



Light quality

—

A photograph of an elderly woman with a joyful expression, her mouth wide open in a laugh or shout. She has short, wavy blonde hair with a large red fabric flower on top. She wears round black-rimmed glasses and a vibrant red top. Her accessories include a multi-strand necklace with blue, white, and black beads, and large, colorful earrings. In her right hand, she holds a thick, dark cigar. The background is a plain, light-colored wall.

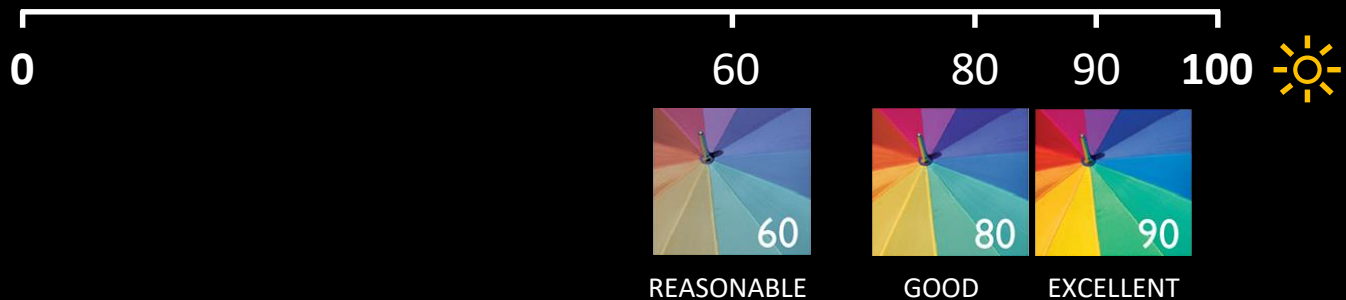
**Light begins at
90+**

CRI

index
rendering
colour

CRI

Measurement
of how colors look under a light source



The **higher** the CRI, the **more natural** the colors appear.

TM-30-15

Method of evaluating colour rendition

- R_f : fidelity index, similar to CRI
- R_g : gamut index, provides information about saturation
 - Colour vector graphic- a graphical representation

WHAT IS THE DIFFERENCE ?

CRI

8 colour measurements

Last revision was **22 years ago** by CIE
(= Commission Internationale de l'Éclairage)

Doesn't provide info on saturation



TM-30-15

99 colour measurements

New method to measure colour rendering by IES
(= Illuminating Engineering Society)

Rf = fidelity index (similar to CRI)
Rg = gamut index to show saturation

Gamut Index (R_g)



2 pictures have **same CRI** but **different level of saturation**.

TM-30-15 uses the **Gamut Index (R_g)** to describe differences in saturation.

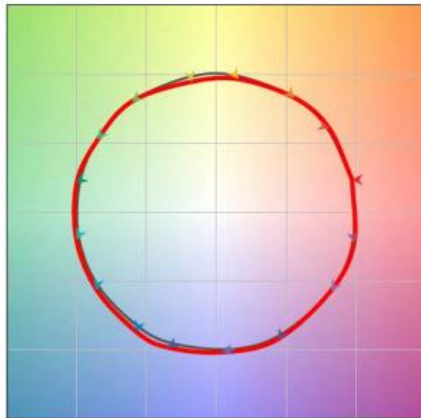
Gamut Index (R_g)



CRI95

$R_f = 93$

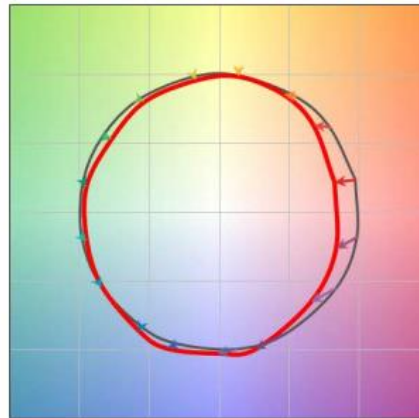
$R_g = 100$



CRI80

$R_f = 78$

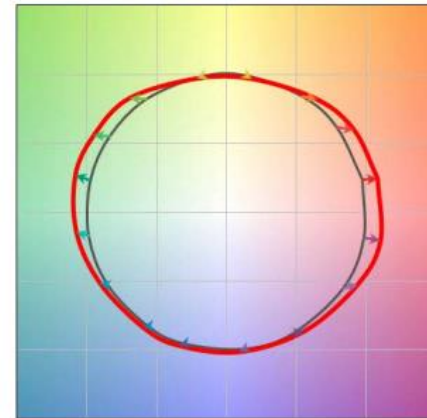
$R_g = 90$



CRI80

$R_f = 78$

$R_g = 110$





HIGH END RESIDENTIAL/HOSPITALITY



OFFICE



Modular's standard for light quality

TM-30-15 on datasheet



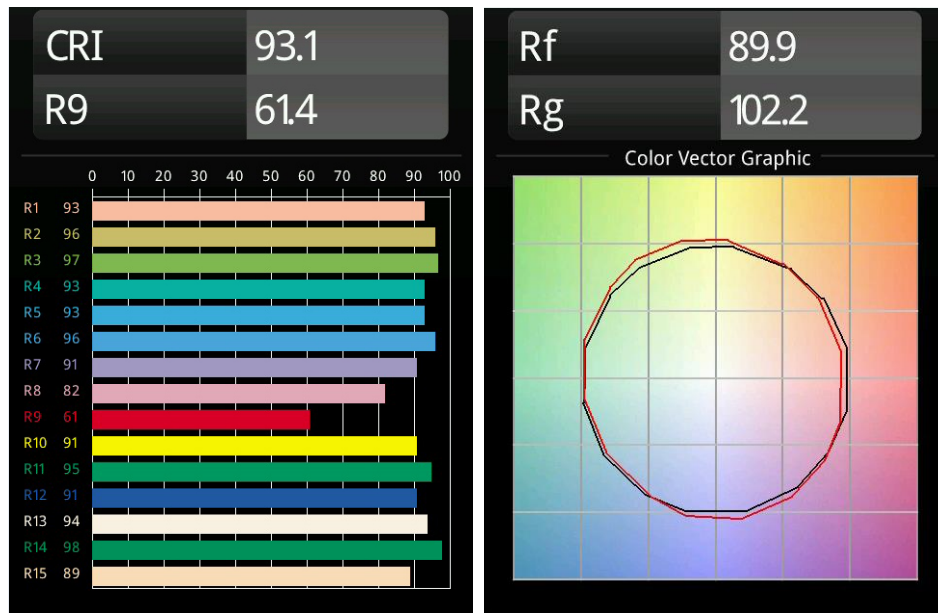
Article Nr.	Colour	Reflector	Colour Temp.	PDF
14101109	white struc	flood / 40°	warm white / 2700K	
14101132	black struc	flood / 40°	warm white / 2700K	
14102109	white struc	flood / 40°	warm white / 3000K	
14102132	black struc	flood / 40°	warm white / 3000K	
14103109	white struc	flood / 40°	neutral white / 4000K	
14103132	black struc	flood / 40°	neutral white / 4000K	

Art. Nr. **14101109**

Specifications	Accessories	Photometric	Downloads
Lamp	1x LED Array		
Gear / Transfo	LED gear not incl.		
Weight	0.19 kg		
Min. Distance	0.1 m		
IP	IP54		
Glow Wire Test	960°		
Source lifetime	50000 hrs		
CRI	92 (view TM30 data)		
Power supply	350mA	500mA	
	8.6Vf	8.6Vf	
Connected load	3W	4.3W	
Lumen	302 lm	402 lm	
Efficacy	101 lm/W	94 lm/W	
UGR	16	17	
Remark	! must be used with Qbini frame ! 3500K on request		

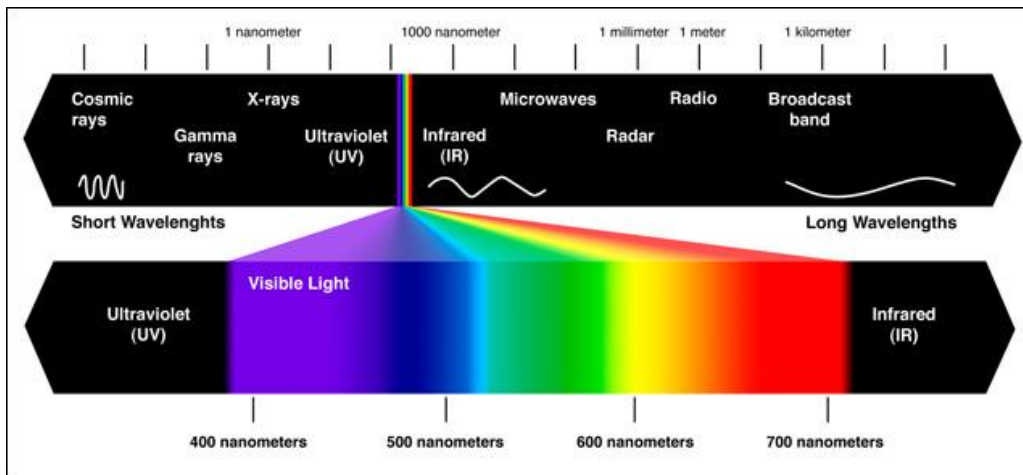
Modular's standard for light quality

TM-30-15 colour graph



- Link on **datasheet** to colour graph
- Based on **99 colour points**
- **Peak R values** = rendering in specific colour points
- Not just colour fidelity but also **colour gamut**
- **Perfect indicator** for special applications!

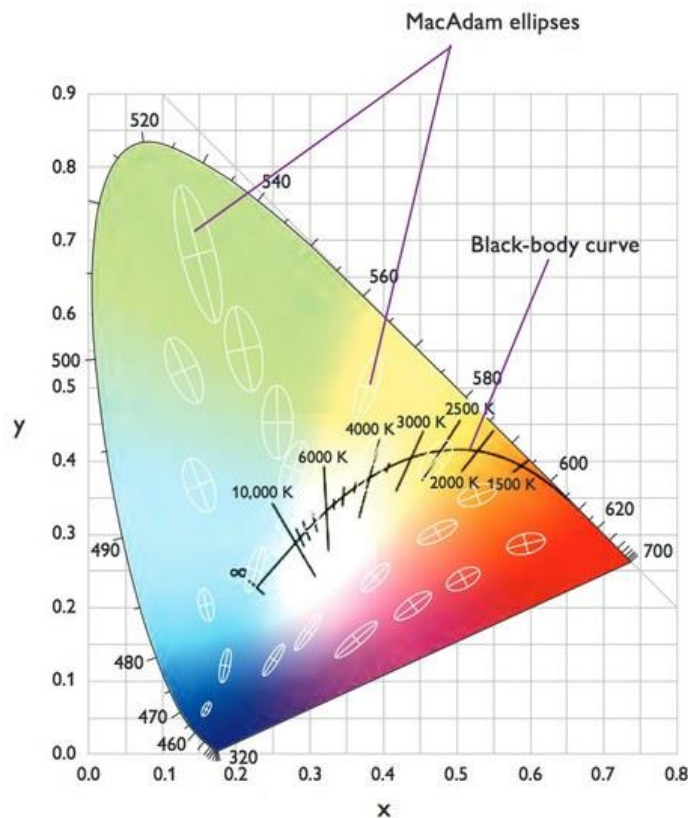
Electromagnetic spectrum



- **Light = (photon) energy**
Nm to Km-long wavelengths
- **We're blind creatures**
Most of the light around is invisible to us
Visible spectrum between UV & IR light

CIE 1931

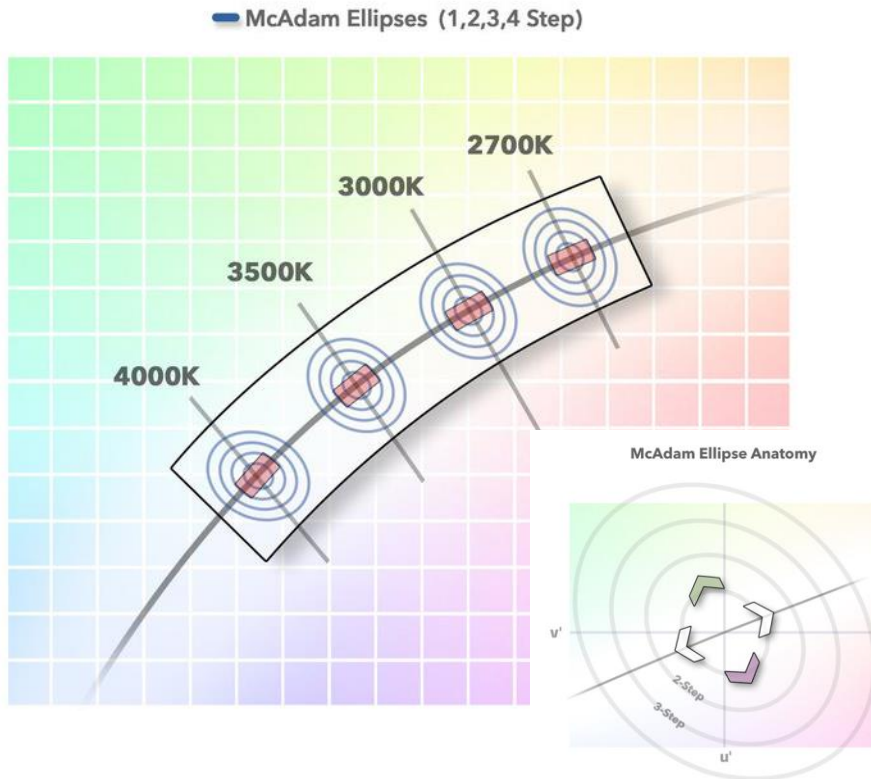
= Graphical representation of visible light spectrum



- **Colour space chromaticity diagram**
 - Human eye = receptor
 - Circadian rhythm
- **It shows:**
 - x/y colour coordinates
 - Wavelengths in nanometres
 - Black-body curve (white light!)
 - MacAdam ellipses

CIE 1931

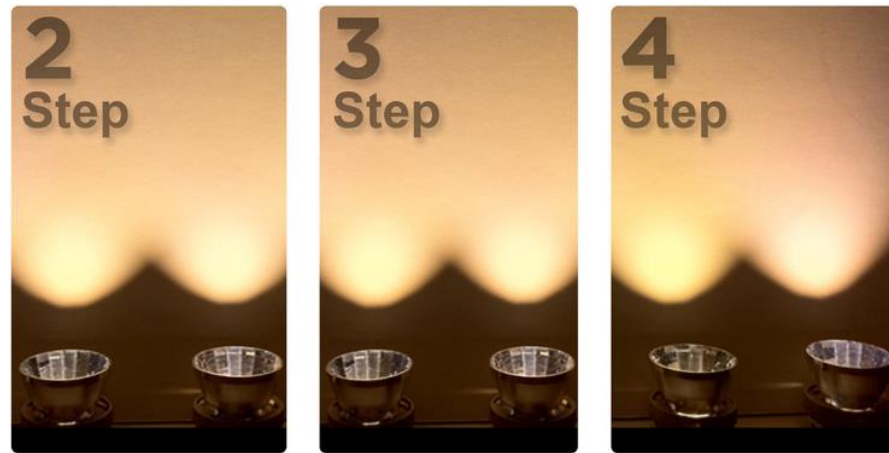
= Graphical representation of visible light spectrum



- **Black-body curve:**
Shows **white (visible) light**
Correlated Colour Temperature (CCT) in Kelvin (K)
- **MacAdam ellipses:**
Regions in the CIE diagram visible by the naked human eye
Now inevitable with LEDs due to colour inconsistencies
- **Industrial implications:**
LED makers use binning system following MacAdam
SDCM = standard deviation of colour matching = step

Macadam ellipses

1 step Macadam = deviation from a specific colour point
Noticeable when LED fixtures are grouped



Less steps
Less deviation
Higher cost
Higher light quality

More steps
More deviation
Lower cost
Lower light quality