I. Proposal

Requirement in 6.2.2.3.4.3.

CMS shall display a sufficient tonal range of at least 8 distinguishable tonal differences of grey tonal steps on the monitor.

Test method in Annex 12

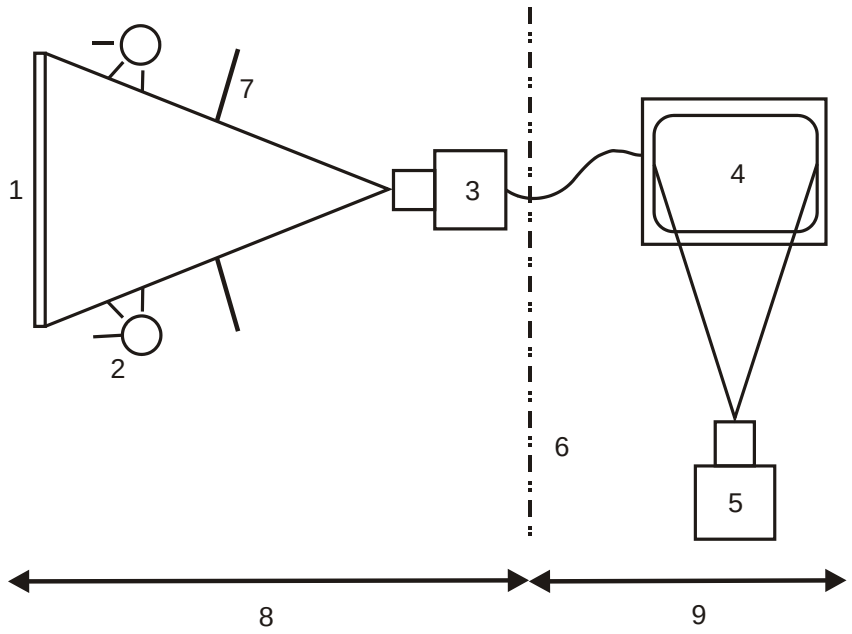
2.5. Grey scale rendering test method

The grey scale rendering test shall verify that CMS have a capability to display at least 8 tonal grey steps distinguishable within the darkest and brightest output range from the reproduced chart on the CMS monitor. The grey scale rendering test is evaluated using a 20:1 low contrast grey scale chart as described in ISO 14524:2009, Table A.1, under 500 lx illuminated scene environment.

The distinguishable tonal difference described herein is defined as an display output signal whose luminance difference between two different tonal input through the CMS satisfy at least delta L*>3.0, with L* defined as luminance according the definition in CIE 1976 L*a*b* color space.

Figure 4 shows the test arrangement for the grey scale rendering test.

Figure 4: Test arrangement for the grey scale rendering test



1: **Test chart (grey scale rendering chart)**
2: **Illumination for test chart**
3: **Camera under test**
4: **Monitor under test**
5: **Reference camera**
6: **Optical or spatial isolation between camera and monitor lightning environment**
7: **Optical isolation barrier to avoid direct light into lens**
8: **Camera-side**
9: **Monitor-side**

Figure 5 shows an example of a grey scale rendering chart to be used in this measurement. The grey scale rendering chart shall consists of 12 different tonal density grey patches.

The density value D_i may follow the values as defined by ISO 14524:2009 Table A.1 for low contrast 20:1, but it is not restricted to this definition as long as the adopted chart could display a sufficient tonal range of at least 8 distinguishable grey steps on the monitor. The definition of Di is given in the ISO 14524:2009.

The background of the patches should be covered with a neutral grey colour having a density value D_i of 0.54 ±0,05.

Both reflective and transmissive charts with a Lambertian characteristic can be used.

The whole camera image area shall be covered by the chart image. The grey scale rendering chart shall be placed in such a way so that the grey patches are visible in the centre of the monitor defined size.

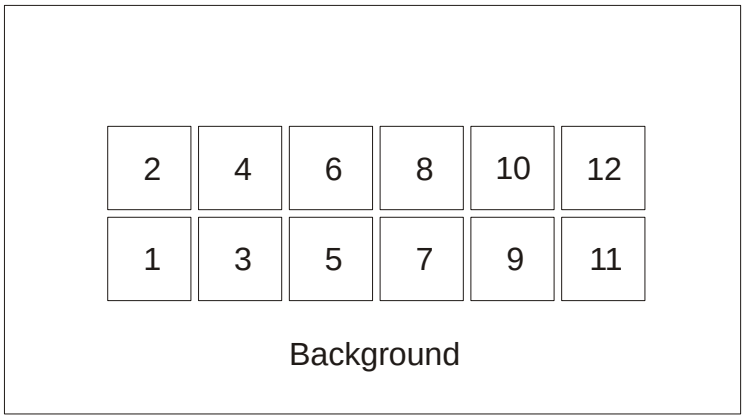
Adjust the distance between the camera under test and the test chart to have individual patches of the chart displayed by at least 50x50 pixels on the monitor under test, whenever possible. For class IV devices exhibiting high distortion and/or optical vignetting, a reduced size area may also be used to minimize the vignetting effect affecting the measurement results.

The illumination shall be similar to the CIE D65 standard illuminant and have a correlated colour temperature of T = 6 500 K with a tolerance of ±1 500 K.

The test is performed with a scene illumination of 500 lux (this test condition is equivalent to test condition for color rendering as defined in ISO 16505 clause 7.8.3), and at room temperature 22 °C ±5 °C.

Ambient illumination at the monitor-side shall be ≤ 10 lux, and glare light source to the monitor shall be avoided.

Figure 5: Example of the grey scale rendering chart



Each patch on the grey scale rendering chart shall have a size of 50 x 50 mm. The distance between the patches shall be 5 mm.

Table 1 shows density value D_i of the 12 different grey patches as well D_i of the background.

Table 1: Density values D_i

Grey patch No.	Density D_i
1	1,40
2	1,21
3	1,05
4	0,90
5	0,77
6	0,65
7	0,54
8	0,44
9	0,35
10	0,26
11	0,18
12	0,10
Background	0,54 ±0,05

Measure the luminance Y_i of each grey patch i = 1…12 by using the reference camera. Then, calculate the lightness of each grey patch:

$$L_i^* = 116 \times \left(\frac{Y_i}{Y_{12}} \right)^{1/3} - 16$$ **, when $Y_i/Y_{12} > 0{,}008856$**

$$L_i^* = 903{,}3 \times \left(\frac{Y_i}{Y_{12}} \right)$$ **, when $Y_i/Y_{12} \leq 0{,}008856$**

Calculate the lightness difference between each grey patch: $\Delta L^* = L_{i+1}^* - L_i^*$ and compare the result with the requirement.