

## **Adjustment of video sequences to be used in conjunction with ITU-R BT.500**

### **Summary**

Recommendation ITU-R BT.500, “Methodology for the Subjective Assessment of the Quality of Television Pictures” provides for careful setup of the picture monitor as part of the requirements for general viewing conditions. It does not provide any specifications for the input video signals to the monitor when displaying either the source (reference) sequence or the processed sequence being evaluated. Good television operating practice dictates that video signals are adjusted for correct level and other system parameters appropriate for the intended application. This contribution explains why such adjustments should be included in ITU-R BT.500 and suggests specific changes for the recommendation.

### **Introduction**

In Section 2.1 of Recommendation ITU-R BT.500 (Rec. 500), “General viewing conditions”; there are specifications for such parameters as:

- Ratio of luminance of inactive screen to peak luminance,
- Ratio of the luminance of the screen, when displaying only black level in a completely dark room, to that corresponding to peak white,
- Display brightness and contrast: set up via PLUGE,
- Ratio of luminance of background behind picture monitor to peak luminance of picture.

Since the viewing monitor for subjective assessment will display the source (reference) and processed sequences it should be required that both video signals be adjusted to compliment the viewing conditions. Such a requirement is not extant in the present version of the recommendation. It is the purpose of this contribution to explain why such adjustment is appropriate, expand the concept for component systems and propose changes to the recommendation.

In compressed video systems, there may be errors in the processed sequences that are a time varying function of picture content. That is, they are not system adjustment errors but are picture quality degradations. Such degradations must be included in the picture quality assessment.

Systematic adjustment errors that can be compensated by typical operational controls must be removed to insure meaningful picture quality assessment. These errors do result in degraded pictures hence the removal of such errors before subjective assessment must be reported as a system problem as part of the overall evaluation report.

### **Adjustment of processed pictures**

It should be safe to assume signal parameters will be adjusted using a suitable test signal such as color bars in order to meet the viewing condition requirements. Color bars are likely to be associated with the source sequence. Therefore, the source sequence will be displayed in an optimum manner for the purpose at hand.

It is possible, perhaps even likely, that the system under test has controls for adjusting gain and black level. It is also possible that those controls will be improperly adjusted during the processing of the sequence or that the system under test will produce gain and/or black level changes. If the processing were live, one would expect those parameters to be readjusted to their correct values prior to making the subjective assessment. In fact, if there were color bars at the start of the processed sequence it would be nearly impossible to keep a skilled television technician from making such adjustments. Alternately, if the processed sequence is recorded, there is still an opportunity to make such adjustments for playback and subjective assessment.

The question is, will the system be fairly evaluated if such adjustments are, or are not, made? Because adjusting gain and black level is always considered good practice in an operational environment and the mechanism for such adjustments is virtually always available, it would be unfair to evaluate a system with incorrect gain and black level. Consider two similar systems with different picture quality. An engineer is going to decide which one to purchase. The one with the better picture quality has modest gain and black level errors. These errors are of such a nature that the subjective assessment results will reverse the true ranking of picture quality. Clearly it would be better to properly adjust the gain and black level of all processed sequences, since this is a normal operational practice, in order to make the best purchase decision.

Therefore, the specifications in section 2.1 of Rec. 500 should be changed to apply to both the reference and processed sequences. Certainly, adjustments to the processed sequences will only be to the extent practical in an operational environment considering the distortions (perhaps non-linearity) that may be present.

### **Adjustments for Component Systems**

Rec. 500 does specify the chromaticity of background as  $D_{65}$ . It would seem more appropriate for this to be the chromaticity of the peak white if the interpretation is to set the relative RGB gain and level of the monitor correctly. Certainly, such color balance of the monitor is required.

In component systems, there exists the possibility to misadjust chrominance just as there is for luminance. Therefore, by the argument given above for luminance and black level, the gain and DC level of chrominance signals should also be adjusted for the source and processed sequences. This will remove systematic operational errors that would unfairly interfere with proper subjective evaluation.

The same argument may be made for constant timing errors between the three component channels. Although operational controls to remove such errors are not generally available, these errors represent a serious design or adjustment problem that should be resolved prior to any consideration of picture quality.

### **Proposed Change to Rec. 500**

Add the following text to section 2.1 as the fourth paragraph.

“Reference video and video processed by the system under test shall be adjusted to produce equivalent viewing displays based on settings of system-appropriate operational controls. When displaying test signals, such as color bars, the reference and processed video shall match the expected monitor viewing conditions specified in this section. That is, gain and DC levels of each channel of a component signal or the luminance and chrominance of a composite signal shall be adjusted to meet this requirement. The systematic adjustment errors do result in degraded pictures hence the removal of such errors before subjective assessment must be reported as a system problem as part of the overall evaluation report.”

In section 2.1.1.1 f, change “Chromaticity of background” to “Chromaticity of the peak white picture”.

Add a note referenced to the fourth paragraph in section 2.1, “Note: Constant timing errors between component channels can produce significant picture degradation. Although operational controls to remove such errors are not generally available, these errors represent a serious design or adjustment problem that should be resolved prior to any consideration of picture quality.”

### **Appendix – Draft addition to ITU-T P.910 and P.911**

(included for information only, not intended as a change to BT.500)

The following draft addition was proposed at the ITU-T SG12 WP2 meeting held November 30 to December 3, 1998. It is to be included in: draft Recommendation P.911, “Subjective Audiovisual Quality Assessment Method for Multimedia Applications” and Recommendation P.910, “Subjective Video Quality Assessment Methods for Multimedia Applications”

“Operational parameters, such as signal level, for the test sequences shall match those of the alignment signals used to verify the viewing [and listening] conditions. Any operational adjustments performed so that source or processed sequences meet this requirement should be reported.”