Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supporting Information

Copper-catalyzed one-pot hydroboration/azidation/cycloaddition reaction of alkynes

Hamilton C. Zimba,[§] Lucas L. Baldassari,[§] and Angélica V. Moro*[§]

*angelica.venturini@ufrgs.br

Institute of Chemistry, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves 9500, 91501-970, Porto Alegre, RS, Brazil.

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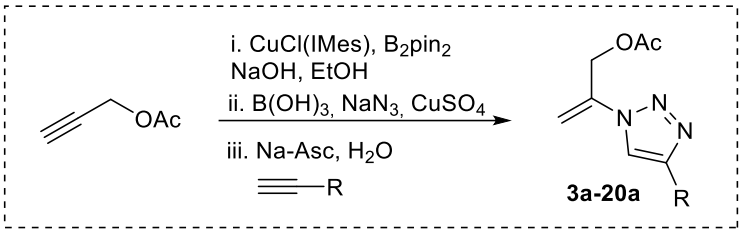
1. General Information

All reagents were used as received from commercial suppliers unless otherwise stated. Cu(Cl)(IMes) was prepared according to procedures described in the literature.[1] Reaction progress was monitored by thin layer chromatography (TLC) performed on aluminium plates coated with silica gel F254 with 0.2 mm thickness. Chromatograms were visualized by fluorescence quenching with UV light at 254 nm or by staining using vanillin solution. Flash column chromatography was performed using silica gel 60 (230-400 mesh). Neat infra-red spectra were recorded using a Perkin-Elmer Spectrum 100 FT-IR spectrometer. Wavenumbers (= 1/l) are reported in cm-1. Mass spectra were obtained using a Finnigan MAT 8200 or (70 eV) or an Agilent 5973 (70 eV) spectrometer, using electrospray ionization (ESI). All ^{1}H NMR and ^{13}C NMR spectra were recorded using a Bruker AV-400 spectrometer at 298K. Chemical shifts were given in parts per million (ppm, δ), referenced to the solvent peak of $CDCl_3$, defined at δ = 7.27 ppm (^{1}H NMR) and δ = 77.0 (^{13}C NMR). Coupling constants are quoted in Hz (*J*). ^{1}H NMR splitting patterns were designated as singlet (s), doublet (d), triplet (t), quartet (q), quintet (qui) and sextet (sex). Splitting patterns that could not be interpreted or easily visualized were designated as multiplet (m).

2. General Procedure for the synthesis of α-vinyltriazoles

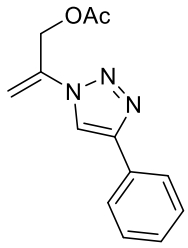


Step 1: To an open flask were added terminal alkyne (0.50 mmol), EtOH (1.0 mL), B_2pin_2 (0.55 mmol,1.1 equiv., 140 mg), NaOH 1.0 M solution (5 mol%, 25 µL) and CuCl(IMes) (0,04 mmol, 8 mol%, 17 mg). The reaction was kept stirring for 48 hours at 30º C. After this time, the solvent was completely removed by evaporation under reduced pressure at 35° C (Caution: do not remove EtOH at temperatures above 40° C because it can lead to a proto-deborylation reaction). **Step 2:** After complete removal of EtOH, $B(OH)_3$ (0.55 mmol, 1.1 equiv., 34 mg), NaN_3 (0.75 mmol, 1.5 equiv., 48.8 mg), EtOH (1.0 mL) and $CuSO_4.5H_2O$ (0.025 mmol, 5 mol%, 6.7 mg) were added. The reaction was kept stirring

[1] C. A. Citadelle, E. L. Nouy, F. Bisaro, A. M. Z. Slawin, C. S. J. Cazin, *Dalton Trans.* **2010**, *39*, 4489.

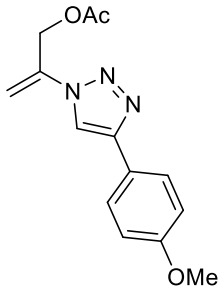
for 20h at 45°C. **Step 3:** The triazole formation step is performed by the addition of H_2O (0.5 mL), terminal alkyne (0.60 mmol, 1.2 equiv.) and sodium ascorbate (0.015 mmol, 3 mg). The reaction was kept stirring for 20h at 45°C. The solvent was removed under reduced pressure. The product was purified by column chromatography using a mixture of hexane and ethyl acetate as the eluent.

2-(4-phenyl-1*H*-1,2,3-triazol-1-yl)allyl acetate (3a)



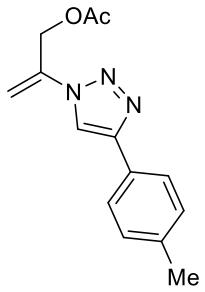
White solid. **Yield**: 51.1 mg, 42%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.03 (s, 1H), 7.89 – 7.85 (m, 2H), 7.47 – 7.42 (m, 2H), 7.39 – 7.34 (m, 1H), 5.77 (d, *J* = 1.8 Hz, 1H), 5.37 (dt, *J* = 1.8, 1.0 Hz, 1H), 5.21 (d, *J* = 1.0 Hz, 2H), 2.12 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 147.9, 138.0, 129.9, 128.9, 128.5, 125.8, 117.2, 107.7, 62.3, 20.8. **IR** (vmax, cm^{-1}): 2911, 1738, 1229, 923, 773, 692. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{13}H_{13}N_3O_2Na$) requires m/z 266.0905, found: m/z 266.0903.

2-(4-(4-methoxyphenyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (4a)



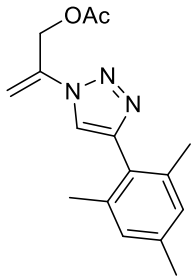
White solid. **Yield**: 56 mg, 41%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.95 (s, 1H), 7.79 (d, *J* = 8.9 Hz, 2H), 6.98 (d, *J* = 8.9 Hz, 2H), 5.74 (d, *J* = 1.7 Hz, 1H), 5.35-5.33 (m, 1H), 5.21 (d, *J* = 0.7 Hz, 2H), 3.85 (s, 3H), 2.12 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 159.8, 147.8, 138.1, 127.2, 122.6, 116.4, 114.3, 107.3, 62.3, 55.3, 20.8. **IR** (vmax, cm^{-1}): 3143, 1736, 1447, 1231, 1022. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{14}H_{15}N_3O_3Na$) requires m/z 296.1011, found: m/z 296.1008.

2-(4-(p-tolyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (5a)



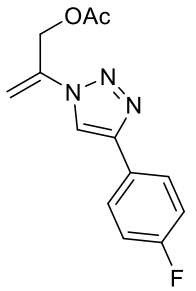
White solid. **Yield**: 42.5 mg, 33%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.98 (s, 1H), 7.75 (d, *J* = 8,1 Hz, 2H), 7.25 (d, *J* = 8,1 Hz, 2H), 5.75 (d, *J* = 1.7 Hz, 1H), 5.34 (dt, *J* = 1.7, 1.0 Hz, 1H), 5.20 (d, *J* = 1.0 Hz, 2H), 2.39 (s, 3H), 2.11 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 148.0, 138.4, 138.1, 129.5, 127.1, 125.7, 116.8, 107.4, 62.3, 21.3, 20.8. **IR** (vmax, cm^{-1}): 3143, 1736, 1231, 877, 812. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{14}H_{15}N_3O_2Na$) requires m/z 280.1062, found: m/z 280.1059.

2-(4-mesityl-1*H*-1,2,3-triazol-1-yl)allyl acetate (6a)



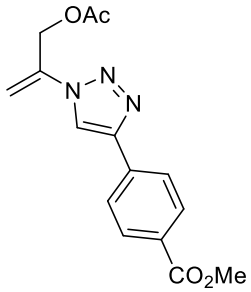
White solid. **Yield**: 34.2 mg, 24%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.71 (s, 1H), 6.95 (s, 2H), 5.78 (d, *J* = 1.7 Hz, 1H), 5.35 (dt, *J* = 1.7, 1.0 Hz, 1H), 5.23 (d, *J* = 1.0 Hz, 2H), 2.32 (s, 3H), 2.13 (s, 6H), 2.12 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 145.8, 138.4, 138.0, 137.7, 128.4, 126.4, 120.3, 107.1, 62.3, 29.7, 21.1, 20.9. **IR** (vmax, cm^{-1}): 3155, 2958, 2918, 1745, 1689, 1487, 1431, 1215, 1013. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{16}H_{19}N_3O_2Na$) requires m/z 308.1375, found: m/z 308.1370.

2-(4-(4-fluorophenyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (7a)



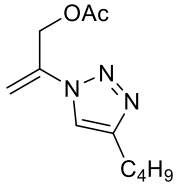
White solid. **Yield**: 40.5 mg, 31%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.99 (s, 1H), 7.87 – 7.81 (m, 2H), 7.17 – 7.09 (m, 2H), 5.77 (d, *J* = 1.7 Hz, 1H), 5.37 (dt, *J* = 1.7, 1.0 Hz, 1H), 5.21 (d, *J* = 1.0 Hz, 2H), 2.12 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 162.9 (d, *J* = 247.9 Hz), 147.0, 138.0, 127.6 (d, *J* = 8.2 Hz), 126.2 (d, *J* = 3.1 Hz), 117.0, 115.9 (d, *J* = 21.8 Hz), 107.8, 62.3, 20.8. **^{19}F NMR** (376 MHz, $CDCl_3$): δ -112.9. **IR** (vmax, cm^{-1}): 3126, 1721, 1231, 1029, 789. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{13}H_{12}FN_3O_2Na$) requires m/z 284.0811, found: m/z 284.0810.

Methyl 4-(1-(3-acetoxyprop-1-en-2-yl)-1*H*-1,2,3-triazol-4-yl)benzoate (8a)



White solid. **Yield**: 78.3 mg, 52%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.15 – 8.10 (m, 3H), 7.97 – 7.93 (m, 2H), 5.81 (d, *J* = 1.8 Hz, 1H), 5.41 (dt, *J* = 1.8, 1.0 Hz, 1H), 5.22 (d, *J* = 1.0 Hz, 2H), 3.95 (s, 3H), 2.13 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 166.7, 146.9, 137.9, 134.2, 130.2, 129.9, 125.6, 118.2, 108.3, 62.2, 52.2, 20.8. **IR** (vmax, cm^{-1}): 3143, 2942, 1736, 1705, 1231, 773. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{15}H_{15}N_3O_4Na$) requires m/z 324.0960, found: m/z 324.0958.

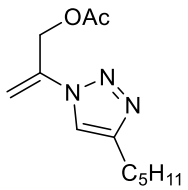
2-(4-butyl-1*H*-1,2,3-triazol-1-yl)allyl acetate (9a)



Yellow oil. **Yield**: 44.6 mg, 40%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.54 (s, 1H), 5.65 (d, *J* = 1.4 Hz, 1H), 5.27 (s, 1H), 5.16 (s, 2H), 2.75 (t, *J* = 7.8 Hz, 2H), 2.11 (s, 3H), 1.68 (qui, *J* = 7.6 Hz, 2H), 1.40 (sex, *J* = 7.5 Hz, 2H), 0.95 (t, *J* = 7.3 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 148.7, 138.1, 118.4, 106.7, 62.3, 31.4, 25.2, 22.3, 20.8, 13.8. **IR** (vmax, cm^{-1}): 3143, 2918, 1745,

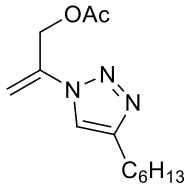
1206, 1029. **HRMS** (ESI+): exact mass calculated for $[M+H]^+$ ($C_{11}H_{18}N_3O_2$) requires m/z 224.1399, found: m/z 224.1392.

2-(4-pentyl-1*H*-1,2,3-triazol-1-yl)allyl acetate (10a)



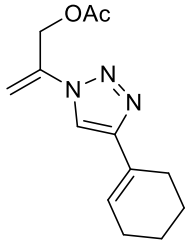
Yellow oil. **Yield**: 55.8 mg, 47%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 5.65 (d, *J* = 1.6 Hz, 1H), 5.29-5.26 (m, 1H), 5.16 (*d*, *J* = 0.8 Hz, 2H), 2.74 (t, *J* = 7.8 Hz, 2H), 2.11 (s, 3H), 1.70 (qui, *J* = 7.8 Hz, 2H), 1.39 – 1.34 (m, 4H), 0.91 (t, *J* = 7.1 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 148.7, 138.1,118.4, 106.6, 62.3, 31.4, 28.9, 25.5, 22.4, 20.8, 13.9. **IR** (vmax, cm^{-1}): 3143, 2926, 2854, 1736, 1231, 1029. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{12}H_{19}N_3O_2Na$) requires m/z 260.1375, found: m/z 260.1372.

2-(4-hexyl-1*H*-1,2,3-triazol-1-yl)allyl acetate (11a)



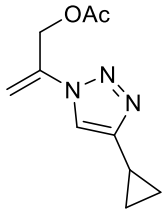
White solid. **Yield**: 54 mg, 43%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (s, 1H), 5.66 (d, *J* = 1.5 Hz, 1H), 5.28-5.26 (m, 1H), 5.17 (d, *J* = 0.8 Hz, 2H), 2.75 (t, *J* = 7.8 Hz, 2H), 2.12 (s, 3H), 1.69 (qui, *J* = 7.8 Hz, 2H), 1.43 – 1.26 (m, 6H), 0.90 (t, *J* = 7.0 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 148.7, 138.1, 118.4, 106.6, 62.3, 31.5, 29.2, 28.8, 25.5, 22.5, 20.8, 14.0. **IR** (vmax, cm^{-1}): 2910, 2845, 1721, 1238, 1038. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{13}H_{21}N_3O_2Na$) requires m/z 274.1531, found: m/z 274.1530.

2-(4-(cyclohex-1-en-1-yl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (12a)



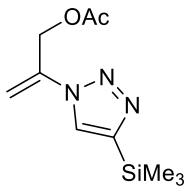
White solid. **Yield**: 42 mg, 34%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.63 (s, 1H), 6.62-6.58 (m, 1H), 5.66 (d, *J* = 1.6 Hz, 1H), 5.28 (dd, *J* = 1.6, 1.0 Hz, 1H), 5.17 (d, *J* = 1.0 Hz, 2H), 2.42 – 2.37 (m, 2H), 2.26 – 2.19 (m, 2H), 2.10 (s, 3H), 1.82 – 1.76 (m, 2H), 1.73 – 1.63 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 149.5, 138.0, 126.6, 126.1, 115.8, 106.8, 62.3, 26.3, 25.3, 22.4, 22.1, 20.8. **IR** (vmax, cm^{-1}): 3119, 2926, 1736, 1431, 1215, 1013. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{13}H_{17}N_3O_2Na$) requires m/z 270.1218, found: m/z 270.1223.

2-(4-cyclopropyl-1*H*-1,2,3-triazol-1-yl)allyl acetate (13a)



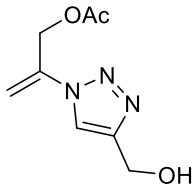
Yellow oil. **Yield**: 42.5 mg, 41%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 5.62 (d, *J* = 1.6 Hz, 1H), 5.27-5.25 (m, 1H), 5.14 (d, *J* = 0.9 Hz, 2H), 2.11 (s, 3H), 2.02-1.93 (m, 1H), 1.01-0.96 (m, 2H), 0.93-0.85 (m, 2H).**^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 150.4, 138.0, 117.5, 106.7, 62.2, 20.7, 7.8, 6.5. **IR** (vmax, cm^{-1}): 2999, 1729, 1222, 1029. **HRMS** (ESI+): exact mass calculated for $[M+H]^+$ ($C_{10}H_{14}N_3O_2$) requires m/z 208.1086, found: m/z 208.1085.

2-(4-(trimethylsilyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (14a)



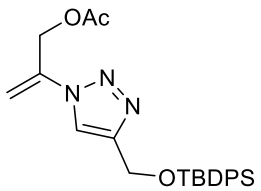
White solid. **Yield**: 28.7 mg, 24%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.77 (s, 1H), 5.69 (d, *J* = 1.5 Hz, 1H), 5.31-5.29 (m, 1H), 5.17 (d, *J* = 0.8 Hz, 2H), 2.12 (s, 3H), 0.35 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.2, 146.8, 138.0, 126.7, 107.1, 62.5, 20.8, -1.2. **IR** (vmax, cm^{-1}): 3126, 2950, 1736, 1238, 845. **HRMS** (ESI+): exact mass calculated for $[M+H]^+$ ($C_{10}H_{18}N_3O_2Si$) requires m/z 240.1168, found: m/z 240.1164.

2-(4-(hydroxymethyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (15a)



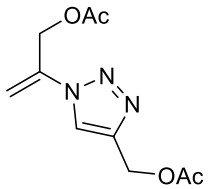
Yellow oil. **Yield**: 21.7 mg, 22%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.83 (s, 1H), 5.71 (d, *J* = 1.8 Hz, 1H), 5.33 (dt, *J* = 1.8, 1.0 Hz, 1H), 5.13 (d, *J* = 1.0 Hz, 2H), 4.81 (s, 2H), 3.13 (bs, 1H), 2.09 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 147.9, 138.0, 119.7, 108.1, 62.3, 56.3, 20.7. **IR** (vmax, cm^{-1}): 3368, 3143, 2942, 1745, 1455, 1367, 1215, 1022. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_8H_{12}N_3O_3Na$) requires m/z 221.0776, found: m/z 221.0775.

2-(4-(((tert-butyldiphenylsilyl)oxy)methyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (16a)



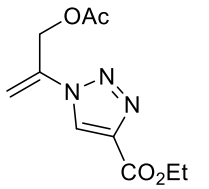
White solid. **Yield**: 89.3 mg, 41%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.71 – 7.67 (m, 4H), 7.60 (s, 1H), 7.47 – 7.36 (m, 6H), 5.66 (d, *J* = 1.6 Hz, 1H), 5.31-5.29 (m, 1H), 5.14 (s, 2H), 4.91 (s, 2H), 2.10 (s, 3H), 1.08 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 148.4, 138.0, 135.5, 133.0, 129.9, 127.8, 119.5, 107.3, 62.3, 58.4, 26.8, 20.7, 19.2. **IR** (vmax, cm^{-1}): 2926, 2861, 1745, 1215, 1110, 1029. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{24}H_{29}N_3O_3SiNa$) requires m/z 458.1876, found: m/z 458.1871.

2-(4-(acetoxymethyl)-1H-1,2,3-triazol-1-yl)allyl acetate (17a)



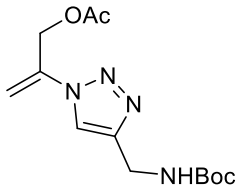
White solid. **Yield**: 40 mg, 33%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.89 (s, 1H), 5.73 (d, *J* = 1.7 Hz, 1H), 5.37-5.35 (m, 1H), 5.25 (s, 2H), 5.16 (d, *J* = 0.6 Hz, 2H), 2.11 (s, 3H), 2.10 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.9, 170.1, 143.1, 137.9, 121.7, 108.1, 62.2, 57.4, 20.8, 20.7. **IR** (vmax, cm^{-1}): 3143, 2926, 1729, 1222, 1022. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{10}H_{13}N_3O_4Na$) requires m/z 262.0804, found: m/z 262.0813.

Ethyl 1-(3-acetoxyprop-1-en-2-yl)-1*H*-1,2,3-triazole-4-carboxylate (18a)



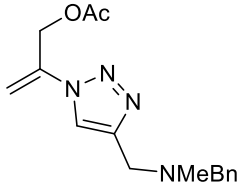
Yellow oil. **Yield**: 31.1 mg, 26%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.36 (s, 1H), 5.88 (d, *J* = 1.8 Hz, 1H), 5.47 (bs, 1H), 5.15 (s, 2H), 4.45 (q, *J* = 7.1 Hz, 2H), 2.11 (s, 3H), 1.43 (t, *J* = 7.1 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.0, 160.4, 140.4, 137.6, 125.4, 110.1, 62.2, 61.5, 20.7, 14.3. **IR** (vmax, cm^{-1}): 2973, 1738, 1221, 1020. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{10}H_{13}N_3O_4Na$) requires m/z 262.0804, found: m/z 262.0798.

2-(4-(((tert-butoxycarbonyl)amino)methyl)-1*H*-1,2,3-triazol-1-yl)allyl acetate (19a)

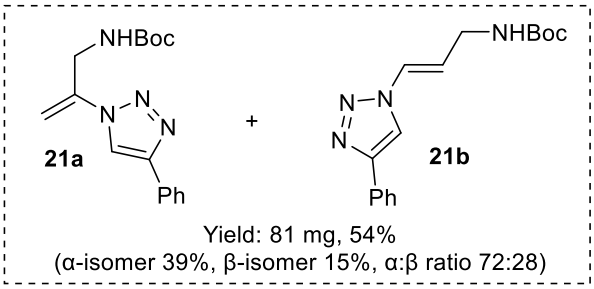


White solid. **Yield**: 88.9 mg, 60%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.80 (s, 1H), 5.70 (d, *J* = 1.7 Hz, 1H), 5.34-5.31 (m, 1H), 5.20 – 5.13 (m, 3H), 4.43 (d, *J* = 6.1 Hz, 2H), 2.11 (s, 3H), 1.45 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 155.8, 145.7, 137.9, 119.9, 107.7, 79.8, 62.2, 35.9, 28.3, 20.7. **IR** (vmax, cm^{-1}): 3352, 2923, 1752, 1705, 1503, 1222, 1158. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{13}H_{20}N_4O_4Na$) requires m/z 319.1382, found: m/z 319.1380.

2-(4-((benzyl(methyl)amino)methyl)-1H-1,2,3-triazol-1-yl)allyl acetate (20a)

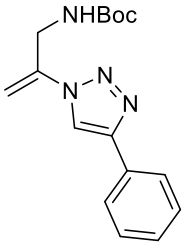


White solid. **Yield**: 69.1 mg, 46%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.37 – 7.24 (m, 5H), 5.70 (d, *J* = 1.6 Hz, 1H), 5.33-5.31 (m, 1H), 5.16 (d, *J* = 0.7 Hz, 2H), 3.75 (s, 2H), 3.59 (s, 2H), 2.28 (s, 3H), 2.10 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.1, 145.7, 138.4, 138.0, 129.0, 128.3, 127.1, 120.4, 107.3, 62.3, 61.5, 51.8, 42.2, 20.7. **IR** (vmax, cm^{-1}): 2937, 1736, 1213, 1030. **HRMS** (ESI+): exact mass calculated for $[M+H]^+$ ($C_{16}H_{21}N_4O_2$) requires m/z 301.1665, found: m/z 301.1663.



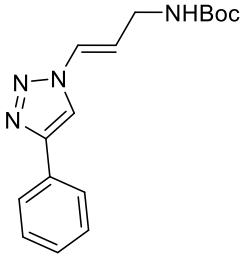
Yield: 81 mg, 54%
(α-isomer 39%, β-isomer 15%, α:β ratio 72:28)

tert-butyl (2-(4-phenyl-1H-1,2,3-triazol-1-yl)allyl)carbamate (21a)

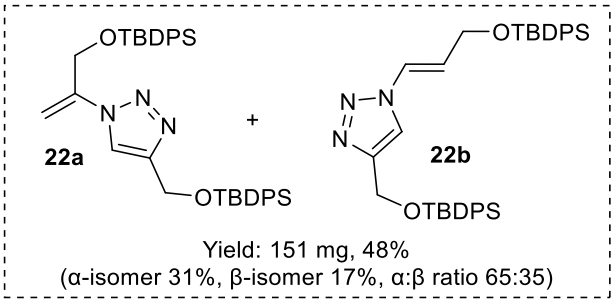


White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.10 (s, 1H), 7.88 – 7.83 (m, 2H), 7.47 – 7.41 (m, 2H), 7.39 – 7.33 (m, 1H), 5.54 (s, 1H), 5.25 (s, 2H), 4.43 (d, *J* = 6.5 Hz, 2H), 1.43 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 155.7, 147.9, 140.2, 130.0, 128.9, 128.5, 125.8, 117.3, 105.0, 80.1, 42.3, 28.3. **IR** (vmax, cm^{-1}): 3352, 2950, 1680, 1512, 1022. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{16}H_{20}N_4O_2Na$) requires m/z 323.1484, found: m/z 323.1491.

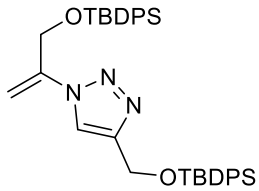
tert-butyl (E)-(3-(4-phenyl-1H-1,2,3-triazol-1-yl)allyl)carbamate (21b)



White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.48-7.41 (m, 2H), 7.39-7.33 (m, 1H), 7.30 (d, *J* = 14.4 Hz, 1H), 6.30 (dt, *J* = 14.4, 6.1 Hz, 1H), 4.83 (s, 1H), 4.02-3.93 (m, 2H), 1.48 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 155.7, 147.9, 130.0, 128.9, 128.5, 125.8, 125.6, 119.1, 116.6, 80.0, 39.6, 28.2. **IR** (vmax, cm^{-1}): 3352, 3135, 2958, 2918, 1689, 1512, 1247, 1022. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{16}H_{20}N_4O_2Na$) requires m/z 323.1484, found: m/z 323.1487.

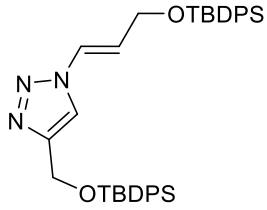


4-(((tert-butyldiphenylsilyl)oxy)methyl)-1-(3-((tert-butyldiphenylsilyl)oxy)prop-1-en-2-yl)-1H-1,2,3-triazole (22a)



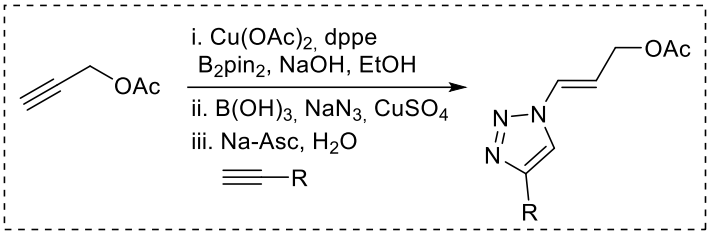
White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.70 – 7.63 (m, 9H), 7.45 – 7.34 (m, 12H), 5.58 (d, *J* = 0.9 Hz, 1H), 5.33 – 5.30 (m, 1H), 4.88 (d, *J* = 0.5 Hz, 2H), 4.68 (s, 2H), 1.08 (s, 9H), 1.07 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 147.9, 141.9, 135.6, 135.5, 133.1, 132.6, 130.0, 129.8, 127.9, 127.8, 119.7, 104.1, 62.7, 58.5, 26.8, 26.7, 19.2, 19.1. **IR** (vmax, cm^{-1}): 2934, 2854, 1110, 700. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{38}H_{45}N_3O_2Si_2Na$) requires m/z 654.2948, found: m/z 654.2941.

(E)-4-(((tert-butyldiphenylsilyl)oxy)methyl)-1-(3-((tert-butyldiphenylsilyl)oxy)prop-1-en-1-yl)-1H-1,2,3-triazole (22b)



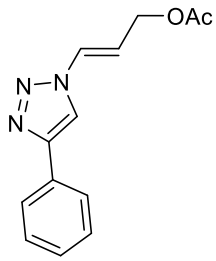
White solid. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.72 – 7.67 (m, 8H), 7.49 (s, 1H), 7.48 – 7.32 (m, 13H), 6.26 (dt, *J* = 14.2, 4.4 Hz, 1H), 4.90 (s, 2H), 4.40 (dd, *J* = 4.4, 2.1 Hz, 2H), 1.11 (s, 9H), 1.09 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.4, 135.6, 135.5, 133.1, 133.0, 129.9, 129.8, 127.9, 127.8, 124.2, 121.1, 119.1, 61.4, 58.5, 26.81, 26.80, 19.24, 19.20. **IR** (vmax, cm^{-1}): 3143, 3063, 2926, 1673, 1586, 1423, 1102. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{38}H_{45}N_3O_2Si_2Na$) requires m/z 654.2948, found: m/z 654.2947.

2. General Procedure for the synthesis of β-vinyltriazoles



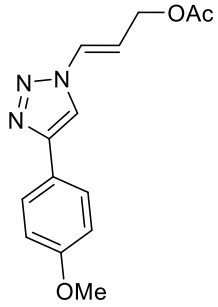
Step 1: To an open flask were added terminal alkyne (0.50 mmol), EtOH (2.0 mL), B_2pin_2 (0.55 mmol,1.1 equiv., 140 mg), NaOH 1.0 M solution (0.15 mol%, 25 µL), $Cu(OAc)_2$ (0.04 mmol, 8 mol%, 8.0 mg) and dppe (10 mol%, 0.05 mmol, 19.9 mg). The reaction was kept stirring for 48 hours at 30º C. After this period, the solvent was completely removed by evaporation under reduced pressure at 35° C (Caution: do not remove EtOH at temperatures above 40° C because it can lead to a proto-deborylation reactions). **Step 2:** After complete removal of EtOH, $B(OH)_3$ (0.55 mmol, 1.1 equiv., 34 mg), NaN_3 (0.75 mmol, 1.5 equiv., 48.8 mg), EtOH (2.0 mL) and $CuSO_4.5H_2O$ (0.025 mmol, 5 mol%, 6.7 mg) were added. The reaction was kept stirring for 20h at 45°C. **Step 3:** The triazole formation step is performed by the addition of H_2O (0.5 mL), terminal alkyne (0.60 mmol, 1.2 equiv.) and sodium ascorbate (0.015 mmol, 3 mg). The reaction was kept stirring for 20h at 45°C. The solvent was removed under reduced pressure. The product was purified by column chromatography using a mixture of hexane and ethyl acetate as the eluent.

(E)-3-(4-phenyl-1H-1,2,3-triazol-1-yl)allyl acetate (3b)



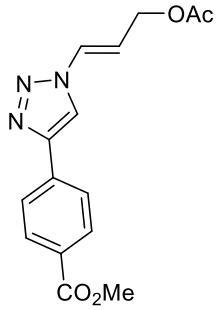
White solid. **Yield**: 50 mg, 41% (α-isomer 11%, β-isomer 30%, α:β ratio 27:73). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.85 (d, *J* = 7.3 Hz, 2H), 7.47-7.40 (m, 3H), 7.39-7.34 (m, 1H), 6.38 (dt, *J* = 14.2, 6.4 Hz, 1H), 4.79 (dd, *J* = 6.4, 1.0 Hz, 2H), 2.13 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.5, 148.1, 129.8, 128.9, 128.6, 127.5, 125.8, 116.7, 115.5, 61.5, 20.8. **IR** (vmax, cm^{-1}): 3136, 2921, 1733, 1360, 1238, 928, 766, 692. **HRMS** (ESI+): exact mass calculated for $[M+H]^+$ ($C_{13}H_{13}N_3O_2$) requires m/z 244.1086, found: m/z 244.1078.

(E)-3-(4-(4-methoxyphenyl)-1H-1,2,3-triazol-1-yl)allyl acetate (4b)



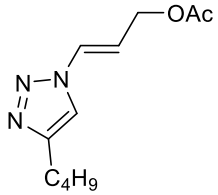
White solid. **Yield**: 59 mg, 48% (α-isomer 13%, β-isomer 35%, α:β ratio 27:73). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.89 (s, 1H), 7.78 (d, *J* = 8.9 Hz, 2H), 7.43 (dt, *J* = 14.4, 1.3 Hz, 1H), 6.98 (d, *J* = 8.9 Hz, 2H), 6.35 (dt, *J* = 14.4, 6.4 Hz, 1H), 4.78 (dd, *J* = 6.4, 1.3 Hz, 2H), 3.86 (s, 3H), 2.13 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.6, 159.9, 148.0, 127.7, 127.2, 122.5, 115.7, 115.2, 114.3, 61.6, 55.3, 20.8. **IR** (vmax, cm^{-1}): 3126, 2926, 2854, 1752, 1705, 1455, 1263, 1086, 1029, 780. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{14}H_{15}N_3O_3Na$) requires m/z 296.1011, found: m/z 296.1015.

methyl (E)-4-(1-(3-acetoxyprop-1-en-1-yl)-1H-1,2,3-triazol-4-yl)benzoate (8b)



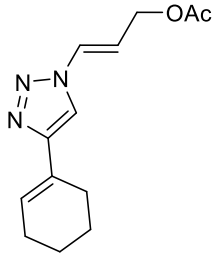
White solid. **Yield**: 77 mg, 48% (α-isomer 14%, β-isomer 34%, α:β ratio 29:71). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.14-8.10 (m, 2H), 8.07 (s, 1H), 7.97-7.91 (m, 2H), 7.44 (dt, *J* = 14.4, 1.4 Hz, 1H), 6.43 (dt, *J* = 14.4, 6.3 Hz, 1H), 4.80 (dd, *J* = 6.3, 1.4 Hz, 2H), 3.94 (s, 3H), 2.14 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.5, 166.7, 147.1, 134.1, 130.3, 127.3, 125.6, 117.6, 116.2, 108.3, 61.4, 52.2, 20.8. **IR** (vmax, cm^{-1}): 3126, 2950, 2845, 1736, 1712, 1496, 1263, 1093, 1022. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{15}H_{15}N_3O_4Na$) requires m/z 324.0960, found: m/z 324.0955.

(E)-3-(4-butyl-1H-1,2,3-triazol-1-yl)allyl acetate (9b)



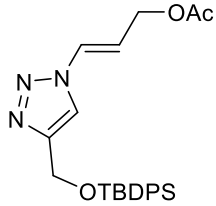
Colorless oil. **Yield**: 62 mg, 56% (α-isomer 14%, β-isomer 42%, α:β ratio 25:75). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (s, 1H), 7.36 (dt, *J* = 14.4, 1.4 Hz, 1H), 6.27 (dt, *J* = 14.4, 6.5 Hz, 1H), 4.75 (dd, *J* = 6.5, 1.4 Hz, 2H), 2.74 (t, *J* = 7.5 Hz, 2H), 2.12 (s, 3H), 1.67 (qui, *J* = 7.5 Hz, 2H), 1.39 (sex, *J* = 7.5 Hz, 2H), 0.94 (t, *J* = 7.5 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.6, 148.9, 127.8, 117.9, 114.6, 61.6, 31.3, 25.1, 22.2, 20.8, 13.7. **IR** (vmax, cm^{-1}): 3143, 3087, 2950, 2918, 1745, 1455, 1215, 1029, 941.

(E)-3-(4-(cyclohex-1-en-1-yl)-1H-1,2,3-triazol-1-yl)allyl acetate (12b)



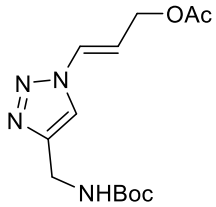
White solid. **Yield**: 76 mg, 62% (α-isomer 18%, β-isomer 44%, α:β ratio 29:71). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.59 (s, 1H), 7.37 (d, *J* = 14.4 Hz, 1H), 6.64-6.58 (m, 1H), 6.26 (dt, *J* = 14.4, 6.5 Hz, 1H), 4.75 (dd, *J* = 6.5, 1.1 Hz, 2H), 2.41-2.34 (m, 2H), 2.26-2.18 (m, 2H), 2.12 (s, 3H), 1.82-1.74 (m, 2H), 1.73-1.64 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.6, 149.8, 127.8, 126.6, 126.3, 115.2, 114.6, 61.7, 26.3, 25.3, 22.4, 22.1, 20.8. **IR** (vmax, cm^{-1}): 3143, 2918, 1745, 1455, 1263, 1077, 1022, 805. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{13}H_{17}N_3O_2Na$) requires m/z 270.1218, found: m/z 270.1225.

(E)-3-(4-(((tert-butyldiphenylsilyl)oxy) methyl)-1H-1,2,3-triazol-1-yl)allyl acetate (16b)



White solid. **Yield**: 77 mg, 36% (α-isomer 9%, β-isomer 27%, α:β ratio 25:75). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 7.0 Hz, 4H), 7.57 (s, 1H), 7.48-7.33 (m, 7H), 6.29 (dt, *J* = 14.4, 6.4 Hz, 1H), 4.89 (s, 2H), 4.76 (dd, *J* = 6.4, 0.9 Hz, 2H), 2.13 (s, 3H), 1.08 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.6, 148.8, 135.5, 133.0, 129.9, 127.8, 127.6, 119.0, 115.3, 119.0, 115.3, 61.6, 58.5, 26.8, 20.8, 19.2. **IR** (vmax, cm^{-1}): 3071, 2918, 2854, 1745, 1423, 1222, 1110, 1029, 692. **HRMS** (ESI+): exact mass calculated for $[M+Na]^+$ ($C_{24}H_{29}N_3O_3SiNa$) requires m/z 458.1276, found: m/z 458.1282.

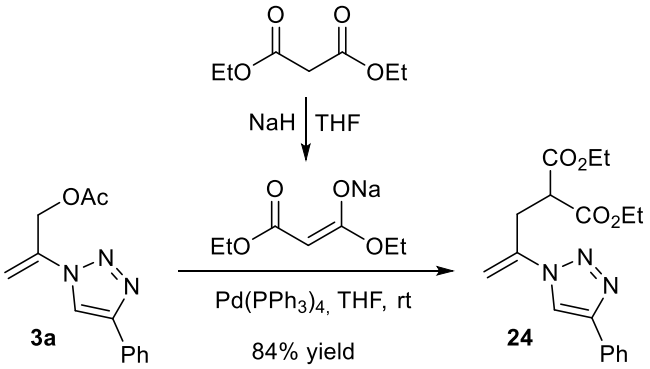
(E)-3-(4-(((tert-butoxycarbonyl)amino)methyl)-1H-1,2,3-triazol-1-yl)allyl acetate (19b)



White solid. **Yield**: 82 mg, 55% (α-isomer 17%, β-isomer 38%, α:β ratio 31:69). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.35 (dt, *J* = 14.4, 1.3 Hz, 1H), 6.33 (dt, *J* = 14.4, 6.4 Hz, 1H), 5.29 (bs, 1H), 4.76 (dd, *J* = 6.4, 1.3 Hz, 2H), 4.41 (d, *J* = 6.1 Hz, 2H), 2.12 (s, 3H), 1.44 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.5, 155.8, 146.0, 127.4, 119.5, 115.8, 79.9, 61.5, 35.9, 28.3, 20.8. **IR** (vmax, cm^{-1}): 3352, 3143, 3087, 2974, 1736, 1705, 1455, 1022, 941.

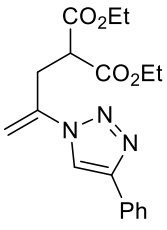
4. Allylic Substitution Reaction

*- Synthesis of compound **24***



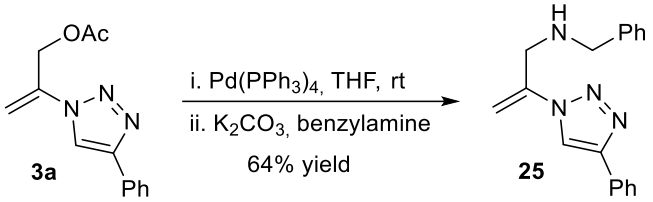
An oven-dried reaction flask equipped with a stir bar was charged with $Pd(PPh_3)_4$ (23 mg, 10 mol%) acetate **3a** (46 mg, 0.19 mmol) and dry tetrahydrofuran (1 mL) under an argon atmosphere. The mixture was stirred for 10 minutes at room temperature and a solution of sodium dimethylmalonate (prepared by reaction between diethyl malonate (0.4 mmol) and sodium hydride (60% in mineral oil, 12 mg, 0.3 mmol) in dry tetrahydrofuran (1 mL) under an argon atmosphere) was added. The reaction mixture was then stirred for 20h at room temperature. After this time, saturated $NH_4Cl_{(aq)}$ was added and the aqueous solution was extracted with ethyl acetate (3 x 5 mL). The combined organic layers were dried with $MgSO_4$, filtered and the solvent was evaporated. The crude product was purified by flash chromatography eluting with hexane/ethyl acetate.

diethyl 2-(2-(4-phenyl-1H-1,2,3-triazol-1-yl)allyl)malonate (24)



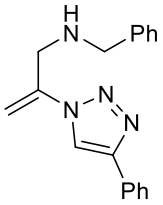
White solid. **Yield**: 55 mg, 84%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.02 (s, 1H), 7.86 (d, *J* = 7.1 Hz, 2H), 7.48-7.41 (m, 2H), 7.39-7.33 (m, 1H), 5.48 (d, *J* = 1.7 Hz, 1H), 5.11 (s, 1H), 4.20 (q, *J* = 7.1 Hz, 4H), 3.82 (t, *J* = 7.7 Hz, 1H), 3.43 (d, *J* = 7.7 Hz, 2H), 1.26 (t, *J* = 7.1 Hz, 6H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 168.2, 147.8, 140.0, 130.0, 128.9, 128.5, 125.8, 117.2, 106.2, 61.7, 50.0, 32.1, 14.0. **IR** (vmax, cm^{-1}): 2958, 1736, 1664, 1423, 1367, 1238, 1150, 1022.

*- Synthesis of compound **25***



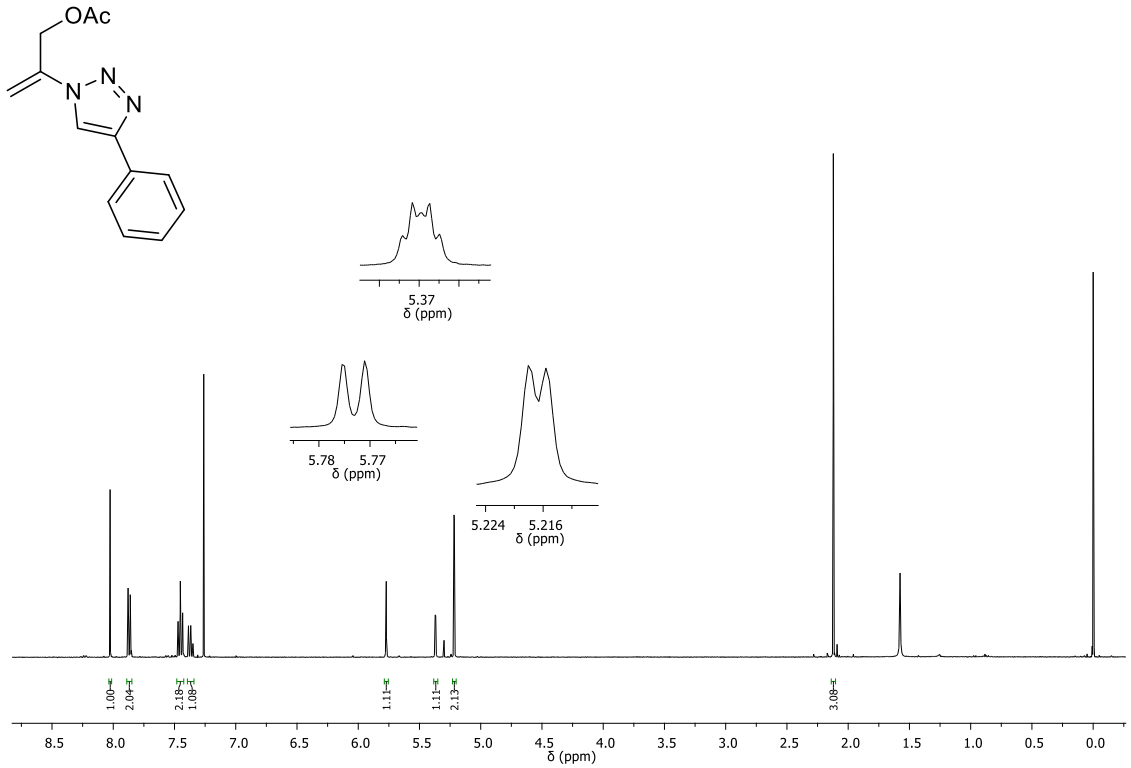
An oven-dried reaction flask equipped with a stir bar was charged with $Pd(PPh_3)_4$ (23 mg, 10 mol%) acetate **3a** (46 mg, 0.19 mmol) and dry tetrahydrofuran (1 mL) under an argon atmosphere. The mixture was stirred for 10 minutes at room temperature and potassium carbonate (26 mg, 0.19 mmol) and benzylamine (23 μL, 0.21 mmoL) were added. The reaction mixture was then stirred for 20h at room temperature. After this time, saturated $NH_4Cl_{(aq)}$ was added and the aqueous solution was extracted with ethyl acetate (3 x 5 mL). The combined organic layers were dried with $MgSO_4$, filtered and the solvent was evaporated. The crude product was purified by flash chromatography eluting with hexane/ethyl acetate.

N-benzyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)prop-2-en-1-amine (25)

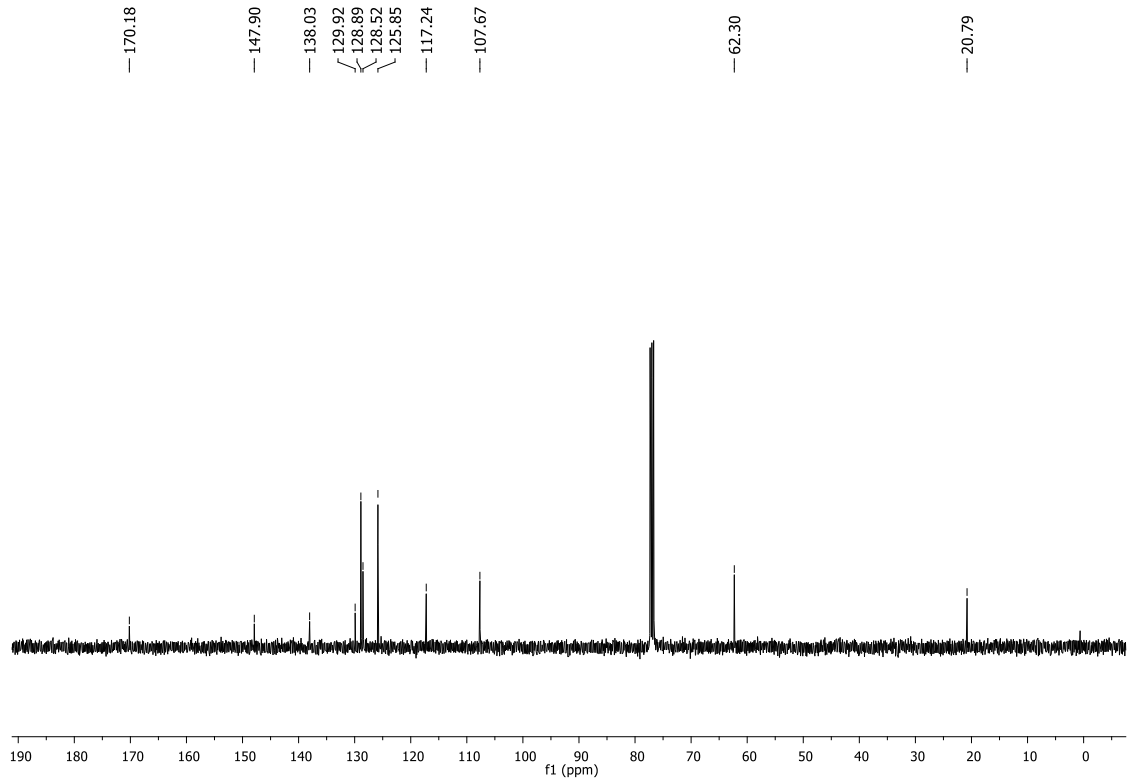


White solid. **Yield**: 35 mg, 64%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.11 (s, 1H), 7.88-7.83 (m, 2H), 7.47-7.41 (m, 2H), 7.38-7.31 (m, 5H), 7.29-7.23 (m, 1H), 5.64 (d, *J* = 1.2 Hz, 1H), 5.21-5.18 (m, 1H), 3.89 (d, *J* = 0.5 Hz, 2H), 3.85 (s, 2H), 2.20 (bs, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 147,5, 141.0, 139.5, 130.1, 128.8, 128.5, 128.3, 128.2, 127.2, 125.8, 117.6, 105.8, 52.5, 50.3. **IR** (vmax, cm^{-1}): 3349, 3131, 3060, 3027, 2925, 2843, 1652, 1453, 1234, 1016.

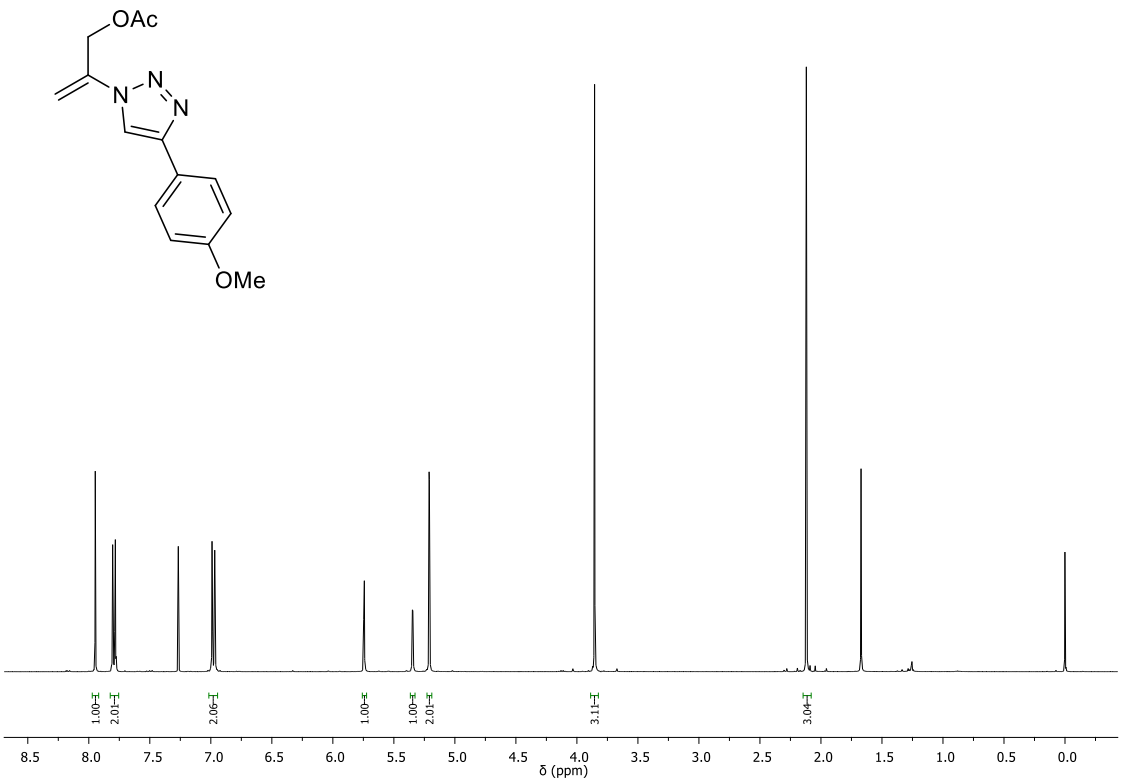
4. NMR SPECTRA



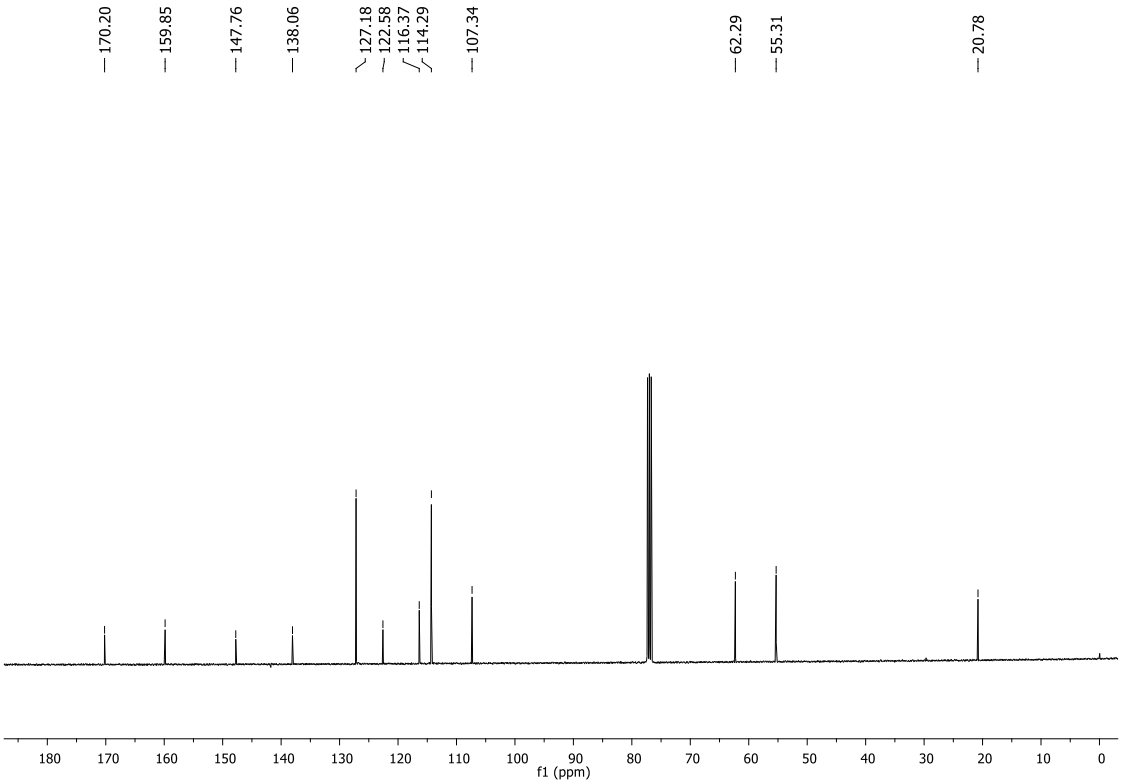
^{1}H NMR spectrum for compound **3a** in $CDCl_3$, 400 MHz



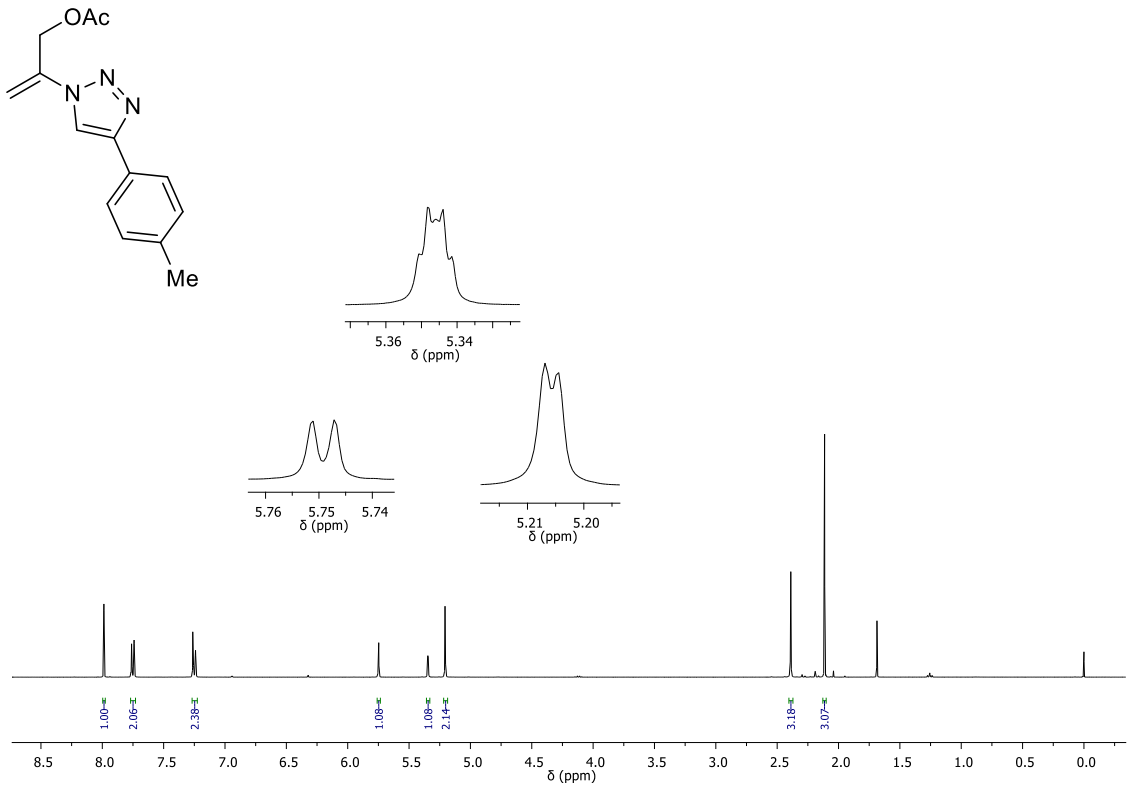
^{13}C NMR spectrum for compound **3a** in $CDCl_3$, 100 MHz



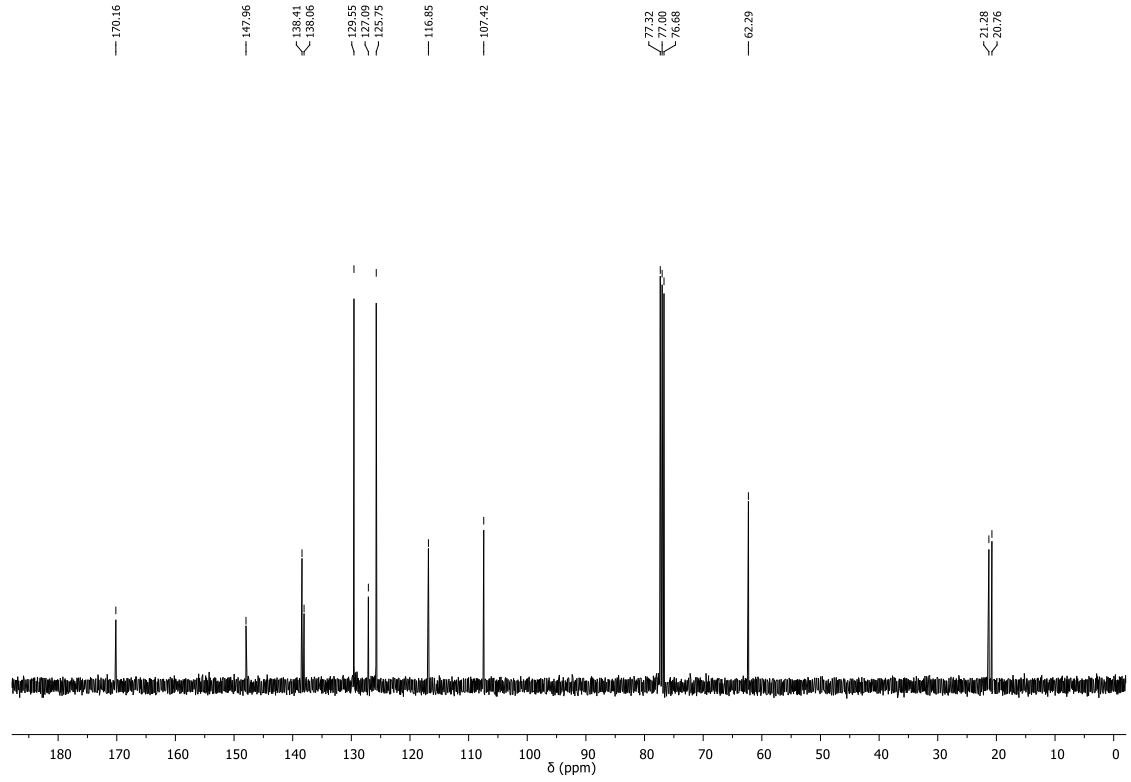
^{1}H NMR spectrum for compound **4a** in $CDCl_3$, 400 MHz



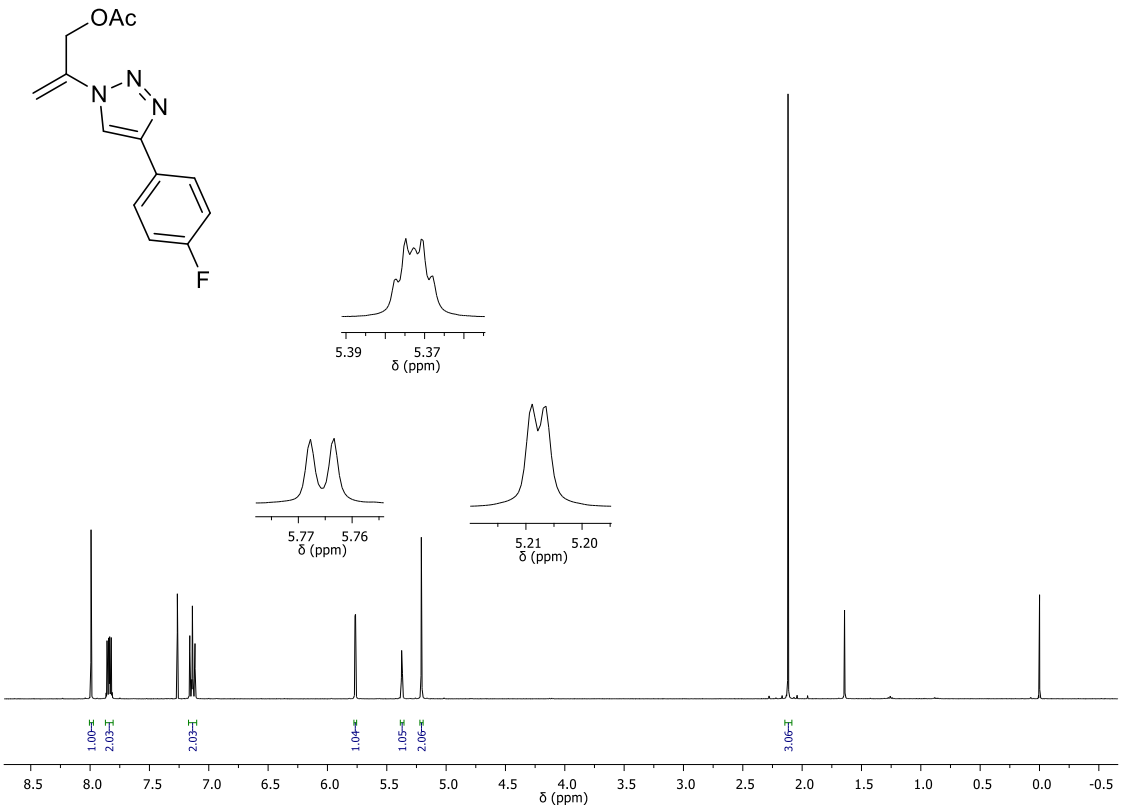
^{13}C NMR spectrum for compound **4a** in $CDCl_3$, 100 MHz



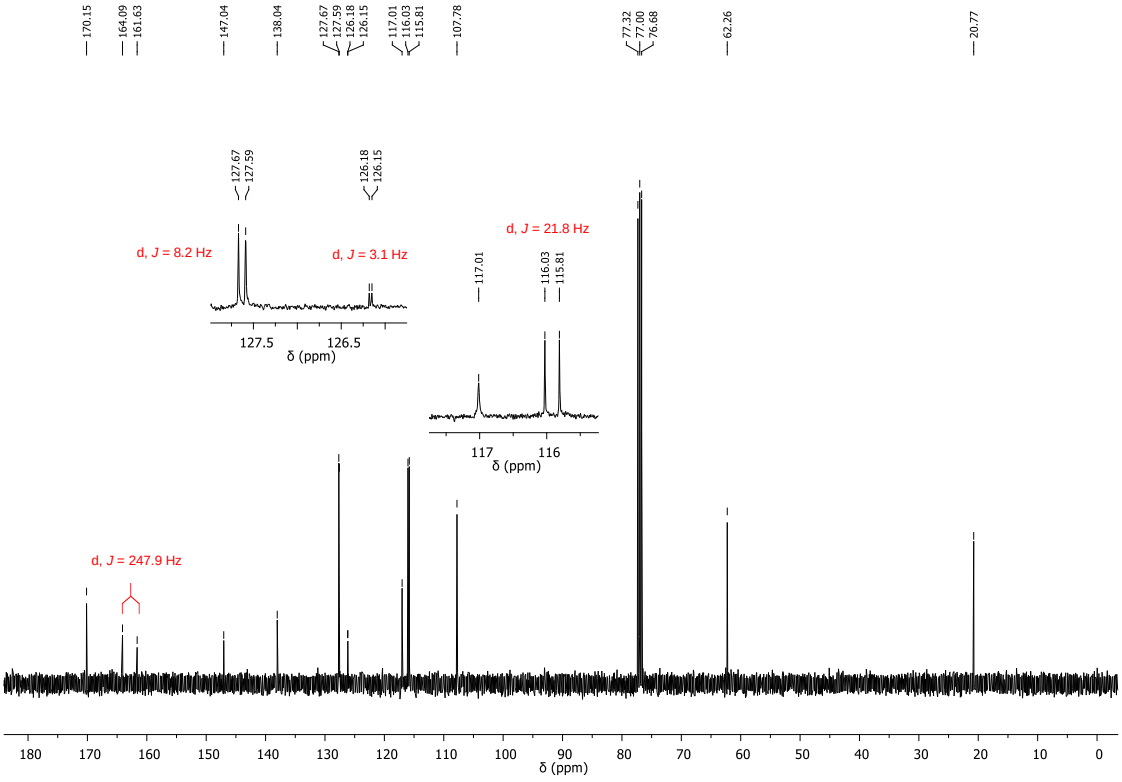
^{1}H NMR spectrum for compound **5a** in $CDCl_3$, 400 MHz



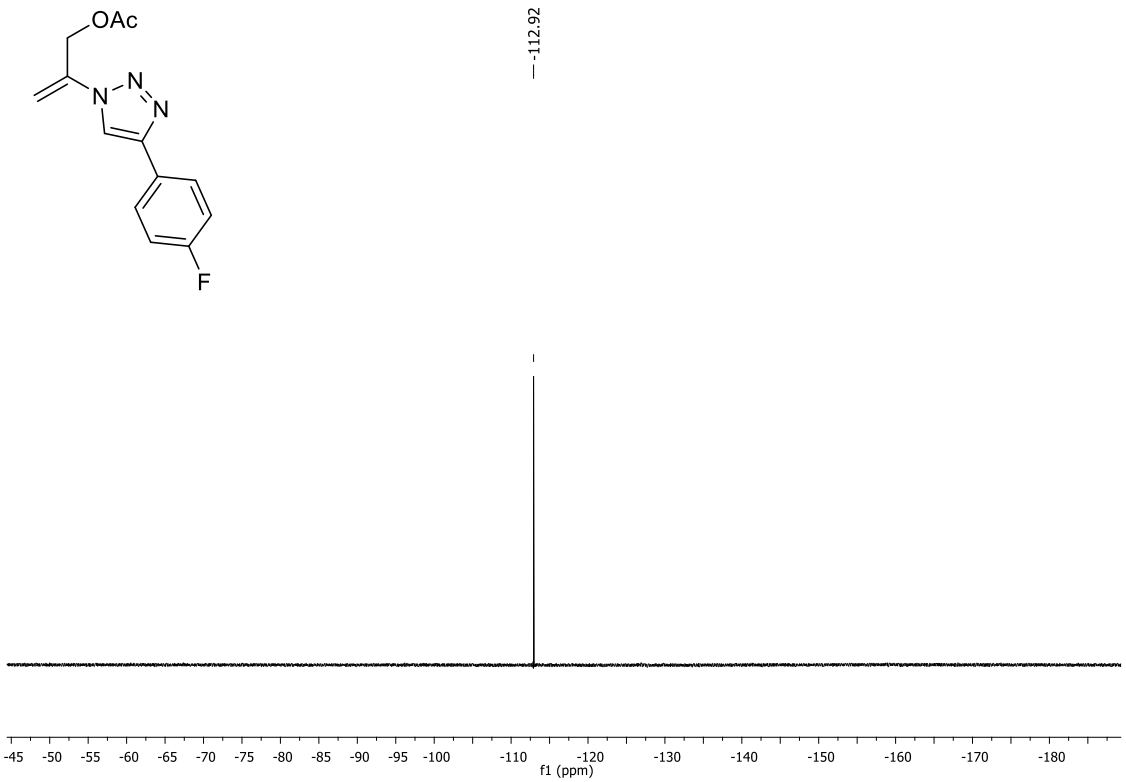
^{13}C NMR spectrum for compound **5a** in $CDCl_3$, 100 MHz



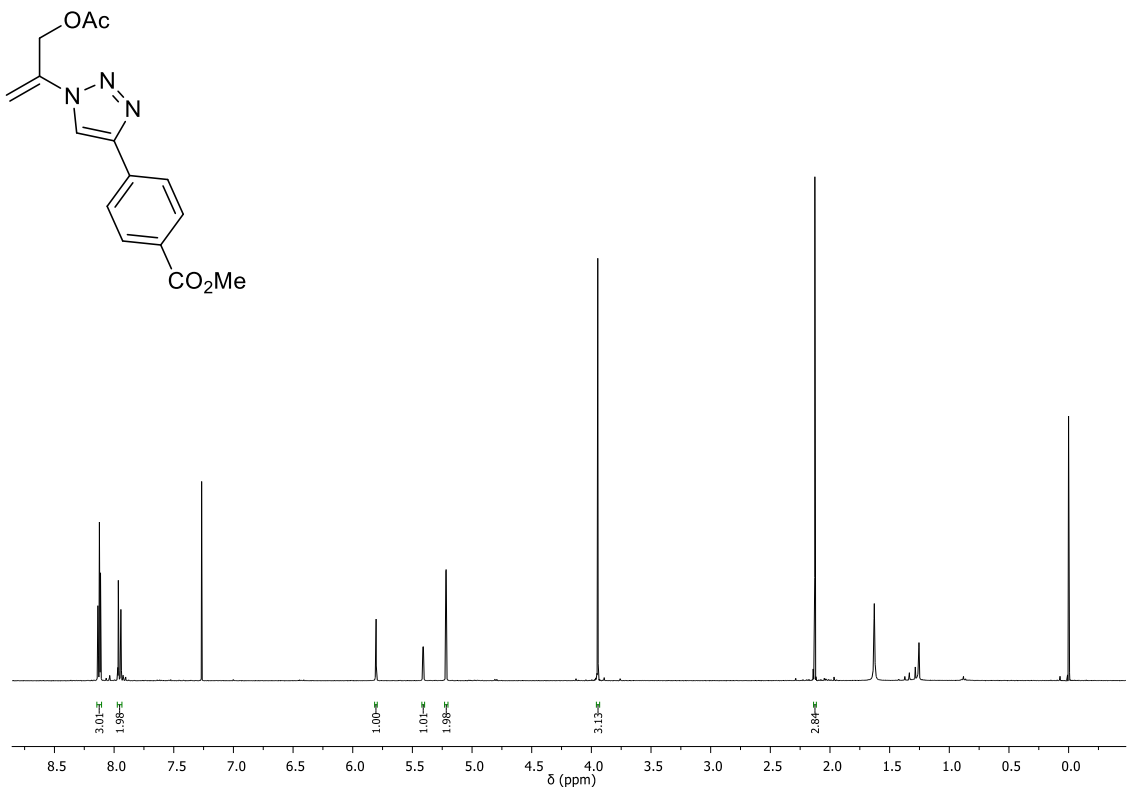
^{1}H NMR spectrum for compound **7a** in $CDCl_3$, 400 MHz



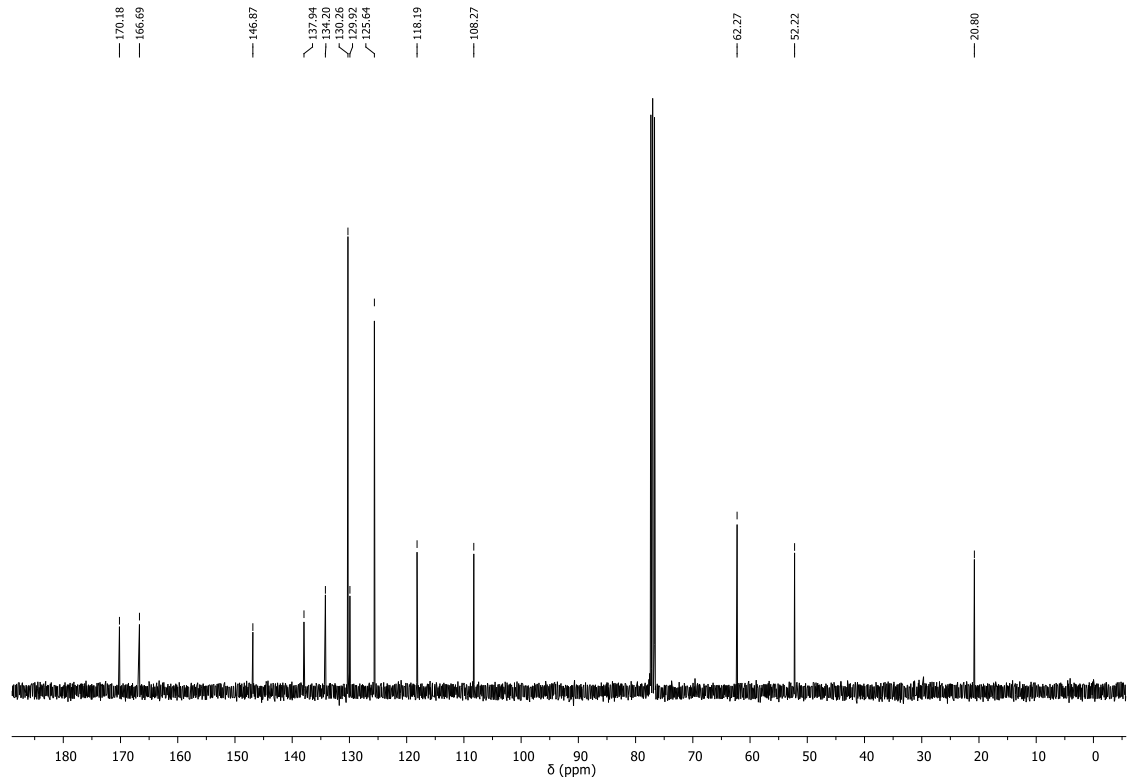
^{13}C NMR spectrum for compound **7a** in $CDCl_3$, 100 MHz



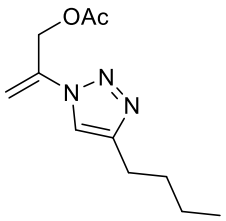
^{19}F NMR spectrum for compound **7a** in $CDCl_3$, 376 MHz

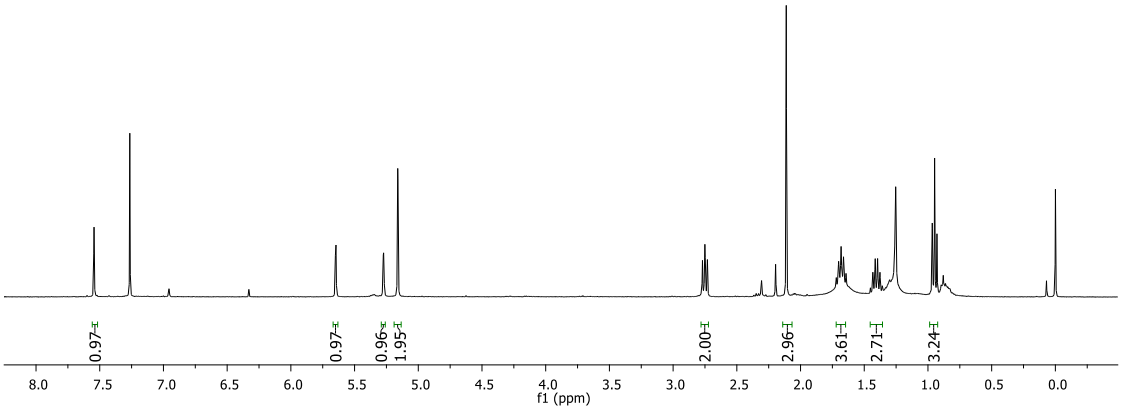


^{1}H NMR spectrum for compound **8a** in $CDCl_3$, 400 MHz

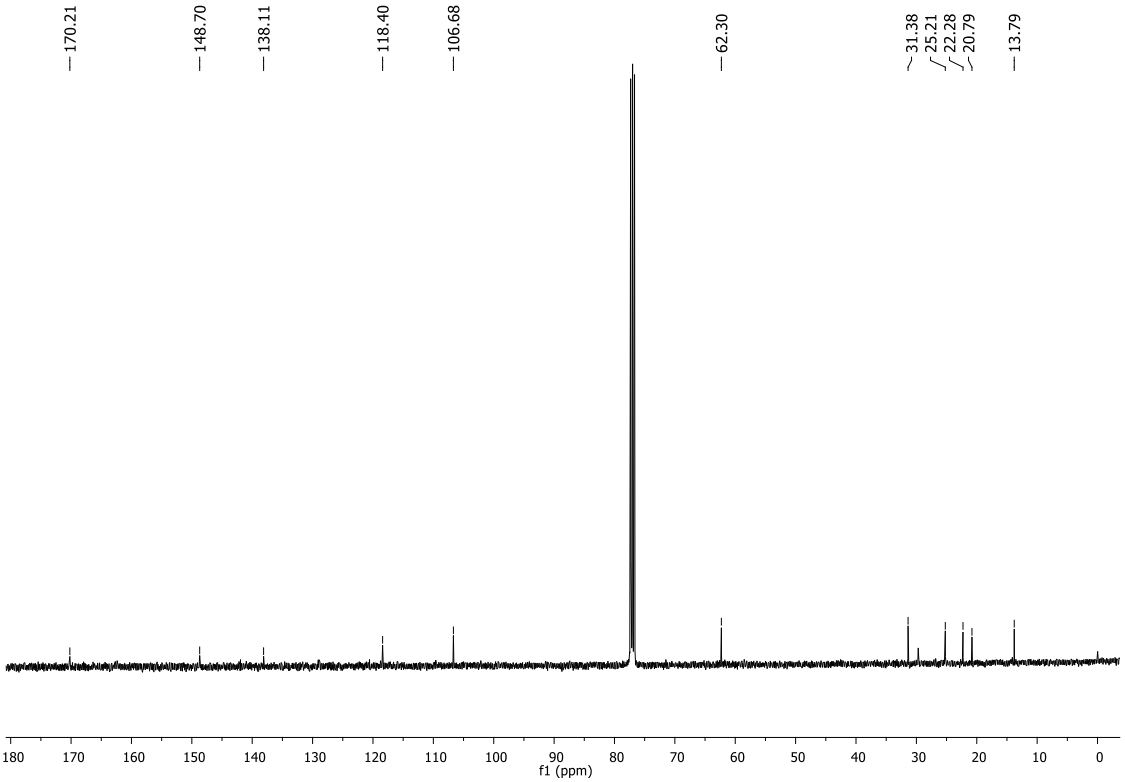


^{13}C NMR spectrum for compound **8a** in $CDCl_3$, 100 MHz

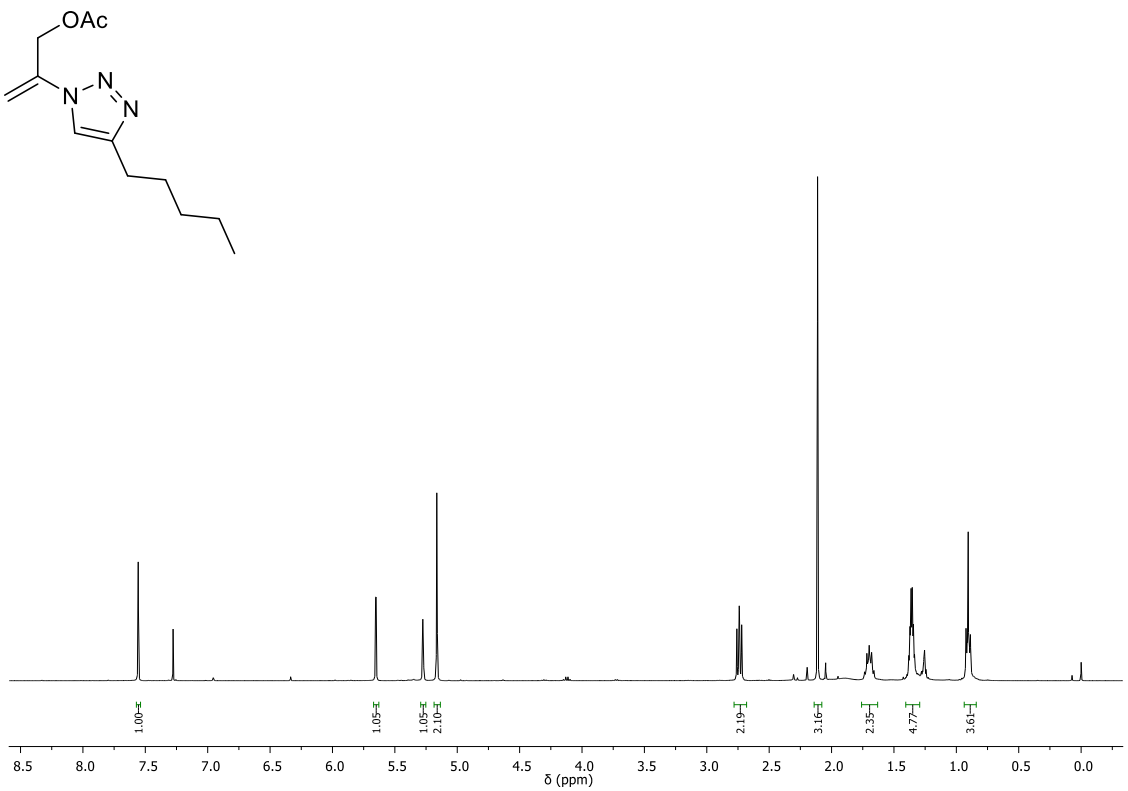




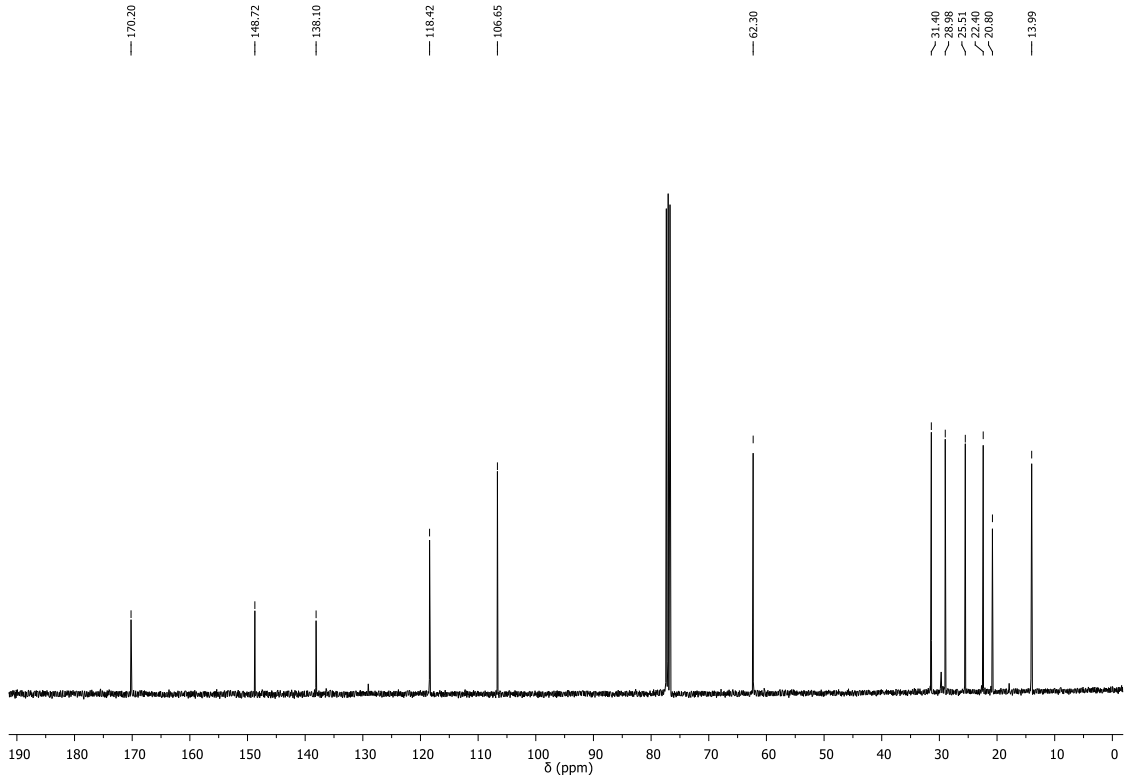
^{1}H NMR spectrum for compound **9a** in $CDCl_3$, 400 MHz



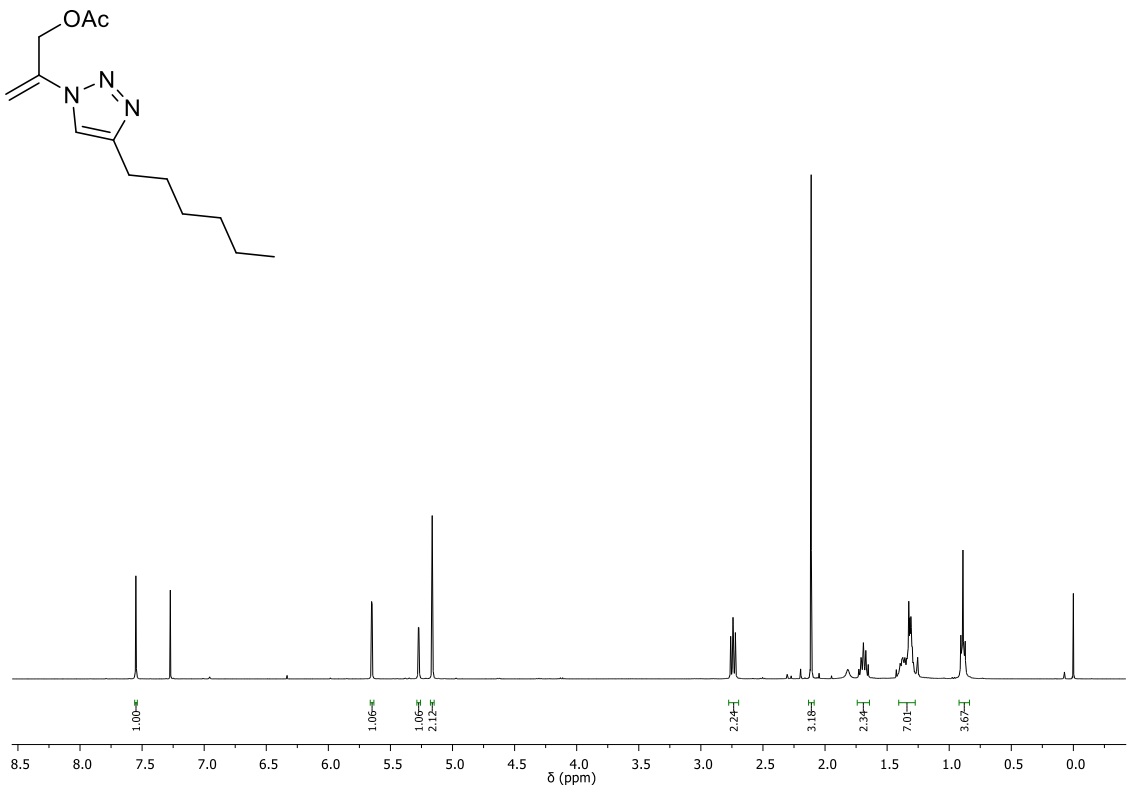
^{13}C NMR spectrum for compound **9a** in $CDCl_3$, 100 MHz



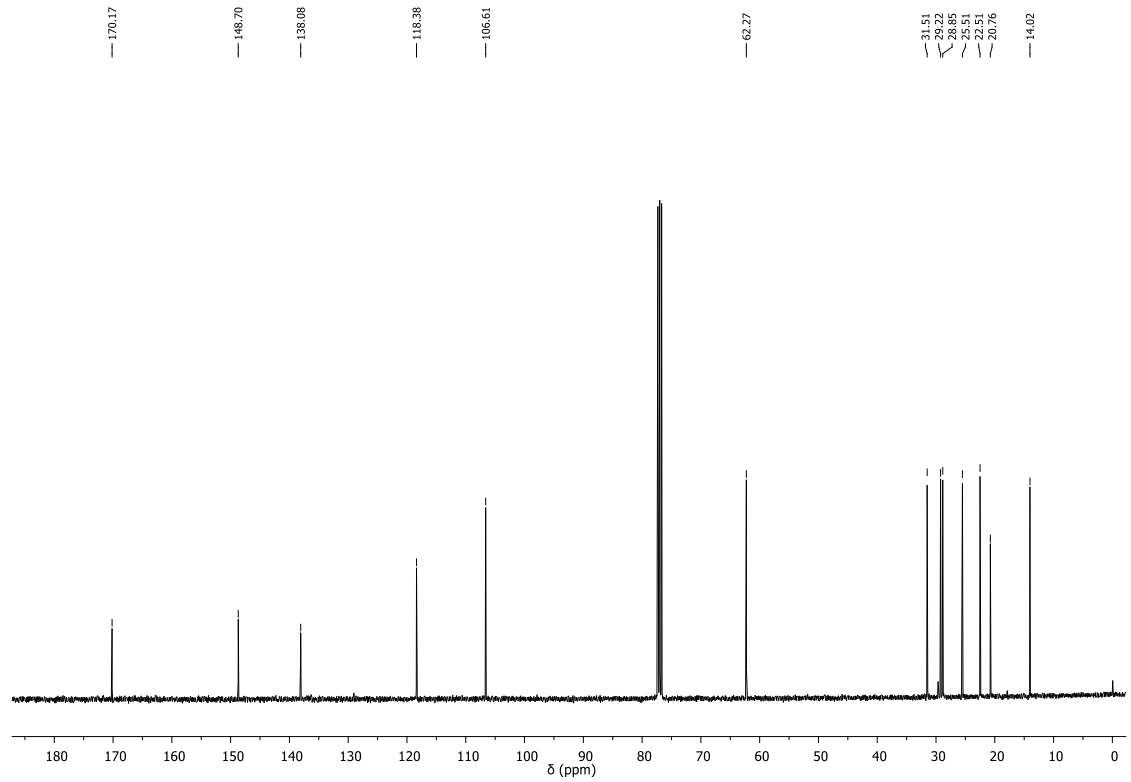
^{1}H NMR spectrum for compound **10a** in $CDCl_3$, 400 MHz



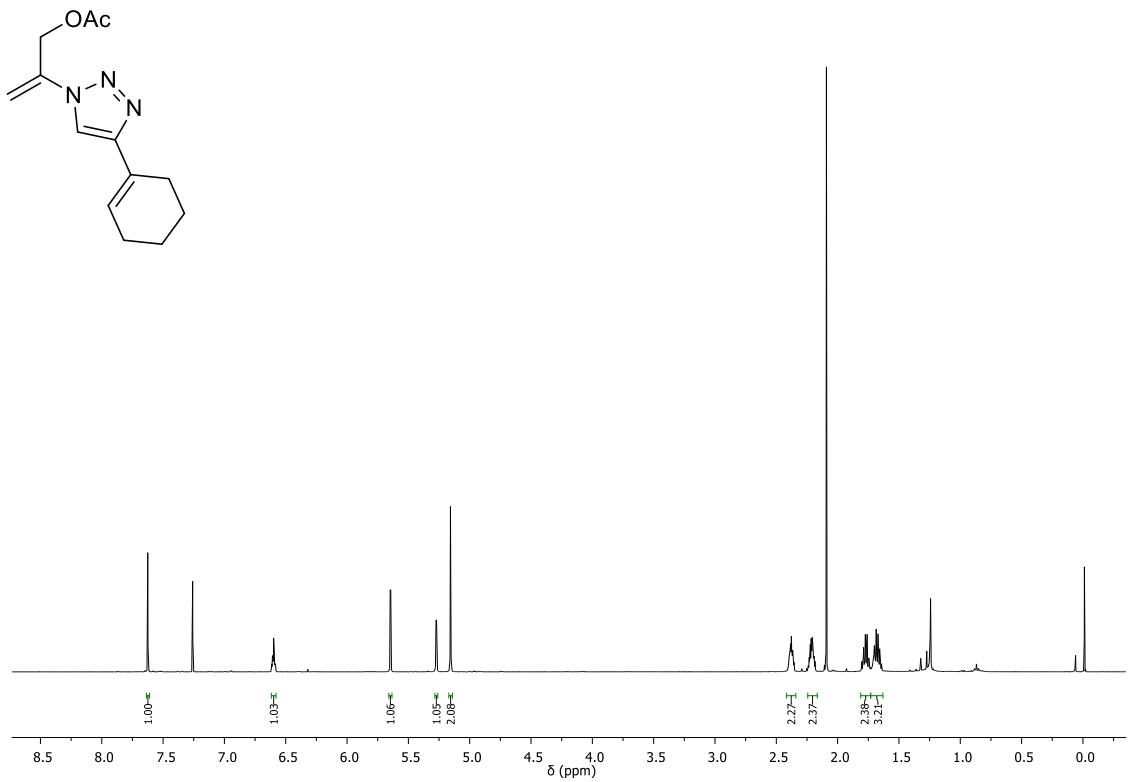
^{13}C NMR spectrum for compound **10a** in $CDCl_3$, 100 MHz



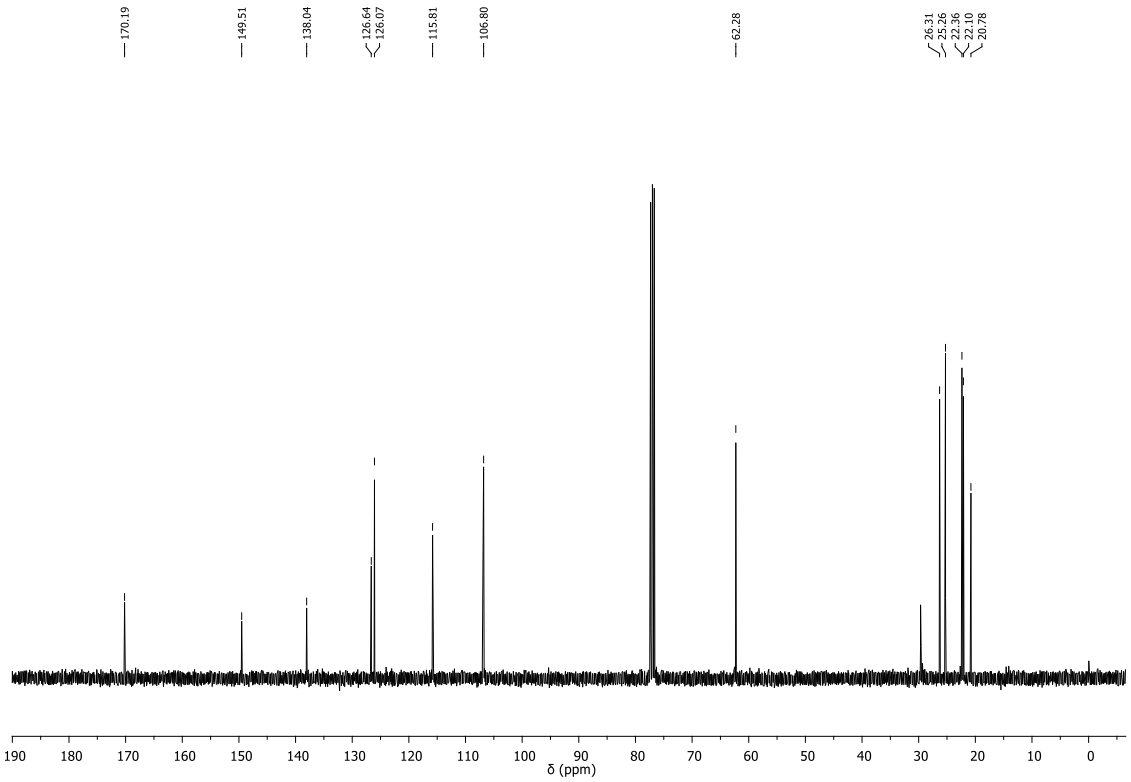
^{1}H NMR spectrum for compound **11a** in $CDCl_3$, 400 MHz



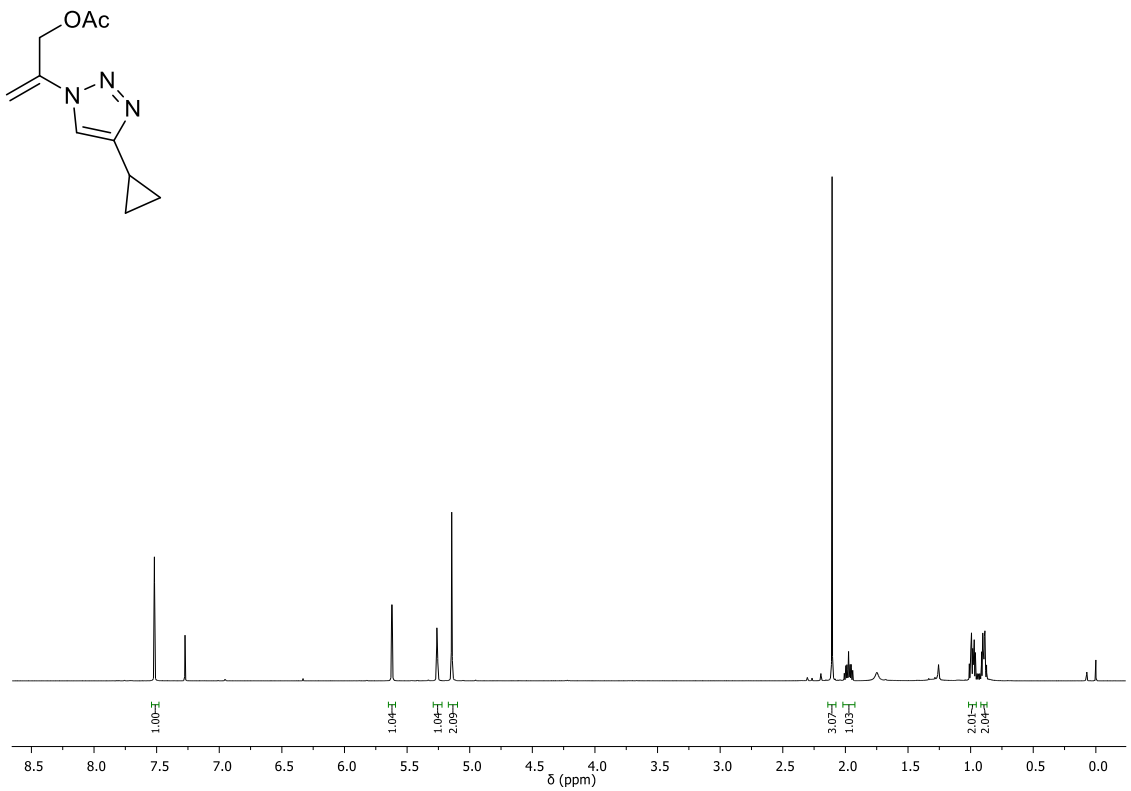
^{13}C NMR spectrum for compound **11a** in $CDCl_3$, 100 MHz



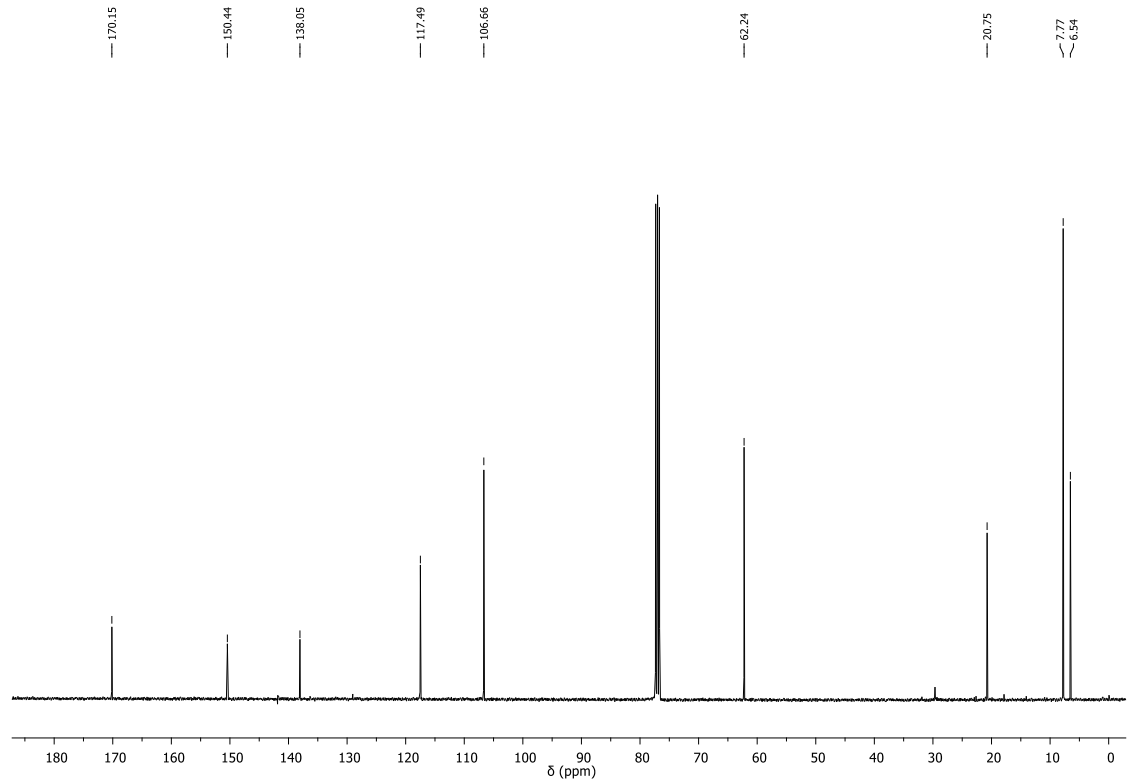
^{1}H NMR spectrum for compound **12a** in $CDCl_3$, 400 MHz



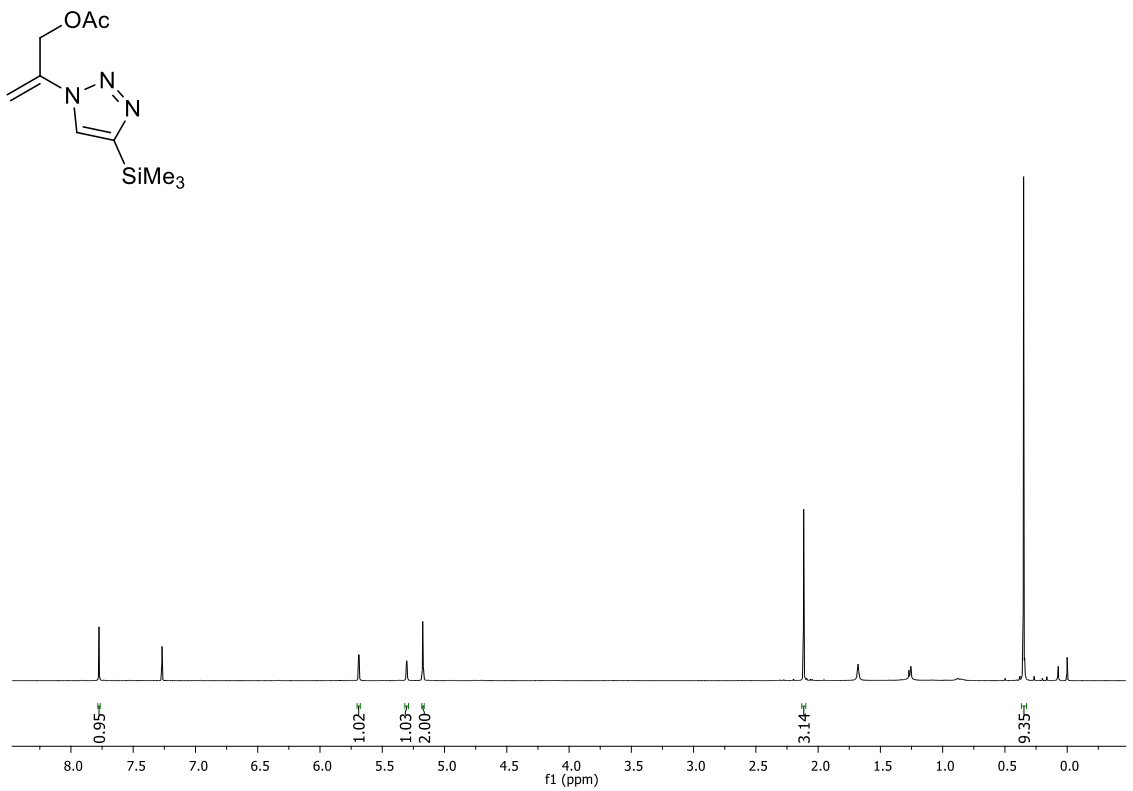
^{13}C NMR spectrum for compound **12a** in $CDCl_3$, 100 MHz



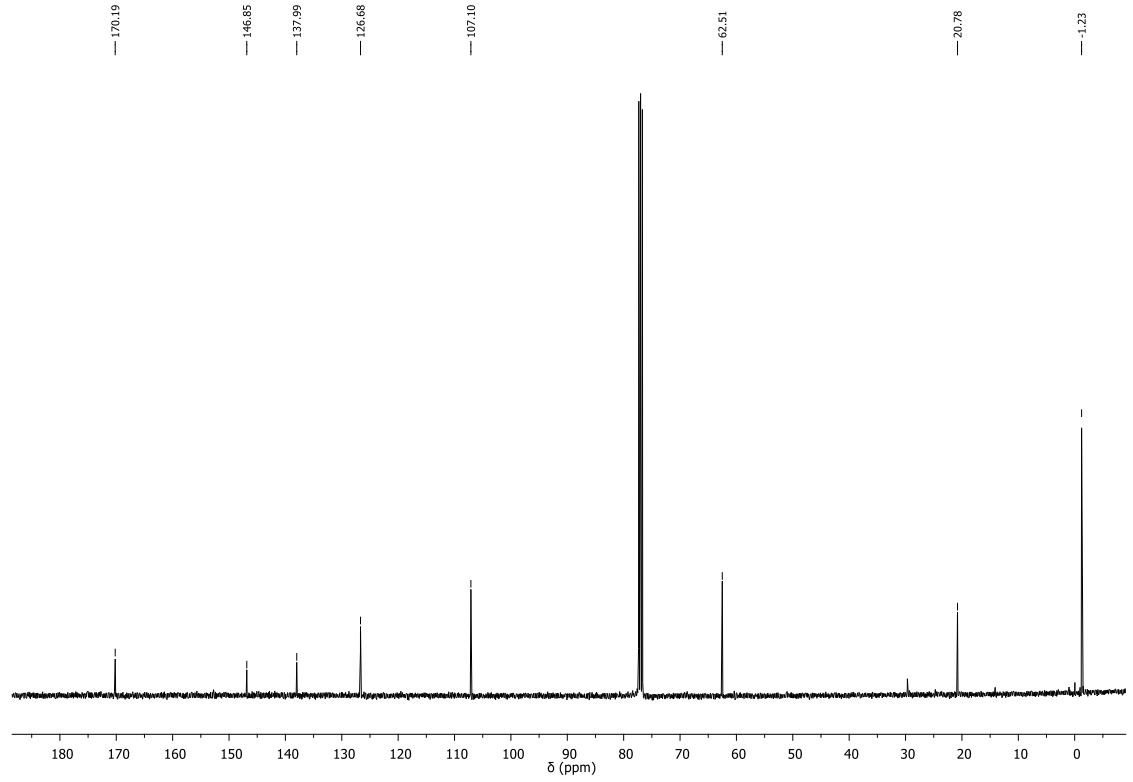
^{1}H NMR spectrum for compound **13a** in $CDCl_3$, 400 MHz



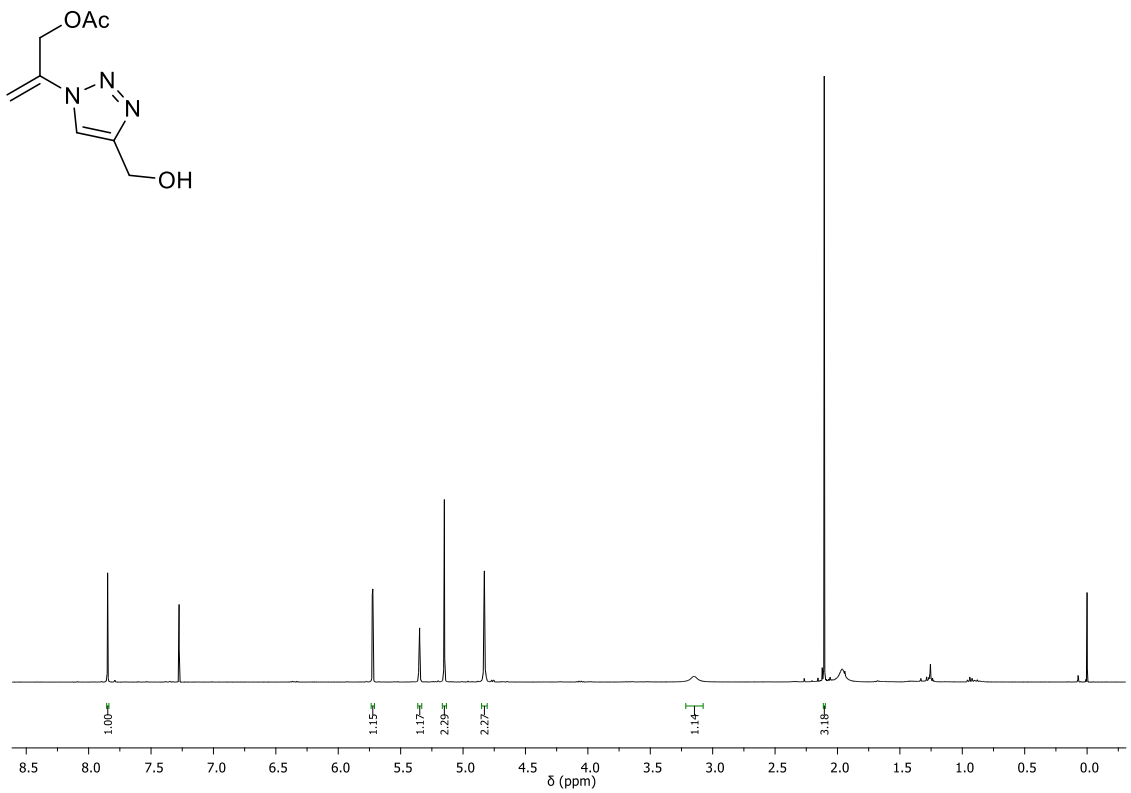
^{13}C NMR spectrum for compound **13a** in $CDCl_3$, 100 MHz



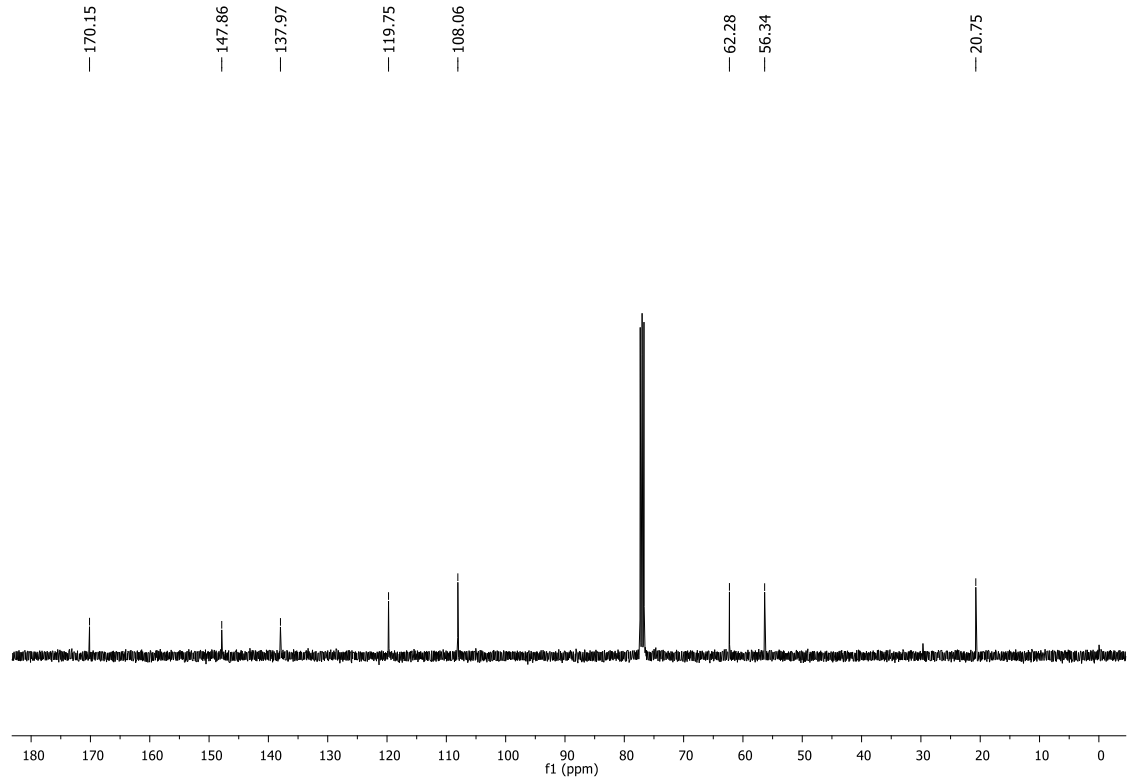
^{1}H NMR spectrum for compound **14a** in $CDCl_3$, 400 MHz



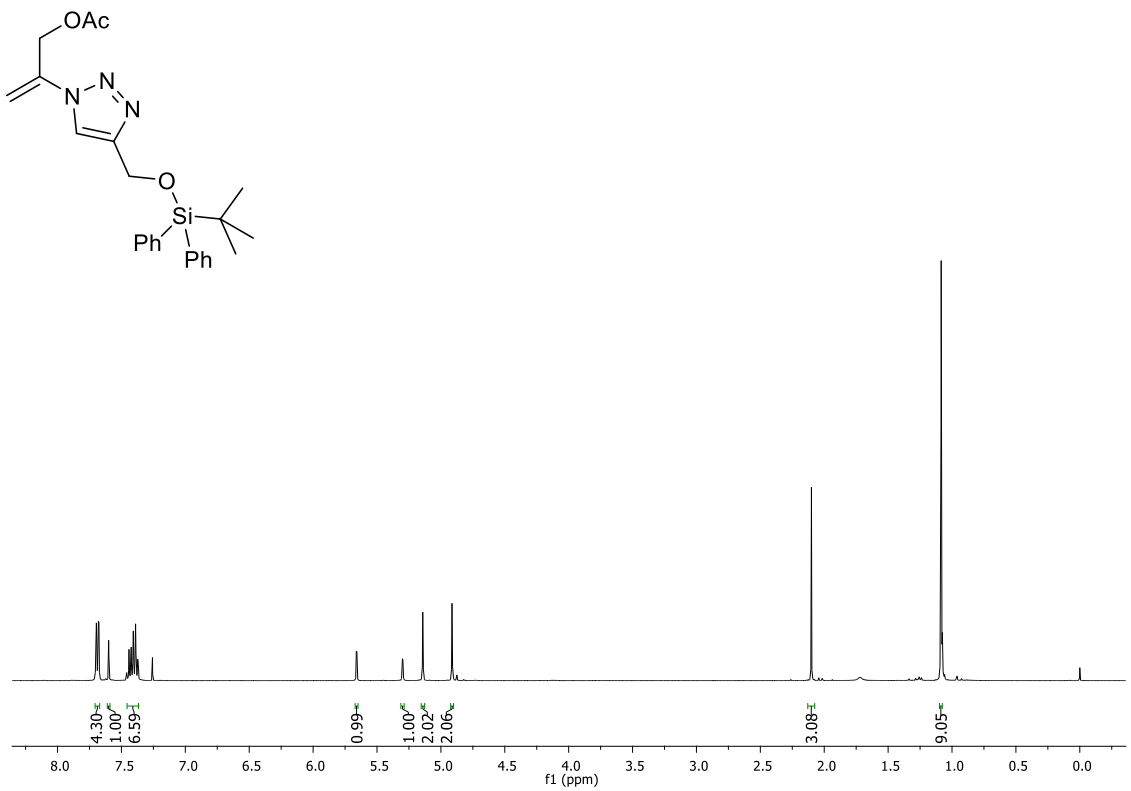
^{13}C NMR spectrum for compound **14a** in $CDCl_3$, 100 MHz



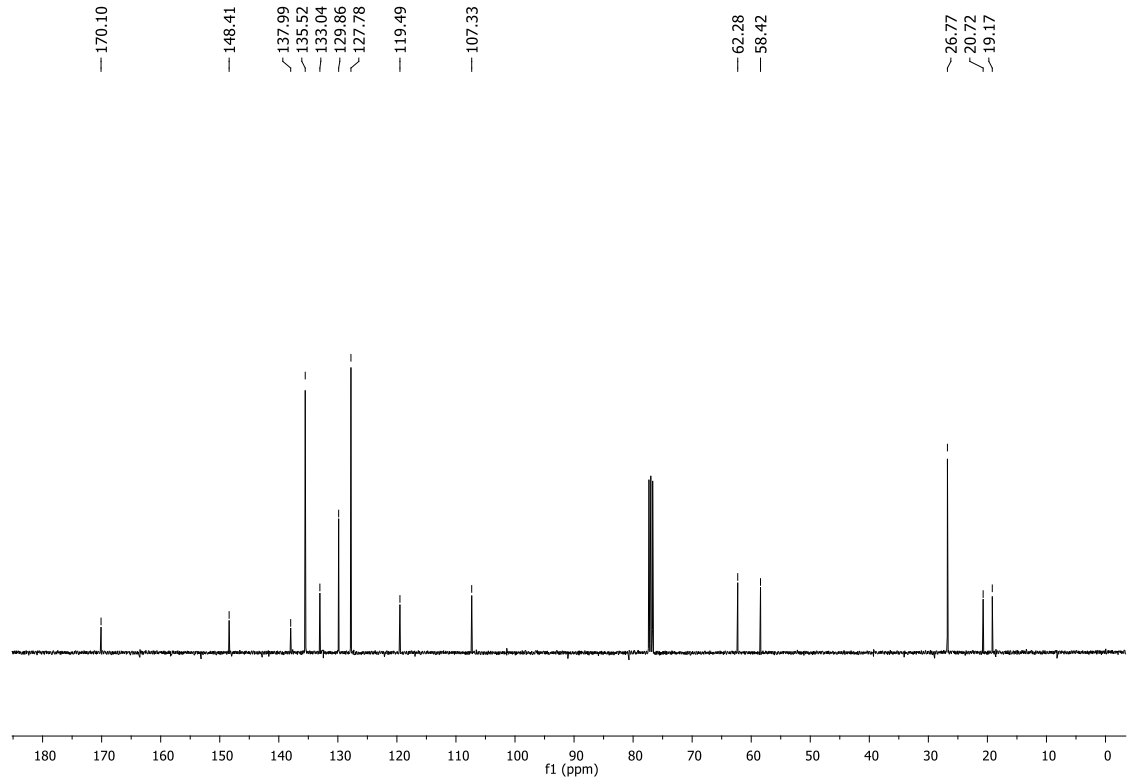
^{1}H NMR spectrum for compound **15a** in $CDCl_3$, 400 MHz



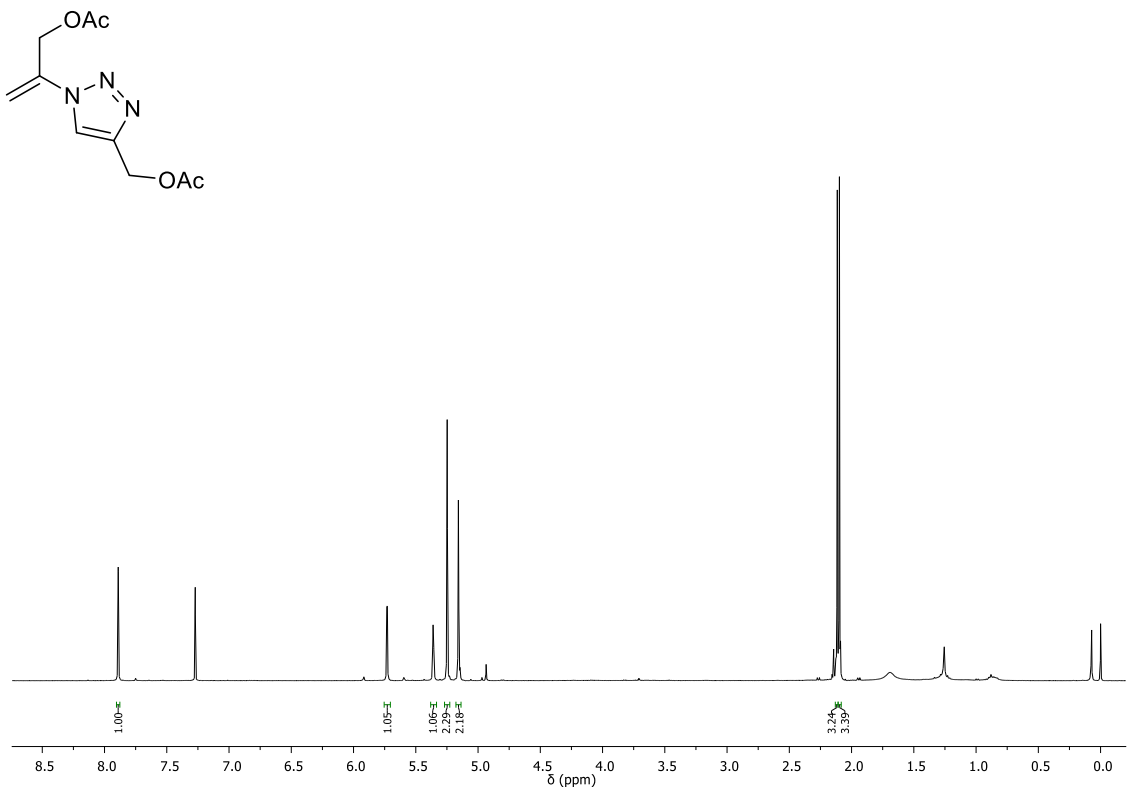
^{13}C NMR spectrum for compound **15a** in $CDCl_3$, 100 MHz



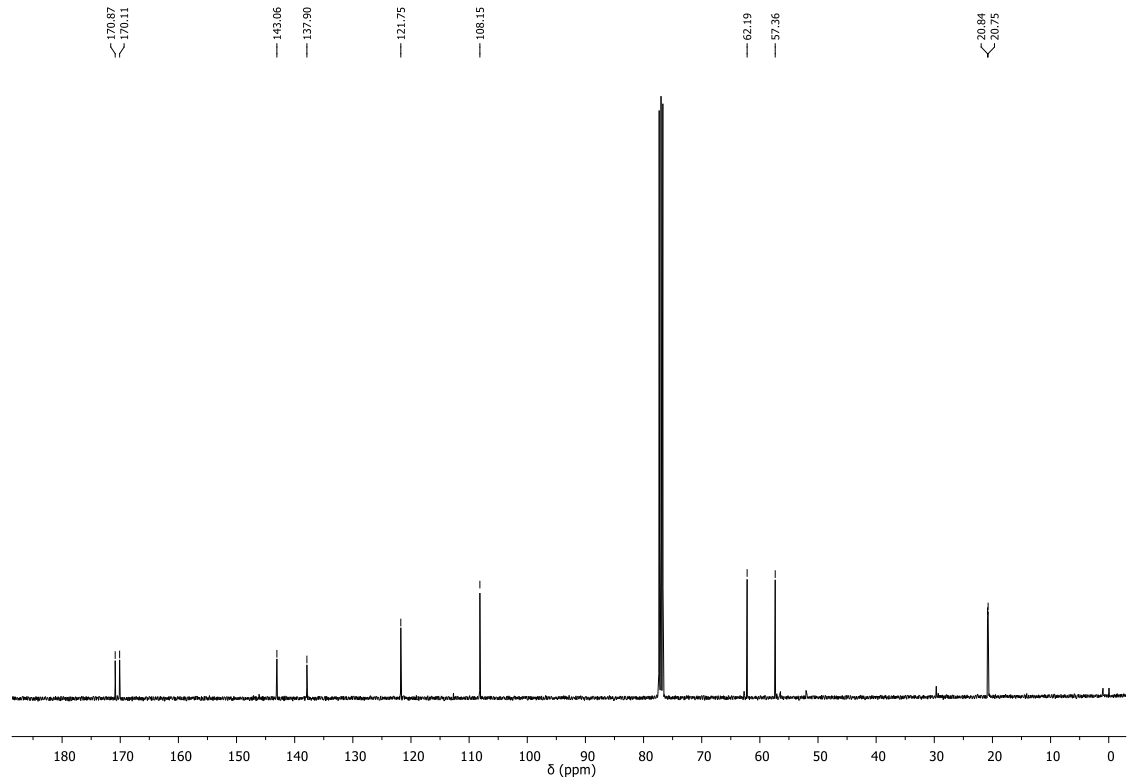
^{1}H NMR spectrum for compound **16a** in $CDCl_3$, 400 MHz



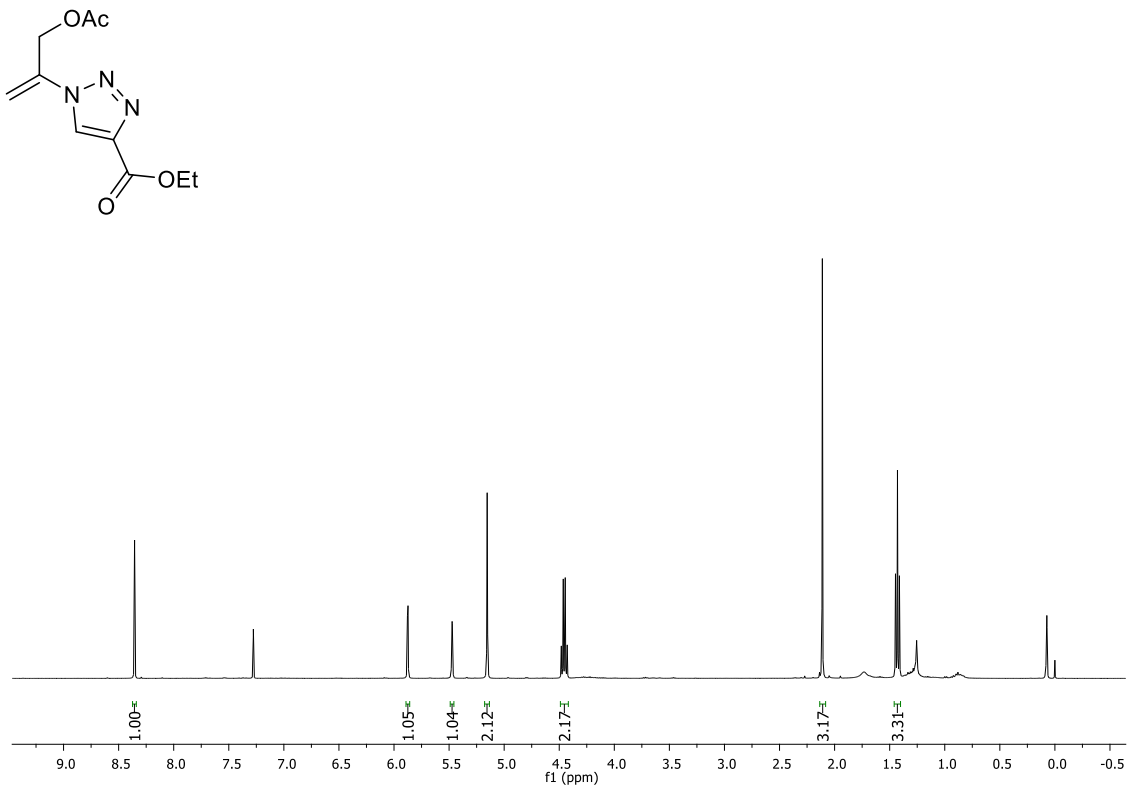
^{13}C NMR spectrum for compound **16a** in $CDCl_3$, 100 MHz



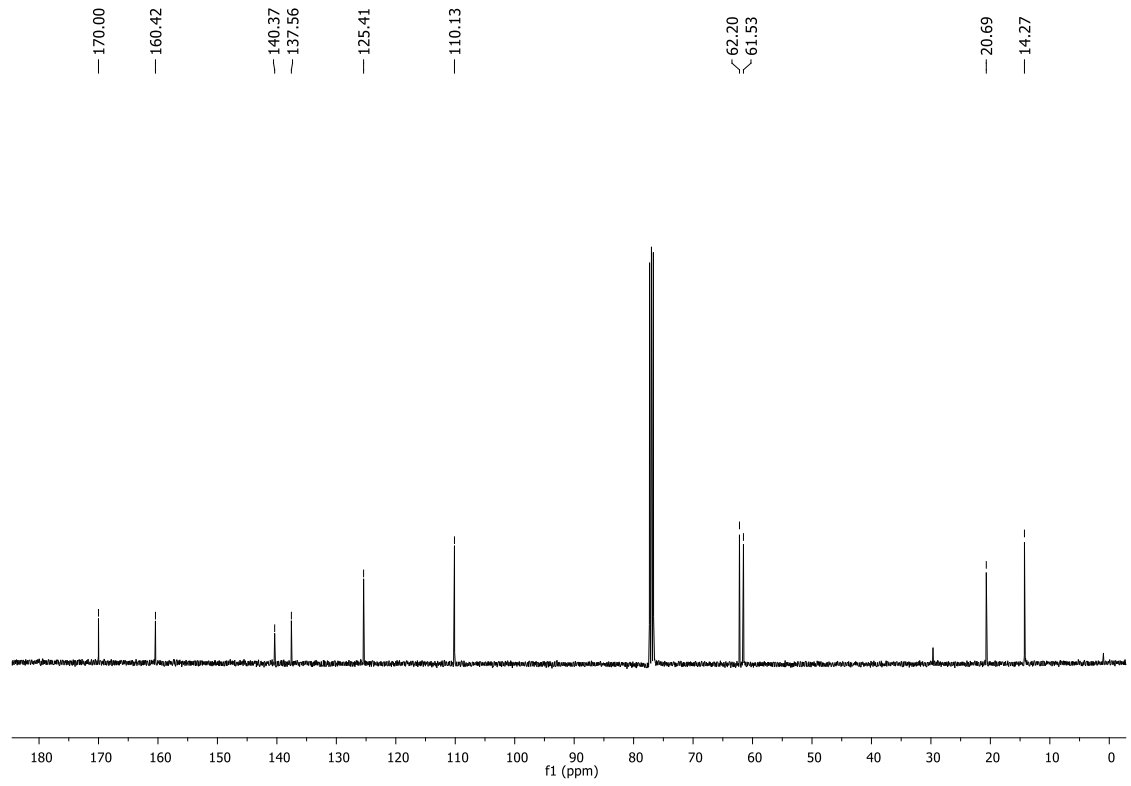
^{1}H NMR spectrum for compound **17a** in $CDCl_3$, 400 MHz



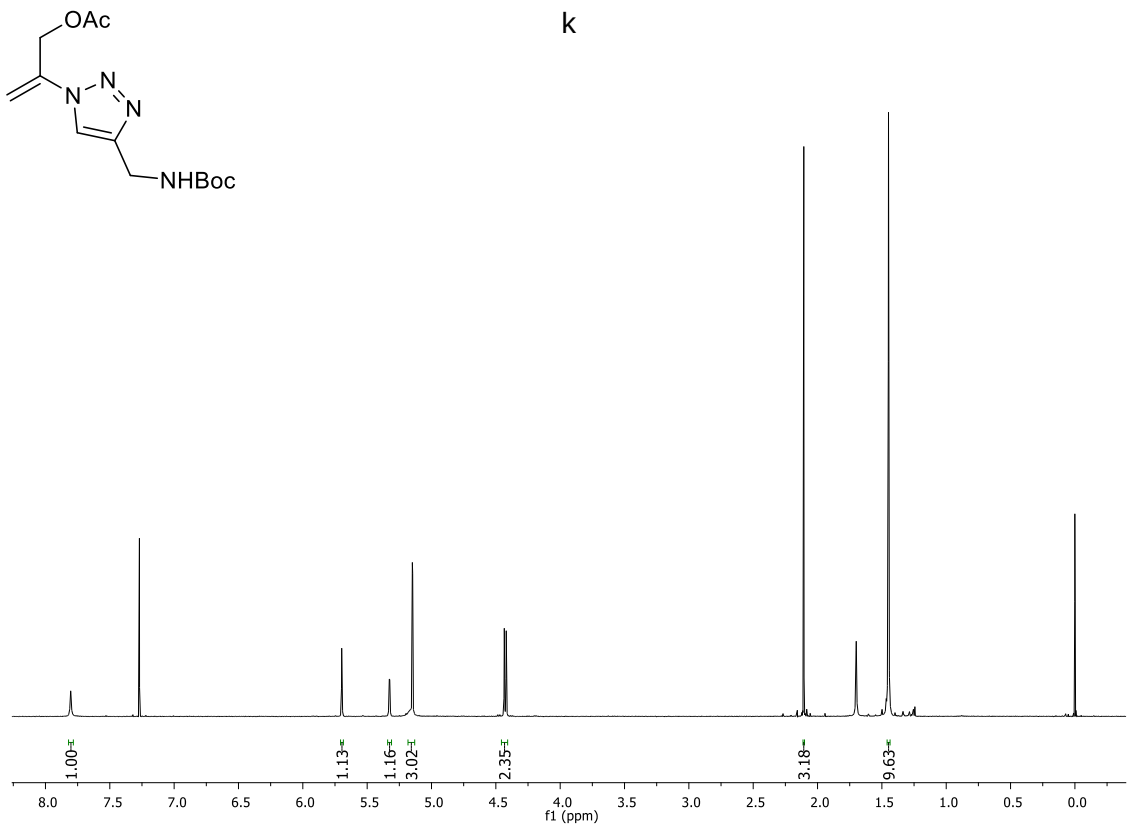
^{13}C NMR spectrum for compound **17a** in $CDCl_3$, 100 MHz



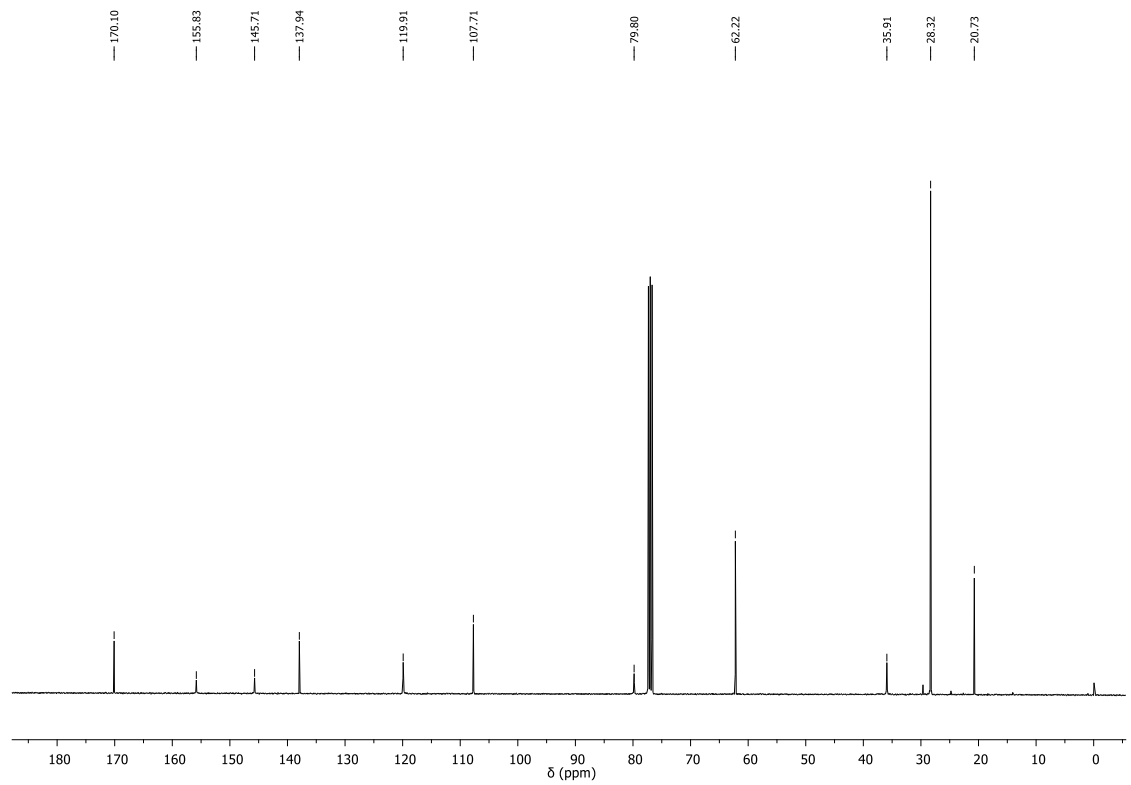
^{1}H NMR spectrum for compound **18a** in $CDCl_3$, 400 MHz



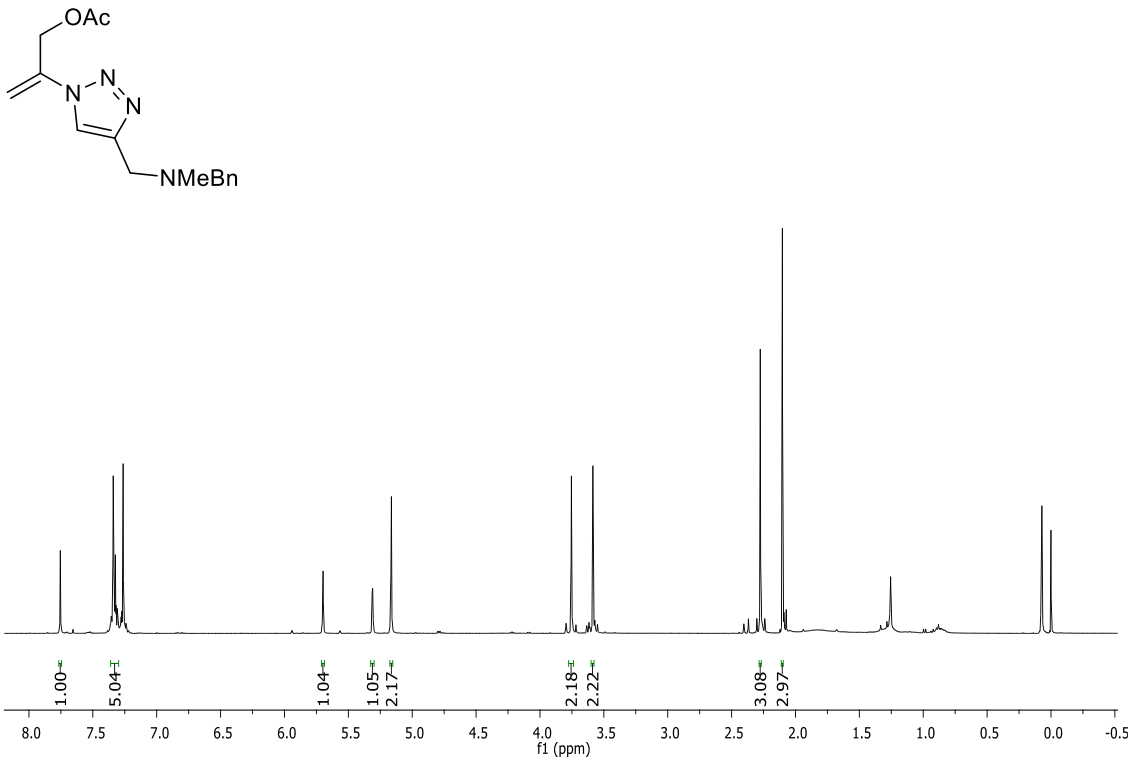
^{13}C NMR spectrum for compound **18a** in $CDCl_3$, 100 MHz



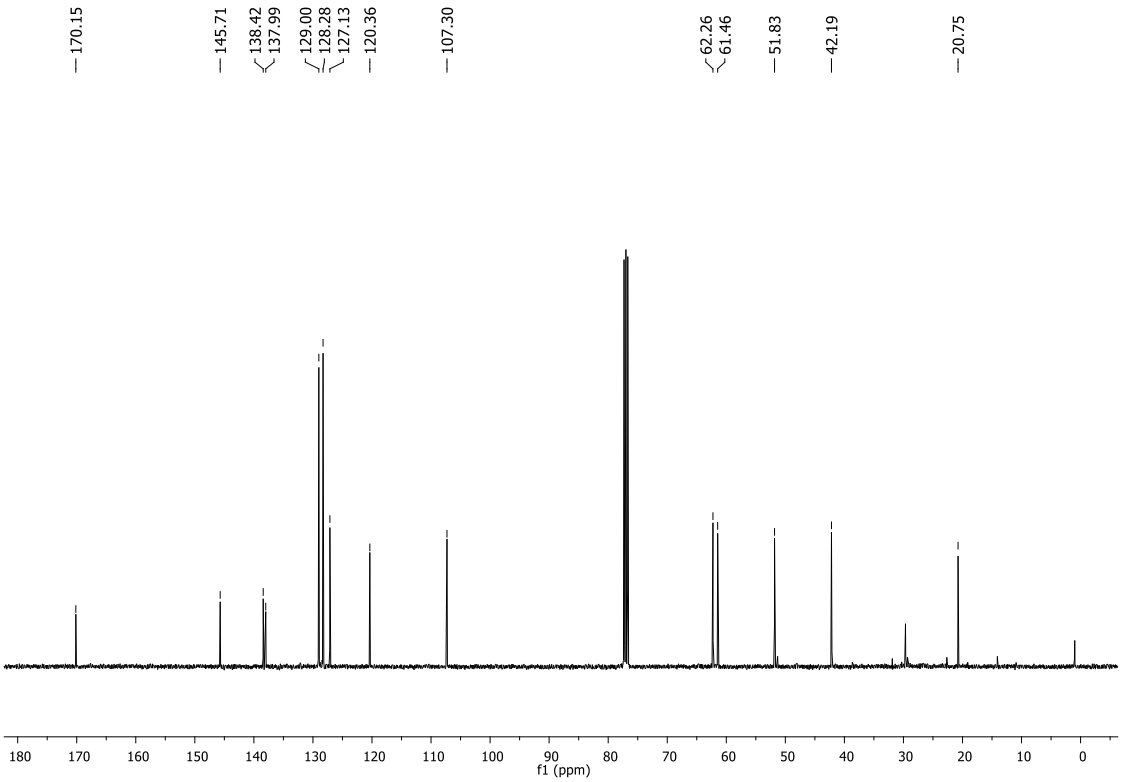
^{1}H NMR spectrum for compound **19a** in $CDCl_3$, 400 MHz



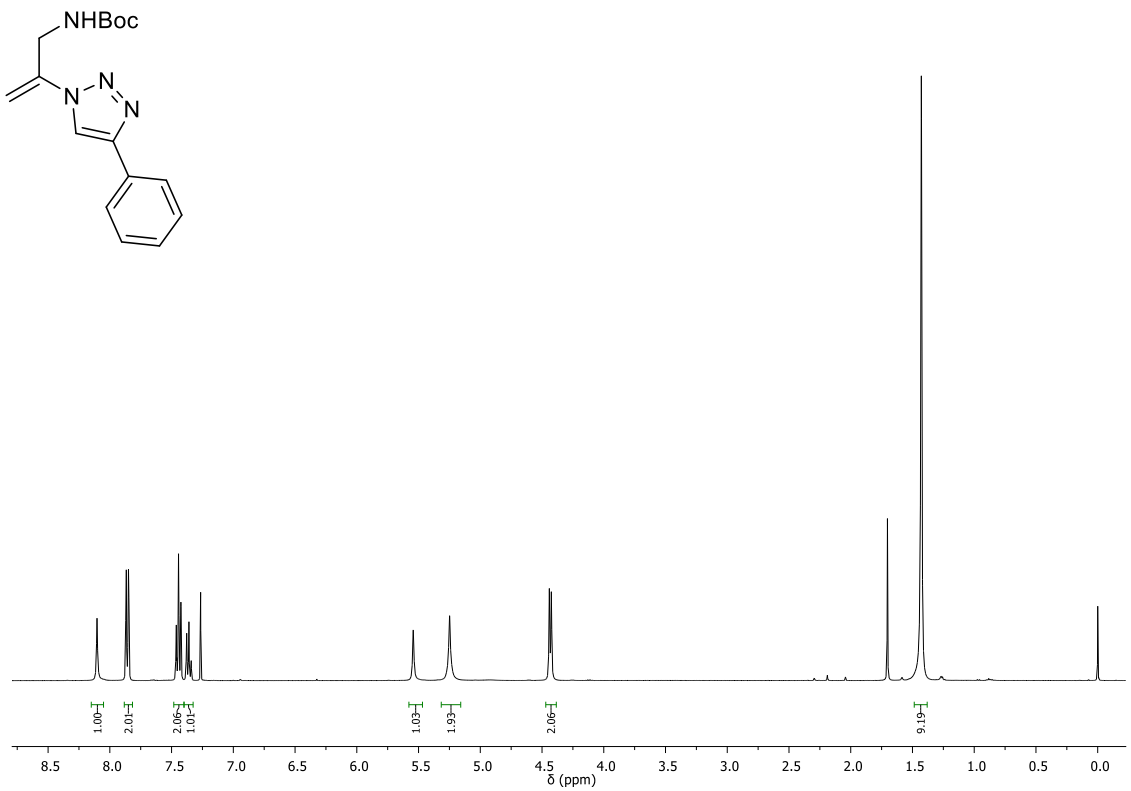
^{13}C NMR spectrum for compound **19a** in $CDCl_3$, 100 MHz



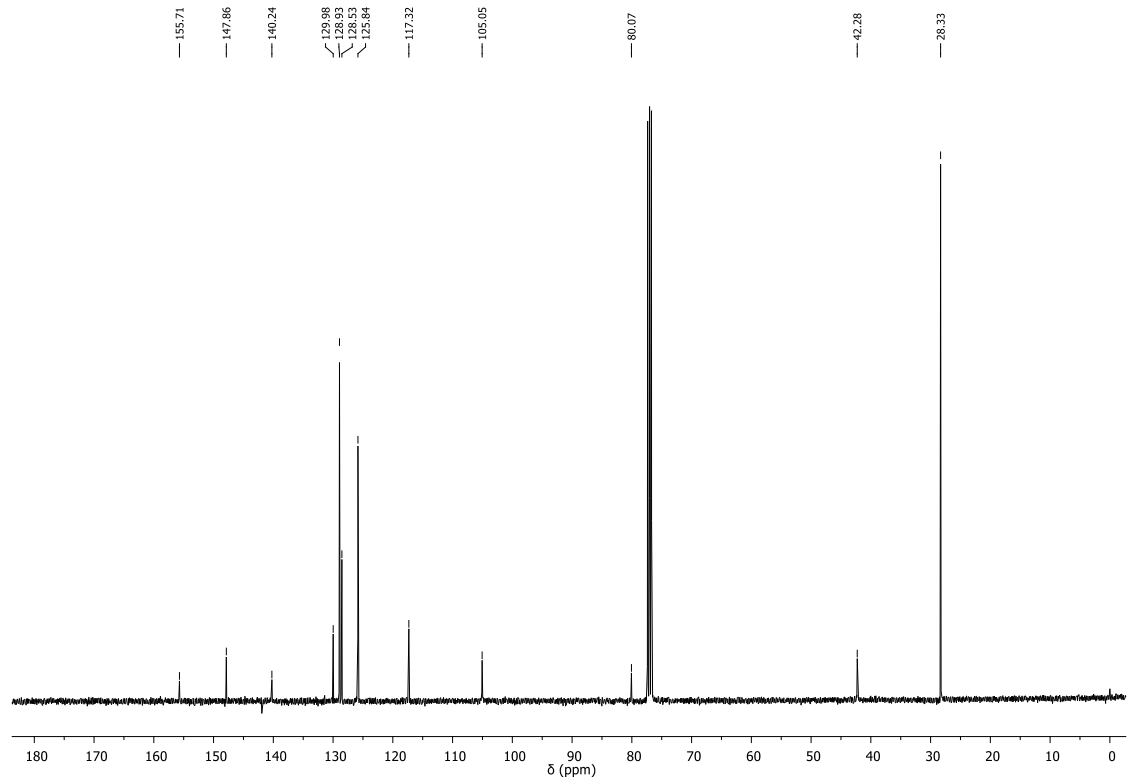
^{1}H NMR spectrum for compound **20a** in $CDCl_3$, 400 MHz



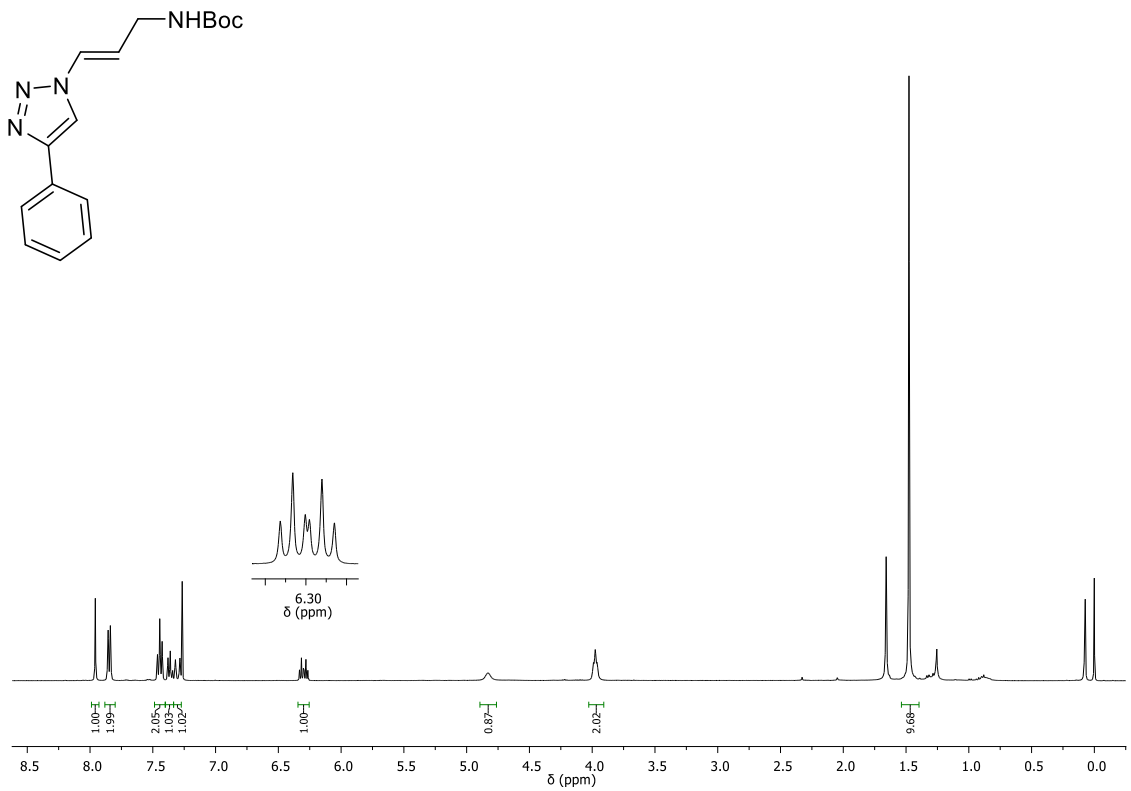
^{13}C NMR spectrum for compound **20a** in $CDCl_3$, 100 MHz



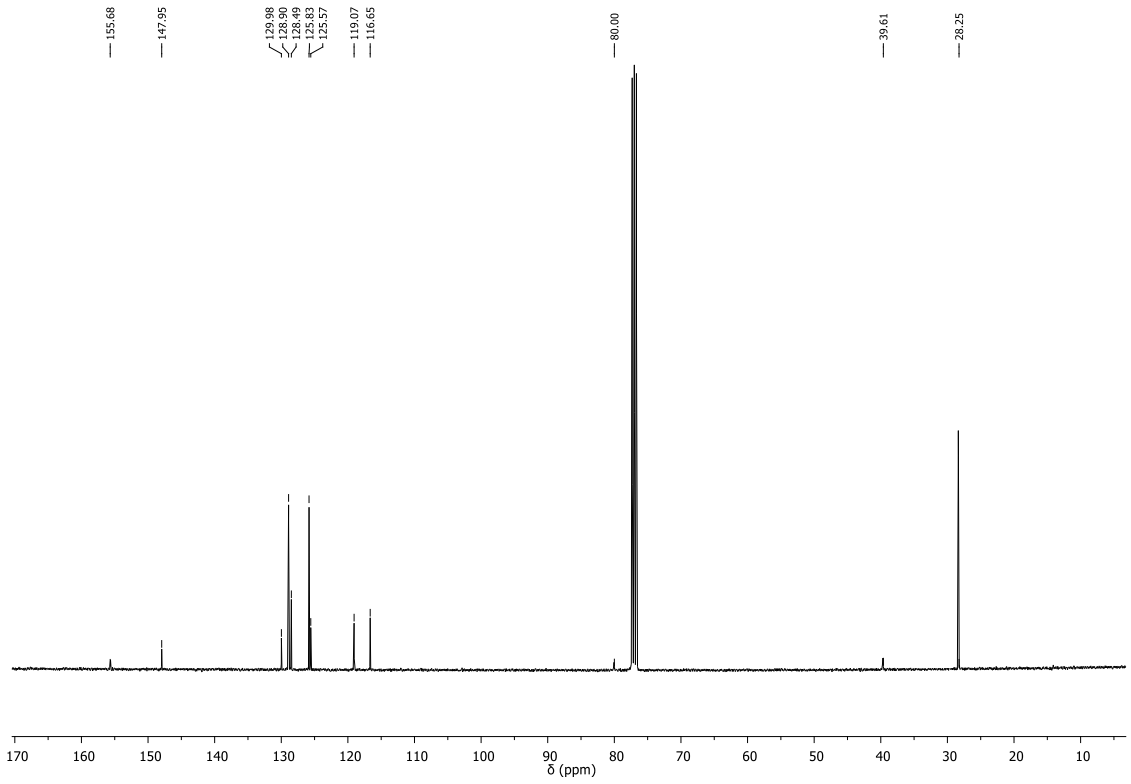
^{1}H NMR spectrum for compound **21a** in $CDCl_3$, 400 MHz



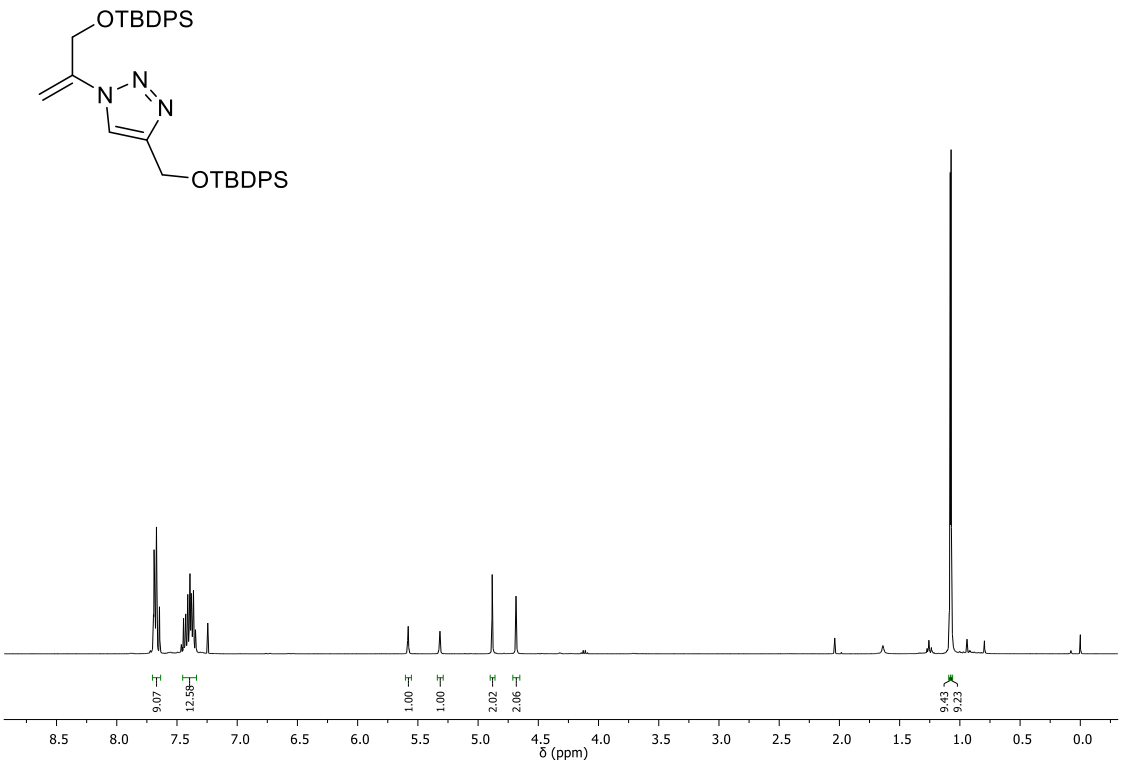
^{13}C NMR spectrum for compound **21a** in $CDCl_3$, 100 MHz



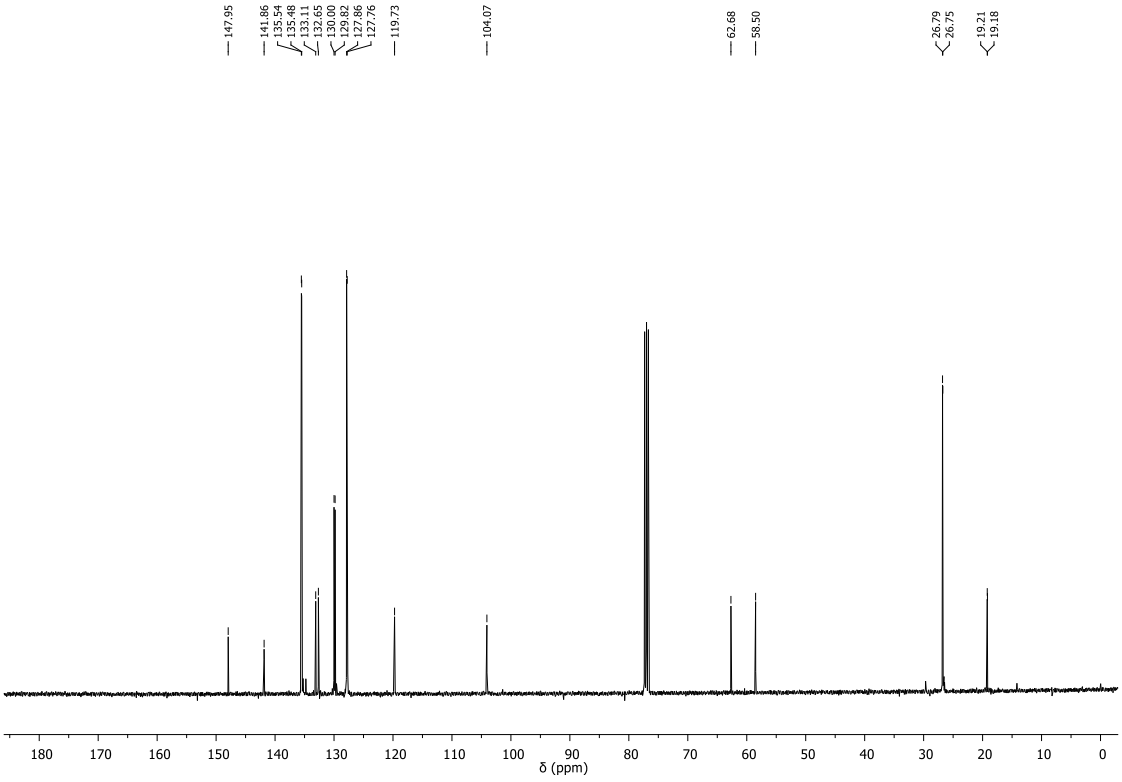
^{1}H NMR spectrum for compound **21b** in $CDCl_3$, 400 MHz



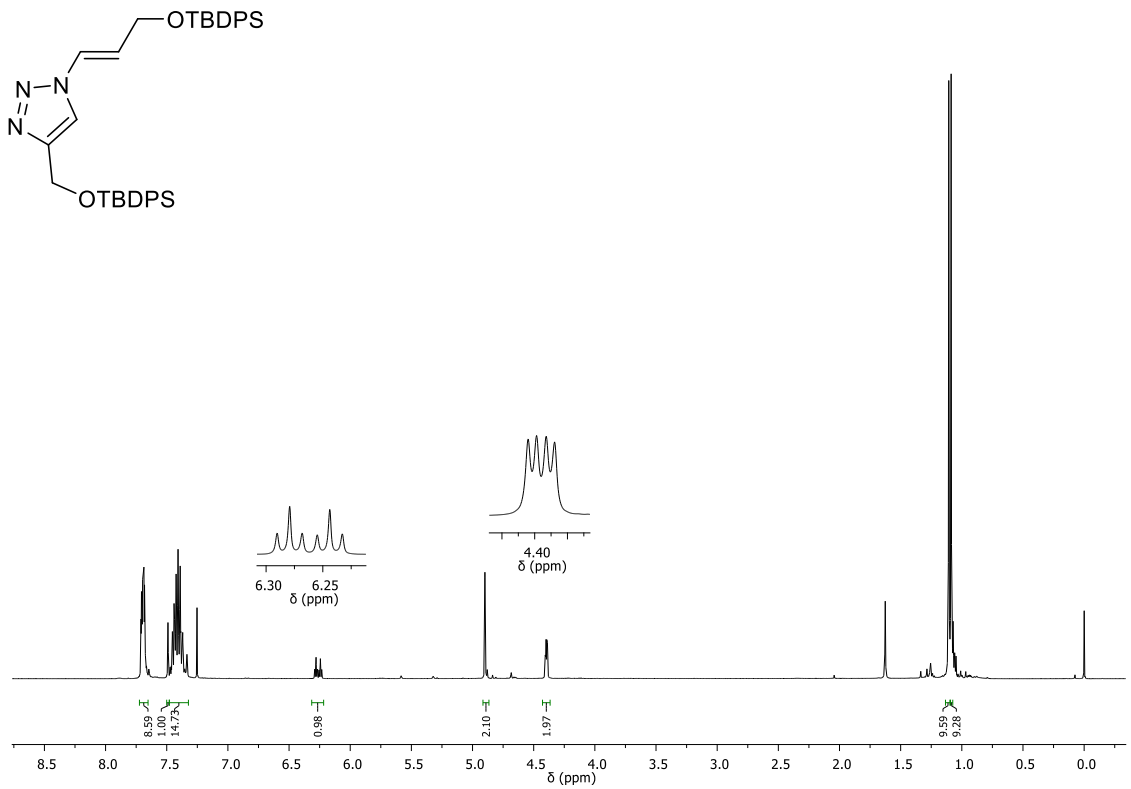
^{13}C NMR spectrum for compound **21b** in $CDCl_3$, 100 MHz



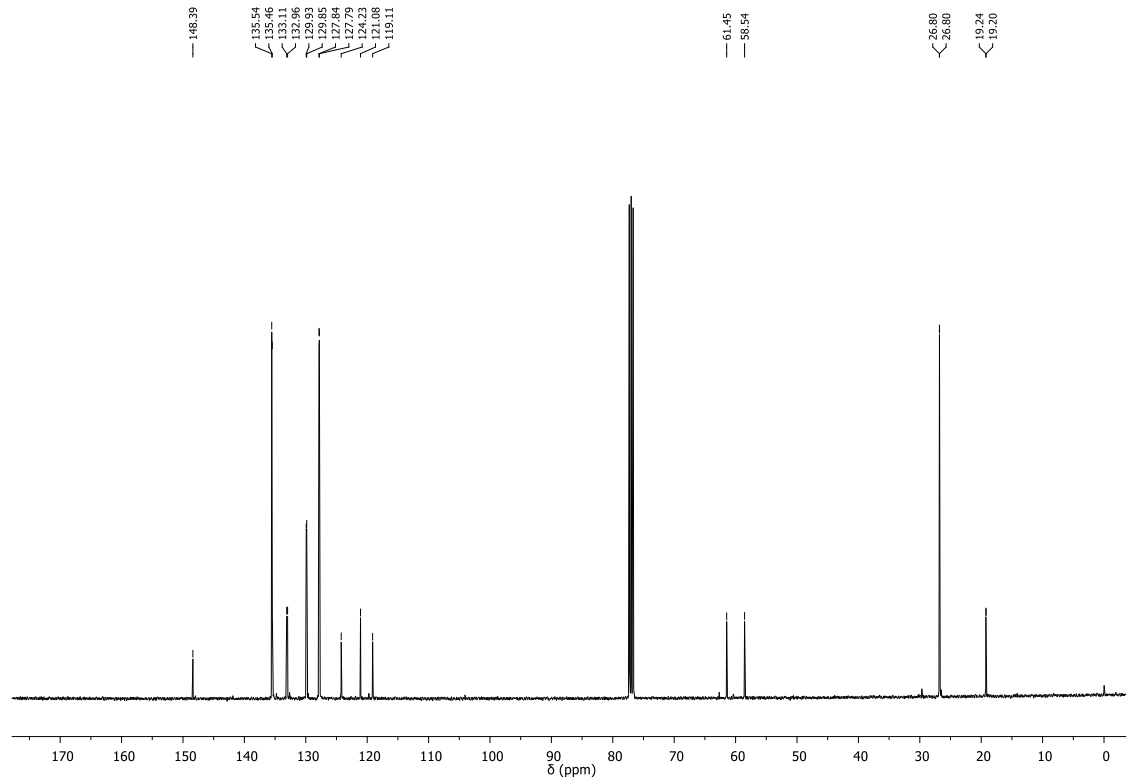
^{1}H NMR spectrum for compound **22a** in $CDCl_3$, 400 MHz



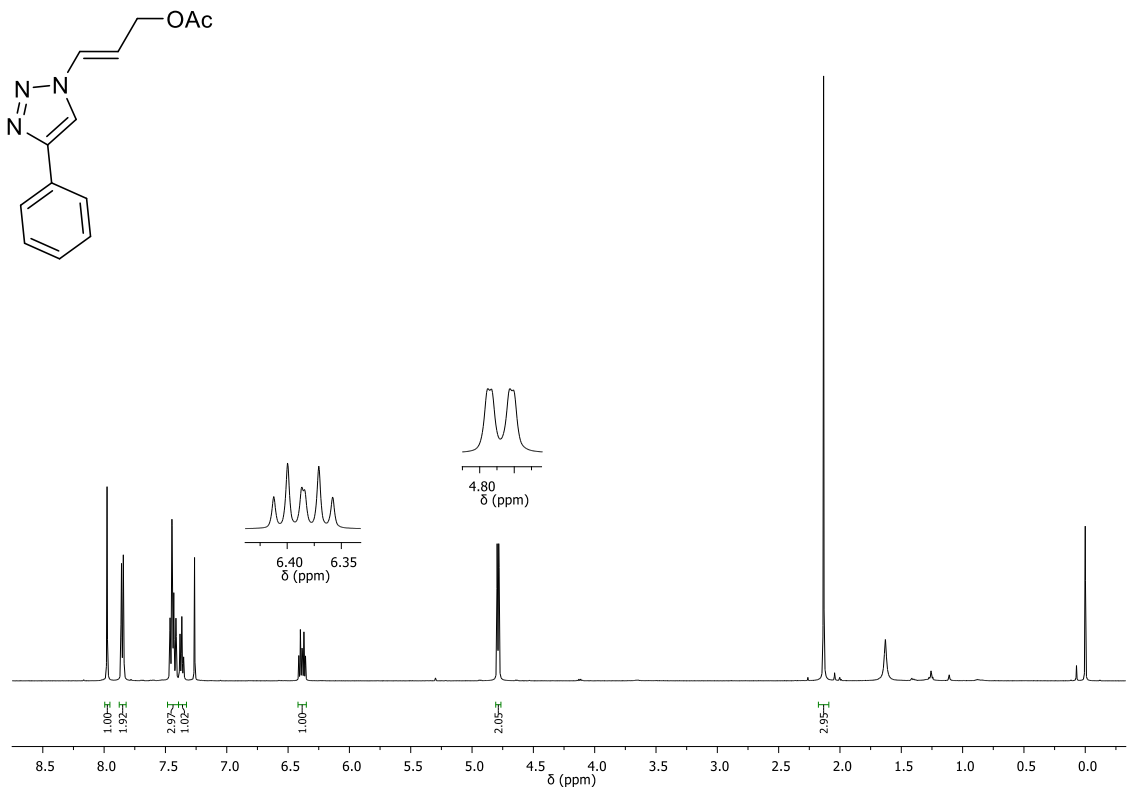
^{13}C NMR spectrum for compound **22a** in $CDCl_3$, 100 MHz



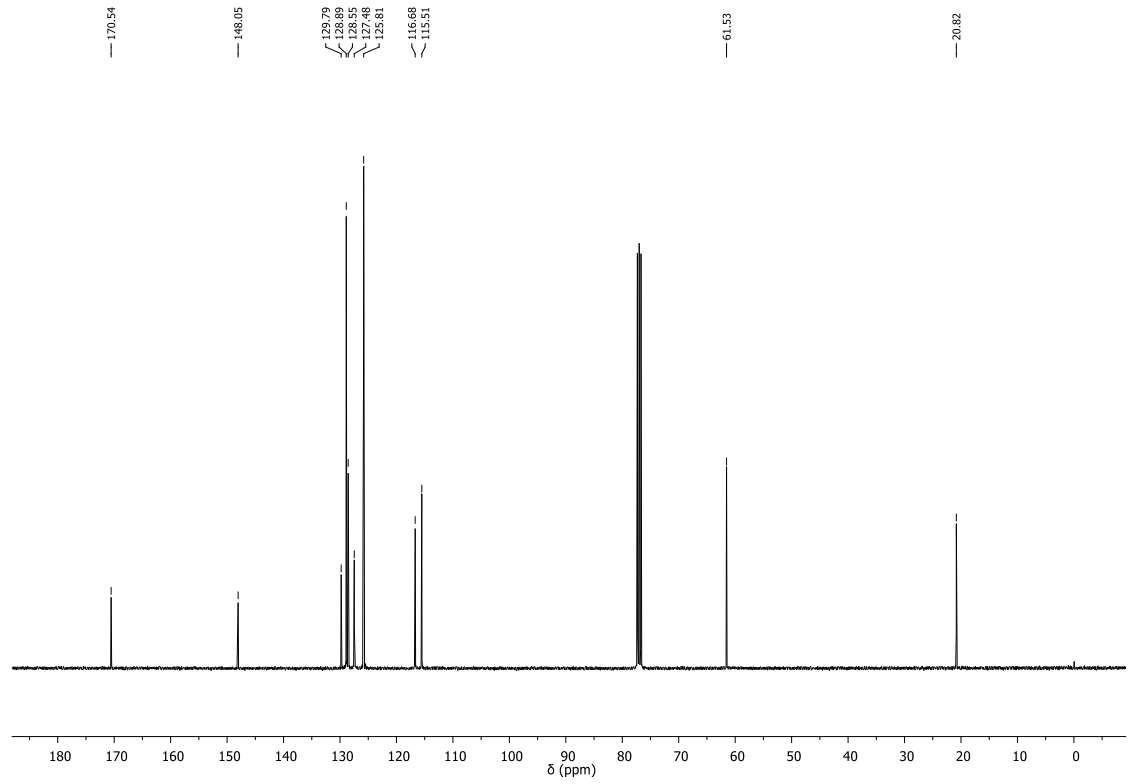
^{1}H NMR spectrum for compound **22b** in $CDCl_3$, 400 MHz



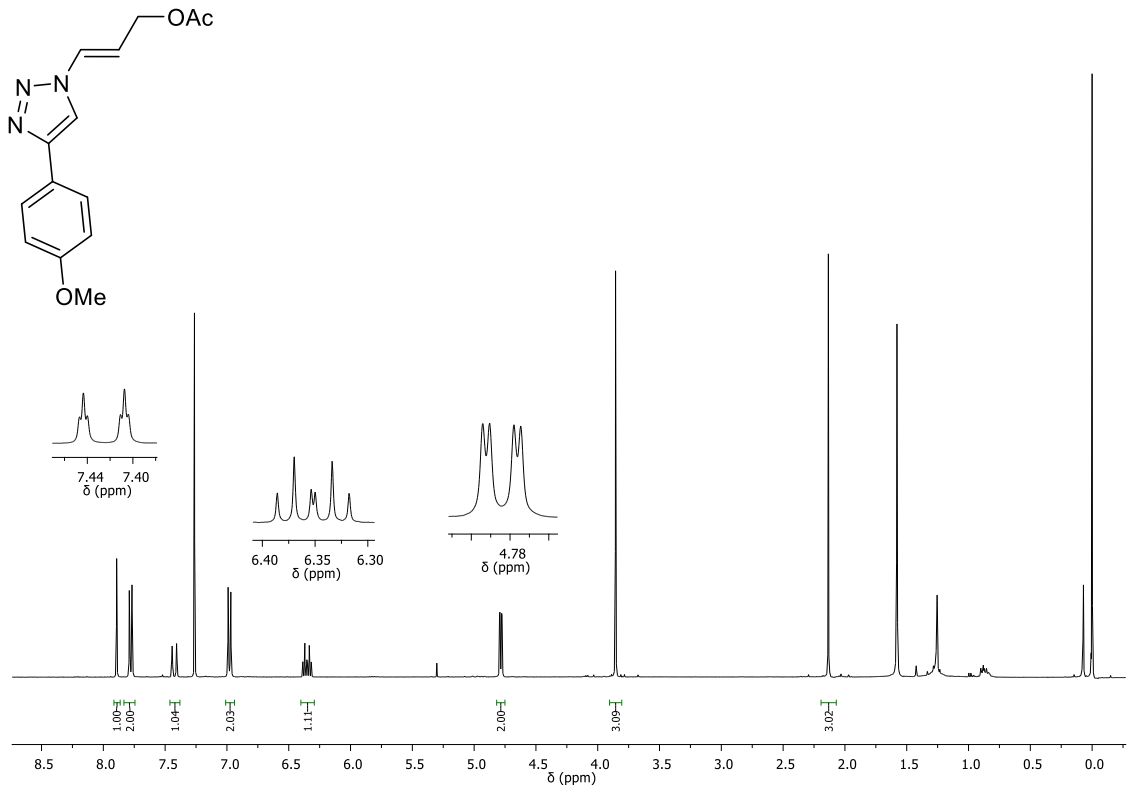
^{13}C NMR spectrum for compound **22b** in $CDCl_3$, 100 MHz



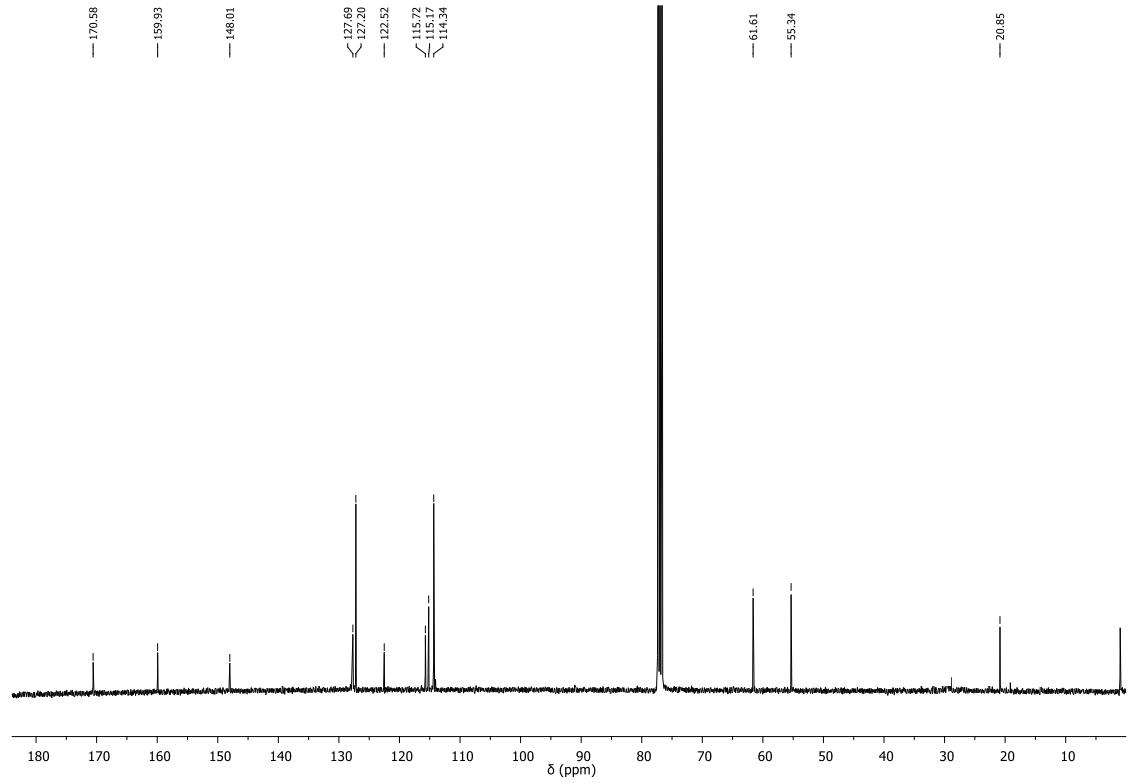
^{1}H NMR spectrum for compound **3b** in $CDCl_3$, 400 MHz



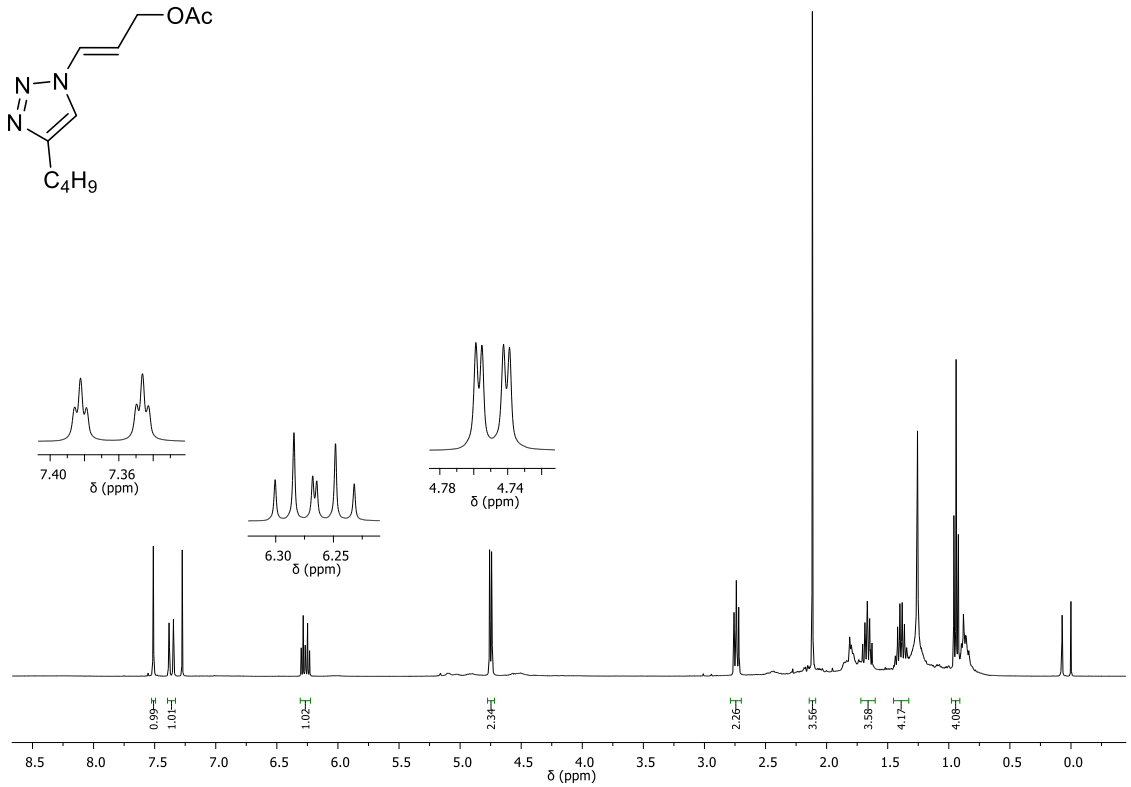
^{13}C NMR spectrum for compound **3b** in $CDCl_3$, 100 MHz



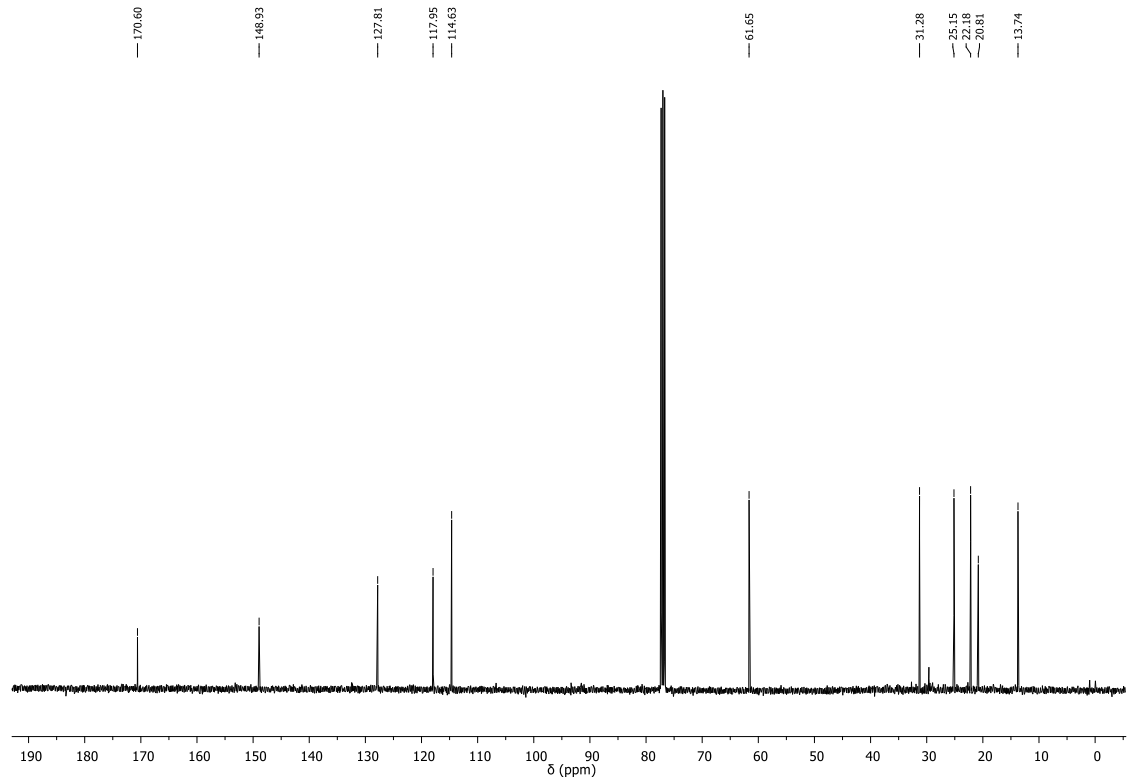
^{1}H NMR spectrum for compound **4b** in $CDCl_3$, 400 MHz



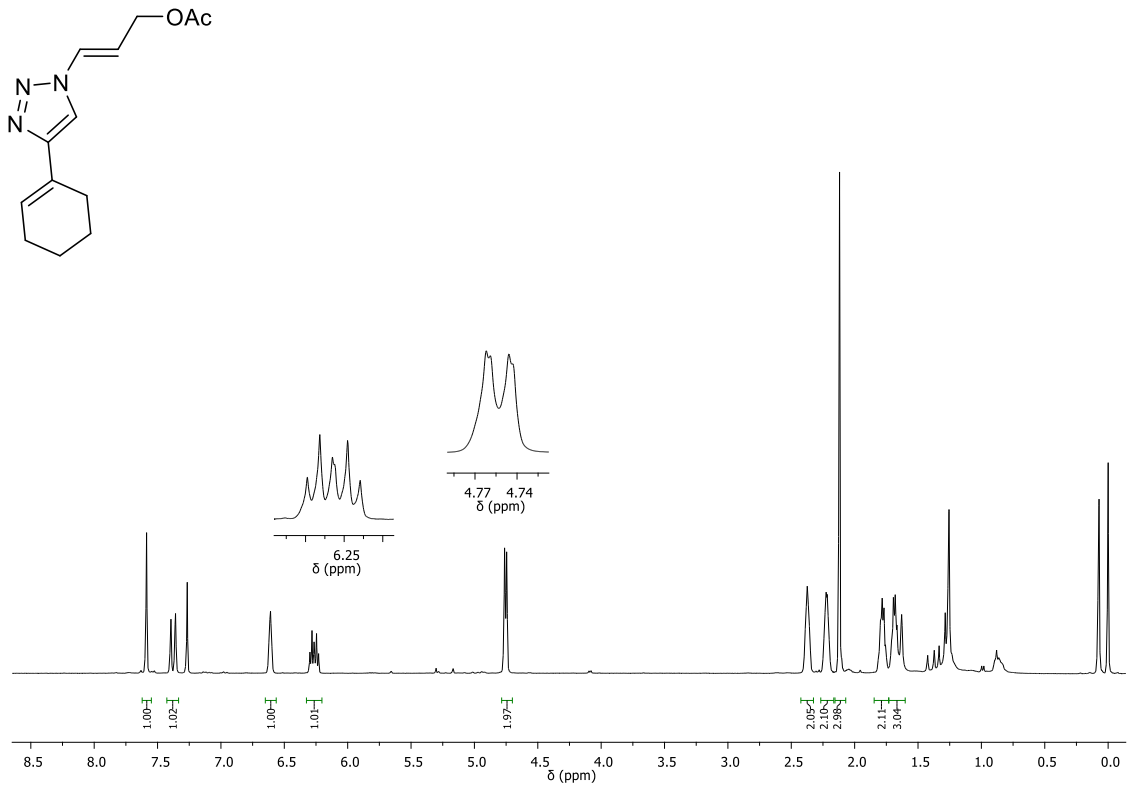
^{13}C NMR spectrum for compound **4b** in $CDCl_3$, 100 MHz



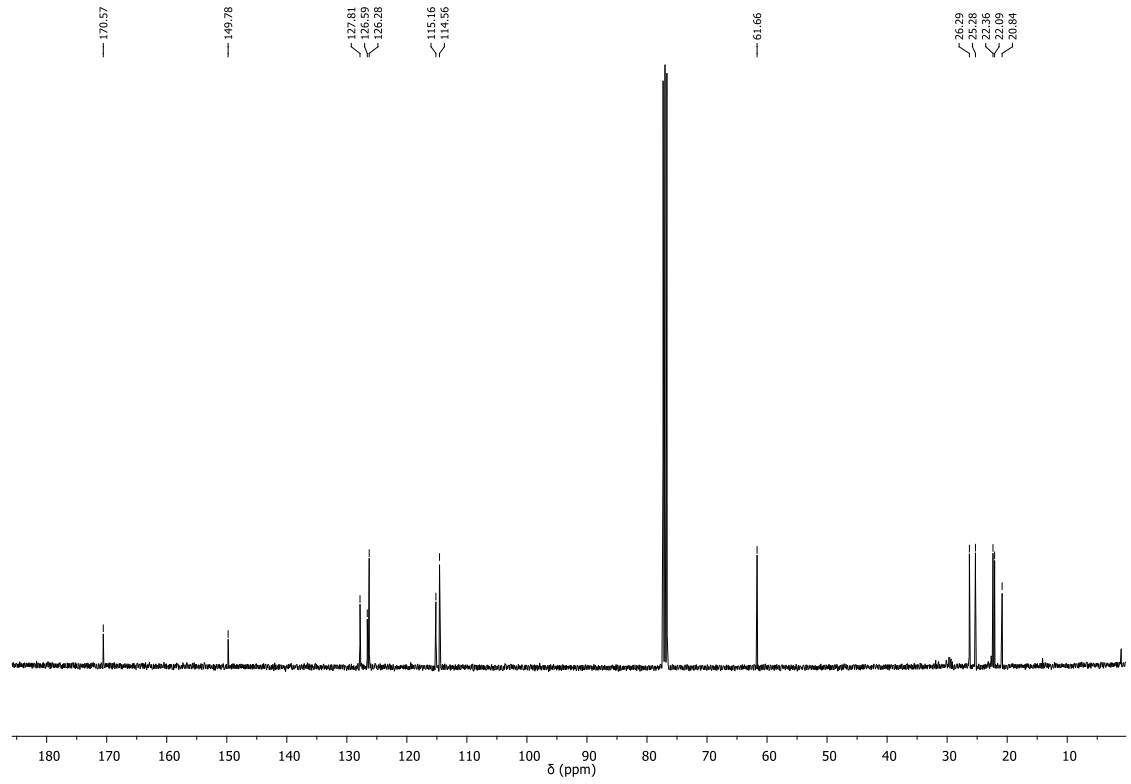
^{1}H NMR spectrum for compound **9b** in $CDCl_3$, 400 MHz



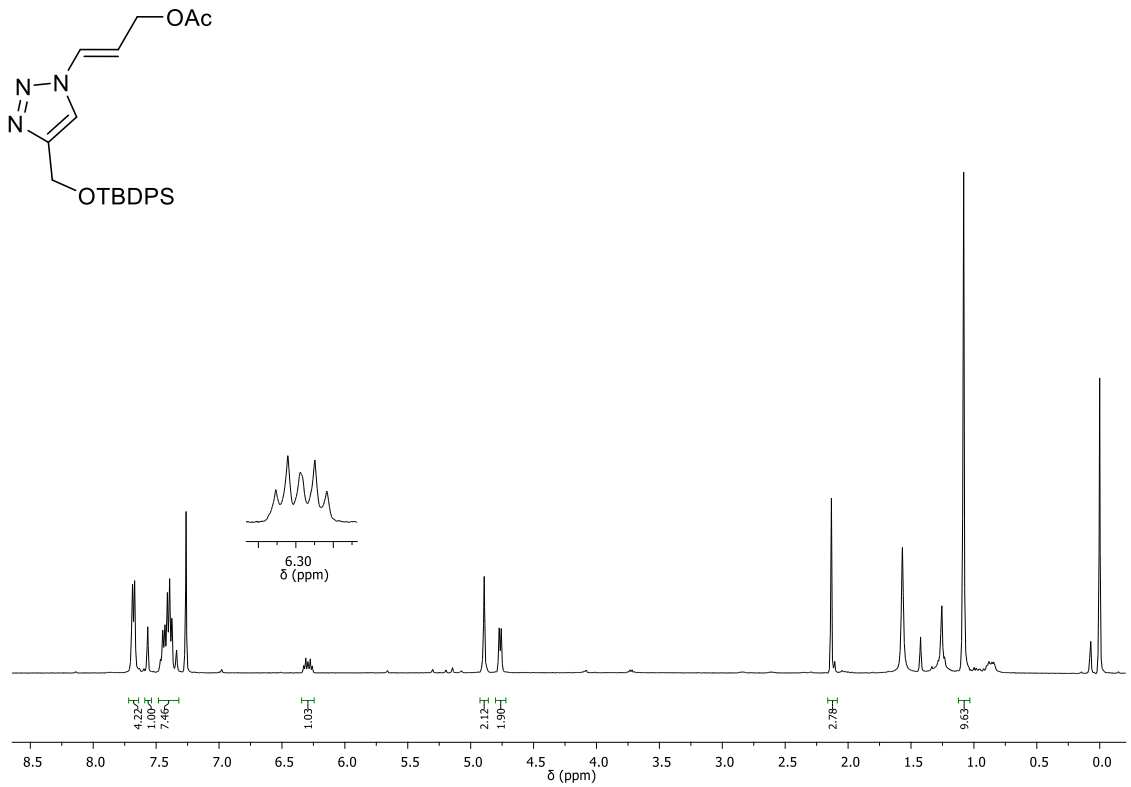
^{13}C NMR spectrum for compound **12b** in $CDCl_3$, 100 MHz



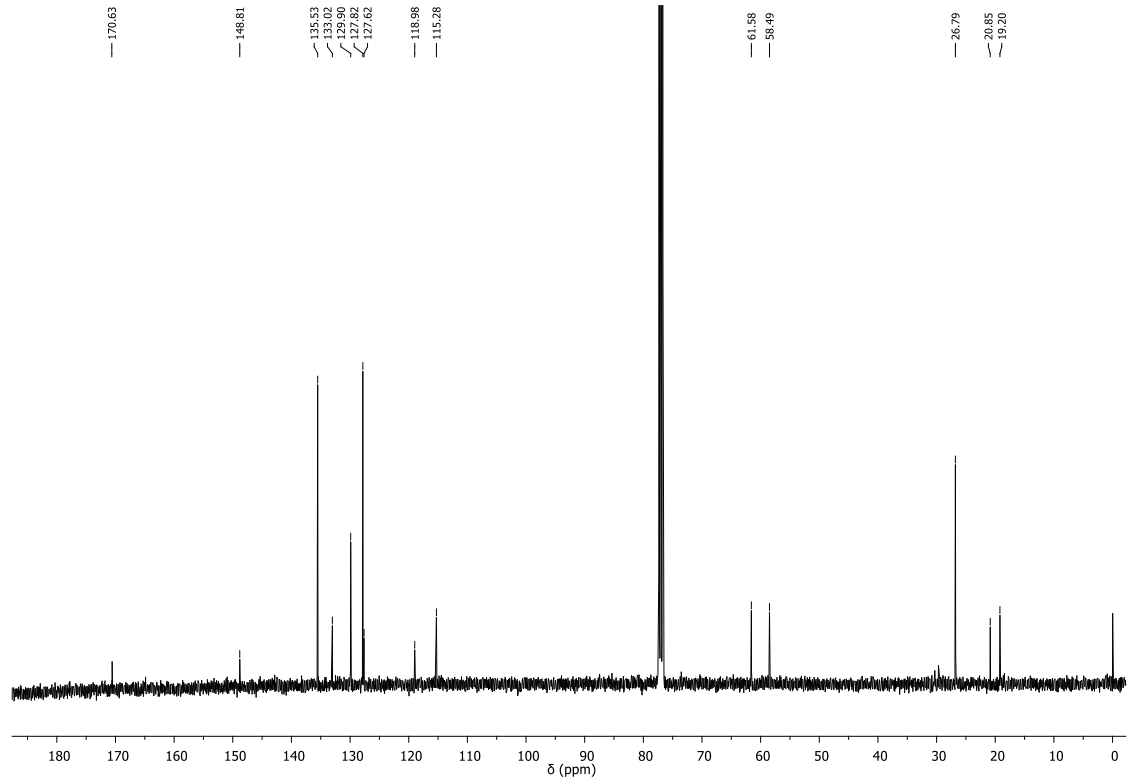
^{1}H NMR spectrum for compound **12b** in $CDCl_3$, 400 MHz



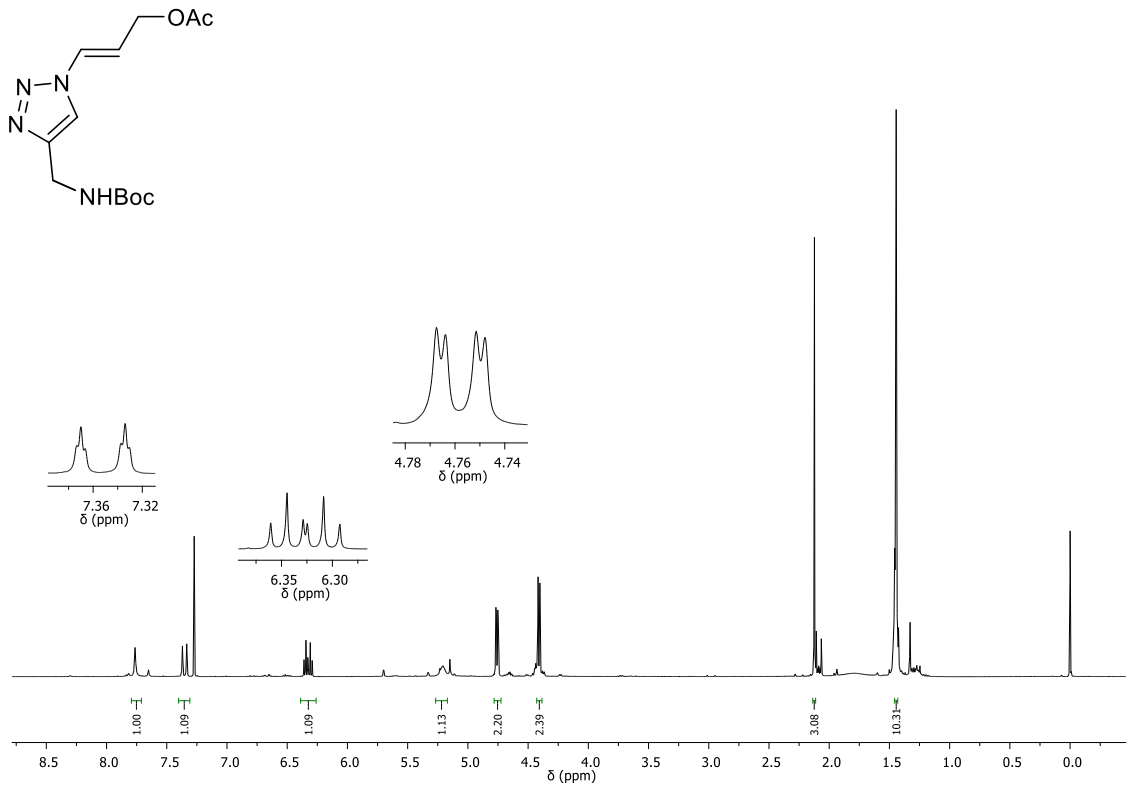
^{13}C NMR spectrum for compound **12b** in $CDCl_3$, 100 MHz



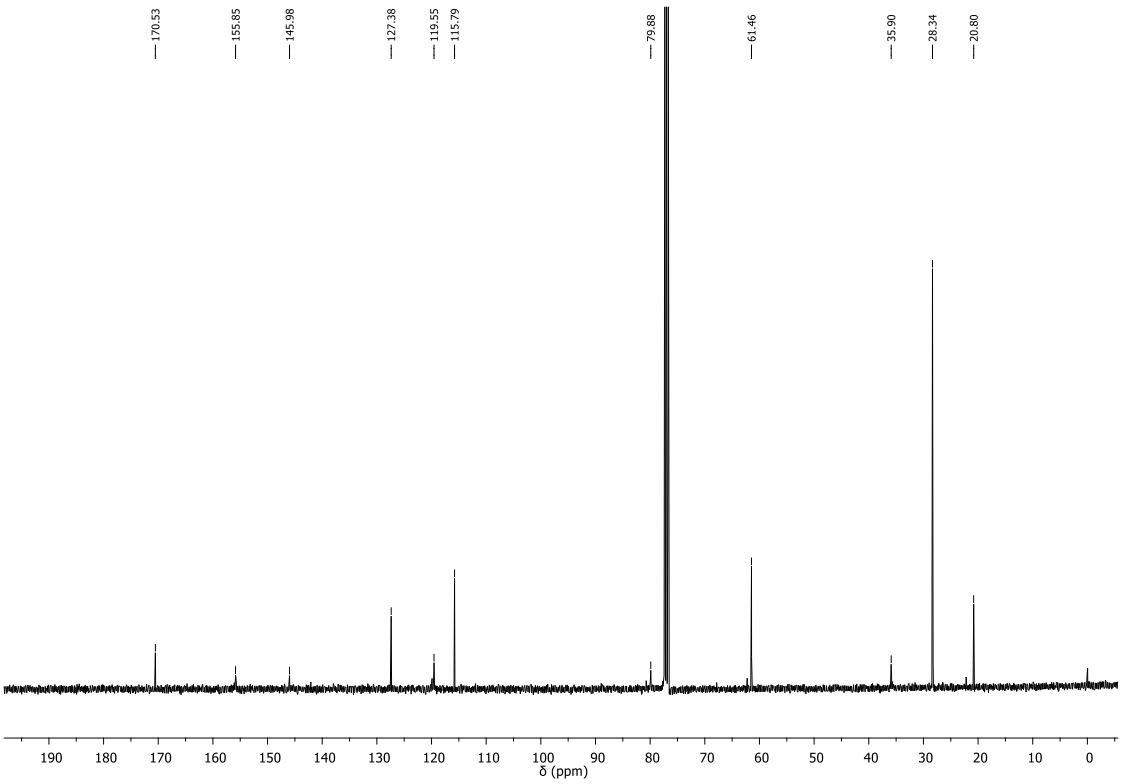
^{1}H NMR spectrum for compound **16b** in $CDCl_3$, 400 MHz



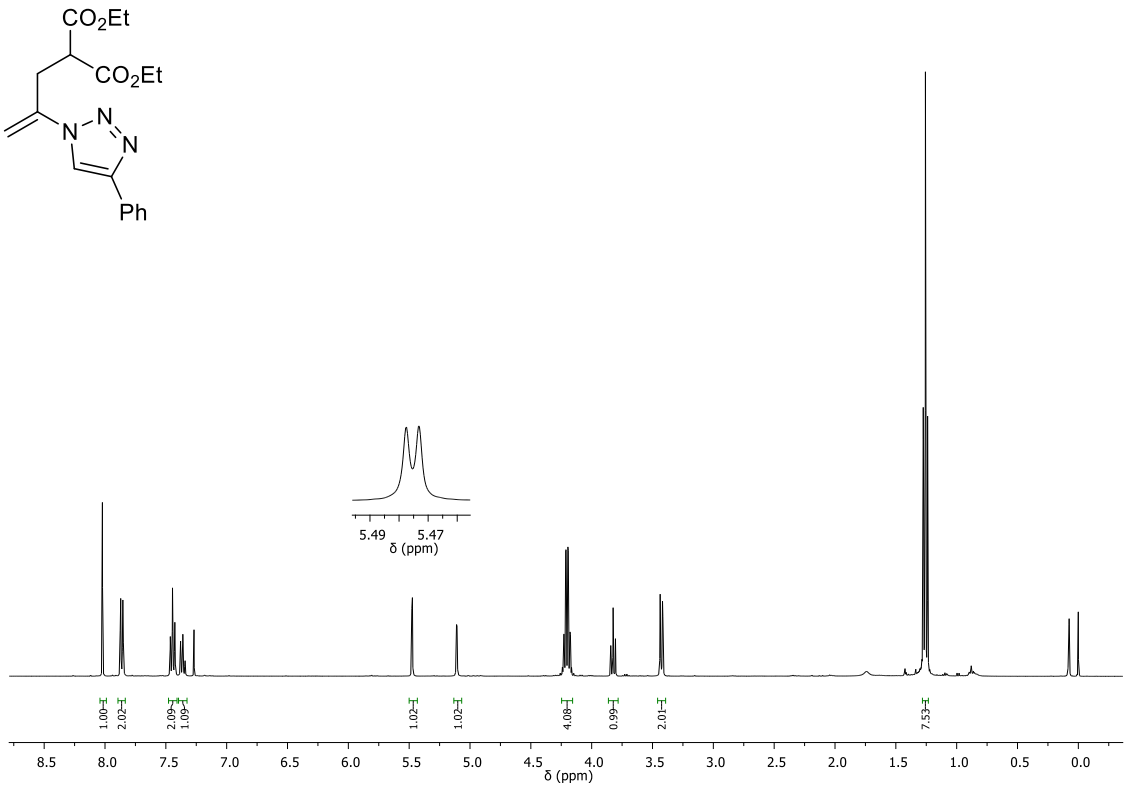
^{13}C NMR spectrum for compound **16b** in $CDCl_3$, 100 MHz



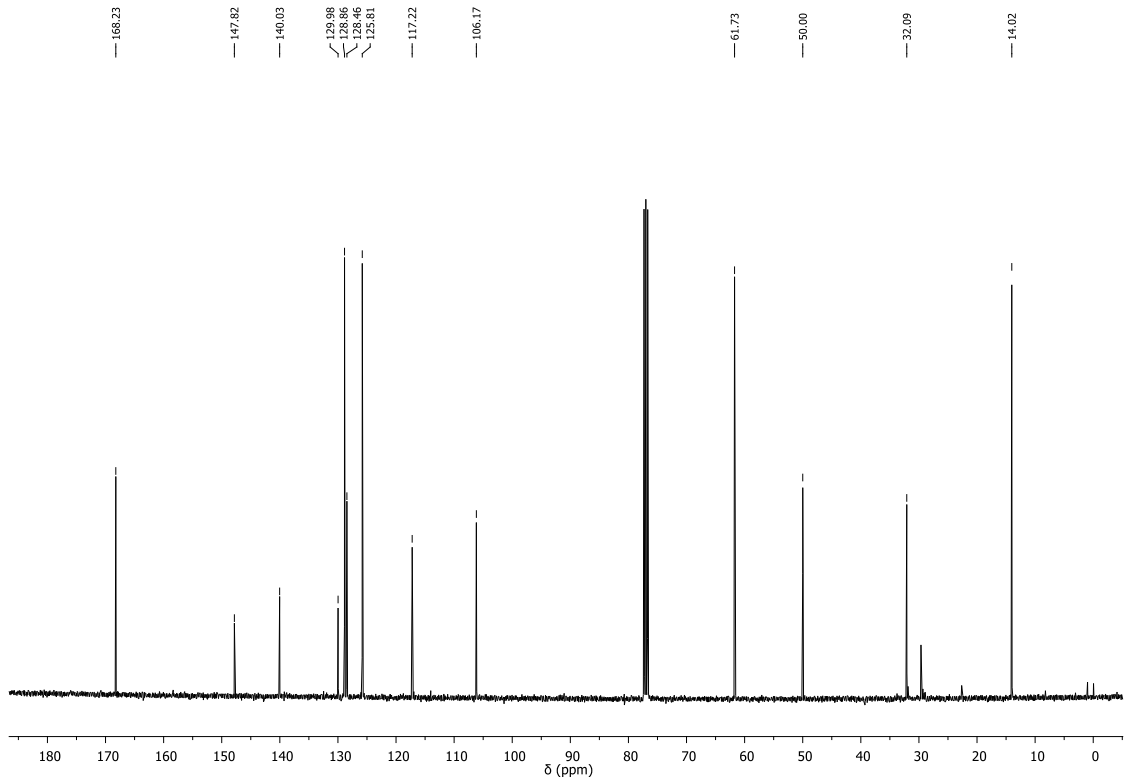
^{1}H NMR spectrum for compound **19b** in $CDCl_3$, 400 MHz
(small amount of minor α-isomer)



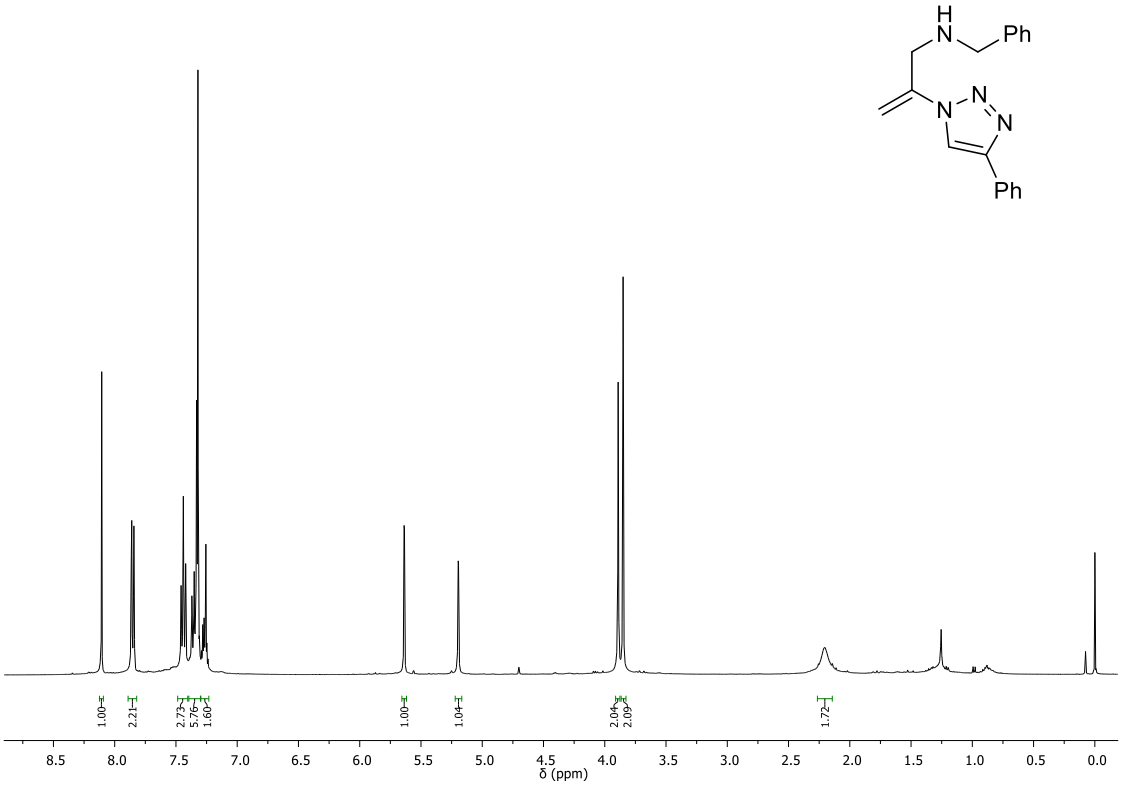
^{13}C NMR spectrum for compound **19b** in $CDCl_3$, 100 MHz



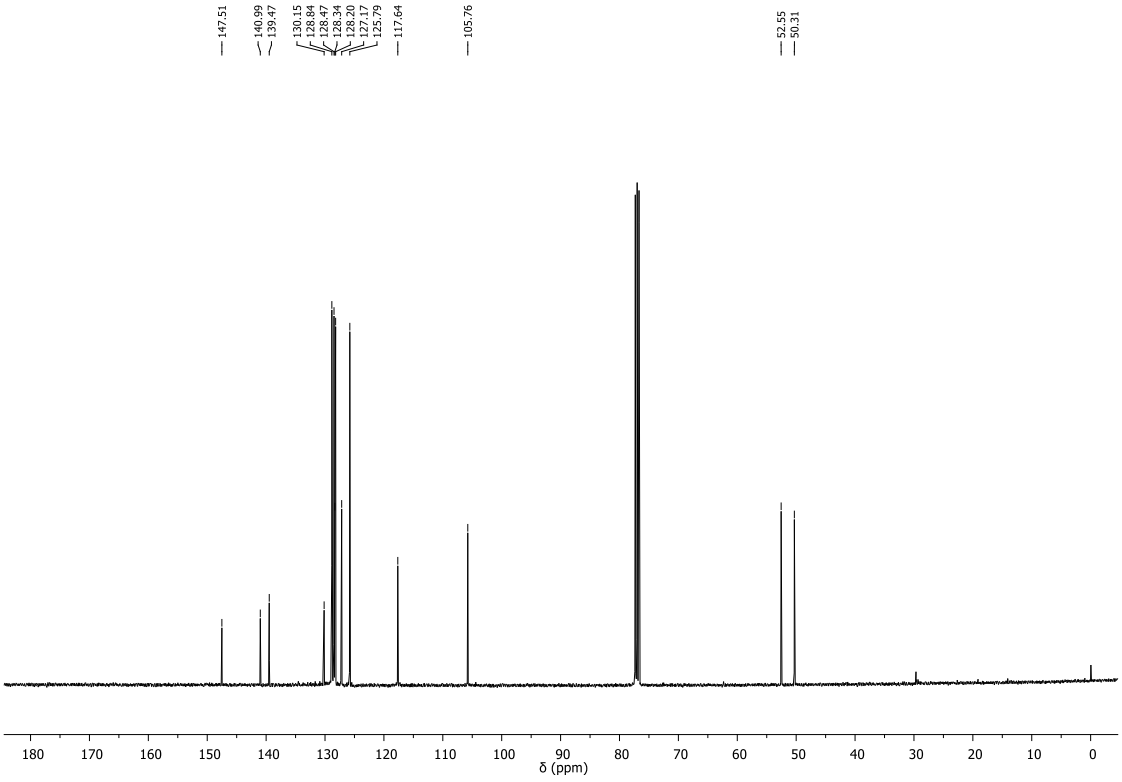
^{1}H NMR spectrum for compound **24** in $CDCl_3$, 400 MHz



^{13}C NMR spectrum for compound **24** in $CDCl_3$, 100 MHz



^{1}H NMR spectrum for compound **25** in $CDCl_3$, 400 MHz



^{13}C NMR spectrum for compound **25** in $CDCl_3$, 100 MHz