

# EBU Technical Recommendation R103-2000

## Tolerances on "Illegal" colours in television

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### Introduction

The gamut of possible values in the YUV colour space used in television systems is greater than the combinations that can be produced by real combinations of RGB primary signals.

When television signals are manipulated in YUV form, it is possible to produce "illegal" combinations that, when de-matrixed, would produce R, G or B signals outside the range 0% to 100%. Ideally there should be no illegal combinations in a television signal but experience has shown that a certain tolerance can be allowed, based on similar tolerances allowed for RGB signals. <sup>1</sup>

Experience has also shown that so-called colour gamut "legalisers" should be used with caution because they may create artefacts in the picture that are more visible than the colour gamut errors.

### Tolerances on colour gamut

The EBU recommends that the colour gamut in television programme material can be accepted if both the following conditions are met:

- When matrixed to RGB, all of the R, G or B signals should lie inside the range -5% and 105%
- The resultant luminance signal should lie inside the range -1% to 103%

### Horizontal Signal Filtering

In order to remove transient over and under-excursions of the signals <sup>2</sup>, and to minimise the effect of high frequency noise on the colour gamut measurements, the use of appropriate filters in all measurement channels are recommended. These filters should satisfy the following characteristics:

- The 10% to 90% rise time period should lie between 300 ns and 350 ns.
- No over or undershoot should be produced on a non-bandlimited step response input.

These conditions may be met using a 1 MHz (nominal) low-pass filter. A suitable filter is specified in IEEE-205 [1].

### Vertical Signal Filtering

Certain operations may produce relatively benign gamut overshoot errors in the vertical picture domain, and possibly in the temporal domain as well. Examples of the former condition may be found in the operation of Aspect Ratio Conversion. It is therefore recommended that:

- The measuring equipment should indicate that an "Out-of-Gamut" error has occurred only when the error occupies an integrated area of the active screen exceeding 1%.

In addition, signals outside the active picture area should be optionally exempted from measurement.

### Bibliography

[1] IEEE Standard 205 - Measurement of Luminance Signal Levels

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<sup>1</sup> Based on work initiated by the i2a organisation and a joint agreement between the UK broadcasters

<sup>2</sup> If the signals are expected to be processed further, these transients should preferably be removed