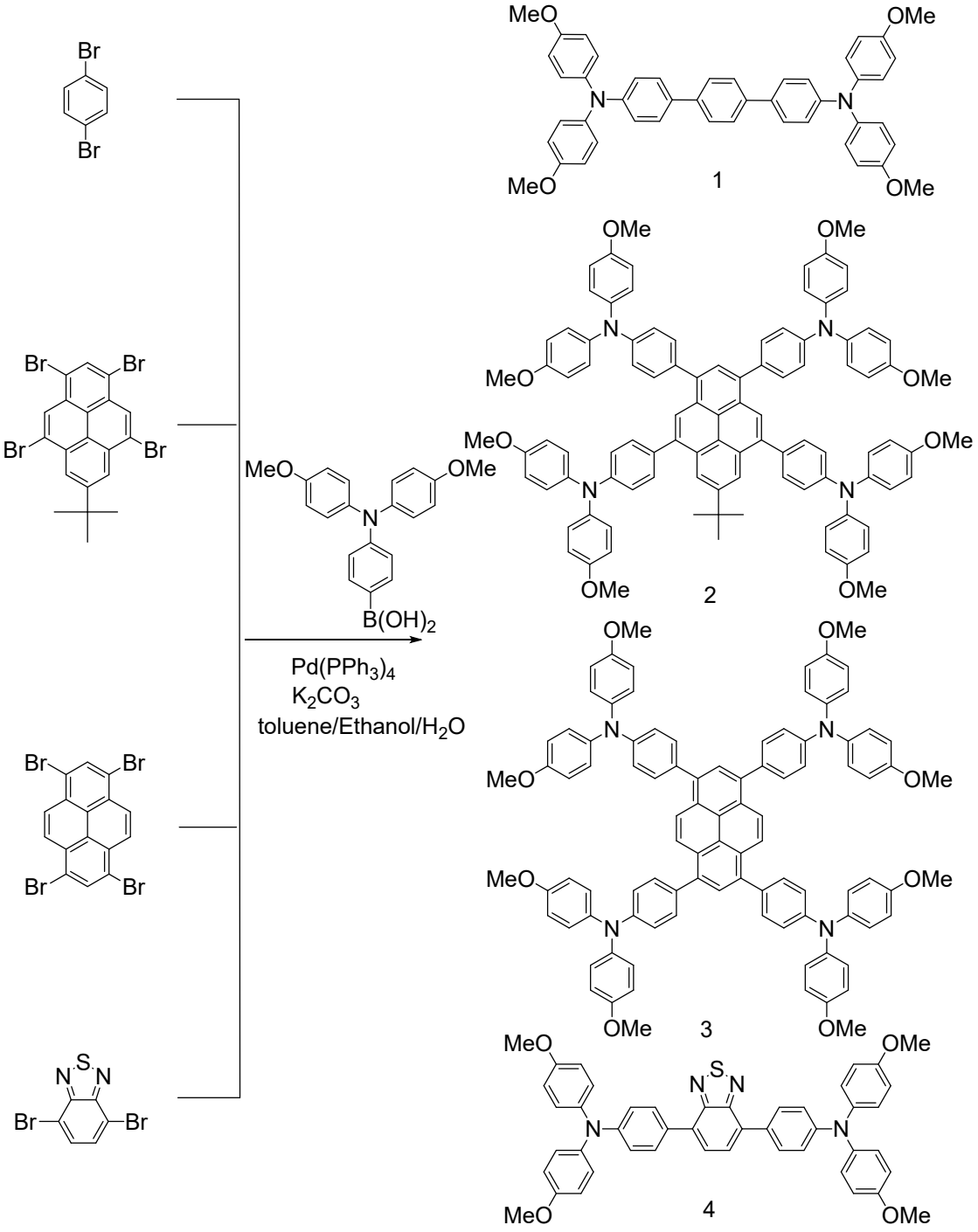
Supplementary Information

Tunable fluorescence emission for multi-color light-emitting diodes and voice-activated intelligent lighting applications

Yiwei Liu,[a] Yuanwei Wang,[b] Xinyi Song,[a] Xiaohui Wang,[a] Haoxian Zhu,[a] Juchang Zhang,[a] Jie Bai,[a] Carl Redshaw,[c] Xin-Long Ni,[d] Xing Feng, *[ae] Dong Wang[b] and Ben Zhong Tang*[bf]

[a] Guangdong Provincial Key Laboratory of Information Photonics Technology. School of Material and Energy, Guangdong University of Technology, Guangzhou 510006, P. R. China.
[b] Center for AIE Research, Shenzhen Key Laboratory of Polymer Science and Technology, Guangdong Research Center for Interfacial Engineering of Functional Materials, College of Materials Science and Engineering, Shenzhen University, Shenzhen 518060, P. R. China.
[c] Department of Chemistry, University of Hull, Cottingham Road, Hull, Yorkshire HU6.
[d] Key Laboratory of the Assembly and Application of Organic Functional Molecules of Hunan Province, Hunan Normal University, Changsha 410081, P. R. China.
[e] Guangdong Provincial Key Laboratory of Luminescence from Molecular Aggregates (South China University of Technology), Guangzhou 510640, P. R. China.
[f] Shenzhen Institute of Aggregate Science and Technology, School of Science and Engineering, The Chinese University of Hong Kong, Shenzhen, 2001 Longxiang Boulevard, Longgang District, Shenzhen City, Guangdong 518172, China.
* Corresponding authors (emails: hyxhn@sina.com (X. Feng); tangbenz@cuhk.edu.cn (B. Z. Tang)

Synthetic route



Scheme S1 Synthetic route to color-tunable emission materials **1**-**4**.

NMR spectroscopy

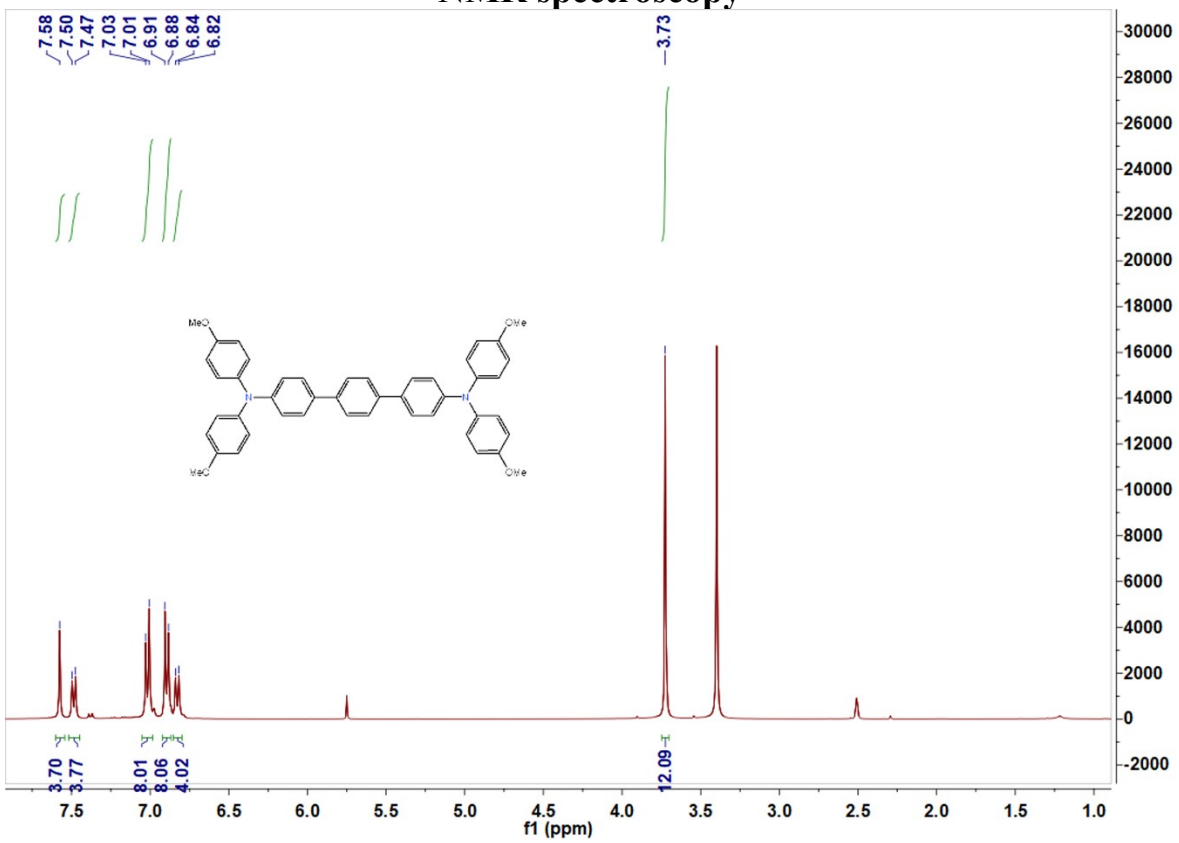


Figure S1 ^{1}H-NMR spectrum (400 MHz, 293 K, DMSO-d*6*) for **1**.

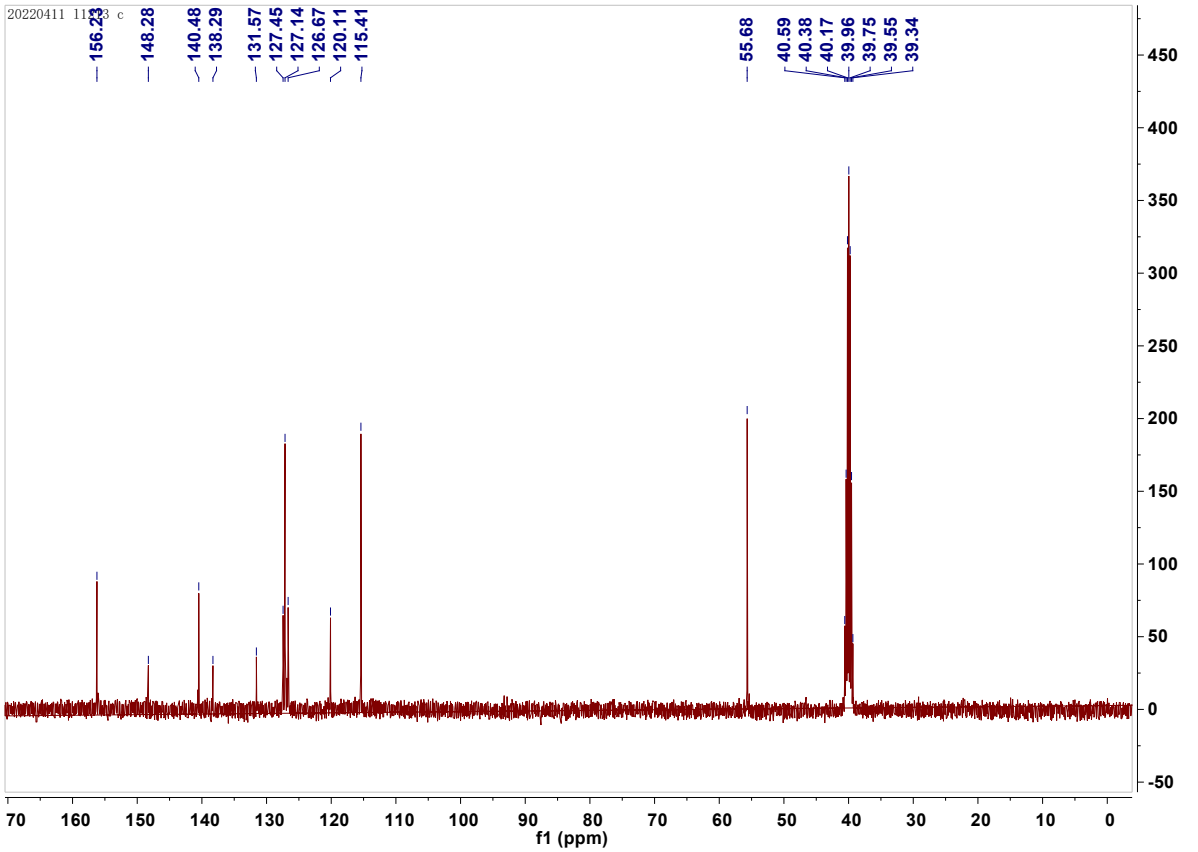


Figure S2 ^{13}C-NMR spectrum (400 MHz, 293 K, DMSO-d*6*) for **1**.

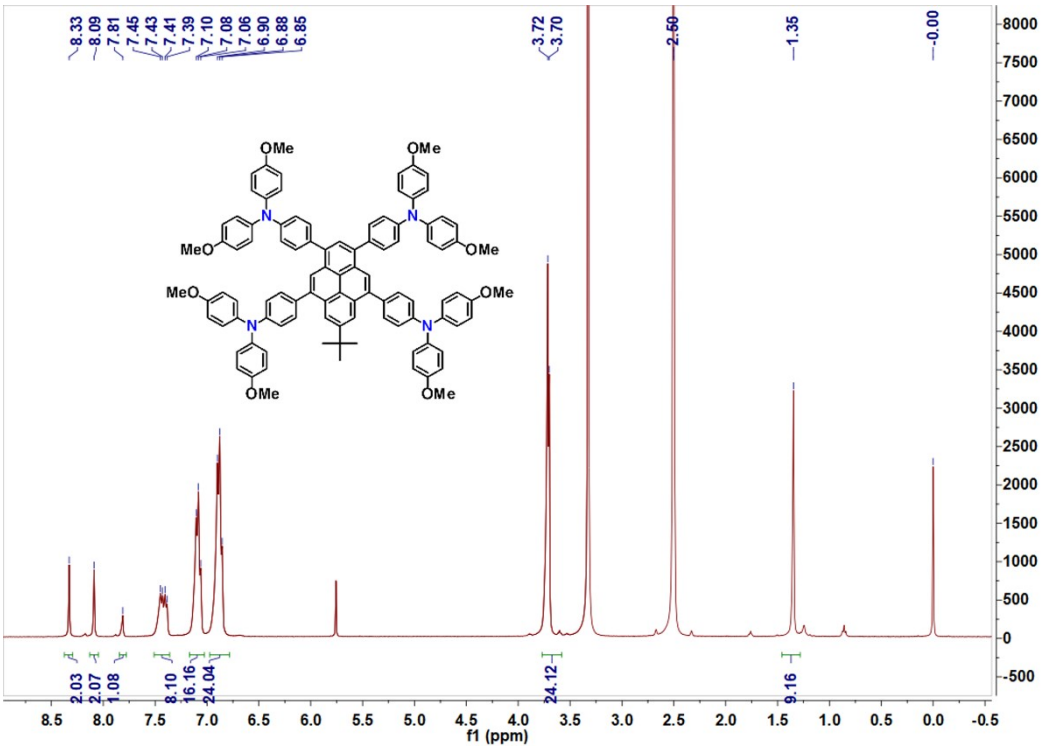


Figure S3 ^{1}H-NMR spectrum (400 MHz, 293 K, DMSO-d*6*) for **2**.

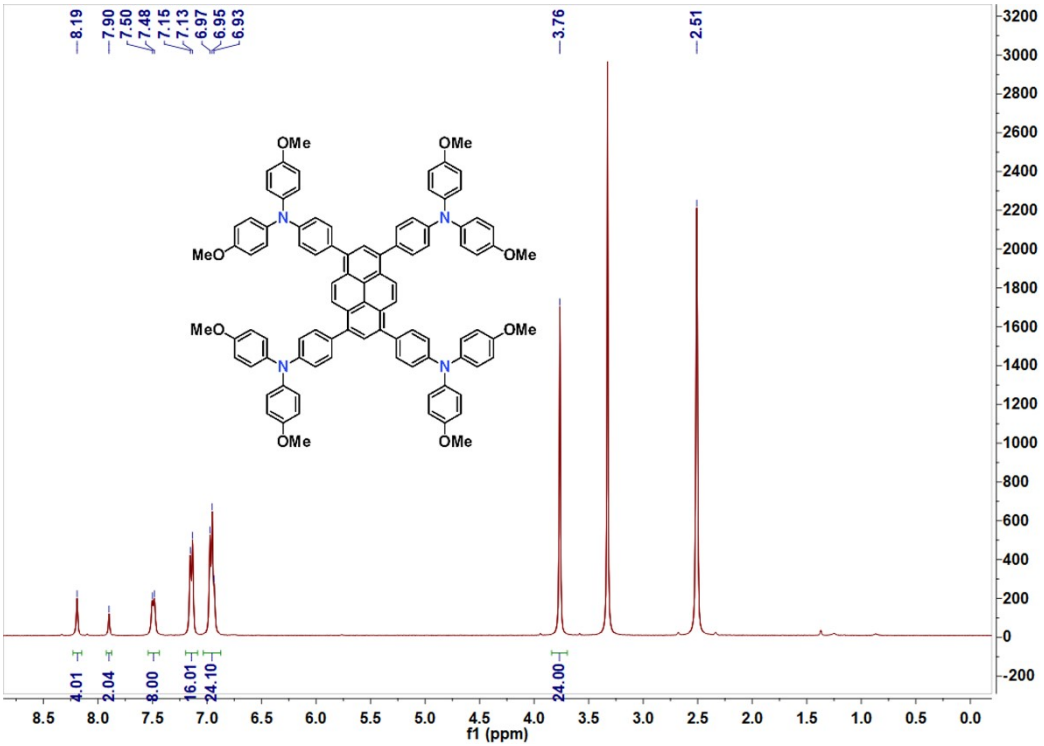


Figure S4 ^{1}H-NMR spectrum (400 MHz, 293 K, DMSO-d*6*) for **3**.

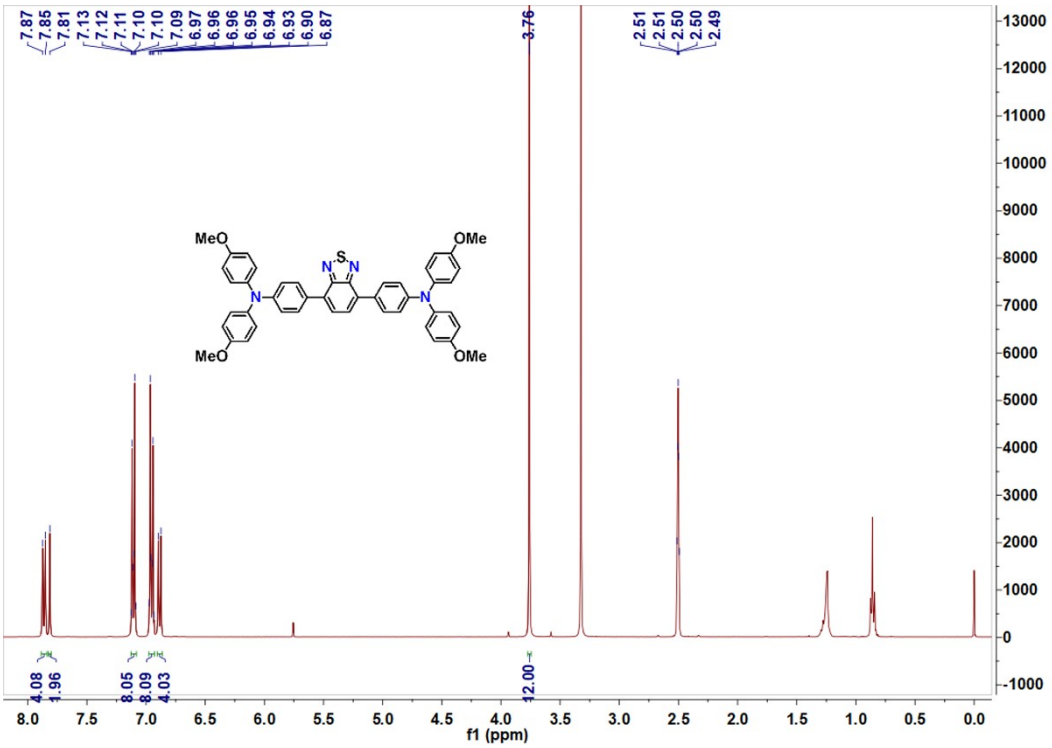


Figure S5 ^{1}H-NMR spectrum (400 MHz, 293 K, DMSO-d*6*) for **4**.

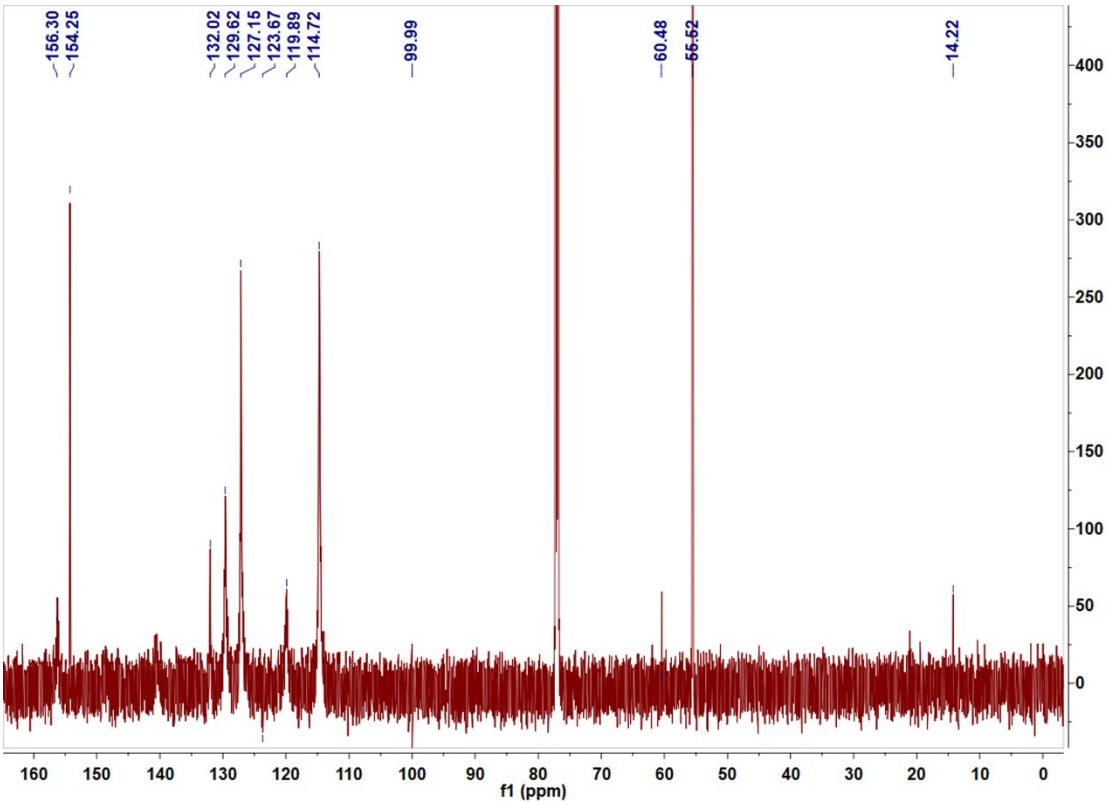


Figure S6 ^{1}H-NMR spectrum (400 MHz, 293 K, DMSO-d*6*) for **4**.

High Resolution Mass Spectrometry (HRMS)

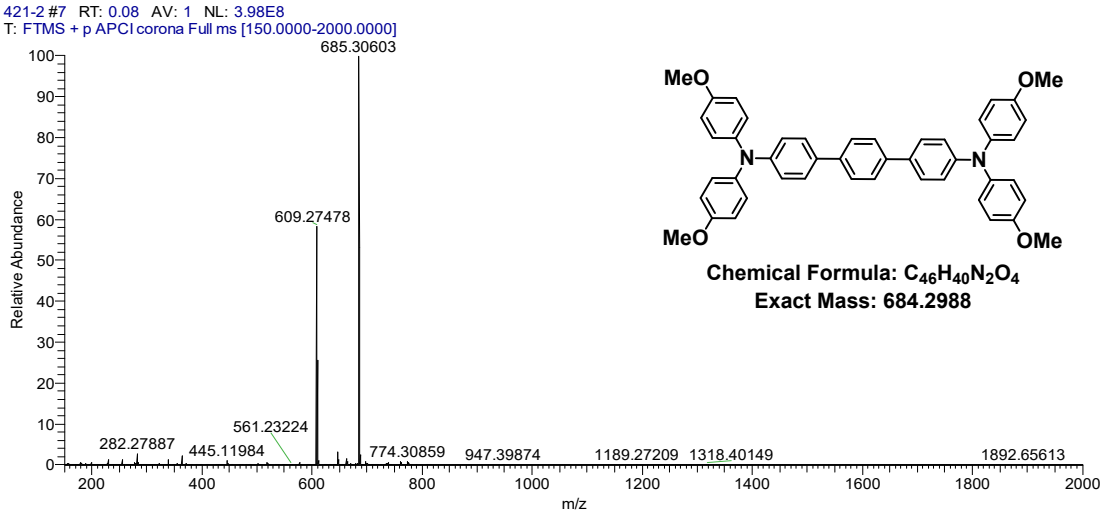


Figure S7 HRMS spectra of **1**.

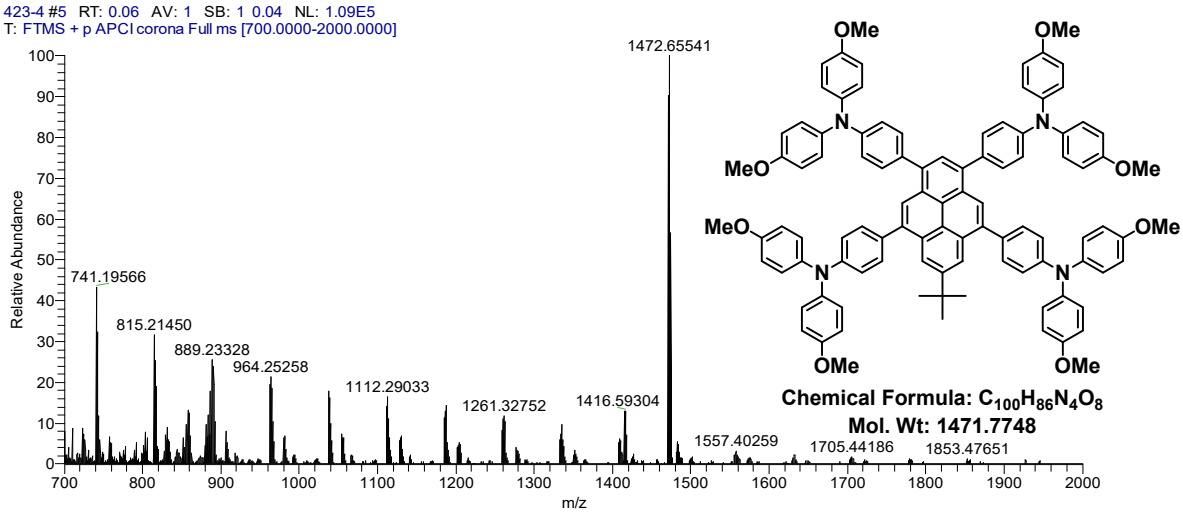


Figure S8 HRMS spectra of **2**.

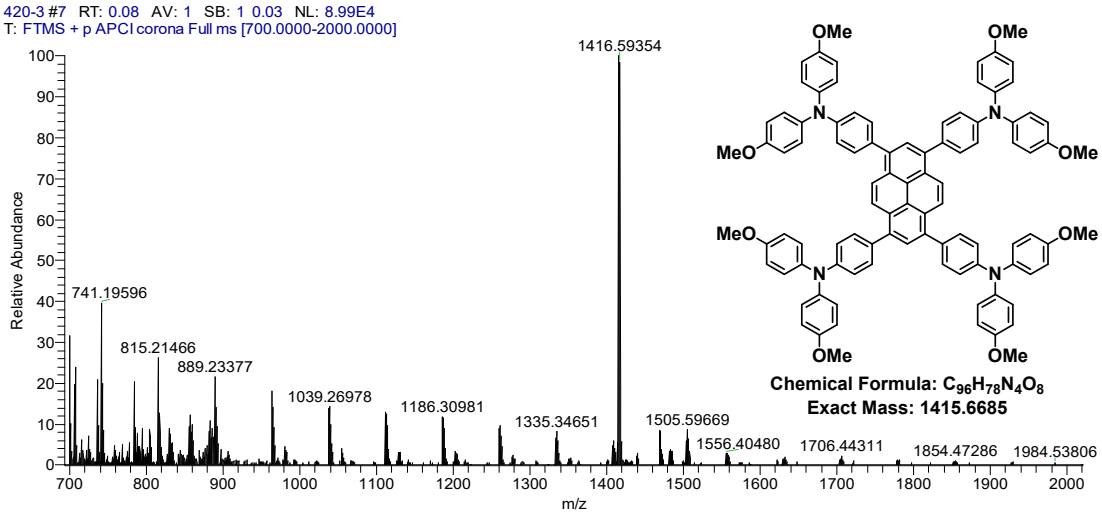


Figure S9 HRMS spectra of **3**.

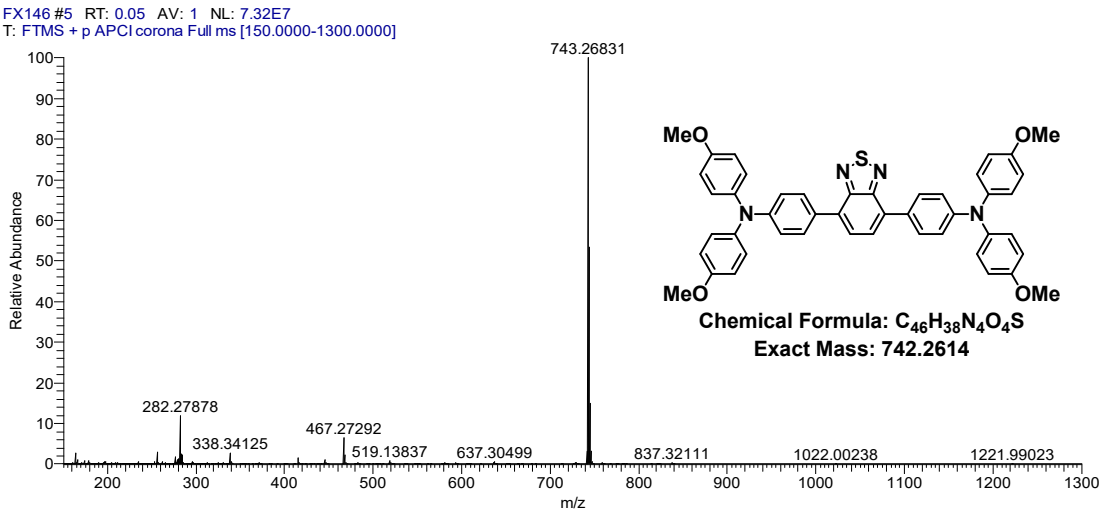


Figure S10 HRMS spectra of **4**.

Thermal Stability

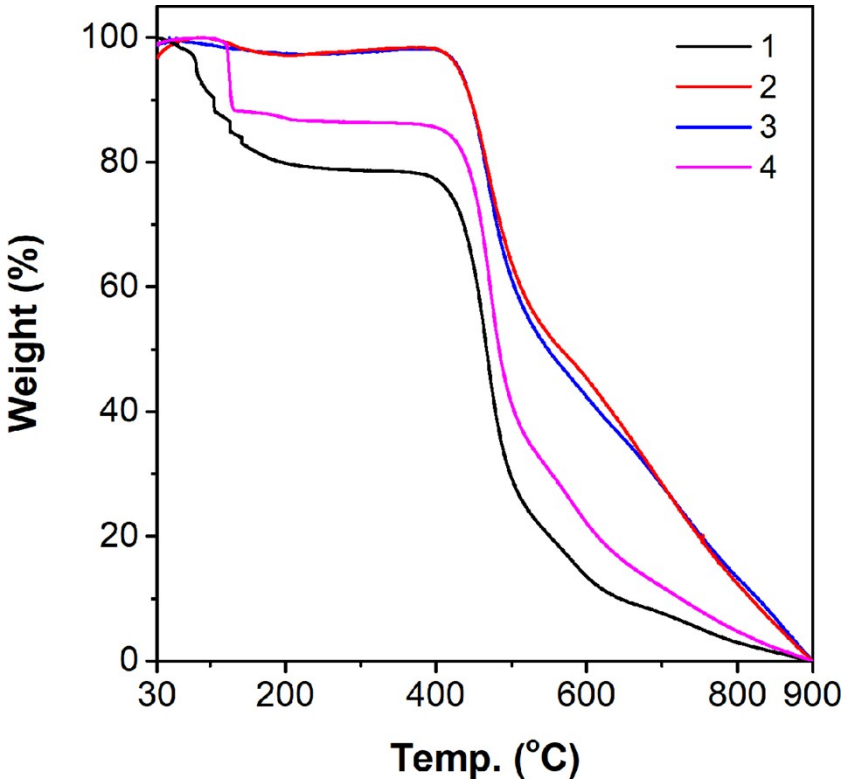


Figure S11 TGA curve of compounds **1-4**.

Photophysical Properties

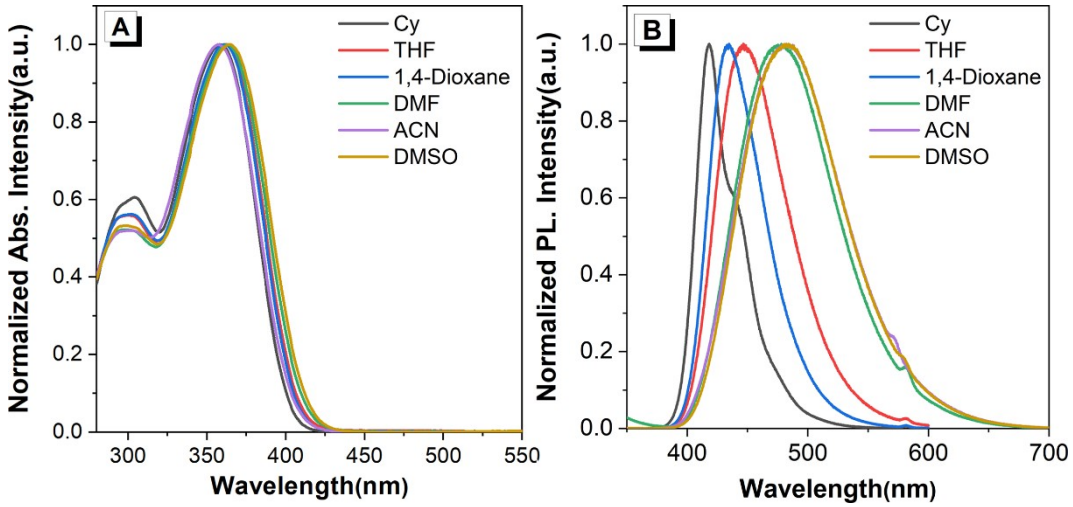


Figure S12 (A) UV-vis and (B) fluorescence spectra of the compound **1** recorded in different solvents at 10^{-5} M and 25 °C.

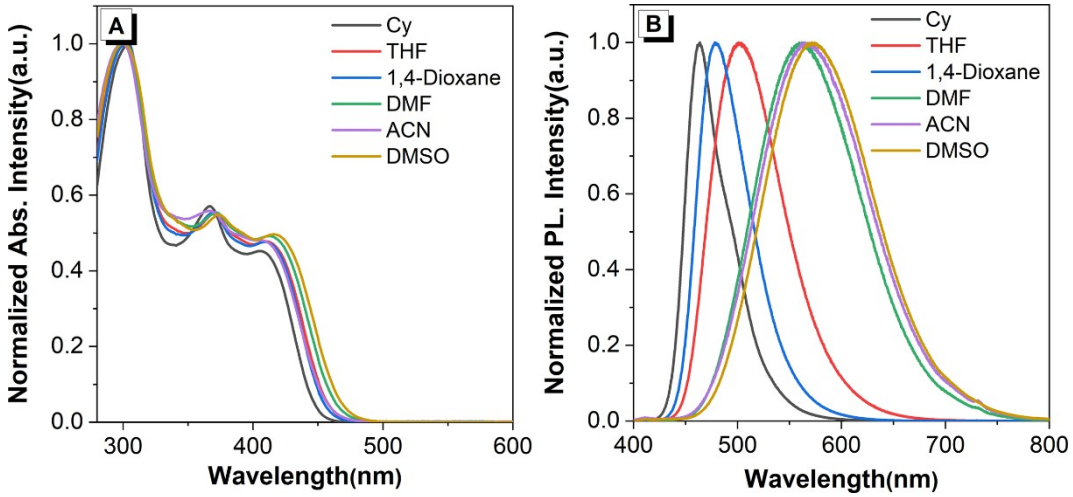


Figure S13 (A) UV-vis and (B) fluorescence spectra of the compound **2** recorded in different solvents at 10^{-5} M and 25 °C.

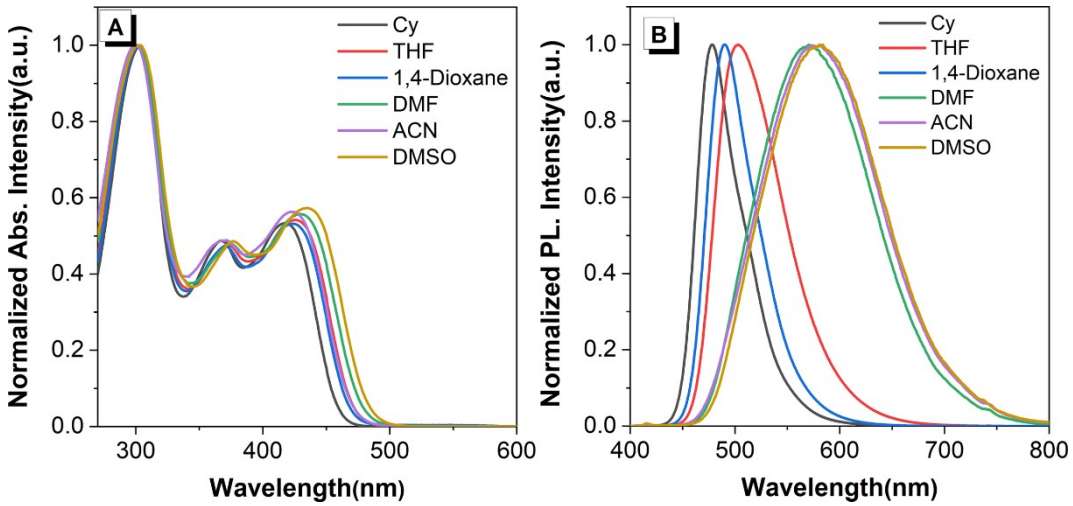


Figure S14 (A) UV-vis and (B) fluorescence spectra of the compound **3** recorded in different solvents at 10^{-5} M and 25 °C.

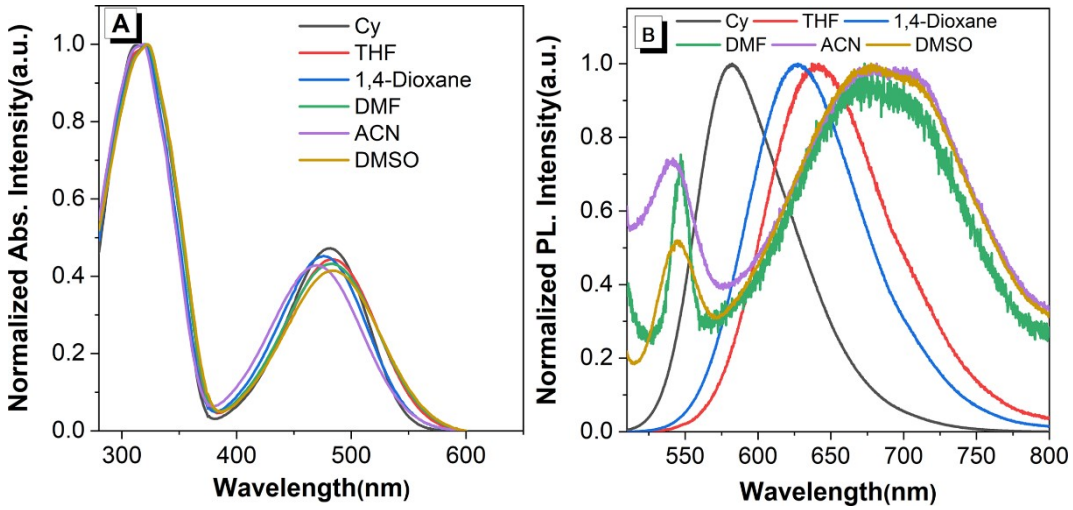


Figure S15 (A) UV-vis and (B) fluorescence spectra of the compound **4** recorded in different solvents at 10^{-5} M and 25 °C.

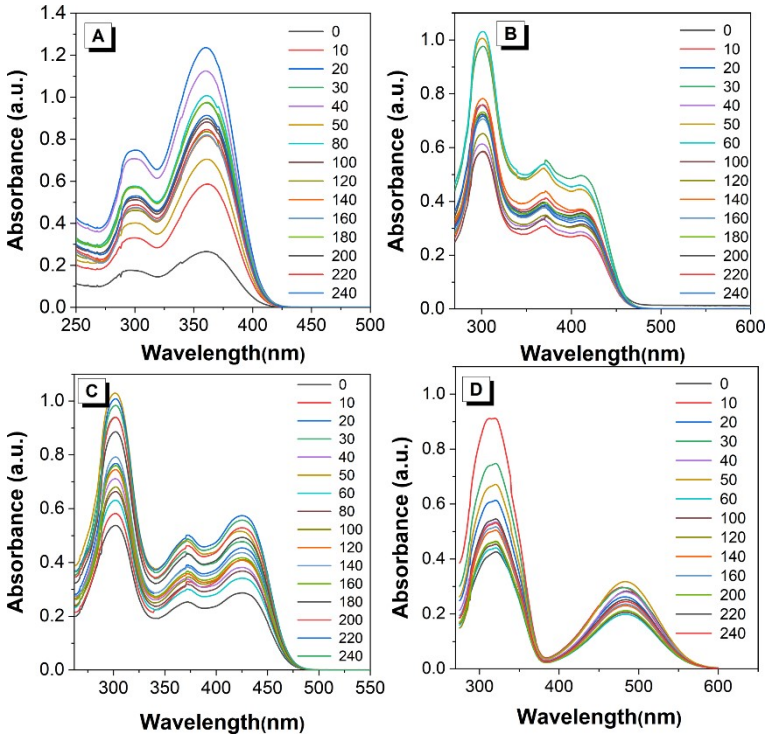


Figure S16 UV-vis spectra of compound **1**-**4** (A-D) in THF under UV light irradiation (λ_{ex} = 365 nm).

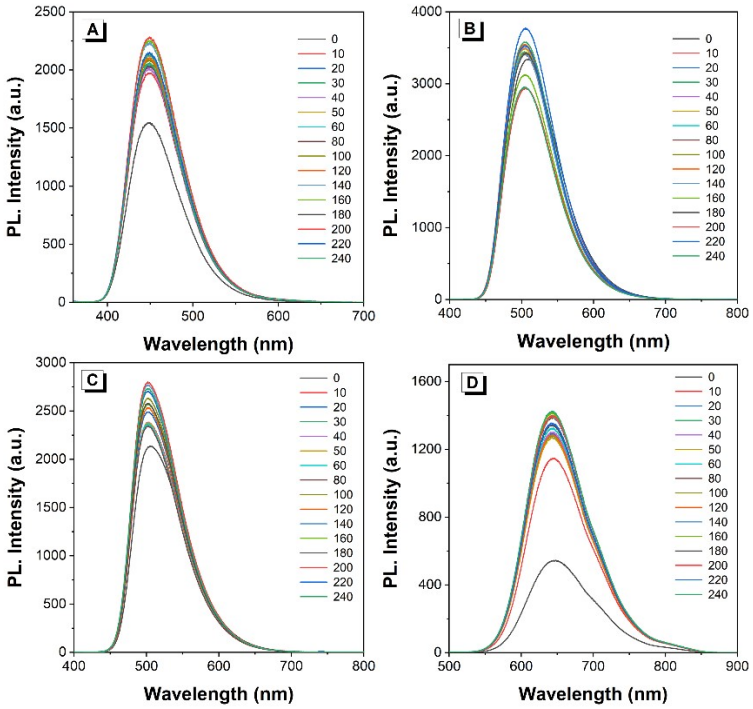


Figure S17 Fluorescence spectra spectra of compound **1-4** (A-D) in THF under UV light irradiation (λ_{ex} = 365 nm).

LED devices

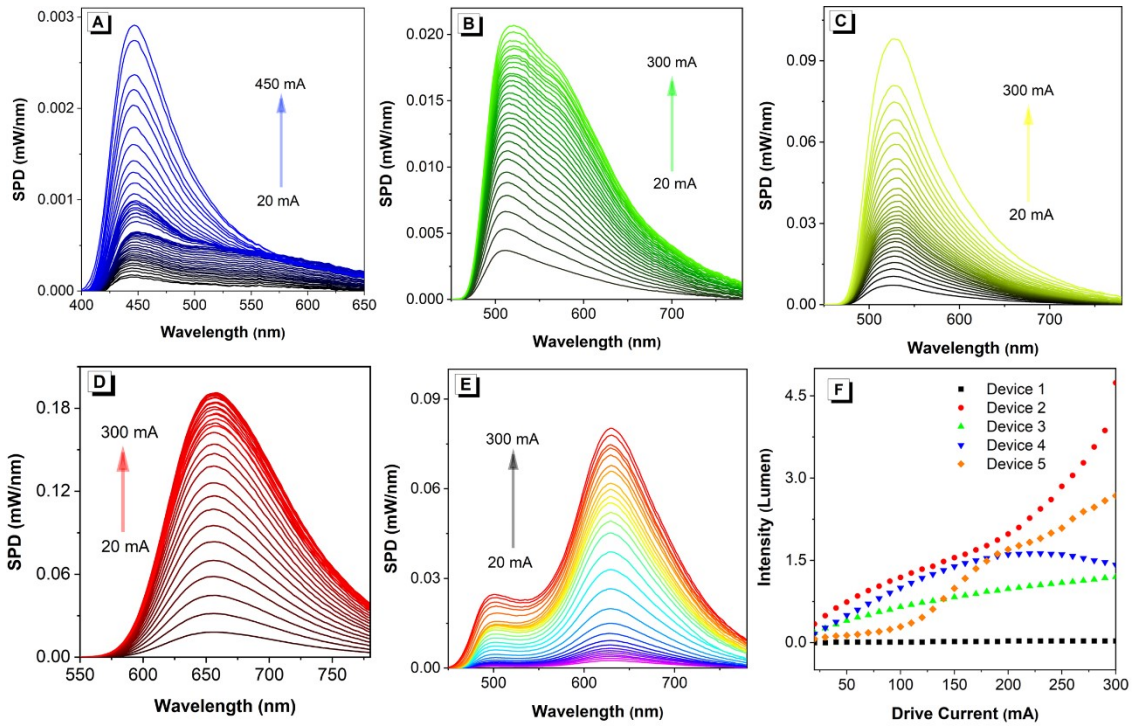


Figure S18 The fluorescence spectra of (A) b-LED 1, (B) g-LED 2 (C) g- LED 3, (D) r- LED 4 and (E) y-LED 5 using compound **1**, compound **2**, compound **3**, compound **4** and mixture of **1** and **4** as emitters, under different drive current, and (F) Luminous flux of Device **1-4** under different drive current.

Intelligent Lighting and Lighting Control System

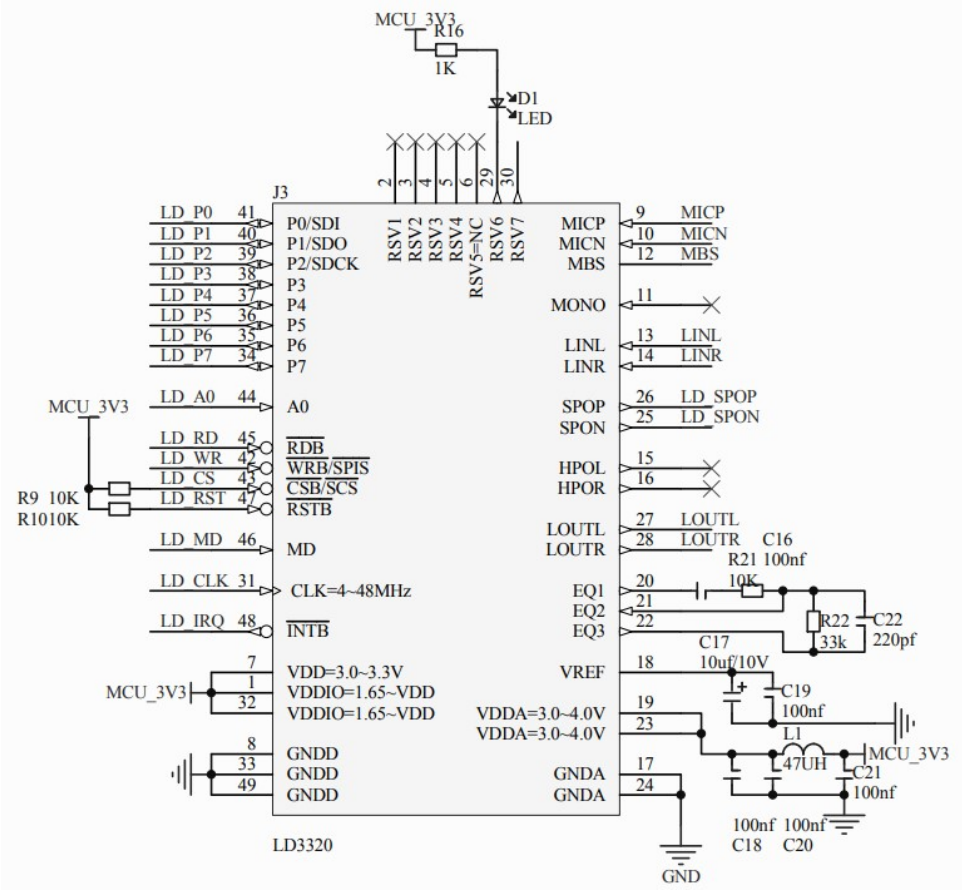


Figure S19 The sound sensor module.

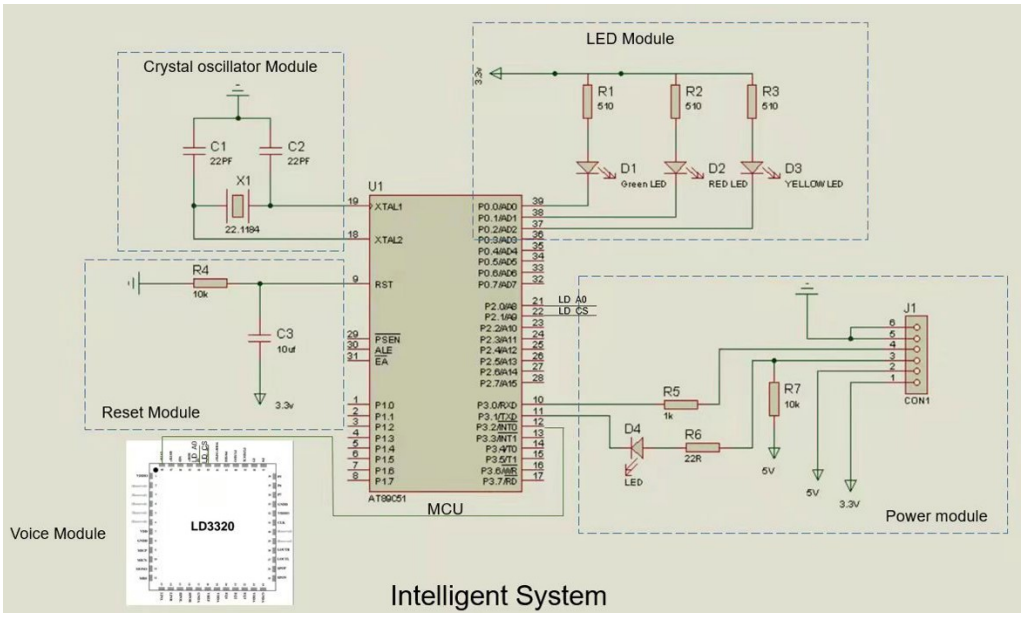


Figure S20 The detail designed intelligent lighting and lighting control system.

Table S1 Summary of crystal data of compound **4**.

Complex	**4**
Empirical formula	$C_{46}H_{38}N_4O_4S$,1.5(C_2H_6O), 0.5(H_2O)
Formula weight	820.97
Crystal system	Monoclinic
Space group	P 1 21/n 1
a[Å]	10.964(5)
b[Å]	22.254(9)
c[Å]	18.198(7)
α[°]	90
β[°]	99.095(14)
γ[°]	90
Volume[Å^3]	4384(3)
F(000)	1736
Z	4
Dcalcd[Mg/m^3]	1.244
temperature [K]	230(2)
Measured reflns	53610
unique reflns	13175
obsd reflns, $I > 2\sigma(I)$	7580
parameters	557
R(int)	0.0544
$R[I > 2\sigma(I)]$[a]	0.0807
wR_2[all data][b]	0.2773
GOF on F^2	1.083
Largest diff map features /e Å^{-3}	1.24, -0.61

[a] Conventional *R* on F_{hkl}: $\Sigma||F_o| - |F_c||/\sigma|F_o|$. [b] Weighted *R* on $|F_{hkl}|^2$: $\Sigma[w(F_o^2 - F_c^2)^2]/\Sigma[w(F_o^2)^2]^{1/2}$

Table S2 Emission spectroscopic data for **1-4** in different solvents at 25 °C.

Comp.	**Cy** λ_{abs} / λ_{em} (nm)	**THF** λ_{abs} / λ_{em} (nm)	**1,4-dioxane** λ_{abs} / λ_{em} (nm)	**DMF** λ_{abs} / λ_{em} (nm)	**ACN** λ_{abs} / λ_{em} (nm)	**DMSO** λ_{abs} / λ_{em} (nm)
1	304,358/418	300,361/445	302,360/433	299,362/472	301,357/483	298,364/481
2	304,405/464	302,409/499	302,409/479	300,412/559	299,409/563	301,415/572
3	303,417/475	302,425/500	302,423/488	301,428/564	299,422/576	302,433/573
4	319,483/582	321,483/637	320,476/627	321,482/673	318,470/681	322,485/677

Table S3 Emission spectroscopic data for **1-4** in different concentration in THF solvents at 25 °C.

Concentration (mol/L)	**1** $\lambda_{max\ em}$ (nm)	**2** $\lambda_{max\ em}$ (nm)	**3** $\lambda_{max\ em}$ (nm)	**4** $\lambda_{max\ em}$ (nm)
10^{-7}	446	497	501	641
10^{-6}	446	502	499	641
10^{-5}	445	501	501	642
10^{-4}	447	506	503	643
10^{-3}	454	504	509	651