## Supporting Materials Fluorine Substituted Thiophene-Quinoxaline Copolymer to Reduce HOMO Level and Increase Dielectric Constant for High Open-circuit Voltage Organic Solar Cell

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Figure S5. <sup>1</sup>H NMR spectrum of FTQ.

Figure S6. AFM phase images of blend film with 5 and 30 min annealing (1  $\mu$ m×

1μm).



Scheme 1. Synthesis routine of FTQ

\_\_\_\_\_ 6.81 6.80 1.00 4.00 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 Figure S1. <sup>1</sup>H NMR spectrum of compound 2. 154.16 152.25 109.44 109.35 108.83 108.83 96.78 96.58 77.28 7.6.77 ΝH2 120 150 140 130 110 100 90 80 70 60 50 40 30 20 10 0

Figure S2. <sup>13</sup>C NMR spectrum of compound 2.

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Figure S4. <sup>13</sup>C NMR spectrum of compound 4.





FigureS6. AFM phase images of blend film with 5 min (a) and 30 min (b) annealing (1  $\mu m \times$  1  $\mu m$ ).