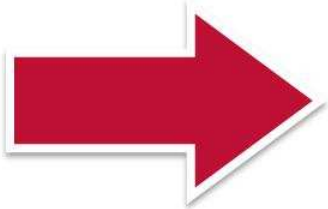
DANILO PALEARI
Studio Associato Quantis

# *LED tra prodotto e progetto*

nov 29, 2012

# The LED REVOLUTION



**SOLID STATE LIGHTING**
un cambiamento tecnologico **epocale**
nel mondo dell'illuminazione

opportunità

opportunità

**Opportunità**

Efficienza

Risparmio energetico

Durata

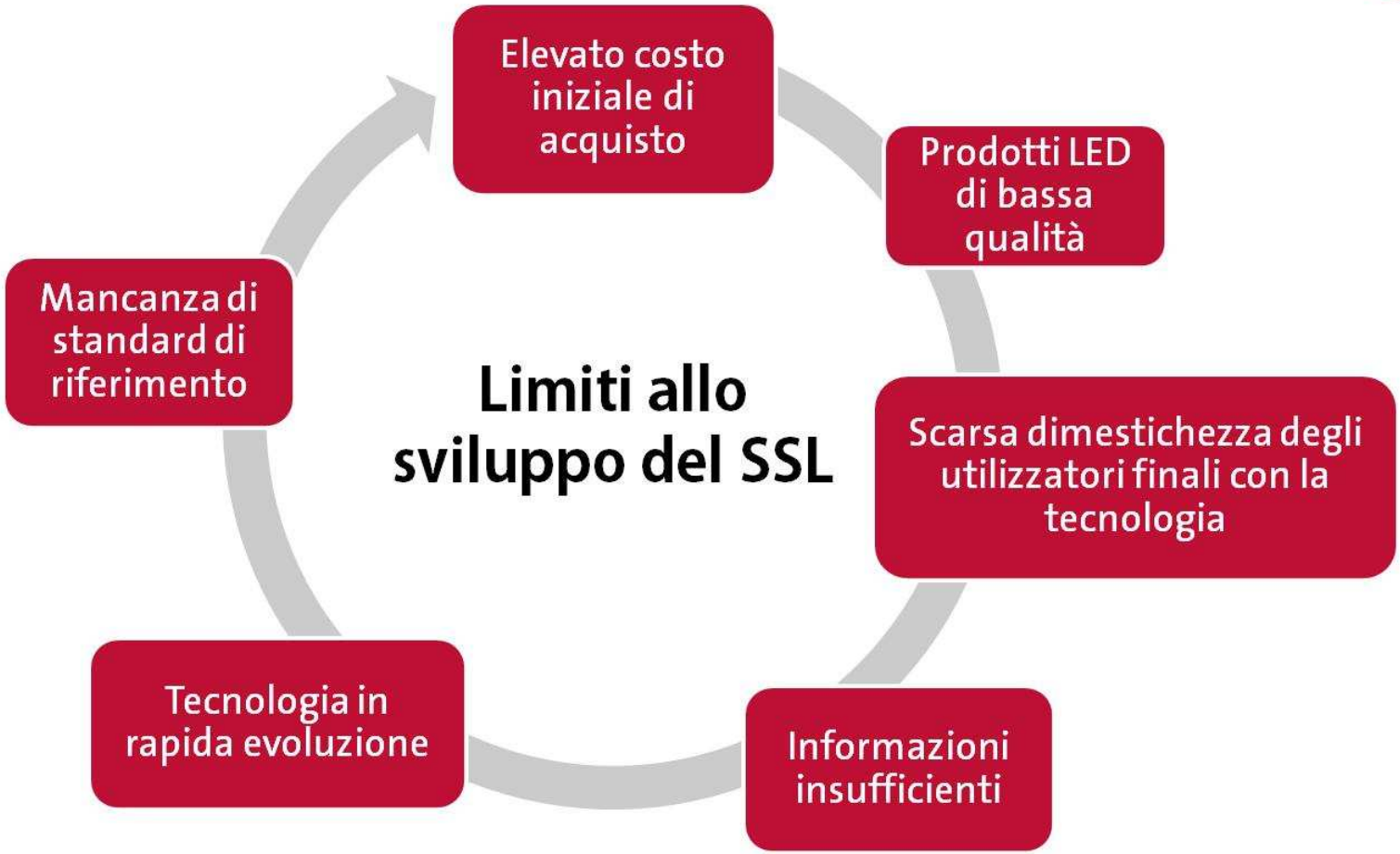
Qualità della luce

Controllo della luce

Design

opportunità

confusione




*Problematiche e **sfide** che riguardano consumatori e utilizzatori professionali*

*In recent years the lighting market has been flooded by a vast number of **new and unproven entrants**. Some are making **dubious claims** about their products' performance that are too good to be true, and **not supported on a technical basis**.*

*As things stand, it can be difficult to know **who to trust** or **what to believe**.*

**Apples & Pears - CELMA guiding paper**

?

*who to trust*

?

*what to believe*

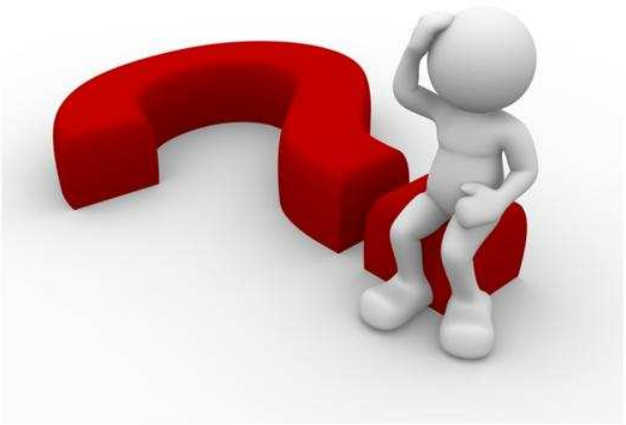
## Parametri fotometrici

Flusso
Efficienza (lm/w)
Distribuzione delle intensità

## Parametri cromatici

Temperatura colore (CCT)
Resa cromatica (CRI)
Coordinate cromatiche
Distribuzione spettrale (SPD)

# Parametri fotometrici



Il flusso dichiarato è dell'apparecchi o dei LED?

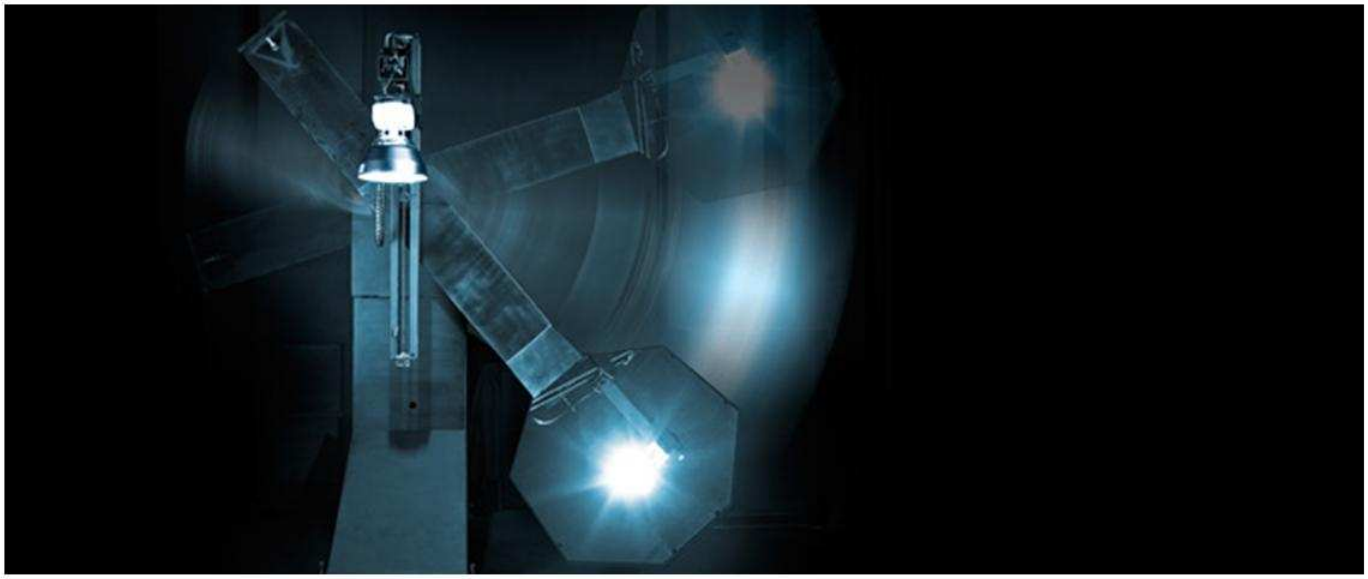
La fotometria è relativa o assoluta?

L'efficienza dichiarata è del LED o dell'apparecchio?

La fotometria rispetta i passi angolari previsti dalle norme?

La fotometria è stata eseguita al raggiungimento dell'equilibrio termico?

Il flusso definito è legato alla temperatura colore?

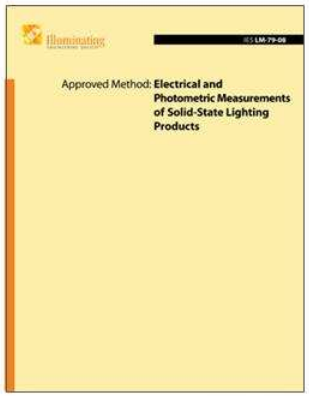


## Parametri fotometrici

Flusso

Efficienza (lm/w)

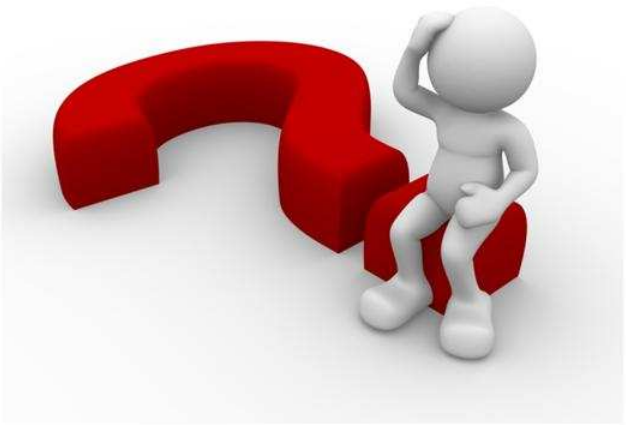
Distribuzione delle intensità




LM 79

UNI 11356

# Parametri colorimetrici



La CCT è riferita al LED o all'apparecchio?

La CCT è definita a quale temperatura dei LED?

Due prodotti a parità di CCT hanno stessa apparenza cromatica?

Viene fornito solo il valore di CRI o anche i dettagli di tutti gli altri campioni?

Viene definita l'uniformità cromatica dell'emissione al variare di gamma?

Esiste color shifting con l'invecchiamento?


ARTE PROGRAMMATA

**LED 1**

CCT **3000 K**
CRI > 90

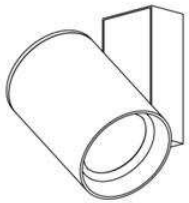
**LED 2**

CCT **3000 K**
CRI > 90

**LED 3**

CCT **3000 K**
CRI > 80

**LED 4**



CCT **3000 K**
CRI > 80

**LED 1**

| | | |
|---|---|---|
| CCT | **3000 K** | **3153 K** |
| CRI | > 90 | x=0,4279 |
| | | y=0,4035 |
| | | Δ uv=0,0011 |

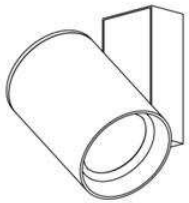
**LED 2**

| | | |
|---|---|---|
| CCT | **3000 K** | **3065 K** |
| CRI | > 90 | x=0,4287 |
| | | y=0,3946 |
| | | Δ uv=-0,0027 |

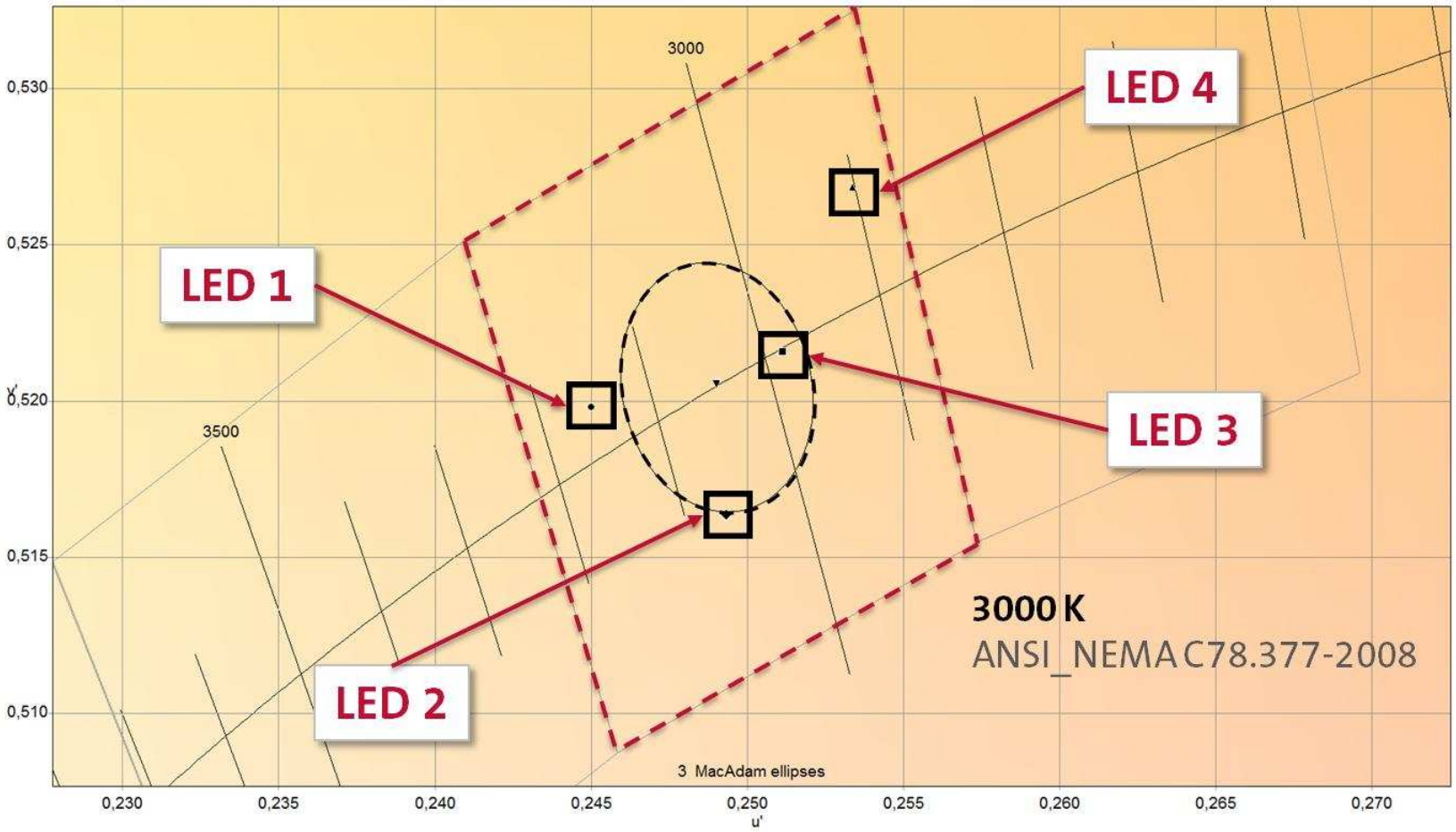
**LED 3**

| | | |
|---|---|---|
| CCT | **3000 K** | **2985 K** |
| CRI | > 80 | x=0,4379 |
| | | y=0,4042 |
| | | Δ uv=0,0001 |

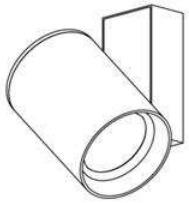
**LED 4**

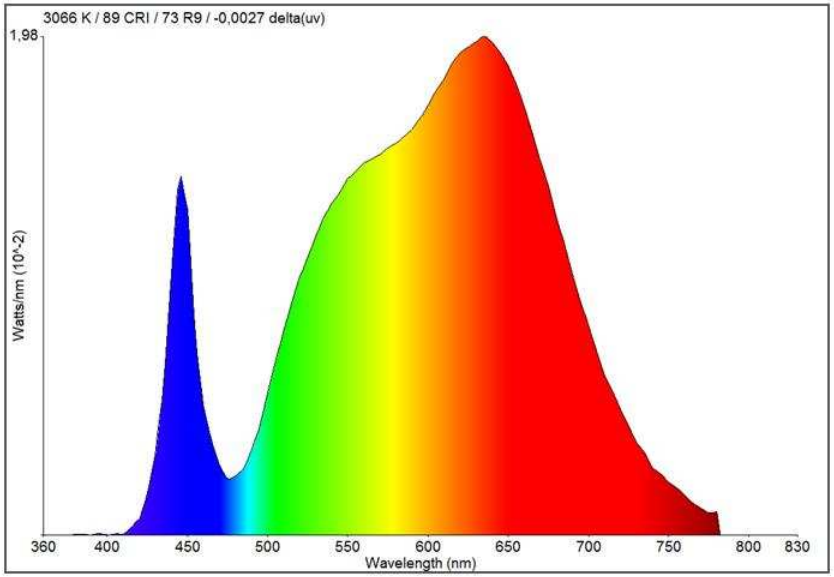


| | | |
|---|---|---|
| CCT | **3000 K** | **2902 K** |
| CRI | > 80 | x=0,4479 |
| | | y=0,4139 |
| | | Δ uv=0,0024 |

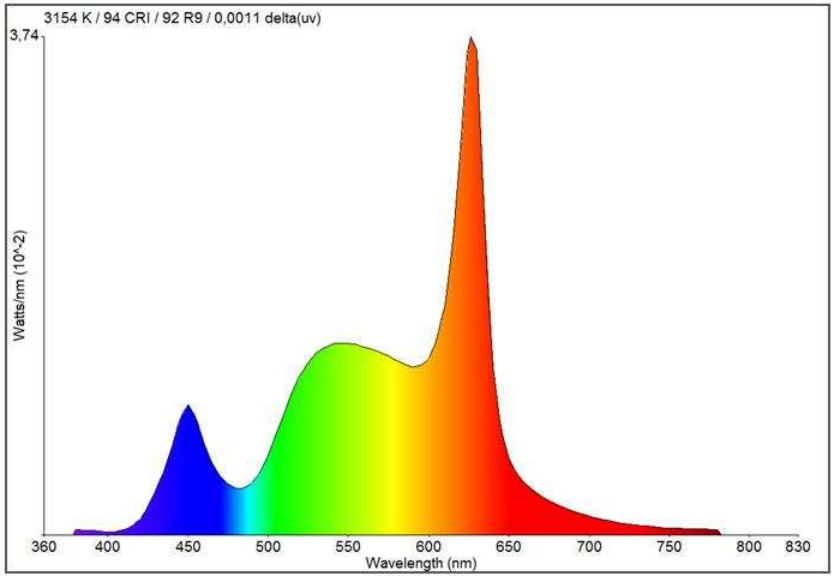

LED 4
LED 1
LED 3
LED 2
3000
3500
3000 K
ANSI_NEMA C78.377-2008
3 MacAdam ellipses
0,530
0,525
0,520
0,515
0,510
v'
0,230
0,235
0,240
0,245
0,250
0,255
0,260
0,265
0,270
u'

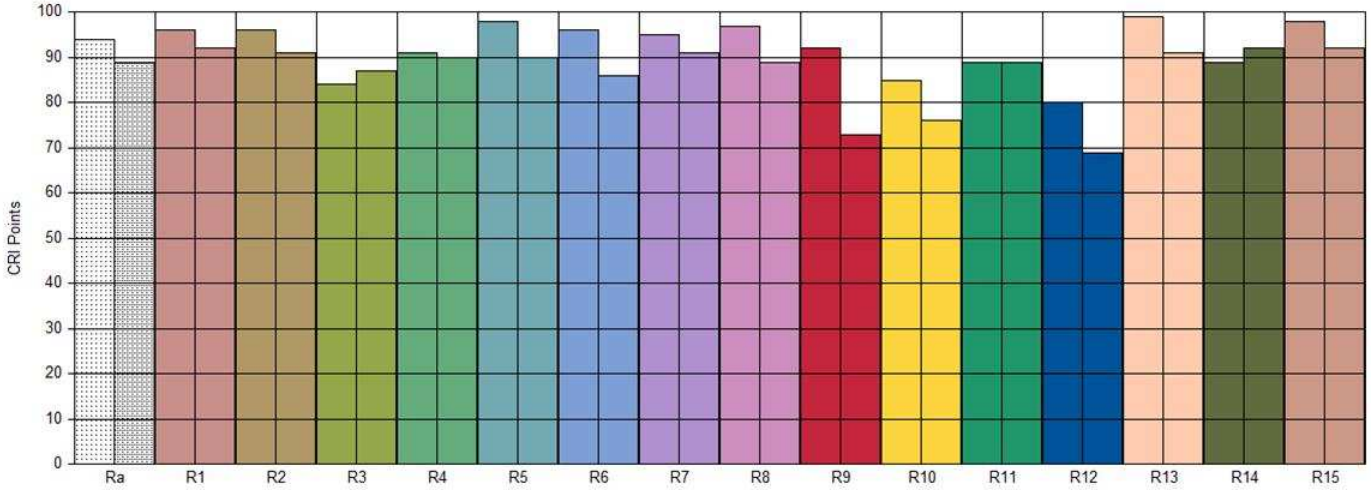
# LED 1

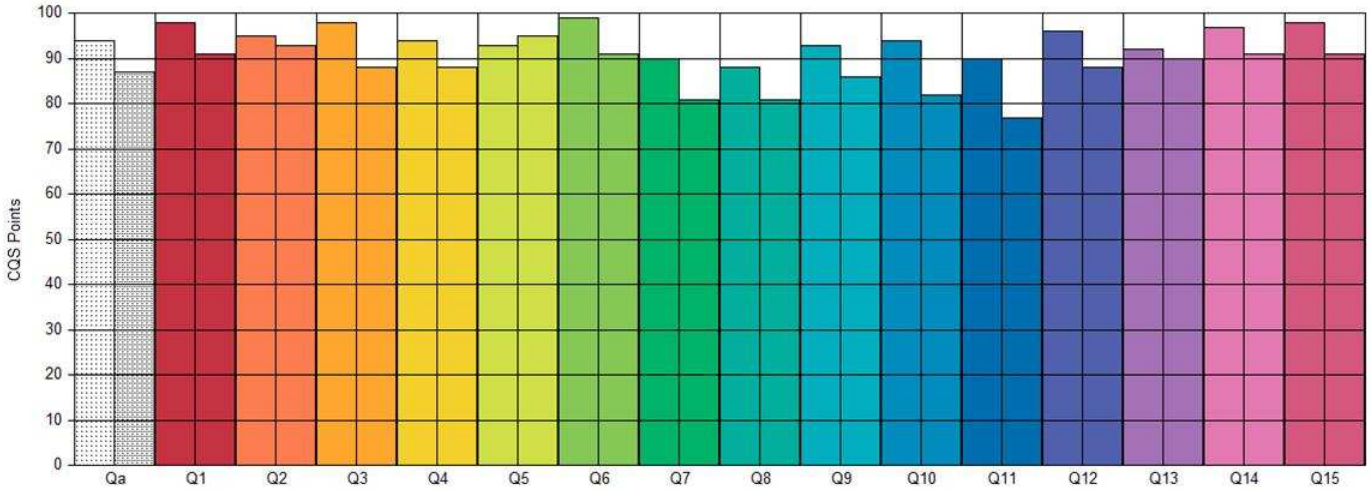



3066 K / 89 CRI / 73 R9 / -0,0027 delta(uv)
1,98
Watts/nm (10^-2)
360 400 450 500 550 600 650 700 750 800 830
Wavelength (nm)

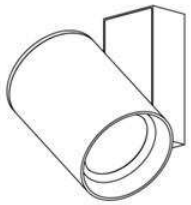
# LED 2

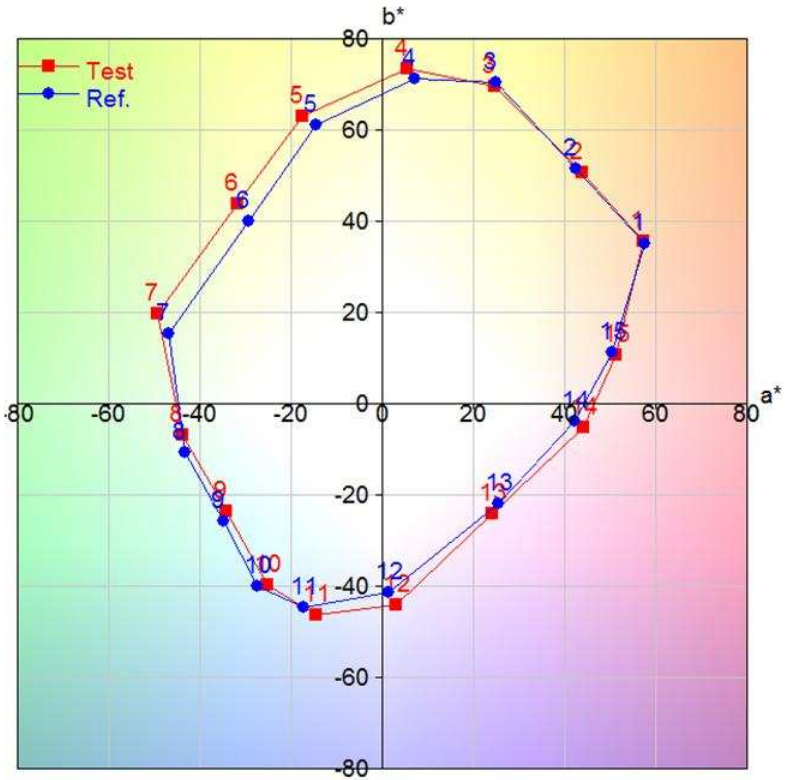

3154 K / 94 CRI / 92 R9 / 0,0011 delta(uv)
3,74
Watts/nm (10^-2)
360 400 450 500 550 600 650 700 750 800 830
Wavelength (nm)


CRI Points
100
90
80
70
60
50
40
30
20
10
0
Ra
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15

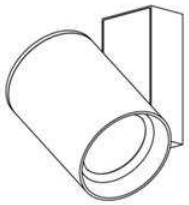

CQS Points
100
90
80
70
60
50
40
30
20
10
0
Qa
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15

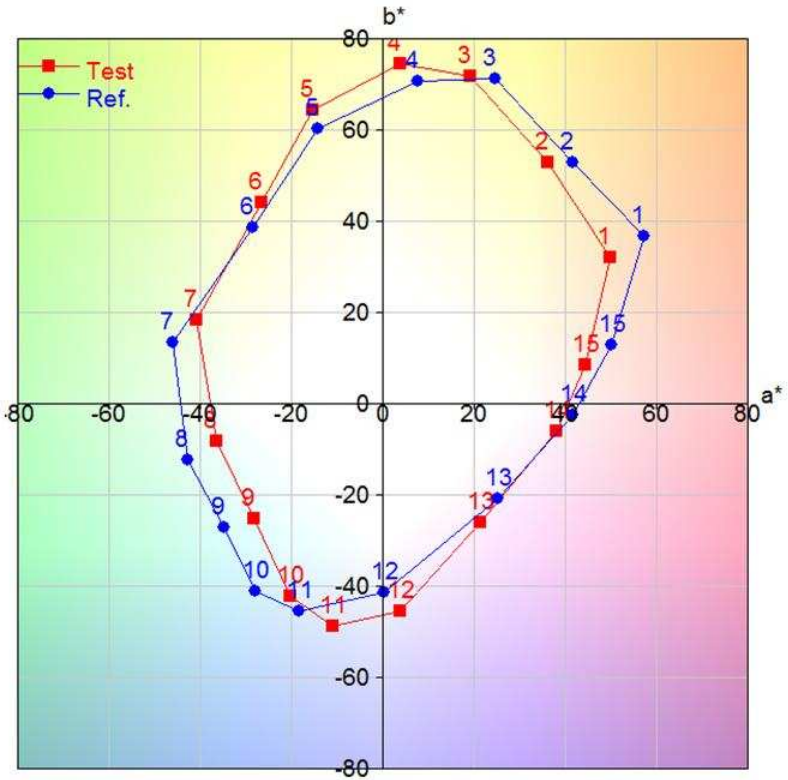
# LED 1




b*
a*
Test
Ref.
80
60
40
20
0
-20
-40
-60
-80
-80
-60
-40
-20
0
20
40
60
80

# LED 3

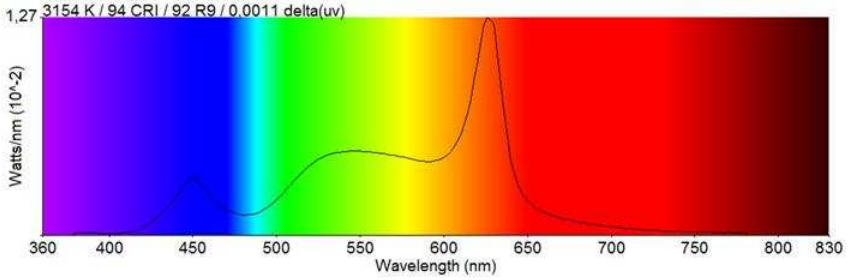



b*
a*
Test
Ref.
80
60
40
20
0
-20
-40
-60
-80
-80
-60
-40
-20
0
20
40
60
80

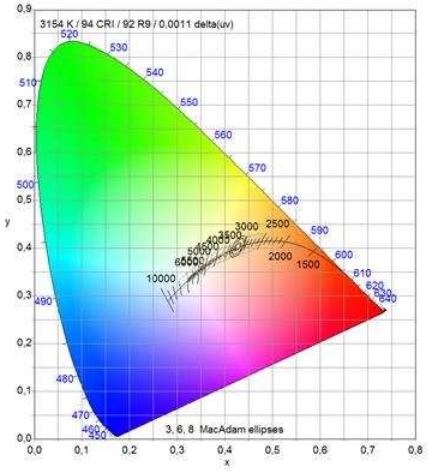
Illuminating Engineering Society

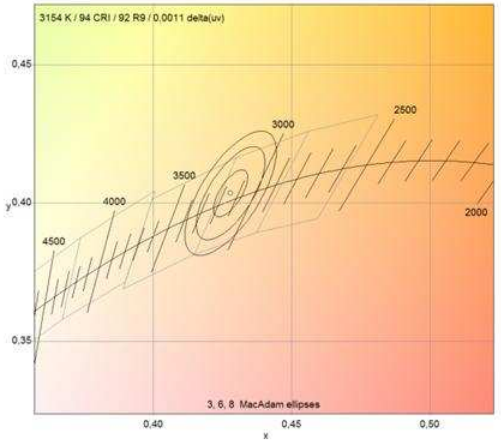
IES LM-79-08

Approved Method: **Electrical and Photometric Measurements of Solid-State Lighting Products**




| x | y | u' | v' | delta(uv) |
|---|---|---|---|---|
| 0,4279 | 0,4035 | 0,2450 | 0,5198 | 0,0011 |



# Lighting Facts

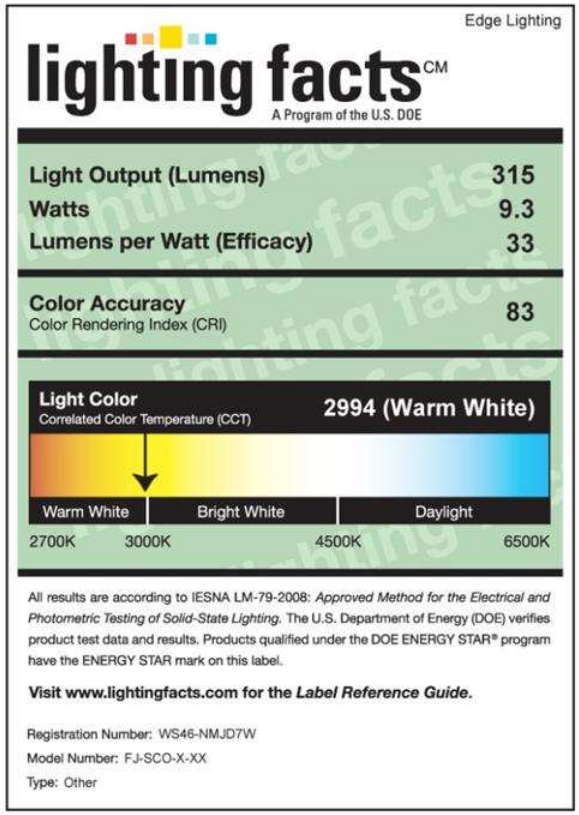
**Light Output/Lumens**
Measures light output. The higher the number, the more light is emitted.
**Reported as "Total Integrated Flux (Lumens)" on LM-79 test report.**

**Watts**
Measures energy required to light the product. The lower the wattage, the less energy used.
**Reported as "Input Power (Watts)" on LM-79 report.**

**Lumens per Watt/Efficacy**
Measures efficiency. The higher the number, the more efficient the product.
**Reported as "Efficacy" on LM-79 test report.**

**IESNA LM-79-2008**
Industry standardized test procedure that measures performance qualities of LED luminaires and integral lamps. It allows for a true comparison of luminaires regardless of the light source.

**Brand & Model Number**




**Color Rendering Index (CRI)**
Measures color accuracy.
**Color rendition is the effect of the lamp's light spectrum on the color appearance of objects.**

**Correlated Color Temperature (CCT)**
Measures light color.
"Cool" colors have higher Kelvin temperatures (3600–5500K); "Warm" colors have lower color temperatures (2700–3500K).

DANILO PALEARI
Studio Associato Quantis

# GRAZIE