Supporting Information

The Impact of Backbone Fluorination and Side-Chain Position in Thiophene-Benzothiadiazole-Based Hole-Transport Materials on the Performance and Stability of Perovskite Solar Cells

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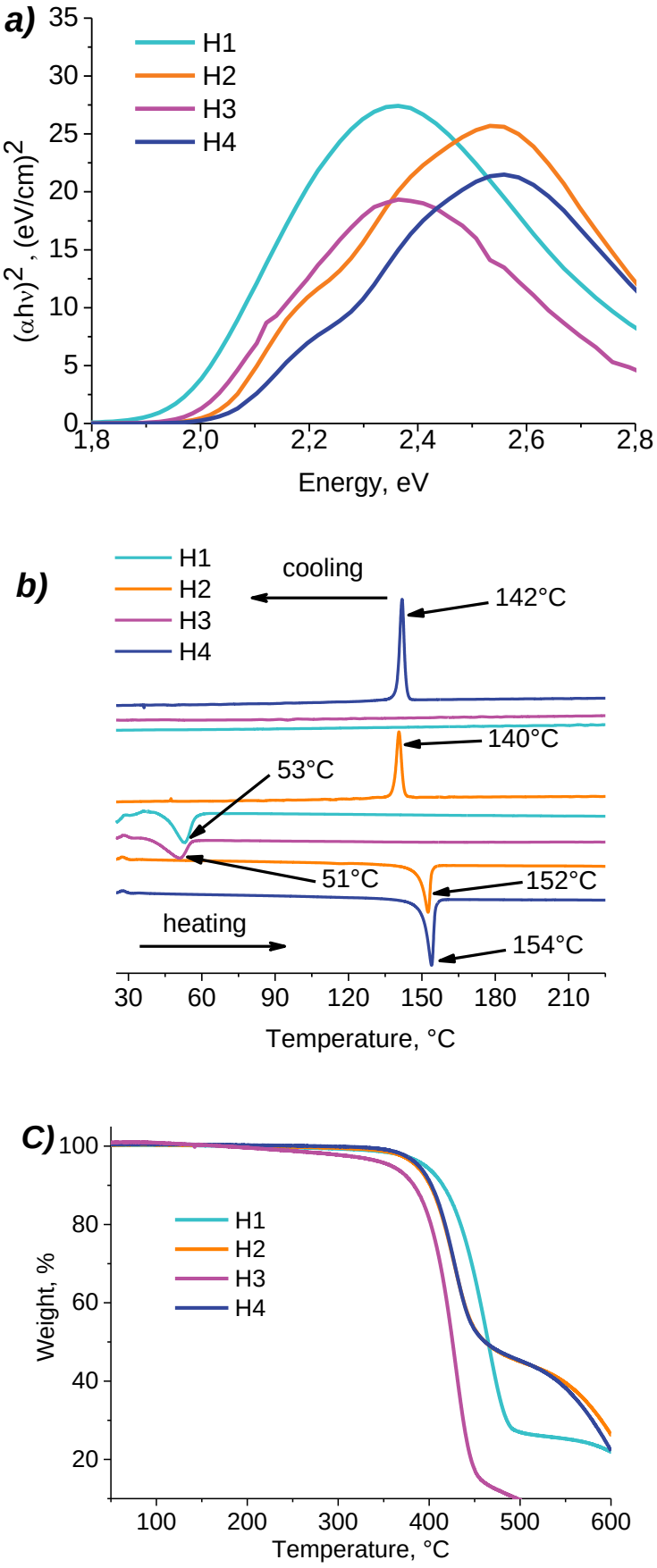

Figure S1. Tauc plots (***a***), DSC curves (***b***) and TGA ***(c)*** for **H1-4**

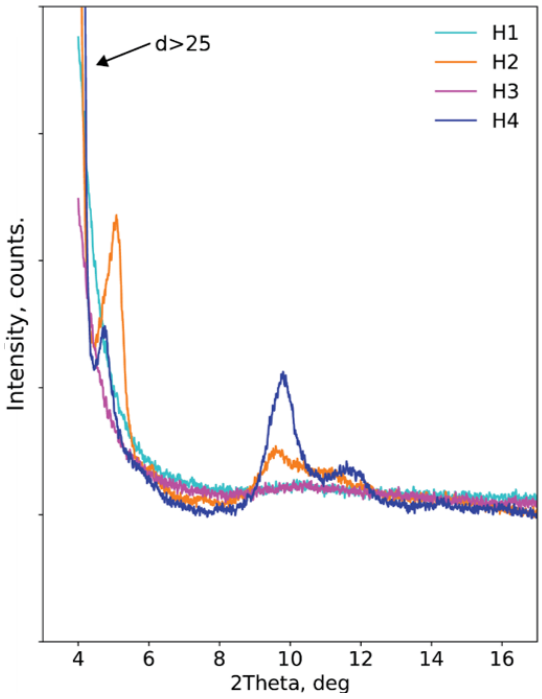

Figure S2. Selected regions of the XRD patterns of **H1-4**

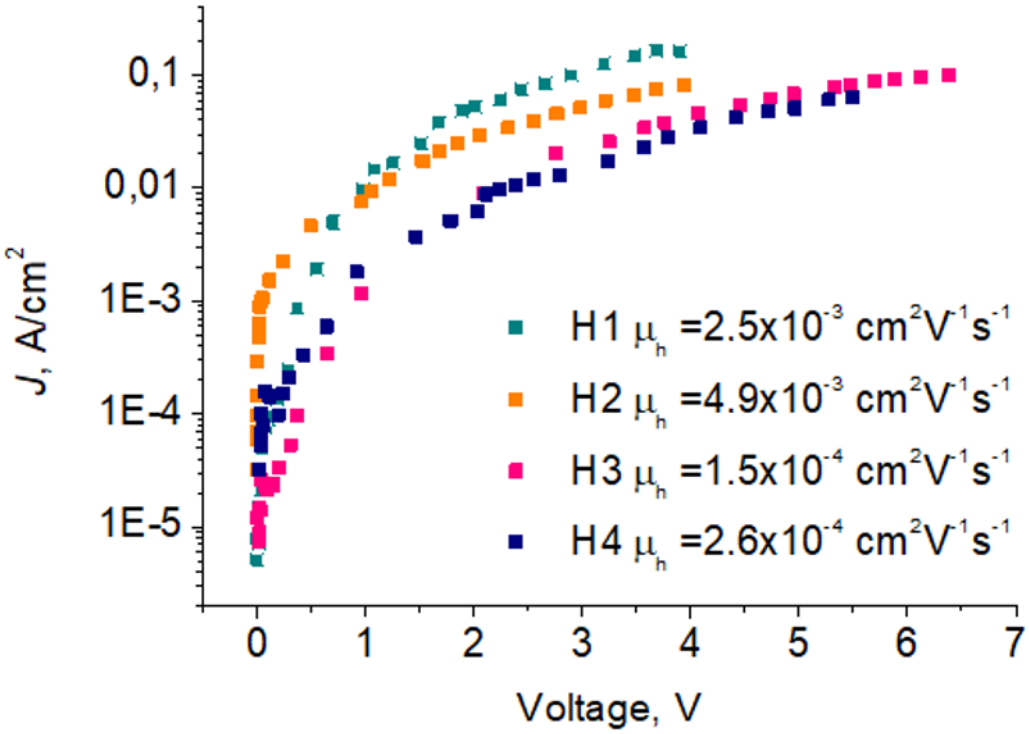

Figure S3. J-V curves of hole-only devices based on compounds **H1-H4**

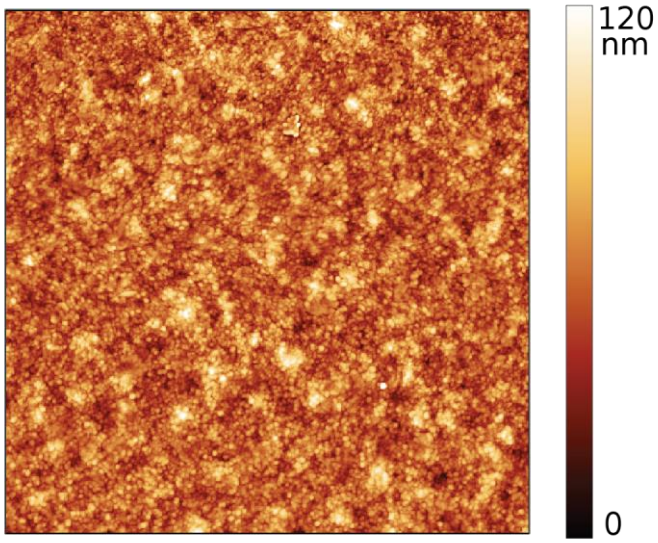

Figure S4. 30×30 μm AFM scan of bare perovskite layer.

HTM	V_{OC}, mV	J_{SC}, mA cm^{-2}	FF,%	PCE,%
Spiro-OMeTAD	910±60	16.1±0.5	46±10	7.0±2.0

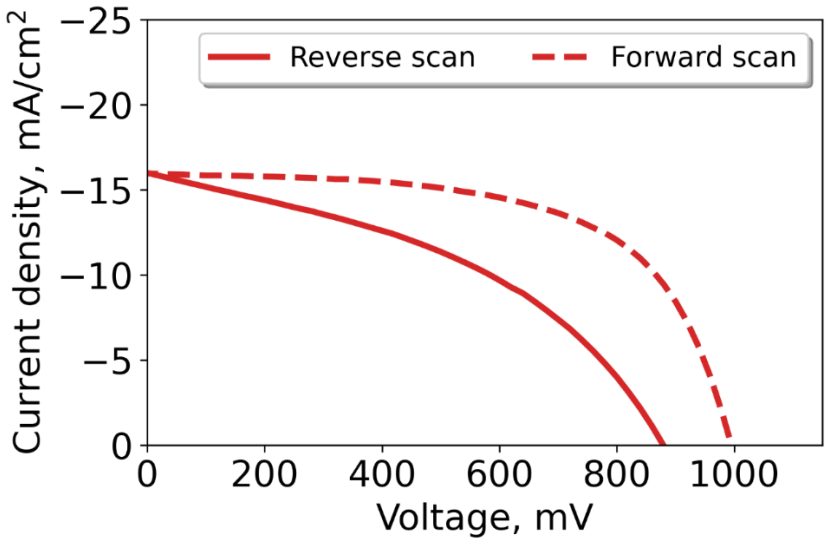

Figure S5. *J*-V curve for PSCs with spiro-OMeTAD as HTM.

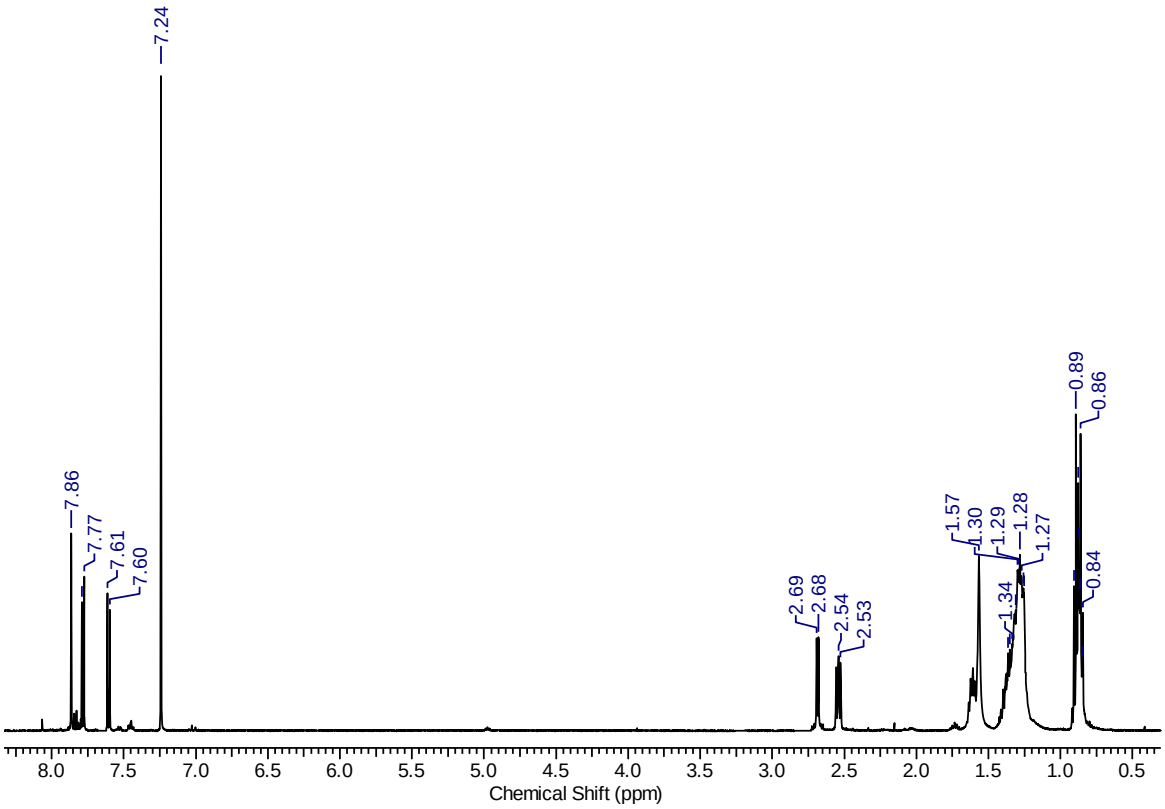

Figure S6. [1]H NMR spectrum of compound **2a**

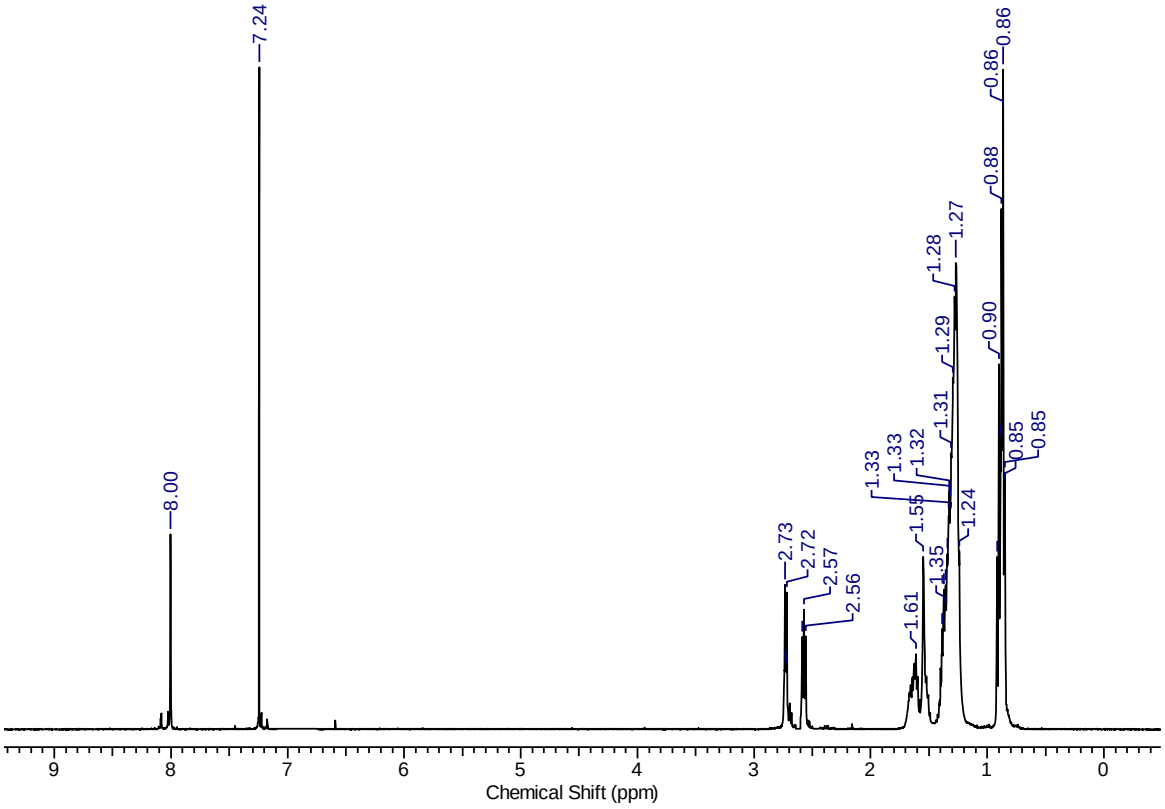

Figure S7. [1]H NMR spectrum of compound **2b**

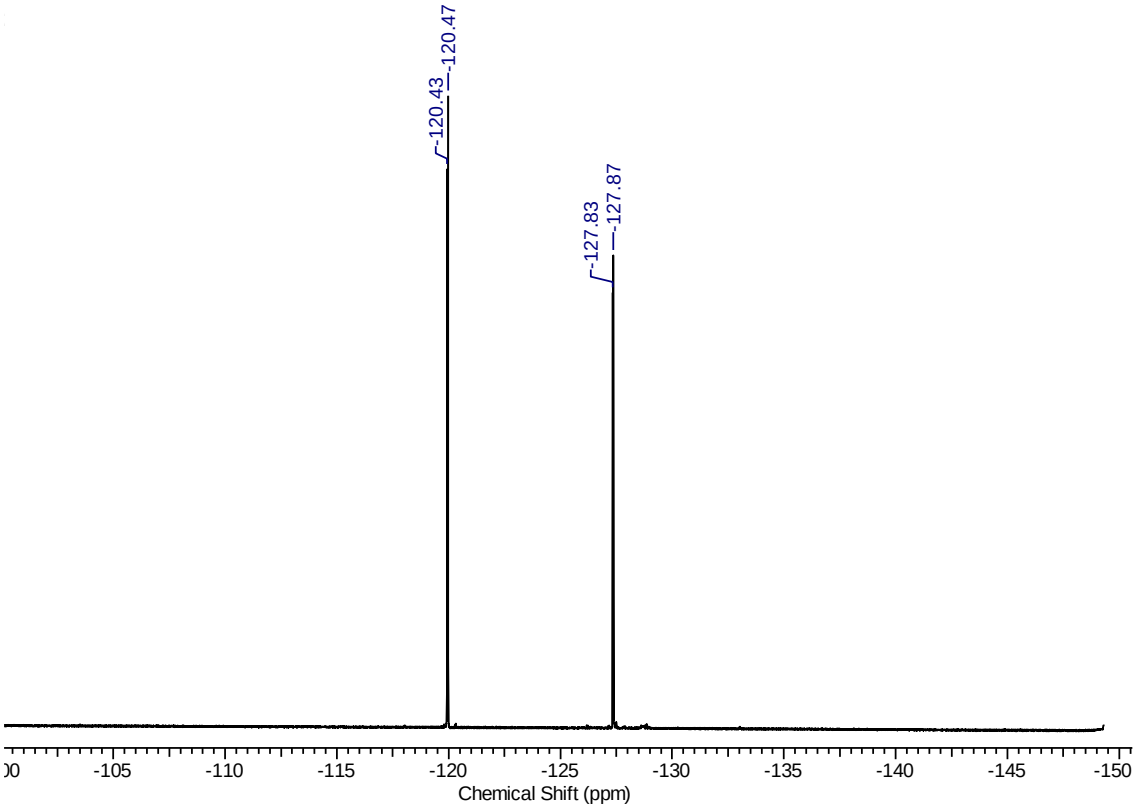

Figure S8. ^{19}F NMR spectrum of compound **2b**

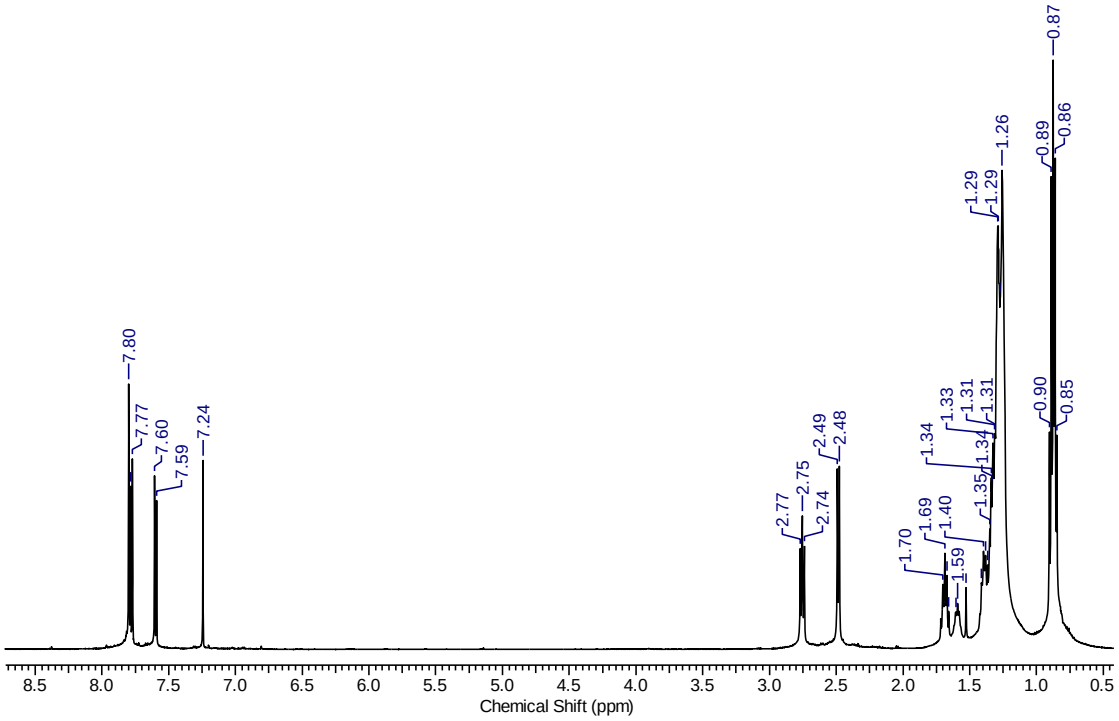

Figure S9. ^{1}H NMR spectrum of compound **2c**

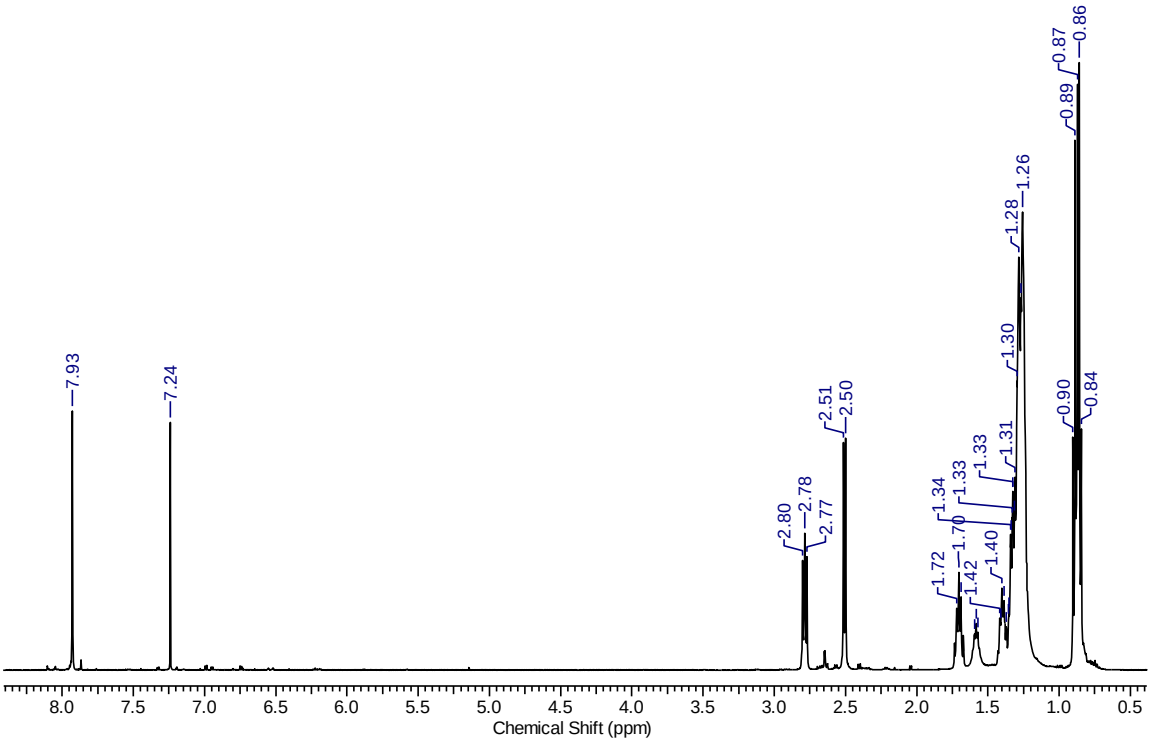

Figure S10. ^{1}H NMR spectrum of compound **2d**

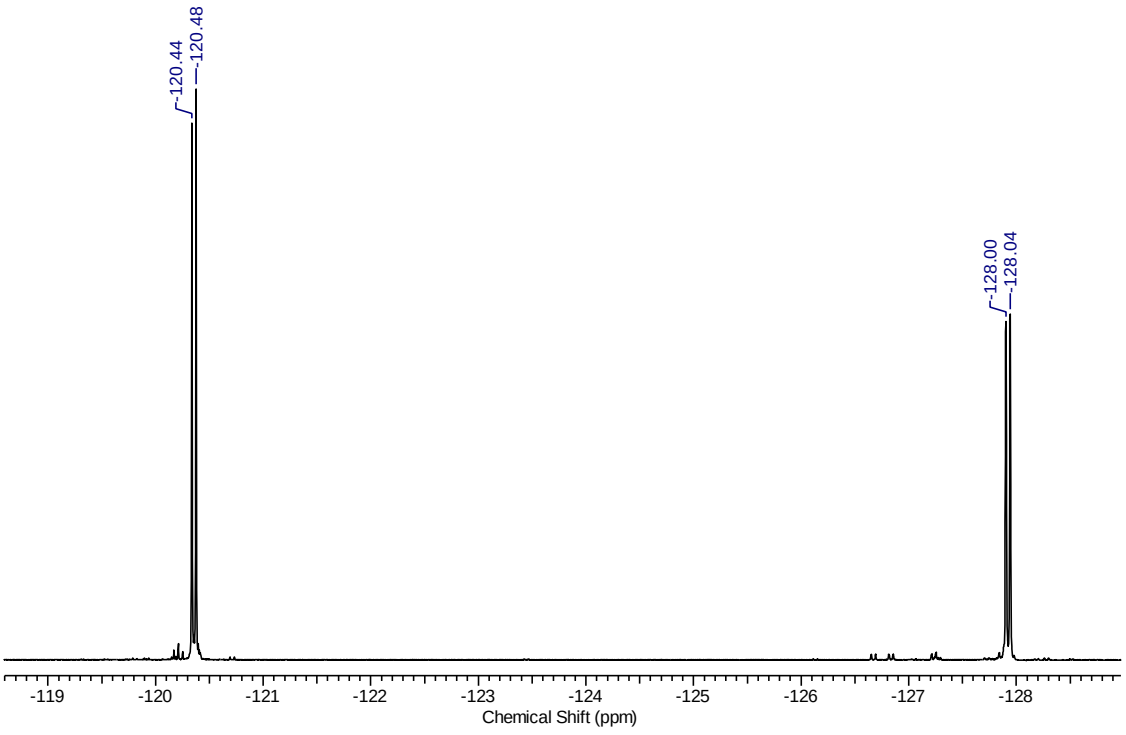

Figure S11. ^{19}F NMR spectrum of compound **2d**

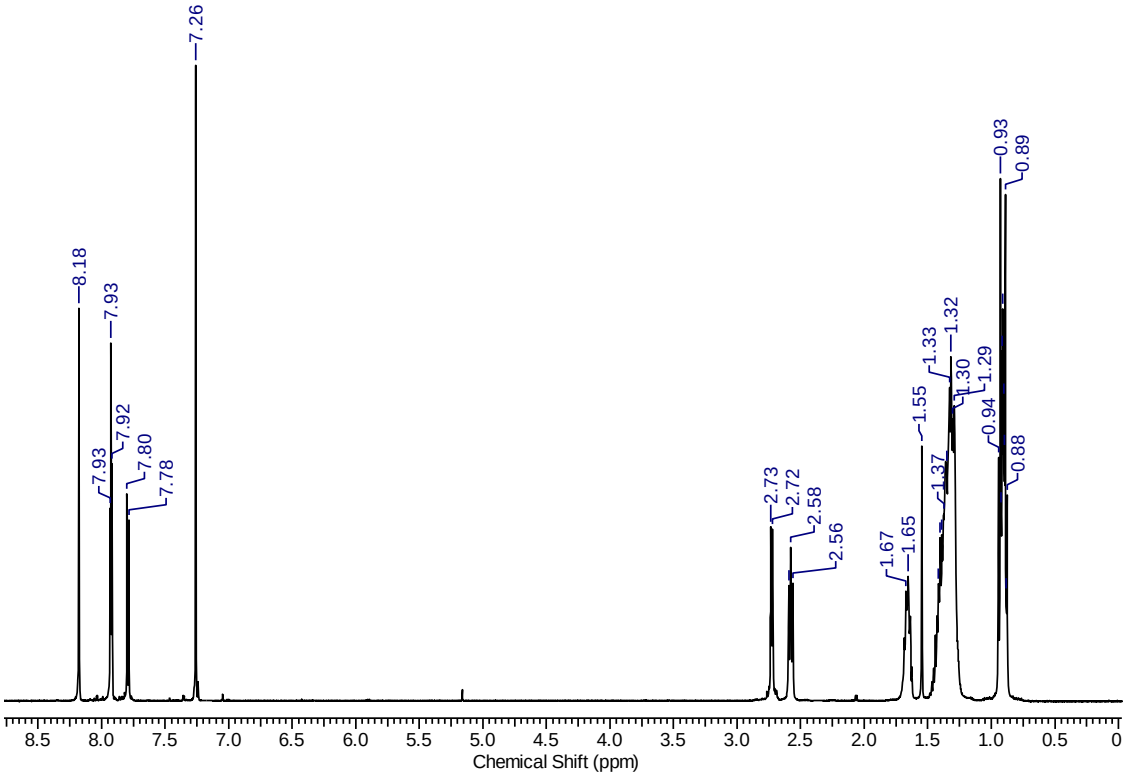

Figure S12. [1]H NMR spectrum of compound **H1**

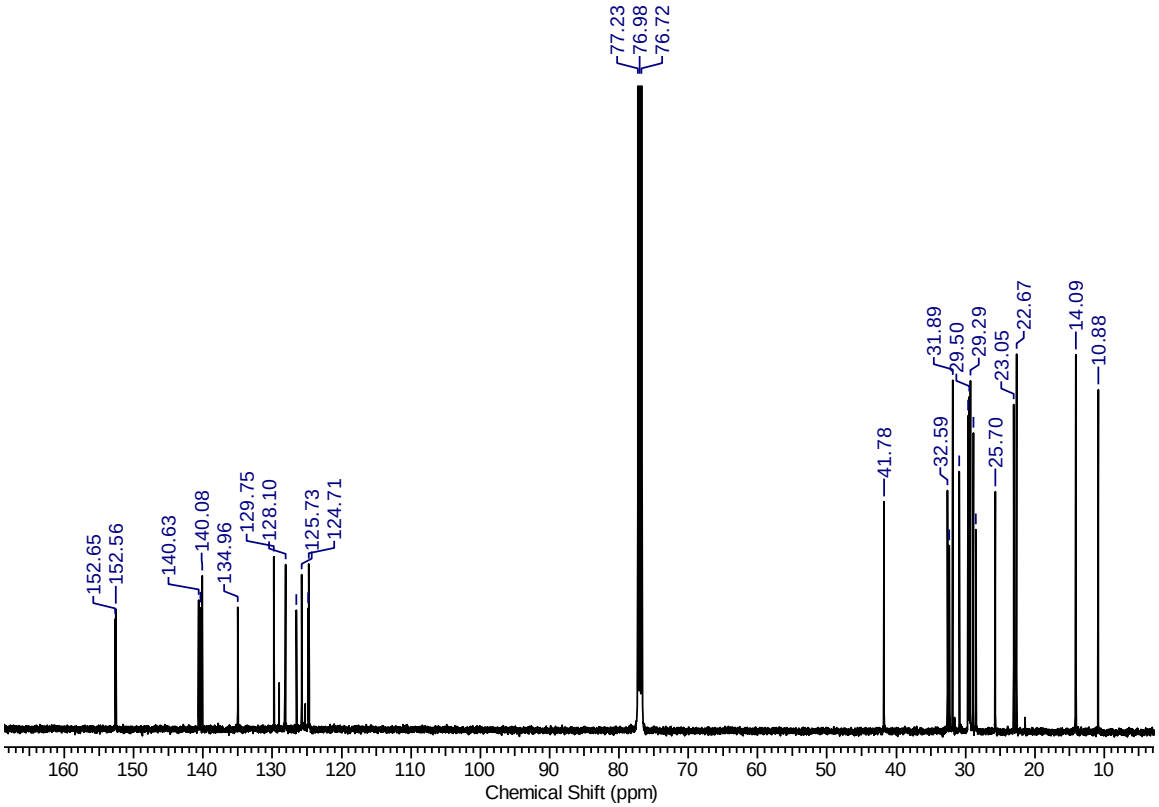

Figure S13. [13]C NMR spectrum of compound **H1**

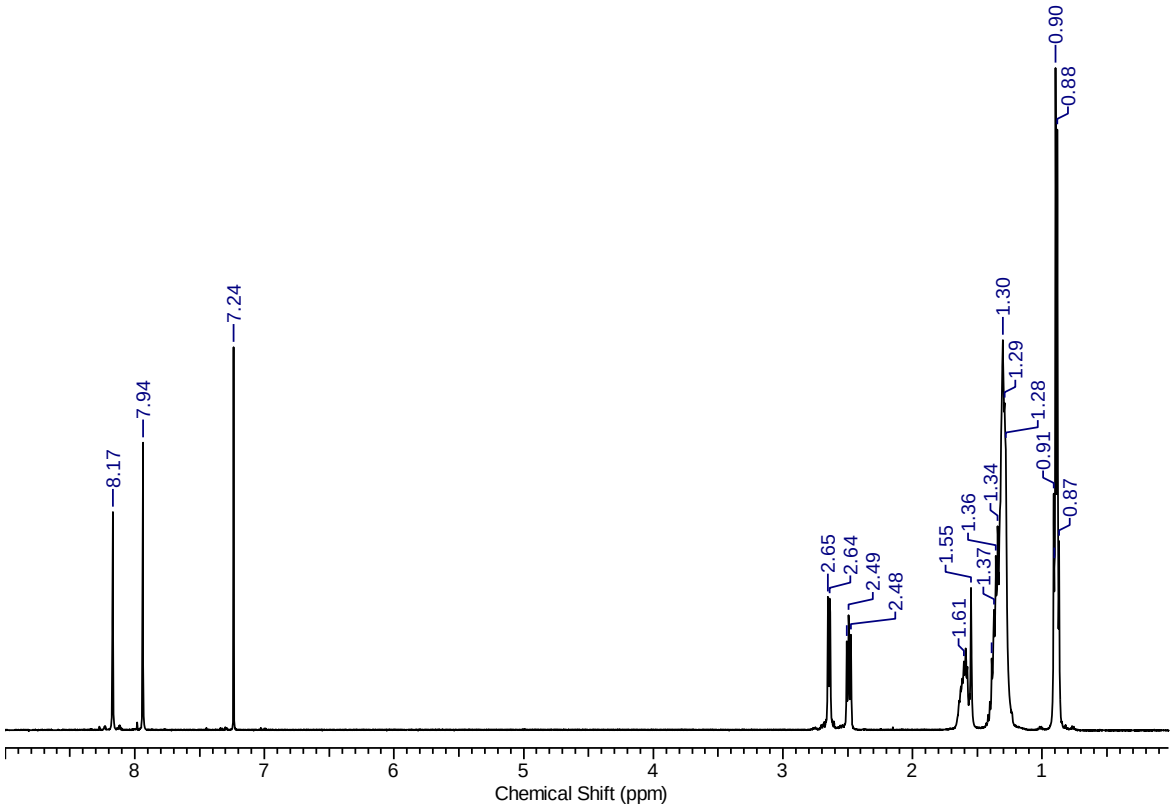

Figure S14. [1]H NMR spectrum of compound **H2**

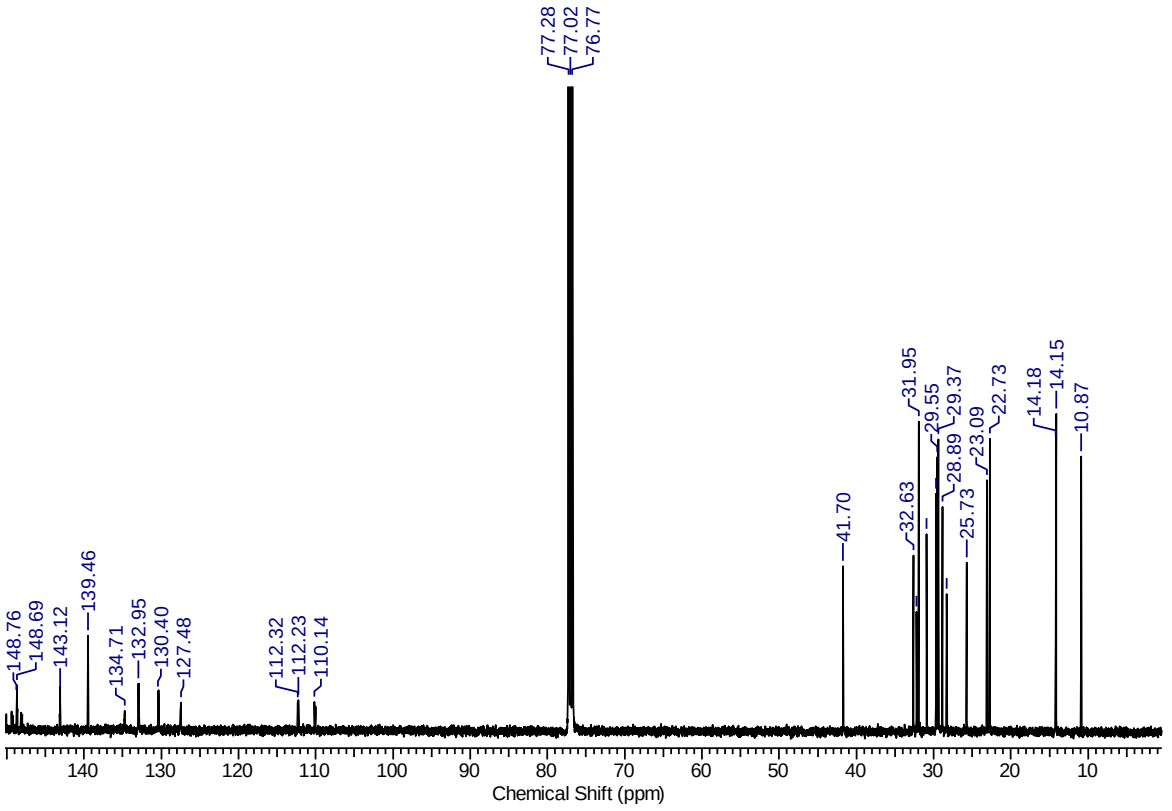

Figure S15. [13]C NMR spectrum of compound **H2**

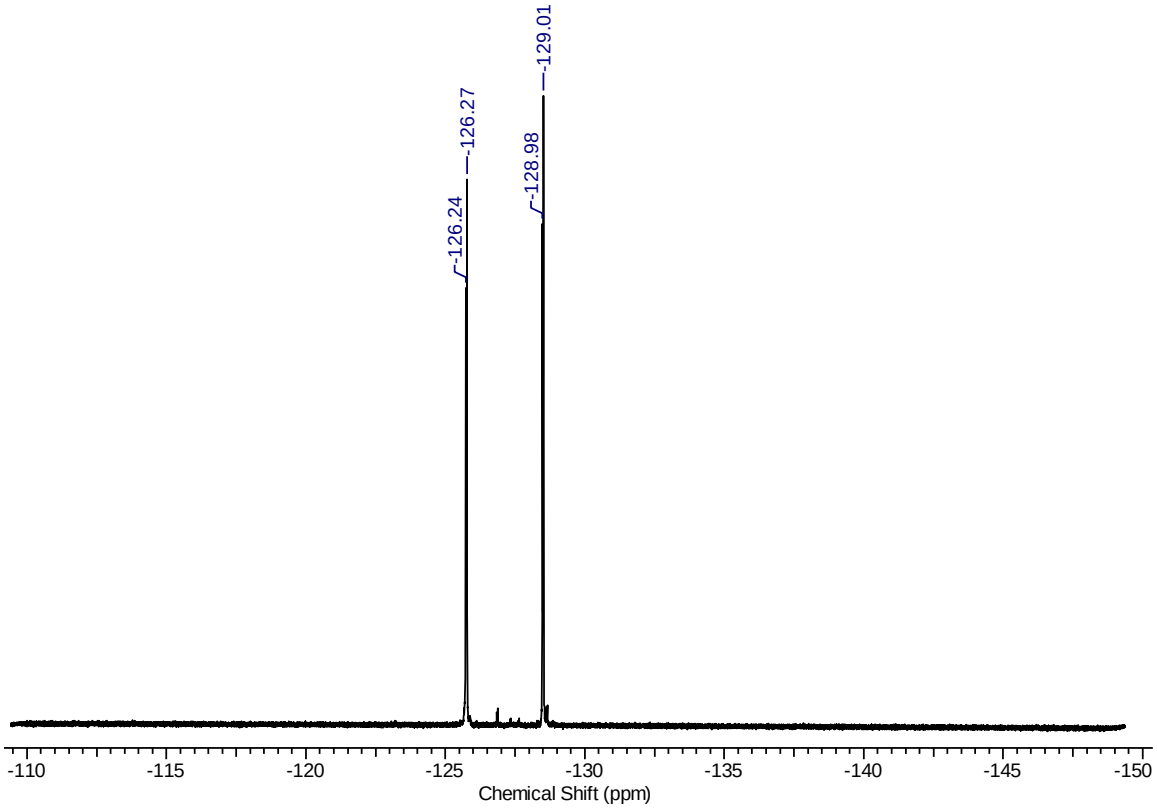

Figure S16. ^{19}F NMR spectrum of compound **H2**

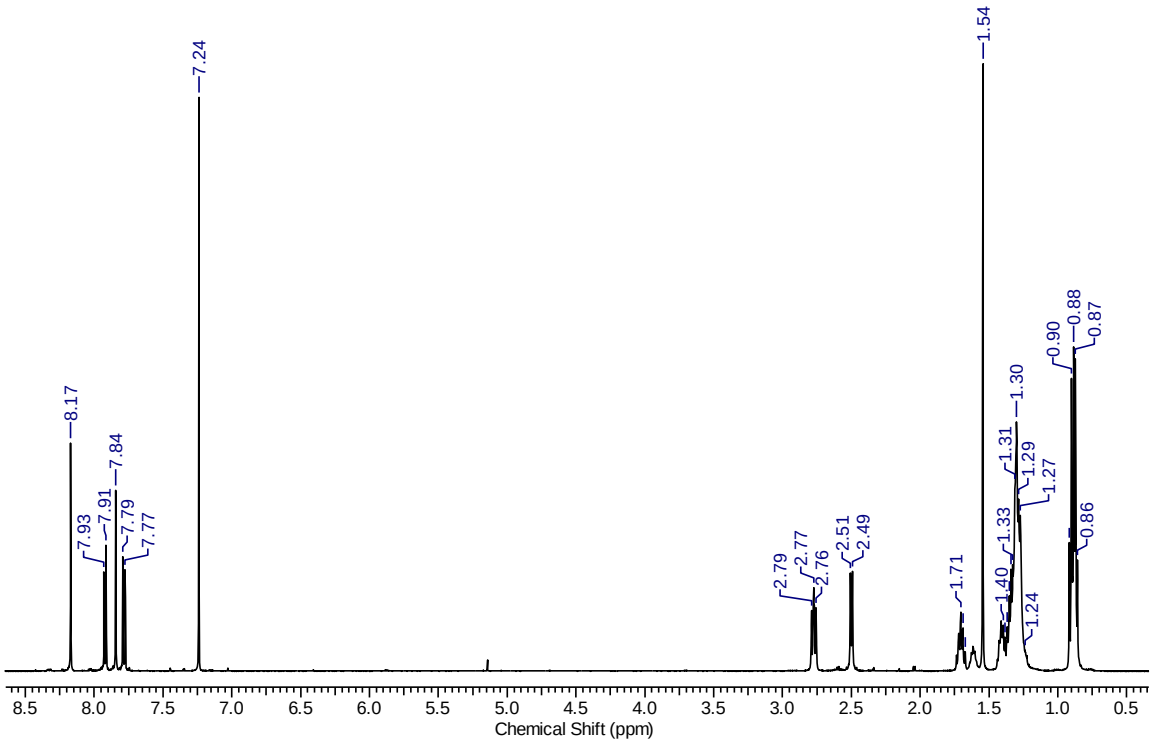

Figure S17. ^{1}H NMR spectrum of compound **H3**

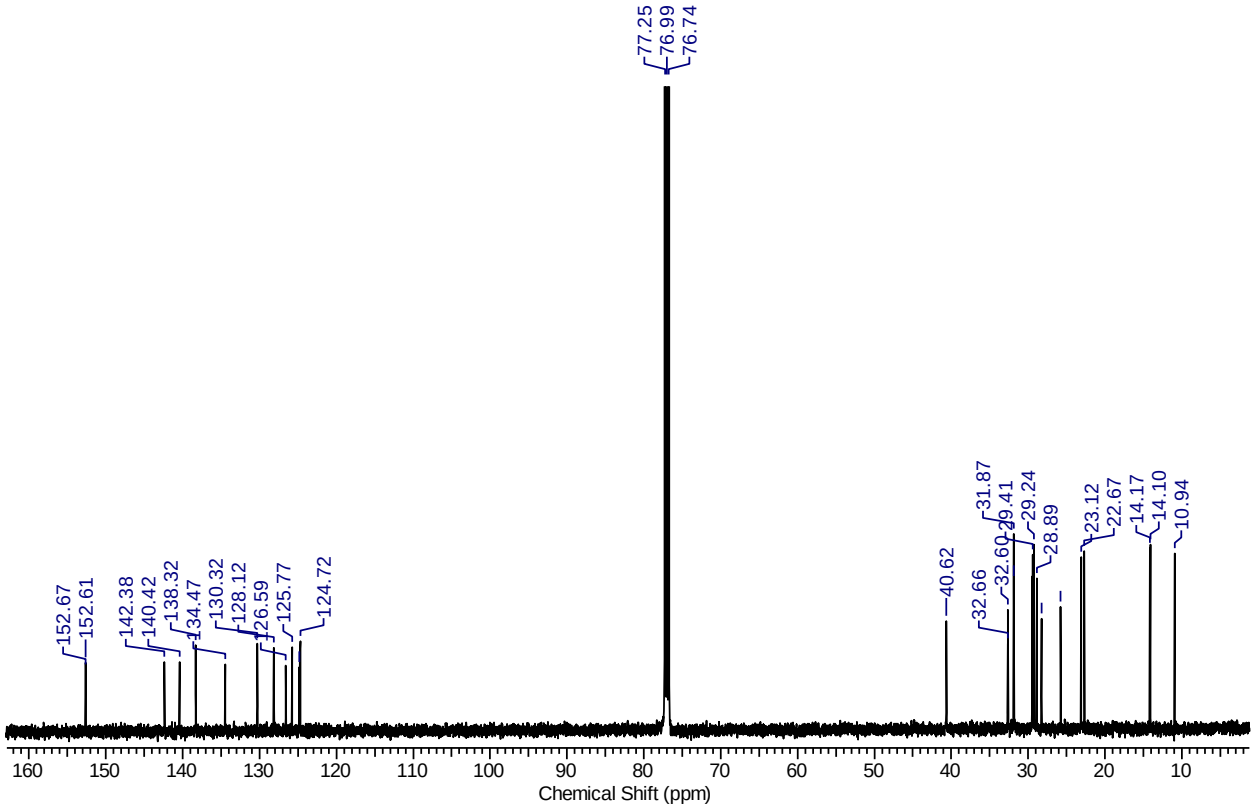

Figure S18. ^{13}C NMR spectrum of compound **H3**

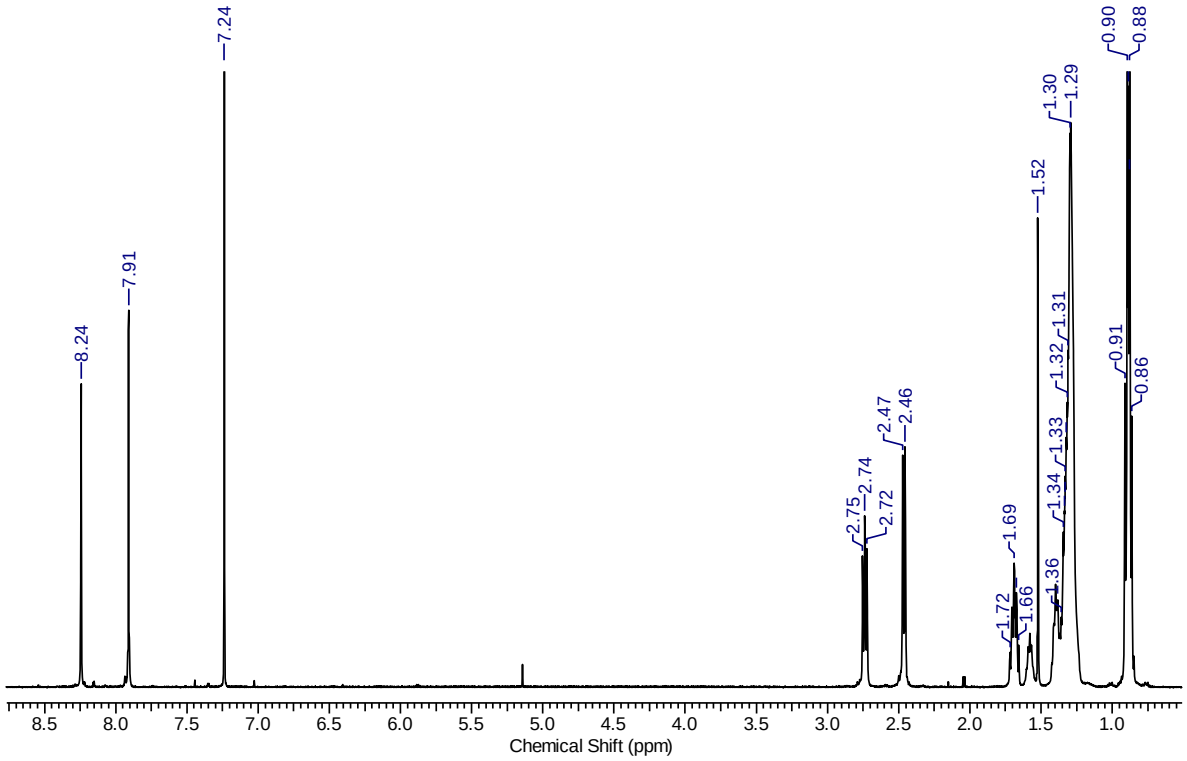

Figure S19. ^{1}H NMR spectrum of compound **H4**

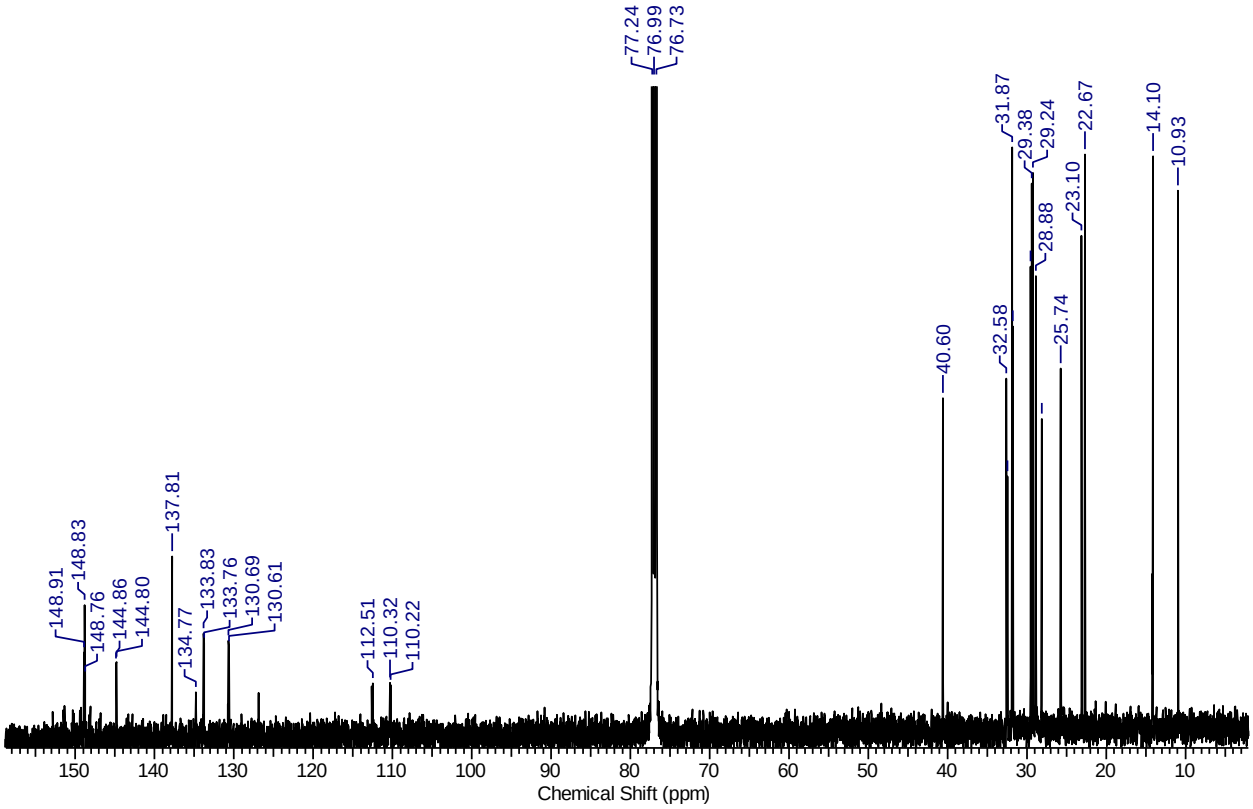

Figure S20. ^{13}C NMR spectrum of compound **H4**

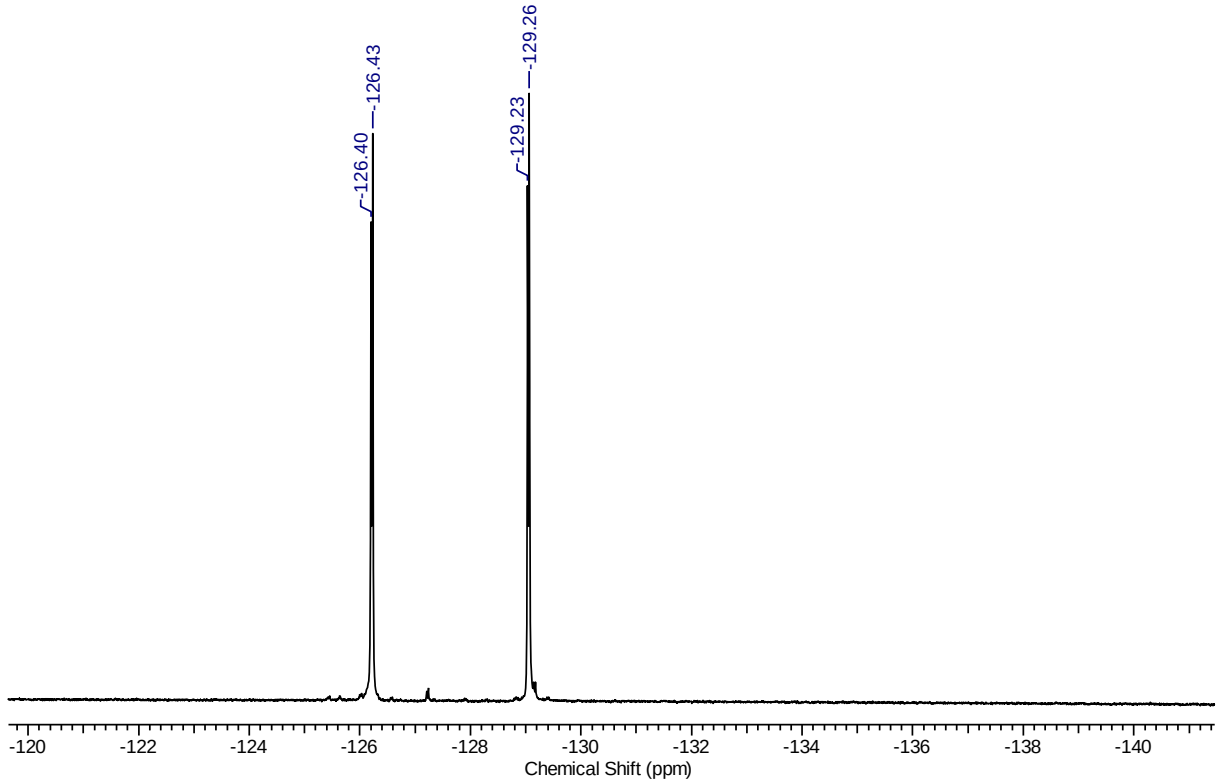

Figure S21. ^{19}F NMR spectrum of compound **H4**