Supporting Information

for

Cu-Mediated trifluoromethylation of benzyl, allyl and propargyl methanesulfonates with $TMSCF_3$

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Experimental details, characterization data of all products and copies of NMR spectra.

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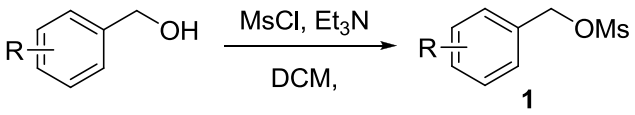
General information:

^{1}H NMR (TMS as the internal standard) and ^{19}F NMR spectra ($CFCl_3$ as the outside standard and low field is positive) were recorded on a Bruker AM300 or Bruker AM400 spectrometer. ^{13}C NMR was recorded on a Bruker AM400 spectrometer. Chemical shifts (δ) are reported in ppm, and coupling constants (*J*) are in Hertz (Hz). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q =quartet, m = multiplet, br = broad. Substrates were purchased from commercial sources (Aldrich, Alfa and Chemical Reagent Companies of China) and used as received. Reactions were performed under an atmosphere of nitrogen using glassware that was flame-dried under vacuum. Benzyl alcohols and allylic alcohols were obtained commercially. Propargylic alcohols 1-phenylhex-4-yn-3-ol [1], 1-phenylnon-4-yn-3-ol [2] and 5-phenyl-1-(trimethylsilyl)pent-1-yn-3-ol [3] were prepared according to literature procedures. Compounds **2a** [4], **2b** [5], **2d** [5], **2e** [6], **2f** [7], **2h** [8], **2i-2j** [7] and **2o** [9] have been published previously.

Preparation of substrates:

General procedure for the preparation of benzyl, allylic and propargylic methanesulfonates:



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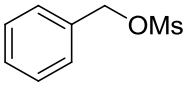
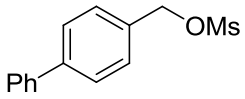
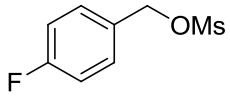
To a stirred solution of benzyl alcohol (5.0 mmol) and triethylamine (10 mmol) in DCM (20 mL) under N_2 atmosphere at −20 °C was added methanesulfonyl chloride (7.5 mmol) dropwise. The reaction was stirred for 1 hour (monitored by TLC). The mixture was then allowed to warm to room temperature and washed with water, 2 M HCl and brine, dried over sodium sulfate. The solvent was removed to give the crude product, which was used without purification.



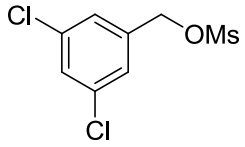
Benzyl methanesulfonate (1a): Colorless oil; yield 91%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.41 (m, 5H), 5.24 (s, 2H), 2.90 (s, 3H).



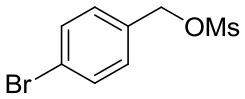
Biphenyl-4-ylmethyl methanesulfonate (1b): White solid; yield 83%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.38-7.65 (m, 9H), 5.29 (s, 2H), 2.95 (s, 3H).



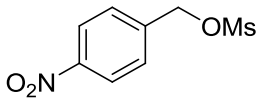
4-Fluorobenzyl methanesulfonate (1c): Colorless oil; yield 91%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.39-7.41 (m, 2H), 7.10-7.13 (m, 2H), 5.13 (s, 2H), 2.93 (s, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -111.5 (m, 1F).



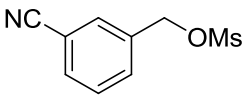
3,5-Dichlorobenzyl methanesulfonate (1d): White solid; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.39 (s, 1H), 7.31 (s, 2H), 5.17 (s, 2H), 3.04 (s, 3H).



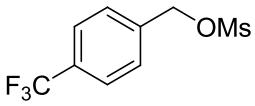
4-Bomobenzyl methanesulfonate (1e): White solid; yield 98%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.55 (d, *J* = 8.4 Hz, 2H), 7.30 (d, *J* = 8.4 Hz, 2H), 5.19 (s, 2H), 2.95 (s, 3H).



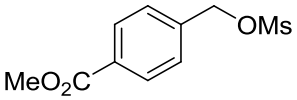
4-Nitrobenzyl methanesulfonate (1f): White solid; yield 97%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 8.29 (d, *J* = 8.4 Hz, 2H), 7.74 (m, *J* = 8.4 Hz, 2H), 5.46 (s, 2H), 3.34 (s, 3H).



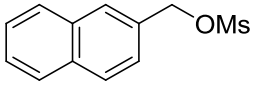
3-Cyanobenzyl methanesulfonate (1g): White solid; yield 95%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.52-7.72 (m, 4H), 5.26 (s, 2H), 3.05 (s, 3H).



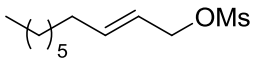
4-(Trifluoromethyl)benzyl methanesulfonate (1h): Colorless oil; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.68 (d, *J* = 7.2 Hz, 2H), 7.54 (m, *J* = 7.2 Hz, 2H), 5.29 (s, 2H), 3.01 (s, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm –62.8 (s, 3F).



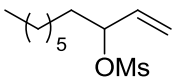
Methyl 4-((methylsulfonyloxy)methyl)benzoate (1i): White solid; yield 98%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 8.08 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 8.4 Hz, 2H), 5.29 (s, 2H), 2.94 (s, 3H), 2.98 (s, 3H).



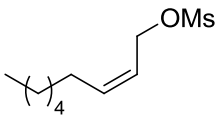
Naphthalen-2-ylmethyl methanesulfonate (1j): White solid; yield 93%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.85-7.91 (m, 4H), 7.50-7.55 (m, 3H), 5.41 (s, 2H), 2.91 (s, 3H).



(*E*)-dec-2-enyl methanesulfonate (1k): Colorless oil; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 5.88-5.97 (m, 1H), 5.56-5.66 (m, 1H), 4.69 (d, *J* = 6.6 Hz, 2H), 3.01 (s, 3H), 2.06-2.12 (m, 2H), 1.27-1.41 (m, 10H), 0.88 (t, *J* = 6.9 Hz, 3H).

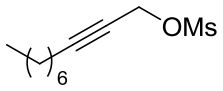


Dec-1-en-3-yl methanesulfonate (1l): Colorless oil; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 5.80-5.92 (m, 1H), 5.32-5.44 (m, 2H), 4.97-5.04 (m, 1H), 2.98 (s, 1H), 1.28-1.82 (m, 12H), 0.88 (t, *J* = 6.6 Hz, 3H).

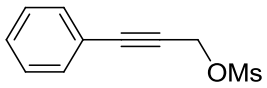


(*Z*)-non-2-enyl methanesulfonate (1m): Colorless oil; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 5.76-5.85 (m, 1H), 5.55-5.63 (m, 1H), 4.80 (d, *J* = 6.9 Hz, 2H), 3.01 (s, 3H), 2.10-2.17 (m,

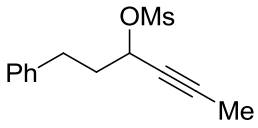
2H), 1.28-1.39 (m, 8H), 0.88 (t, *J* = 6.6 Hz, 3H).



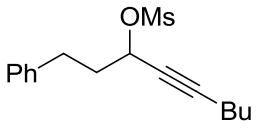
Dec-2-ynyl methanesulfonate (1n): Colorless oil; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 4.86 (m, 2H), 3.11 (s, 3H), 2.25 (t, *J* = 6.9 Hz, 2H), 1.28-1.58 (m, 10H), 0.89 (t, *J* = 6.9 Hz, 3H).



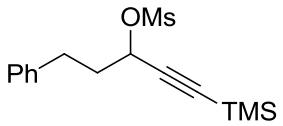
3-Phenylprop-2-ynyl methanesulfonate (1o): Yellow oil; yield 97%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.35-7.48 (m, 5H), 5.09 (s, 2H), 3.17 (s, 3H).



1-Phenylhex-4-yn-3-yl methanesulfonate (1p): Colorless oil; yield 83%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.19-7.32 (m, 5H), 5.12-5.17 (m, 1H), 3.11 (s, 3H), 2.78-2.84 (m, 2H), 2.12-2.22 (m, 2H), 1.91 (d, *J* = 1.8 Hz, 3H).



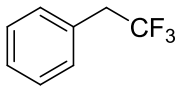
1-Phenylnon-4-yn-3-yl methanesulfonate (1q): Colorless oil; yield 93%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.19-7.32 (m, 5H), 5.16 (t, *J* = 6.6 Hz, 1H), 3.11 (s, 1H), 2.81-2.82 (m, 2H), 2.18-2.29 (m, 4H), 1.42-1.52 (m, 4H), 0.92 (t, *J* = 6.9 Hz, 3H).



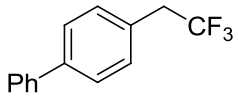
5-Phenyl-1-(trimethylsilyl)pent-1-yn-3-yl methanesulfonate (1r): Colorless oil; yield 100%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.19-7.32 (m, 5H), 5.13 (t, *J* = 6.6 Hz, 1H), 3.14 (s, 3H), 2.78-2.85 (m, 2H), 2.14-2.25 (m, 2H), 0.20 (s, 9H).

General procedure for the Cu-mediated trifluoromethylation of benzyl methanesulfonates:

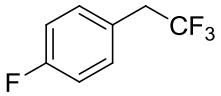
Into a Schlenk tube equipped with a magnetic stir bar were added CuI (2.2 mmol) and KF (4.0 mmol) under Ar atmosphere. DMF (5.0 mL) and Me_3SiCF_3 (2.0 equiv) were added. After stirring for 20 minutes, the mixture was heated to 60 °C and then the benzyl methanesulfonate (2.0 mmol) was added under N_2 atmosphere. The reaction mixture was kept at 60 °C for 4 hours and then allowed to cool down to room temperature. The resulting mixture was diluted with diethyl ether, washed with water and brine, dried over sodium sulfate, and concentrated. The crude products were purified by column chromatography on silica gel to give the products.



(2,2,2-Trifluoroethyl)benzene (2a): Colorless liquid; yield 76% after distillation on 10 mmol scale. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.27-7.32 (m, 5H), 3.31 (q, *J* = 10.8 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -66.0 (t, *J* = 11.6 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 130.2, 128.7, 128.1, 125.9 (q, *J* = 275.5 Hz), 40.2 (q, *J* = 29.6 Hz). HRMS (EI) Calculated for $C_8H_7F_3$:160.0500; Found: 160.0502.

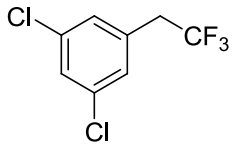


4-(2,2,2-Trifluoroethyl)biphenyl (2b): White solid; yield 79%; mp 81-82 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.36-7.60 (m, 9H), 3.41 (q, *J* = 10.5 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.8 (t, *J* = 11.3 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 141.1, 140.5, 130.6, 129.2, 128.9, 127.6, 127.4, 127.1, 125.9 (q, *J* = 275.6 Hz), 39.9 (q, *J* = 29.6 Hz). Anal. Calcd. for $C_{14}H_{11}F_3$: C, 71.18; H, 4.69. Found: C, 71.17; H, 4.69.

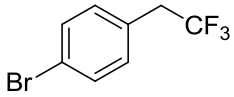


1-Fluoro-4-(2,2,2-trifluoroethyl)benzene (2c): Colorless liquid; yield 75% after distillation on 10 mmol scale. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.22-7.27 (m, 2H), 7.00-7.05 (m, 2H), 3.32 (q, *J* = 10.8 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -66.4 (t, *J* = 11.3 Hz, 3F), -114.2 (s, 1F). ^{13}C

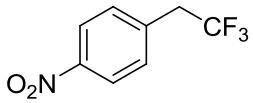
NMR (100 MHz, $CDCl_3$) δ ppm 162.9 (d, *J* = 245.9 Hz), 132.0 (d, *J* = 8.4 Hz),126.1, 125.8 (q, *J* = 275.5 Hz), 115.8 (d, *J* = 22.0 Hz), 39.6 (q, *J* = 29.6 Hz). HRMS (EI) Calculated for $C_8H_6F_4$: 178.0406; Found: 178.0403.



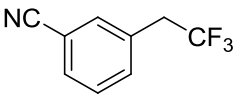
1,3-Dichloro-5-(2,2,2-trifluoroethyl)benzene (2d): White solid; yield 72%; mp 46-47 ^oC. ^1H NMR (300 MHz, $CDCl_3$) δ ppm 7.36 (s, 1H), 7.20 (s, 2H), 3.33 (q, *J* = 10.5 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.7 (t, *J* = 10.0 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 135.1, 133.3, 128.8, 128.7, 125.3 (q, *J* = 276.1 Hz), 39.7 (q, *J* = 30.0 Hz). Anal. Calcd. for $C_8H_5Cl_2F_3$: C, 49.95; H, 2.20. Found: C, 41.89; H, 2.21.



1-Bromo-4-(2,2,2-trifluoroethyl)benzene (2e): White solid; yield 78%; mp 55-57 ^oC. ^1H NMR (300 MHz, $CDCl_3$) δ ppm 7.48 (d, *J* = 6.6 Hz, 2H), 7.15 (d, *J* = 7.8 Hz, 2H), 3.30 (q, *J* = 10.5 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -66.0 (t, *J* = 10.2 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 132.0, 131.9, 129.2, 125.6 (q, *J* = 274.8 Hz), 39.8 (q, *J* = 29.6 Hz). HRMS (EI) Calculated for $C_8H_6BrF_3$: 237.9605; Found: 237.9607.

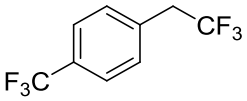


1-Nitro-4-(2,2,2-trifluoroethyl)benzene (2f): White solid; yield 40%; mp 65-66 ^oC. ^1H NMR (300 MHz, $CDCl_3$) δ ppm 8.24 (d, *J* = 8.4 Hz, 2H), 7.50 (d, *J* = 8.4 Hz, 2H), 3.50 (q, *J* = 10.4 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.5 (t, *J* = 10.9 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 148.1, 137.4, 131.3, 125.2 (q, *J* = 276.6 Hz), 124.0, 40.1 (q, *J* = 30.6 Hz). HRMS (EI) Calculated for $C_8H_6F_3NO_2$: 205.0351; Found: 205.0347.

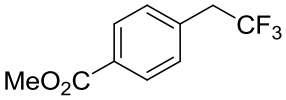


3-(2,2,2-Trifluoroethyl)benzonitrile (2g): White solid; yield 81%; mp 65-67 ^oC. ^1H NMR (300

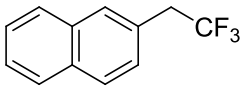
MHz, $CDCl_3$) δ ppm 7.47-7.66 (m, 4H), 3.43 (q, *J* = 10.8 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.9 (t, *J* = 10.2 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 134.6, 133.6, 131.8, 125.2 (q, *J* = 275.5 Hz), 118.2, 113.0, 39.7 (q, *J* = 30.4 Hz). HRMS (EI) Calculated for $C_9H_6F_3N$: 185.0452; Found: 185.0452.



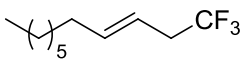
1-(2,2,2-Trifluoroethyl)-4-(trifluoromethyl)benzene (2h): Colorless liquid; yield 80%. ^1H NMR (300 MHz, $CDCl_3$) δ ppm 7.63 (d, *J* = 8.1 Hz, 2H), 7.43 (d, *J* = 7.8 Hz, 2H), 3.44 (q, *J* = 10.5 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -62.7 (s, 3F), -65.7 (t, *J* = 11.3 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 134.3, 130.7, 129.0, 125.8 (q, *J* = 4.2 Hz), 125.6 (q, *J* = 275.3 Hz), 124.2 (q, *J* = 270.8 Hz), 40.2 (q, *J* = 30.1 Hz). HRMS (EI) Calculated for $C_9H_6F_6$: 228.0374; Found: 228.0375.



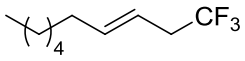
Methyl 4-(2,2,2-trifluoroethyl)benzoate (2i): White solid; yield 68%; mp 54-55 ^oC. ^1H NMR (300 MHz, $CDCl_3$) δ ppm 8.03 (d, *J* = 8.7 Hz, 2H), 7.38 (d, *J* = 8.1 Hz, 2H), 3.92 (s, 2H), 3.43 (q, *J* = 10.5 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.6 (t, *J* = 10.7 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 166.7, 135.2, 130.3, 130.2, 130.0, 125.6 (q, *J* = 275.7 Hz), 52.2, 40.2 (q, *J* = 29.3 Hz).



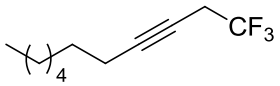
2-(2,2,2-Trifluoroethyl)naphthalene (2j): White solid; yield 78%; mp 54-55 ^oC. ^1H NMR (300 MHz, $CDCl_3$) δ ppm 7.39-7.85 (m, 7H), 3.53 (q, *J* = 11.1 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.6 (t, *J* = 11.3 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 133.4, 133.0, 129.6, 128.5, 127.9, 127.8, 127.7, 126.5, 126.4, 126.1 (q, *J* = 275.6 Hz), 40.4 (q, *J* = 29.8 Hz). Anal. Calcd. for $C_{12}H_9F_3$: C, 68.57; H, 4.32. Found: C, 68.57; H, 4.36.



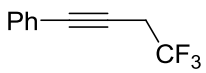
(*E*)-1,1,1-Trifluoroundec-3-ene (2k): Colorless liquid; yield 78% from **1k**, 80% from **1l**. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 5.65-5.73 (m, 1H), 5.33-5.40 (m, 1H), 2.70-2.79 (m, 2H), 2.02-2.07 (m, 2H), 1.28-1.39 (m, 10H), 0.88 (t, *J* = 6.8 Hz, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -67.0 (t, *J* = 9.4 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 138.7, 126.3 (q, *J* = 274.9 Hz), 117.7 (q, *J* = 4.3 Hz), 37.6 (q, *J* = 29.0 Hz), 32.7, 32.1, 29.4, 29.3, 29.2, 22.9, 14.2. HRMS (EI) Calculated for $C_{11}H_{19}F_3$: 208.1439; Found: 208.1438.



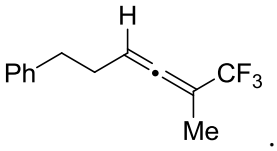
(*E*)-1,1,1-Trifluorodec-3-ene (2m): Colorless liquid; yield 87%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 5.66-5.73 (m, 1H), 5.33-5.40 (m, 1H), 2.71-2.81 (m, 2H), 2.02-2.07 (m, 2H), 1.28-1.39 (m, 8H), 0.88 (t, *J* = 4.8 Hz, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -66.8 (t, *J* = 8.2 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 138.7, 126.3 (q, *J* = 275.0 Hz), 117.7 (q, *J* = 3.6 Hz), 37.6 (q, *J* = 28.6 Hz), 32.7, 31.9, 29.1, 28.9, 22.8, 14.2. IR (neat) 2960, 2930, 1367, 1253, 1138 cm^{-1}. HRMS (EI) Calculated for $C_{10}H_{17}F_3$: 194.1282; Found: 194.1279.



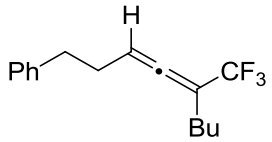
1,1,1-Trifluoroundec-3-yne (2n): Colorless liquid; yield 64%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 2.98 (q, *J* = 7.5 Hz, 2H), 2.16 (t, *J* = 5.4 Hz, 2H), 1.28-1.54 (m, 10H), 0.88 (t, *J* = 5.1 Hz, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -67.3 (t, *J* = 9.8 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 124.7 (q, *J* = 274.2 Hz), 85.2, 68.3 (q, *J* = 4.8 Hz), 31.9, 28.94, 28.89, 28.6, 26.3 (q, *J* = 33.7 Hz), 22.8, 18.7, 14.2. IR (neat) 2933, 2859, 2245, 1366, 1258, 1113 cm^{-1}. Anal. Calcd. for $C_{11}H_{17}F_3$: C, 64.06; H, 8.31. Found: C, 64.09; H, 8.32.



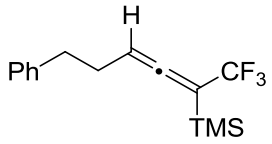
(4,4,4-Trifluorobut-1-ynyl)benzene (2o): Yellow liquid; yield 50%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.46-7.31 (m, 5H), 3.27 (q, *J* = 9.6 Hz, 2H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -66.0 (t, *J* = 11.6 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 131.0, 128.9, 128.5, 124.4 (q, *J* = 275.1 Hz), 122.3, 84.5, 77.5 (q, J = 4.1 Hz), 26.9 (q, *J* = 35.1 Hz). HRMS (EI) Calculated for $C_{10}H_7F_3$: 184.0500; Found: 184.0498.



(6,6,6-Trifluoro-5-methylhexa-3,4-dienyl)benzene (2p): Colorless liquid; yield 89%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.17-7.31 (m, 5H), 5.56 (m, 1H), 2.74 (t, *J* = 7.5 Hz, 2H), 2.37-2.44 (m, 2H), 1.73 (d, *J* = 2.7 Hz, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -65.8 (d, *J* = 4.2 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 202.7, 141.1, 128.6, 128.5, 126.2, 124.1 (q, *J* = 271.9 Hz), 96.5, 94.3 (q, *J* = 34.3 Hz), 34.9, 29.7, 13.0. IR (neat) 3065, 3029, 2932, 1981, 1455, 1307, 1118 cm^{-1}. Anal. Calcd. for $C_{13}H_{13}F_3$: C, 69.02; H,5.79. Found: C, 69.00; H, 5.72.



(5-(Trifluoromethyl)nona-3,4-dienyl)benzene (2q): Colorless liquid; yield 93%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.17-7.31 (m, 5H), 5.60-5.65 (m, 1H), 2.74 (t, *J* = 7.8 Hz, 2H), 2.37-2.46 (m, 2H), 2.05 (m, 2H), 1.31-1.34 (m, 4H), 0.89 (t, *J* = 7.2 Hz, 3H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -64.3 (d, *J* = 3.1 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 202.4, 141.1, 128.6, 128.5, 126.2, 124.2 (q, *J* = 273.2 Hz), 99.5 (q, *J* = 34.3 Hz), 97.9, 35.1, 29.9, 29.5, 26.0, 22.2, 13.9. IR (neat) 3066, 2959, 2864, 1976, 1455, 1298, 1118 cm^{-1}. HRMS (EI) Calculated for $C_{16}H_{19}F_3$: 268.1439; Found: 268.1440.



Trimethyl(1,1,1-trifluoro-6-phenylhexa-2,3-dien-2-yl)silane (2r): Colorless liquid; yield 70%. ^{1}H NMR (300 MHz, $CDCl_3$) δ ppm 7.18-7.32 (m, 5H), 5.34-5.38 (m, 1H), 2.73 (t, *J* = 7.8 Hz, 2H), 2.36-2.43 (m, 2H), 0.16 (s, 9H). ^{19}F NMR (282 MHz, $CDCl_3$) δ ppm -55.8 (d, *J* = 4.2 Hz, 3F). ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 208.7, 141.2, 128.63, 128.58, 126.3, 125.2 (q, *J* = 271.6 Hz), 94.4 (q, *J* = 34.7 Hz), 90.9, 35.5, 29.2, -1.2. IR (neat) 3066, 2960, 1956, 1269, 1113 cm^{-1}. Anal. Calcd. for $C_{15}H_{19}F_3Si$: C, 63.35; H, 6.73. Found: C, 62.98; H, 6.82.

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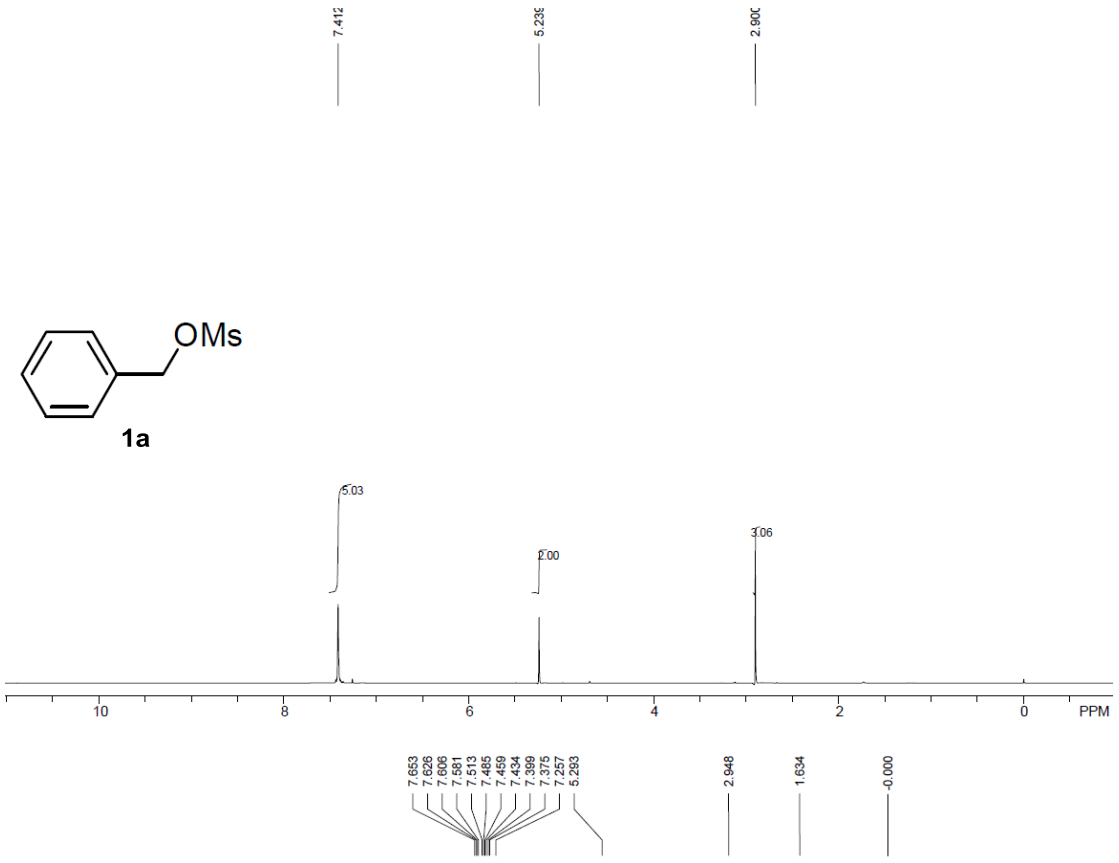
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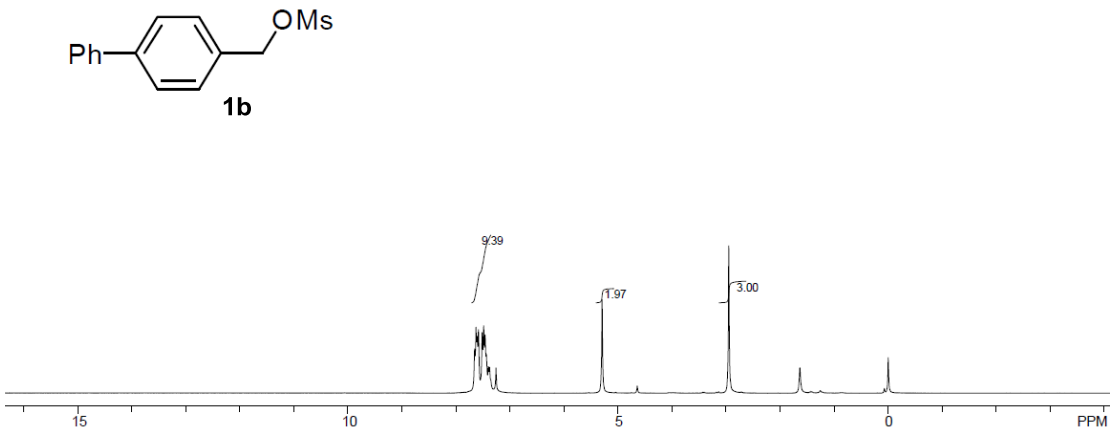
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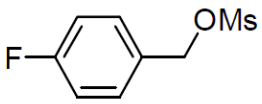
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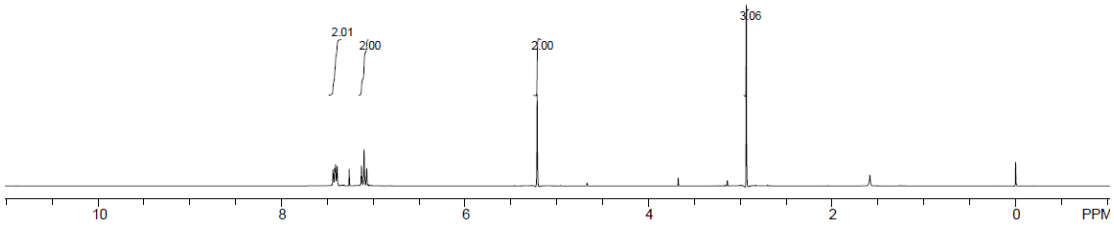
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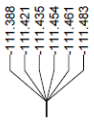
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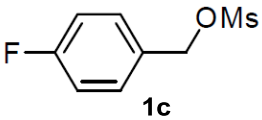
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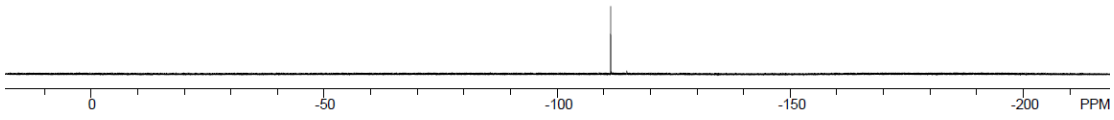
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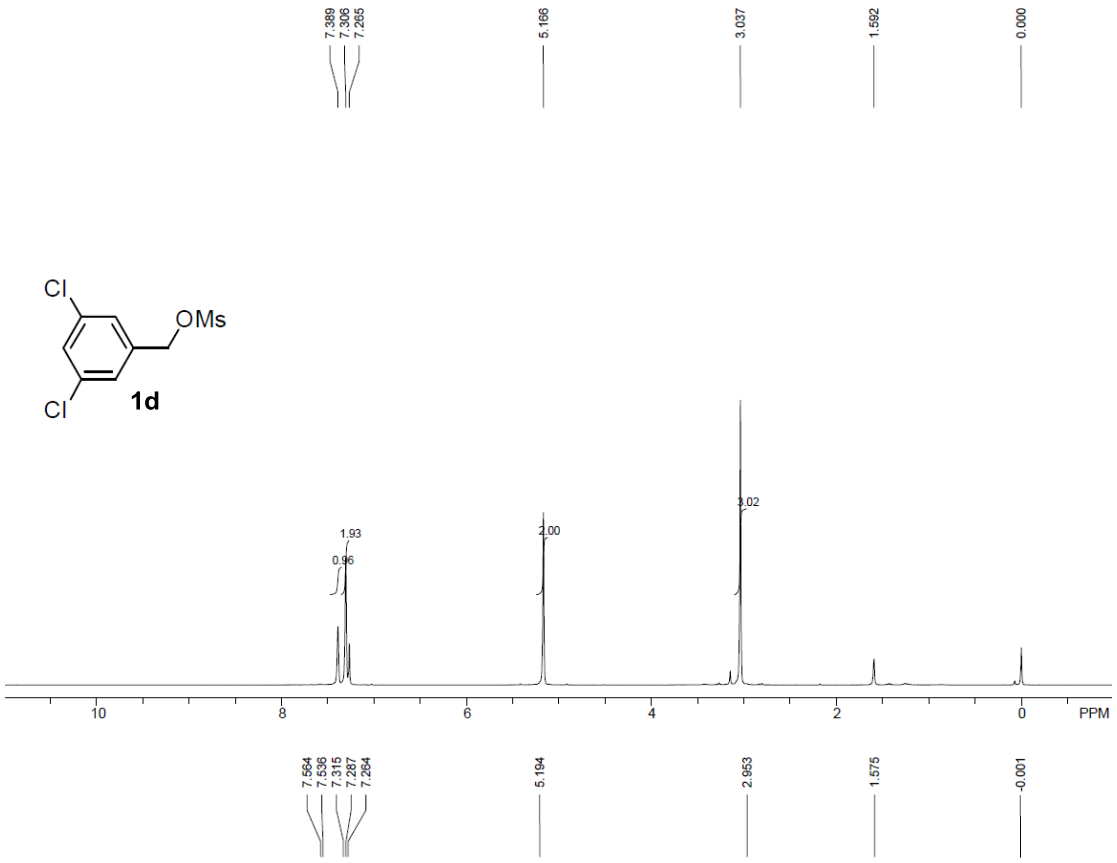
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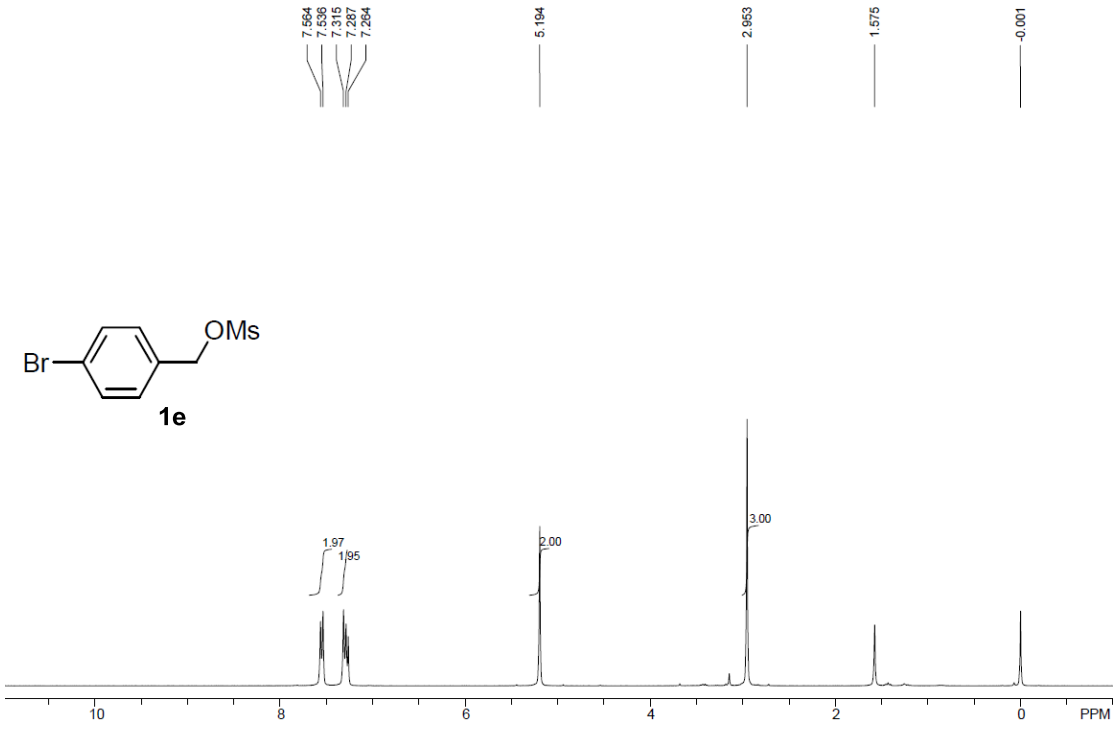
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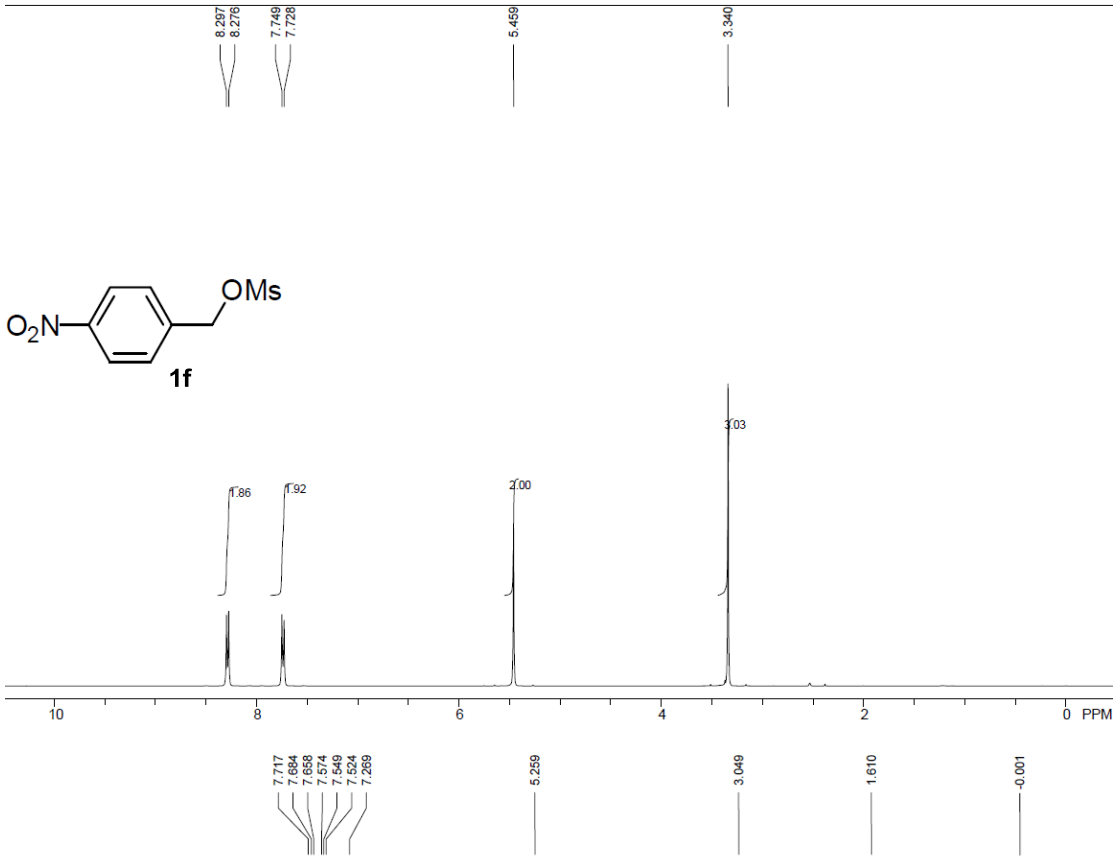
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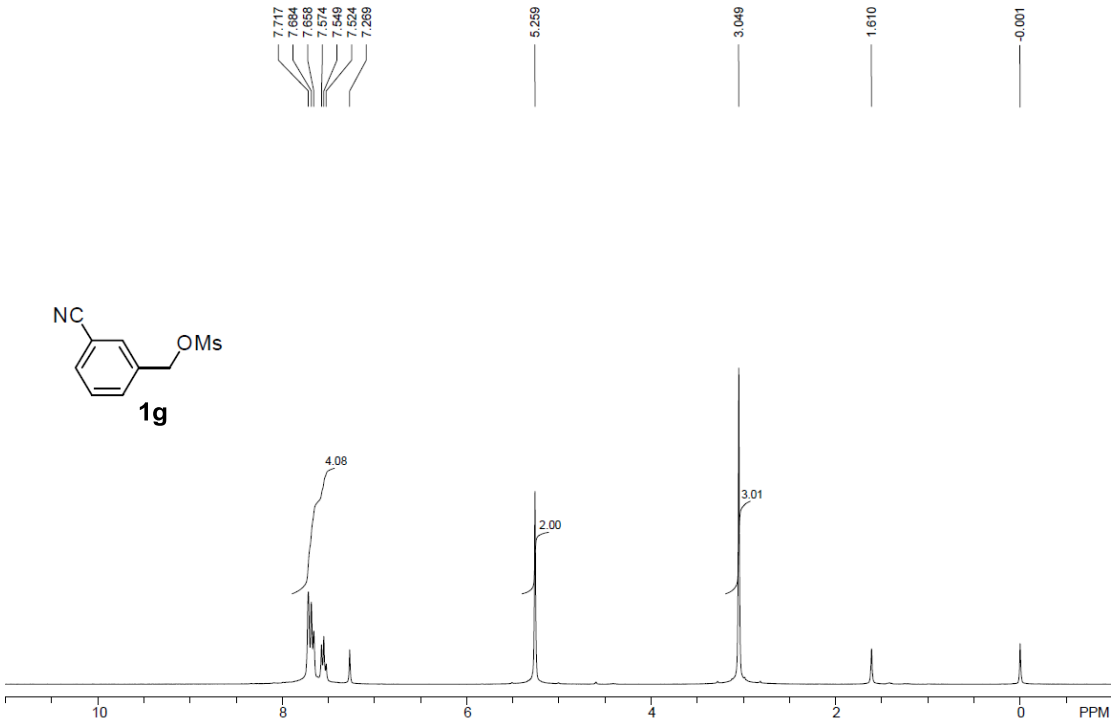
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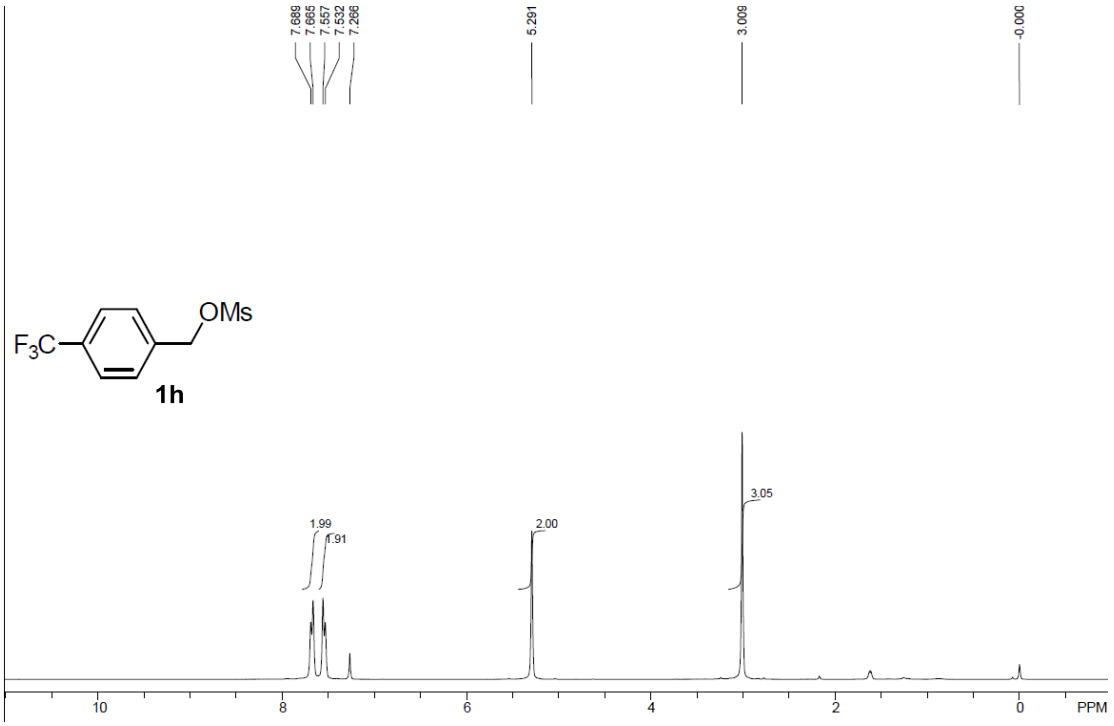
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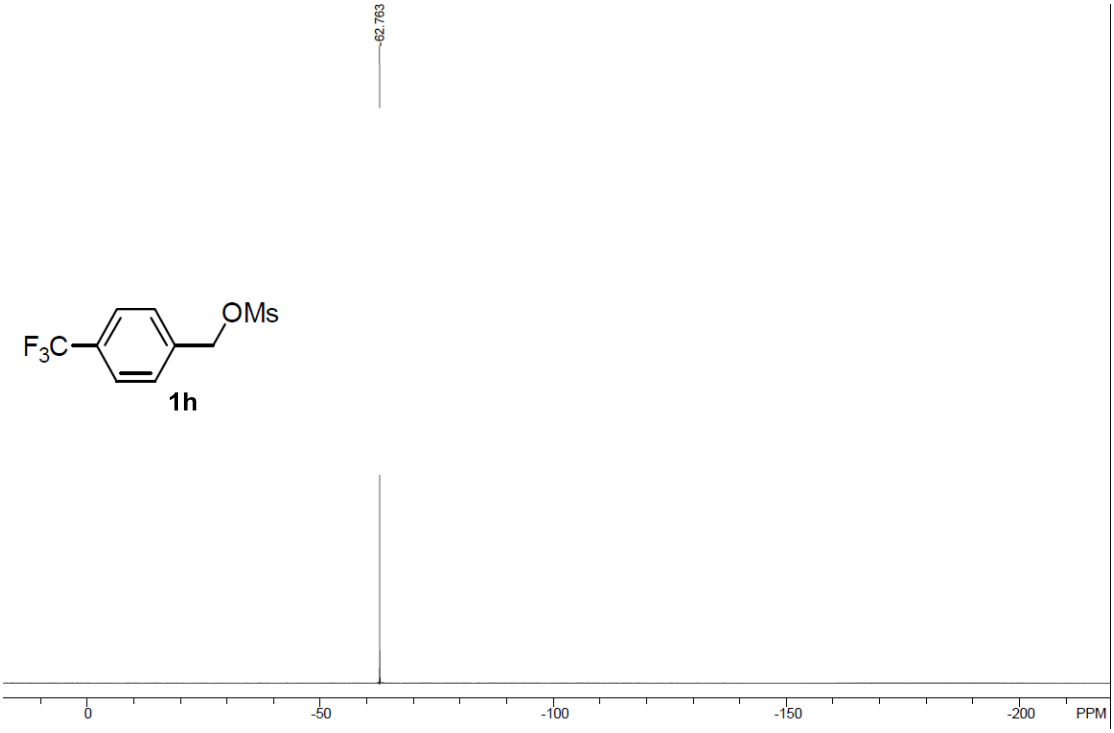
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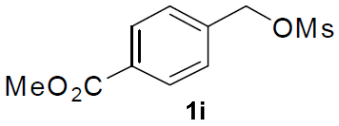
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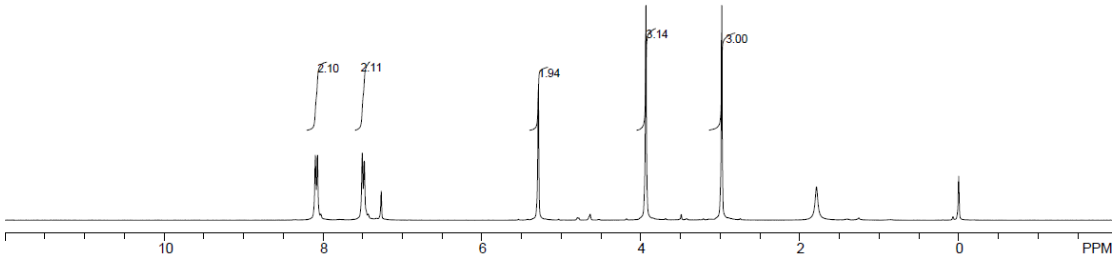
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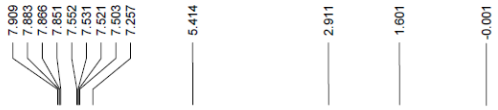
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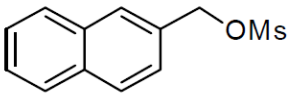
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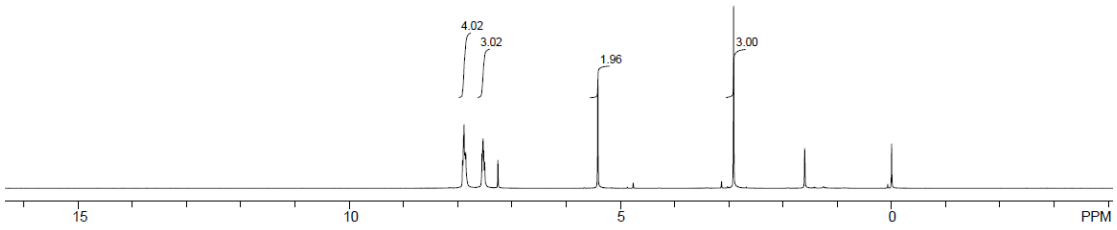
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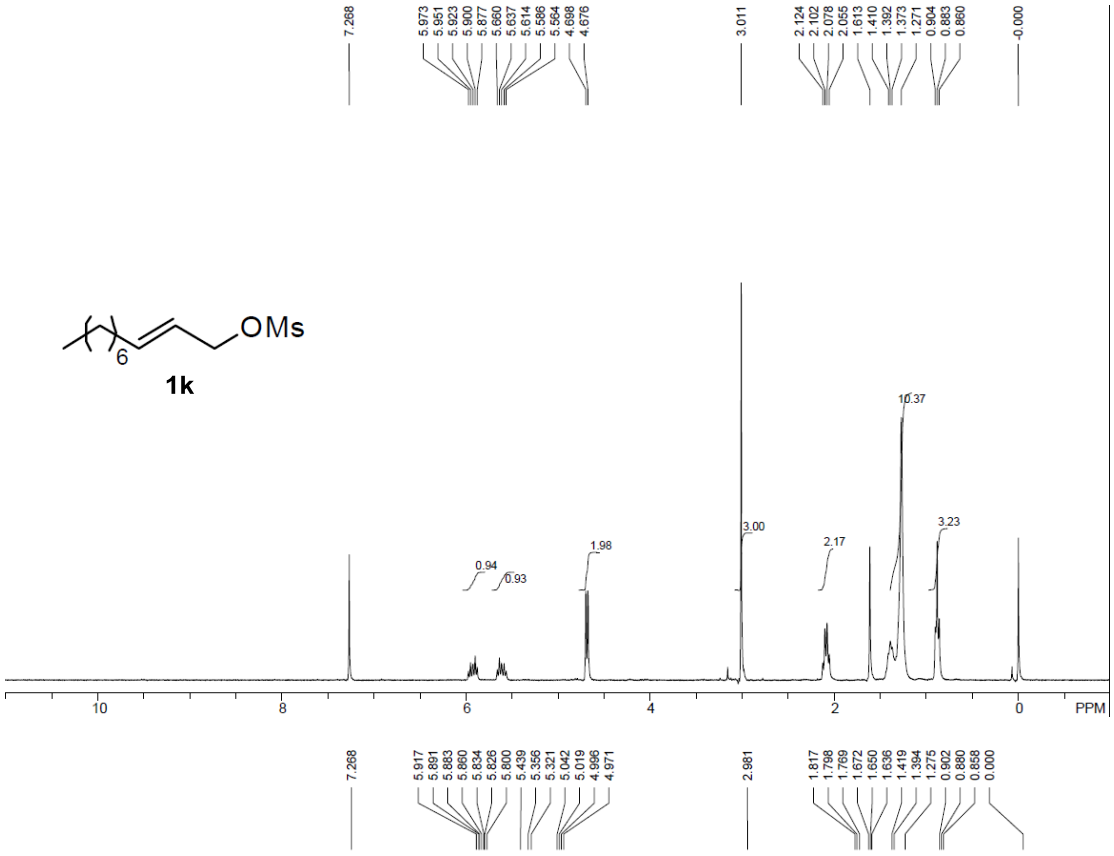
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5.586
5.564
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3.011
2.124
2.102
2.078
2.055
1.613
1.410
1.392
1.373
1.271
0.904
0.883
0.860
-0.000
OMs
6
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0.94
0.93
10
8
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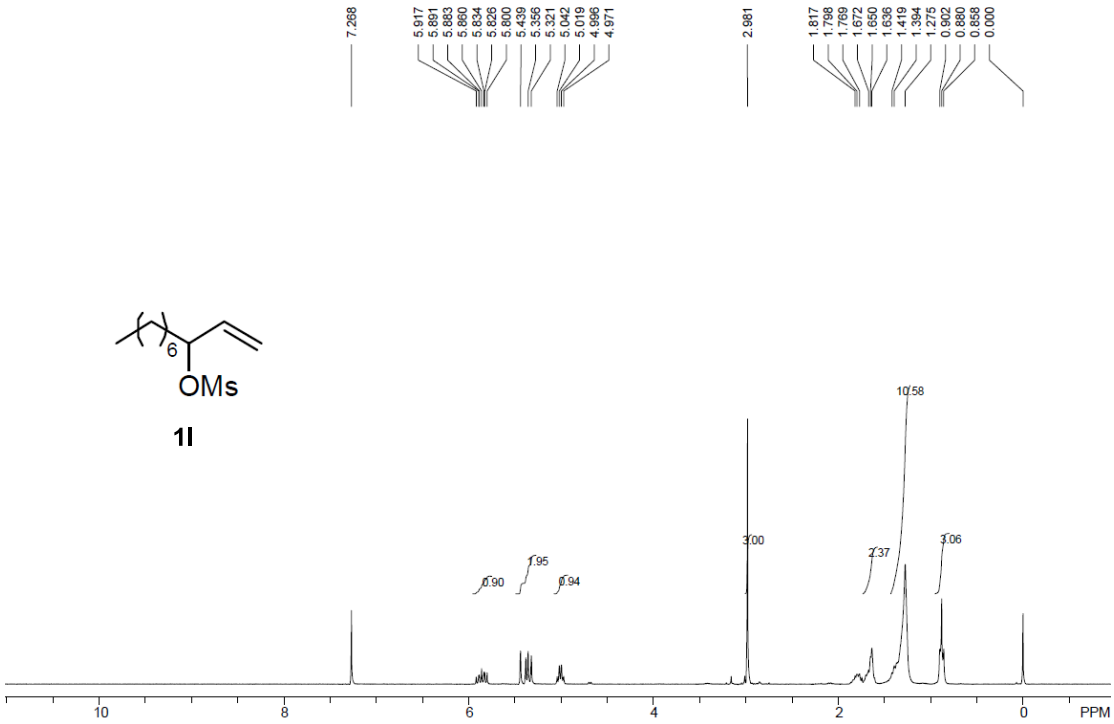
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5.800
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5.042
5.019
4.996
4.971
2.981
1.817
1.798
1.769
1.672
1.650
1.636
1.419
1.394
1.275
0.902
0.880
0.858
0.000
6
OMs
1l
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0.94
10
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6
4
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0
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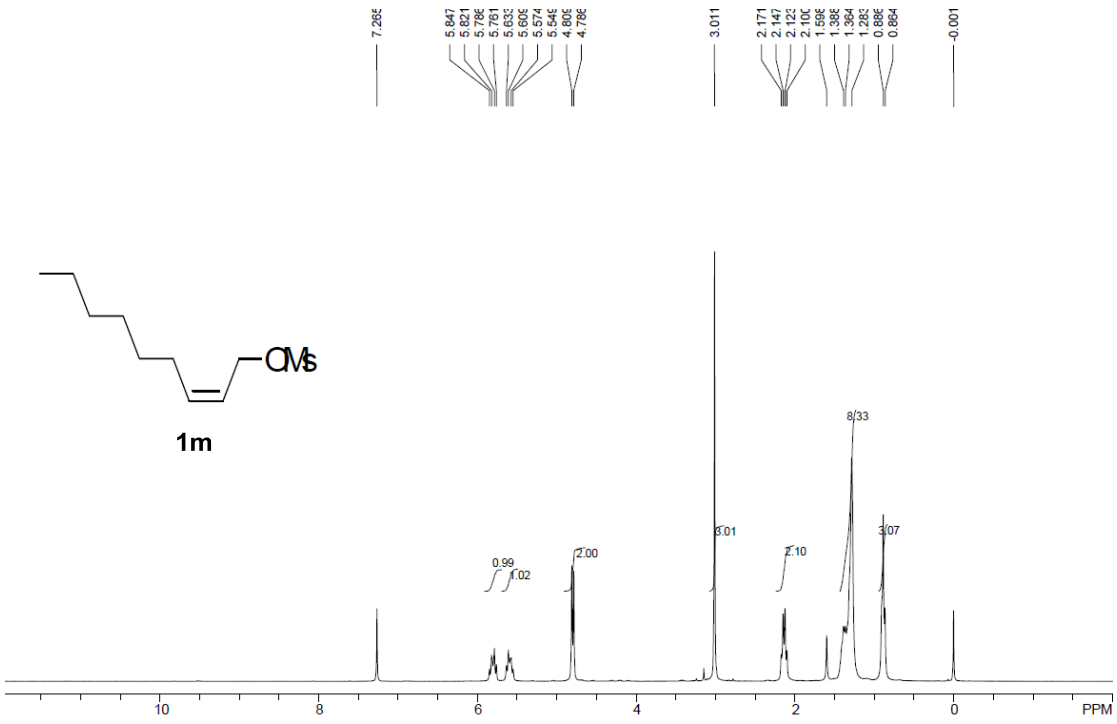
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1.02
10
8
6
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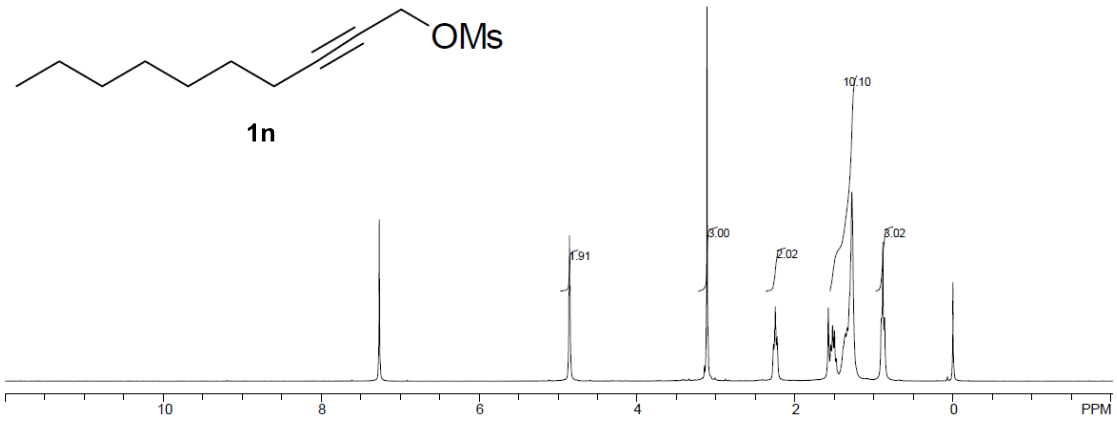
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8
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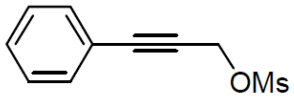
OMs

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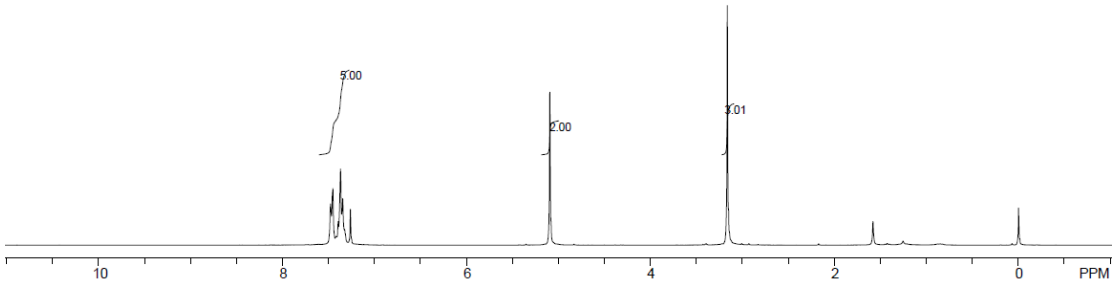
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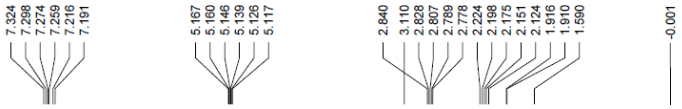
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2.840
3.110
2.828
2.807
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2.151
2.124
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1.910
1.590
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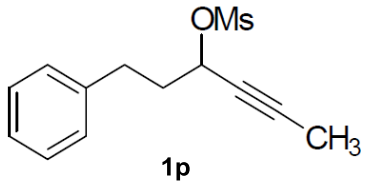
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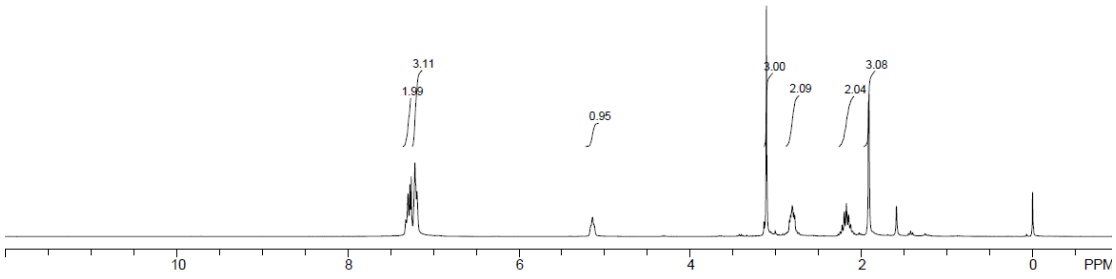
CH3

1p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3.00
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2.04
3.08
10
8
6
4
2
0
PPM


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7.300
7.276
7.260
7.228
7.215
7.190
5.182
5.160
5.140
2.821
3.113
2.811
2.291
2.273
2.268
2.250
2.179
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0.922
0.898
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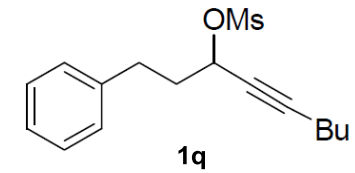
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Bu

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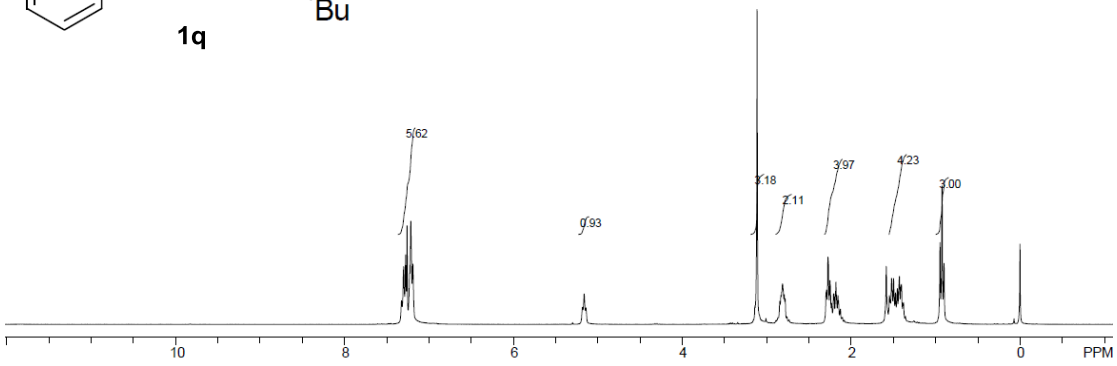
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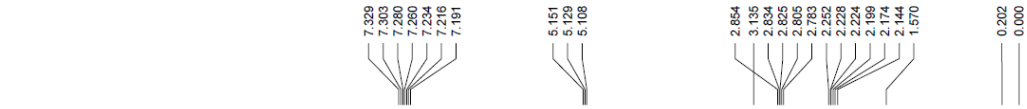
10
8
6
4
2
0
PPM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7.216
7.191
5.151
5.129
5.108
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3.135
2.834
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2.224
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2.174
2.144
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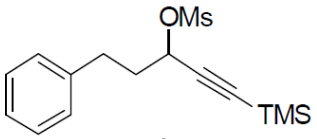
0.202
0.000


OMs
TMS

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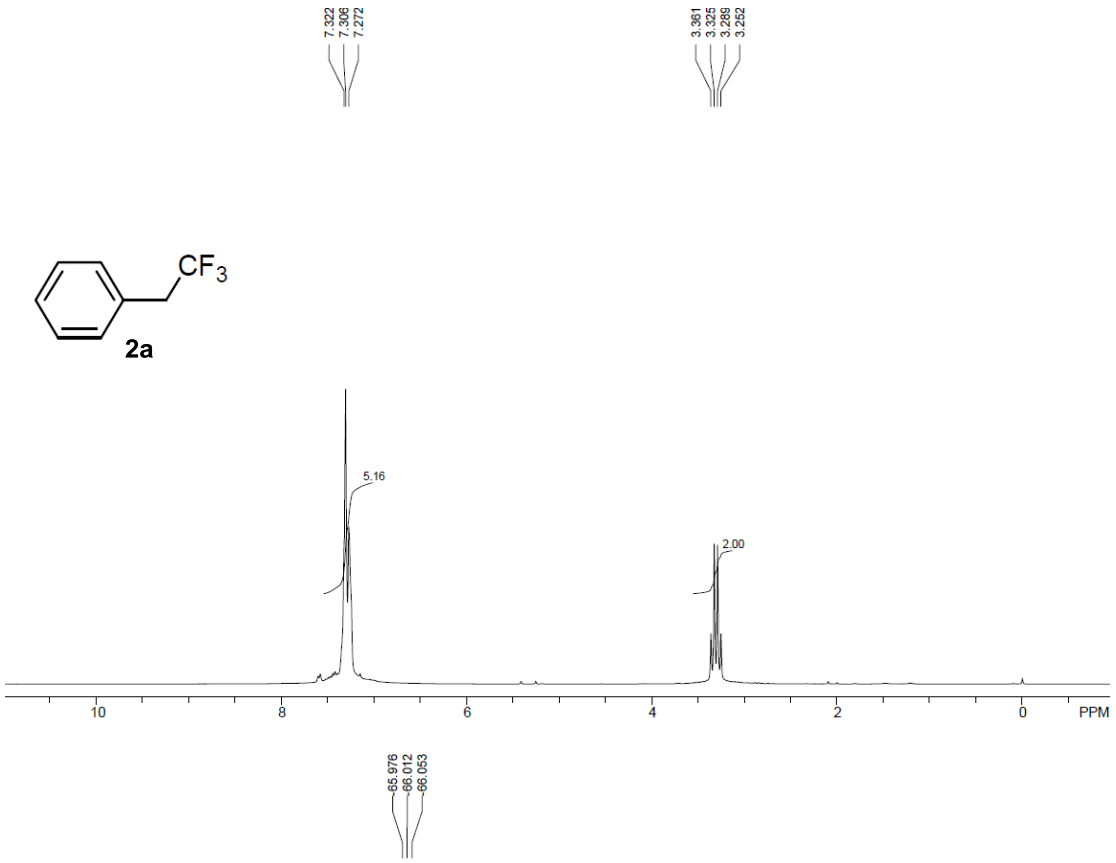
6
4
2
0
PPM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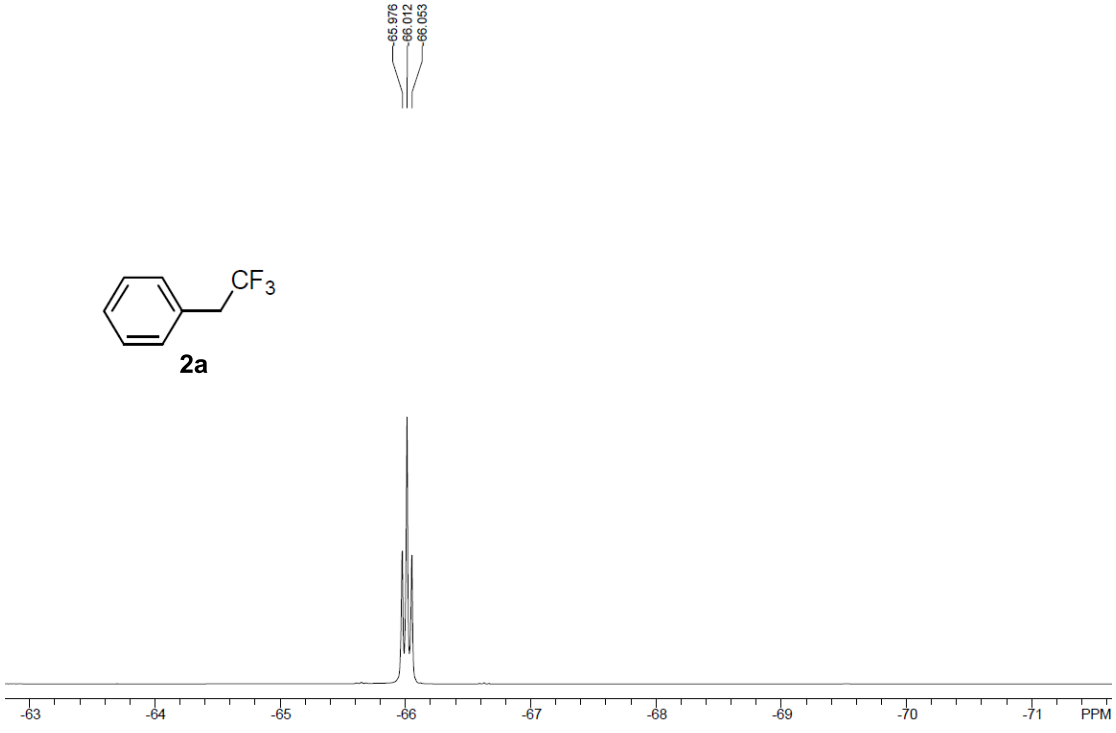
4
2
0
PPM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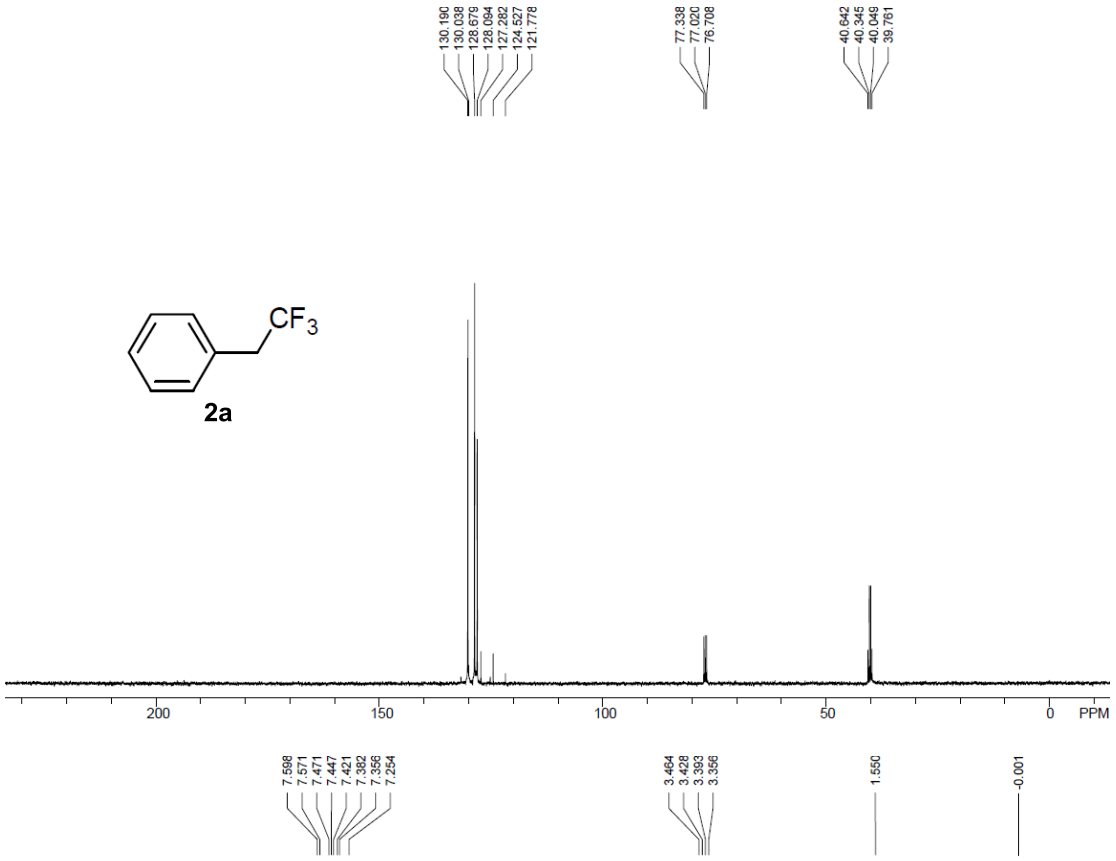
PPM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77.338
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76.708
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40.345
40.049
39.761
CF3
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200
150
100
50
0
PPM
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7.571
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7.254
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3.356
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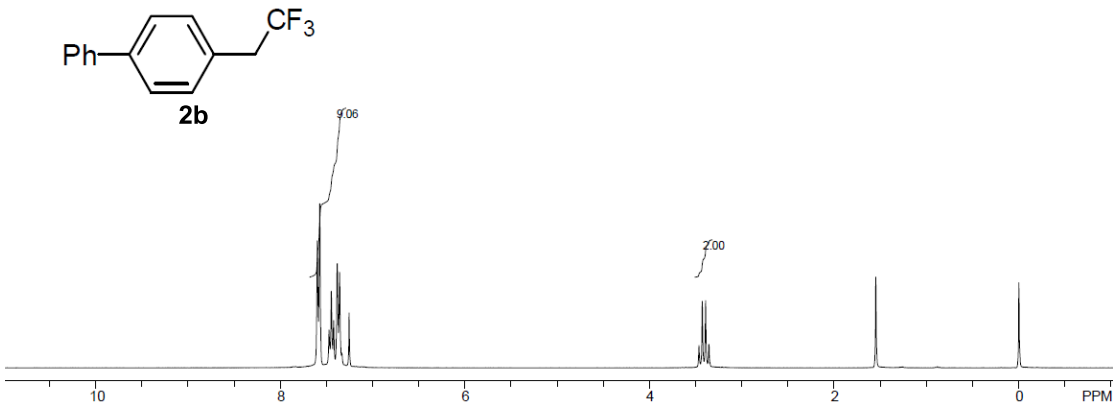
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2.00
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8
6
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2
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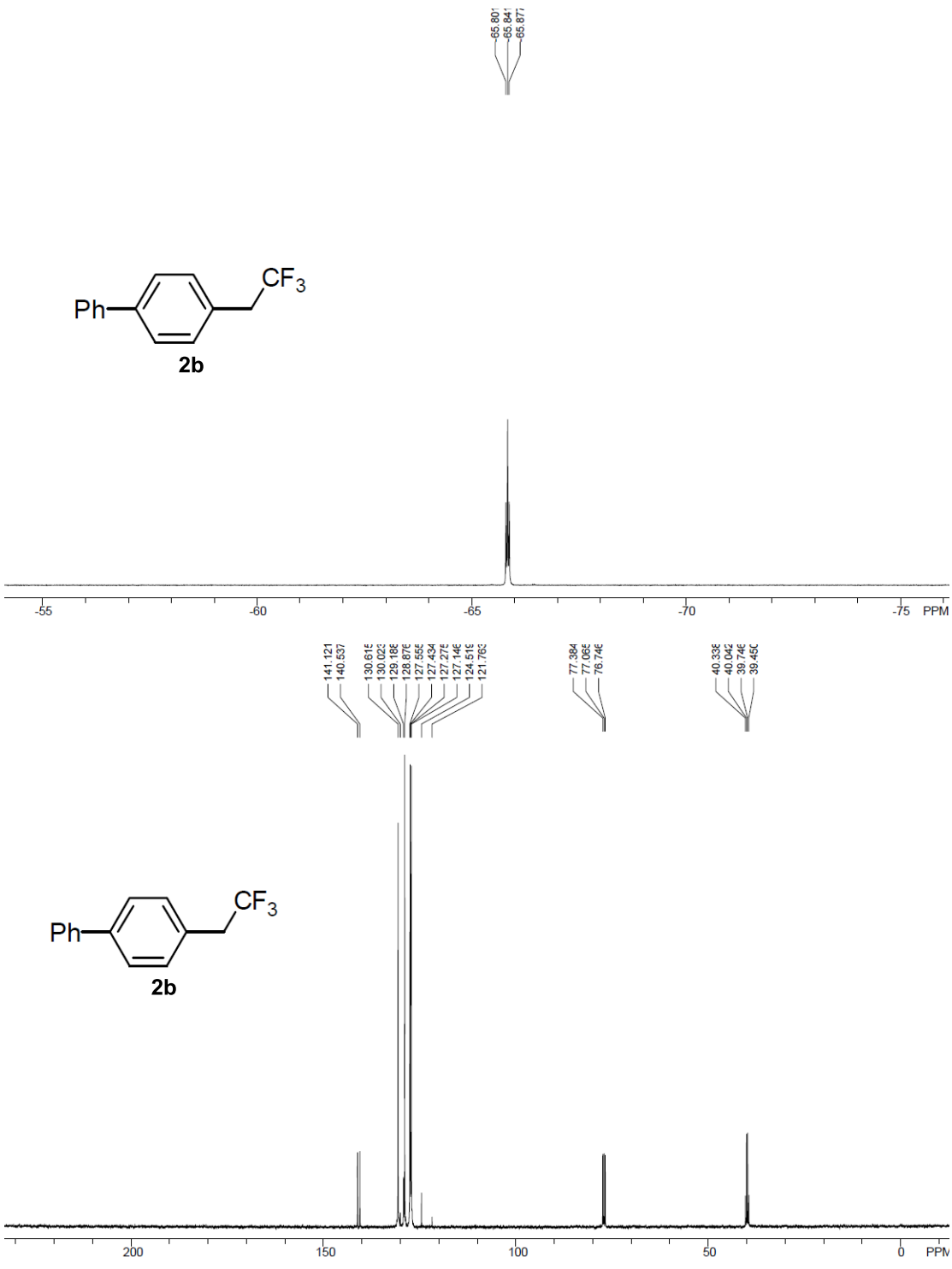
Ph
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PPM
Ph
CF3
2b
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150
100
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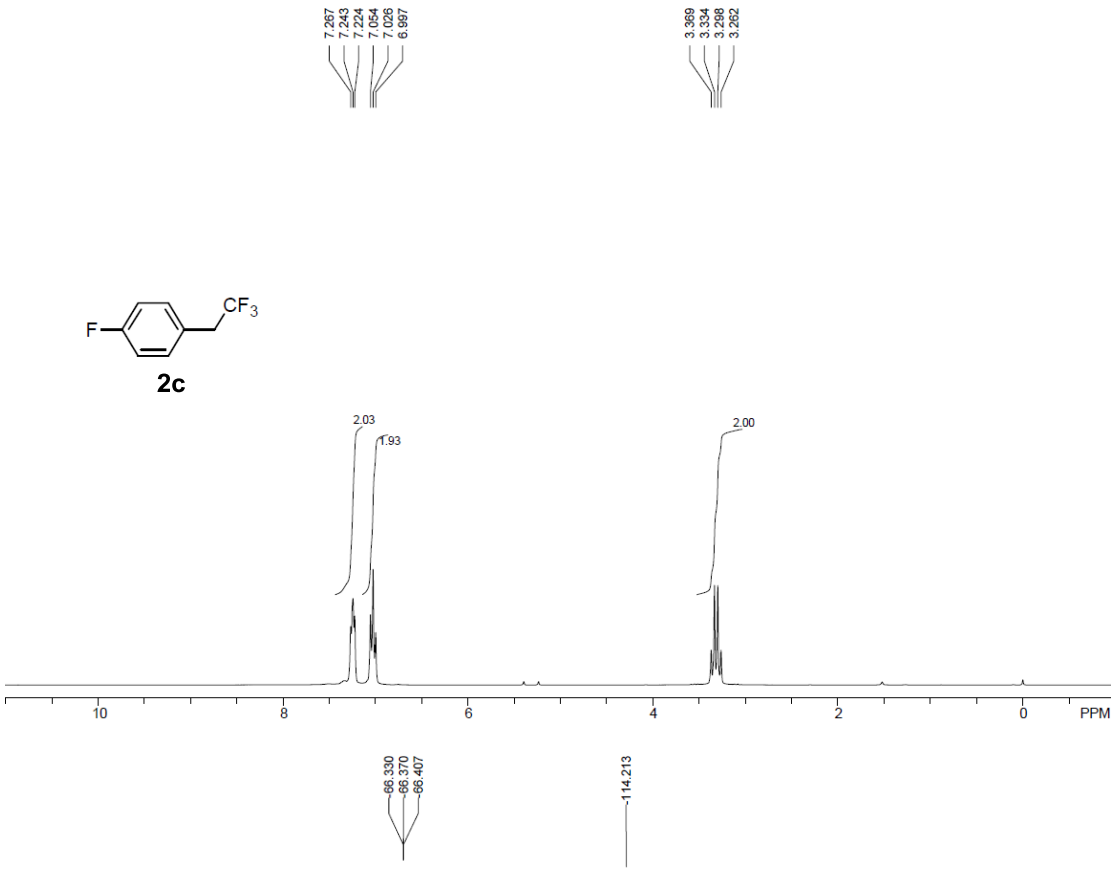
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3.334
3.298
3.262
F
CF3
2c
2.03
1.93
2.00
10
8
6
4
2
0
PPM
-66.330
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CF3
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-150
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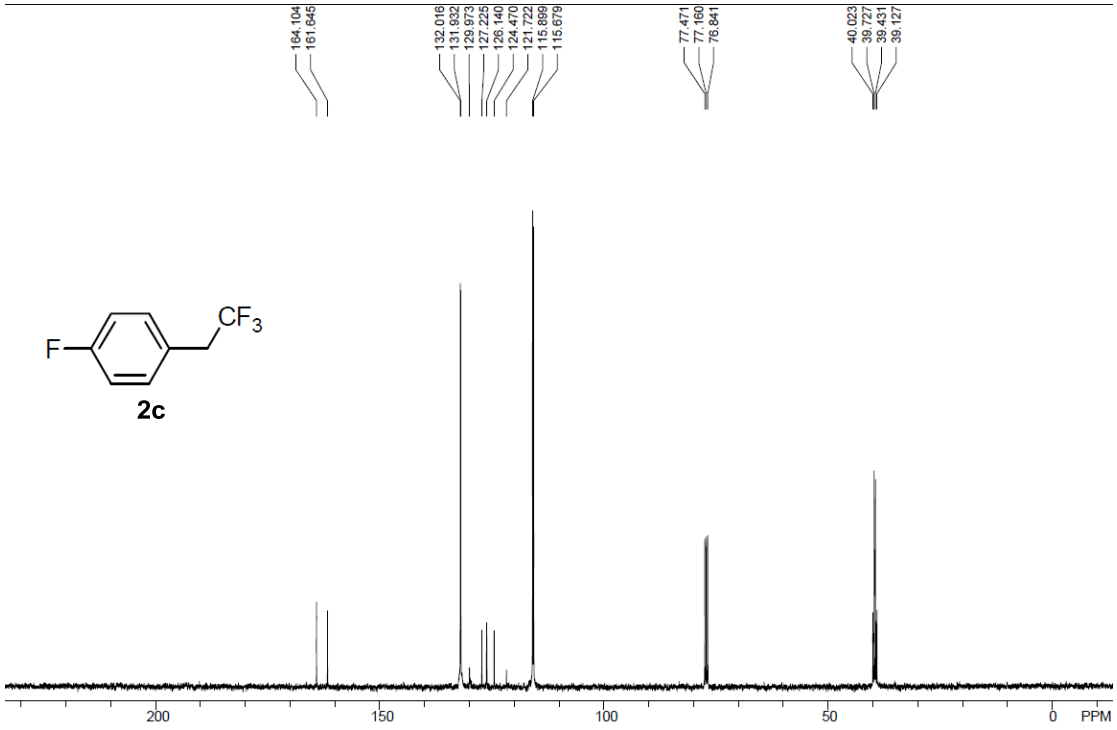
PPM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2c
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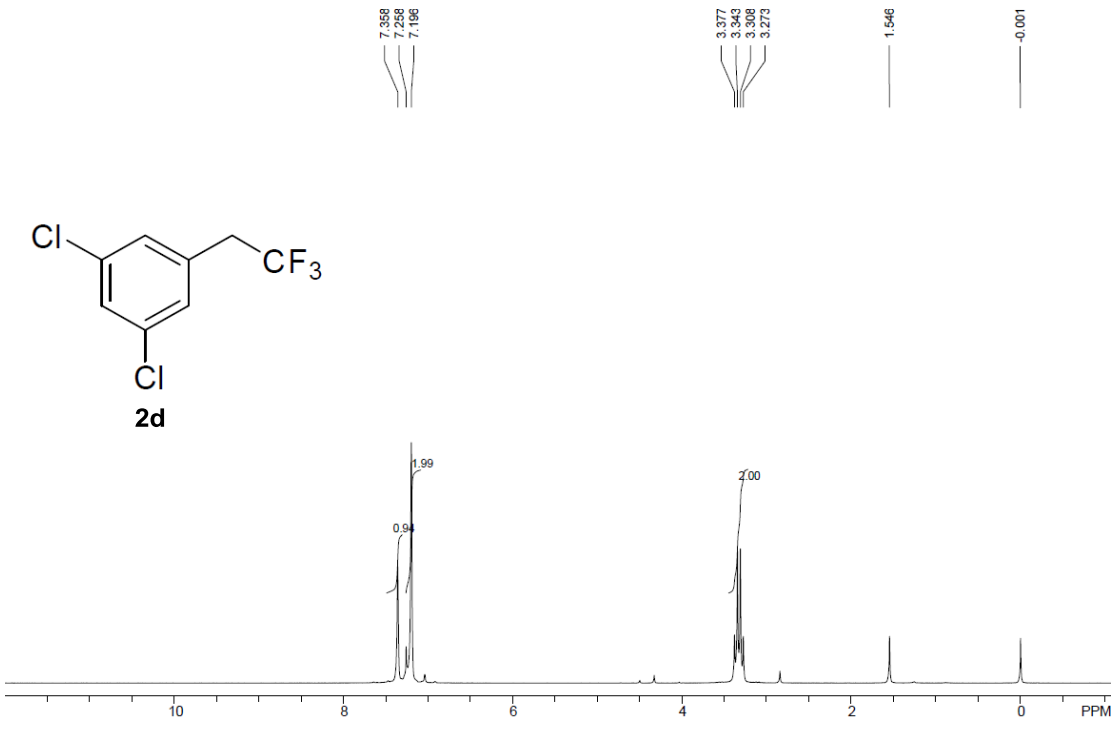
0
PPM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CF3
Cl
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4
2
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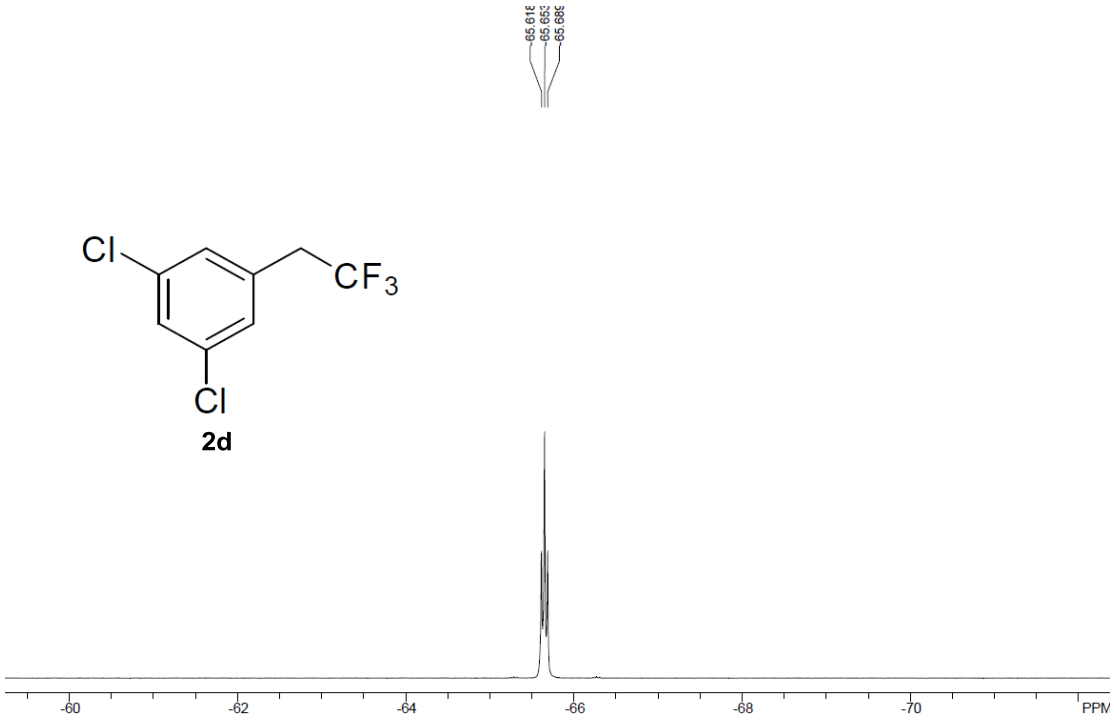
PPM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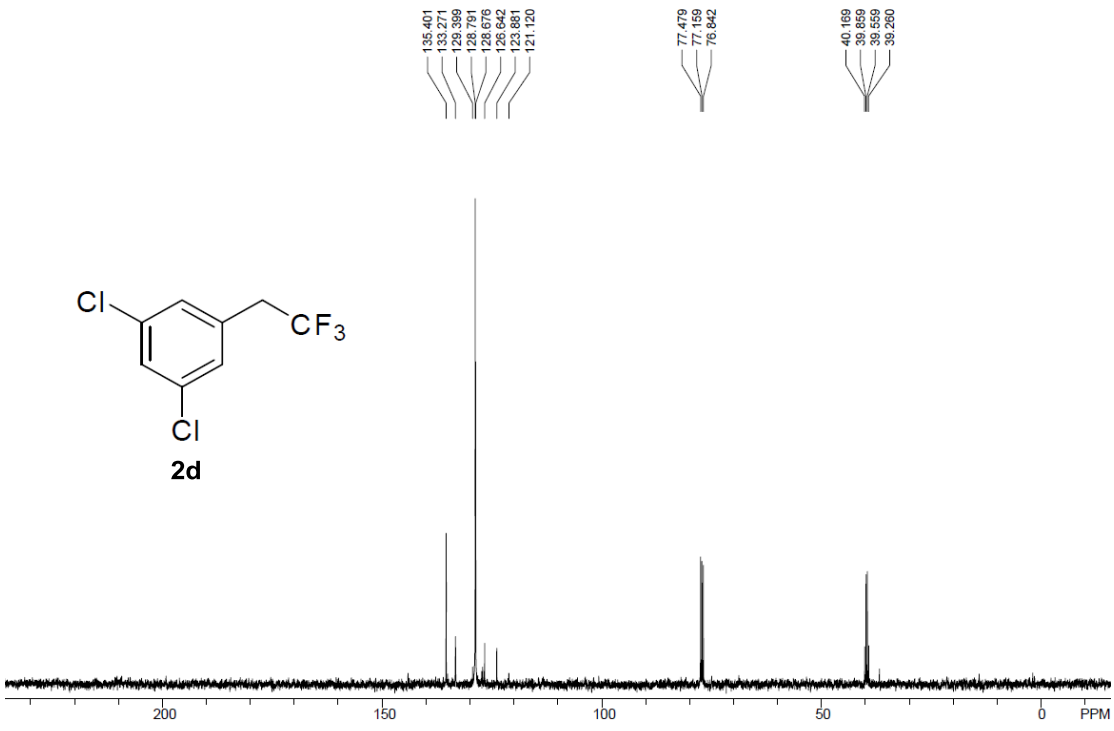
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121.120
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39.559
39.260
Cl
CF3
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2d
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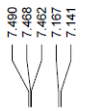
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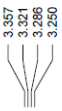
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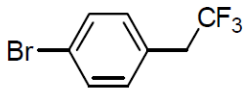
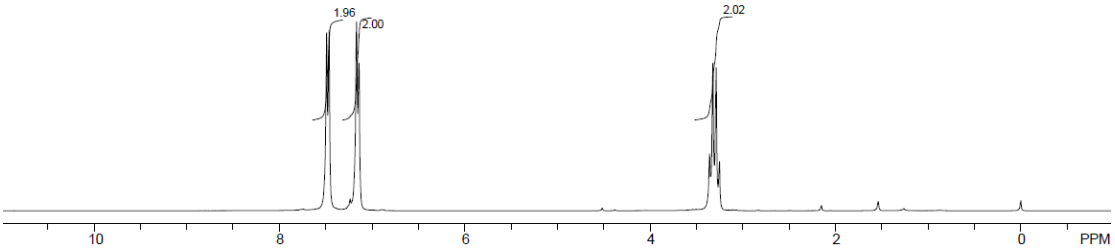

Br
CF3

2e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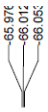
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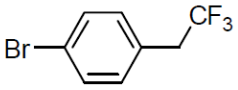
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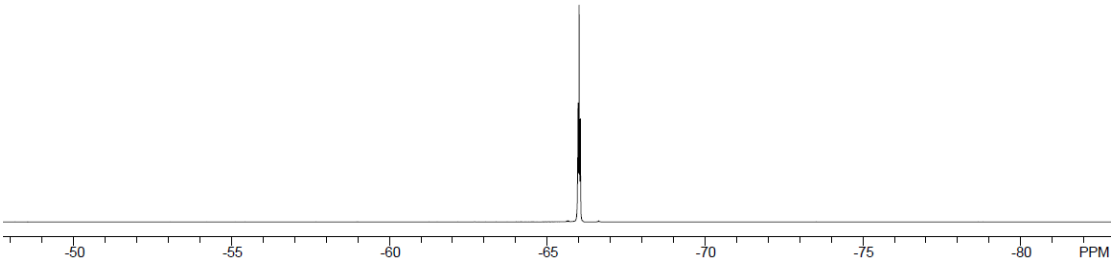
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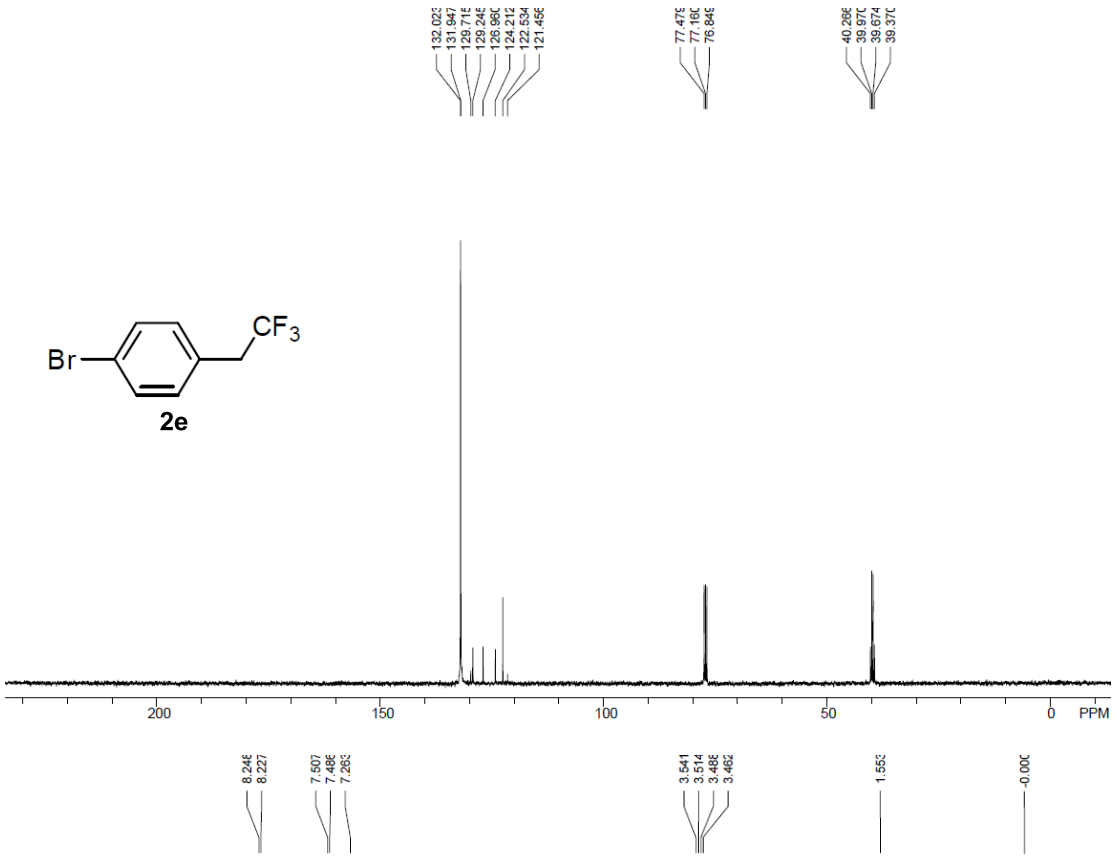
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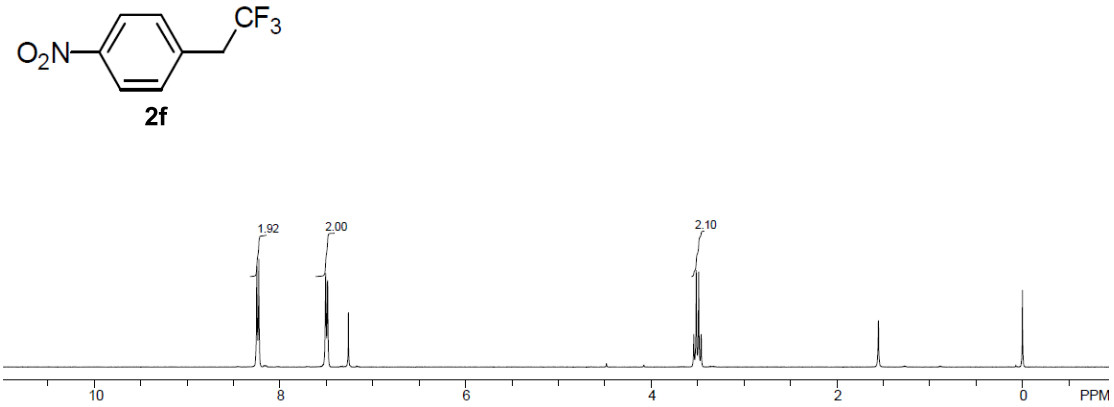
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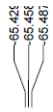
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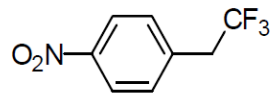
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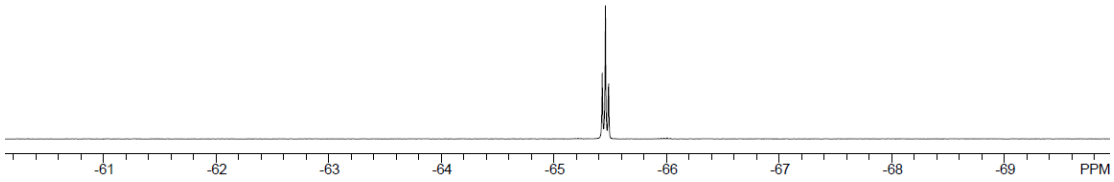
CF_3

2f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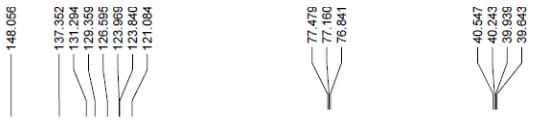
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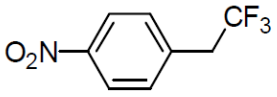
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CF_3

2f

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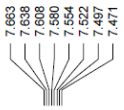
PPM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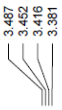
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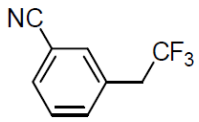
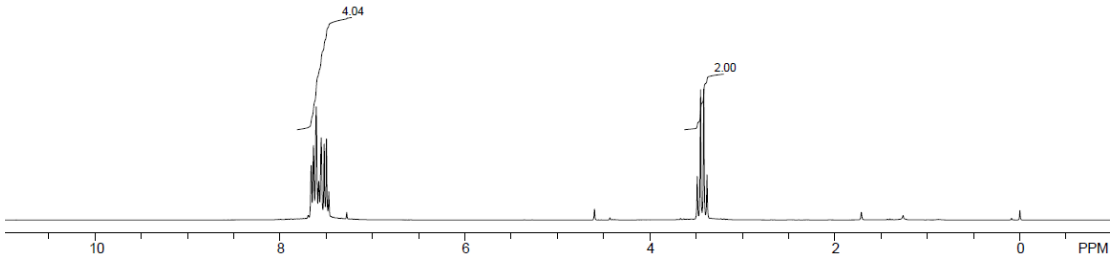

NC
CF3

2g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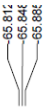
PPM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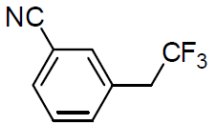
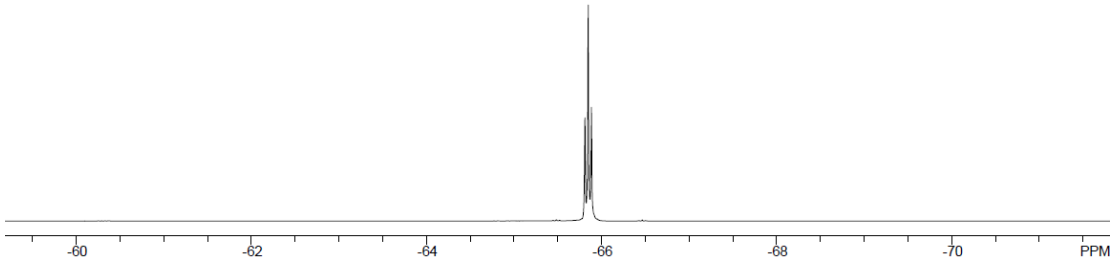

NC
CF3

2g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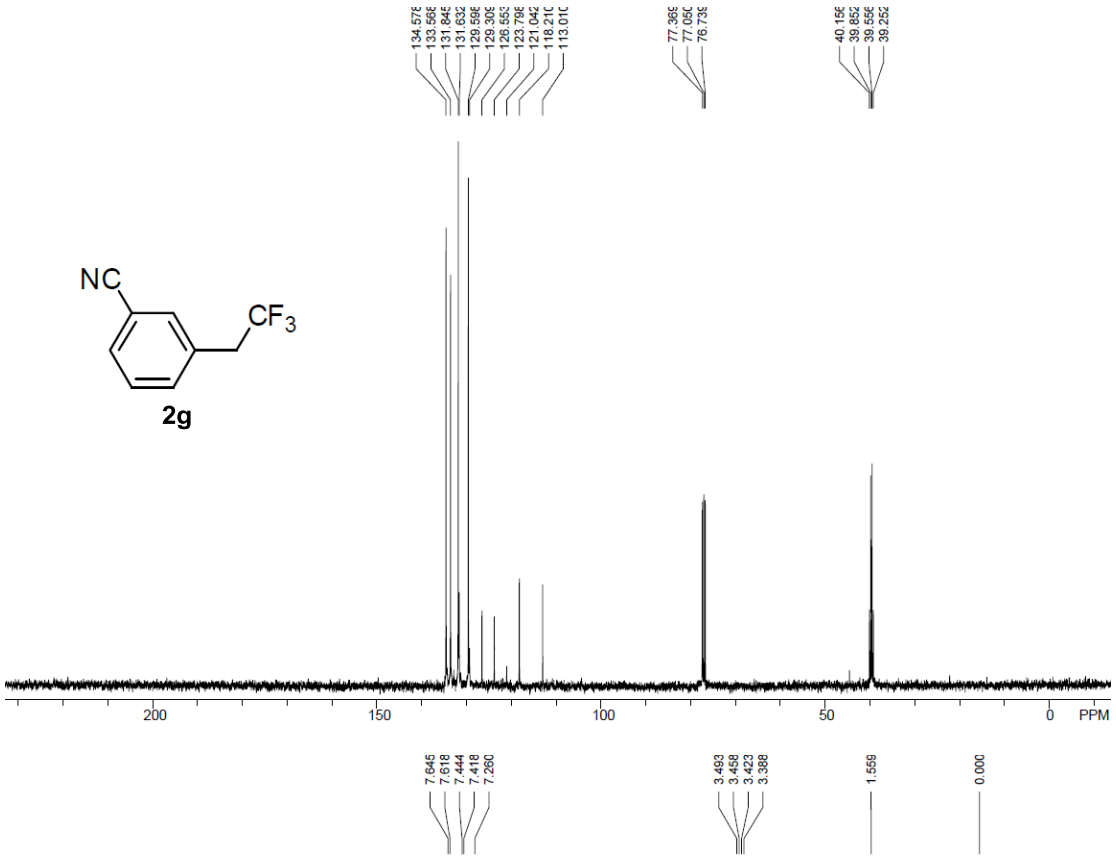
-68
-70
PPM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CF3
2g
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100
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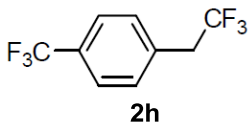
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CF3
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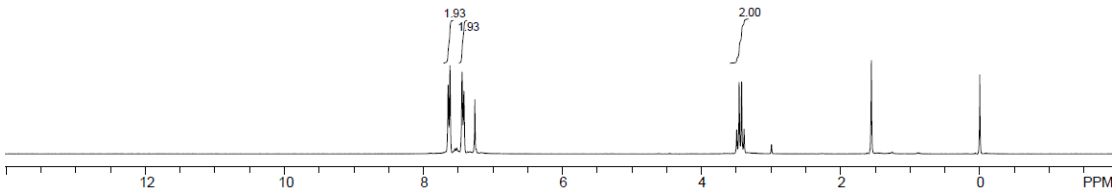
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10
8
6
4
2
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PPM


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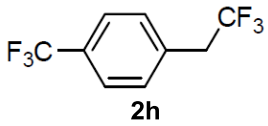
-65.698
-65.735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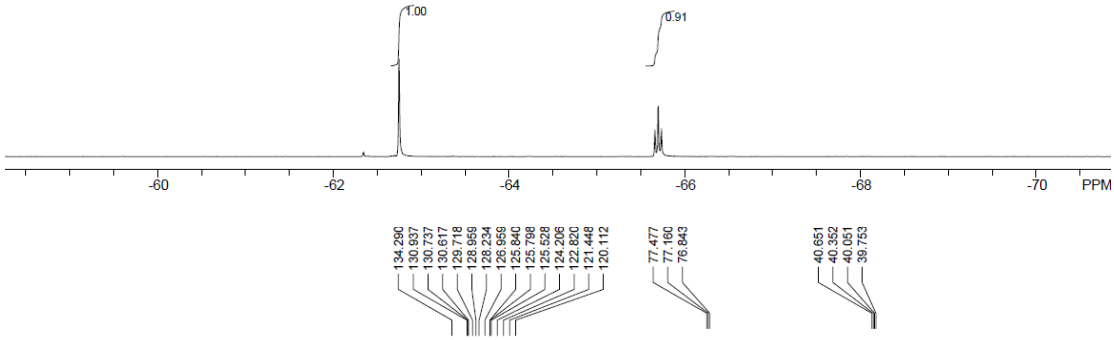
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-66
-68
-70
PPM
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130.737
130.617
129.718
128.956
128.234
126.956
125.840
125.798
125.528
124.206
122.820
121.448
120.112
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77.160
76.843
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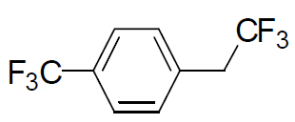
40.352
40.051
39.753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CF3

2h

200
150
100
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0
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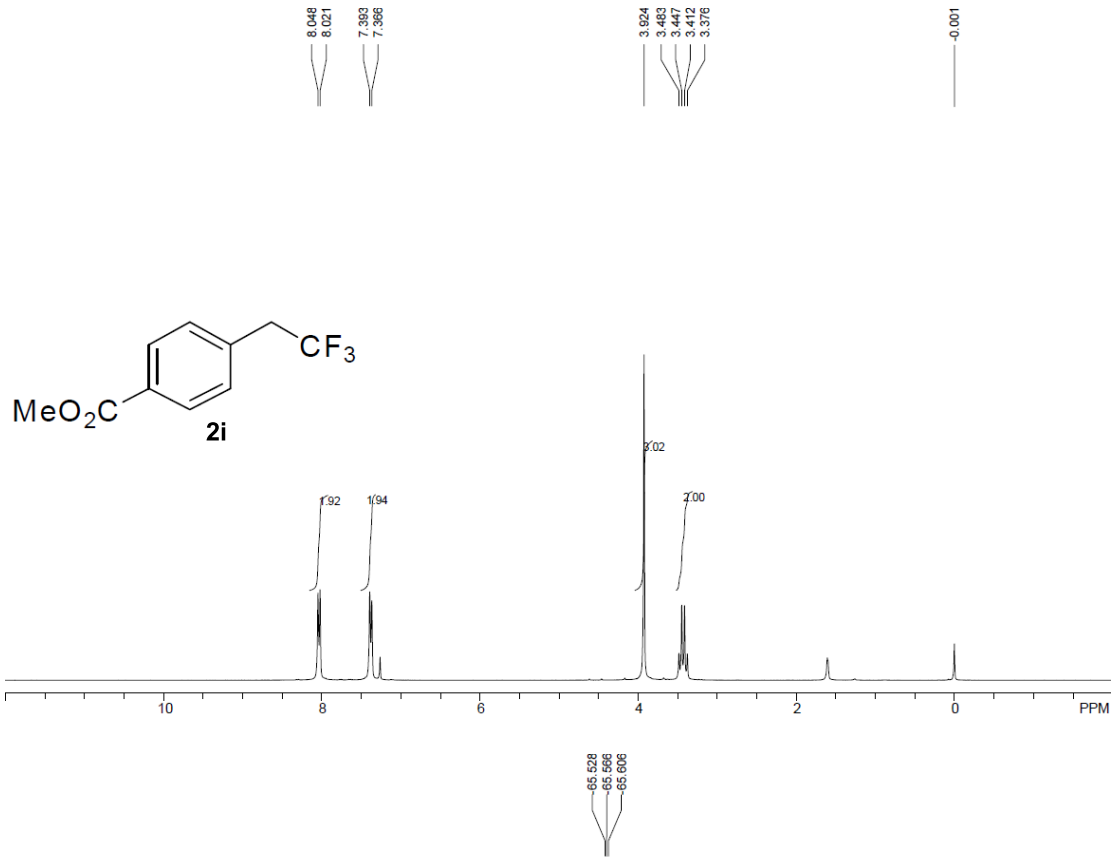
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7.393
7.366
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3.483
3.447
3.412
3.376
-0.001
CF3
MeO2C
2i
1.92
1.94
3.02
2.00
10
8
6
4
2
0
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CF3
MeO2C
2i
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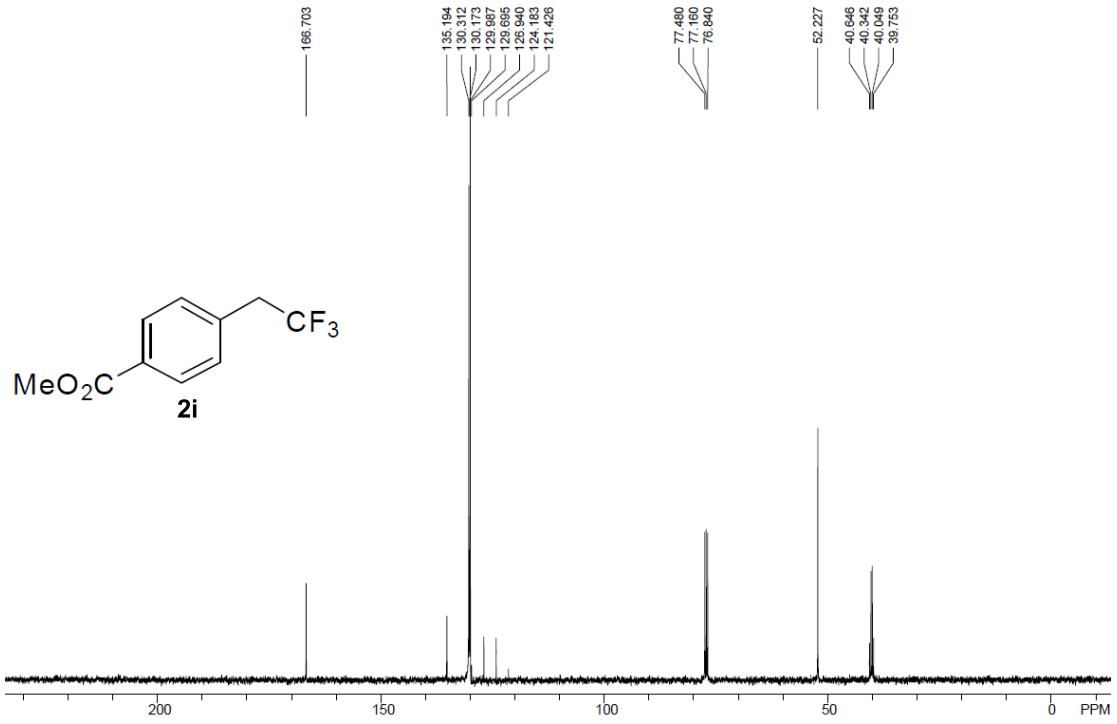
-65
-70
-75
PPM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129.695
126.940
124.183
121.426
77.480
77.160
76.840
52.227
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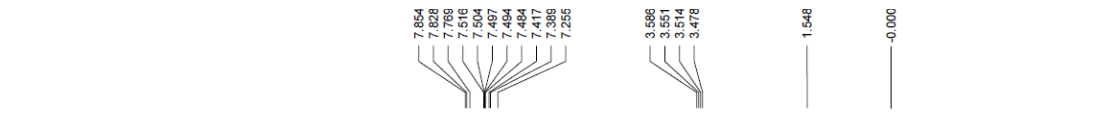
40.342
40.049
39.753
CF3
MeO2C
200
150
100
50
0
PPM

2i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7.828
7.769
7.516
7.504
7.497
7.494
7.484
7.417
7.386
7.255
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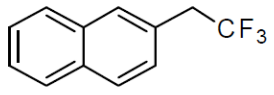
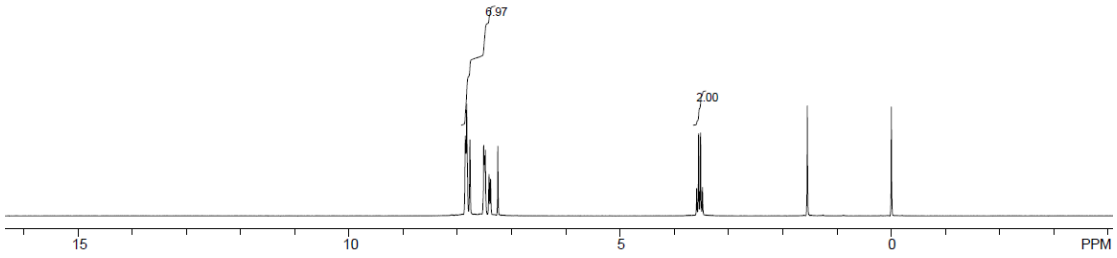
3.551
3.514
3.478
1.548
-0.000


CF3

2j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5
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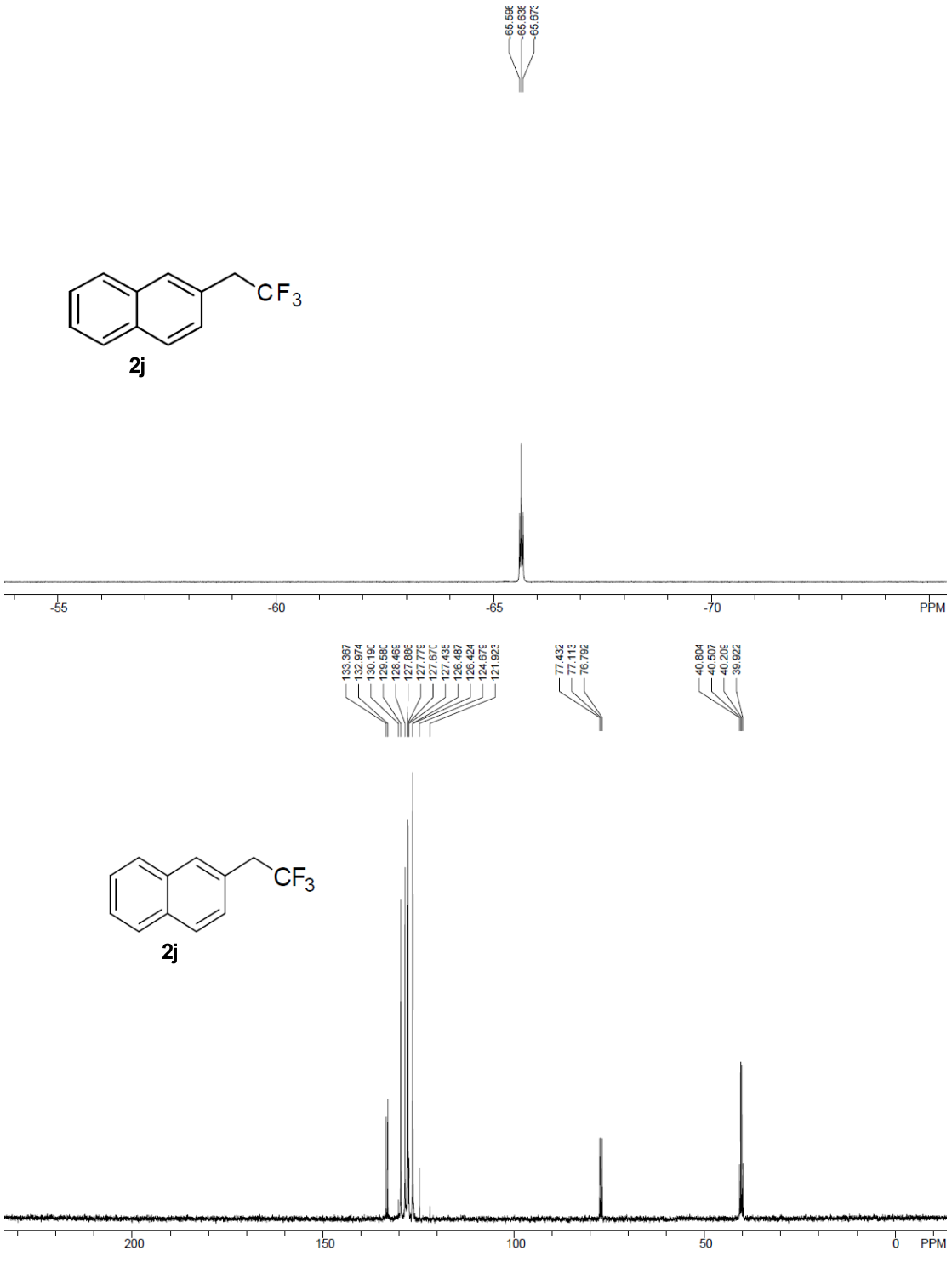
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-65.677
CF3
2j
-55
-60
-65
-70
PPM
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132.974
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129.586
128.468
127.888
127.778
127.676
127.435
126.487
126.424
124.676
121.923
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77.115
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39.922
CF3
2j
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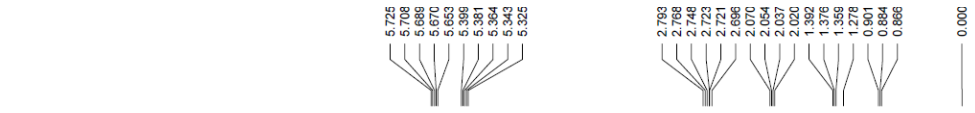
150
100
50
0
PPM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5.670
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5.381
5.364
5.343
5.325
2.793
2.768
2.748
2.723
2.721
2.696
2.070
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2.037
2.020
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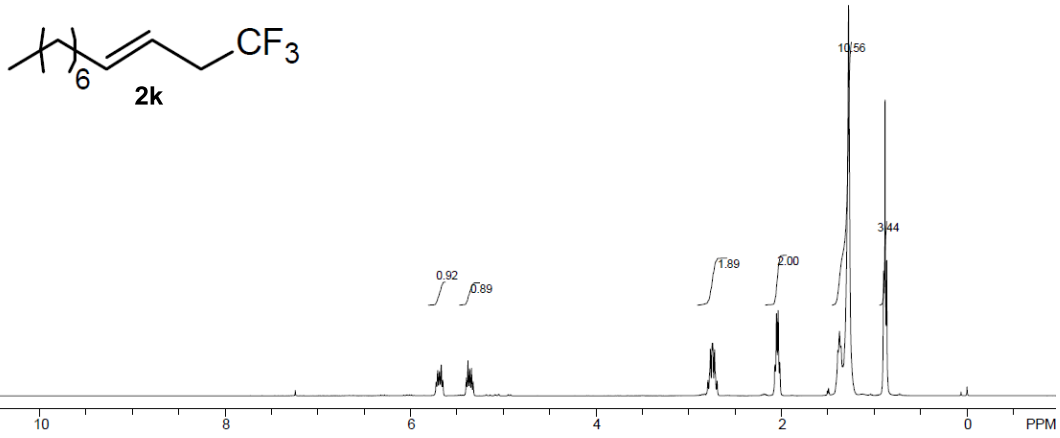
1.376
1.359
1.278
0.901
0.884
0.866
0.000


6
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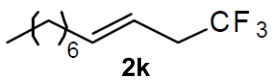
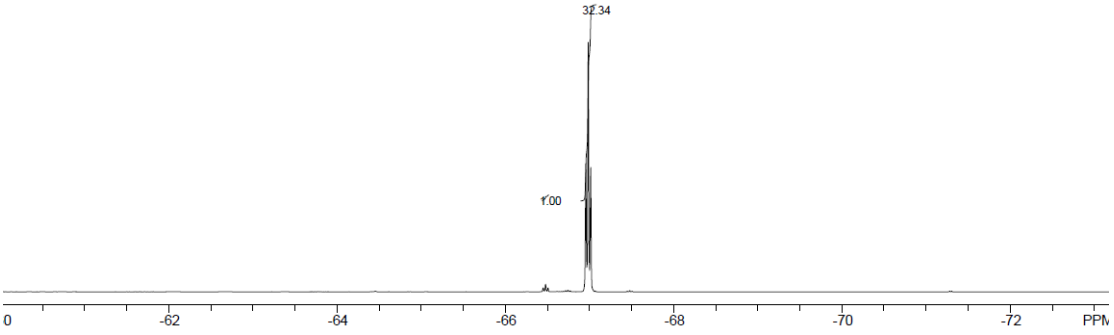
6
4
2
0
PPM


6
CF3
2k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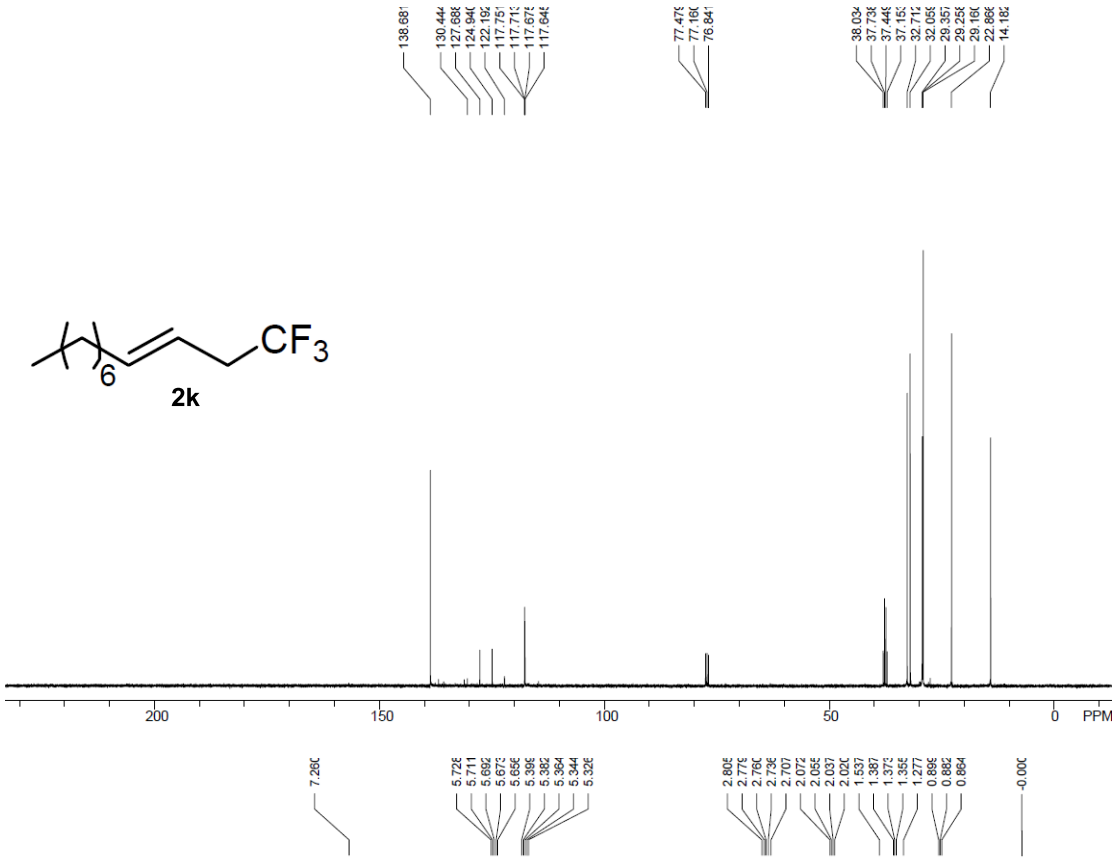
-66
-68
-70
-72
PPM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2k
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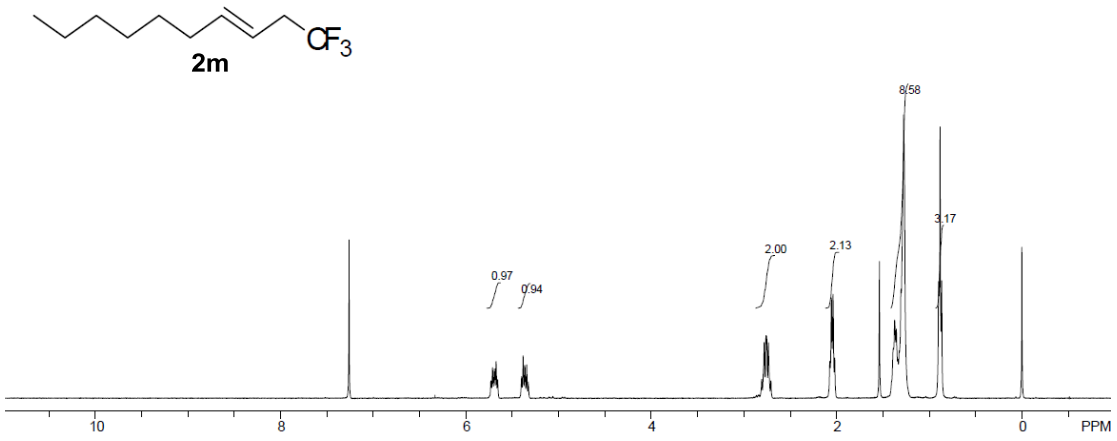
100
50
0
PPM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2.13
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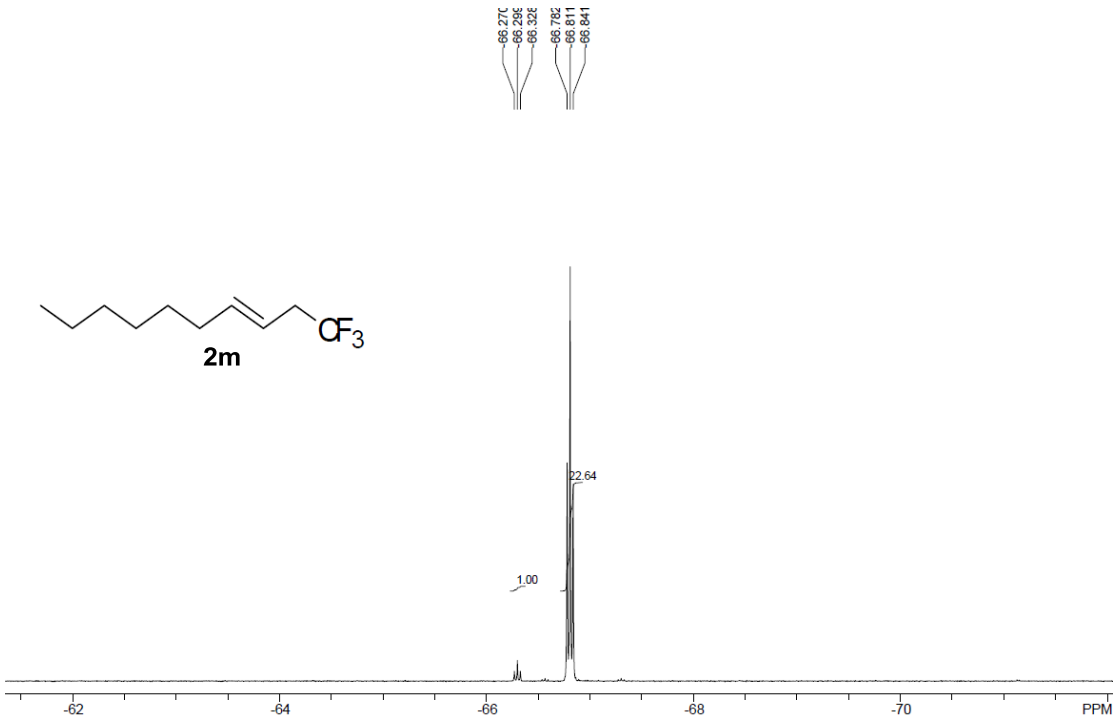
10
8
6
4
2
0
PPM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CF3
2m
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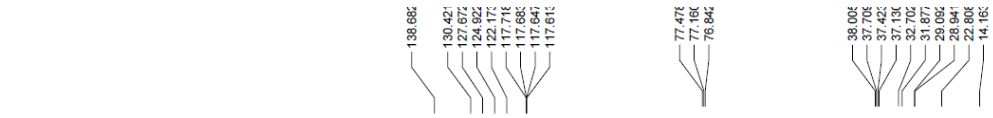
1.00
-62
-64
-66
-68
-70
PPM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117.647
117.613
77.478
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37.708
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37.134
32.702
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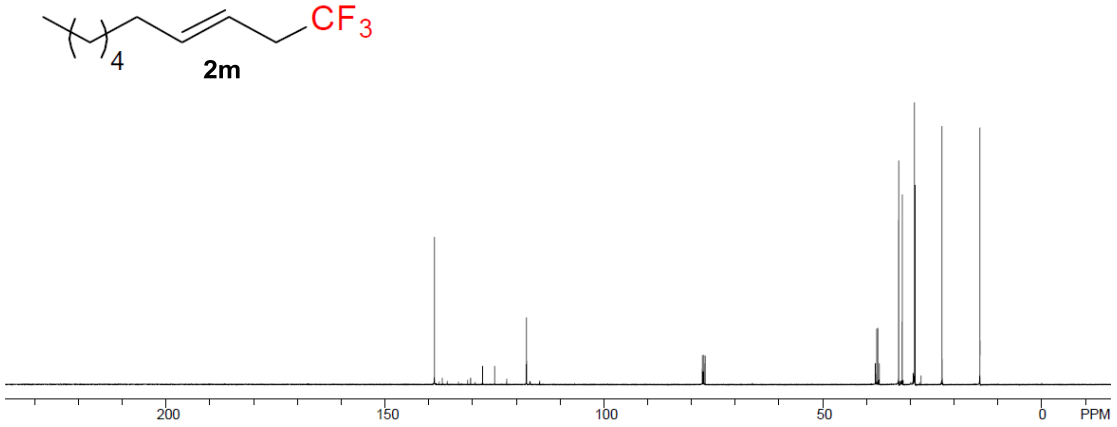
22.808
14.163


CF3
4
2m
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150
100
50
0
PPM


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3.287
3.255
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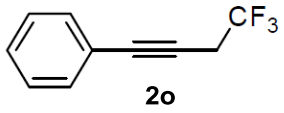
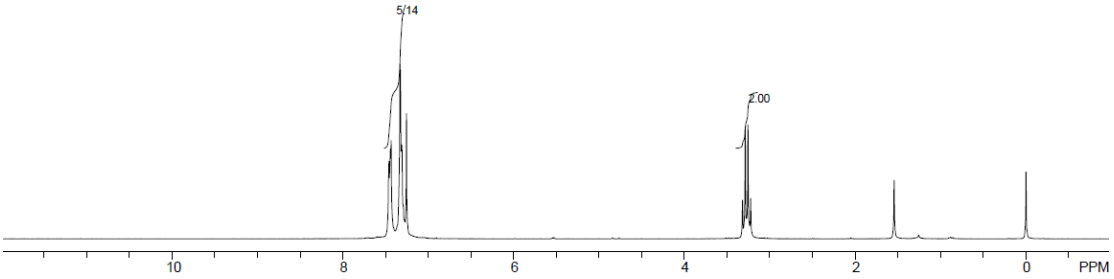
0.000


CF3

2o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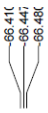
8
6
4
2
0
PPM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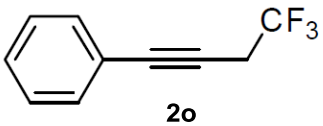
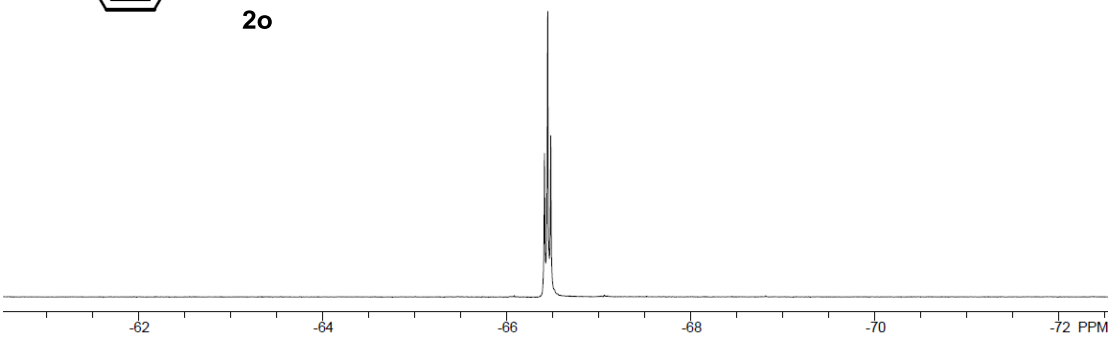

CF3

2o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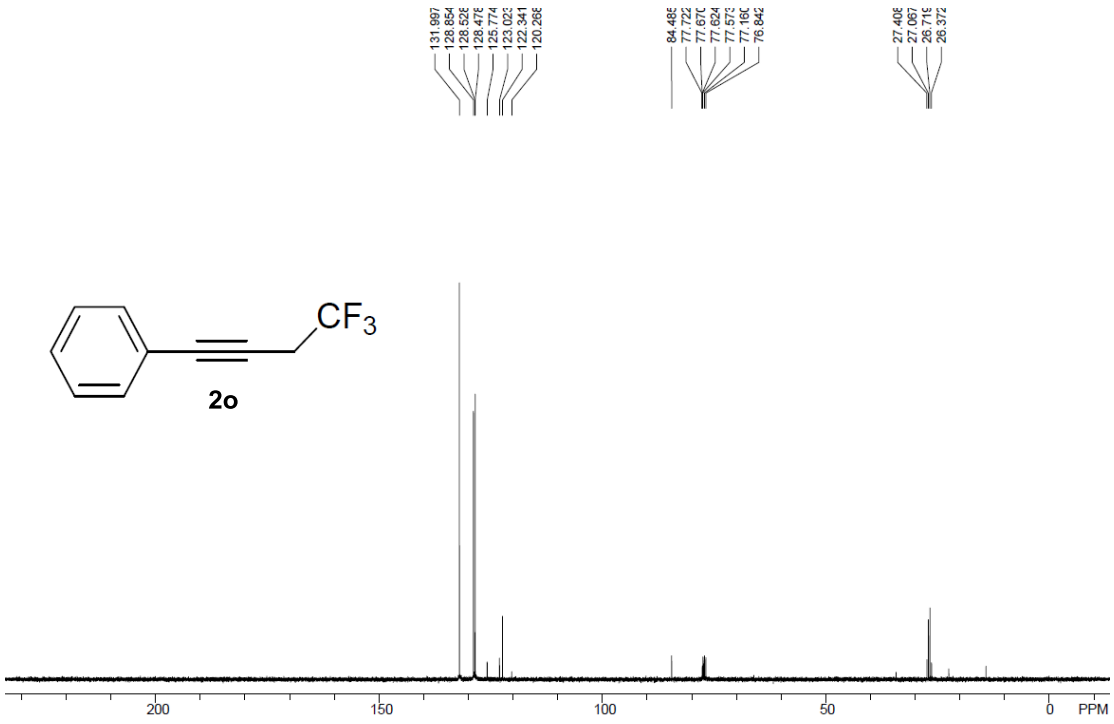
-64
-66
-68
-70
-72 PPM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2o
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150
100
50
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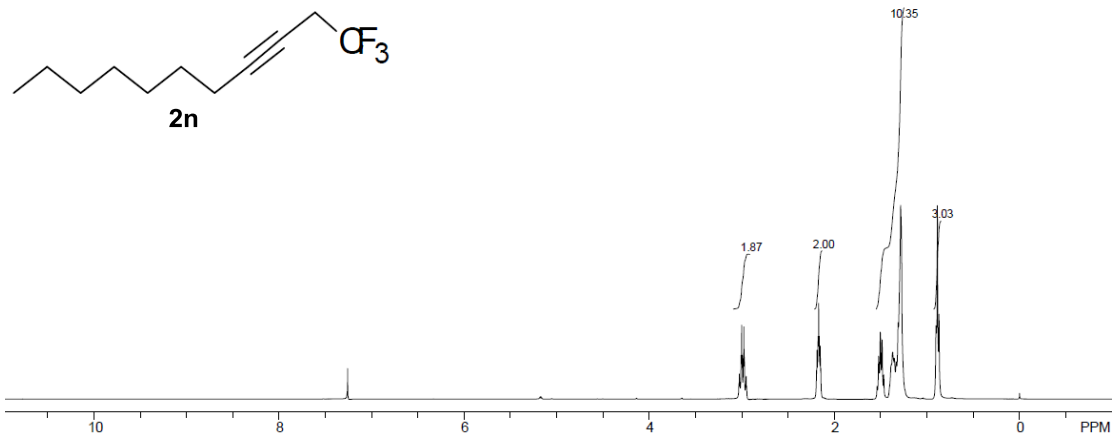
PPM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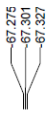
10
8
6
4
2
0
PPM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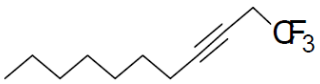
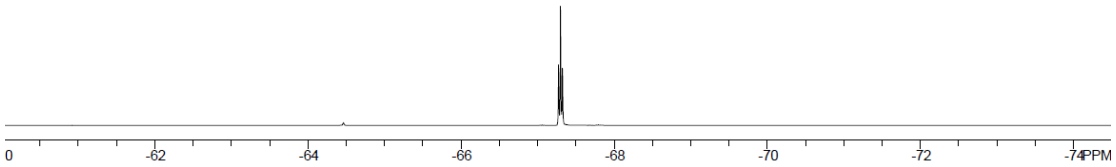

CF3

2n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-68
-70
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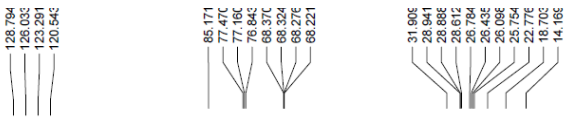
PPM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126.033
123.291
120.543
85.171
77.470
77.160
76.842
68.370
68.324
68.278
68.221
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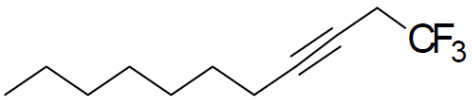
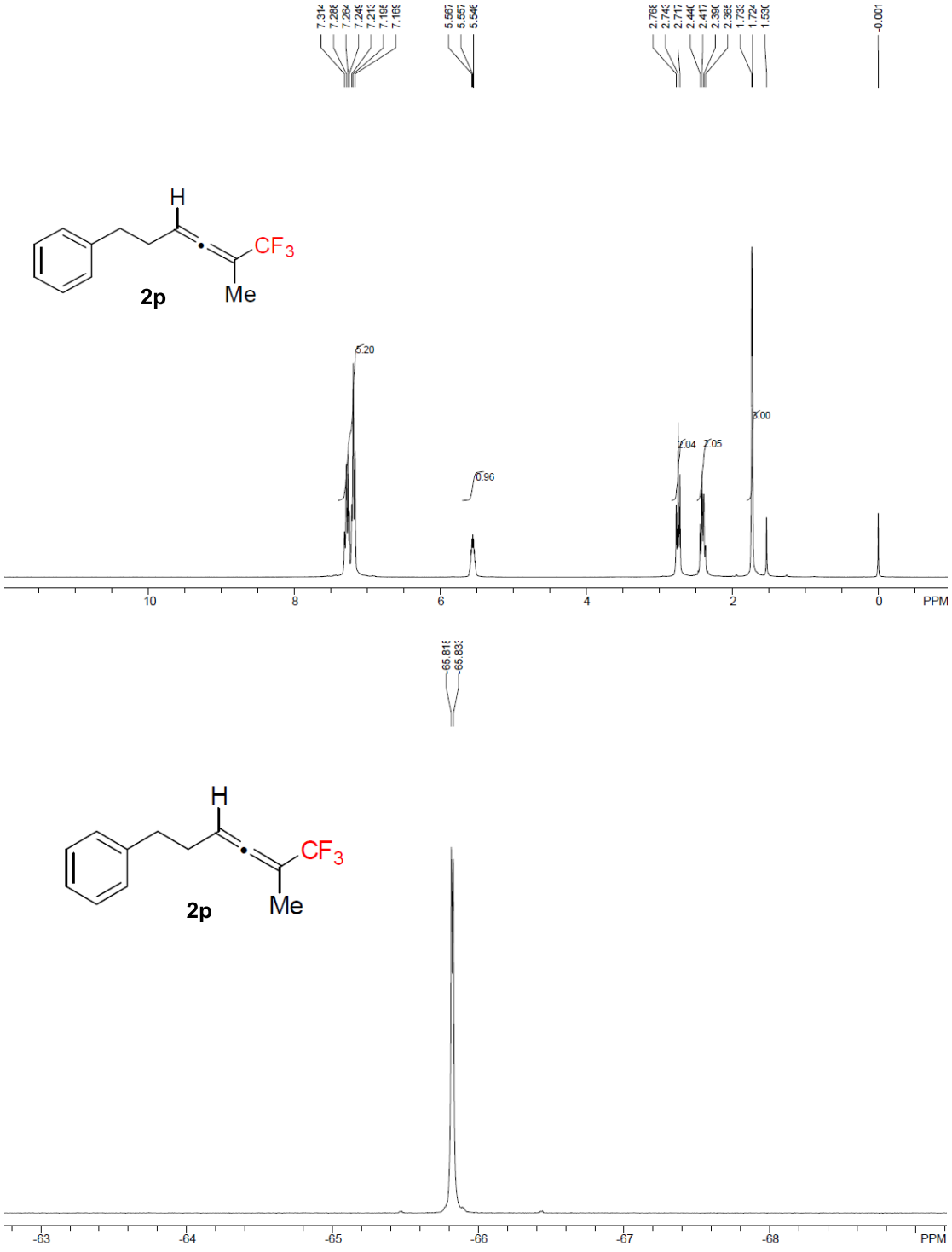
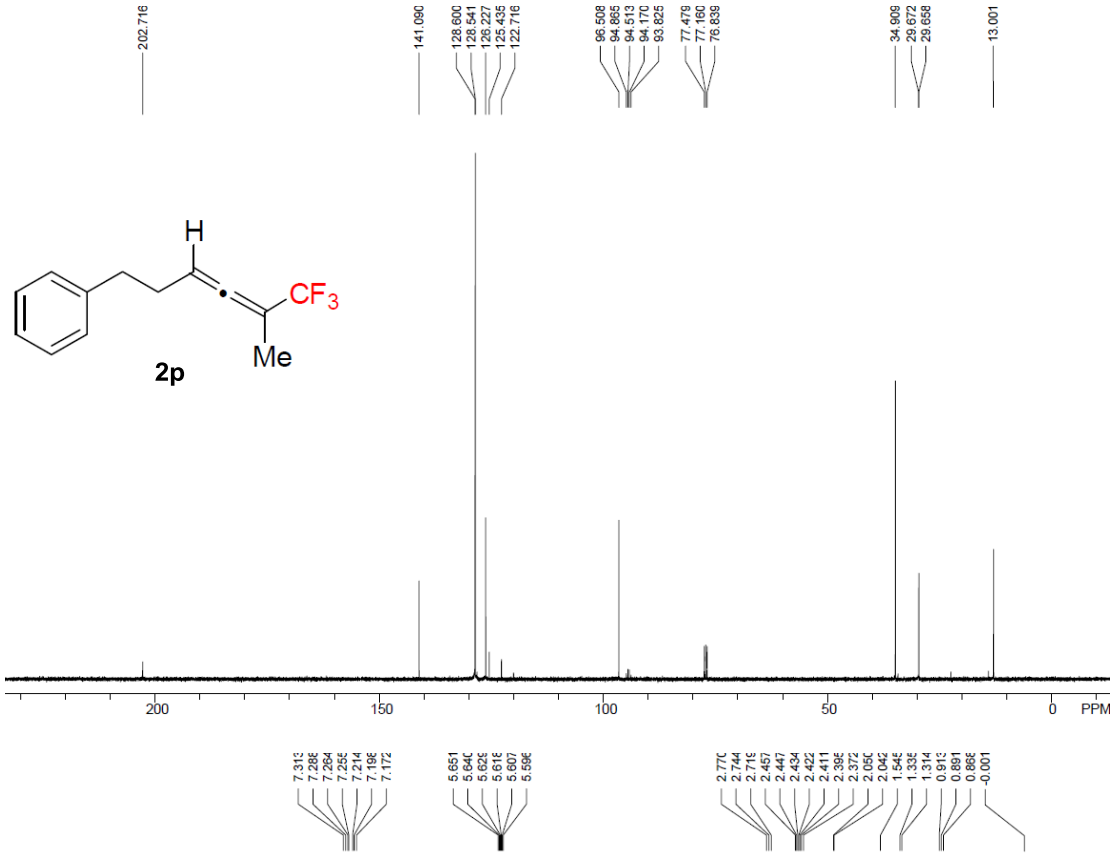
26.784
26.435
26.098
25.754
22.776
18.703
14.168


CF3

2n

200
150
100
50
0
PPM


H
CF3
Me
2p
5.20
0.96
2.04
2.05
3.00
10
8
6
4
2
0
PPM
H
CF3
Me
2p
-63
-64
-65
-66
-67
-68
PPM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77.160
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29.672
29.658
13.001
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Me
2p
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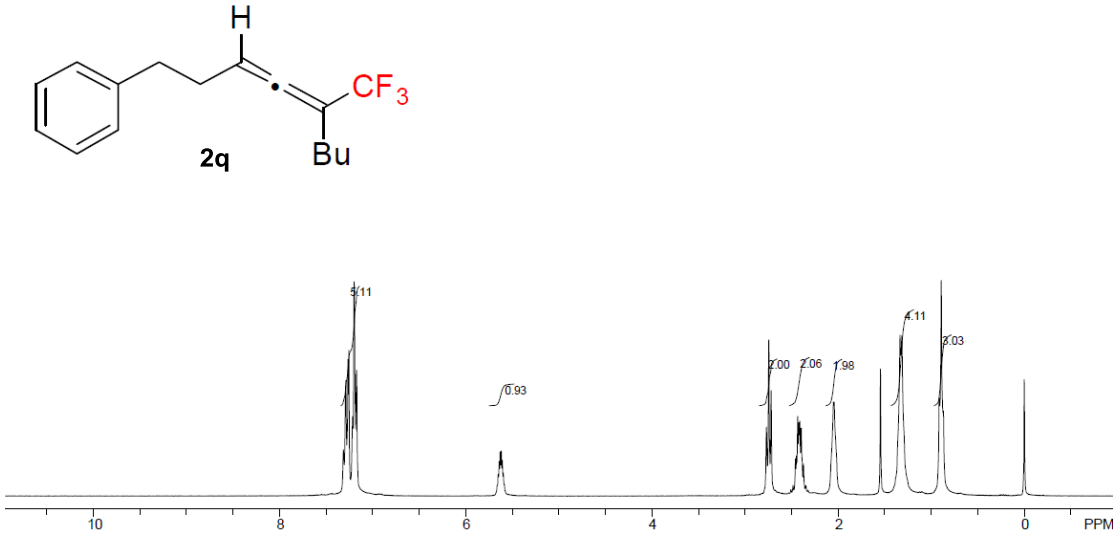
100
50
0
PPM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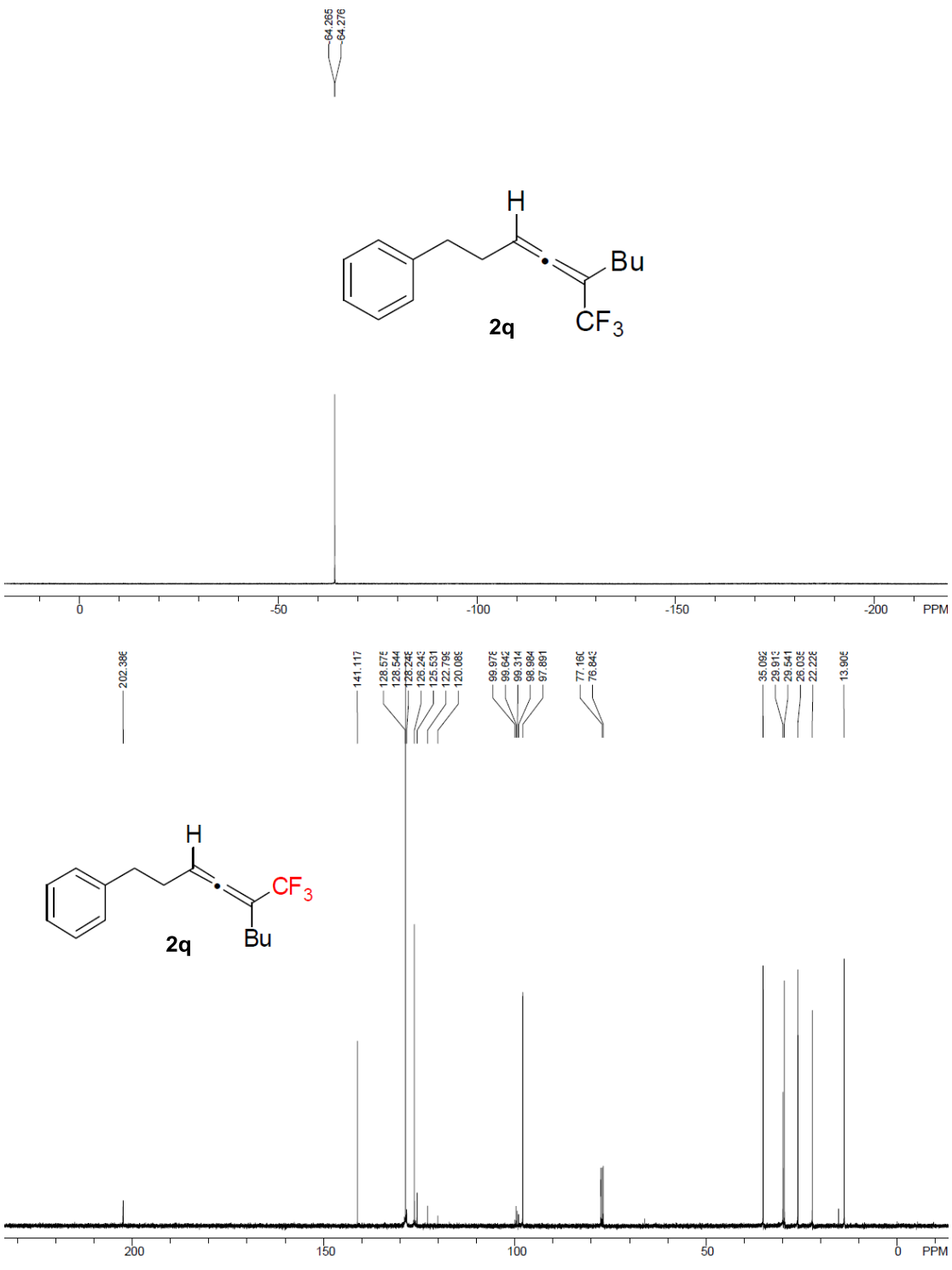
3.03
10
8
6
4
2
0
PPM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Bu
CF3
2q
0
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-100
-150
-200
PPM
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125.531
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120.086
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99.642
99.314
98.984
97.891
77.166
76.843
35.092
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29.541
26.038
22.226
13.905
H
CF3
Bu
2q
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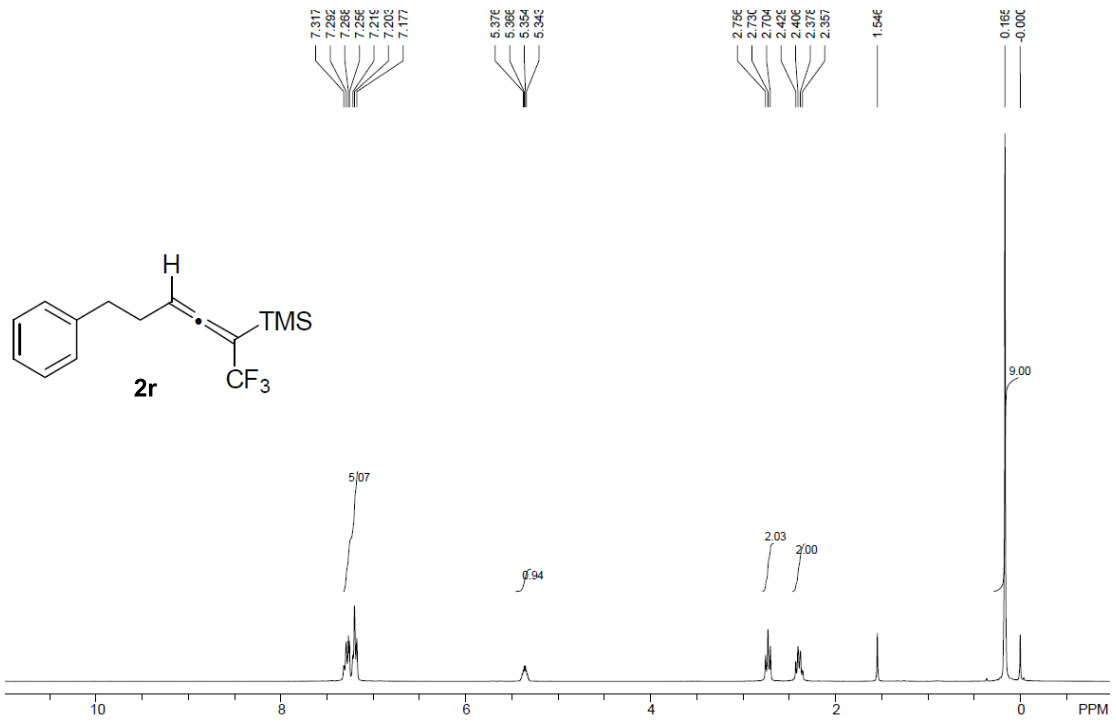
150
100
50
0
PPM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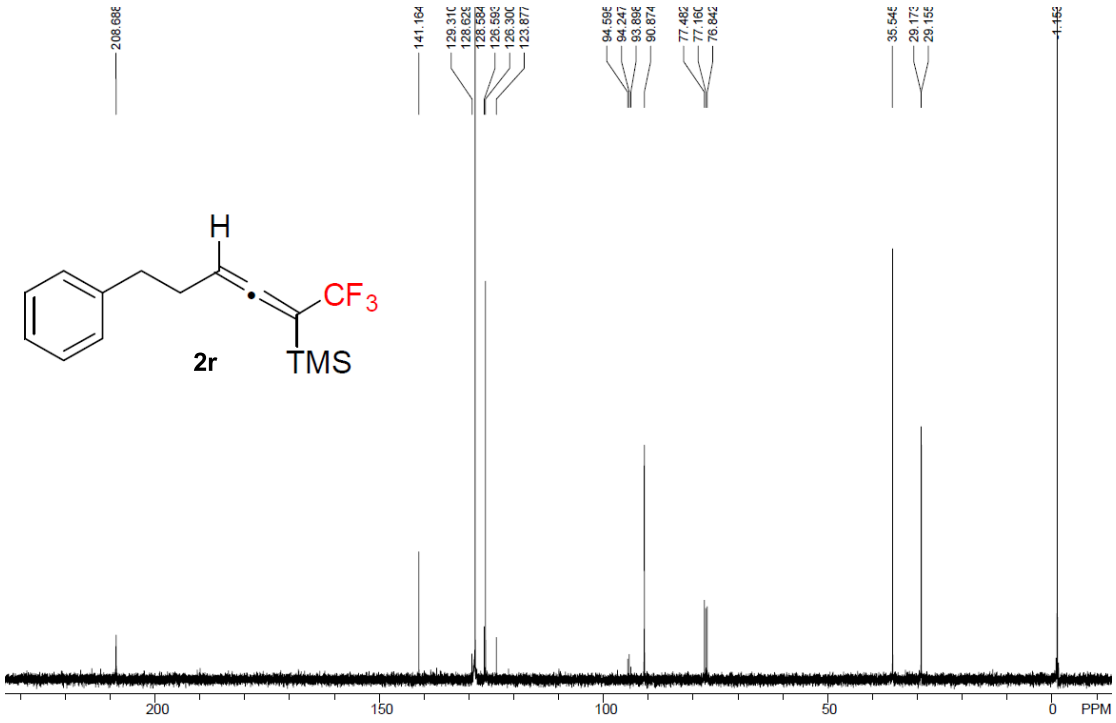
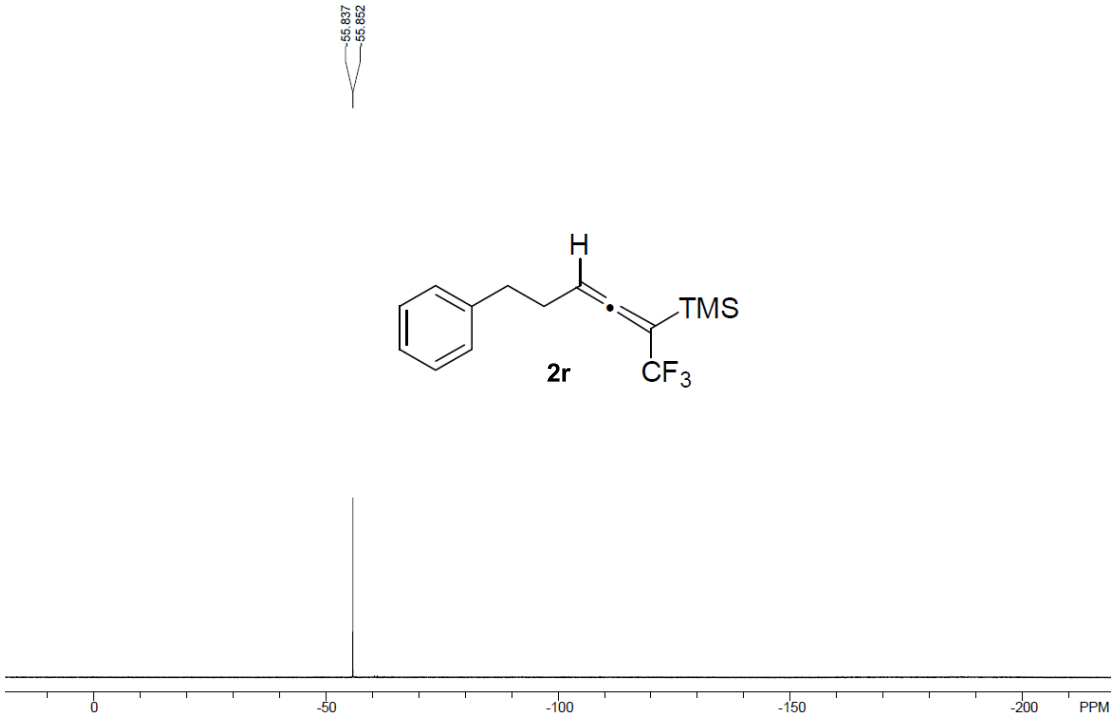
0.94
10
8
6
4
2
0
PPM


H
CF3
TMS
2r
200
150
100
50
0
PPM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55.852
H
TMS
2r
CF3
0
-50
-100
-150
-200
PPM