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Title: Experimental results for adaptive prediction error coding in spatial and frequency domain for common test conditions

Purpose: Information

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1 Abstract

This document presents the experimental results for the adaptive prediction error coding in spatial and frequency domain with respect to the common test conditions as recommended in [3]. For the recommended test sequences the data rate is reduced by the adaptive prediction error coding by about 3.14% in average for the same quality compared to H.264/AVC. This corresponds to an increased Y-PSNR of 0.14 dB in average for the same data rate. In order to verify the results also an extended set of VCEG and MPEG test sequences has been investigated. Taking the extended set into account, the data rate is reduced by the adaptive prediction error coding by about 3.83% in average for the same quality which corresponds to an increased Y-PSNR of 0.19 dB in average for the same data rate compared to H.264/AVC.

2 Introduction

At the last VCEG meeting in Hangzhou, China, in October 2006, the adaptive prediction error coding in the spatial and frequency domain with a fixed scan in the spatial domain [2] was proposed and adopted into the KTA-Software [1]. Since in [2], experimental results were shown for test sequences and test conditions which were slightly different from the common ones recommended in [3], it was desired to have the experimental results also for the common test conditions. These results are provided in the following section.

3 Experimental results

In Figures 1-13, the operational rate distortion curves are shown for the test sequences which are recommended in [3] to be used for coding efficiency tests. They are measured by the use of the current KTA-Software [1]. The coder settings correspond to those recommended in [3]. H.264/AVC is used as reference. In the following text and in the Figures, H.264/AVC extended by the adaptive prediction error coding is abbreviated by APEC. Figure 14 shows the measured bit rate reduction for the same Y-PSNR achieved by the use of APEC compared to H.264/AVC using the recommended measurement method which is described in [5]. It can be seen that the bit rate is reduced by 3.14% in average whereas the reduction for test sequences in QCIF and

CIF is higher than for test sequences in HDTV. Figure 15 shows the measured increase of the Y-PSNR for the same bit rate achieved by the use of APEC compared to H.264/AVC using the recommended measurement method as also described in [5]. The Y-PSNR is increased by 0.14 dB in average whereas the increase for test sequences in QCIF and CIF is higher than for test sequences in HDTV.

In order to verify the results also an extended set of VCEG and MPEG test sequences has been investigated. In Figures 16-28, the operational rate distortion curves are shown for test sequences which are tested in addition to the recommended ones. Figure 29 shows the measured bit rate reduction for the same Y-PSNR by the use of APEC compared to H.264/AVC using the extended test set. It can be seen, that the bit rate is reduced by 3.83% in average. Figure 30 shows the measured increase of the Y-PSNR for the same bit rate by the use of APEC compared to H.264/AVC using the recommended measurement method. It can be observed that the Y-PSNR is increased by 0.19 dB in average.

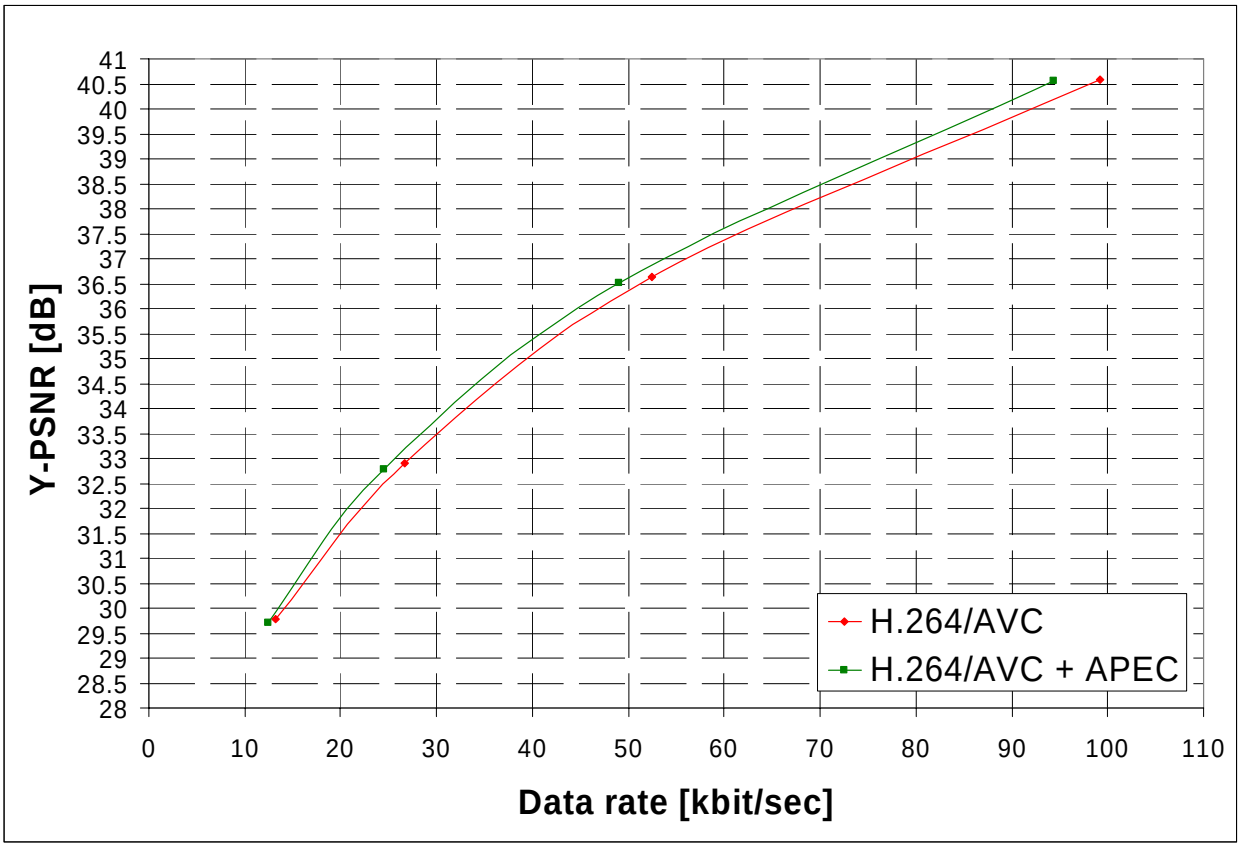

Figure 1: Measured operational rate distortion curves for the test sequence Silent, QCIF, 15Hz, progressive.

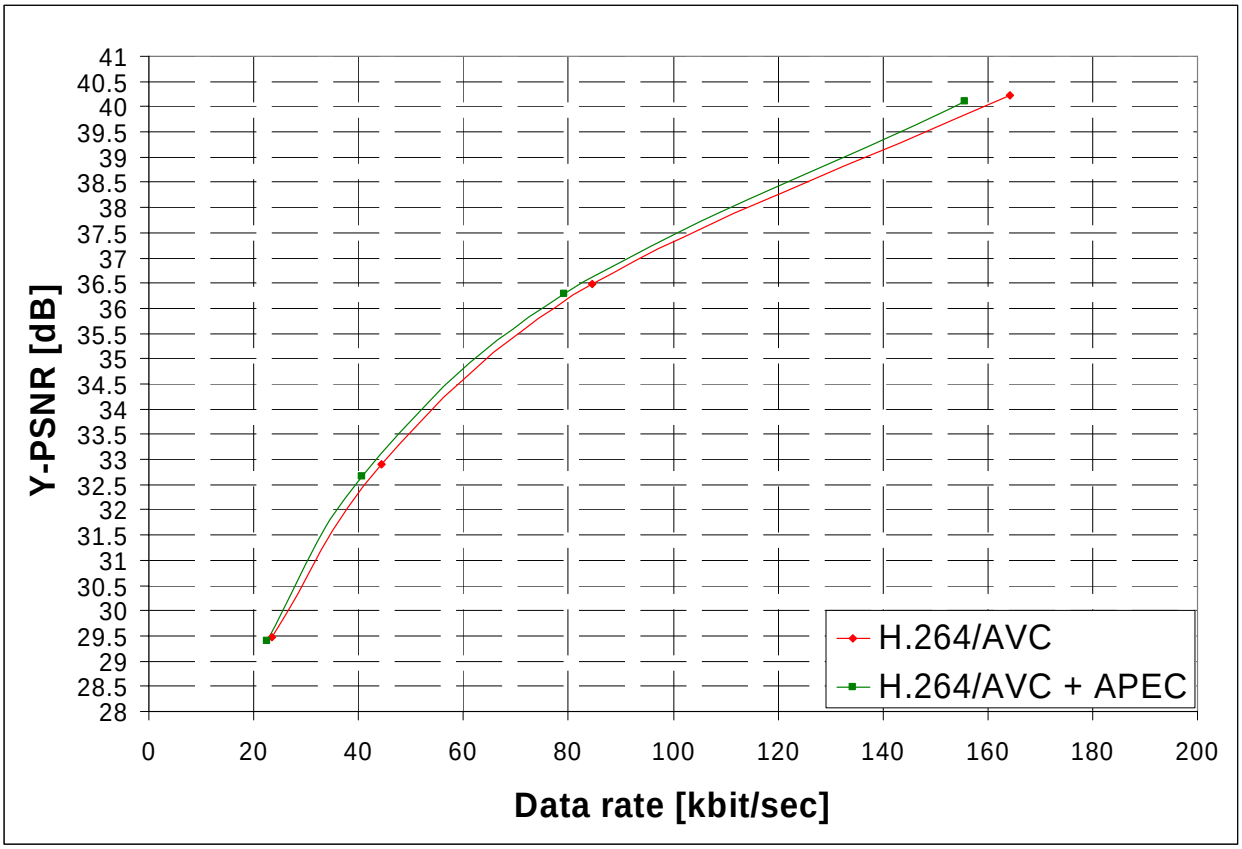

Figure 2: Measured operational rate distortion curves for the test sequence Foreman, QCIF, 15Hz, progressive.

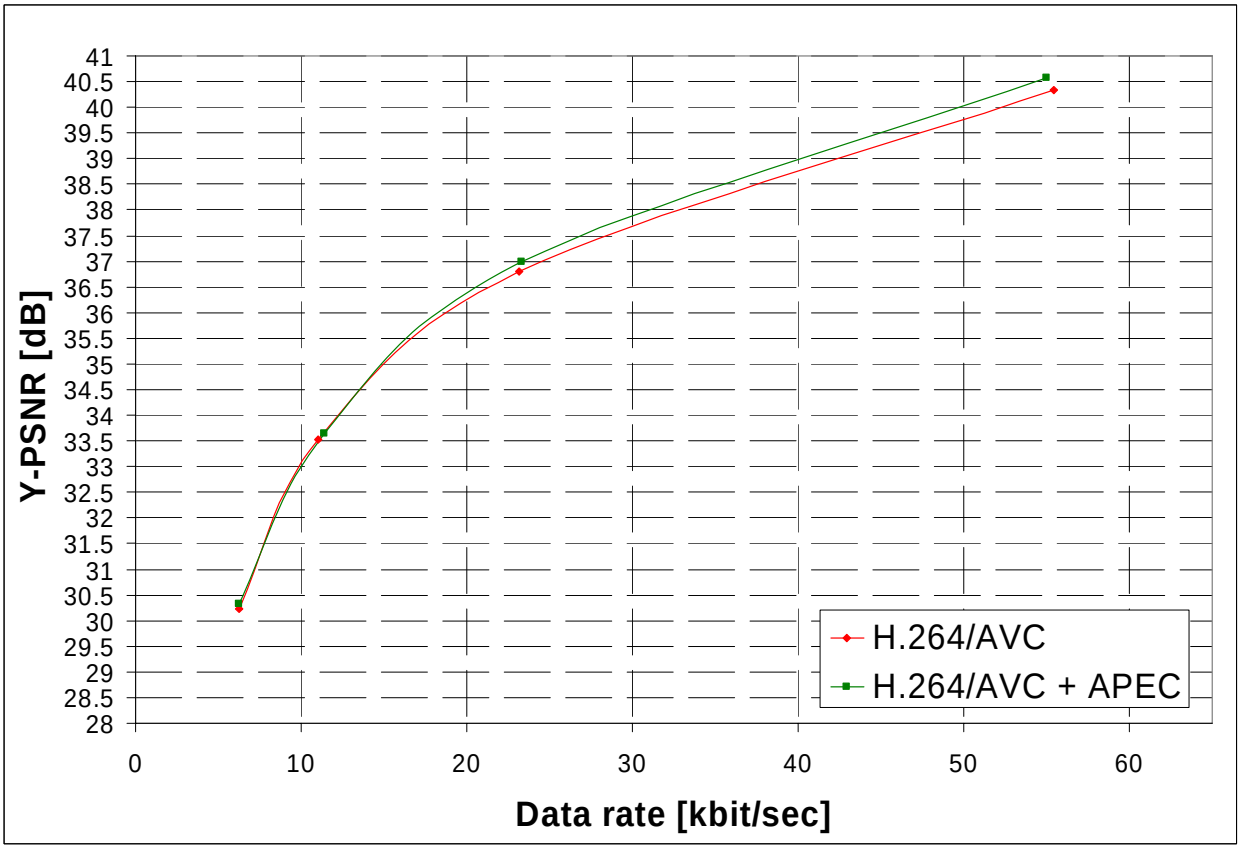

Figure 3: Measured operational rate distortion curves for the test sequence Container, QCIF, 15Hz, progressive.

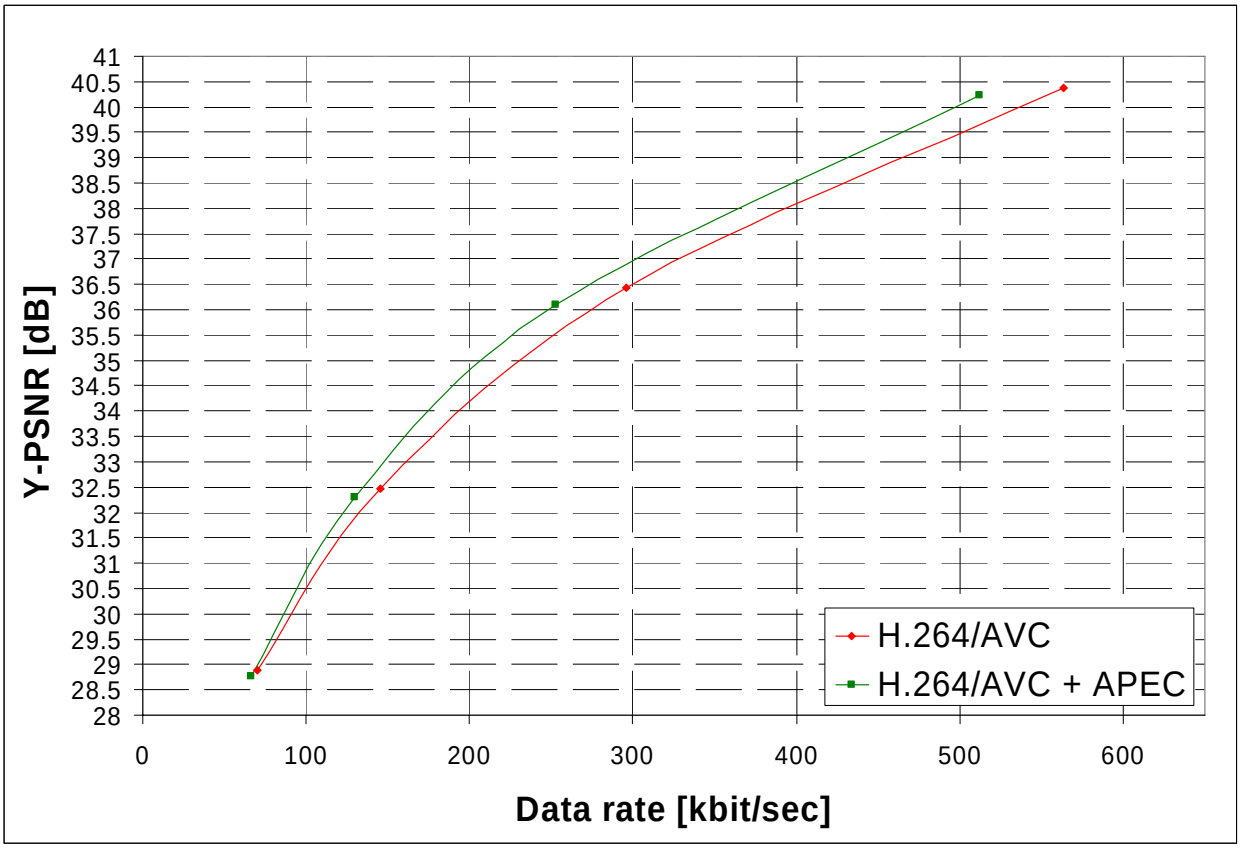

Figure 4: Measured operational rate distortion curves for the test sequence Paris, CIF, 15Hz, progressive.

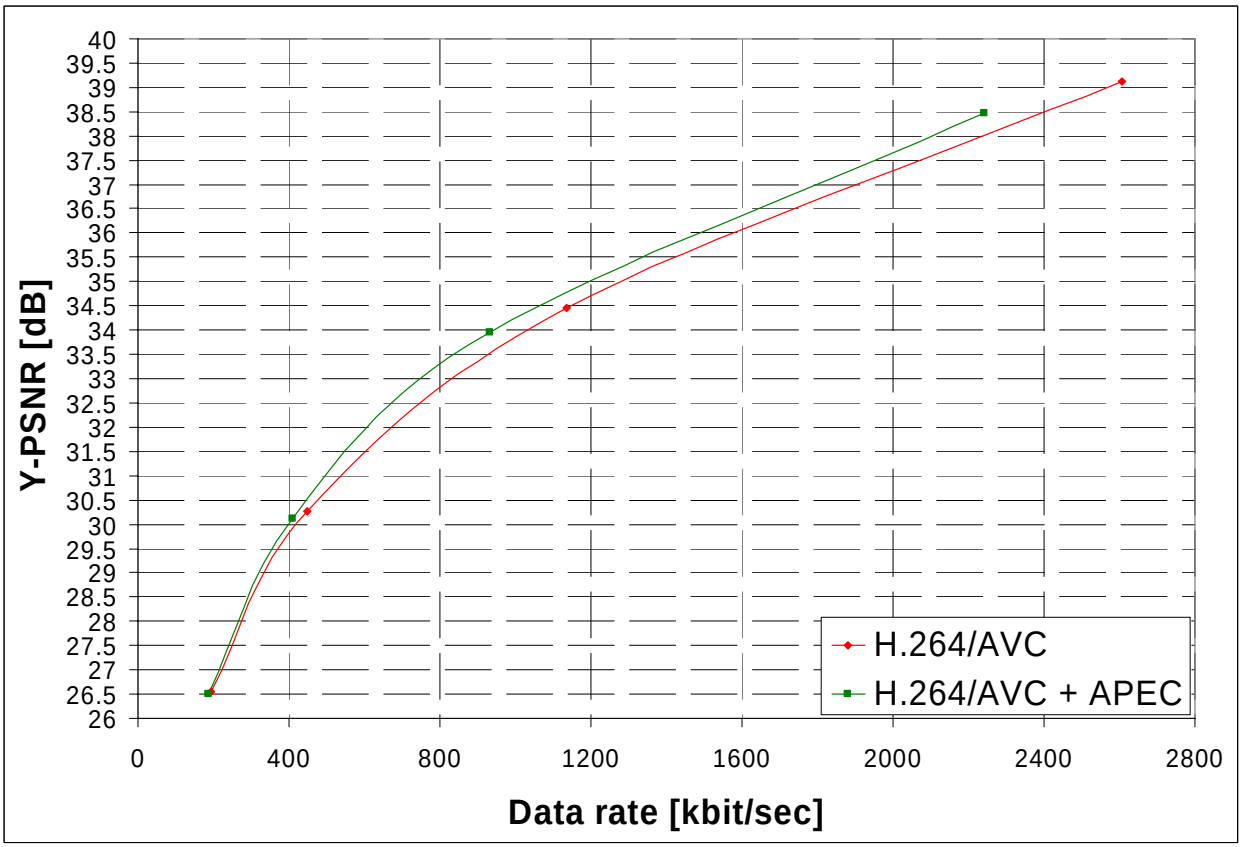

Figure 5: Measured operational rate distortion curves for the test sequence Mobile & Calendar, CIF, 30Hz, progressive.

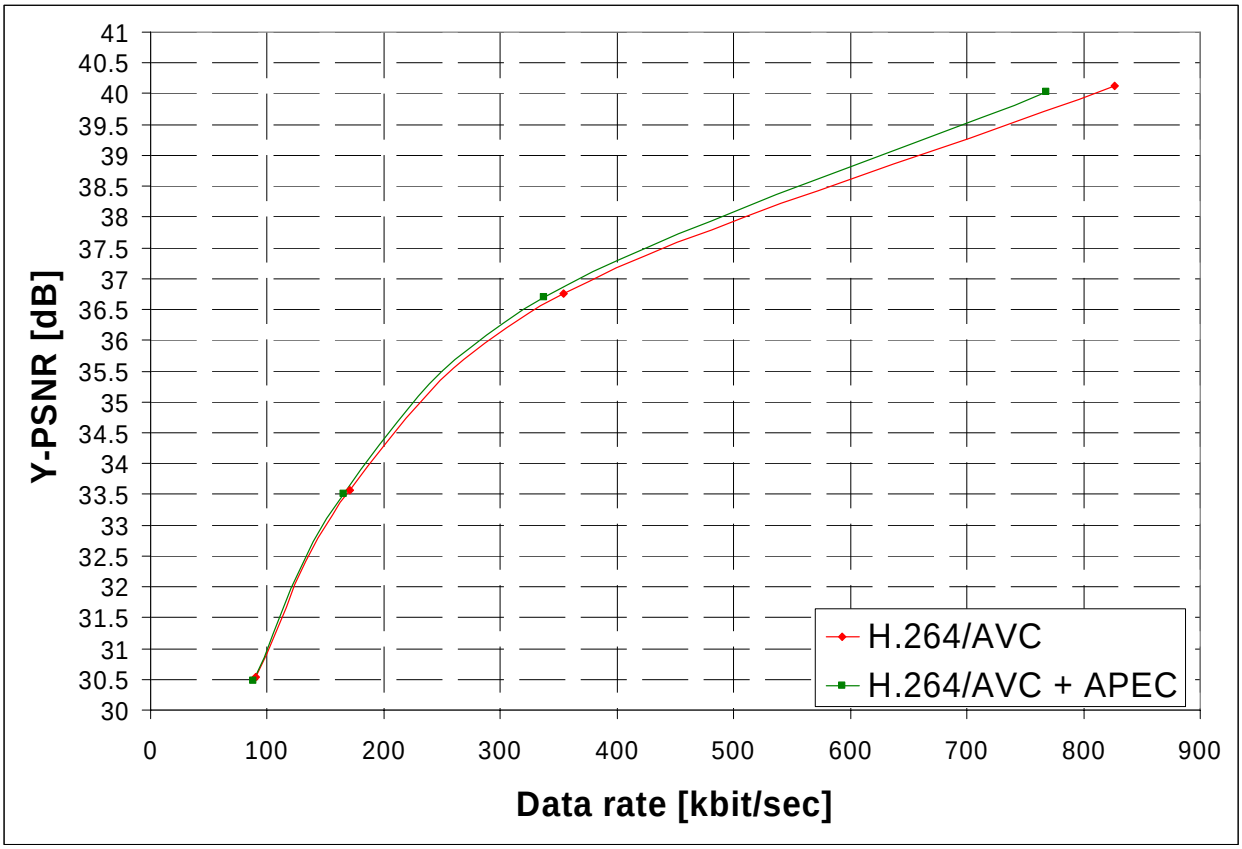

Figure 6: Measured operational rate distortion curves for the test sequence Foreman, CIF, 30Hz, progressive.

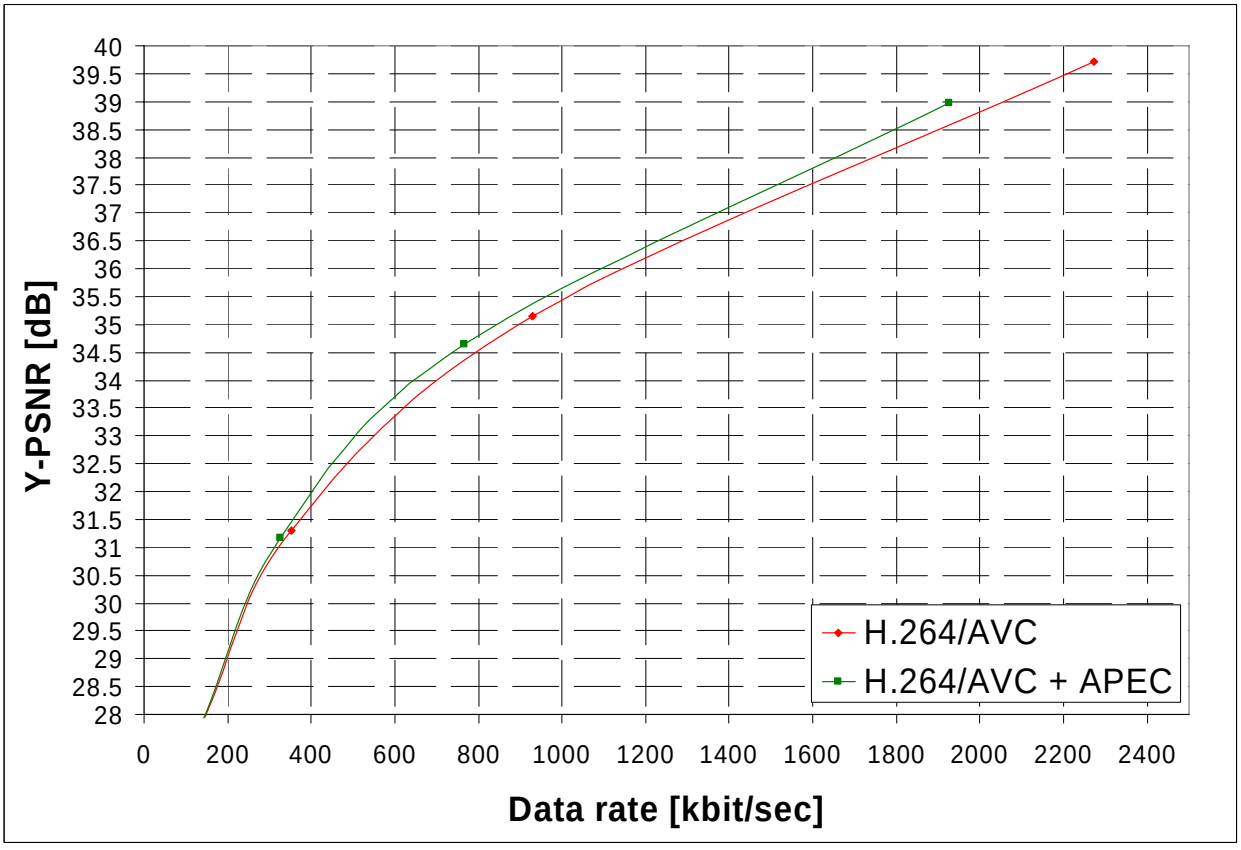

Figure 7: Measured operational rate distortion curves for the test sequence Tempete, CIF, 30Hz, progressive.

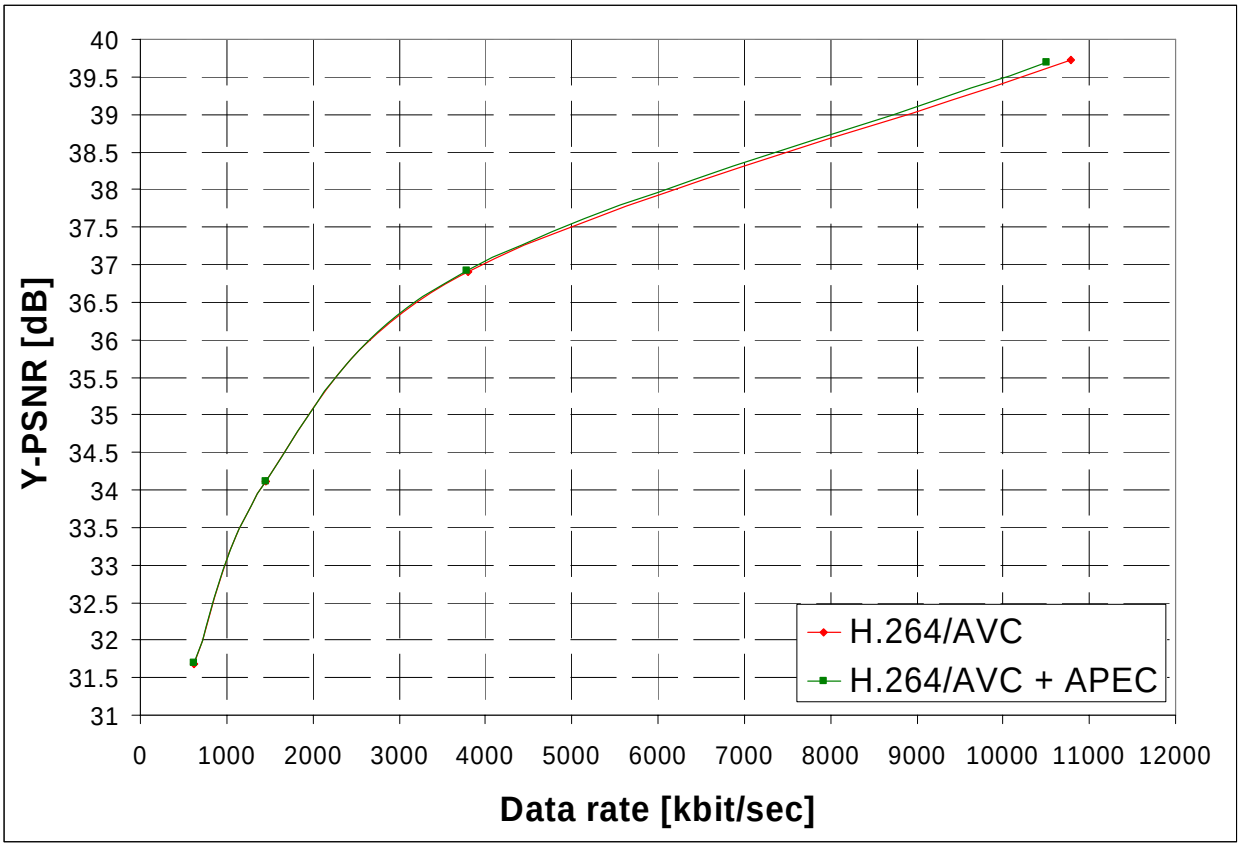

Figure 8: Measured operational rate distortion curves for the test sequence Big Ships, HDTV (720p), 60Hz, progressive.

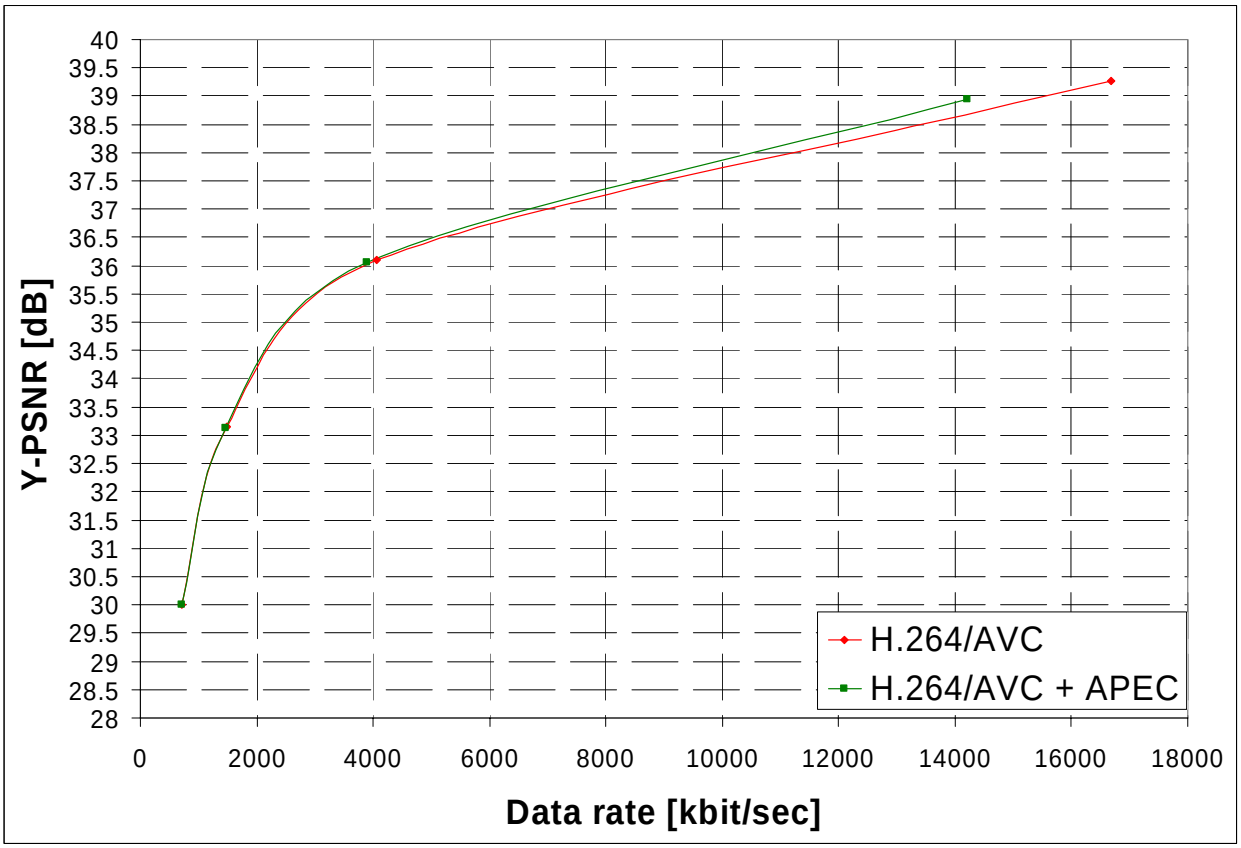

Figure 9: Measured operational rate distortion curves for the test sequence City, HDTV (720p), 60Hz, progressive.

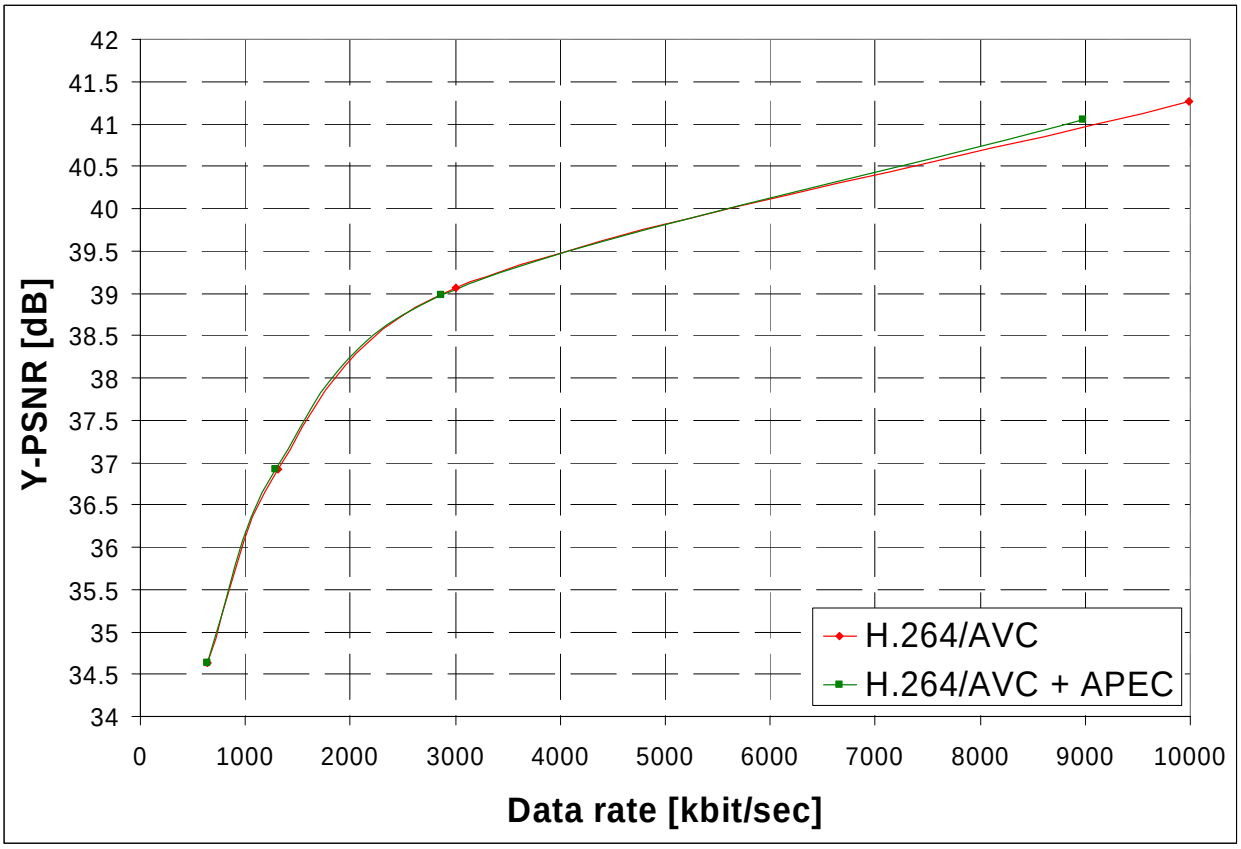

Figure 10: Measured operational rate distortion curves for the test sequence Crew, HDTV (720p), 60Hz, progressive.

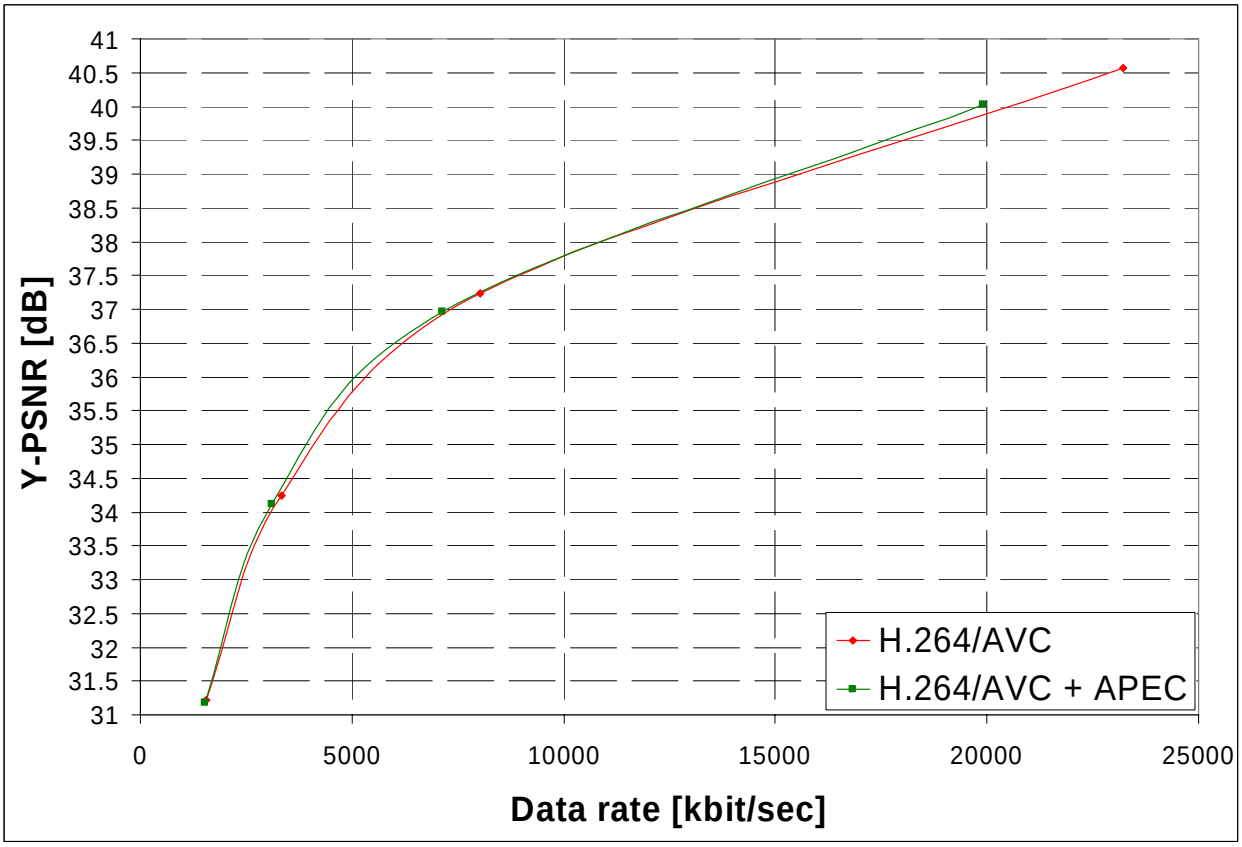

Figure 11: Measured operational rate distortion curves for the test sequence Night, HDTV (720p), 60Hz, progressive.

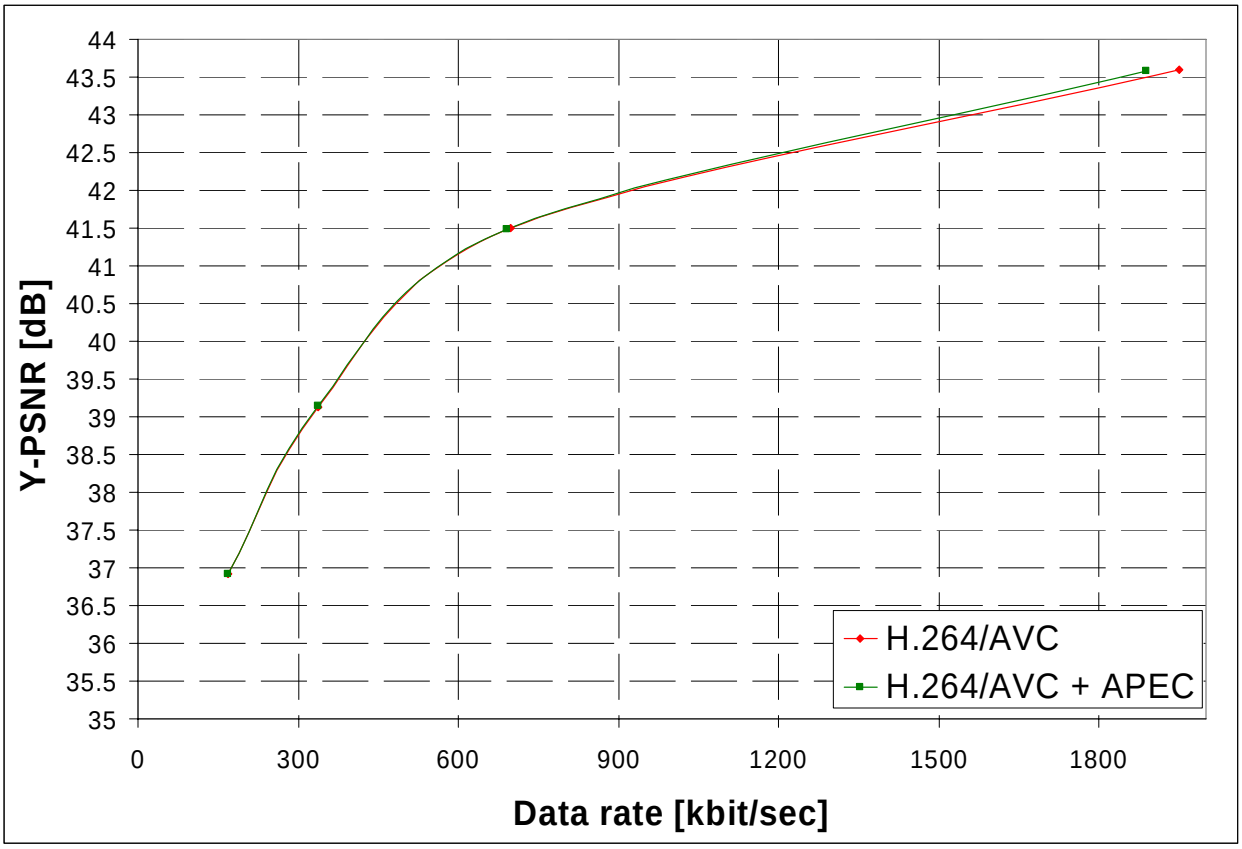

Figure 12: Measured operational rate distortion curves for the test sequence Shuttle Start, HDTV (720p), 60Hz, progressive.

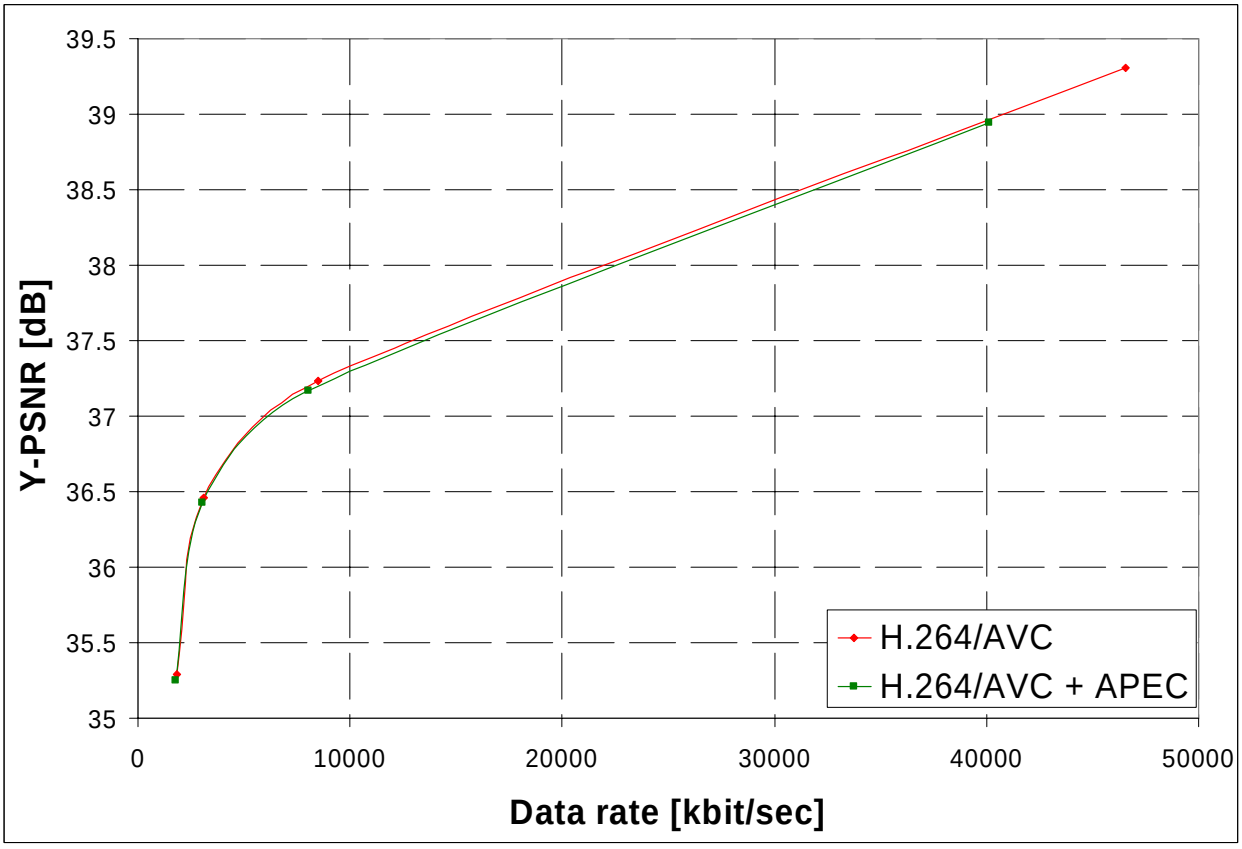

Figure 13: Measured operational rate distortion curves for the test sequence Rolling Tomatoes, HDTV (1080p), 60Hz, progressive.

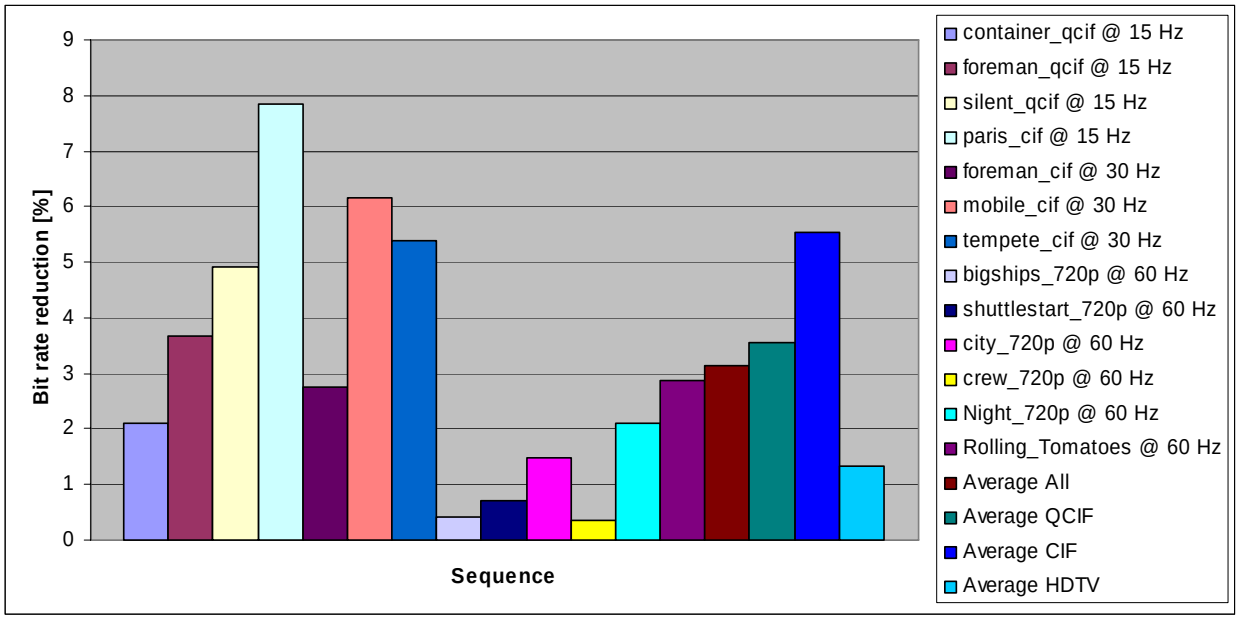

Figure 14: Measured bit rate reduction by using the adaptive prediction error coding compared to H.264/AVC for the test sequences recommended to use in [3].

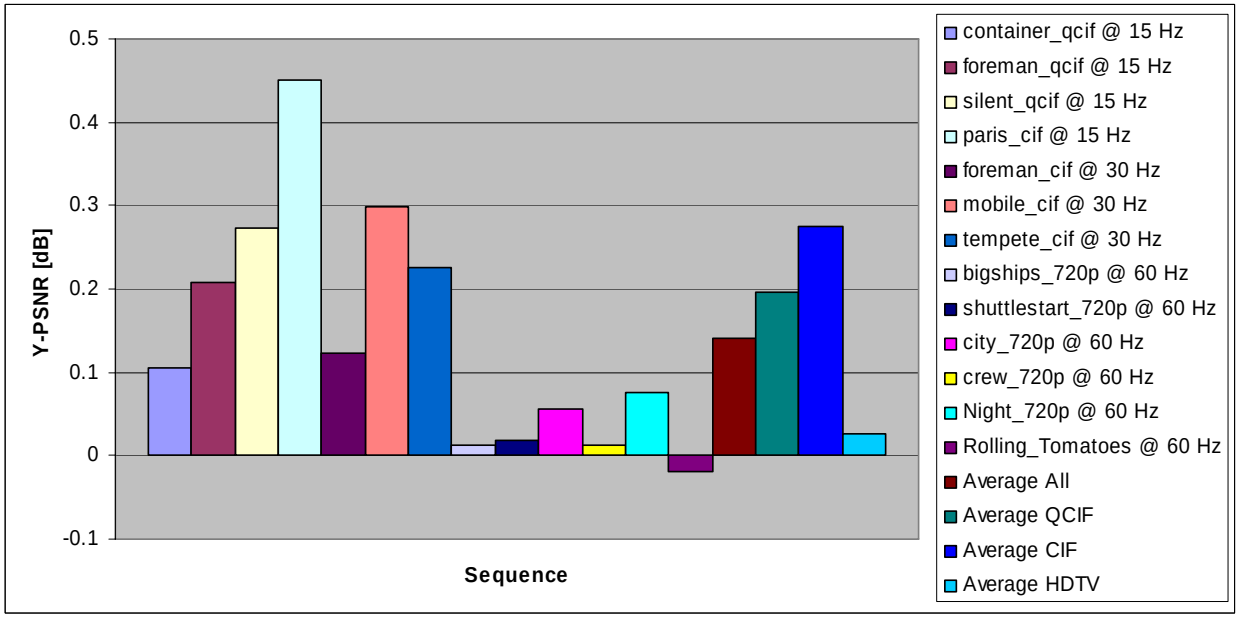

Figure 15: Measured increase of the Y-PSNR by using adaptive prediction error coding compared to H.264/AVC for the test sequences recommended to use in [3].

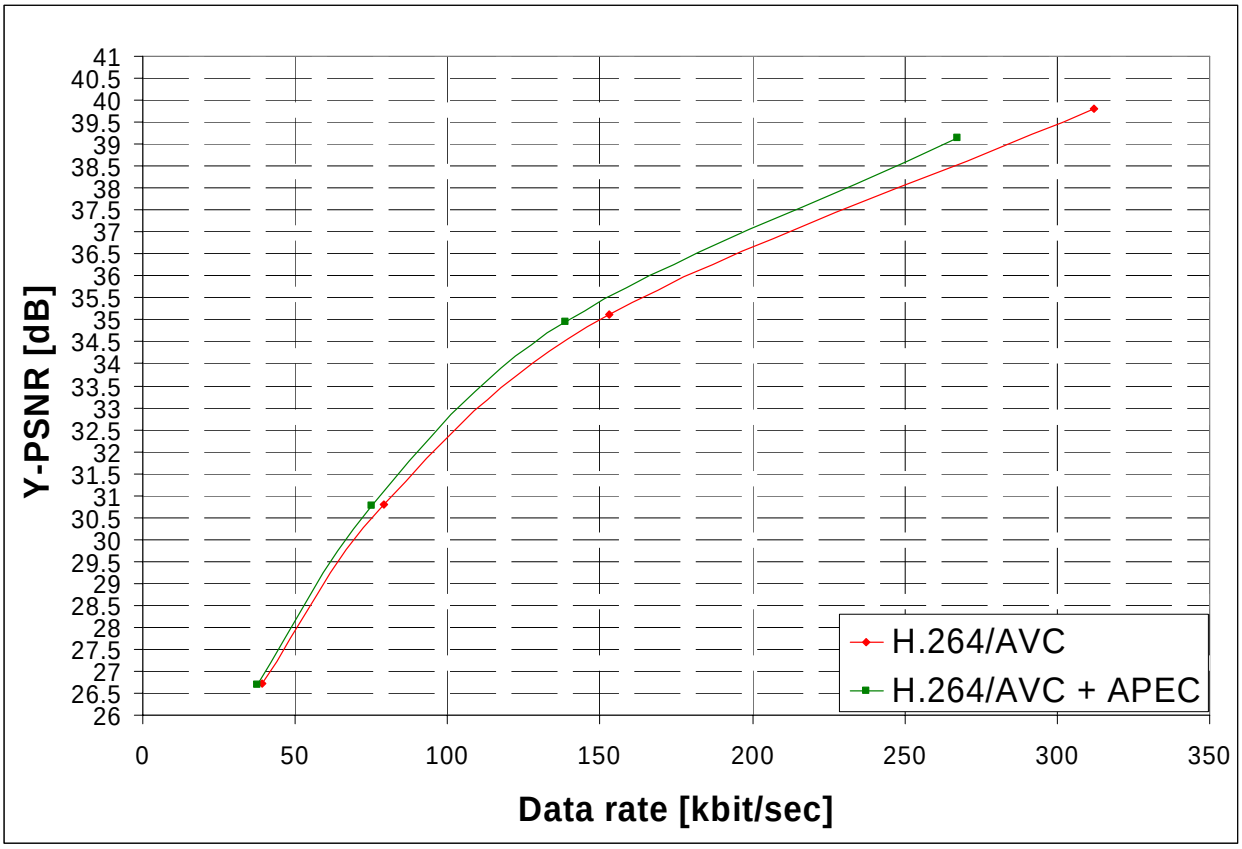

Figure 16: Measured operational rate distortion curves for the test sequence Flowergarden, QCIF, 15Hz, progressive.

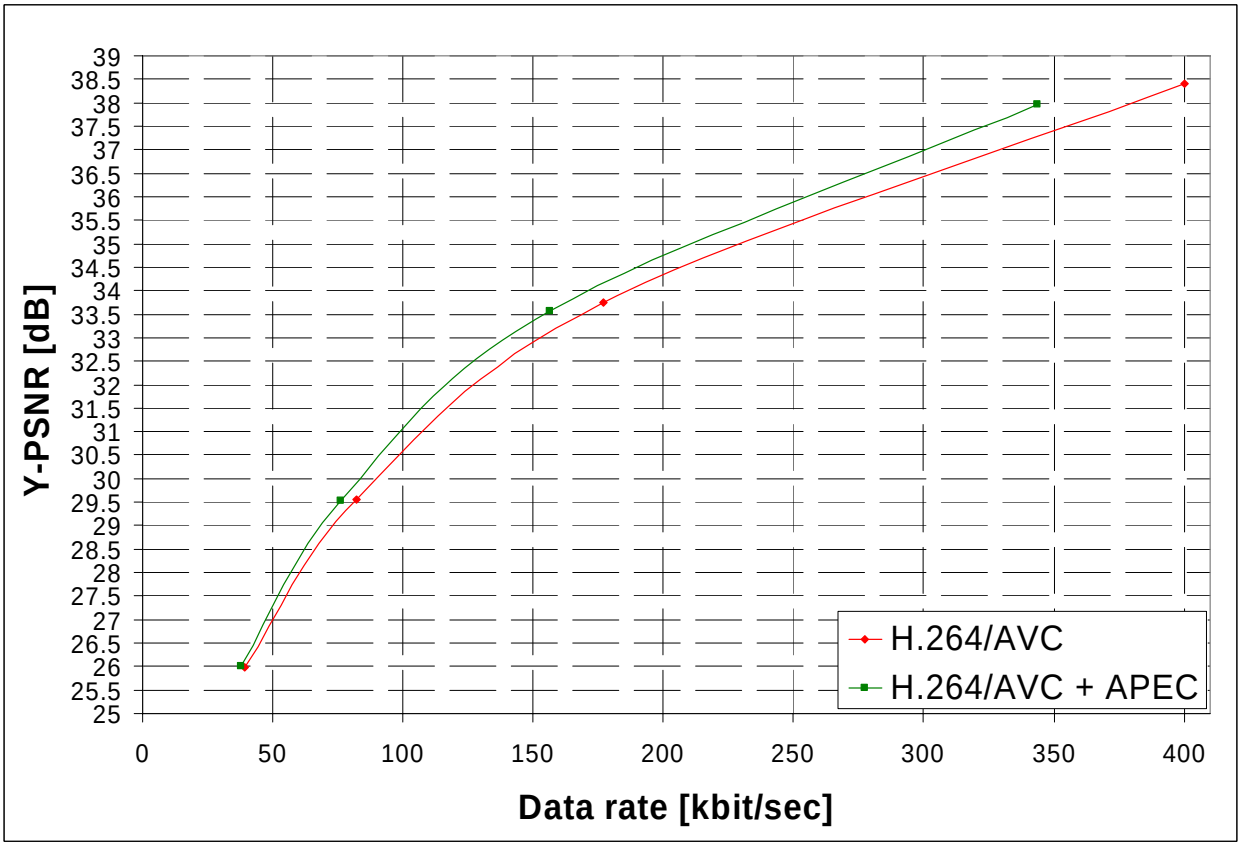

Figure 17: Measured operational rate distortion curves for the test sequence Mobile & Calendar, QCIF, 15Hz, progressive.

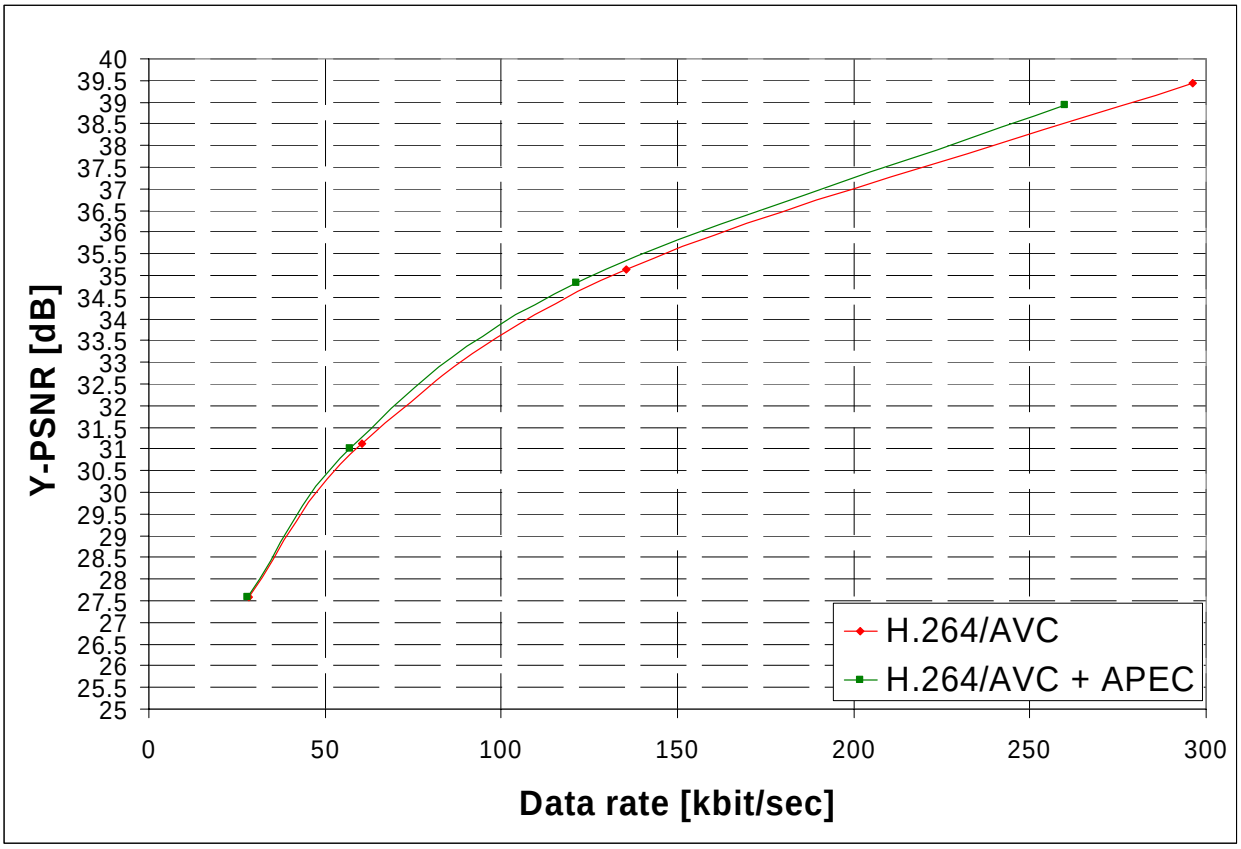

Figure 18: Measured operational rate distortion curves for the test sequence Tempete, QCIF, 15Hz, progressive.

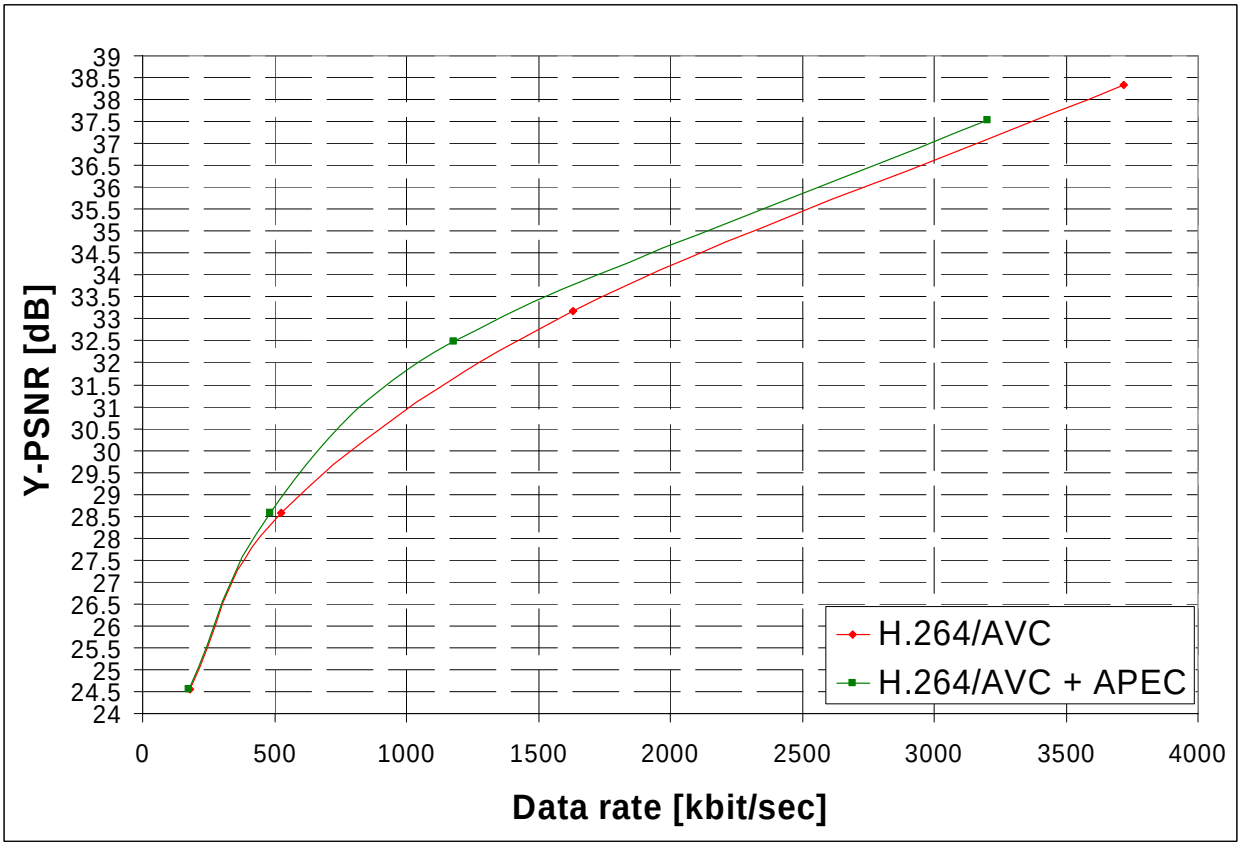

Figure 19: Measured operational rate distortion curves for the test sequence Concrete, CIF, 30Hz, progressive.

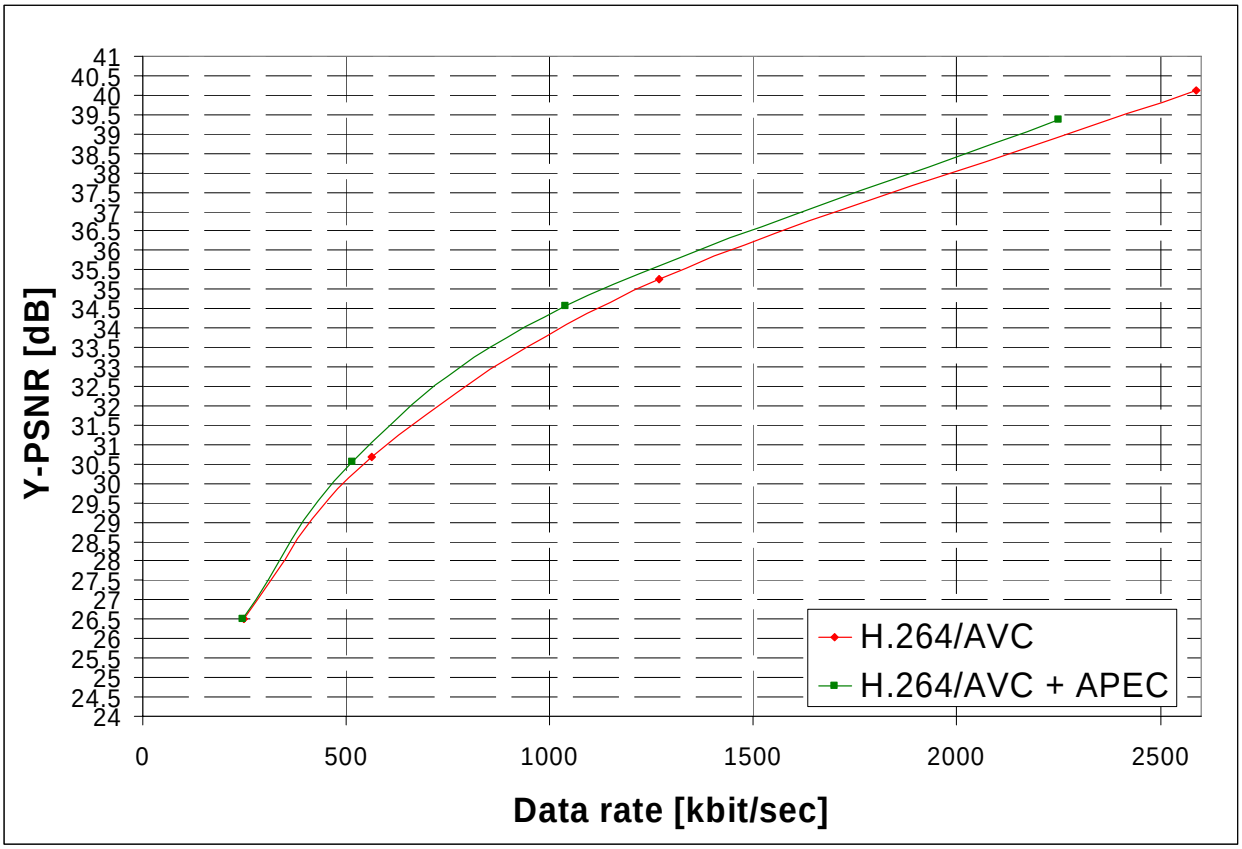

Figure 20: Measured operational rate distortion curves for the test sequence Flowergarden, CIF, 30Hz, progressive.

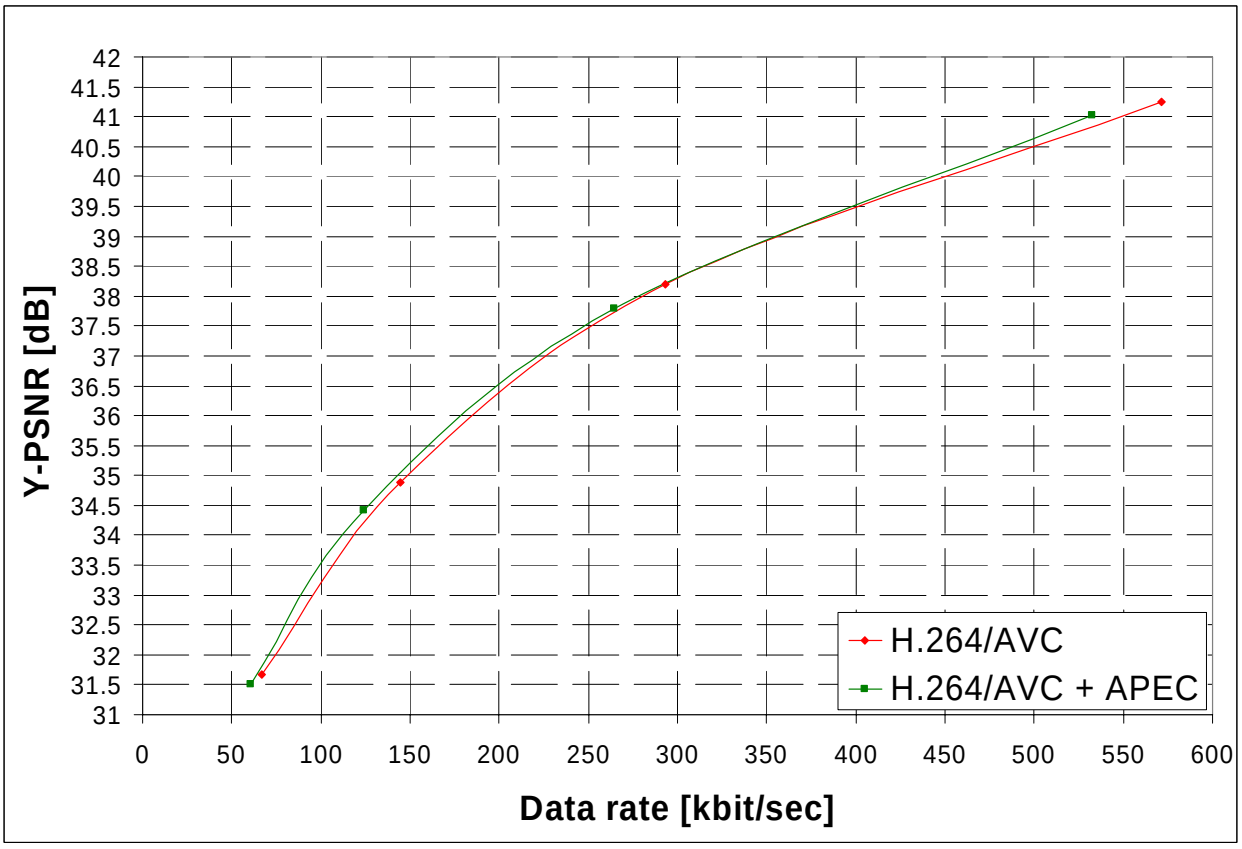

Figure 21: Measured operational rate distortion curves for the test sequence Carphone, CIF, 15Hz, progressive.

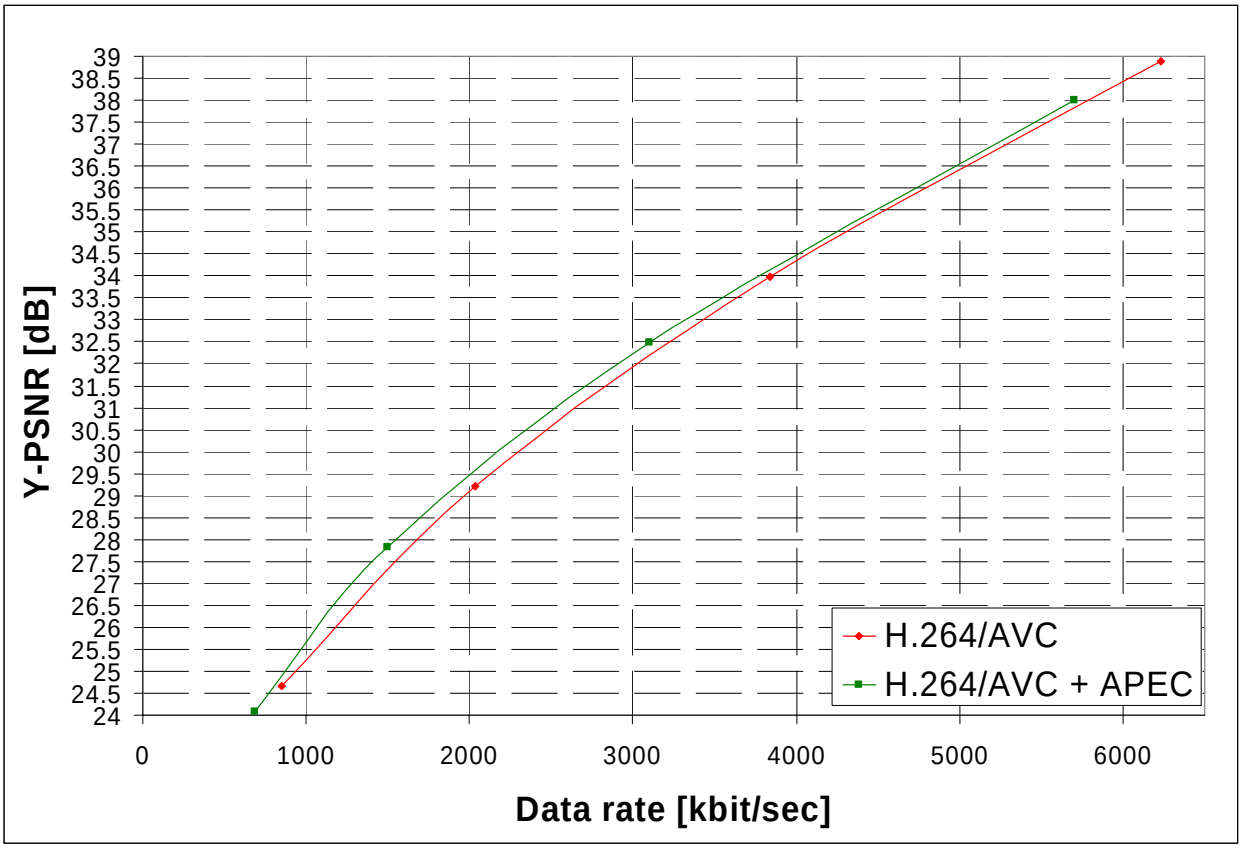

Figure 22: Measured operational rate distortion curves for the test sequence Husky, CIF, 30Hz, progressive.

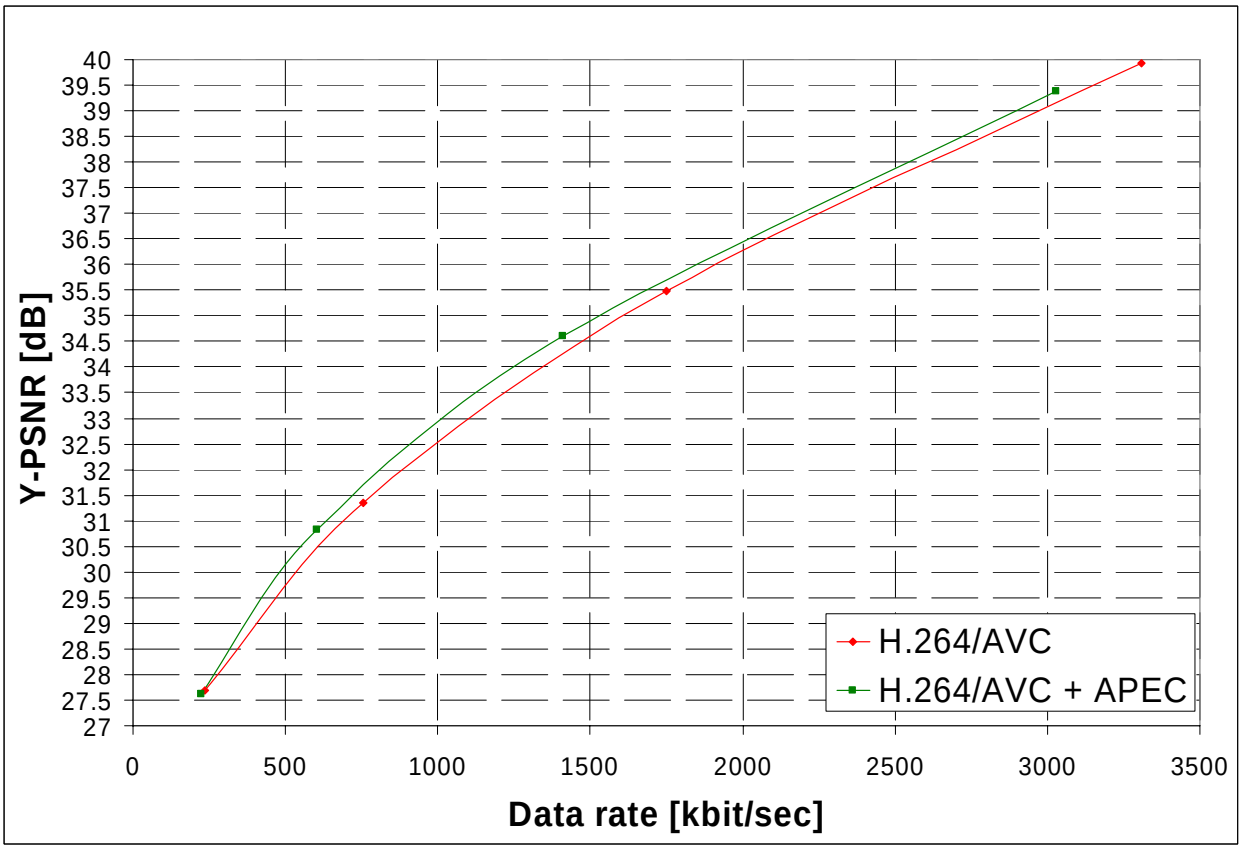

Figure 23: Measured operational rate distortion curves for the test sequence Formula 1, CIF, 30Hz, progressive.

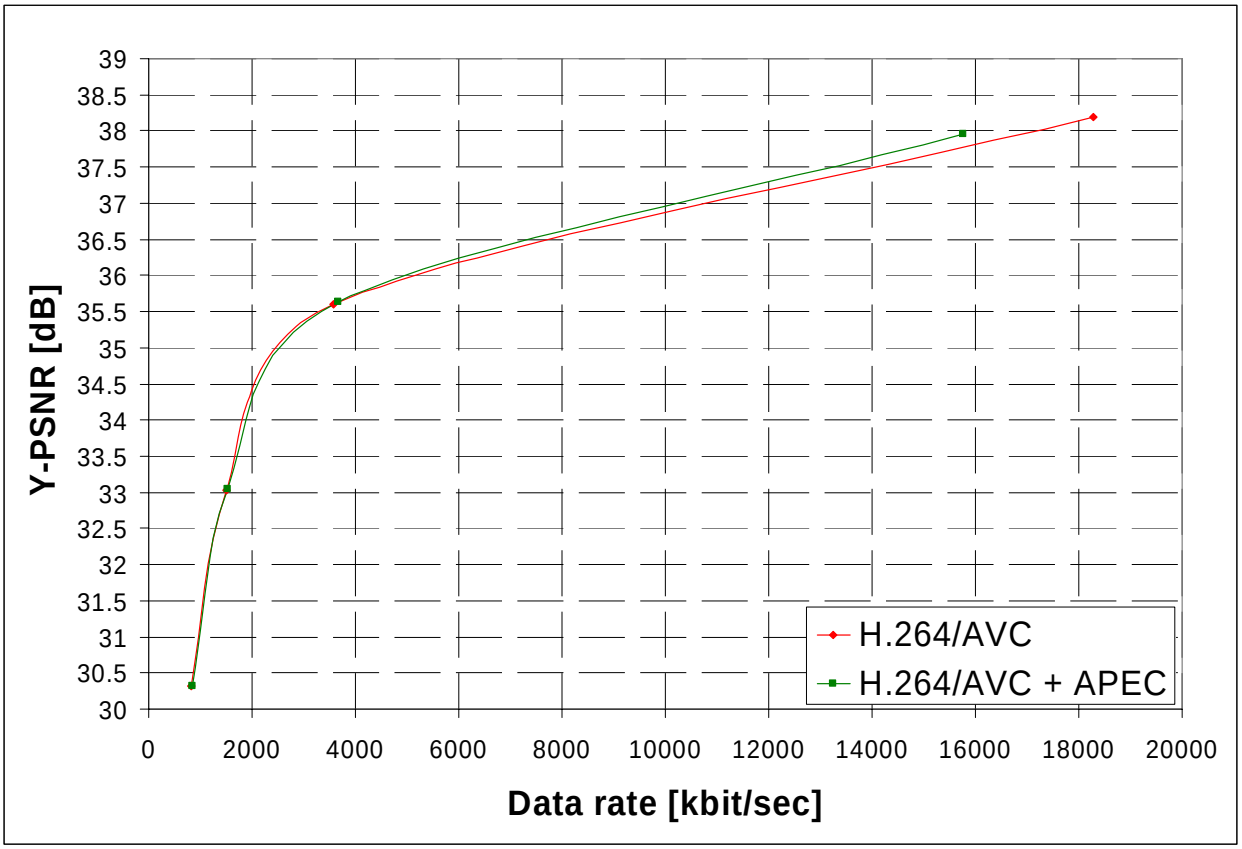

Figure 24: Measured operational rate distortion curves for the test sequence Spincalendar, HDTV (720p), 60Hz, progressive.

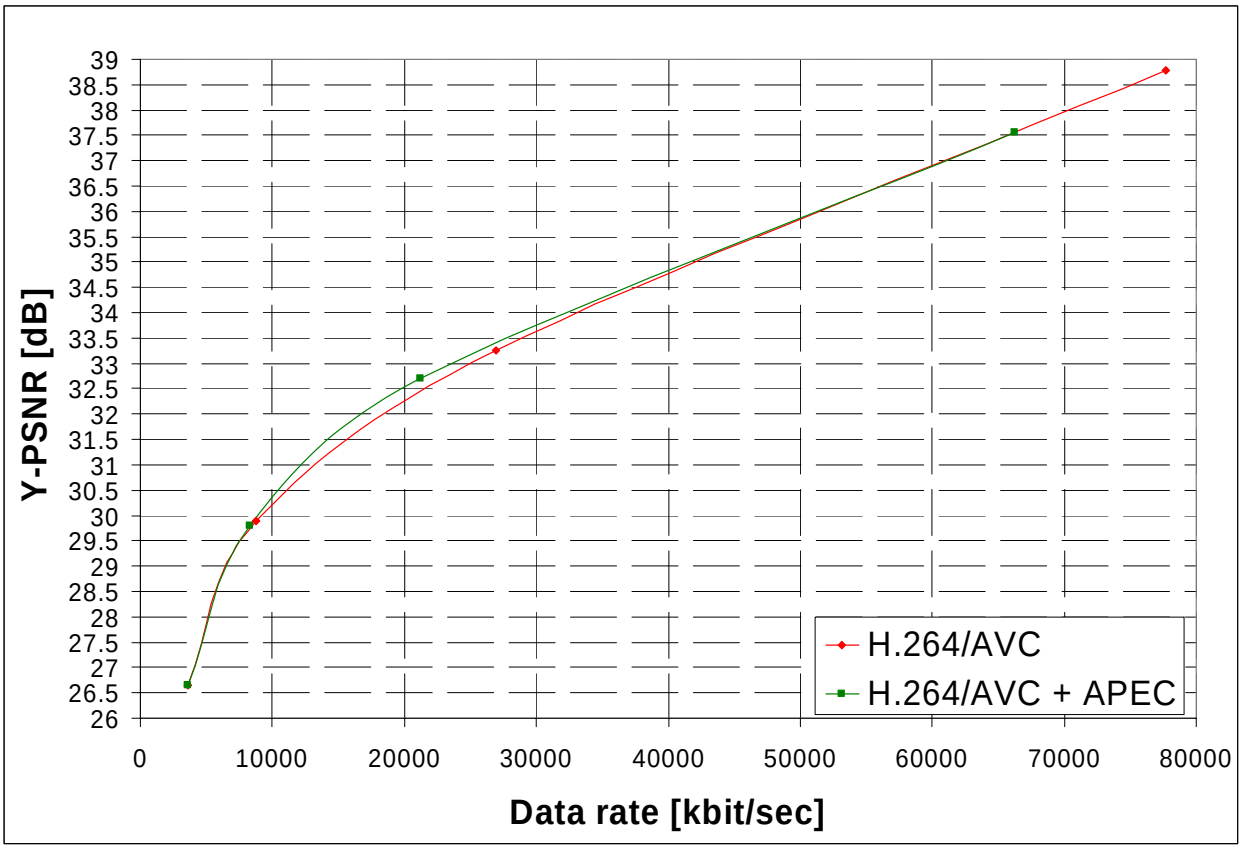

Figure 25: Measured operational rate distortion curves for the test sequence Preakness, HDTV (720p), 60Hz, progressive.

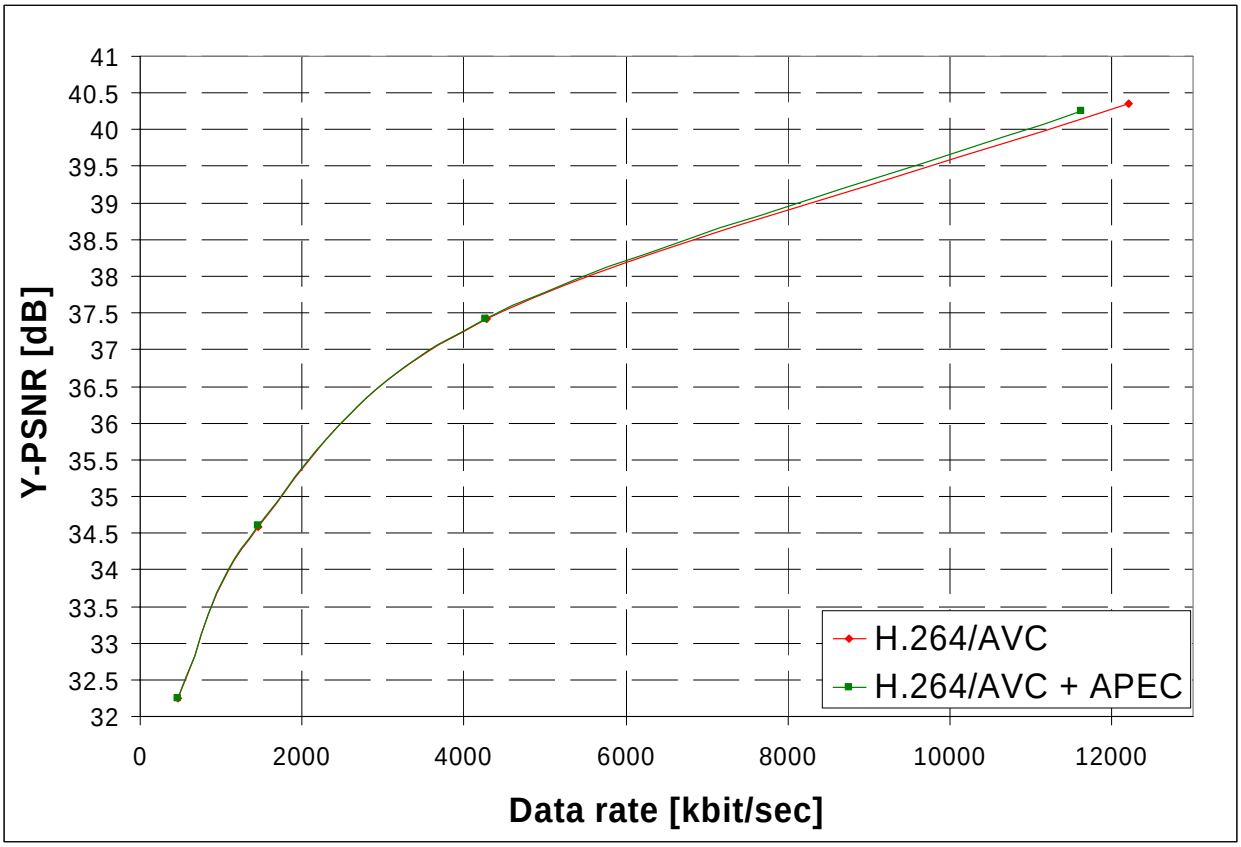

Figure 26: Measured operational rate distortion curves for the test sequence Optis, HDTV (720p), 60Hz, progressive.

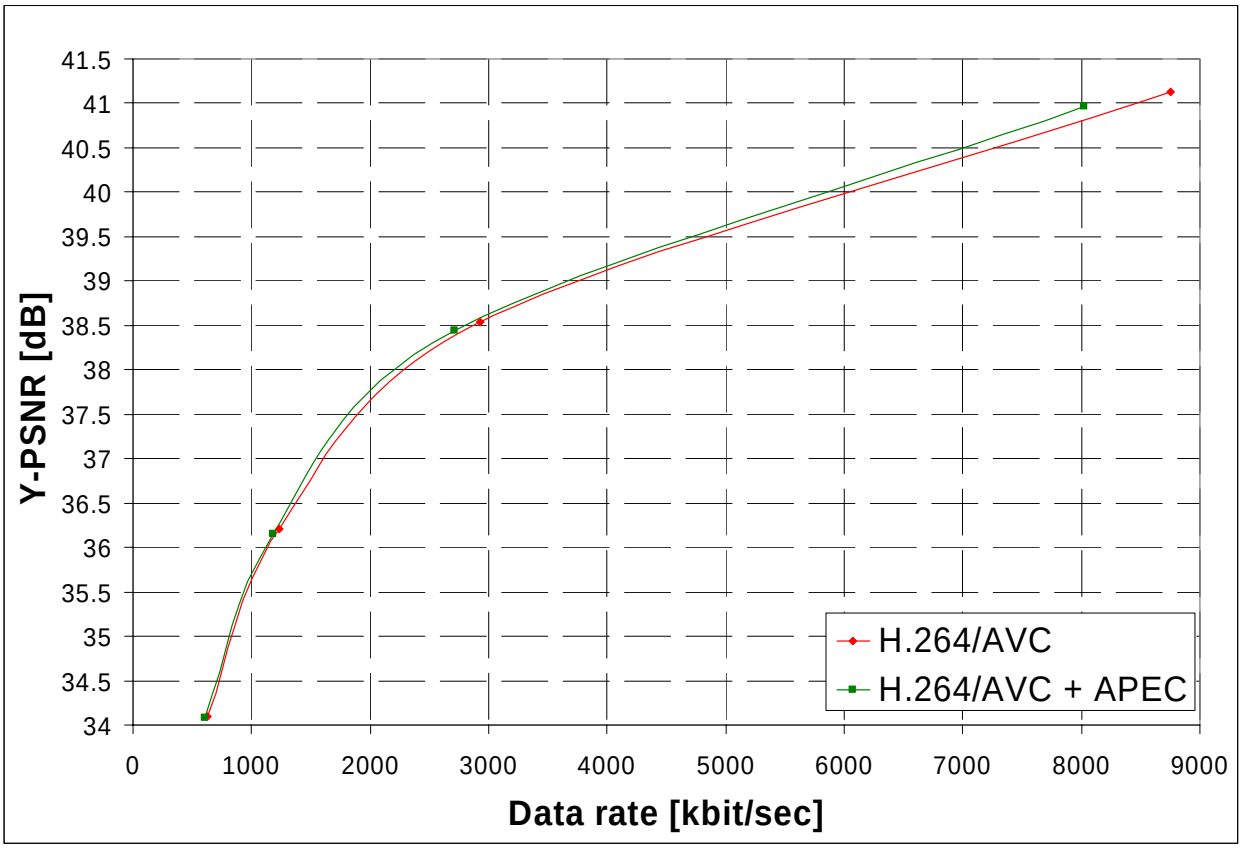

Figure 27: Measured operational rate distortion curves for the test sequence Cyclists, HDTV (720p), 60Hz, progressive.

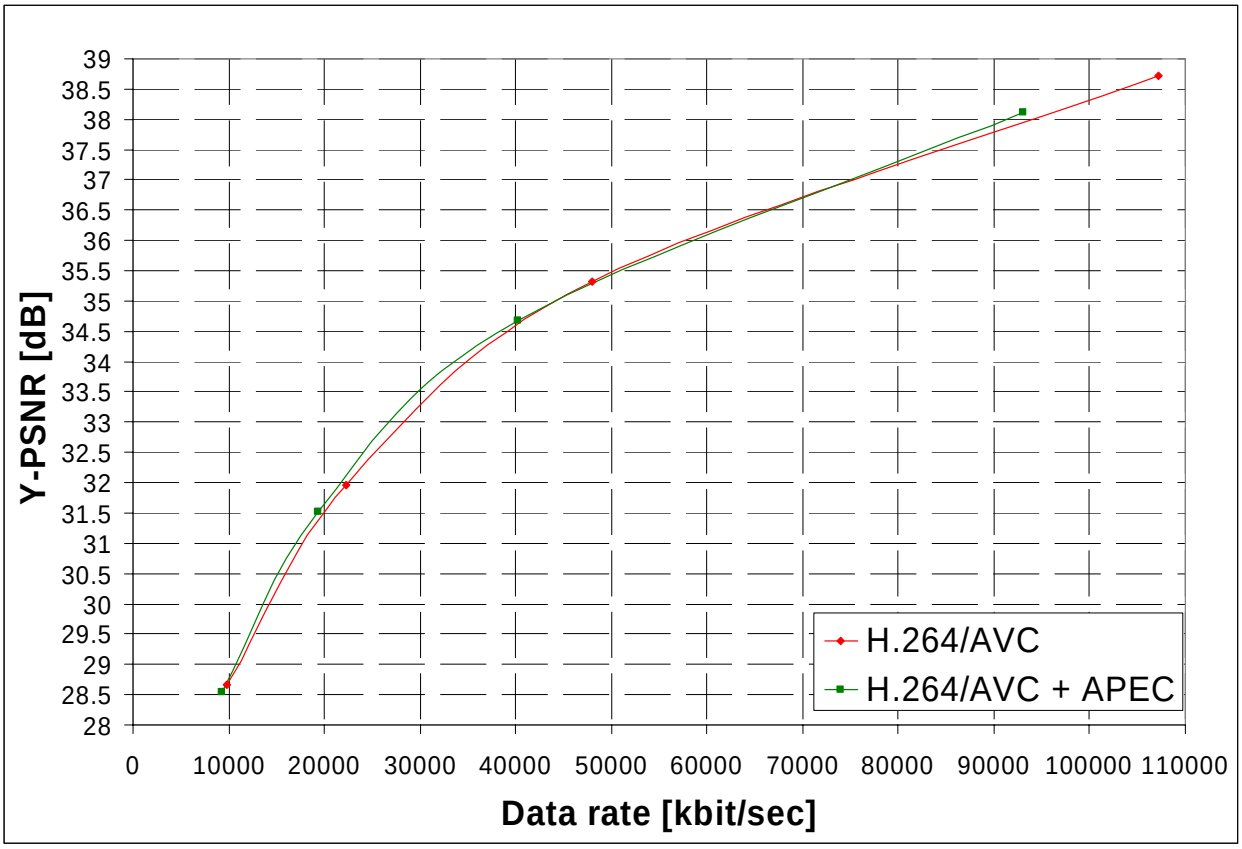

Figure 28: Measured operational rate distortion curves for the test sequence Crowdrun, HDTV (720p), 60Hz, progressive.

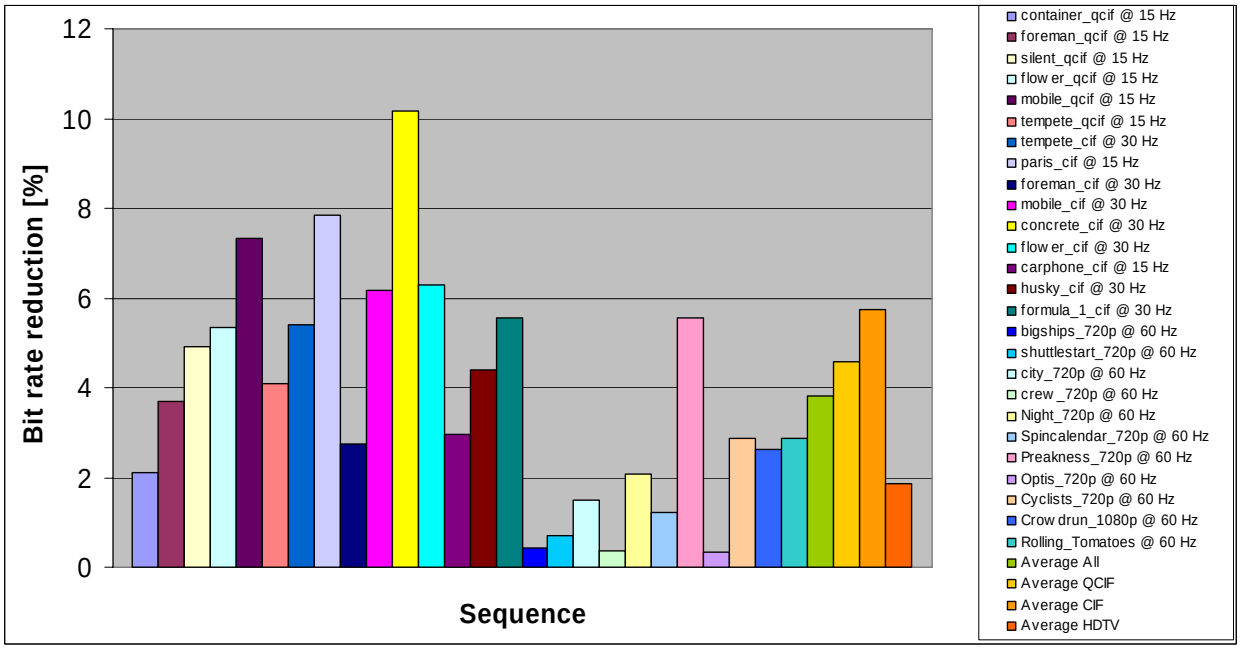

Figure 29: Measured bit rate reduction by using the adaptive prediction error coding compared to H.264/AVC for the test sequences recommended to use in [3] and for further test sequences.

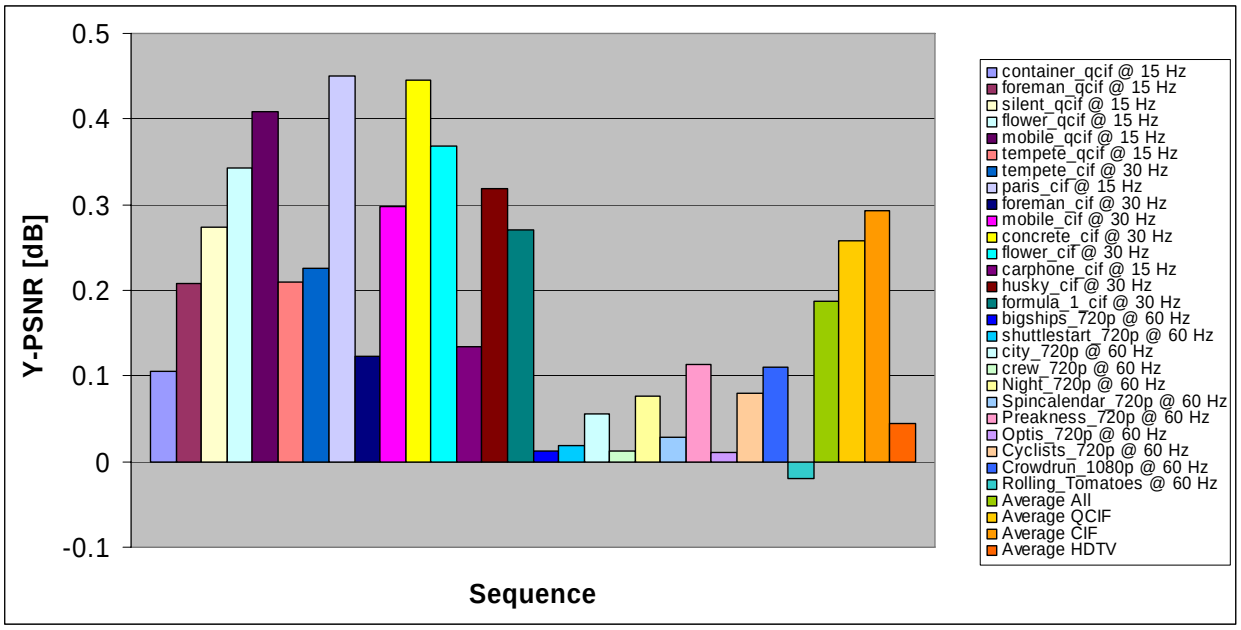

Figure 30: Measured increase of the Y-PSNR by using adaptive prediction error coding compared to H.264/AVC for the test sequences recommended to use in [3] and for further test sequences.

4 References

[1] KTA reference model, downloadable at http://www.tnt.uni-hannover.de/~vatis/kta/jm11.0kta1.2.zip.

[2] M. Narroschke, H.G. Musmann, “Adaptive prediction error coding in spatial and frequency domain with a fixed scan in the spatial domain”, ITU-T Q.6/SG16, doc. VCEG-AD07, Hangzhou, China, October 2006.

[3] TK. Tan, G. Sullivan, T. Wedi, “Recommended Simulation Common Conditions for Coding Efficiency Experiments”, ITU-T Q.6/SG16, doc. VCEG-AA10, Nice, France, October 2005.

[4] G. Sullivan, “Meeting report for 30th VCEG Meeting (Hangzhou, CN, 23 October, 2006)”, ITU-T Q.6/SG16, doc. VCEG-AD01, Hangzhou, China, October 2006.

[5] G. Bjontegard, “Calculation of Average PSNR Differences between RD curves”, ITU-T Q.6/SG16, doc. VCEG-M33, Austin, Texas, USA, April 2001.