Electronic Supplementary Information

Cross-Conjugated Poly(selenylene vinylene)s

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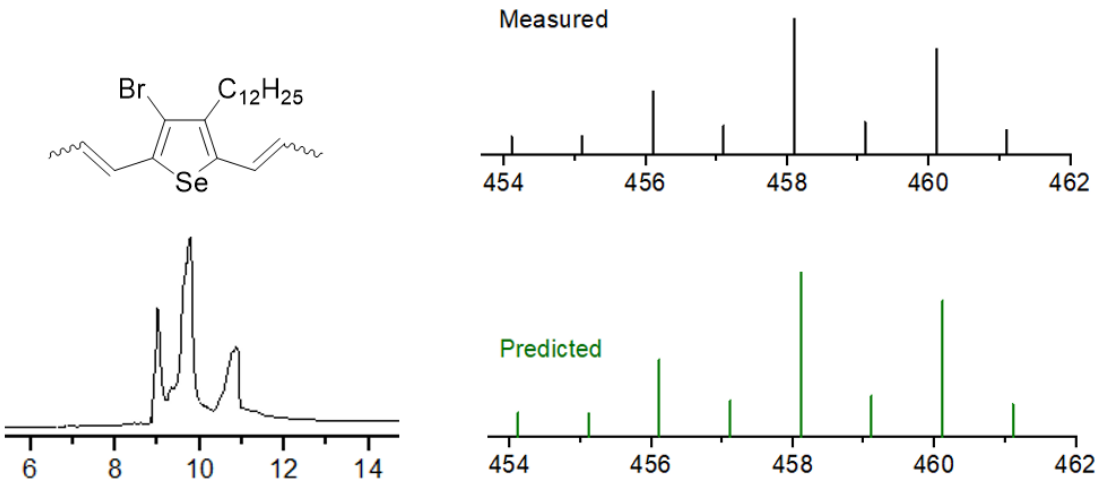

Figure S1. Gas chromatograms (GC, left column), measured isotope patterns of mass spectra of molecular ions (MS, black, right column) and predicted isotope patterns (green) of **SV-Br**.

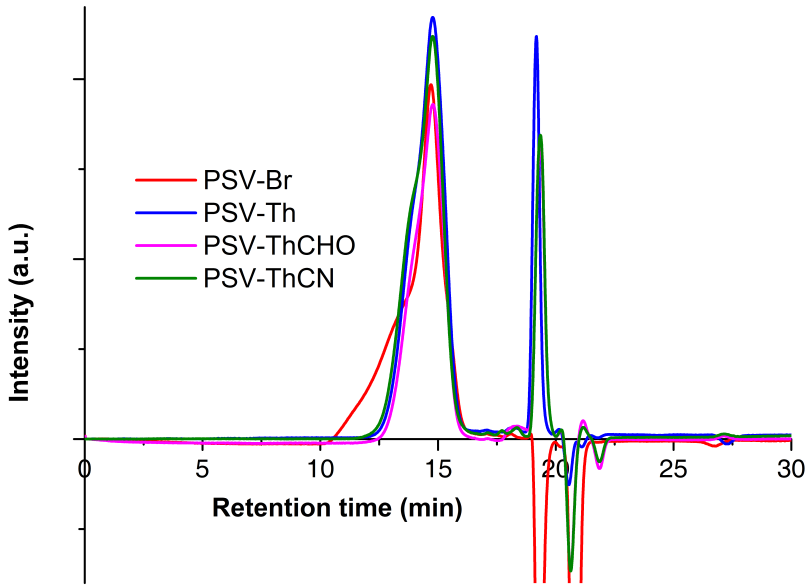

Figure S2. Size exclusion chromatogram (SEC) of **PSV-Br**, **PSV-Th**, **PSV-ThCHO** and **PSV-ThCN** ($CHCl_3$ w/ 0.5% NEt_3, 1 mL/min, RI detector).

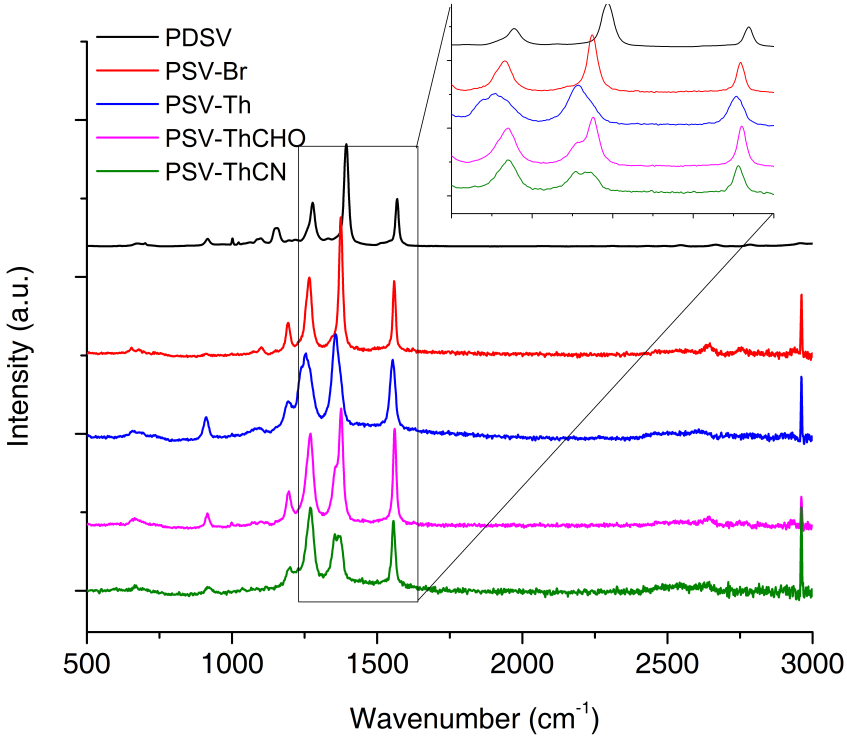

Figure S3. Raman spectra of chlorobenzene solutions of **PSV-H**, **PSV-Br**, **PSV-Th**, **PSV-ThCHO** and **PSV-ThCN**.

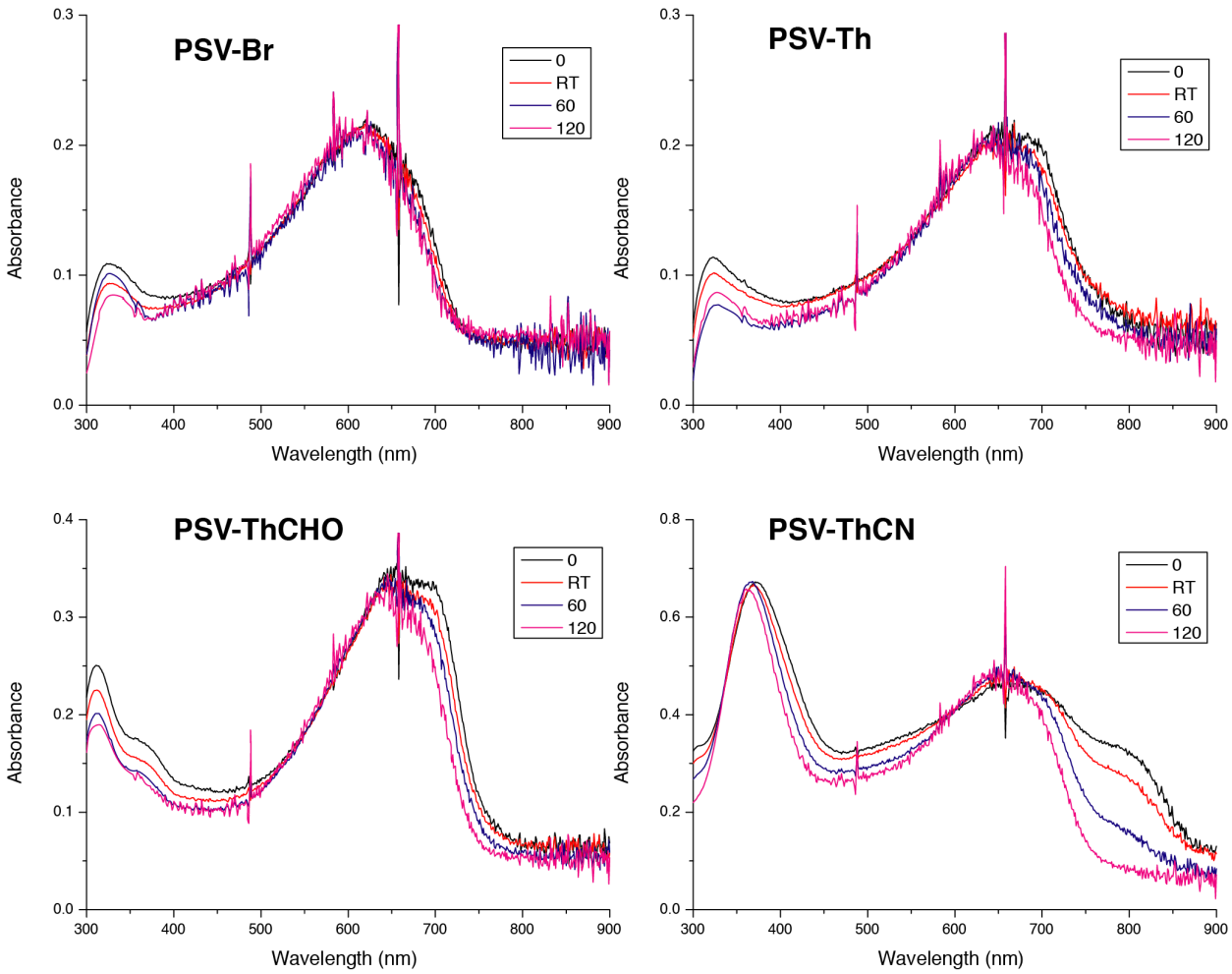

Figure S4. UV-vis absorption spectra of PSV polymers in dilute chlorobenzene solutions (10^{-5} M repeat unit) at 0 °C (black), room temperature (RT, red), 60 °C (blue), and 120 °C (magenta).

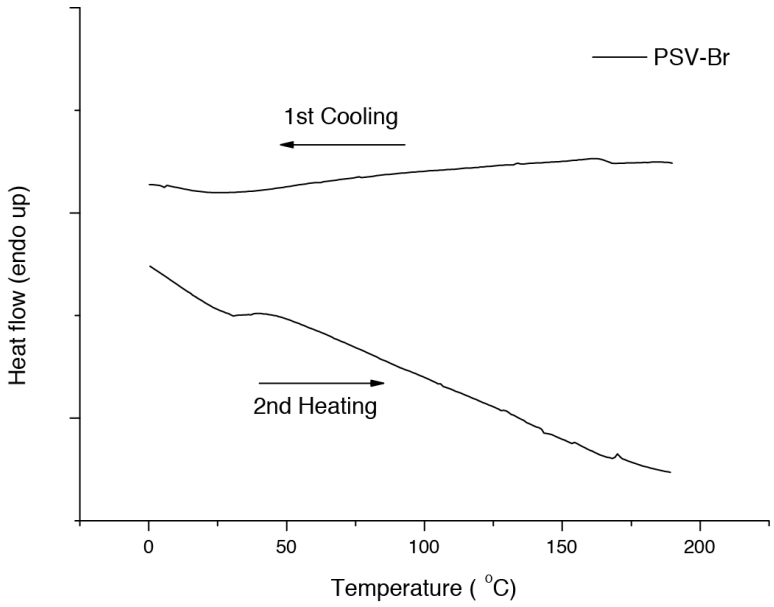

Figure S5. Differential scanning calorimetry (DSC) histogram of **PSV-Br** (2 °C/min).

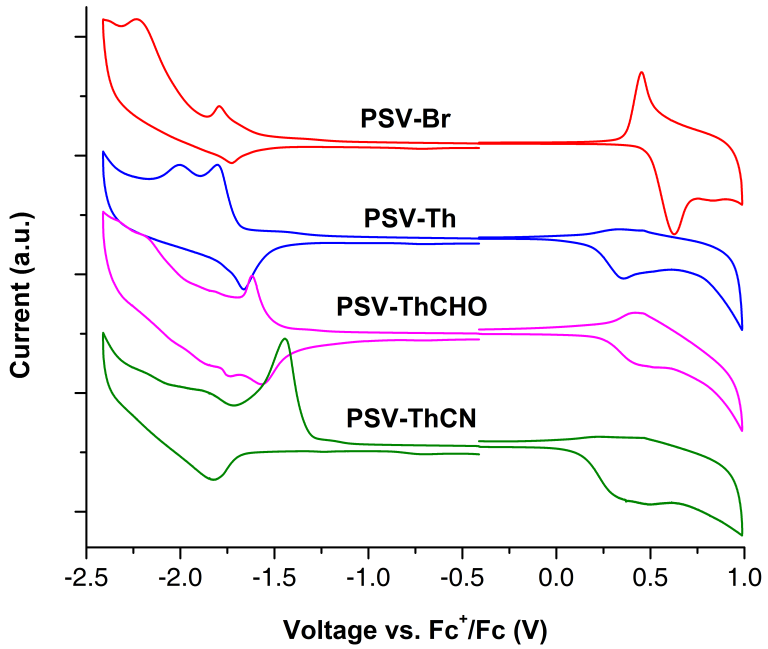

Figure S6. Cyclic voltammograms (CV) of thin films of **PSV-Br**, **PSV-Th**, **PSV-ThCHO** and **PSV-ThCN** deposited onto the glassy carbon working electrodes (supporting electrolytes: 0.1 M Bu_4NPF_6 in acetonitrile, scan rate: 100 mV/s).

Table S1. Optimized OSC Device Performances Employing PSV Polymers.[a]

	PSVs:PCBM[b]	V_{oc}[c]	J_{sc}[d]	*FF*[e]	*PCE (%)*	R_{sh} (Ω cm^2)	R_s (Ω cm^2)
PSV-Br	1:3	0.73±0 (0.73)	2.94±0.21 (3.30)	0.58±0.014 (0.60)	1.25±0.063 (1.36)	1976.3±218.0 (2227.2)	14.9±3.23 (18.9)
PSV-Th	1:3	0.53±0.005 (0.54)	1.96±0.26 (2.41)	0.42±0.004 (0.43)	0.44±0.06 (0.55)	633.06±180.6 (896.9)	32.58±3.23 (37.3)
PSV-ThCHO	1:4	0.66±0.004 (0.66)	1.84±0.25 (2.16)	0.34±0.008 (0.35)	0.41±0.06 (0.48)	119.10±17.3 (134.1)	11.60±1.31 (13.4)
PSV-ThCN	1:3	0.64±0 (0.64)	2.11±0.16 (2.32)	0.55±0.012 (0.56)	0.74±0.07 (0.83)	1054.4±104.1 (1153.2)	8.42±0.99 (9.6)

[a] Average numbers and standard deviations from at least five devices under optimized conditions are given. Highest parameter numbers are given in parentheses. [b] Weight ratio. [c] Open circuit voltage. [d] Short circuit current. [e] Fill factor.

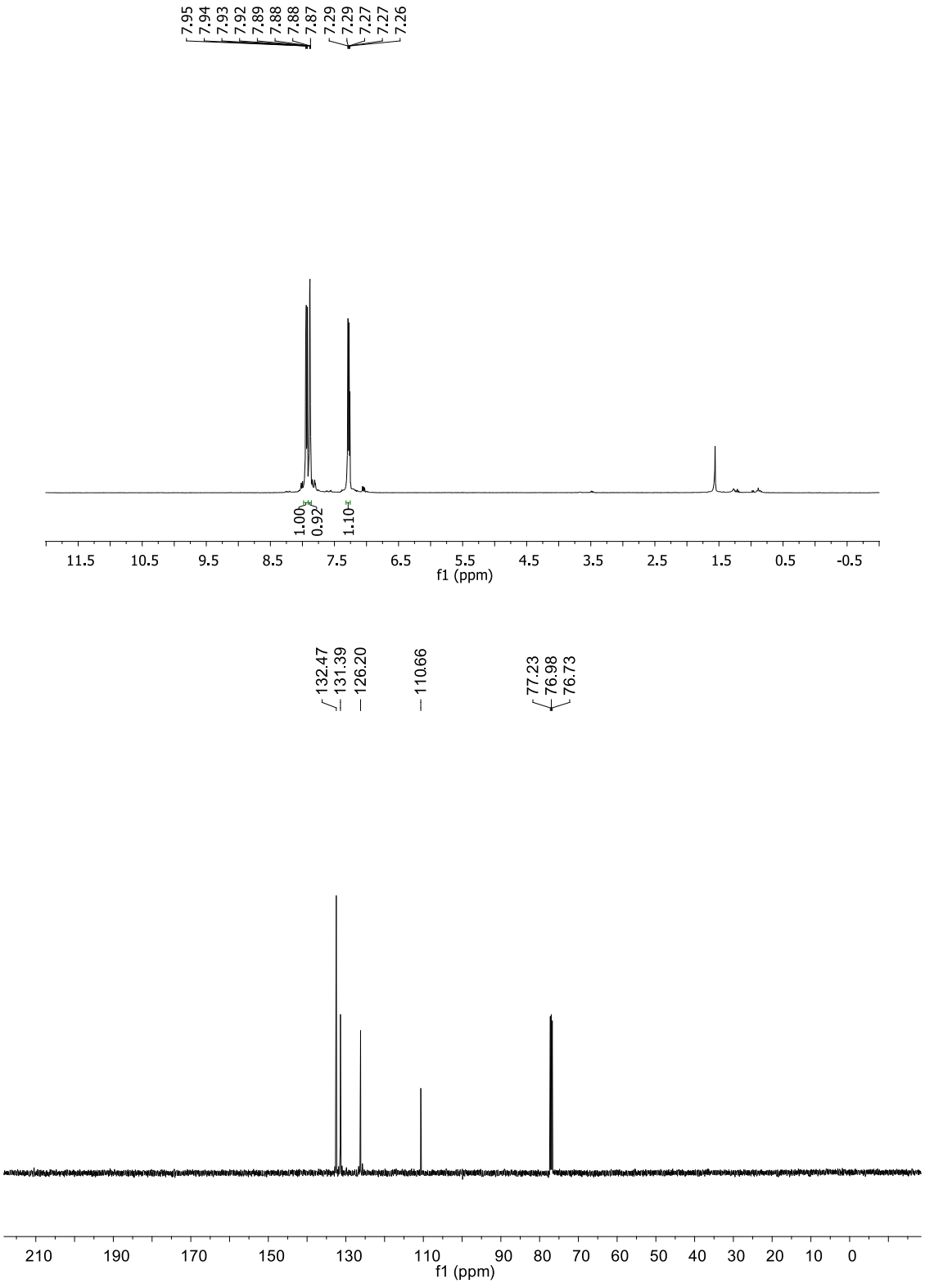

Figure S7. ^{1}H NMR and C^{13} NMR spectra of 3-bromoselenophene (**1**).

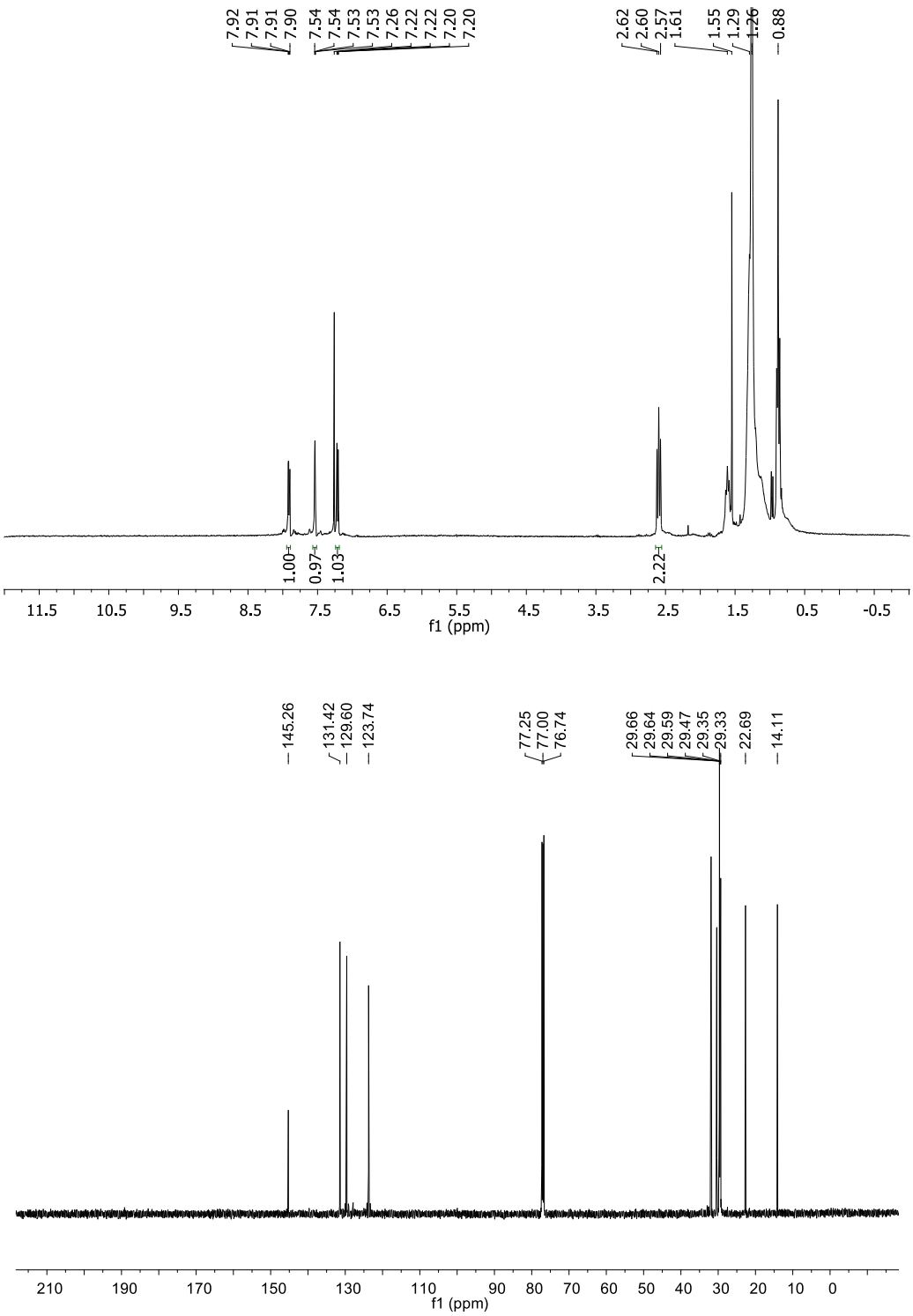

Figure S8. ^{1}H NMR and C^{13} NMR spectra of 3-dodecylselenophene (**2**).

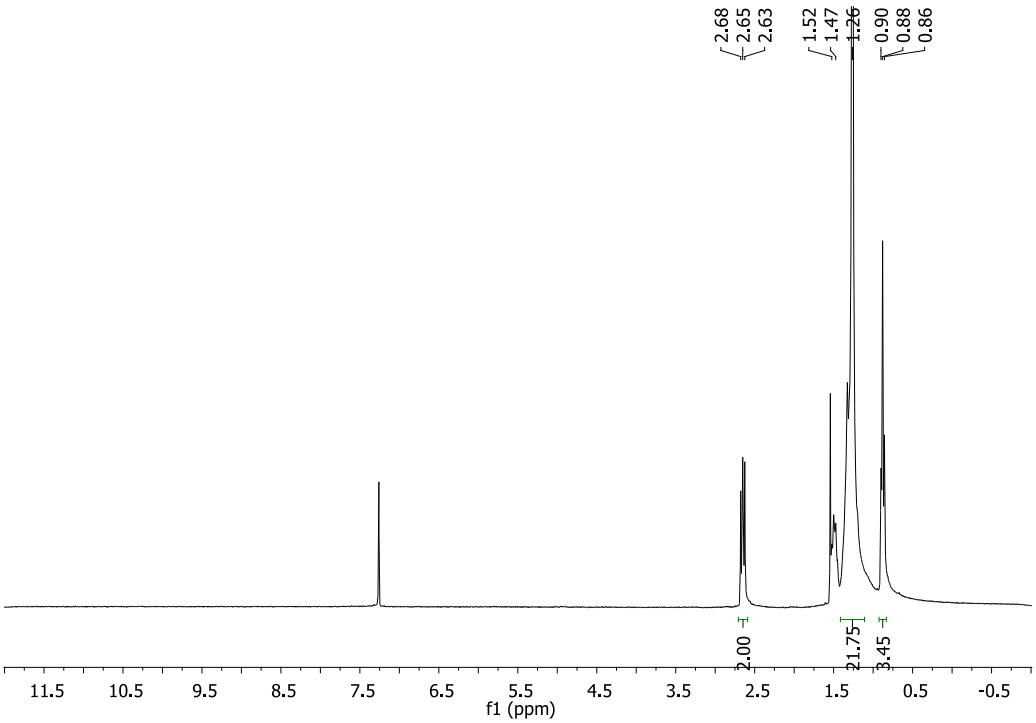

Figure S9. ^{1}H NMR spectrum of 2, 3, 5-tribromo-4-dodecylselenophene (**3**).

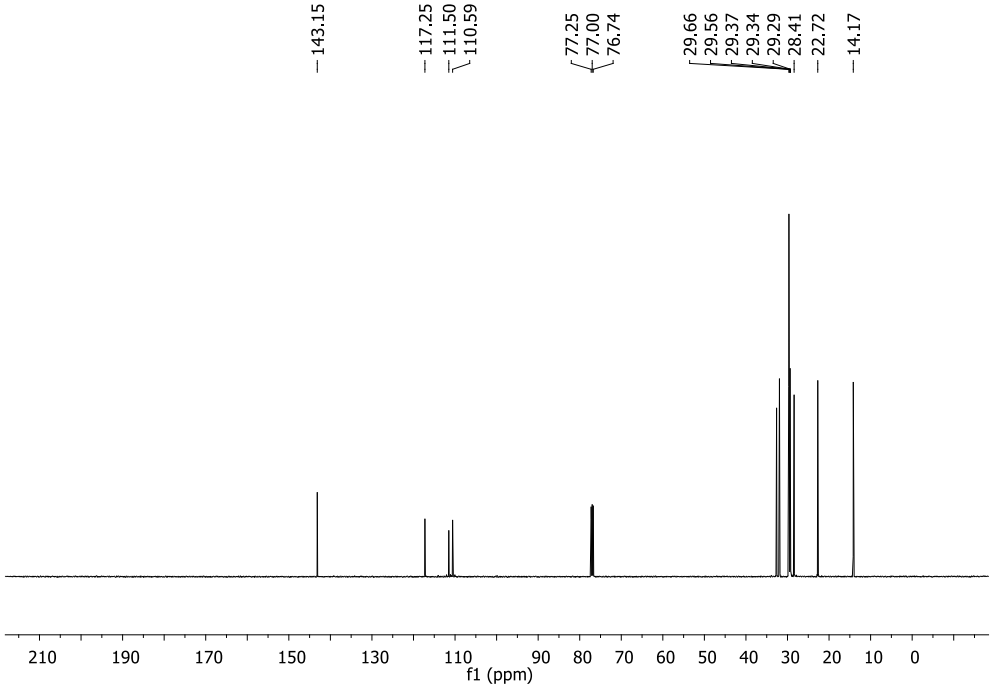

Figure S10. ^{13}C NMR spectrum of 2, 3, 5-tribromo-4-dodecylselenophene (**3**).

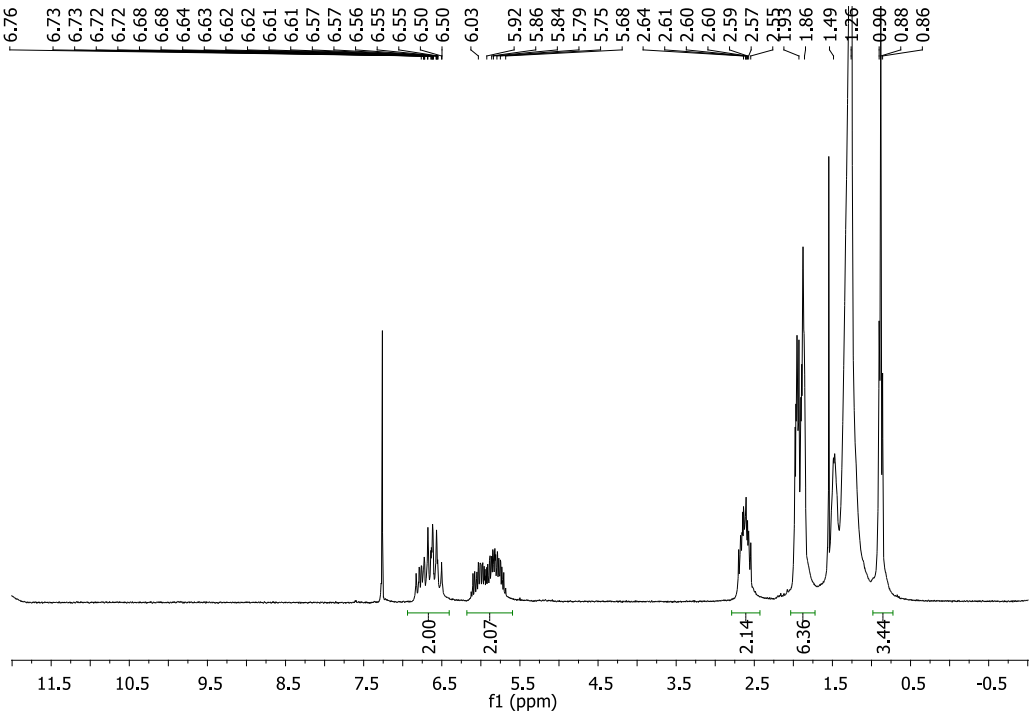

Figure S11. ^{1}H NMR spectrum of 3-bromo-4-dodecyl-2,5-dipropenylselenophene (**SV-Br**).

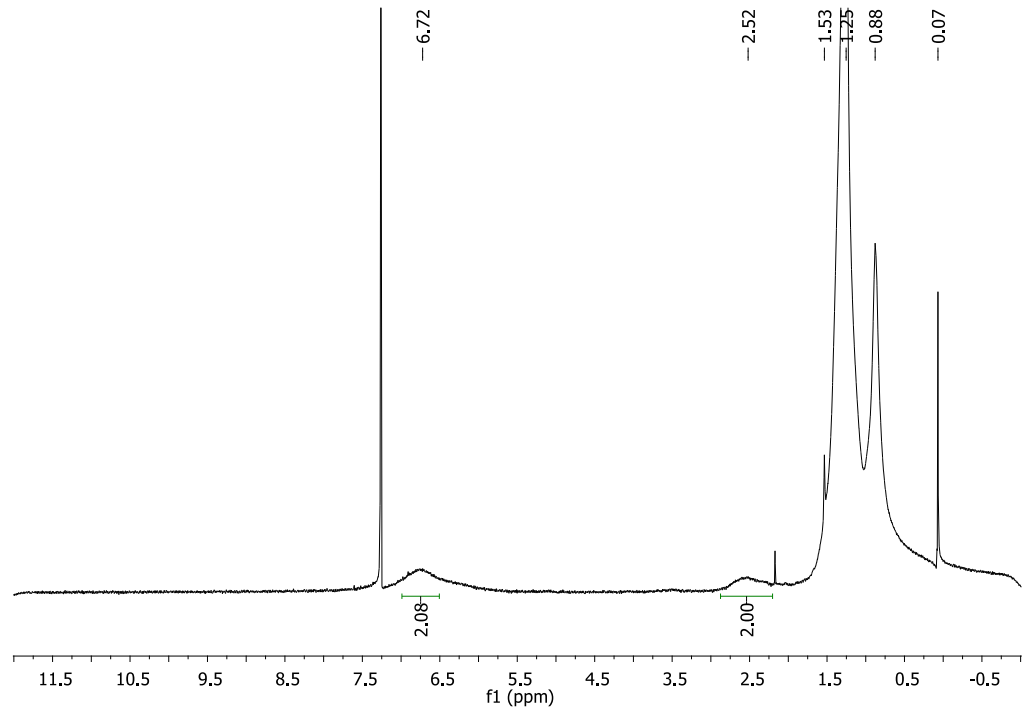

Figure S12. ^{1}H NMR spectrum of **PSV-Br**.

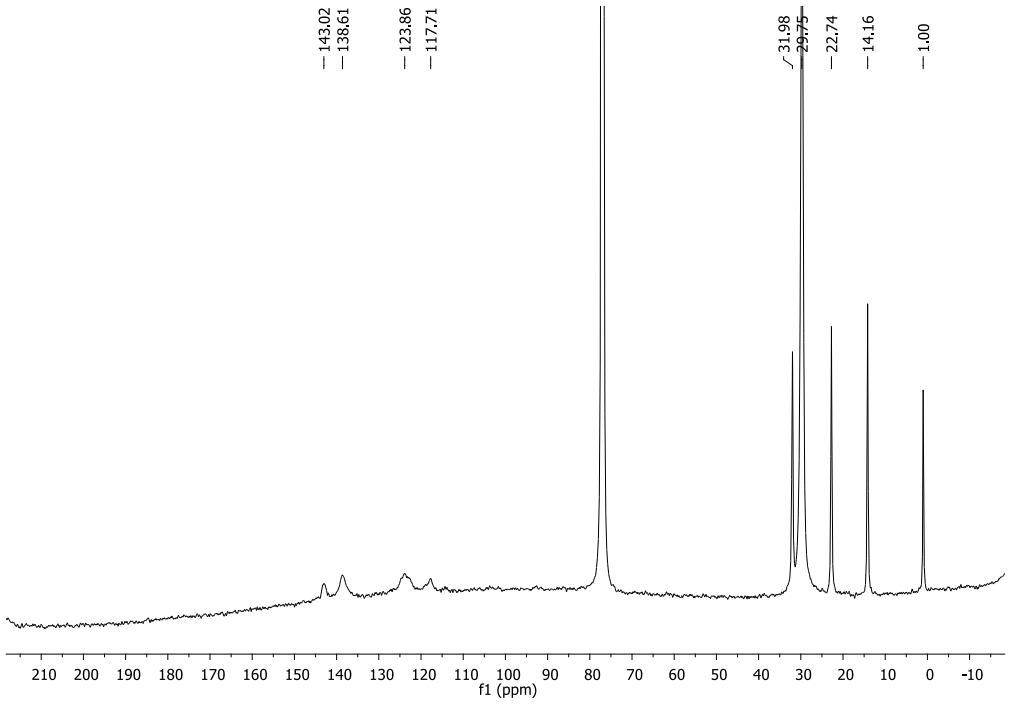

Figure S13. ^{13}C NMR spectrum of **PSV-Br**.

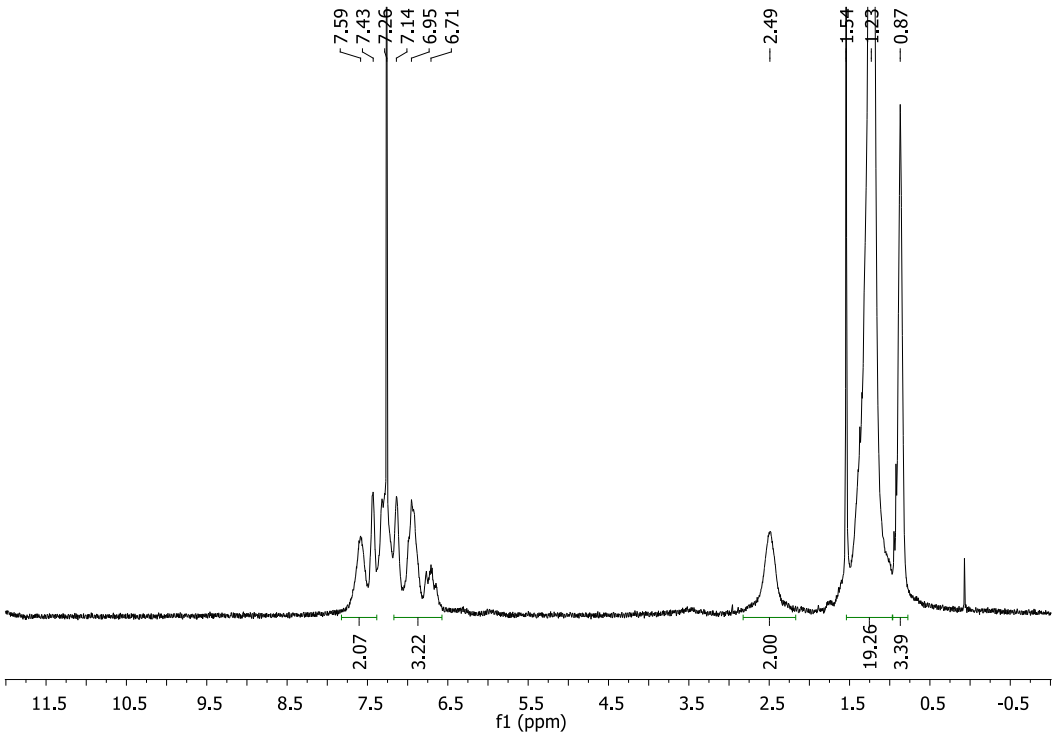

Figure S14. ^{1}H NMR spectrum of **PSV-Th**.

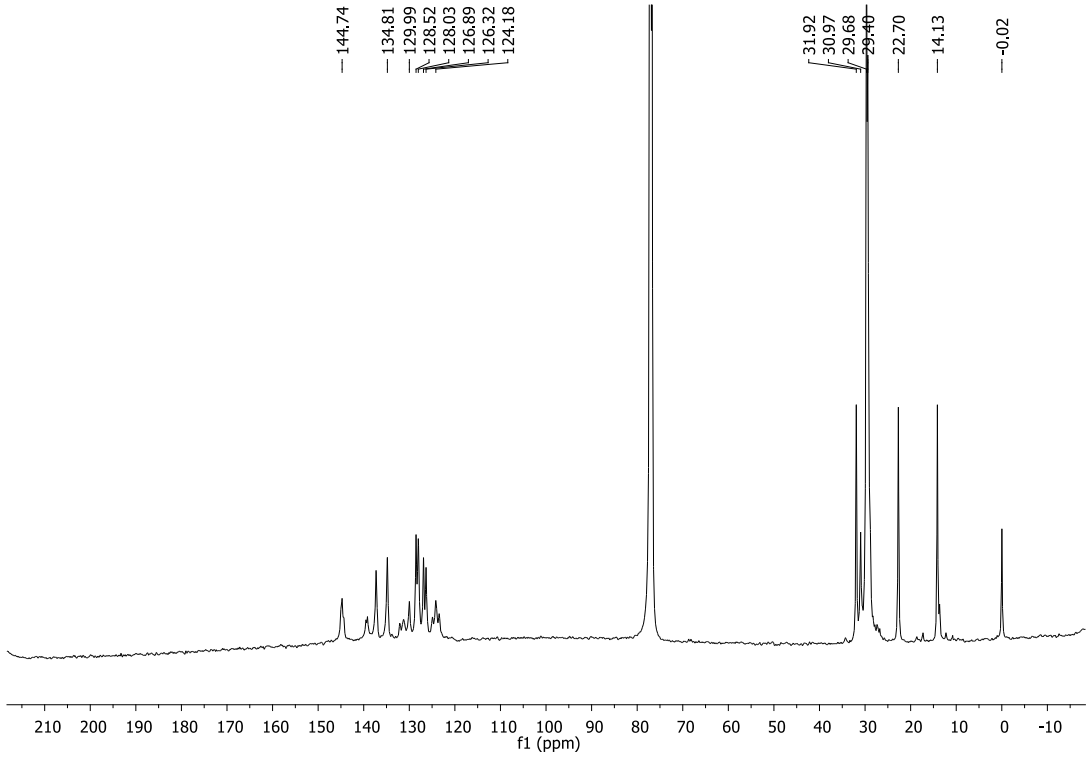

Figure S15. ^{13}C NMR spectrum of **PSV-Th**.

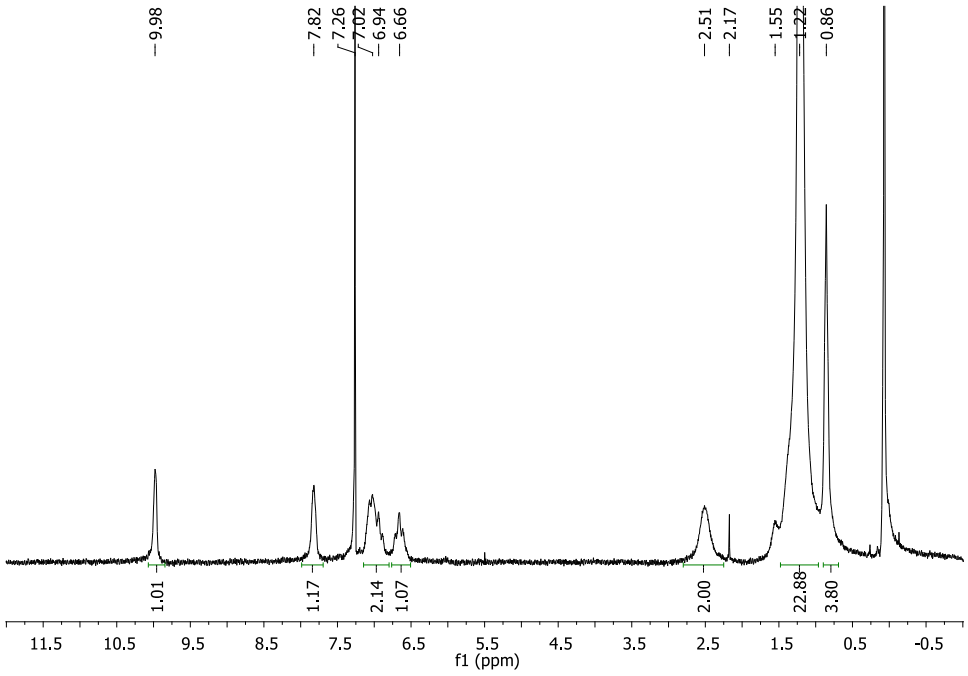

Figure S16. ^{1}H NMR spectrum of **PSV-ThCHO**.

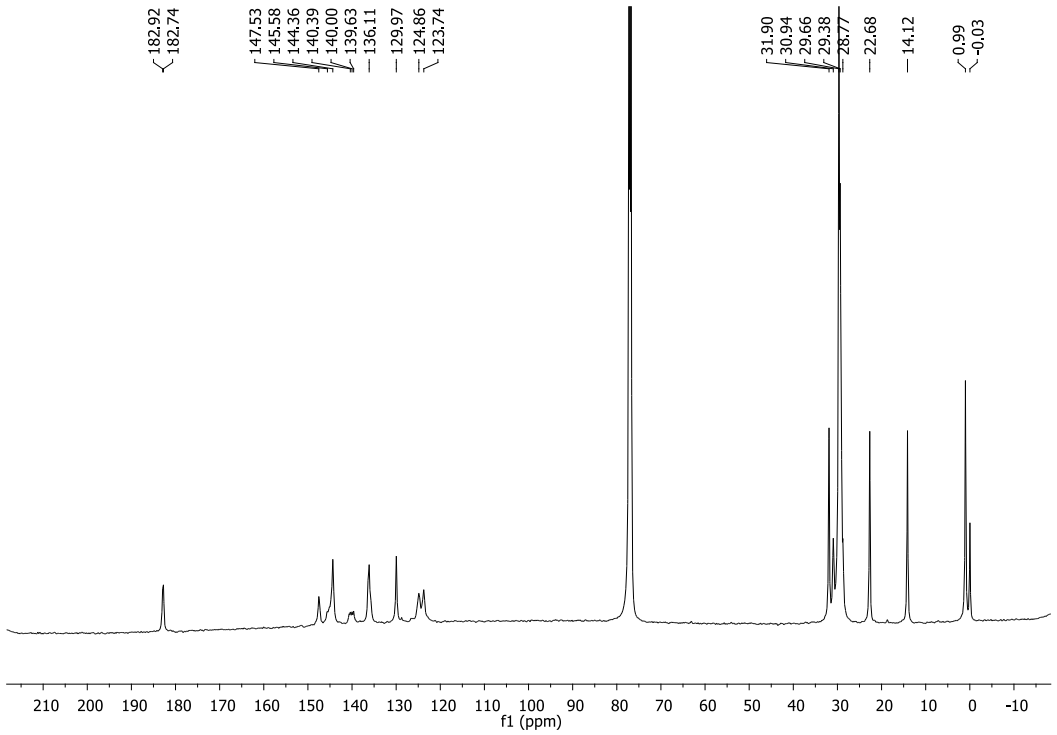

Figure S17. ^{13}C NMR spectrum of **PSV-ThCHO**.

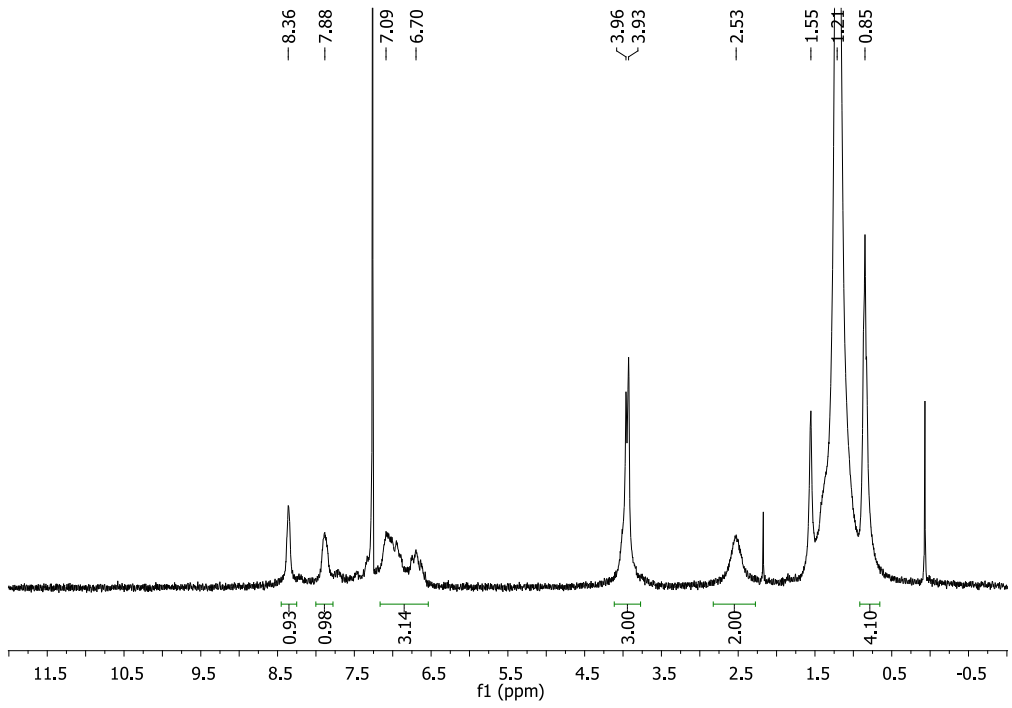

Figure S18. ^{1}H NMR spectrum of **PSV-ThCN**.

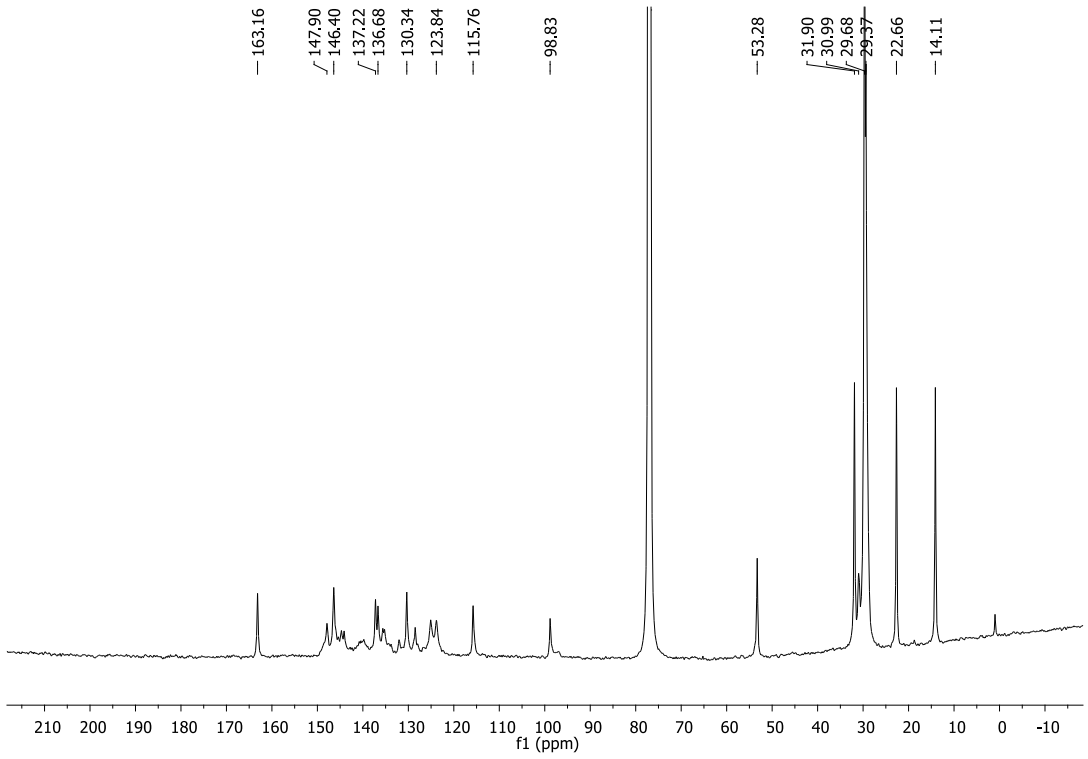

Figure S19. ^{13}C NMR spectrum of **PSV-ThCN**.

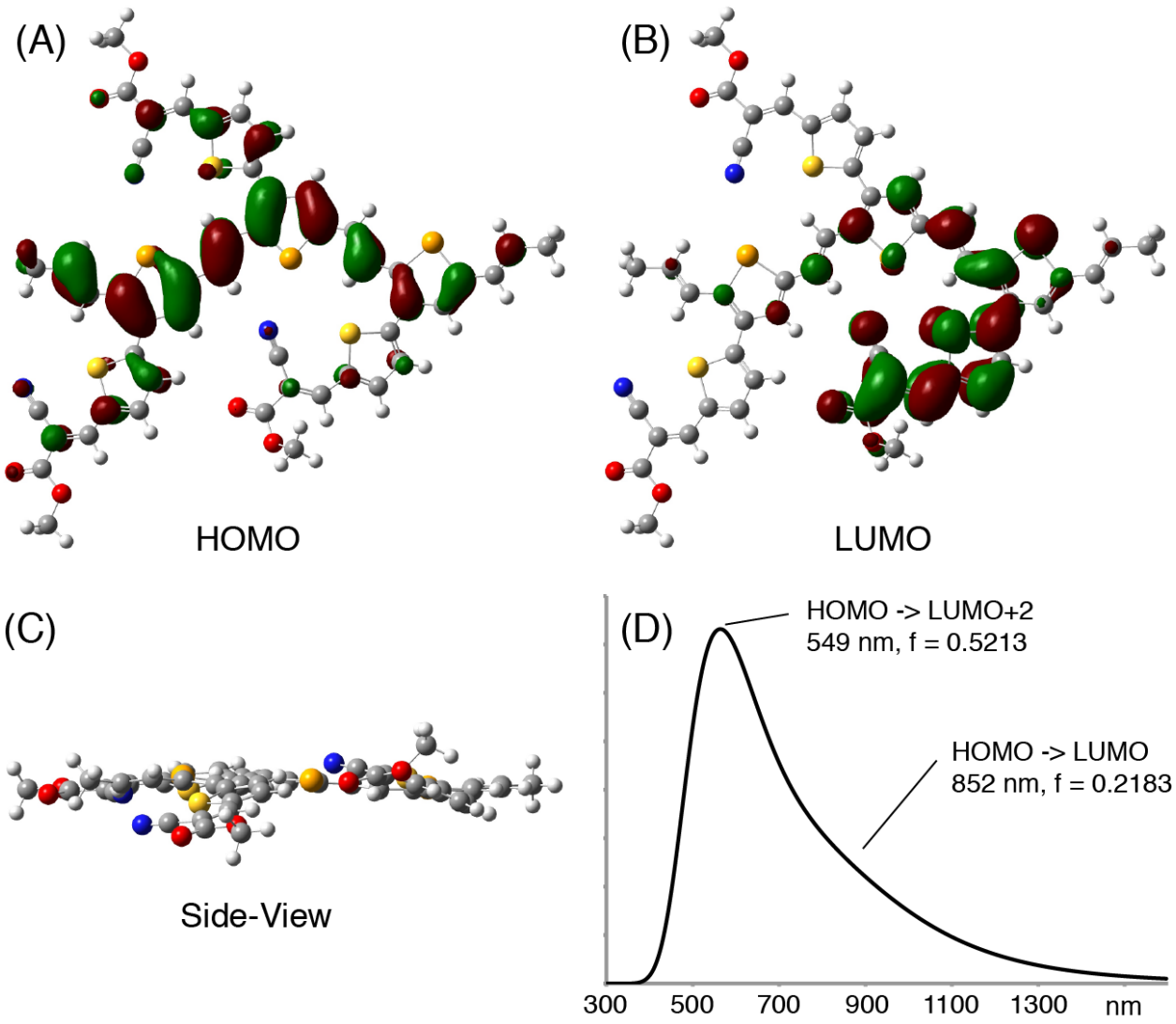

Figure S20. Density functional theory (DFT) calculation results (B3LYP, 6-31G*) on oligomer containing three repeat units of **PSV-ThCN** with alkyl side-chains replaced with protons. (A) HOMO diagram; (B) LUMO diagram; (C) side-view of the optimized structure; and (D) simulated UV-vis absorption spectrum.