Supporting Information

for

Gold(I)-catalyzed formation of furans from γ-acyloxyalkynyl ketones

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General procedures, characterization data and NMR spectra for compounds 1a–l, 2a–l and 3

Contents

General Information S2

Preparation and characterization of compounds S2

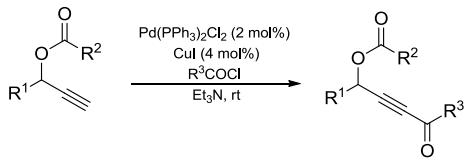
Proton and Carbon NMR spectra for all compounds S9

General Information:

Proton (^{1}H NMR) and carbon (^{13}C NMR) nuclear magnetic resonance spectra were recorded on 300, 400 or 500 MHz instruments. The chemical shifts are given in part per million (ppm) on the delta scale. The solvent peak was used as reference value. For ^{1}H NMR: $CDCl_3$ = 7.26 ppm. For ^{13}C NMR: $CDCl_3$ = 77.16 ppm. Data are presented as follow: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, quint = quintet, m = multiplet), coupling constants (*J*/Hz) and integration. Assignments were determined either on the basis of unambiguous chemical shifts or coupling patterns, COSY, HMQC, HMBC, NOESY experiments to fully interpreted spectra for related compounds. Infrared spectra were recorded neat with Hewlett-Packard spectrometer. Wavelengths of maximum absorbance (ν_{max}) are quoted in wave numbers (cm^{-1}). High resolution mass spectra (HRMS) data were recorded on a microTOF spectrometer equipped with orthogonal electrospray interface (ESI). The parent ions $[M]^+$, $[M + H]^+$, $[M + Li]^+$ or $[M + Na]^+$ are quoted. Analytical thin-layer chromatography (TLC) was carried out on silica gel 60 F254 plates or basic alumina (63−200 μm) with visualization by ultraviolet light, cerium ammonium molybdate (CAM) or potassium permanganate dip. Flash-column chromatography was carried out using silica gel 60 (40−63 μm) or basic Al_2O_3 (63−200 μm) and the procedure included the subsequent evaporation of solvents in vacuo. Reagents and solvents were purified using standard means. Dichloroethane ($(CH_2Cl)_2$), and triethylamine (NEt_3) were distilled from CaH_2 under an argon atmosphere; pyridine was distilled from potassium carbonate; diisopropylamine (DIPA) was distilled from KOH; and tetrahydrofuran (THF) was dried using Glasstechnology GT S100 device. Anhydrous reactions were carried out in flame-dried glassware and under an argon atmosphere.

CuI (98%) and DMA (≥99.5%) was purchased from Sigma Aldrich. $AgSbF_6$ (98%) was purchased from STREM Chemicals. $AgNTf_2$ was prepared from commercially available $HNTf_2$ (Aldrich) and Ag_2CO_3 [1]. Triphenylphosphinegold(I) chloride was prepared by reduction of $NaAuCl_4$ with thiodiethanol and subsequent addition of triphenylphosphine [2]. PPh_3AuNTf_2 catalyst was prepared from the corresponding triphenylphosphinegold(I) chloride and $AgNTf_2$ [3]. $Cu(MeCN)_4NTf_2$ was prepared from commercially available $HNTf_2$ (Aldrich) and Cu_2O (Acros) [4]. All other chemicals were used as received. All extractive procedures were performed using non distilled solvents and all aqueous solutions used were saturated unless details are given.

Procedure A: preparation of γ-acyloxyalkynyl ketone by Sonogashira reaction [5]

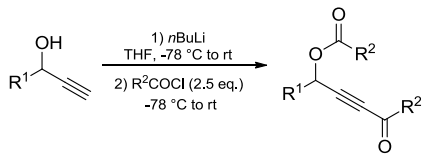


To an oven-dried flask under argon were successively added copper iodide (4 mol %), dichlorobis(triphenylphosphine)palladium (2 mol %) and NEt_3 [0.4 M]. The acyloxyalkyne (1 equiv) previously dissolved in NEt_3 [0.5 M] was added to the catalyst mixture via cannula

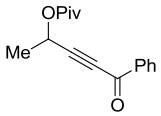
[1] Vij, A.; Zheng, Y. Y.; Kirchmeier, R. L.; Shreeve, J. M. *Inorg. Chem*. **1994**, *33*, 3281−3288.
[2] Al'Sa-Ady, A. K.; McAuliffe, C. A.; Parish, R. V.; Sandeank, J. A. *Inorg. Synth*. **1985**, 191−194.
[3] Mezailles, N.; Ricard, L.; Gagosz, F. *Org. Lett*. **2005**, *7*, 4133−4136.
[4] Gronnier C.; Kramer S.; Odabachian Y.; Gagosz F. *J. Am. Chem. Soc*. **2012**, *134*, 828–831.
[5] Schwier, T.; Sromek, A. W.; Yap, D. M. L.; Chernyak, D.; Gevorgyan, V. *J. Am. Chem. Soc.* **2007**, *129*, 9868–9878.

and briefly stirred. The acid chloride (1.1 equiv) was then added dropwise. The reaction was stirred at room temperature and monitored by TLC until completion. The mixture was quenched with HCl (1 N) and extracted with Et_2O. The organic layers were washed with HCl (1 N), $NaHCO_3$ solution and brine, dried over $MgSO_4$ and concentrated under vacuum. The resulting crude product was purified by flash-column chromatography on silica gel (cyclohexane/EtOAc).

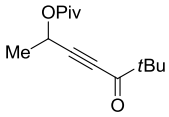
Procedure B: preparation of γ-acyloxyalkynyl ketone by condensation [5]



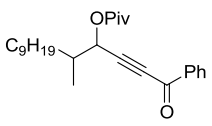
To a stirred solution of propargyl alcohol (1 equiv) in THF [0.5 M] under argon at −78 °C, was dropwise added *n*-BuLi ([1.6 M] in hexanes, 2.2 equiv). The resulting solution was then allowed to warm to room temperature and stirred for 0.5 to 1 hour. A solution of acid chloride (2.5 equiv) in THF [1.8 M] under argon at −78 °C was added via cannula to the mixture. The reaction was then allowed to warm to room temperature and stirred for 2 to 7 hours (monitored by TLC). The reaction was quenched with NH_3 (aqueous solution) and extracted with Et_2O. The organic layers were washed with HCl (1 N), $NaHCO_3$ and brine, dried over $MgSO_4$ and concentrated under vacuum. The resulting crude product was purified by column chromatography on silica gel (cyclohexane/EtOAc).



5-Oxo-5-phenylpent-3-yn-2-yl pivalate (1a) [5]: Prepared following the **Procedure A** in 63% yield (1.06 g, 4.10 mmol) from 1.00 g (6.48 mmol) of but-3-yn-2-yl pivalate. Colorless oil; TLC R_f 0.60 (cyclohexane/EtOAc 25%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.26 (s, 9H), 1.63 (d, J = 6.8 Hz, 3H), 5.66 (q, J = 6.8 Hz, 1H), 7.48 (dd, J = 8.1, 7.5 Hz, 2H), 7.62 (t, J = 7.5 Hz, 1H), 8.10 (d, J = 8.1 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 20.5, 27.2, 38.9, 59.8, 82.0, 92.0, 128.7, 129.7, 134.4, 136.6, 177.3, 177.6.

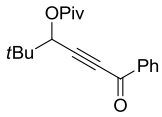


6,6-Dimethyl-5-oxohept-3-yn-2-yl pivalate (1b): Prepared following the **Procedure B** in 38% yield (1.30 g, 5.45 mmol) from 1.00 g (14.30 mmol) of but-3-yn-2-yl pivalate. Colorless oil; TLC R_f 0.40 (pentane/Et_2O 5%); IR (neat) ν_{max} 1007, 1035, 1079, 1133, 1274, 1366, 1396, 1460, 1479, 1675, 1736, 2217, 2872, 2936, 2971 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.18 (s, 9H), 1.22 (s, 9H), 1.55 (d, J = 6.8 Hz, 3H), 5.55 (q, J = 6.8 Hz, 1H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 20.4, 26.0, 27.1, 38.9, 45.0, 59.7, 81.3, 91.4, 177.2, 193.7; HRMS 261.148 ($C_{14}H_{21}O_3$ + Na calcd 261.146).

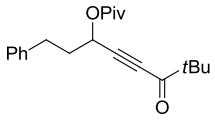


5-Methyl-1-oxo-1-phenyltetradec-2-yn-4-yl pivalate (1c): Prepared following the **Procedure A** in 56% yield (229 mg, 0.57 mmol, mixture 50/50 of 2 diastereoisomers) from 300 mg (1.02 mmol) of 4-methyltridec-1-yn-3-yl pivalate. Colorless oil; TLC R_f 0.56 (cyclohexane/EtOAc 10%); IR (neat) ν_{max} 977, 1031, 1133, 1259, 1312, 1365, 1396, 1450, 1582, 1598, 1650, 1736, 2208, 2226, 2854, 2924, 2958, 3067 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 0.83–0.92 (m, 6H), 1.10 (d, J = 6.9 Hz, 3H, Diastereoisomer 1), 1.11 (d, J = 6.9 Hz, 3H, Diastereoisomer 2), 1.21–1.33 (m, 28H), 1.26–1.27 (m, 18H), 1.35–1.45 (m, 2H), 1.52–1.64 (m, 2H), 1.95–2.05 (m, 2H), 5.50 (d, J = 5.0 Hz, 1H, Diastereoisomer 2), 5.52 (d, J = 5.4 Hz, 1H, Diastereoisomer 1), 7.50–7.45 (m, 4H), 7.59–7.64 (m, 2H), 8.08–8.12 (m, 4H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ

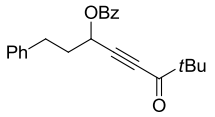
14.27 (x2), 15.3, 15.6, 22.8 (x2), 27.0, 27.1, 27.2 (x2), 29.5 (x2), 29.6 (x2), 29.7 (x2), 29.8, 29.9, 32.0 (x2), 32.4, 32.7, 37.2, 37.5, 39.1, 39.2, 67.4, 67.8, 83.2, 83.5, 90.5, 91.1, 128.7 (x2), 129.7 (x2), 134.4 (x2), 136.7 (x2), 177.3, 177.4, 177.50, 177.53; HRMS 421.270 ($C_{26}H_{38}O_3$ + Na calcd 421.271).



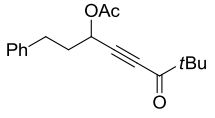
2,2-Dimethyl-6-oxo-6-phenylhex-4-yn-3-yl pivalate (1d): Prepared following the **Procedure A** in 70% yield (1.30 g, 4.33 mmol) from 1.20 g (6.12 mmol) of 4,4-dimethylpent-1-yn-3-yl pivalate. White solid; mp 54 °C; TLC R_f 0.40 (cyclohexane/EtOAc 10%); IR (neat) ν_{max} 1110, 1266, 1313, 1366, 1395, 1448, 1478, 1580, 1596, 1638, 1739, 2238, 2871, 2935, 2972, 3071 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.11 (s, 9H), 1.28 (s, 9H), 5.30 (s, 1H), 7.48 (dd, J = 7.5, 7.3 Hz, 2H), 7.61 (t, J = 7.2 Hz, 1H), 8.10 (d, J = 7.5 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 25.9, 27.2, 35.9, 39.2, 71.5, 83.3, 90.6, 128.8, 129.7, 134.4, 136.8, 177.3, 177.5; HRMS 323.163 ($C_{19}H_{24}O_3$ + Na calcd 323.162).



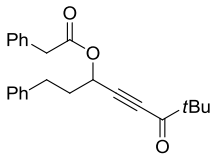
7,7-Dimethyl-6-oxo-1-phenyloct-4-yn-3-yl pivalate (1e): Prepared following the **Procedure A** in 84% yield (553 mg, 1.68 mmol) from 489 mg (2.00 mmol) of 5-phenylpent-1-yn-3-yl pivalate. Colorless oil; TLC R_f 0.50 (cyclohexane/CH_2Cl_2 50%); IR (neat) ν_{max} 699, 745, 1032, 1130, 1275, 1365, 1478, 1496, 1674, 1736, 2214, 2870, 2933, 2969, 3029 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.19 (s, 9H), 1.24 (s, 9H), 2.11−2.23 (m, 2H), 2.79 (t, J = 8.0 Hz, 2H), 5.74 (t, J = 6.8 Hz, 1H), 7.18 (d, J = 7.7 Hz, 2H), 7.21 (t, J = 7.2 Hz, 1H), 7.30 (dd, J = 7.7, 7.2 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 26.0, 27.2, 31.3, 35.7, 39.0, 45.0, 62.8, 82.2, 90.3, 126.5, 128.5, 128.8, 140.3, 177.2, 193.7; HRMS 351.193 ($C_{21}H_{28}O_3$ + Na calcd 351,194).



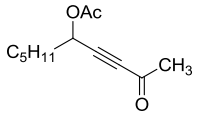
7,7-Dimethyl-6-oxo-1-phenyloct-4-yn-3-yl benzoate (1f): Prepared following the **Procedure A** in 70% yield (478 mg, 1.37 mmol) from 518 mg (1.96 mmol) of 5-phenylpent-1-yn-3-yl benzoate. Colorless oil; TLC R_f 0.23 (pentane/Et_2O 5%); IR (neat) ν_{max} 711, 745, 1025, 1067, 1094, 1141, 1261, 1476, 1672, 1723, 2214, 2868, 2931, 2968, 3028 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 1.21 (s, 9H), 2.23−2.42 (m, 2H), 2.89 (t, J = 7.9 Hz, 2H), 5.74 (t, J = 6.6 Hz, 1H), 7.18−7.25 (m, 3H), 7.27−7.34 (m, 2H), 7.47 (dd, J = 8.3, 7.5 Hz, 2H), 7.60 (t, J = 7.5 Hz, 1H), 8.04 (d, J = 8.3 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 26.0, 31.5, 35.9, 45.0, 63.5, 82.6, 90.0, 126.5, 128.5, 128.6, 128.8, 129.4, 129.9, 133.6, 140.2, 165.4, 193.6; HRMS 371.158 ($C_{23}H_{24}O_3$ + Na calcd 371.163).



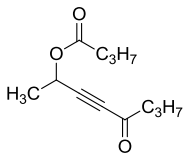
7,7-Dimethyl-6-oxo-1-phenyloct-4-yn-3-yl acetate (1g): Prepared following the **Procedure A** in 57% yield (331 mg, 1.16 mmol) from 410 mg (2.03 mmol) of 5-phenylpent-1-yn-3-yl acetate. Colorless oil; TLC R_f 0.28 (pentane/Et_2O 10%); IR (neat) ν_{max} 699, 745, 1023, 1222, 1369, 1476, 1673, 1745, 2213, 2869, 2933, 2969, 3028 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.20 (s, 9H), 2.10 (s, 3H), 2.11−2.23 (m, 2H), 2.79 (t, J = 7.9 Hz, 2H), 5.47 (t, J = 6.7 Hz, 1H), 7.18 (d, J = 7.8 Hz, 2H), 7.21 (t, J = 7.5 Hz, 1H), 7.30 (dd, J = 7.8, 7.5 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 21.0, 26.0, 31.4, 35.7, 45.0, 63.0, 82.4, 89.9, 126.5, 128.5, 128.8, 140.23, 169.8, 193.6; HRMS 309.149 ($C_{18}H_{22}O_3$ + Na calcd 309.147).



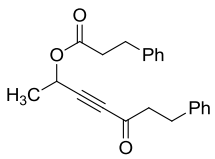
7,7-Dimethyl-6-oxo-1-phenyloct-4-yn-3-yl 2-phenylacetate (1h): Prepared following the **Procedure A** in 66% yield (204 mg, 0.56 mmol) from 489 mg (0.86 mmol) of 5-phenylpent-1-yn-3-yl 2-phenylacetate. Colorless oil; TLC R_f 0.27 (pentane/Et_2O 15%); IR (neat) ν_{max} 1131, 1240, 1455, 1476, 1496, 1672, 2213, 2868, 2931, 2968, 3029, 3063, 3087 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 1.54 (s, 9H), 2.06–2.24 (m, 2H), 2.71 (t, J = 7.8 Hz, 2H), 3.65 (s, 2H), 5.47 (t, J = 6.6 Hz, 1H), 7.10 (d, J = 7.6 Hz, 2H), 7.20 (t, J = 7.3 Hz, 1H), 7.25–7.37 (m, 7H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 26.0, 31.2, 35.7, 41.3, 45.0, 63.3, 82.5, 89.7, 126.5, 127.5, 128.5, 128.7, 128.8, 129.4, 133.5, 140.2, 170.3, 193.6; HRMS 385.176 ($C_{24}H_{26}O_3$ + Na calcd 385.177).



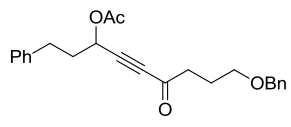
2-Oxodec-3-yn-5-yl acetate (1i) [6]: Prepared following the **Procedure B** in 52% yield (2.11 g 10.03 mmol) from 2.8 mL (19.68 mmol) of oct-1-yn-3-ol. Colorless oil; TLC R_f 0.50 (cyclohexane/EtOAc 20%); ^1H NMR (300 MHz, $CDCl_3$) δ 0.90 (t, J = 6.9 Hz, 3H), 1.27−1.37 (m, 4H), 1.38−1.50 (m, 2H), 1.76−1.86 (m, 2H), 2.10 (s, 3H), 2.35 (s, 3H), 5.46 (t, J = 6.7 Hz, 1H); ^{13}C NMR (75.5 MHz, $CDCl_3$) δ 14.1, 21.0, 22.6, 24.7, 31.3, 32.7, 34.1, 63.4, 84.3, 88.5, 169.9, 184.



5-Oxooct-3-yn-2-yl butyrate (1j): Prepared following the **Procedure B** in 58% yield (876 mg, 4.17 mmol) from 0.5 mL (7.13 mmol) of but-3-yn-2-ol. Colorless oil; TLC R_f 0.38 (pentane/Et_2O 20%); IR (neat) ν_{max} 1023, 1078, 1159, 1245, 1350, 1456, 1678, 1742, 2216, 2876, 2937, 2965 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 0.93 (t, J = 7.4 Hz, 3H), 0.96 (t, J = 7.4 Hz, 3H), 1.53 (d, J = 6.8 Hz, 3H), 1.67 (qt, J = 7.4, 7.4 Hz, 2H), 1.68 (qt, J = 7.4, 7.4 Hz, 2H), 2.32 (t, J = 7.4 Hz, 2H), 2.53 (t, J = 7.4 Hz, 2H), 5.56 (q, J = 6.8 Hz, 1H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 13.6, 13.7, 17.5, 18.5, 20.6, 36.1, 47.3, 59.4, 83.1, 89.3, 172.4, 187.6; HRMS 233.116 ($C_{12}H_{18}O_3$ + Na calcd 233.115).



5-Oxo-7-phenylhept-3-yn-2-yl 3-phenylpropanoate (1k): Prepared following the **Procedure B** in 45% yield (1.89 g, 5.69 mmol) from 1 mL (12.76 mmol) of but-3-yn-2-ol. Yellowish oil; TLC R_f 0.31 (pentane/Et_2O 20%); IR (neat) ν_{max} 698, 748, 1030, 1076, 1087, 1138, 1229, 1453, 1496, 1678, 1740, 2220, 2934, 3028 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 1.50 (d, J = 6.9 Hz, 3H), 2.67 (t, J = 7.6 Hz, 2H), 2.89 (t, J = 7.6 Hz, 2H), 2.97 (m, 4H), 5.54 (q, J = 6.9 Hz, 1H), 7.16−7.23 (m, 6H), 7.26−7.32 (m, 4H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 20.5, 29.7, 30.9, 35.8, 47.0, 59.7, 83.1, 89.6, 126.5, 126.5, 128.4, 128.5, 128.7, 128.7, 140.1, 140.2, 171.6, 186.3; HRMS 357,144 ($C_{22}H_{22}O_3$ + Na calcd 357,146).



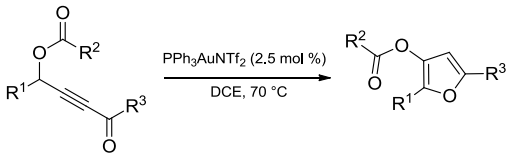
9-(Benzyloxy)-6-oxo-1-phenylnon-4-yn-3-yl acetate (1l): To a stirred solution of 1-(benzyloxy)-7-hydroxy-9-phenylnon-5-yn-4-one [7] (500 mg, 1.31 mmol) in dichloromethane was added at once a mixture of pyridinium chlorochromate (430 mg, 2 mmol) and SiO_2 (430 mg). After 5 h of stirring at room temperature, the reaction mixture was filtered through a pad of Celite® (CH_2Cl_2) and the filtrate was concentrated in vacuo. The crude product was purified by flash chromatography (cyclohexane/EtOAc 10-20%) to afford **1l** as a pale yellow oil (460 mg, 1.22 mmol, 93%). TLC R_f 0.45 (cyclohexane/EtOAc 25%); IR (neat) ν_{max} 698, 737, 1025, 1101, 1155, 1220, 1369, 1454, 1496, 1677, 1743, 2217, 2859, 2931, 3028 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 1.97 (tt, J = 6.0, 7.3 Hz, 2H), 2.09 (s, 3H), 2.10–2.19 (m, 2H),

[6] Sromek, A. W.; Kel'in, A. V.; Gevorgyan, V. *Angew. Chem., Int. Ed.* **2004**, *43*, 2280–2282.

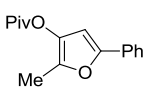
[7] This compound was synthetized according to the sequence described by Singh, M.; Argade, N. P. *J. Org. Chem.* **2010**, *75*, 3121–3124.

2.71 (t, *J* = 7.3 Hz, 2H), 2.78 (t, *J* = 7.9 Hz, 2H), 3.50 (t, *J* = 6.1 Hz, 2H), 4.49 (s, 2H), 5.45 (t, *J* = 6.67 Hz, 1H), 7.16-7.34 (m, 10H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 20.9, 24.0, 31.3, 35.6, 42.4, 62.9, 69.0, 73.0, 84.1, 88.2, 126.5, 127.7, 128.5, 128.5, 128.7, 138.4, 140.2, 169.8, 186.9; HRMS 401.174 ($C_{24}H_{26}O_4$ + Na calcd 401.172).

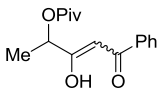
Procedure C: gold(I)-catalyzed formation of furans from γ-acyloxyalkynyl ketones



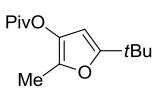
In an oven-dried flask, γ-acyloxyalkynyl ketone (0.4 mmol) was dissolved in dichloroethane [0.1 M] and heated to 70 °C under an argon atmosphere. $Ph_3PAuNTf_2$ (2.5 mol %) was then added to the stirred solution at 70 °C. The reaction was monitored by thin-layer chromatography until completion. The solvent was then removed in vacuo and the crude residue was purified by flash chromatography on silica gel (pentane/Et_2O).



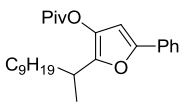
2-Methyl-5-phenylfuran-3-yl pivalate (2a) [5]: Prepared following the **Procedure C** in 95% yield (99 mg, 0.38 mmol) from 102 mg (0.40 mmol) of **1a**. White solid; mp 57 °C; TLC R_f 0.60 (Pentane/Et_2O 5%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.35 (s, 9H), 2.26 (s, 3H), 6.64 (s, 1H), 7.23 (t, *J* = 7.3 Hz, 1H), 7.36 (dd, *J* = 7.9, 7.3 Hz, 2H), 7.59 (d, *J* = 7.8 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 10.8, 27.3, 39.2, 102.1, 123.4, 127.3, 128.7, 131.0, 135.9, 139.8, 150.1, 176.2.



3-Hydroxy-5-oxo-5-phenylpent-3-en-2-yl pivalate (3): By-product obtained following the **Procedure C** (at room temperature instead of 70 °C) in 22% yield (22 mg, 0.09 mmol) from 101 mg (0.39 mmol) of **1a**. Yellowish oil; TLC R_f 0.31 (pentane/Et_2O 5%); IR (neat) ν_{max} 521, 633, 685, 761, 879, 1036, 1060, 1116, 1150, 1278, 1477, 1569, 1598, 1731, 2903, 2958 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.30 (s, 9H), 1.50 (d, *J* = 7.0 Hz, 3H), 5.28 (q, *J* = 7.0 Hz, 1H), 6.30 (s, 1H), 7.46 (dd, *J* = 7.5, 7.1 Hz, 2H), 7.54 (t, *J* = 7.1 Hz, 1H), 7.86 (d, *J* = 7.5 Hz, 2H), 15.79 (s, 1H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 17.9, 27.3, 38.9, 71.9, 92.4, 127.1, 128.9, 132.7, 134.4, 177.6, 182.6, 196.1. HRMS 276.137 ($C_{16}H_{20}O_4$ + Na calcd 276.136).

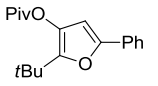


5-(*tert*-Butyl)-2-methylfuran-3-yl pivalate (2b): Prepared following the **Procedure C** in 93% yield (101 mg, 0.42 mmol) from 108 mg (0.45 mmol) of **1b**. Colorless oil; TLC R_f 0.77 (pentane/Et_2O 5%); IR (neat) ν_{max} 939, 1028, 1117, 1190, 1241, 1277, 1363, 1395, 1460, 1479, 1652, 1735, 2871, 2914, 2967 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.23 (s, 9H), 1.31 (s, 9H), 2.14 (s, 3H), 5.95 (s, 1H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 10.7, 27.3, 29.0, 32.8, 39.1, 99.3, 134.2, 137.6, 160.5, 176.5; HRMS 261.146 ($C_{14}H_{22}O_3$ + Na calcd 261.146).

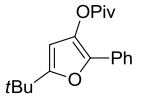


5-Phenyl-2-(undecan-2-yl)furan-3-yl pivalate (2c): Prepared following the **Procedure C** in 90% yield (45 mg, 0.11 mmol) from 49 mg (0.12 mmol) of **1c**. Colorless oil; TLC R_f 0.38 (pentane/Et_2O 5%); IR (neat) ν_{max} 1113, 1175, 1275, 1397, 1456, 1604, 1754, 2838, 2924, 2971 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$) δ 0.86 (t, *J* = 7.0 Hz, 3H), 1.20–1.27 (m, 14H), 1.29 (d, *J* = 7.2 Hz, 3H), 1.34 (s, 9H), 1.51–1.59 (m, 1H), 1.65–1.74 (m, 1H), 2.83 (dqd, *J* = 8.4, 7.2, 5.8 Hz, 1H), 6.65 (s, 1H), 7.22 (t, *J* = 7.4 Hz, 1H), 7.35 (dd, *J* = 8.4, 7.4 Hz, 2H), 7.59 (d, *J* = 8.4 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ

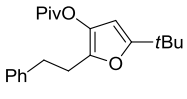
14.3, 19.0, 22.8, 27.3, 27.6, 29.5, 29.6, 29.7, 29.7, 31.3, 32.0, 35.6, 39.2, 102.1, 123.4, 127.2, 128.7, 131.1, 135.0, 146.9, 149.6, 176.3; HRMS 421.272 ($C_{26}H_{38}O_3$ + Na calcd 421.271).



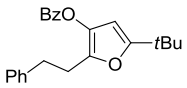
2-(*tert*-Butyl)-5-phenylfuran-3-yl pivalate (2d): Prepared following the **Procedure C** in 61% yield (63 mg, 0.21 mmol) from 104 mg (0.35 mmol) of **1d**. Colorless oil; TLC R_f 0.64 (pentane/Et_2O 10%); IR (neat) ν_{max} 1079, 1117, 1156, 1175, 1275, 1460, 1477, 1601, 1745, 2873, 2905, 2963, 2991, 3058 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.35 (s, 9H), 1.37 (s, 9H), 6.59 (s, 1H), 7.23 (t, J = 7.3 Hz, 1H), 7.35 (dd, J = 8.0, 7.3 Hz, 2H), 7.59 (d, J = 8.0 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 27.3, 29.0, 33.2, 39.1, 102.7, 123.4, 127.3, 128.7, 131.0, 134.0, 148.9, 149.1, 176.4; HRMS 323.161 ($C_{19}H_{24}O_3$ + Na calcd 323.162).



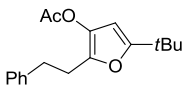
5-(*tert*-Butyl)-2-phenylfuran-3-yl pivalate (2d'): isolated as a mixture of **2d**/**2d'** using **Procedure C** from 104 mg (0.35 mmol) of **1d**. TLC R_f 0.71 (pentane/Et_2O 10%); ^1H NMR (400 MHz, $CDCl_3$) δ 1.32 (s, 9H), 1.39 (s, 9H), 6.24 (s, 1H), 7.21 (t, J = 7.3 Hz, 1H), 7.38 (dd, J = 8.0, 7.3 Hz, 2H), 7.68 (d, J = 8.0 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 27.4, 29.0, 33.1, 39.3, 101.2, 123.9, 126.7, 128.6, 130.3, 135.7, 138.4, 161.6, 176.0.



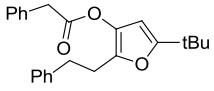
5-(*tert*-Butyl)-2-phenethylfuran-3-yl pivalate (2e): Prepared following the **Procedure C** in 78% yield (71 mg, 0.22 mmol) from 91 mg (0.28 mmol) of **1e**. Colorless oil; TLC R_f 0.52 (pentane/Et_2O 5%); IR (neat) ν_{max} 942, 1029, 1117, 1189, 1273, 1397, 1454, 1748, 2871, 2934, 2966, 3030, 3066, 3088 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.25 (s, 9H), 1.28 (s, 9H), 2.82 (t, J = 7.6 Hz, 2H), 2.92 (t, J = 7.6 Hz, 2H), 5.98 (s, 1H), 7.15 (d, J = 7.7 Hz, 2H), 7.20 (t, J = 7.4 Hz, 1H), 7.28 (dd, J = 7.7, 7.4 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 27.3, 27.5, 28.9, 32.9, 34.2, 39.1, 99.3, 126.1, 128.4, 128.5, 134.3, 140.3, 141.4, 160.6, 176.3; HRMS 351.191 ($C_{21}H_{28}O_3$ + Na calcd 351.193).



5-(*tert*-Butyl)-2-phenethylfuran-3-yl benzoate (2f): Prepared following the **Procedure C** in 81% yield (75 mg, 0.21 mmol) from 100 mg (0.29 mmol) of **1f**. Colorless oil; TLC R_f 0.45 (pentane/Et_2O 10%); IR (neat) ν_{max} 698, 1024, 1057, 1096, 1192, 1260, 1396, 1452, 1741, 2867, 2904, 2930, 2965, 3027 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.27 (s, 9H), 2.90 (t, J = 7.5 Hz, 2H), 2.96 (t, J = 7.5 Hz, 2H), 6.08 (s, 1H), 7.14−7.19 (m, 3H), 7.23−7.27 (m, 2H), 7.48 (dd, J = 8.3, 7.5 Hz, 2H), 7.62 (t, J = 7.5 Hz, 1H), 8.07 (d, J = 8.3 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 27.6, 29.0, 33.0, 34.1, 99.3, 126.1, 128.4, 128.6, 128.6, 129.4, 130.2, 133.6, 134.3, 140.8, 141.4, 160.8, 164.4; HRMS 371.165 ($C_{23}H_{24}O_3$ + Na calcd 371.163).

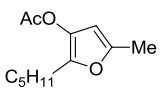


5-(*tert*-Butyl)-2-phenethylfuran-3-yl acetate (2g): Prepared following the **Procedure C** in 70% yield (71 mg, 0.48 mmol) from 101 mg (0.35 mmol) of **1g**. Colorless oil; TLC R_f 0.56 (pentane/Et_2O 10%); IR (neat) ν_{max} 1030, 1094, 1206, 1289, 1366, 1455, 1645, 1759, 2868, 2930, 2964, 3027, 3063, 3073 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.23 (s, 9H), 2.16 (s, 3H), 2.82 (t, J = 7.8 Hz, 2H), 2.91 (t, J = 7.8 Hz, 2H), 5.93 (s, 1H), 7.16 (d, J = 7.0 Hz, 2H), 7.19 (t, J = 7.5 Hz, 1H), 7.27 (dd, J = 7.5, 7.0 Hz, 2H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 20.9, 27.4, 28.9, 32.9, 34.1, 99.2, 126.1, 128.4, 128.5, 134.1, 140.6, 141.4, 160.6, 168.8; HRMS 309.145 ($C_{18}H_{22}O_3$ + Na calcd 309.146).

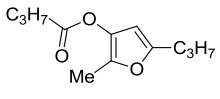


5-(*tert*-Butyl)-2-phenethylfuran-3-yl 2-phenyl acetate (2h): Prepared following the **Procedure C** in 75% yield (64 mg, 0.18 mmol) from 85 mg (0.23 mmol) of **1h**. Colorless oil; TLC R_f 0.42 (pentane/Et_2O 10%); IR (neat) ν_{max} 946, 1121, 1234, 1289, 1397, 1496, 1645, 1757, 2868, 2930, 2965, 3028, 3063, 3086 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.21 (s, 9H), 2.72 (t, J = 7.7 Hz, 2H), 2.82 (t, J =

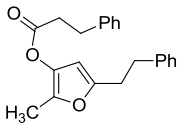
7.7 Hz, 2H), 3.72 (s, 2H), 5.94 (s, 1H), 7.07 (d, *J* = 7.6 Hz, 2H), 7.18 (t, *J* = 7.3 Hz, 1H), 7.25 (t, *J* = 7.3 Hz, 2H), 7.28–7.36 (m, 5H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 27.4, 28.9, 32.9, 34.1, 41.3, 99.1, 126.1, 127.5, 128.4, 128.5, 128.8, 129.4, 133.6, 134.2, 140.6, 141.4, 160.6, 169.3; HRMS 385.176 ($C_{24}H_{26}O_3$+Na calcd 385.177).



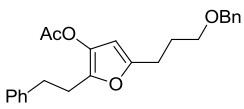
5-Methyl-2-pentylfuran-3-yl acetate (2i) [6]: Prepared following the **Procedure C** in 77% yield (77 mg, 0.37 mmol) from 100 mg (0.48 mmol) of **1i**. Colorless oil; TLC R_f 0.35 (pentane/Et_2O 5%); ^{1}H NMR (300 MHz, $CDCl_3$) δ 0.89 (t, *J* = 7.0 Hz, 3H), 1.25–1.36 (m, 4H), 1.54–1.62 (m, 2H), 2.22 (d, *J* = 1.0 Hz, 3H), 2.23 (s, 3H), 2.48 (t, *J* = 7.7 Hz, 2H), 5.94 (q, *J* = 0.9 Hz, 1H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 14.1, 20.9, 22.5, 25.2, 27.6, 31.4, 102.7, 133.9, 142.3, 148.6, 169.1.



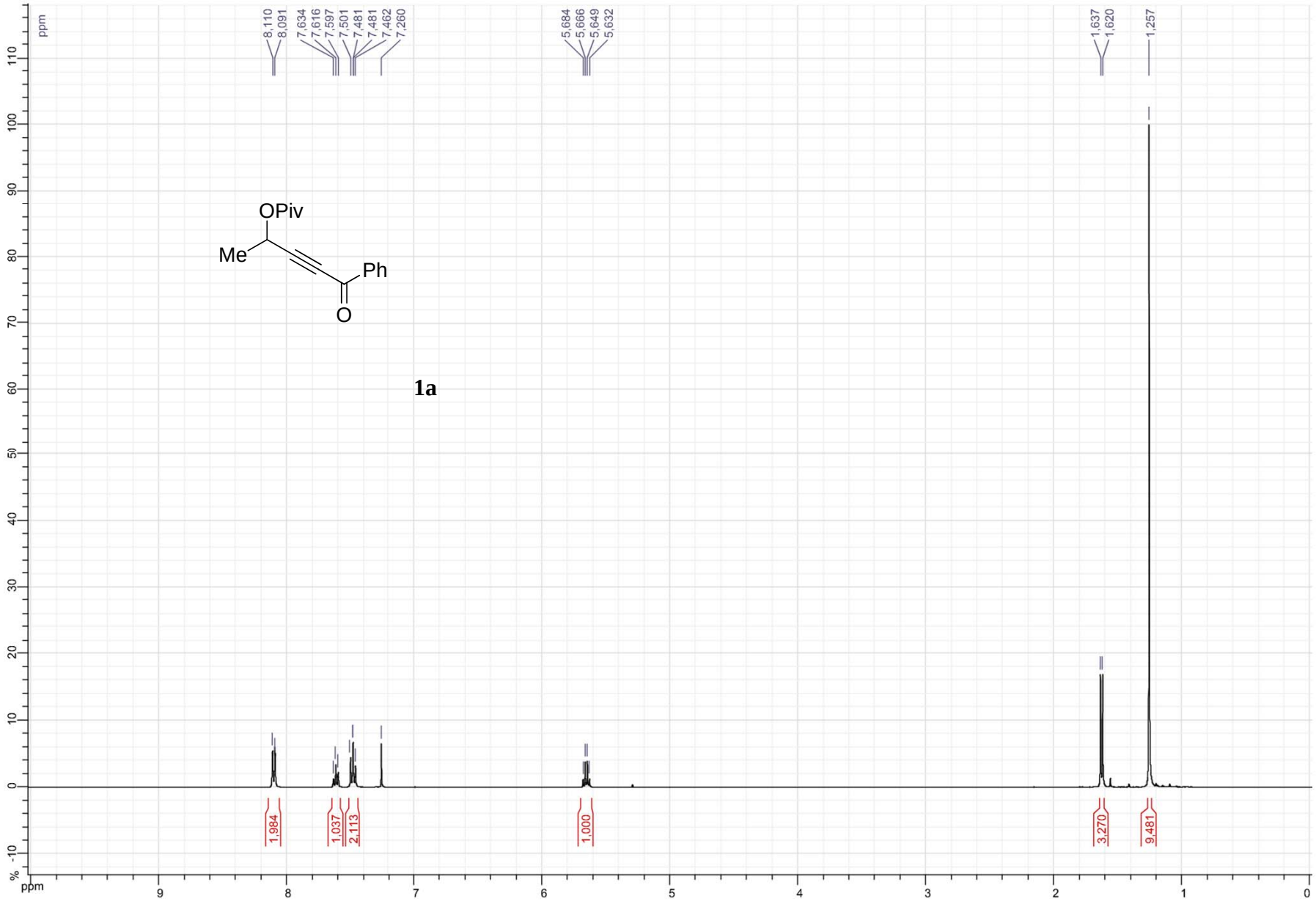
2-Methyl-5-propylfuran-3-yl butyrate (2j): Prepared following the **Procedure C** in 68% yield (71 mg, 0.33 mmol) from 104 mg (0.49 mmol) of **1j**. Colorless oil; TLC R_f 0.58 (pentane/Et_2O 10%); IR (neat) ν_{max} 943, 1149, 1240, 1372, 1456, 1652, 1761, 2874, 2933, 2962 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.95 (t, *J* = 7.5 Hz, 3H), 1.01 (t, *J* = 7.5 Hz, 3H), 1.62 (qt, *J* = 7.5, 7.5 Hz, 2H), 1.75 (qt, *J* = 7.5, 7.5 Hz, 2H), 2.14 (s, 3H), 2.47 (t, *J* = 7.5 Hz, 2H), 2.49 (t, *J* = 7.5 Hz, 2H), 5.96 (s, 1H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 10.7, 13.8, 13.9, 18.6, 21.3, 30.6, 36.0, 102.1, 134.1, 137.9, 152.8, 171.6; HRMS 233.115 ($C_{12}H_{18}O_3$ + Na calcd 233.115).



2-Methyl-5-phenethylfuran-3-yl 3-phenylpropanoate (2k): Prepared following the **Procedure C** in 74% yield (76 mg, 0.23 mmol) from 103 mg (0.31 mmol) of **1k**. Colorless oil; TLC R_f 0.51 (pentane/Et_2O 20%); IR (neat) ν_{max} 697, 747, 789, 933, 1075, 1135, 1235, 1371, 1453, 1495, 1651, 1758, 2860, 2921, 3027 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.09 (s, 3H), 2.83 (t, *J* = 7.8 Hz, 4H), 2.92 (t, *J* = 7.8 Hz, 2H), 3.04 (t, *J* = 7.8 Hz, 2H), 5.93 (s, 1H); 7.18−7.26 (m, 6H), 7.27−7.34 (m, 4H); ^{13}C NMR (125.8 MHz, $CDCl_3$) δ 10.7, 30.5, 31.1, 34.2, 35.7, 102.5, 126.2, 126.6, 128.5, 128.5, 128.5, 128.7, 134.0, 138.7, 140.2, 141.2, 151.8, 170.9; HRMS 357,145 ($C_{22}H_{22}O_3$ + Na calcd 357,146).



5-(3-(Benzyloxy)propyl)-2-phenethylfuran-3-yl acetate (2l): Prepared following the **Procedure C** in 65% yield (68 mg, 0.18 mmol) from 105 mg (0.28 mmol) of **1l**. Colorless oil; TLC R_f 0.43 (cyclohexane/EtOAc 20%); IR (neat) ν_{max} 578, 697, 734, 1071, 1099, 1206, 1367, 1453, 1495, 1759, 2856, 2925, 3027 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.84 (tt, *J* = 7.5, 6.3 Hz, 2H), 2.08 (s, 3H), 2.58 (t, *J* = 7.5 Hz, 2H), 2.72 (t, *J* = 7.7 Hz, 2H), 2.81 (t, *J* = 7.7 Hz, 2H), 3.43 (t, *J* = 6.3 Hz, 2H), 4.23 (s, 2H), 5.89 (s, 1H), 7.06–7.30 (m, 10H);^{13}C NMR (125.8 MHz, $CDCl_3$) δ 20.8, 25.3, 27.4, 28.1, 34.1, 69.4, 73.1, 102.4, 126.2, 127.7, 127.8, 128.5, 128.5, 134.2, 138.7, 141.1, 141.4, 152.4, 168.7; HRMS 402.175 ($C_{24}H_{26}O_4$ + Na calcd 402.176).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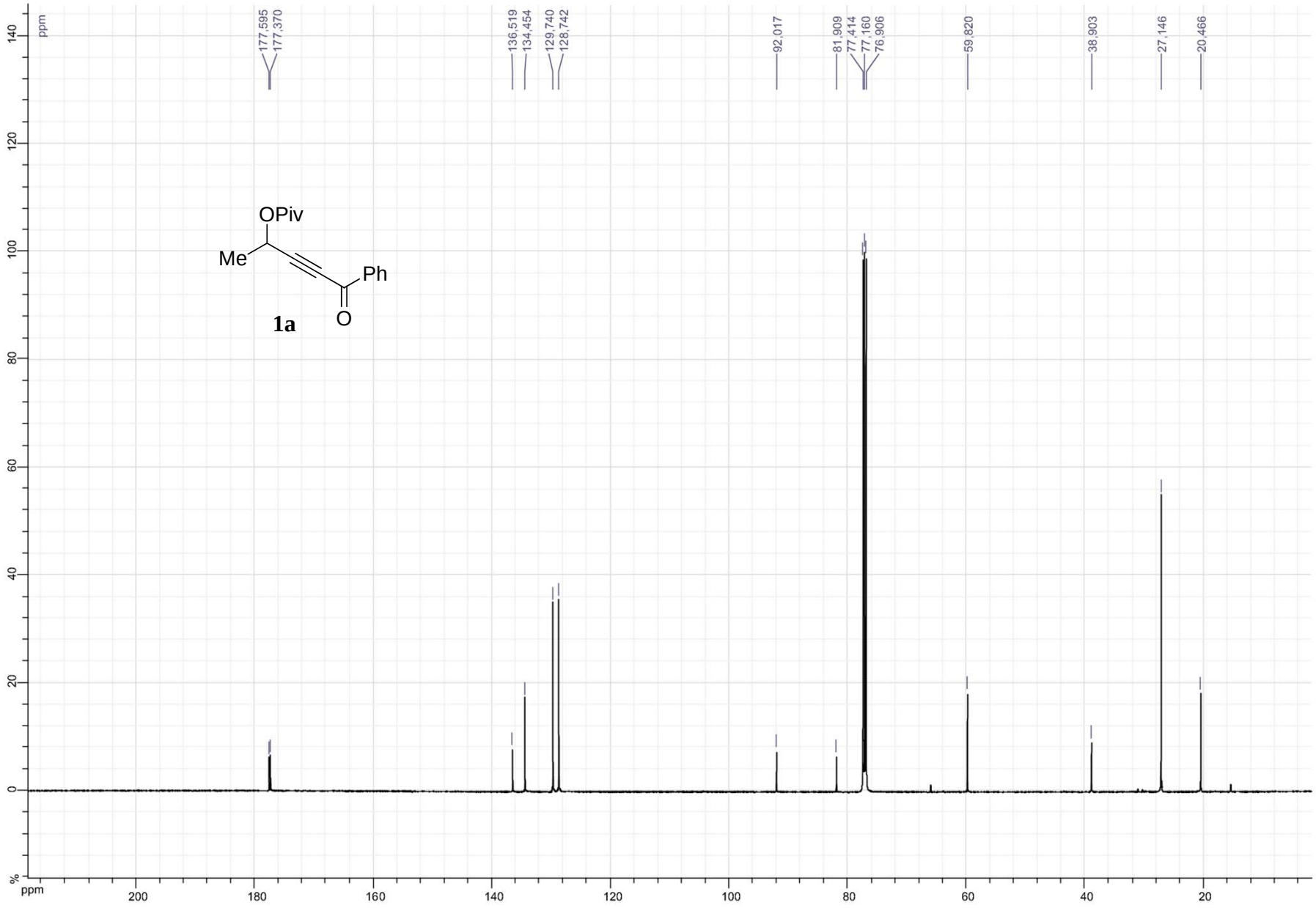
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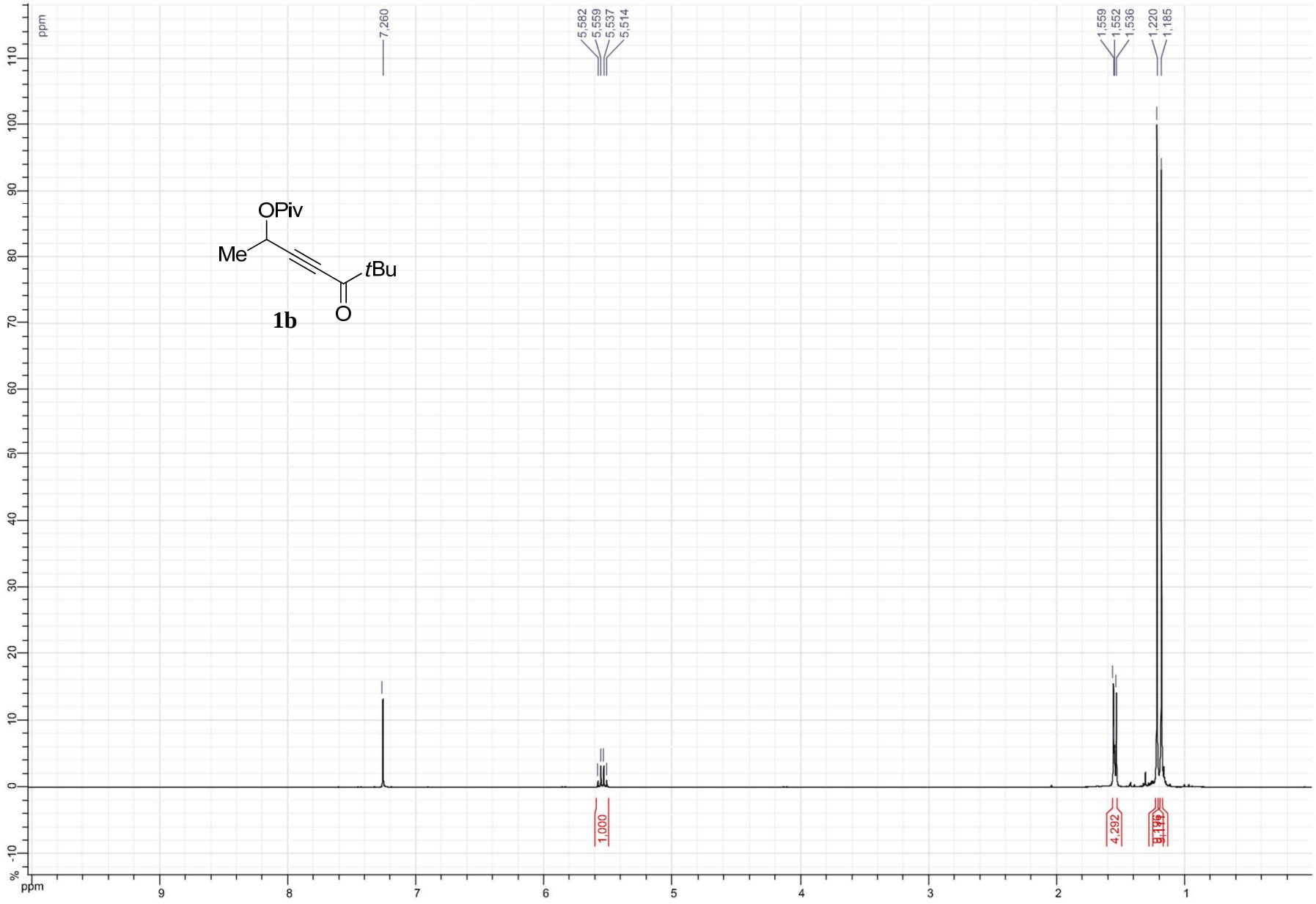
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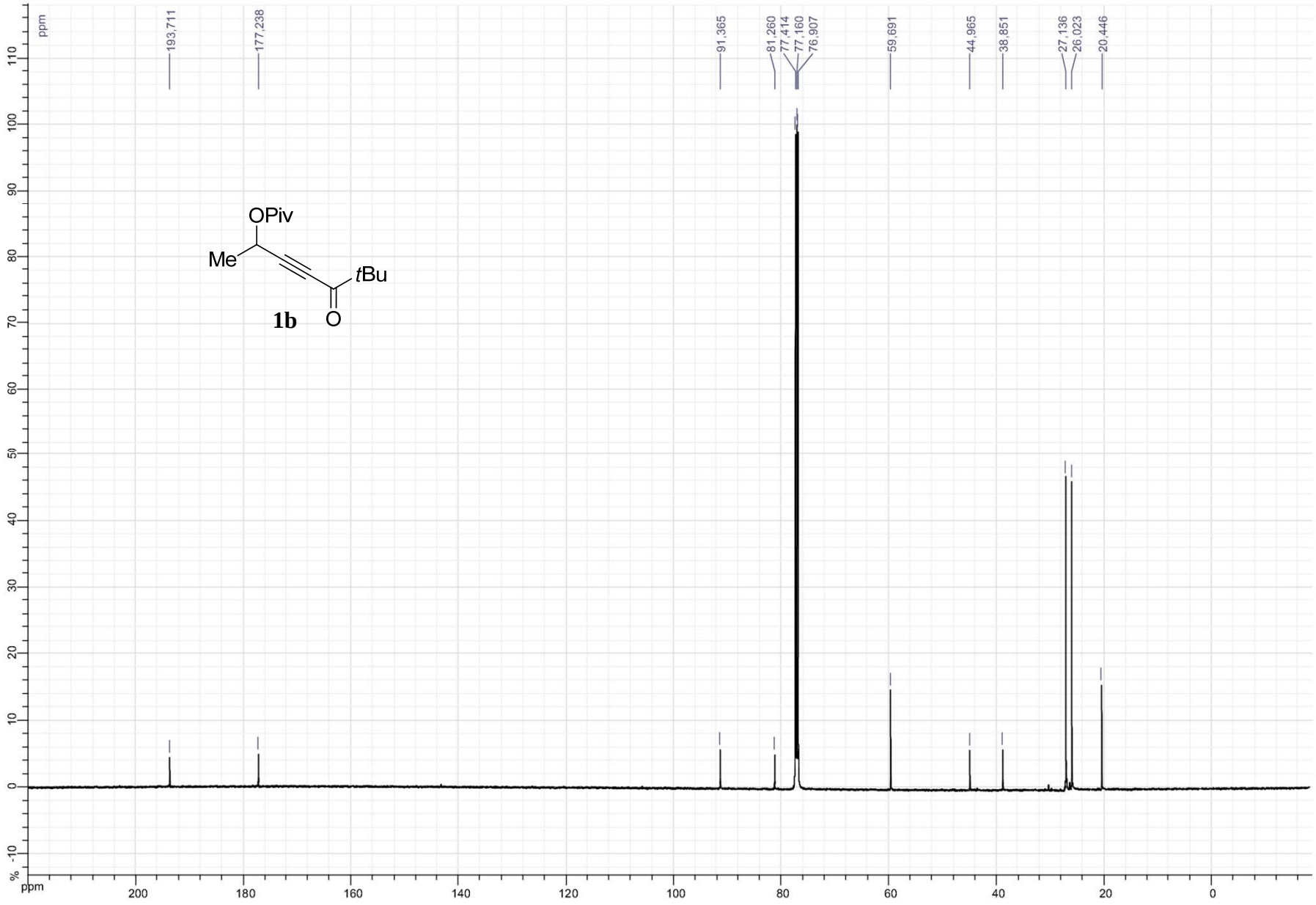
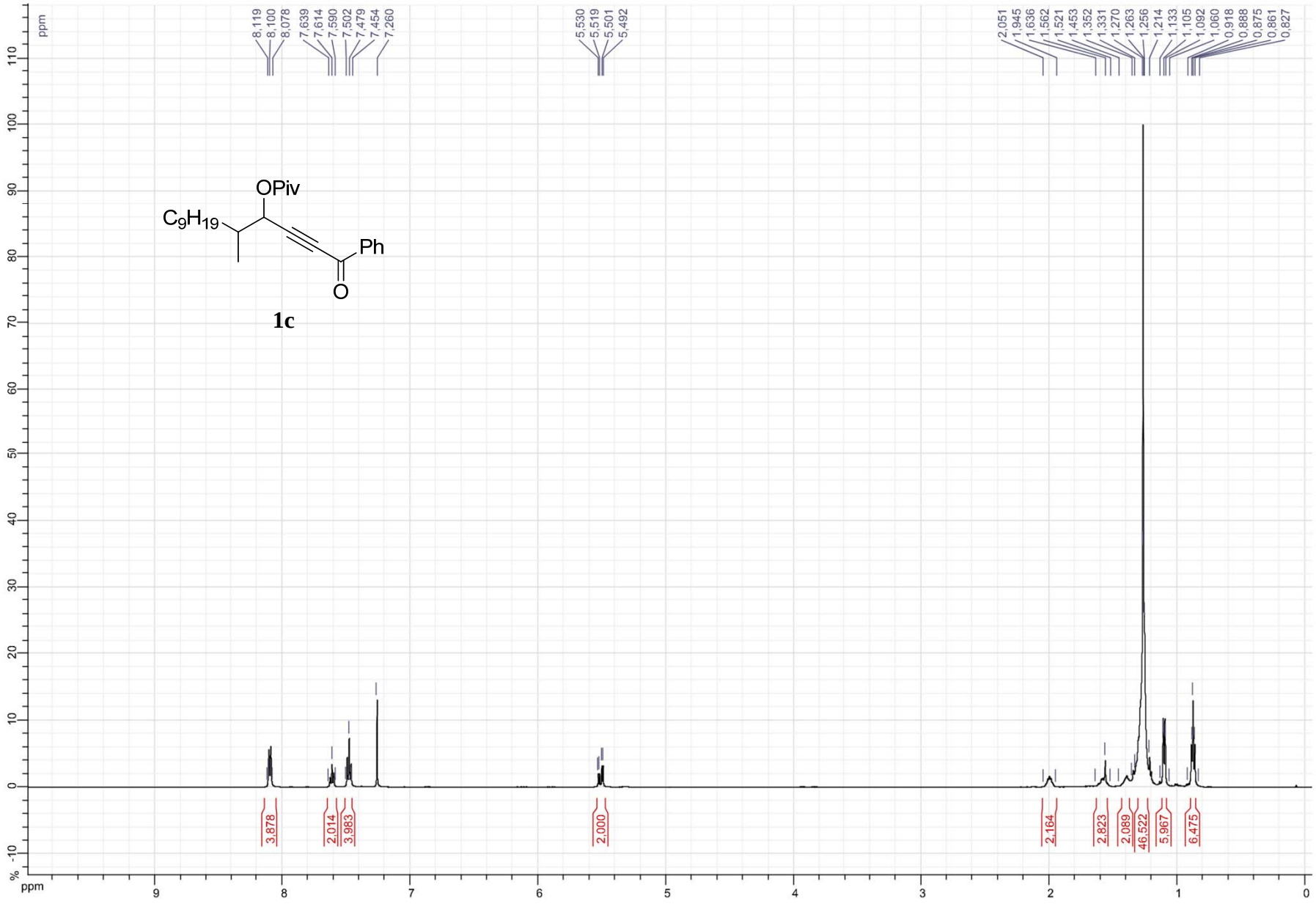
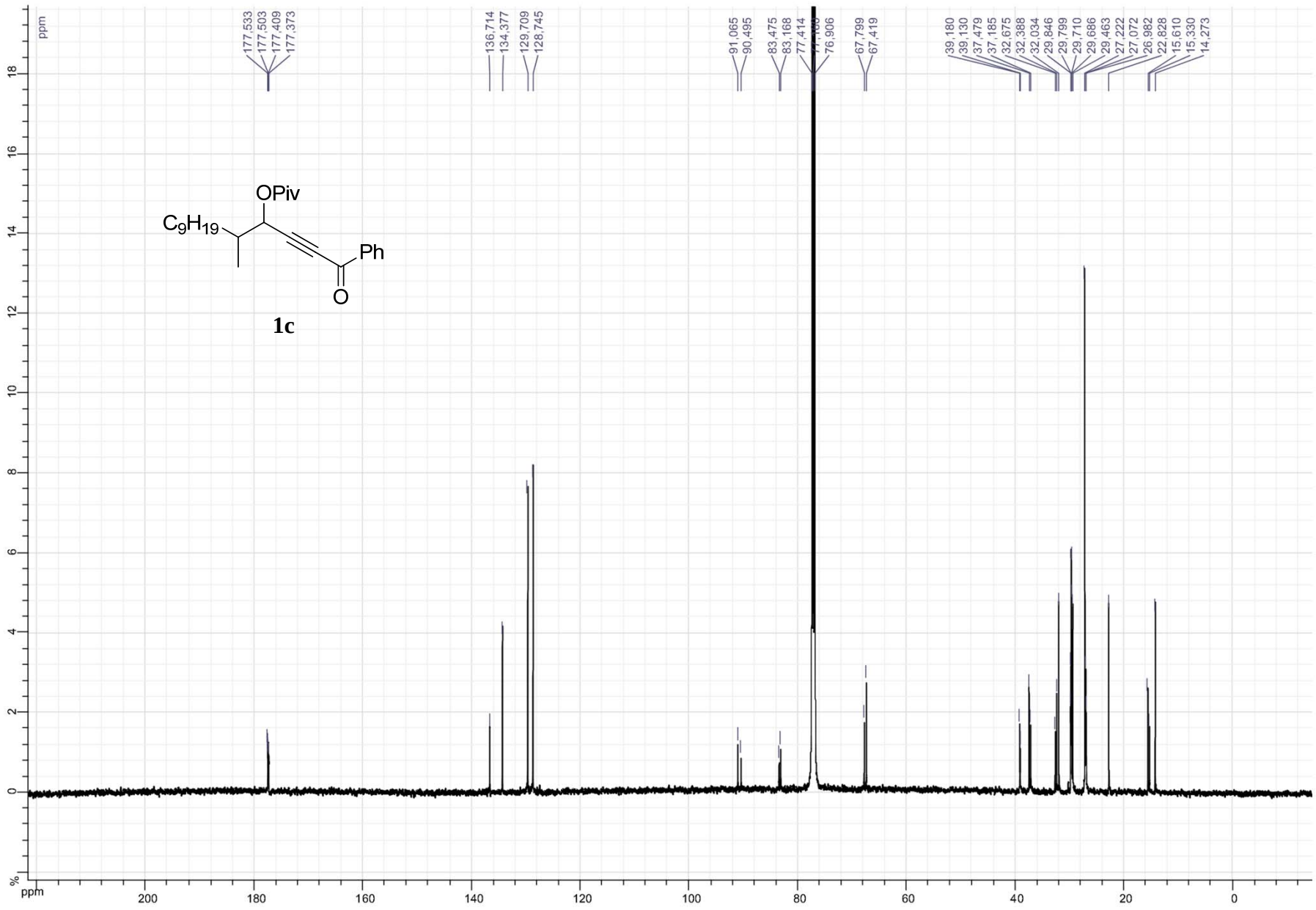
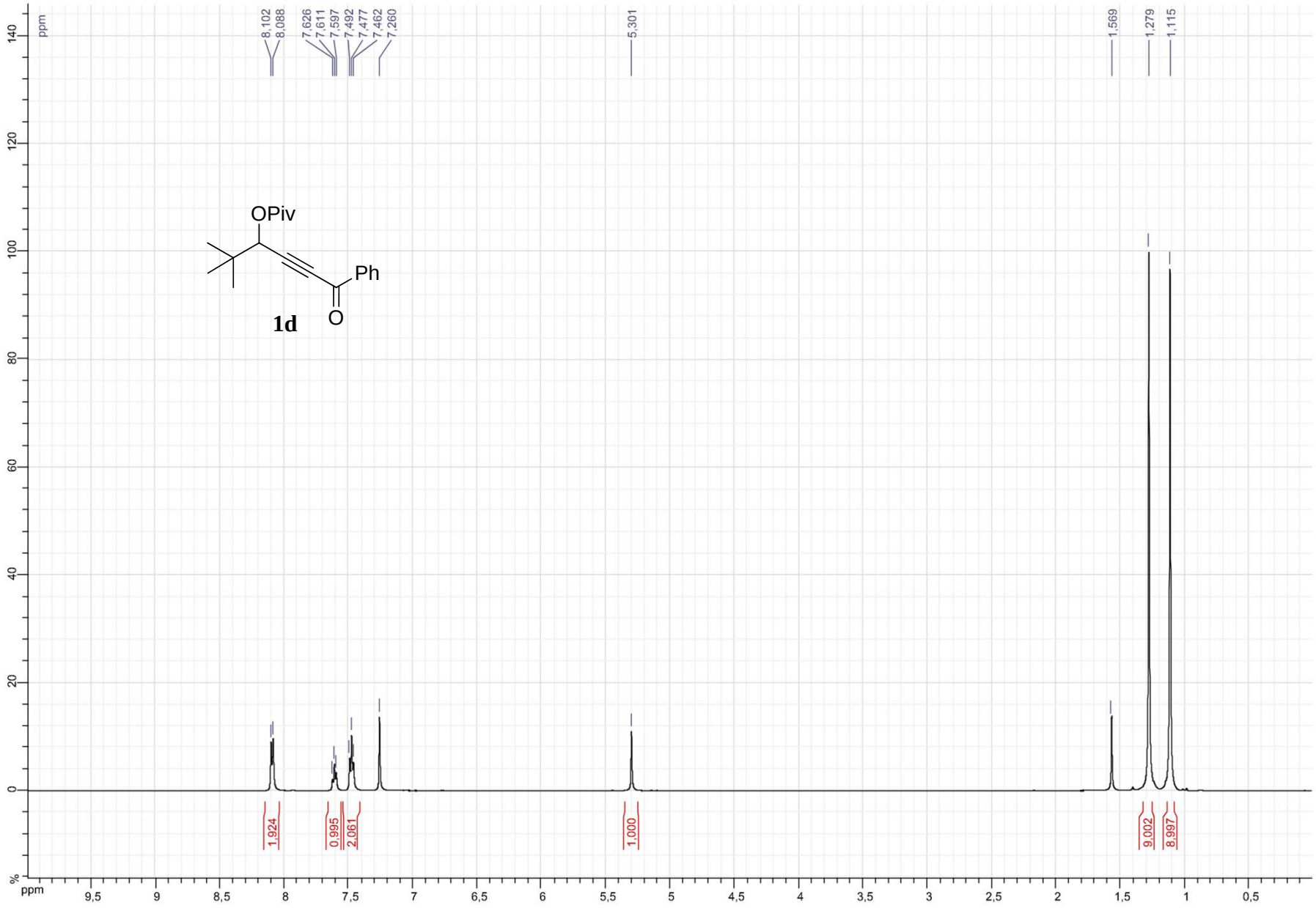
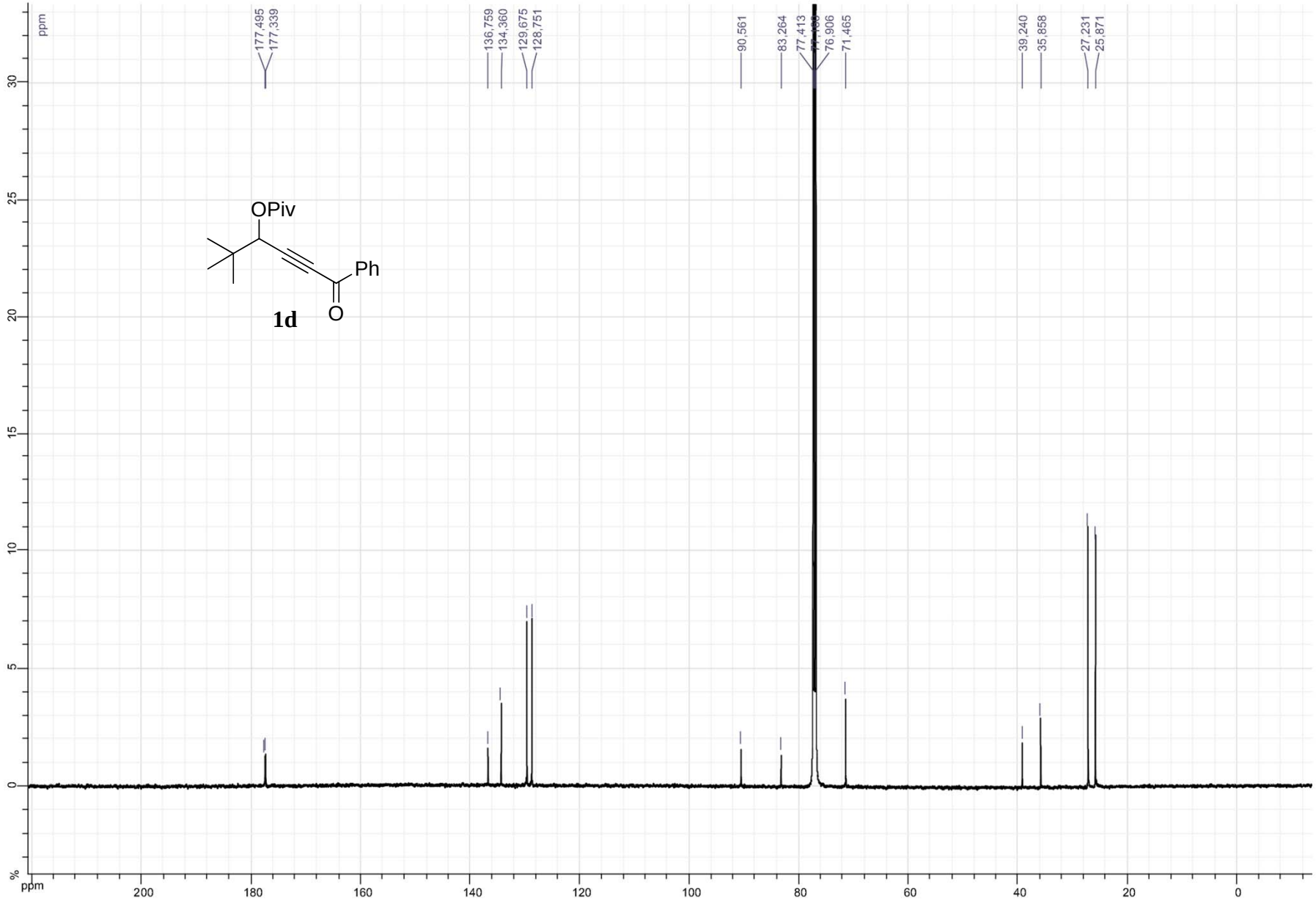
ppm

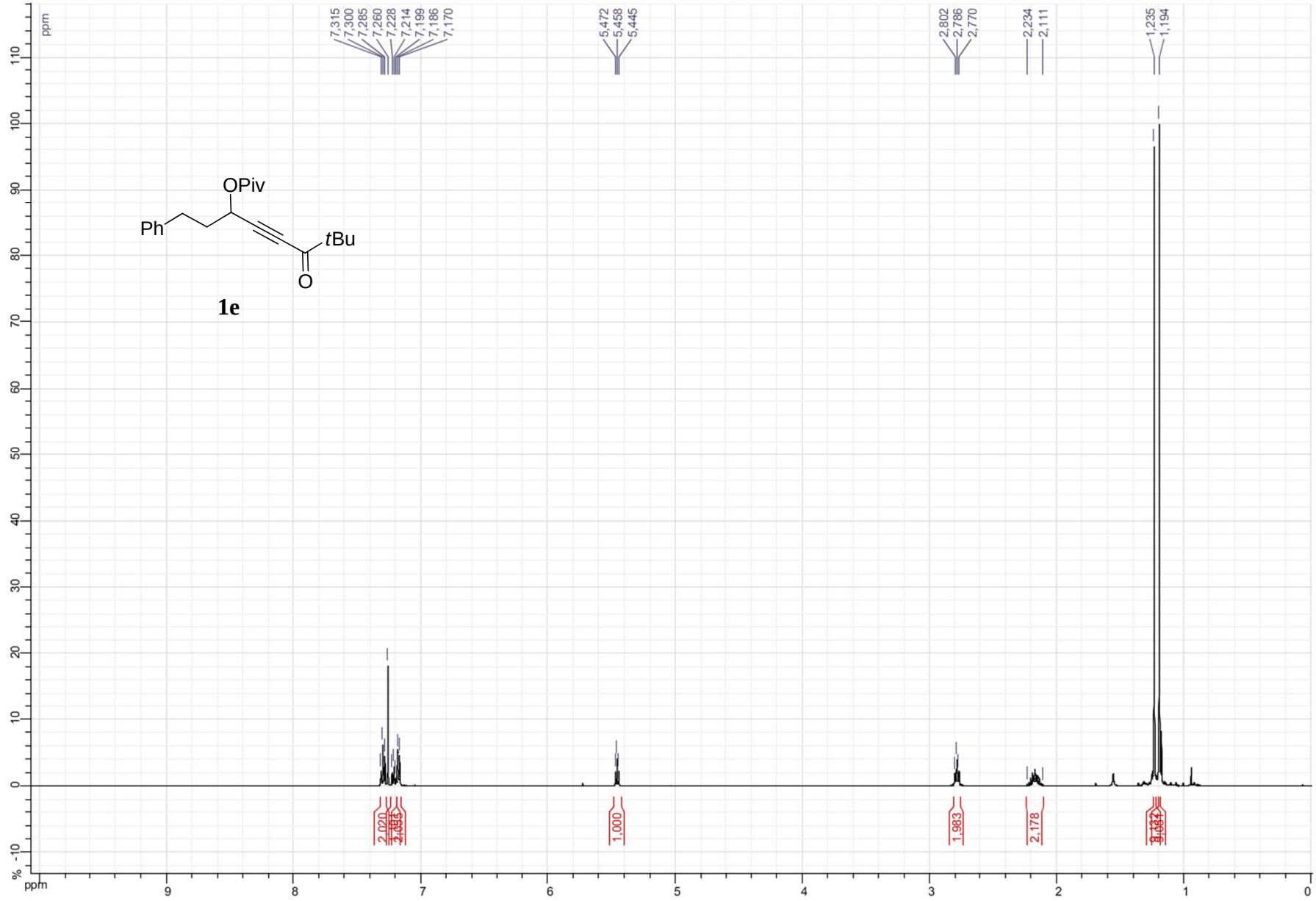

ppm
193,711
177,238
91,365
81,260
77,414
77,160
76,907
59,691
44,965
38,851
27,136
26,023
20,446
OPiv
Me
tBu
O
1b
110
100
90
80
70
60
50
40
30
20
10
0
-10
%
ppm
200
180
160
140
120
100
80
60
40
20
0

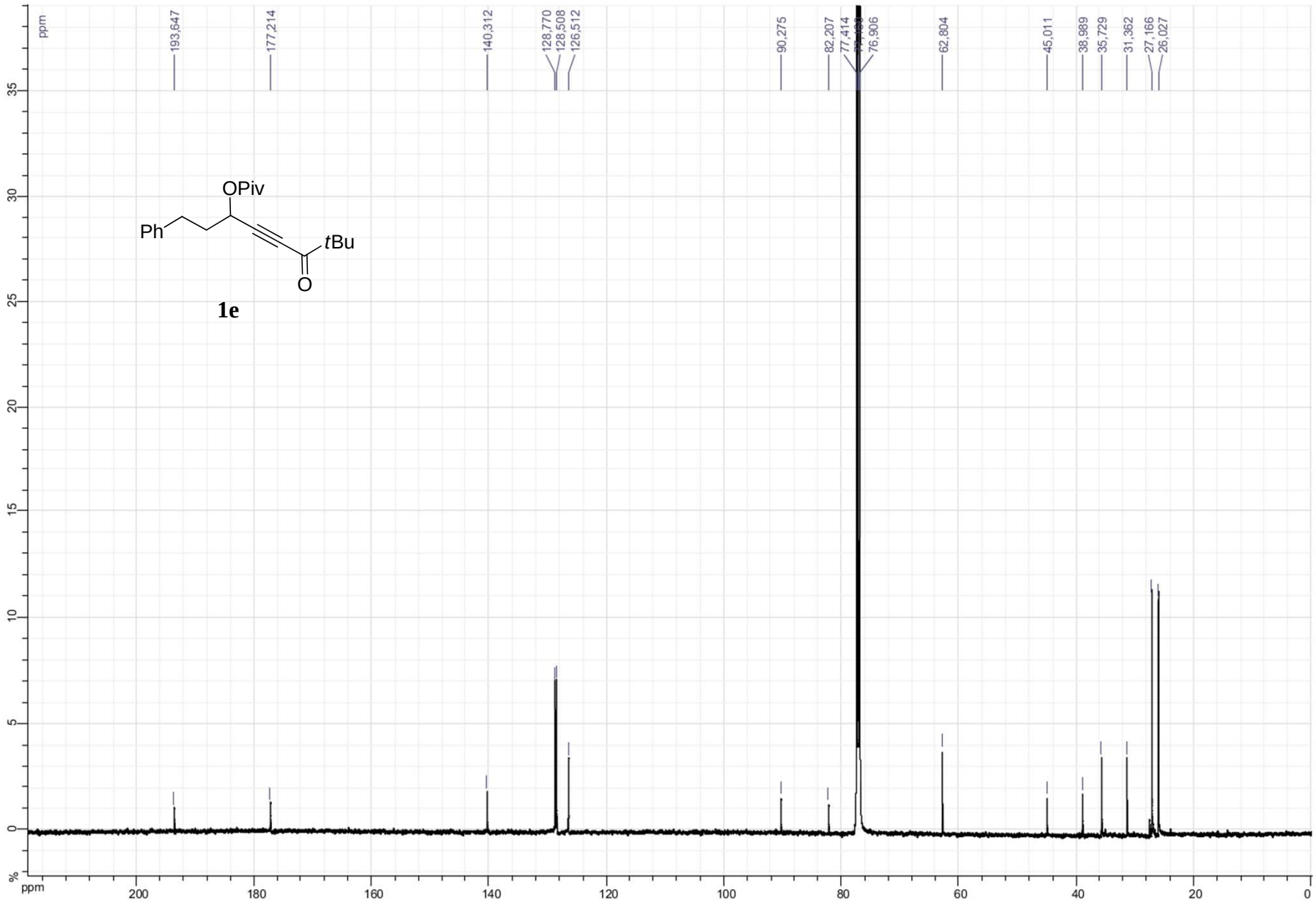

8.119
8.100
8.078
7.639
7.614
7.590
7.502
7.479
7.454
7.260
5.530
5.519
5.501
5.492
2.051
1.945
1.636
1.562
1.521
1.453
1.352
1.331
1.270
1.263
1.256
1.214
1.133
1.105
1.092
1.060
0.918
0.888
0.875
0.861
0.827
OPiv
C9H19
Ph
O
1c
3.878
2.014
3.983
2.000
2.164
2.823
2.089
46.522
5.967
6.475
ppm

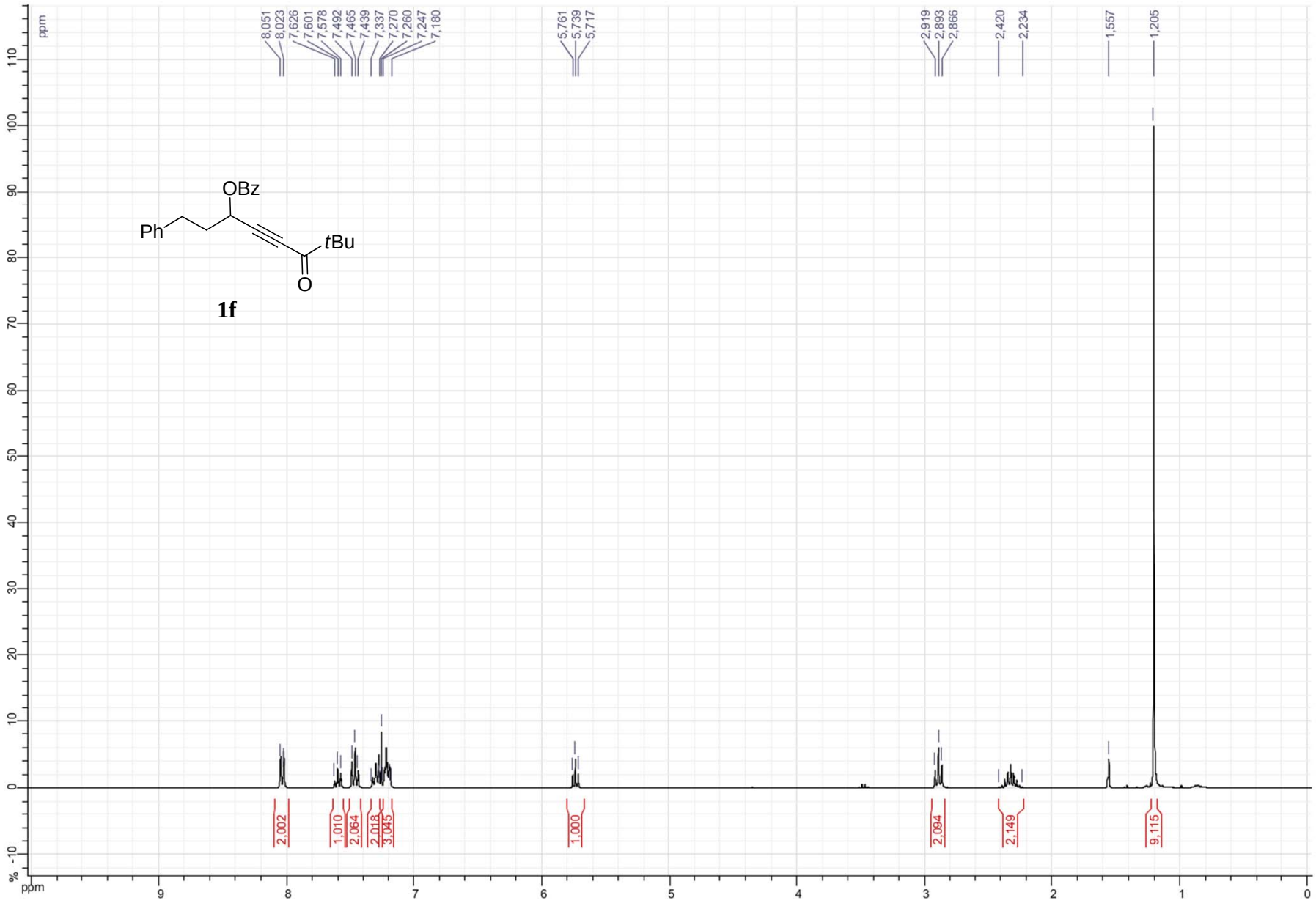

177,533
177,503
177,409
177,373
136,714
134,377
129,709
128,745
91,065
90,495
83,475
83,168
77,414
76,906
67,799
67,419
39,180
39,130
37,479
37,185
32,675
32,388
32,034
29,846
29,799
29,710
29,686
29,463
27,222
27,072
26,982
22,828
15,610
15,330
14,273
OPiv
C9H19
Ph
O
1c
ppm
%
200
180
160
140
120
100
80
60
40
20
0

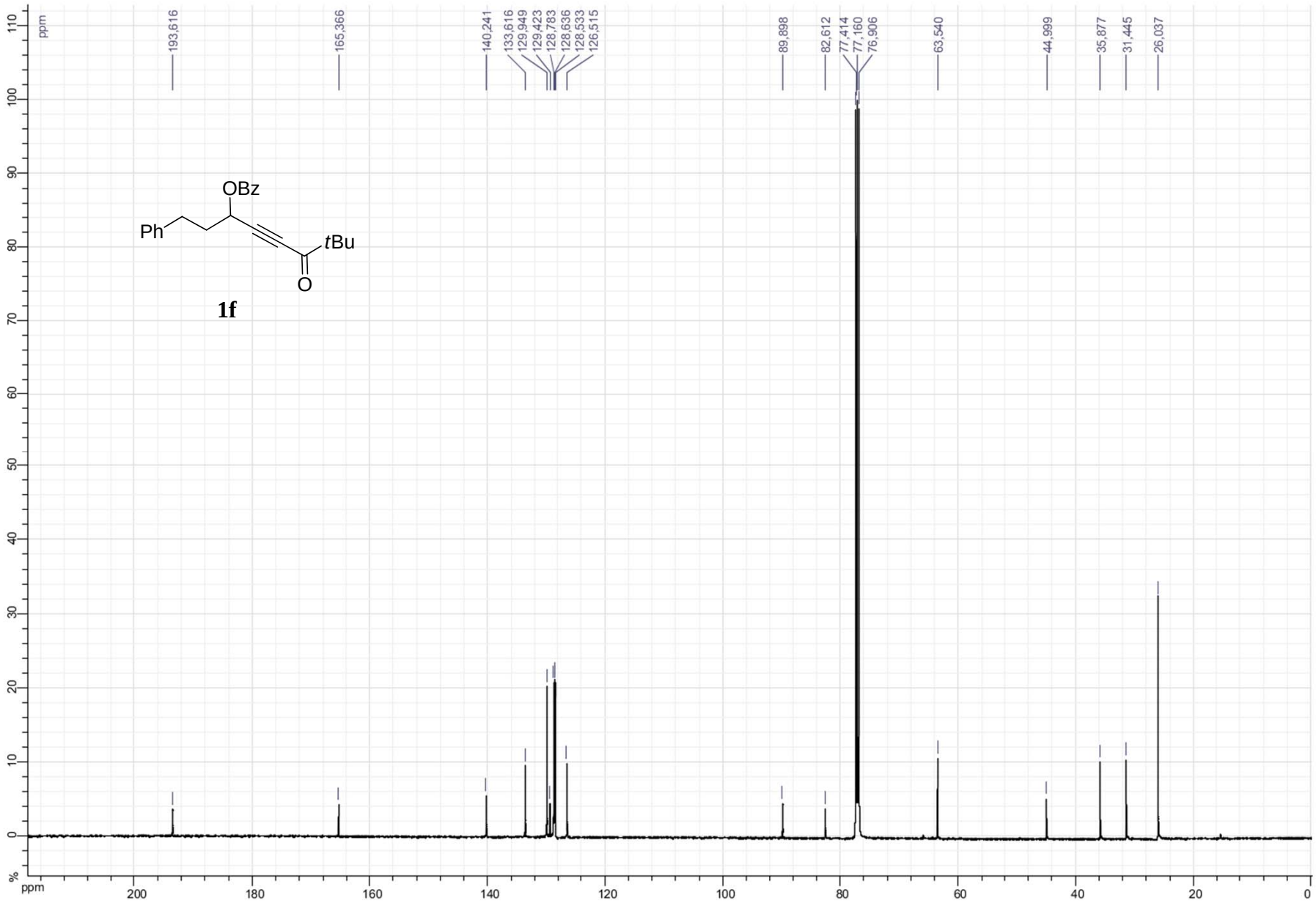

ppm
8.102
8.088
7.626
7.611
7.597
7.492
7.477
7.462
7.260
5.301
1.569
1.279
1.115
OPiv
Ph
O
1d
1.924
0.995
2.061
1.000
9.002
8.997
%
ppm

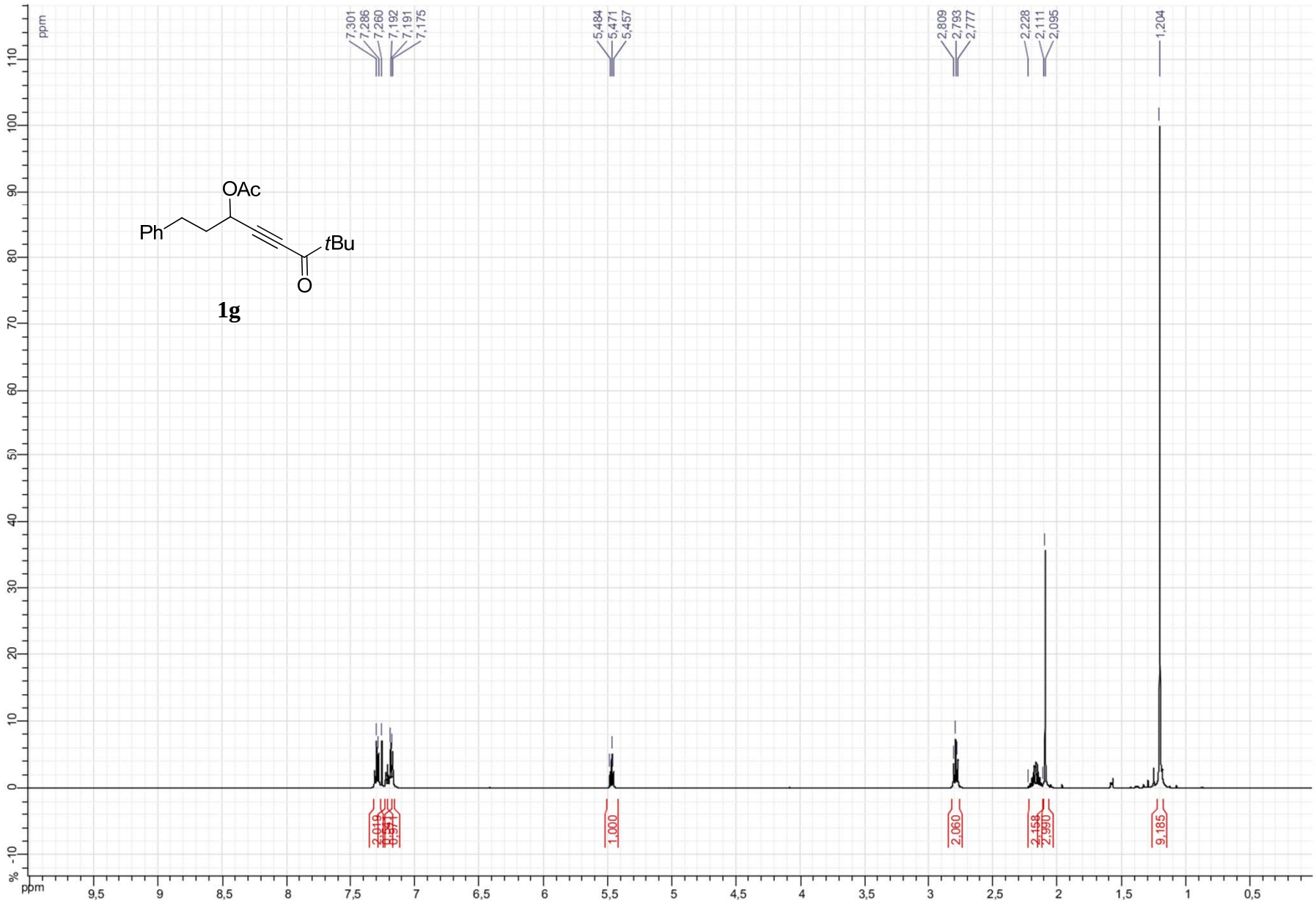

ppm
177,495
177,339
136,759
134,360
129,675
128,751
90,561
83,264
77,413
76,906
71,465
39,240
35,858
27,231
25,871
OPiv
Ph
O
1d
%
ppm
200
180
160
140
120
100
80
60
40
20
0

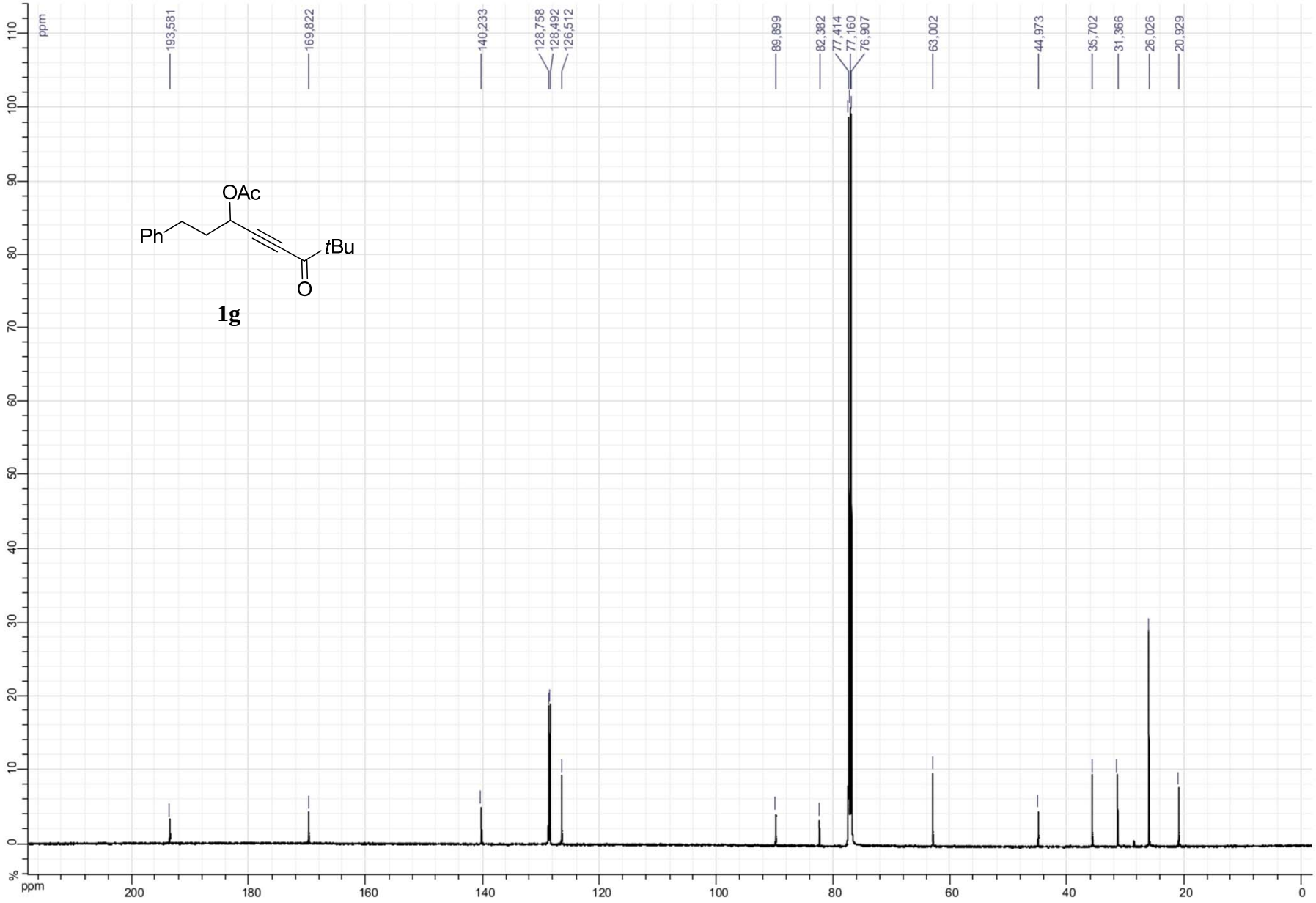

OPiv
Ph
tBu
O
1e
7,315
7,300
7,285
7,260
7,228
7,214
7,199
7,186
7,170
5,472
5,458
5,445
2,802
2,786
2,770
2,234
2,111
1,235
1,194
2,020
1,000
1,983
2,178
ppm

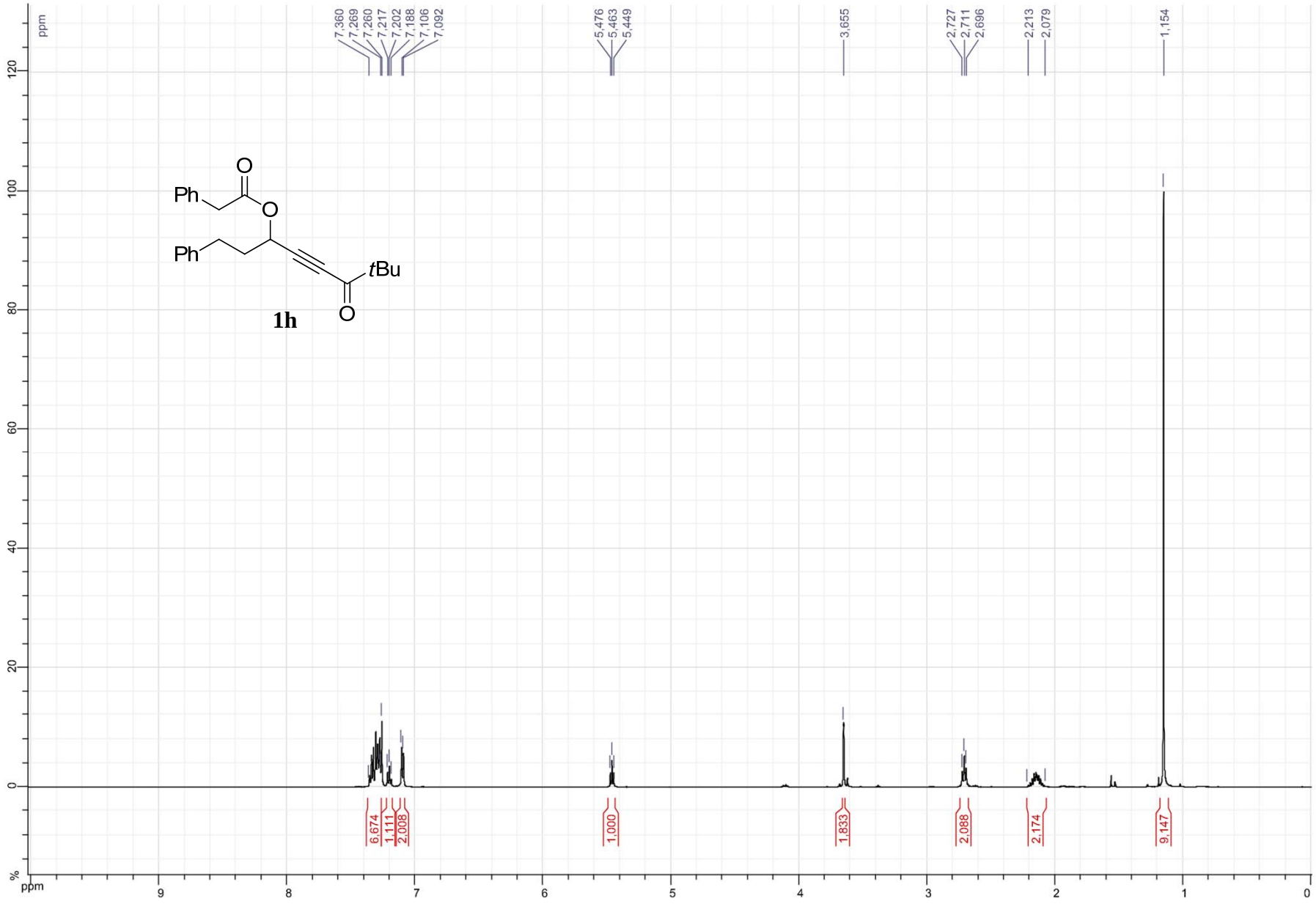

ppm
193,647
177,214
140,312
128,770
128,508
126,512
90,275
82,207
77,414
76,906
62,804
45,011
38,989
35,729
31,362
27,166
26,027
OPiv
Ph
tBu
O
1e
%
ppm
200
180
160
140
120
100
80
60
40
20
0

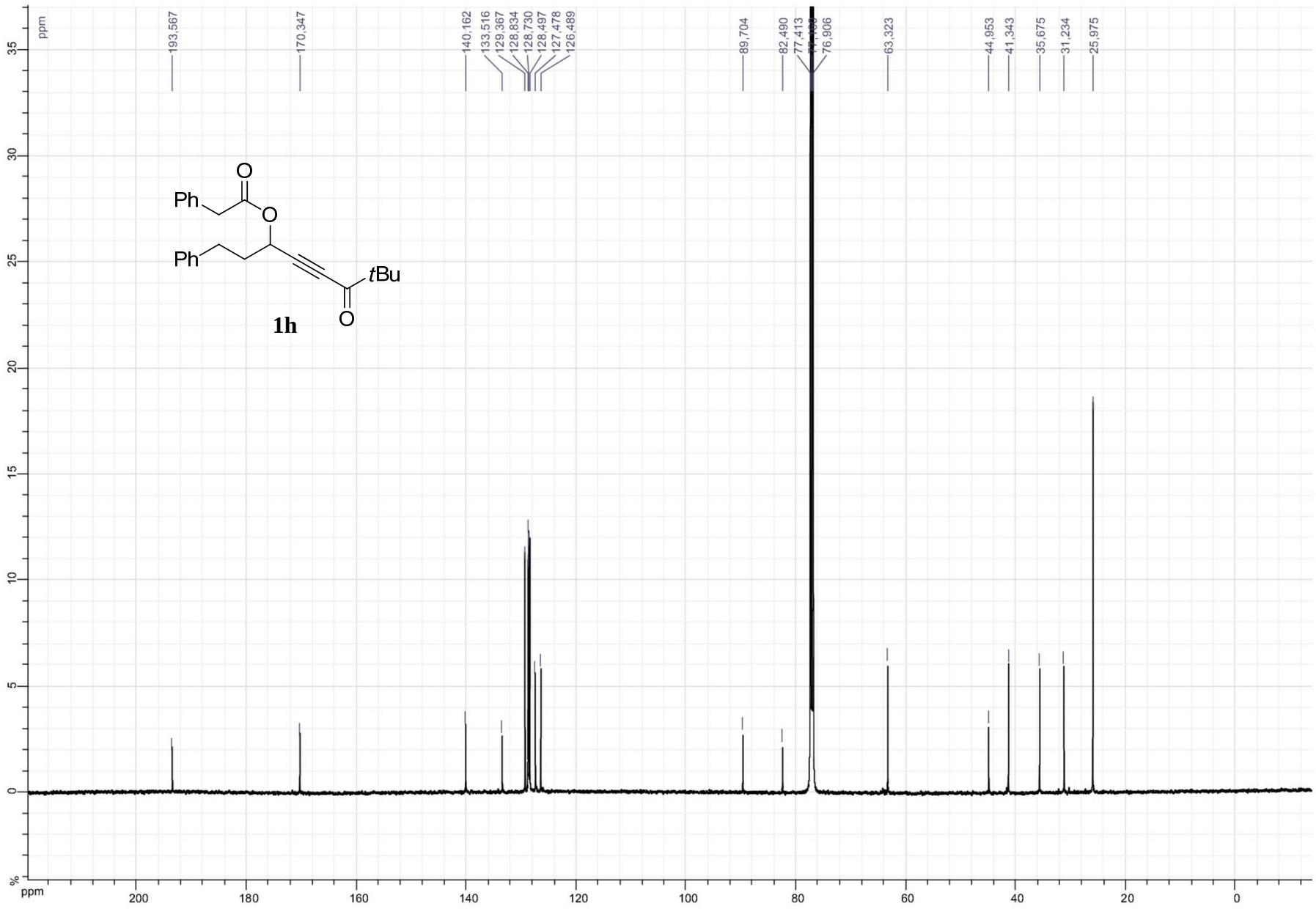

8,051
8,023
7,626
7,601
7,578
7,492
7,465
7,439
7,337
7,270
7,260
7,247
7,180
5,761
5,739
5,717
2,919
2,893
2,866
2,420
2,234
1,557
1,205
OBz
Ph
tBu
O
1f
2,002
1,010
2,064
2,018
3,045
1,000
2,094
2,149
9,115
ppm

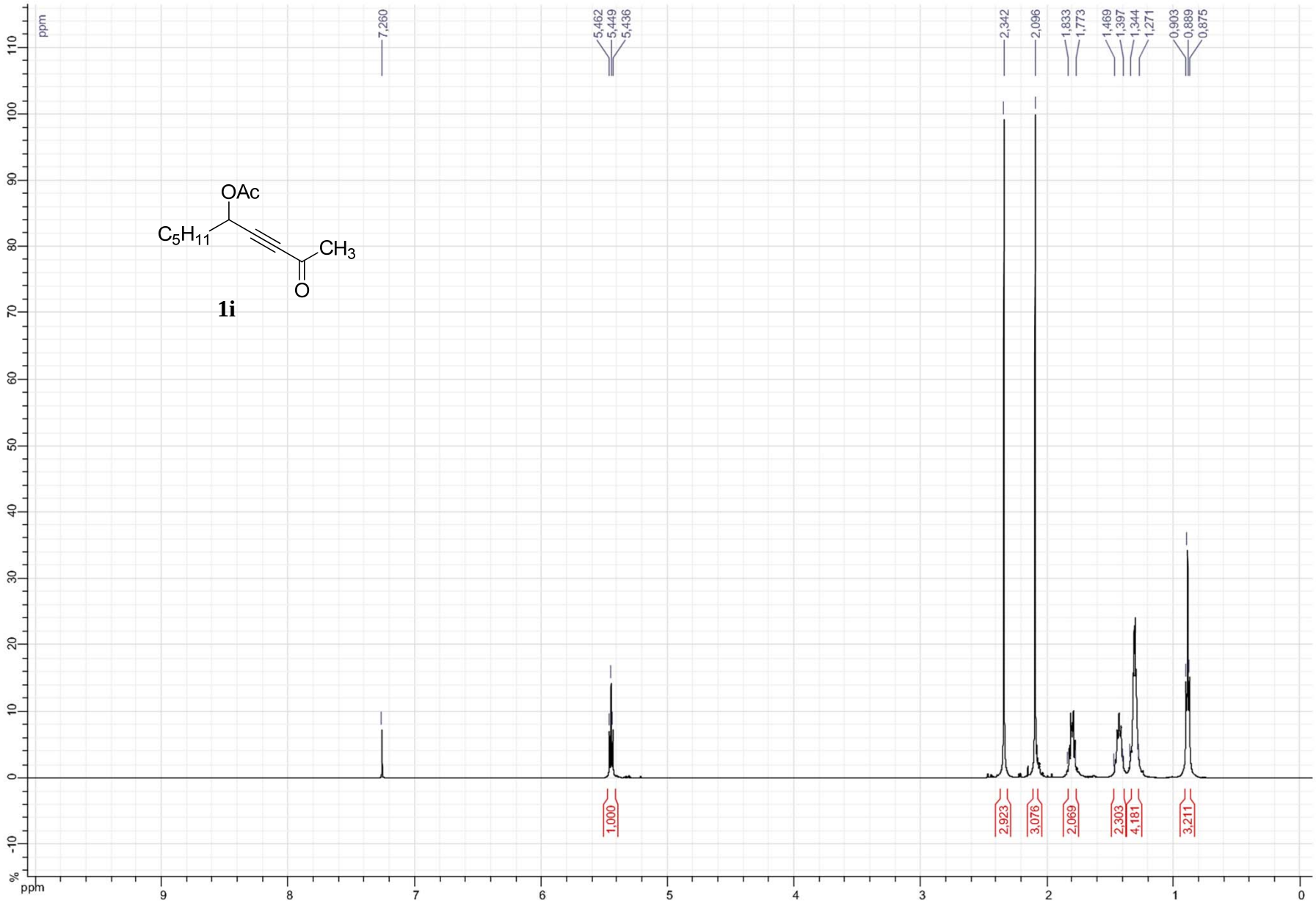

193,616
165,366
140,241
133,616
129,949
129,423
128,783
128,636
128,533
126,515
89,898
82,612
77,414
77,160
76,906
63,540
44,999
35,877
31,445
26,037
OBz
Ph
tBu
O
1f
ppm
200
180
160
140
120
100
80
60
40
20
0

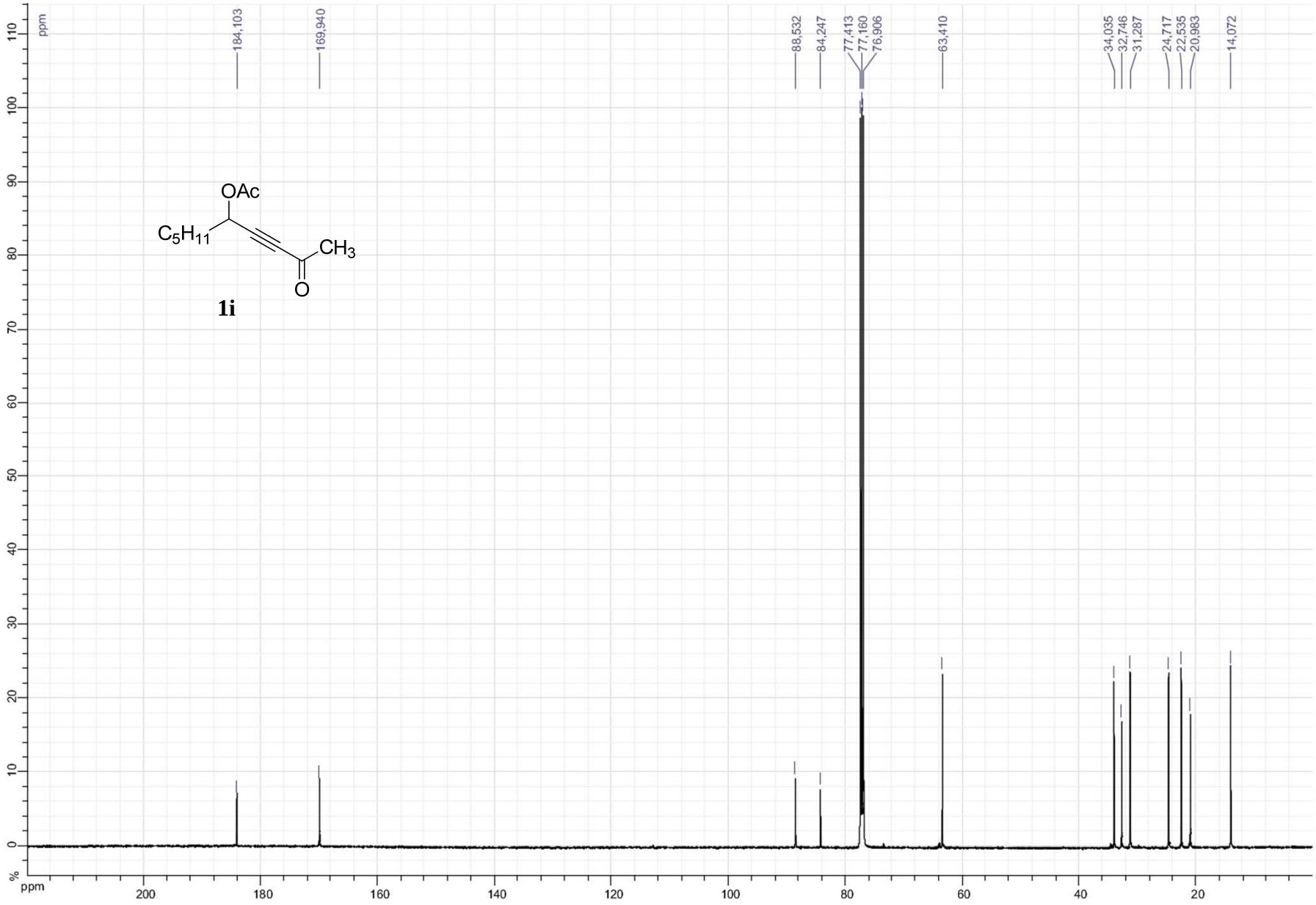

OAc
Ph
tBu
O
1g
7,301
7,286
7,260
7,192
7,191
7,175
5,484
5,471
5,457
2,809
2,793
2,777
2,228
2,111
2,095
1,204
2,018
0,971
1,000
2,060
2,158
2,990
9,185
ppm

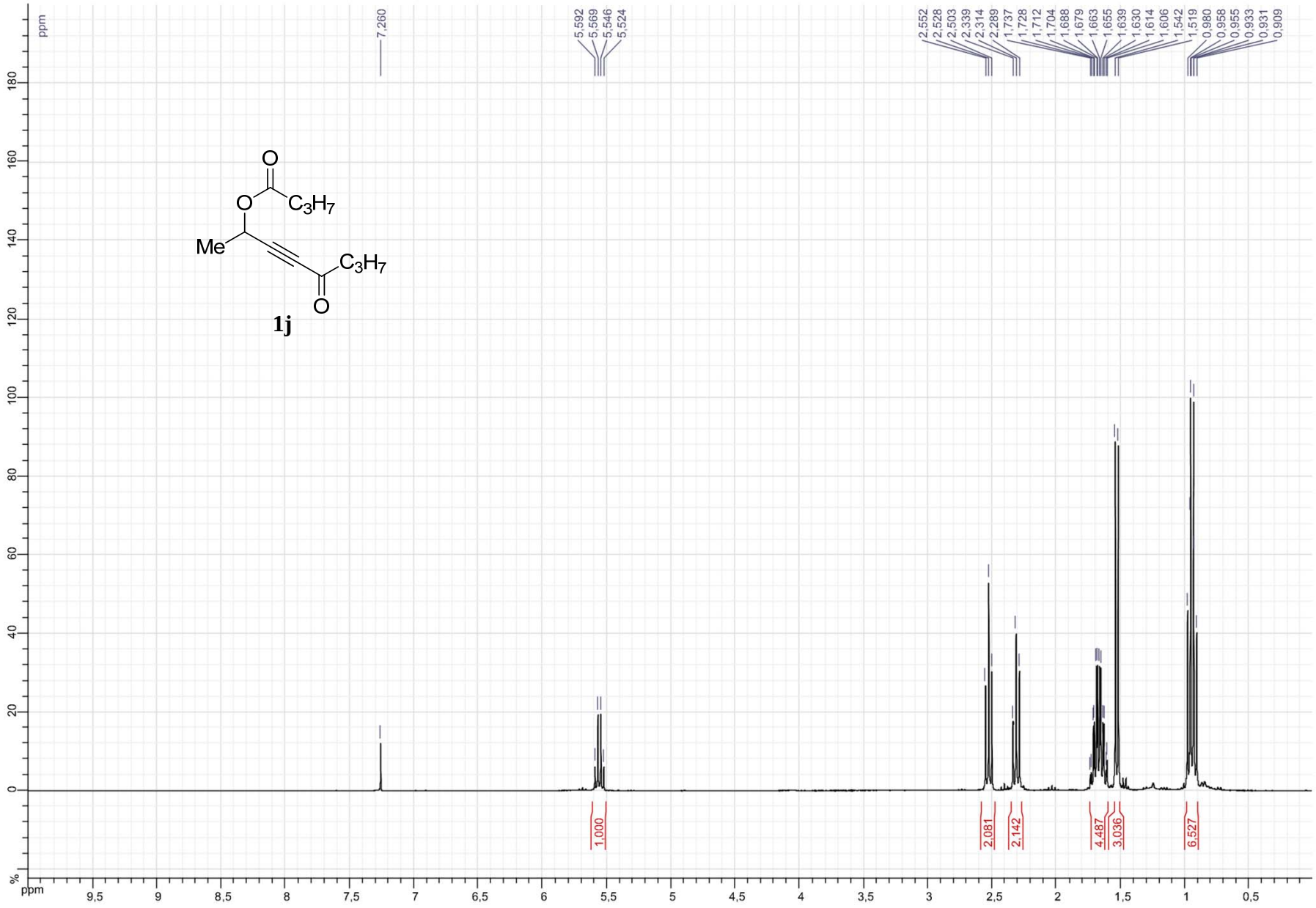

193,581
169,822
140,233
128,758
128,492
126,512
89,899
82,382
77,414
77,160
76,907
63,002
44,973
35,702
31,366
26,026
20,929
OAc
Ph
tBu
O
1g
ppm

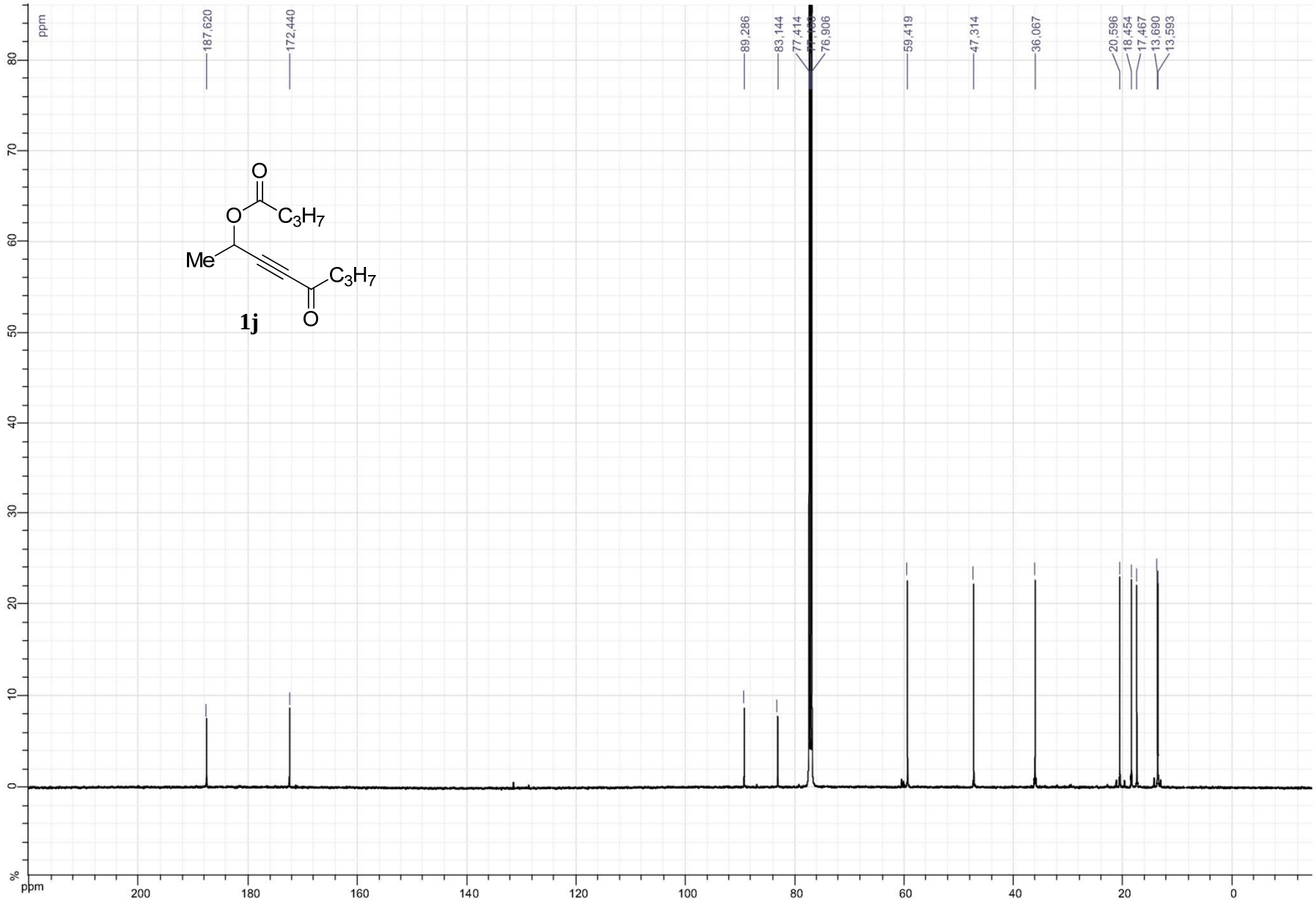

7,360
7,269
7,260
7,217
7,202
7,188
7,106
7,092
5,476
5,463
5,449
3,655
2,727
2,711
2,696
2,213
2,079
1,154
Ph
O
O
Ph
tBu
O
1h
6,674
1,111
2,008
1,000
1,833
2,088
2,174
9,147
ppm

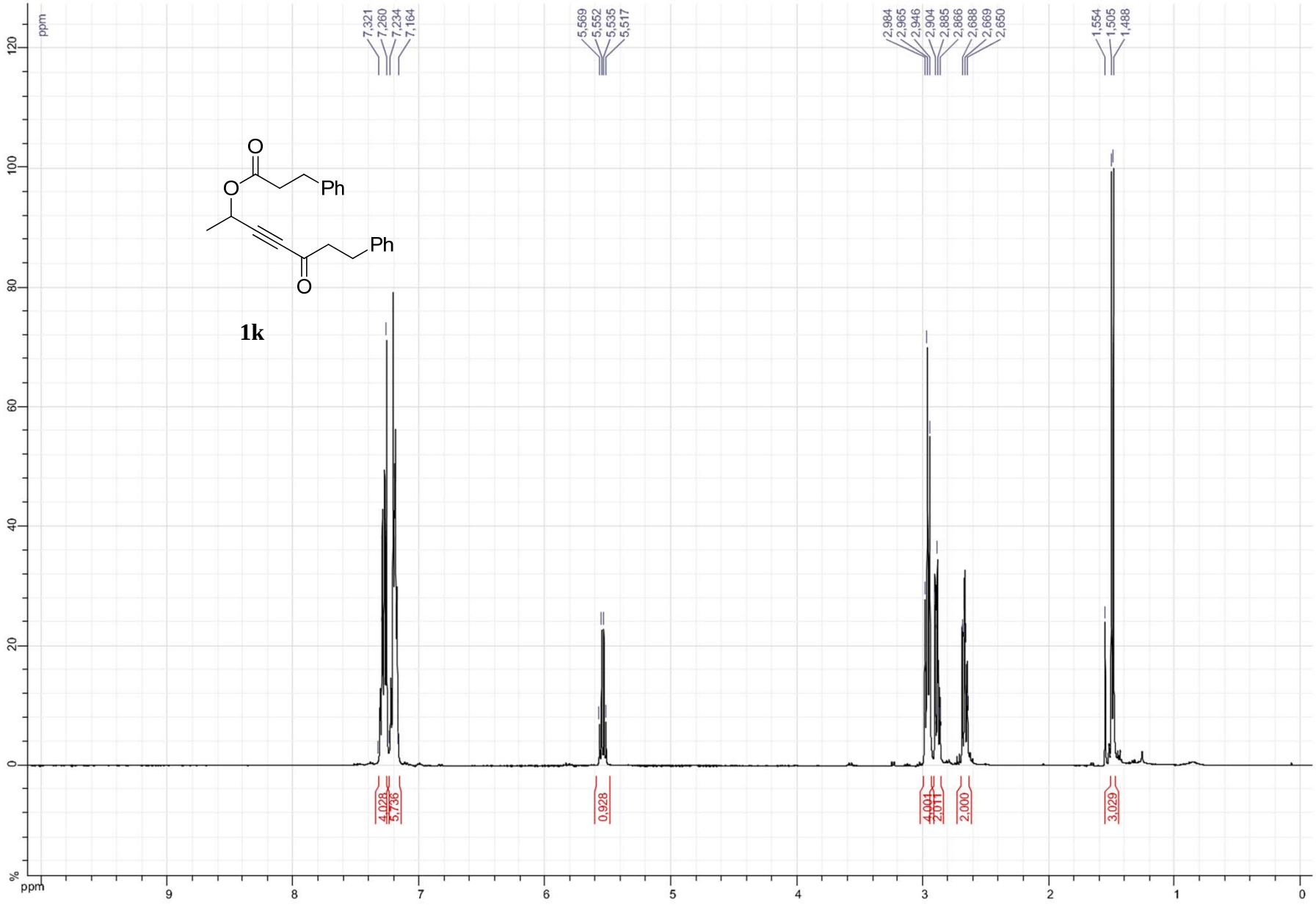

ppm
193,567
170,347
140,162
133,516
129,367
128,834
128,730
128,497
127,478
126,489
89,704
82,490
77,413
76,906
63,323
44,953
41,343
35,675
31,234
25,975
Ph
O
O
Ph
tBu
O
1h
35
30
25
20
15
10
5
0
%
ppm
200
180
160
140
120
100
80
60
40
20
0

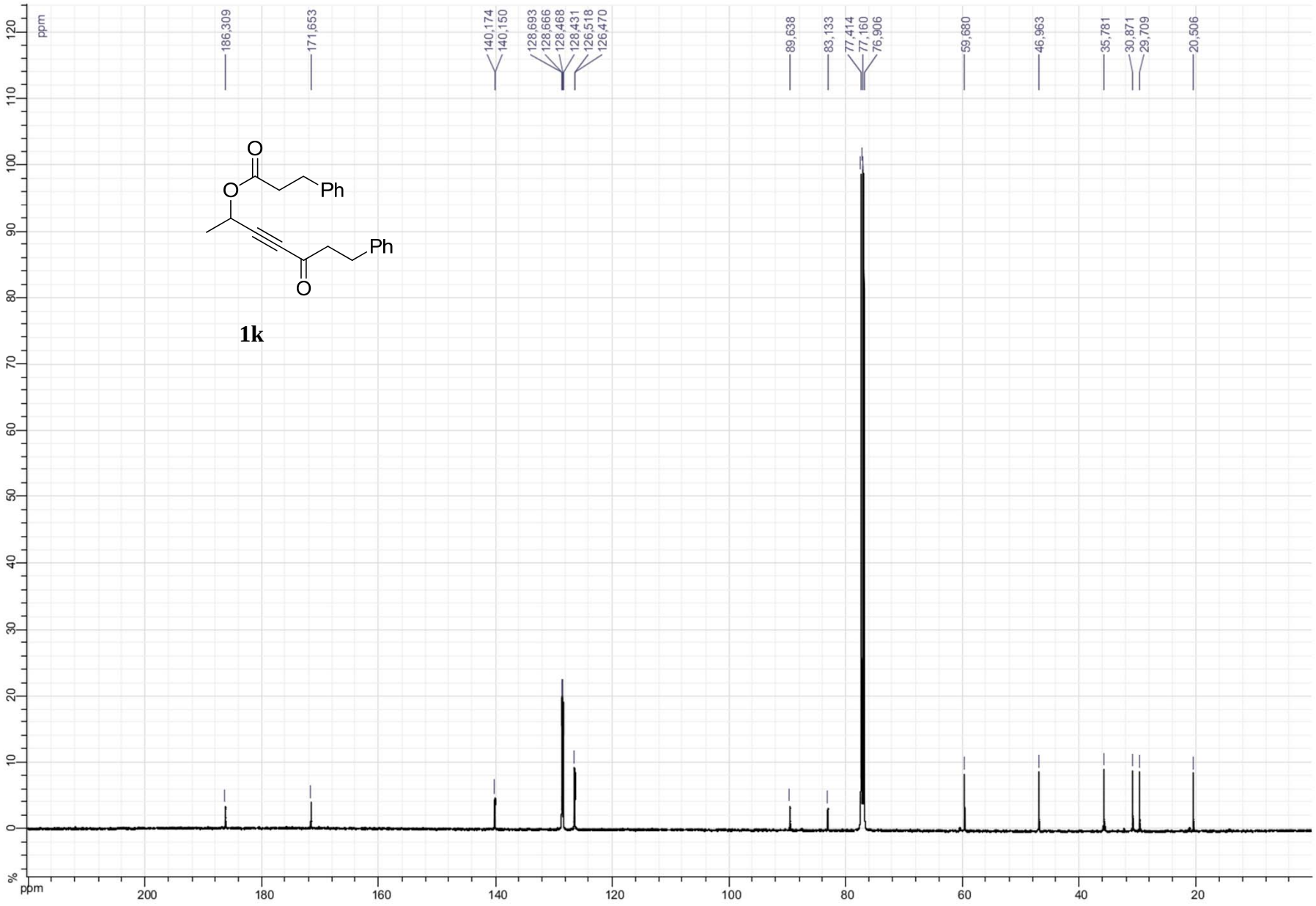

OAc
C5H11
CH3
O
1i
7,260
5,462
5,449
5,436
2,342
2,096
1,833
1,773
1,469
1,397
1,344
1,271
0,903
0,889
0,875
1,000
2,923
3,076
2,069
2,303
4,181
3,211
ppm

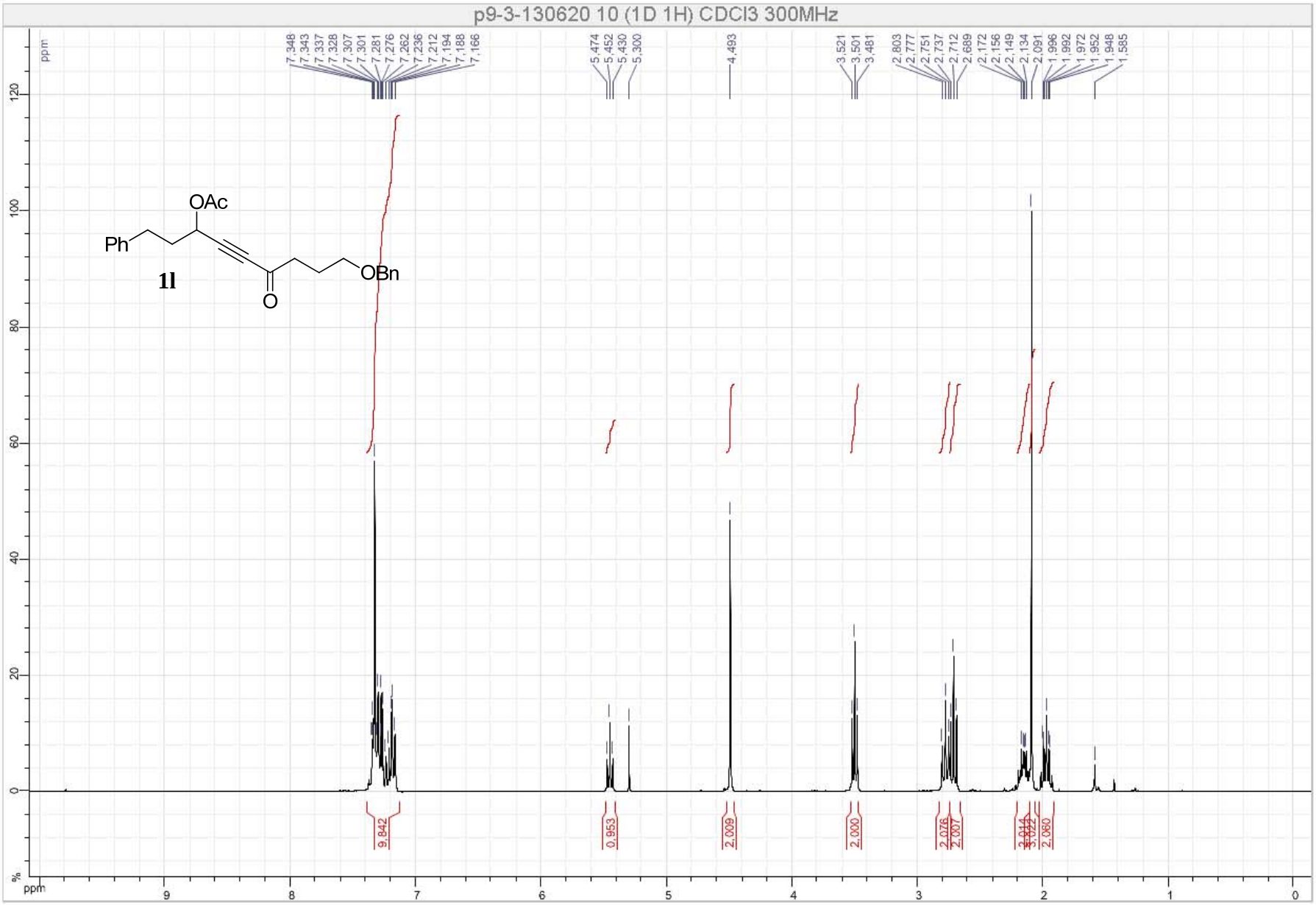

ppm
184,103
169,940
88,532
84,247
77,413
77,160
76,906
63,410
34,035
32,746
31,287
24,717
22,535
20,983
14,072
OAc
C5H11
CH3
O
1i
%
ppm
200
180
160
140
120
100
80
60
40
20

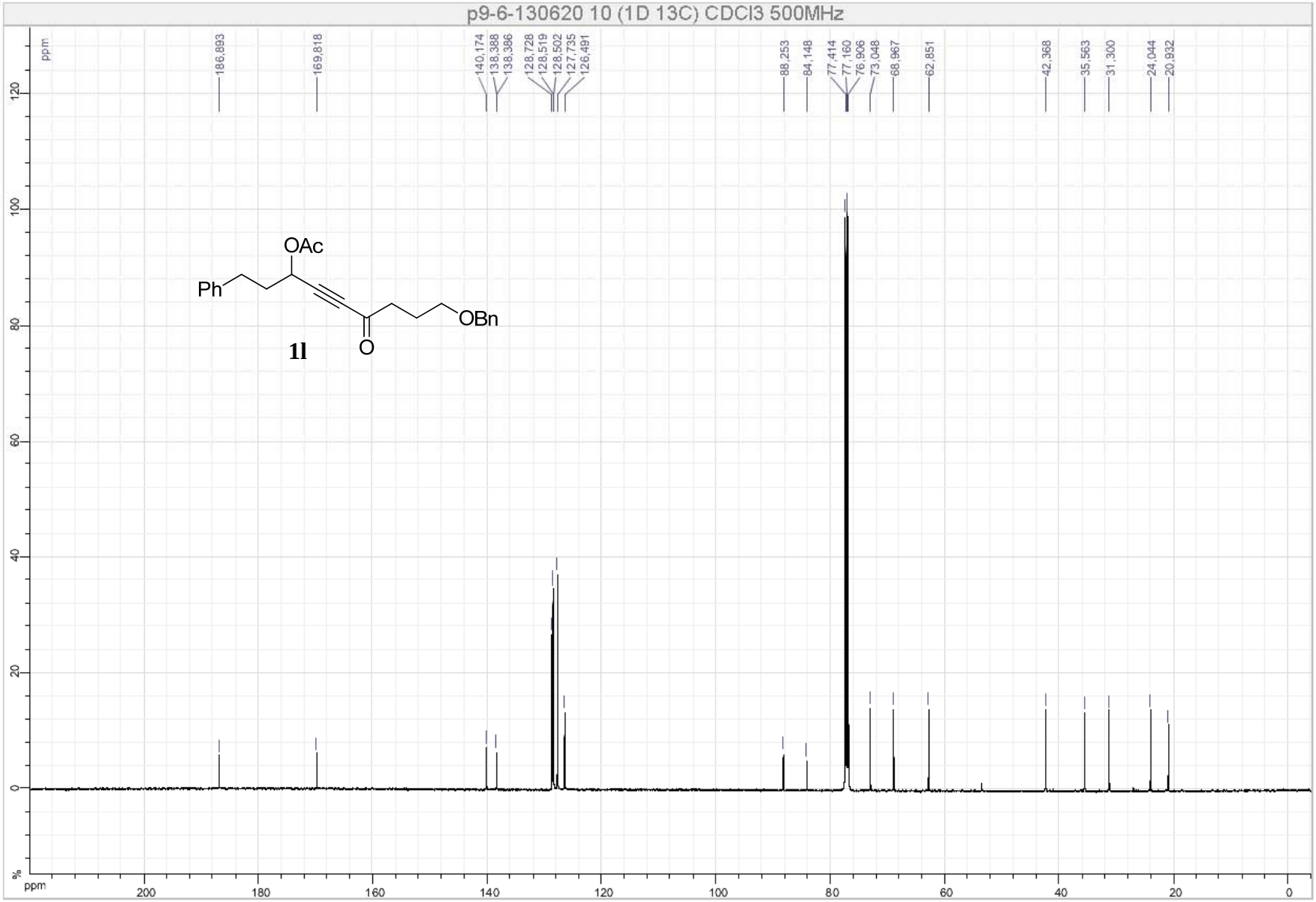

ppm
7,260
5,592
5,569
5,546
5,524
2,552
2,528
2,503
2,339
2,314
2,289
1,737
1,728
1,712
1,704
1,688
1,679
1,663
1,655
1,639
1,630
1,614
1,606
1,542
1,519
0,980
0,958
0,955
0,933
0,931
0,909
O
O
C3H7
Me
C3H7
O
1j
1,000
2,081
2,142
4,487
3,036
6,527
%
ppm

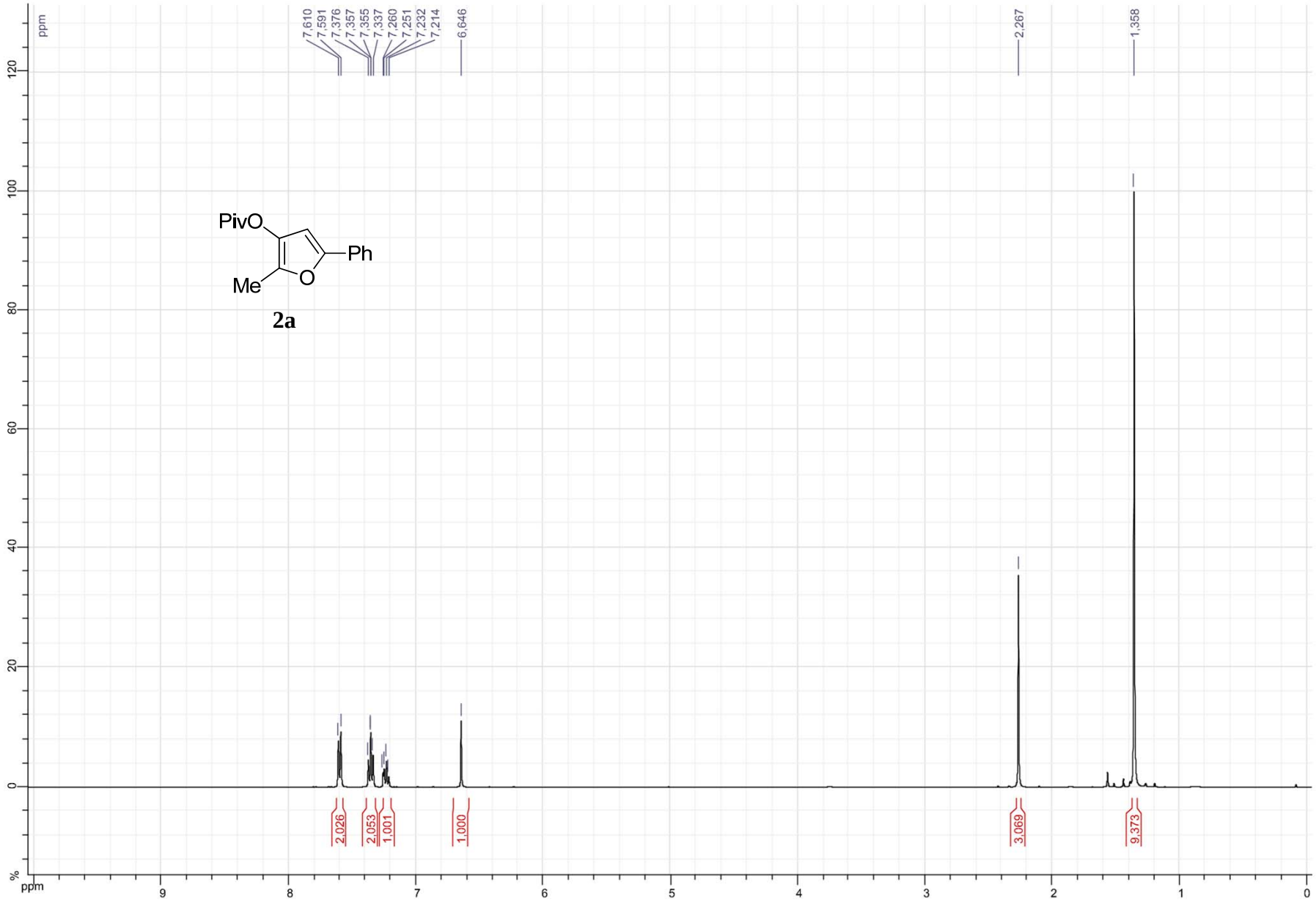

ppm
187,620
172,440
89,286
83,144
77,414
76,906
59,419
47,314
36,067
20,596
18,454
17,467
13,690
13,593
O
O
C3H7
Me
C3H7
O
1j
%
ppm
200
180
160
140
120
100
80
60
40
20
0

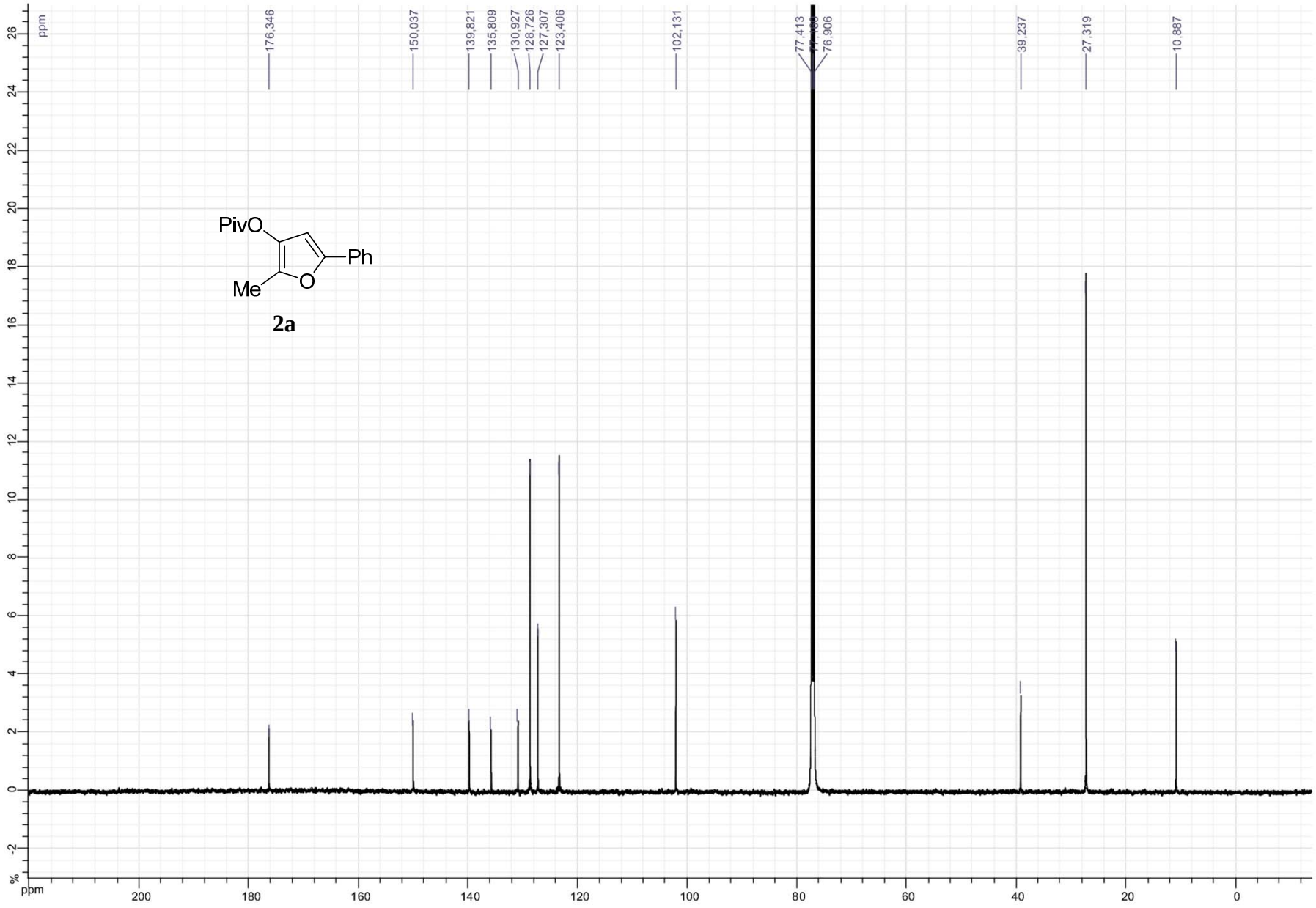

ppm
7,321
7,260
7,234
7,164
5,569
5,552
5,535
5,517
2,984
2,965
2,946
2,904
2,885
2,866
2,688
2,669
2,650
1,554
1,505
1,488
O
O
Ph
Ph
O
1k
4,028
5,736
0,928
4,001
2,011
2,000
3,029
%
ppm

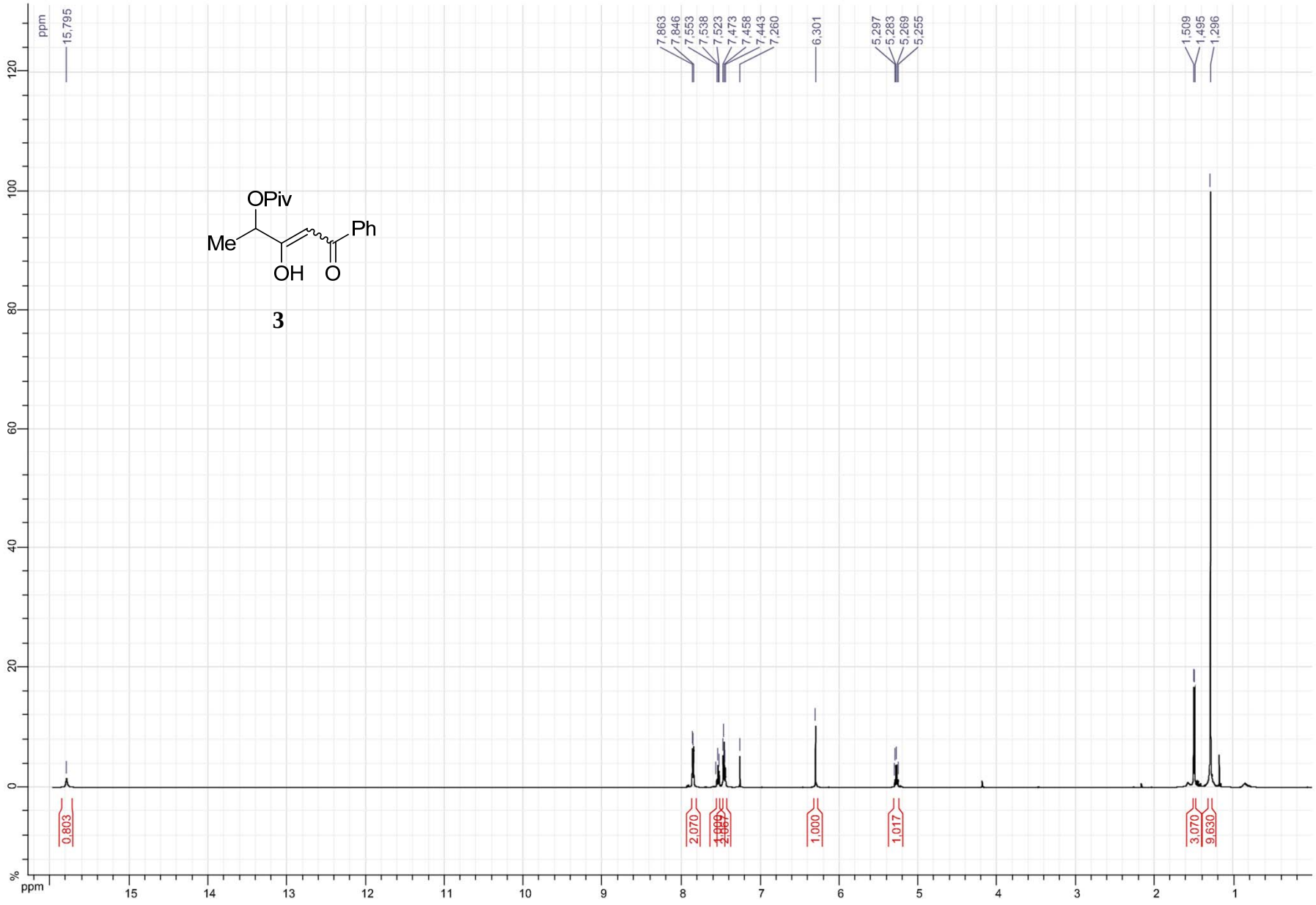

ppm
186,309
171,653
140,174
140,150
128,693
128,666
128,468
128,431
126,518
126,470
89,638
83,133
77,414
77,160
76,906
59,680
46,963
35,781
30,871
29,709
20,506
O
O
Ph
Ph
O
1k


p9-3-130620 10 (1D 1H) CDCl3 300MHz
OAc
Ph
1l
OBn
O

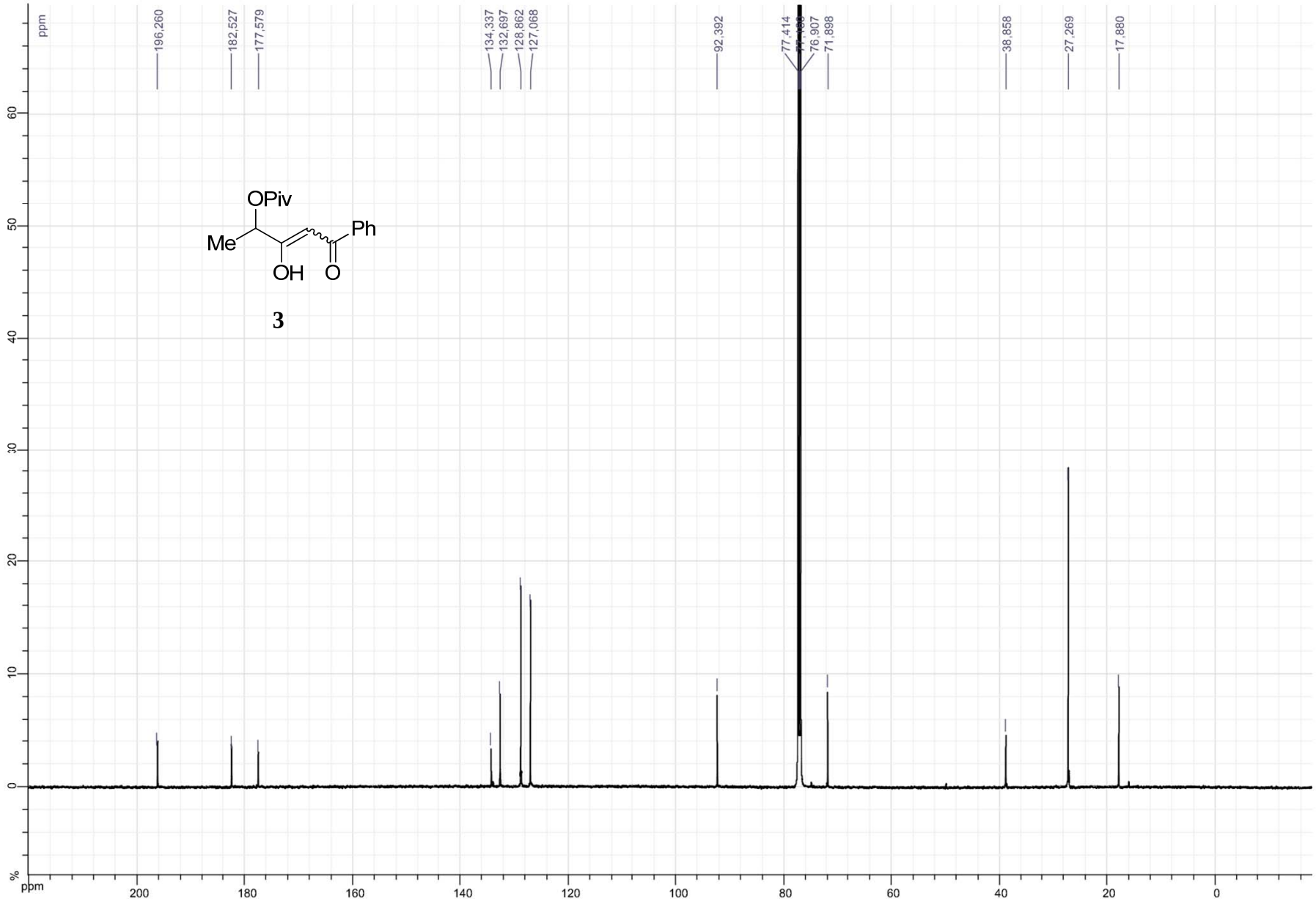

p9-6-130620 10 (1D 13C) CDCl3 500MHz
ppm
186,893
169,818
140,174
138,388
138,386
128,728
128,519
128,502
127,735
126,491
88,253
84,148
77,414
77,160
76,906
73,048
68,967
62,851
42,368
35,563
31,300
24,044
20,932
OAc
Ph
OBn
O
1l
%
200
180
160
140
120
100
80
60
40
20
0

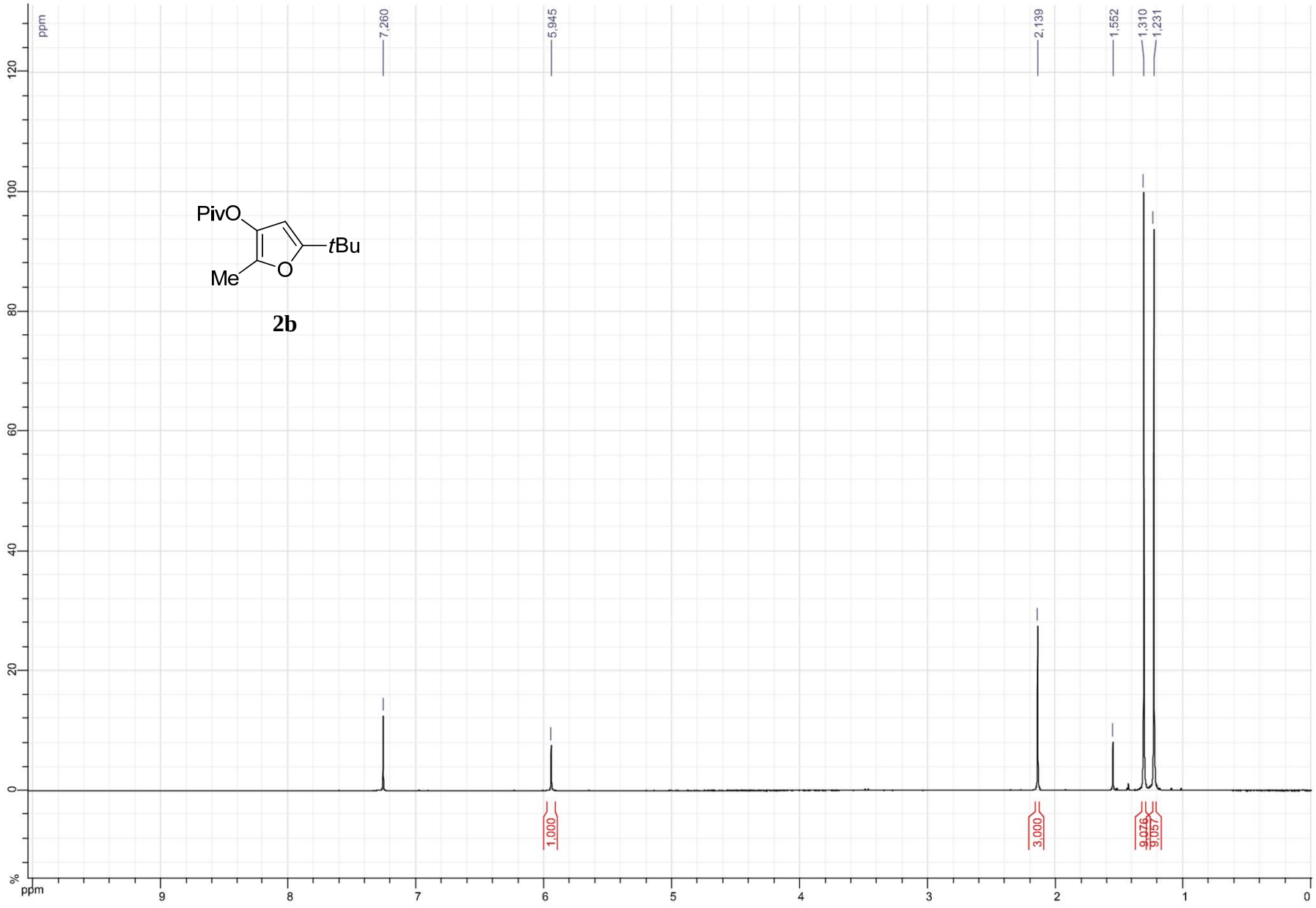

ppm
7,610
7,591
7,376
7,357
7,355
7,337
7,260
7,251
7,232
7,214
6,646
2,267
1,358
PivO
Ph
Me
O
2a
2,026
2,053
1,001
1,000
3,069
9,373
%
ppm

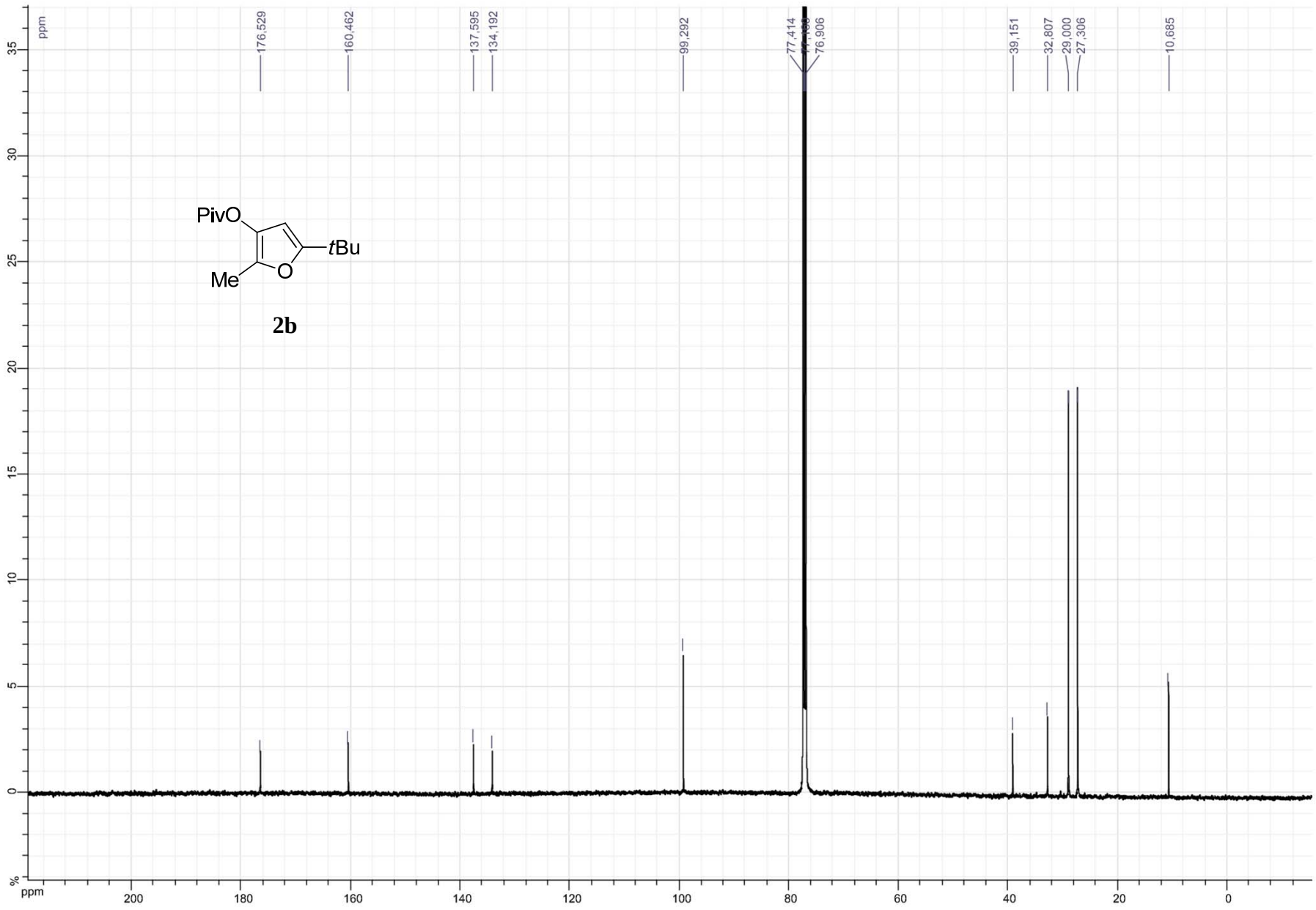

ppm
176,346
150,037
139,821
135,809
130,927
128,726
127,307
123,406
102,131
77,413
76,906
39,237
27,319
10,887
PivO
Ph
Me
O
2a
ppm
200
180
160
140
120
100
80
60
40
20
0

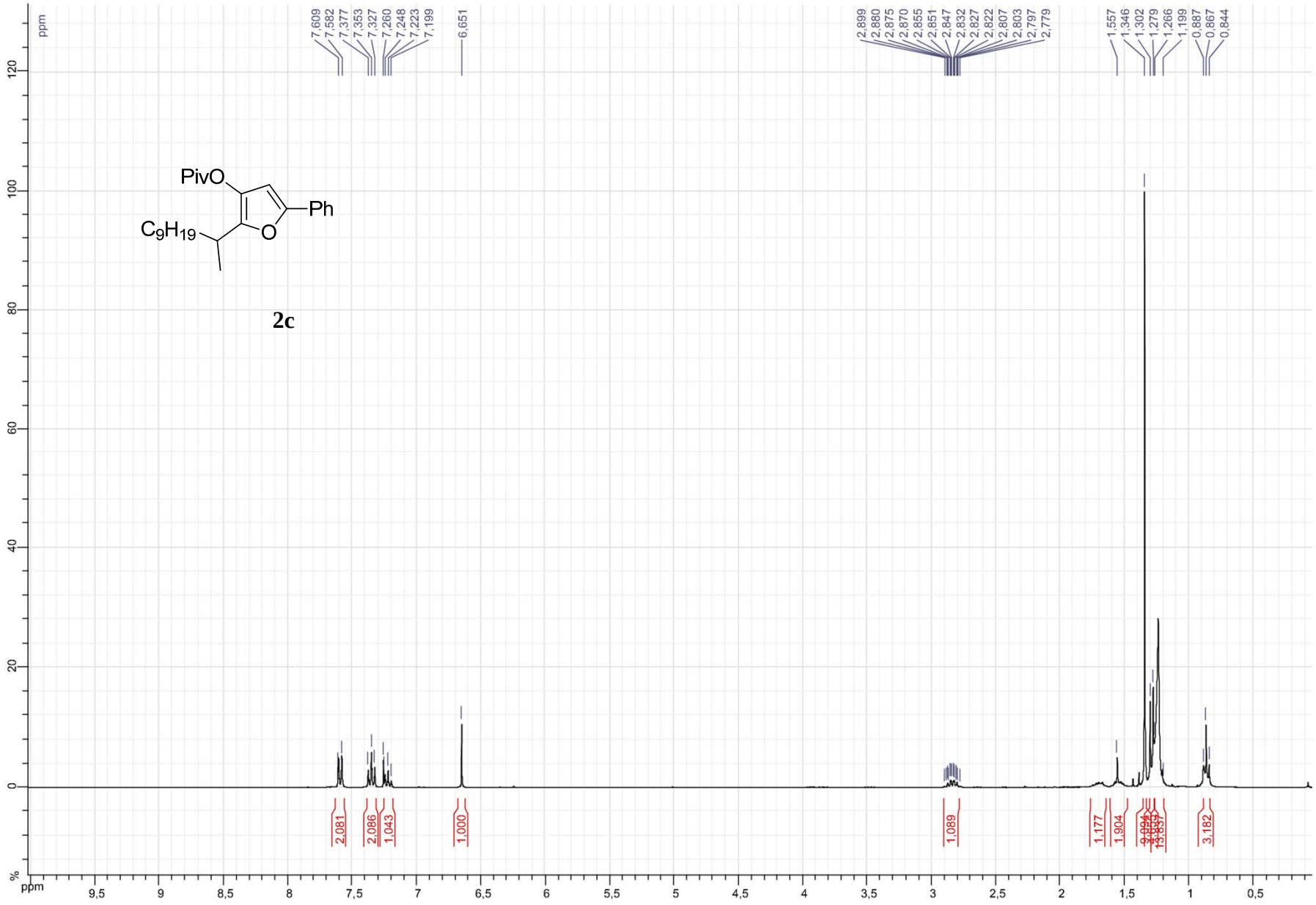

ppm
15,795
7,863
7,846
7,553
7,538
7,523
7,473
7,458
7,443
7,260
6,301
5,297
5,283
5,269
5,255
1,509
1,495
1,296
OPiv
Me
Ph
OH
O
0,803
2,070
1,000
1,017
3,070
9,630

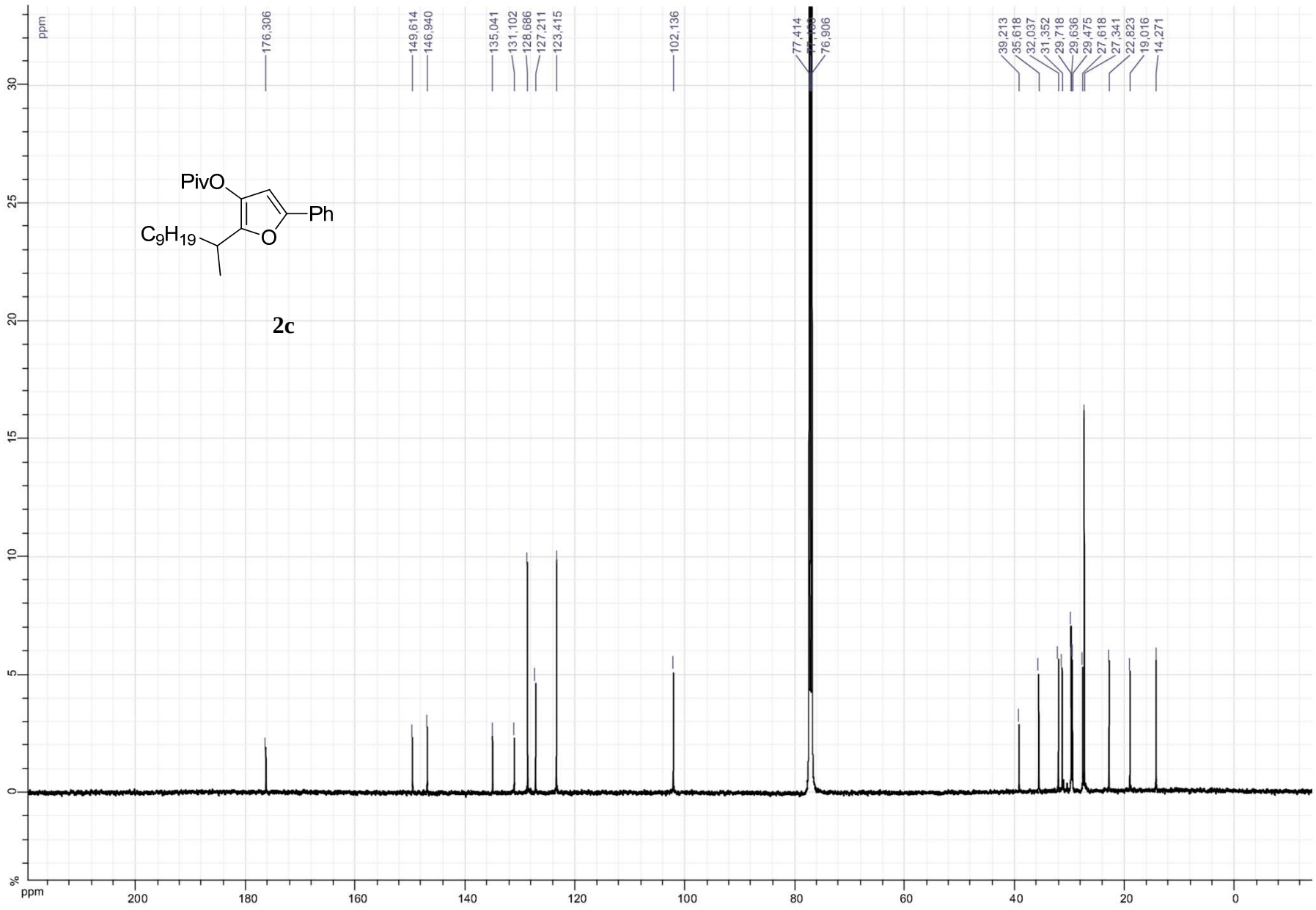
3

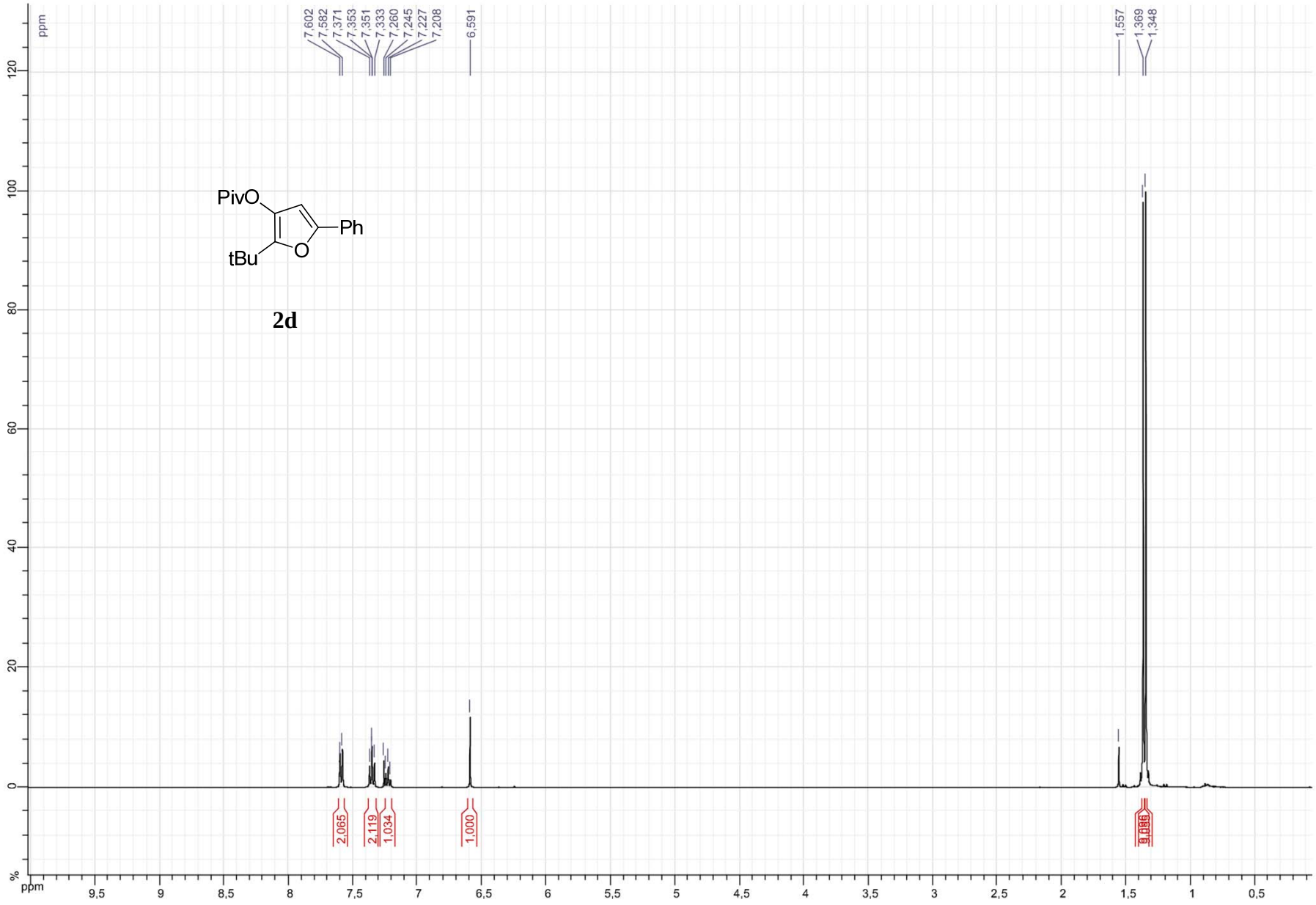

ppm
196,260
182,527
177,579
134,337
132,697
128,862
127,068
92,392
77,414
76,907
71,898
38,858
27,269
17,880
OPiv
Me
Ph
OH
O
3
%
ppm
200
180
160
140
120
100
80
60
40
20
0

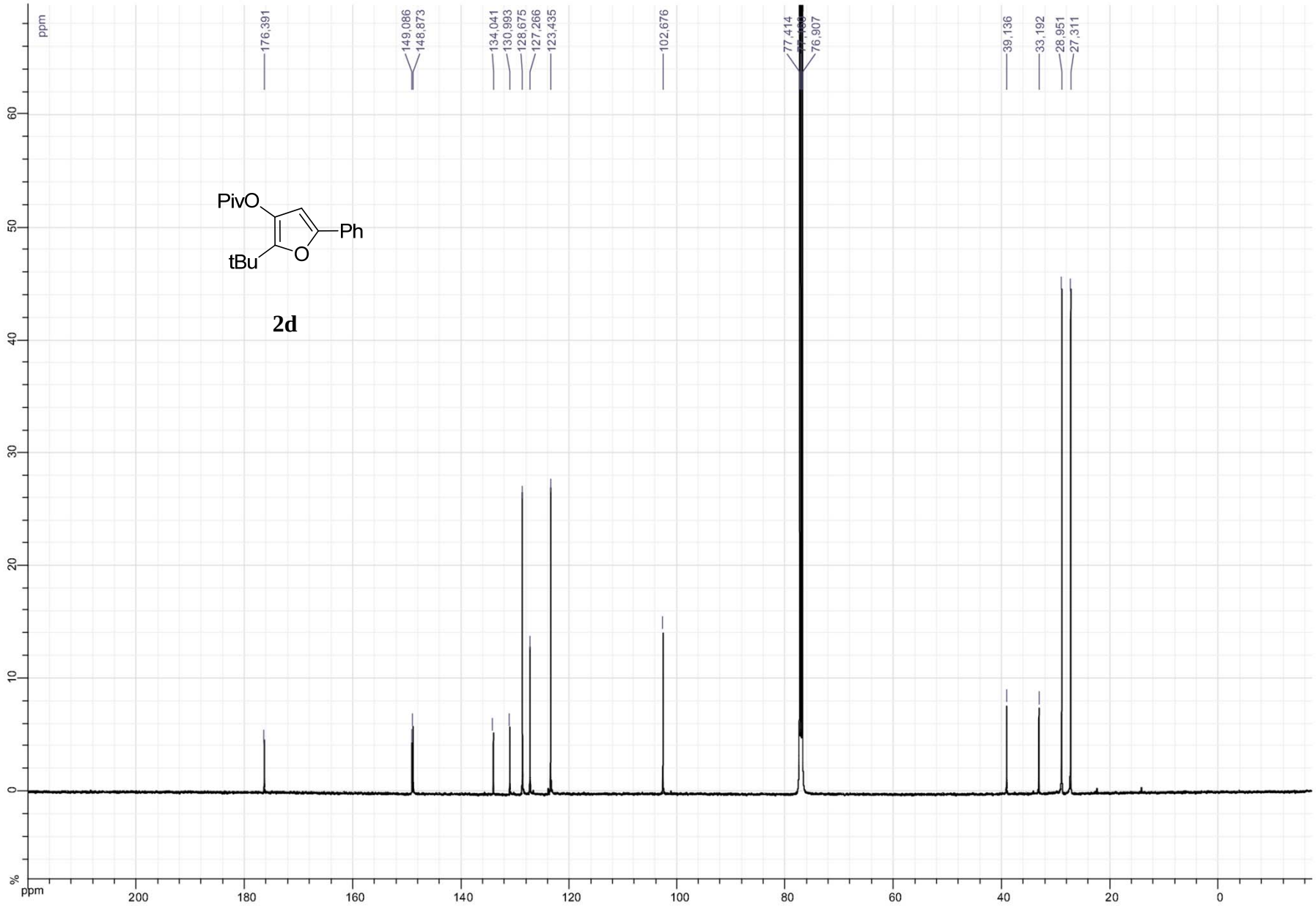

ppm
7,260
5,945
2,139
1,552
1,310
1,231
PivO
tBu
Me
O
2b
1,000
3,000
9,076
9,057
%
ppm

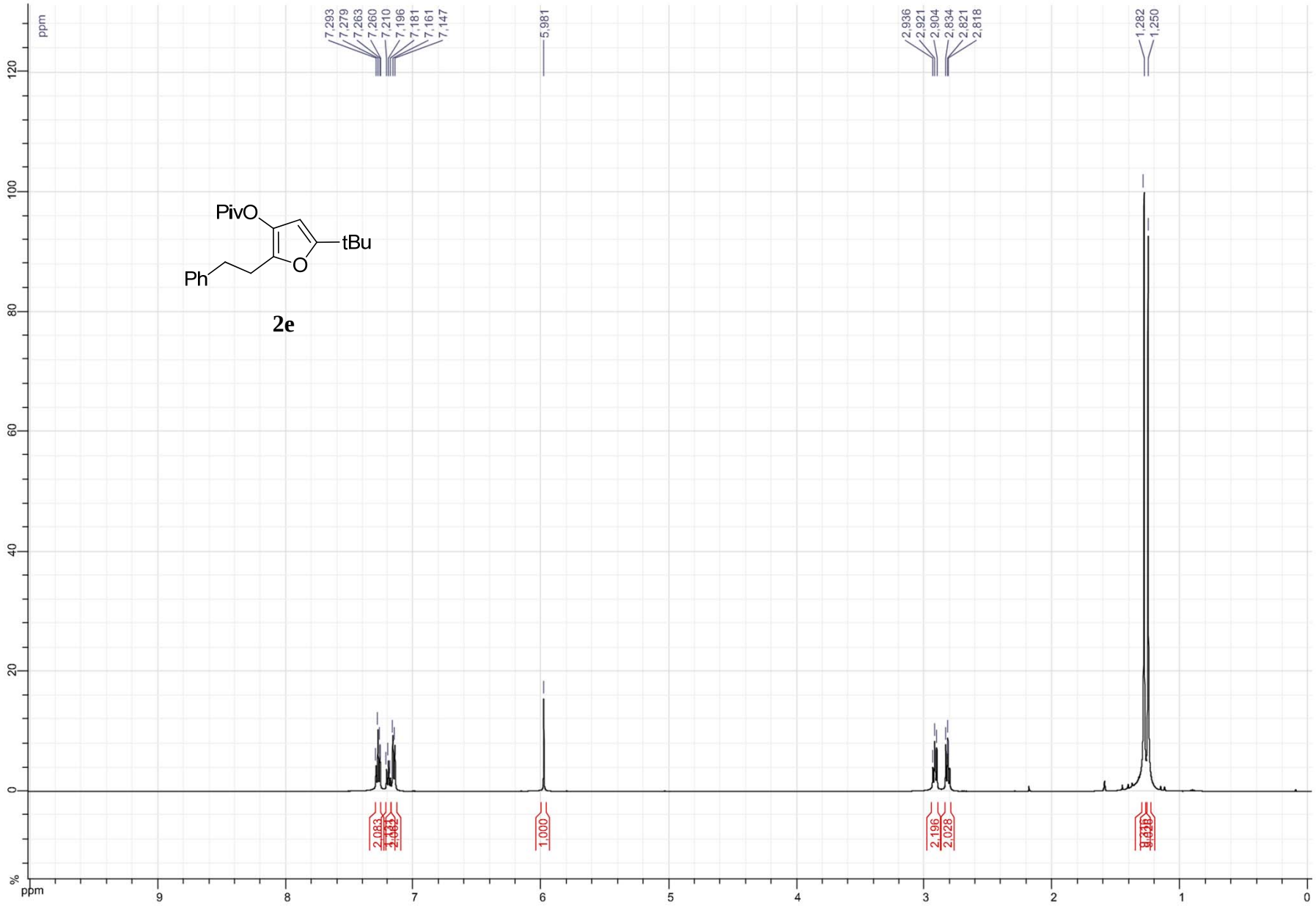

ppm
176,529
160,462
137,595
134,192
99,292
77,414
77,166
76,906
39,151
32,807
29,000
27,306
10,685
PivO
tBu
Me
O
2b
35
30
25
20
15
10
5
0
%
ppm
200
180
160
140
120
100
80
60
40
20
0

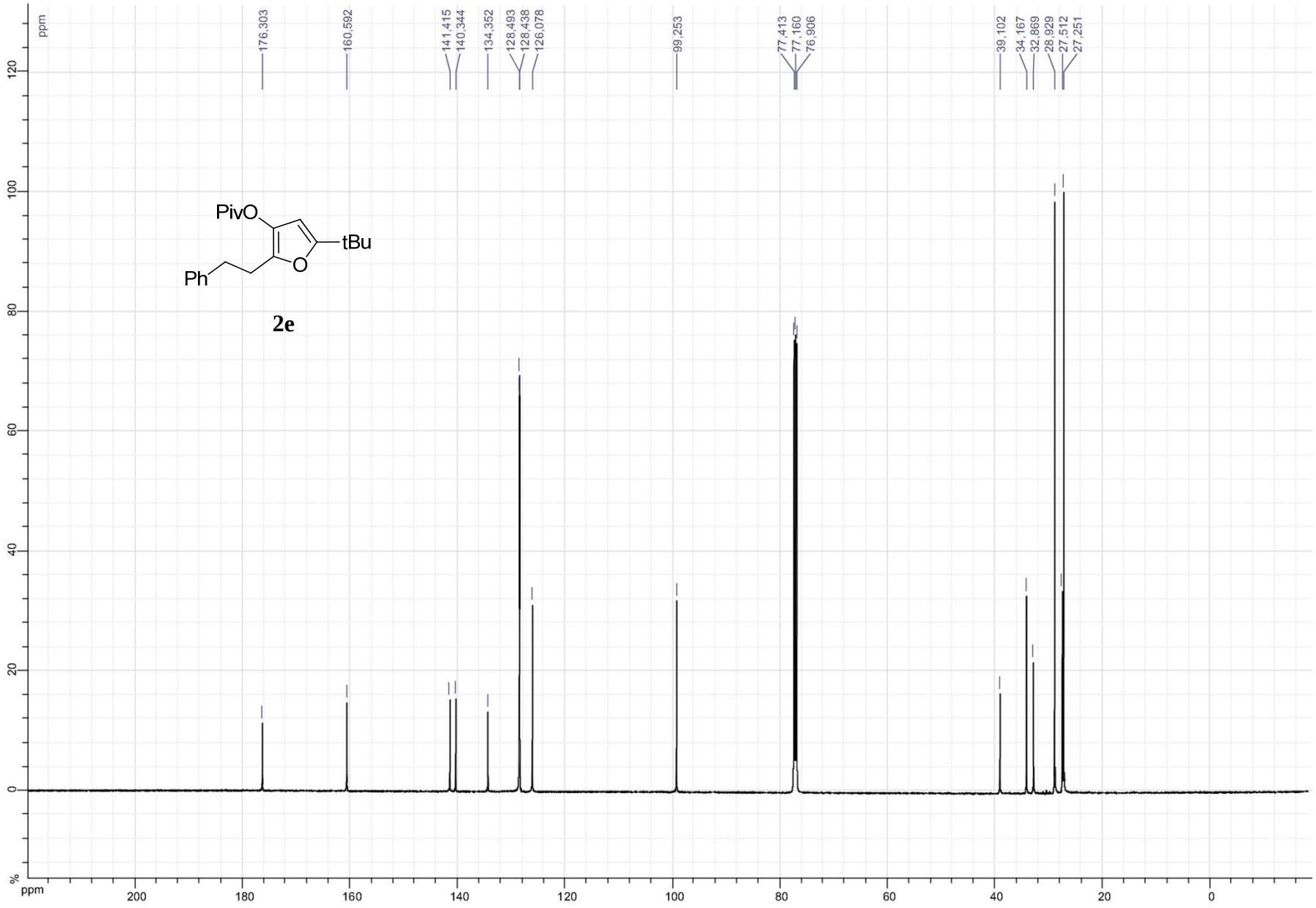

PivO
Ph
C9H19
O
2c

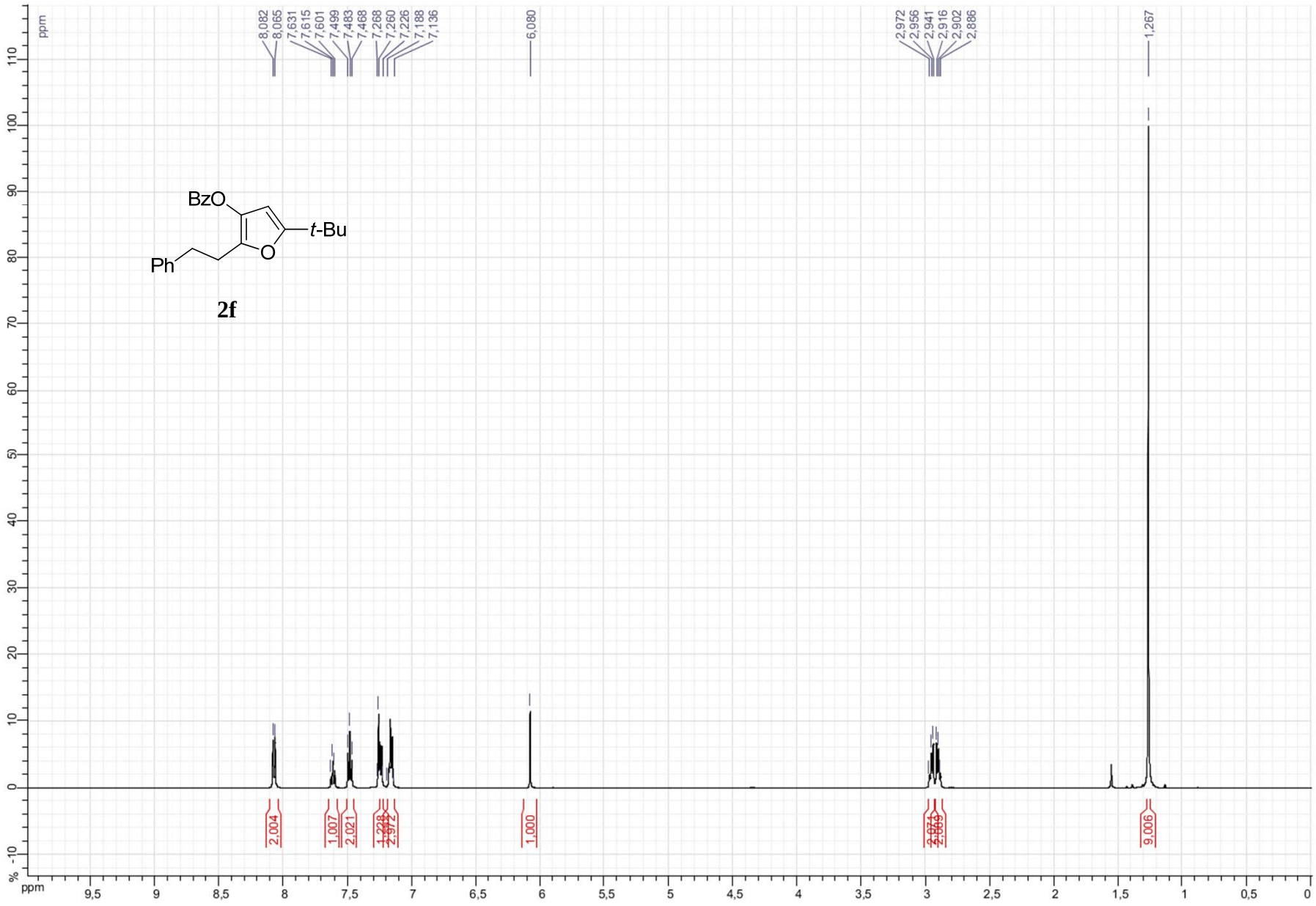

ppm
176,306
149,614
146,940
135,041
131,102
128,686
127,211
123,415
102,136
77,414
76,906
39,213
35,618
32,037
31,352
29,718
29,636
29,475
27,618
27,341
22,823
19,016
14,271
PivO
Ph
C9H19
O
2c
%
ppm
200
180
160
140
120
100
80
60
40
20
0

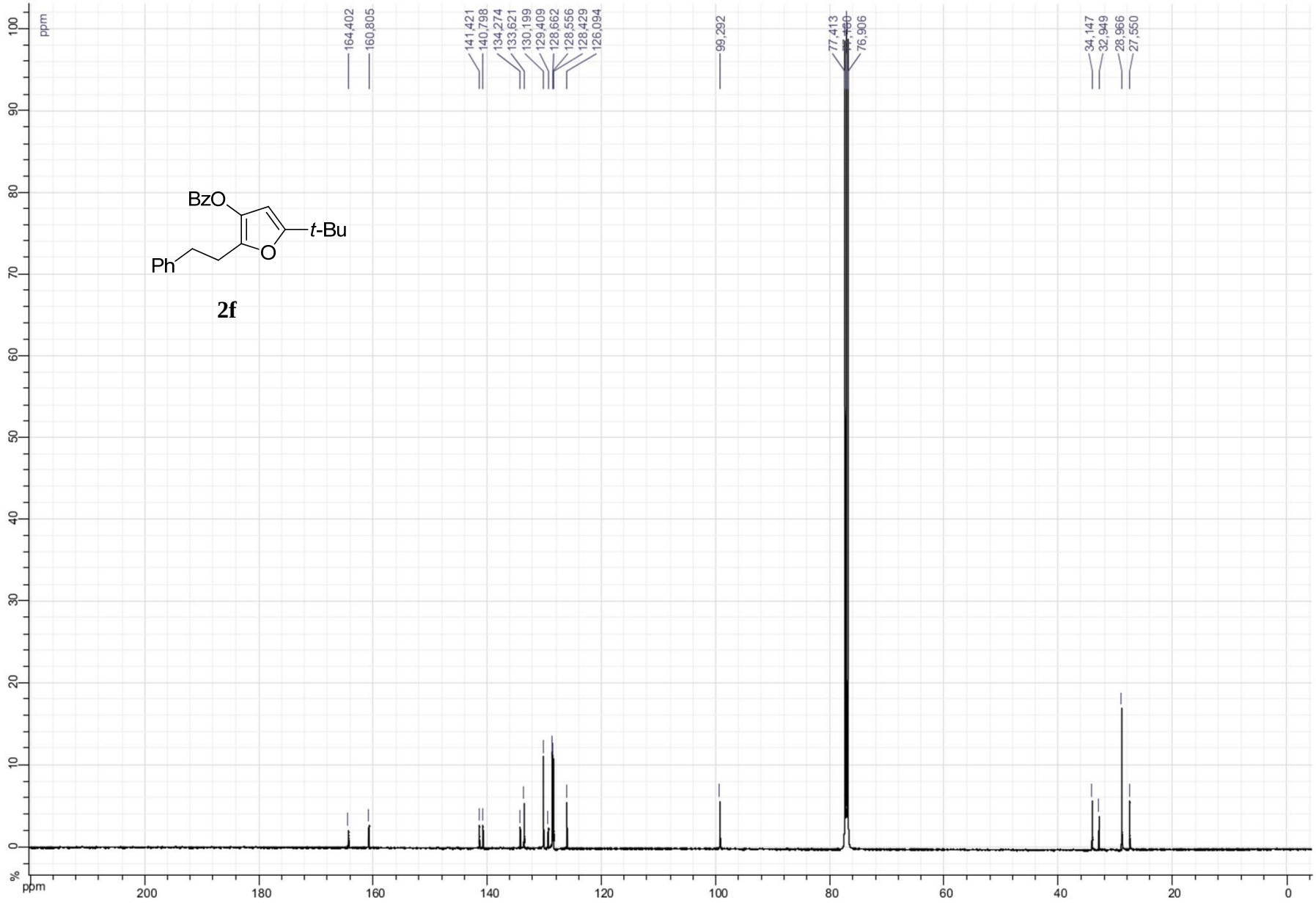

ppm
7,602
7,582
7,371
7,353
7,351
7,333
7,260
7,245
7,227
7,208
6,591
1,557
1,369
1,348
PivO
Ph
tBu
O
2d
2,065
2,119
1,034
1,000
9,086
%
ppm

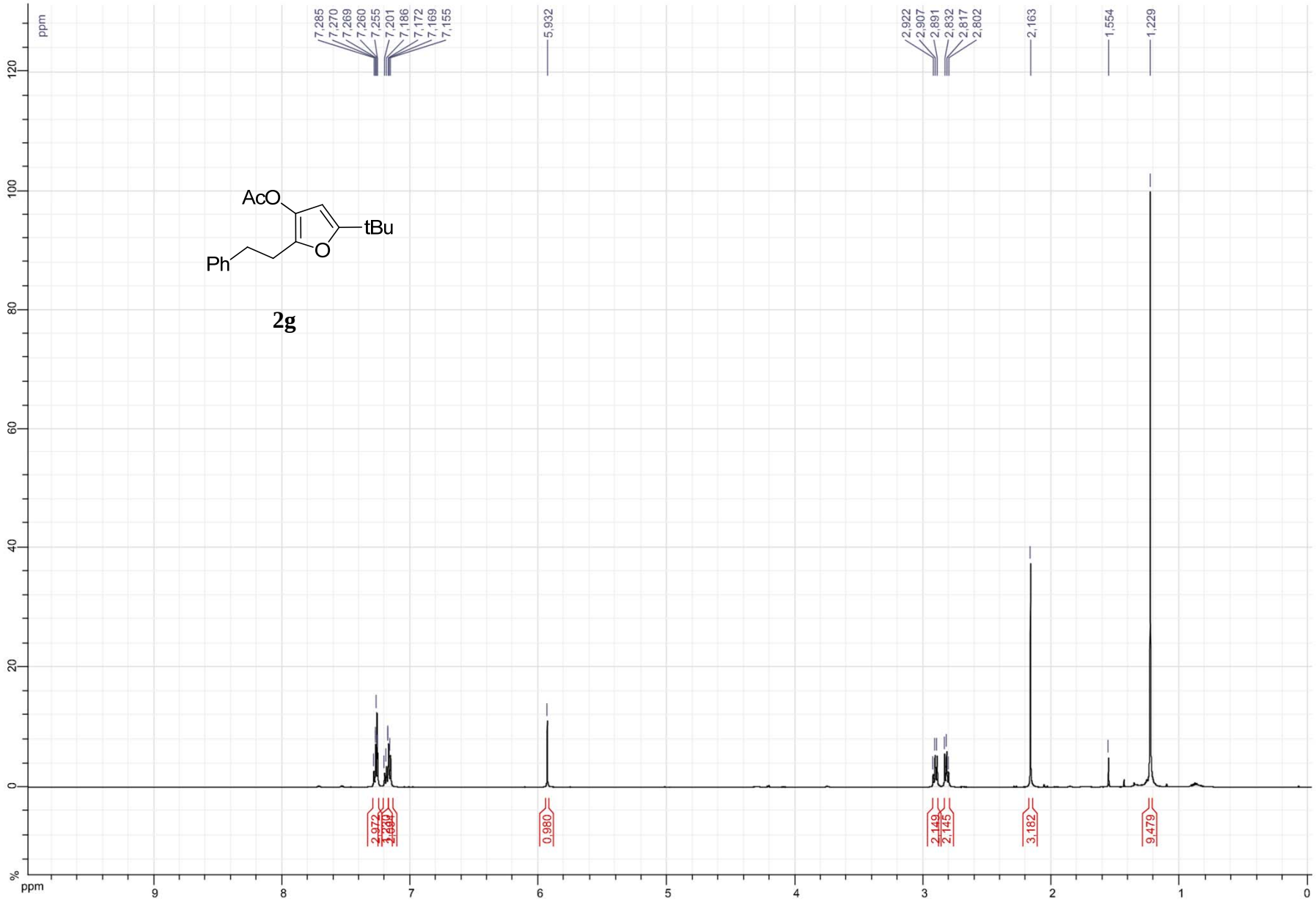

ppm
176,391
149,086
148,873
134,041
130,993
128,675
127,266
123,435
102,676
77,414
76,907
39,136
33,192
28,951
27,311
PivO
Ph
tBu
O
2d
%
ppm
200
180
160
140
120
100
80
60
40
20
0

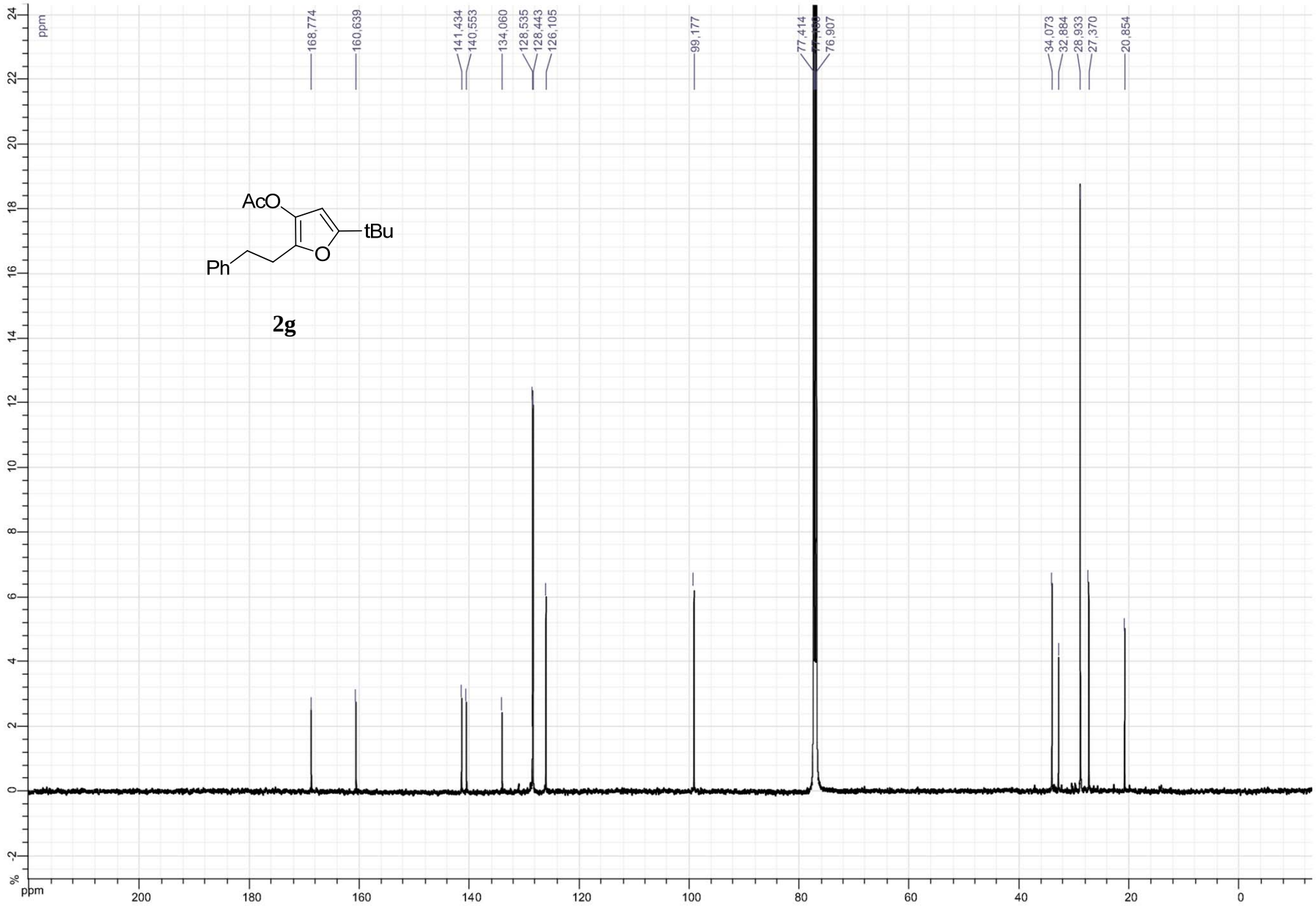

ppm
7.293
7.279
7.263
7.260
7.210
7.196
7.181
7.161
7.147
5.981
2.936
2.921
2.904
2.834
2.821
2.818
1.282
1.250
PivO
tBu
Ph
O
2e
2.083
1.000
2.196
2.028
ppm

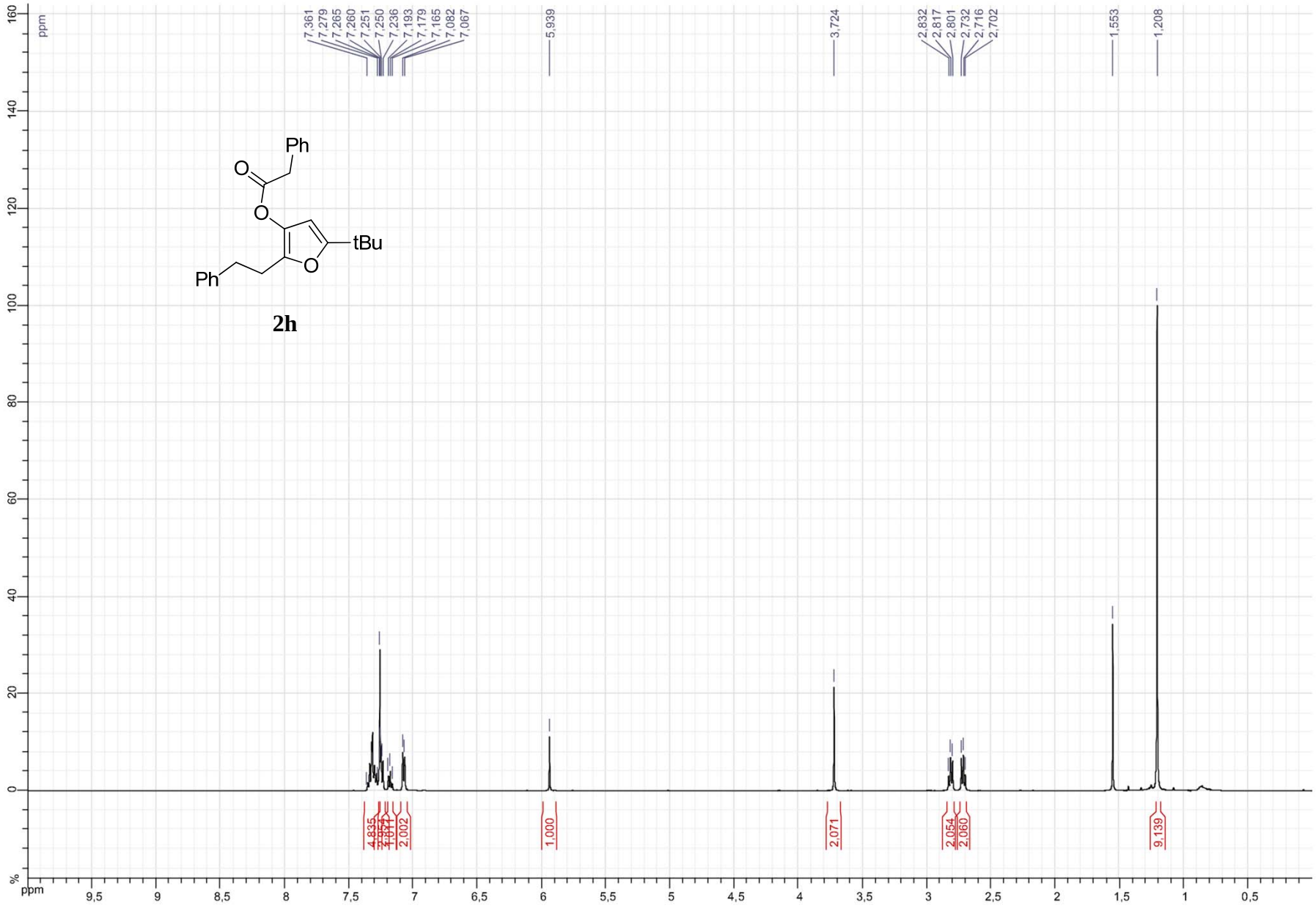

ppm
176,303
160,592
141,415
140,344
134,352
128,493
128,438
126,078
99,253
77,413
77,160
76,906
39,102
34,167
32,869
28,929
27,512
27,251
PivO
tBu
O
Ph
2e
120
100
80
60
40
20
0
%
ppm
200
180
160
140
120
100
80
60
40
20
0


ppm
8,082
8,065
7,631
7,615
7,601
7,499
7,483
7,468
7,268
7,260
7,226
7,188
7,136
6,080
2,972
2,956
2,941
2,916
2,902
2,886
1,267
BzO
t-Bu
O
Ph
2f
2,004
1,007
2,021
1,000
9,006
ppm

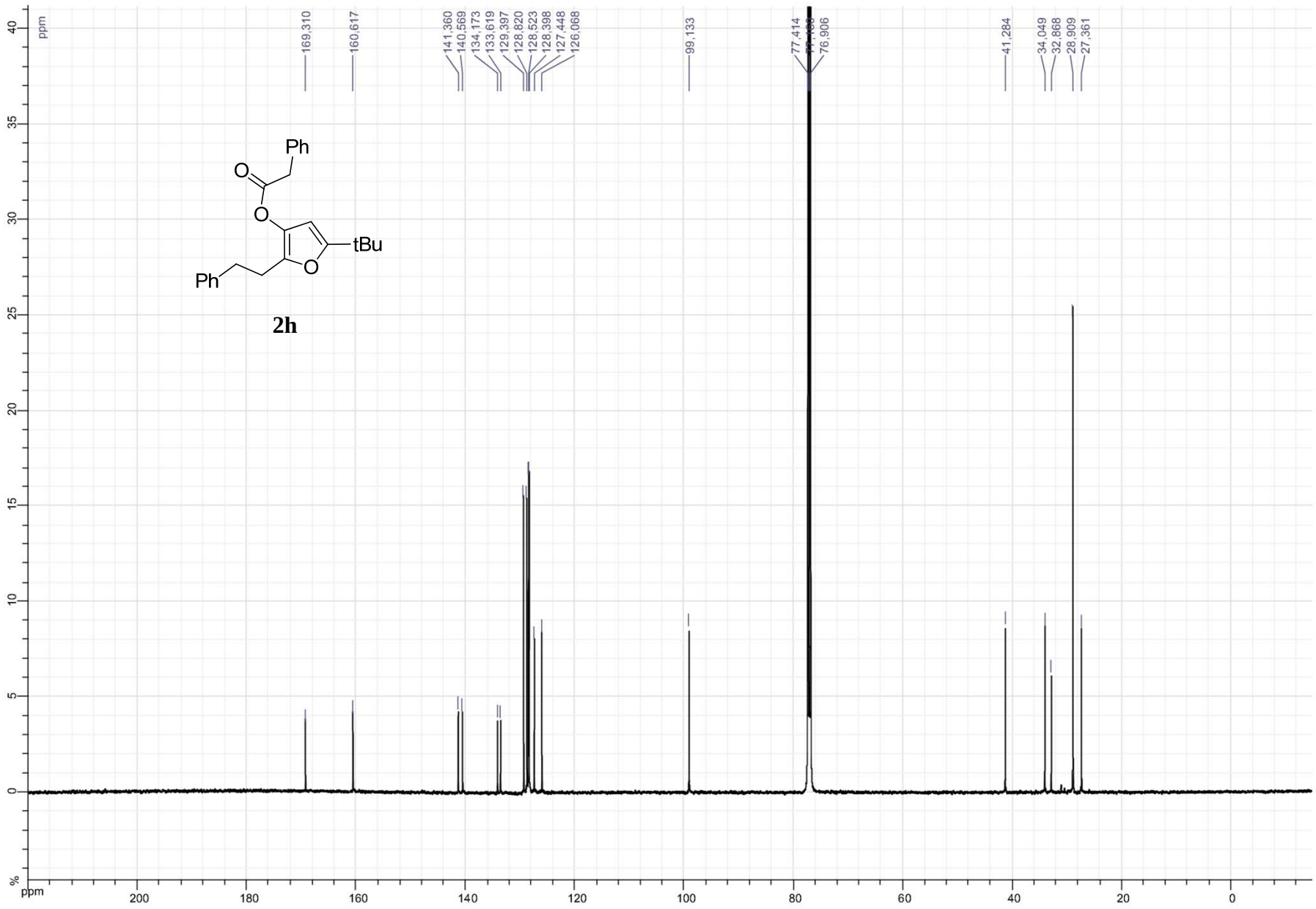

ppm
164,402
160,805
141,421
140,798
134,274
133,621
130,199
129,409
128,862
128,556
128,429
126,094
99,292
77,413
76,906
34,147
32,949
28,966
27,550
BzO
t-Bu
O
Ph
2f
%
ppm
200
180
160
140
120
100
80
60
40
20
0

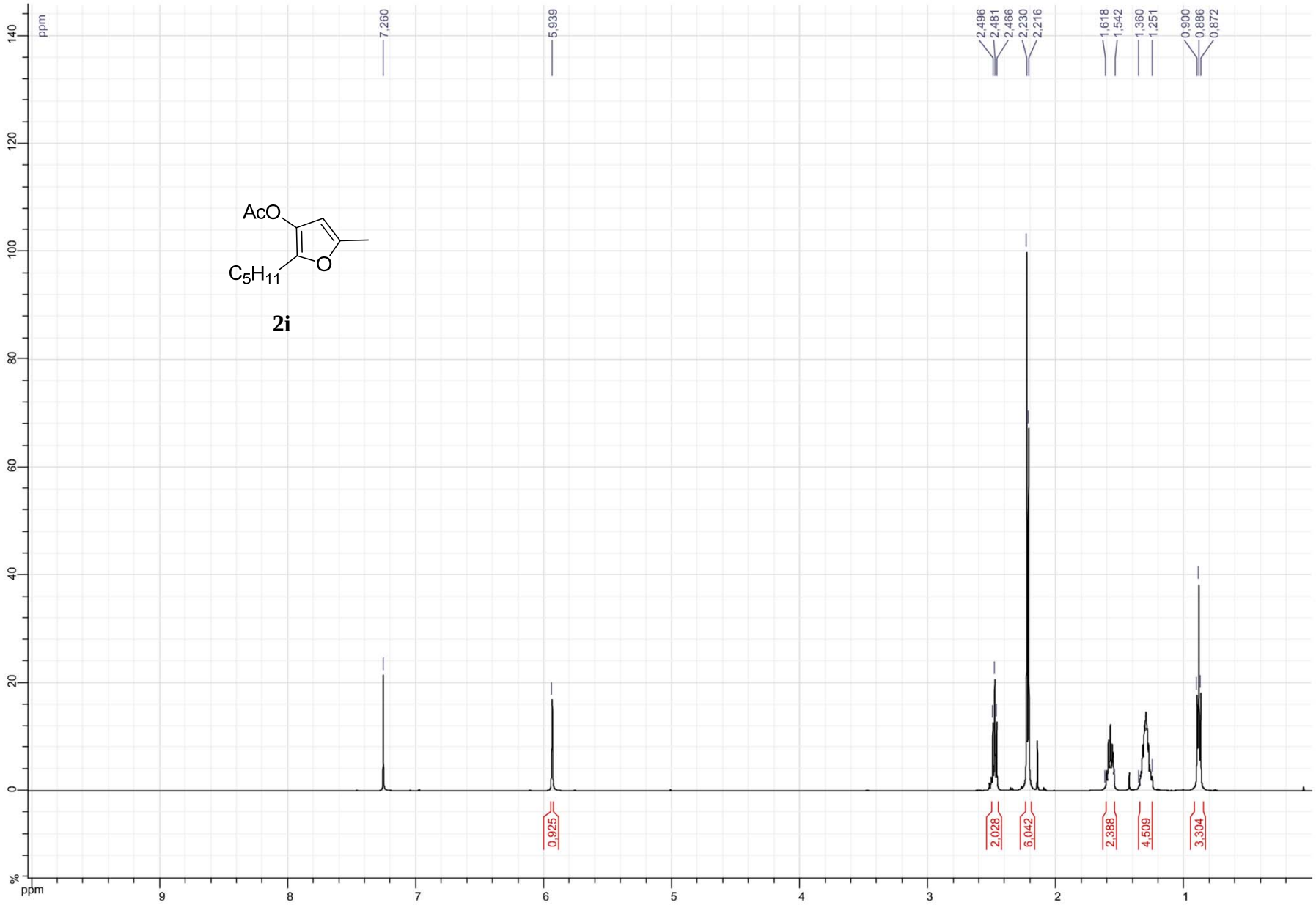

7,285
7,270
7,269
7,260
7,255
7,201
7,186
7,172
7,169
7,155
5,932
2,922
2,907
2,891
2,832
2,817
2,802
2,163
1,554
1,229
AcO
tBu
O
Ph
2g
2,972
0,980
2,149
2,145
3,182
9,479
ppm


ppm
168,774
160,639
141,434
140,553
134,060
128,535
128,443
126,105
99,177
77,414
76,907
34,073
32,884
28,933
27,370
20,854
AcO
tBu
O
Ph
2g
%
ppm
200
180
160
140
120
100
80
60
40
20
0

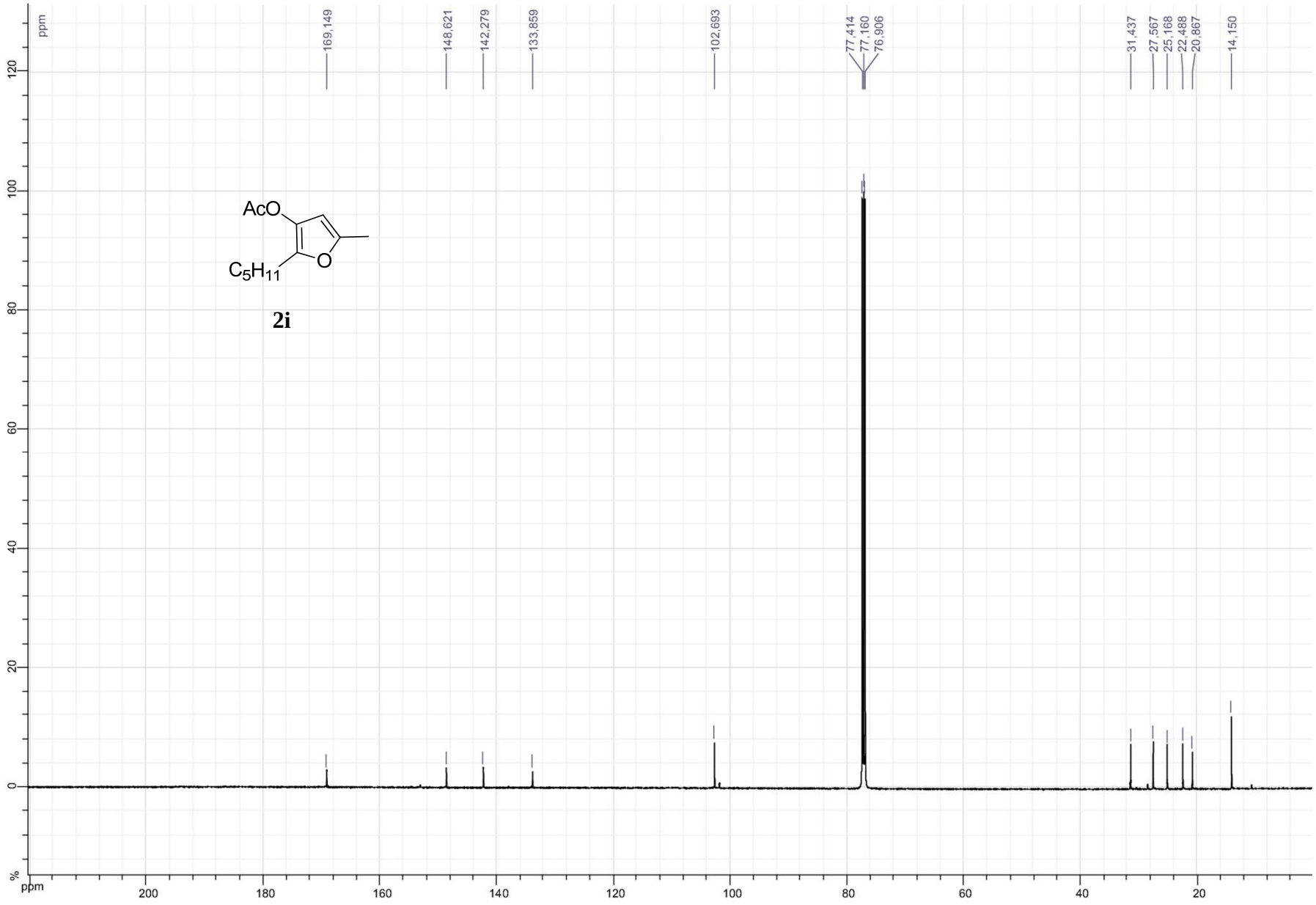

ppm
7.361
7.279
7.265
7.260
7.251
7.250
7.236
7.193
7.179
7.165
7.082
7.067
5.939
3.724
2.832
2.817
2.801
2.732
2.716
2.702
1.553
1.208
Ph
O
O
tBu
O
Ph
4.835
2.002
1.000
2.071
2.054
2.060
9.139
%
ppm

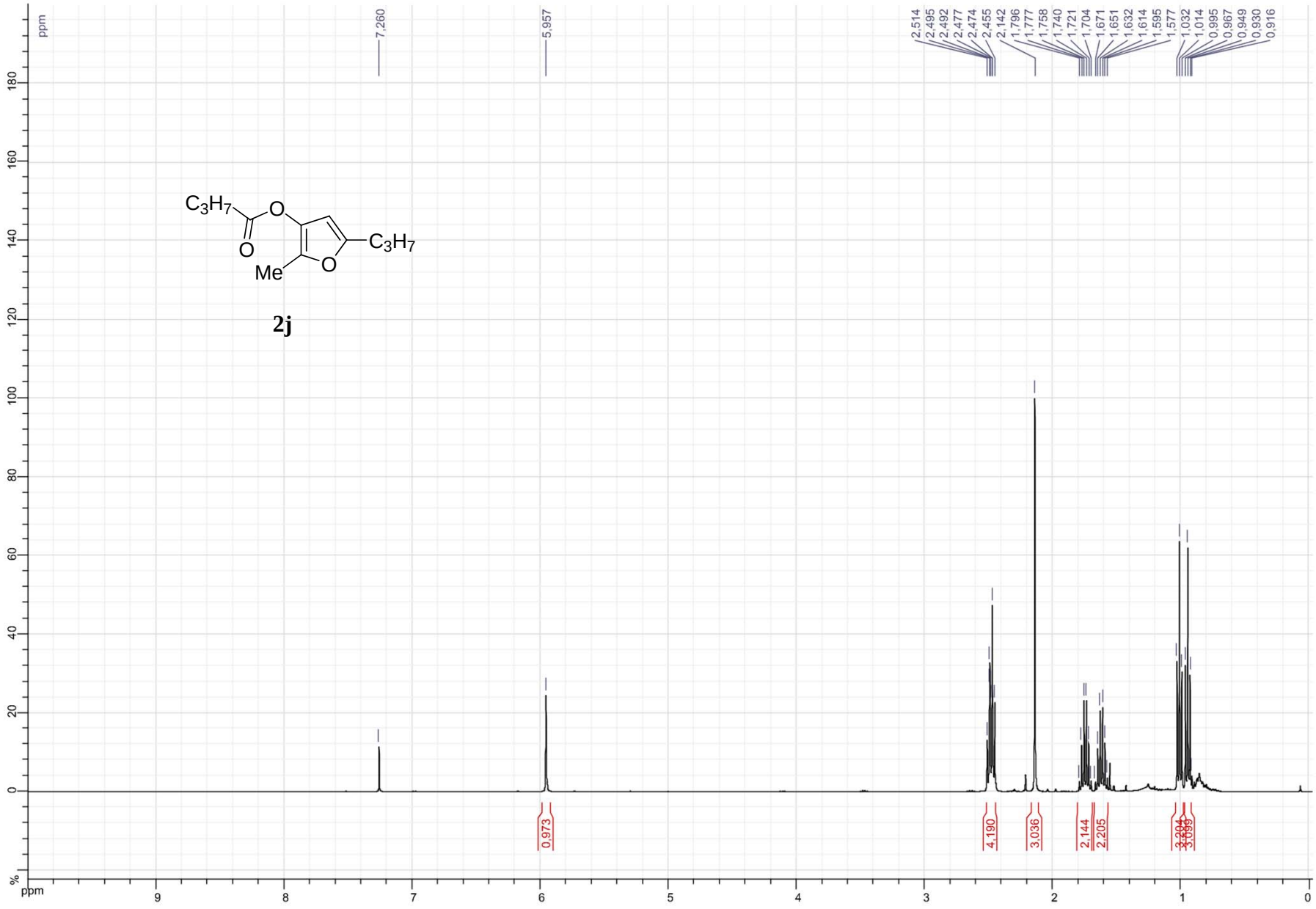
2h


ppm
169,310
160,617
141,360
140,569
134,173
133,619
129,397
128,820
128,523
128,398
127,448
126,068
99,133
77,414
76,906
41,284
34,049
32,868
28,909
27,361
Ph
O
O
tBu
O
Ph
2h
%
ppm
200
180
160
140
120
100
80
60
40
20
0

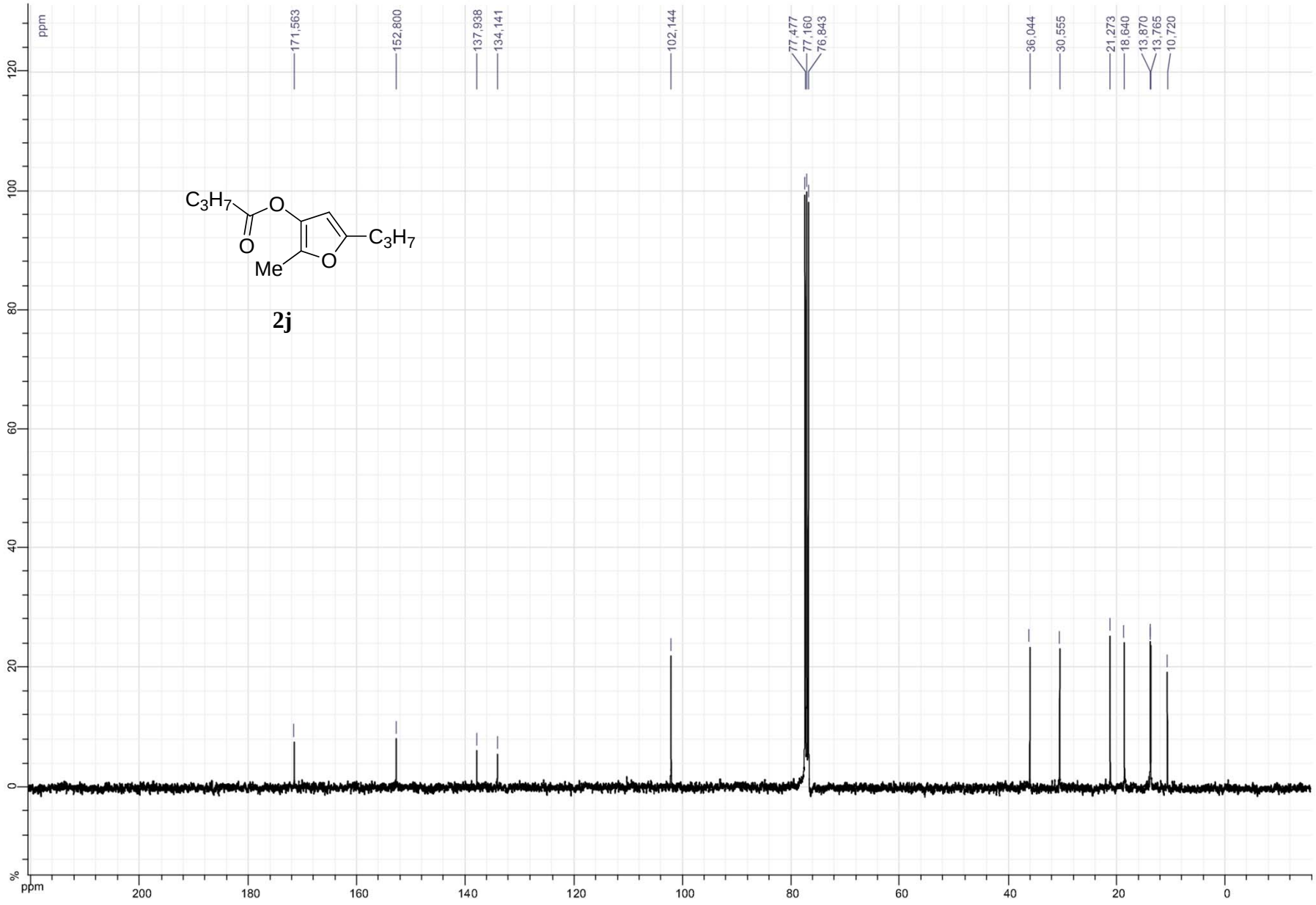

ppm
7.260
5.939
2.496
2.481
2.466
2.230
2.216
1.618
1.542
1.360
1.251
0.900
0.886
0.872
AcO
O
C_5H_{11}
0.925
2.028
6.042
2.388
4.509
3.304
ppm
%

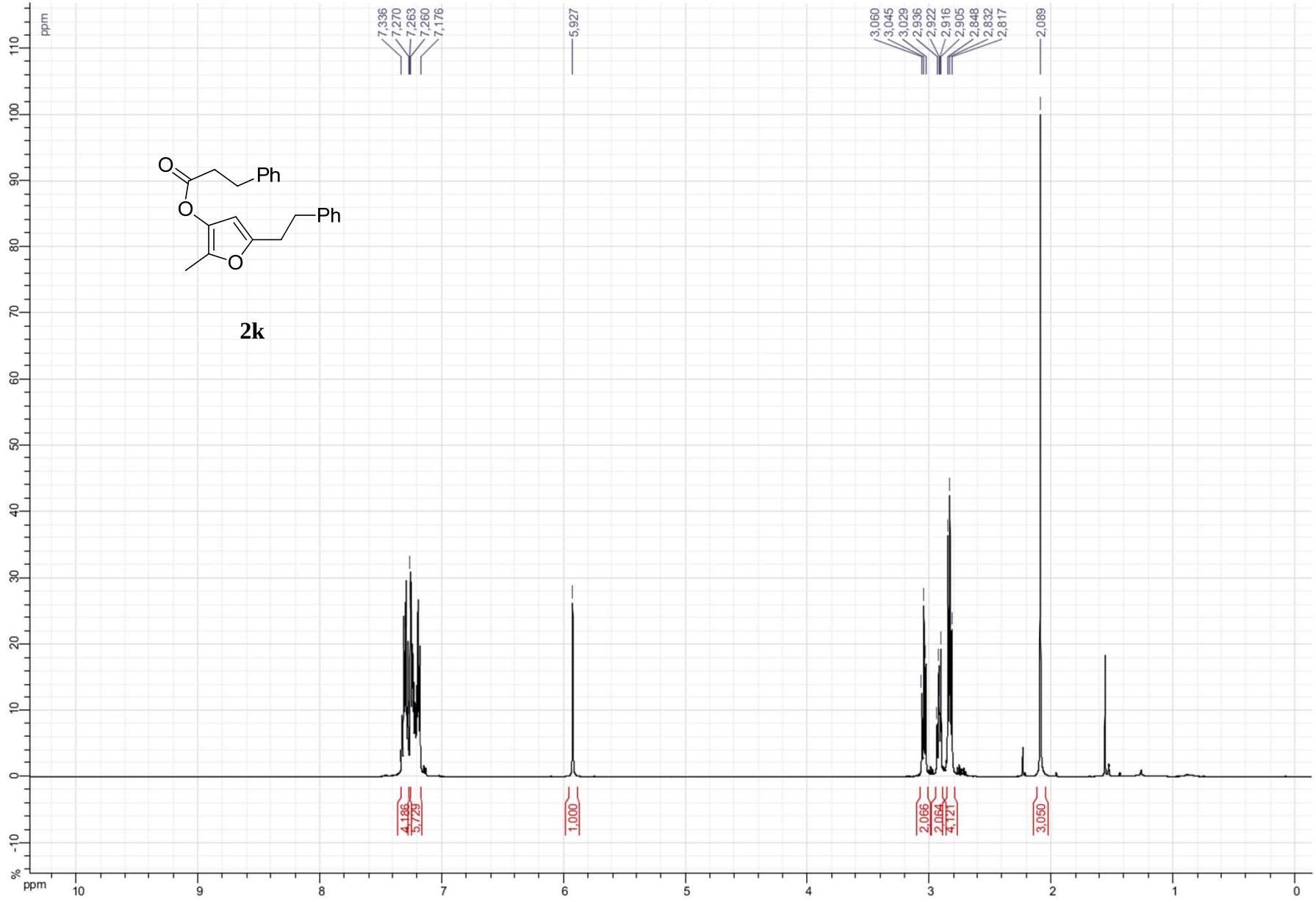
2i


ppm
169,149
148,621
142,279
133,859
102,693
77,414
77,160
76,906
31,437
27,567
25,168
22,488
20,867
14,150
AcO
C5H11
O
2i
120
100
80
60
40
20
0
%
ppm
200
180
160
140
120
100
80
60
40
20

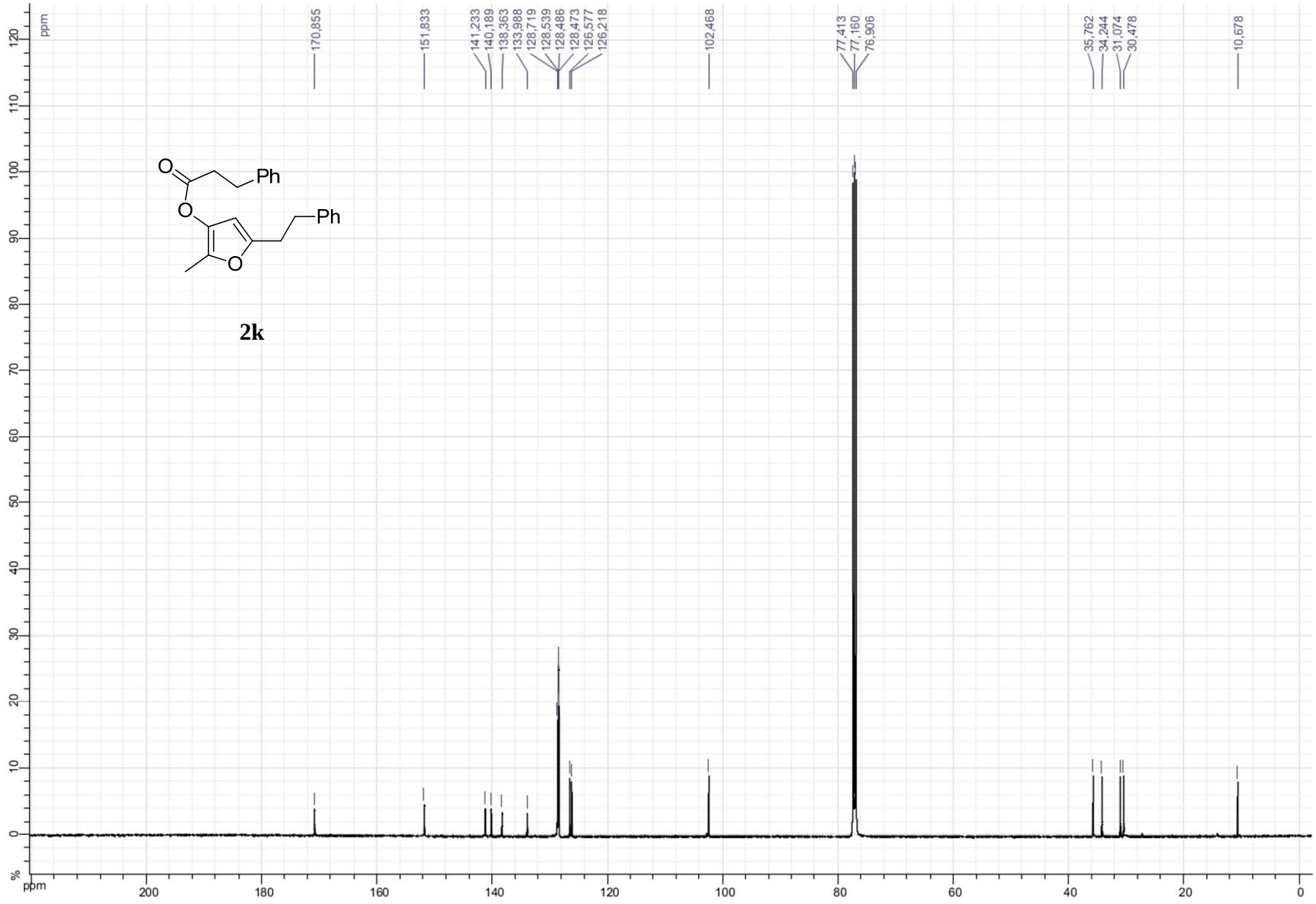

ppm
7.260
5.957
2.514
2.495
2.492
2.477
2.474
2.455
2.142
1.796
1.777
1.758
1.740
1.721
1.704
1.671
1.651
1.632
1.614
1.595
1.577
1.032
1.014
0.995
0.967
0.949
0.930
0.916
0.973
4.190
3.036
2.144
2.205
3.204
3.099
ppm

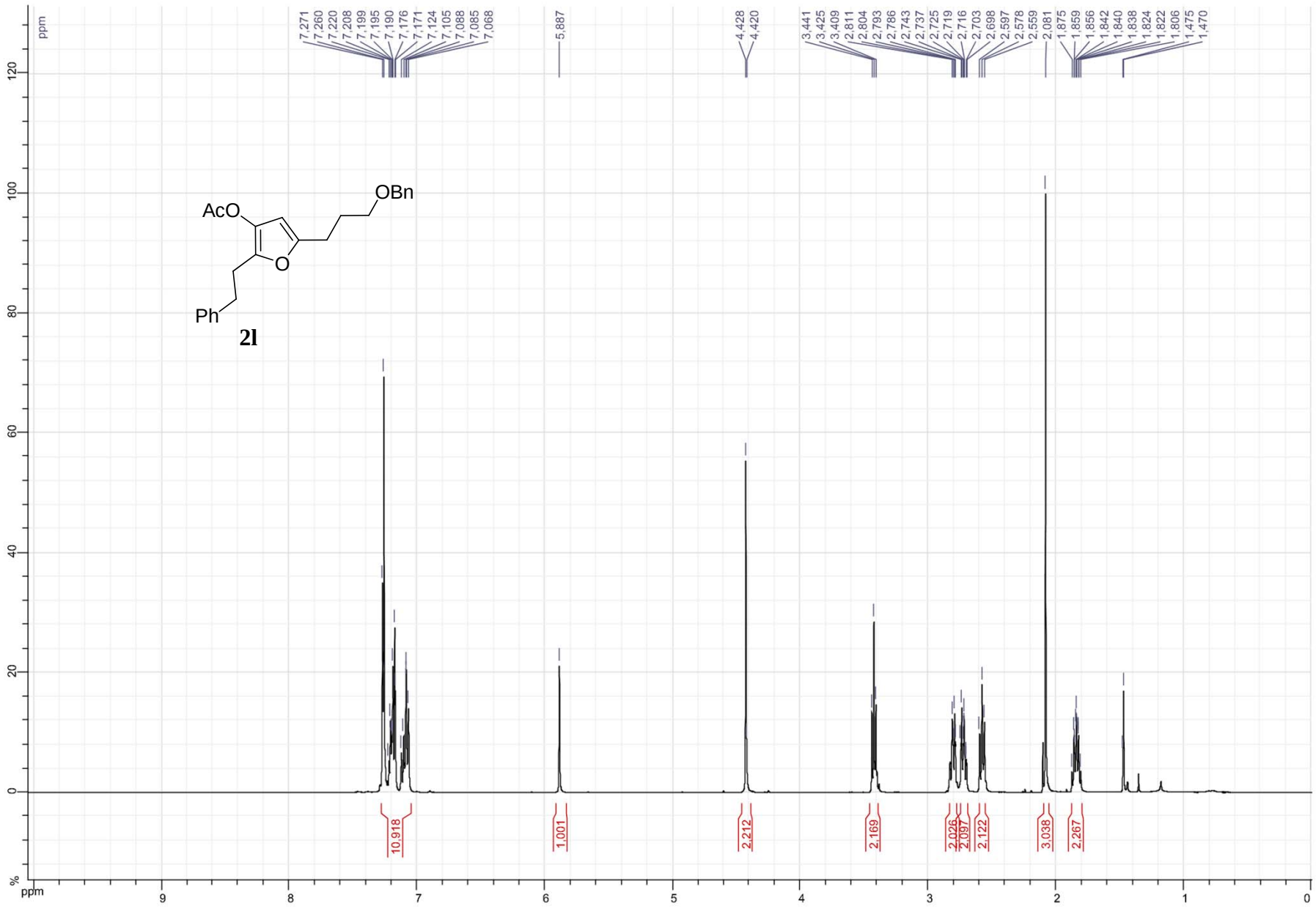
2j

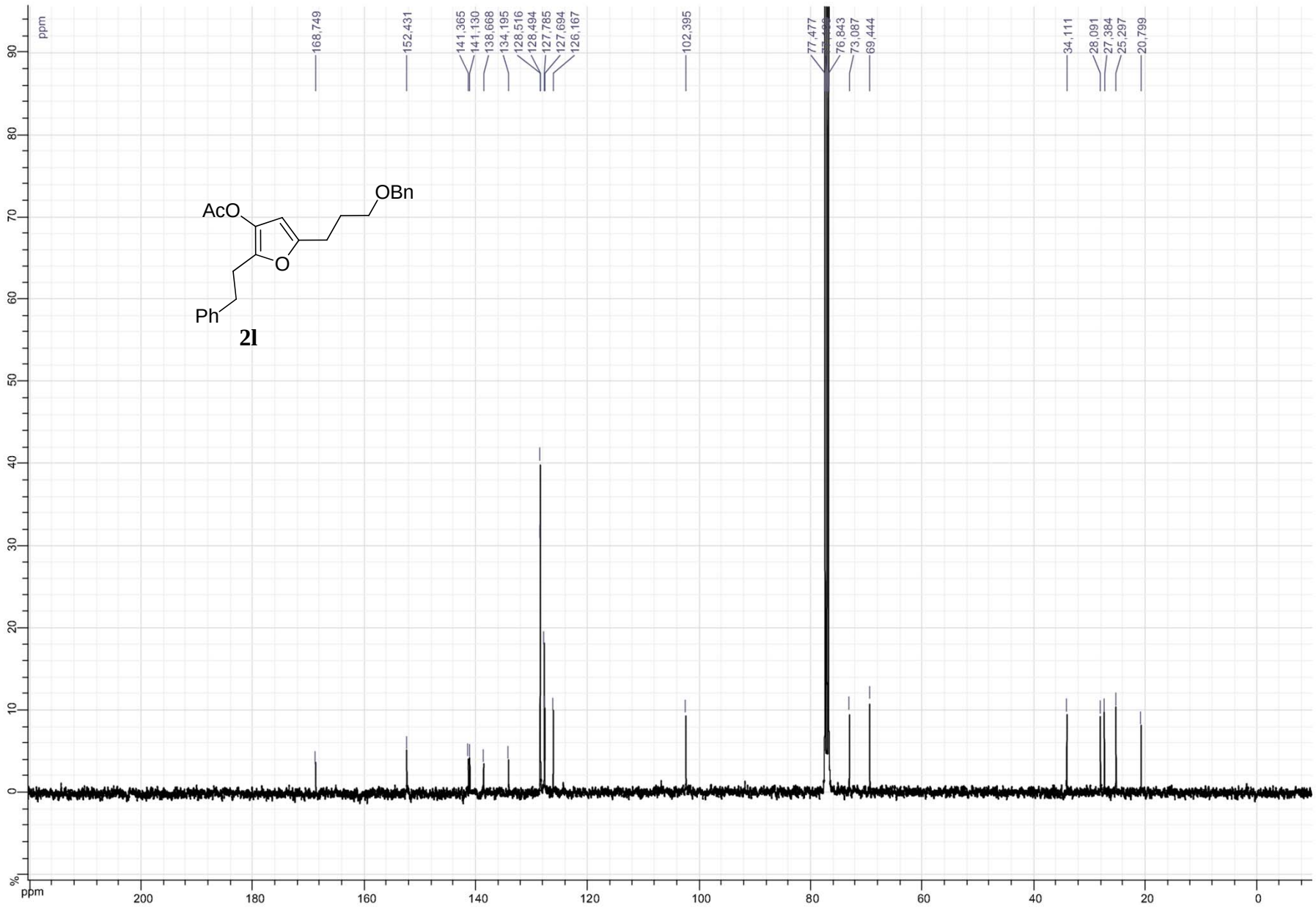

ppm
171,563
152,800
137,938
134,141
102,144
77,477
77,160
76,843
36,044
30,555
21,273
18,640
13,870
13,765
10,720
C3H7
O
O
C3H7
Me
O
2j
%
ppm
200
180
160
140
120
100
80
60
40
20
0


ppm
7,336
7,270
7,263
7,260
7,176
5,927
3,060
3,045
3,029
2,936
2,922
2,916
2,905
2,848
2,832
2,817
2,089
4,186
5,729
1,000
2,066
2,064
4,121
3,050
O
O
Ph
Ph
O

2k


ppm
170,855
151,833
141,233
140,189
138,363
133,988
128,719
128,539
128,486
128,473
126,577
126,218
102,468
77,413
77,160
76,906
35,762
34,244
31,074
30,478
10,678
O
O
Ph
Ph
O
2k
%
ppm
200
180
160
140
120
100
80
60
40
20
0


ppm
7.271
7.260
7.220
7.208
7.199
7.195
7.190
7.176
7.171
7.124
7.105
7.088
7.085
7.068
5.887
4.428
4.420
3.441
3.425
3.409
2.811
2.804
2.793
2.786
2.743
2.737
2.725
2.719
2.716
2.703
2.698
2.597
2.578
2.559
2.081
1.875
1.859
1.856
1.842
1.840
1.838
1.824
1.822
1.806
1.475
1.470
AcO
OBn
O
Ph
2l
10.918
1.001
2.212
2.169
2.026
2.097
2.122
3.038
2.267
%
ppm


ppm
168,749
152,431
141,365
141,130
138,668
134,195
128,516
128,494
127,785
127,694
126,167
102,395
77,477
76,843
73,087
69,444
34,111
28,091
27,384
25,297
20,799
AcO
OBn
O
Ph
2l
%
ppm
200
180
160
140
120
100
80
60
40
20
0