Electronic Supplementary Information for

Signal transmission encryption based on dye-doped chiral liquid crystal *via* tunable and efficient circularly polarized luminescence

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S1. Materials and Methods

Materials: Commercial room-temperature liquid crystal, SLC1717, was bought from the Chengzhi Yonghua Display Material Co., Ltd. Chiral dopant, *R*/*S*-811, was bought from the TOKYO Chemical Industry Co., Ltd. The dye of Coumarin 6 was brought from Shanghai Acmec Biochemical Co., Ltd. Common electronic components including Arduino UNO and photoconductor were purchased on Taobao. Optics were bought from Thorlabs, inc.

Instrumentation: UV-vis spectrum were measured on Hitachi U-3900 spectrophotometer. Fluorescence spectrum and stability were recorded on a Zolix Omin-λ500i monochromator with photomultiplier tube PMTH-R 928 using an external laser as the excitation source. The laser was bought from Changchun New Industries Optoelectronics Technology Co., Ltd. CPL spectrum were measured on JASCO CPL-200 spectrophotometers. The polarizing optical microscope images were recorded on Leica DM2700M upright materials microscope. Lifetime measurements were recorded on the NanoLOG-TCSPC(Nanolog) spectrometer using time-correlated single-photon counting. X-ray diffraction (XRD) spectrum were recorded on Rigaku D/Max-2500 X-ray diffractometer (Japan) with Cu/Kα radiation (λ = 1.5406 Å).

Samples Fabrication: The used chiral nematic liquid crystals (N*LC) samples were fabricated by the following steps. First, add the dichloride solution of *R*/*S*-811, SLC1717 and C6 in proportion to a 1 mL centrifuge tube. As for the prepared achiral liquid crystals, *R*/*S*-811 is no need to add. Subsequently, the resulting solution was well mixed by vortex to obtain a uniform solution. After that, the solution was transferred to the substrate and then dichloromethane was evaporated slowly by using a hot stage. Finally, the heating mixture was loaded into the liquid crystal cell by capillary action.

S2. Supplementary Figures

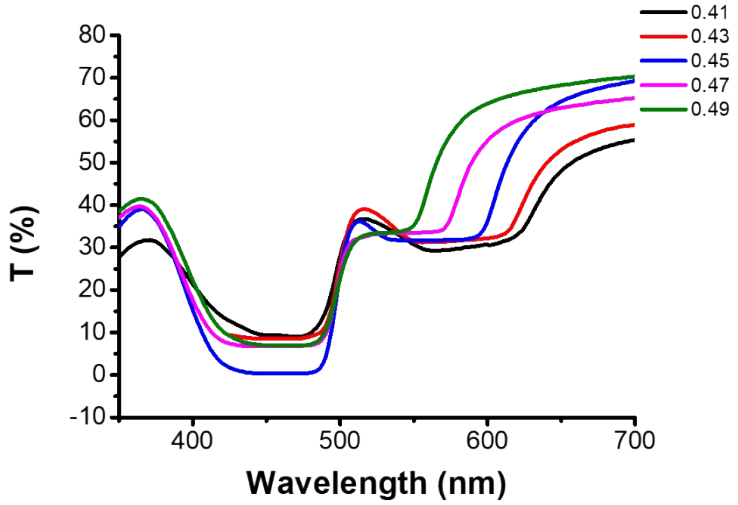

Fig. S1 The transmittances of N*LC with different weight ratios of R811/SLC1717, C6/SLC1717 = 1 wt%. Cell thickness = 29 μm.

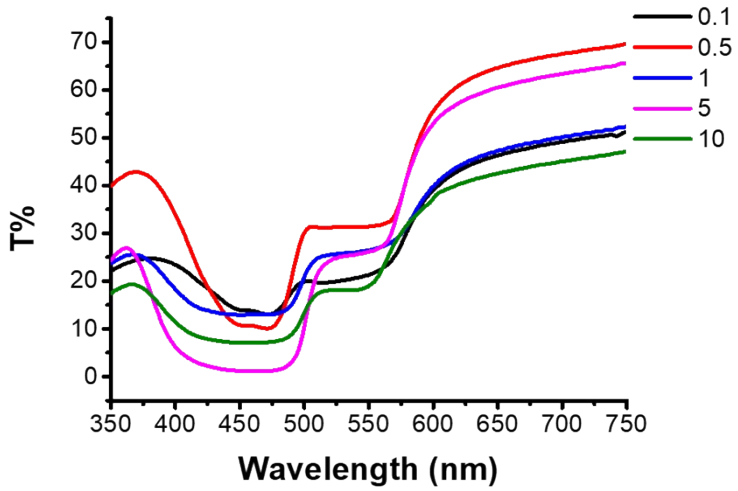

Fig. S2 The transmittances of N*LC with different weight percentage of C6/SLC1717 (wt%), R811/SLC1717 = 47 wt%. Cell thickness = 29 μm.

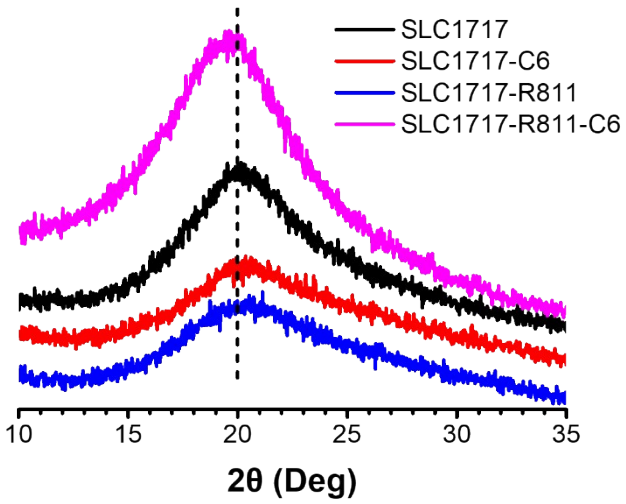

Fig. S3 the XRD spectrum of liquid crystal with various components, C6/SLC1717 = 1 wt% (red line), R811/SLC1717 = 47 wt% (blue line) and the weight ratios C6/R811/SLC1717 = 1/47/100 (purple line).

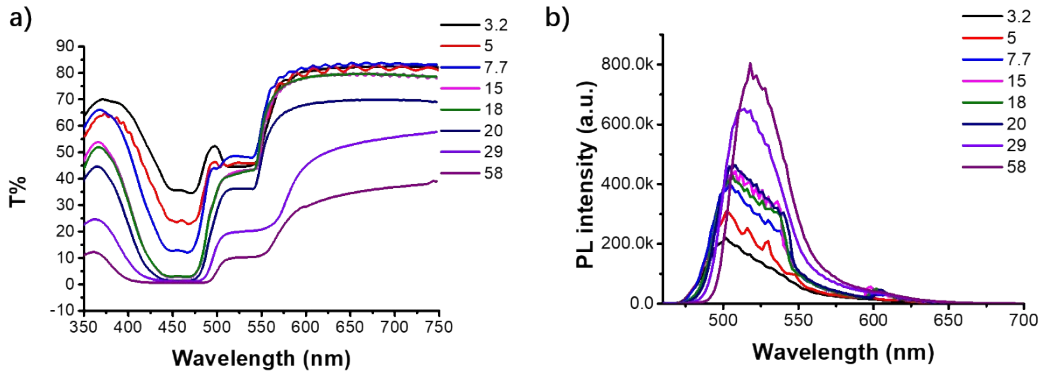

Fig. S4 (a) The transmittances of N*LC in different thickness. (b) the emission spectrum of N*LC in different thickness, excited by 447 nm laser. Unit: μm, the weight ratios C6/R811/SLC1717 = 1/47/100.

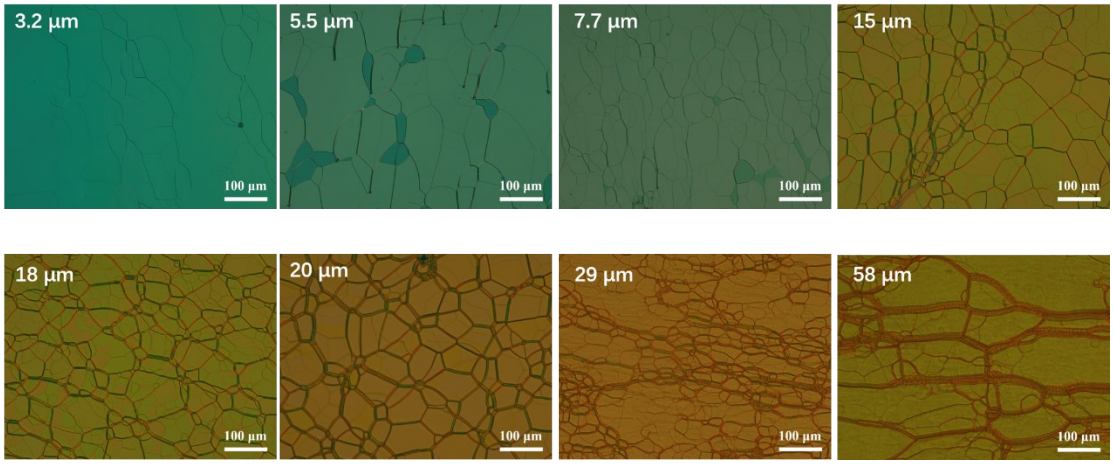

Fig. S5 The polarizing optical microscope images of N*LC in different thickness, the weight ratios C6/R811/SLC1717 =1/47/100.

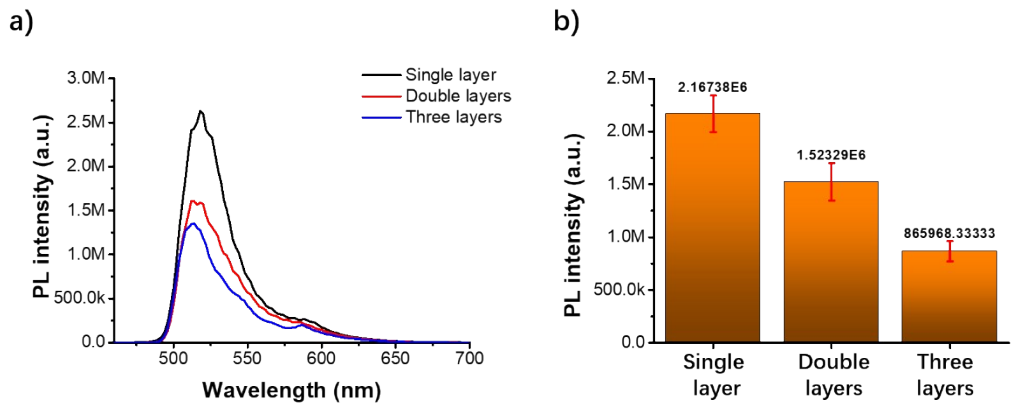

Fig. S6 (a) The emission spectrum and (b) photoluminescence intensity at 524 nm of N*LC in 58 μm cell stilted into single (1*58 μm), double (2*29 μm) and three layers (3*20 μm), respectively. 447 nm laser excitation. The weight ratios C6/R811/SLC1717 = 1/47/100.

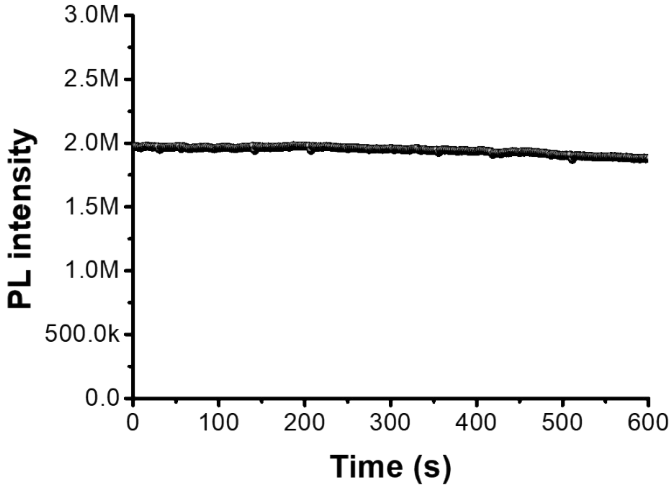

Fig. S7 The stability test of N*LC prepared by the weight ratios C6/R811/SLC1717=1/47/100, under the irritation of 360 nm laser, excitation intensity = 1.27×10^2 mW cm^{-2}.

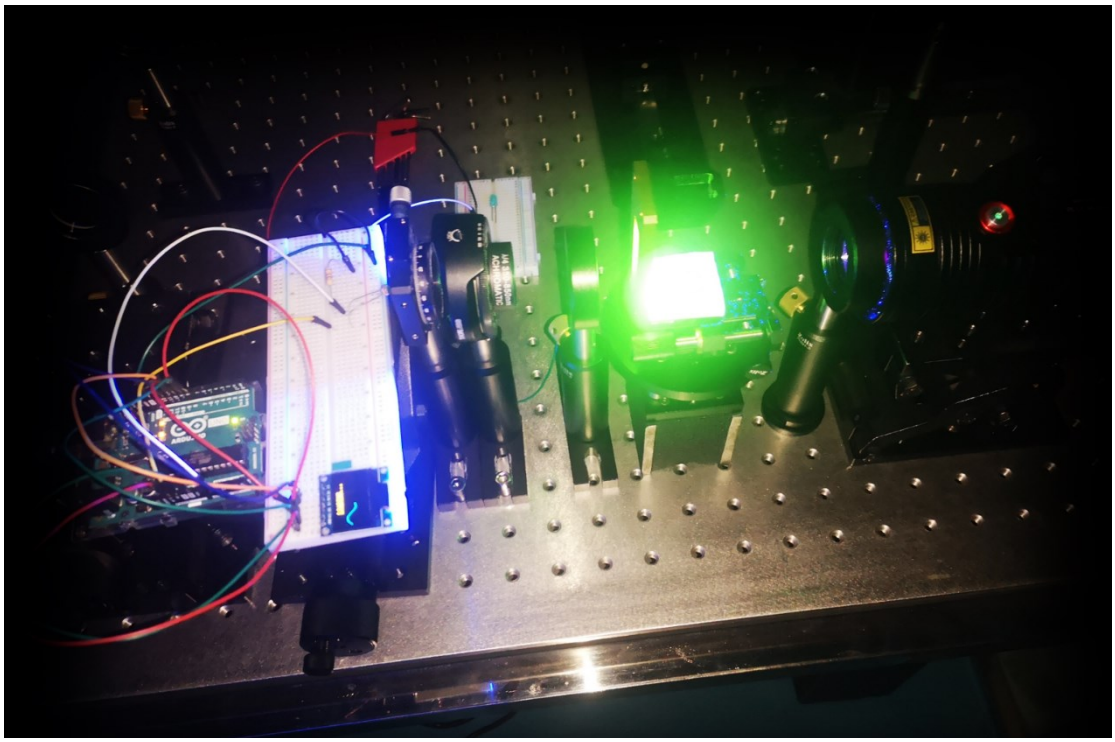

Fig. S8 Photograph of encrypted functional signal generator. From right to left: 365 nm light source, 465 nm short pass, sample, 465 nm long pass, quarter-wave plate, linear polarizer, photoconductor, using Arduino UNO and a OLED screen to modulate and display the signal respectively.

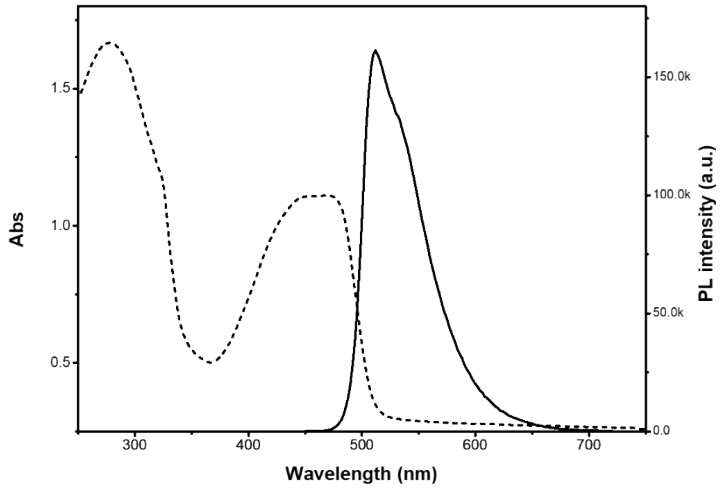

Fig. S9 The absorption of achiral liquid crystal prepared by C6/SLC1717 = 1 wt% (dashed line) with corresponding emission spectrum (solid line), λ_{ex} = 360 nm laser.

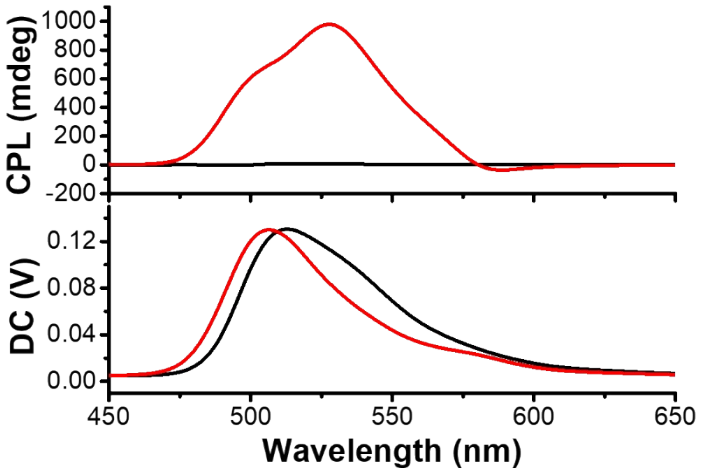

Fig. S10 CPL spectrum of 47 wt% R811 (red line) and no R811 (black line) in SLC1717 with 1 wt% C6 (λ_{ex} = 380 nm).

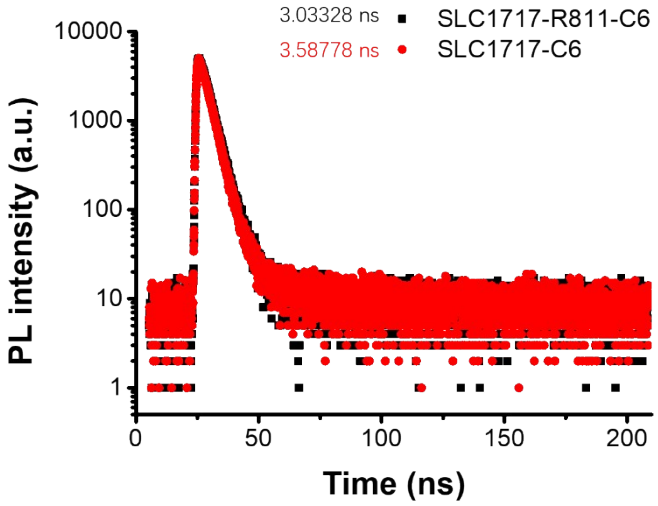

Fig. S11 Time-resolved emission at 510 nm of the 47 wt% R811 (black square) and no R811 (red square) in SLC1717 with 1 wt% C6 (λ_{ex} = 344 nm nanosecond laser).