

Synthesis of 2,3-dihydroselenophene and selenophene derivatives by electrophilic cyclization of homopropargyl selenides

Ricardo F. Schumacher,^a Alisson R. Rosário,^a Ana Cristina G. de Souza,^a Paulo H. Menezes,^b Gilson Zeni^{*,a}

^a*Laboratório de Síntese, Reatividade, Avaliação Farmacológica e Toxicológica de Organocalcogênios, CCNE, UFSM, 97105-900, Santa Maria, RS, Brazil.*

^b*Universidade Federal de Pernambuco, Departamento Química Fundamental, Recife, Pernambuco, Brazil, 50670-901.*

gzeni@pq.cnpq.br

SUPPORTING INFORMATION

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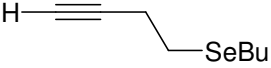
Materials and Methods

Proton nuclear magnetic resonance spectra (^1H NMR) were obtained at 200 MHz on a DPX-200 NMR spectrometer or at 400 MHz on a DPX-400 NMR spectrometer. Spectra were recorded in CDCl_3 solutions. Chemical shifts are reported in ppm, referenced to the solvent peak of CDCl_3 or tetramethylsilane (TMS) as the external reference. Data are reported as follows: chemical shift (δ), multiplicity, coupling constant (J) in Hertz and integrated intensity. Carbon-13 nuclear magnetic resonance spectra (^{13}C NMR) were obtained either at 50 MHz on a DPX-200 NMR spectrometer or at 100 MHz on a DPX-400 NMR spectrometer. Spectra were recorded in CDCl_3 solutions. Chemical shifts are reported in ppm, referenced to the solvent peak of CDCl_3 . Abbreviations to denote the multiplicity of a particular signal are s (singlet), d (doublet), t (triplet), q (quartet), quint (quintet), sex (sextet), dt (double triplet), td (triple doublet) and m (multiplet). High resolution mass spectra were recorded on a Kratos MS50TC double focusing magnetic sector mass spectrometer using EI at 70 eV. Column chromatography was performed using Merck Silica Gel (230-400 mesh) following the methods described by Still.¹ Thin layer chromatography (TLC) was performed using Merck Silica Gel GF₂₅₄, 0.25 mm thickness. For visualization, TLC plates were either placed under ultraviolet light, or stained with iodine vapor, or acidic vanillin. Most reactions were monitored by TLC for disappearance of starting material. The following solvents were dried and purified by distillation from the reagents indicated: tetrahydrofuran from sodium with a benzophenone ketyl indicator. All other solvents were ACS or HPLC grade unless otherwise noted. Air- and moisture-sensitive reactions were conducted in flame-dried or oven dried glassware equipped with tightly fitted rubber septa and under a positive atmosphere of dry nitrogen or argon. Reagents and solvents were handled using standard syringe techniques. Temperatures above room temperature were maintained by use of a mineral oil bath with an electrically heated coil connected to a Variac controller.

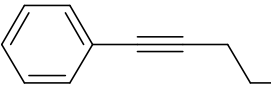
General procedure for the preparation alkynyl selenide 2f ; Starting Material for selenides 2g-2r.

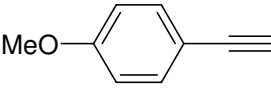
To a suspension of elemental selenium (0.395 g; 5 mmol) in dry THF (25 mL) under argon and with magnetic stirring was added *n*-butyllithium (2.0 mL of a 2.5 M solution in hexane; 5 mmol). A yellow solution was formed. To this solution was added the appropriate tosylate (5 mmol) in THF (10 mL). The resulting solution was stirred for 6 h at room temperature. After this time, the mixture was diluted with ethyl acetate (60 mL) and washed with saturated aq. NH_4Cl (30 mL) and water (3x30 mL). The organic phase was separated, dried over MgSO_4 , and concentrated under vacuum. The residue was purified by flash chromatography on silica gel using hexane as the eluent.

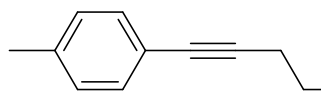
⁽¹⁾ Still, W.C., Kahn, M., Mitra, A.; *J. Org. Chem.* **1978**, *43*, 2923.


 but-3-ynyl(butyl)selane (**2f**) Yield: 0.85g (90 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 2.75-2.53 (m, 4H), 2.05 (t, *J* = 2.35Hz, 1H), 1.66 (quint, *J* = 7.65Hz, 2H), 2.09 (sex, *J* = 7.20Hz, 2H), 0.92 (t, *J* = 7.20Hz, 3H). ¹³C NMR (CDCl₃, 50 MHz): δ 83.44; 68.12; 32.62; 24.03; 22.99; 21.48; 20.69; 13.58. MS (relative intensity) *m/z*: 189 (32), 187 (87), 149 (50), 136 (67), 132 (76), 108 (77), 92 (44), 79 (11), 54 (100). Anal. calcd for C₈H₁₄Se: C, 50.80; H, 7.46. Found: C, 51.01; H, 7.63.

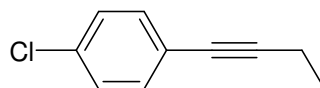
General Procedure for the Preparation of the alkynyl selenides 2a-2e: To a suspension of elemental selenium (0.079 g; 1 mmol) in dry THF (8 mL) under argon and with magnetic stirring was added *n*-butyllithium (0.4 mL of a 2.5 M solution in hexane; 1 mmol). A yellow solution was formed. To this solution was added the appropriate (hetero)aryl tosylate (1 mmol) in THF (2 mL). The resulting solution was stirred for 6 h at room temperature. After this time, the mixture was diluted with ethyl acetate (20 mL) and washed with saturated aq. NH₄Cl (10 mL) and water (3x10 mL). The organic phase was separated, dried over MgSO₄, and concentrated under vacuum. The residue was purified by flash chromatography on silica gel using hexane as the eluent.


 butyl(4-phenylbut-3-ynyl)selane (**2a**) Yield: 0.225g (85 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 7.41- 7.38 (m, 2H), 7.29- 7.27 (m, 3H), 2.81- 2.77 (m, 4H), 2.67 (t, *J* = 7.30Hz, 2H) 1.68 (quint, *J* = 7.30Hz, 2H), 1.41 (sex, *J* = 7.30Hz, 2H), 0.92 (t, *J* = 7.30Hz, 3H). ¹³C NMR (CDCl₃, 100 MHz): δ 131.57, 128.21, 127.77, 123.58, 89.12, 81.32, 32.75, 24.15, 23.05, 21.88, 21.87, 13.61. MS (relative intensity) *m/z*: 262 (24), 127 (100), 114 (16), 101 (10), 54 (11). Anal. calcd for C₁₄H₁₈Se: C, 63.39; H, 6.84. Found: C, 63.60; H, 6.98.

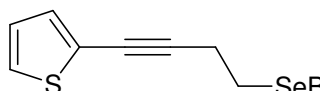

 butyl(4-(4-methoxyphenyl)but-3-ynyl)selane (**2b**) Yield: 0.224g (76 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 7.33 (d, *J* = 8.80Hz, 2H), 6.80 (d, *J* = 8.80Hz, 2H), 3.79 (s, 3H), 2.79-2.75 (m, 4H), 2.66 (t, *J* = 7.33Hz, 2H), 1.67 (quint, *J* = 7.33Hz, 2H), 1.40 (sex, *J* = 7.33Hz, 2H), 0.92 (t, *J* = 7.33Hz, 3H). ¹³C NMR (CDCl₃, 100 MHz): δ 159.16, 132.87, 113.79, 115.69, 87.49, 81.022, 55.20, 32.71, 24.06, 22.99, 21.97, 21.82, 13.56. MS (relative intensity) *m/z*: 292 (28), 236 (12), 157 (100), 143 (88), 126 (23), 114 (50), 101 (15). Anal. calcd for C₁₅H₂₀OSe: C, 61.01; H, 6.83. Found: C, 61.15 H, 6.91.



butyl(4-*p*-tolylbut-3-ynyl)selane (**2c**) Yield: 0.256g (92 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 7.28 (d, $J= 8.00\text{Hz}$, 2H), 7.08 (d, $J= 8.00\text{Hz}$, 2H), 2.80-2.76 (m, 4H), 2.66 (t, $J= 7.33\text{Hz}$, 2H), 2.33 (s, 3H), 1.67 (quint, $J= 7.33\text{Hz}$, 2H), 1.40 (sex, $J= 7.33\text{Hz}$, 2H), 0.92 (t, $J= 7.33\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 137.76, 131.43, 128.96, 120.49, 88.31, 81.37, 32.75, 24.13, 23.04, 21.95, 21.90, 21.41, 13.60. MS (relative intensity) m/z : 276 (23), 141 (100), 127 (72), 108 (10), 54 (9). Anal. calcd for $\text{C}_{15}\text{H}_{20}\text{Se}$: C, 64.51; H, 7.22. Found: C, 64.58; H, 7.25.

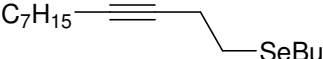


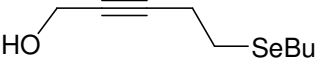
butyl(4-(4-chlorophenyl)but-3-ynyl)selane (**2d**) Yield: 0.26g (87 %); obtained as brown oil. ^1H NMR (CDCl_3 , 200 MHz): δ 7.35-7.23 (m, 4H), 2.81-2.75 (m, 4H), 2.66 (t, $J=7.33\text{Hz}$, 2H), 1.67 (quint, $J= 7.33\text{Hz}$, 2H), 1.41 (sex, $J= 7.33\text{Hz}$, 2H), 0.92 (t, $J= 7.33\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 133.73, 132.79, 128.53, 122.09, 90.18, 80.29, 32.73, 24.17, 23.04, 21.82, 21.72, 13.60. MS (relative intensity) m/z : 296 (47), 160 (100), 149 (24), 126 (93), 107 (33), 54 (27). Anal. calcd for $\text{C}_{22}\text{H}_{16}\text{SeTe}$: C, 54.27; H, 3.88. Found: C, 54.58; H, 3.72.

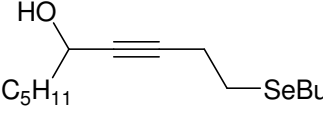


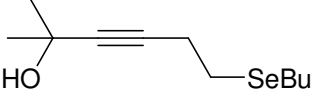
2-(4-(butylselenanyl)but-1-ynyl)thiophene (**2e**) Yield: 0.14g (52 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 7.18 (dd, $J= 1.22\text{Hz}$, 5.38Hz, 1H), 7.13 (dd, $J= 1.22\text{Hz}$, 2.44Hz, 1H), 6.93 (dd, $J= 3.42\text{Hz}$, 5.13Hz, 1H), 2.84-2.74 (m, 4H), 2.66 (t, $J= 7.30\text{Hz}$, 2H), 1.67 (quint, $J= 7.33\text{Hz}$, 2H), 1.41 (sex, $J= 7.33\text{Hz}$, 2H), 0.92 (t, $J= 7.33\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 131.28, 126.80, 126.27, 123.63, 93.15, 74.50, 32.71, 24.20, 23.04, 22.14, 21.51, 13.62. MS (relative intensity) m/z : 268 (23), 133 (100), 119 (21), 107 (28), 90 (25), 54 (17). Anal. calcd for $\text{C}_{12}\text{H}_{16}\text{SSe}$: C, 53.13; H, 5.94. Found: C, 53.40; H, 6.21.

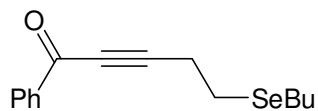
General Procedure for the Preparation of the alkynyl selenides 2g-2r: To a solution of alkynyl selenide **2f** (1 mmol) in THF (10 mL), *n*-BuLi (1 mmol, 2.5 M) was added slowly at -78°C . The resulting solution was stirred for 45 minutes. After, at 0°C the electrophilic source (1.1 equiv) was added and the reaction temperature was increase to room temperature. The reaction was diluted with ethyl acetate (30 mL) and washed with aq. NH_4Cl (3x10 mL). After drying the organic phase over anhydrous MgSO_4 , the solvent was removed under reduced pressure and the residue purified by flash chromatography on silica gel using hexane and ethyl acetate as eluents.


 butyl(undec-3-ynyl)selane (**2g**) Yield: 0.152g (53 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 2.68- 2.60 (m, 4H), 2.53 (t, *J*= 7.33Hz, 2H), 2.14 (t, *J*= 7.09Hz, 2H), 1.65 (quint, *J*= 7.09Hz, 2H), 1.48 (quint, *J*= 7.33Hz, 2H), 1.43- 1.28 (m, 10H), 0.92 (t, *J*= 7.33Hz, 3H), 0.88 (t, *J*= 6.85Hz, 3H). ¹³C NMR (CDCl₃, 100 MHz): δ 81.30, 79.12, 32.72, 31.74, 28.94, 28.82, 28.81, 23.94, 23.02, 22.61, 22.51, 21.17, 18.74, 14.06, 13.58. MS (relative intensity) *m/z*: 231 (100), 161 (22), 147 (89), 132 (22), 121 (23), 107 (76), 93 (44), 79 (50), 67 (51), 55 (81). Anal. calcd for C₁₅H₂₈Se: C, 62.70; H, 9.82. Found: C, 62.79 H, 9.89.

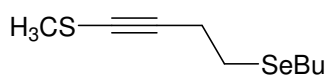

 5-(butylselanyl)pent-2-yn-1-ol (**2h**) Yield: 0.107g (49 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 4.25 (s, 2H), 2.72-2.68 (m, 2H), 2.65-2.58 (m, 4H), 2.45 (s, 1H), 1.65 (quint, *J*= 7.33Hz, 2H), 1.40 (sex, *J*= 7.33Hz, 2H), 0.92 (t, *J*= 7.33Hz, 3H). ¹³C NMR (CDCl₃, 100 MHz): δ 85.01, 79.25, 50.99, 32.53, 23.93, 22.88, 21.68, 20.83, 13.45 MS (relative intensity) *m/z*: 217 (63), 161 (38), 144 (48), 134 (21), 105 (85), 92 (23), 82 (25), 64 (32), 54 (100). Anal. calcd for C₉H₁₆OSe: C, 49.32; H, 7.36. Found: C, 49.60; H, 7.41.


 1-(butylselanyl)dec-3-yn-5-ol (**2i**) Yield: 0.239g (83 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 4.37-4.32 (m, 1H), 2.70-2.57 (m, 6H), 1.79 (s, 1H), 1.72-1.60 (m, 4H), 1.48-1.38 (m, 4H), 1.36-1.26 (m, 4H), 0.92 (t, *J*= 7.33Hz, 3H), 0.90 (t, *J*= 6.84Hz, 3H). ¹³C NMR (CDCl₃, 100 MHz): δ 82.23, 68.72, 62.64, 37.95, 32.64, 31.42, 24.81, 24.00, 22.98, 22.53, 21.83, 20.96, 13.97, 13.56 MS (relative intensity) *m/z*: 286 (7), 230 (46), 212 (23), 162 (100), 143 (20), 132 (68), 122 (46), 108 (58), 90 (25), 80 (44), 66 (24), 54 (88). Anal. calcd for C₁₄H₂₆OSe: C, 58.12; H, 9.06. Found: C, 58.39; H, 9.11.

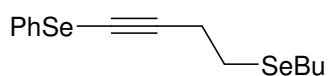

 6-(butylselanyl)-2-methylhex-3-yn-2-ol (**2j**) Yield: 0.177g (72 %); obtained as pale yellow oil. ¹H NMR (CDCl₃, 200 MHz): δ 2.72- 2.53 (m, 6H), 2.06 (s, 1H), 1.72-1.30 (m, 10H), 0.92 (t, *J*= 7.20Hz, 3H). ¹³C NMR (CDCl₃, 100 MHz): δ 85.94, 81.42, 65.17, 32.69, 31.58, 24.02, 23.00, 21.87, 20.95, 13.57. MS (relative intensity) *m/z*: 245 (34), 188 (71), 147 (18), 108 (47), 105 (18), 92 (100), 76 (17), 54 (47). Anal. calcd for C₁₁H₂₀OSe: C, 53.44; H, 8.15. Found: C, 53.51 H, 8.22.



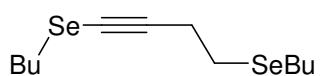
5-(butylselanyl)-1-phenylpent-2-yn-1-one (**2k**) Yield: 0.219g (75 %); obtained as orange oil. ^1H NMR (CDCl_3 , 200 MHz): δ 8.19- 8.15 (m, 2H), 7.65- 7.44 (m, 3H), 2.95-2.77 (m, 4H), 2.67 (t, $J= 7.33\text{Hz}$, 2H), 1.68 (quint, $J= 7.20\text{Hz}$, 2H), 1.41 (sex, $J= 7.20\text{Hz}$, 2H), 0.92 (t, $J= 7.20\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 177.99, 136.71, 133.97, 129.60, 128.47, 94.76, 80.02, 32.58, 24.30, 22.93, 21.45, 20.41, 13.52. MS (relative intensity) m/z : 290 (1), 234 (61), 169 (37), 155 (59), 142 (17), 127 (75), 104 (100), 78 (26), 54 (18). Anal. calcd for $\text{C}_{15}\text{H}_{18}\text{OSe}$: C, 61.43; H, 6.19. Found: C, 61.59 H, 6.23.



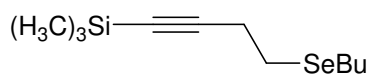
4-(butylselanyl)but-1-ynyl(methyl)sulfane (**2l**) Yield: 0.178g (76 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 2.68-2.58 (m, 4H), 2.36 (s, 3H), 1.66 (quint, $J= 7.21\text{Hz}$, 2H), 1.40 (sex, $J= 7.21\text{Hz}$, 2H), 0.92 (t, $J= 7.21\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 91.99, 71.32, 32.65, 24.02, 22.97, 22.39, 21.78, 19.06, 13.53. MS (relative intensity) m/z : 233 (50), 177 (18), 163 (14), 132 (18), 108 (41), 97 (100), 83 (42), 64 (23), 54 (40). Anal. calcd for $\text{C}_9\text{H}_{16}\text{SSe}$: C, 45.95; H, 6.86. Found: C, 46.01 H, 6.92.



1-(4-(butylselanyl)but-1-ynylselanyl)benzene (**2m**) Yield: 0.223g (65 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 7.56-7.51 (m, 2H), 7.35-7.20 (m, 2H), 2.89-2.71 (m, 4H), 2.64 (t, $J= 7.30\text{Hz}$, 2H), 1.66 (quint, $J= 7.49\text{Hz}$, 2H), 1.39 (sex, $J= 7.49\text{Hz}$, 2H), 0.91 (t, $J= 7.20\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 129.41, 128.92, 128.82, 126.87, 103.27, 59.26, 32.72, 24.19, 23.04, 22.91, 21.76, 13.65. MS (relative intensity) m/z : 341 (39), 285 (17), 127 (100), 114 (27), 105 (17), 76 (15), 54 (12). Anal. calcd for $\text{C}_{14}\text{H}_{18}\text{Se}_2$: C, 48.85; H, 5.27. Found: C, 48.97; H, 5.32.

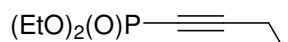


1,4-bis(butylselanyl)but-1-yne (**2n**) Yield: 0.187g (58%); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 2.77 (t, $J= 7.33\text{ Hz}$, 2H), 2.73-2.68 (m, 4H), 2.62 (t, $J= 7.58\text{ Hz}$, 2H), 1.78 (quint, $J= 7.58\text{ Hz}$, 2H), 1.65 (qui, $J= 7.33\text{ Hz}$, 2H), 1.47-1.38 (m, 4H), 0.94 (t, $J= 7.33\text{ Hz}$, 3H), 0.92 (t, $J= 7.33\text{ Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 99.12, 69.12, 32.72, 32.18, 28.67, 24.06, 23.03, 22.79, 22.49, 21.96, 13.59, 13.52. MS (relative intensity) m/z : 266 (78), 264 (78), 211 (95), 158 (17), 131 (100), 105 (84), 92 (42), 78 (21), 56 (93). Anal. calcd for $\text{C}_{12}\text{H}_{22}\text{Se}_2$: C, 44.45; H, 6.84. Found: C, 44.62 H, 6.79.

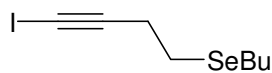


4-(butylselanyl)but-1-ynyltrimethylsilane (**2o**) Yield: 0.174g (67 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 2.71-2.58 (m, 6H), 1.65 (quint, $J= 7.30\text{Hz}$,

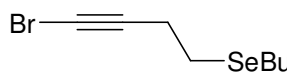
2H), 1.40 (sex, $J=7.30\text{Hz}$, 2H), 0.92 (t, $J=7.30\text{Hz}$, 3H), 0.15 (s, 9H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 106.05, 85.34, 32.70, 24.10, 23.01, 22.37, 21.52, 13.59, 0.02. MS (relative intensity) m/z : 259 (35), 203 (10), 137 (17), 123 (29), 108 (92), 95 (27), 72 (100), 54 (28). Anal. calcd for $\text{C}_{11}\text{H}_{22}\text{SeSi}$: C, 50.55; H, 8.49. Found: C, 50.79; H, 8.85.



diethyl 4-(butylselanyl)but-1-ynylphosphonate (**2p**) Yield: 0.152g (47 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 4.19-4.09 (m, 4H), 2.73-2.70 (m, 4H), 2.63 (t, $J=7.58\text{ Hz}$, 2H), 1.65 (quint, $J=7.33\text{Hz}$, 2H), 1.44-1.32 (m, 8H), 0.92 (t, $J=7.33\text{ Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 100.89 (d, $J=51.96\text{Hz}$), 70.75 (d, $J=300.42\text{Hz}$), 62.57 (d, $J=6.22\text{Hz}$), 32.08, 23.74, 22.45, 21.00 (d, $J=4.39\text{Hz}$), 19.43 (d, $J=2.56\text{ Hz}$), 18.18, 15.62 (d, $J=7.31\text{Hz}$), 13.11. MS (relative intensity) m/z : 280 (33), 187 (15), 160 (28), 145 (15), 132 (100), 114 (15), 106 (12), 79 (11), 54 (11). HRMS calcd for $\text{C}_{12}\text{H}_{23}\text{O}_3\text{PSe}$: 326.0550. Found: 326.0544.

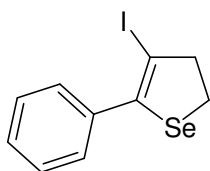


butyl(4-iodobut-3-ynyl)selane (**2q**) Yield: 0.22g (70 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 2.76-2.66 (m, 4H), 2.62 (t, $J=7.33\text{Hz}$, 2H), 1.65 (quint, $J=7.58\text{Hz}$, 2H), 1.40 (sext, $J=7.58\text{Hz}$, 2H), 0.92 (t, $J=7.33\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 93.44, 32.61, 24.17, 23.14, 22.98, 21.38, 13.57, -4.58. MS (relative intensity) m/z : 312 (68), 236 (38), 186 (23), 163 (22), 149 (21), 131 (56), 107 (100), 92 (36), 54 (93). Anal. calcd for $\text{C}_8\text{H}_{13}\text{ISe}$: C, 30.50; H, 4.16. Found: C, 30.75; H, 4.22.

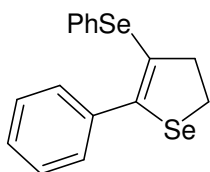


(4-bromobut-3-ynyl)(butyl)selane (**2r**) Yield: 0.152g (57 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 2.70-2.57 (m, 6H), 1.65 (quint, $J=7.33\text{Hz}$, 2H), 1.40 (sext, $J=7.58\text{Hz}$, 2H), 0.92 (t, $J=7.33\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 79.38, 39.27, 32.67, 24.16, 23.02, 22.09, 21.24, 13.59. MS (relative intensity) m/z : 266 (50), 209 (38), 186 (21), 149 (28), 131 (69), 108 (99), 92 (30), 56 (100). HRMS calcd for $\text{C}_8\text{H}_{14}\text{BrSe}$ (M+H): 268.9439. Found: 268.9441.

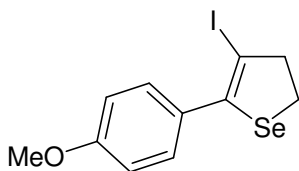
General Procedure for the Electrophilic Cyclization: To a solution of 0.25 mmol of the appropriate alkynyl selenide **2** in 3 mL of CH_2Cl_2 was added gradually 1.1 equiv of electrophilic source dissolved in 3 mL of CH_2Cl_2 . The reaction mixture was allowed to stir at room temperature for the desired time. The reaction was quenched using saturated aq $\text{Na}_2\text{S}_2\text{O}_3$. The mixture was then extracted by CH_2Cl_2 (3x10 mL). The combined organic layers were dried over anhydrous Mg_2SO_4 and concentrated under vacuum to yield the crude product, which was purified by flash chromatography on silica gel using ethyl acetate/hexane as the eluent.



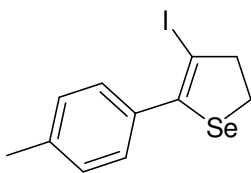
4-iodo-5-phenyl-2,3-dihydro-selenophene (**3a**) Yield: 0.077g (93 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 7.47-7.45 (m, 2H), 7.38-7.30 (m, 3H), 3.43 (t, J = 8.07 Hz, 2H), 3.29 (t, J = 8.07 Hz, 2H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 135.33, 129.65, 129.15, 129.05, 126.69, 82.28, 51.16, 26.23. MS (relative intensity) m/z : 332 (100), 206 (7), 127 (91), 114 (26), 10 (9), 88 (13). Anal. calcd for $\text{C}_{10}\text{H}_9\text{Se}$: C, 35.85; H, 2.71. Found: C, 35.61; H, 2.59.



5-phenyl-4-(phenylselanyl)-2,3-dihydro-selenophene (**3a'**) Yield: 0.056g (62 %); obtained as yellow prisms (m.p. = 43-4 °C). ^1H NMR (CDCl_3 , 400 MHz): δ 7.49-7.47 (m, 3H), 7.40-7.27 (m, 7H), 3.35 (t, J = 8.07 Hz, 2H), 3.16 (t, J = 8.07 Hz, 2H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 132.23, 131.49, 130.64, 129.10, 128.93, 128.16, 128.16, 128.05, 127.09, 119.13, 46.31, 24.85. MS (relative intensity) m/z : 361 (33), 281 (26), 201 (31), 127 (100), 114 (22), 101 (13), 76 (16). Anal. calcd for $\text{C}_{16}\text{H}_{14}\text{Se}_2$: C, 52.76; H, 3.87. Found: C, 52.82; H, 3.90.

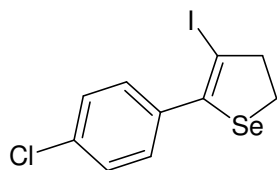


4-iodo-5-(4-methoxyphenyl)-2,3-dihydro-selenophene (**3b**) Yield: 0.073g (80 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 7.43 (d, J = 8.80Hz, 2H), 6.87 (d, J = 8.80Hz, 2H), 3.80 (s, 3H), 3.43-3.21 (m, 4H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 159.55, 135.69, 130.19, 129.08, 113.62, 55.28, 51.87, 25.50. MS (relative intensity) m/z : 361 (100), 236 (21), 157 (76), 143 (58), 126 (18), 114 (51), 101 (21), 88 (12). HRMS calcd for $\text{C}_{11}\text{H}_{12}\text{IOSe}$ (M+H): 366.9093. Found: 366.9101.

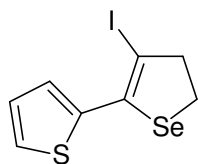


4-iodo-5-*p*-tolyl-2,3-dihydro-selenophene (**3c**) Yield: 0.072g (83 %); obtained as orange oil. ^1H NMR (CDCl_3 , 200 MHz): δ 7.36 (d, J = 8.07Hz, 2H), 7.16 (d, J = 7.58Hz, 2H), 3.41 (t, J = 8.07 Hz, 2H), 3.28 (t, J = 8.07Hz, 2H), 2.35 (s, 3H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 138.83, 136.48,

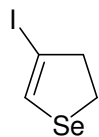
134.36, 129.46, 129.11, 78.33, 52.35, 26.12, 21.93. MS (relative intensity) m/z : 346 (93), 140 (100), 127 (99), 114 (49), 101 (12), 96 (16). Anal. calcd for $C_{11}H_{11}ISe$: C, 37.85; H, 3.18. Found: C, 38.01 H, 3.22.



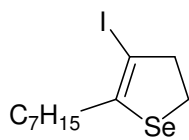
2-(4-chlorophenyl)-3-iodo-4,5-dihydro-selenophene (**3d**) Yield: 0.079g (86 %); obtained as pale yellow prisms (m.p. = 67-8 °C). 1H NMR ($CDCl_3$, 200 MHz): δ 7.43-7.25 (m, 4H), 3.47-3.23 (m, 4H). ^{13}C NMR ($CDCl_3$, 50 MHz): δ 135.39, 134.88, 134.25, 130.18, 128.58, 79.19, 51.94, 25.90. MS (relative intensity) m/z : 367 (35), 365 (100), 240 (13), 205 (10), 160 (39), 147 (32), 126 (63), 112 (16). Anal. calcd for $C_{10}H_8ClISe$: C, 32.51; H, 2.18. Found: C, 32.55 H, 2.23.



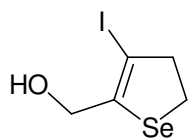
2-(3-iodo-4,5-dihydro-selenophene)thiophene (**3e**) Yield: 0.07g (82 %); obtained as yellow oil. 1H NMR ($CDCl_3$, 200 MHz): δ 7.24 (d, J = 4.41Hz, 2H), 6.94 (t, J = 4.41Hz, 2H), 3.29-3.24 (m, 4H). ^{13}C NMR ($CDCl_3$, 50 MHz): δ 137.55, 130.15, 128.69, 126.76, 126.66, 77.75, 53.15, 25.54. MS (relative intensity) m/z : 337 (100), 212 (19), 133 (78), 120 (39), 107 (12), 90 (17), 76 (10). Anal. calcd for C_8H_7ISe : C, 28.17; H, 2.07. Found: C, 28.41; H, 2.35.



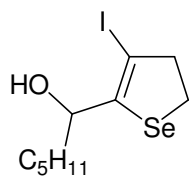
4-iodo-2,3-dihydro-selenophene (**3f**) Yield: 0.043g (67 %); obtained as pale yellow oil. 1H NMR ($CDCl_3$, 400 MHz): δ 6.82 (t, J = 1.95Hz, 1H), 3.30 (t, J = 8.31Hz, 2H), 2.98-2.93 (dt, J = 1.95Hz, 8.31Hz, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 125.12, 78.37, 48.65, 25.34. MS (relative intensity) m/z : 258 (51), 256 (100), 131 (58), 129 (35), 104 (12), 92 (21), 50 (21). Anal. calcd for C_4H_5ISe : C, 18.55; H, 1.95. Found: C, 18.49; H, 1.99.



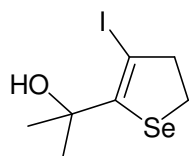
2-heptyl-3-iodo-4,5-dihydro-selenophene (**3g**) Yield: 0.053g (60 %); obtained as pale yellow oil. 1H NMR ($CDCl_3$, 200 MHz): δ 3.26 (t, J = 8.07 Hz, 2H), 3.03 (t, J = 8.07 Hz, 2H), 2.38 (t, J = 7.33 Hz, 2H), 1.48 (qui, J = 7.09 Hz, 2H), 1.39-1.25 (m, 8H), 0.88 (t, J = 7.09 Hz, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 138.91, 77.83, 49.47, 35.91, 31.75, 29.12, 29.06, 28.97, 24.37, 22.66, 14.12. MS (relative intensity) m/z : 353 (72), 270 (21), 145 (100), 106 (28), 92 (34), 78 (28), 64 (21), 54 (26). Anal. calcd for $C_{11}H_{19}ISe$: C, 36.99; H, 5.36. Found: C, 37.03 H, 5.42.



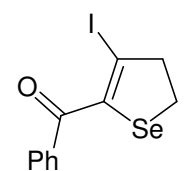
(3-iodo-4,5-dihydro-selenophene)methanol (**3h**) Yield: 0.050g (70 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 4.38 (s, 2H), 3.29 (t, $J= 8.07\text{Hz}$, 2H), 3.08 (t, $J= 8.07\text{Hz}$, 2H), 1.97 (s, 1H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 138.75, 76.87, 65.43, 49.81, 23.88. MS (relative intensity) m/z : 286 (100), 161 (43), 131 (27), 92 (15), 68 (20), 52 (36). Anal. calcd for $\text{C}_5\text{H}_7\text{IOSe}$: C, 20.78; H, 2.44. Found: C, 20.82; H, 2.42.



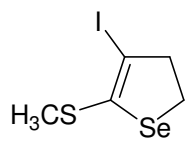
1-(3-iodo-4,5-dihydro-selenophen-2-yl)hexan-1-ol (**3i**) Yield: 0.072g (81 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 4.50 (m, 1H), 3.26-3.24 (m, 2H), 3.12-2.97 (m, 2H), 2.04 (s, 1H), 1.72-1.53 (m, 2H), 1.46-1.25 (m, 6H), 0.90 (t, $J= 7.09\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 82.23, 68.72, 62.64, 37.95, 32.64, 31.42, 24.81, 24.00, 22.98, 22.53, 21.83, 20.96, 13.97, 13.56. MS (relative intensity) m/z : 355 (89), 285 (100), 230 (37), 161 (64), 132 (47), 98 (17), 80 (28), 52 (23). Anal. calcd for $\text{C}_{10}\text{H}_{17}\text{IOSe}$: C, 33.45; H, 4.77. Found: C, 33.72; H, 4.94.



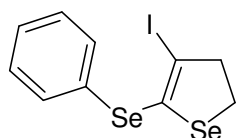
2-(3-iodo-4,5-dihydro-selenophen-2-yl)propan-2-ol (**3j**) Yield: 0.067g (85 %); obtained as off-white prisms (m.p. = 70-1 °C). ^1H NMR (CDCl_3 , 200 MHz): δ 3.22-3.17 (m, 2H), 3.10-3.06 (m, 2H), 2.45 (s, 1H), 1.60 (s, 6H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 147.44, 73.50, 70.62, 54.15, 28.63, 23.03. MS (relative intensity) m/z : 316 (23), 314 (100), 299 (60), 188 (17), 173 (20), 131 (33), 108 (22), 94 (17), 58 (18). Anal. calcd for $\text{C}_7\text{H}_{11}\text{IOSe}$: C, 26.52; H, 3.50. Found: C, 26.48; H, 3.47.



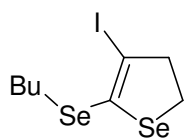
(3-iodo-4,5-dihydro-selenophen-2-yl)(phenyl)methanone (**3k**) Yield: 0.054g (60 %); obtained as brown oil. ^1H NMR (CDCl_3 , 200 MHz): δ 7.97 (d, $J= 7.82\text{ Hz}$, 2H), 7.62 (t, $J= 7.33\text{ Hz}$, 1H), 7.49 (t, $J= 7.33\text{ Hz}$, 2H), 3.50 (t, $J= 8.31\text{ Hz}$, 2H), 3.30 (t, $J= 8.31\text{ Hz}$, 2H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 192.83, 134.94, 134.67, 133.97, 129.89, 128.70, 82.76, 51.78, 26.79. MS (relative intensity) m/z : 361 (15), 359 (66), 234 (11), 155 (14), 127 (56), 104 (100), 76 (62), 50 (37). HRMS calcd for $\text{C}_{11}\text{H}_9\text{IOSe}$: 363.8863. Found: 363.8868.



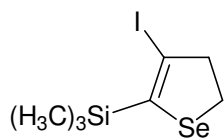
(3-iodo-4,5-dihydro-selenophen-2-yl)(methyl)sulfane (**3l**) Yield: 0.057g (75 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 3.40-3.32 (m, 2H), 3.14-3.06 (m, 2H), 2.45 (s, 3H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 132.91, 78.48., 50.00, 15.86, 19.24. MS (relative intensity) m/z : 302 (100), 176 (23), 162 (16), 131 (19), 83 (25), 68 (10). The compound **3l** was easily purified by column chromatography, however, it was unstable to obtain reliable elemental analysis or HRMS.



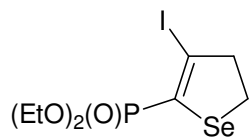
4-iodo-5-(phenylselanyl)-2,3-dihydro-selenophene (**3m**) Yield: 0.067g (65 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 7.69-7.66 (m, 2H), 7.41-7.30 (m, 3H), 3.28-3.23 (m, 2H), 3.15-3.11(m, 2H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 135.33, 129.64, 129.14, 129.05, 126.69, 82.28, 51.16, 26.23. MS (relative intensity) m/z : 411 (69), 205 (48), 155 (32), 127 (100), 114 (42), 76 (37), 50 (34). Anal. calcd for $\text{C}_{10}\text{H}_9\text{ISe}_2$: C, 29.01; H, 2.19. Found: C, 28.95; H, 2.20.



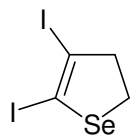
2-(butylselanyl)-3-iodo-4,5-dihydro-selenophene (**3n**) Yield: 0.078g (80 %); obtained as orange oil. ^1H NMR (CDCl_3 , 200 MHz): δ 3.86-3.30 (m, 2H), 3.12-3.03 (m, 2H), 2.91 (t, $J = 7.20\text{Hz}$, 2H), 1.75 (quint, $J = 7.49\text{Hz}$, 2H), 1.43 (sex, $J = 7.49\text{Hz}$, 2H), 0.94 (t, $J = 7.20\text{Hz}$, 3H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 124.72, 83.28, 50.70, 32.82, 30.02, 26.44, 22.83, 13.56. MS (relative intensity) m/z : 391 (89), 335 (100), 210 (74), 210 (38), 131 (53), 116 (20), 92 (17), 52 (25). Anal. calcd for $\text{C}_8\text{H}_{13}\text{ISe}_2$: C, 24.39; H, 3.33. Found: C, 24.44; H, 3.29.



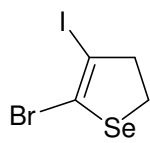
(3-iodo-4,5-dihydro-selenophen-2-yl)trimethylsilane (**3o**) Yield: 0.033g (40 %); obtained as orange oil. ^1H NMR (CDCl_3 , 400 MHz): δ 3.16-3.14 (m, 4H), 0.31 (s, 9H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 87.28, 55.37, 29.68, 24.35, -0.70. MS (relative intensity) m/z : 328 (100), 313 (30), 182 (13), 121 (31), 108 (19), 95 (11), 72 (34). Anal. calcd for $\text{C}_7\text{H}_{13}\text{ISeSi}$: C, 25.39; H, 3.96. Found: C, 25.44; H, 4.00.



diethyl (3-iodo-4,5-dihydro-selenophen-2-yl)phosphonate (**3p**) Yield: 0.069g (70 %); obtained as light brown oil. ^1H NMR (CDCl_3 , 200 MHz): δ 4.22-4.14 (m, 4H), 3.32-3.24 (m, 4H), 1.38 (t, 6H, $J=7.0$ Hz). ^{13}C NMR (CDCl_3 , 100 MHz): δ 126.96 (d, $J=199.06\text{Hz}$), 62.93 (d, $J=5.85\text{Hz}$), 55.18 (d, $J=17.56\text{Hz}$), 32.45, 25.17 (d, $J=3.65\text{Hz}$), 16.20 (d, $J=6.58\text{Hz}$). MS (relative intensity) m/z : 391 (100), 335 (32), 265 (13), 210 (33), 194 (30), 154 (29), 131 (75), 107 (17), 80 (25), 56 (30). HRMS calcd for $\text{C}_8\text{H}_{14}\text{IO}_3\text{PSe}$: 395.8890. Found: 395.8896.

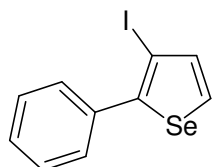


4-iodo-5-iodo-2,3-dihydro-selenophene (**3q**) Yield: 0.083g (87 %); obtained as yellow oil. ^1H NMR (CDCl_3 , 200 MHz): δ 3.46-3.38 (m, 2H), 3.05-2.97 (m, 2H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 88.62, 80.69, 49.89, 29.73. MS (relative intensity) m/z : 383 (21), 281 (100), 130 (94), 104 (10), 50 (15). Anal. calcd for $\text{C}_4\text{H}_4\text{I}_2\text{Se}$: C, 12.48; H, 1.05. Found: C, 12.81; H, 1.38.



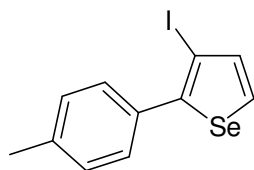
4-iodo-5-bromo-2,3-dihydro-selenophene (**3r**) Yield: 0.059g (70 %); obtained as pale yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 3.49-3.45 (m, 2H), 3.03-2.99 (m, 2H). ^{13}C NMR (CDCl_3 , 100 MHz): δ 110.83, 86.46, 48.74, 28.28. MS (relative intensity) m/z : 335 (65), 333 (82), 208 (14), 130 (100), 125 (52), 116 (13), 50 (23). HRMS calcd for $\text{C}_{11}\text{H}_9\text{BrISe}$ ($\text{M}+\text{H}$): 337.7706. Found: 337.7697.

General procedure for the aromatization with DDQ: To a solution of dihydro-selenophene **3** (0.25 mmol) in toluene (3 mL), DDQ (2 equiv) was added. The resulting solution was stirred at 90°C for the desired time. The reaction was diluted with ethyl acetate (30 mL) and washed with aqueous NH_4Cl (3x10 mL). After drying the organic phase over anhydrous MgSO_4 , the solvent was removed under reduced pressure and the residue purified by flash chromatography on silica gel using hexane and ethyl acetate as eluents.

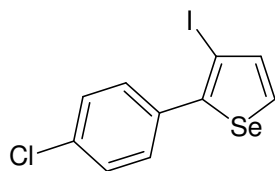


3-iodo-2-phenylselenophene¹ (**4a**) Yield: 0.064g (77%); obtained as yellow oil. ^1H NMR (CDCl_3 , 400 MHz): δ 7.91 (d, $J=5.73\text{Hz}$, 1H), 7.58-7.53 (m, 2H), 7.43-7.34 (m, 4H). ^{13}C NMR (CDCl_3 , 50 MHz): δ 147.07, 139.26, 136.42, 132.05, 129.48, 128.42, 128.33, 79.74. MS (relative

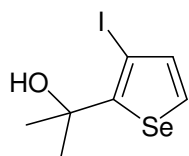
intensity) m/z : 330 (100), 204 (33), 125 (51), 114 (95), 101 (12), 75 (14). HRMS calcd for $C_{10}H_7ISe$: 333.8757. Found: 333.8761.



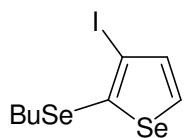
3-iodo-2-*p*-tolylselenophene (**4b**) Yield: 0.074g (86 %); obtained as yellow oil. 1H NMR ($CDCl_3$, 400 MHz): δ 7.86 (d, J = 5.62 Hz, 1H), 7.44 (d, J = 8.07 Hz, 2H), 7.33 (d, J = 5.62 Hz, 1H), 7.20 (d, J = 7.82 Hz, 2H). 2.37 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 147.19, 139.16, 138.26, 133.48, 131.66, 129.27, 129.10, 79.44, 21.32. MS (relative intensity) m/z : 347 (82), 220 (20), 141 (100), 115 (18), 89(7). Anal. calcd for $C_{11}H_9ISe$: C, 38.07; H, 2.61. Found: C, 38.11 H, 2.57.



2-(4-chlorophenyl)-3-iodoselenophene (**4c**) Yield: 0.058g (80 %); obtained as off-white prisms (m.p. = 52-3 °C). 1H NMR ($CDCl_3$, 400 MHz): δ 7.92 (d, J = 5.73 Hz, 1H), 7.52-7.45 (m, 2H), 7.40-7.33 (m, 3H). ^{13}C NMR ($CDCl_3$, 50 MHz): δ 145.61, 139.34, 134.89, 134.40, 132.44, 130.74, 128.68, 80.29. MS (relative intensity) m/z : 367 (100), 240 (32), 203 (31), 160 (22), 149 (32), 126 (25). The compound **4c** was easily purified by column chromatography, however, it was unstable to obtain reliable elemental analysis or HRMS.



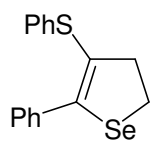
2-(3-iodoselenophen-2-yl)propan-2-ol (**4e**) Yield: 0.055g (70 %); obtained as pale yellow prisms (m.p. = 55-6 °C). 1H NMR ($CDCl_3$, 400 MHz): δ 7.70 (d, J = 5.88 Hz, 1H), 7.28 (d, J = 5.88 Hz, 1H), 2.64 (s, 1H), 1.76 (s, 6H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 157.79, 140.97, 129.34, 74.58, 73.16, 29.74. MS (relative intensity) m/z : 315 (41), 300 (100), 298 (51), 91 (24), 77 (7), 61 (7), 51 (7). Anal. calcd for C_7H_9IOSe : C, 26.69; H, 2.88. Found: C, 26.72 H, 2.92.



2-(butylselanyl)-3-iodoselenophene (**4f**) Yield: 0.066g (68 %); obtained as yellow oil. 1H NMR ($CDCl_3$, 400 MHz): δ 7.97 (d, J = 5.86 Hz, 1H), 7.25 (d, J = 5.86 Hz, 1H), 2.95 (t, J = 7.45 Hz, 2H), 1.73 (qui, J = 7.45 Hz, 2H), 1.44 (sex, J = 7.45 Hz, 2H), 0.92 (t, J = 7.21 Hz, 3H). ^{13}C NMR ($CDCl_3$, 100

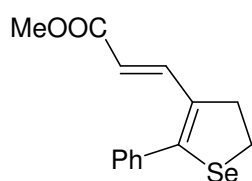
MHz): δ 138.75, 135.99, 131.34, 91.89, 32.03, 31.77, 22.79, 13.51. MS (relative intensity) m/z : 393 (100), 337 (72), 210 (74), 208 (67), 135 (14), 129 (31), 126 (25). HRMS calcd for $C_8H_{12}ISe_2$ (M+H): 394.8309. Found: 394.8319.

General procedure for the copper-catalyzed cross-coupling reaction of 3a with benzenethiol: To a solution of dihydroselenophene **3a** (0.5 mmol) in dioxane (3 mL), the benzenethiol (0.6 mmol) was added in dioxane (2 mL). After this, Et_3N was added dropwise (1 mmol), followed by CuI (10 mol%), and the reaction mixture was stirred at reflux temperature for 12 h. The reaction was diluted with ethyl acetate (30 mL) and washed with aqueous NH_4Cl (3x10 mL). After drying the organic phase over anhydrous $MgSO_4$, the solvent was removed under reduced pressure and the residue purified by flash chromatography on silica gel using hexane and ethyl acetate as eluents.



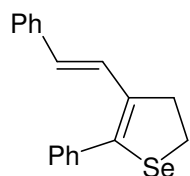
phenyl(2-phenyl-4,5-dihydroselenophen-3-yl)sulfane (**5a**) Yield: 0.063g (80 %); obtained as pale yellow prisms (m.p. = 54-5 °C). 1H NMR ($CDCl_3$, 400 MHz): δ 7.51-7.48 (m, 2H), 7.35-7.25 (m, 7H), 3.30 (t, J = 7.82 Hz, 2H), 3.13 (t, J = 7.82 Hz, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 141.10, 135.96, 135.59, 129.05, 129.04, 128.95, 128.42, 128.18, 126.34, 122.56, 44.26, 23.65. MS (relative intensity) m/z : 314 (100), 281 (12), 220 (26), 201 (19), 158 (18), 127 (98), 114 (33), 88 (18), 76 (18). Anal. calcd for $C_{16}H_{14}SSe$: C, 60.56; H, 4.45. Found: C, 60.62; H, 4.47.

General procedure for the palladium-catalyzed Heck cross-coupling reaction of 3a: To a solution of dihydroselenophene **3a** (0.5 mmol) in DMF (5 mL) was added $Pd(OAc)_2$ (5 mol %), $n-Bu_4NI$ (1 equiv), Na_2CO_3 (2.5 equiv) and the alquenyl (1.2 equiv). The resulting solution was stirred at 100° C for 12h. The reaction was diluted with ethyl acetate (30 mL) and washed with aqueous NH_4Cl (3x10 mL). After drying the organic phase over anhydrous $MgSO_4$, the solvent was removed under reduced pressure and the residue purified by flash chromatography on silica gel using hexane and ethyl acetate as eluents.



(*E*)-methyl 3-(2-phenyl-4,5-dihydroselenophen-3-yl)acrylate (**5b**) Yield: 0.055g (75 %); obtained as pale yellow prisms (m.p. = 77-8 °C). 1H NMR ($CDCl_3$, 400 MHz): δ 7.39-7.33 (m, 6H), 5.72 (d, J = 15.49HZ, 1H), 3.69 (s, 3H), 3.39 (t, J = 8.18Hz, 2H), 3.25 (t, J = 8.18Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$, 100 MHz): δ 168.08, 150.26, 138.22, 135.41, 132.22, 129.14, 128.84, 128.56, 117.02,

51.26, 39.08, 24.11. MS (relative intensity) m/z : 293 (46), 231 (43), 213 (23), 181 (37), 154 (100), 141 (36), 128 (23), 115 (34), 77 (16). Anal. calcd for $C_{14}H_{14}O_2Se$: C, 57.35; H, 4.81. Found: C, 57.31 H, 4.76.

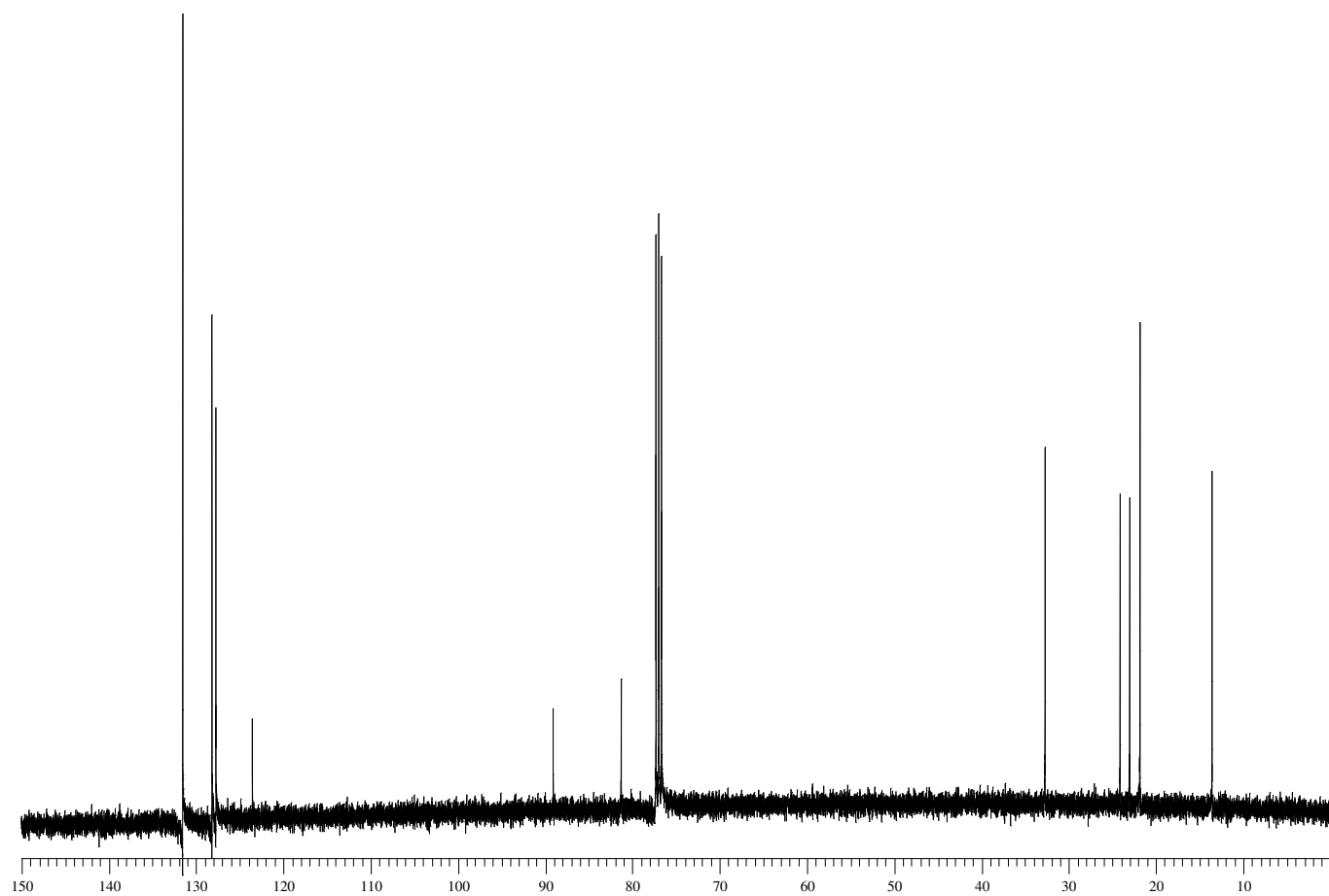
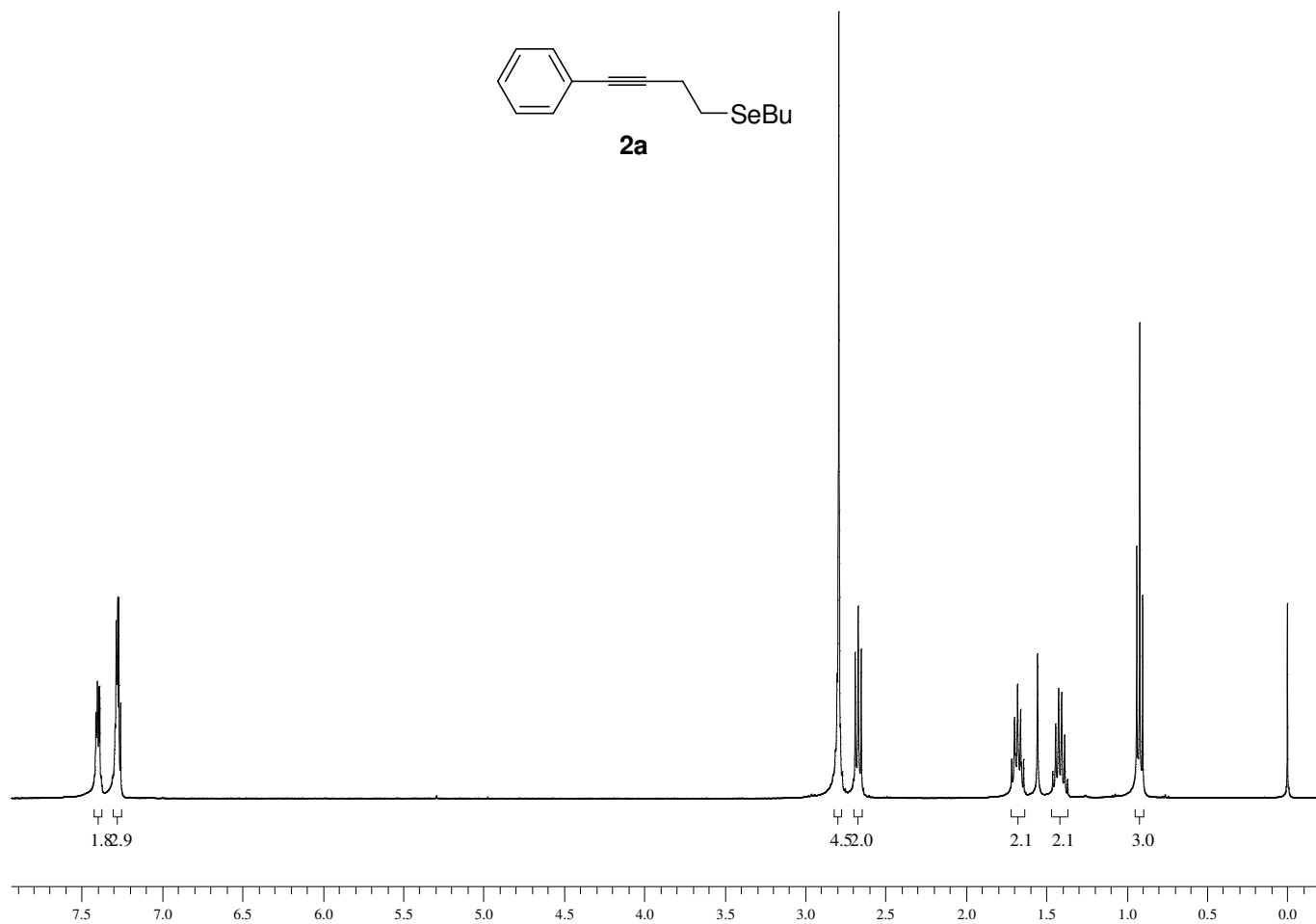
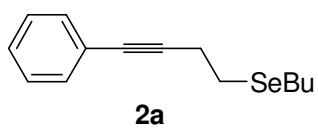


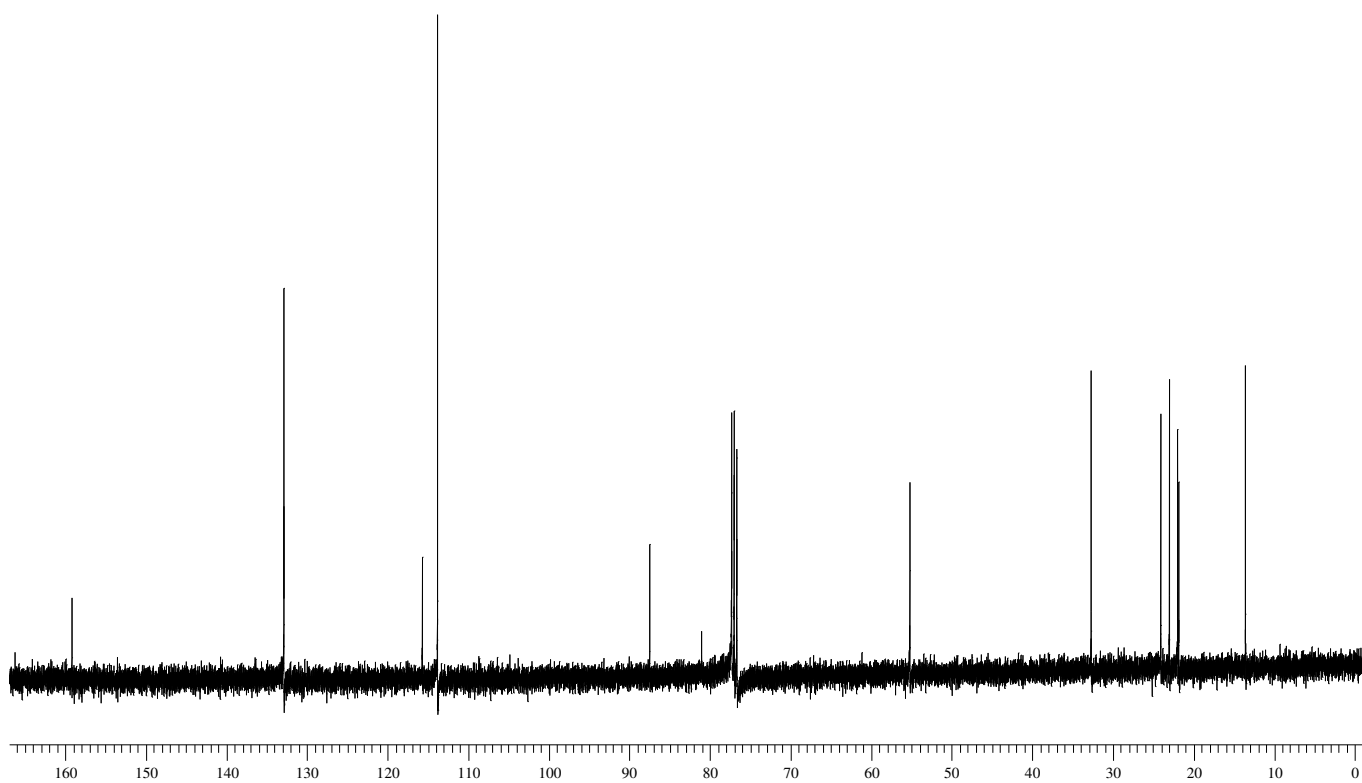
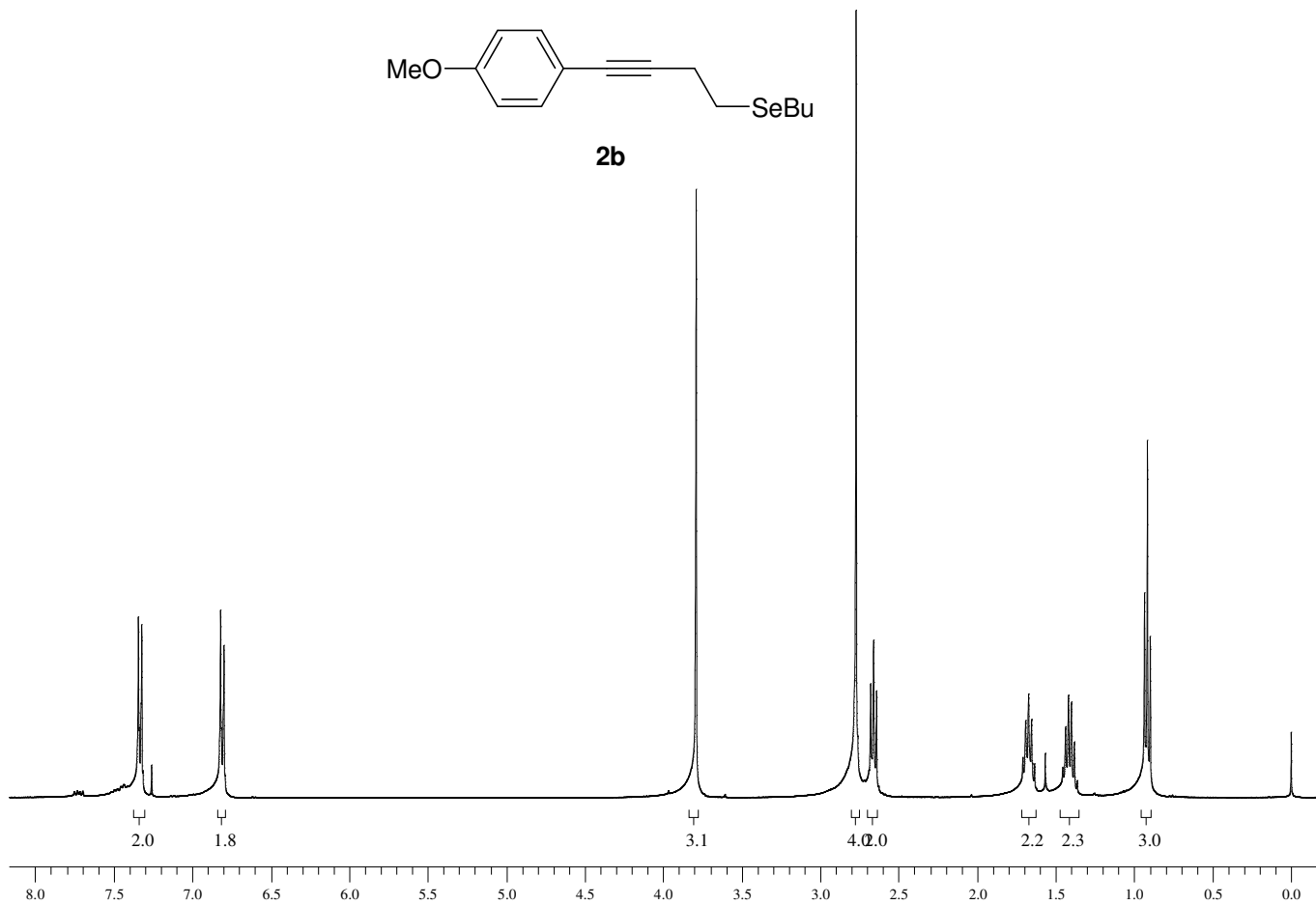
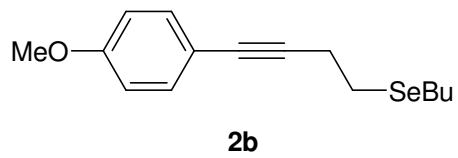
(*E*)-5-phenyl-4-styryl-2,3-dihydro-selenophene (**5c**) Yield: 0.038g (50 %); obtained as pale yellow prisms (m.p. = 71-2 °C). 1H NMR ($CDCl_3$, 400 MHz): δ 7.42-7.23 (m, 10H), 6.90 (d, $J= 16.07$ Hz, 1H), 6.40 (d, $J= 16.07$ Hz, 1H), 3.42-3.34 (m, 4H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 138.93; 137.94; 136.49; 133.84; 129.46; 128.89; 128.60; 128.45; 128.02; 127.10; 126.16; 123.83; 39.67; 23.78. MS (relative intensity) m/z : 311 (86), 231 (65), 217 (100), 202 (60), 153 (27), 128 (26), 115 (27), 101 (14), 77 (17). Anal. calcd for $C_{18}H_{16}Se$: C, 69.45; H, 5.18. Found: C, 69.50 H, 5.23.

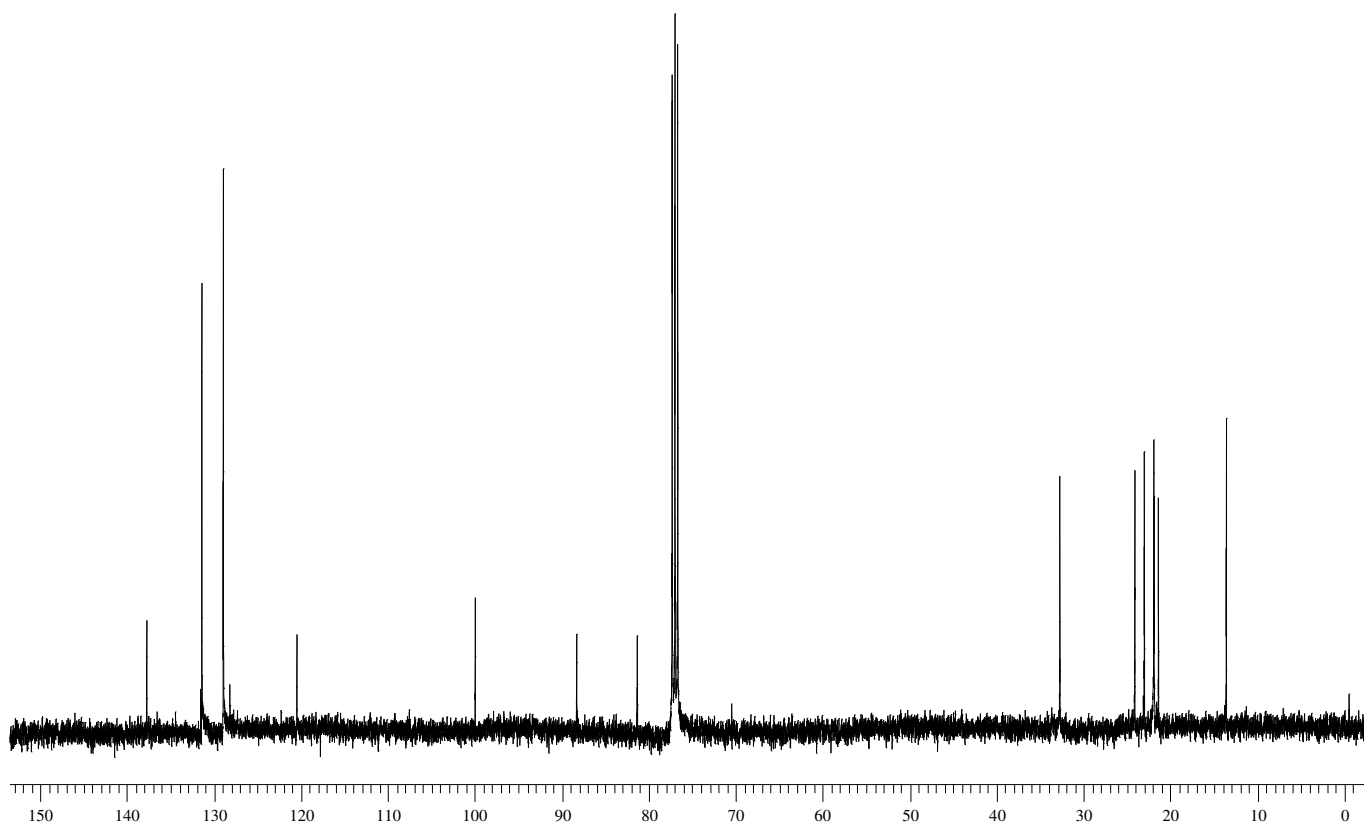
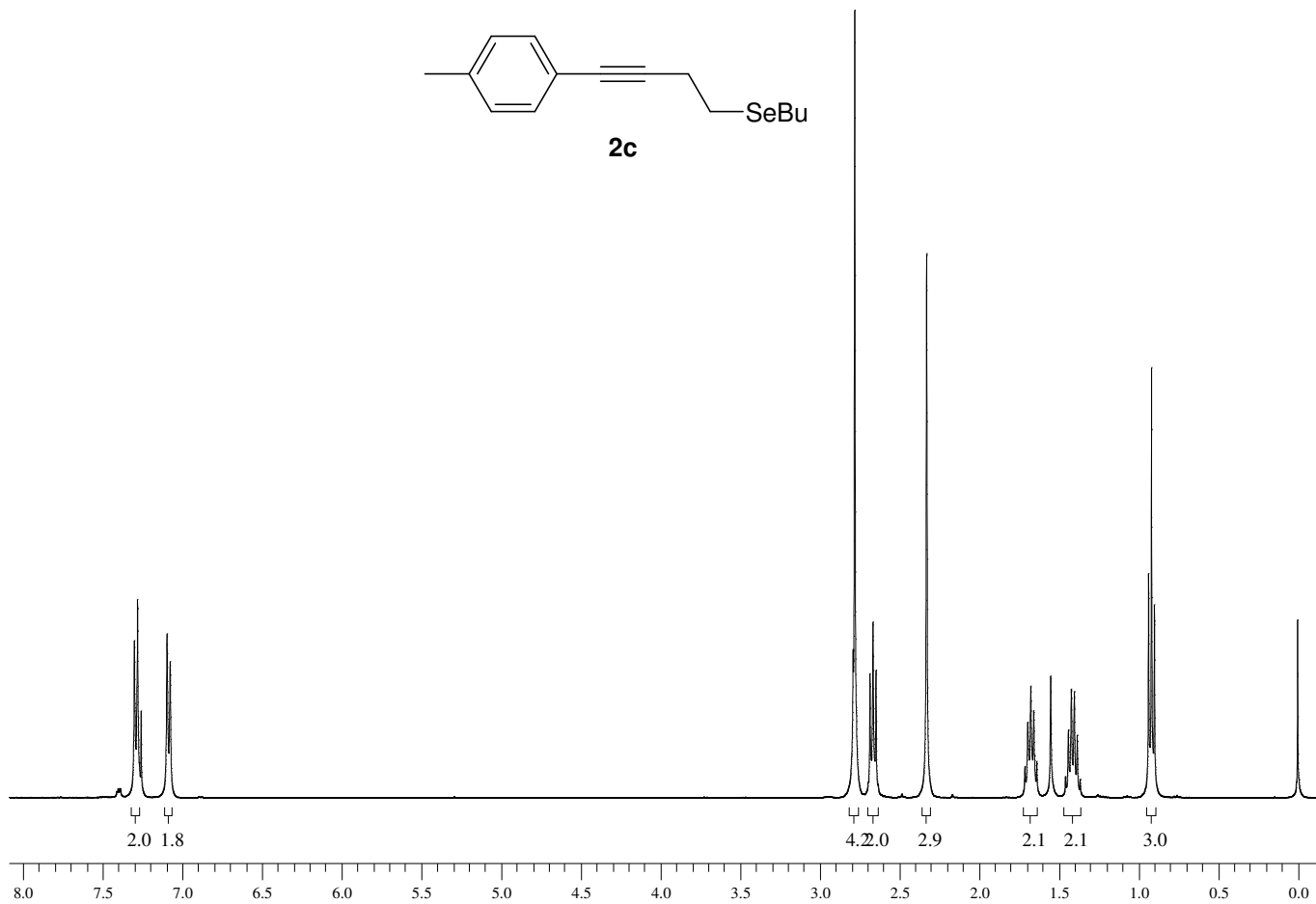
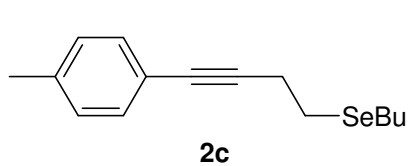
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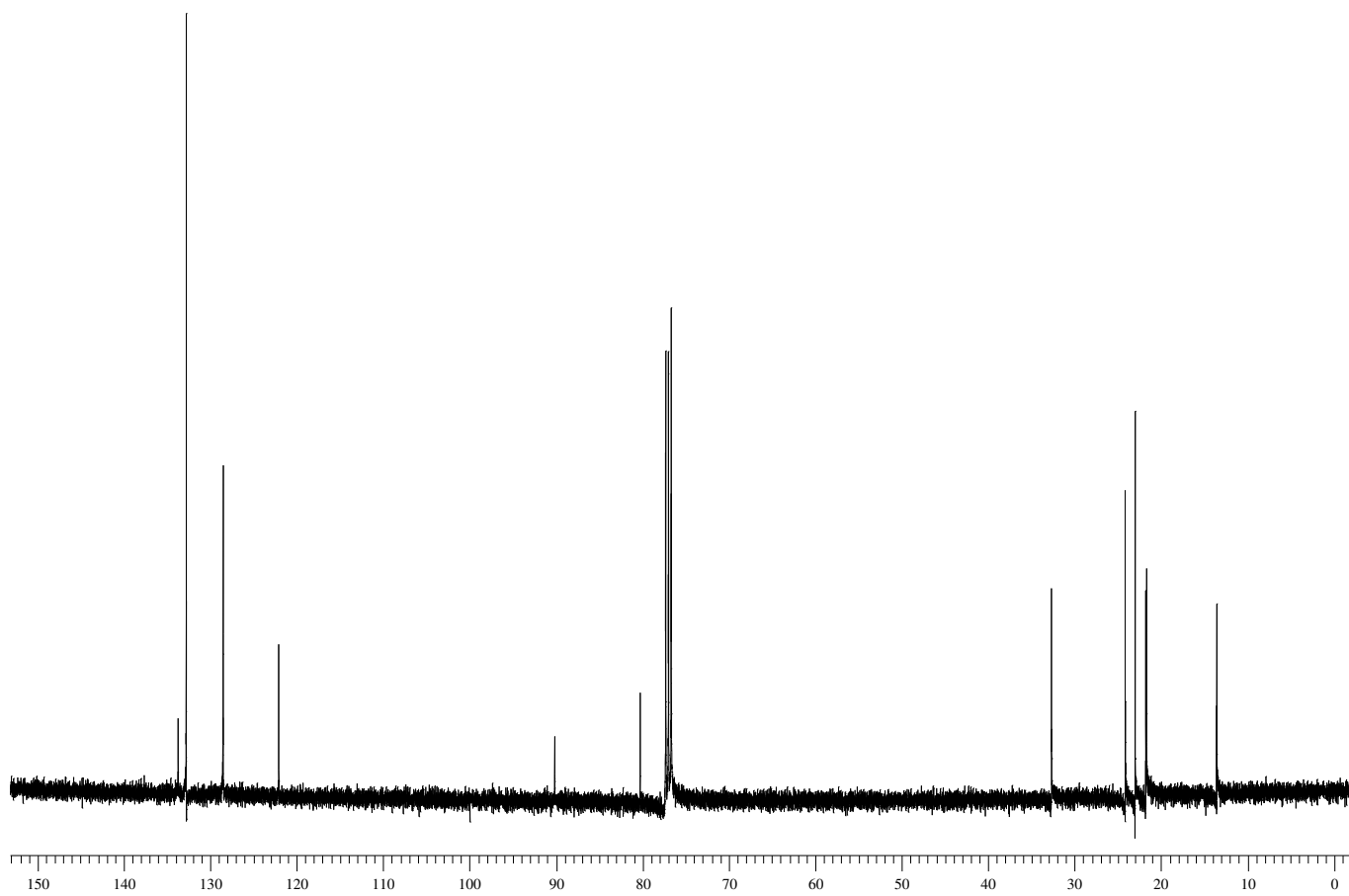
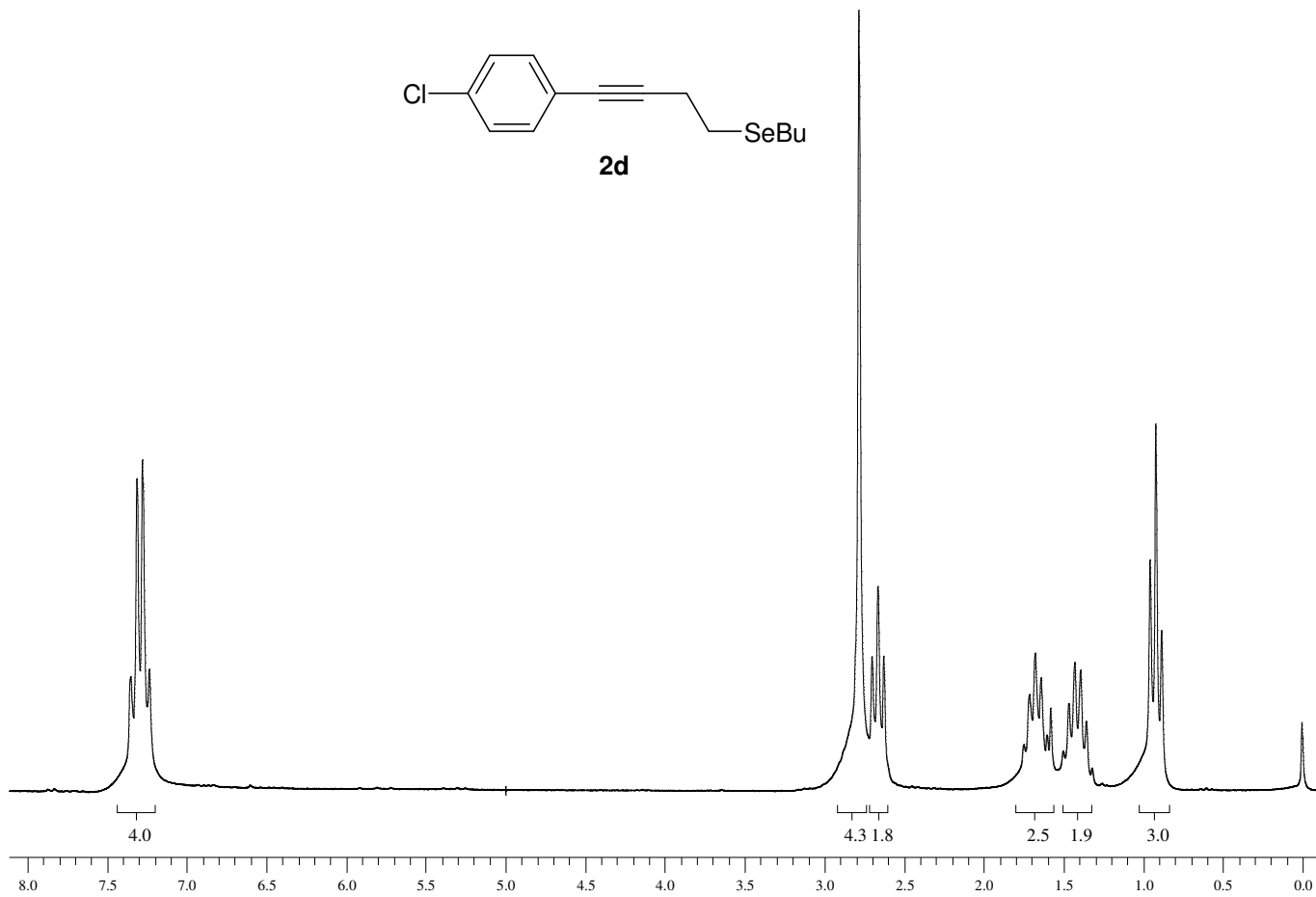
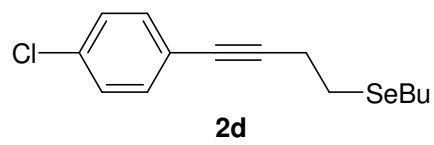
1) Alves, D.; Luchese, C.; Nogueira, C. W.; Zeni, G. *J. Org. Chem.* **2007**, *72*, 6726.

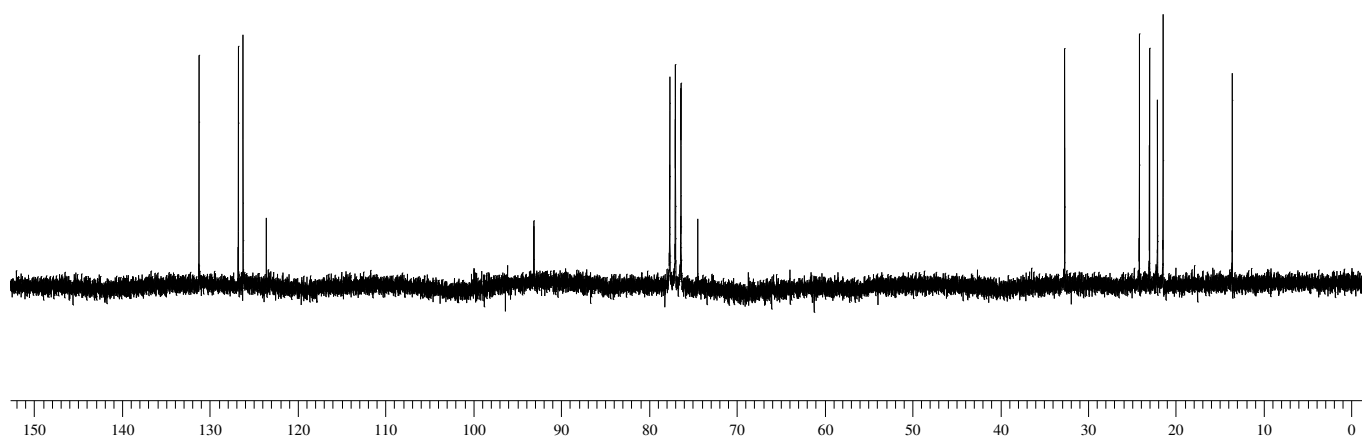
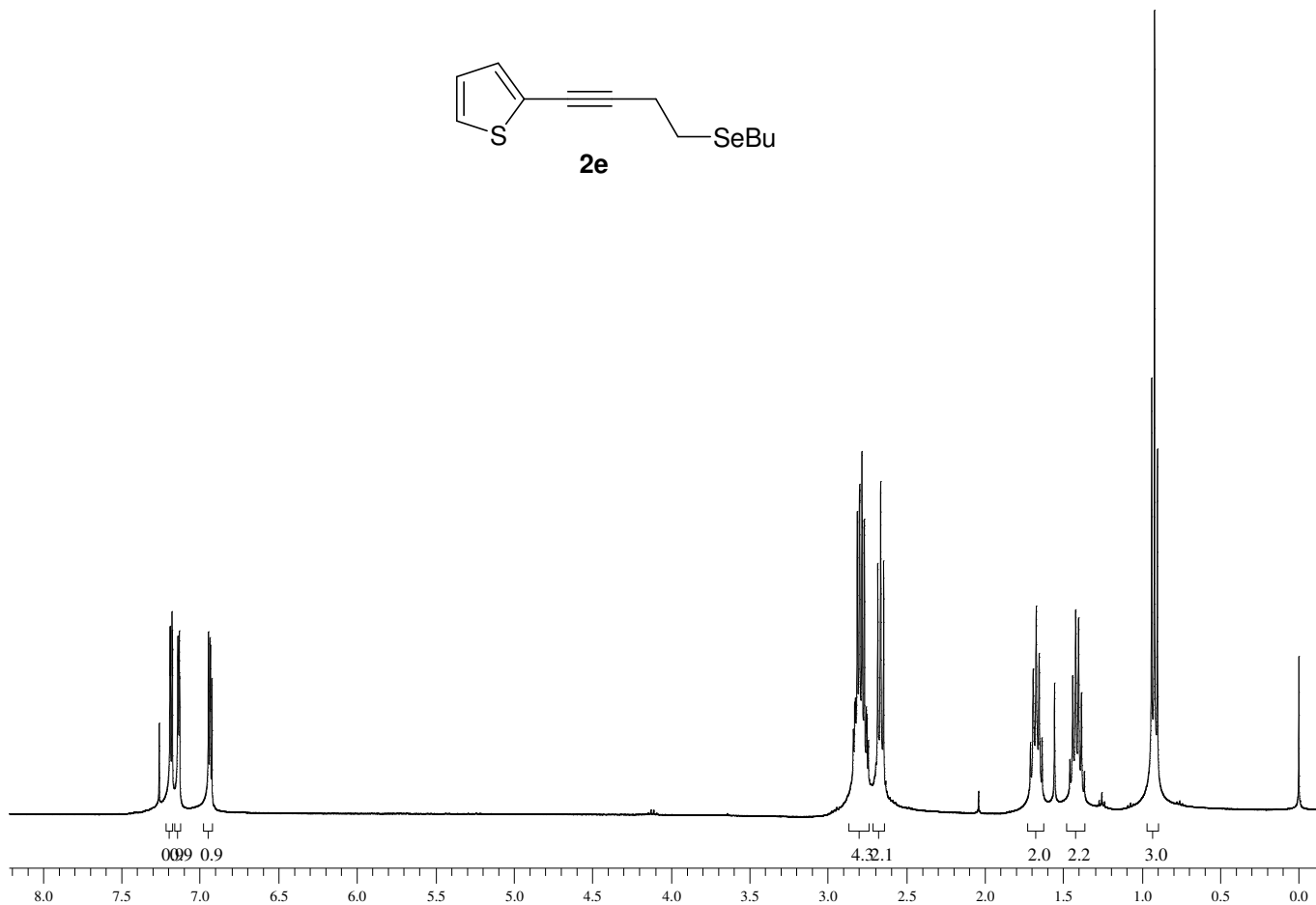
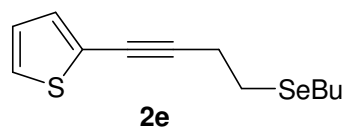
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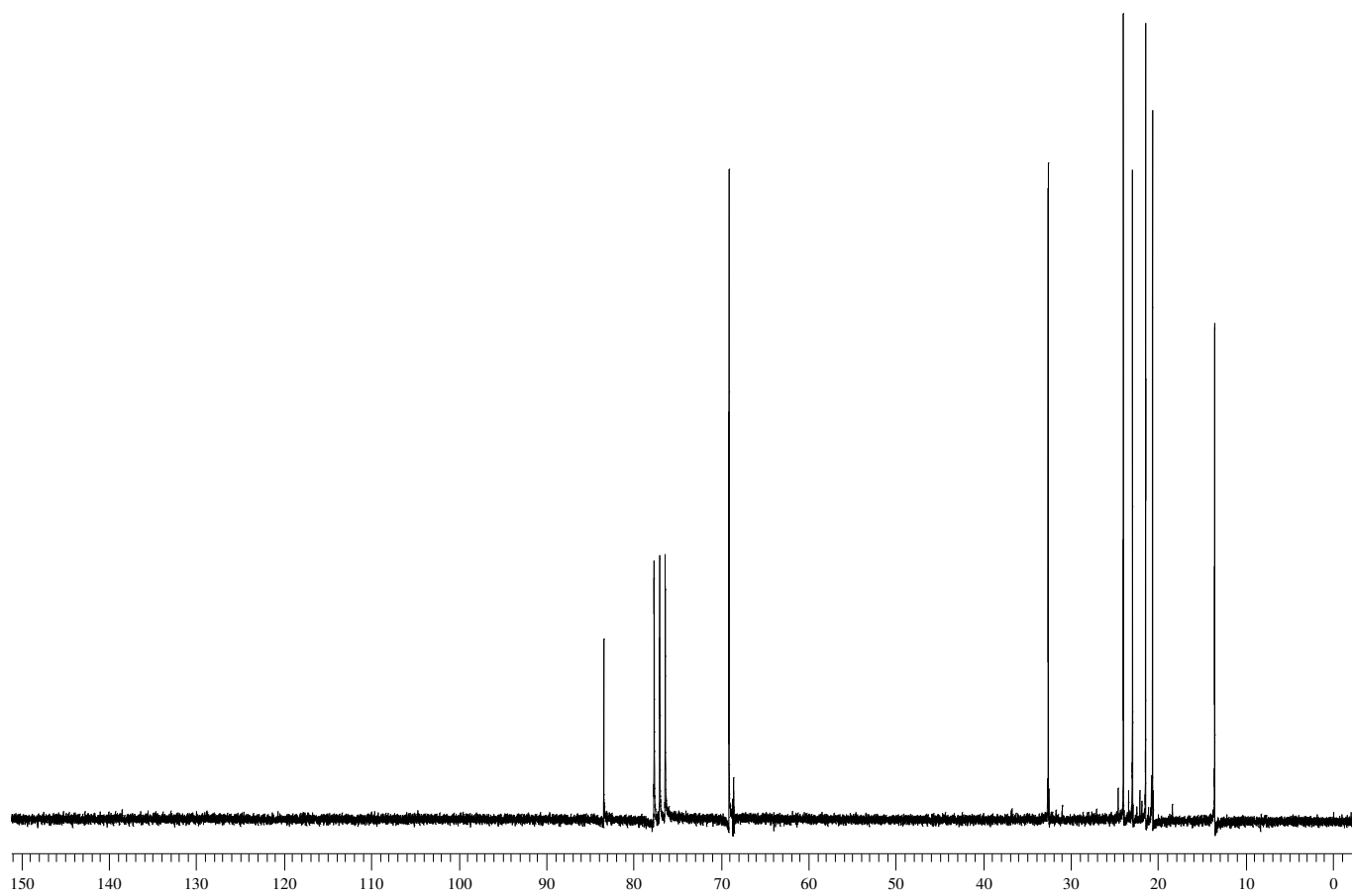
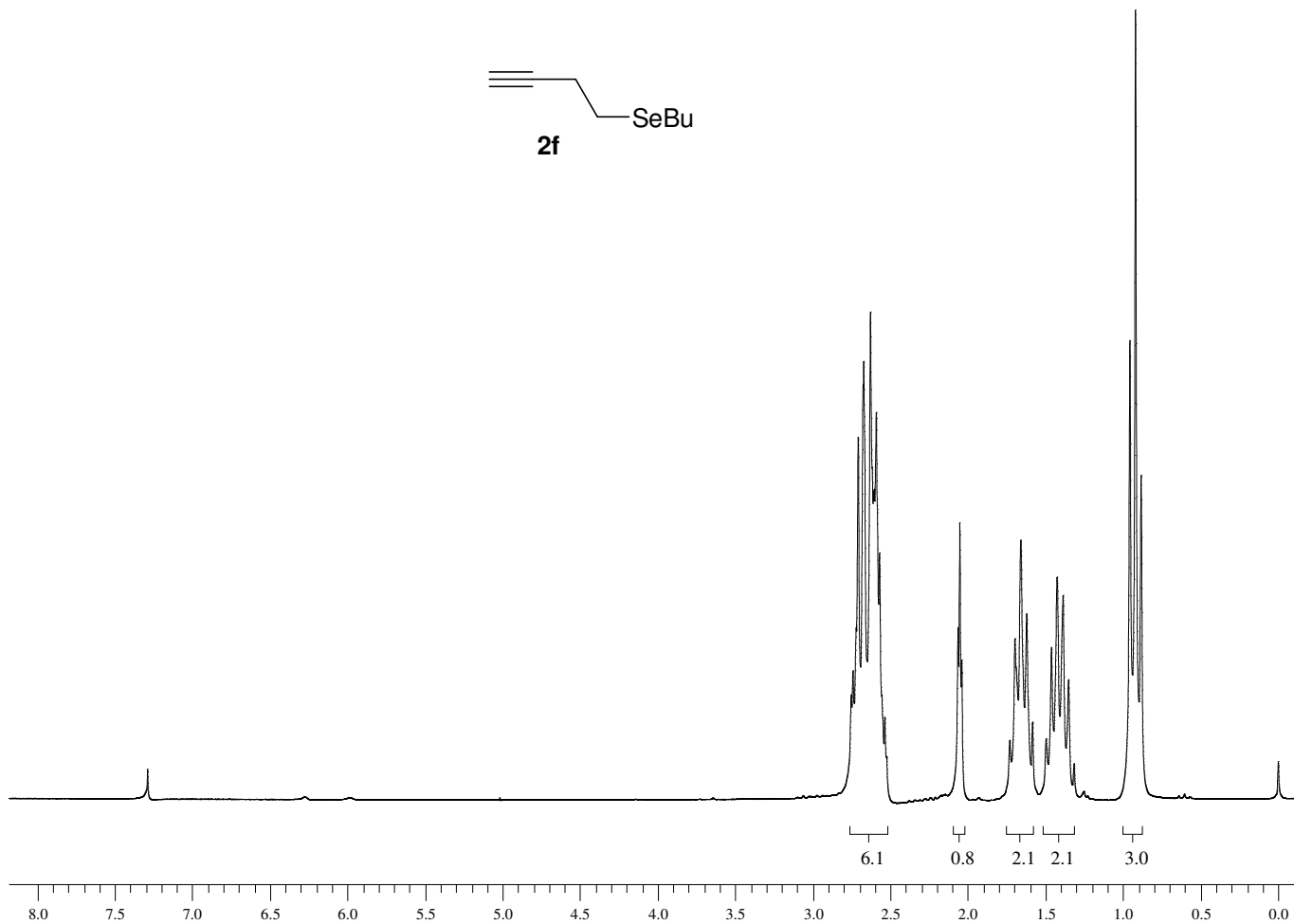
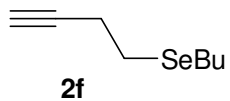


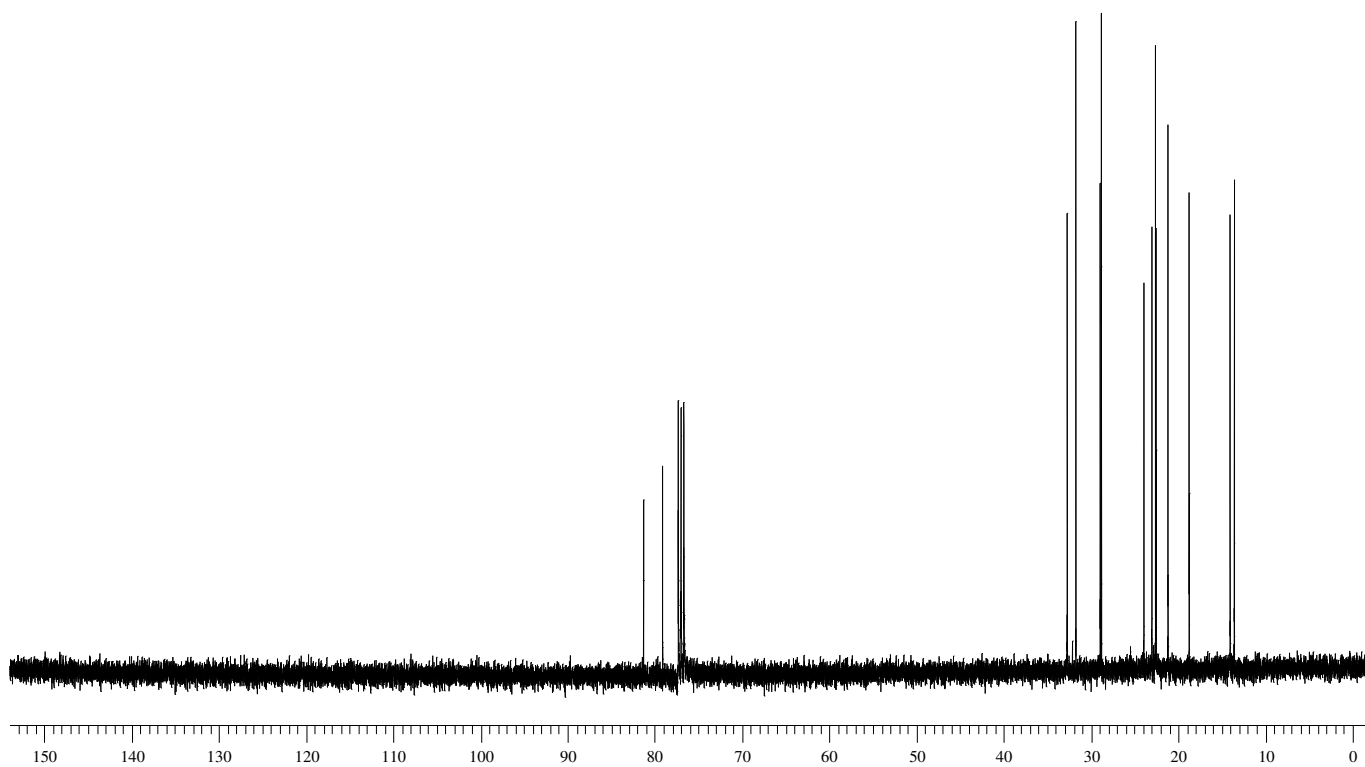
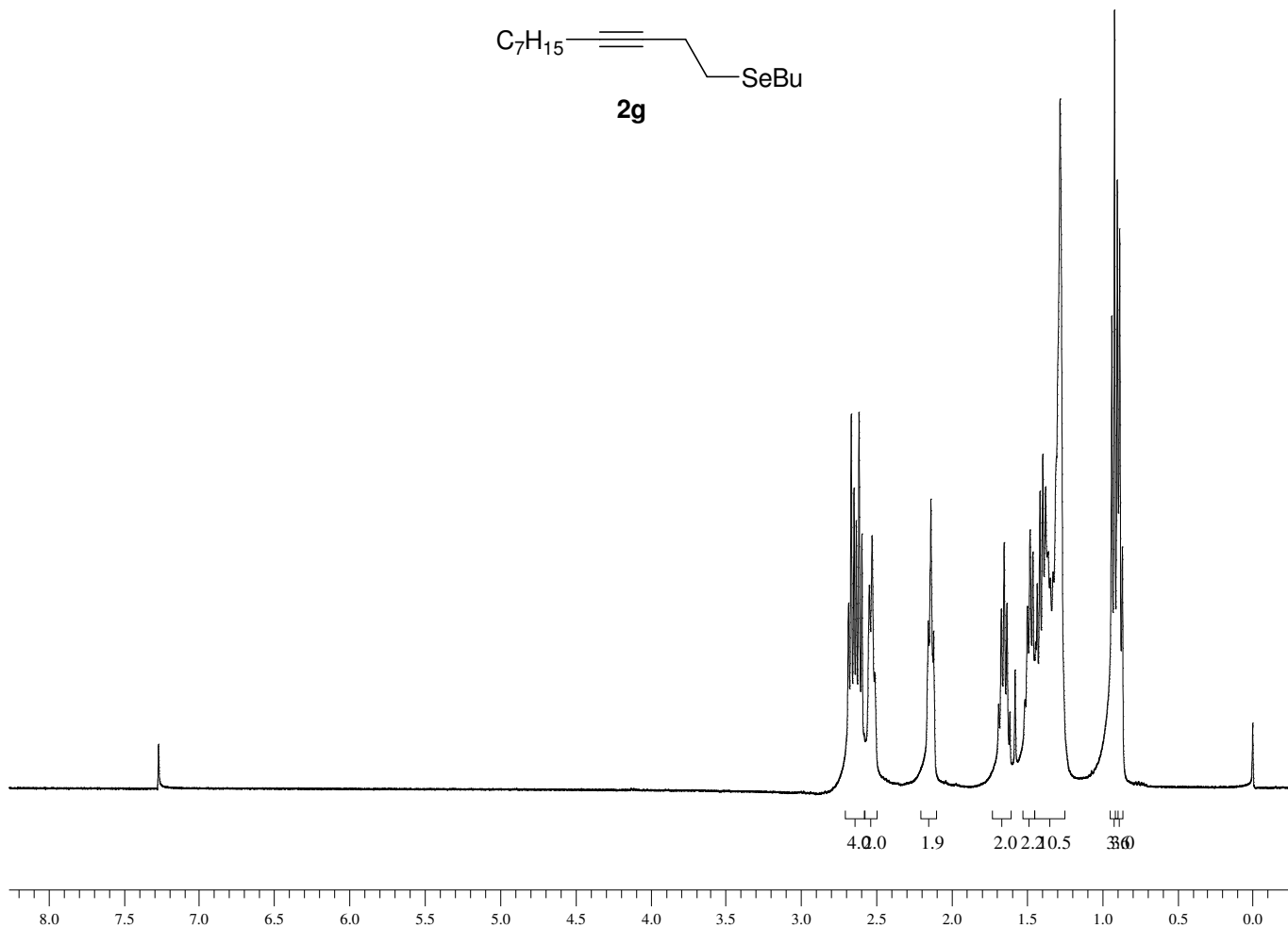
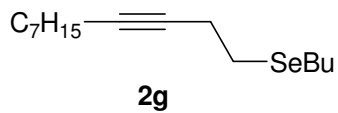


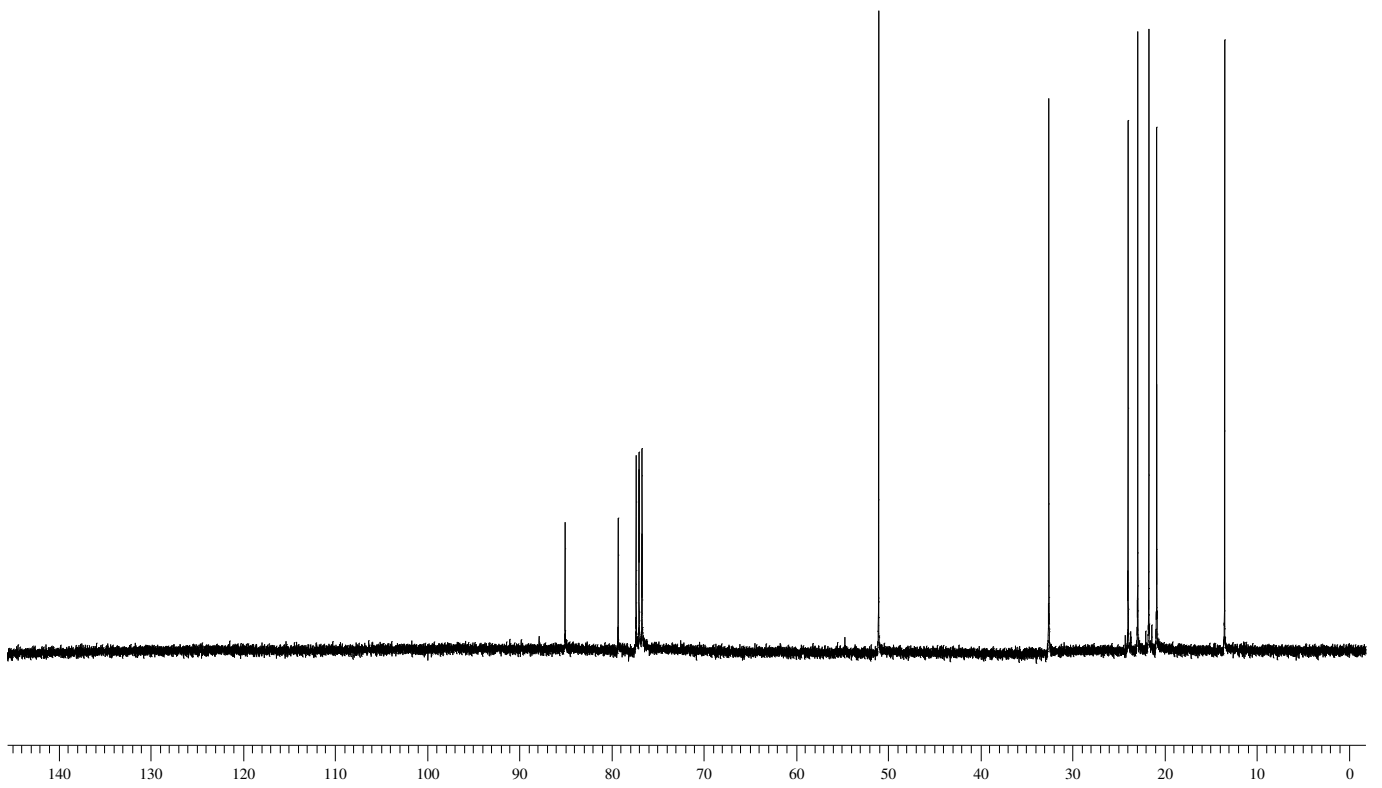
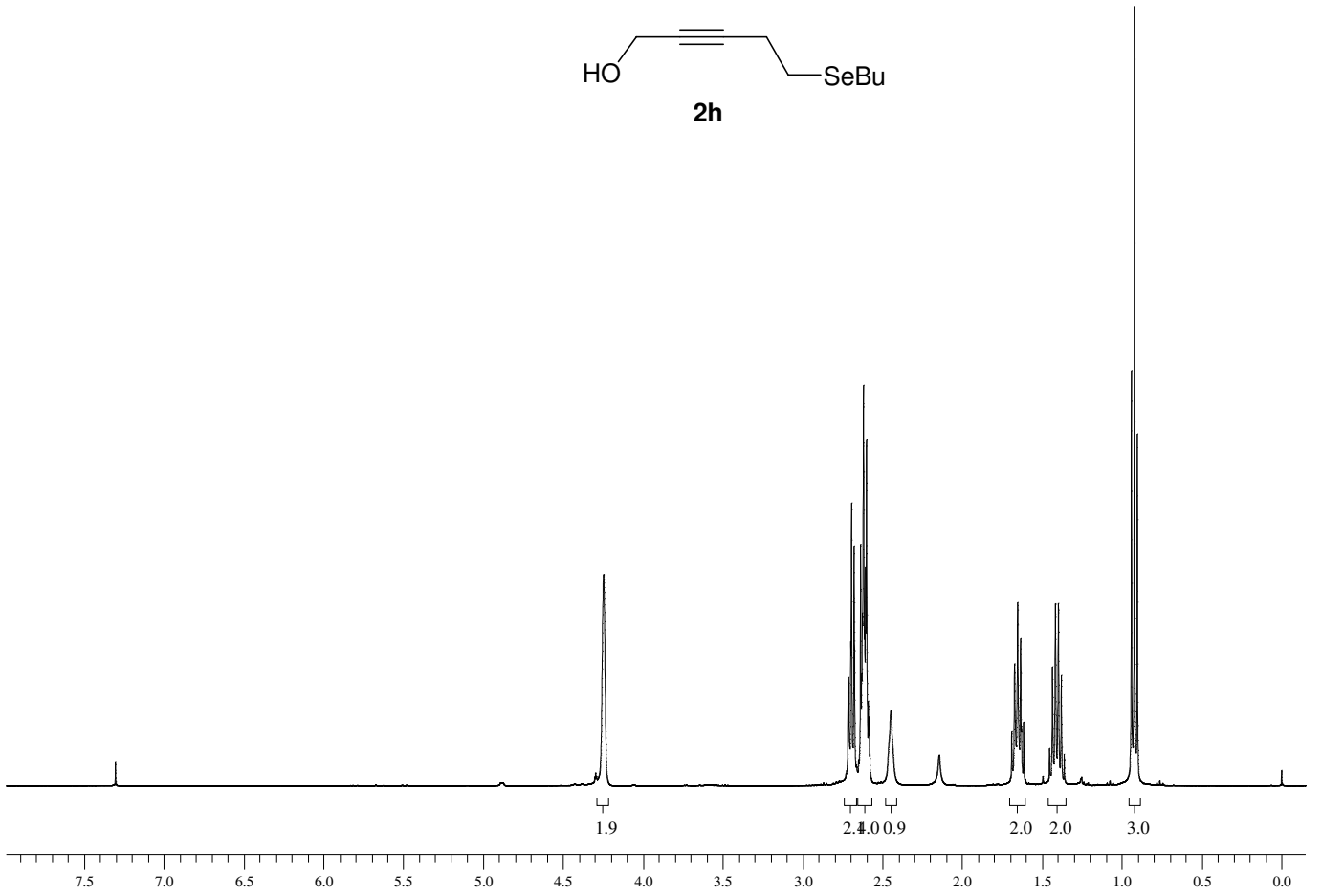
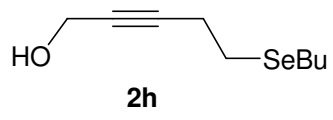


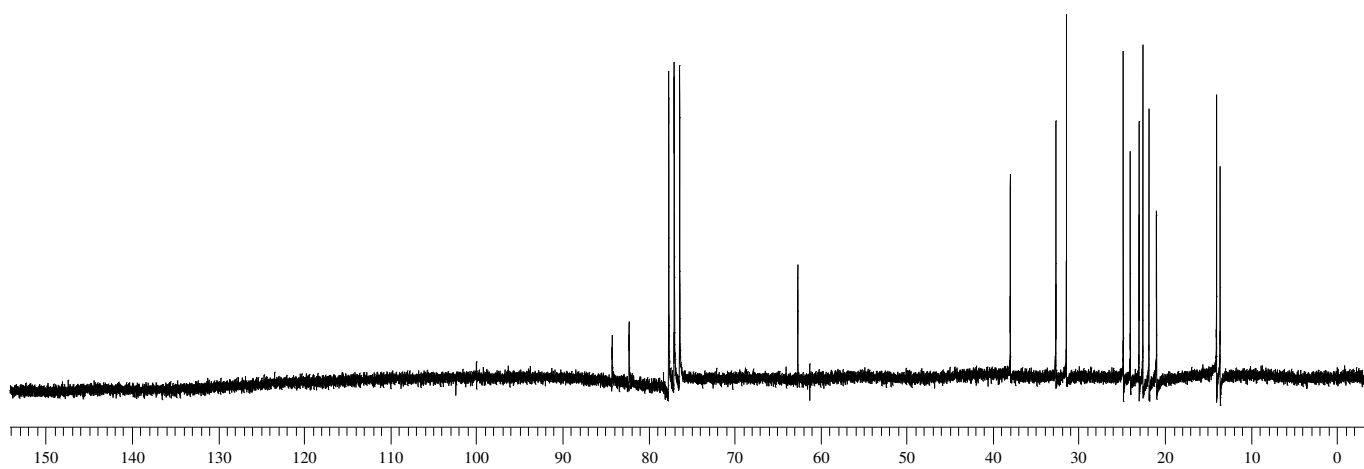
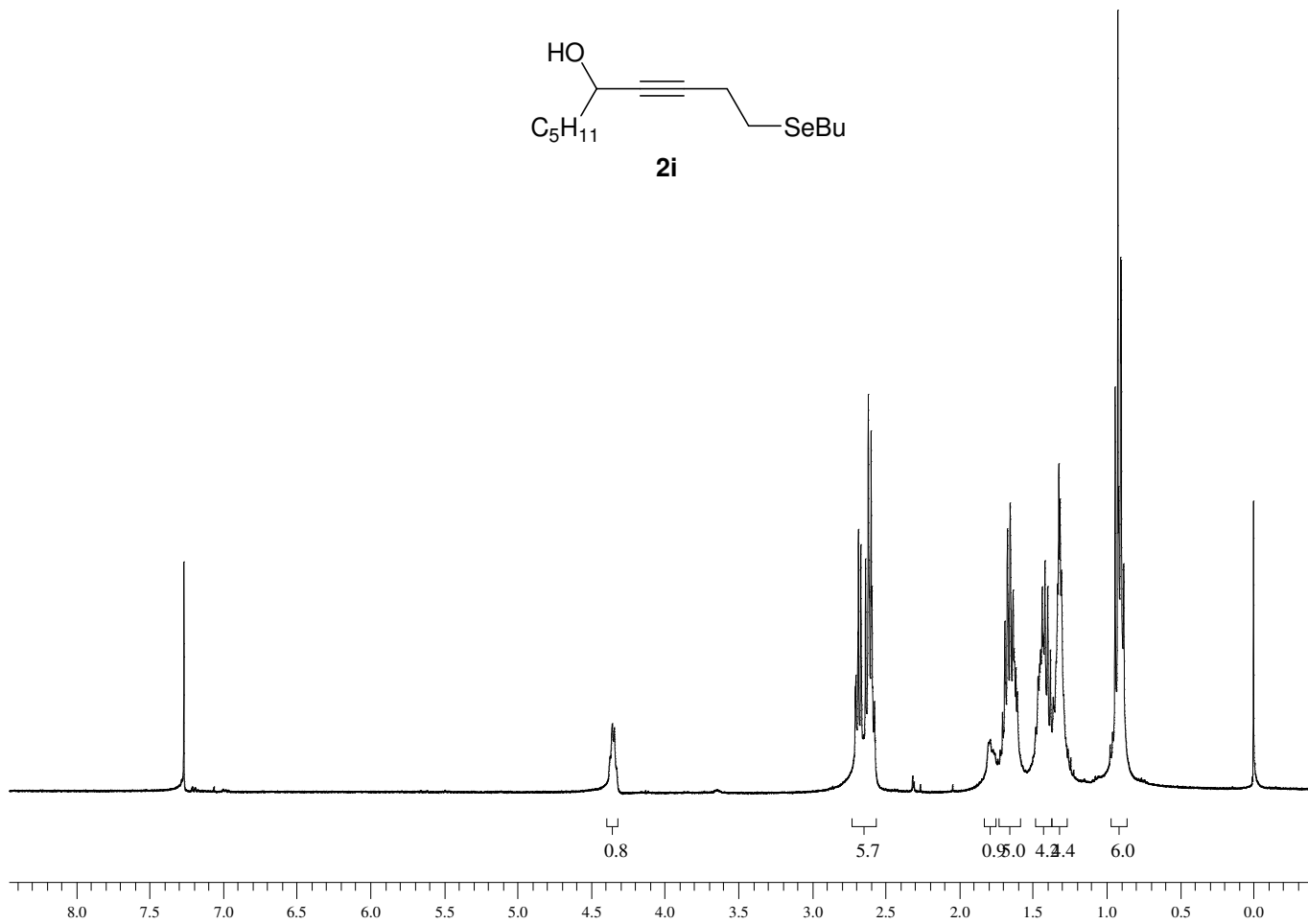
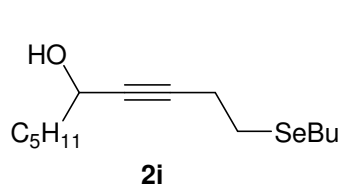


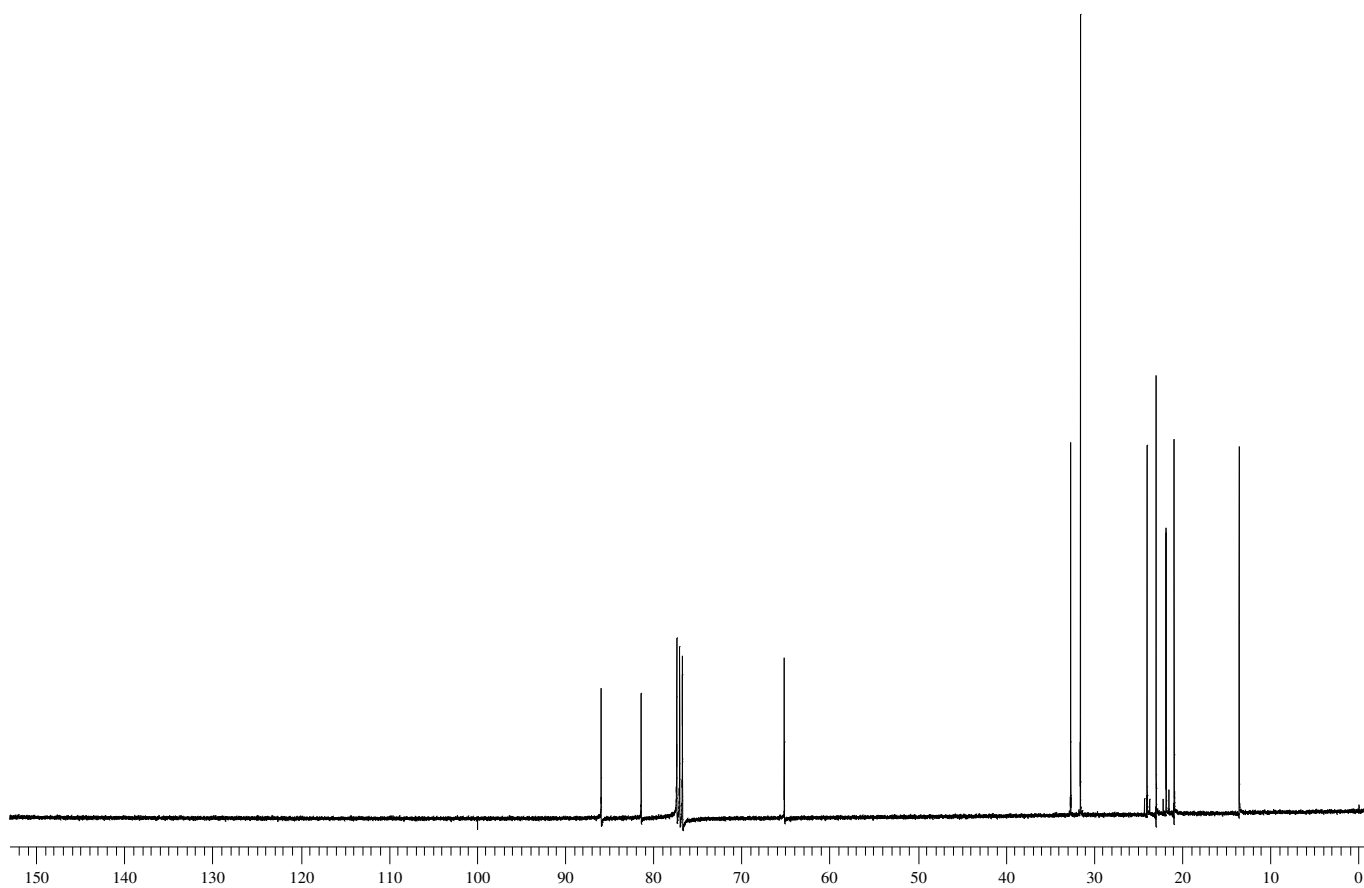
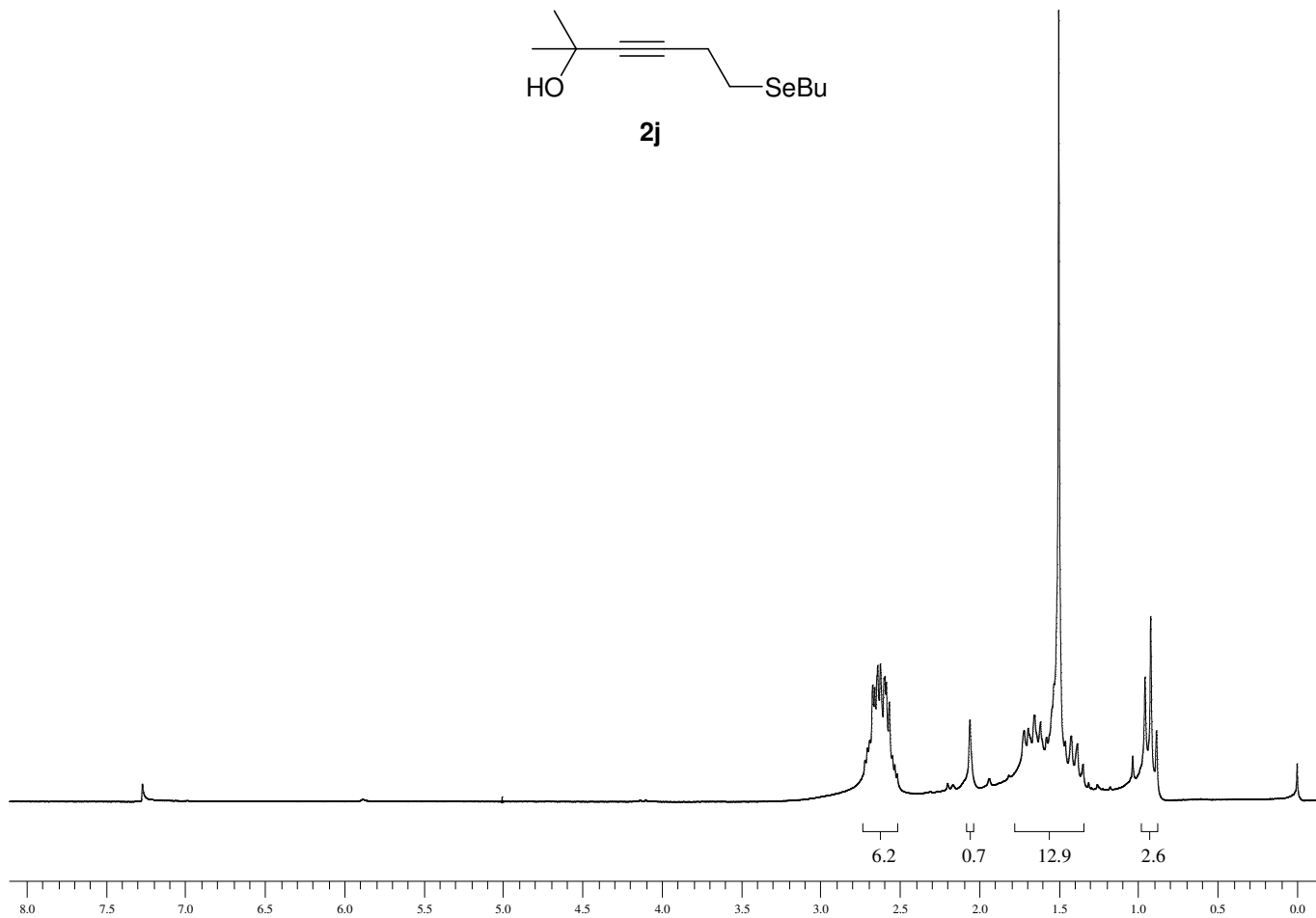
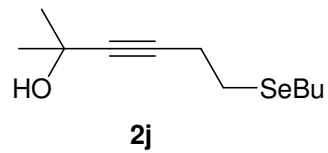


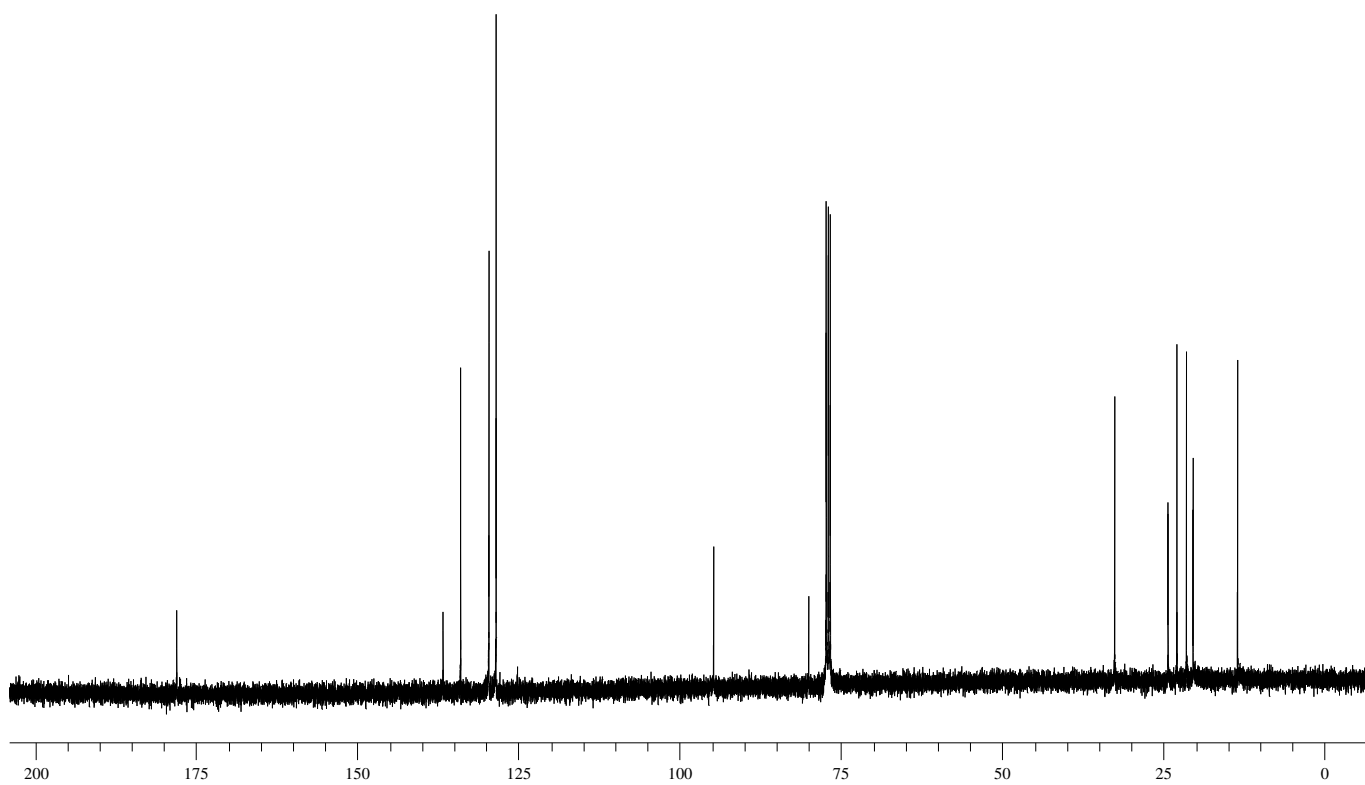
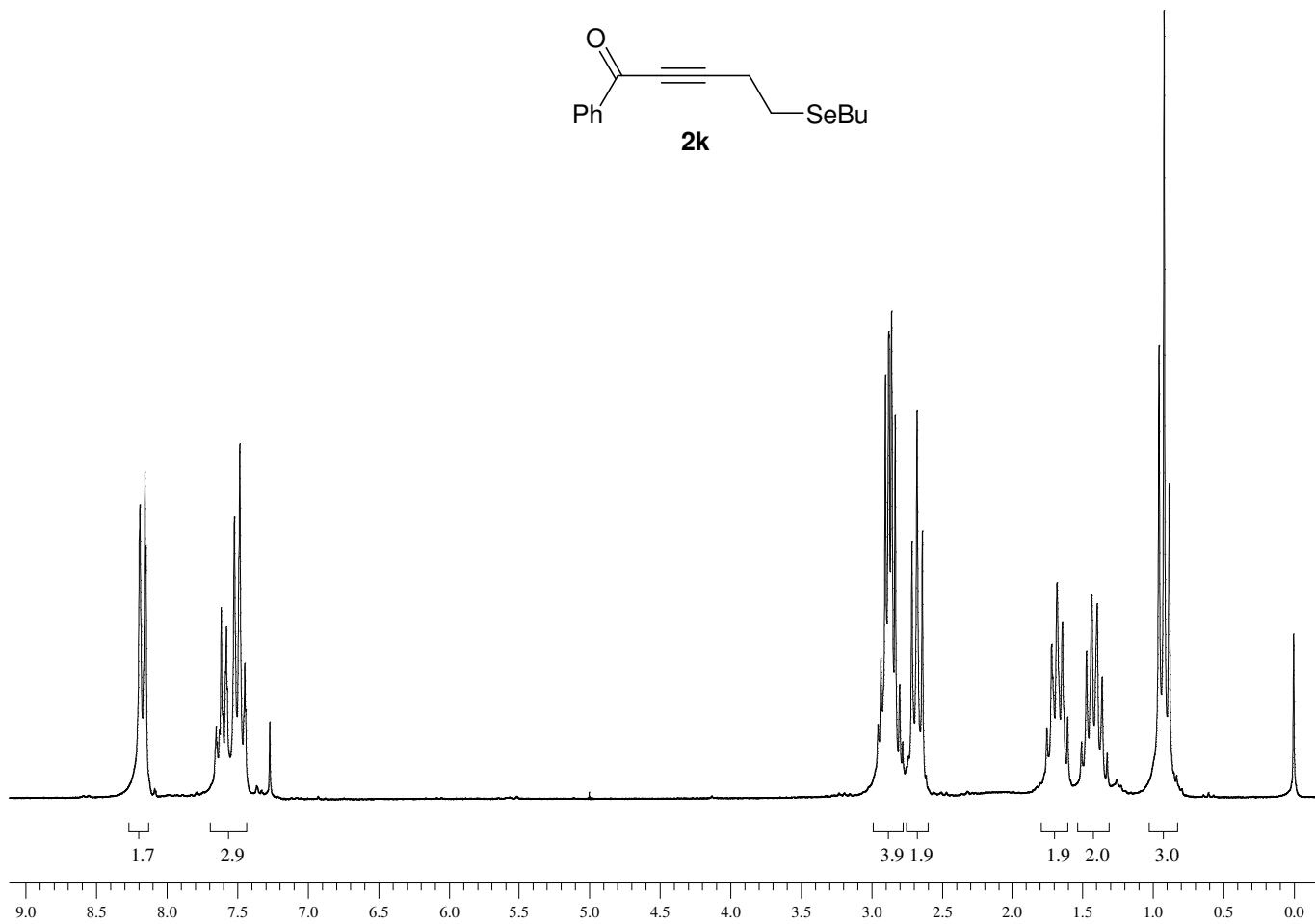
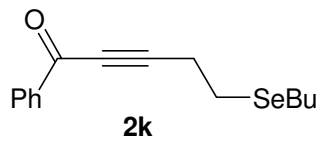


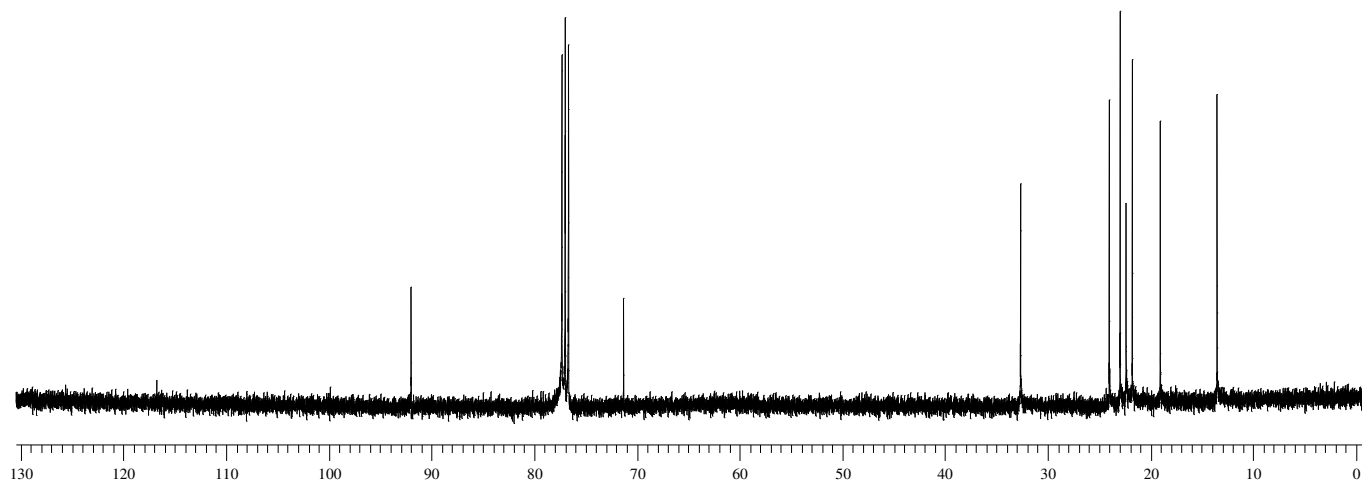
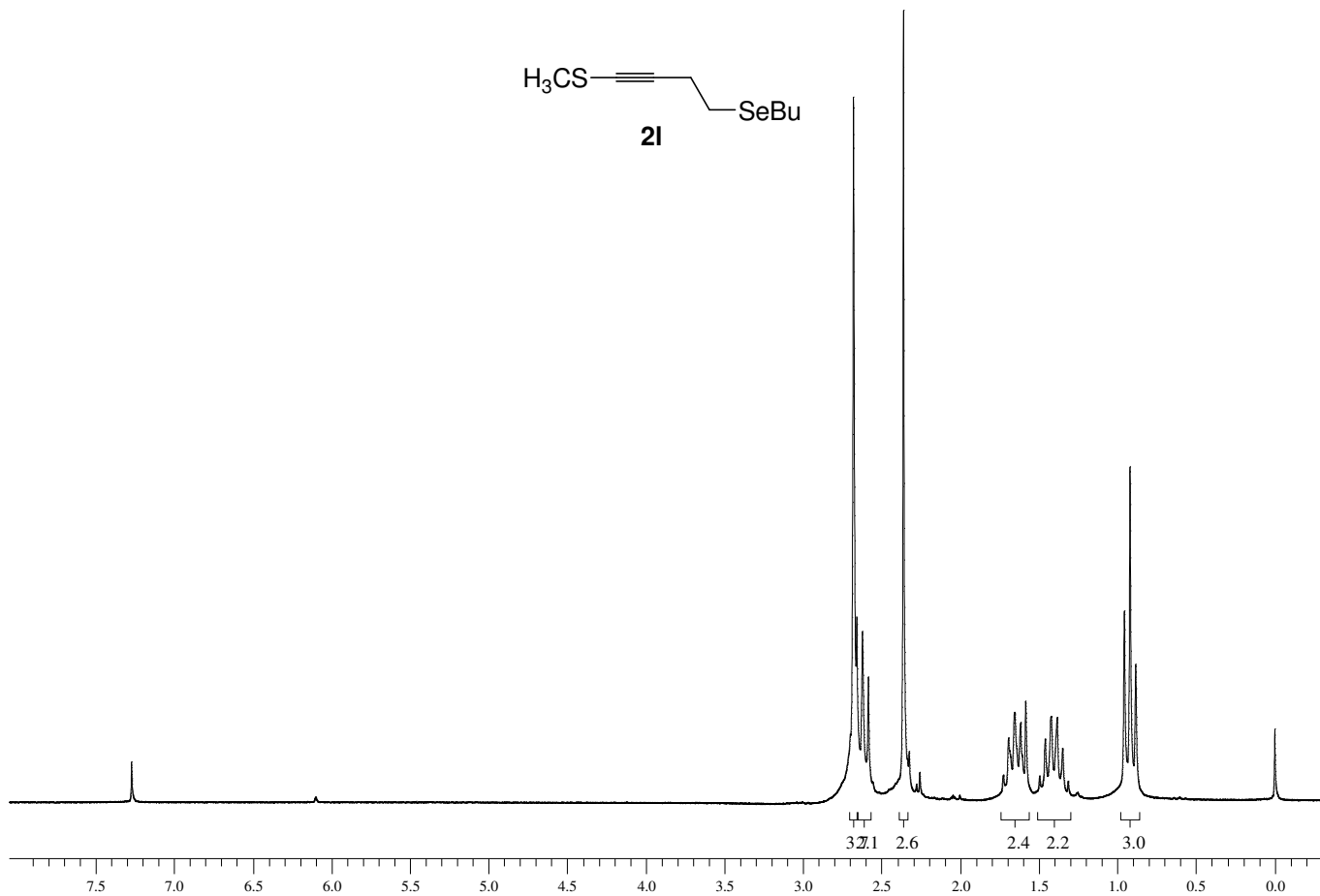
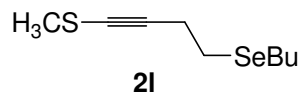


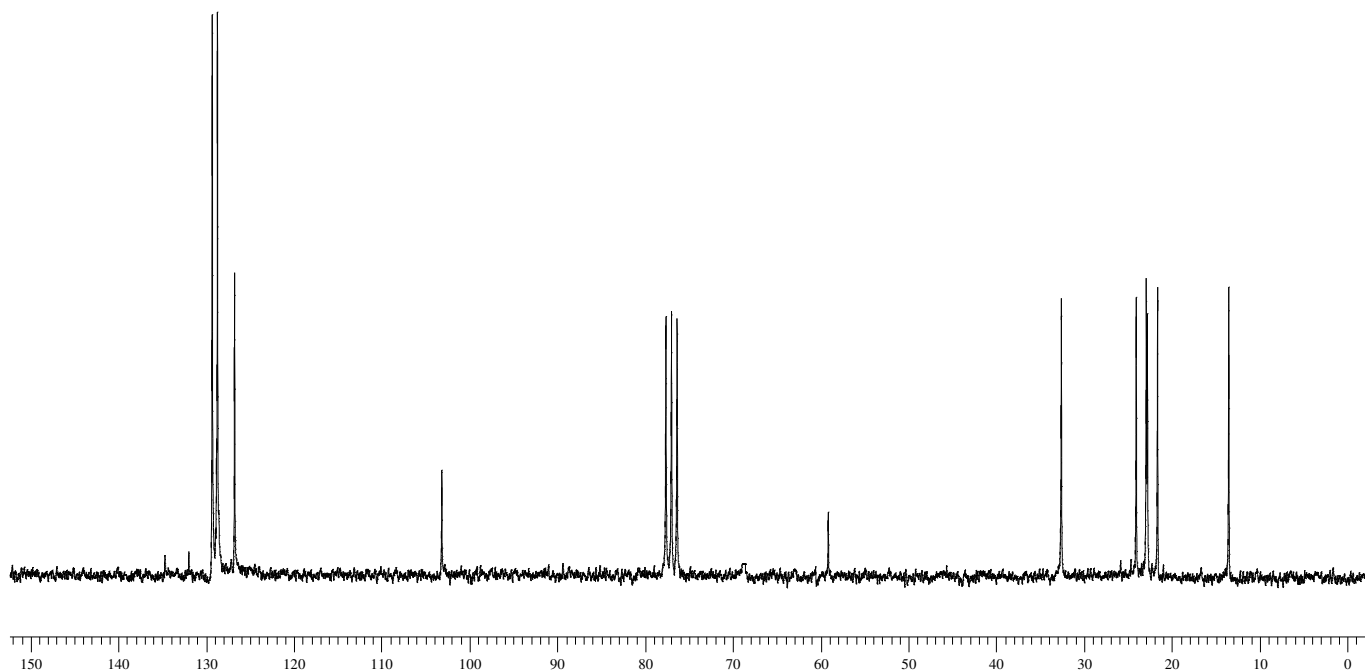
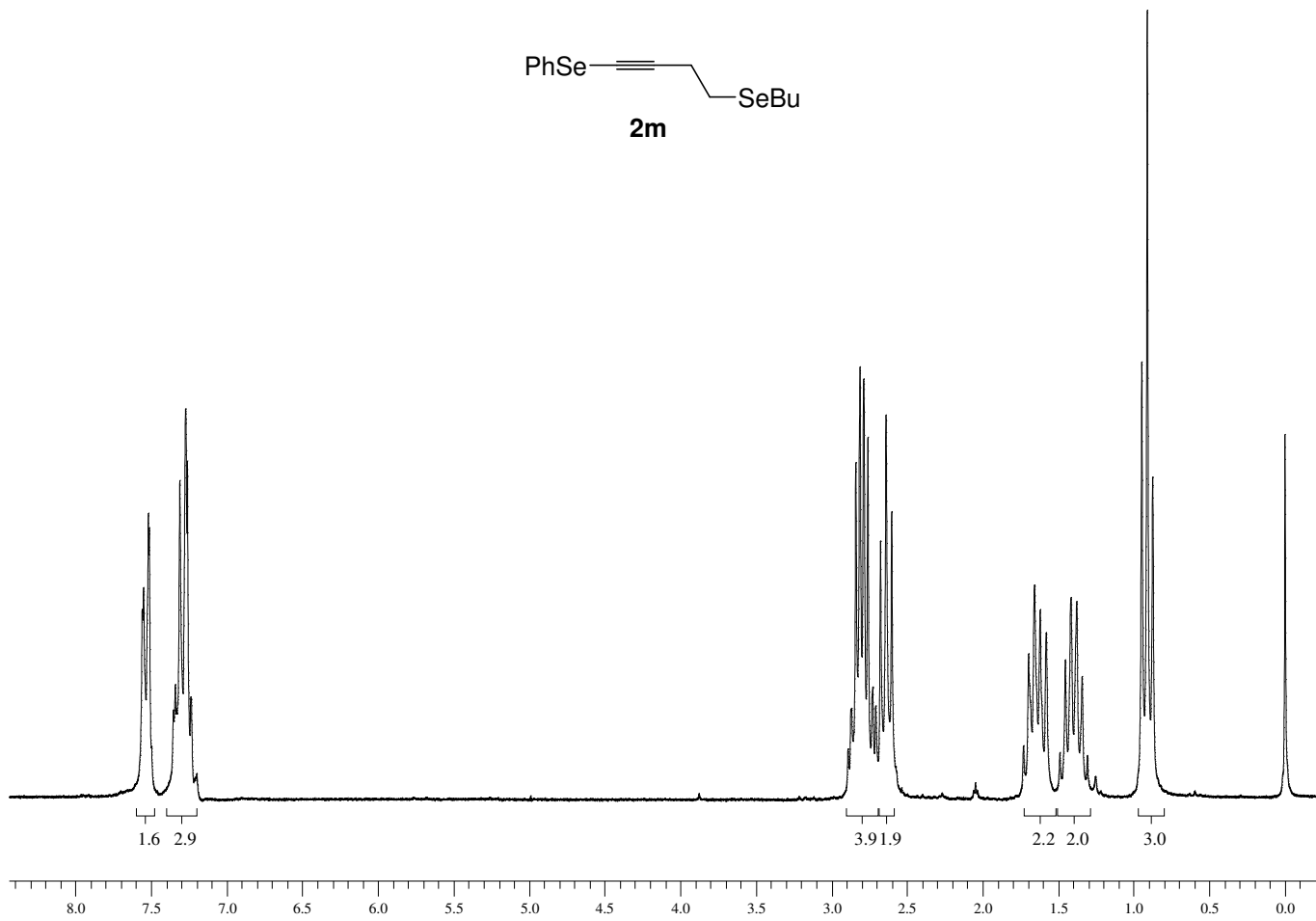
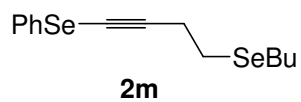


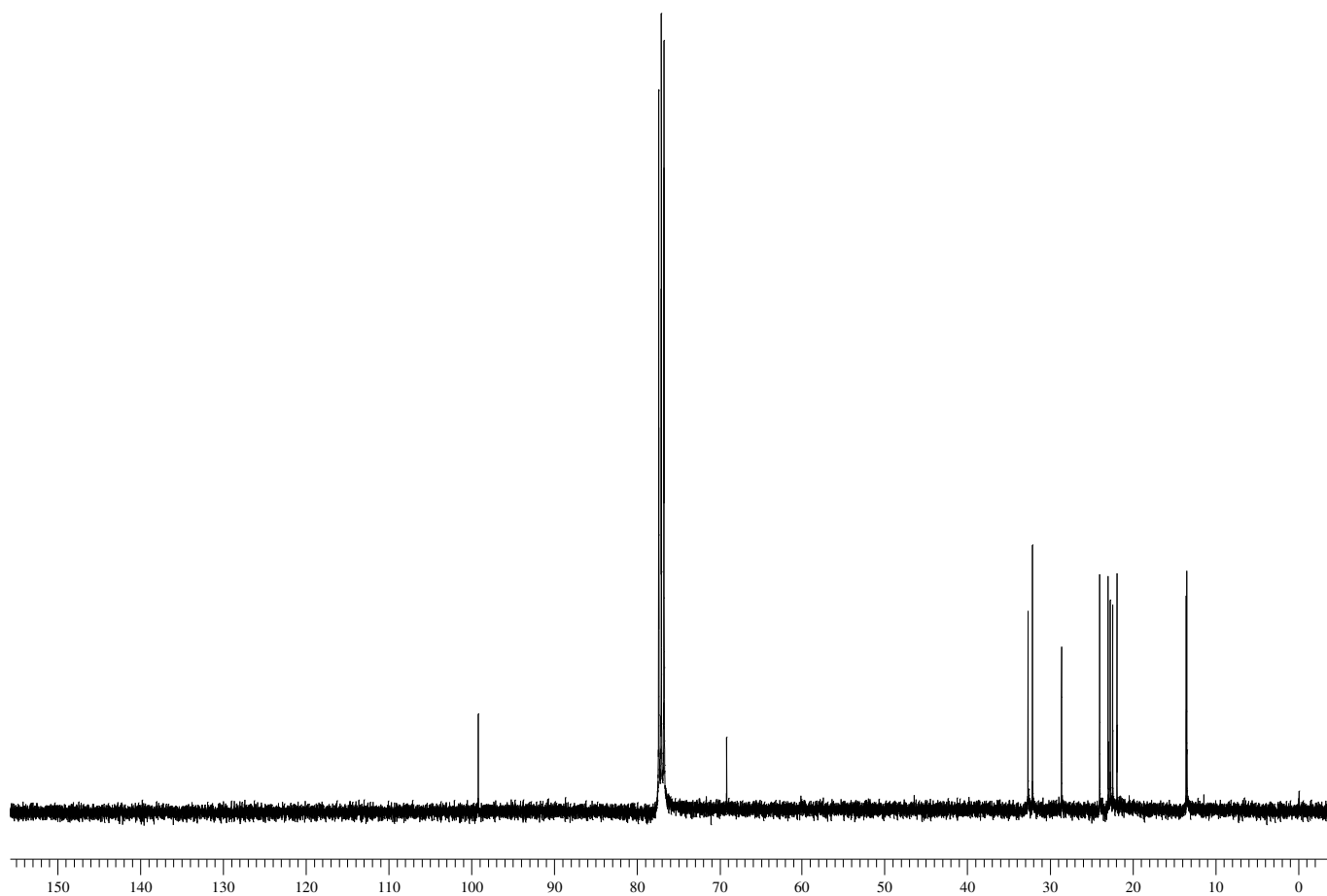
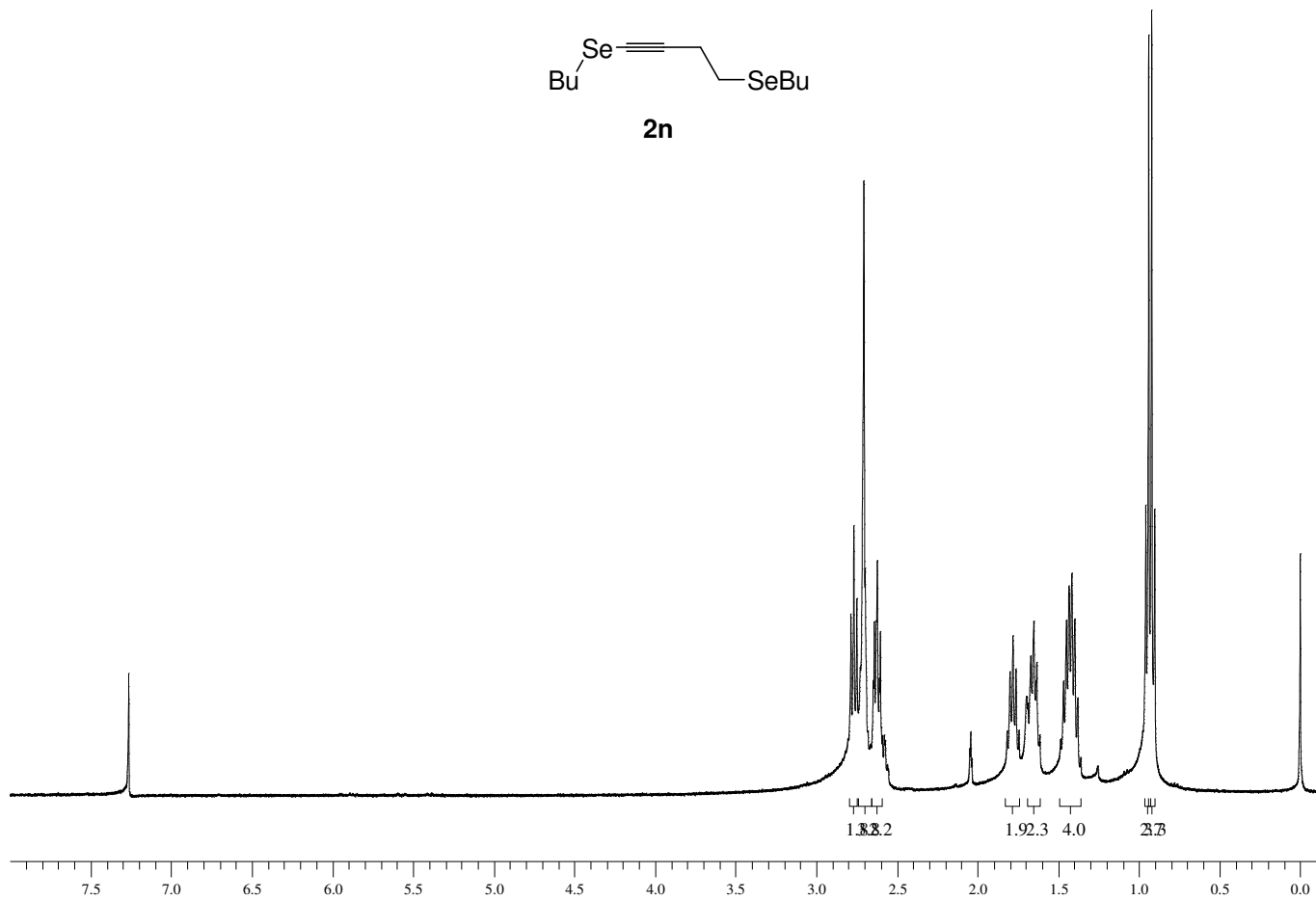
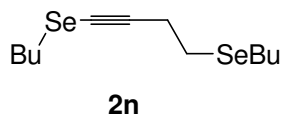


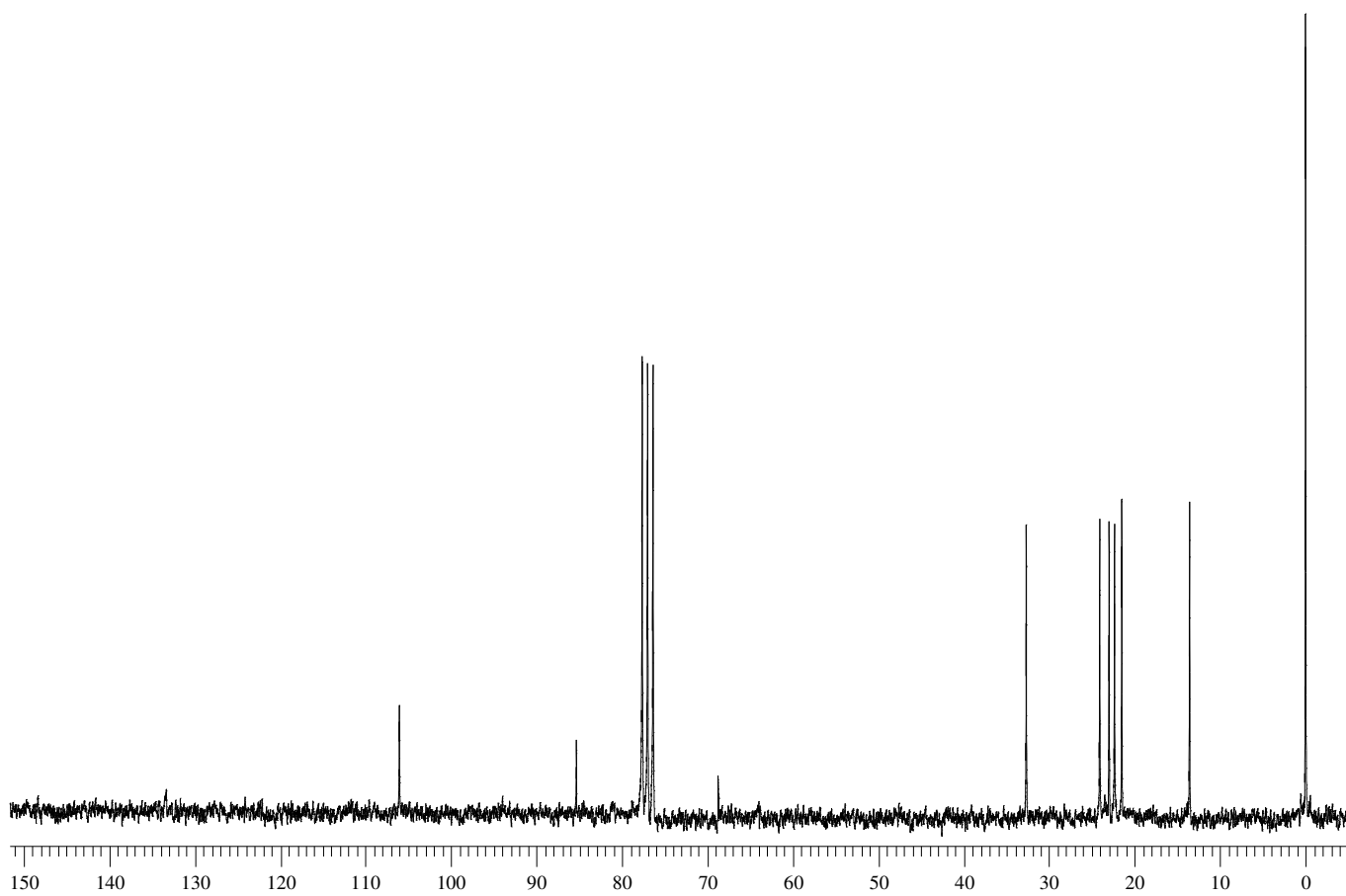
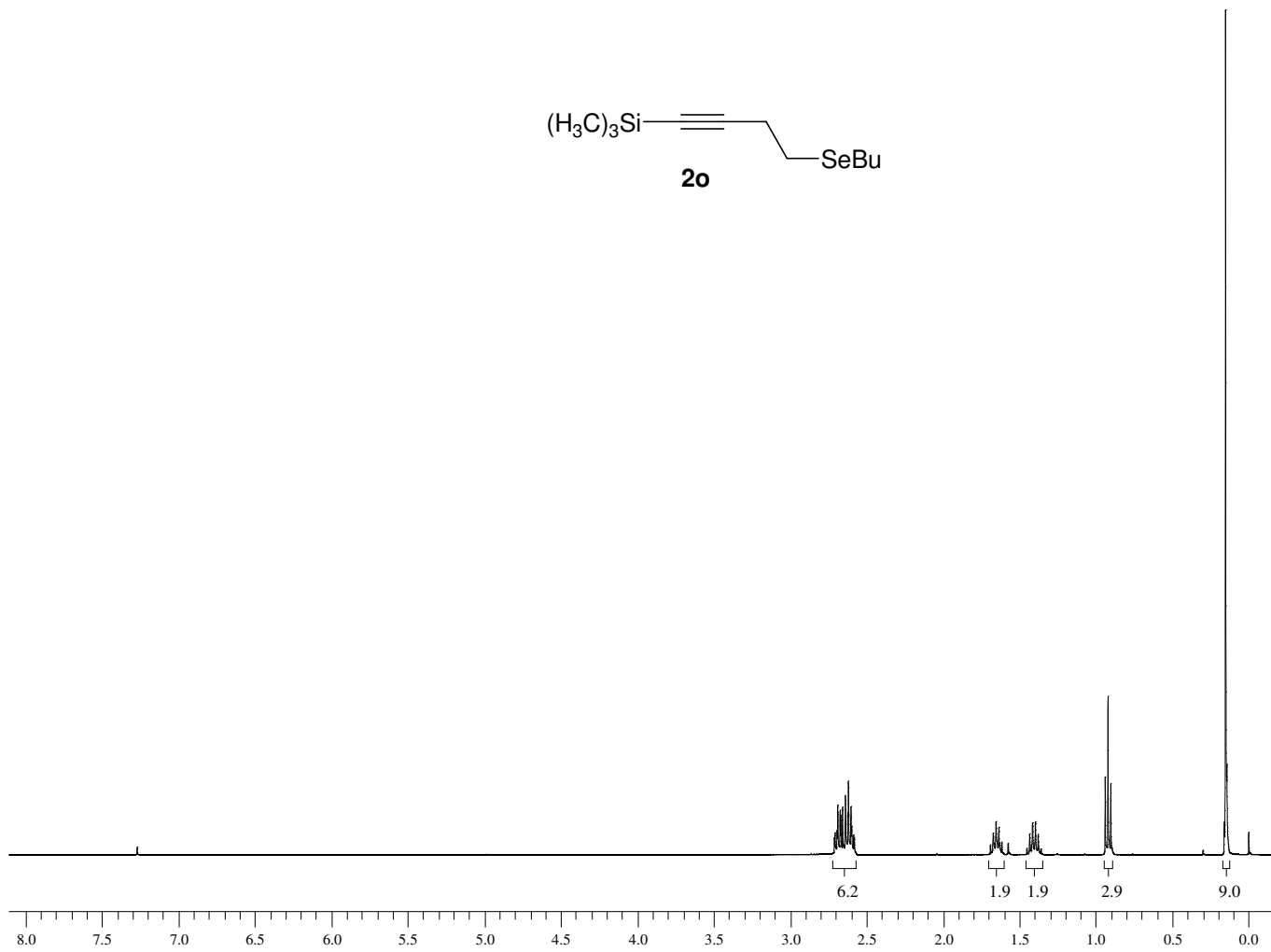
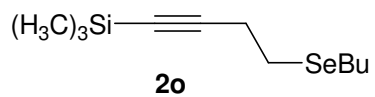


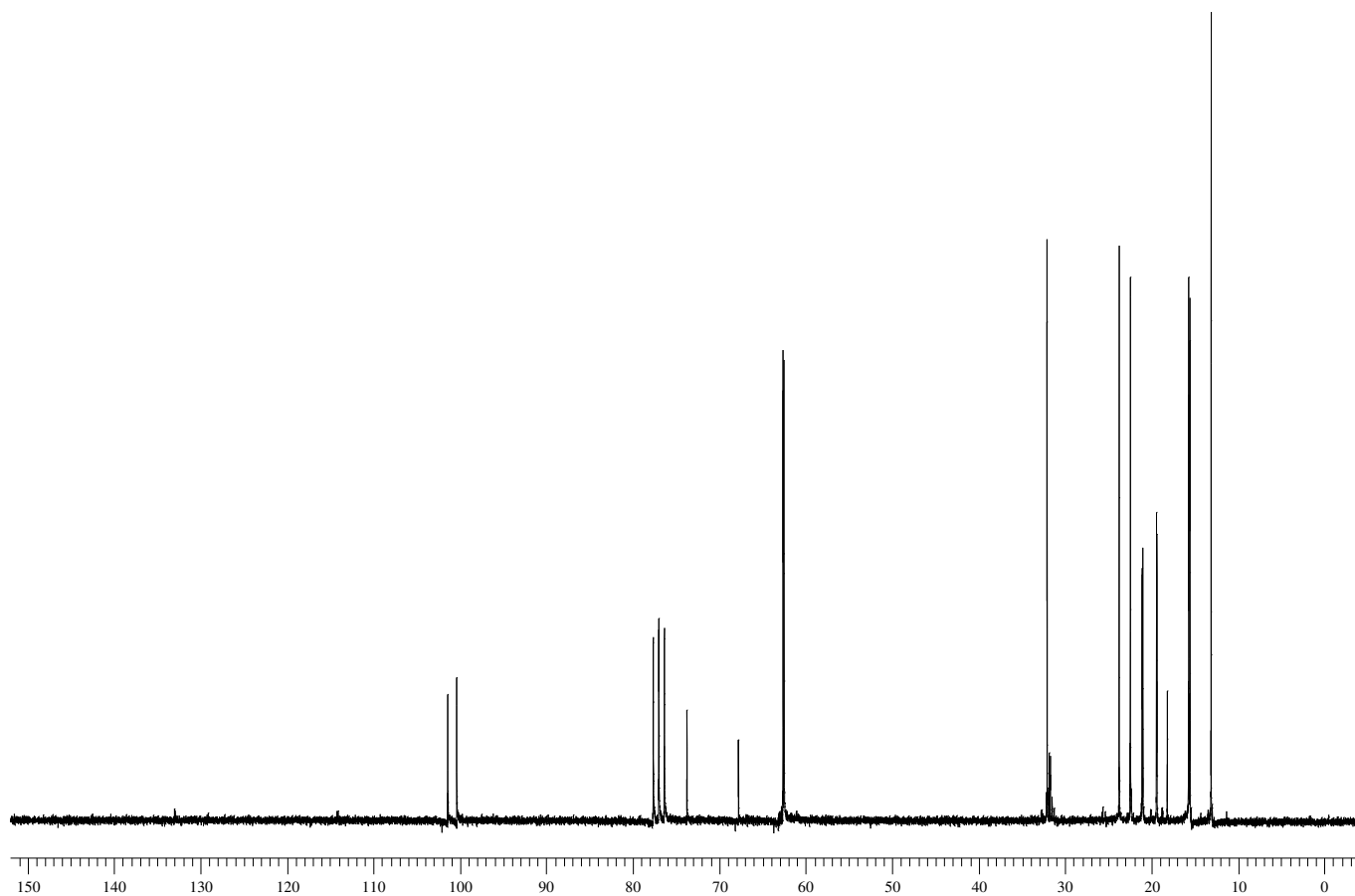
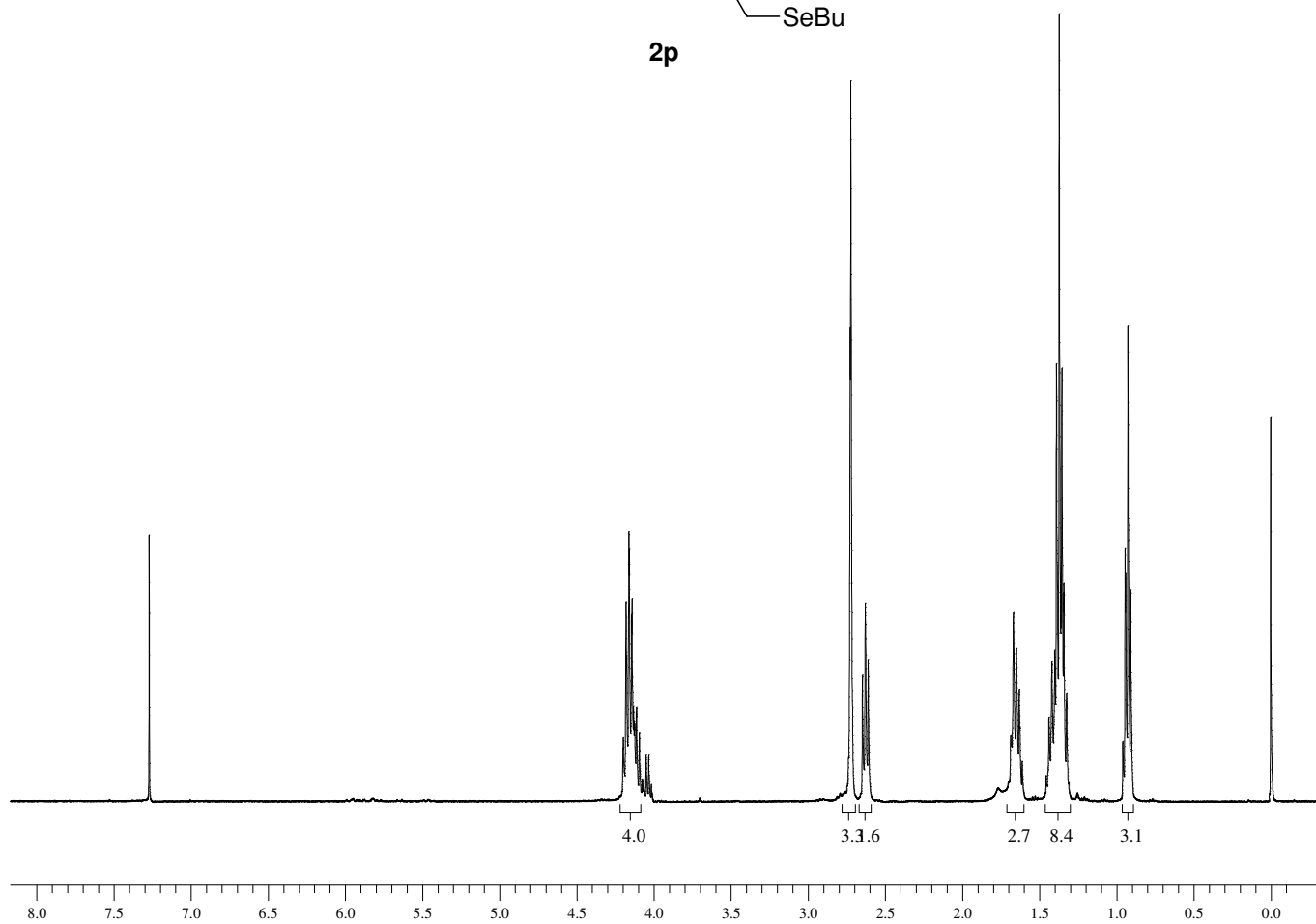
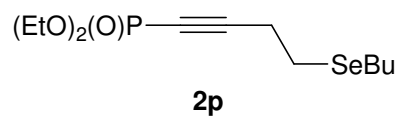


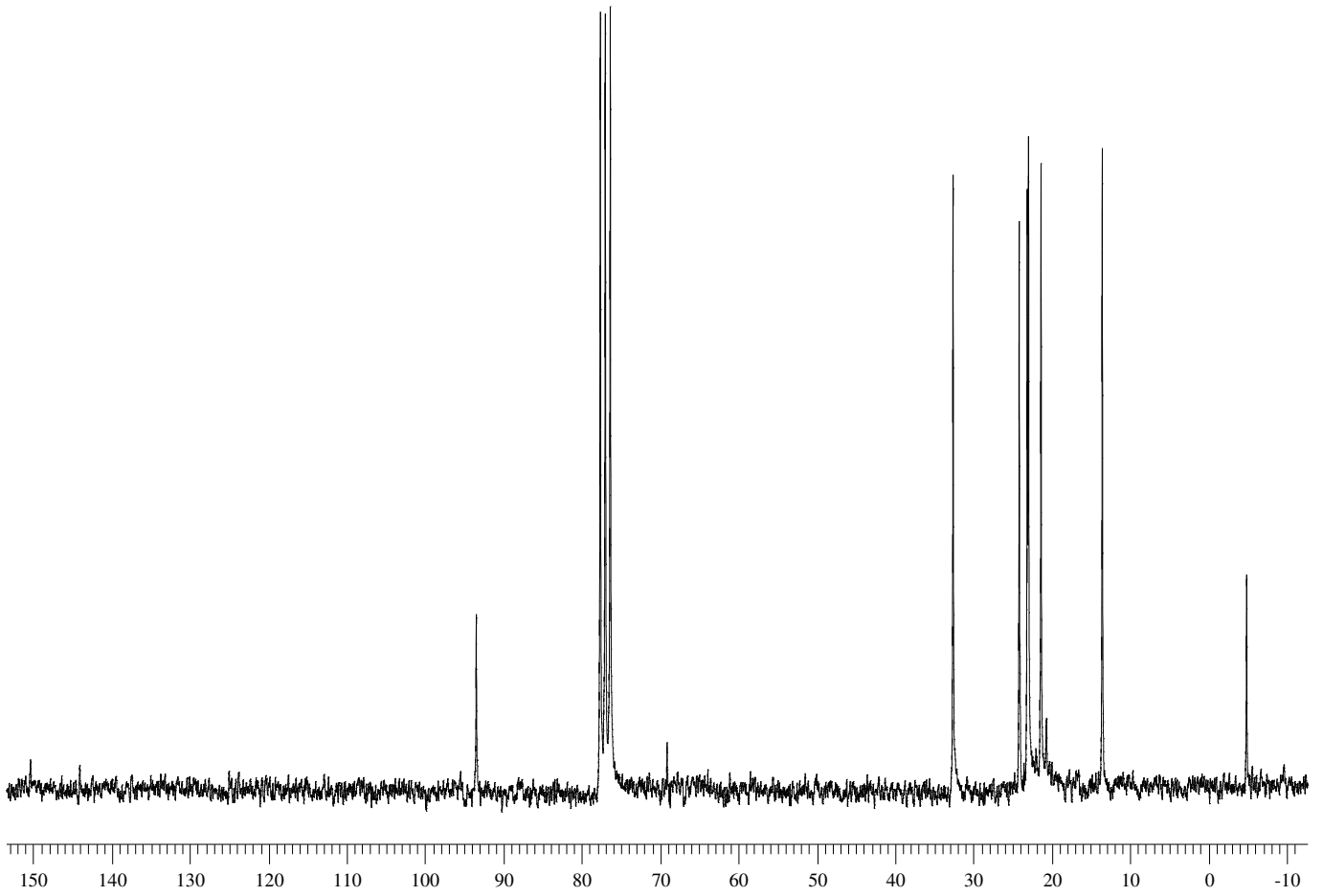
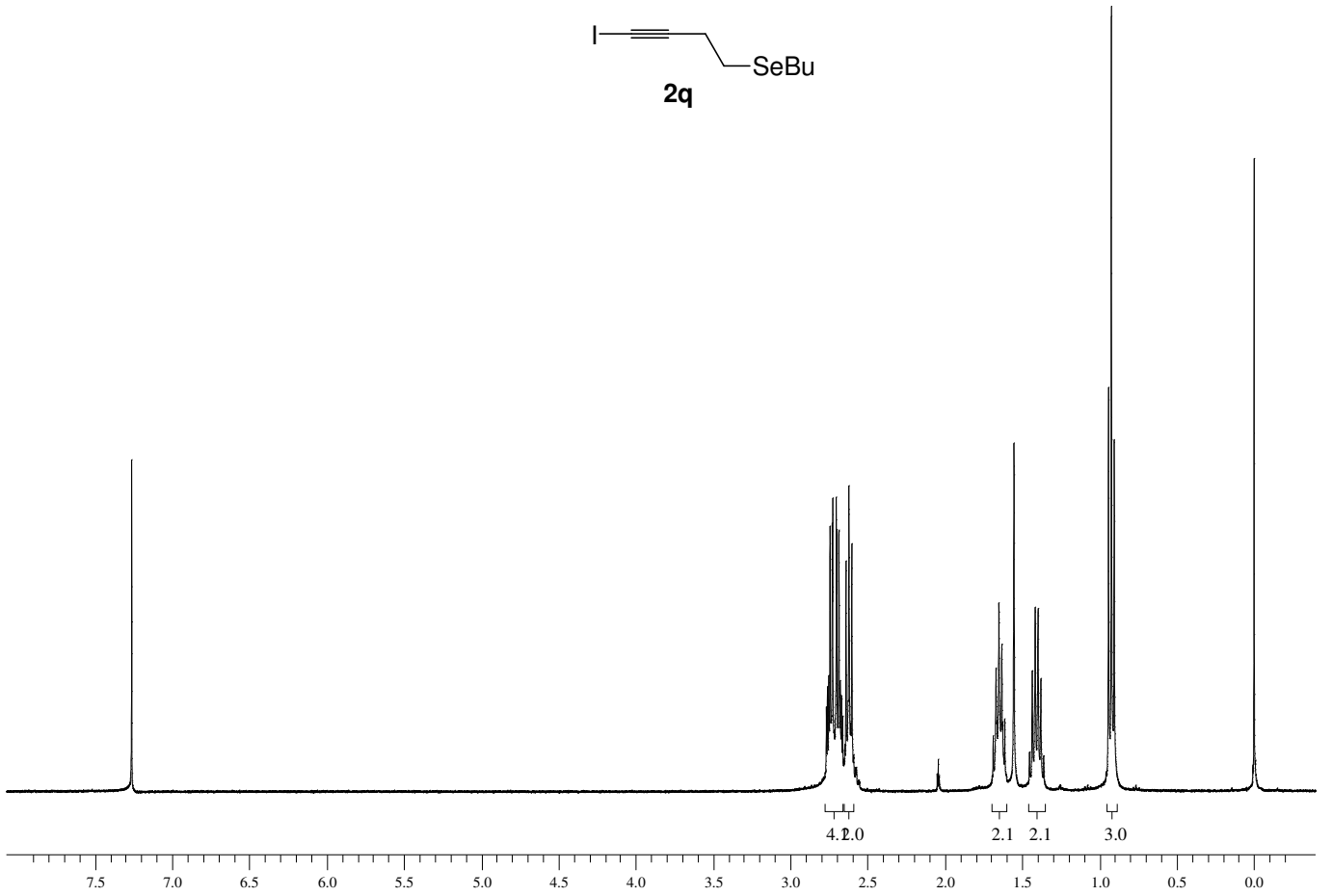
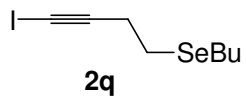


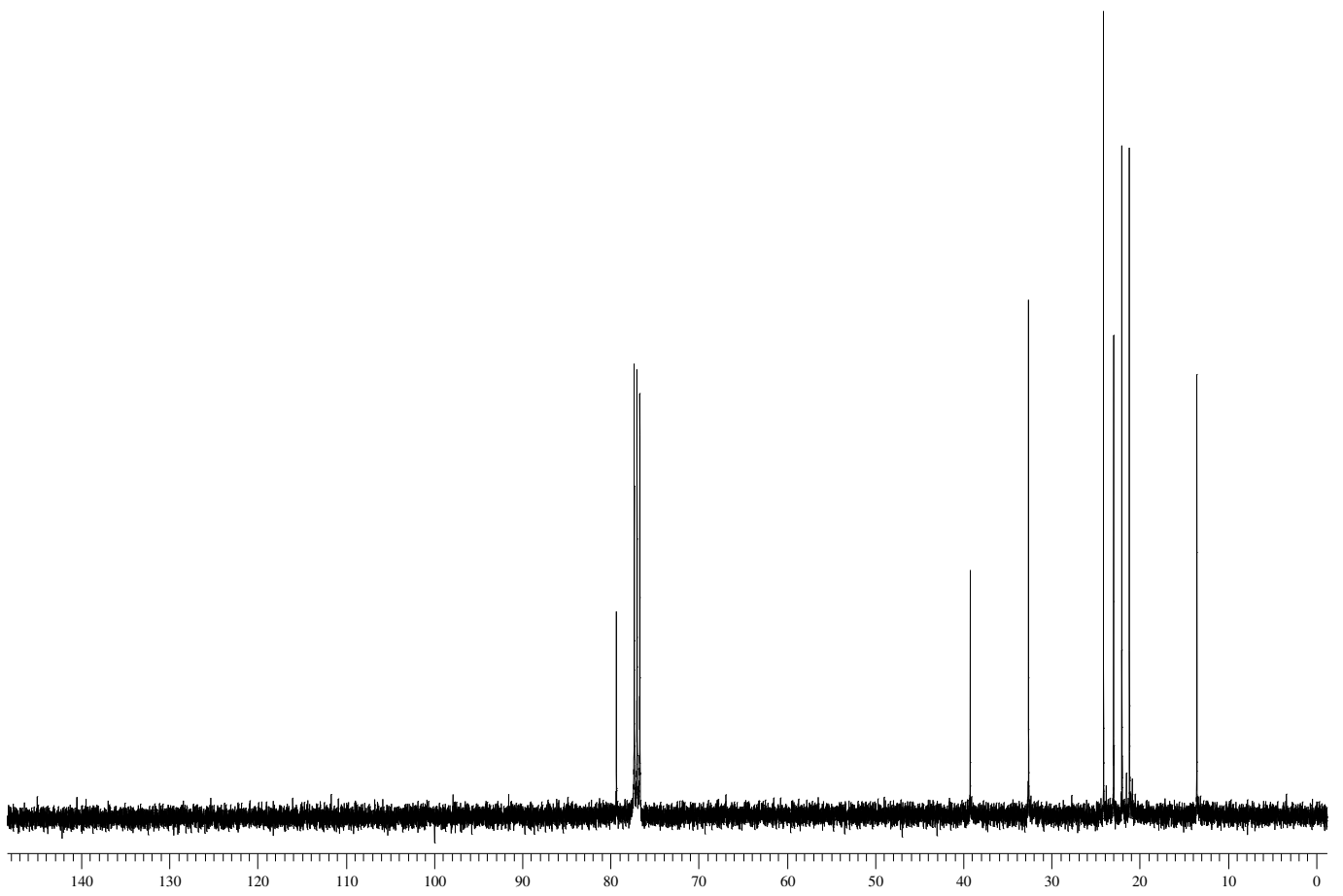
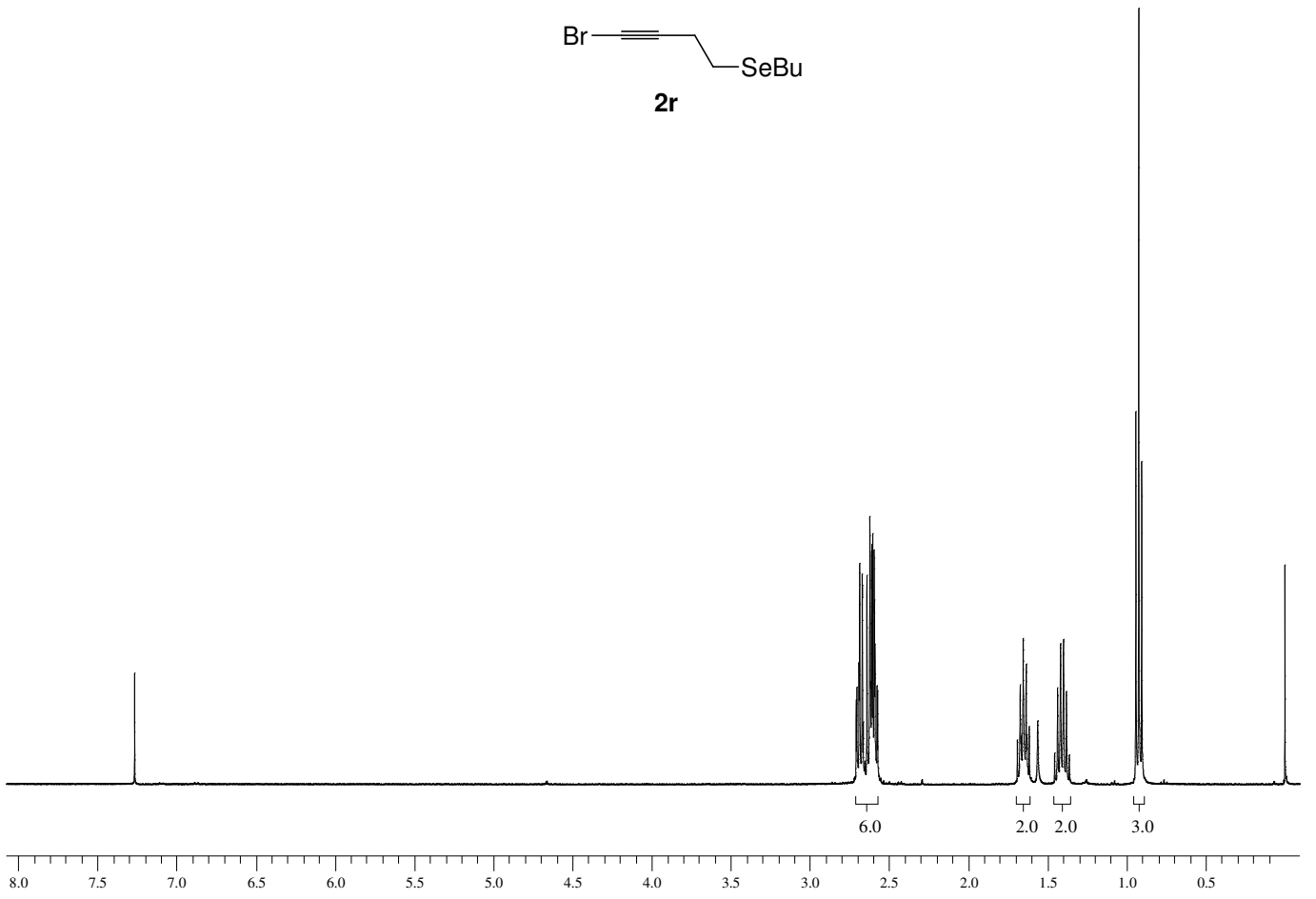
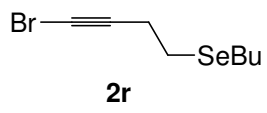


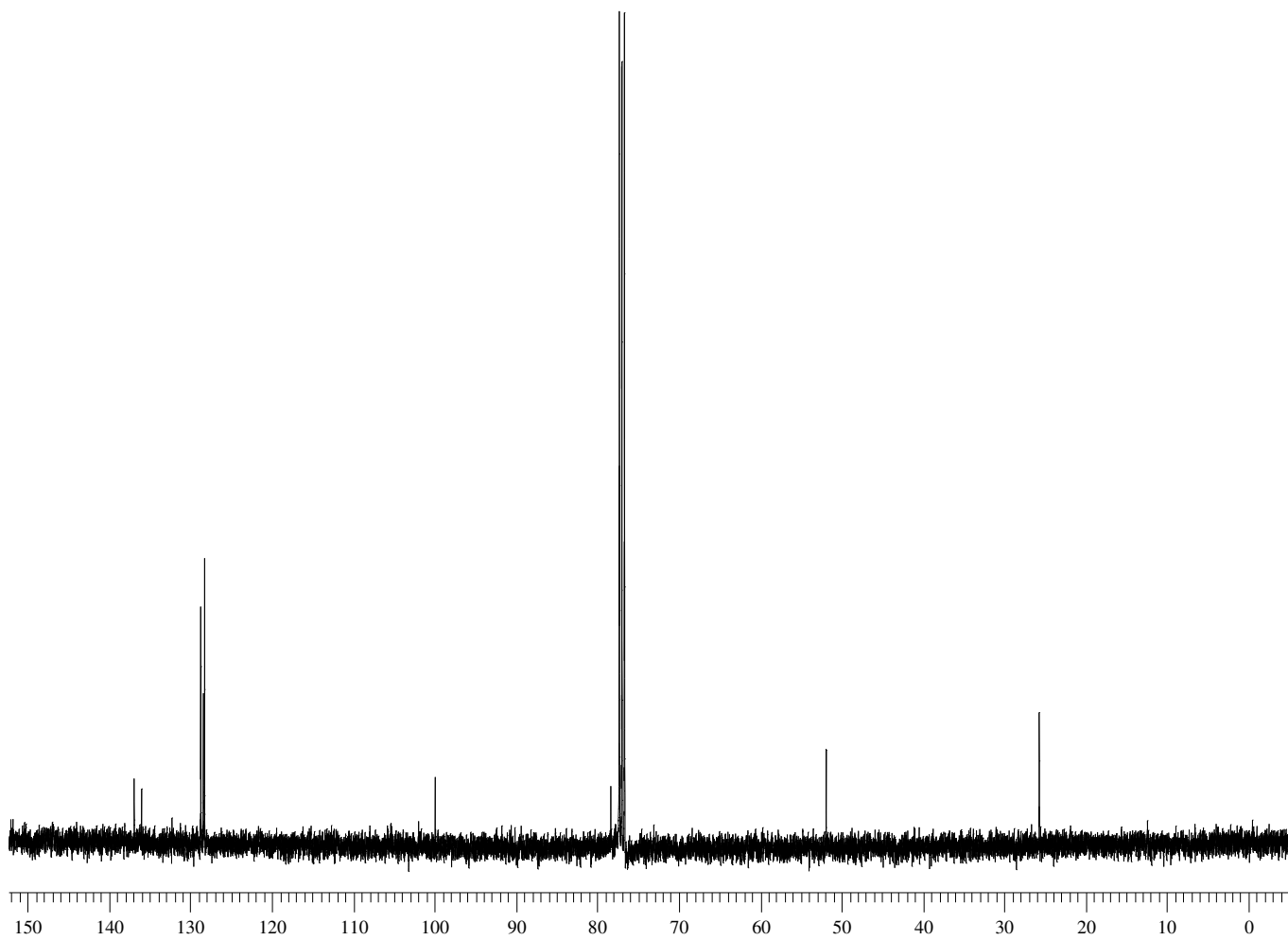
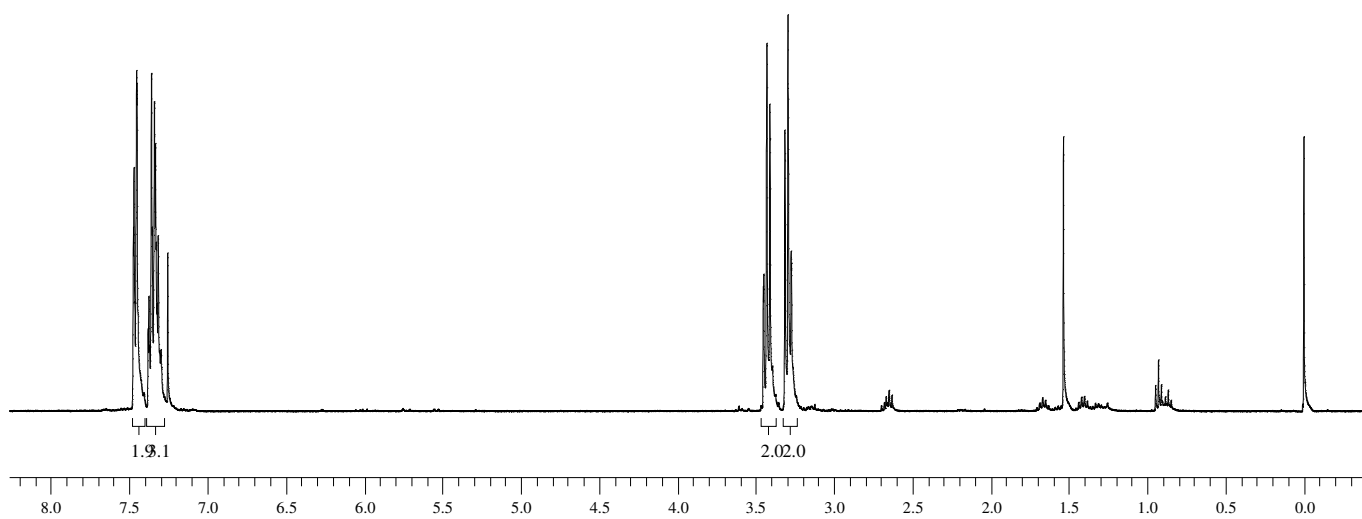
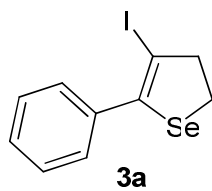


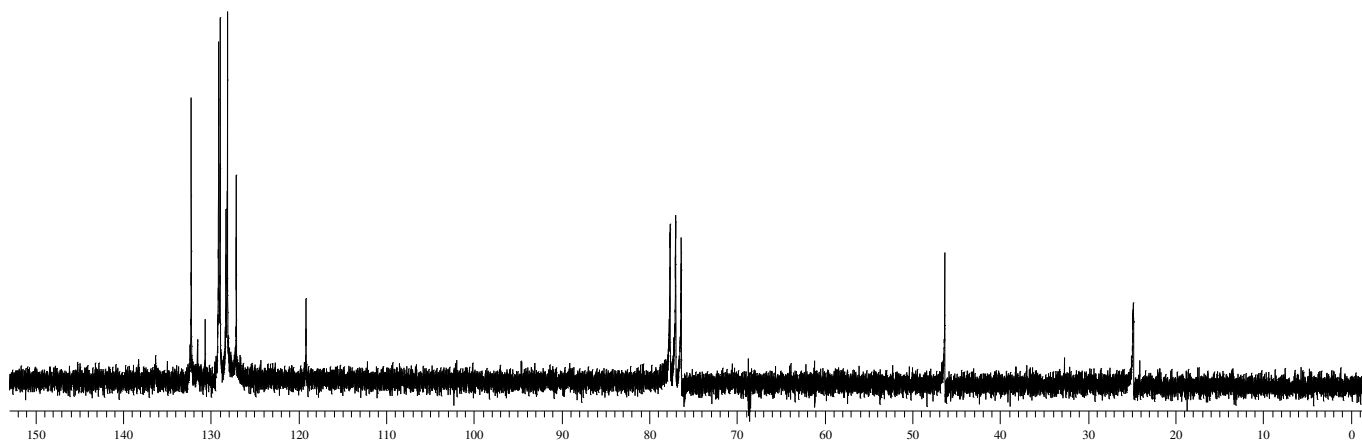
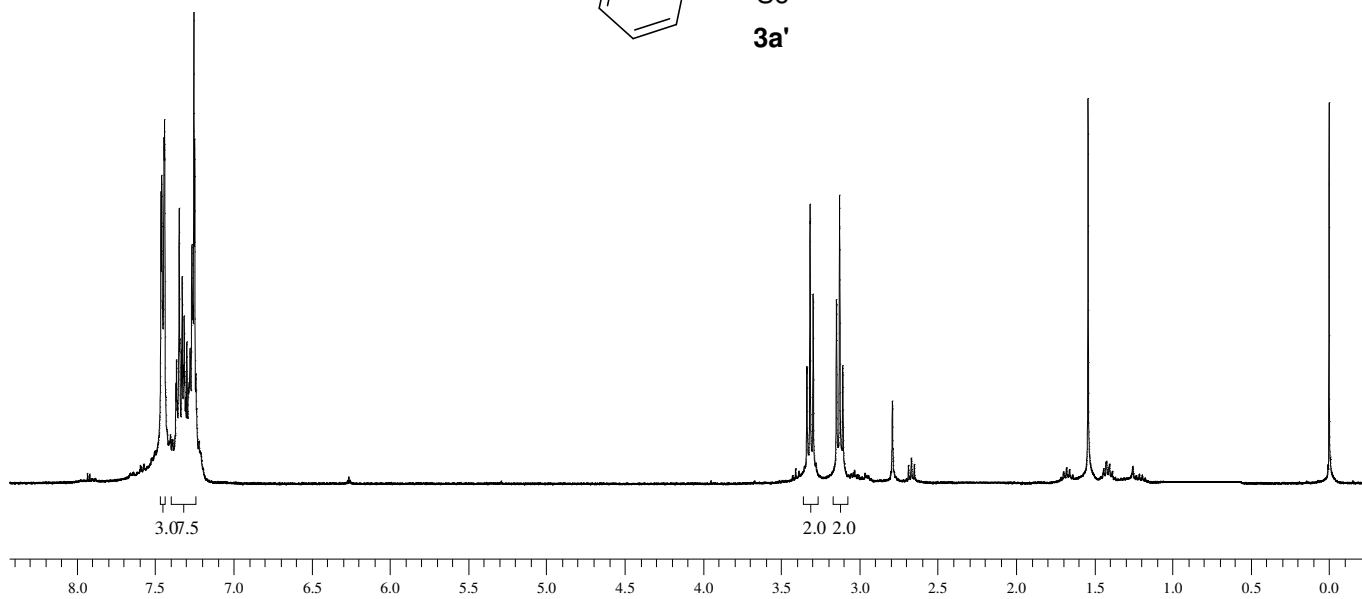
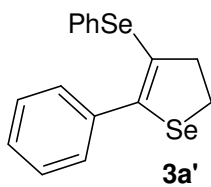


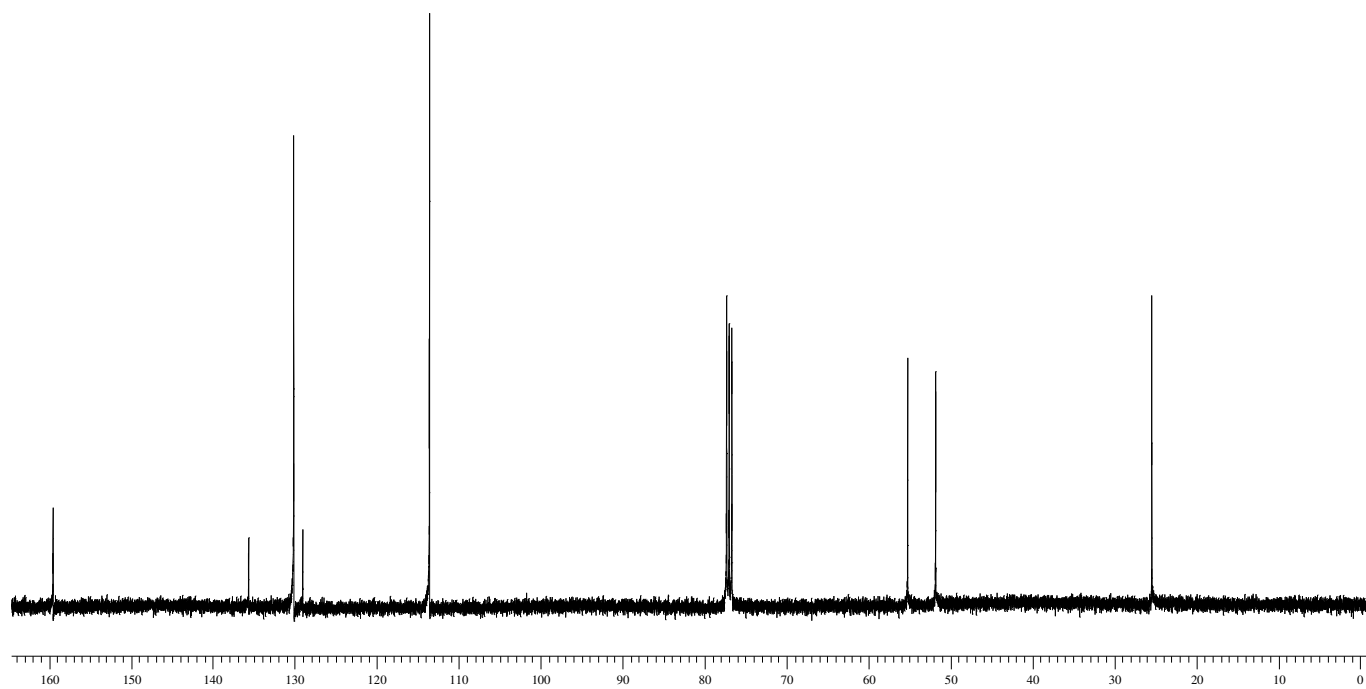
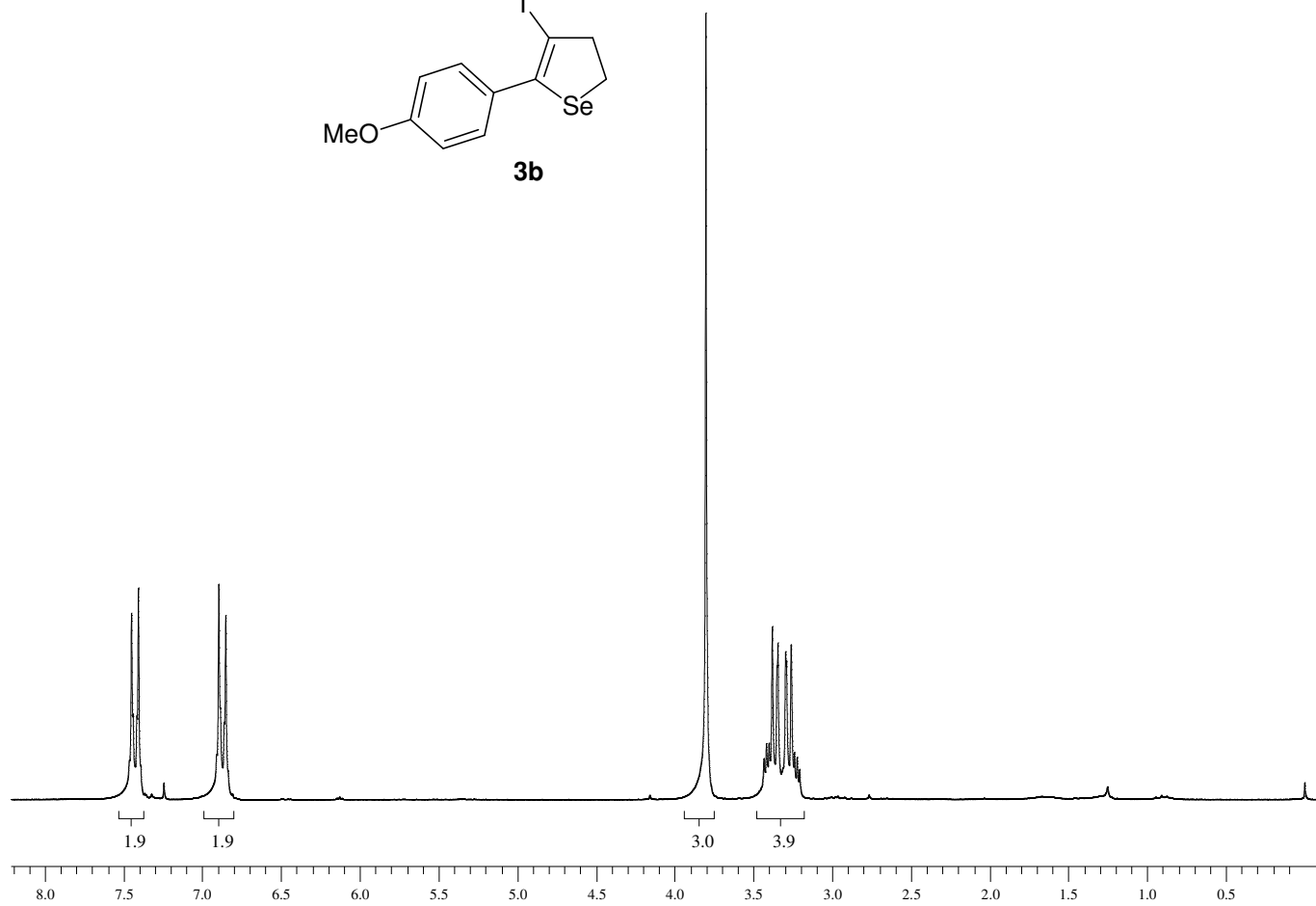
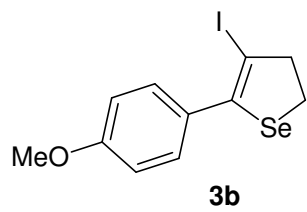


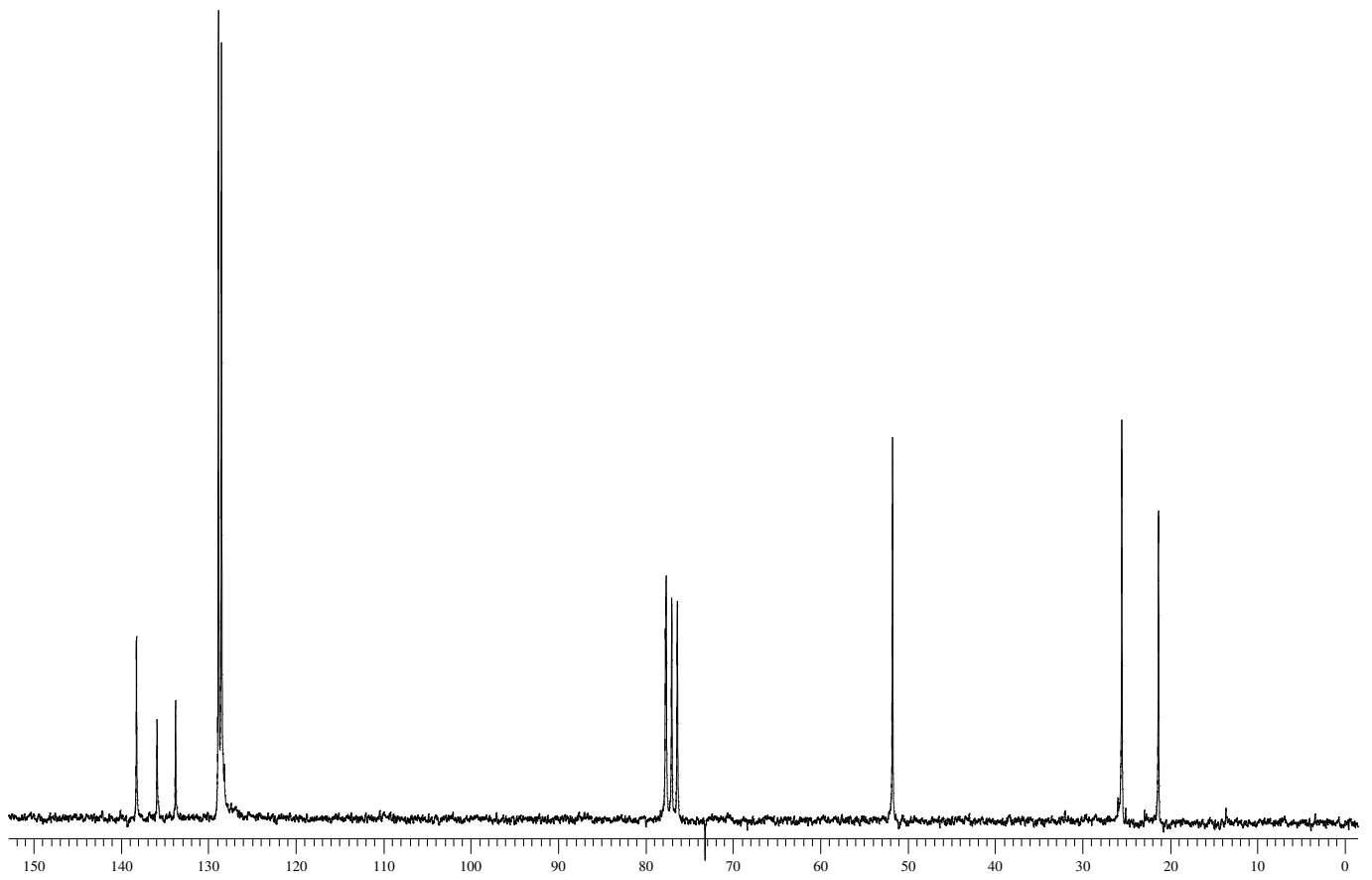
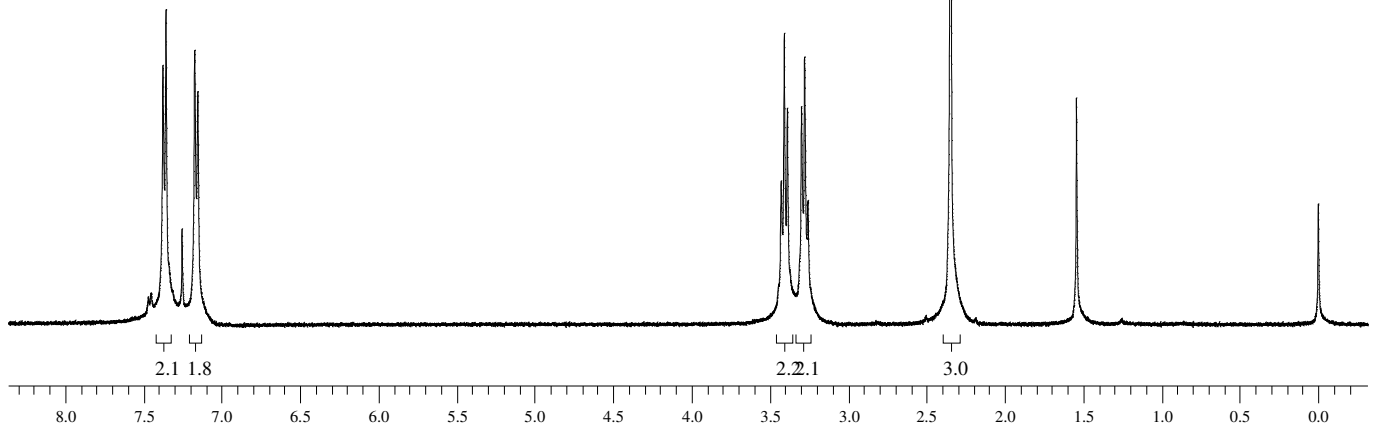
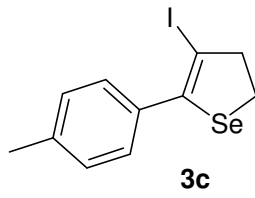


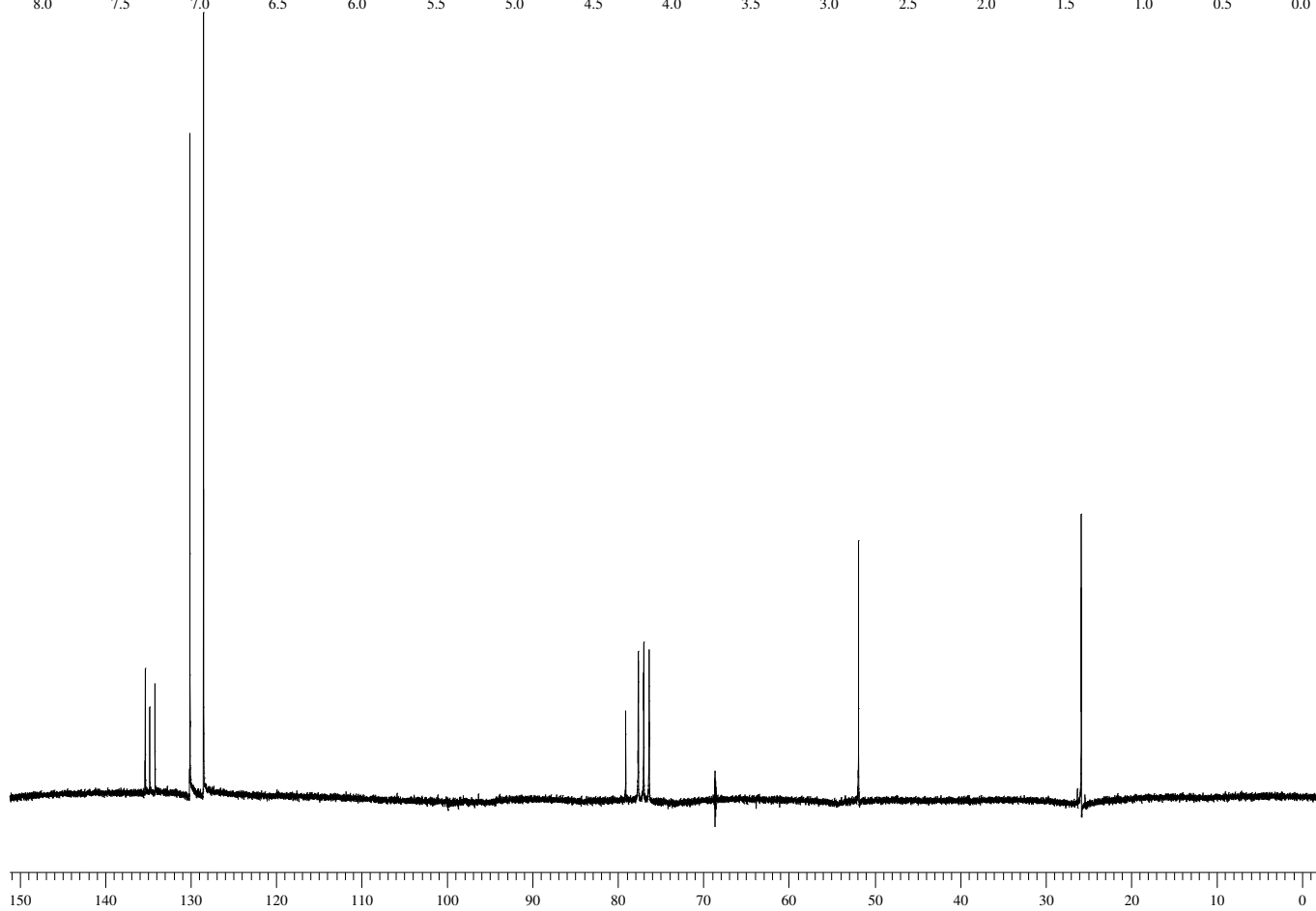
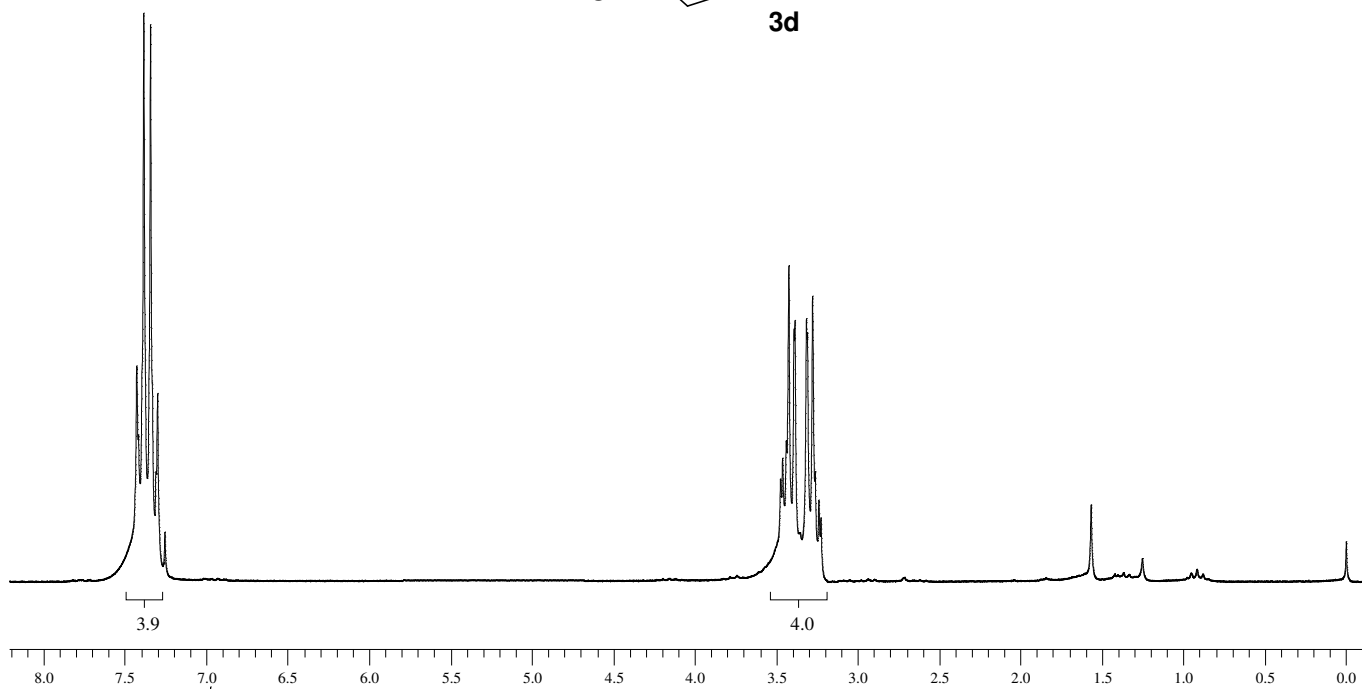
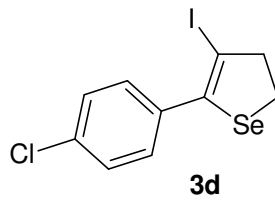


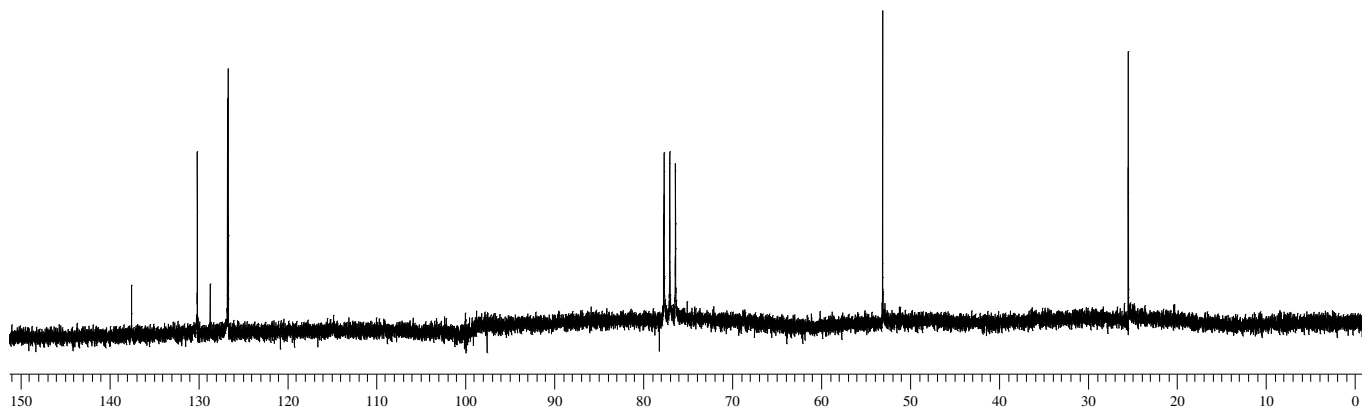
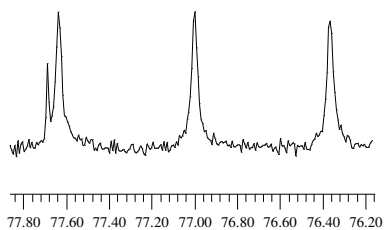
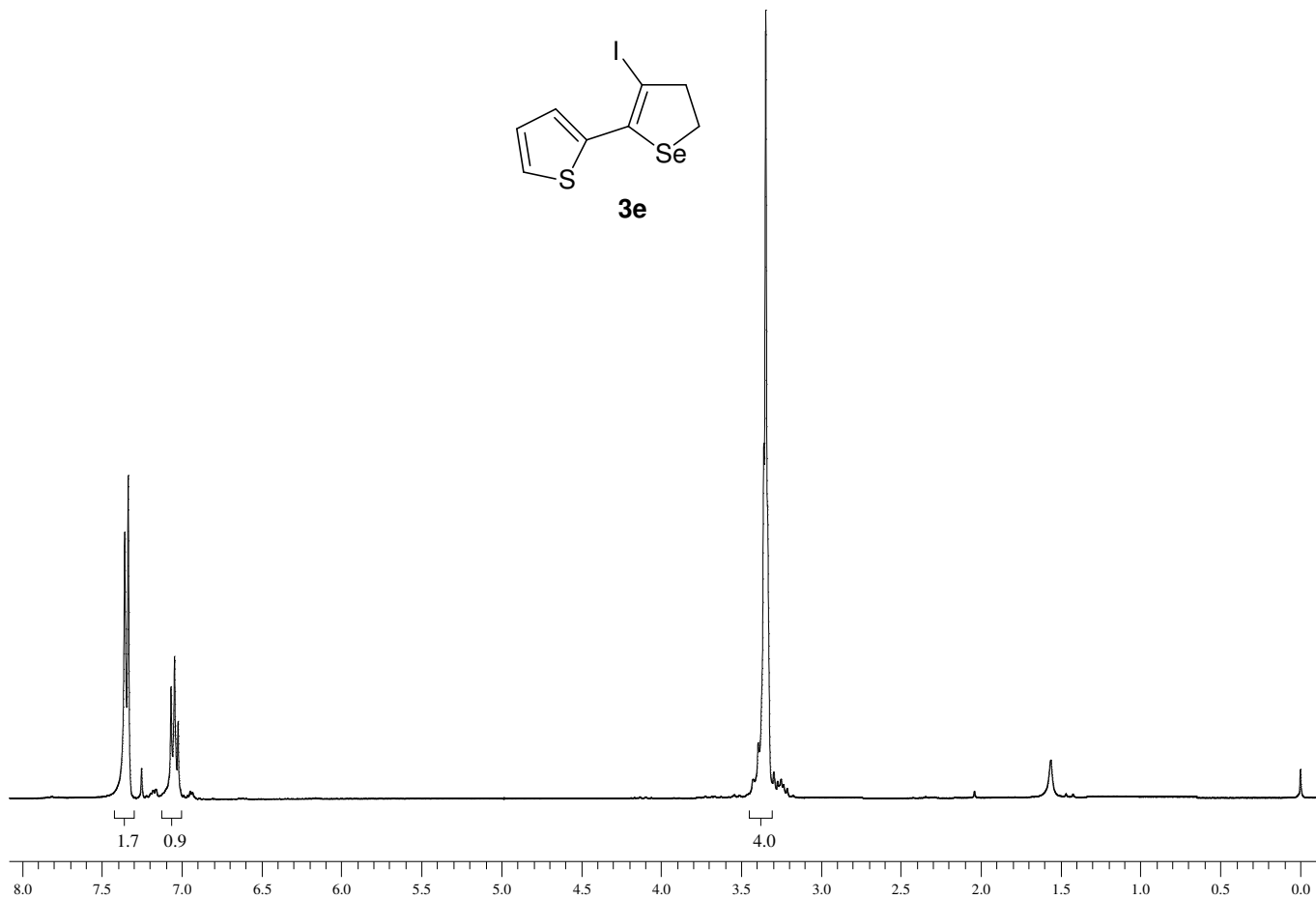
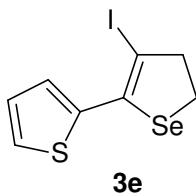


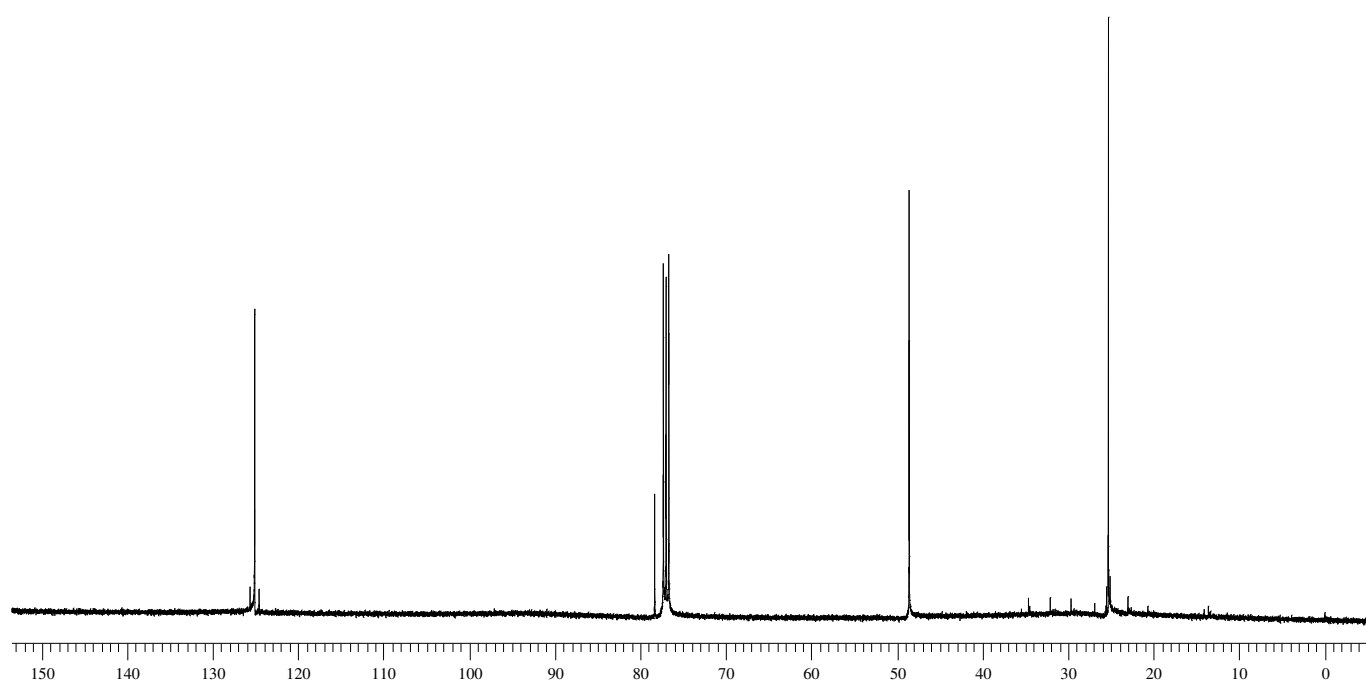
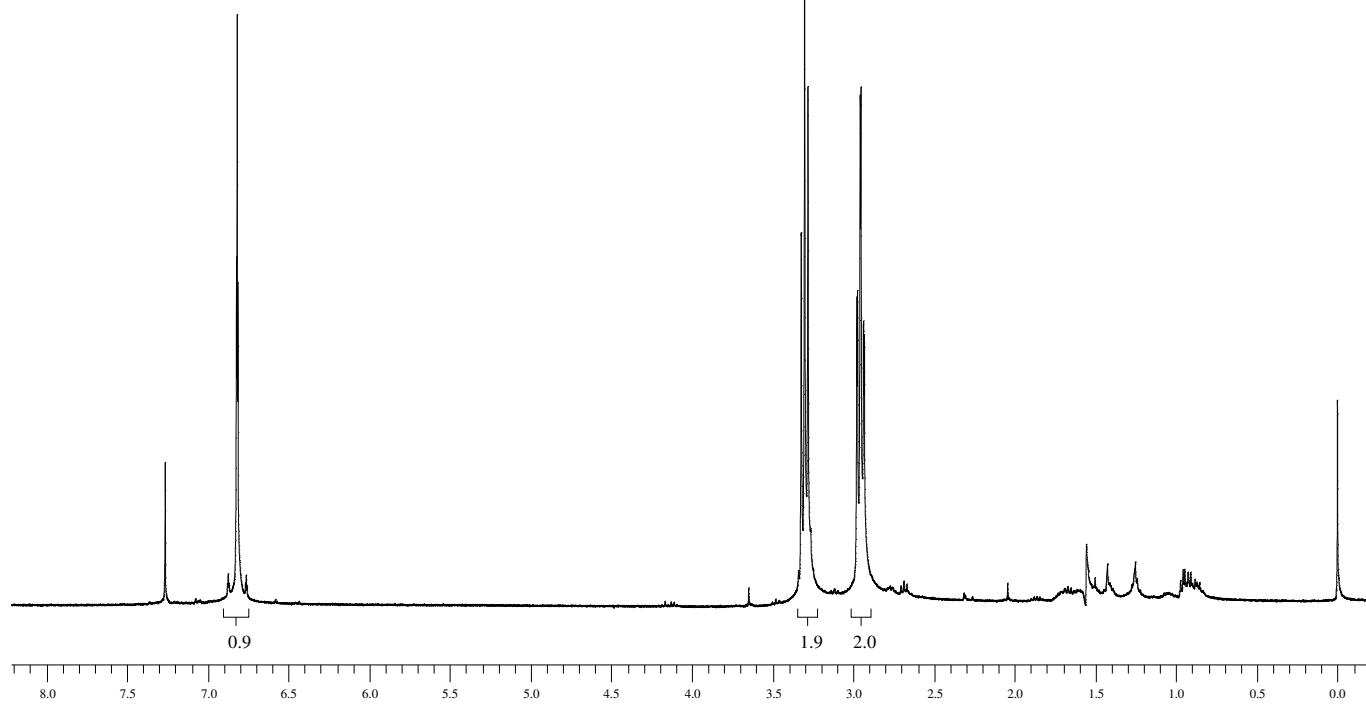
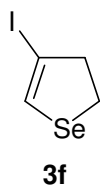


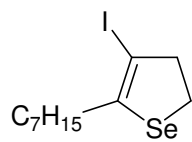




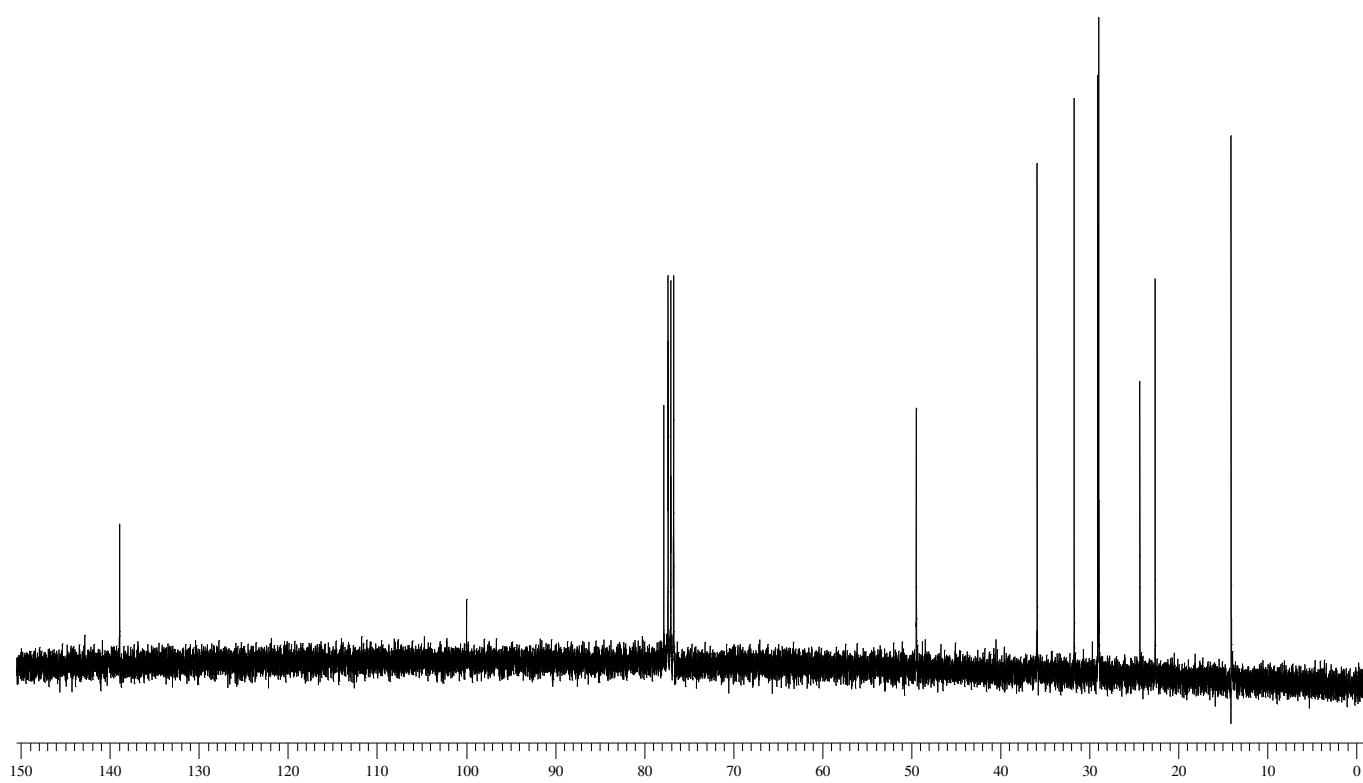
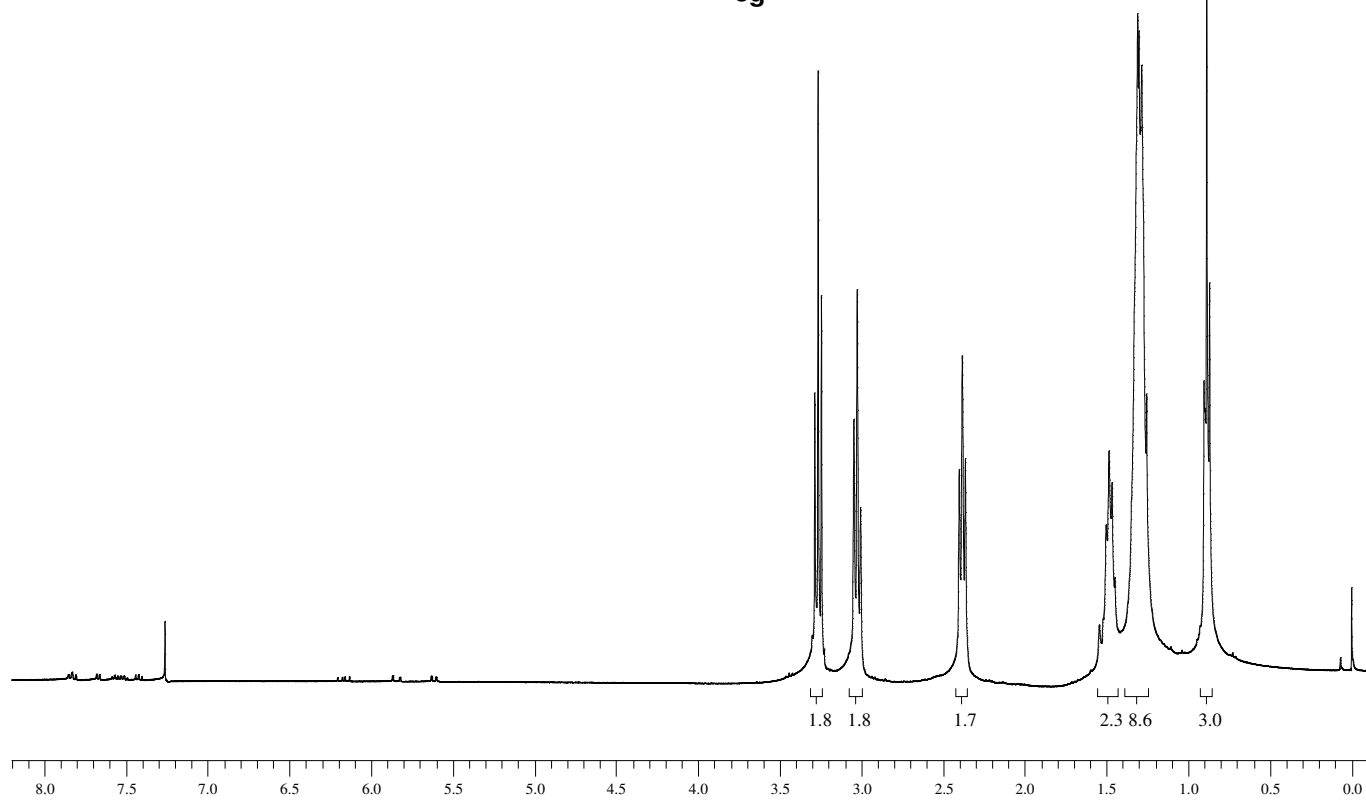


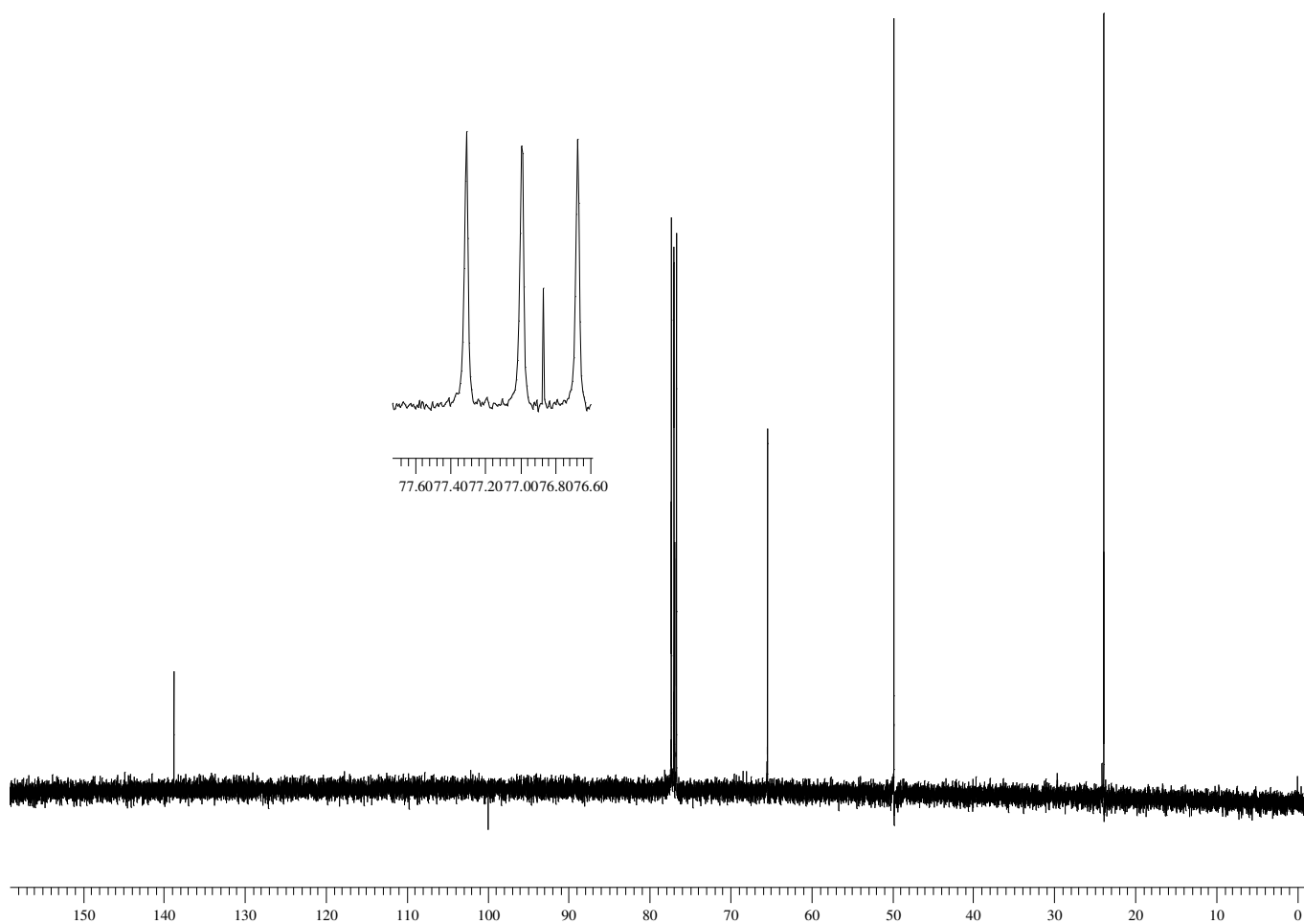
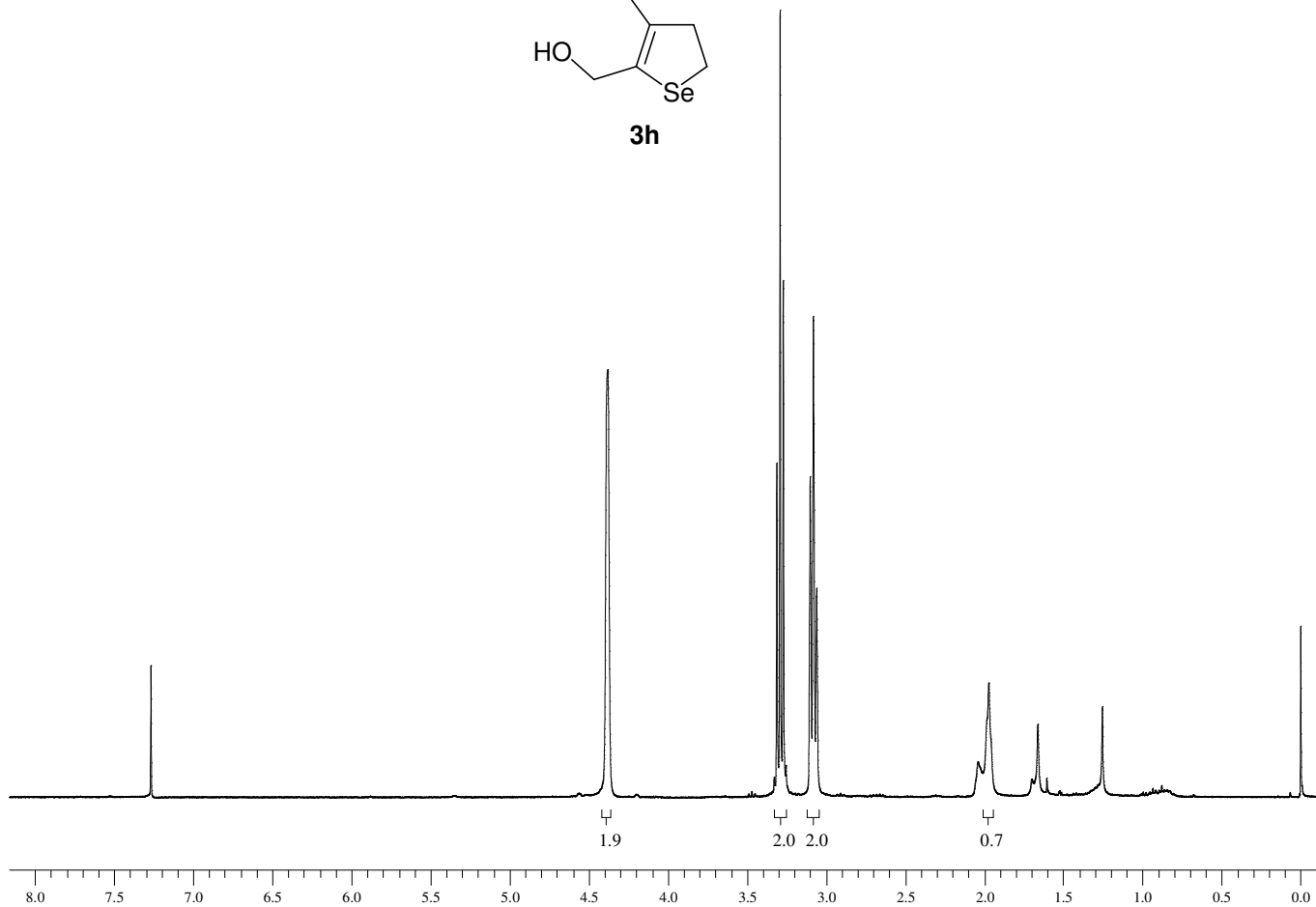
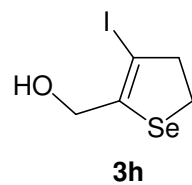


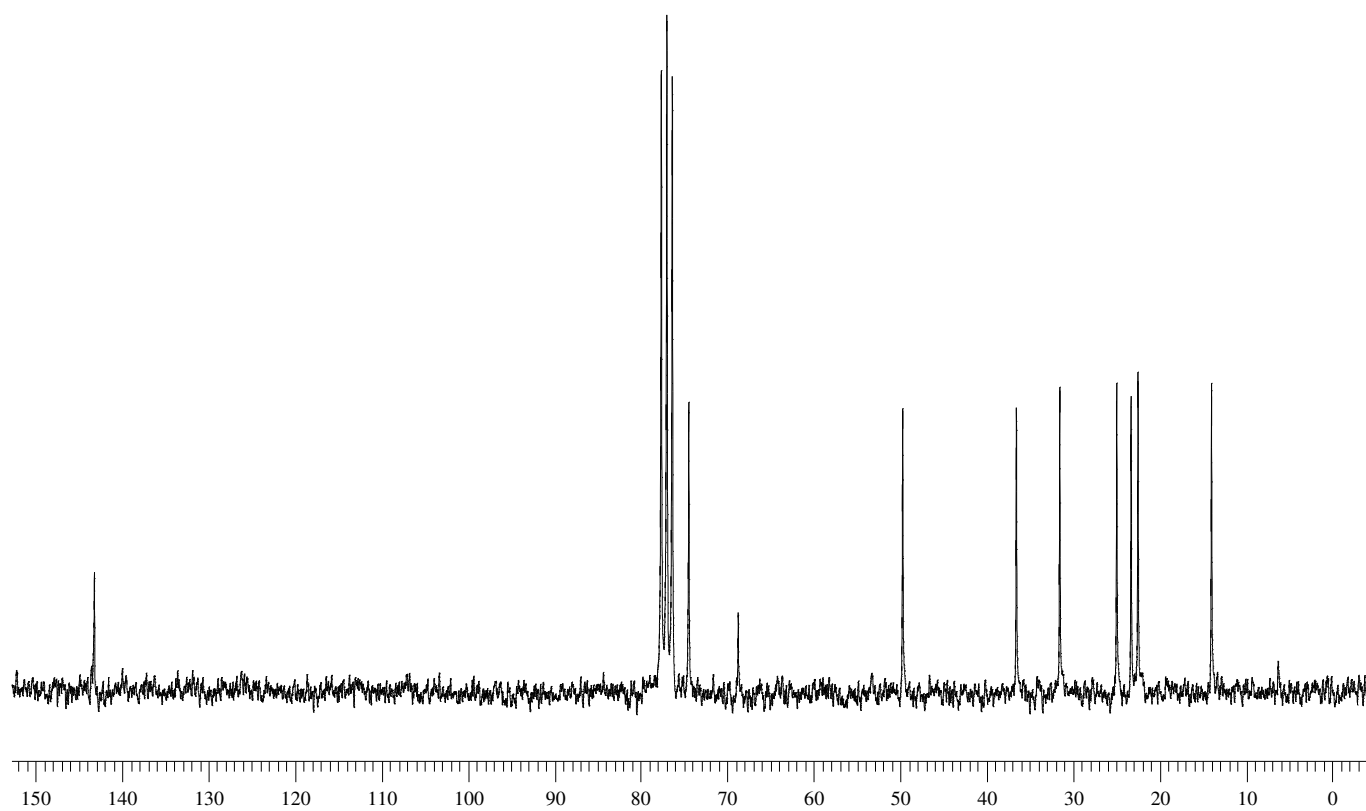
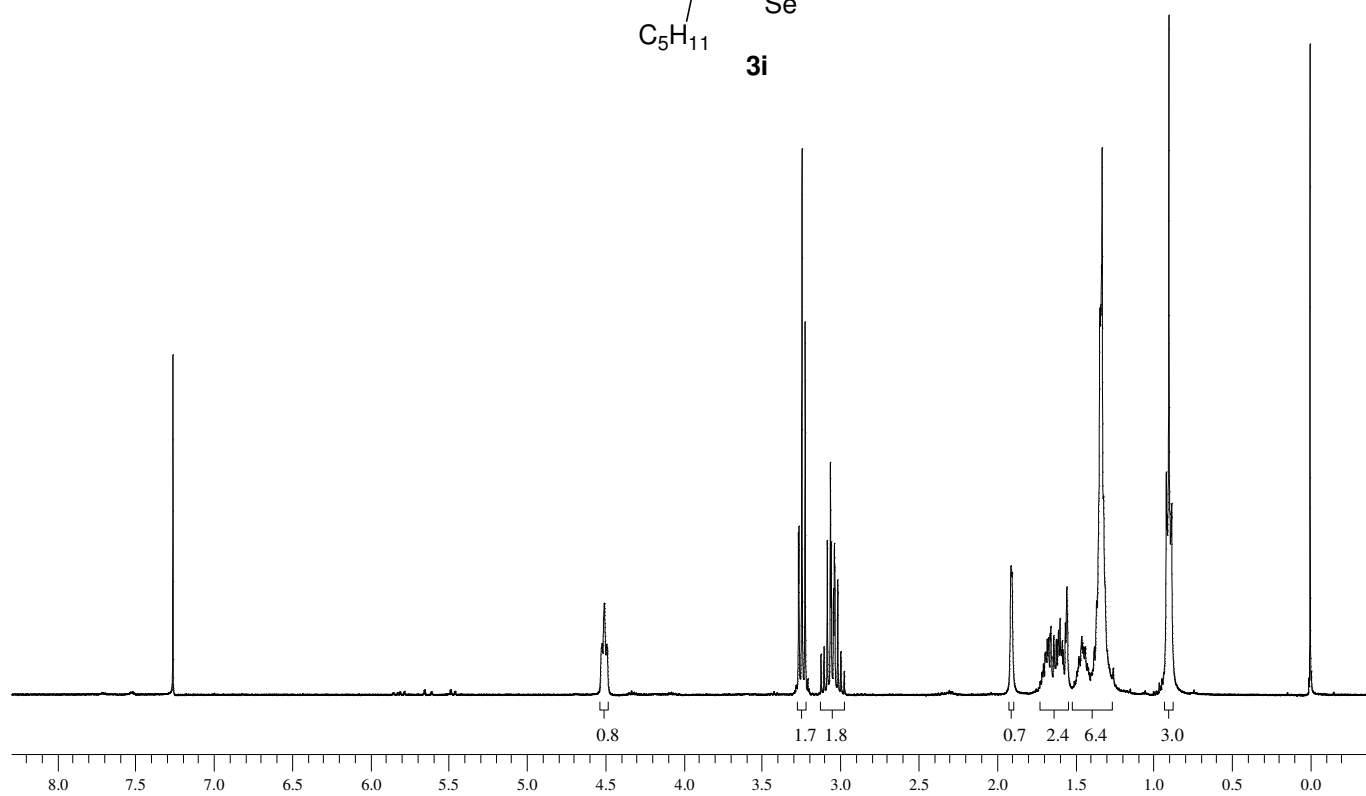
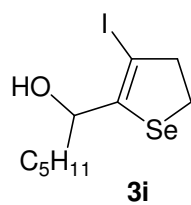


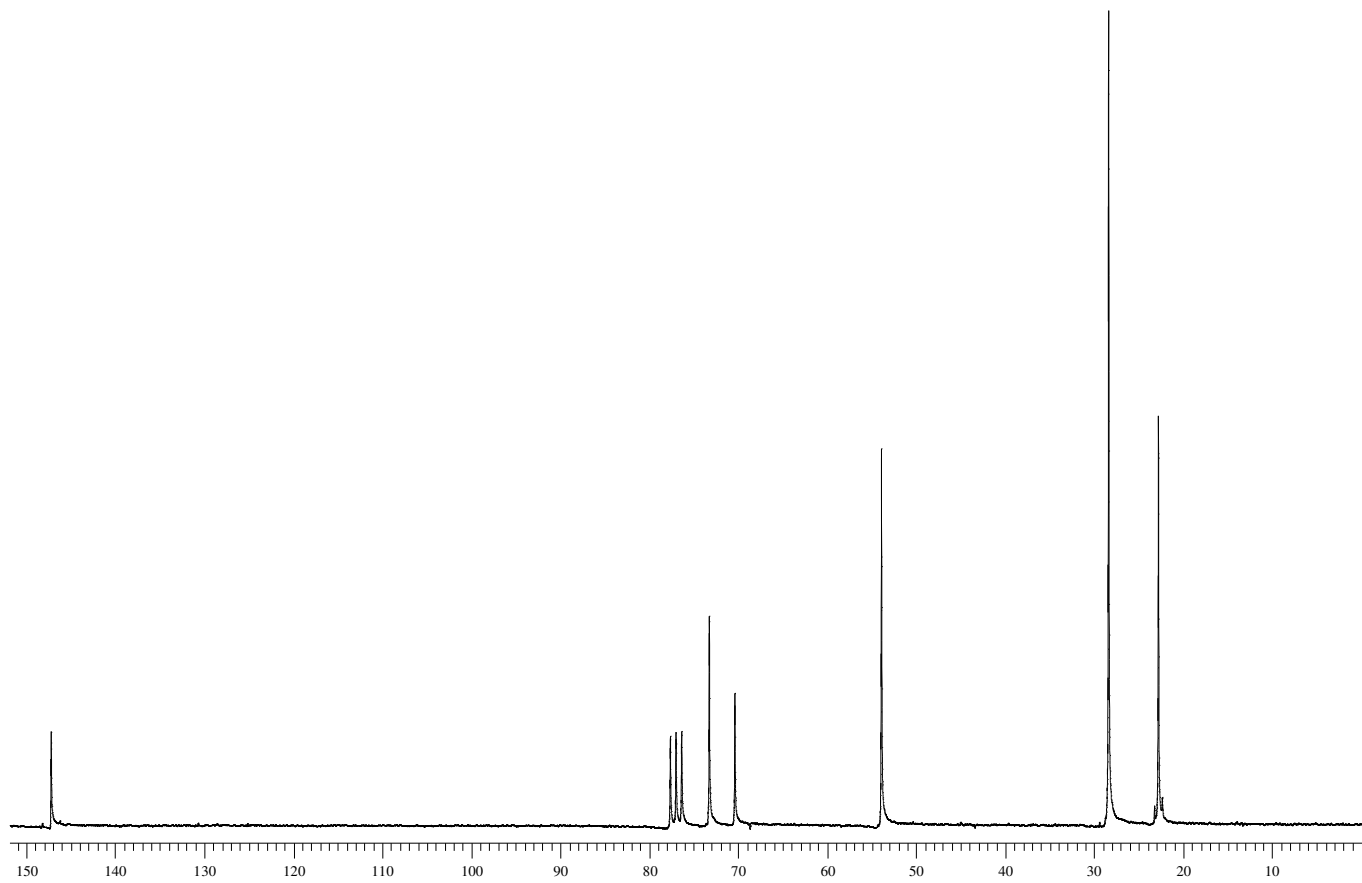
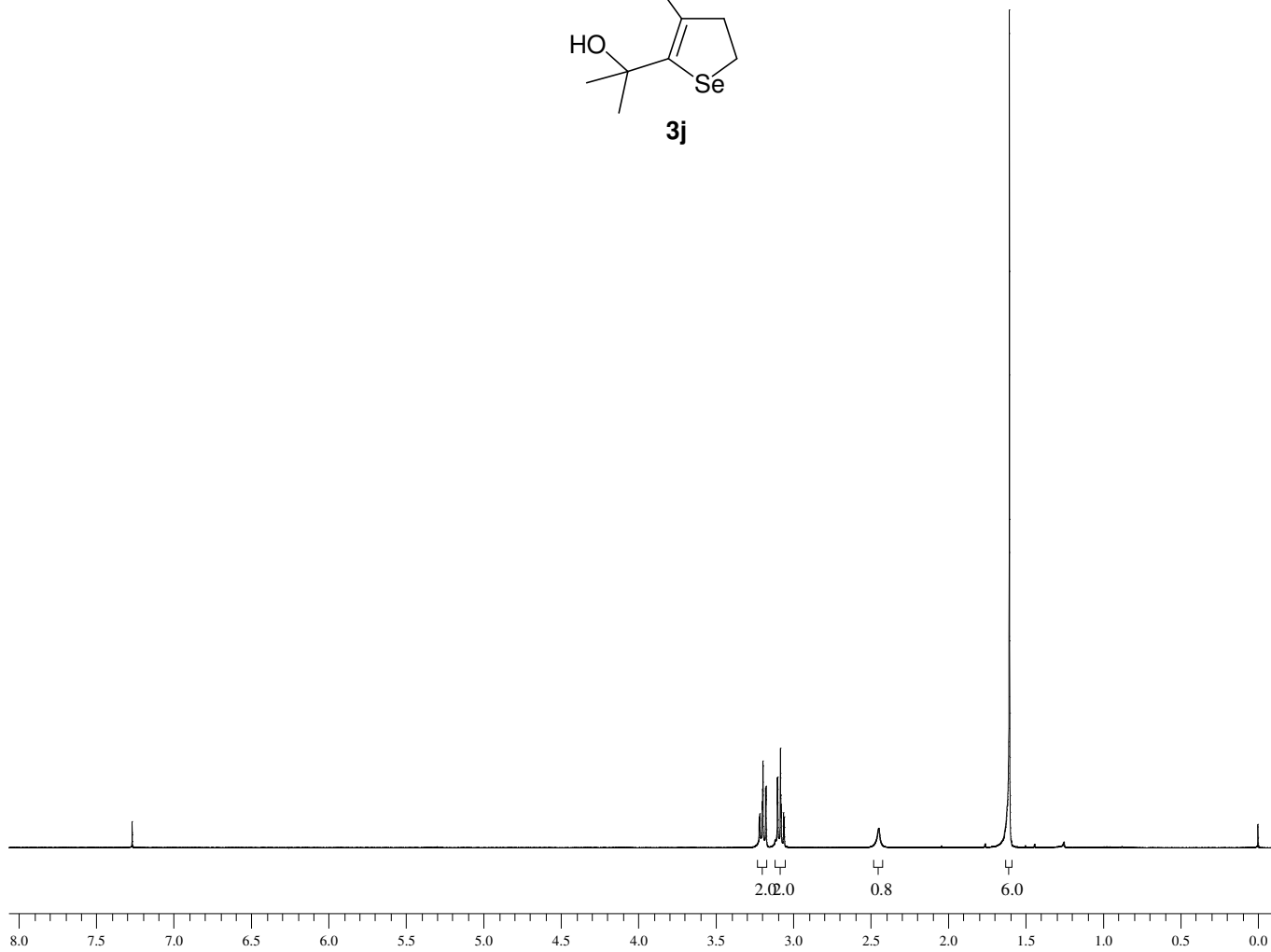
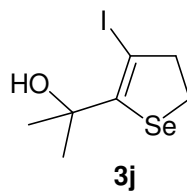


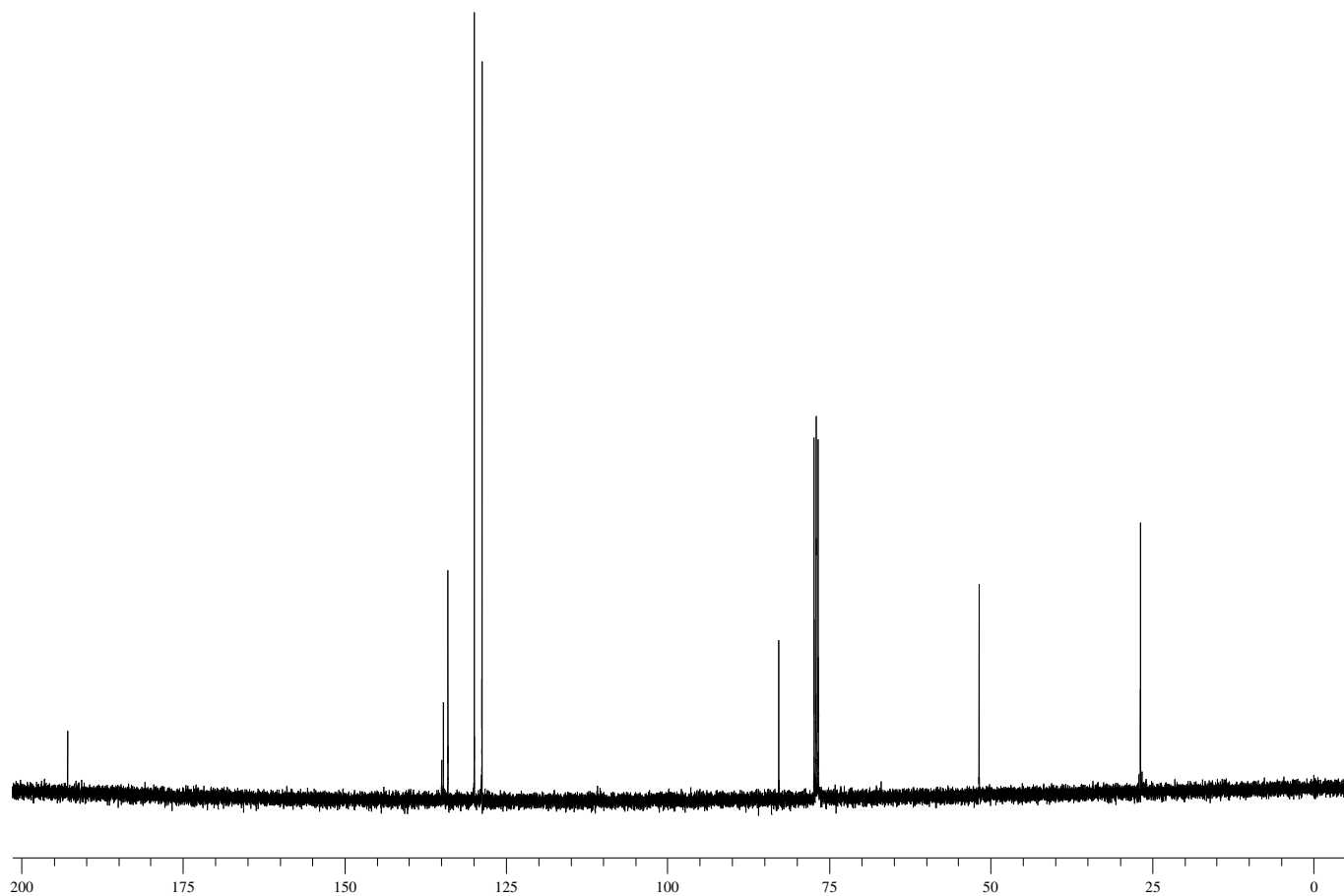
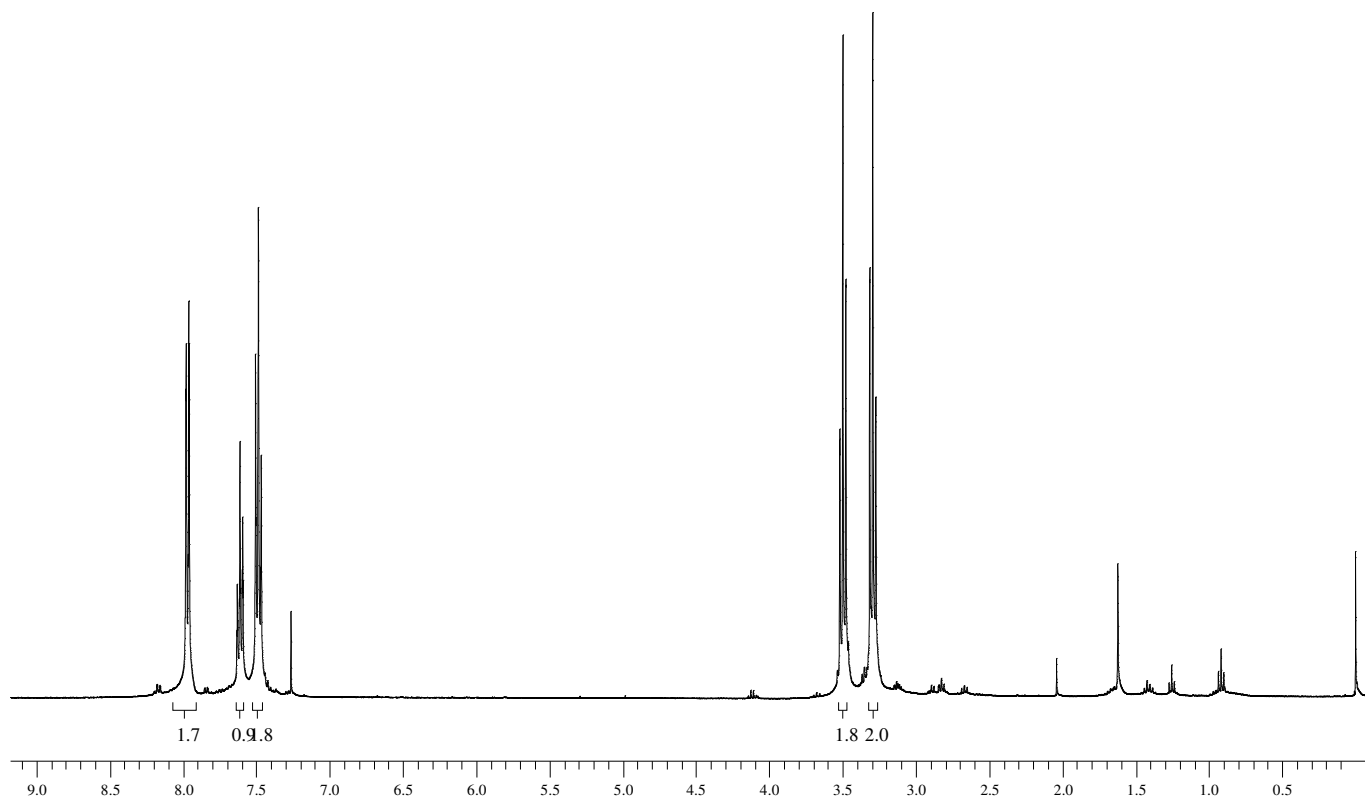
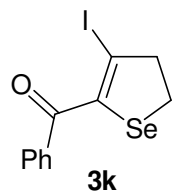
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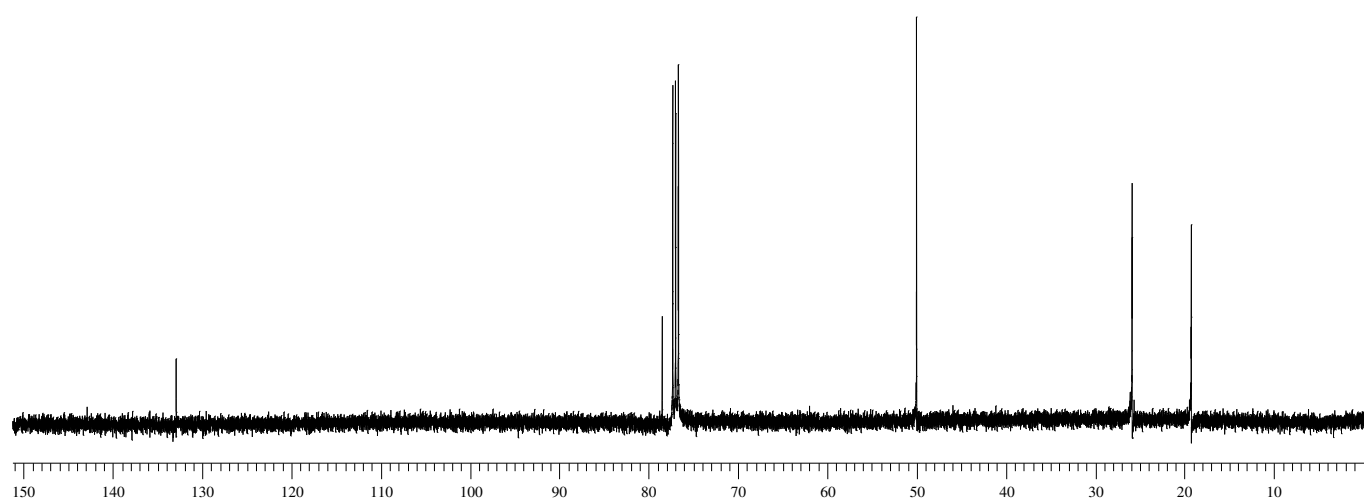
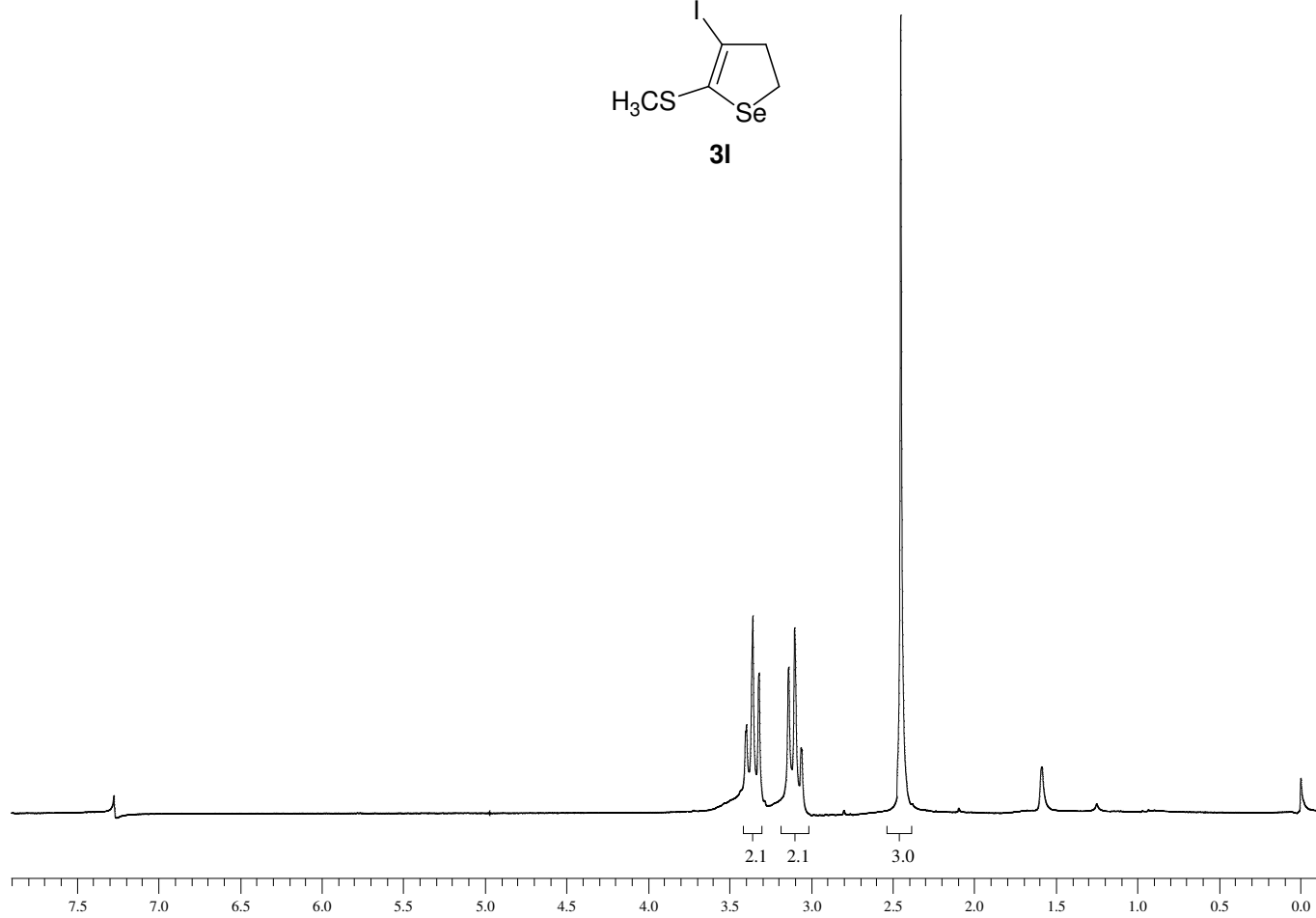
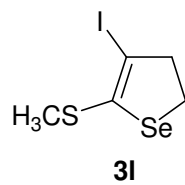


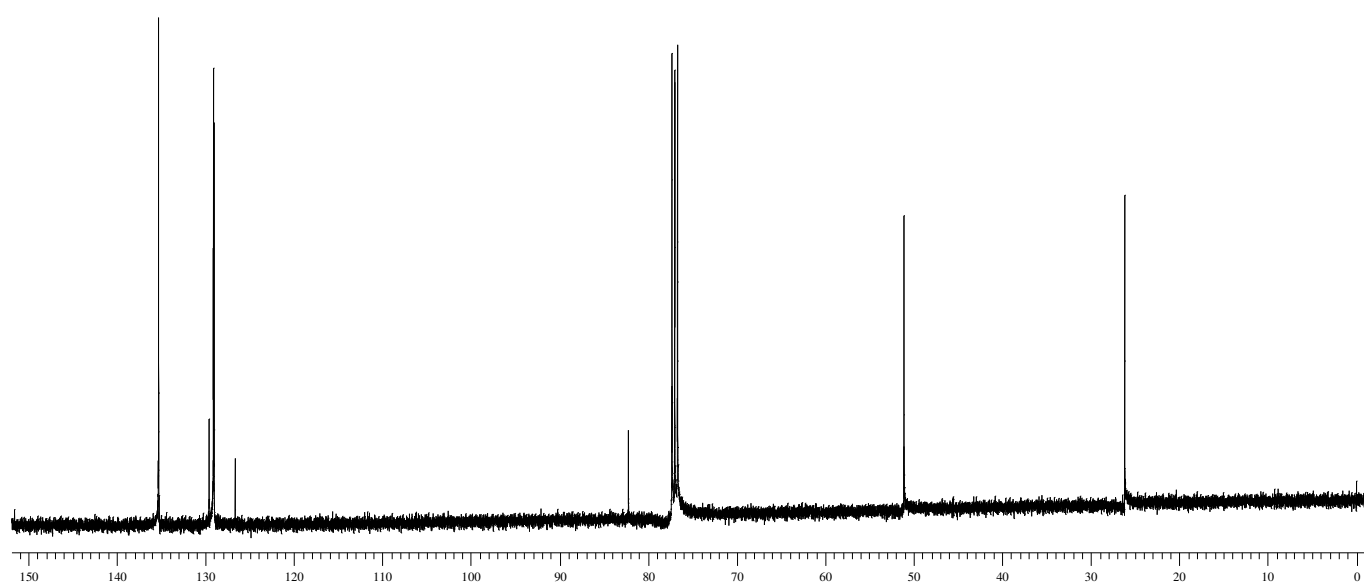
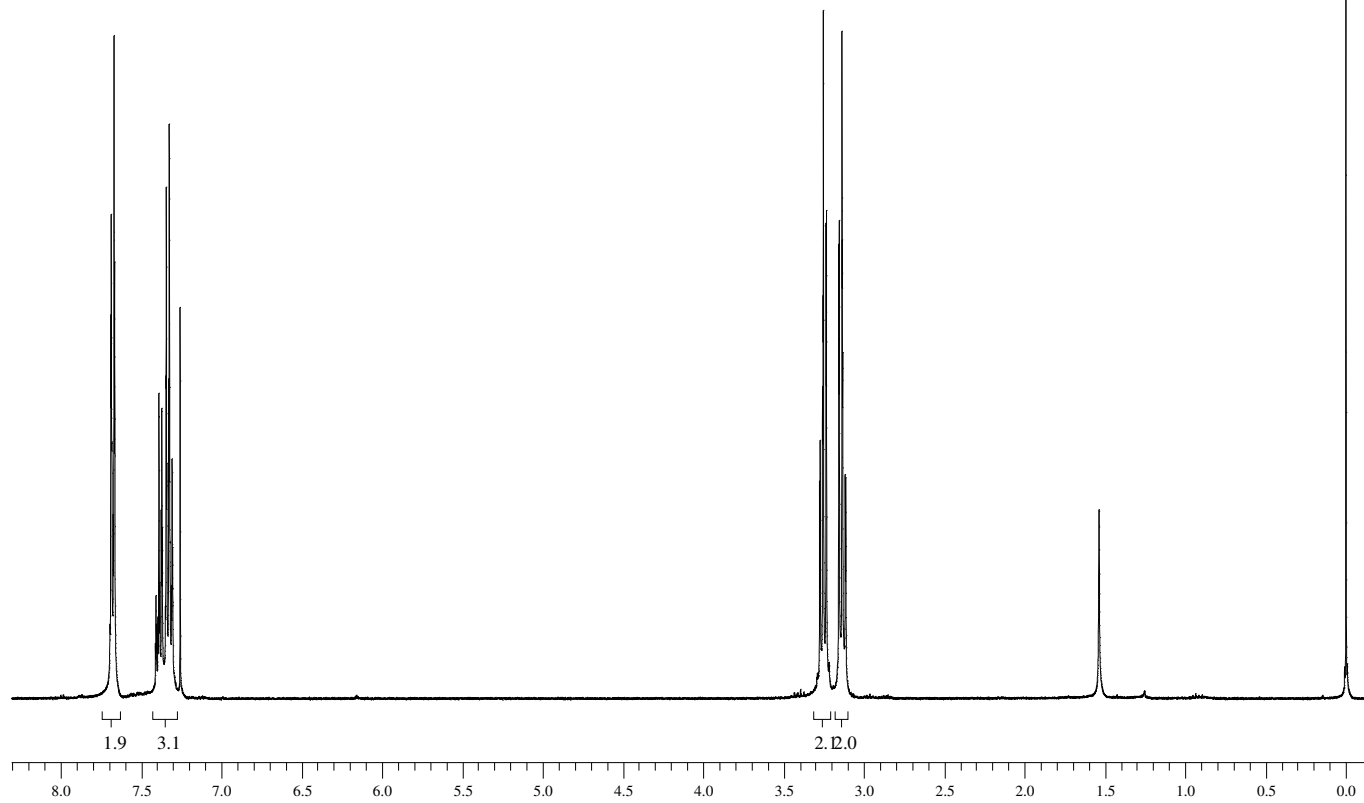
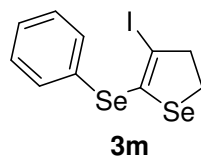


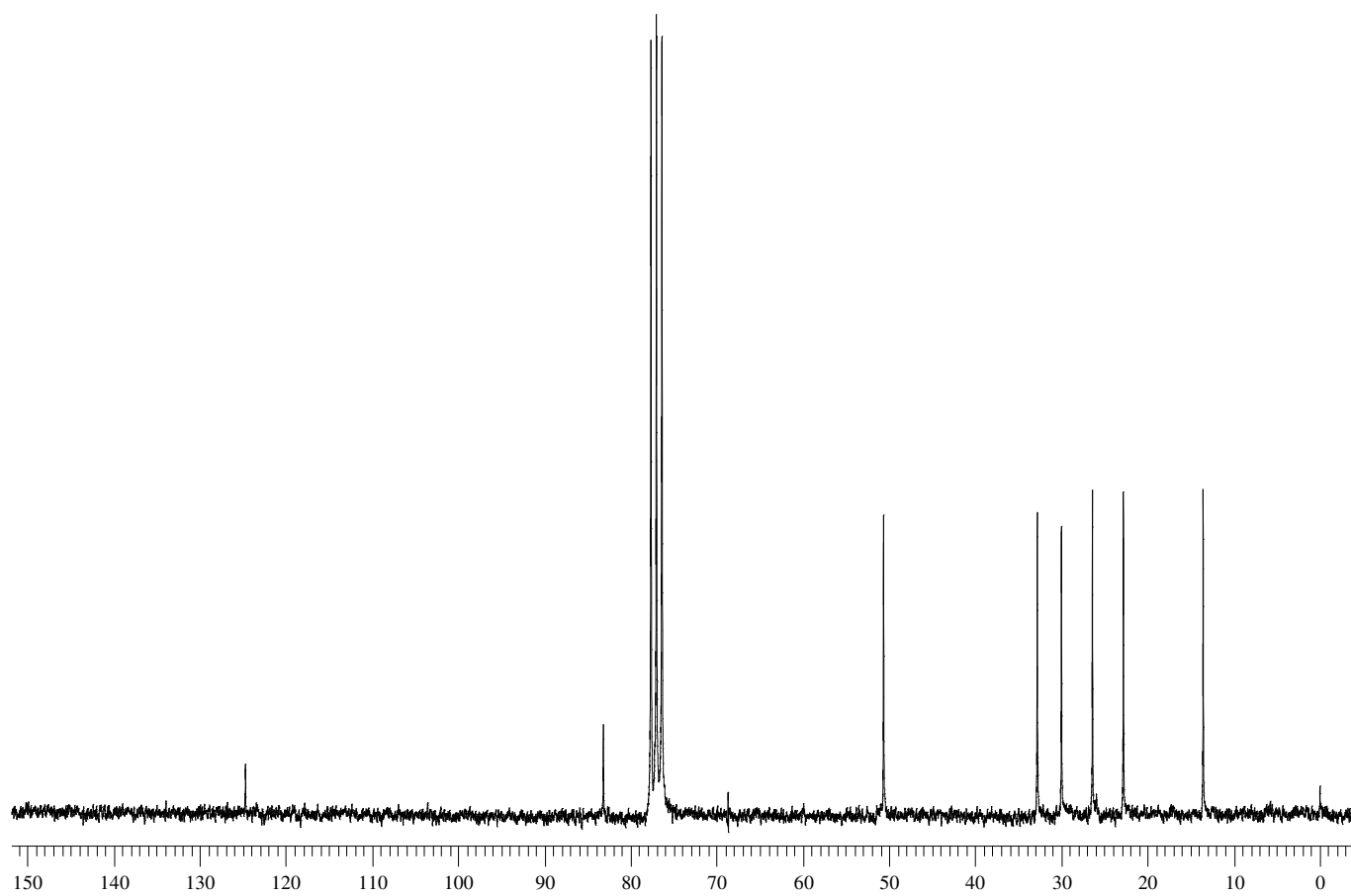
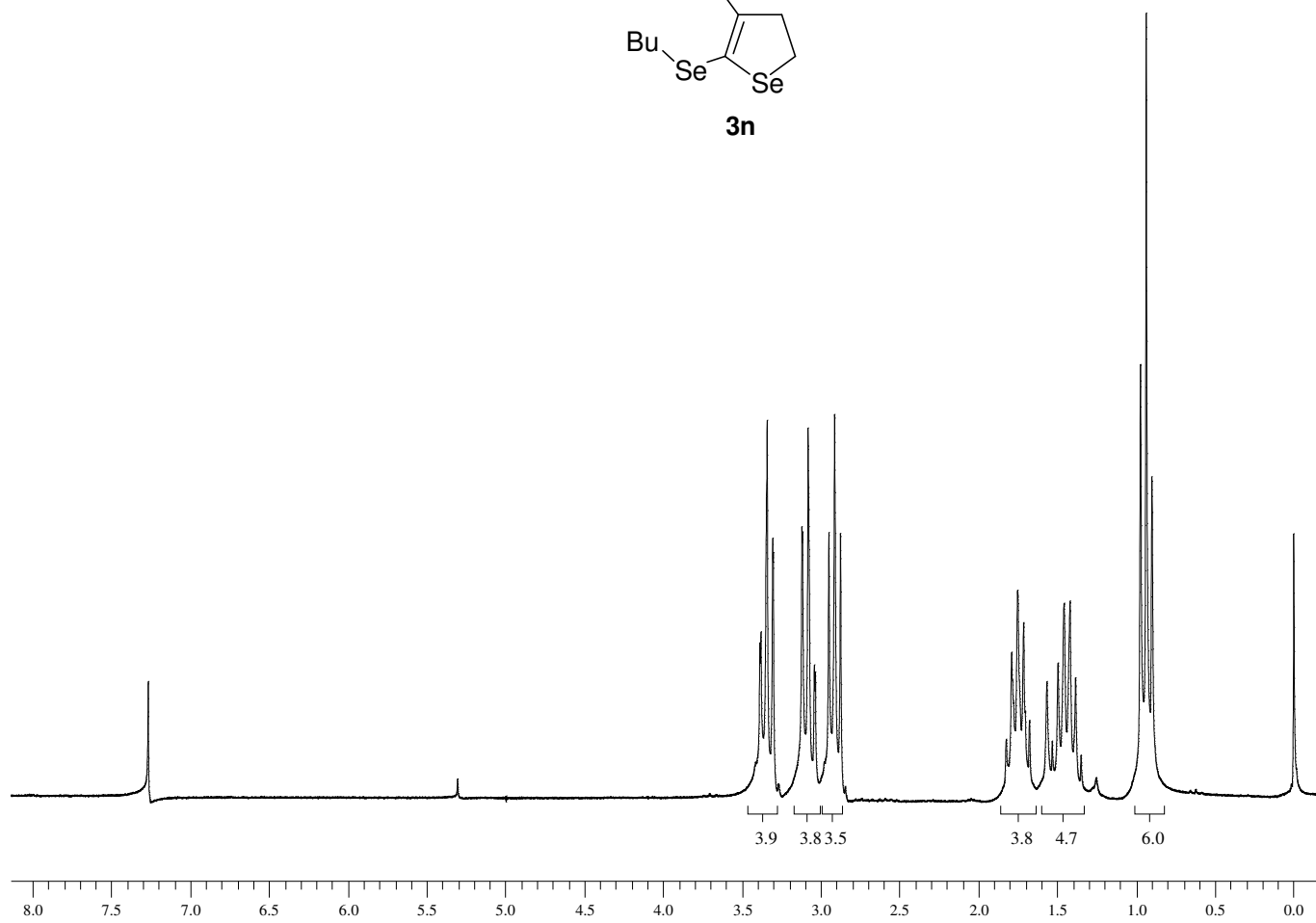
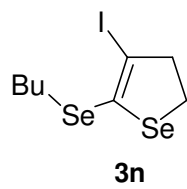


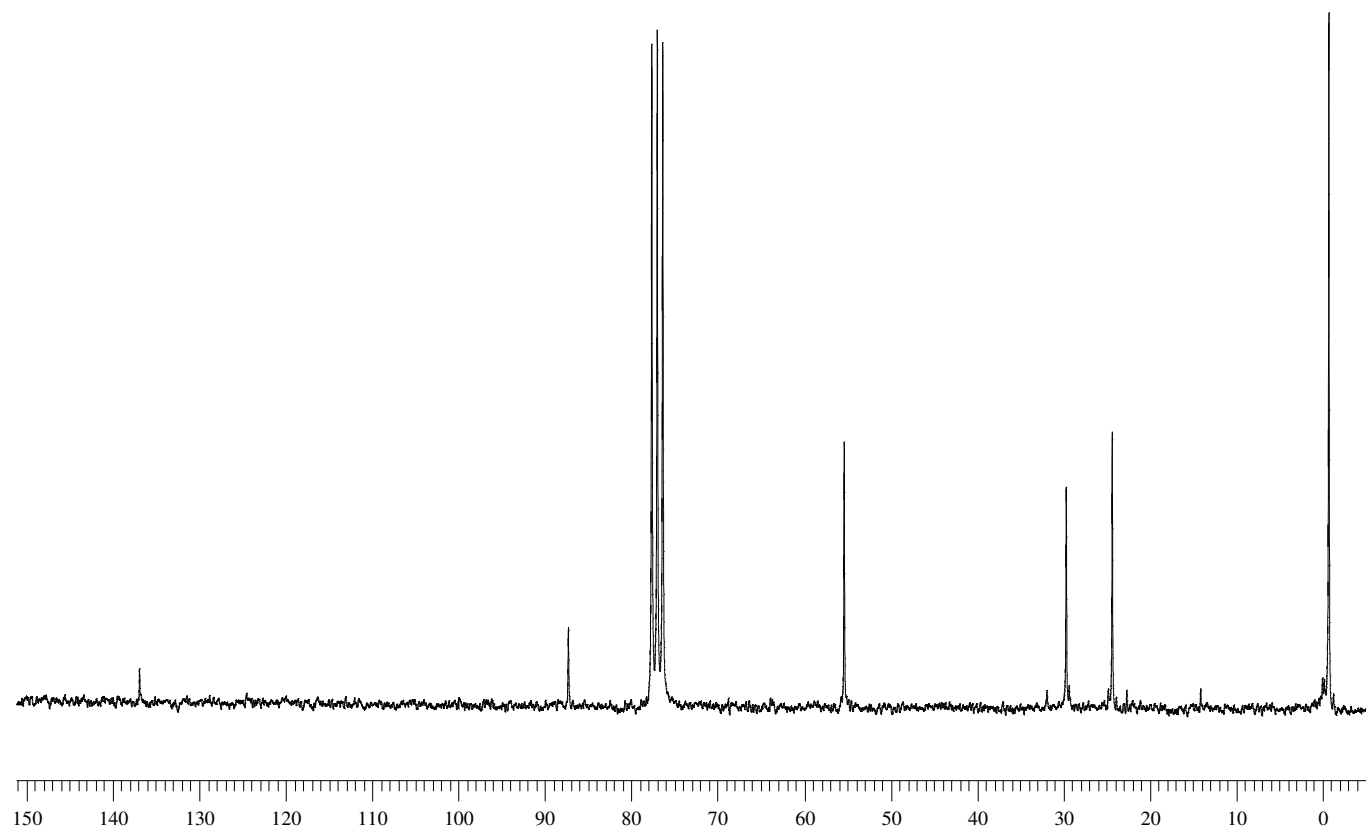
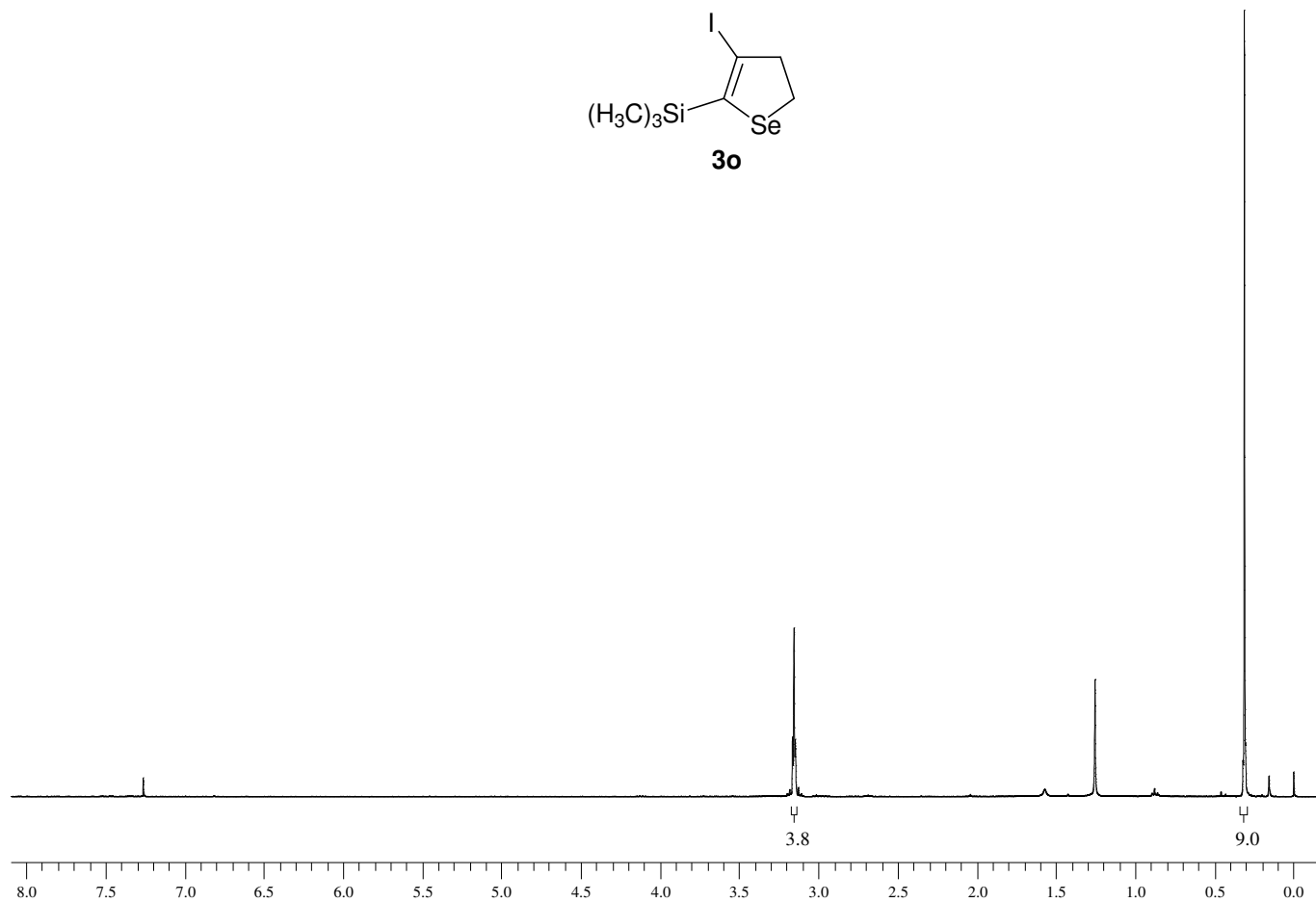
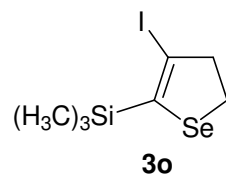


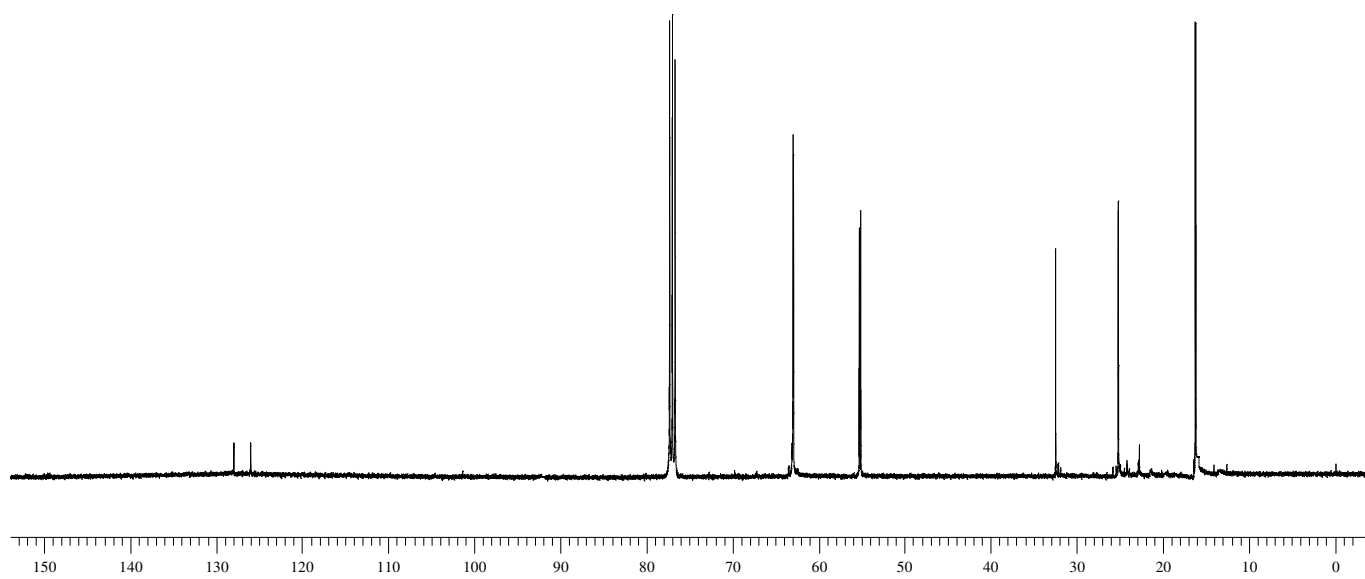
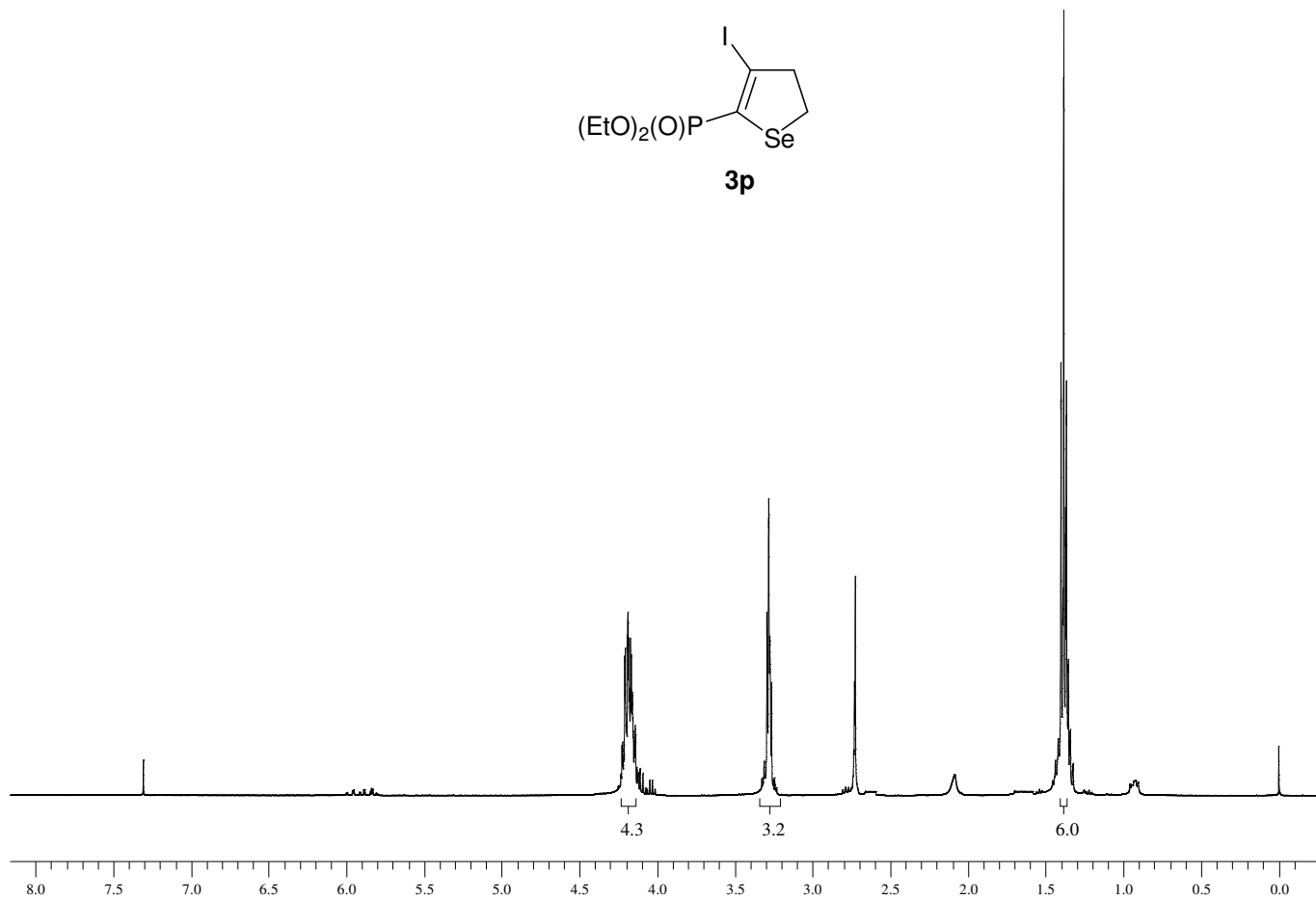
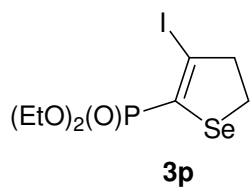


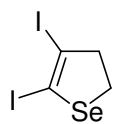




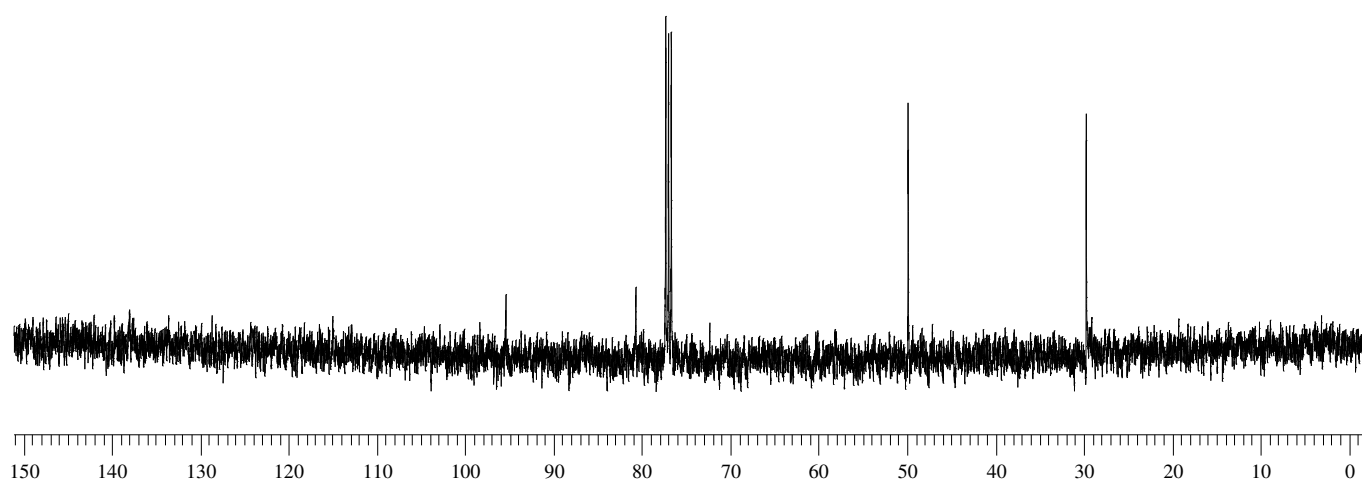
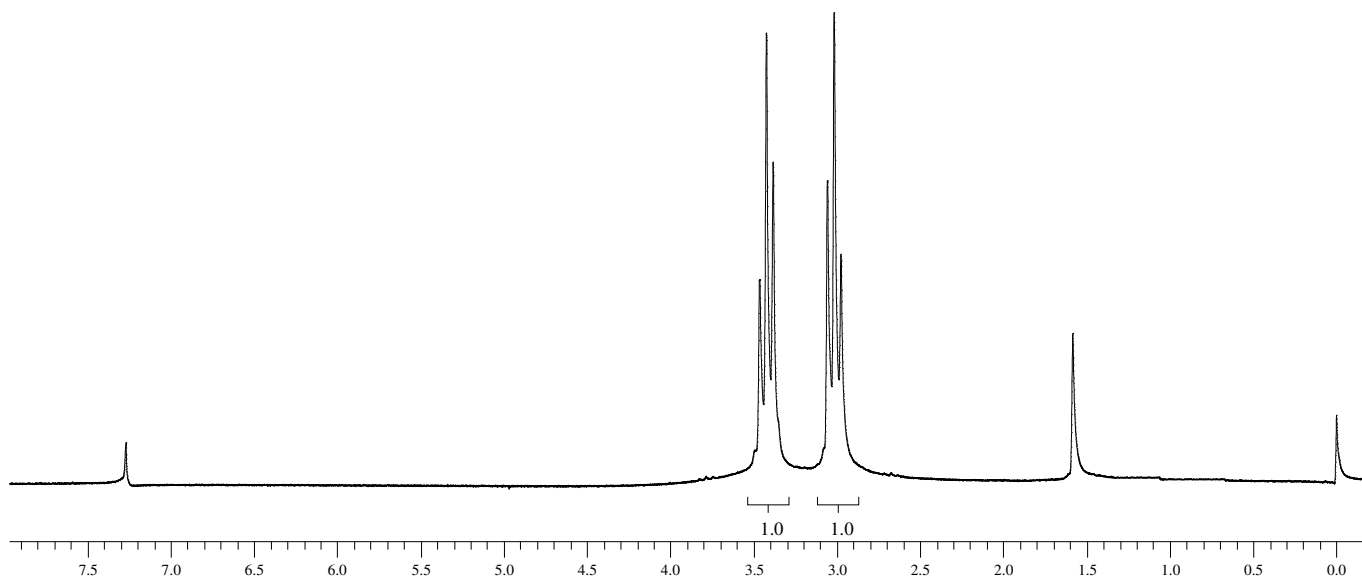


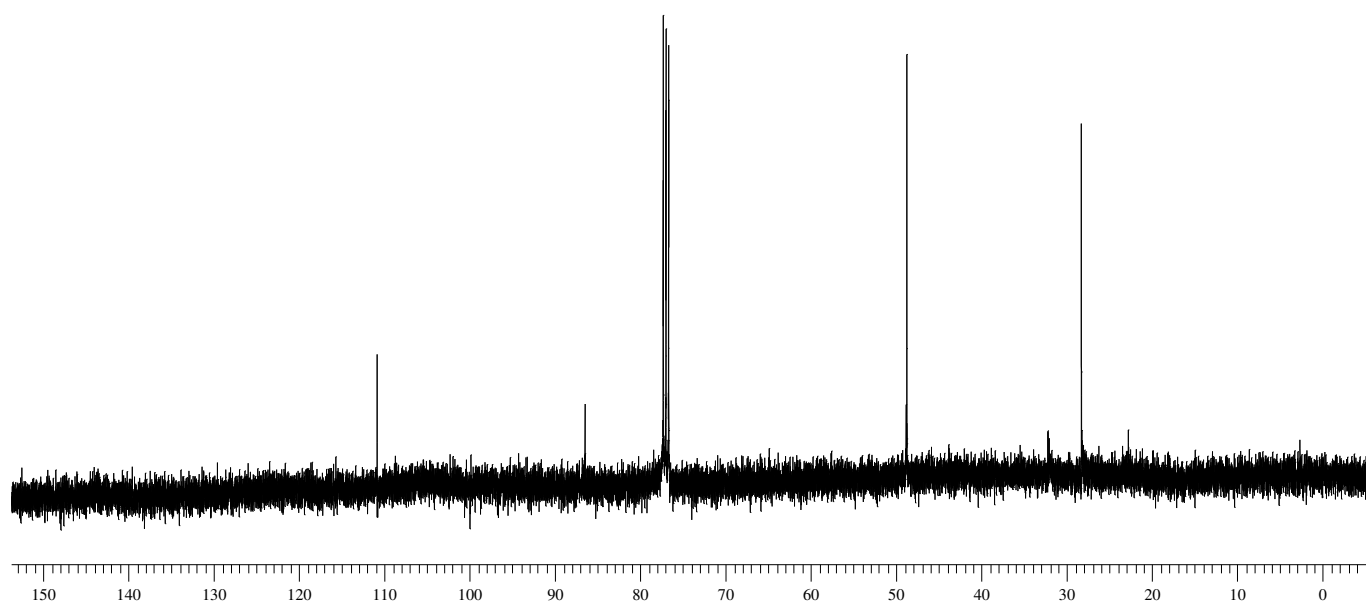
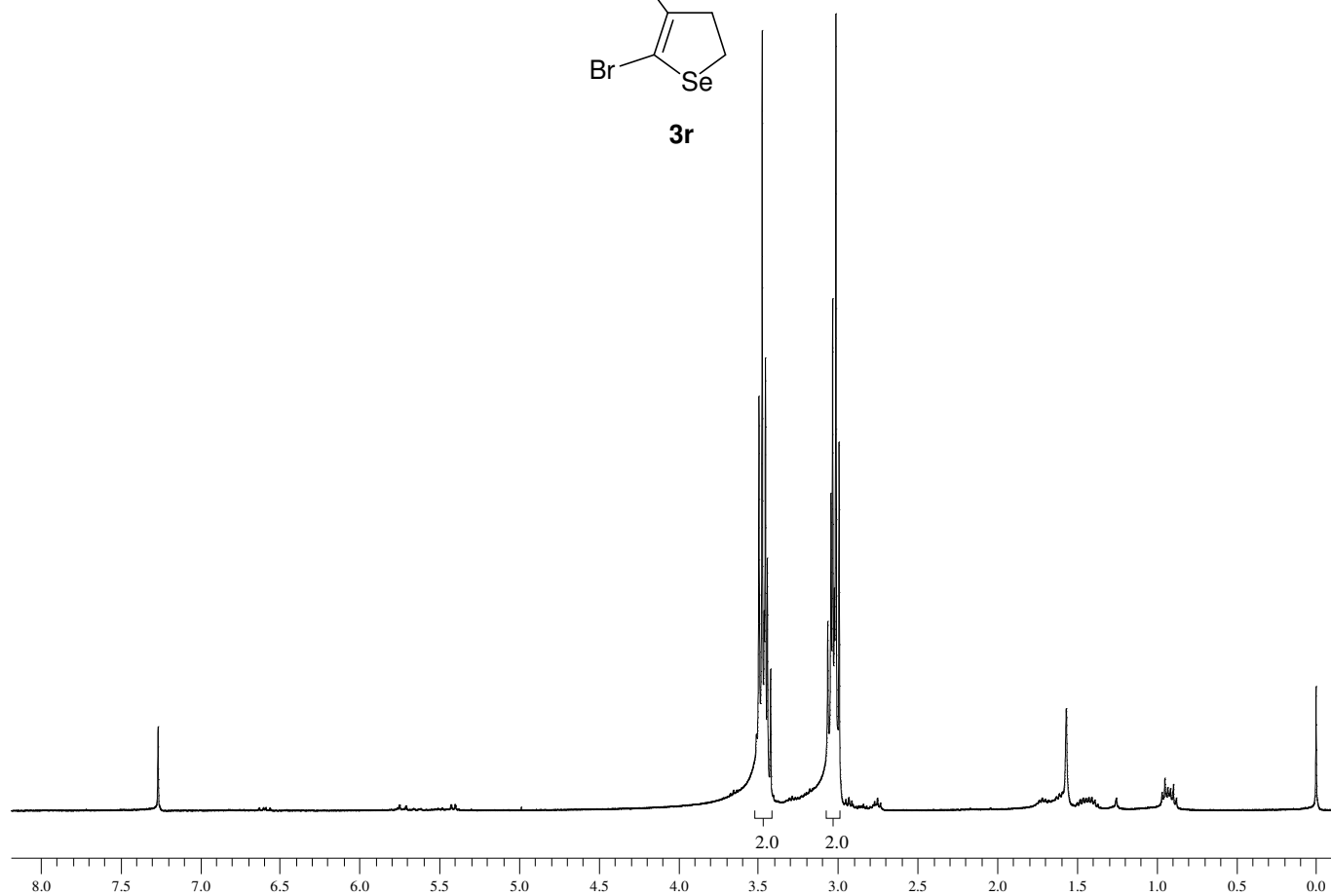
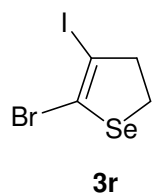


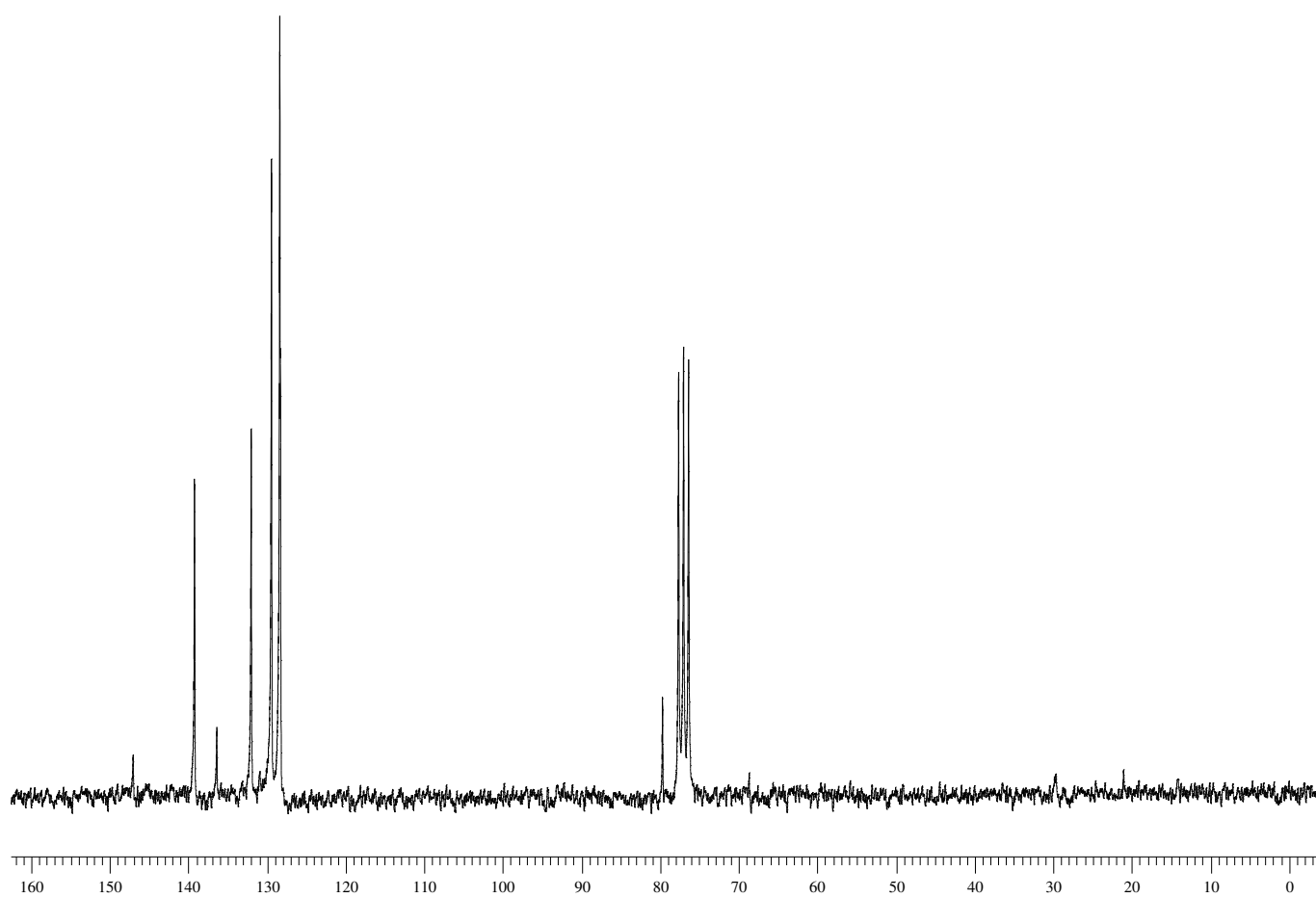
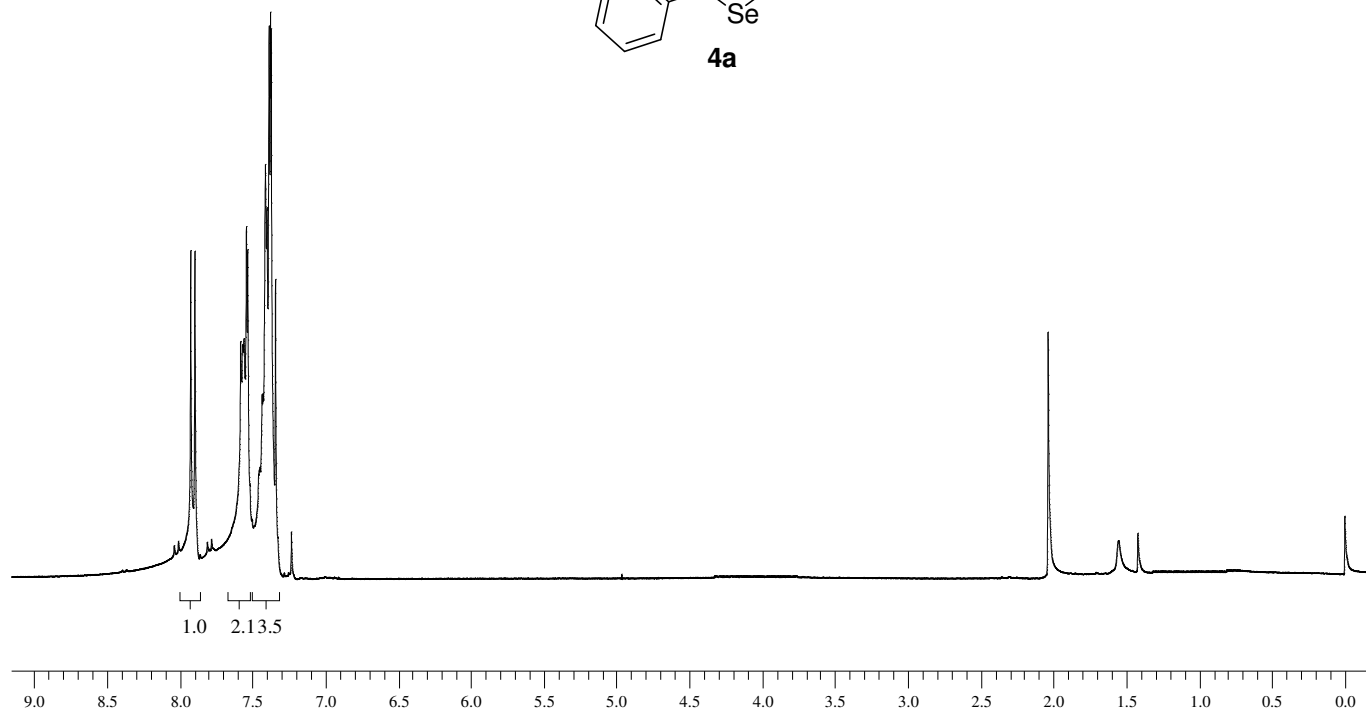
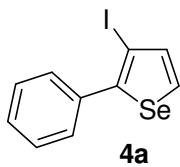


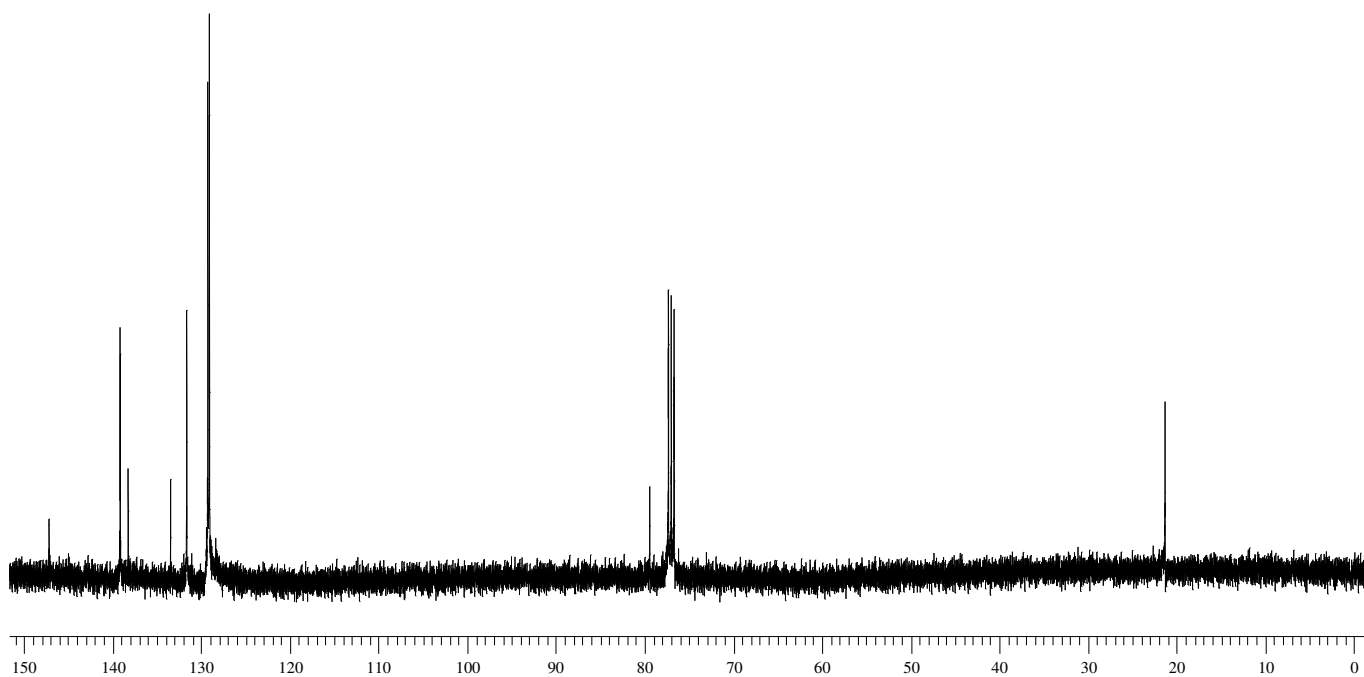
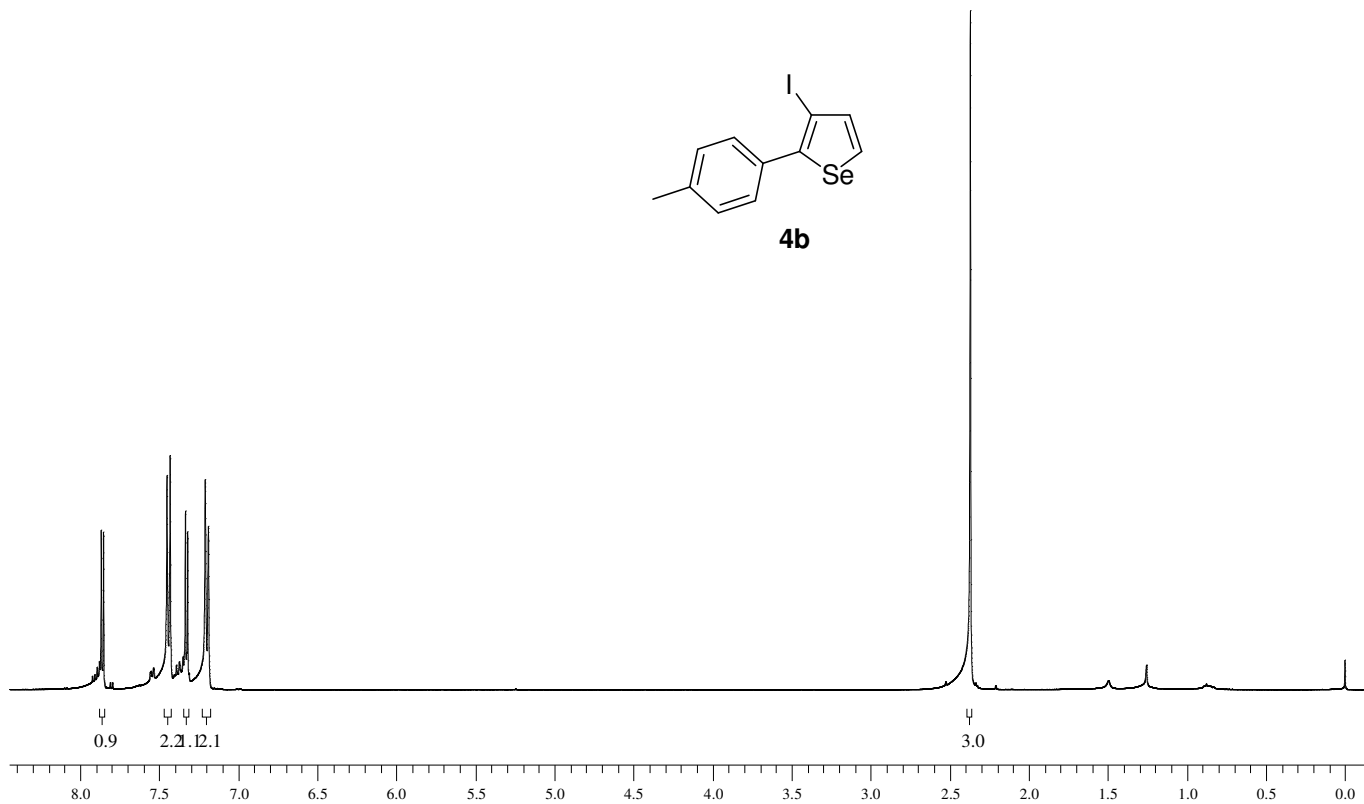
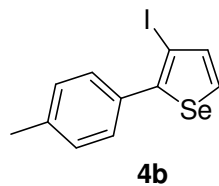


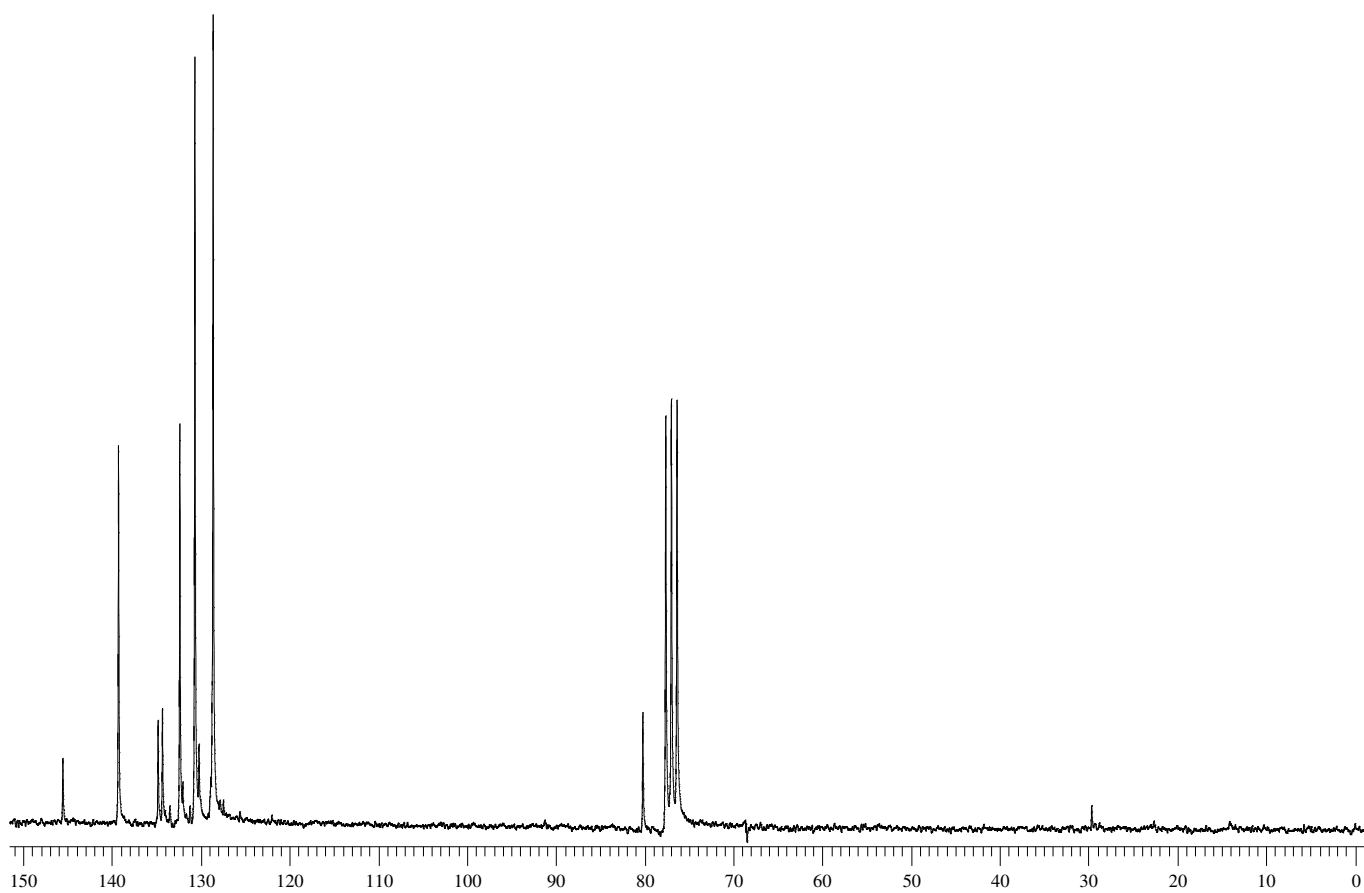
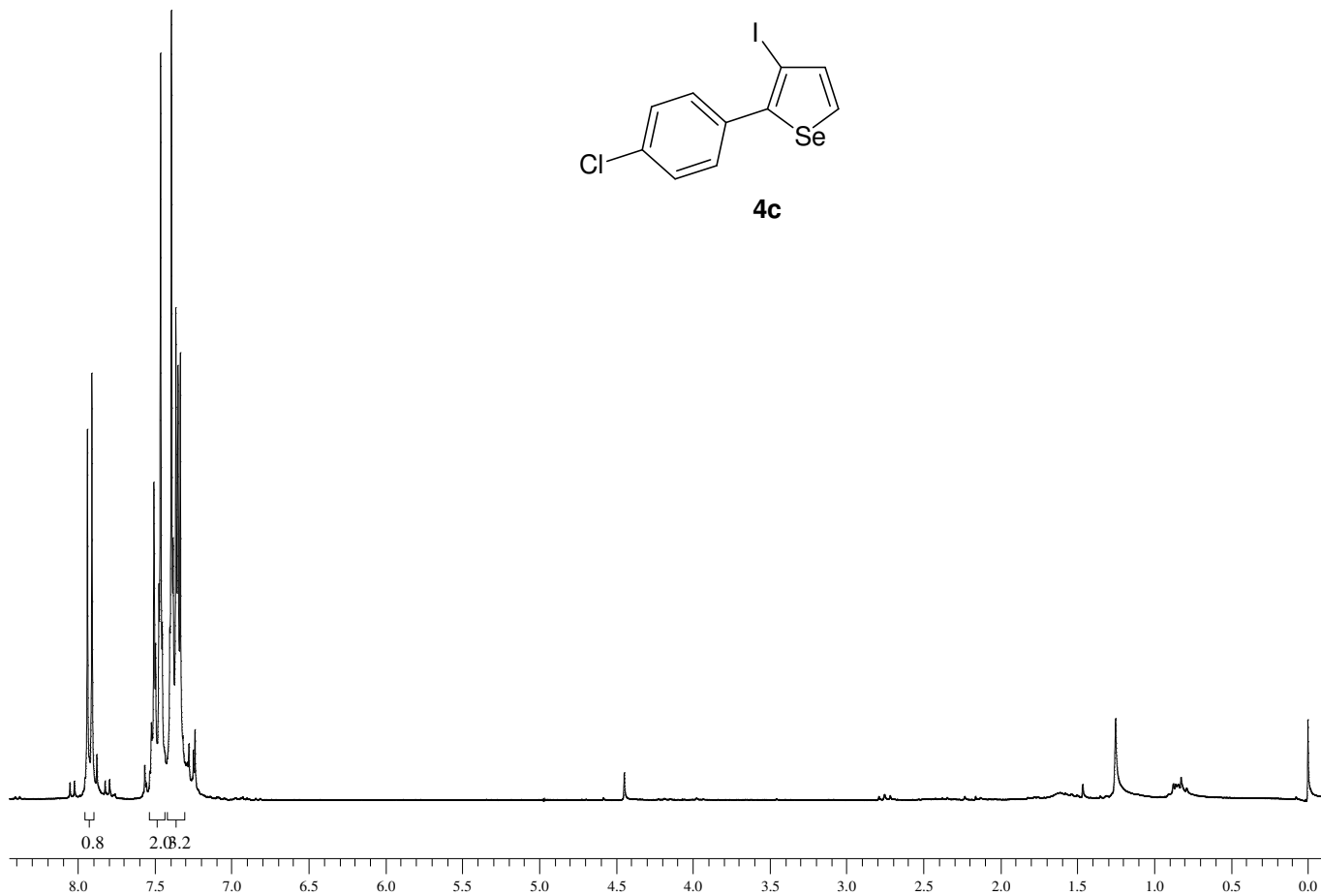
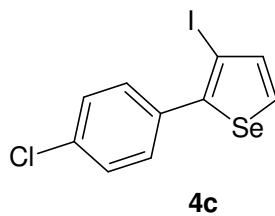
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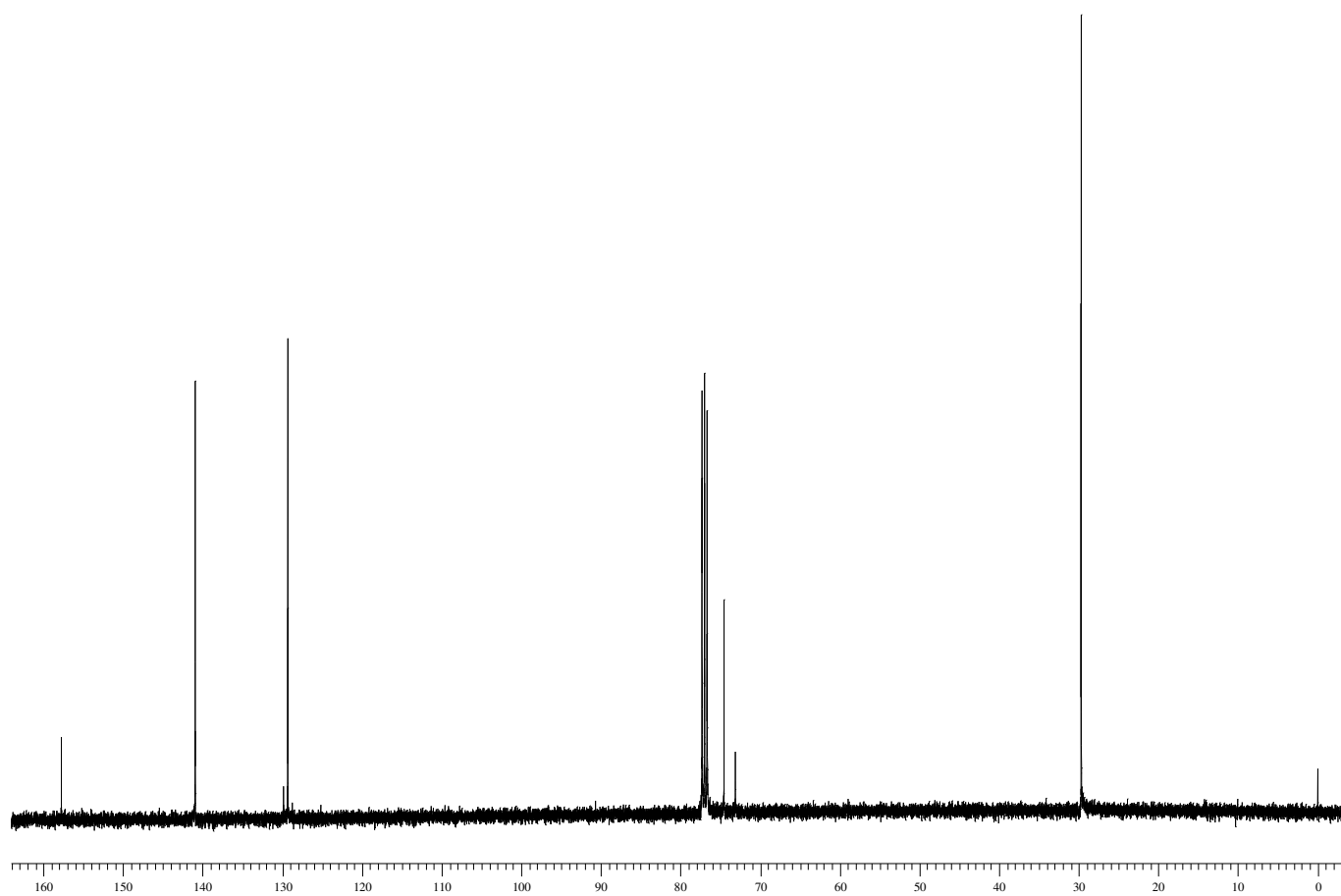
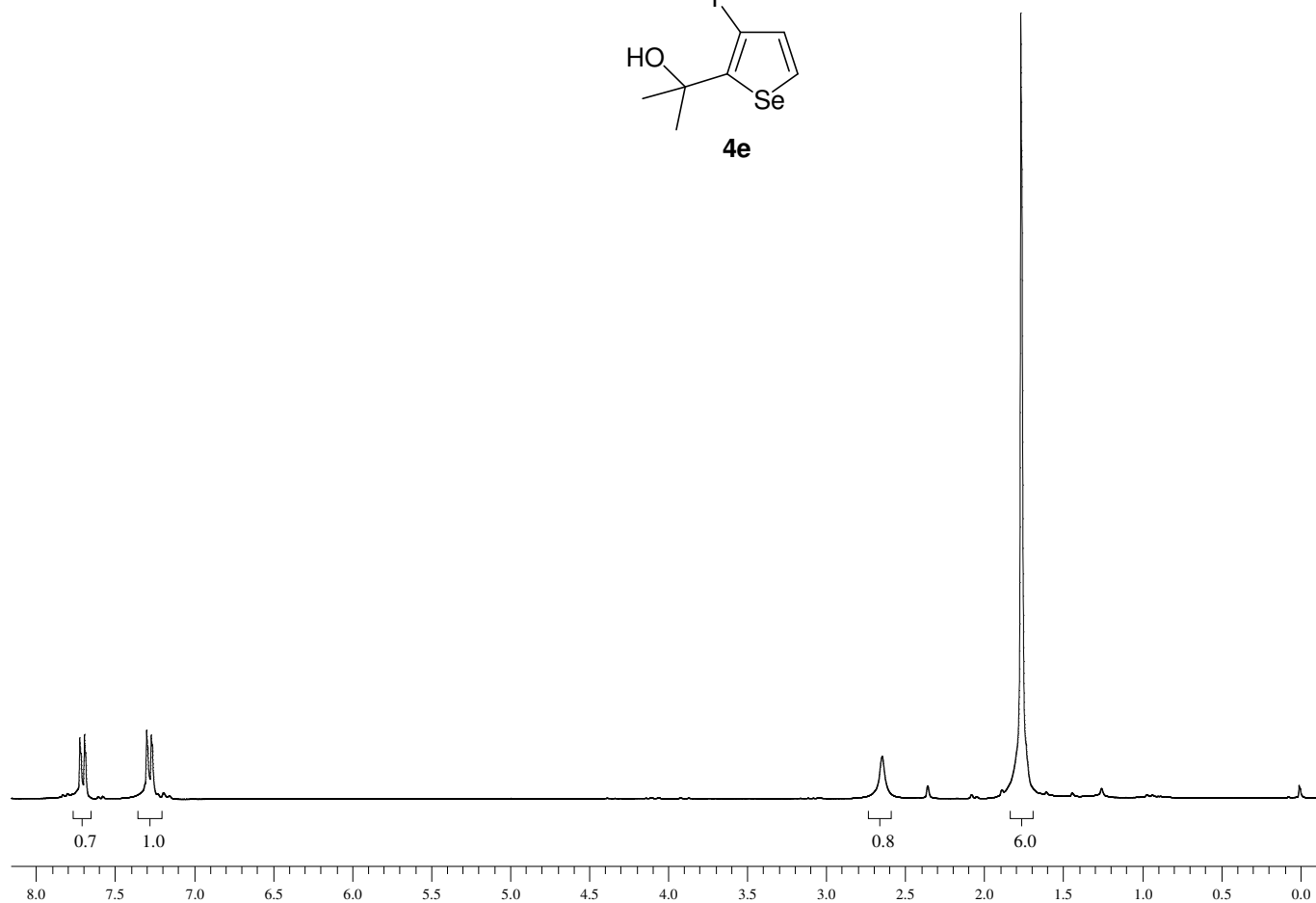
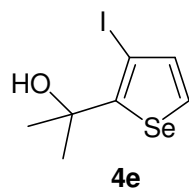


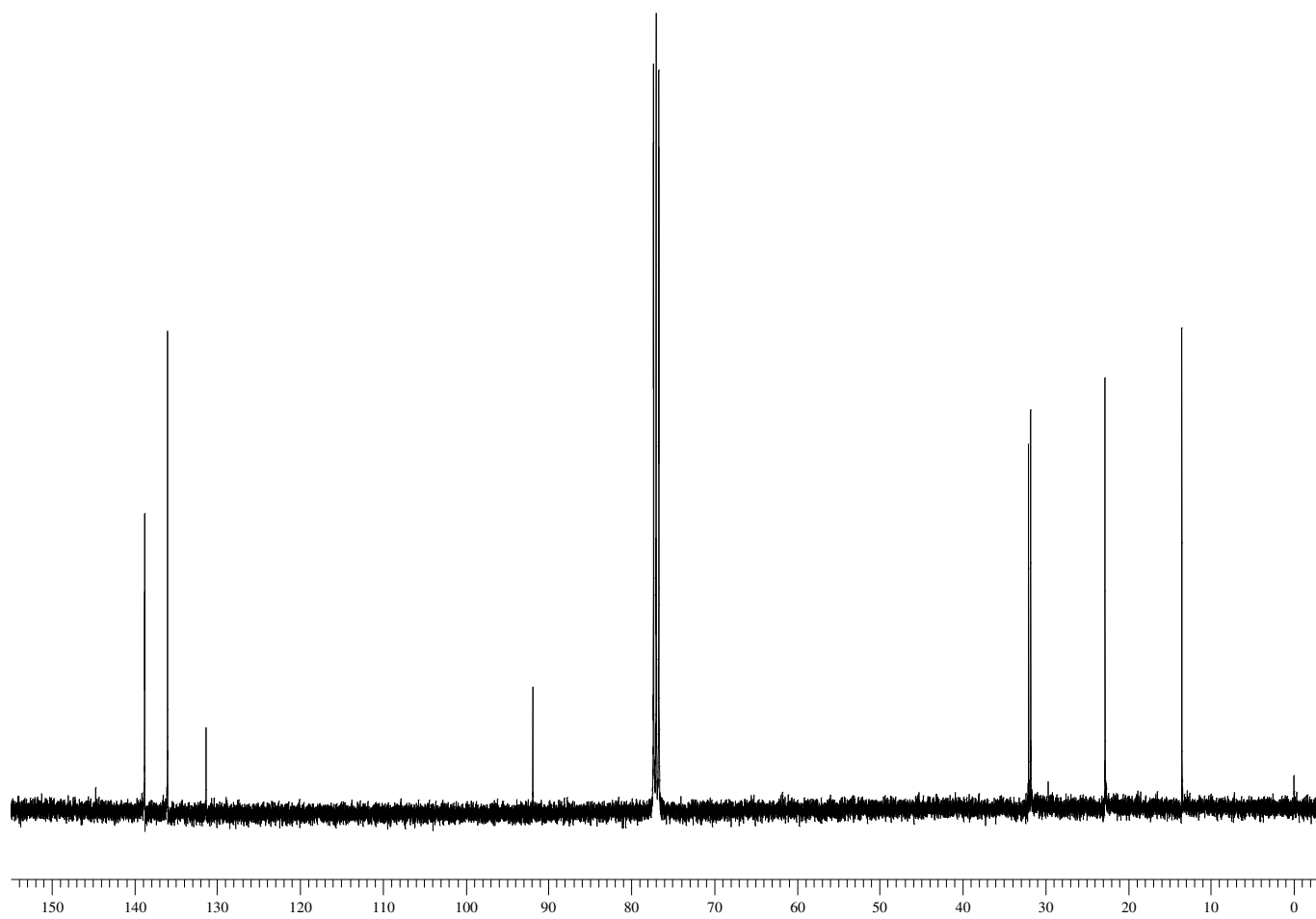
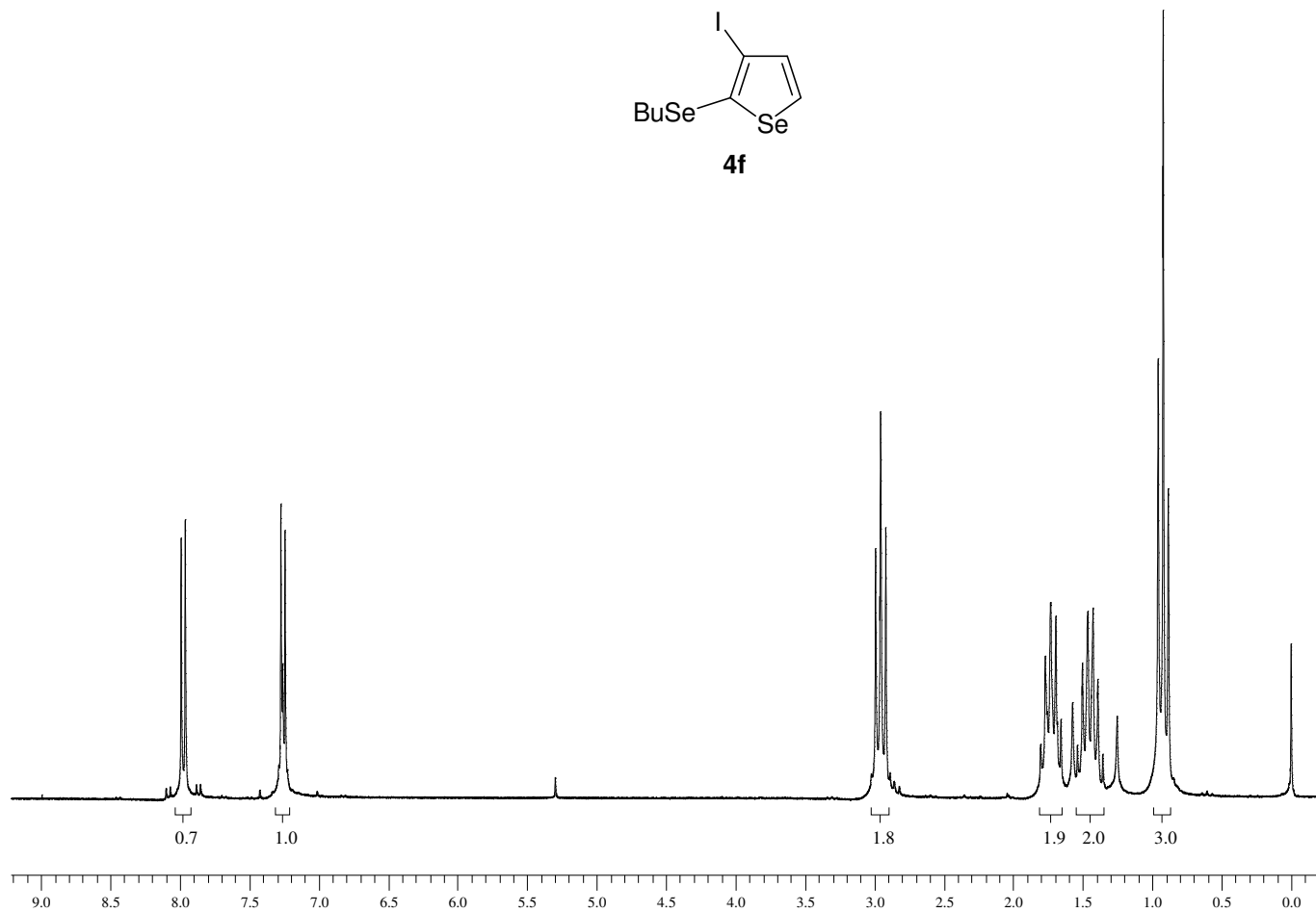
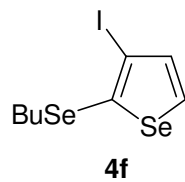


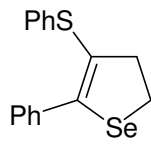












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