

Supplementary Information for

Alleviating the crosstalk effect via a fine-moulded light-blocking matrix for colour-converted micro-LED display with a 122% NTSC gamut

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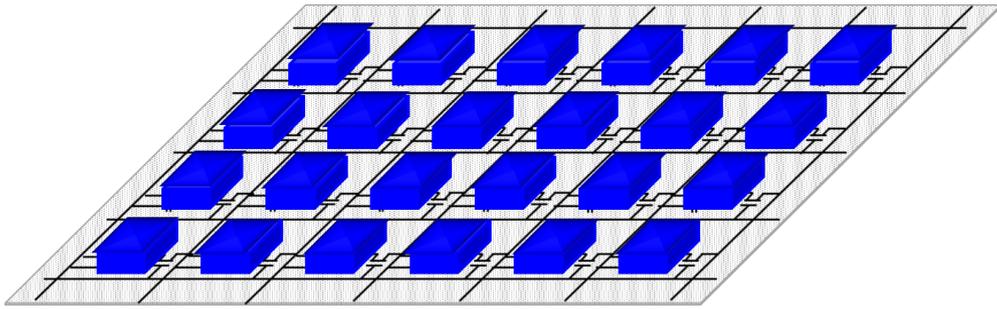


Fig. S1 Schematic diagram of top-emitting micro-LED array without LBM.

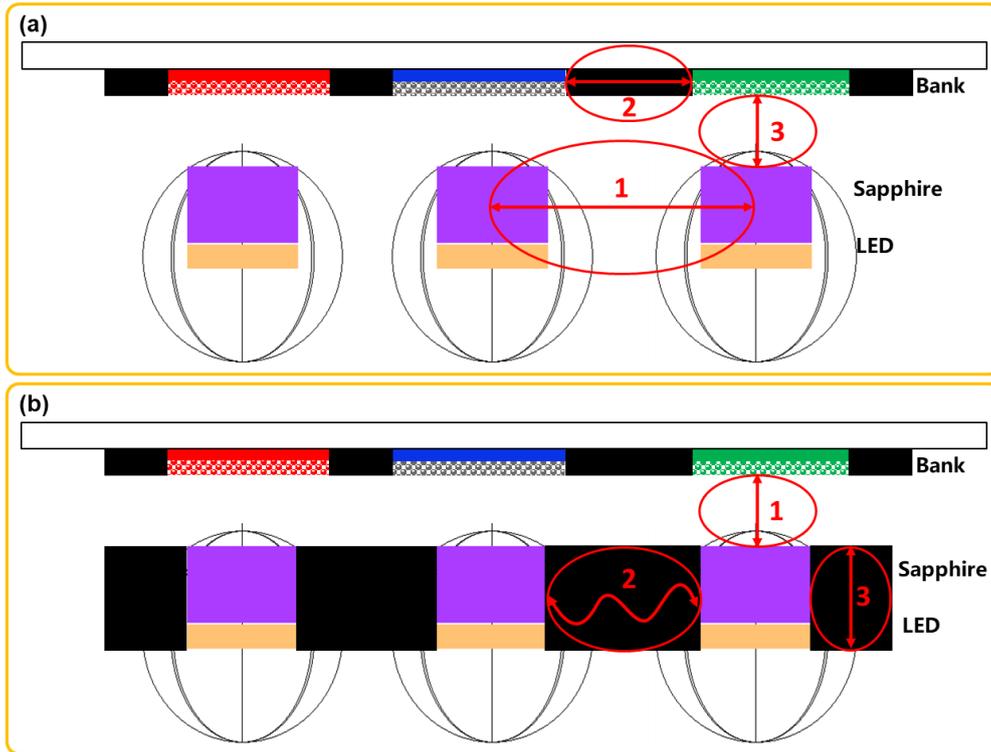


Fig. S2 Simulation model of top-emitting structure (a) without and (b) with light-blocking matrix (LBM).

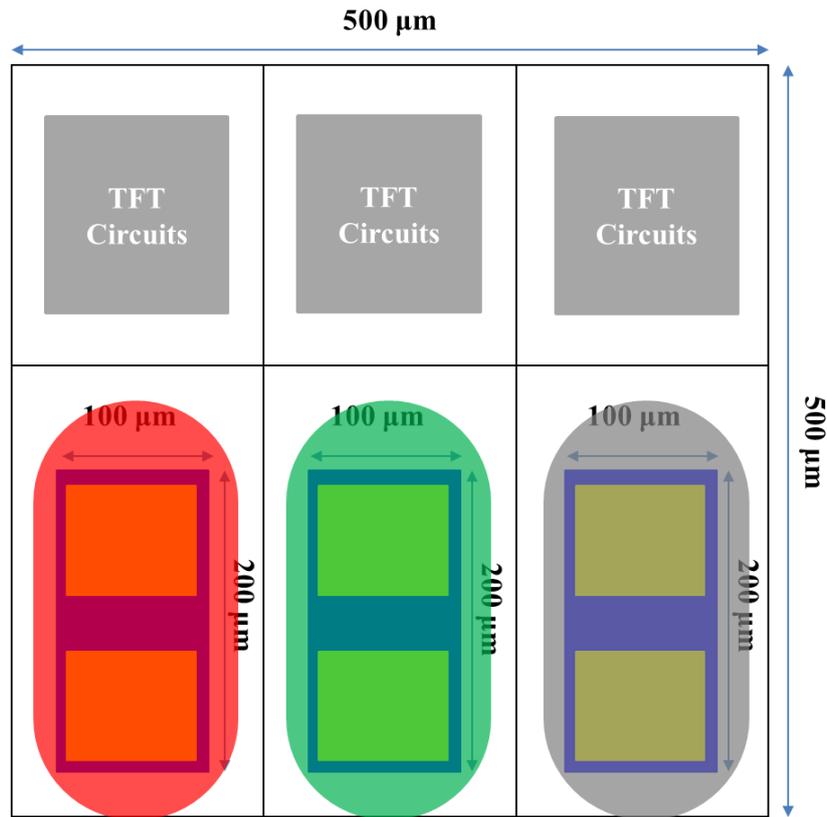


Fig. S3 Schematic of the pixel design for the target display panel. The elliptical circles drawn here are to indicate the bank design of the CCL plate.

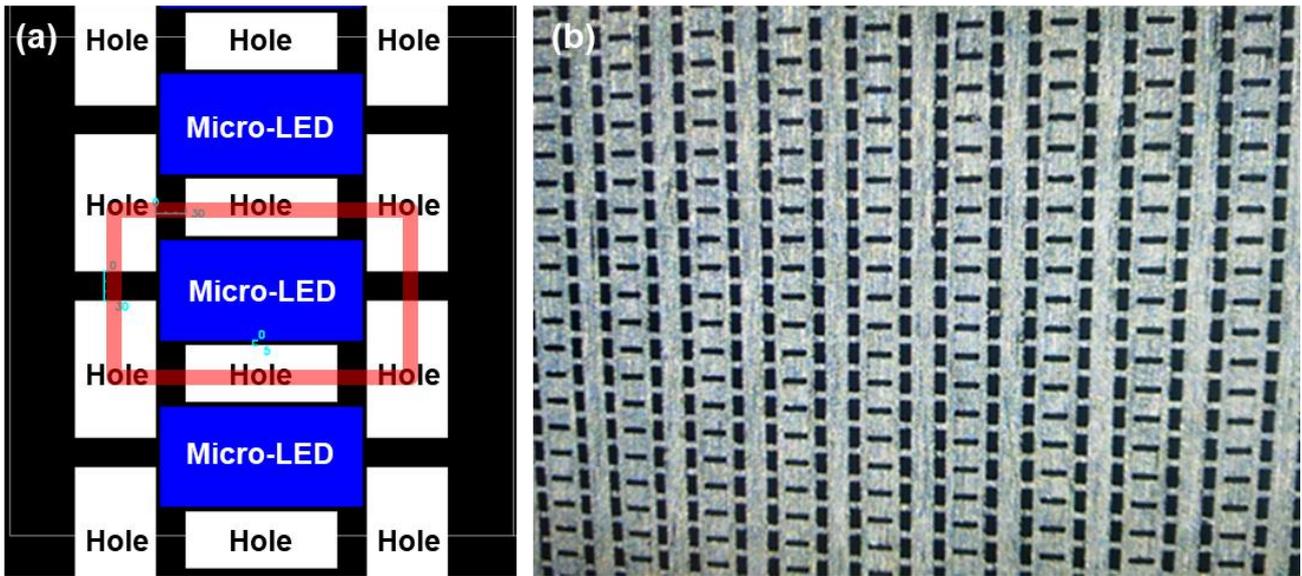


Fig. S4 (a) Schematic and (b) image of the metal mask design for MSP approach. It contains approximate rings (see the red rectangle in Fig. S4a) where the metal blocks corresponding to the micro-LED positions were connected with narrow metal stripes. Based this design and the fluid characteristics of pastes, it was anticipated to encircle the micro-LED chips with black paste.

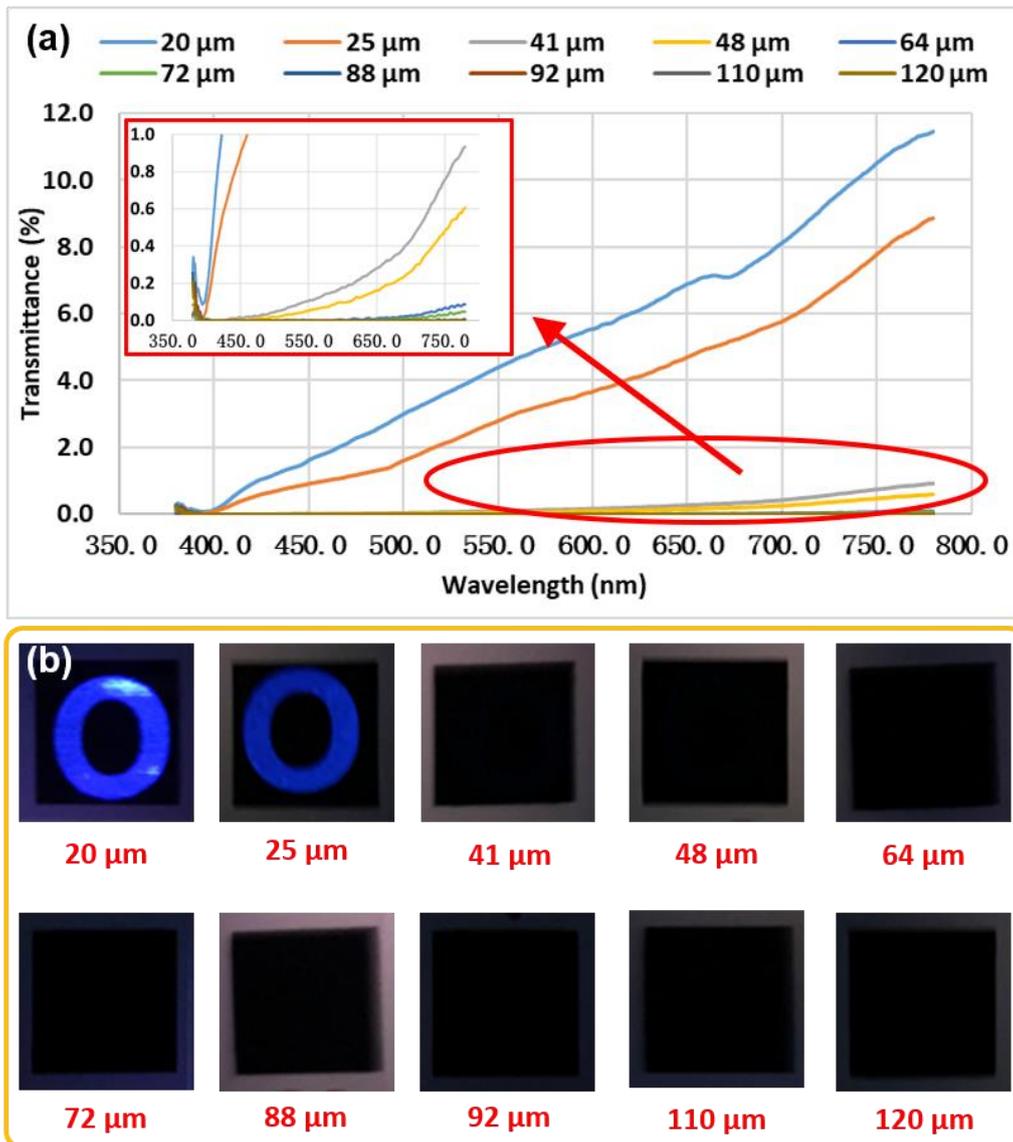


Fig. S5 (a) Transmittance spectra of black LBM films with different thickness and (b) photographs of LBM films stacked on top of blue "O" patterns.

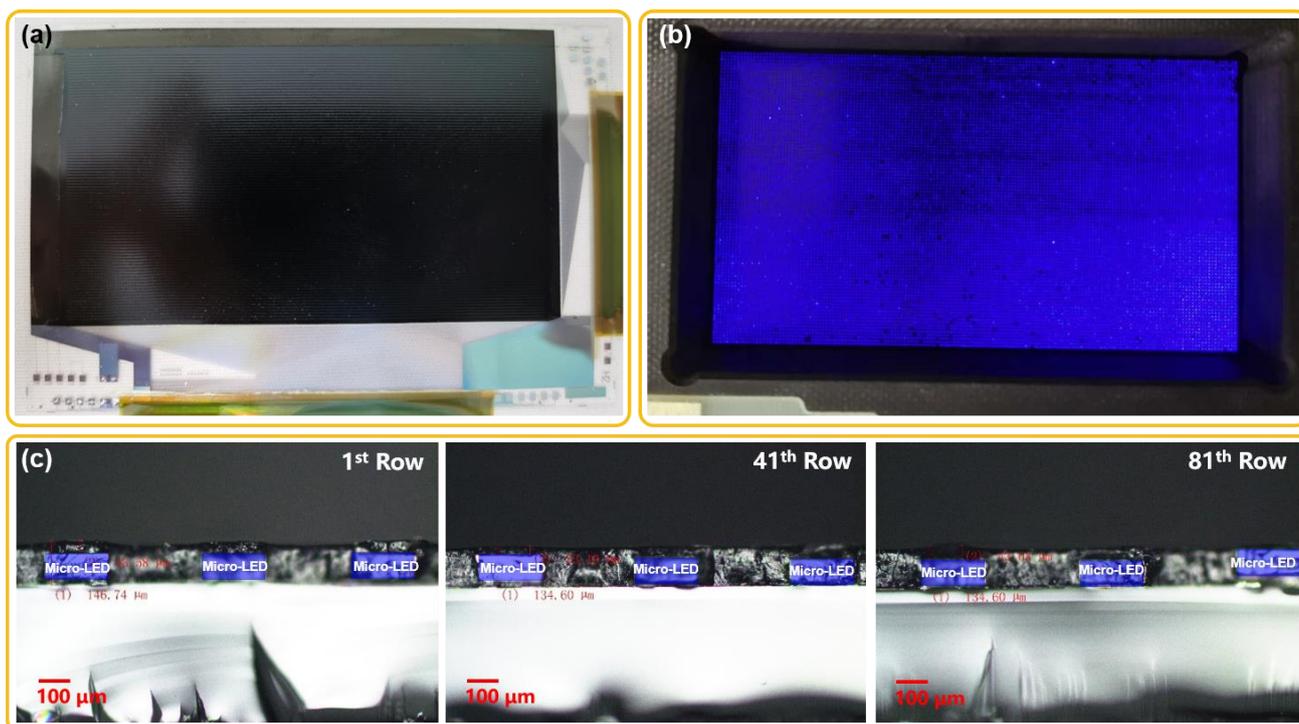


Fig. S6 Characteristics of blue micro-LED backlight. Photographs of a blue micro-LED backlight molded with black LBM under (a) off and (b) on states. (c) Cross-sectional microscopic images of the micro-LED chips filled with black LBM.

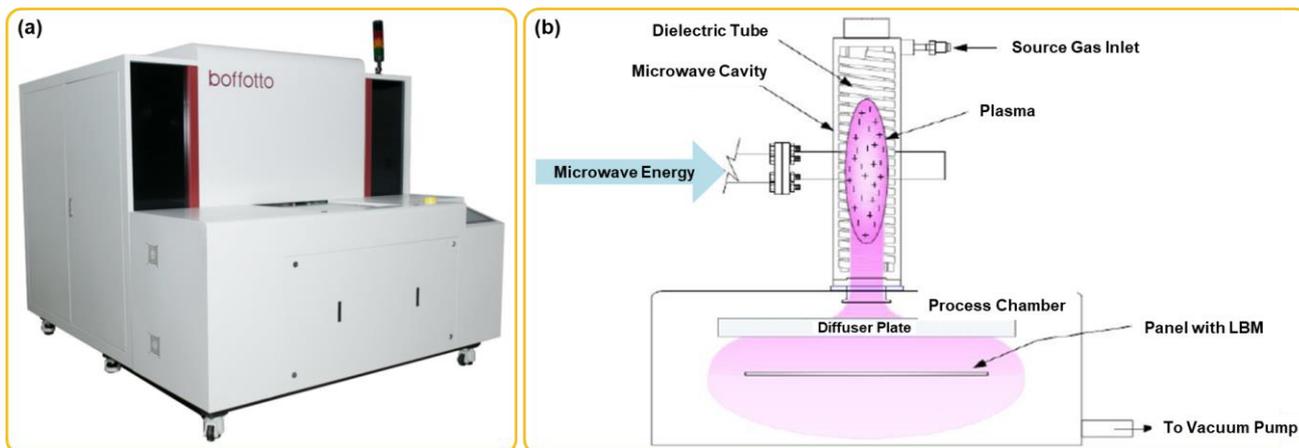


Fig. S7 (a) External photograph and (b) internal schematic view of the plasma etching equipment (Boffotto M01S, Boffotto Co., Ltd., Zhuhai, China).

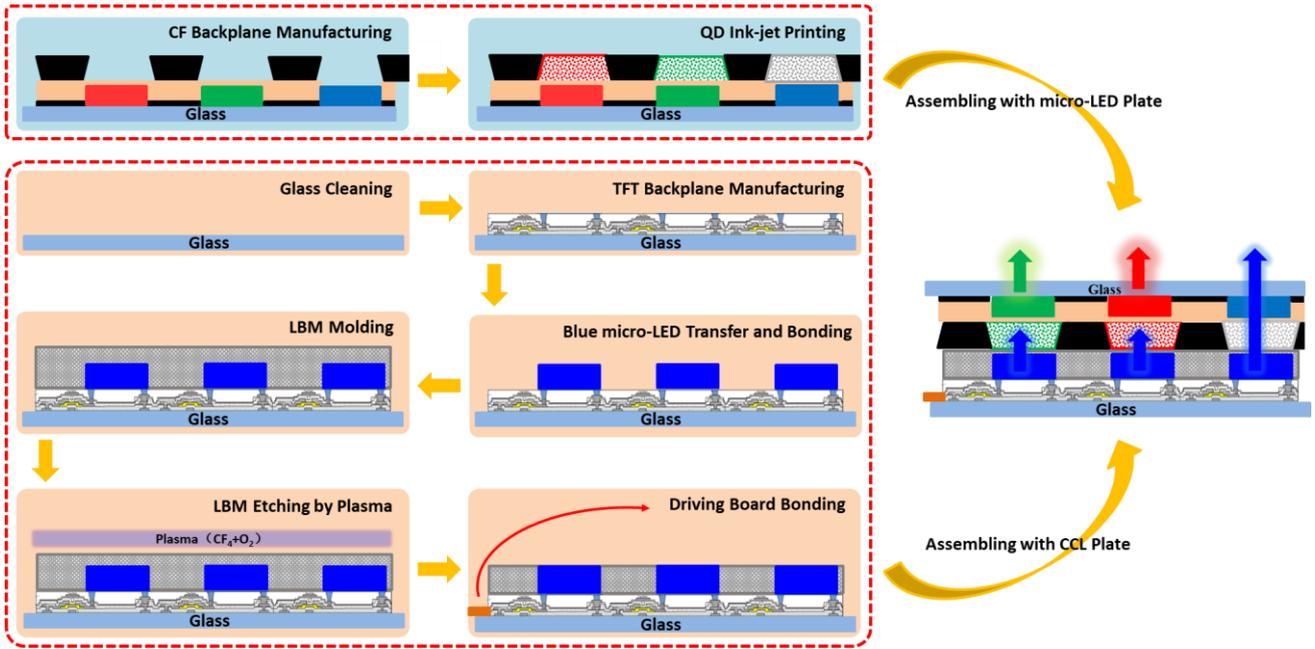


Fig. S8 Processes to manufacture top-emitting active matrix color-converted micro-LED display.



Fig. S9 Photographs of (a) red and (b) green CdSe patterns under excitation by UV light. (c) Red, green and blue pixel patterns illuminated by blue backlight.

Table S1 Simulation results of top-emitting architecture without LBM.

Simulation Component	Value (μm)	Crosstalk Ratio
	166.6 (Pixel Pitch: 500 μm)	19.9%
Micro-LED Pitch	300	4.53%
(Gap: 10 μm ; Black Bank CD: 80 μm)	350	3.33%
	400	2.48%
	450	1.3%
	20	1.9%
Black Bank Critical Dimension (CD)	60	1.6%
(Micro-LED Pitch: 450 μm ; Gap: 10 μm)	80	1.3%
	100	1.1%
	20	1.7%
Gap	10	1.3%
(Micro-LED Pitch: 450 μm ; Black Bank CD: 80 μm)	5	1.1%
	0	1.0%

Table S2 Simulation results of top-emitting architecture with LBM of different transmittance.

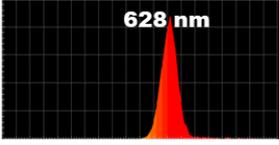
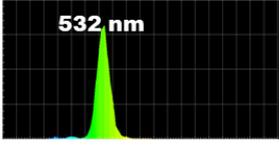
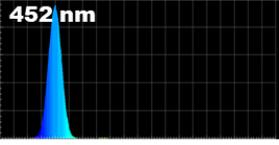
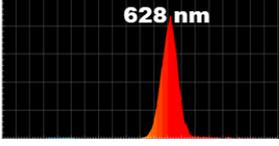
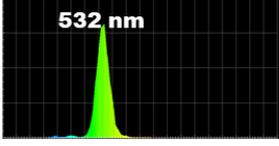
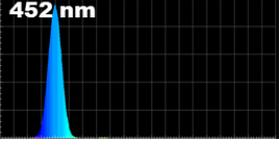
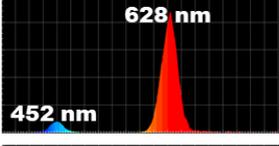
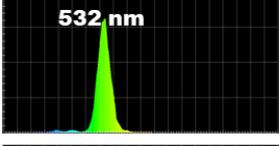
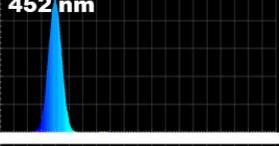
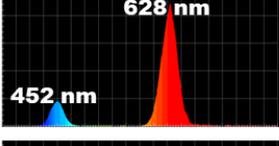
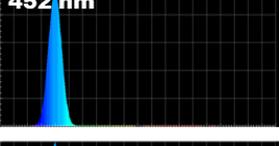
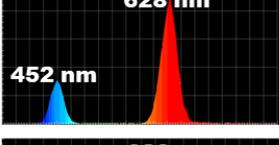
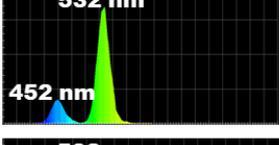
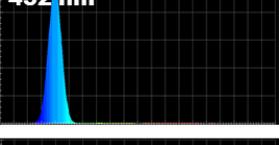
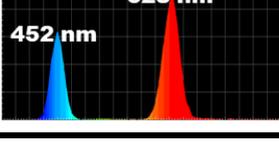
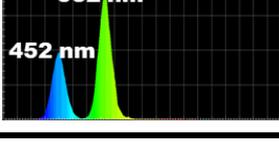
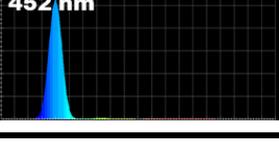
Tr% of LBM	Red	Green	Blue	XT%	Gamut (NTSC)
0				0	128.0%
1%				0.2%	126%
10%				4.1%	112.5%
20%				7.3%	85.3%
30%				9.6%	63.2%
50%				15.8%	32.3%

Table S3 Photoconversion performance and optical characteristics.

Component	Emission Peak (nm)	CIE Coordinates (x, y)	FWHM (nm)
Blue Micro-LED	452	(0.1494, 0.0243)	19
Blue Micro-LED + Red CdSe	628	(0.6732, 0.3052)	27
Blue Micro-LED + Green CdSe	532	(0.1567, 0.7671)	22
Blue Micro-LED	462	(0.1432, 0.0396)	15
Red Micro-LED	619	(0.6898, 0.3103)	14
Green Micro-LED	541	(0.2469, 0.7161)	25