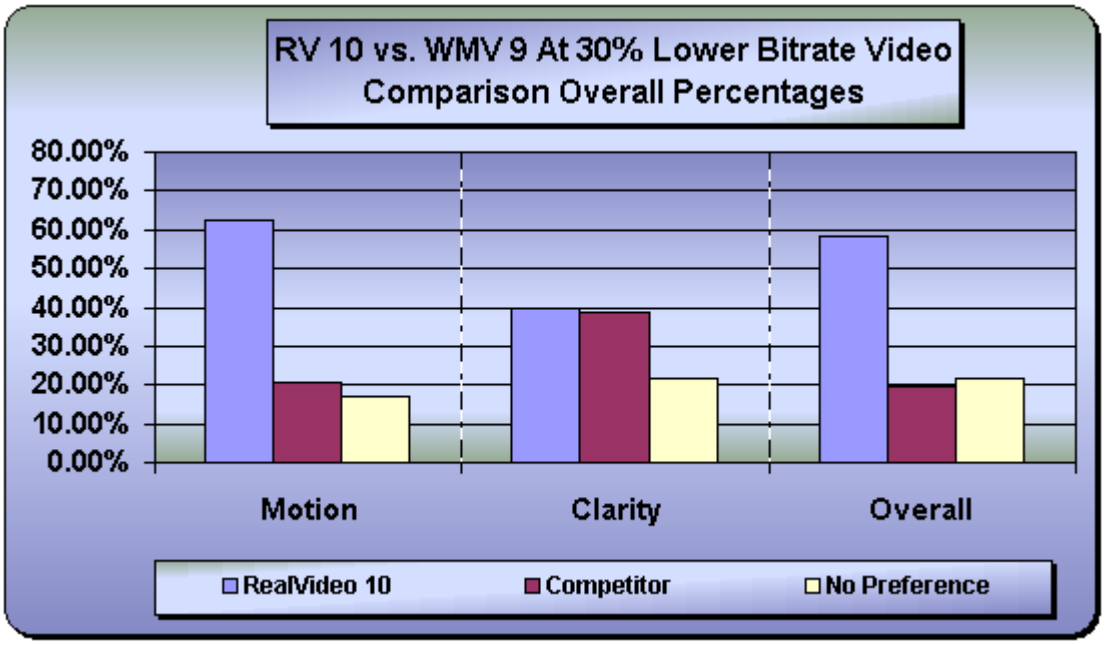

Figure 2: RV 10 vs. WMV 9 @ 30% Lower Bitrate Overall Percentages

3.0 CONFIGURATIONS & SETTINGS

3.1 Hardware Setup

KeyLabs used a single computer system to configure and perform the tests. This system was used to decode and display the video clips encoded and provided by RealNetworks (See Section 4.1 Video Selection for video clip details).

The following is a configuration list for this system:

Video Test System Specifications

- Single Intel P4 2.4 GHz
- 533 MHz Front Side Bus
- 40 GB Hard Drive
- 256 MB RAM
- nVidia GeForce 4 Video Card
- 3Com 3C509x NIC

Connectivity

All clips were stored locally on the test machine. This was done to create a test independent of network effects.

Monitors

KeyLabs used two monitors during testing. The first was not viewable by the participants, and was used by KeyLabs staff during clip setup. The following is a specification list for this monitor:

- Model: Dell Trinitron UltraScan P780
- Maximum Resolution: 1600x1200 @ 75Hz
- Size: 17 inches
- Dot Pitch: at 0.24 – 0.25mm as listed at http://www.dell.com/
- Resolution Setting During Test: 1024x768 @ 85Hz

The second monitor was viewable by the participants. The following is a specification list for this monitor:

- Model: Sun Microsystems GDM-5410
- Maximum Resolution: 1600x1200 @ 75Hz
- Size: 21 inches
- Dot Pitch: 0.24 as listed at sunsolve.sun.com/handbook_pub/Devices?monitor/MONITOR_Color_21_Prem_Flat_CRT.html
- Resolution Setting During Test: 1024x768 @ 75Hz

3.2 Software Setup

The following is a list of software used on the machine for this test:

Operating System

- Windows XP Professional with SP1 and the latest Microsoft hot fixes

Encoding Software

- RealVideo Clips – RealVideo 10 command line Producer
- Windows Media Video Clips – Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980)
- MPEG-4 ASP Video Clips - DivX Pro 5.1 Build b959-Tahiti

Playback Software

- RealNetworks RealOne Player (build 6.0.11.868)
- Microsoft Windows Media Player (v. 9.00.00.3075)

4.0 TEST METHODOLOGY

4.1 Video Selection

The clips that were shown during this test are included in the table below.

Table 3: Video Clip Details

Name	Description	Encoding Rate (Kbps)	Duration (seconds)	Video Type
Kill Bill	Movie Trailer	500	60	RealVideo 10 (RV 10)
Kill Bill	Movie Trailer	500	60	Windows Media 9 (WMV 9)
Kill Bill	Movie Trailer	500	60	MPEG-4 ASP
Elf	Movie Trailer	300	60	RealVideo 10 (RV 10)
Elf	Movie Trailer	300	60	Windows Media 9 (WMV 9)
Elf	Movie Trailer	450	60	Windows Media 9 (WMV 9)
CNN	News Footage	32	60	RealVideo 10 (RV 10)
CNN	News Footage	32	60	Windows Media 9 (WMV 9)
CNN	News Footage	48	60	Windows Media 9 (WMV 9)

4.2 Video Encoding / Decoding

RealNetworks supplied KeyLabs with all necessary AVI clips already encoded. RealVideo 10 command line Producer was used for encoding the RealVideo clips, Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980) was used for encoding the Windows Media Video clips, and DivX Pro 5.1 Build b959-Tahiti was used for encoding the MPEG-4 ASP clips. The clips were encoded to allow the maximum quality settings for each encoder (see Section 5.2 Test Requirements for details). The encoded files were played (decoded) using RealNetworks RealOne Player (build 6.0.11.868) and Microsoft Windows Media Player (v. 9.00.00.3075). Files were encoded using the methodology detailed in the following section.

4.2.1 Encoding Methodology for RV 10 and WMV 9

The following encoding bit rates were used for the clips selected by RealNetworks:

CNN

- 32kbps RV 10 clip encoded at 32kbps video
- 32/48kbps Windows Media Video 9 clips encoded at 32/48kbps video, respectively

Elf

- 300kbps RV 10 clip encoded at 300kbps video
- 300/450kbps Windows Media Video 9 clips encoded at 300/450kbps video, respectively

Kill Bill

- 500kbps RV 10 clip encoded at 500kbps video
- 500 DivX 5.1 clips encoded at 500kbps video

Table 4: Original Clip Information

Clip	Size	FPS	Duration (Sec)
Kill Bill	624x344	24	62
Elf	624x336	24	56
CNN	640x480	30	59

Table 5: RV 10 Detail Settings

Clip	Video Bit-Rate	Mode	Motion	Key Frame Interval	Max FPS	Resize	Filters
Kill Bill	500000	2Pass VBR	Normal	10	30	None	None
Elf	300000	1Pass CBR	Normal	10	30	512x272	None
CNN	32000	1Pass CBR	Normal	10	30	320x240	None

Table 6: WMV 9 Detail Settings

Clip	Video Bit-Rate	Mode	Quality	Key Frame Interval	Max FPS	Resize	Filters
Kill Bill	500000	2Pass VBR	90	10	30	None	None
Elf	300000 / 450000	1Pass CBR	90	10	30	512x272	None
CNN	32000 / 48000	1Pass CBR	90	10	30	320x240	None

Table 7: MPEG-4 ASP Detail Settings

Clip	Video Bit-Rate	Mode	Quality	Key Frame Interval	Max FPS	Resize	Filters
Kill Bill	500000	2Pass VBR	90	10	30	None	None

Table 8: RV 10 Encoded File Statistics

Clip	Video Kbps-Rate	File Size (KB)	Duration (sec)
Kill Bill	500000	3843	62
Elf	300000	2112	56
CNN	32000	249	59

Table 9: WMV 9 Encoded File Statistics

Clip	Video Kbps-Rate	File Size (KB)	Duration (sec)
Kill Bill	500000	3941	62
Elf	300000	2188	56
Elf	450000	3152	56
CNN	32000	266	59
CNN	48000	354	59

Table 10: MPEG-4 ASP Encoded File Statistics

Clip	Video Kbps-Rate	File Size (KB)	Duration (sec)
Kill Bill	500000	3843	62

4.3 Lab Configuration

The following diagram shows the lab setup used for the viewing portion of the test.

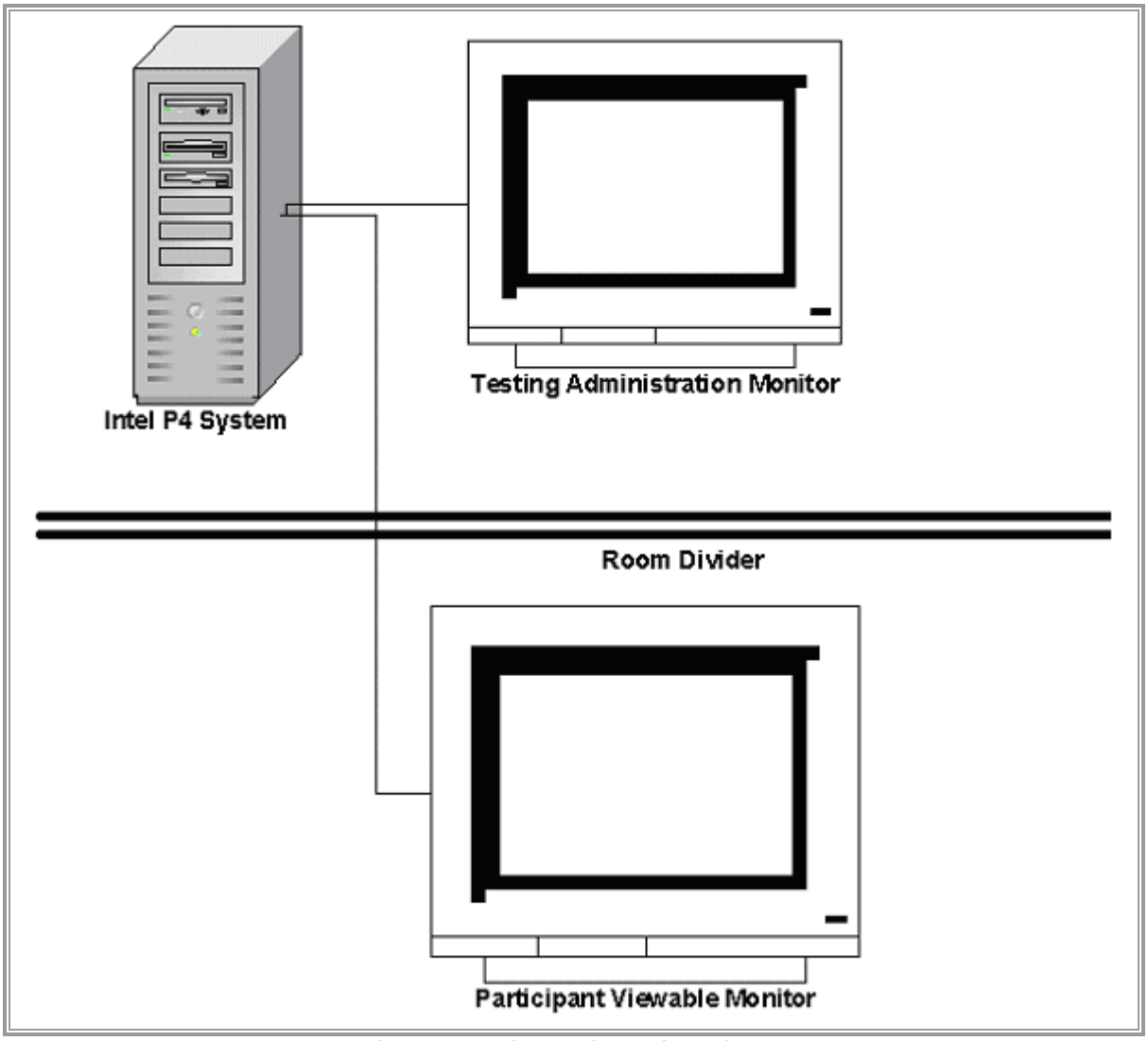

Figure 3: Lab Configuration Diagram

4.4 Test Specifications

The following table provides the test specifications and requirements for this comparison.

Table 11: Test Specifications and Requirements

Test Parameter	Notes
Number of Test Scenarios	Six (6) Test Scenarios: - See Test Requirement (Section 5.2) for further details.
Timing	All tests to be administered within a 2-day time period
AVI Files	None – see below
Video Clips	Nine (9) Clips: - Three (3) for RealVideo 10 - Five (5) for Windows Media Video 9 - One (1) for MPEG-4 ASP RealNetworks encoded the AVI files and provided the clips to KeyLabs.
Audience	Each participant must be 16 years of age or older There are no requirements for experience with computers, the Internet, or video viewing
Viewing Distance	Each viewer must view the 21" monitor at a distance between 24" and 72"
Viewing Groups	Groups of 1 to 5 individuals to be placed in front of the 21" monitor
Survey Preferences	Preference criteria are as follows: Which clip has the smoothest motion? Clip A Clip B No Preference Which clip has the sharpest image quality? Clip A Clip B No Preference Which clip do you prefer overall? Clip A Clip B No Preference
Consistency	All tests must be performed on identical machine and monitor combinations. All viewing equipment must be separated from the test equipment so that viewers cannot see the PC screen prior to the start of playback.
View Size	Each video clip should fill the entire viewing area of the 21" monitor.
Software Availability	RealNetworks and Microsoft Windows Media software were downloaded from the www.real.com and www.microsoft.com websites respectively.

5.0 TEST PROCEDURES

5.1 Test Facilities

The KeyLabs facility in Lindon, Utah was selected as the location to conduct the survey. Two rooms apart from the main testing lab were used, one to register the participants and the other to conduct the testing. Display was switched to the testing administration monitor in order to start the clip and change the video size to full screen removing all indications of the player being used. Display was then switched to the participant viewable monitor as playback was started. This was done to ensure that participants could not watch the configuration or determine which version of the clip was playing.

RealNetworks selected the video clips used in this test. Test assistants were present during the survey to start the video playback, respond to participant requests, handle any technical difficulties, and to monitor, validate, and record the activities of the test participants.

As incentive to attract volunteers in order to allow KeyLabs to conduct this testing, it was determined that each participant would receive fifteen dollars for completing the survey.

5.2 Test Requirements

The following table lists the requirements for this comparison.

Table 12: Test Requirements

Test Scenario 1	RealVideo 10 Clip	Windows Media 9 Clip
Source File	kb_500.rmvb	kb_wmv9_500.wmv
Encoding Software	RealVideo 10 command line Producer	Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980)
Video Encoding	500Kbps @ original size & 24 fps	500Kbps @ original size & 24 fps
Clip Lengths	62 Sec	62 Sec
Playback Size	21"	21"
Test Scenario 2	**RealVideo 10 Clip**	**MPEG-4 ASP Clip**
Source File	kb_500.rmvb	kb_dx_500.avi
Encoding Software	RealVideo 10 command line Producer	DivX Pro 5.1 Build b959-Tahiti
Video Encoding	500Kbps @ original size & 24 fps	500Kbps @ original size & 24 fps
Clip Lengths	62 Sec	62 Sec
Playback Size	21"	21"
Test Scenario 3	**RealVideo 10 Clip**	**Windows Media 9 Clip**
Source File	elf_300.rm	elf_300.wmv
Encoding Software	RealVideo 10 command line Producer	Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980)
Video Encoding	300Kbps @ 512x272 & 24 fps	300Kbps @ 512x272 & 24 fps
Clip Lengths	56 Sec	56 Sec
Playback Size	21"	21"
Test Scenario 4	**RealVideo 10 Clip**	**Windows Media 9 Clip**
Source File	elf_300.rm	elf_450.wmv
Encoding Software	RealVideo 10 command line Producer	Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980)
Video Encoding	300Kbps @ 512x272 & 24 fps	450Kbps @ 512x272 & 24 fps
Clip Lengths	56 Sec	56 Sec
Playback Size	21"	21"
Test Scenario 5	**RealVideo 10 Clip**	**Windows Media 9 Clip**
Source File	cnn_32_320x240.rm	cnn_32.wmv
Encoding Software	RealVideo 10 command line Producer	Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980)
Video Encoding	32Kbps @ 320x240 & 15 fps	32Kbps @ 320x240 & 15 fps
Clip Lengths	59 Sec	59 Sec
Playback Size	21"	21"

Test Scenario 6	RealVideo 10 Clip	Windows Media 9 Clip
Source File	cnn_32_320x240.rm	cnn_48.wmv
Encoding Software	RealVideo 10 command line Producer	Microsoft Windows Media Encoder 9 Series (v. 9.00.00.2980)
Video Encoding	32Kbps @ 320x240 & 15 fps	48Kbps @ 320x240 & 15 fps
Clip Lengths	59 Sec	59 Sec
Playback Size	21"	21"
Note: The video clips were displayed at full screen so the software interface was not visible to the participants.		

5.3 Test Participant Recruitment

Test participants were recruited from the local area. These participants were then qualified by responding to verbal questioning as to whether they were 16 years of age or older. If so, they were then given the information form to complete, after which they were given instructions on how to complete the survey.

Participants were recruited in several age brackets to limit potential age bias. The number of participants from each age group is representative of the individuals that agreed to participate, but in no case less than 20% or greater than 50% of the total. Fifty viewers participated in tests 1–2, and fifty-three others participated in tests 3-6. The defined age groups were as follows: 16-24, 25-34, and 35+.

A total of 100 test subjects were required to generate the data; a total of 103 people actually participated. Data from all 103 of the participants was compiled for this report. After being qualified by completeness and accuracy of the forms, the responses were then used to compile the test summary data.

5.4 Testing Process

The test machine was set up and configured at KeyLabs test facilities in Lindon, Utah. A temporary wall was set up in front of the lab configuration to conceal the back-end test equipment and prevent viewers from observing the process of switching between media types. No participant was allowed to view the player that was used to decode the clips. This prevented the participants from knowing what technology was being tested, or what application was in use during the test.

To allow the tester quick access to each of the files used in the test, icons were created on the desktop of the machine used when conducting the test. KeyLabs performed the tests prior to beginning the survey to refine the test process and ensure that the video clips being viewed were anonymous. The order in which the test clips were shown to each video group was randomized to eliminate bias. This was done by giving each participant a video survey form with a Test Group # that instructed the KeyLabs tester regarding the order of the clips to be displayed. This also balanced any tendency to pick the first or last clip.

Test participation was voluntary and all participants were at least 16 years old. Test participation was limited to a total of one session per person. To ensure a steady stream of participants and increase their willingness to be patient with the testing process, each participant was given fifteen dollars once he or she had properly completed the survey at the conclusion of the test.

Three KeyLabs employees conducted the test execution. Two employees operated and monitored the backend test machines while the other registered the viewers and collected the completed survey forms from those completing the test. The employees executing the actual test comparison instructed each group of participants on how the test was to be conducted. Each volunteer was given the same instructions for each test. The instructions were as follows:

"You will be shown four groups of two movie clips – Clip A and Clip B, Clip C and Clip D, Clip E and Clip F, and Clip G and Clip H. When viewing the clips, you will need to pay close attention to motion, image, and overall quality of the clips and mark which clip you prefer in each of these three categories.

You will have the opportunity to view each of these clips twice in the same order – Clip A, Clip B followed by Clip A and then Clip B again. Please allow the group of clips to finish, watching the clips in their entirety before indicating your preferences. You will then be asked to mark your preferences before the next group of clips is shown.

Please turn off any cell phones or pagers that may distract you from viewing the clips. If you answer a phone during the test, your test will be invalidated and you will have to restart the testing process."

6.0 Test Results

This section of the report provides details of the results for each of the test scenarios. A graphic representation of the average responses derived from the data collected from each test scenario is provided. Each graph is preceded by a table that includes the total numbers as collected from the data for that scenario.

6.1 Test Scenario 1 – Kill Bill Clip

Table 13: Kill Bill Participant Selections

	Motion	Clarity	Overall
RealVideo 10	20	30	29
Windows Media Video 9	15	13	12
No Preference	15	7	9
Total Participants	50	50	50

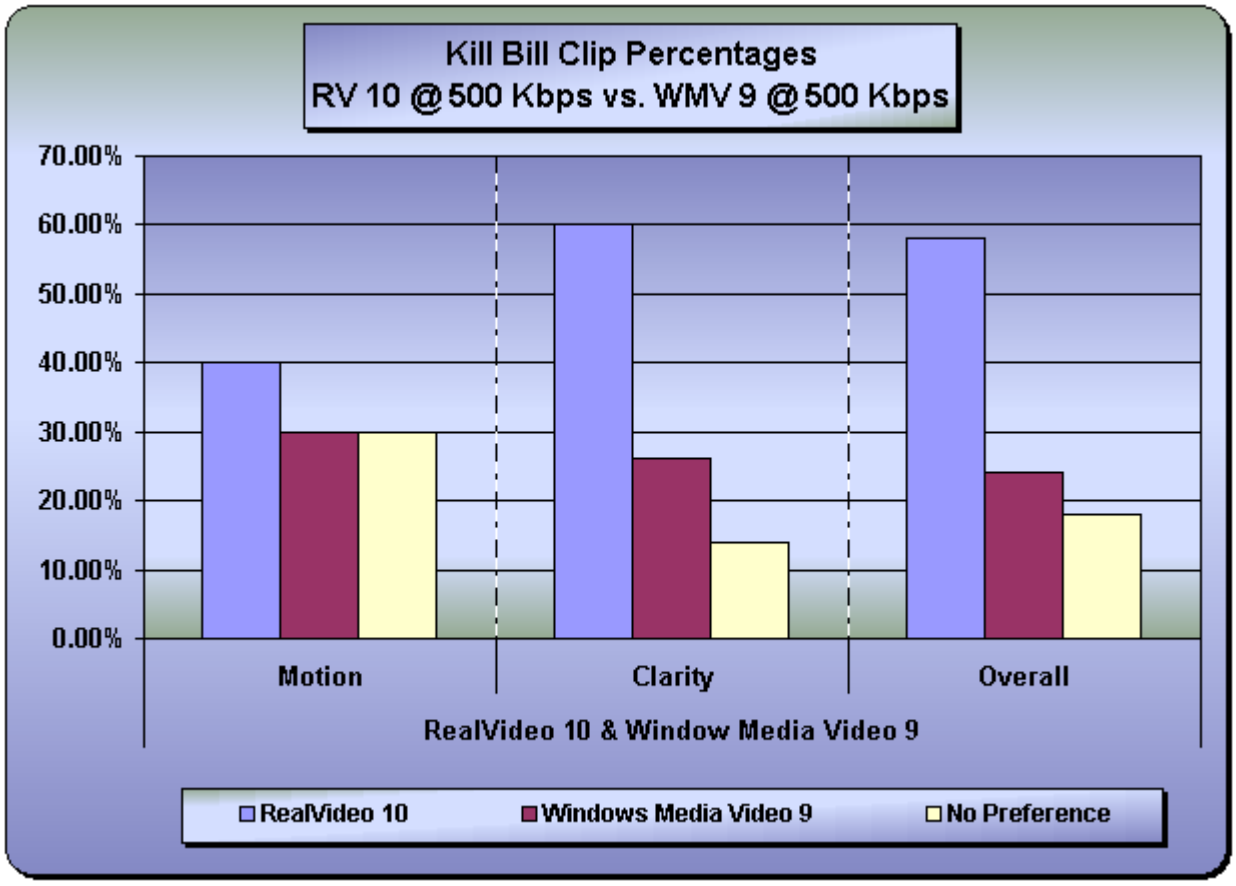

Figure 4: Kill Bill Clip Percentages – RV 10 @ 500 Kbps vs. WMV 9 @ 500 Kbps

6.2 Test Scenario 2 – Kill Bill Clip

Table 14: Kill Bill Participant Selections

	Motion	Clarity	Overall
RealVideo 10	23	37	31
MPEG-4 ASP	14	9	13
No Preference	13	4	6
Total Participants	50	50	50

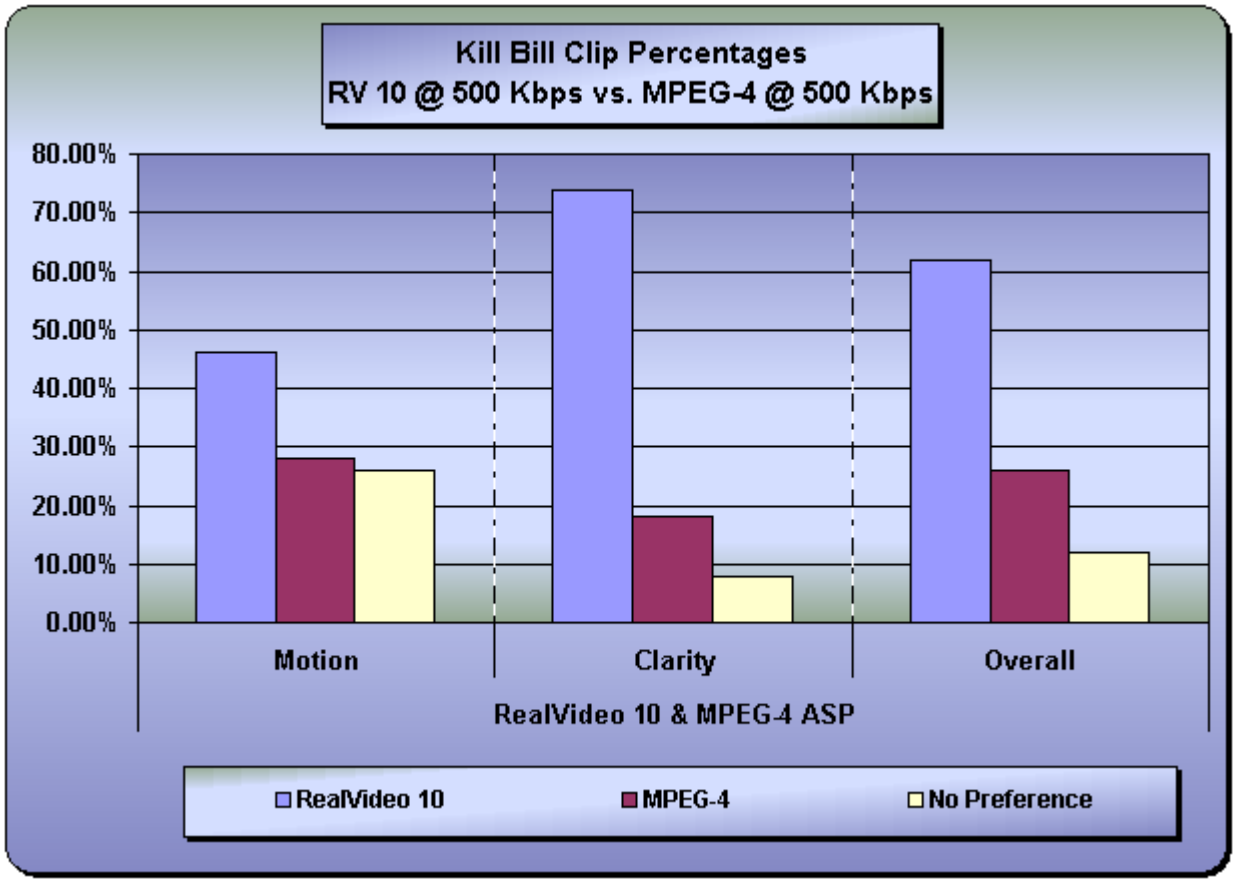

Figure 5: Kill Bill Clip Percentages – RV 10 @ 500 Kbps vs. MPEG-4 @ 500 Kbps

6.3 Test Scenario 3 – Elf Clip

Table 15: Elf Participant Selections

	Motion	Clarity	Overall
RealVideo 10	28	38	37
Windows Media Video 9	8	7	9
No Preference	17	8	7
Total Participants	53	53	53

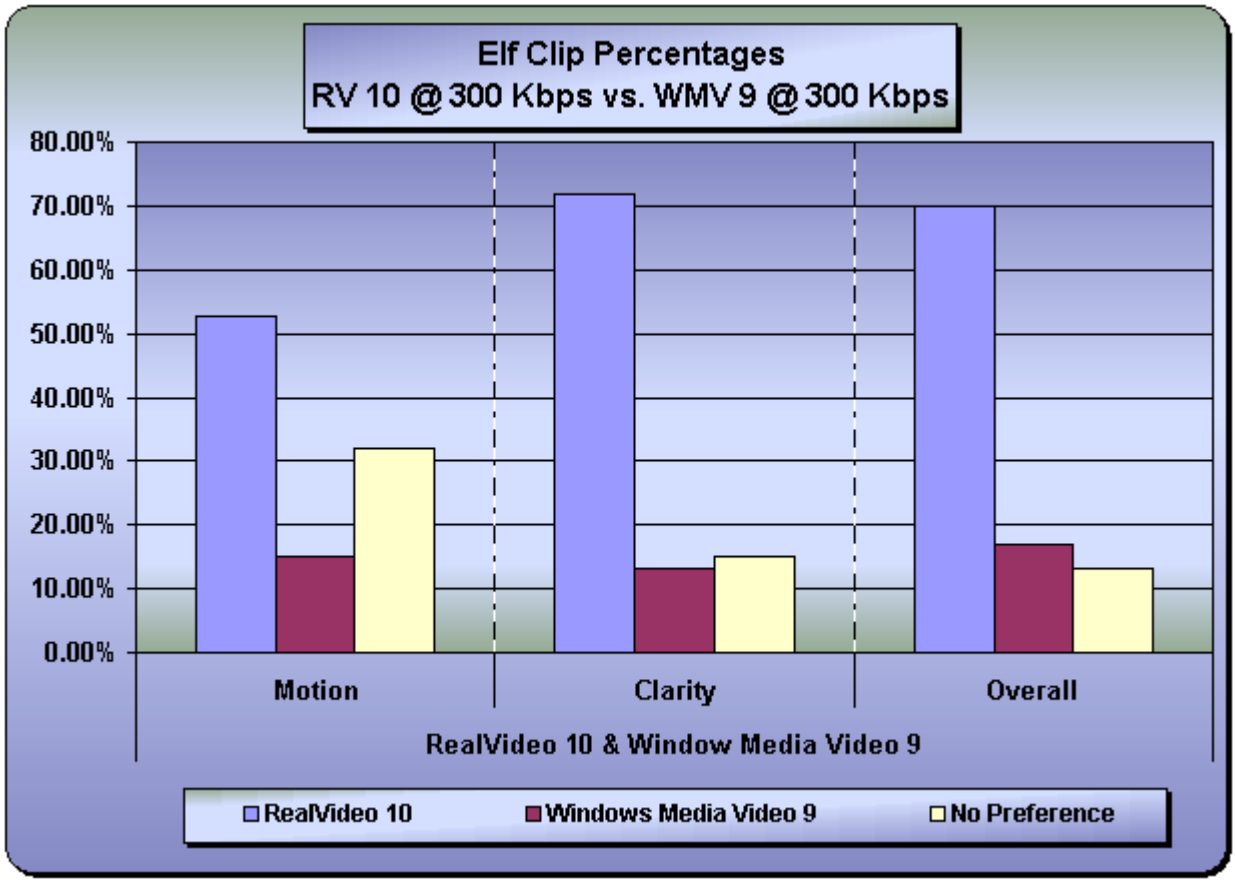

Figure 6: Elf Clip Percentages – RV 10 @ 300 Kbps vs. WMV 9 @ 300 Kbps

6.4 Test Scenario 4 – Elf Clip

Table 16: Elf Participant Selections

	Motion	Clarity	Overall
RealVideo 10	17	32	29
Windows Media Video 9	20	10	9
No Preference	16	11	15
Total Participants	53	53	53

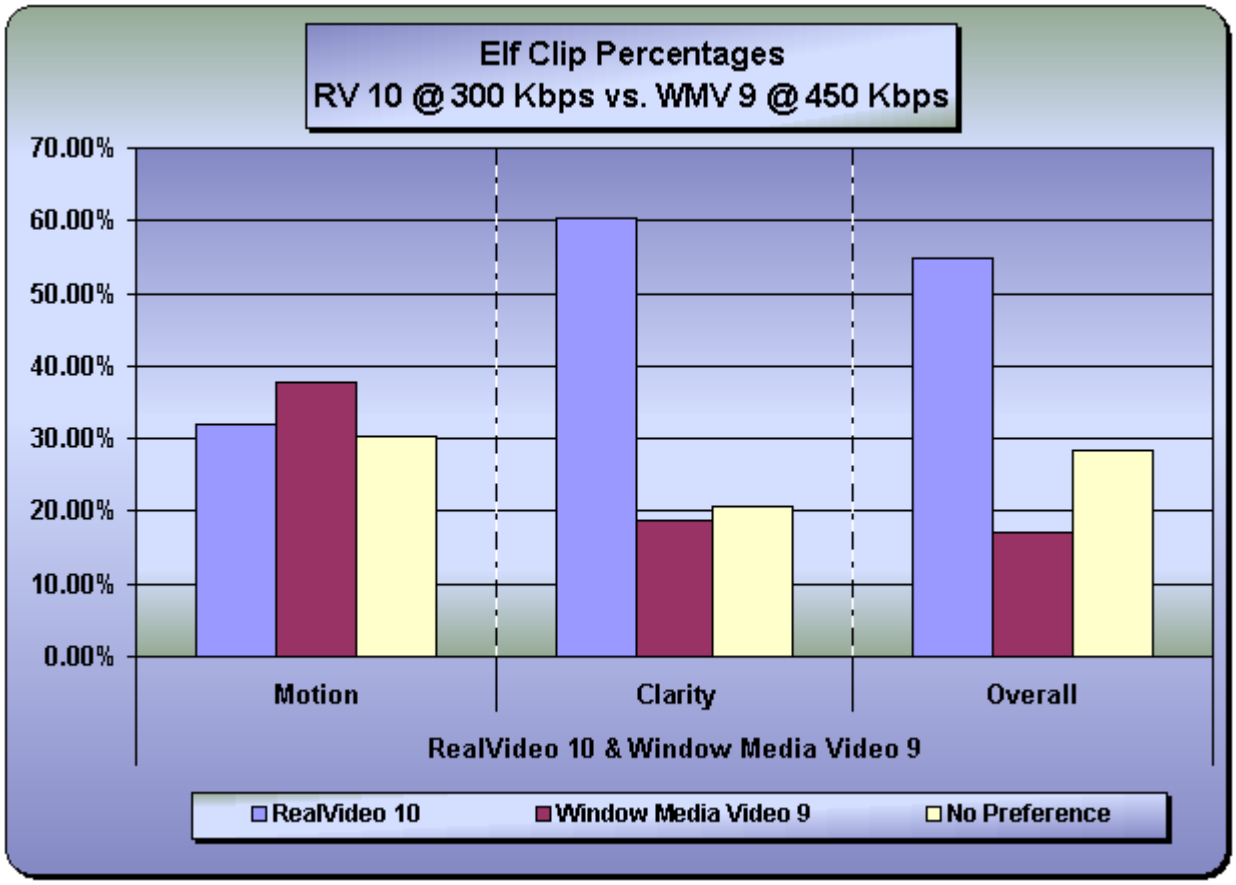

Figure 7: Elf Clip Percentages – RV 10 @ 300 Kbps vs. WMV 9 @ 450 Kbps

6.5 Test Scenario 5 – CNN Clip

Table 17: CNN Participant Selections

	Motion	Clarity	Overall
RealVideo 10	31	43	39
Windows Media Video 9	18	6	10
No Preference	4	4	4
Total Participants	53	53	53

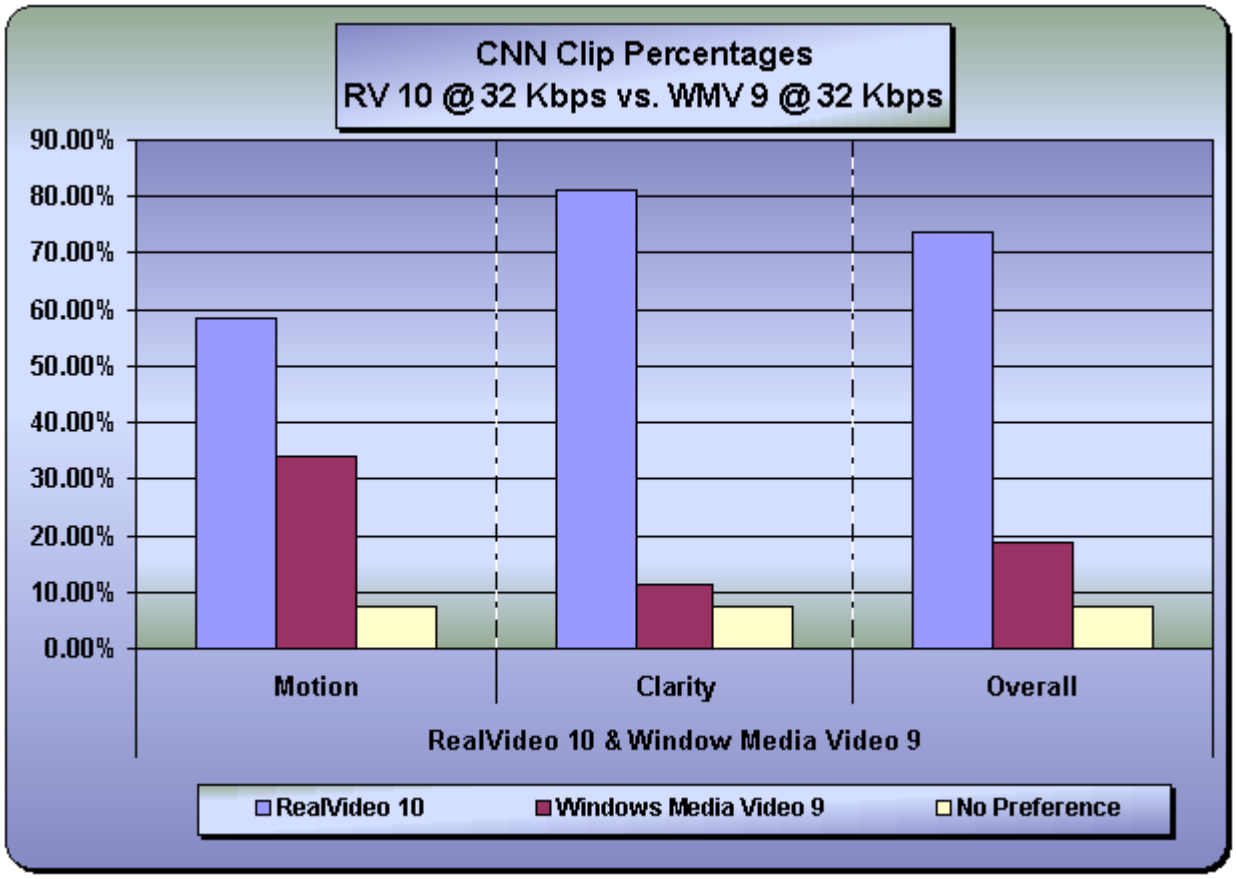

Figure 8: CNN Percentages – RV 10 @ 32 Kbps vs. WMV 9 @ 32 Kbps

6.6 Test Scenario 6 – CNN Clip

Table 18: CNN Participant Selections

	Motion	Clarity	Overall
RealVideo 10	25	34	33
Windows Media Video 9	21	12	12
No Preference	7	7	8
Total Participants	53	53	53

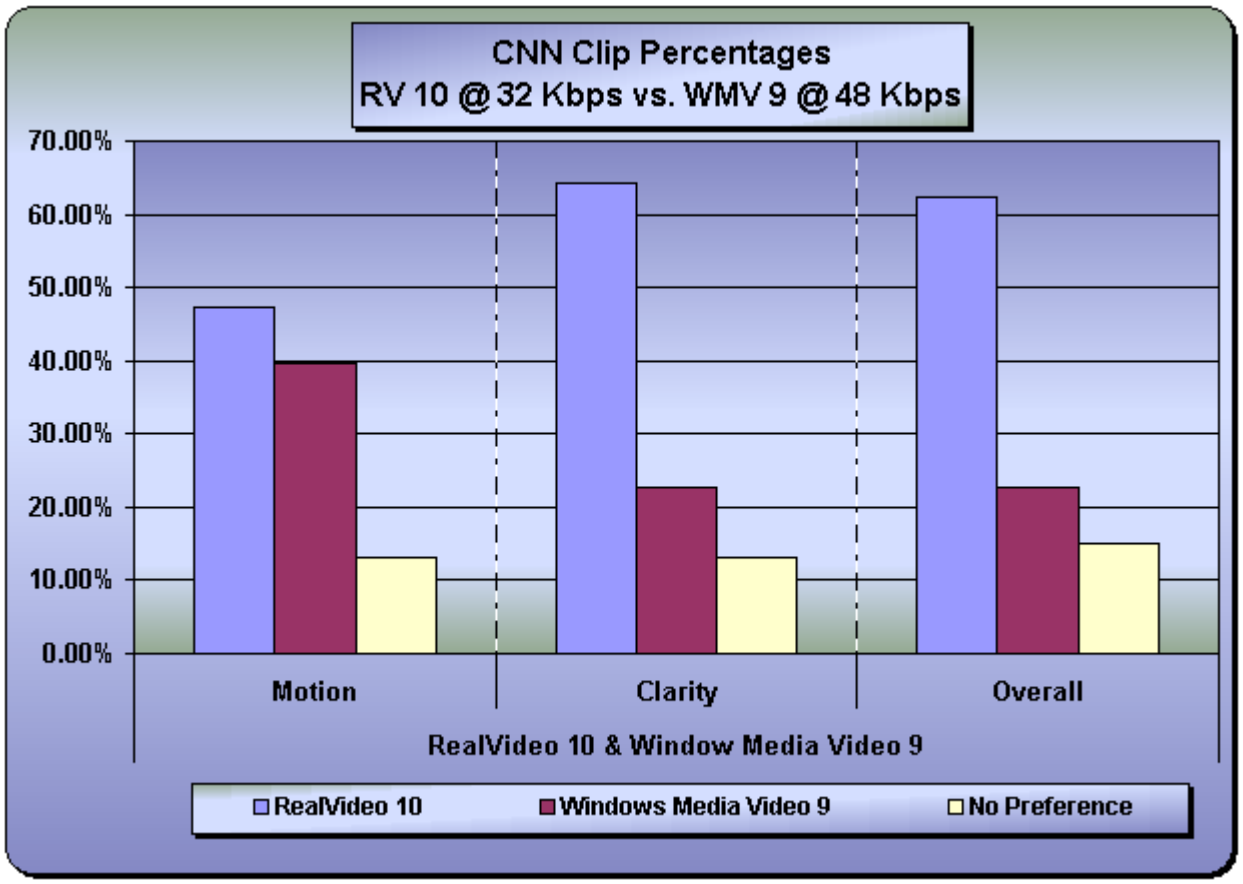

Figure 9: CNN Percentages – RV 10 @ 32 Kbps vs. WMV 9 @ 48 Kbps

7.0 APPENDICES

7.1 Appendix A – Sample Video Forms

KeyLabs Welcome to the Video Encoding Challenge! Date: _____

You can participate if you are at least 16 years of age AND have thirty minutes to complete the test and survey.

Personal Information (Please Print)

First Name	Middle	Last Name	Gender ☐ Male ☐ Female	Age ☐ 16-24 ☐ 25-34 ☐ 35+
Street	City	ST	Zip	Phone

Instructions

You will watch four groups of video clips. Please watch each clip in its entirety.

Test Scenario 1	Test Scenario 2	Test Scenario 3	Test Scenario 4	Test Group#
Clip A Clip B	Clip C Clip D	Clip E Clip F	Clip G Clip H	Z1

Indicate which clip you preferred for each of the following criteria.

Test Scenario 1	
Criteria	Preference
Which clip has the smoothest motion?	☐ A ☐ B ☐ No Preference
Which clip has the sharpest image quality?	☐ A ☐ B ☐ No Preference
Which clip do you prefer overall?	☐ A ☐ B ☐ No Preference

Test Scenario 2	
Criteria	Preference
Which clip has the smoothest motion?	☐ C ☐ D ☐ No Preference
Which clip has the sharpest image quality?	☐ C ☐ D ☐ No Preference
Which clip do you prefer overall?	☐ C ☐ D ☐ No Preference

Test Scenario 3	
Criteria	Preference
Which clip has the smoothest motion?	☐ E ☐ F ☐ No Preference
Which clip has the sharpest image quality?	☐ E ☐ F ☐ No Preference
Which clip do you prefer overall?	☐ E ☐ F ☐ No Preference

Test Scenario 4	
Criteria	Preference
Which clip has the smoothest motion?	☐ G ☐ H ☐ No Preference
Which clip has the sharpest image quality?	☐ G ☐ H ☐ No Preference
Which clip do you prefer overall?	☐ G ☐ H ☐ No Preference

Thank you for your time and participation!

TReu3.0

7.2 Appendix B – Test Groups

Test Group #	Test Scenarios	# People
Y1	1-2	25
Y2	1-2	25
Z1	3-6	25
Z2	3-6	28
Total Participants		**103**

7.3 Appendix C – Test Clip Matrix (Video Survey Forms)

			Video Survey Form	
			Test Group	Test Group
Test Scenario	**Clip**	**Clip Group**	Y1	Y2
1	Kill Bill	Group 1	RV 10-A, WMV 9-B	WMV 9-A, RV 10-B
2	Kill Bill	Group 2	RV 10-C, MPEG-4-D	MPEG-4-C, RV 10-D
Test Scenario	**Clip**	**Clip Group**	Z1	Z2
3	Elf	Group 1	RV 10-A, WMV 9-B	WMV 9-A, RV 10-B
4	Elf	Group 2	RV 10-C, WMV 9-D	WMV 9-C, RV 10-D
5	CNN	Group 3	RV 10-E, WMV 9-F	WMV 9-E, RV 10-F
6	CNN	Group 4	RV 10-G, WMV 9-H	WMV 9-G, RV 10-H