NAB TV TechCheck

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# ATSC Mobile DTV Video Quality

One of the newest and most exciting DTV technologies is ATSC Mobile DTV. A session at the upcoming NAB Broadcast Engineering Conference (BEC, April 10-15, 2010, Las Vegas, Nev. – see below for additional information) entitled "*Mobile Television: Part II*" includes a paper, excerpted here, which discusses the results of subjective evaluations of ATSC Mobile DTV video quality as a function of bit rate.

**INTRODUCTION** – this paper presents the results of a subjective assessment experiment that was conducted to examine the relation between bit rate and perceived picture quality in the new ATSC mobile digital TV standard. Using this new standard, broadcasting services will be delivered using a portion of the 19.39 Mbps ATSC 8-VSB payload, leaving the rest available for normal HD/SD television (and data) services. Since the bandwidth dedicated to mobile service will be rather limited, every single bit allocated to mobile will reduce the number of bits allocated to regular services by several bits depending on the level of error protection chosen. Therefore, it is important to determine the video quality performance of the mobile system at different bit rates.

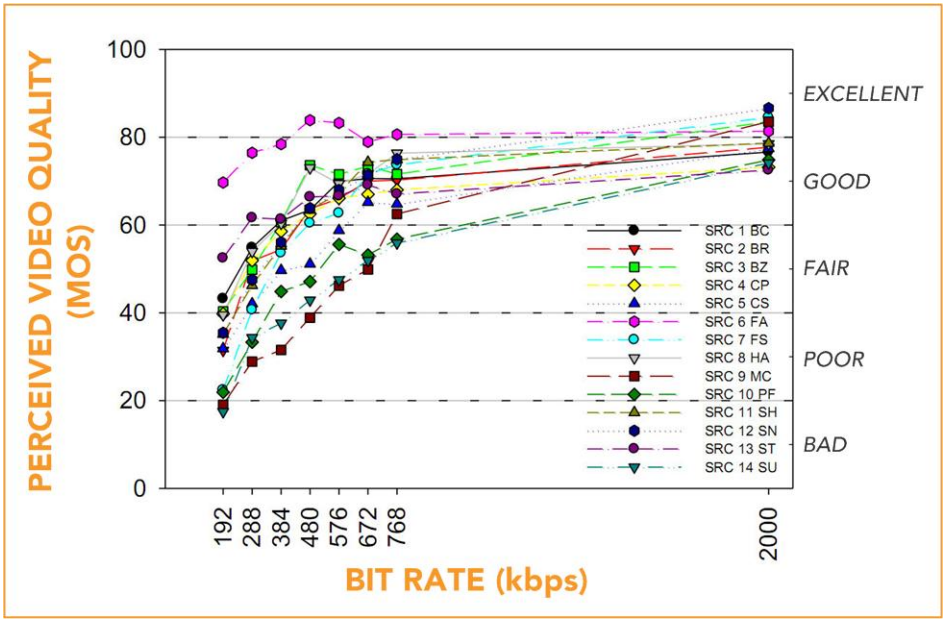
**ASSESSMENT OVERVIEW** – a group of non-expert viewers used a single stimulus methodology to rate the perceived quality and the degree of commercial acceptability of several short video sequences. Thirty-two viewers, with a mean age of 28.6 years, participated in this experiment. All viewers were screened for normal visual acuity and color vision. They had no knowledge of the purpose of the experiment. Video quality was rated using a standard continuous scale. The sequences were displayed on a mobile device. The video material was processed at eight different bit rates using a current generation video encoder that supported the ATSC Mobile DTV Standard (H.264 baseline profile; 416x240; 29.97 Hz).

**VIDEO MATERIAL** – the video material consisted of 14 video sequences that had been selected to cover a wide range of picture content. The duration of each sequence was eight seconds. Each of the 14 original video sequences was processed at eight different bit rates – 192, 288, 384, 480, 576, 672, 768 kbps and 2 Mbps. The 2 Mbps bit rate is not formally part of the ATSC Mobile DTV Standard; nonetheless, it was included in the study to provide a high quality anchor. Viewing distance was not controlled; viewers were allowed to hold the devices at any viewing distance they deemed appropriate. Furthermore, the viewers were advised to hold the devices as to maximize comfort and visibility, for example, to avoid any possible reflections from ambient lights. Ambient light varied between 12 and 15 lux, depending on seating position.

**DESIGN AND ASSESSMENT PROCEDURE** – the combination of 14 source sequences and eight bit rate conditions resulted in 112 test sequences to be evaluated. The viewers were asked to rate the perceived video quality and the commercial acceptability of each test sequence. Perceived video quality and commercial acceptability were measured with a single-stimulus presentation method. The method consists of a series of trials; in each trial only one test sequence is presented and rated independently. Perceived quality was rated using a standard continuous quality scale. The scale consists of a continuous vertical line with five equal segments. The descriptions: "Bad", "Poor", "Fair", "Good", and "Excellent" are aligned with the five segments.

**RESULTS** – the figure shows the relationship between bit rate and perceived video quality for each of the 14 video sequences. It can be noted that, as often observed, the effect of compression on perceived video quality is highly dependent on the content of the sequence (*i.e.*, its spatiotemporal characteristics). At low bit rates, there is a large difference between the perceived video qualities of the different sequences; however, this difference decreases with increasing bit rate.

**SUMMARY** – the results suggest that bit rates around 300-400 kbps might be adequate for a mobile service, if high video quality is not deemed necessary and/or the broadcasted content does not have complex spatiotemporal characteristics. Higher bit rates might be necessary if the broadcasted material must have a high level of video quality and/or it consists of complex content.




This paper, entitled "Perceived Video Quality and Bit Rate in the ATSC Mobile DTV Standard," will be presented by Filippo Speranza, Research Scientist, Communications Research Centre Canada, on Sunday, April 11, 2009 starting at 5:00 p.m. in room S219 of the Las Vegas Convention Center. It will also be included in its entirety in the *2010 NAB Broadcast Engineering Conference Proceedings*, on sale at the 2010 NAB Show Store and available on-line from the NAB Store (www.nabstore.com) after the convention. Other papers being presented during this session include the following:

- *ATSC A/153 Overview*, Brett Jenkins, VP of Technology, ION Media Networks
- *Enhancing DTV Coverage: Implementing Vertical Polarization for Existing Broadcast Antenna Systems*, Kerry Cozad, Sr. VP, Broadcast Engineering, Dielectric Communications
- *Mobile DTV Service Guide and Data Services*, Peter Mataga, CTO, Roundbox
- *Practical Applications to the Installation of ATSC-M/H*, Don Tenhundfeld, Harris Corporation
- *Audio Processing Requirements for Portable/Mobile Video Applications*, Ed Simeone, VP sales North America, Linear Acoustic

For additional conference information visit the NAB Show Web page at www.nabshow.com.

## 2010 NAB Broadcast Engineering Conference Summary of Presentations

Check out the papers that will be presented at the 2010 NAB Broadcast Engineering Conference in Las Vegas, April 10 –15, 2010.

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