Electronic Supporting Information

Iodine-Catalyzed Intermolecular 1,2-Thio (Seleno)amination of Alkenes with 1,2,3-Triazoles and Disulfides (Diselenides) in Air

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1. General information

All reactions and manipulations were carried out in air, in a 4 mL sealed vial equipped with a stir bar, ^{1}H NMR, ^{19}F NMR and ^{13}C NMR spectra were recorded using a Brucker 400 MHz spectrometer in $CDCl_3$. Tetramethylsilane (TMS) served as an internal standard (δ = 0) for ^{1}H NMR, and $CDCl_3$ was used as internal standard (δ = 77.0) for ^{13}C NMR. Chemical shifts are reported in parts per million as follows: chemical shift, multiplicity (s =singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad). High-resolution mass spectrometry (HRMS) was performed on IonSpec FT-ICR or Waters Micromass Q-TOF micro Synapt High-Definition Mass Spectrometer. Mass spectra were recorded on the HP-5989 instrument by ESI methods. The X-ray diffraction analysis was performed using a Bruker Smart-1000 X-ray diffractometer.

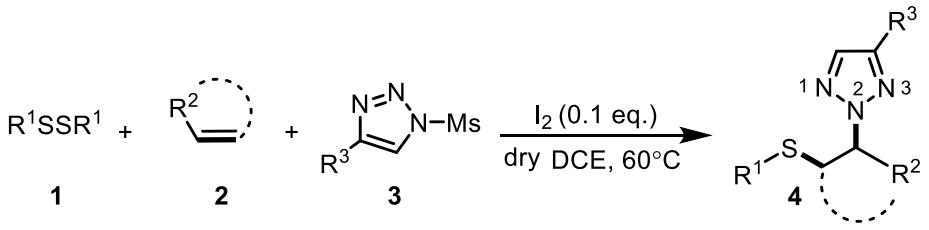
2. Starting materials

N-sulfonyl-1,2,3-triazoles 3

1-sulfonyl-1,2,3-triazoles **3** were prepared from the corresponding alkynes and sulfonyl azides according to previously reported synthetic procedures. [1] Attention! Sulfonyl azides are potentially explosive materials and must be handled with caution! Due to the potential danger of methane sulfonyl azide, we strongly recommend to avoid isolating this compound in large quantities.

3. Experimental procedures

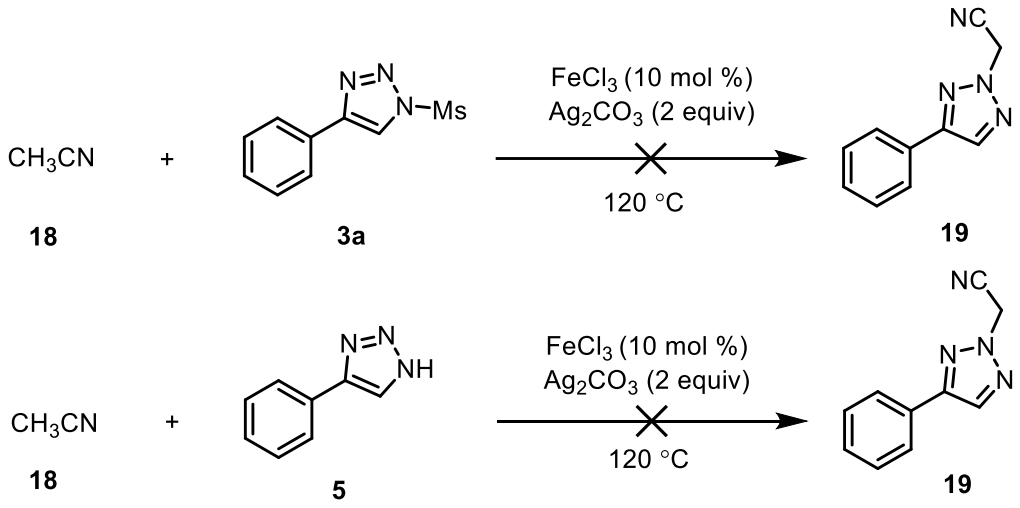
General procedures for products 4:



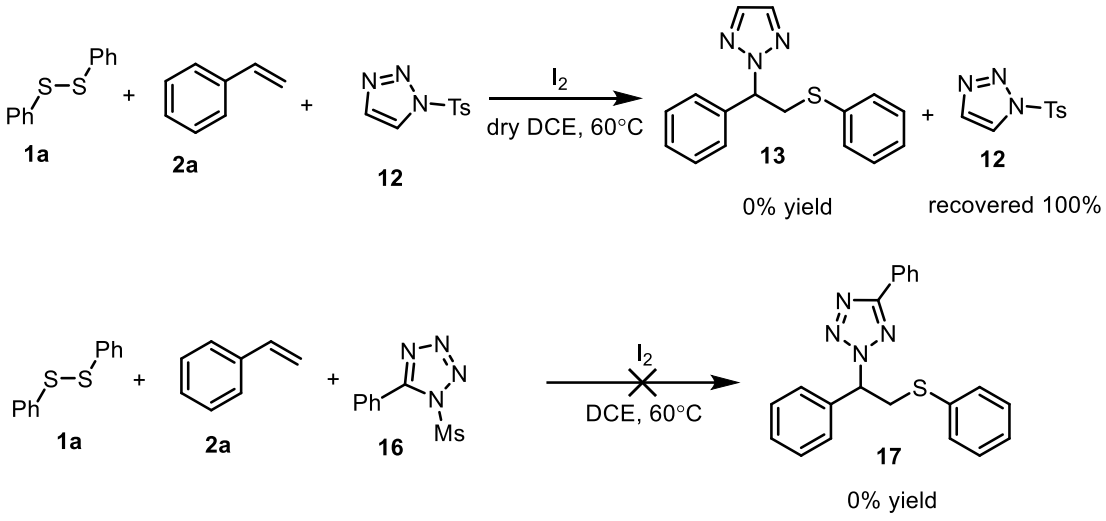
1 2 3 4

To a flame-dried Schlenk tube was added *N*-sulfonyl-1,2,3-triazoles **3** (0.2 mmol, 1.0 equiv), then disulfides (diselenides) **1** (0.2 mmol, 1.0 equiv), alkene **2** (0.4 mmol, 2.0 equiv) were added respectively, I_2 (0.02 mmol, 0.1 equiv), and dry DCE (2 mL) was

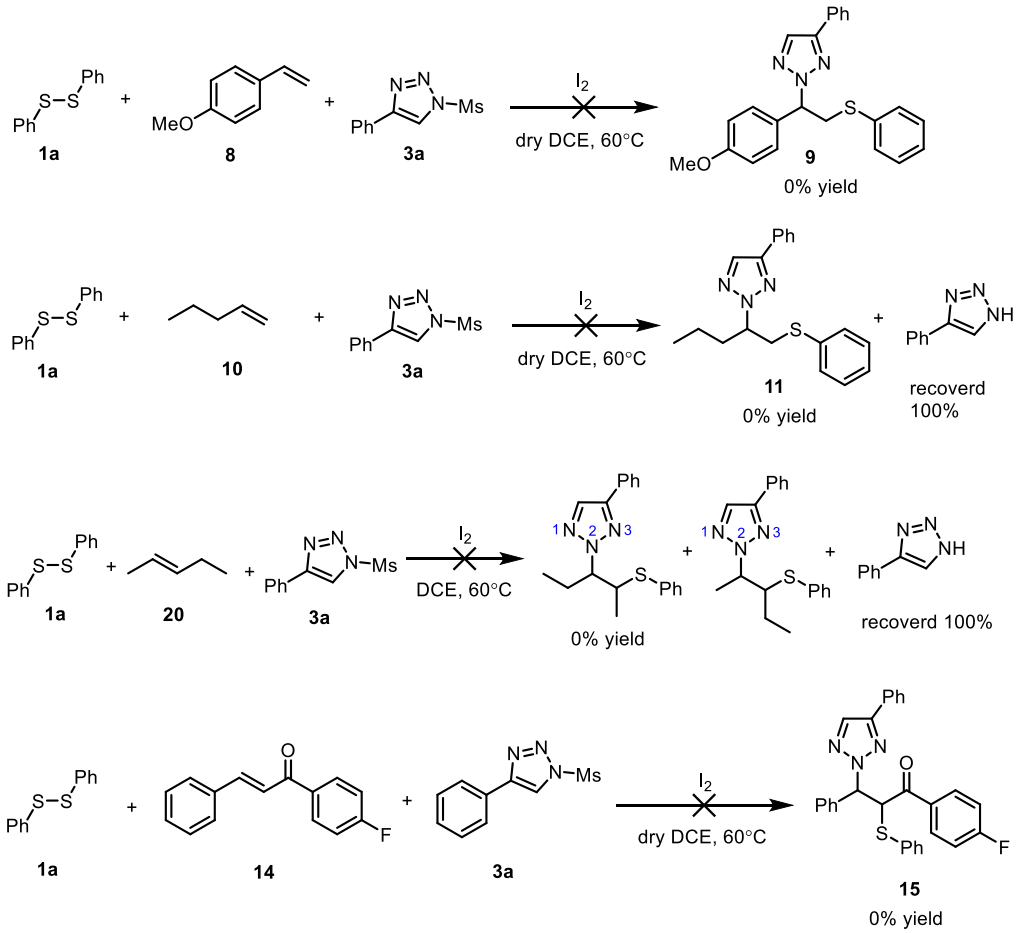
added to the tube and the mixture was stirred at 60 °C for 12 h. After completion as detected by TLC, the solvent was removed by rotary evaporation under vacuum, and the residue was purified by silica gel chromatography with eluent (petroleum ether/ethyl acetate = 20/1 - 15/1) to give the desired product **4**.



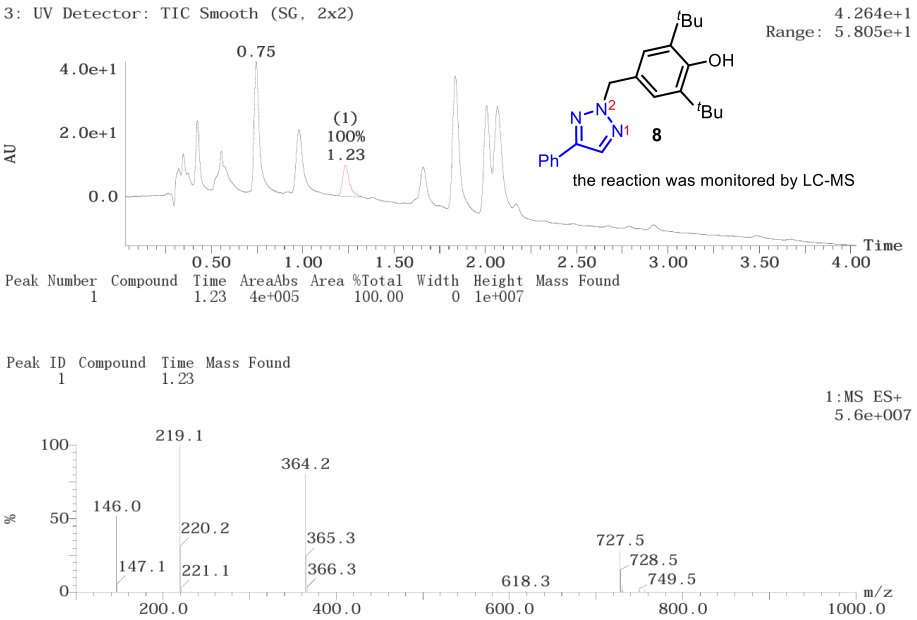
Scheme S1 Acetonitrile to generat a carbon radical intermediate to react with Ms-triazole and the unprotected triazole

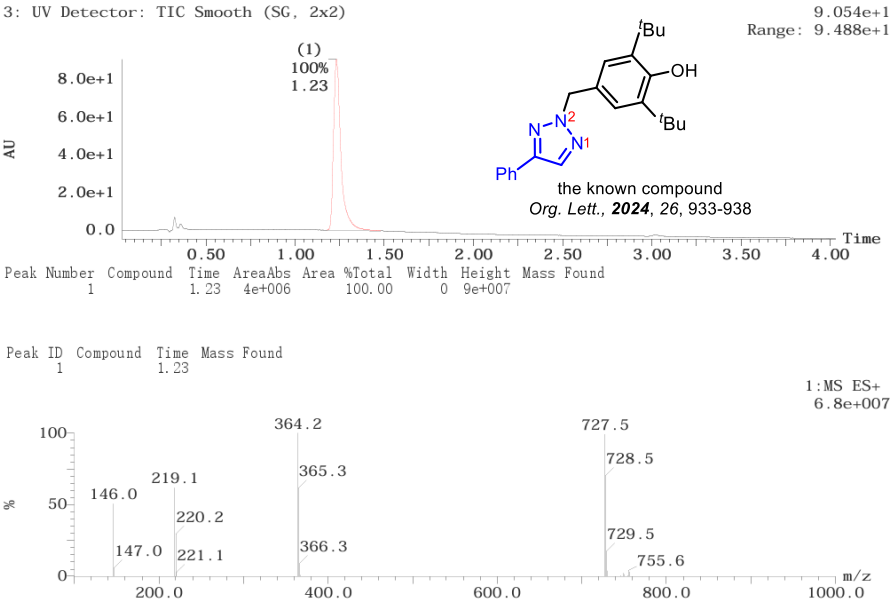


Scheme S2 Using the sulfonyl-1,2,3-triazole without substituent and Ms-tetrazole to test this reaction.

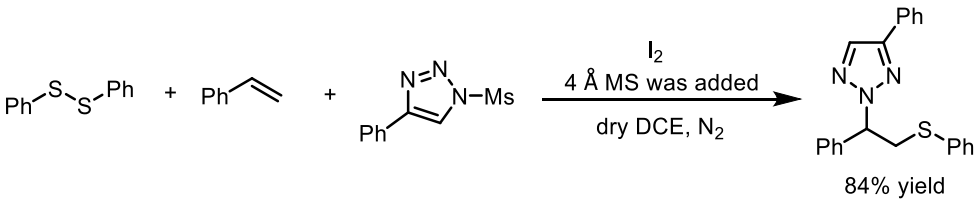


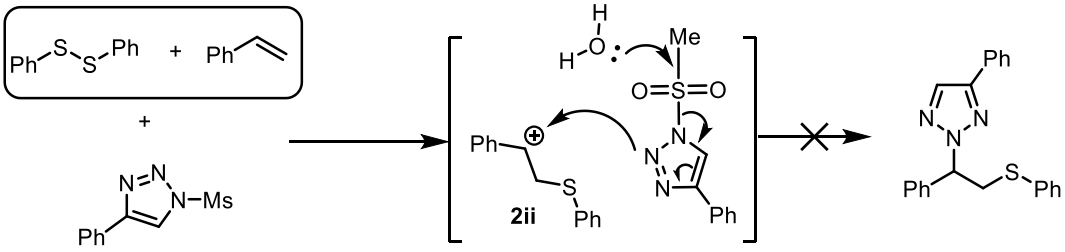
Scheme S3 Using 4-methoxy styrene **8**, 1-pentene **10**, 2-pentene **10**, and chalcone **14** as the raw material to test this reaction.



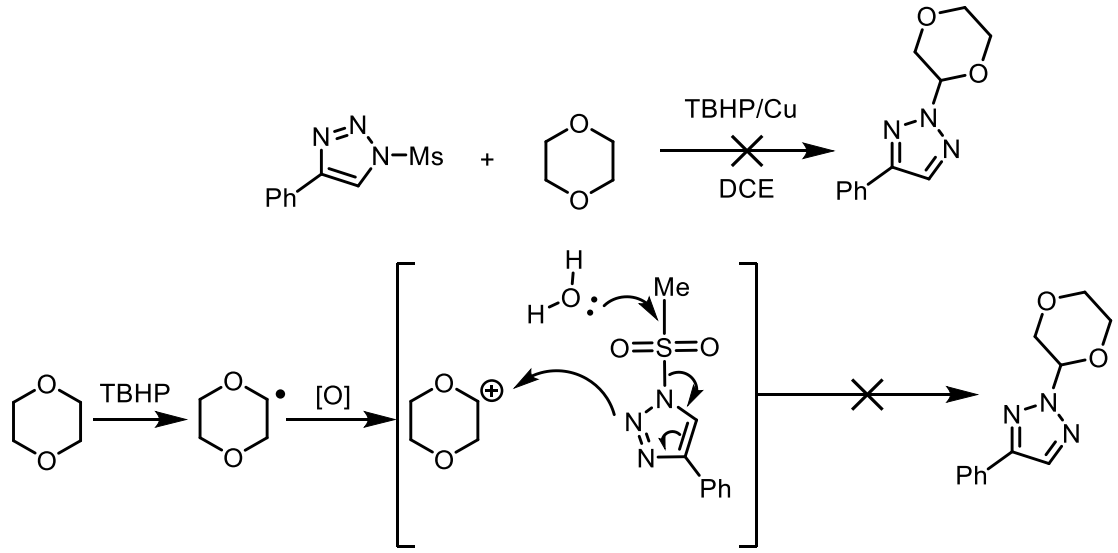


Scheme S4 The LC-MS of product **8**





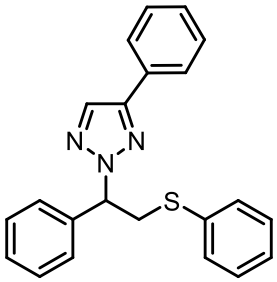
Scheme S5 Exclude the possibility of the reaction of intermediate **2ii** with Ms-triazole



Scheme S6 Using Ms-triazole to react with carbocations

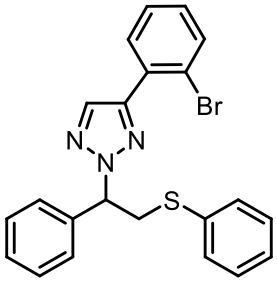
4. ^{1}H NMR, ^{19}F NMR and ^{13}C NMR data of compounds 4

4-phenyl-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4a)



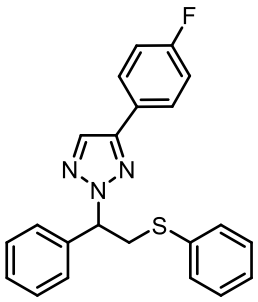
Following the procedure, product **4a** was obtained as a colorless oil. (82% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.84 (s, 1H), 7.76 (d, J = 7.6 Hz, 2H), 7.38 (d, J = 7.7 Hz, 6H), 7.28 (dt, J = 15.1, 8.2 Hz, 6H), 7.19 (t, J = 7.2 Hz, 1H), 5.81 – 5.76 (m, 1H), 4.16 – 4.03 (m, 1H), 3.66 (dd, J = 14.1, 4.8 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.9, 138.3, 134.8, 131.3, 131.2, 130.5, 129.2, 128.9, 128.7, 128.5, 127.1, 127.0, 126.1, 68.5, 40.1. HRMS (ESI) m/z: $[M+Na]^{+}$ Calcd for $C_{22}H_{19}N_3SNa$ $(M+Na)^{+}$ 380.1192, Found: 380.1200.

4-(2-bromophenyl)-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4b)



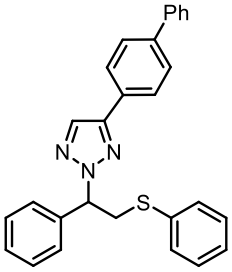
Following the procedure, product **4b** was obtained as a colorless oil. (80% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 8.14 (s, 1H), 7.73 (dd, J = 7.8, 1.6 Hz, 1H), 7.65 – 7.62 (m, 1H), 7.40 – 7.37 (m, 4H), 7.35 – 7.25 (m, 6H), 7.23 – 7.17 (m, 2H), 5.80 (dd, J = 9.6, 5.5 Hz, 1H), 4.10 (dd, J = 14.1, 9.6 Hz, 1H), 3.67 (dd, J = 14.1, 5.5 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.9, 141.6, 140.5, 137.2, 134.7, 131.3, 131.2, 130.5, 129.2, 128.8, 128.9, 128.5, 127.6, 127.5, 127.2, 126.1, 68.3, 40.0. **HRMS** (ESI) m/z: $[M+Na]^{+}$ Calcd for $C_{22}H_{18}BrN_3SNa$ $(M+Na)^{+}$ 458.0297, Found: 458.0290.

4-(4-fluorophenyl)-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4c)



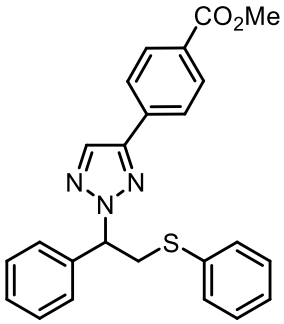
Following the procedure, product **4c** was obtained as a colorless oil. (78% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.79 (s, 1H), 7.72 (dd, *J* = 8.6, 5.4 Hz, 2H), 7.38 (d, *J* = 7.5 Hz, 4H), 7.34 – 7.25 (m, 5H), 7.21 (d, *J* = 7.0 Hz, 1H), 7.08 (t, *J* = 8.6 Hz, 2H), 5.77 (dd, *J* = 9.7, 5.3 Hz, 1H), 4.09 (dd, *J* = 14.1, 9.8 Hz, 1H), 3.65 (dd, *J* = 14.1, 5.3 Hz, 1H). **^{19}F NMR** (376 MHz, Chloroform-*d*) δ -113.02. **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 162.9 (d, *J* = 247.6 Hz), 147.0, 138.2, 134.7, 131.2, 130.9, 129.2, 128.9, 128.7, 127.8 (d, *J* = 8.2 Hz), 127.2, 127.0, 126.7 (d, *J* = 3.3 Hz), 115.8 (d, *J* = 21.8 Hz), 68.6, 40.0. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{19}FN_3S$ $(M+H)^+$ 376.4654, Found: 376.4661.

4-([1,1'-biphenyl]-4-yl)-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4d)



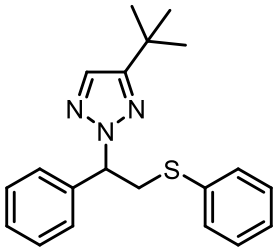
Following the procedure, product **4d** was obtained as a colorless oil. (76% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.87 (s, 1H), 7.84 (d, *J* = 7.5 Hz, 2H), 7.63 (t, *J* = 8.0 Hz, 4H), 7.41 (dt, *J* = 23.1, 7.7 Hz, 6H), 7.35 – 7.25 (m, 6H), 7.21 (t, *J* = 7.1 Hz, 1H), 5.80 (dd, *J* = 8.9, 5.5 Hz, 1H), 4.11 (dd, *J* = 13.8, 9.9 Hz, 1H), 3.68 (dd, *J* = 14.0, 5.1 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.5, 141.2, 140.6, 138.3, 134.8, 131.3, 131.2, 129.4, 129.2, 128.9, 128.8, 128.6, 127.5, 127.2, 127.1, 127.0, 126.5, 68.6, 40.1. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{28}H_{23}N_3SNa$ $(M+Na)^+$ 456.1505, Found: 456.1508.

methyl 4-(2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazol-4-yl) benzoate (4e)



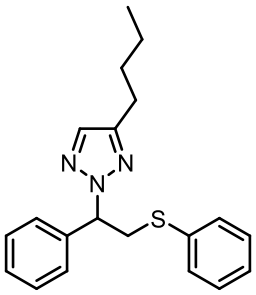
Following the procedure, product **4e** was obtained as a colorless oil. (77% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 8.08 (d, *J* = 8.1 Hz, 2H), 7.90 (s, 1H), 7.83 (d, *J* = 8.1 Hz, 2H), 7.37 (d, *J* = 6.1 Hz, 4H), 7.33 – 7.23 (m, 5H), 7.20 (d, *J* = 7.2 Hz, 1H), 5.80 (dd, *J* = 9.6, 5.2 Hz, 1H), 4.10 (dd, *J* = 14.0, 9.9 Hz, 1H), 3.90 (s, 3H), 3.66 (dd, *J* = 14.1, 5.1 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 166.8, 146.8, 138.1, 134.8, 134.6, 131.8, 131.2, 130.2, 129.8, 129.2, 128.9, 128.7, 127.2, 127.0, 125.9, 68.8, 52.2, 40.02. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{24}H_{21}N_3O_2SNa$ $(M+Na)^+$ 438.1247, Found: 438.1256.

4-(tert-butyl)-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4f)



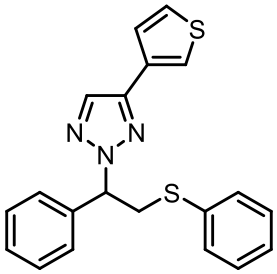
Following the procedure, product **4f** was obtained as a colorless oil. (75% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.39 (s, 1H), 7.38 – 7.34 (m, 2H), 7.33 – 7.29 (m, 4H), 7.29 – 7.25 (m, 3H), 7.22 (d, *J* = 7.4 Hz, 1H), 5.69 (dd, *J* = 9.4, 5.6 Hz, 1H), 4.01 (dd, *J* = 14.0, 9.5 Hz, 1H), 3.61 (dd, *J* = 14.0, 5.6 Hz, 1H), 1.31 (s, 9H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 157.6, 138.7, 134.9, 131.0, 130.6, 129.1, 128.7, 128.4, 127.0, 126.9, 68.0, 40.2, 30.8, 30.4. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{20}H_{23}N_3SNa$ $(M+Na)^+$ 360.1505, Found: 360.1515.

4-butyl-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4g)



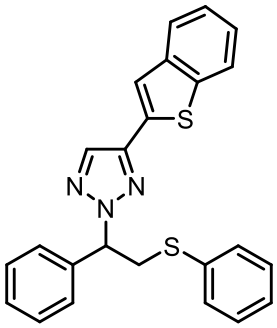
Following the procedure, product **4g** was obtained as a colorless oil. (74% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.37 (d, *J* = 7.4 Hz, 3H), 7.33 – 7.26 (m, 7H), 7.25 – 7.22 (m, 1H), 5.69 (dd, *J* = 9.5, 5.6 Hz, 1H), 4.02 (dd, *J* = 14.0, 9.6 Hz, 1H), 3.61 (dd, *J* = 14.0, 5.6 Hz, 1H), 2.65 (t, *J* = 8.0 Hz, 2H), 1.67 – 1.58 (m, 2H), 1.42 – 1.32 (m, 2H), 0.92 (t, *J* = 8.0 Hz, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 148.8, 138.5, 134.8, 132.7, 131.0, 129.1, 128.7, 128.4, 127.0, 126.9, 67.9, 39.9, 31.3, 25.3, 22.4, 13.8. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{20}H_{23}N_3SNa$ $(M+Na)^+$ 360.1505, Found: 360.1515.

2-(1-phenyl-2-(phenylthio) ethyl)-4-(thiophen-3-yl)-2H-1,2,3-triazole (4h)



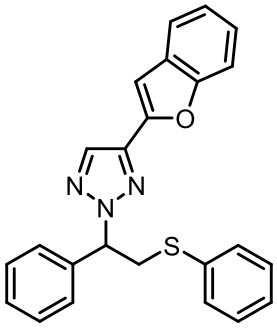
Following the procedure, product **4h** was obtained as a colorless oil. (70% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 7.40 – 7.34 (m, 6H), 7.33 (s, 1H), 7.30 (d, *J* = 6.9 Hz, 4H), 7.25 (d, *J* = 3.9 Hz, 1H), 7.07 (t, *J* = 4.0, 1H), 5.75 (dd, *J* = 9.6, 5.4 Hz, 1H), 4.07 (dd, *J* = 14.1, 9.7 Hz, 1H), 3.65 (dd, *J* = 14.1, 5.4 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 143.0, 138.1, 134.6, 132.7, 131.2, 130.9, 129.2, 128.8, 128.6, 127.6, 127.1, 127.0, 125.5, 124.8, 68.5, 39.9. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{20}H_{17}N_3S_2Na$ $(M+Na)^+$ 386.0756, Found: 386.0765.

4-(benzo[b]thiophen-2-yl)-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4i)



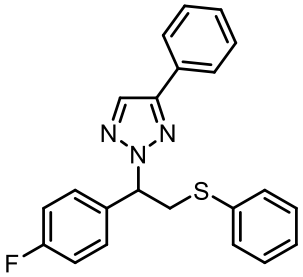
Following the procedure, product **4i** was obtained as a colorless oil. (72% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.85 (s, 1H), 7.77 (d, *J* = 7.4 Hz, 1H), 7.59 (s, 1H), 7.40 (d, *J* = 7.1 Hz, 4H), 7.37 – 7.31 (m, 6H), 7.29 (d, *J* = 7.6 Hz, 2H), 7.25 (s, 1H), 5.78 (dd, *J* = 9.6, 5.4 Hz, 1H), 4.10 (dd, *J* = 14.1, 9.7 Hz, 1H), 3.67 (dd, *J* = 14.1, 5.4 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 142.9, 139.9, 139.5, 137.9, 134.5, 132.8, 131.5, 131.3, 129.2, 128.8, 128.7, 127.2, 127.1, 124.7, 124.6, 123.7, 122.4, 121.1, 68.7, 40.0. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{24}H_{19}N_3S_2$ $(M+Na)^+$ 436.0913, Found: 436.0903.

4-(benzofuran-2-yl)-2-(1-phenyl-2-(phenylthio) ethyl)-2H-1,2,3-triazole (4j)



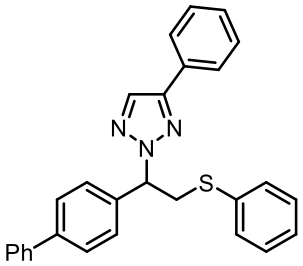
Following the procedure, product **4j** was obtained as a colorless oil. (75% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.96 (s, 1H), 7.59 (d, *J* = 7.6 Hz, 1H), 7.54 (d, *J* = 8.1 Hz, 1H), 7.39 (d, *J* = 7.4 Hz, 4H), 7.35 – 7.26 (m, 6H), 7.24 (d, *J* = 7.8 Hz, 2H), 7.08 (s, 1H), 5.83 (dd, *J* = 9.6, 5.4 Hz, 1H), 4.11 (dd, *J* = 14.1, 9.7 Hz, 1H), 3.69 (dd, *J* = 14.1, 5.4 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 154.8, 147.7, 140.0, 137.9, 134.4, 132.1, 131.3, 129.2, 128.9, 128.7, 128.5, 127.2, 127.0, 124.8, 123.2, 121.2, 111.4, 103.6, 68.8, 39.9. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{24}H_{19}N_3OSNa$ $(M+Na)^+$ 420.1141, Found: 420.1142.

2-(1-(4-fluorophenyl)-2-(phenylthio) ethyl)-4-phenyl-2H-1,2,3-triazole (4k)



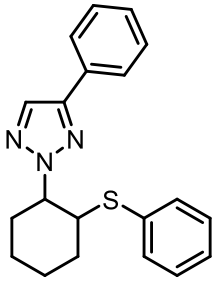
Following the procedure, product **4k** was obtained as a colorless oil. (82% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.83 (s, 1H), 7.76 (d, *J* = 7.3 Hz, 2H), 7.42 – 7.33 (m, 7H), 7.27 (t, *J* = 7.4 Hz, 2H), 7.23 – 7.19 (m, 1H), 6.99 (t, *J* = 8.6 Hz, 2H), 5.76 (dd, *J* = 9.2, 5.9 Hz, 1H), 4.05 (dd, *J* = 14.0, 9.2 Hz, 1H), 3.64 (dd, *J* = 14.0, 5.9 Hz, 1H). **^{19}F NMR** (376 MHz, Chloroform-*d*) δ -112.98. **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 162.7 (d, *J* = 247.6 Hz), 147.9, 134.5, 134.0 (d, *J* = 3.2 Hz), 131.3, 131.2, 130.3, 129.2, 129.0 (d, *J* = 8.4 Hz), 128.8, 128.5, 127.2, 126.1, 115.7 (d, *J* = 21.6 Hz), 67.7, 40.1. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{22}H_{18}FN_3SNa$ $(M+Na)^+$ 398.1098, Found: 398.1094.

2-(1-([1,1'-biphenyl]-4-yl)-2-(phenylthio) ethyl)-4-phenyl-2H-1,2,3-triazole (4l)



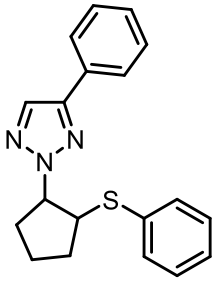
Following the procedure, product **4l** was obtained as a colorless oil. (77% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.86 (s, 1H), 7.78 (d, *J* = 7.4 Hz, 2H), 7.55 – 7.50 (m, 4H), 7.45 (d, *J* = 8.3 Hz, 2H), 7.43 – 7.37 (m, 6H), 7.33 (dd, *J* = 7.2, 3.8 Hz, 2H), 7.28 (t, *J* = 7.5 Hz, 2H), 7.22 (d, *J* = 7.1 Hz, 1H), 5.83 (dd, *J* = 9.5, 5.6 Hz, 1H), 4.12 (dd, *J* = 14.0, 9.5 Hz, 1H), 3.71 (dd, *J* = 14.1, 5.6 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.9, 141.6, 140.5, 137.2, 134.7, 131.3, 131.2, 130.5, 129.2, 128.9, 128.8, 128.5, 127.6, 127.5, 127.2, 126.1, 68.3, 40.0. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{28}H_{23}N_3SNa$ $(M+Na)^+$ 456.1515, Found: 456.1522.

4-phenyl-2-(2-(phenylthio) cyclohexyl)-2H-1,2,3-triazole (4m)



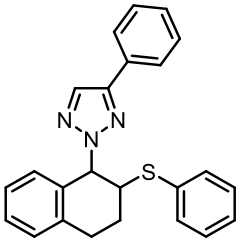
Following the procedure, product **4m** was obtained as a colorless oil. (71% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.75 (s, 1H), 7.73 (d, *J* = 2.8 Hz, 2H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.36 – 7.30 (m, 3H), 7.20 – 7.13 (m, 3H), 4.47 (td, *J* = 11.3, 4.2 Hz, 1H), 3.64 (td, *J* = 11.3, 3.9 Hz, 1H), 2.33 – 2.26 (m, 1H), 2.24 – 2.16 (m, 1H), 2.05 (qd, *J* = 12.6, 3.6 Hz, 1H), 1.91 – 1.78 (m, 2H), 1.57 – 1.31 (m, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.2, 134.0, 132.7, 130.7, 130.5, 128.8, 128.6, 128.2, 127.5, 125.9, 68.3, 51.9, 33.8, 33.4, 25.8, 24.8. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{22}N_3S$ $(M+H)^+$ 336.1534, Found: 336.1530. (known product)[2]

4-phenyl-2-(2-(phenylthio)cyclopentyl)-2H-1,2,3-triazole (4n)



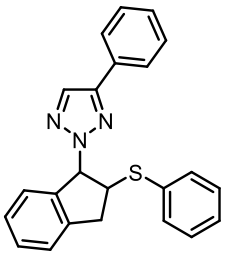
Following the procedure, product **4n** was obtained as a colorless oil. (82% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.73 (d, *J* = 7.7 Hz, 3H), 7.41 (t, *J* = 7.5 Hz, 2H), 7.37 – 7.31 (m, 3H), 7.20 (t, *J* = 7.4 Hz, 2H), 7.13 (t, *J* = 7.2 Hz, 1H), 4.95 (q, *J* = 6.4 Hz, 1H), 4.13 (q, *J* = 7.2 Hz, 1H), 2.45 – 2.34 (m, 2H), 2.33 – 2.24 (m, 1H), 2.07 – 1.96 (m, 1H), 1.96 – 1.86 (m, 1H), 1.84 – 1.74 (m, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.5, 134.3, 131.6, 130.8, 130.6, 128.8, 128.8, 128.3, 126.9, 125.9, 71.6, 51.9, 31.9, 31.8, 22.8. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{19}H_{19}N_3SNa$ $(M+Na)^+$ 344.1192, Found: 344.1201.

4-phenyl-2-(2-(phenylthio)-1,2,3,4-tetrahydronaphthalen-1-yl)-2H-1,2,3-triazole (4o)



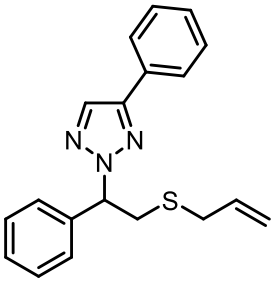
Following the procedure, product **4o** was obtained as a colorless oil. (71% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 7.69 (d, *J* = 7.3 Hz, 2H), 7.38 (d, *J* = 6.8 Hz, 2H), 7.32 (t, *J* = 7.5 Hz, 2H), 7.24 (t, *J* = 7.4 Hz, 1H), 7.19 – 7.11 (m, 3H), 7.09 – 7.02 (m, 2H), 6.96 (t, *J* = 7.3 Hz, 1H), 6.68 (d, *J* = 7.8 Hz, 1H), 5.78 (d, *J* = 8.9 Hz, 1H), 4.08 – 3.99 (m, 1H), 3.05 – 2.94 (m, 1H), 2.88 (dt, *J* = 17.1, 4.9 Hz, 1H), 2.41 (dq, *J* = 13.2, 4.8 Hz, 1H), 2.01 – 1.84 (m, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 136.1, 133.9, 133.6, 132.3, 131.3, 130.5, 128.90, 128.9, 128.8, 128.4, 128.1, 127.9, 127.8, 126.6, 126.1, 68.2, 49.2, 28.6, 28.5. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{24}H_{22}N_3S$ $(M+H)^+$ 384.1456, Found: 384.1451.

4-phenyl-2-(2-(phenylthio)-2,3-dihydro-1H-inden-1-yl)-2H-1,2,3-triazole (4p)



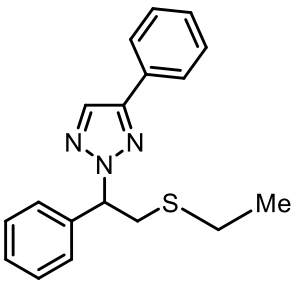
Following the procedure, product **4p** was obtained as a colorless oil. (75% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.80 (s, 1H), 7.73 (d, *J* = 7.5 Hz, 2H), 7.42 – 7.38 (m, 4H), 7.34 (d, *J* = 7.3 Hz, 1H), 7.28 (d, *J* = 5.2 Hz, 2H), 7.25 – 7.14 (m, 4H), 7.03 (d, *J* = 7.6 Hz, 1H), 6.13 (d, *J* = 6.7 Hz, 1H), 4.64 (q, *J* = 7.4 Hz, 1H), 3.68 (dd, *J* = 16.2, 8.0 Hz, 1H), 3.10 (dd, *J* = 16.2, 7.5 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 148.0, 140.9, 139.5, 133.4, 132.4, 131.5, 130.4, 129.2, 129.0, 128.8, 128.5, 127.5, 127.4, 126.0, 124.9, 124.5, 75.1, 51.9, 37.9. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{23}H_{19}N_3SNa$ $(M+Na)^+$ 392.1192, Found: 392.1184.

2-(2-(allylthio)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4q)



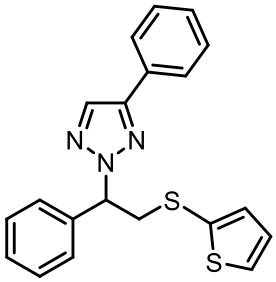
Following the procedure, product **4q** was obtained as a colorless oil. (71% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.89 (s, 1H), 7.80 (d, *J* = 7.3 Hz, 2H), 7.44 – 7.39 (m, 4H), 7.37 – 7.29 (m, 4H), 5.84 – 5.75 (m, 2H), 5.16 (d, *J* = 5.3 Hz, 1H), 5.12 (s, 1H), 3.65 (dd, *J* = 14.1, 9.7 Hz, 1H), 3.25 (dd, *J* = 14.1, 5.6 Hz, 1H), 3.08 (dd, *J* = 7.0, 4.4 Hz, 2H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.5, 134.2, 131.1, 130.5, 128.8, 128.8, 128.5, 128.4, 127.0, 126.0, 117.7, 69.2, 35.7, 35.1. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{19}H_{20}N_3S$ $(M+H)^+$ 322.1300, Found: 322.1306.

2-(2-(methylthio)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4r)



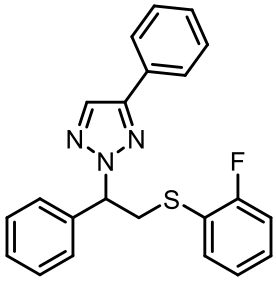
Following the procedure, product **4r** was obtained as a colorless oil. (78% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.88 (s, 1H), 7.79 (d, *J* = 7.8 Hz, 2H), 7.44 (d, *J* = 7.6 Hz, 2H), 7.39 (d, *J* = 7.7 Hz, 2H), 7.35 – 7.27 (m, 4H), 5.82 (dd, *J* = 9.3, 5.8 Hz, 1H), 3.73 (dd, *J* = 14.0, 9.5 Hz, 1H), 3.32 (dd, *J* = 14.0, 5.8 Hz, 1H), 2.47 (q, *J* = 7.4 Hz, 2H), 1.21 (t, *J* = 7.4 Hz, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.6, 131.2, 130.5, 128.9, 128.8, 128.6, 128.5, 127.1, 126.1, 69.6, 36.9, 26.5, 14.8. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{18}H_{19}N_3SNa$ $(M+Na)^+$ 332.1192, Found: 332.1194.

4-phenyl-2-(1-phenyl-2-(thiophen-2-ylthio) ethyl)-2H-1,2,3-triazole (4s)



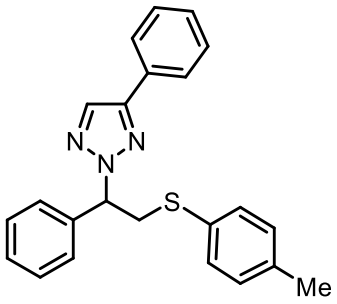
Following the procedure, product **4s** was obtained as a colorless oil. (72% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.88 (s, 1H), 7.79 (d, *J* = 7.5 Hz, 2H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.38 – 7.27 (m, 7H), 7.13 (d, *J* = 3.4 Hz, 1H), 6.97 (dd, *J* = 5.2, 3.7 Hz, 1H), 5.81 (dd, *J* = 10.0, 5.1 Hz, 1H), 3.97 (dd, *J* = 14.0, 10.1 Hz, 1H), 3.50 (dd, *J* = 14.1, 5.1 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.1, 135.3, 132.7, 131.3, 130.5, 130.3, 128.8, 128.8, 128.6, 128.5, 127.8, 127.0, 126.1, 68.1, 43.8. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{20}H_{17}N_3S$ $(M+Na)^+$ 386.0756, Found: 386.0765.

2-(2-((2-fluorophenyl) thio)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4t)



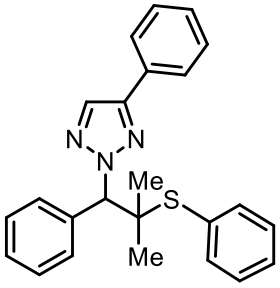
Following the procedure, product **4t** was obtained as a colorless oil. (79% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.80 (s, 1H), 7.75 (d, *J* = 7.2 Hz, 2H), 7.41 – 7.34 (m, 4H), 7.34 – 7.25 (m, 5H), 7.22 – 7.15 (m, 1H), 7.01 (q, *J* = 7.7, 6.8 Hz, 2H), 5.78 (dd, *J* = 9.8, 5.2 Hz, 1H), 4.10 (dd, *J* = 14.1, 9.9 Hz, 1H), 3.64 (dd, *J* = 14.1, 5.2 Hz, 1H). **^{19}F NMR** (376 MHz, Chloroform-*d*) δ -107.85. **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 162.2 (d, *J* = 246.2 Hz), 147.8, 138.2, 134.3 (d, *J* = 1.3 Hz), 131.2, 130.5, 129.7 (d, *J* = 8.0 Hz), 128.8, 128.8, 128.6, 128.4, 127.0, 126.0, 124.5 (d, *J* = 3.8 Hz), 121.3 (d, *J* = 17.7 Hz), 116.0 (d, *J* = 22.7 Hz), 69.2, 39.2. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{22}H_{18}FN_3SNa$ $(M+Na)^+$ 398.1098, Found: 398.1094.

4-phenyl-2-(1-phenyl-2-(p-tolylthio) ethyl)-2H-1,2,3-triazole (4u)



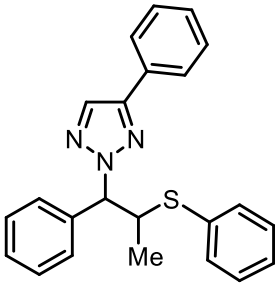
Following the procedure, product **4u** was obtained as a colorless oil. (82% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.83 (s, 1H), 7.75 (d, *J* = 7.4 Hz, 2H), 7.41 – 7.33 (m, 4H), 7.33 – 7.25 (m, 6H), 7.07 (d, *J* = 7.9 Hz, 2H), 5.76 (dd, *J* = 9.7, 5.3 Hz, 1H), 4.05 (dd, *J* = 14.1, 9.8 Hz, 1H), 3.60 (dd, *J* = 14.1, 5.3 Hz, 1H), 2.27 (s, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.4, 137.4, 132.0, 131.2, 130.9, 130.5, 129.9, 128.8, 128.8, 128.6, 128.4, 127.1, 126.1, 68.6, 40.8, 21.2. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{23}H_{21}N_3SNa$ $(M+Na)^+$ 394.1348, Found: 394.1357.

2-(2-methyl-1-phenyl-2-(phenylthio) propyl)-4-phenyl-2H-1,2,3-triazole (4v)



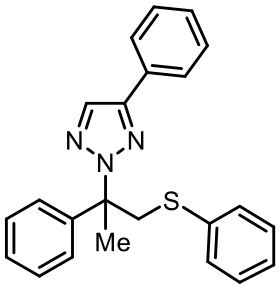
Following the procedure, product **4v** was obtained as a colorless oil. (50% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.67 (d, *J* = 7.6 Hz, 2H), 7.48 (s, 1H), 7.33 (t, *J* = 7.5 Hz, 2H), 7.24 (t, *J* = 7.2 Hz, 1H), 7.13 (s, 5H), 7.08 – 7.00 (m, 5H), 4.78 (s, 1H), 1.92 (s, 3H), 1.64 (s, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 146.5, 138.2, 134.6, 131.5, 130.8, 129.5, 128.8, 128.7, 128.1, 127.9, 127.7, 127.2, 125.7, 118.7, 65.3, 65.0, 26.0, 25.5. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{24}H_{23}N_3SNa$ $(M+Na)^+$ 408.1505, Found: 408.1515.

4-phenyl-2-(1-phenyl-2-(phenylthio) propyl)-2H-1,2,3-triazole (4w)



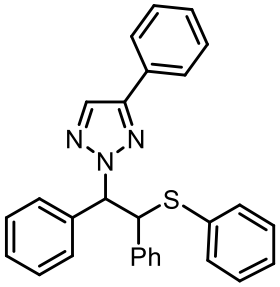
Following the procedure, product **4w** was obtained as a colorless oil. (53% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.78 (d, *J* = 7.5 Hz, 2H), 7.62 (s, 1H), 7.39 (t, *J* = 7.5 Hz, 3H), 7.32 (t, *J* = 5.4 Hz, 4H), 7.23 – 7.12 (m, 6H), 4.24 (d, *J* = 13.6 Hz, 1H), 3.92 (d, *J* = 13.6 Hz, 1H), 2.19 (s, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.5, 142.5, 136.1, 130.7, 130.6, 128.9, 128.8, 128.7, 128.4, 128.1, 126.8, 125.7, 125.6, 119.4, 67.8, 46.7, 26.9. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{22}N_3S$ $(M+H)^+$ 372.1456, Found: 372.1448.

4-phenyl-2-(2-phenyl-1-(phenylthio) propan-2-yl)-2H-1,2,3-triazole (4x)



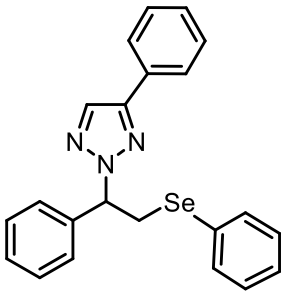
Following the procedure, product **4x** was obtained as a colorless oil. (48% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.78 (d, *J* = 7.5 Hz, 2H), 7.62 (s, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.32 (t, *J* = 5.5 Hz, 4H), 7.26 (d, *J* = 4.8 Hz, 2H), 7.23 – 7.13 (m, 5H), 4.24 (d, *J* = 13.6 Hz, 1H), 3.92 (d, *J* = 13.6 Hz, 1H), 2.19 (s, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 142.5, 136.0, 130.6, 130.6, 128.9, 128.8, 128.7, 128.4, 128.1, 126.8, 125.7, 125.7, 119.4, 67.8, 46.7, 26.9. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{22}N_3S$ $(M+H)^+$ 372.1534, Found: 372.1530. (known product)[2]

2-(1,2-diphenyl-2-(phenylthio) ethyl)-4-phenyl-2H-1,2,3-triazole (4y)



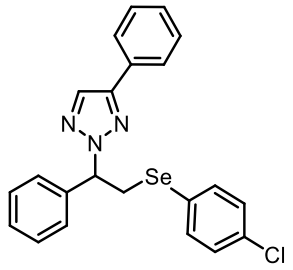
Following the procedure, product **4y** was obtained as a colorless oil. (78% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.78 – 7.74 (m, 2H), 7.62 – 7.59 (m, 2H), 7.54 (s, 1H), 7.34 (t, *J* = 7.6 Hz, 5H), 7.29 – 7.23 (m, 3H), 7.14 – 7.02 (m, 8H), 6.08 (d, *J* = 11.6 Hz, 1H), 5.31 (d, *J* = 11.6 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.4, 138.9, 136.7, 133.7, 133.4, 130.7, 130.4, 128.8, 128.7, 128.6, 128.6, 128.5, 128.3, 128.1, 128.0, 127.7, 127.3, 125.9, 73.2, 58.2. **HRMS** (ESI) m/z: [M+Na] $^{+}$ Calcd for $C_{28}H_{23}N_3SNa$ (M+Na) $^{+}$ 456.1505, Found: 456.1515.

4-phenyl-2-(1-phenyl-2-(phenylselanyl) ethyl)-2H-1,2,3-triazole (4z)



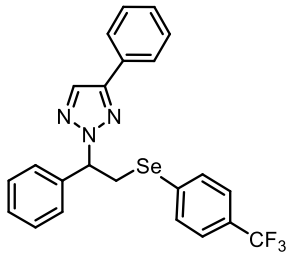
Following the procedure, product **4z** was obtained as a colorless oil. (83% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.83 (d, *J* = 1.5 Hz, 1H), 7.79 – 7.75 (m, 2H), 7.53 – 7.49 (m, 2H), 7.40 (t, *J* = 7.7 Hz, 2H), 7.37 – 7.26 (m, 6H), 7.25 – 7.22 (m, 3H), 5.86 – 5.80 (m, 1H), 4.09 – 4.01 (m, 1H), 3.66 – 3.57 (m, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.9, 133.9, 131.2, 130.5, 129.2, 129.2, 128.9, 128.8, 128.6, 128.5, 127.7, 126.9, 126.1, 69.4, 32.9. **HRMS** (ESI) m/z: [M+H] $^{+}$ Calcd for $C_{22}H_{20}N_3Se$ (M+H) $^{+}$ 406.0766, Found: 406.0760.

2-(2-((4-chlorophenyl) selanyl)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4aa)



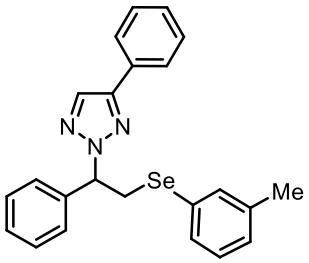
Following the procedure, product **4aa** was obtained as a colorless oil. (81% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.82 (s, 1H), 7.75 (d, *J* = 7.5 Hz, 2H), 7.44 – 7.38 (m, 4H), 7.36 – 7.26 (m, 6H), 7.18 (d, *J* = 8.2 Hz, 2H), 5.81 (dd, *J* = 9.9, 5.3 Hz, 1H), 4.03 (dd, *J* = 12.7, 10.3 Hz, 1H), 3.58 (dd, *J* = 13.1, 5.3 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.7, 135.4, 134.0, 131.2, 130.3, 129.3, 128.8, 128.6, 128.5, 127.1, 126.9, 126.0, 69.4, 33.2. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{22}H_{18}ClN_3SeNa$ $(M+Na)^+$ 462.0247, Found: 462.0249.

4-phenyl-2-(1-phenyl-2-((4-(trifluoromethyl) phenyl) selanyl) ethyl)-2H-1,2,3-triazole (4ab)



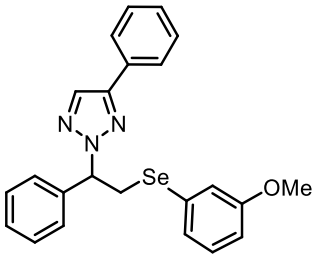
Following the procedure, product **4ab** was obtained as a colorless oil. (55% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.81 (s, 1H), 7.75 (d, *J* = 7.4 Hz, 2H), 7.55 (d, *J* = 8.0 Hz, 2H), 7.47 – 7.29 (m, 10H), 5.86 (dd, *J* = 9.8, 5.3 Hz, 1H), 4.12 (dd, *J* = 12.9, 10.1 Hz, 1H), 3.68 (dd, *J* = 13.1, 5.3 Hz, 1H). **^{19}F NMR** (376 MHz, Chloroform-*d*) δ -62.69. **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.8, 138.5, 134.4, 132.9, 131.2, 130.2, 129.6, 129.2, 128.9, 128.8, 128.7, 128.5, 126.8, 125.9, 125.8 (q, *J* = 3.6 Hz), 69.5, 32.6. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{19}F_3N_3Se$ $(M+H)^+$ 474.0618, Found: 474.0610.

4-phenyl-2-(1-phenyl-2-(m-tolylselanyl) ethyl)-2H-1,2,3-triazole (4ac)



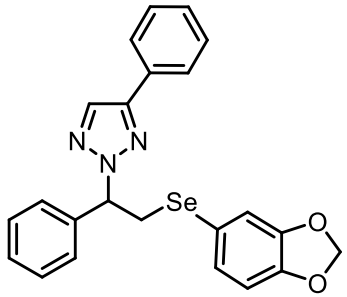
Following the procedure, product **4ac** was obtained as a colorless oil. (85% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.83 (s, 1H), 7.76 (d, *J* = 7.7 Hz, 2H), 7.42 – 7.26 (m, 10H), 7.13 (t, *J* = 7.5 Hz, 1H), 7.03 (d, *J* = 7.5 Hz, 1H), 5.84 (dd, *J* = 9.7, 5.6 Hz, 1H), 4.04 (dd, *J* = 12.6, 10.1 Hz, 1H), 3.61 (dd, *J* = 13.0, 5.5 Hz, 1H), 2.27 (s, 3H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 147.7, 139.0, 138.9, 134.5, 131.1, 130.8, 130.5, 129.0, 128.9, 128.8, 128.8, 128.5, 128.4, 128.4, 126.9, 126.0, 69.5, 32.8, 21.3. HRMS (ESI) m/z: $[M+Na]^+$ Calcd for $C_{23}H_{21}N_3SeNa$ $(M+Na)^+$ 442.0793, Found: 442.0789.

2-(2-((3-methoxyphenyl) selanyl)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4ad)



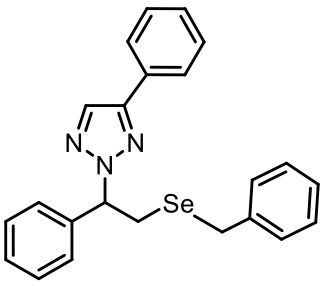
Following the procedure, product **4ad** was obtained as a colorless oil. (78% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.84 (s, 1H), 7.77 (d, *J* = 7.6 Hz, 2H), 7.44 – 7.27 (m, 9H), 7.16 (t, *J* = 7.8 Hz, 1H), 7.09 (d, *J* = 7.5 Hz, 1H), 6.78 (d, *J* = 8.1 Hz, 1H), 5.85 (dd, *J* = 9.8, 5.4 Hz, 1H), 4.05 (dd, *J* = 12.7, 10.2 Hz, 1H), 3.74 (s, 3H), 3.62 (dd, *J* = 13.2, 5.2 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 159.7, 147.7, 138.9, 131.2, 130.4, 130.1, 130.0, 128.8, 128.8, 128.6, 128.4, 126.9, 126.0, 125.8, 119.0, 113.5, 69.4, 55.3, 32.8. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{23}H_{21}N_3OSeNa$ $(M+Na)^+$ 458.0742, Found: 458.0739.

2-(2-(benzo[d] [1,3] dioxol-5-ylselanyl)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4ae)



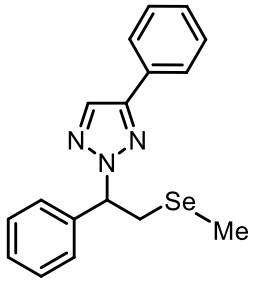
Following the procedure, product **4ae** was obtained as a colorless oil. (68% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.83 (s, 1H), 7.76 (d, *J* = 7.6 Hz, 2H), 7.42 – 7.25 (m, 8H), 7.03 – 6.97 (m, 2H), 6.67 (d, *J* = 7.9 Hz, 1H), 5.84 (s, 2H), 5.83 – 5.79 (m, 1H), 4.02 – 3.94 (m, 1H), 3.51 (dd, *J* = 13.0, 5.3 Hz, 1H). **^{13}C NMR** (100 MHz, Chloroform-*d*) δ 148.0, 147.9, 147.7, 138.9, 131.1, 130.5, 129.1, 128.9, 128.8, 128.5, 128.4, 126.9, 126.0, 119.9, 115.3, 109.1, 101.3, 69.5, 33.9. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{23}H_{19}N_3O_2SeNa$ $(M+Na)^+$ 472.0535, Found: 472.0529.

2-(2-(benzylselanyl)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4af)



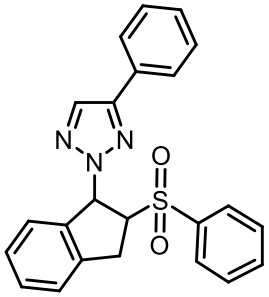
Following the procedure, product **4af** was obtained as a colorless oil. (85% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.79 (d, *J* = 7.6 Hz, 2H), 7.57 (s, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.35 – 7.24 (m, 11H), 5.40 (t, *J* = 7.5 Hz, 1H), 3.69 (s, 2H), 3.64 (dd, *J* = 13.3, 8.7 Hz, 1H), 3.27 (dd, *J* = 13.2, 6.5 Hz, 1H). **^{13}C NMR** (101 MHz, Chloroform-*d*) δ 147.5, 138.9, 138.3, 130.5, 129.1, 129.0, 128.9, 128.8, 128.7, 128.2, 127.1, 127.0, 125.7, 119.6, 66.1, 28.3, 28.1. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{22}N_3Se$ $(M+H)^+$ 420.0901, Found: 420.0909.

2-(2-(methylselanyl)-1-phenylethyl)-4-phenyl-2H-1,2,3-triazole (4ag)



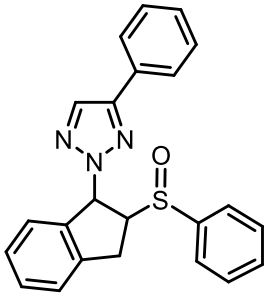
Following the procedure, product **4ag** was obtained as a colorless oil. (86% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.87 (s, 1H), 7.79 (d, *J* = 7.9 Hz, 2H), 7.46 – 7.38 (m, 4H), 7.36 – 7.28 (m, 4H), 5.86 (dd, *J* = 9.1, 6.3 Hz, 1H), 3.71 (dd, *J* = 12.9, 9.6 Hz, 1H), 3.31 (dd, *J* = 13.0, 6.0 Hz, 1H), 1.91 (s, 3H). **^{13}C NMR** (101 MHz, Chloroform-*d*) δ 147.7, 138.9, 131.1, 130.5, 128.8, 128.8, 128.5, 128.4, 127.0, 126.0, 70.0, 29.8, 5.1. **HRMS** (ESI) m/z: $[M+Na]^+$ Calcd for $C_{17}H_{17}N_3SeNa$ $(M+Na)^+$ 366.0480, Found: 366.0482.

4-phenyl-2-(2-(phenylsulfonyl)-2,3-dihydro-1H-inden-1-yl)-2H-1,2,3-triazole (6)



Product **6** was obtained as a white solid. (90% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.85 (d, *J* = 7.3 Hz, 2H), 7.62 (d, *J* = 8.7 Hz, 3H), 7.45 – 7.29 (m, 9H), 6.94 (d, *J* = 7.6 Hz, 1H), 6.57 (d, *J* = 7.6 Hz, 1H), 5.01 (q, *J* = 8.3 Hz, 1H), 3.74 (dd, *J* = 16.3, 8.4 Hz, 1H), 3.63 (dd, *J* = 16.4, 9.1 Hz, 1H). **^{13}C NMR** (101 MHz, Chloroform-*d*) δ 148.0, 138.5, 137.8, 133.8, 131.6, 129.9, 129.7, 129.1, 128.8, 128.6, 128.4, 127.9, 125.9, 125.0, 123.9, 69.9, 68.2, 31.1. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{20}N_3O_2S$ $(M+H)^+$ 402.1198, Found: 402.1190.

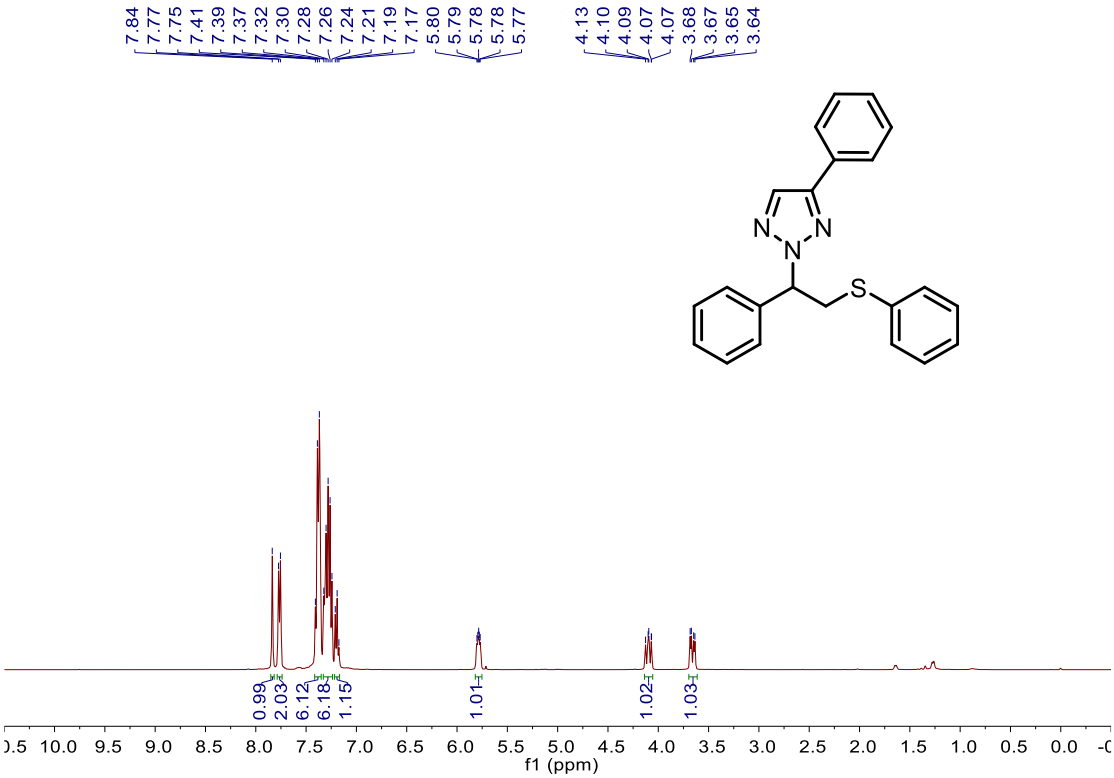
4-phenyl-2-(2-(phenylsulfinyl)-2,3-dihydro-1H-inden-1-yl)-2H-1,2,3-triazole (7)



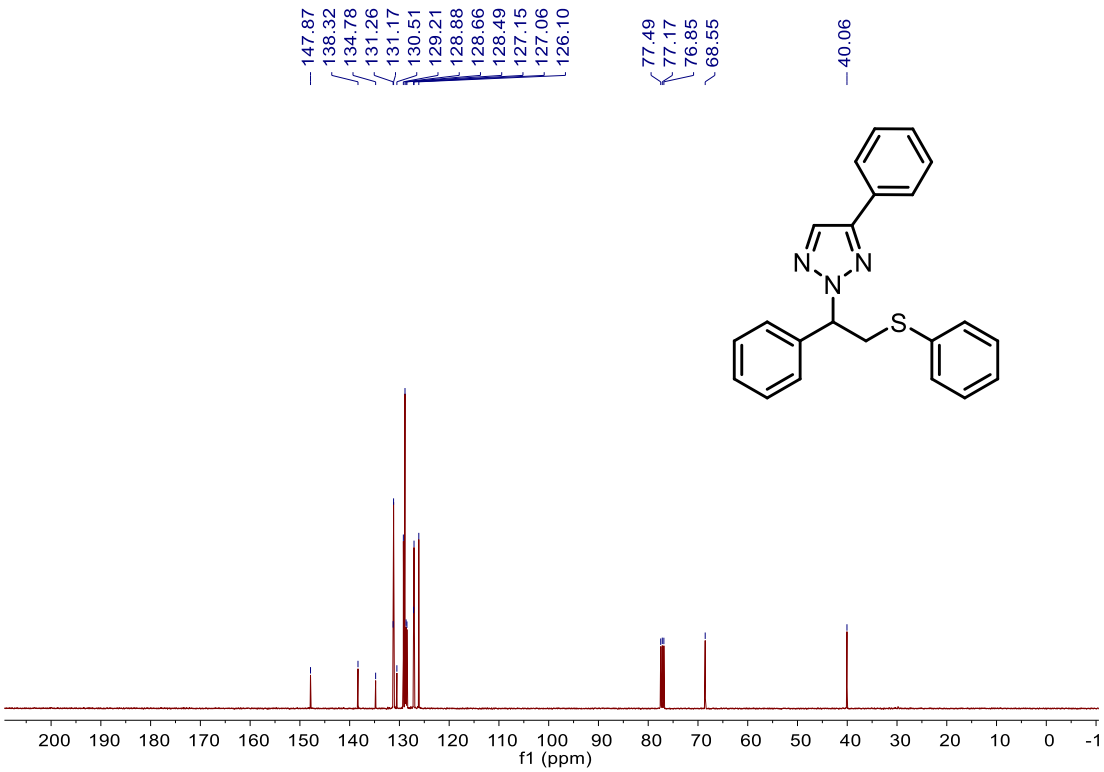
Product **7** was obtained as a white solid. (85% yield). **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 7.89 (s, 1H), 7.78 (d, *J* = 7.5 Hz, 2H), 7.64 (d, *J* = 7.1 Hz, 2H), 7.51 – 7.41 (m, 5H), 7.40 – 7.33 (m, 1H), 7.28 – 7.14 (m, 3H), 7.06 (d, *J* = 7.6 Hz, 1H), 6.59 (d, *J* = 7.7 Hz, 1H), 4.46 (q, *J* = 8.2 Hz, 1H), 3.59 (dd, *J* = 16.4, 8.1 Hz, 1H), 2.96 (dd, *J* = 16.4, 8.8 Hz, 1H). **^{13}C NMR** (101 MHz, Chloroform-*d*) δ 148.3, 141.8, 139.7, 138.7, 131.8, 131.2, 130.1, 129.4, 129.2, 128.9, 128.6, 127.6, 126.0, 125.0, 124.3, 124.2, 69.1, 68.6, 27.8. **HRMS** (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{20}N_3OS$ $(M+H)^+$ 386.1249, Found: 386.1241.

5. ^{1}H, ^{19}F and ^{13}C NMR Spectra of products 4

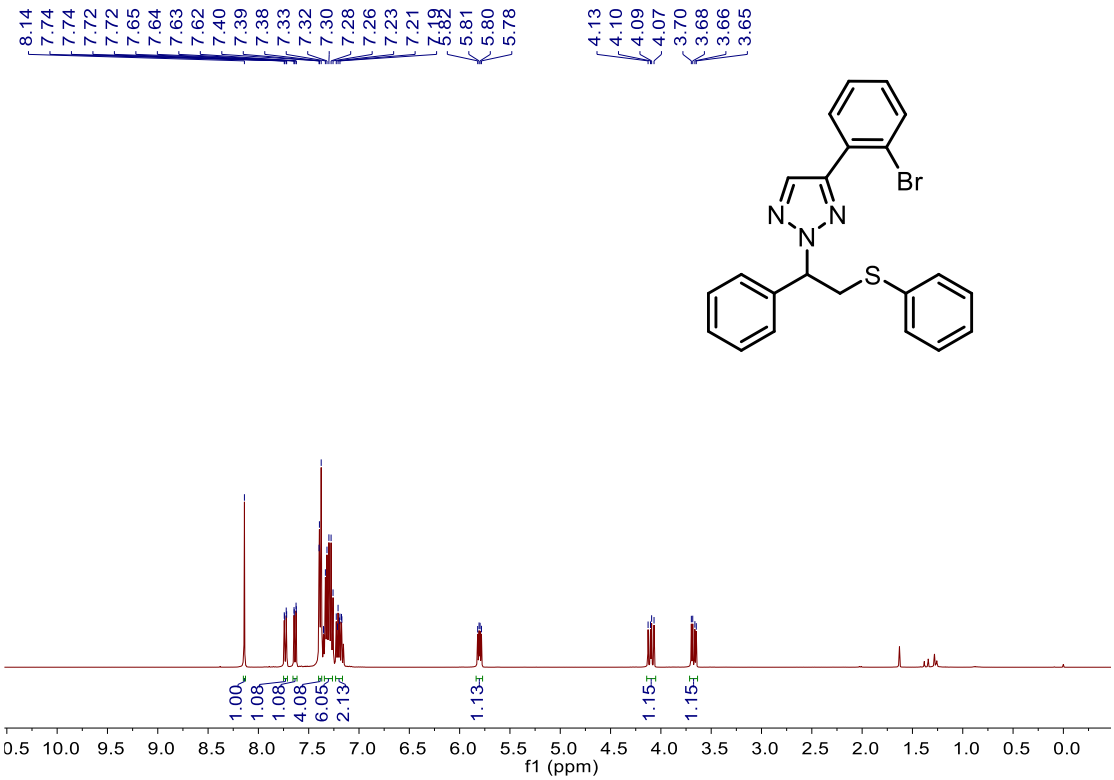
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4a**



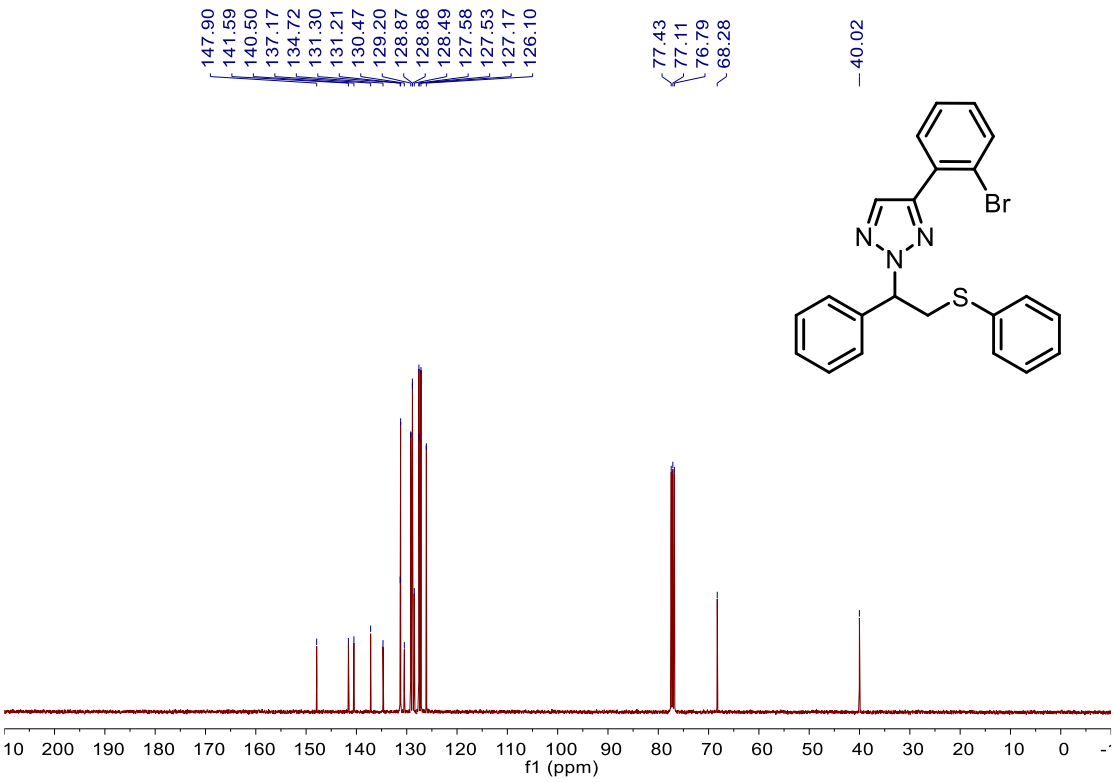
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4a



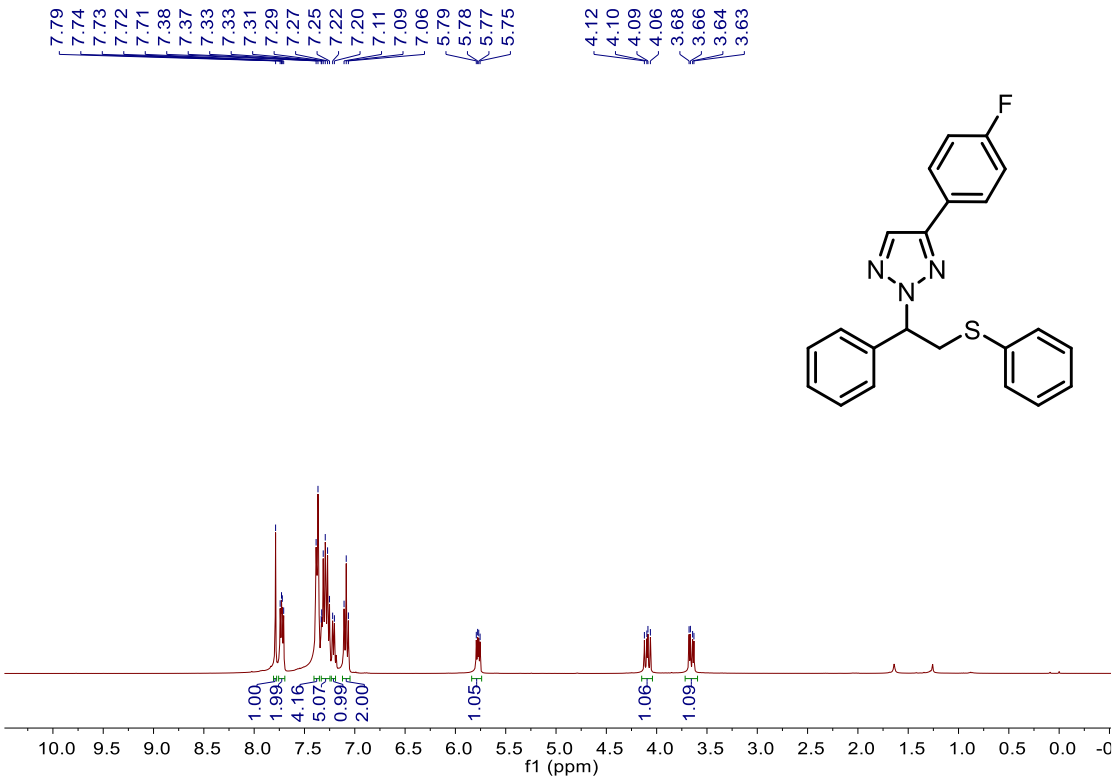
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4b**



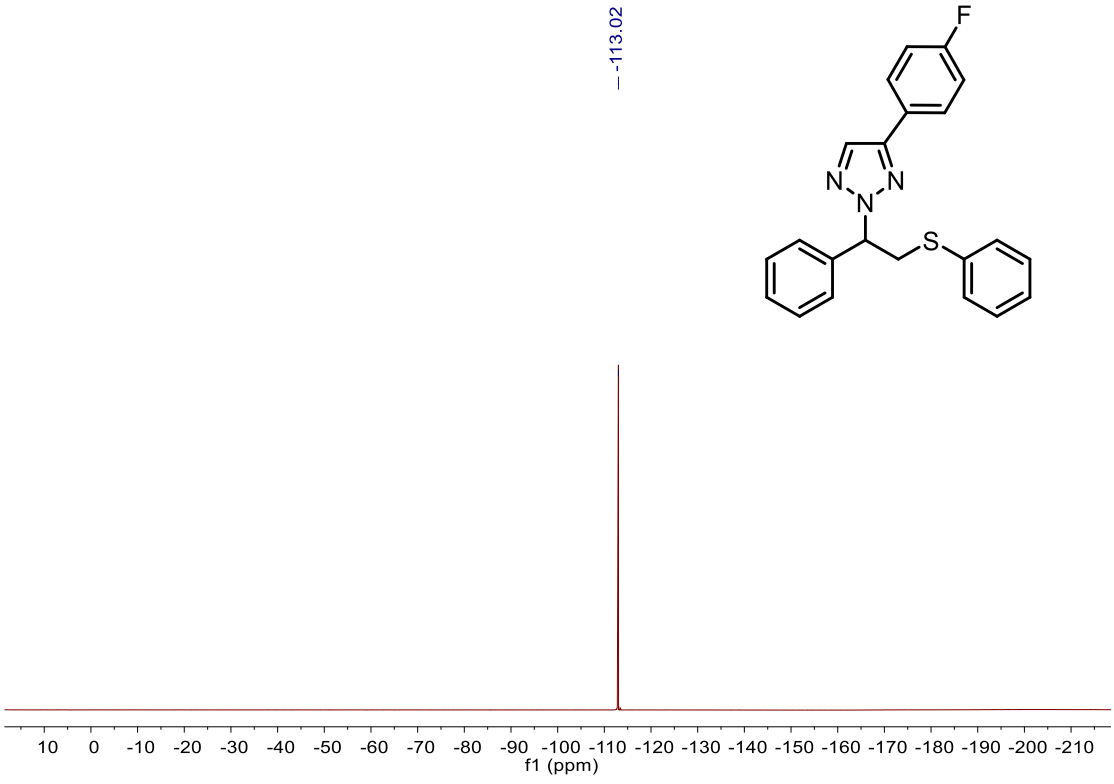
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4b



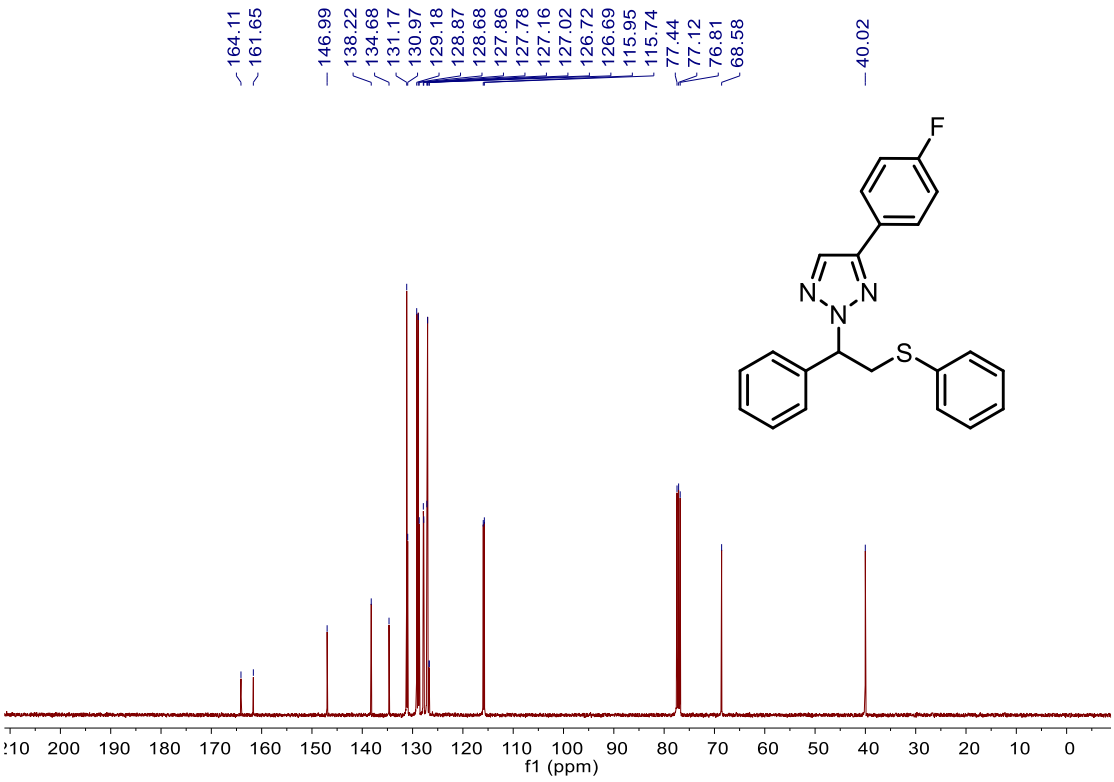
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4c**



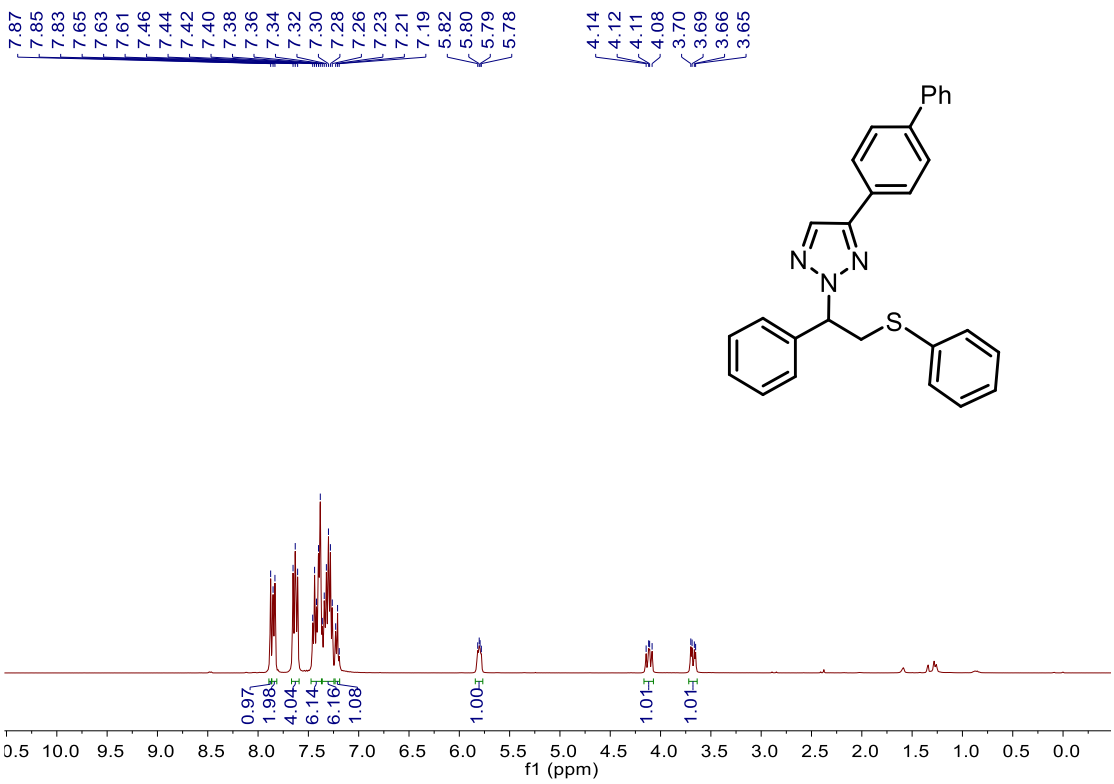
^{19}F NMR (376 MHz, $CDCl_3$) spectrum for 4c



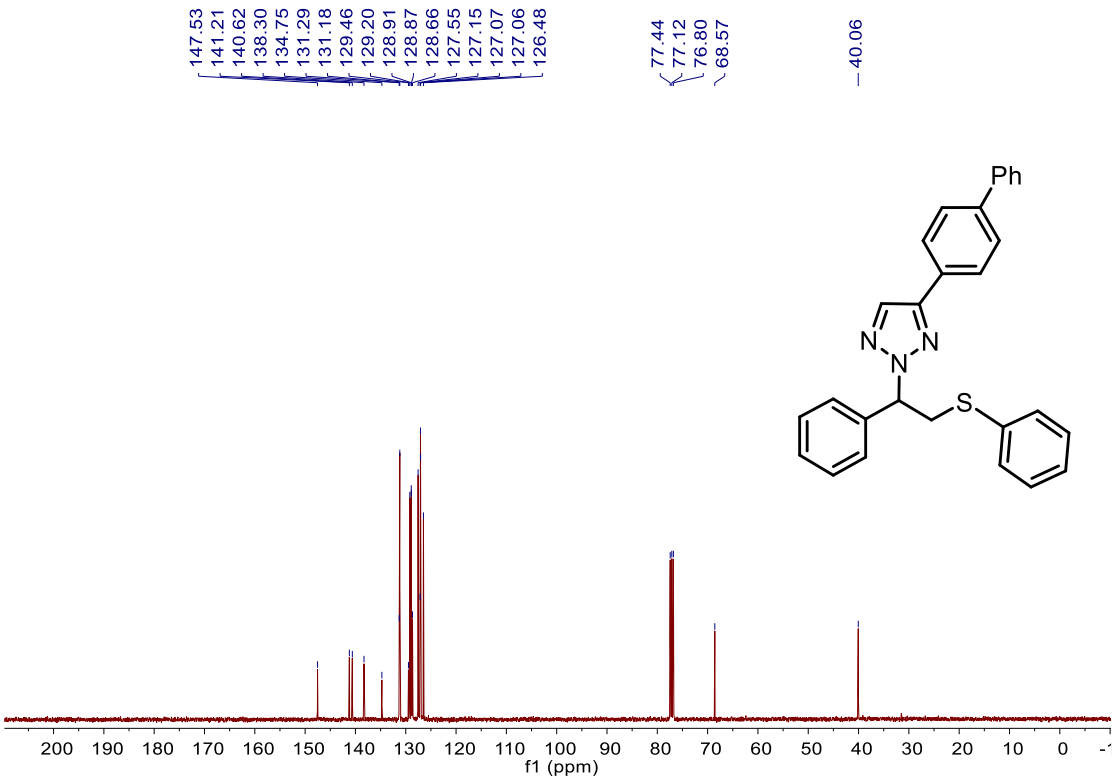
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4c



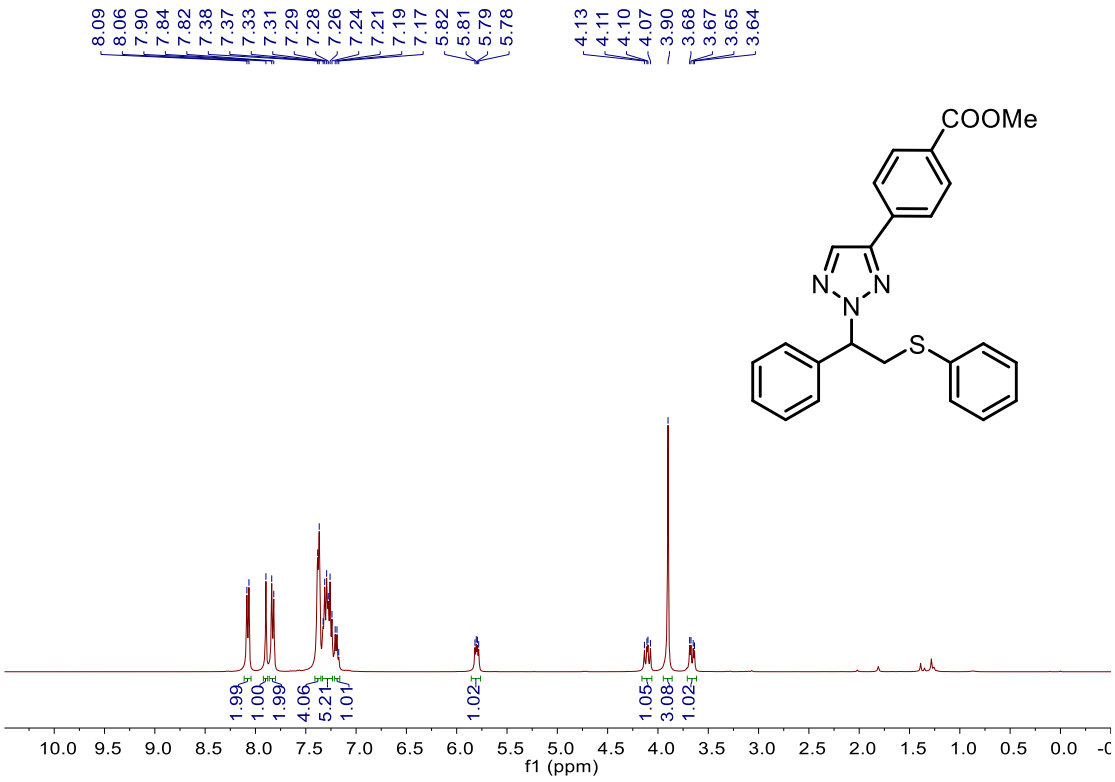
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4d**



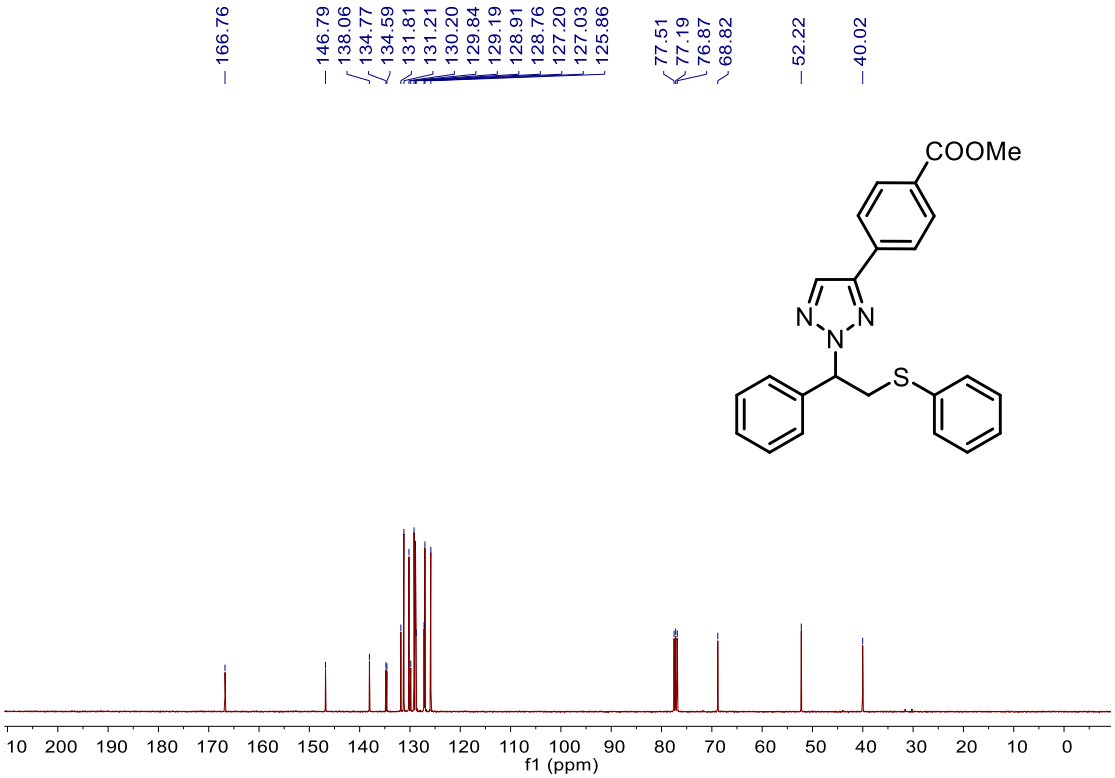
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4d



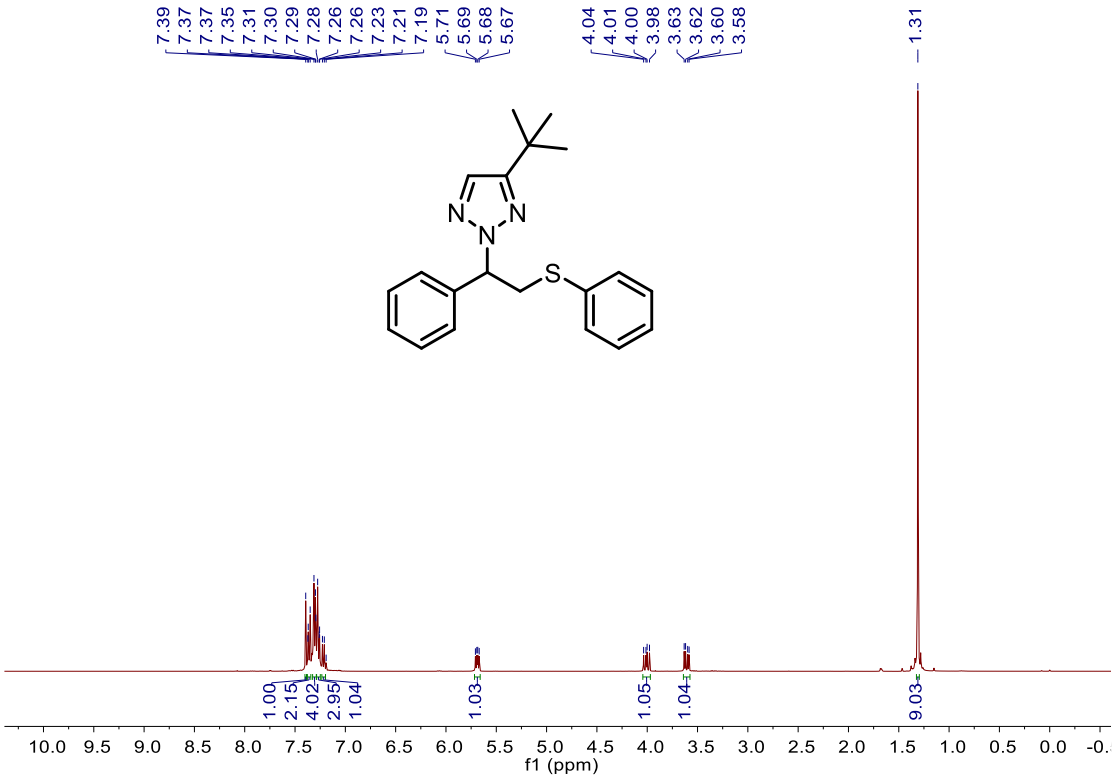
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4e**



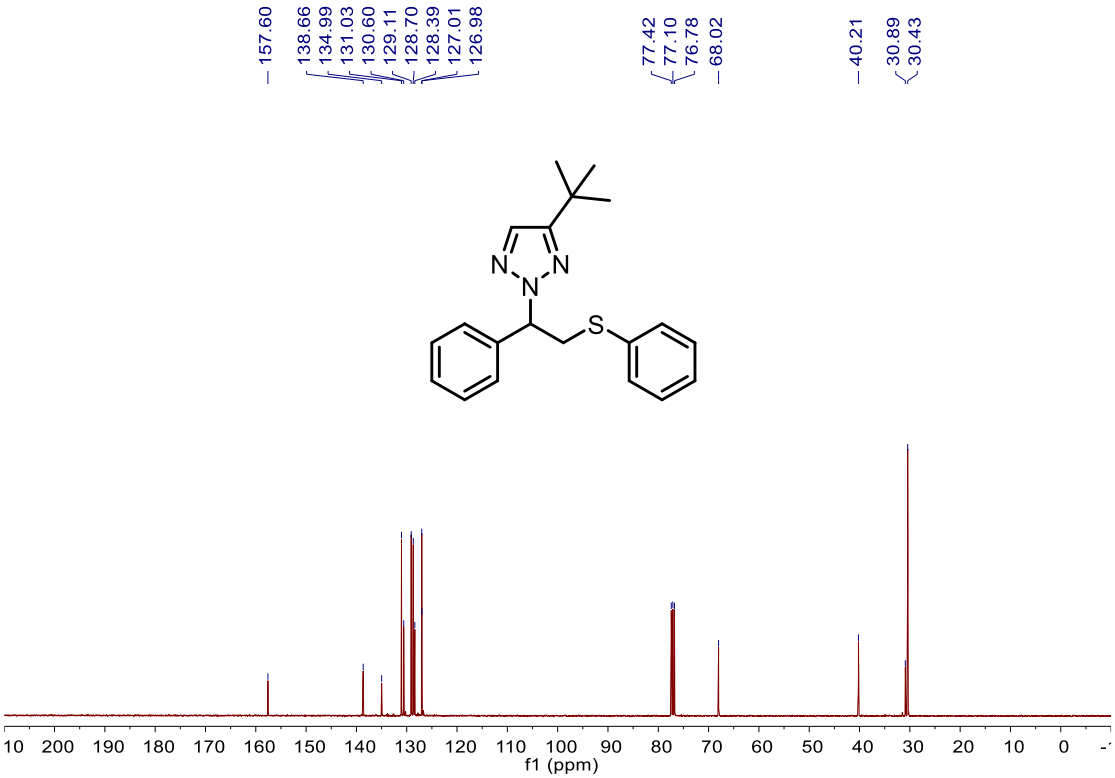
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4e



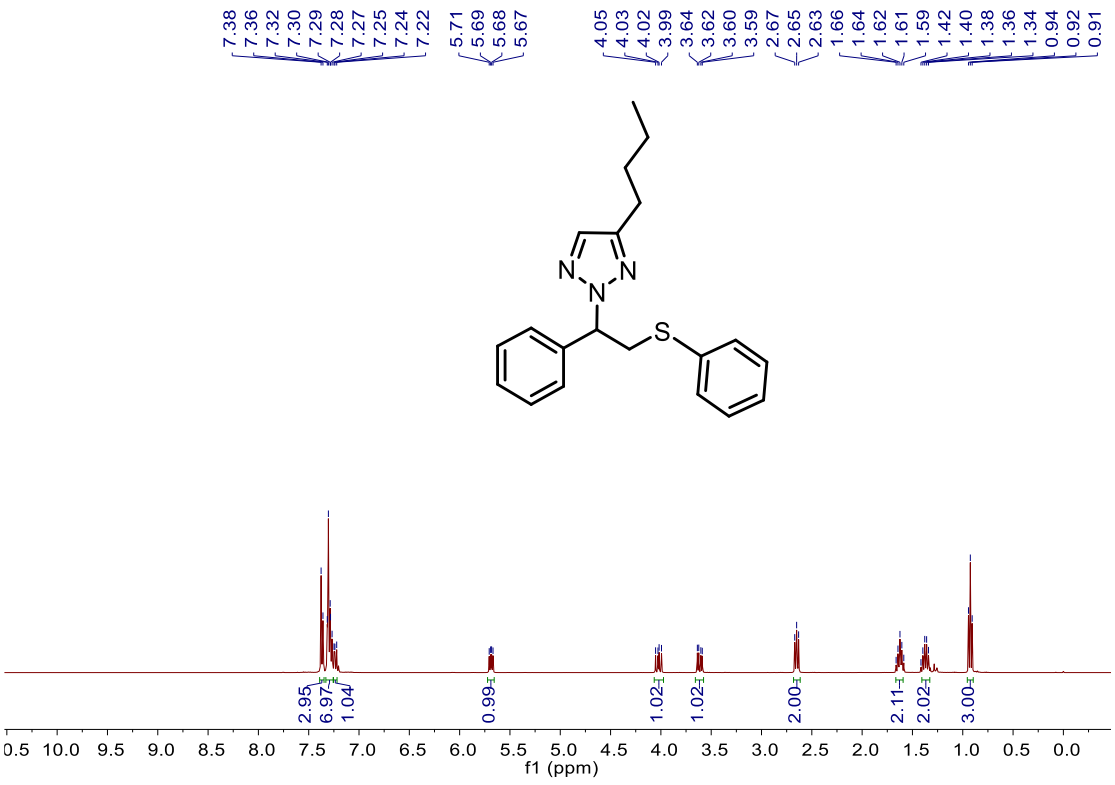
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4f**



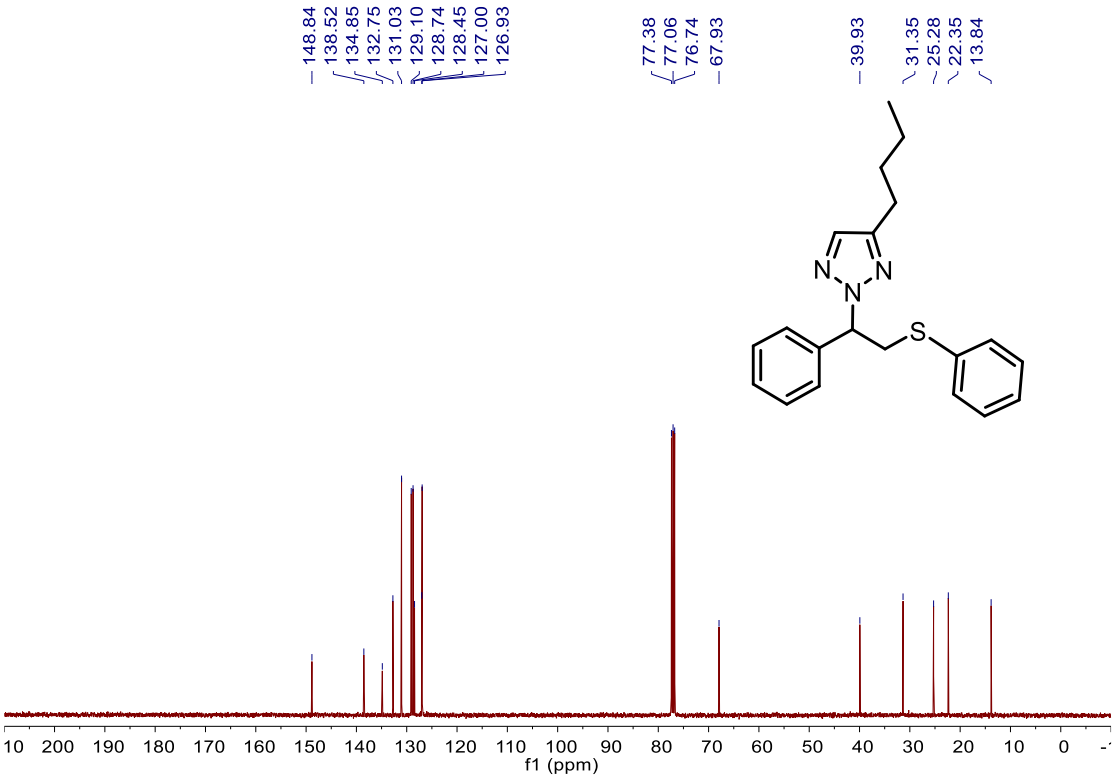
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4f



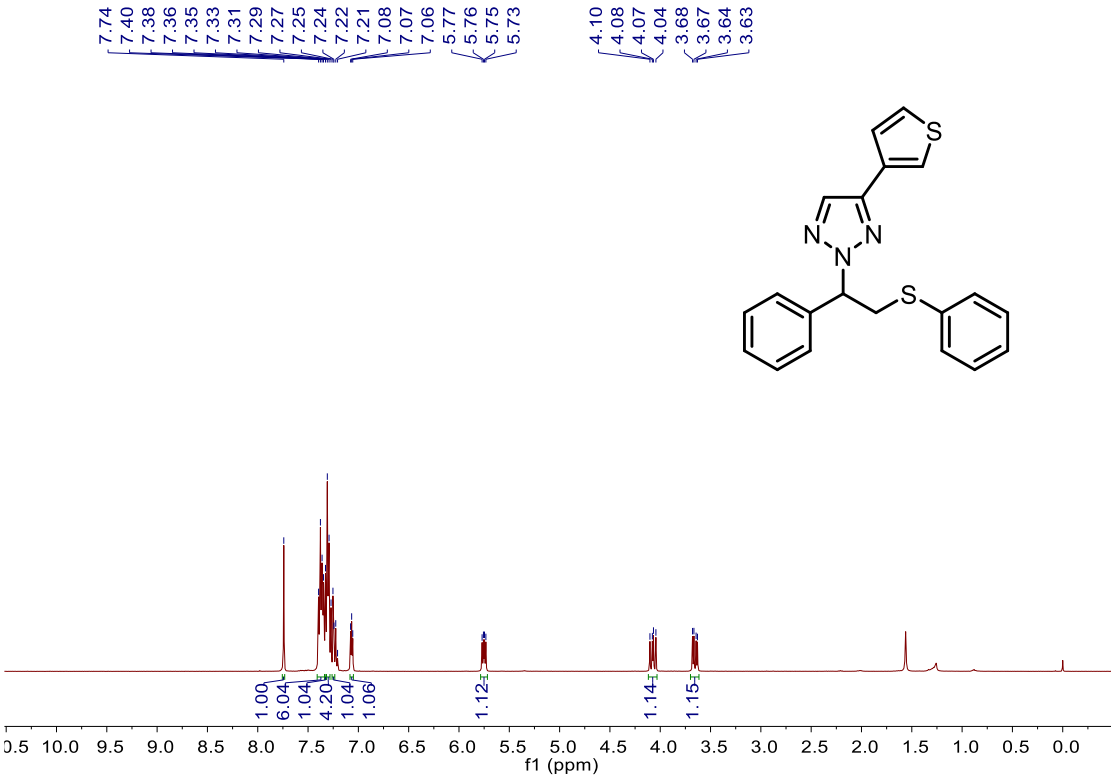
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4g**



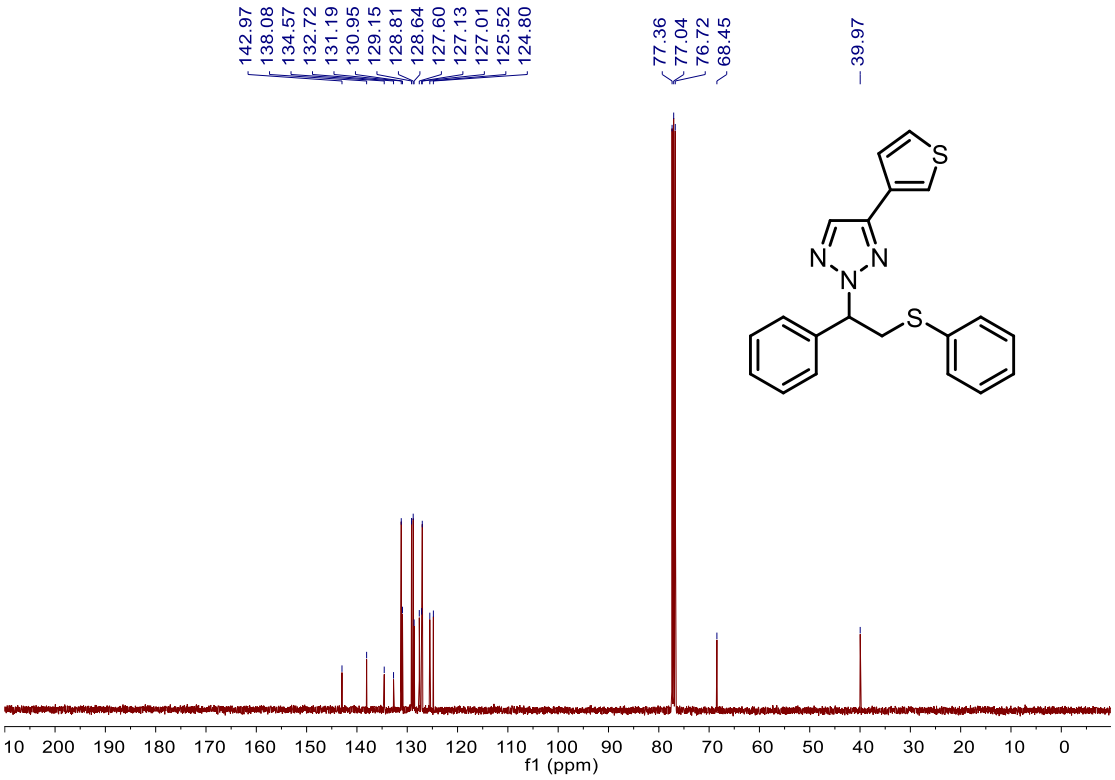
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4g



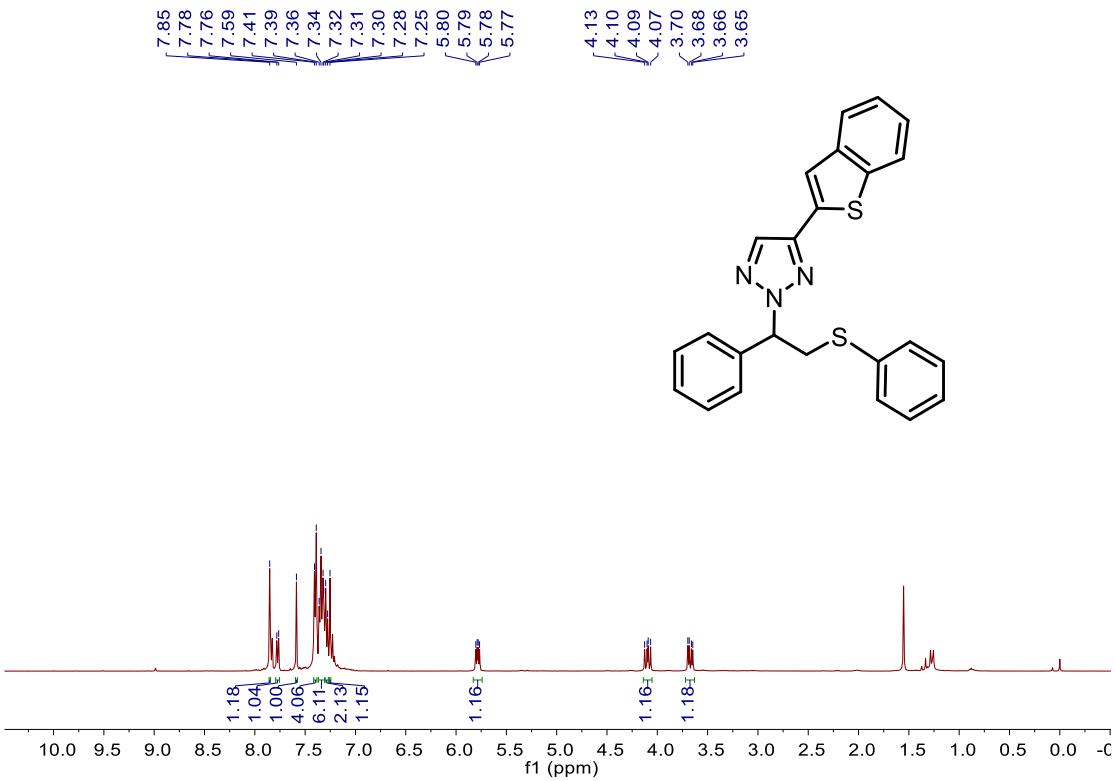
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4h**



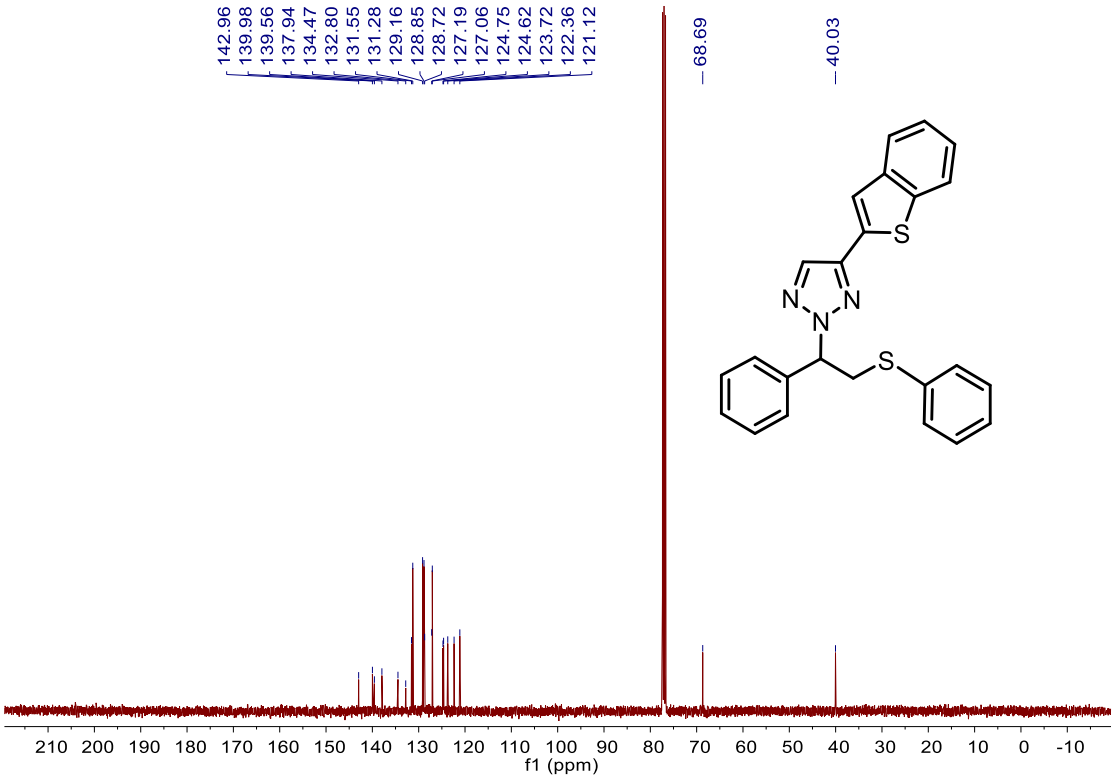
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4h



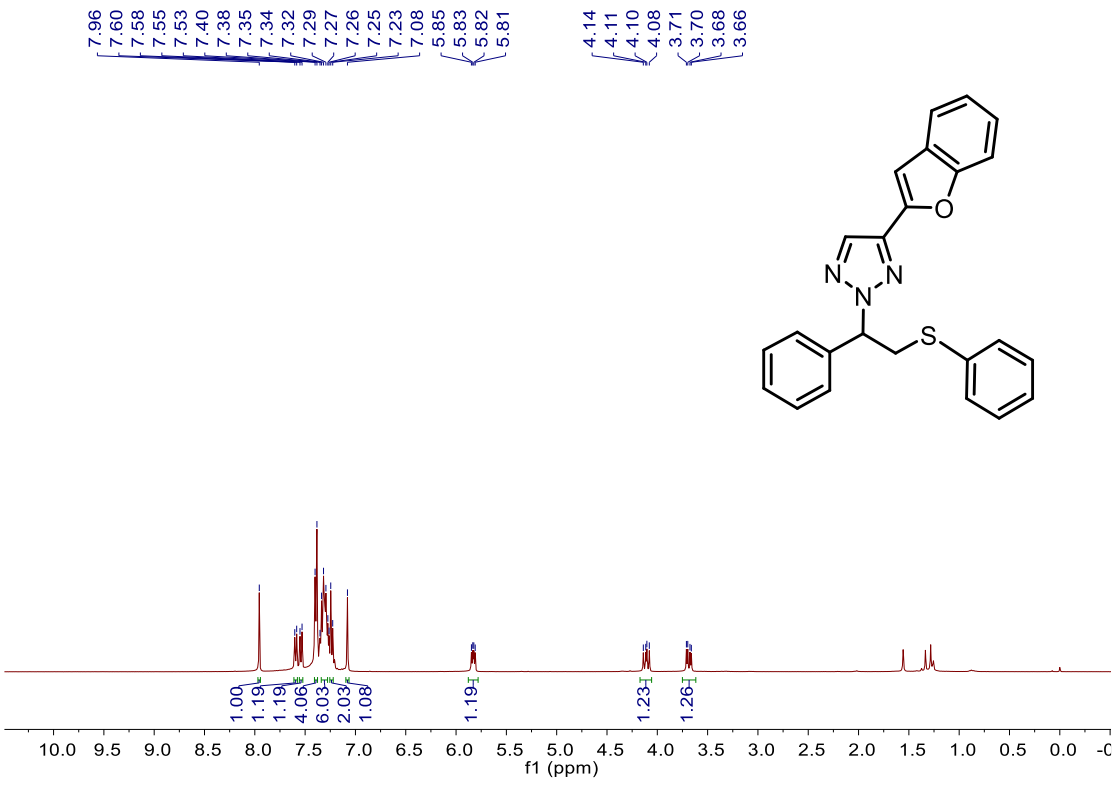
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4i**



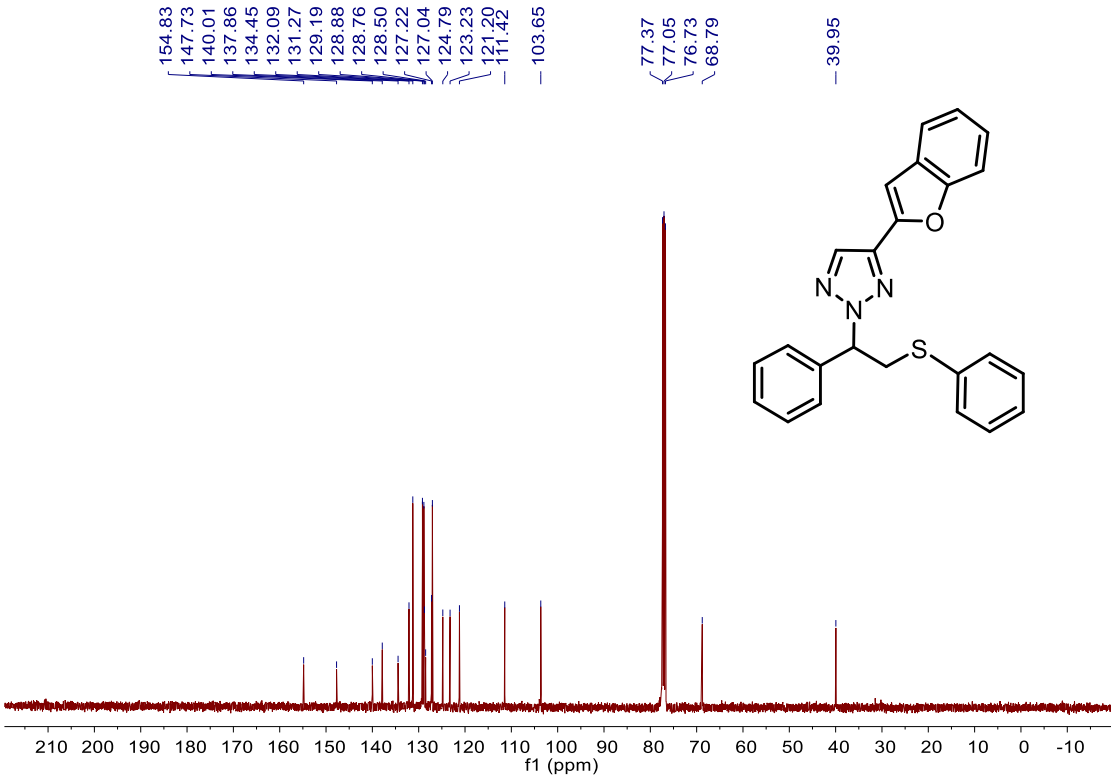
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4i



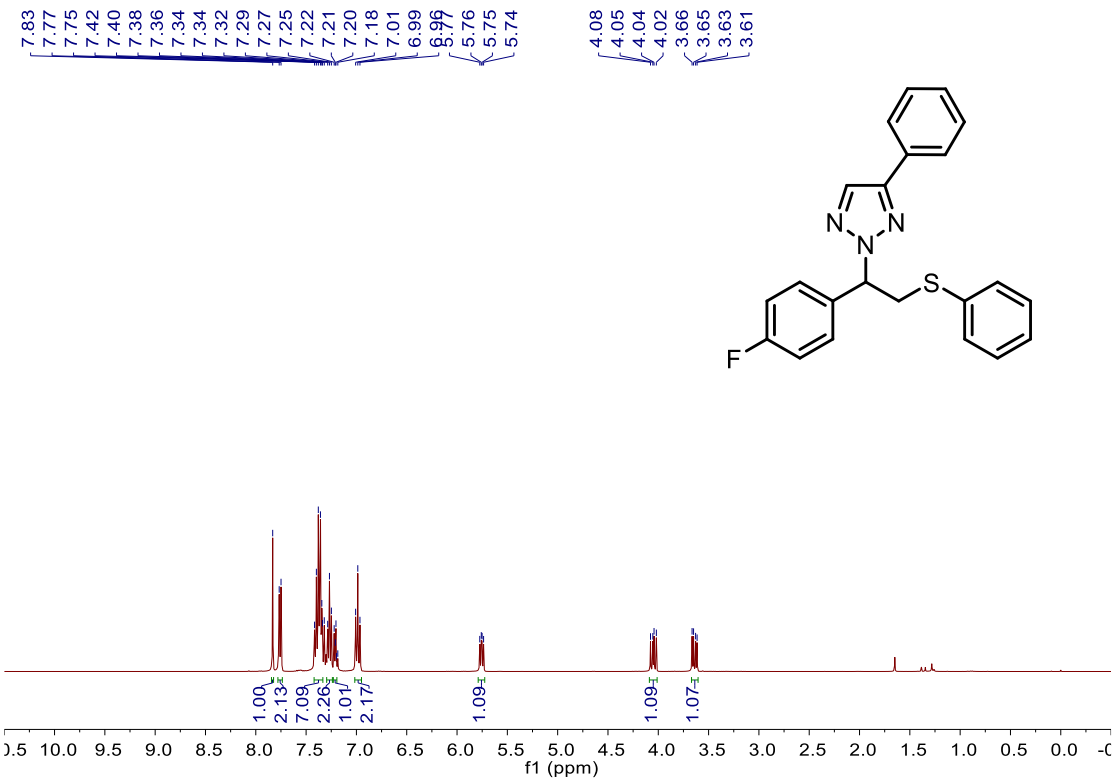
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4j**



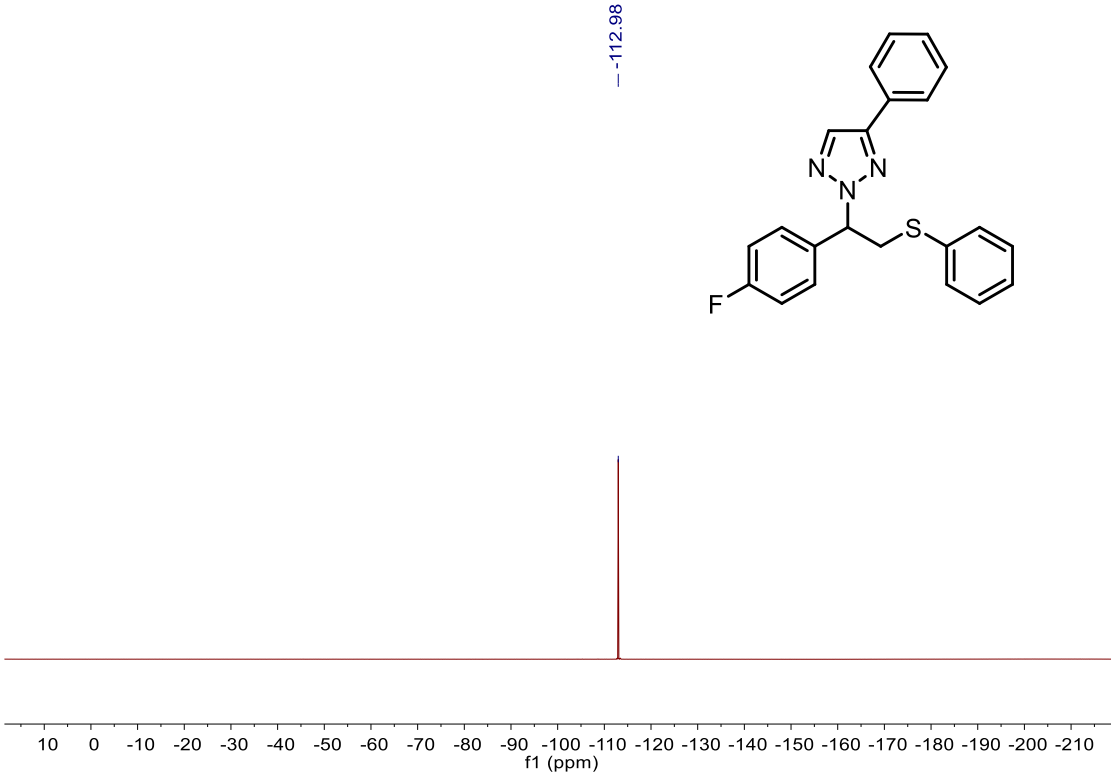
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4j



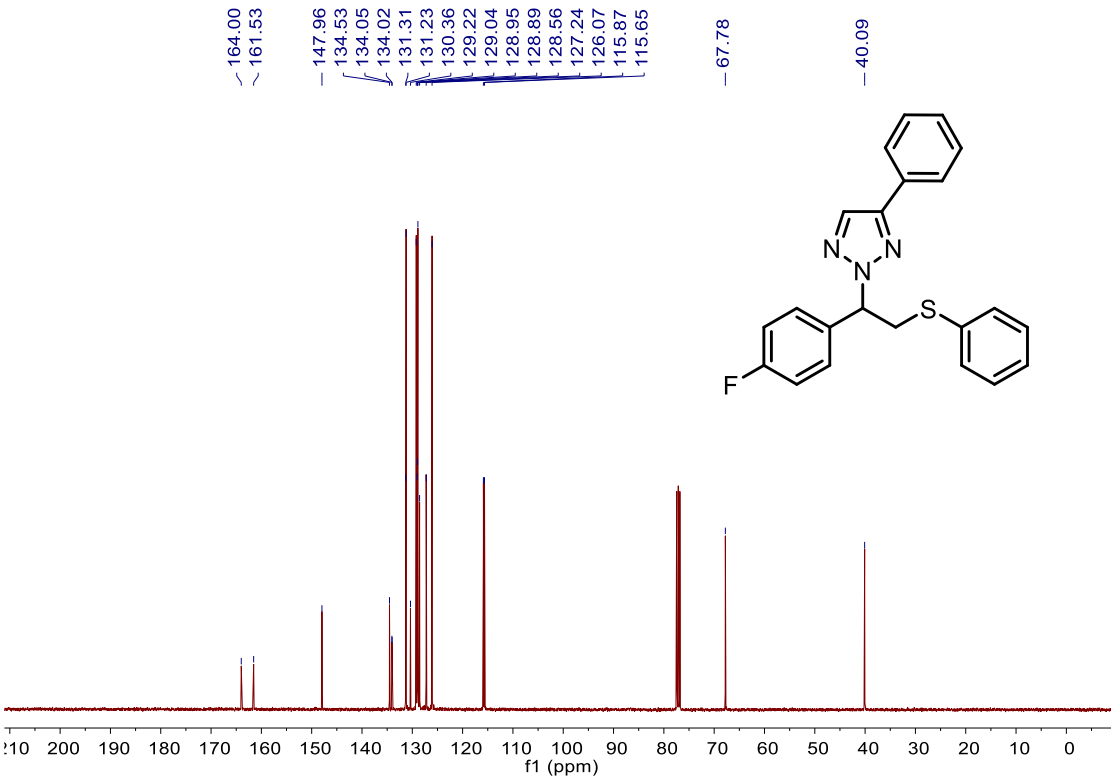
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4k**



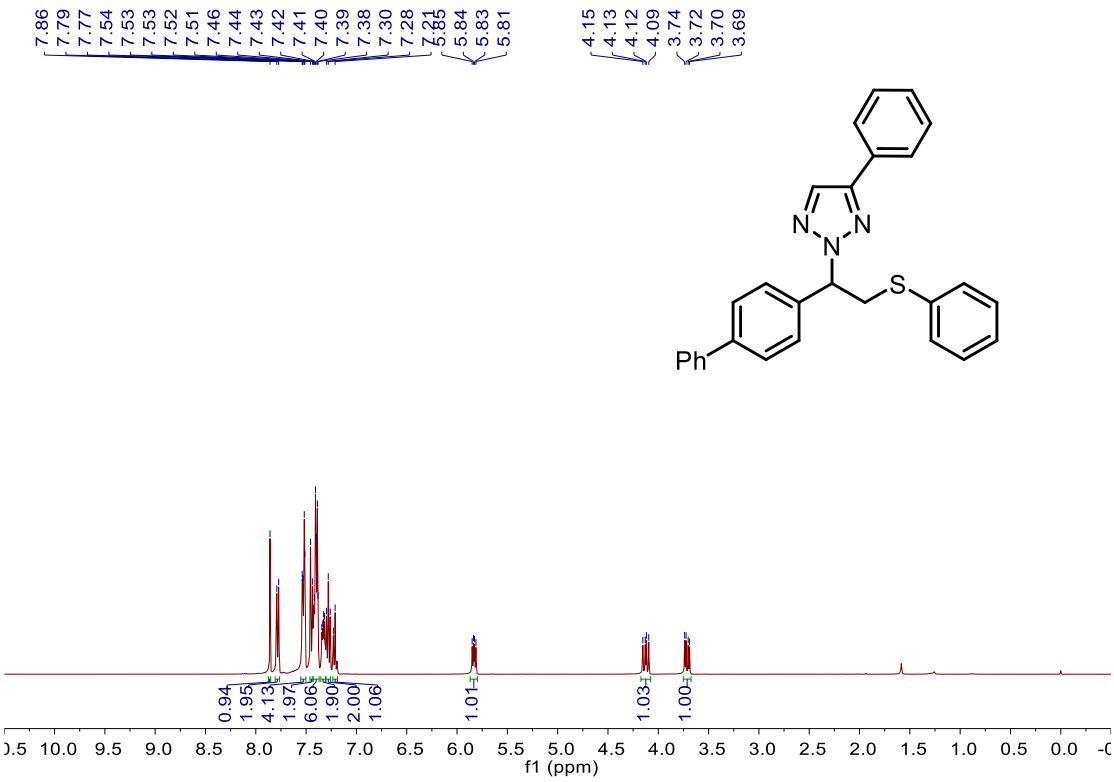
^{19}F NMR (376 MHz, $CDCl_3$) spectrum for 4k



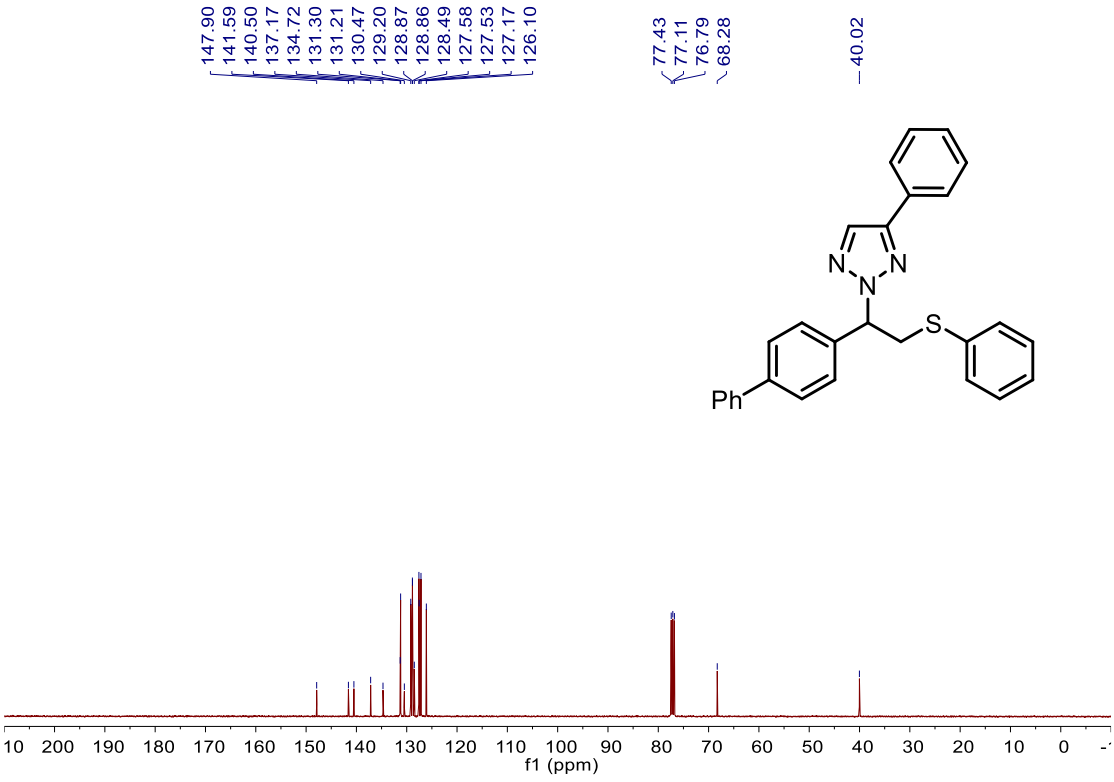
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4k



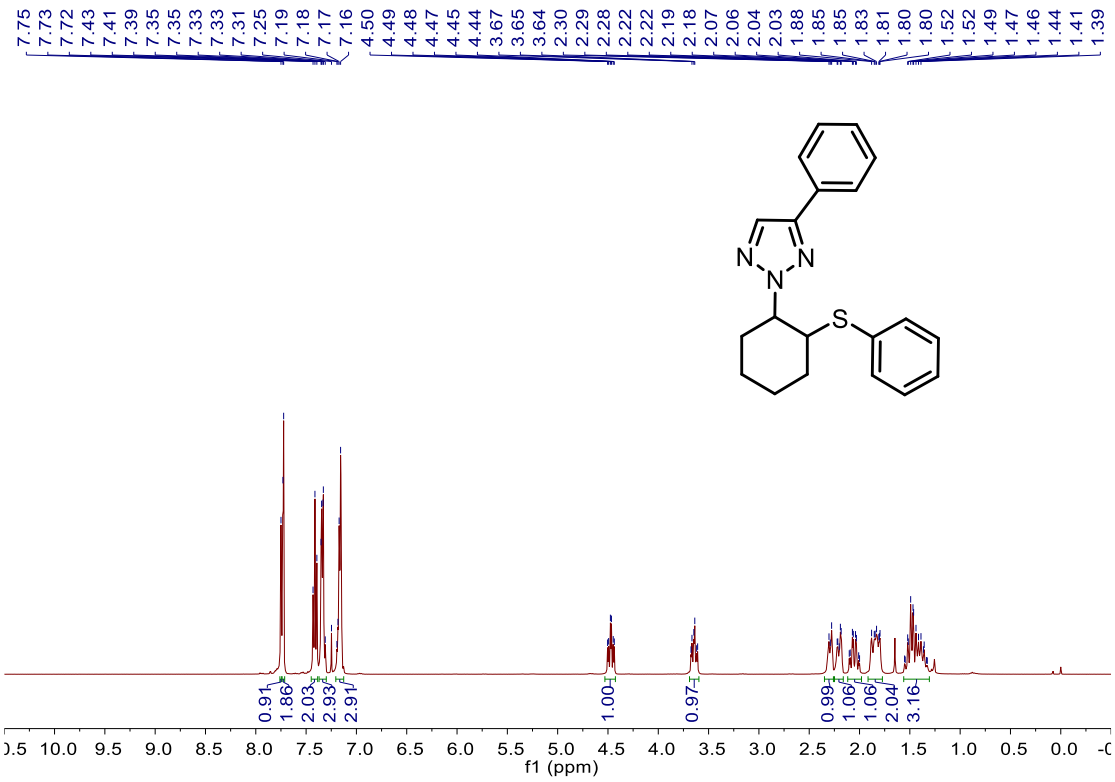
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4l**



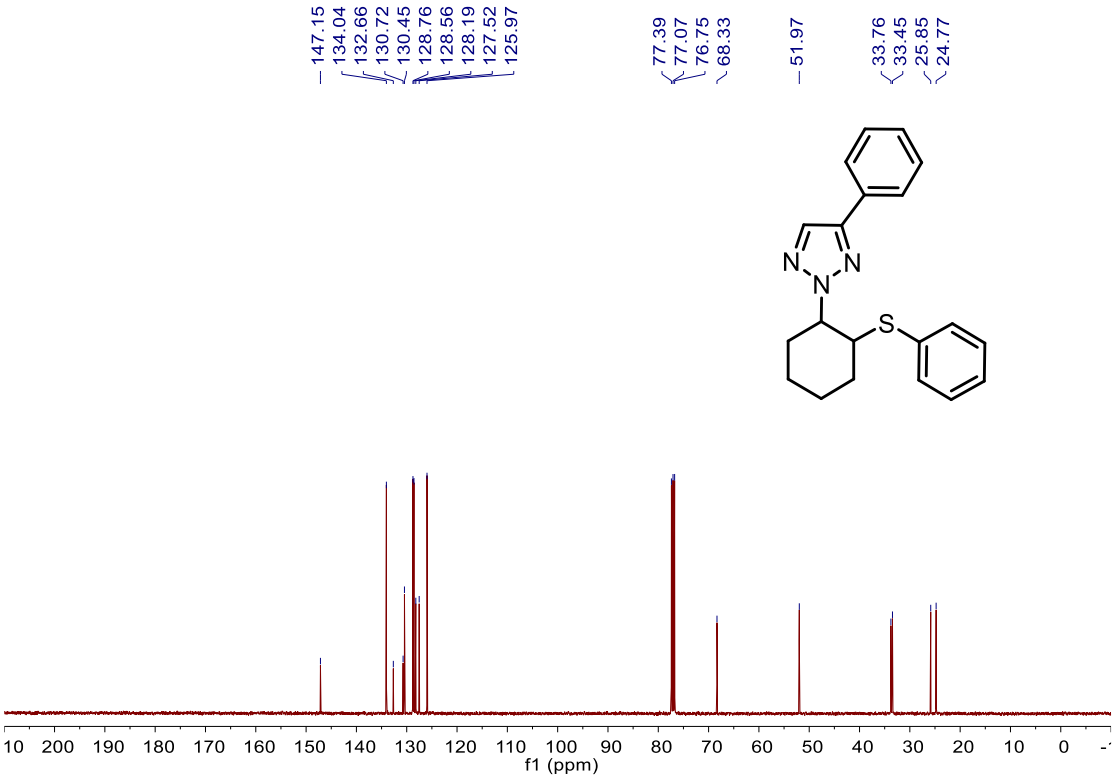
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4l



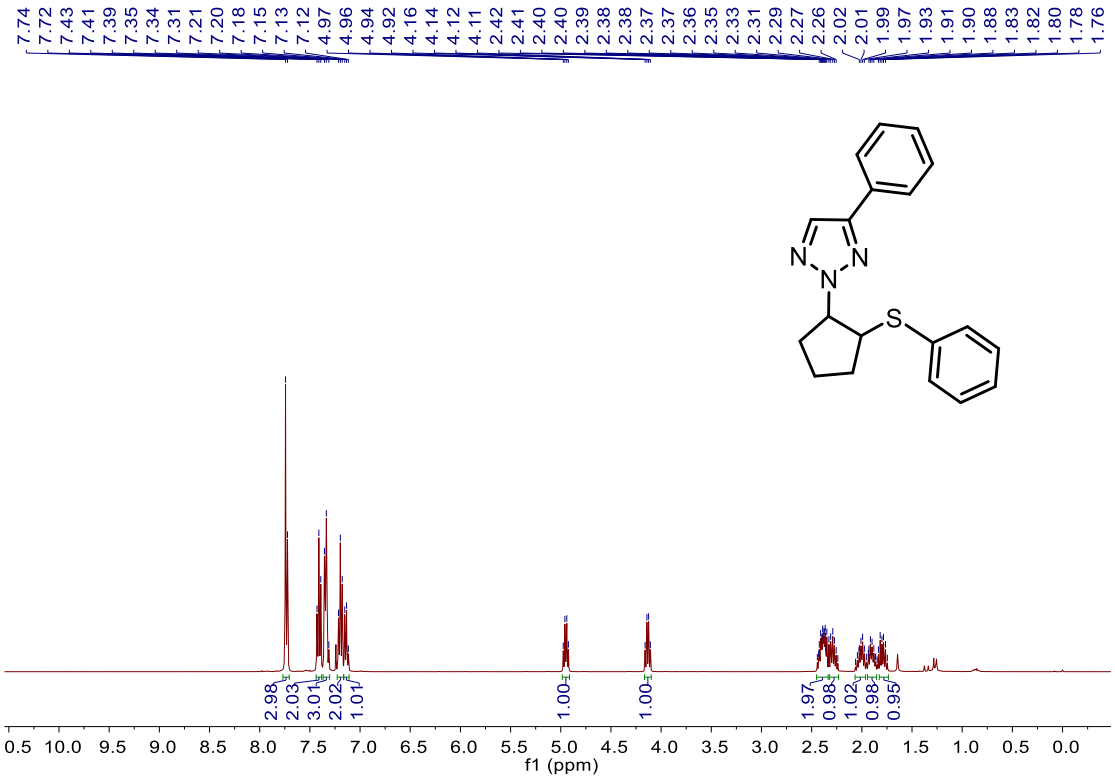
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4m**



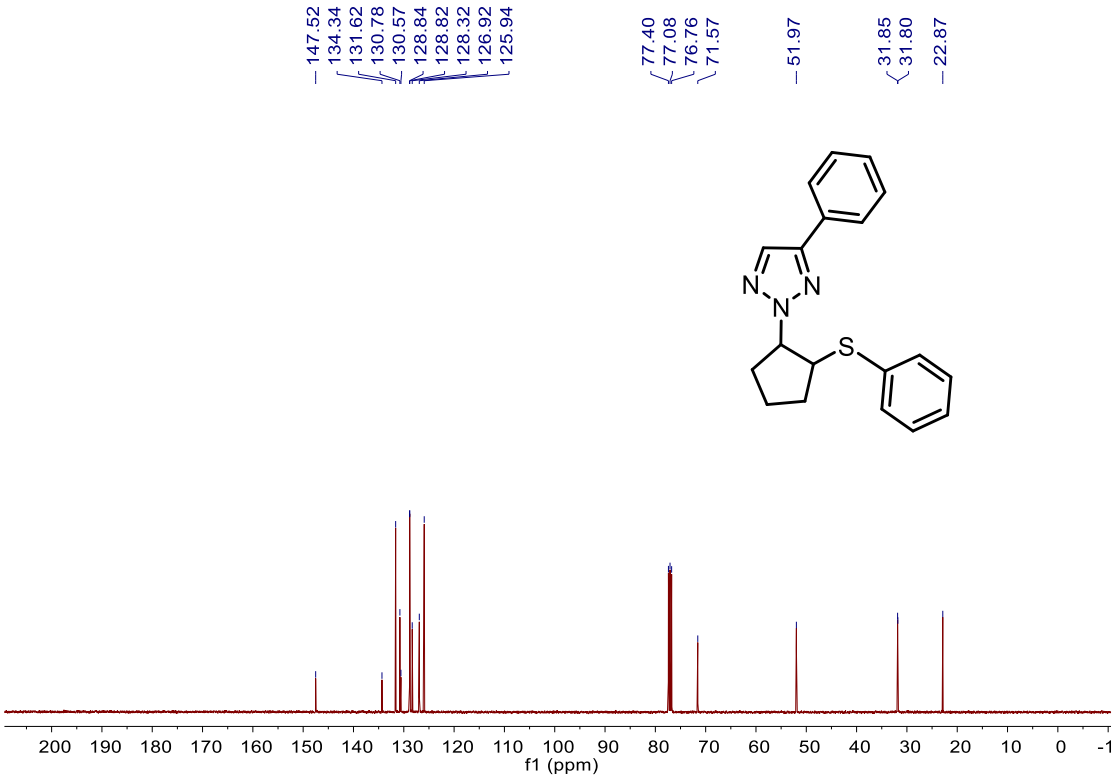
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4m



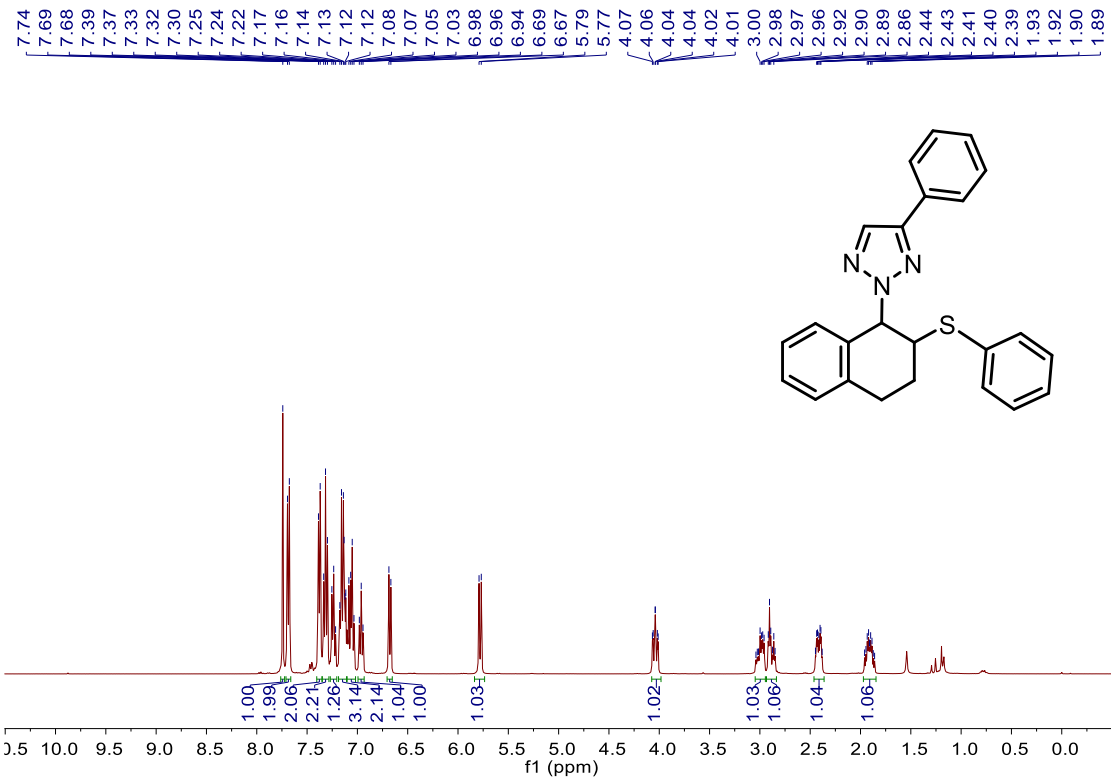
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4n**



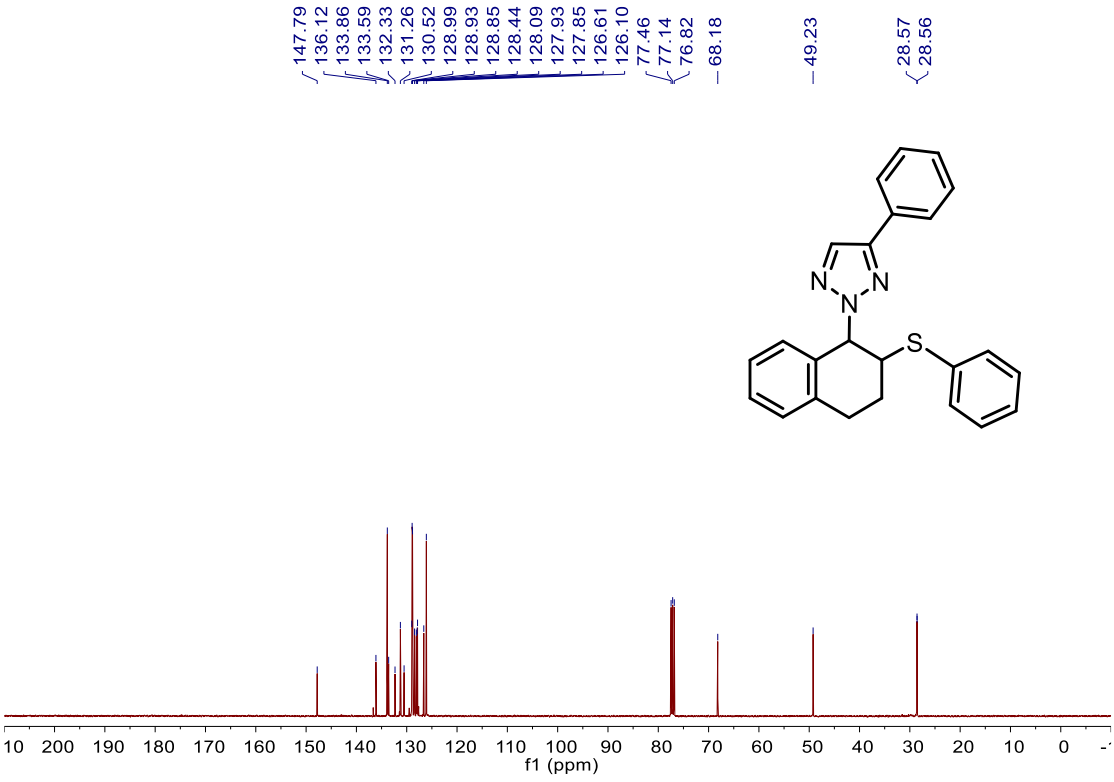
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4n



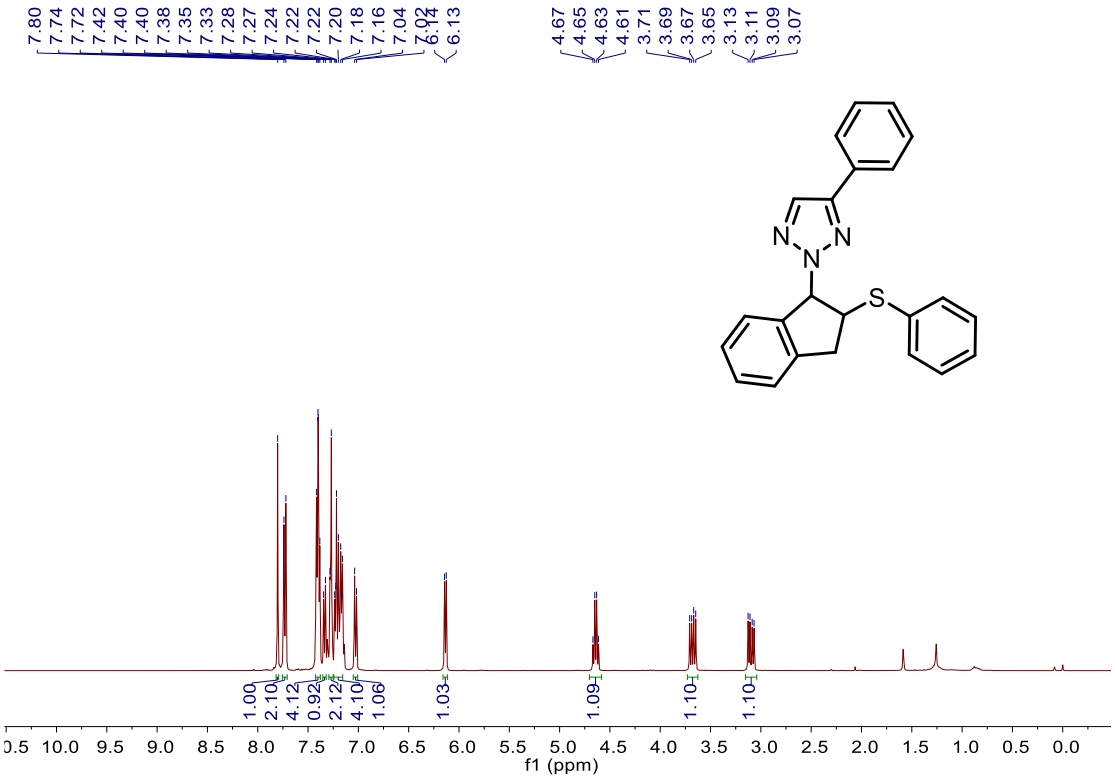
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4o**



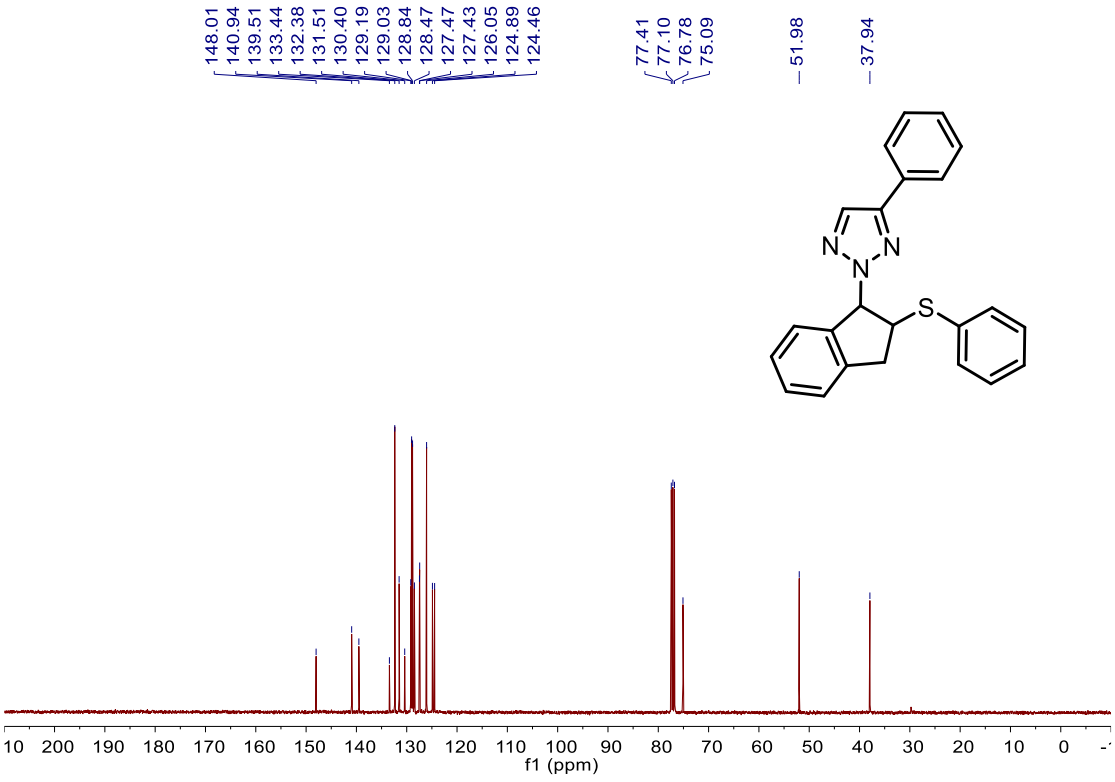
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4o



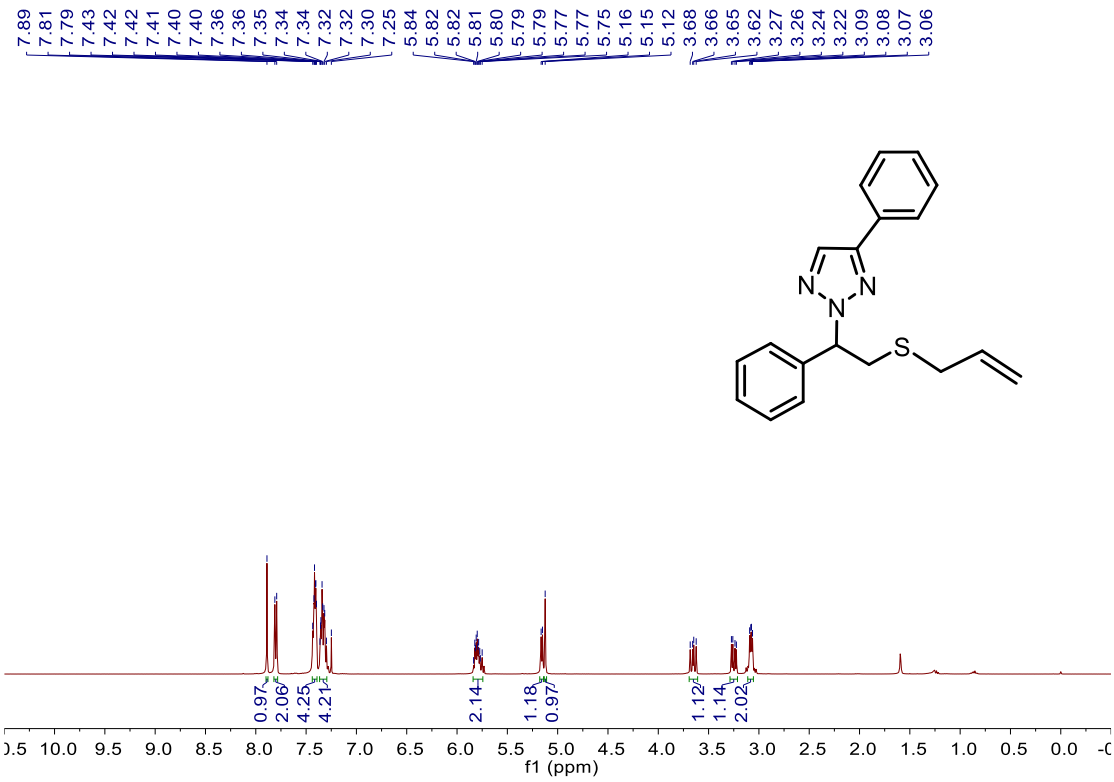
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4p**



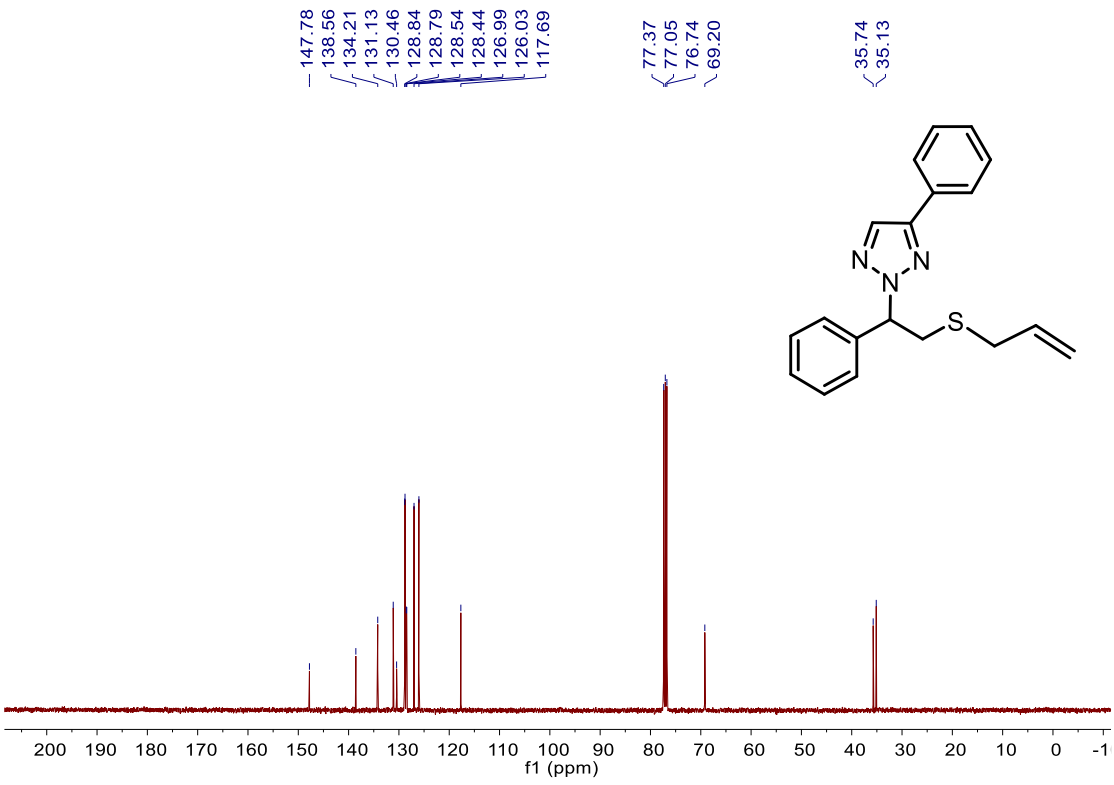
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4p



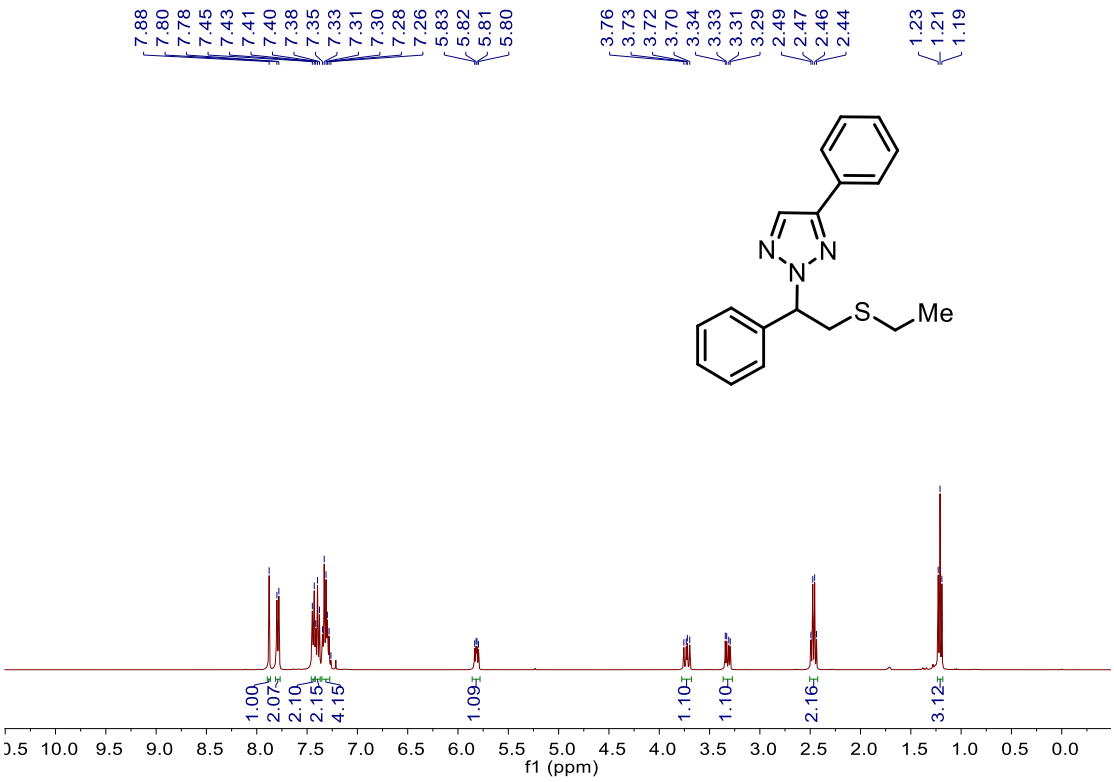
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4q**



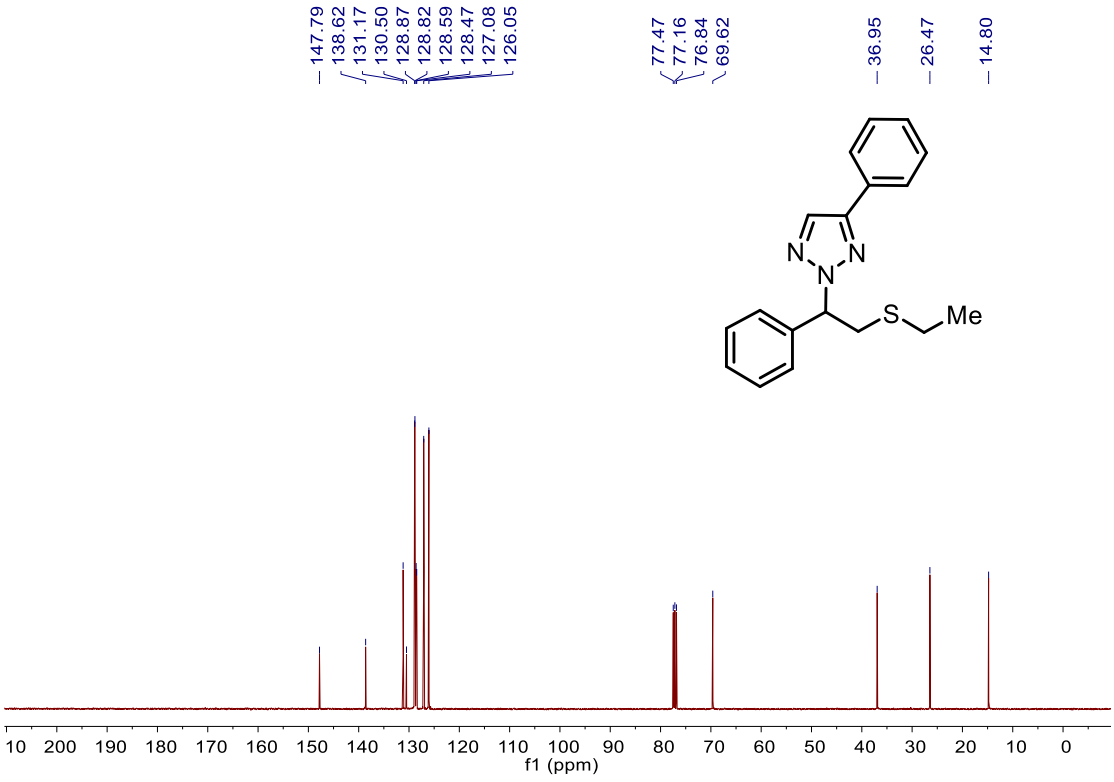
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4q



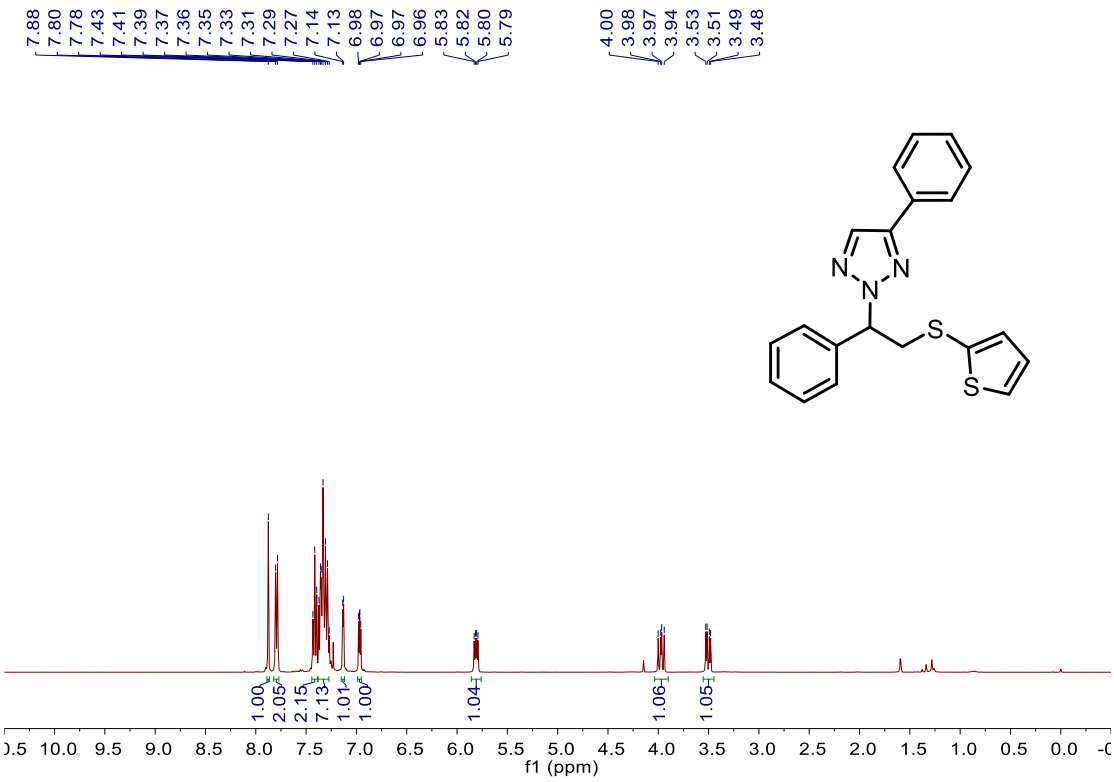
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4r**



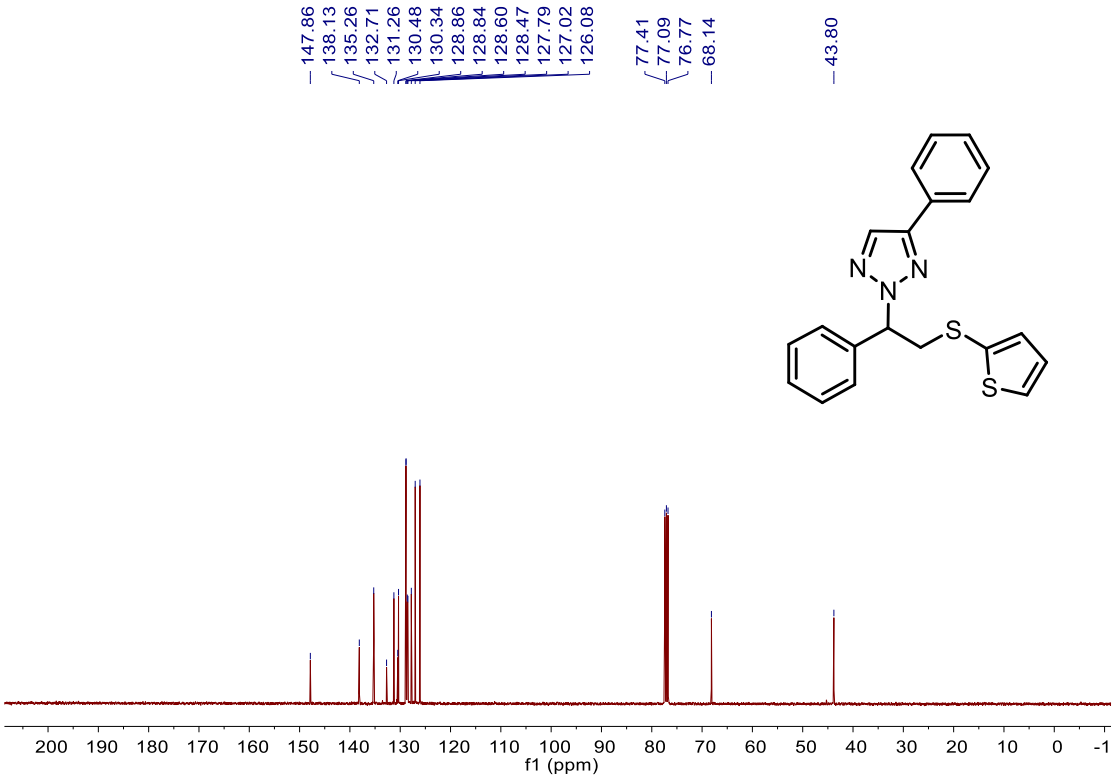
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4r



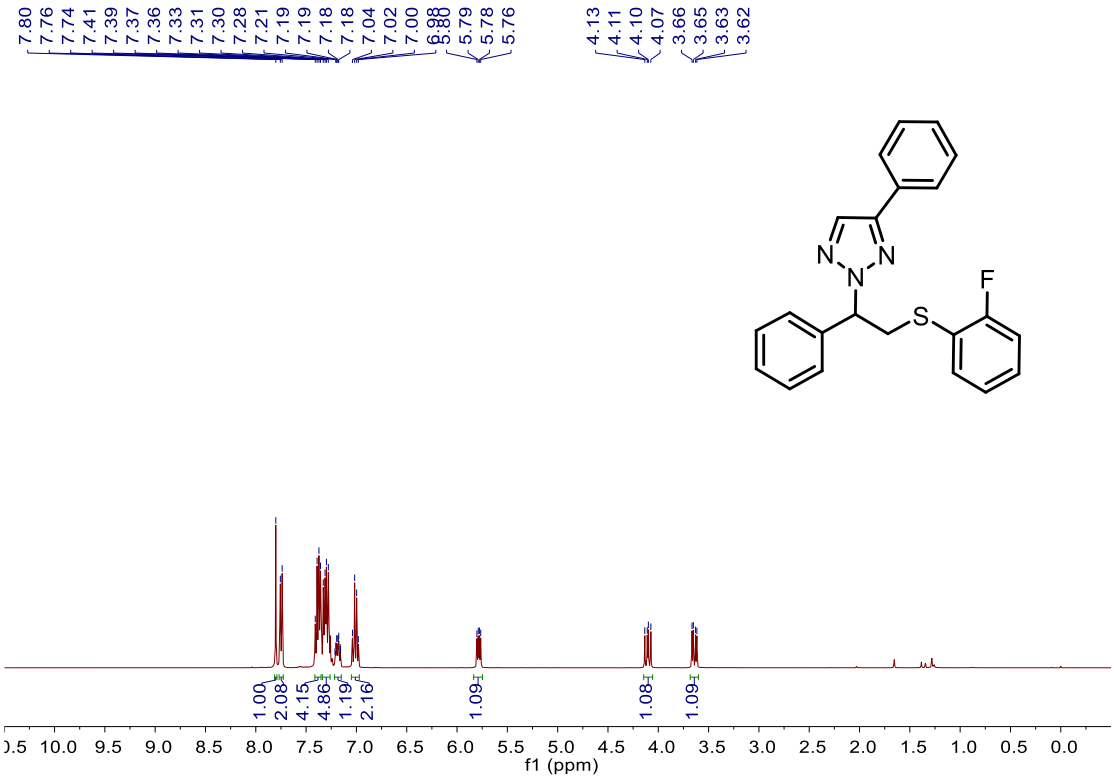
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4s**



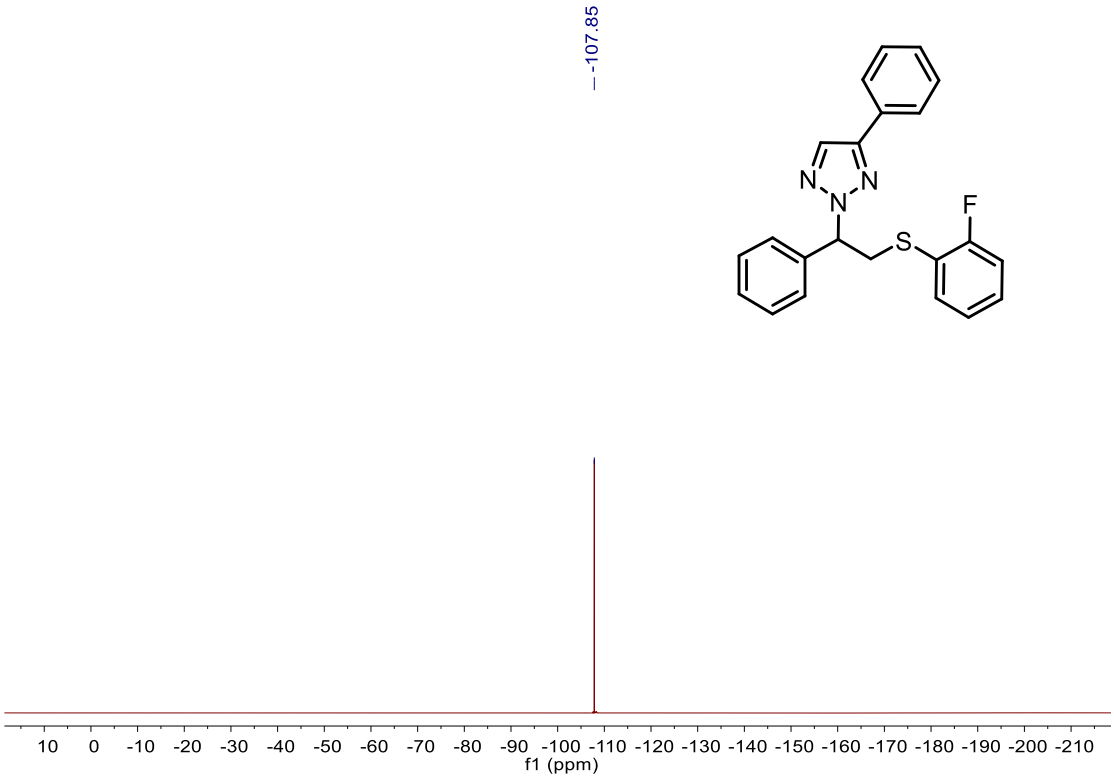
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4s



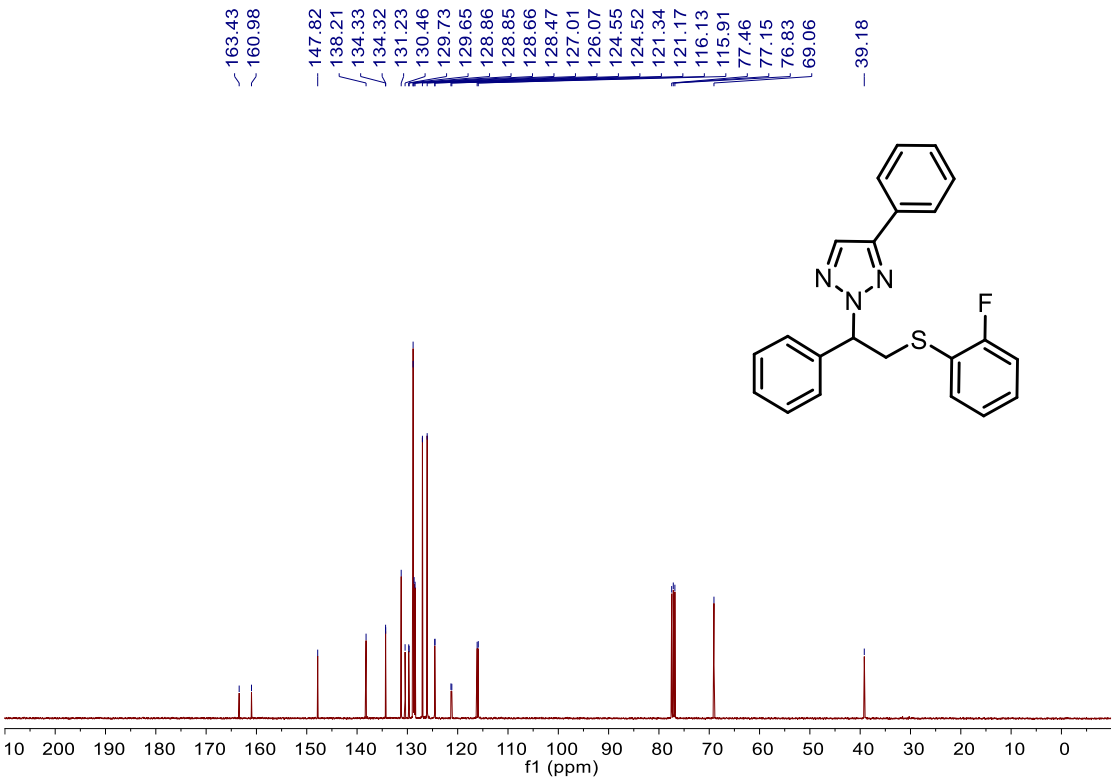
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4t**



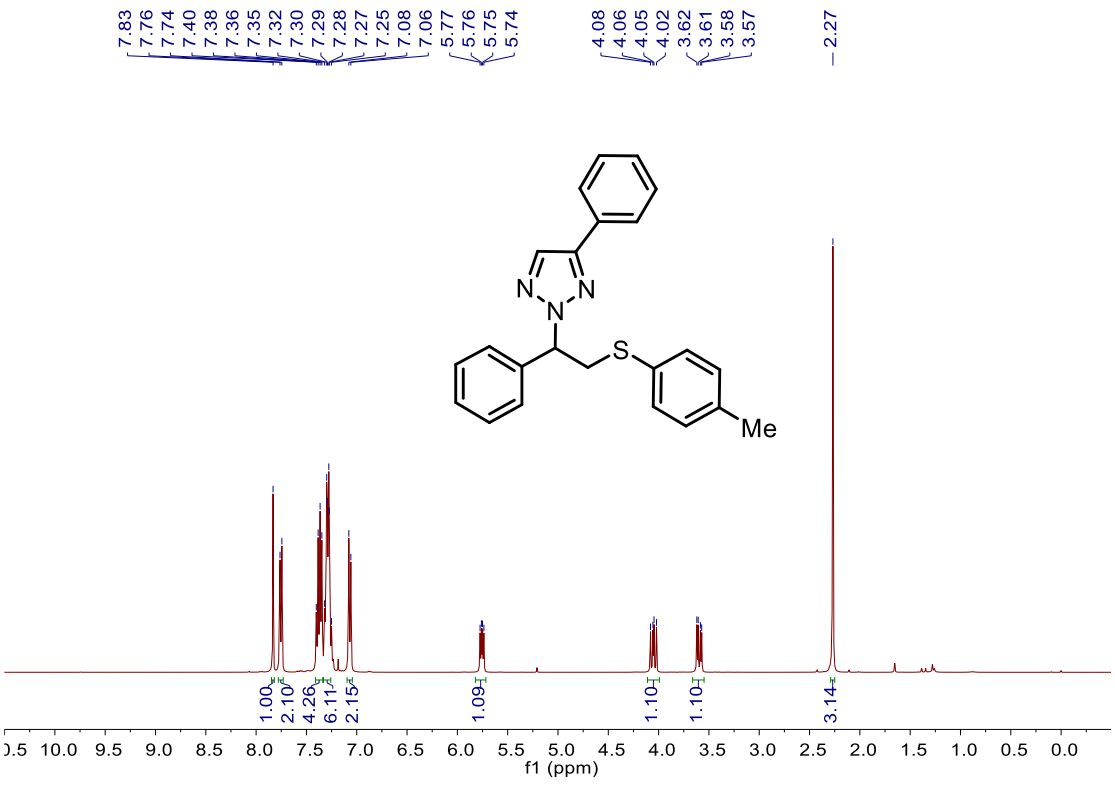
^{19}F NMR (376 MHz, $CDCl_3$) spectrum for 4t



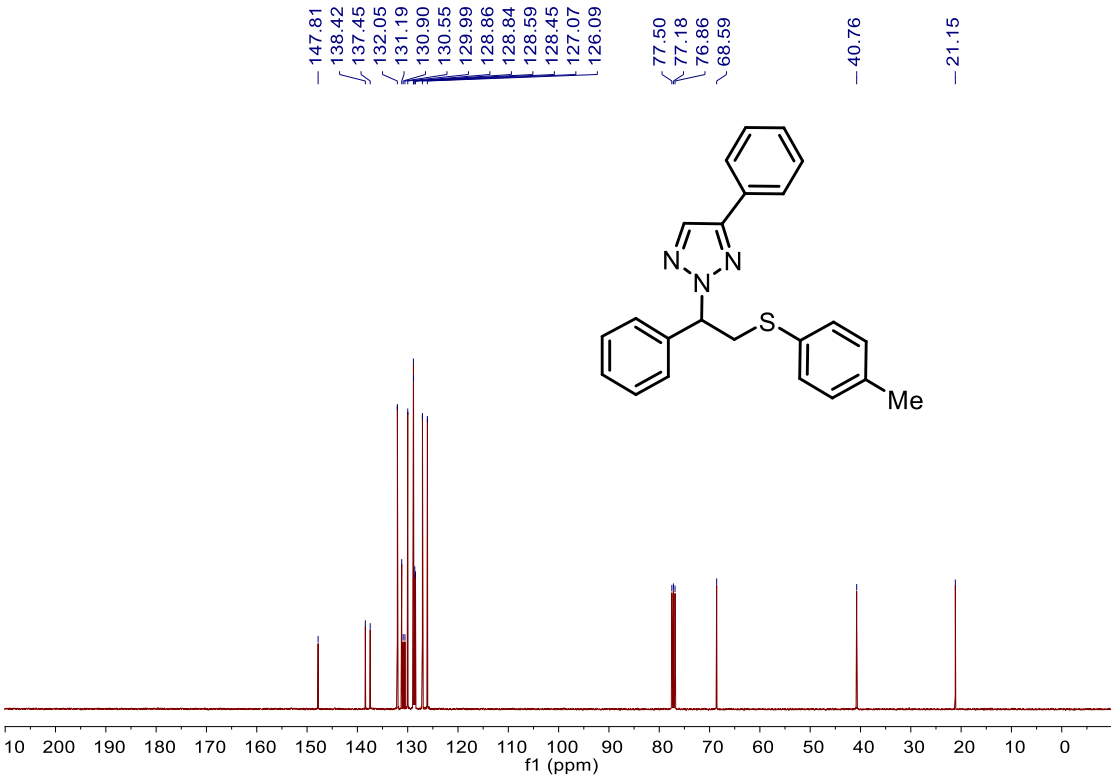
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4t



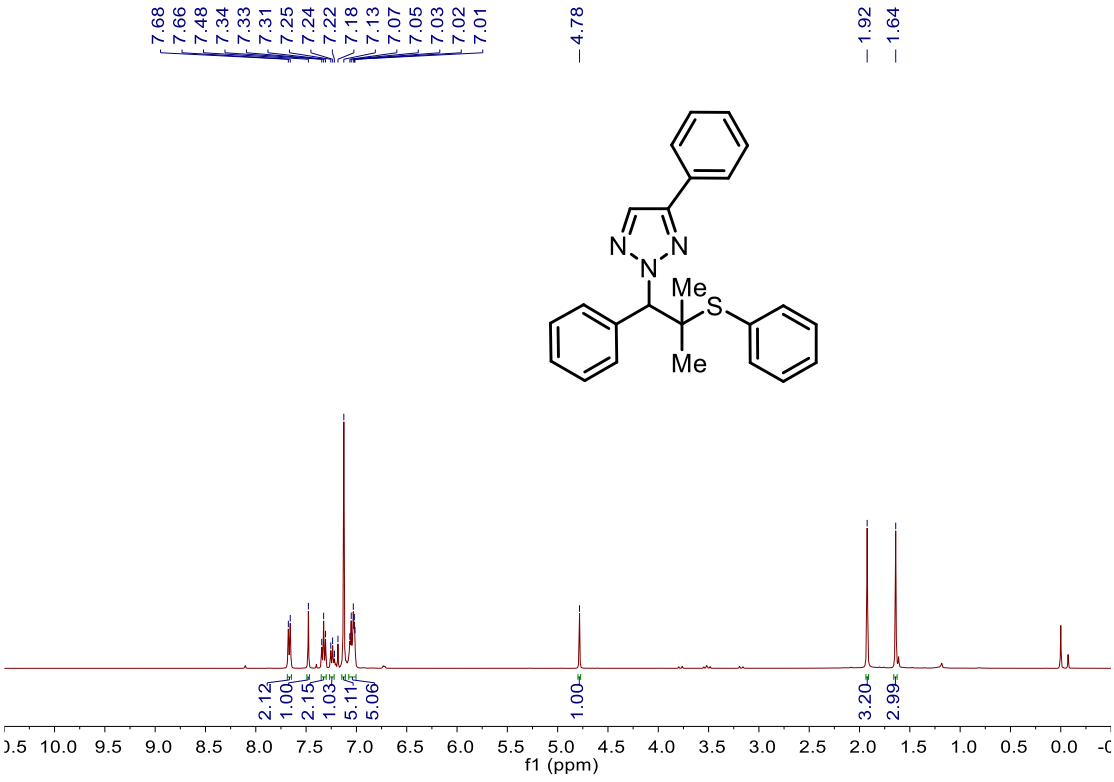
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4u**



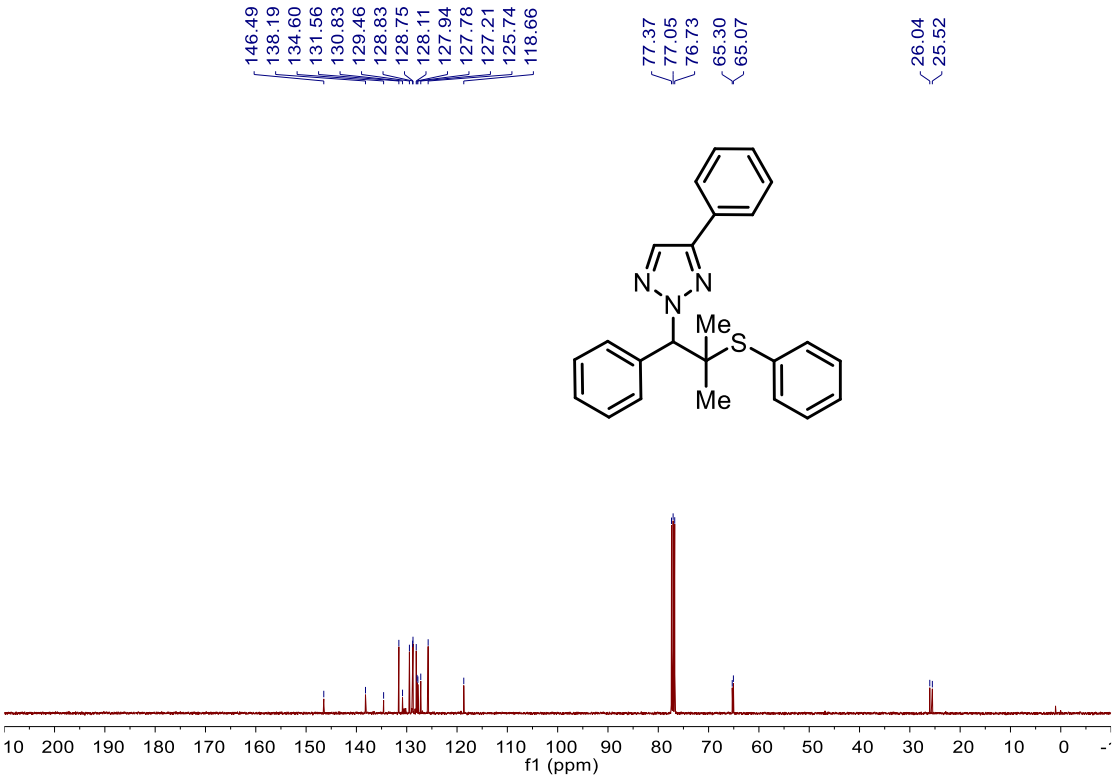
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4u



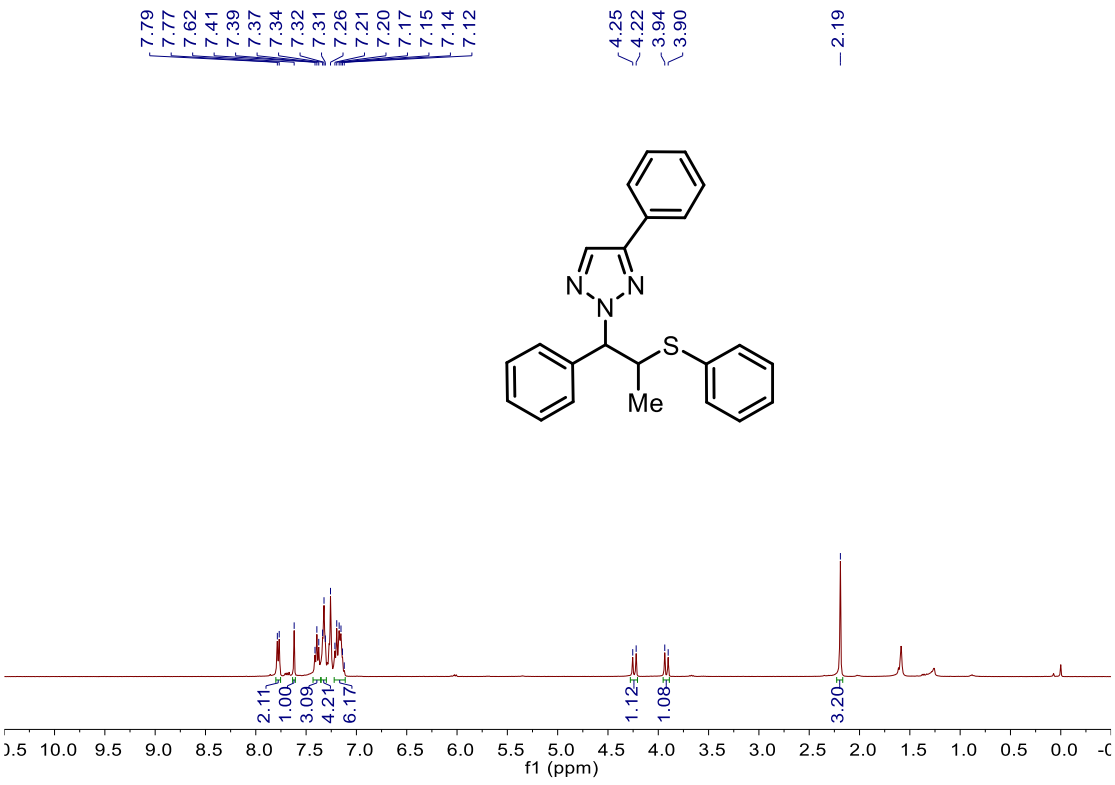
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4v**



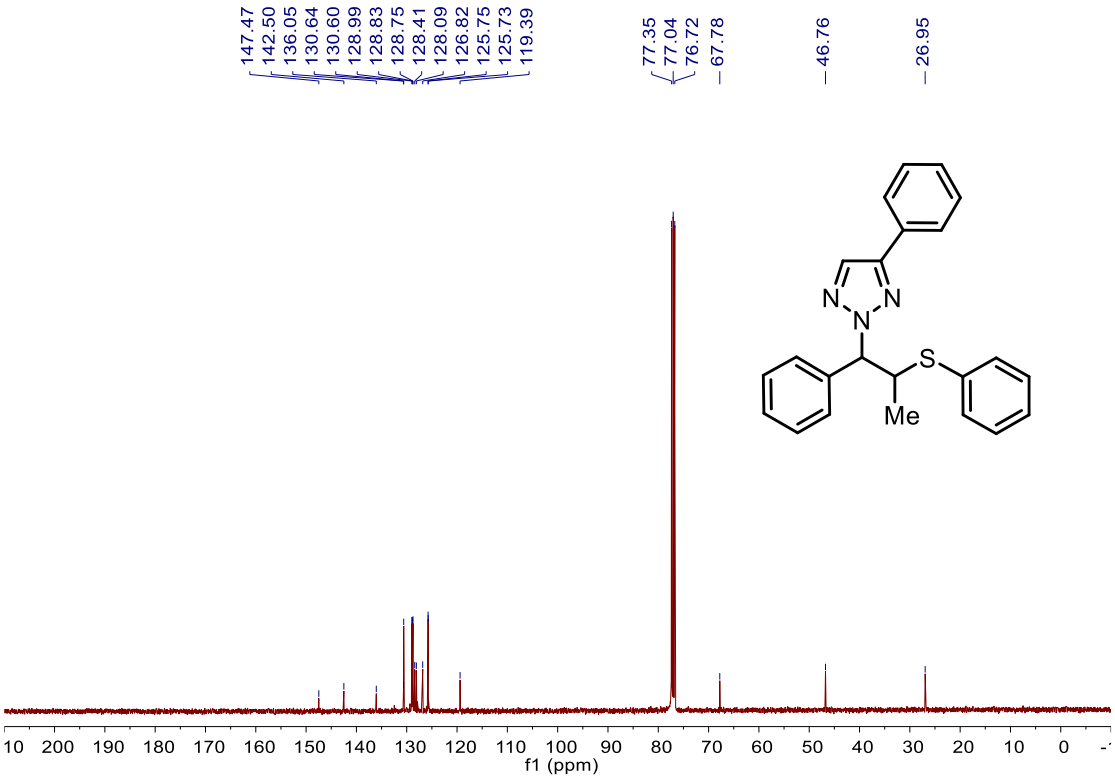
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4v



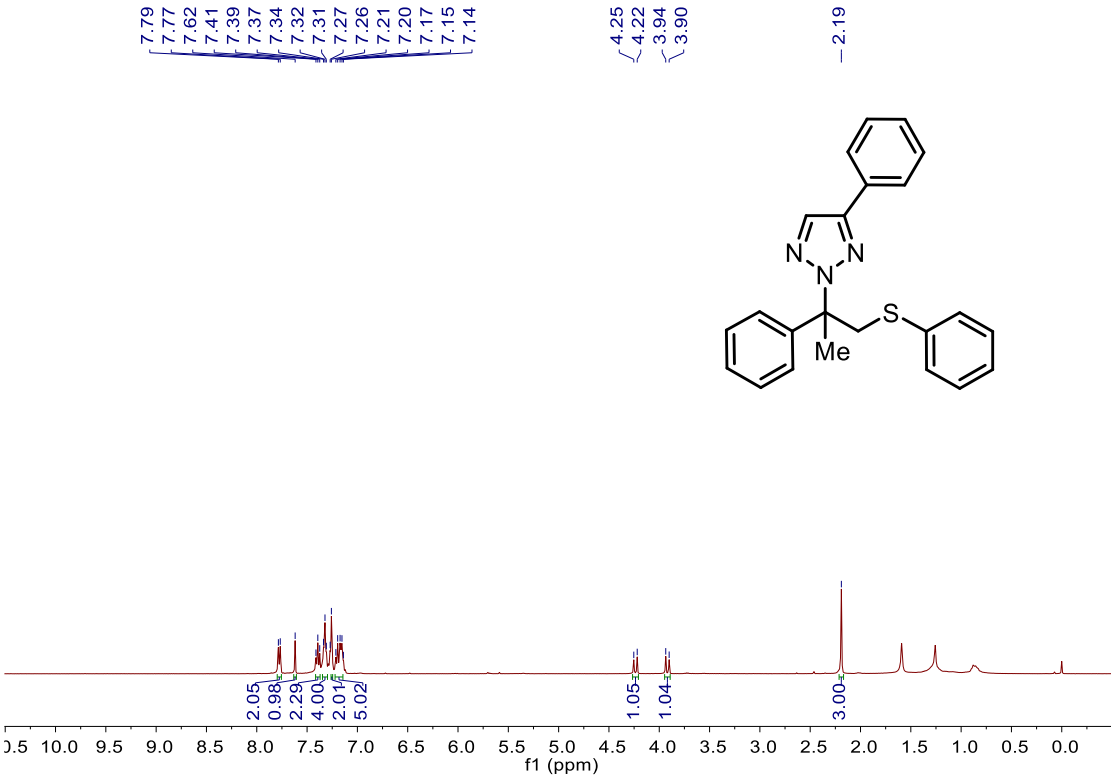
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4w**



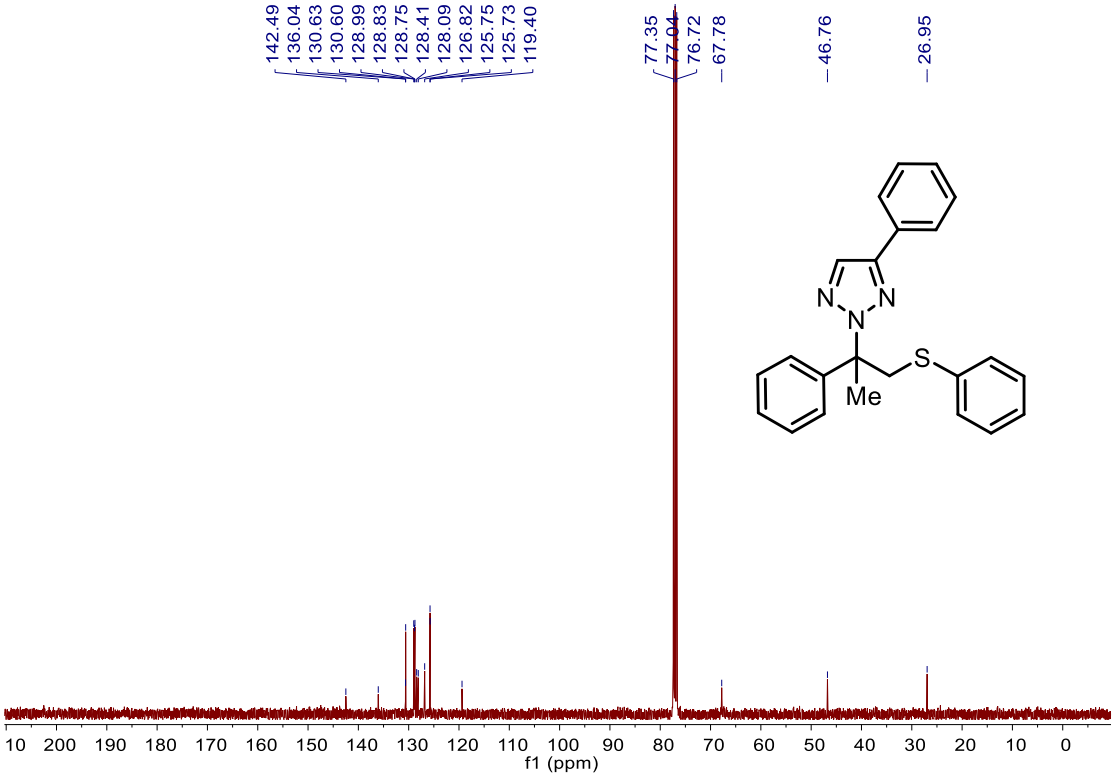
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4w



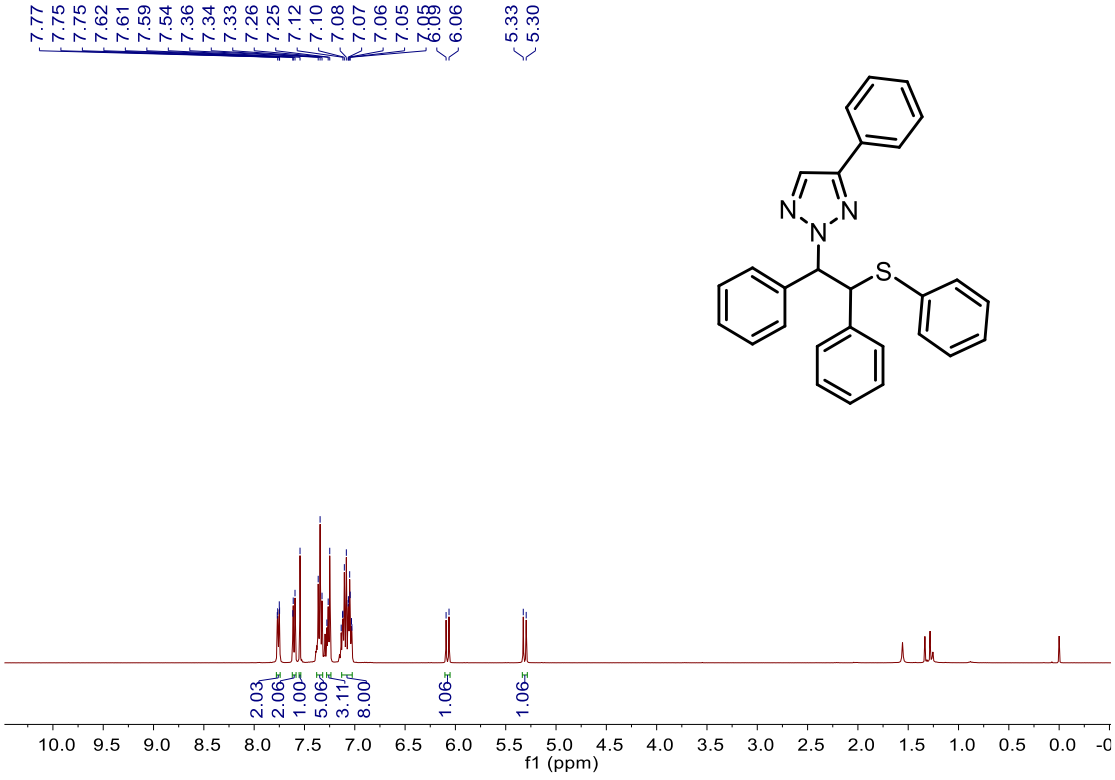
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4x**



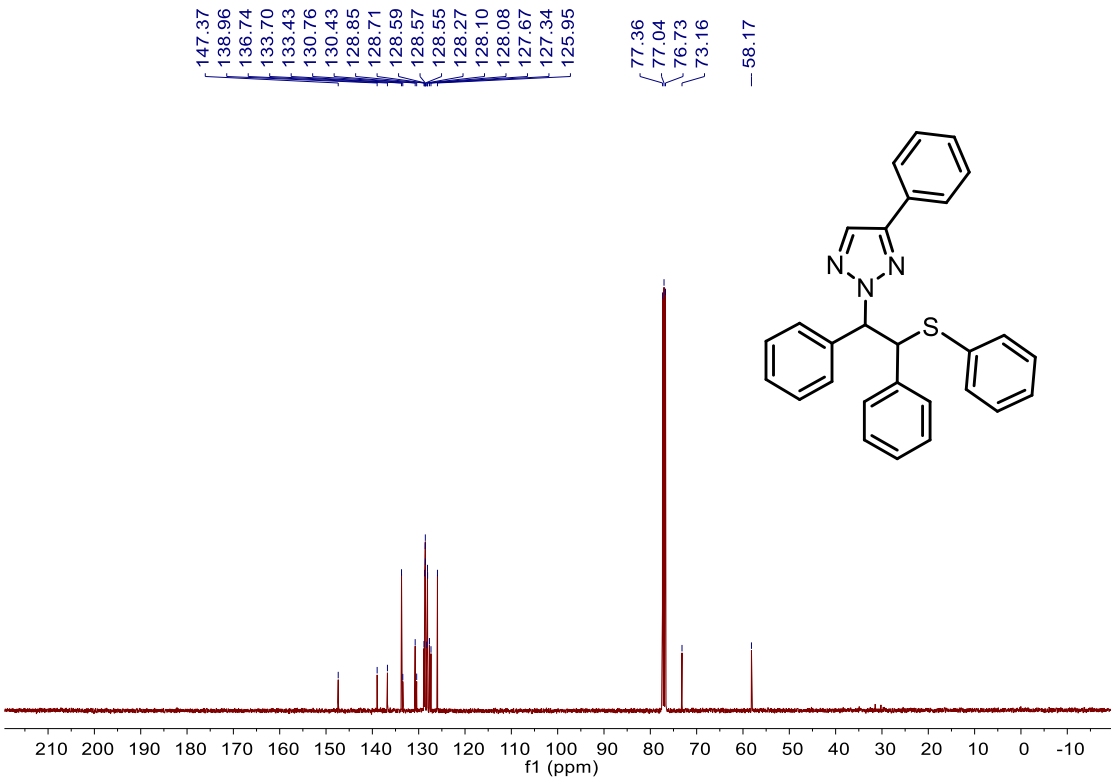
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4x



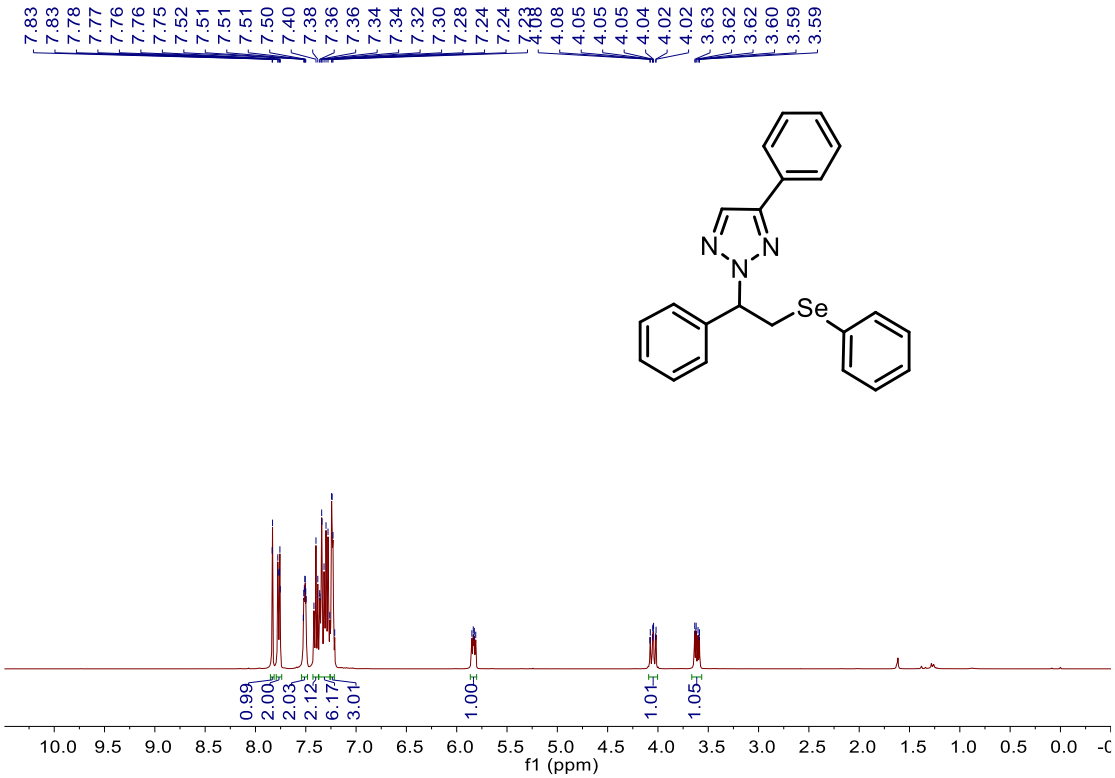
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4y**



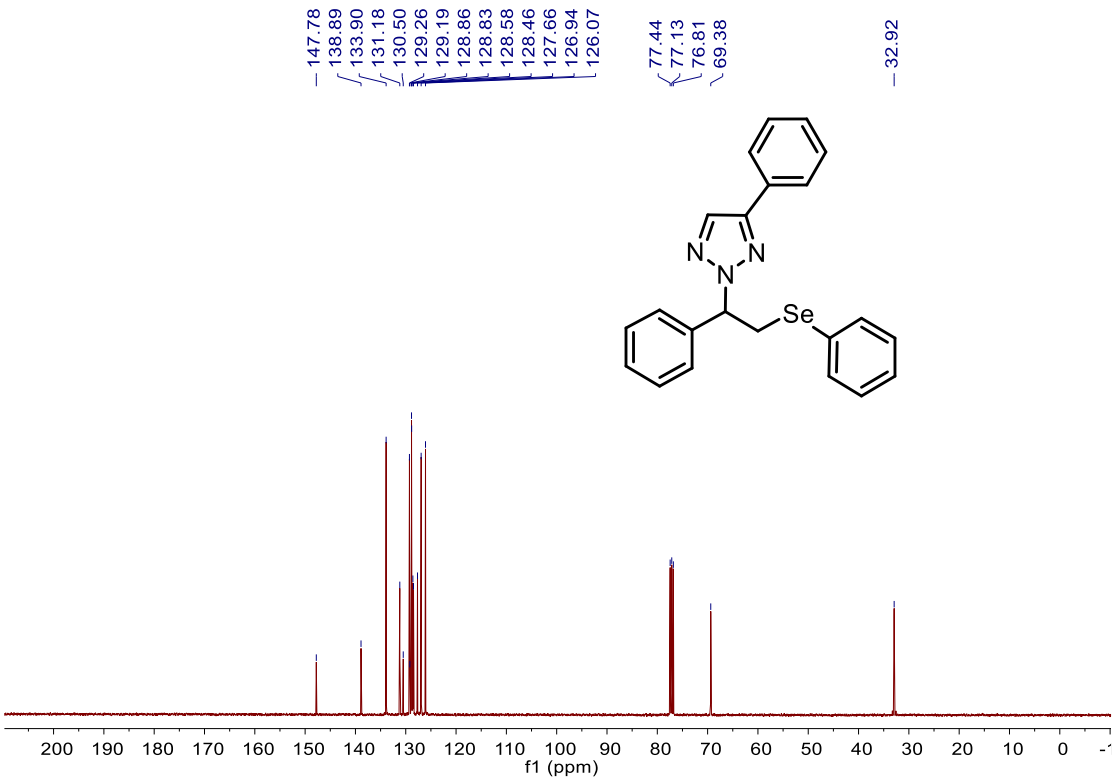
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4y



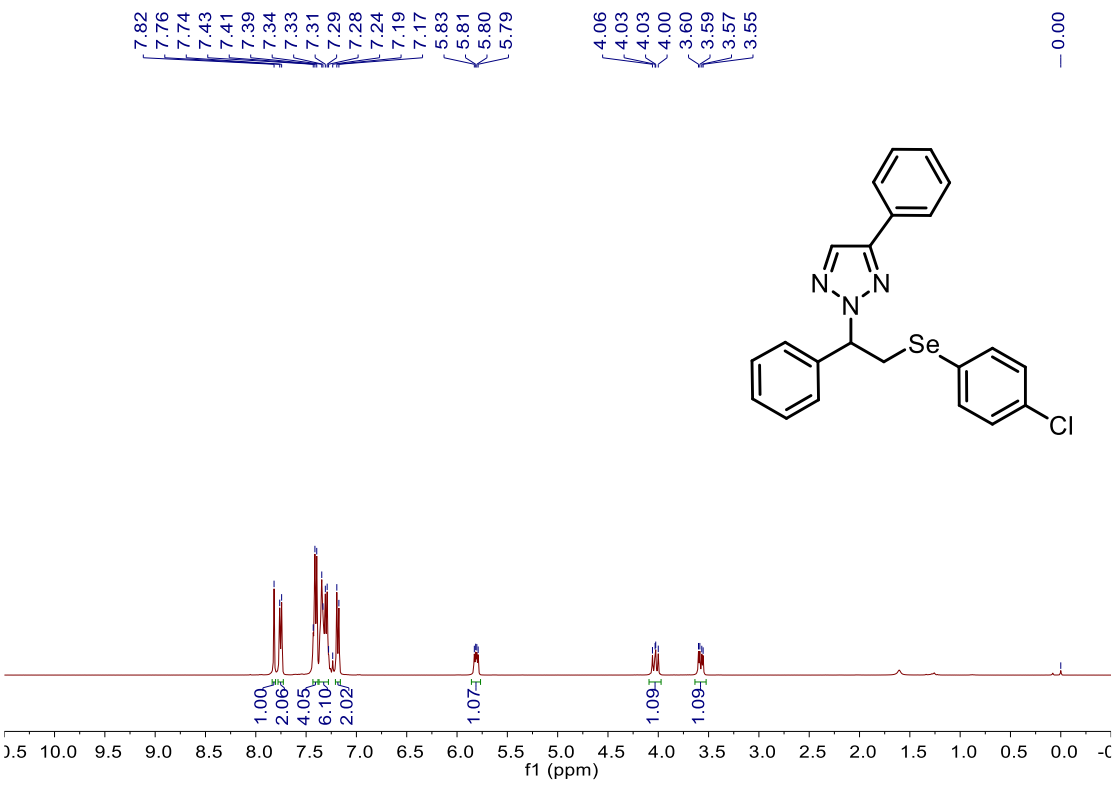
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4z**



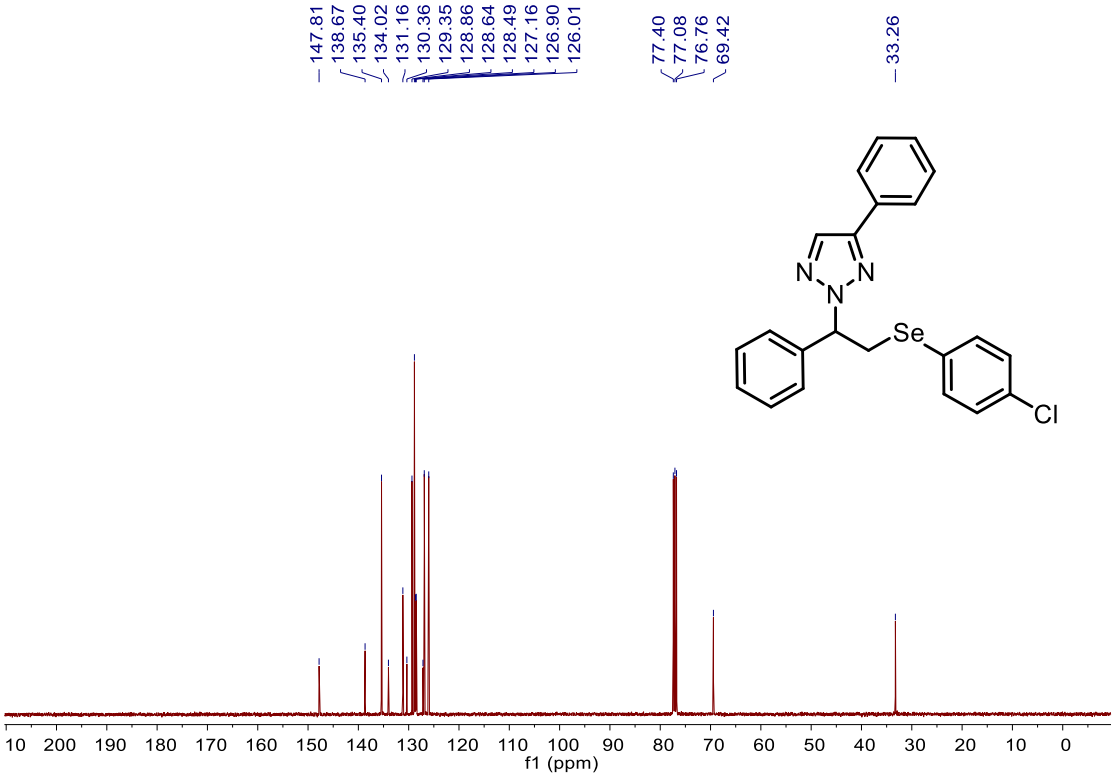
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4z



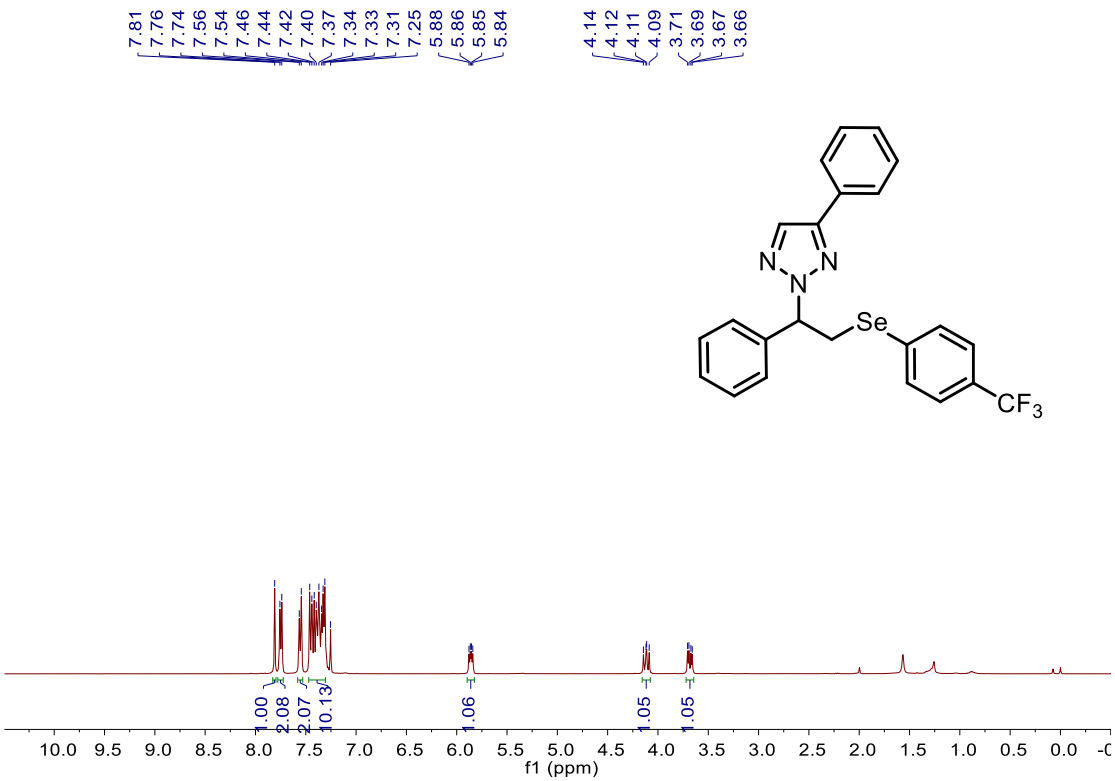
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4aa**



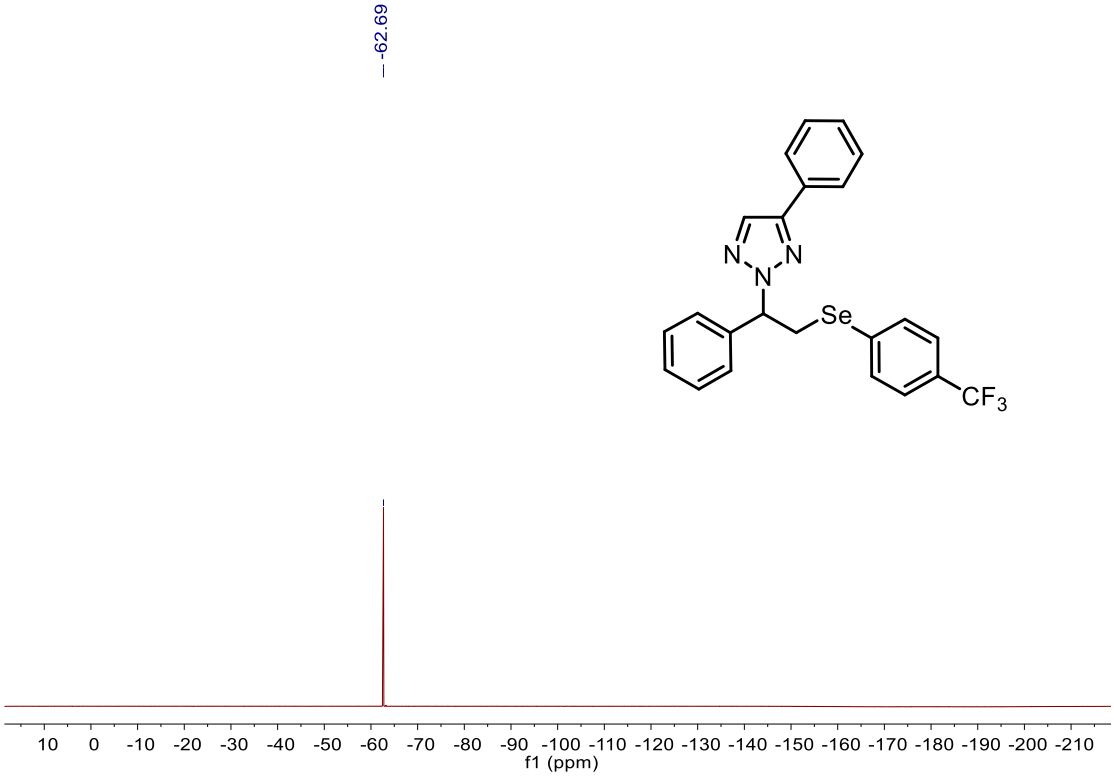
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4aa



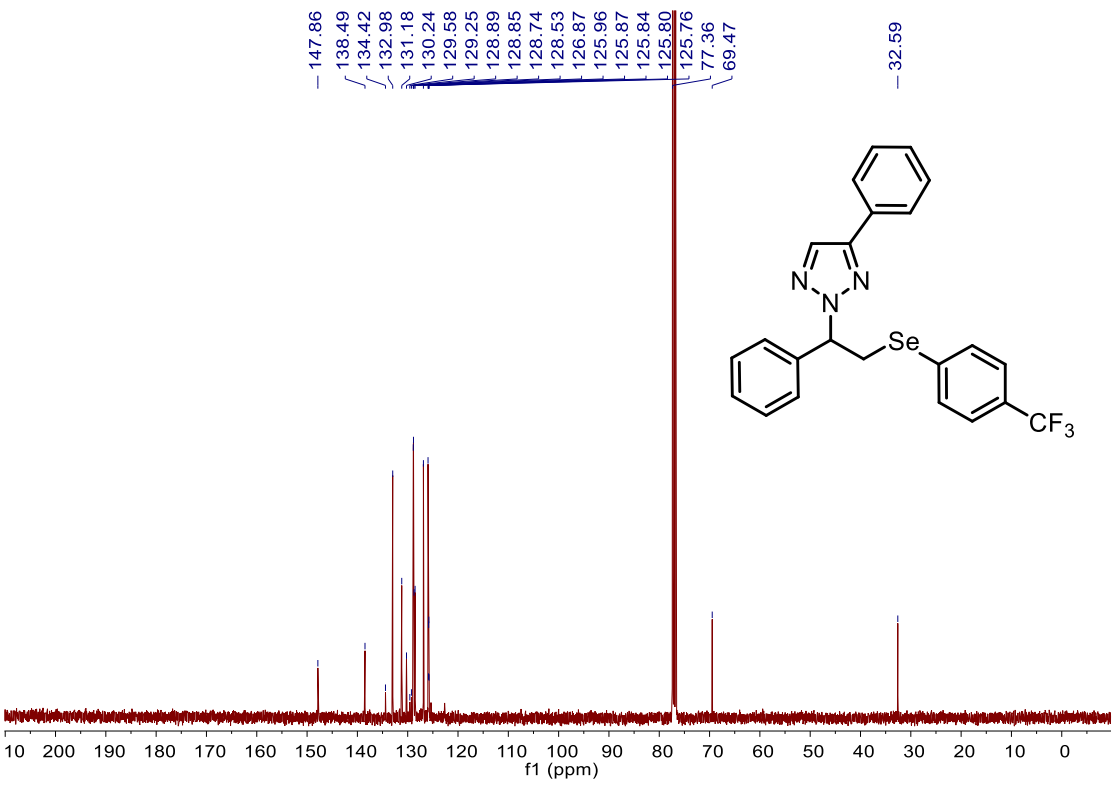
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4ab**



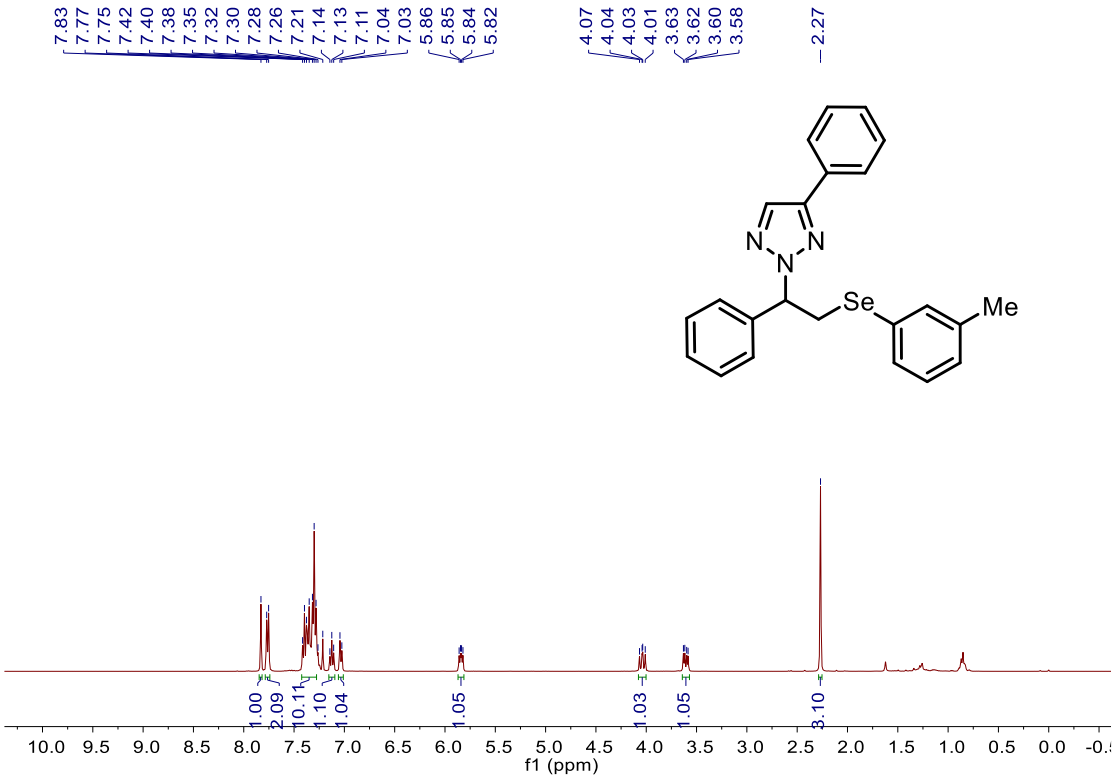
^{19}F NMR (376 MHz, $CDCl_3$) spectrum for 4ab



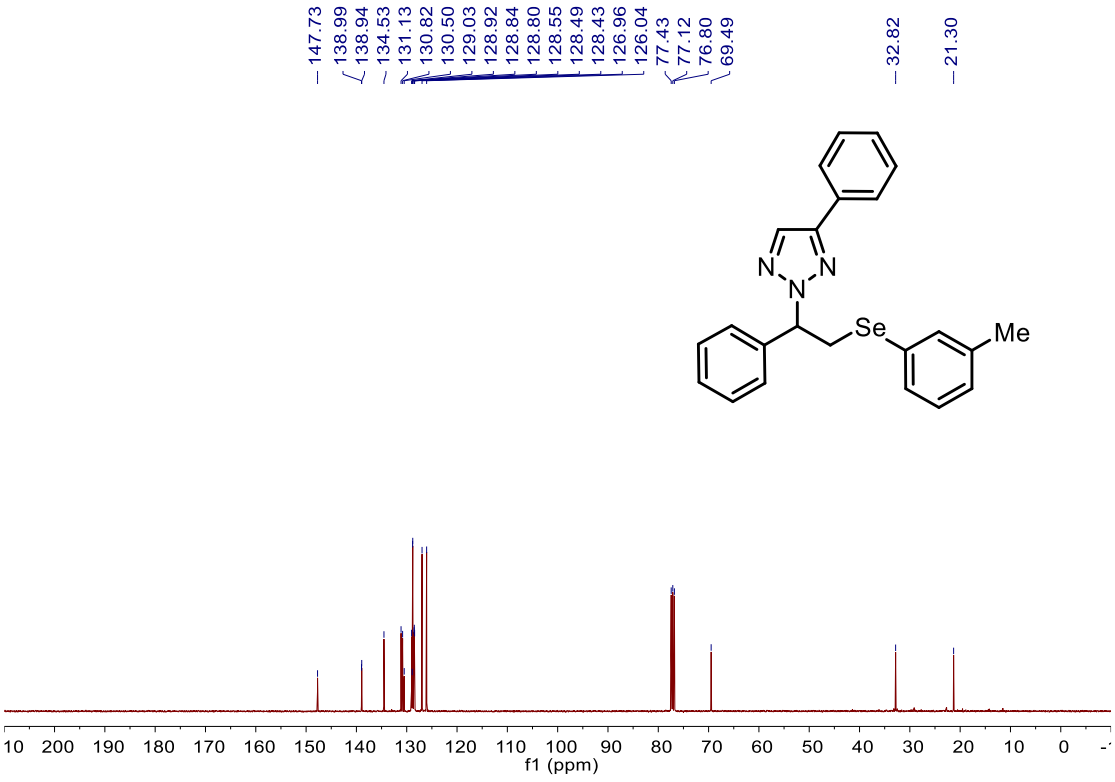
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4ab



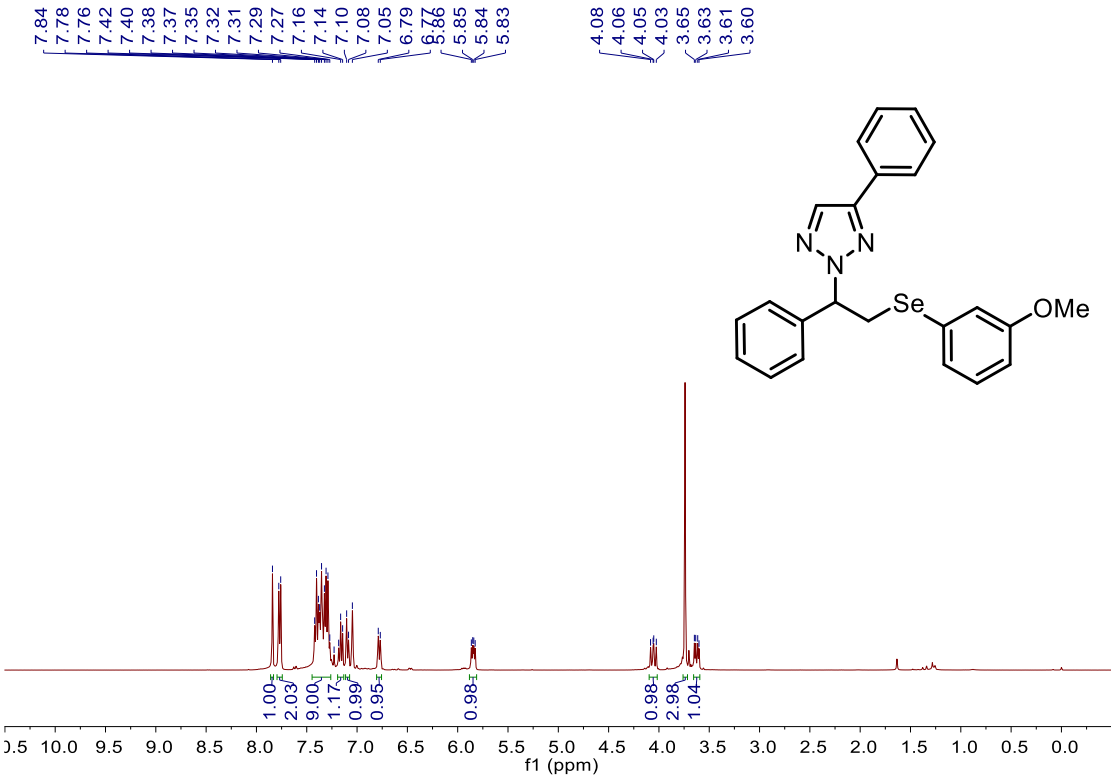
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4ac**



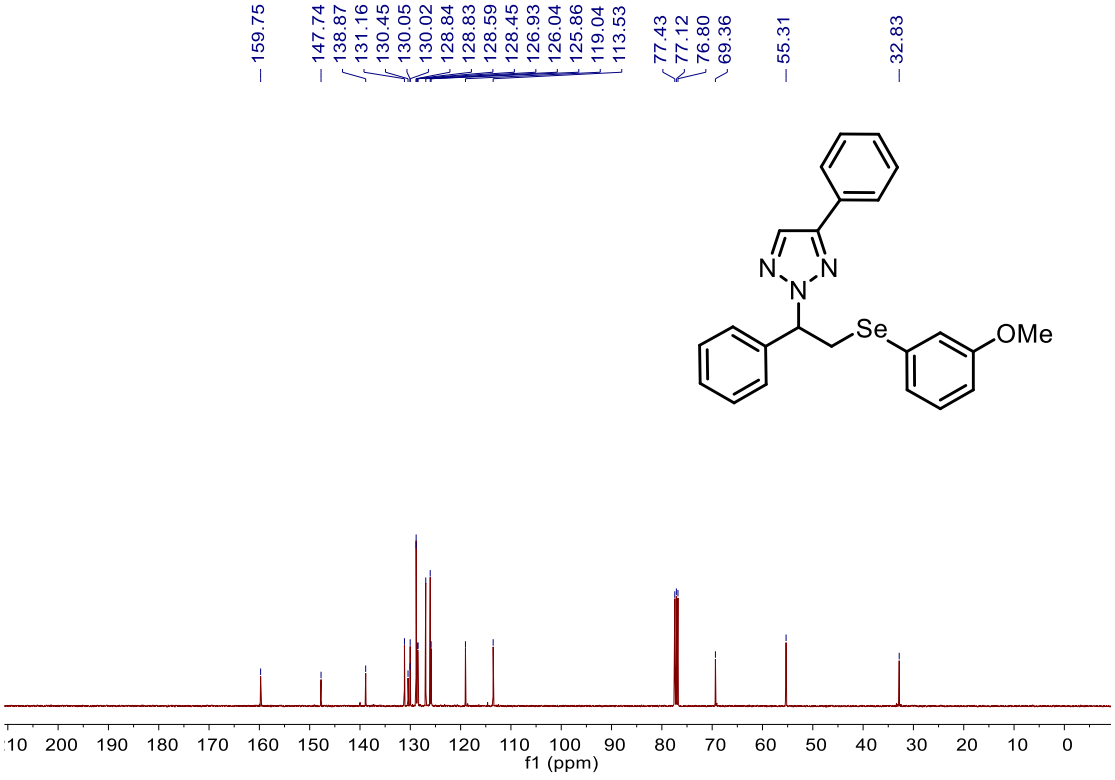
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4ac



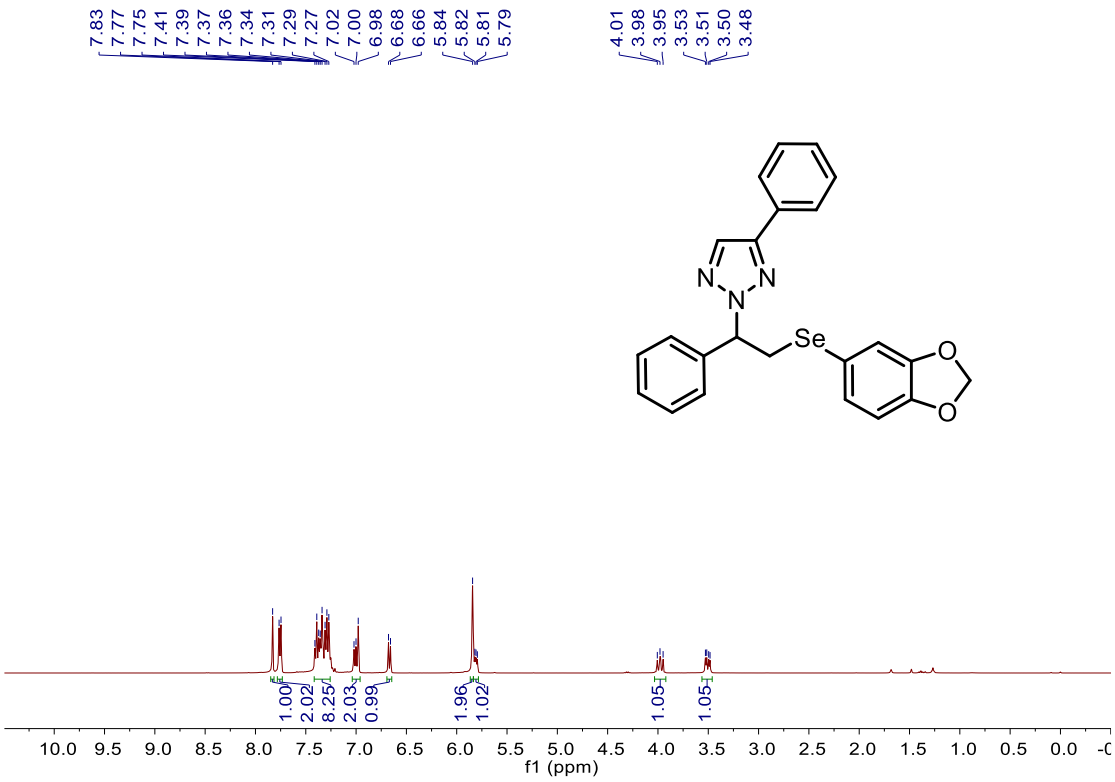
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4ad**



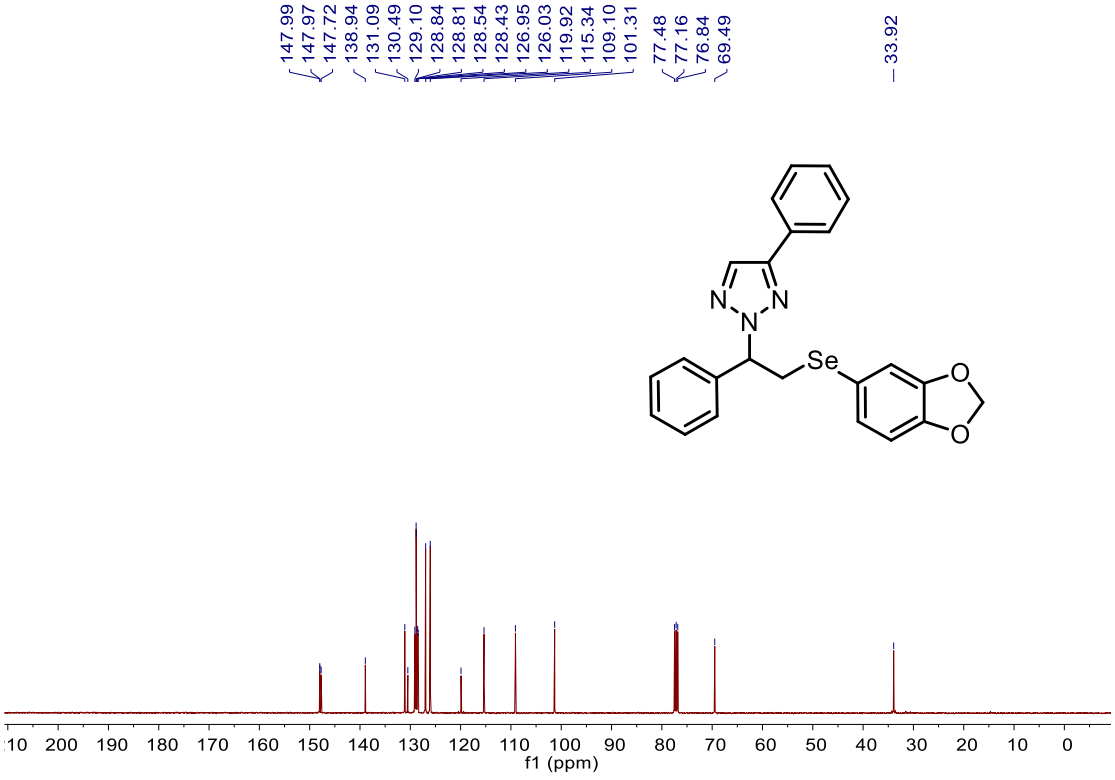
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4ad



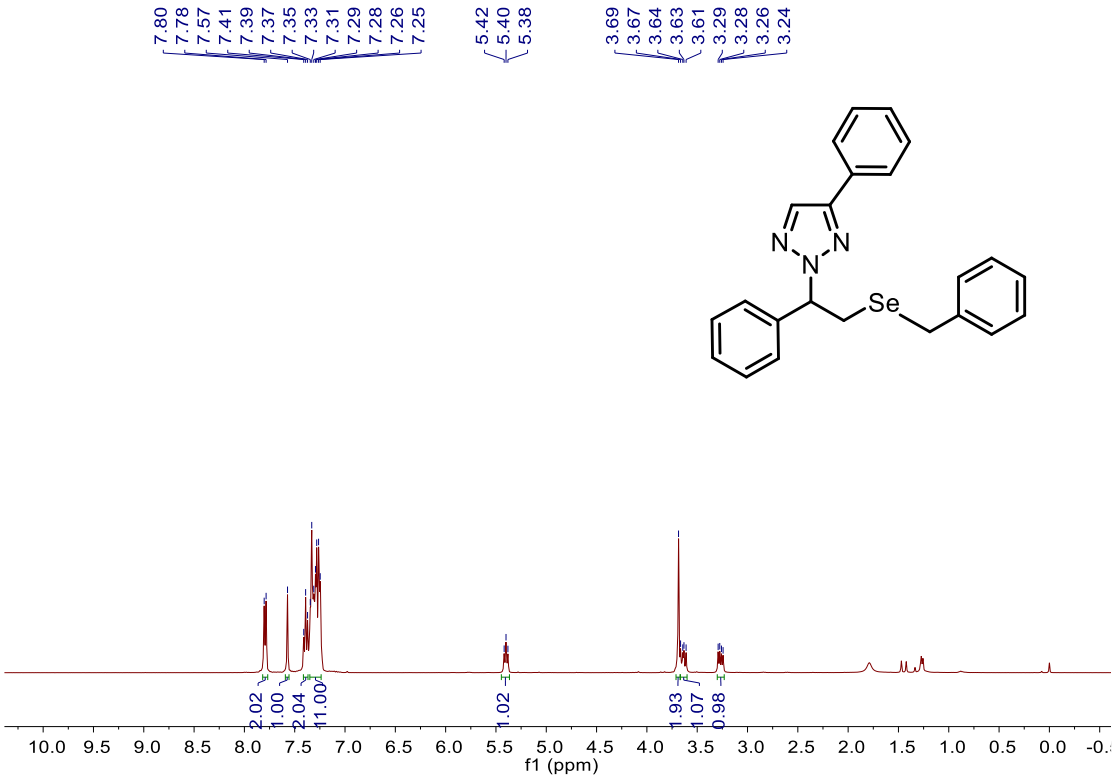
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4ae**



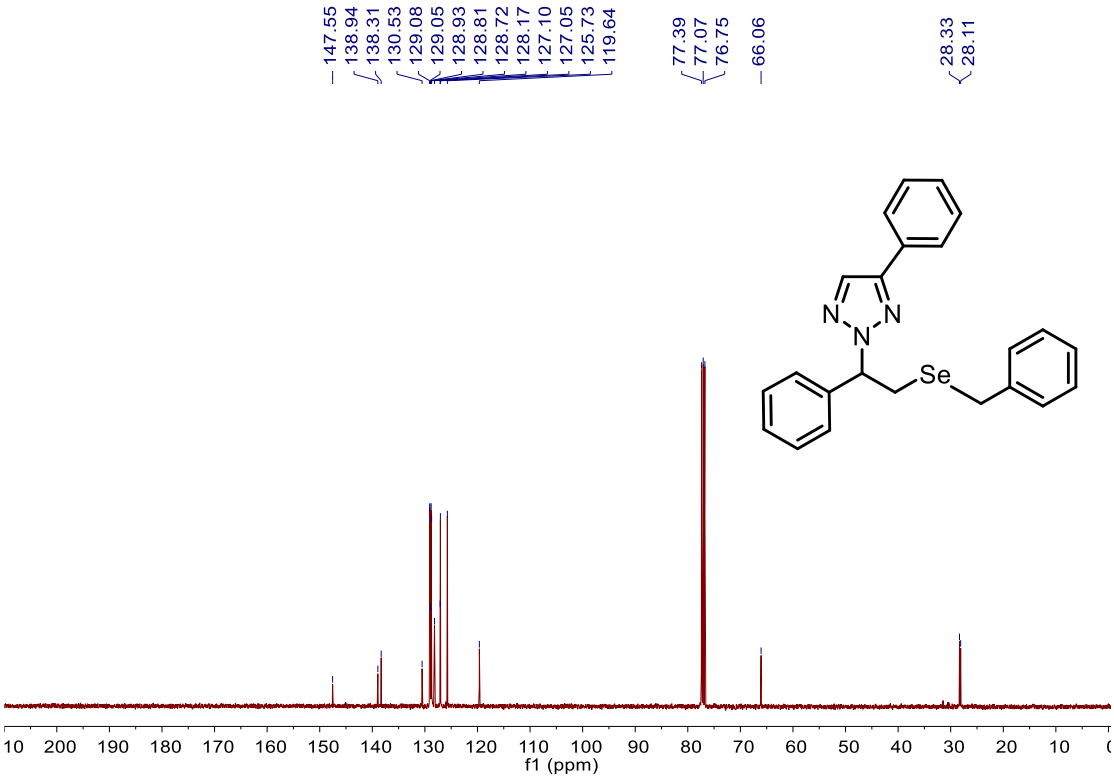
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4ae



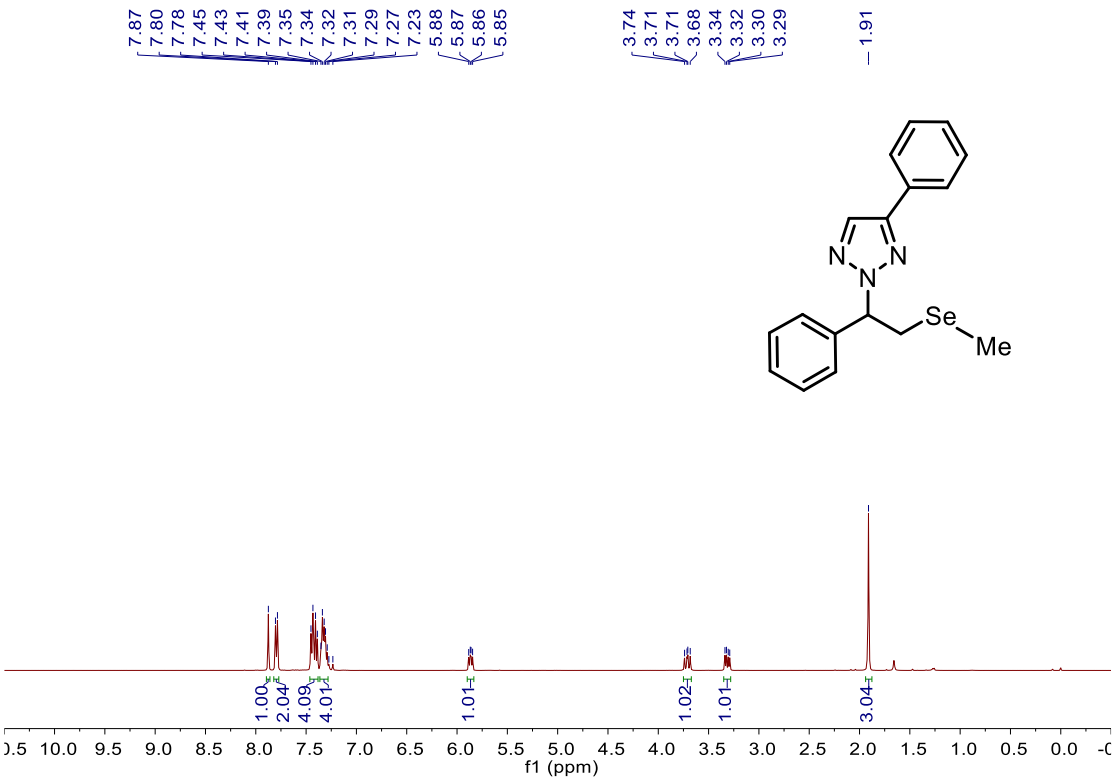
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4af**



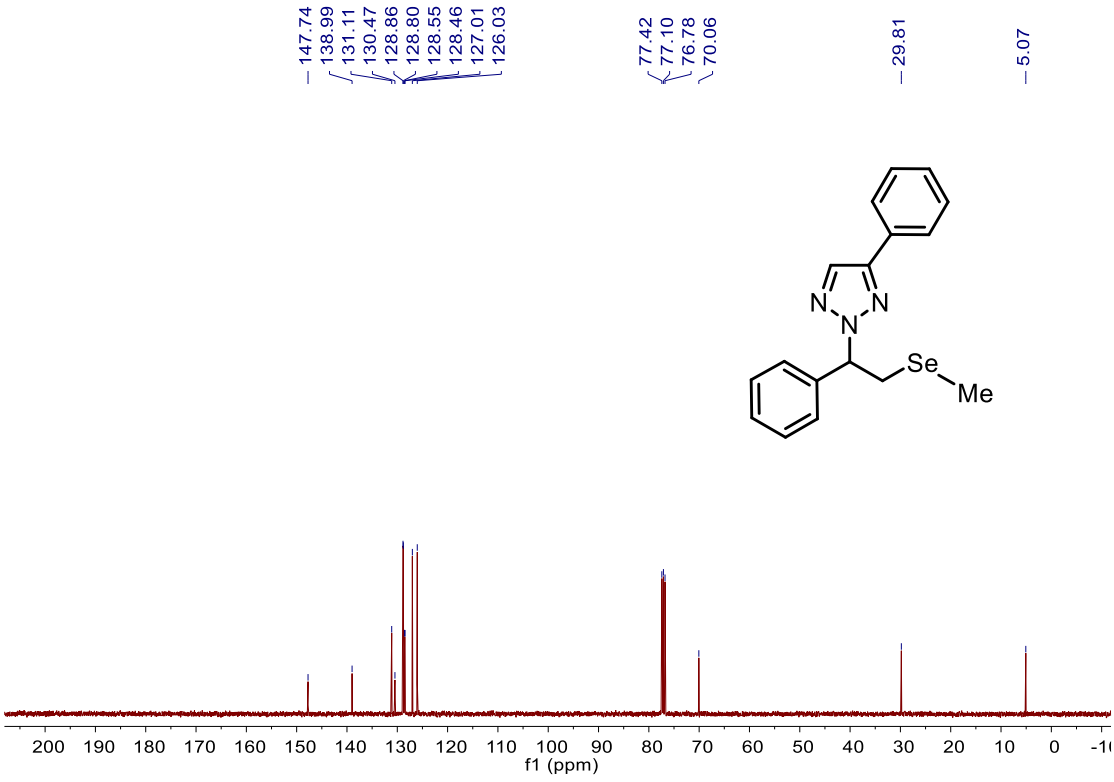
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4af



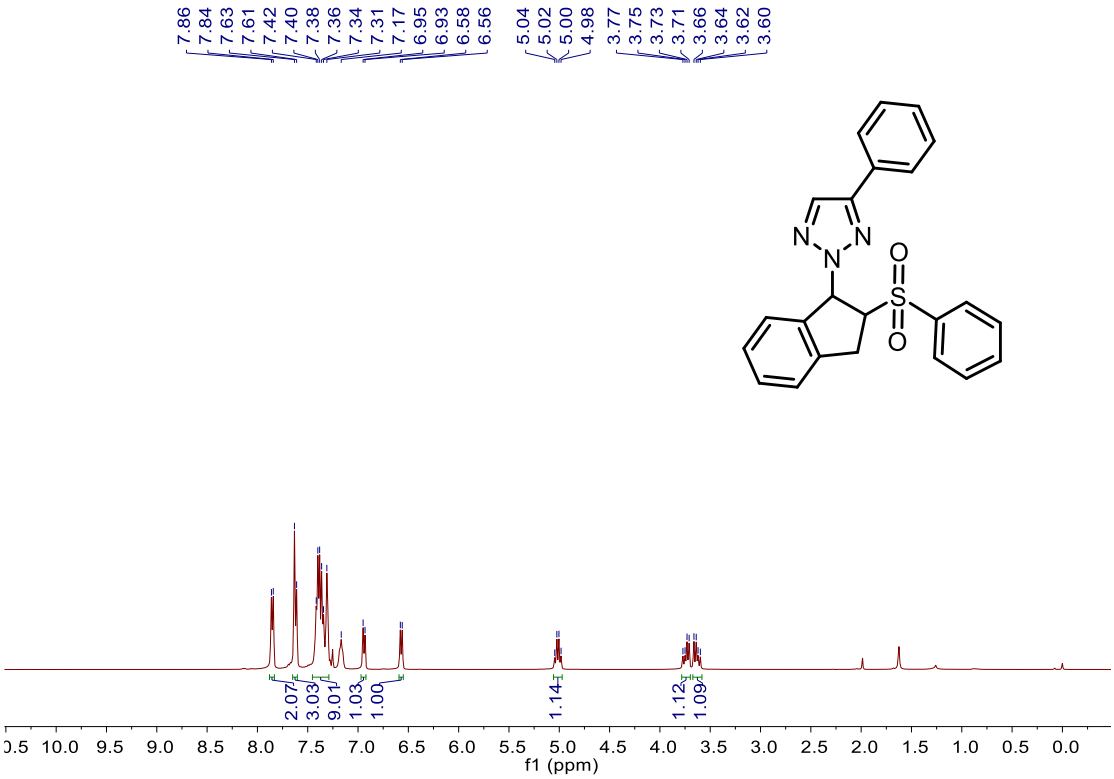
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **4ag**



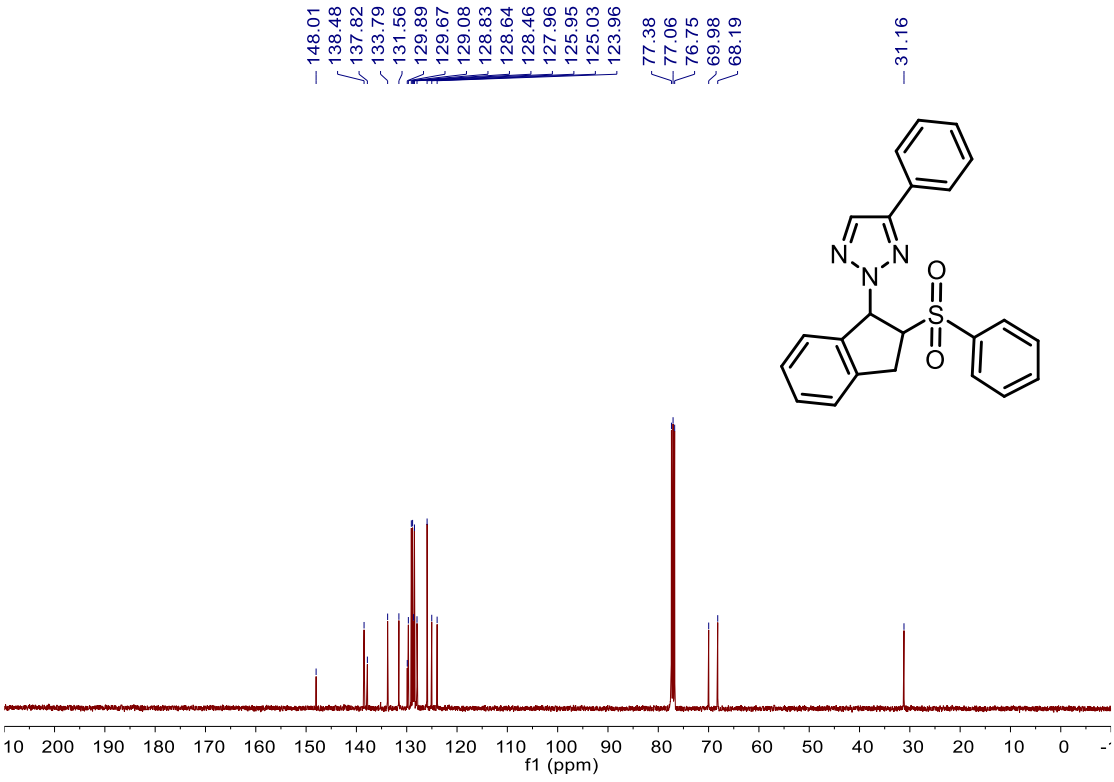
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 4ag



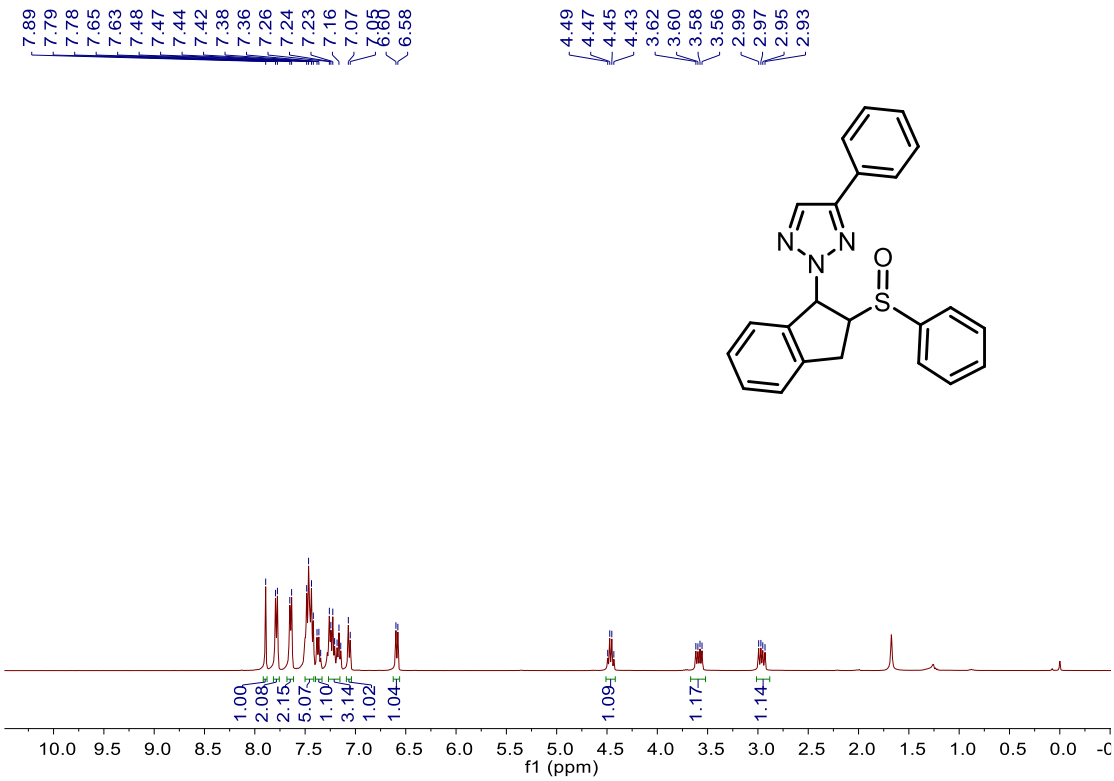
^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **6**



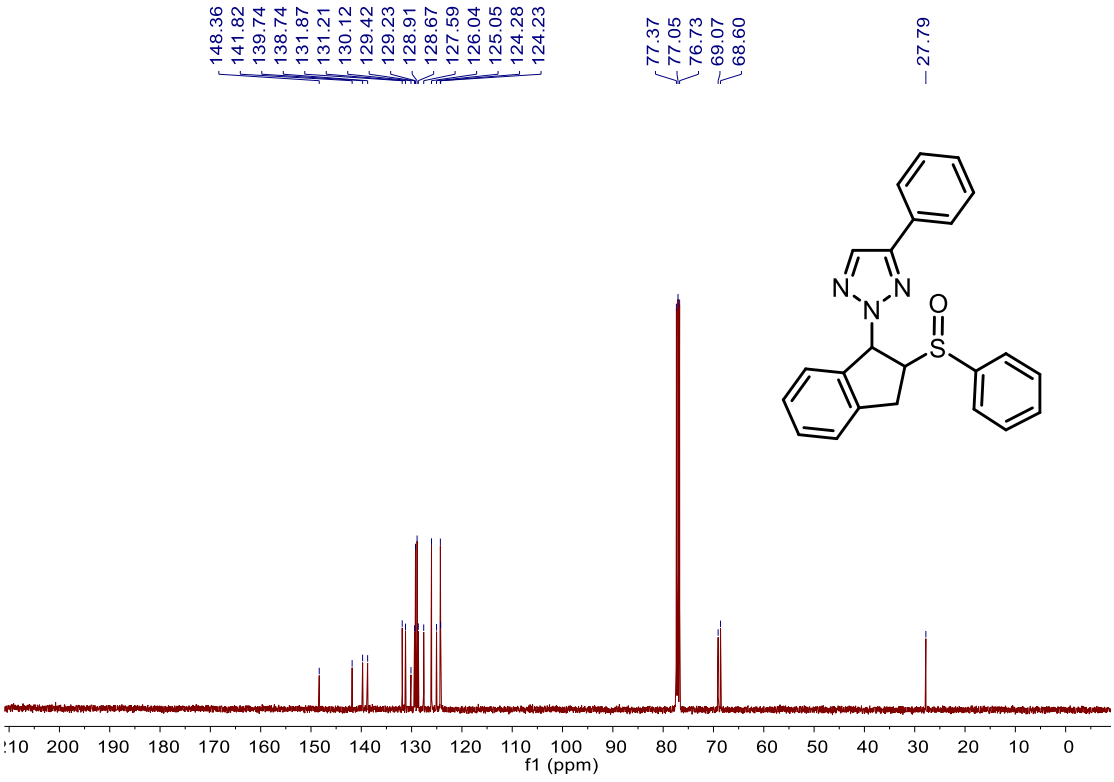
^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 6



^{1}H NMR (400 MHz, $CDCl_3$) spectrum for **7**



^{13}C NMR (100 MHz, $CDCl_3$) spectrum for 7



Supplementary References

(1) Kwok, S. W.; Zhang, L.; Grimster, N. P.; Fokin, V. V., Catalytic Asymmetric Transannulation of *N*H-1,2,3-Triazoles with Olefins. *Angew. Chem., Int. Ed.,* **2014**, *53*, 3452–3456.

(2) Zhu, L.-L.; Tian, L. F.; Sun, K. H.; Li, Y. W.; Liu, G. L.; Cai, B.; Zhang, H.; Wang, Y. H. N^2-selective β-thioalkylation of benzotriazoles with alkenes. *J. Org. Chem.* **2022**, *87*, 12963−12974.