

# Pd-Catalyzed Oxidative Heck Reaction of Grignard Reagents with Diaziridinone as Oxidant

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## Supporting Information

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**General methods.** All commercially available reagents were used without further purification. Column chromatography was performed on silica gel (200-400 mesh). <sup>1</sup>H NMR spectra were recorded on a 300 or 400 MHz NMR spectrometer and <sup>13</sup>C NMR spectra were recorded on a 75 or 100 MHz NMR spectrometer. IR spectra were recorded on a FT-IR spectrometer. Melting points were uncorrected. Di-*t*-butyldiaziridinone (**1**) was prepared by following the reported procedure (H. Du, B. Zhao, Y. Shi, *Org. Synth.* **2009**, 86, 315).

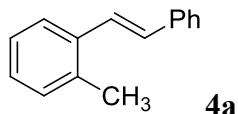
**Representative procedure for oxidative Heck reaction of Grignard reagents (Table 2, entry 1, 4a):** To a 4.0 mL flame dried vial equipped with a magnetic stir bar was added Pd(OAc)<sub>2</sub> (0.00089 g, 0.0040 mmol). The sealed vial was vacuumed and refilled with argon three times, followed by the addition of dry ether (0.25 mL), THF (0.05 mL), styrene (**3a**) (0.0208 g, 0.20 mmol), and di-*t*-butyldiaziridinone (**1**) (0.068 g, 0.40 mmol) via syringe. The vial was placed in an ice bath and Grignard reagent **2a** (2.0 M in Et<sub>2</sub>O) (0.30 mL, 0.60 mmol) was added dropwise in 5 min. The ice bath was removed and the reaction mixture was vigorously stirred at rt overnight. To the reaction mixture was added hexane to precipitate urea and magnesium salts. The solid was removed by filtration. The filtrate was concentrated and purified by flash chromatography (silica gel, hexanes/ether/DCM = 100:1:2) to give product **4a** (0.028 g, 72%) as a colorless oil.

**Representative procedure for oxidative Heck reaction of Grignard reagents on 1 mmol Scale (Table 2, entry 1, 4a):** To a 10 mL flame dried vial equipped with a magnetic stir bar was added Pd(OAc)<sub>2</sub> (0.0045 g, 0.020 mmol). The sealed vial was vacuumed and refilled with argon three times, followed by the addition of dry ether (1.25 mL), THF (0.25 mL), styrene (**3a**) (0.104 g, 1.00 mmol), and di-*t*-butyldiaziridinone (**1**) (0.34 g, 2.0 mmol) via syringe. The vial was placed in an ice bath and Grignard reagent **2a** (2.0 M in Et<sub>2</sub>O) (1.50 mL, 3.00 mmol) was added dropwise in 5 min. The ice bath was removed and the reaction mixture was vigorously stirred at rt overnight. To the reaction mixture was added hexane to precipitate urea and magnesium salts. The solid was removed by filtration. The filtrate was concentrated and purified by flash

chromatography (silica gel, hexanes/ether/DCM = 100:1:2) to give product **4a** (0.132 g, 68%) as a colorless oil.

### Characterization data

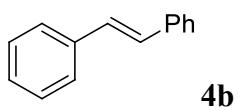
**Table 2, entry 1**



Colorless oil (0.028 g, 72%); IR (film) 1598, 1495 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.60 (d, *J* = 7.2 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 2H), 7.37 (dd, *J* = 8.0, 7.2 Hz, 2H), 7.34 (d, *J* = 16.4 Hz, 1H), 7.30-7.16 (m, 4H), 7.00 (d, *J* = 16.4 Hz, 1H), 2.44 (s, 3H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 137.8, 136.5, 135.9, 130.5, 130.1, 128.8, 127.73, 127.69, 126.70, 126.69, 126.3, 125.5, 20.1.

E. Alacid, C. Na'jera, *J. Org. Chem.* **2009**, *74*, 2321.

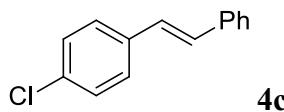
**Table 2, entry 2**



White solid (0.026 g, 72%); m.p. 123-124 °C; IR (film) 1598, 1495, 1452, 961 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.52 (d, *J* = 7.6 Hz, 4H), 7.36 (t, *J* = 7.6 Hz, 4H), 7.26 (t, *J* = 7.6 Hz, 2H), 7.11 (s, 2H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 137.4, 128.8, 127.7, 126.6.

R. Wang, B. Twamley, J.M. Shreeve, *J. Org. Chem.* **2006**, *71*, 426.

**Table 2, entry 3**

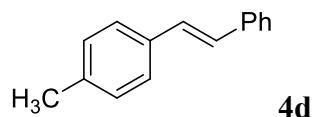


White solid (0.027 g, 63%); m.p. 122-123 °C; IR (film) 1588, 1488, 1087 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.50 (d, *J* = 7.6 Hz, 2H), 7.43 (d, *J* = 8.4 Hz, 2H), 7.36 (dd, *J* = 8.0, 7.2 Hz, 2H), 7.32 (d, *J* = 8.4 Hz, 2H), 7.27 (t, *J* = 7.6 Hz, 1H), 7.08 (d, *J* = 16.4 Hz, 1H), 7.04 (d, *J* = 16.4 Hz,

1H);  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ )  $\delta$  137.1, 136.0, 133.3, 129.4, 129.0, 128.9, 128.0, 127.8, 127.5, 126.7.

Z. Xi, B. Liu, W. Chen, *J. Org. Chem.* **2008**, *73*, 3954.

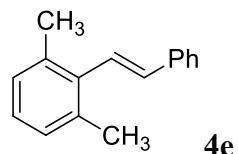
**Table 2, entry 4**



White solid (0.018 g, 46%); m.p. 108-109 °C; IR (film) 1593, 1509, 1448  $\text{cm}^{-1}$ ;  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.50 (d,  $J = 8.0$  Hz, 2H), 7.41 (d,  $J = 8.0$  Hz, 2H), 7.35 (t,  $J = 8.0, 7.6$  Hz, 2H), 7.24 (t,  $J = 7.6$  Hz, 1H), 7.17 (d,  $J = 8.0$  Hz, 2H), 7.10 (d,  $J = 16.4$  Hz, 1H), 7.05 (d,  $J = 16.4$  Hz, 1H), 2.36 (s, 3H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  137.7, 134.7, 129.5, 128.79, 128.77, 127.8, 127.5, 126.6, 126.5, 21.4.

R. Wang, B. Twamley, J.M. Shreeve, *J. Org. Chem.* **2006**, *71*, 426.

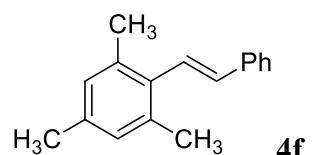
**Table 2, entry 5**



Colorless oil (0.030 g, 72%); IR (film) 1594, 1465  $\text{cm}^{-1}$ ;  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.53 (d,  $J = 7.6$  Hz, 2H), 7.40 (t,  $J = 7.6$  Hz, 2H), 7.30 (dd,  $J = 7.6, 7.2$  Hz, 1H), 7.14 (d,  $J = 16.8$  Hz, 1H), 7.12-7.07 (m, 3H), 6.63 (d,  $J = 16.8$  Hz, 1H), 2.40 (s, 6H);  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ )  $\delta$  137.7, 137.1, 136.4, 134.1, 128.8, 128.0, 127.7, 127.0, 126.8, 126.4, 21.2.

H. Huang, H. Liu, H. Jiang, K. Chen, *J. Org. Chem.* **2008**, *73*, 6037.

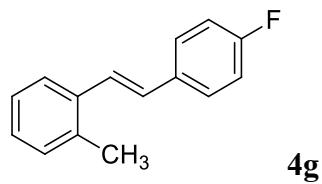
**Table 2, entry 6**



White solid (0.025 g, 56%); m.p. 47-49 °C; IR (film) 1596, 1448, 1375 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.50 (d, *J* = 8.0 Hz, 2H), 7.37 (t, *J* = 7.6 Hz, 2H), 7.27 (dd, *J* = 7.6, 7.2 Hz, 1H), 7.10 (d, *J* = 16.8 Hz, 1H), 6.91 (s, 2H), 6.59 (d, *J* = 16.8 Hz, 1H), 2.34 (s, 6H), 2.29 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 137.9, 136.5, 136.3, 134.1, 133.8, 128.84, 128.78, 127.6, 127.0, 126.4, 21.2, 21.1.

T. E. Barder, S.D. Walker, J. R. Martinelli, S. L. Buchwald, *J. Am. Chem. Soc.* **2005**, *127*, 4685.

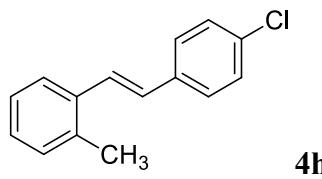
**Table 3, entry 1**



Colorless oil (0.029 g, 68%); IR (film) 1600, 1507, 1459, 1231 cm<sup>-1</sup>; <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) δ 7.63 (d, *J* = 6.9 Hz, 1H), 7.59-7.50 (m, 2H), 7.31 (d, *J* = 16.2 Hz, 1H), 7.32-7.22 (m, 3H), 7.17-7.07 (m, 2H), 7.03 (d, *J* = 16.2 Hz, 1H), 2.49 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 164.1, 160.8, 136.3, 135.9, 134.0, 133.9, 130.6, 128.9, 128.2, 128.1, 127.7, 126.42, 126.39, 126.36, 125.4, 115.9, 115.6, 20.1; HRMS calcd for C<sub>15</sub>H<sub>13</sub>F (M<sup>+</sup>): 212.1001; found: 212.0997.

Z. Chen, M. Luo, Y. Wen, G. Luo, L. Liu, *Org. Lett.* **2014**, *16*, 3020.

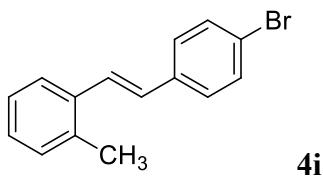
**Table 3, entry 2**



White solid (0.039 g, 86%); m.p. 63-64 °C; IR (film) 1489, 1457, 1086 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.58 (d, *J* = 7.6 Hz, 1H), 7.45 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.31 (d, *J* = 16.4 Hz, 1H), 7.28-7.18 (m, 3 H), 6.95 (d, *J* = 16.4 Hz, 1H), 2.44 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 136.3, 136.1, 136.0, 133.3, 130.6, 128.9, 128.8, 127.9, 127.8, 127.2, 126.4, 125.4, 20.1. HRMS calcd for C<sub>15</sub>H<sub>13</sub>Cl (M<sup>+</sup>): 228.0706; found: 228.0707.

A. Bhunia, A. Studer, *ACS Catal.* **2018**, *8*, 1213.

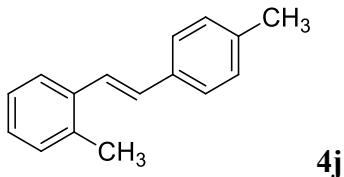
**Table 3, entry 3**



White solid (0.038 g, 70%); m.p. 66-67 °C; IR (film) 1487, 1457, 1069 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.57 (d, *J* = 7.2 Hz, 1H), 7.48 (d, *J* = 8.4 Hz, 2H), 7.38 (d, *J* = 8.4 Hz, 2H), 7.32 (d, *J* = 16.0 Hz, 1H), 7.25-7.16 (m, 3H), 6.92 (d, *J* = 16.0 Hz, 1H), 2.43 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 136.7, 136.1, 136.0, 131.9, 130.6, 128.8, 128.2, 127.9, 127.3, 126.4, 125.5, 121.4, 20.1; HRMS calcd for C<sub>15</sub>H<sub>13</sub>Br (M<sup>+</sup>): 272.0201; found: 272.0199.

A. Bhunia, A. Studer, *ACS Catal.* **2018**, 8, 1213.

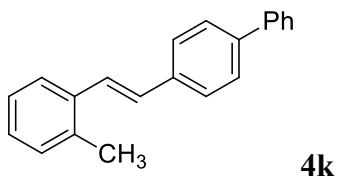
**Table 3, entry 4**



Colorless oil (0.026 g, 63%); IR (film) 1573, 1511, 1483, 1457 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.58 (d, *J* = 7.2 Hz, 1H), 7.42 (d, *J* = 8.0 Hz, 2H), 7.29 (d, *J* = 16.0 Hz, 1H), 7.24-7.13 (m, 5H), 6.98 (d, *J* = 16.0 Hz, 1H), 2.43 (s, 3H), 2.37 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 137.6, 136.7, 135.8, 135.0, 130.5, 130.0, 129.5, 127.5, 126.6, 126.3, 125.7, 125.4, 21.4, 20.1.

E. Shirakawa, X. Zhang, T. Hayashi *Angew. Chem. Int. Ed.* **2011**, 50, 4671.

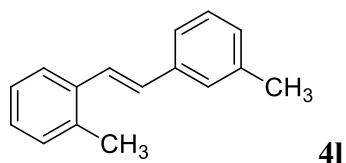
**Table 3, entry 5**



White solid (0.035 g, 65%); m.p. 108-109 °C; IR (film) 1486, 1408 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.65-7.58 (m, 7H), 7.45 (t, *J* = 7.6 Hz, 2H), 7.38 (d, *J* = 16.4 Hz, 1H), 7.35 (t, *J* = 7.2 Hz, 1H), 7.35-7.16 (m, 3H), 7.04 (d, *J* = 16.4 Hz, 1H), 2.45 (s, 3H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 140.8, 140.5, 136.9, 136.5, 136.0, 130.6, 129.6, 129.0, 127.7, 127.51, 127.47, 127.13, 127.07, 126.7, 126.4, 125.5, 20.1; HRMS calcd for C<sub>21</sub>H<sub>18</sub> (M<sup>+</sup>): 270.1409; found: 270.1408.

A. Bhunia, A. Studer, *ACS Catal.* **2018**, 8, 1213.

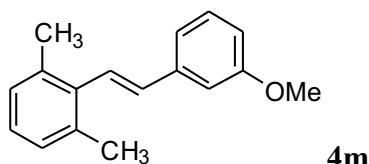
**Table 3, entry 6**



Colorless oil (0.029 g, 70%); IR (film) 1602, 1489, 1378 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.60 (d, *J* = 7.2 Hz, 1H), 7.38-7.30 (m, 3H), 7.27 (t, *J* = 7.6 Hz, 1H), 7.24-7.15 (m, 3H), 7.10 (d, *J* = 7.6 Hz, 1H), 6.99 (d, *J* = 16.4 Hz, 1H), 2.45 (s, 3H), 2.40 (s, 3H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 138.4, 137.8, 136.6, 135.9, 130.5, 130.3, 128.7, 128.6, 127.6, 127.4, 126.5, 126.3, 125.5, 123.9, 21.6, 20.1.

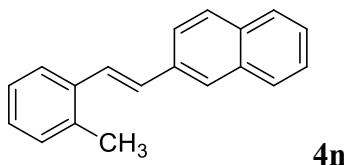
A. Bhunia, A. Studer, *ACS Catal.* **2018**, 8, 1213.

**Table 3, entry 7**



Pale yellow oil (0.034 g, 71%); IR (film) 1595, 1578, 1464, 1270 cm<sup>-1</sup>; <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) δ 7.33 (t, *J* = 7.8 Hz, 1H), 7.15 (d, *J* = 16.5 Hz, 1H); 7.19-7.05 (m, 5H), 6.86 (ddd, *J* = 8.1, 2.4, 0.9 Hz, 1H), 6.62 (d, *J* = 16.5 Hz, 1H), 3.89 (s, 3H), 2.41 (s, 6H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 160.0, 139.2, 136.9, 136.3, 134.0, 129.8, 128.0, 127.4, 126.9, 119.1, 113.1, 111.9, 55.4, 21.2; HRMS calcd for C<sub>17</sub>H<sub>18</sub>O (M<sup>+</sup>): 238.1358; found: 238.1355.

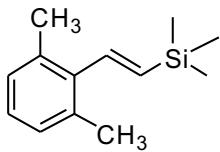
**Table 3, entry 8**



White solid (0.036 g, 74%); m.p. 86-87 °C; IR (film) 1595, 1460 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.88-7.80 (m, 4H), 7.76 (d, *J* = 8.8 Hz, 1H), 7.66 (d, *J* = 7.2 Hz, 1H), 7.52-7.42 (m, 3H), 7.26-7.19 (m, 3H), 7.17 (d, *J* = 16.4 Hz, 1H), 2.48 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 136.5, 136.0, 135.3, 133.8, 133.1, 130.6, 130.2, 128.4, 128.1, 127.84, 127.75, 126.9, 126.8, 126.5, 126.4, 126.0, 125.5, 123.7, 20.2.

A. Bhunia, A. Studer, *ACS Catal.* **2018**, *8*, 1213.

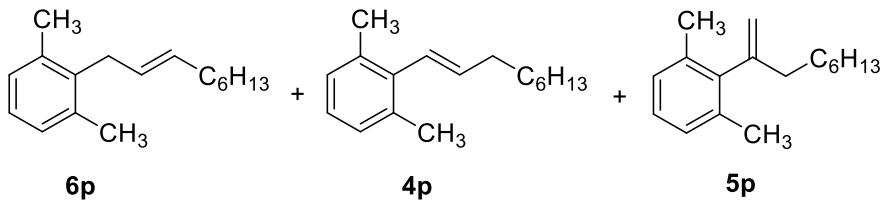
**Table 3, entry 9**



**4o**

Colorless oil (0.037 g, 91%); IR (film) 1487, 1457, 1399 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.10-6.96 (m, 3H), 6.87 (d, *J* = 19.6 Hz, 1H), 5.92 (d, *J* = 19.6 Hz, 1H), 2.28 (s, 6H), 0.17 (s, 9H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 142.5, 139.6, 136.2, 135.4, 127.9, 126.6, 20.9, -1.1; HRMS calcd for C<sub>13</sub>H<sub>20</sub>Si (M<sup>+</sup>): 204.1334; found: 204.1331.

**Table 3, entry 10**

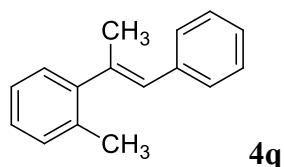


Colorless oil (0.022 g, 48%); IR (film) 1465, 1377 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.15-6.95 (m, 3H), 6.29 (d, *J* = 16.4 Hz, 0.11H for **4p**), 5.65 (dt, *J* = 16.4, 6.8 Hz, 0.11H for **4p**), 5.44 (dt, *J* = 15.2, 6.0 Hz, 0.89H for **6p** and **5p**), 5.36-5.22 (m, 0.89H for **6p**), 4.80 (s, 0.08H for **5p**),

3.32 (d,  $J = 5.6$  Hz, 1.62H for **6p**), 2.63-2.15 (m, 6.38H), 1.95 (q,  $J = 6.8$  Hz, 1.62H for **6p**), 1.51-1.18 (m, 8.38H), 0.93-0.80 (m, 3H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  137.3, 136.7, 131.3, 128.1, 126.5, 125.9, 32.8, 32.7, 31.9, 29.6, 29.0, 22.8, 20.1, 14.2.

(1) Y. Nakao, S. Ebata, J. Chen, H. Imanaka, T. Hiyama *Chem. Lett.* **2007**, 36, 606. (2) M. Thimmaiah, X. Zhang, S. Fang *Tetrahedron Lett.* **2008**, 49, 5605. (3) R. Knorr, M. Knittl, C. Behringer, J. Ruhdorfer, P. Böhrer *J. Org. Chem.* **2017**, 82, 2843.

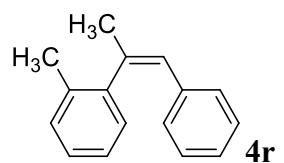
**Table 3, entry 11**



Colorless oil (0.020 g, 48%); IR (film) 1599, 1489, 1442  $\text{cm}^{-1}$ ;  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.43-7.34 (m, 4H), 7.28-7.15 (m, 5H), 6.38 (s, 1H), 2.36 (s, 3H), 2.19 (s, 3H);  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ )  $\delta$  145.9, 139.2, 138.2, 134.9, 130.3, 129.3, 129.1, 128.3, 128.2, 126.9, 126.6, 125.8, 20.1, 20.0.

X. Xu, J. Chen, W. Gao, H. Wu, J. Ding, W. Su, *Tetrahedron* **2010**, 66, 2433.

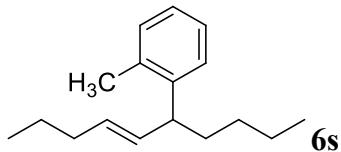
**Table 3, entry 12**



Colorless oil (0.024 g, 58%); IR (film) 1598, 1488, 1439  $\text{cm}^{-1}$ ;  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.25-7.15 (m, 3H), 7.12-7.00 (m, 4H), 6.83 (d,  $J = 8.0$  Hz, 2H), 6.47 (s, 1H), 2.14 (s, 3H), 2.12 (s, 3H);  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ )  $\delta$  142.2, 138.6, 137.6, 134.7, 130.5, 128.1, 128.0, 127.1, 127.0, 126.5, 126.3, 27.6, 19.3.

I. C. Burkow, L. K. Sydnes, D. C. N. Ubeda, *Acta Chem. Scand.* **1987**, B41, 235.

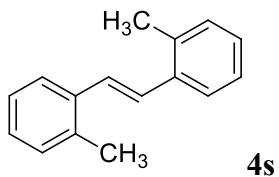
**Table 3, entry 13**



Colorless oil (0.024 g, 52%); IR (film) 1460, 1378 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.20-7.01 (m, 4H), 5.46 (dd, *J* = 15.2, 7.6 Hz, 1H), 5.37 (dt, *J* = 15.2, 6.4 Hz, 1H), 3.43-3.37 (m, 1H), 2.31 (s, 3H), 2.00-1.90 (m, 2H), 1.71-1.60 (m, 2H), 1.41-1.15 (m, 6H), 0.95-0.80 (m, 6H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 143.8, 135.8, 133.9, 130.4, 130.1, 126.3, 126.2, 125.7, 44.1, 35.5, 34.8, 30.0, 22.9, 22.8, 19.8, 14.2, 13.8.

HRMS calcd for C<sub>17</sub>H<sub>26</sub> (M<sup>+</sup>): 230.2035; found: 230.2032.

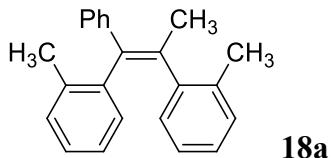
### Scheme 3, 4s



White solid (0.027 g, 65%); m.p. 76-78 °C; IR (film) 1493, 1460, 1378 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.59 (d, *J* = 7.2 Hz, 2H), 7.25-7.16 (m, 8H), 2.42 (s, 6H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 136.9, 136.0, 130.5, 128.1, 127.7, 126.3, 125.7, 20.1.

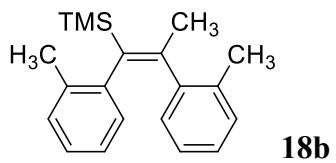
D-H. Lee, A. Taher, S. Hossain, and M-J. Jin, *Org. Lett.*, **2011**, *13*, 5540.

### Scheme 5, 18a



Pale yellow oil (0.040 g, 67%); IR (film) 1598, 1491, 1440 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.38-7.28 (m, 4H), 7.26-7.18 (m, 1H), 7.10-6.81 (m, 8H), 2.31 (s, 3H), 2.16 (s, 3H), 2.07 (s, 3H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 136.1, 134.7, 130.0, 129.99, 129.94, 127.9, 126.6, 126.5, 126.4, 125.3, 124.9, 22.6, 20.6, 19.8.; HRMS calcd for C<sub>23</sub>H<sub>22</sub> (M<sup>+</sup>): 298.1722; found: 298.1722.

### Scheme 5, 18b



Colorless oil (0.037 g, 63%); IR (film) 1457, 1375 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.02-6.60 (m, 8H), 2.29 (s, 3H), 2.21 (s, 6H), 0.15 (s, 9H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 148.7, 145.1, 144.5, 140.5, 134.2, 133.5, 129.6, 129.2, 126.7, 126.2, 126.1, 125.1, 125.0, 24.6, 20.8, 19.7, 0.5.

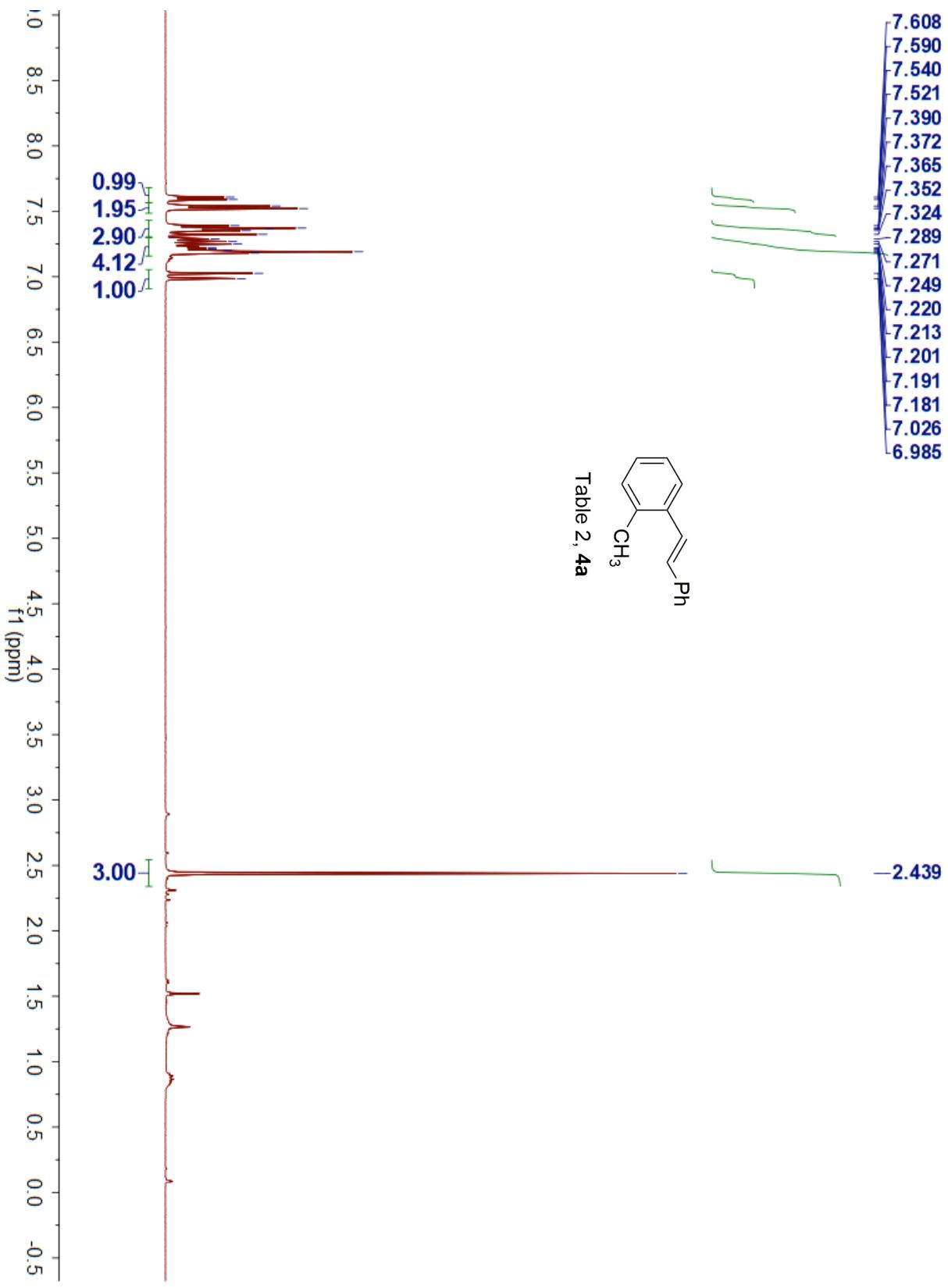
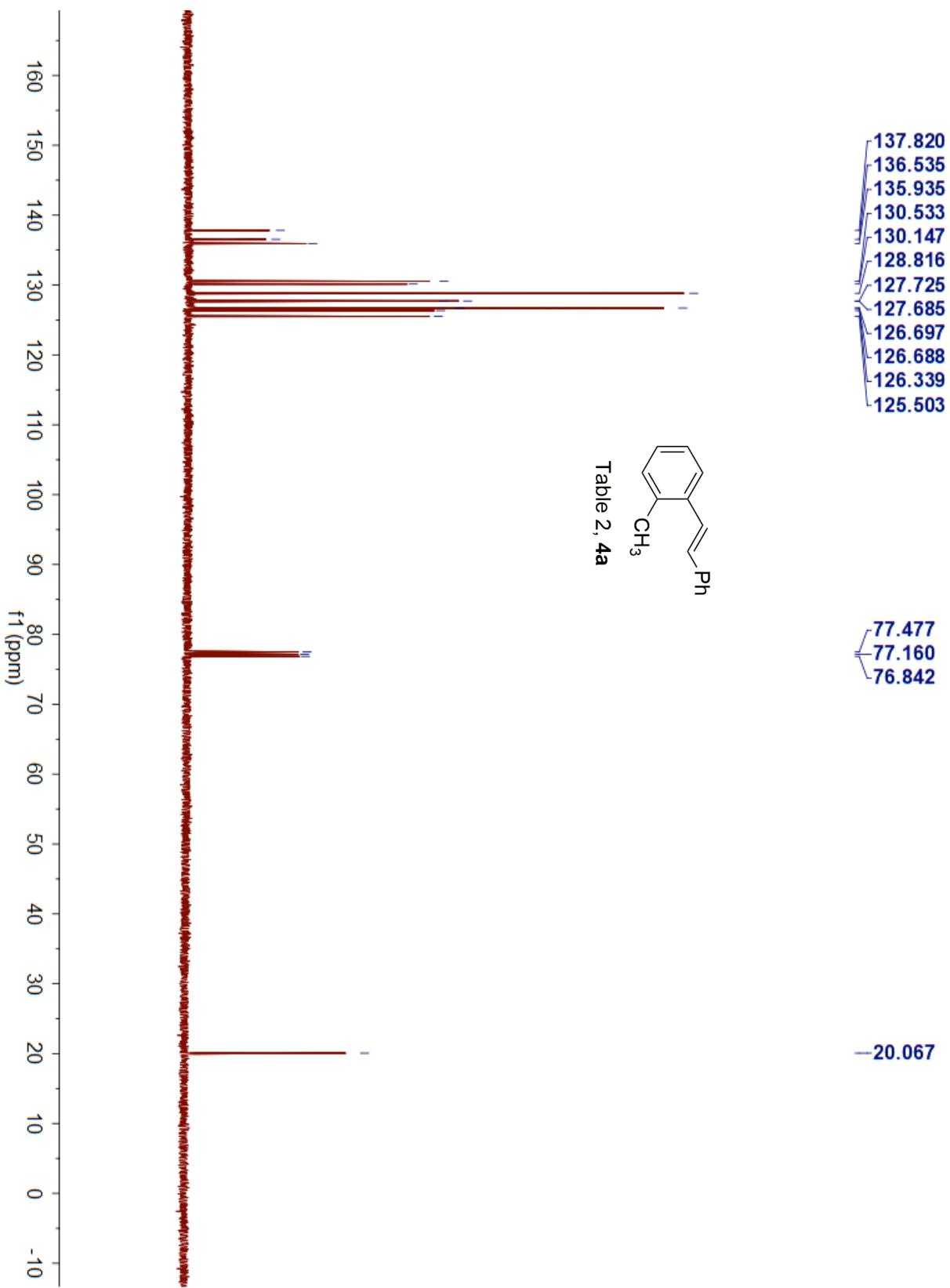


Table 2, 4a



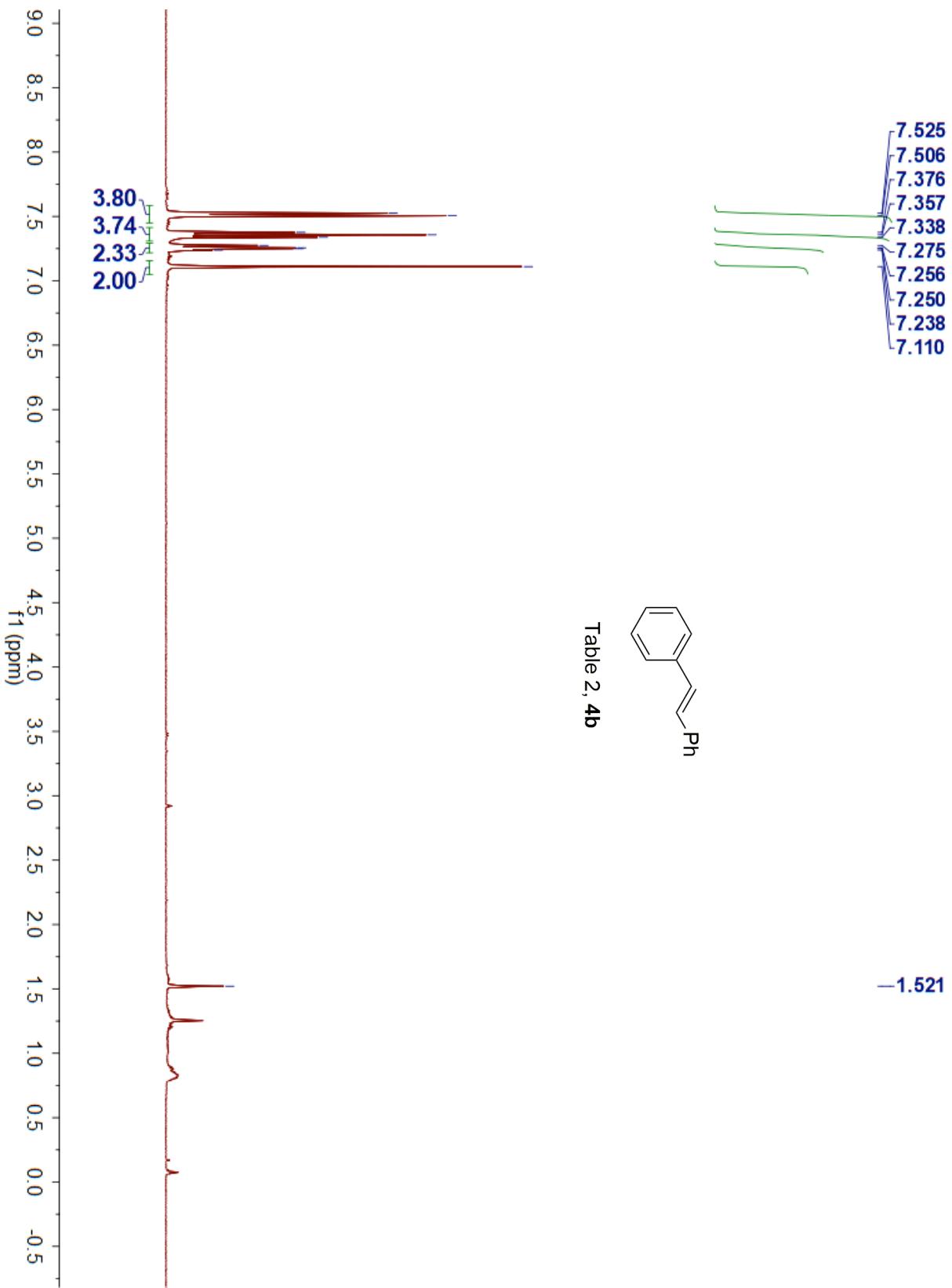
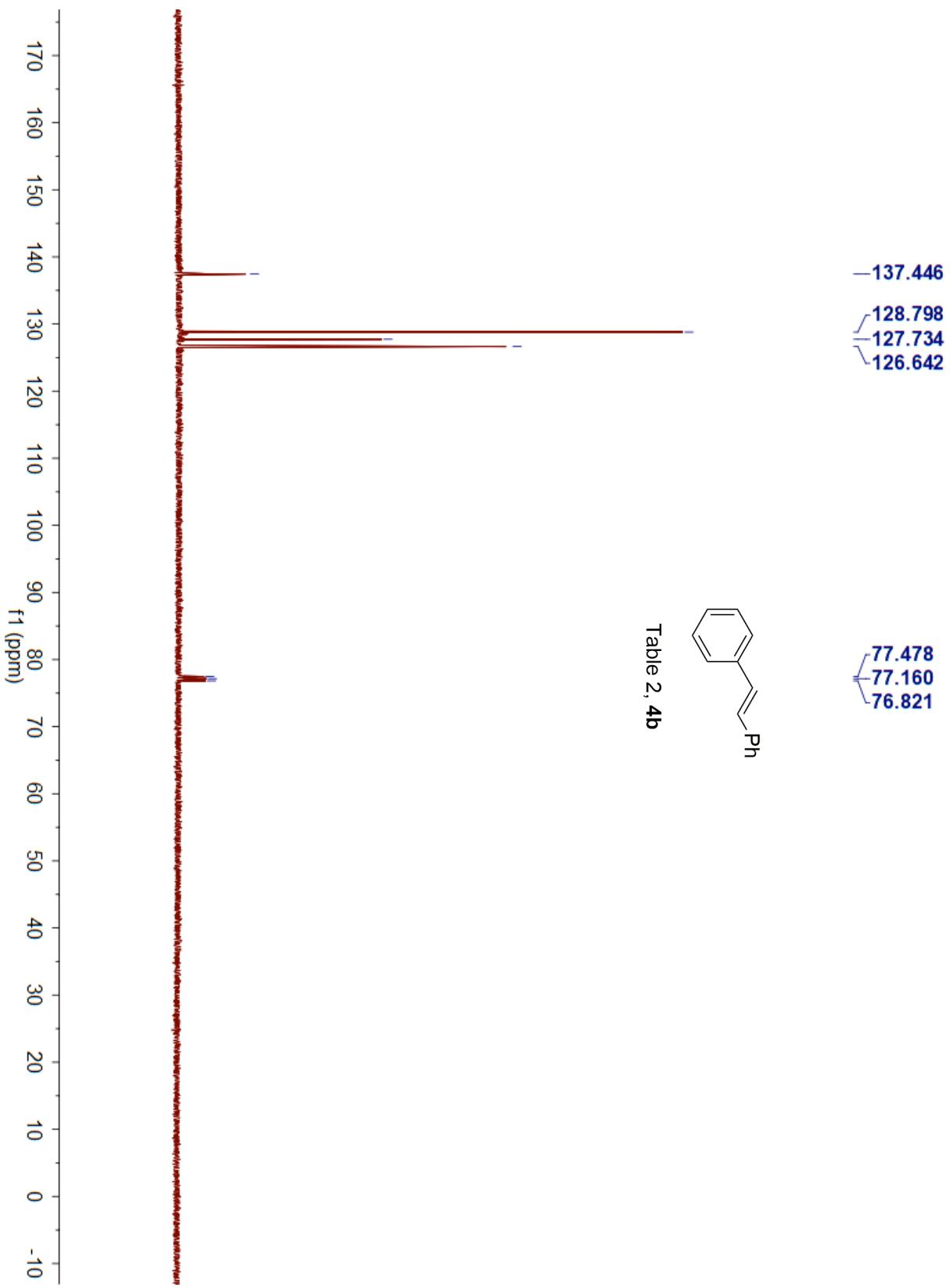
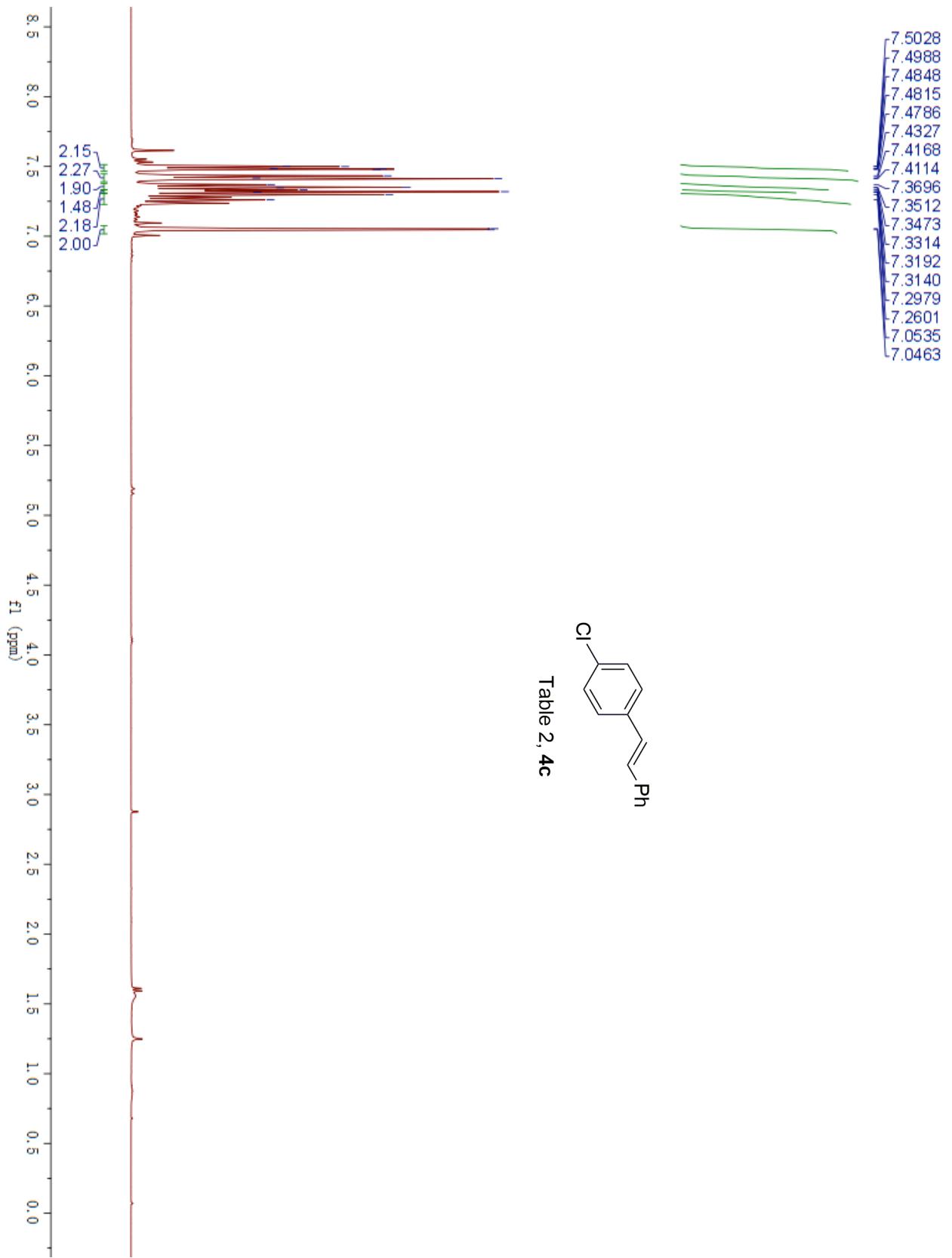
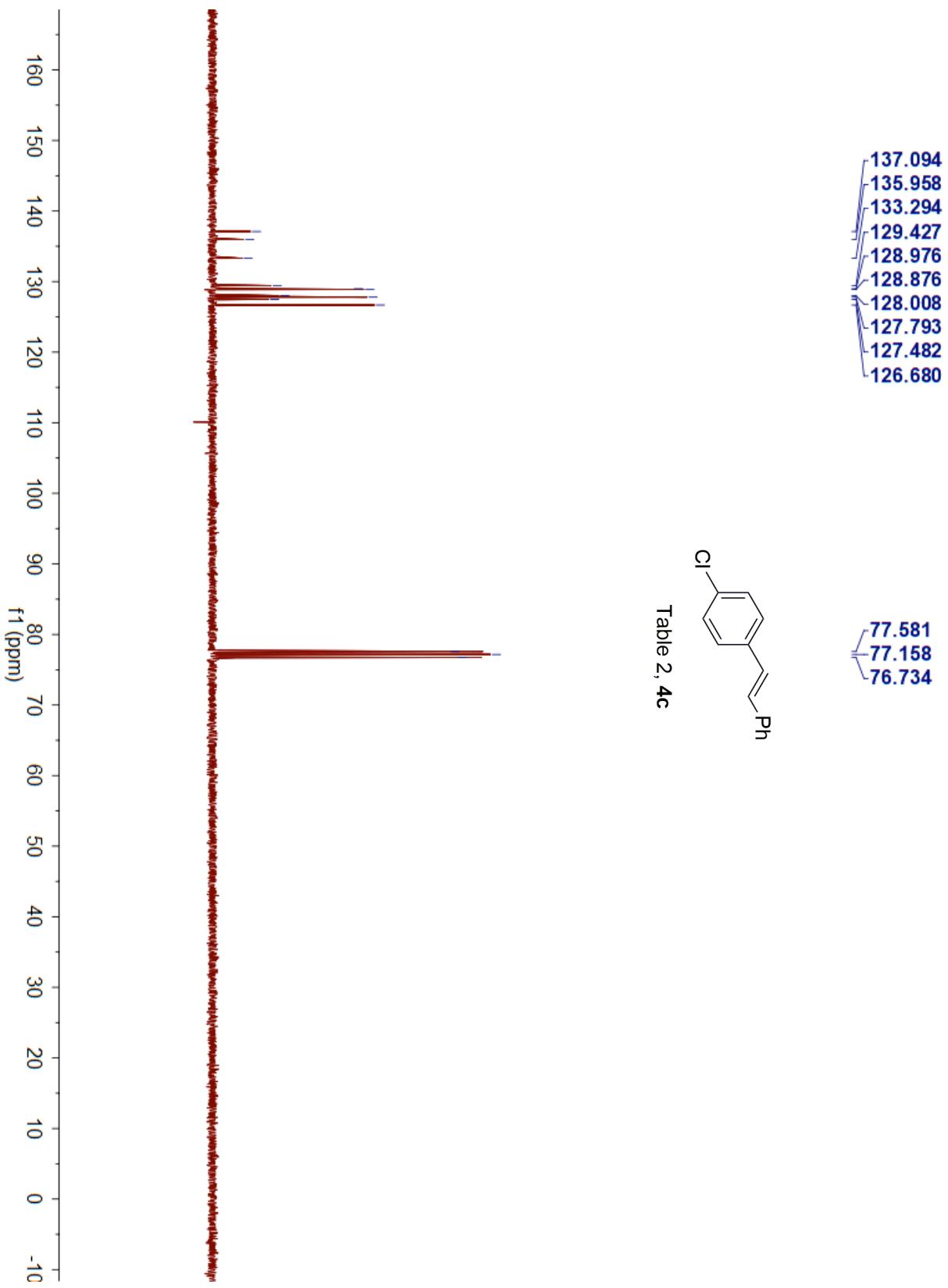
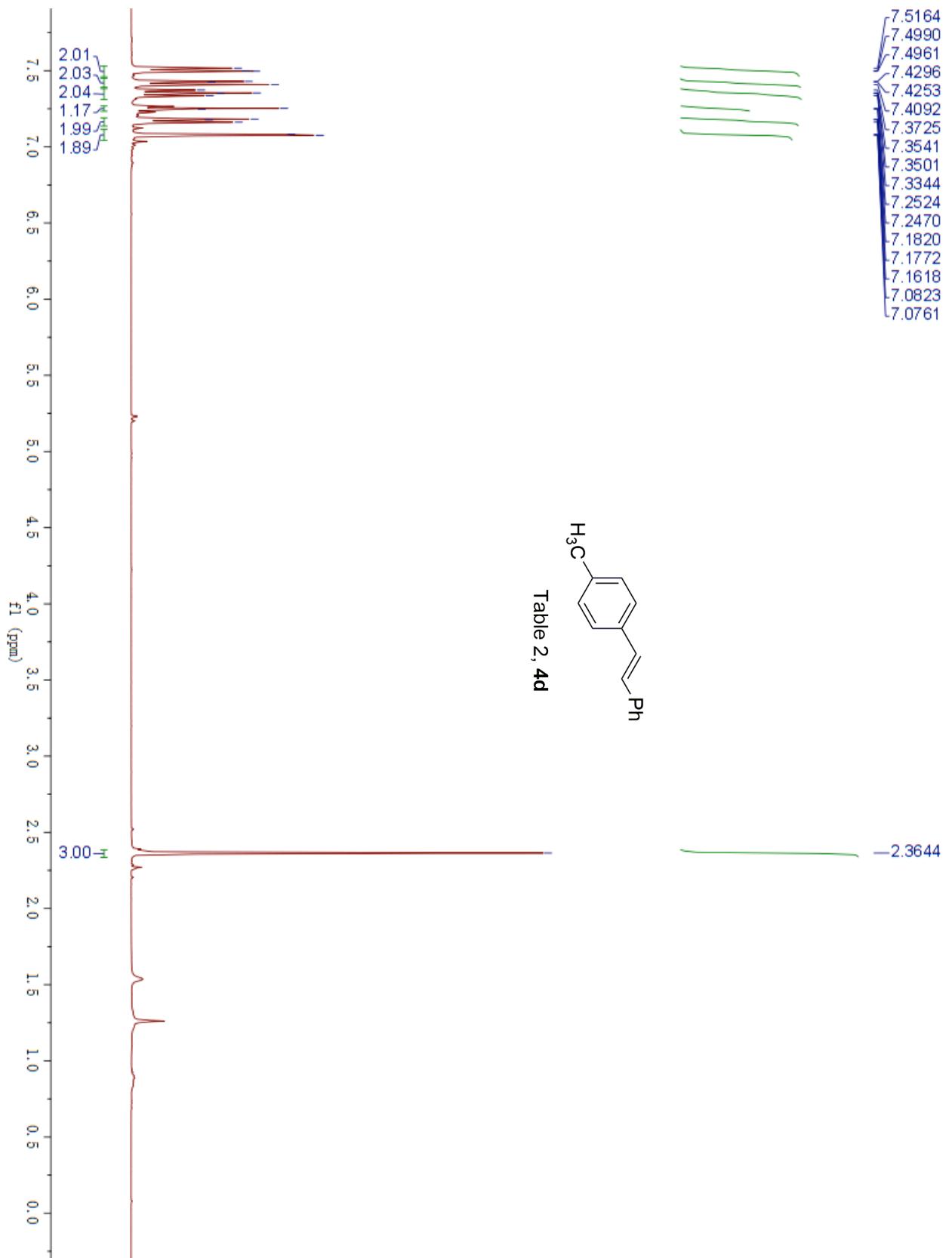


Table 2, **4b**









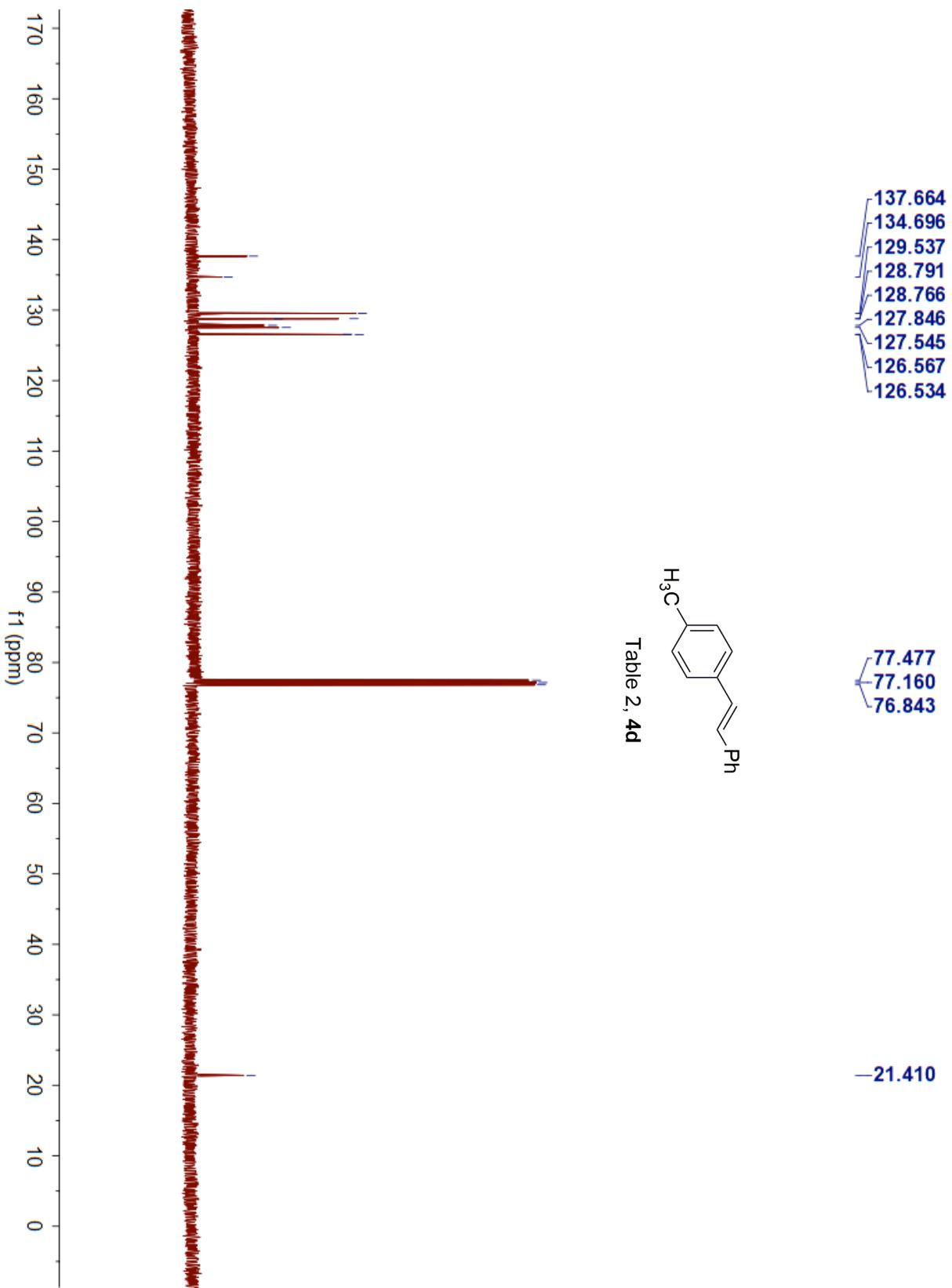
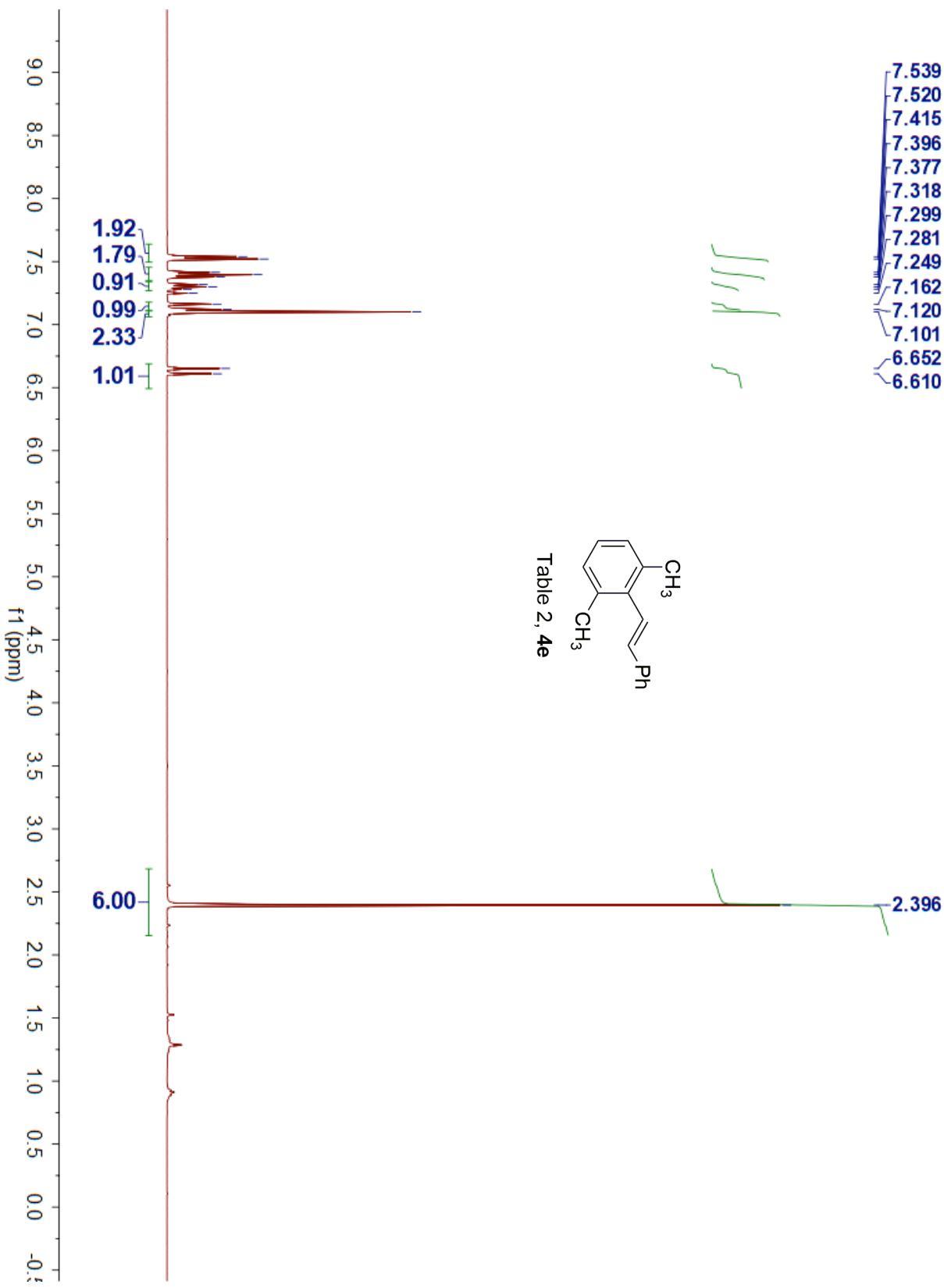
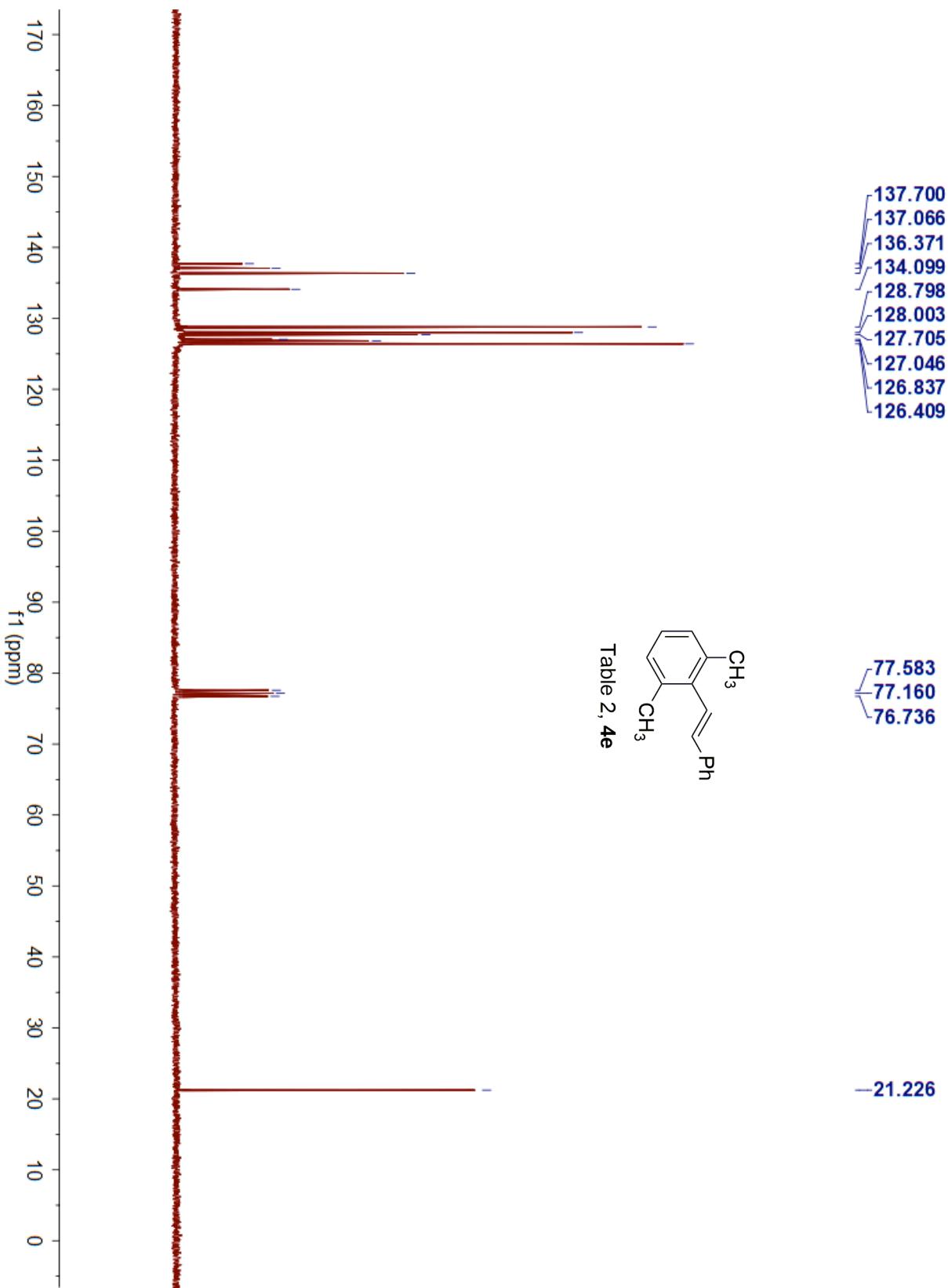
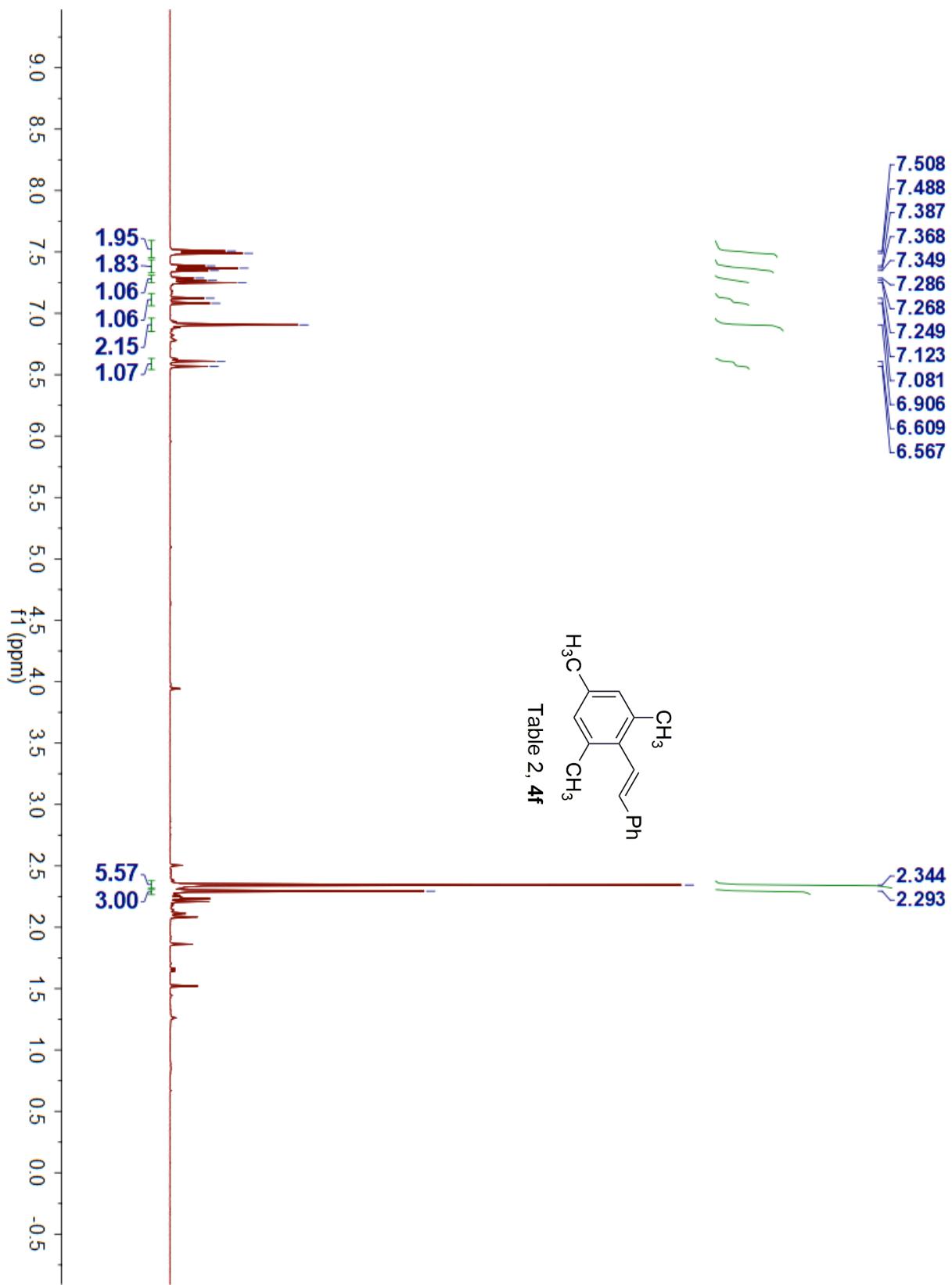
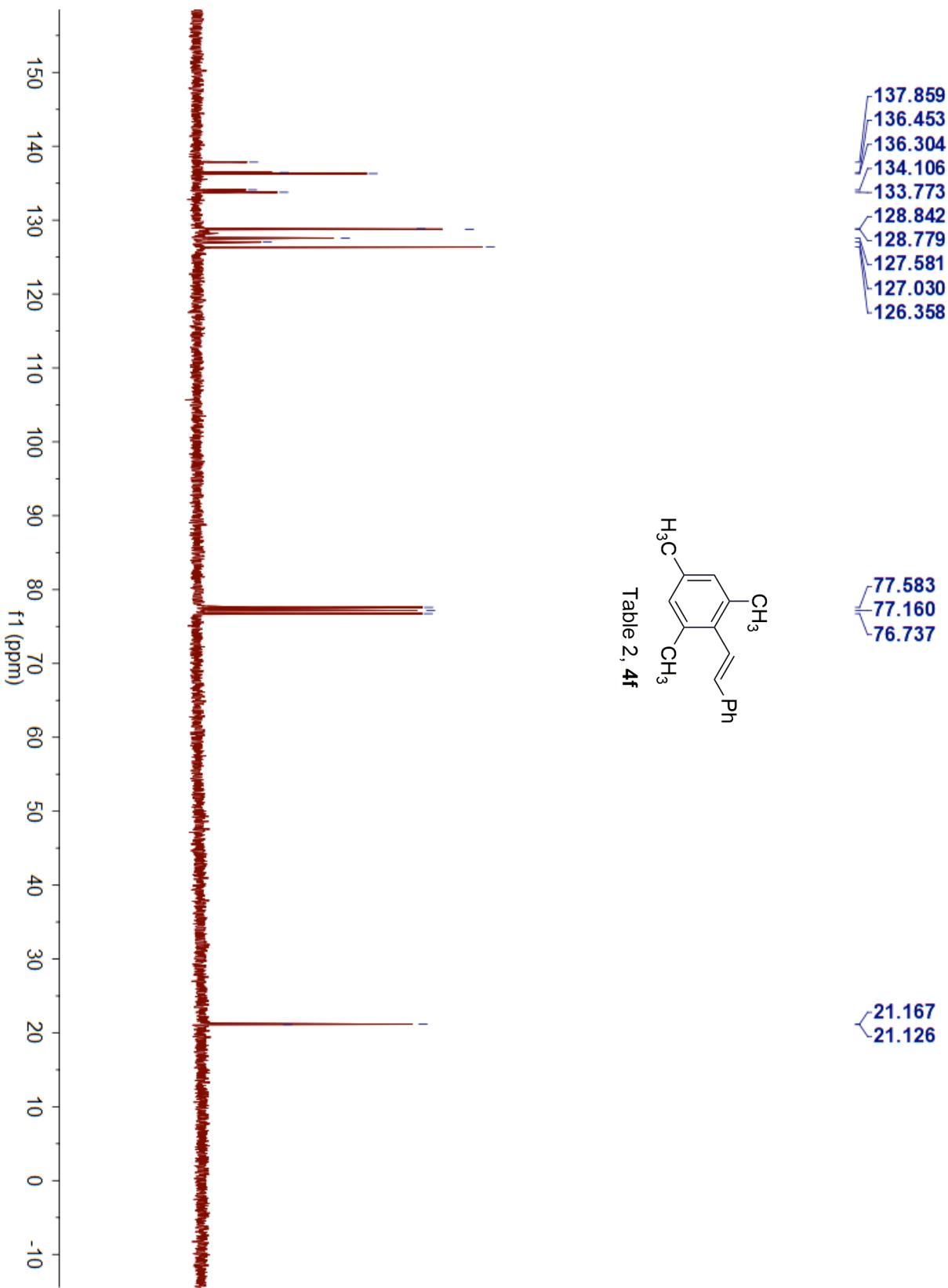


Table 2, **4d**









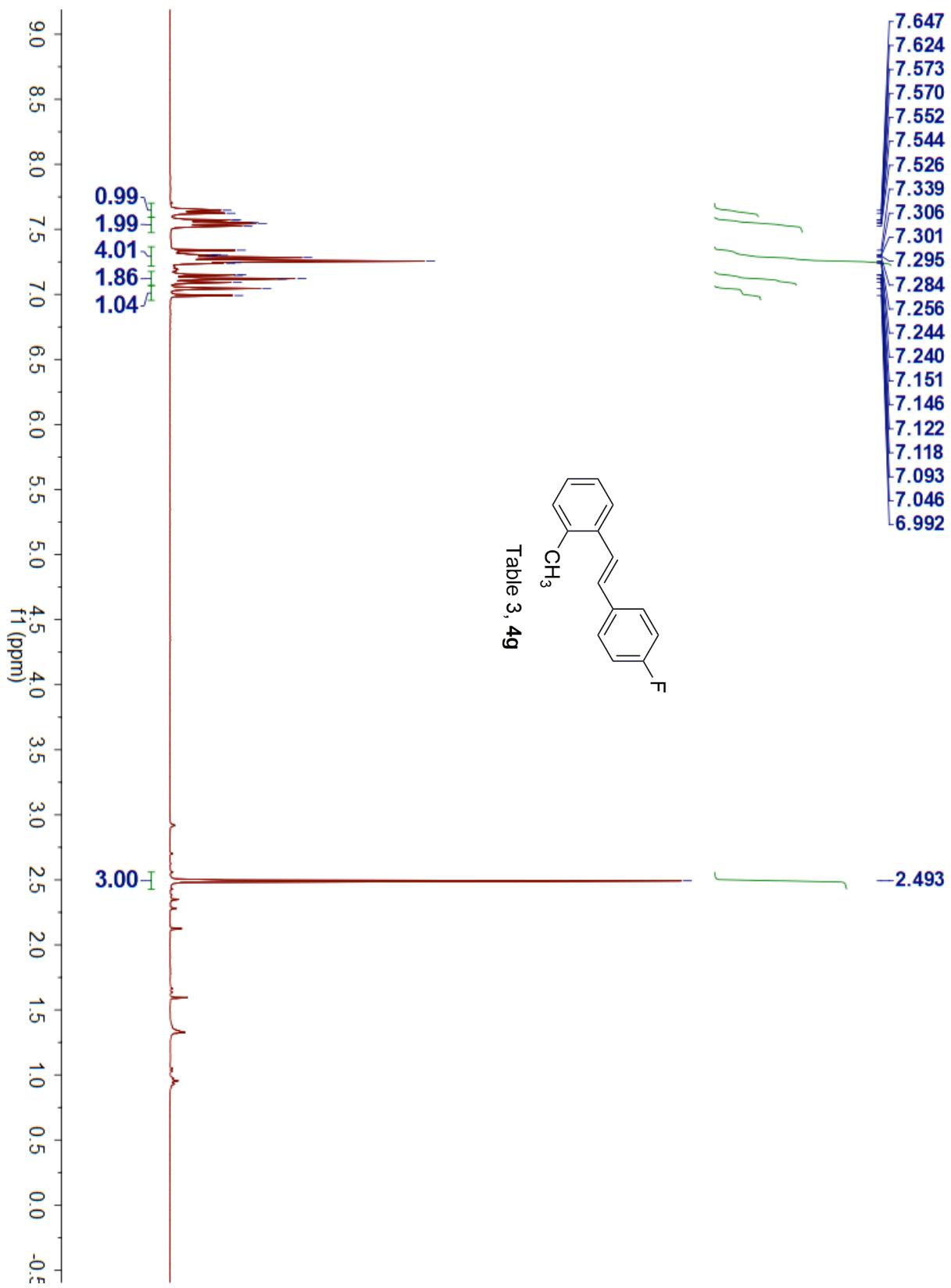
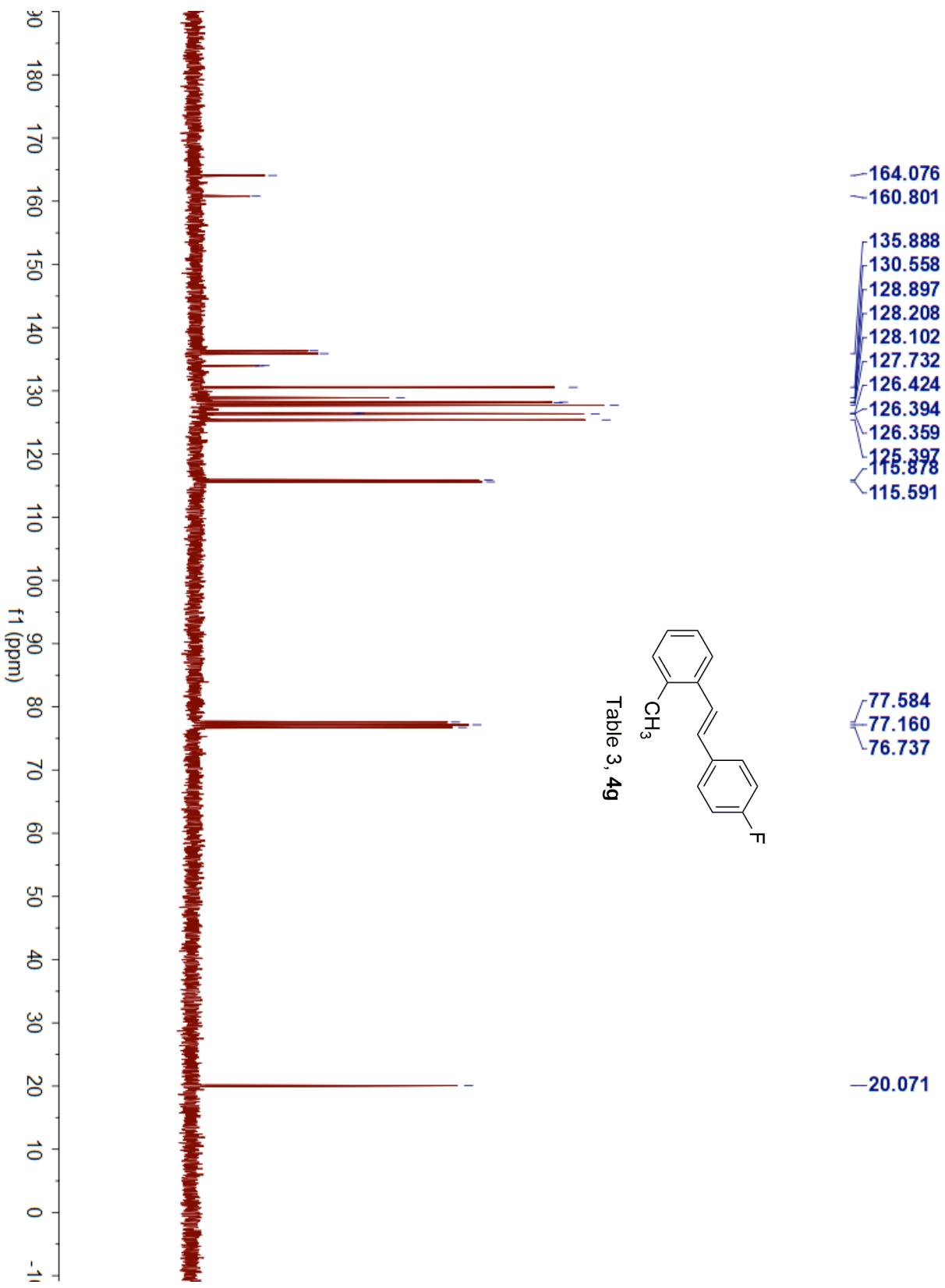
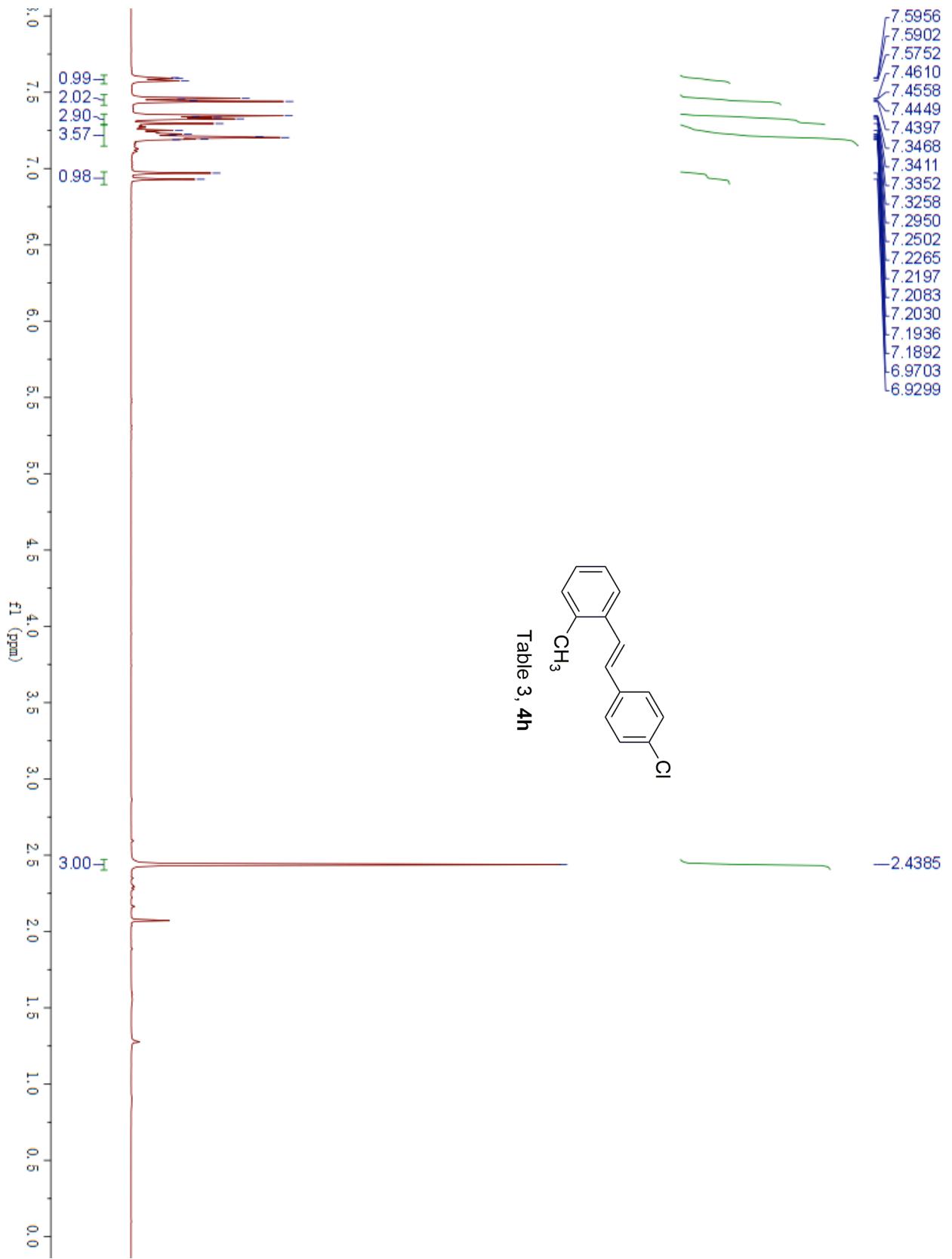
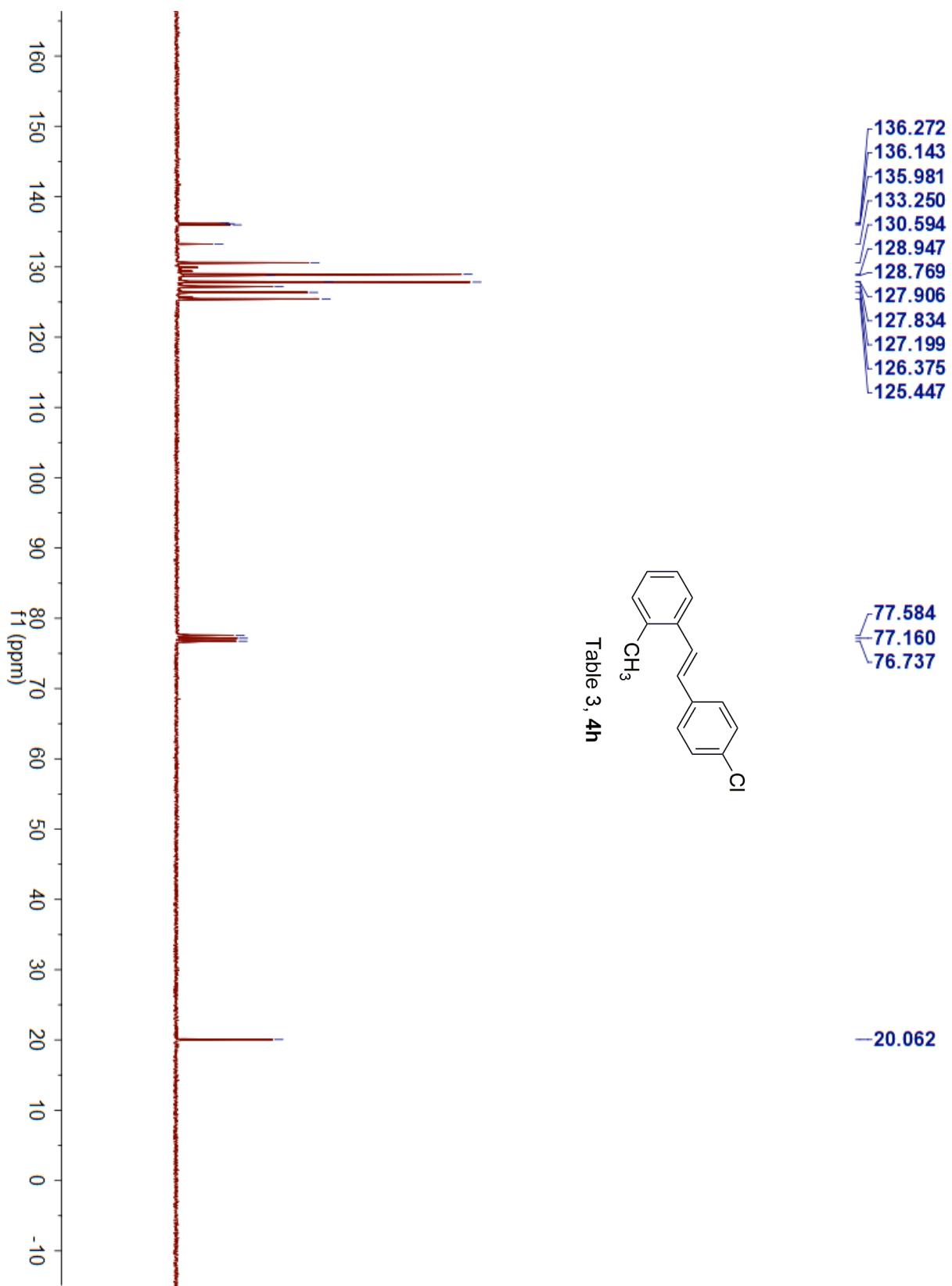
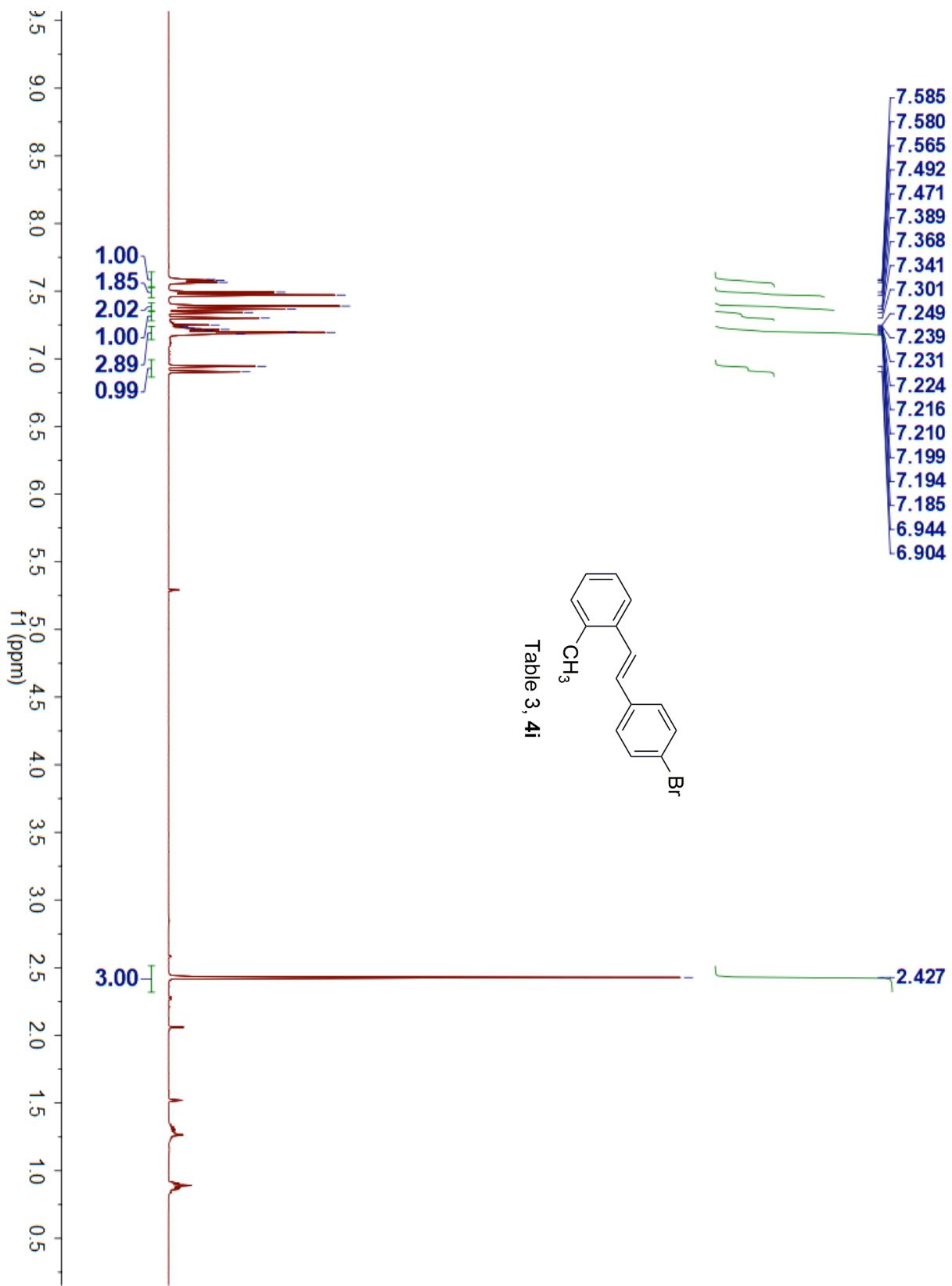


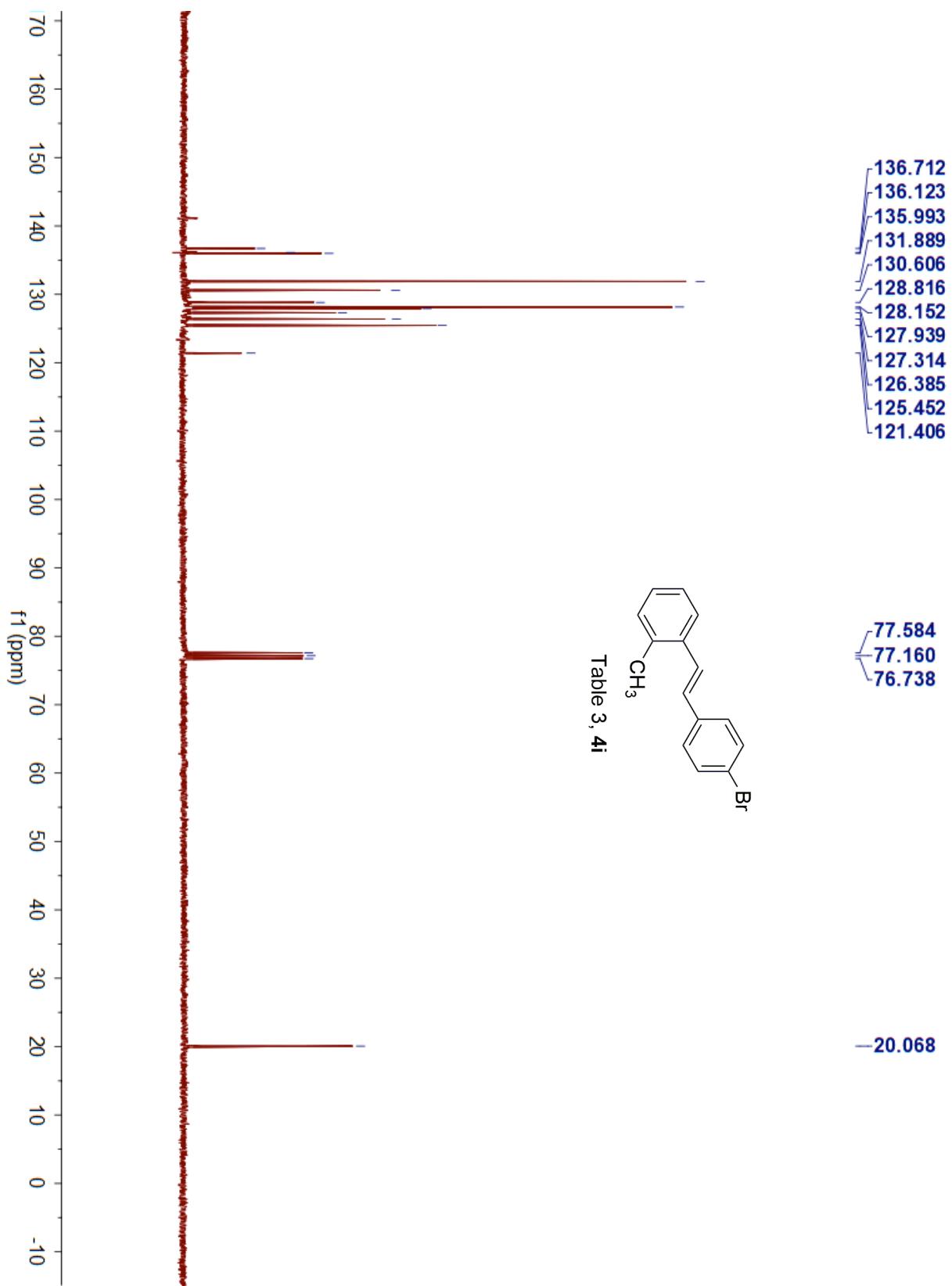
Table 3, 4g

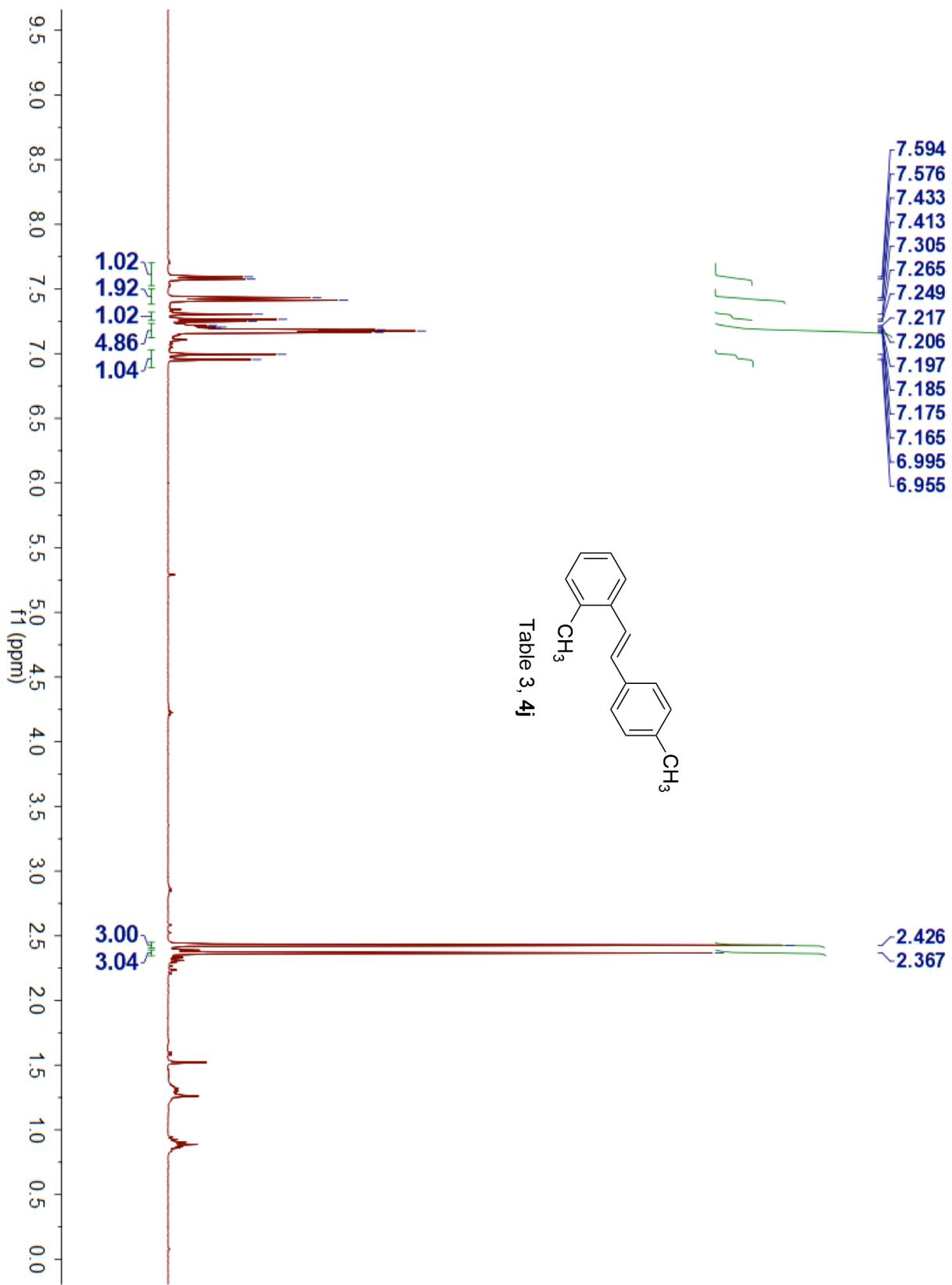


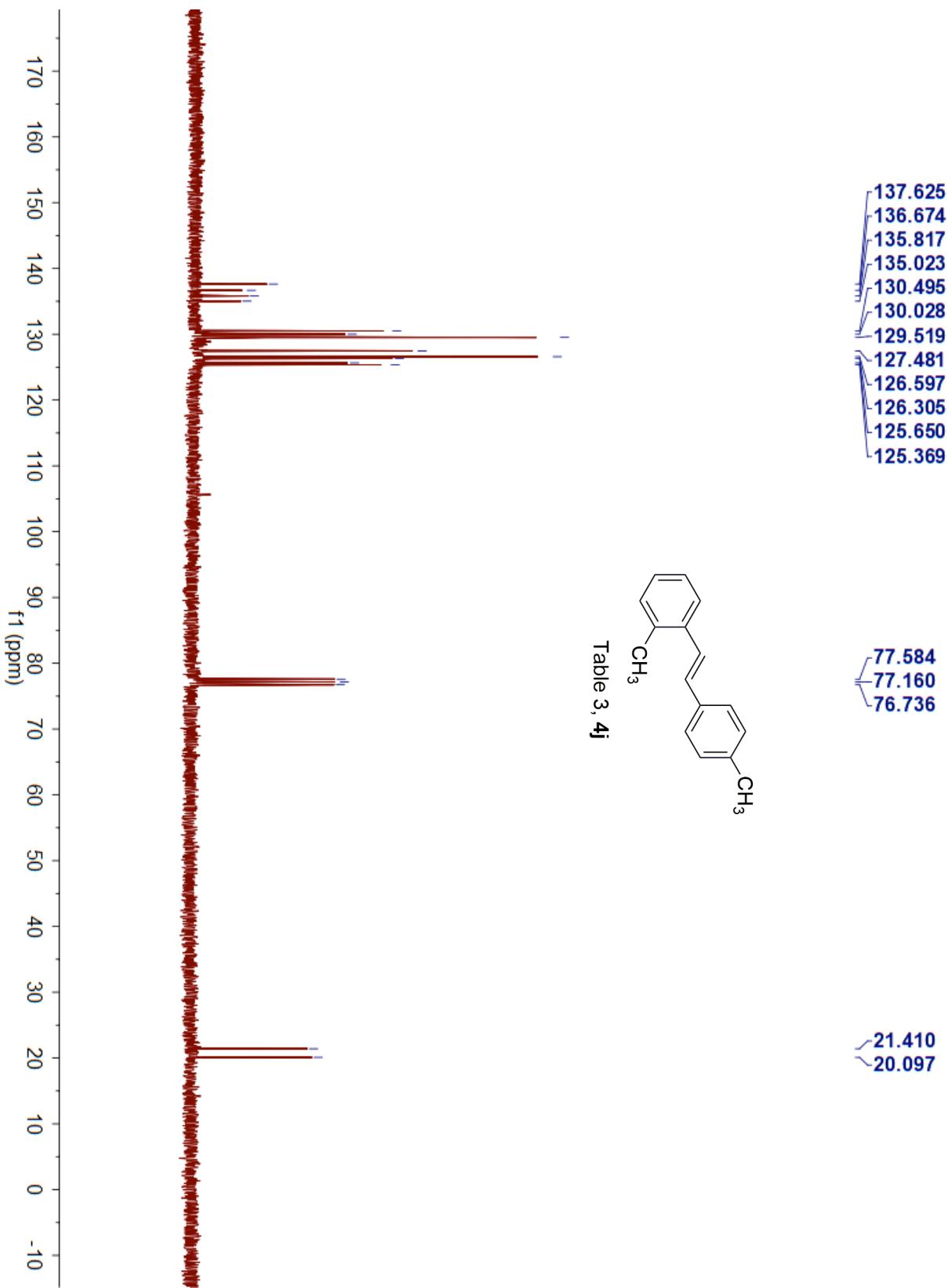


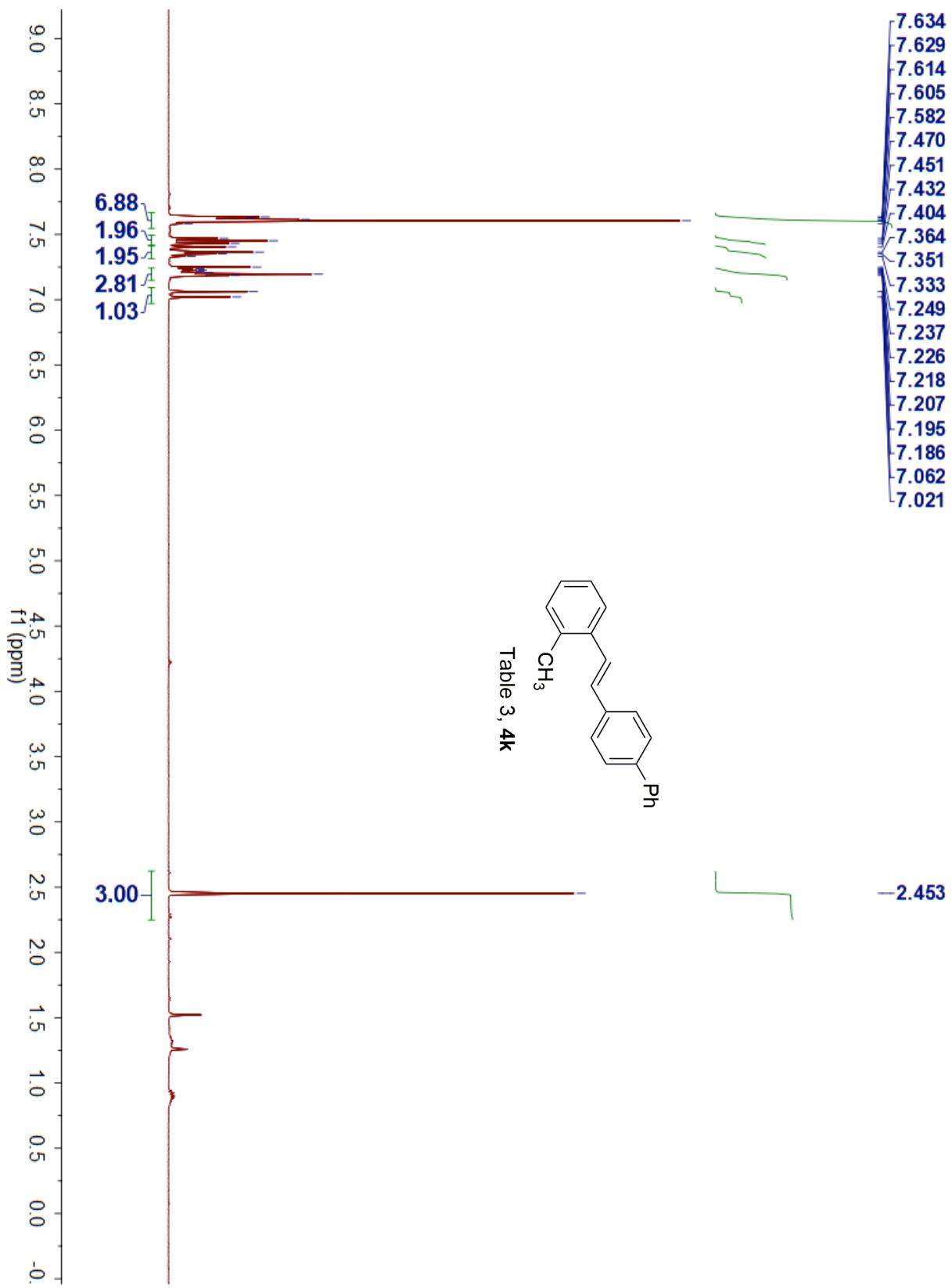












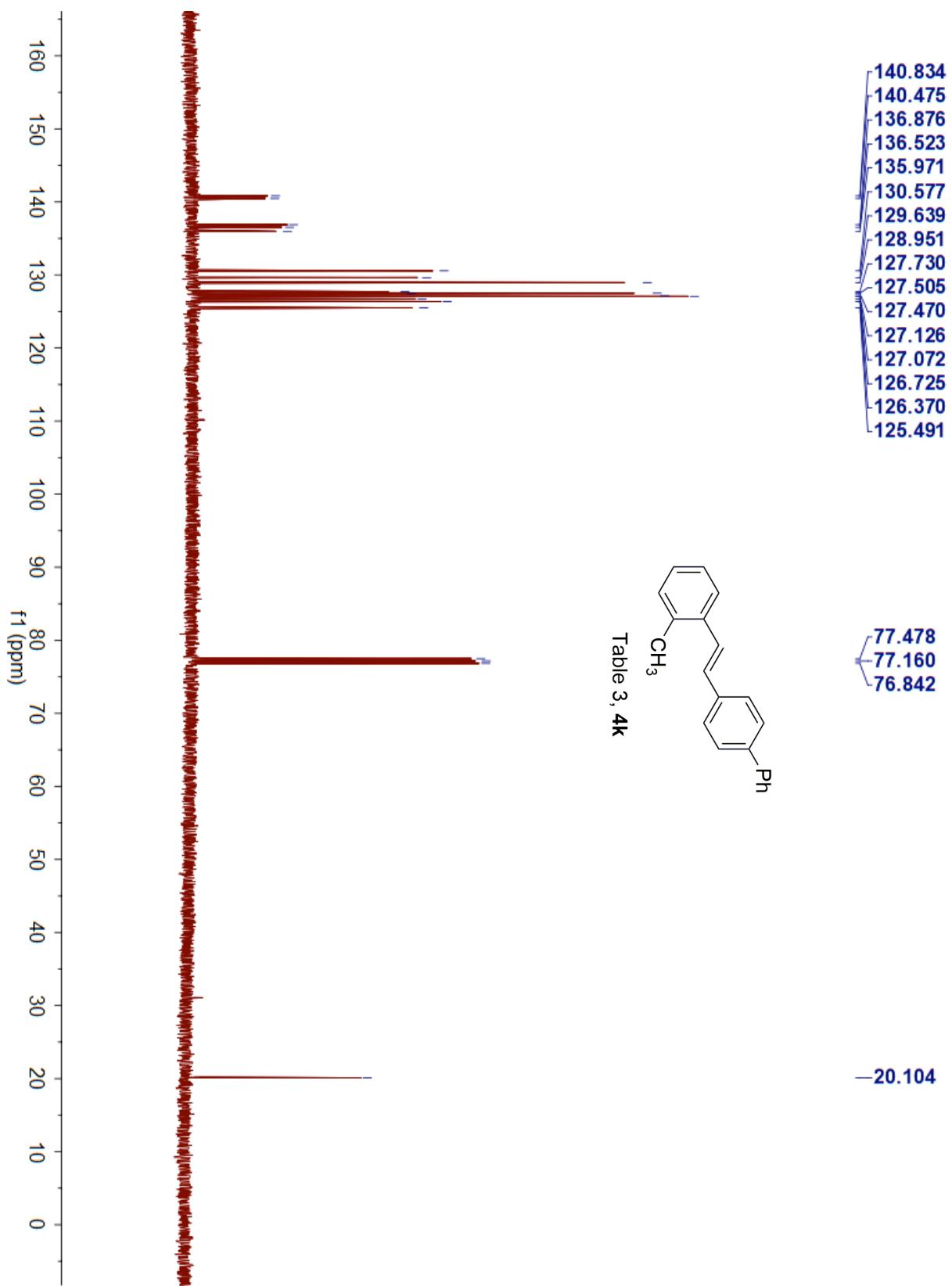
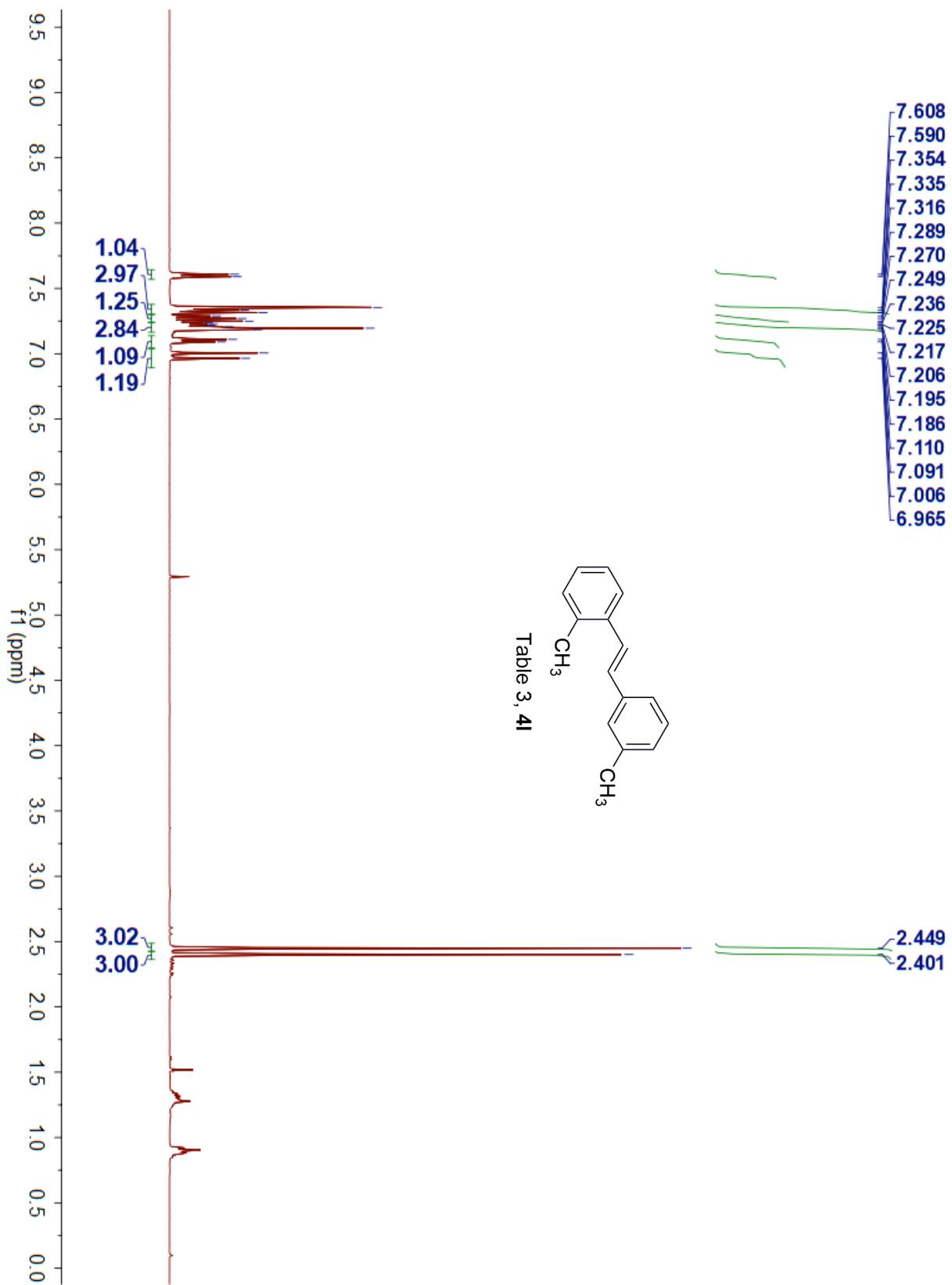
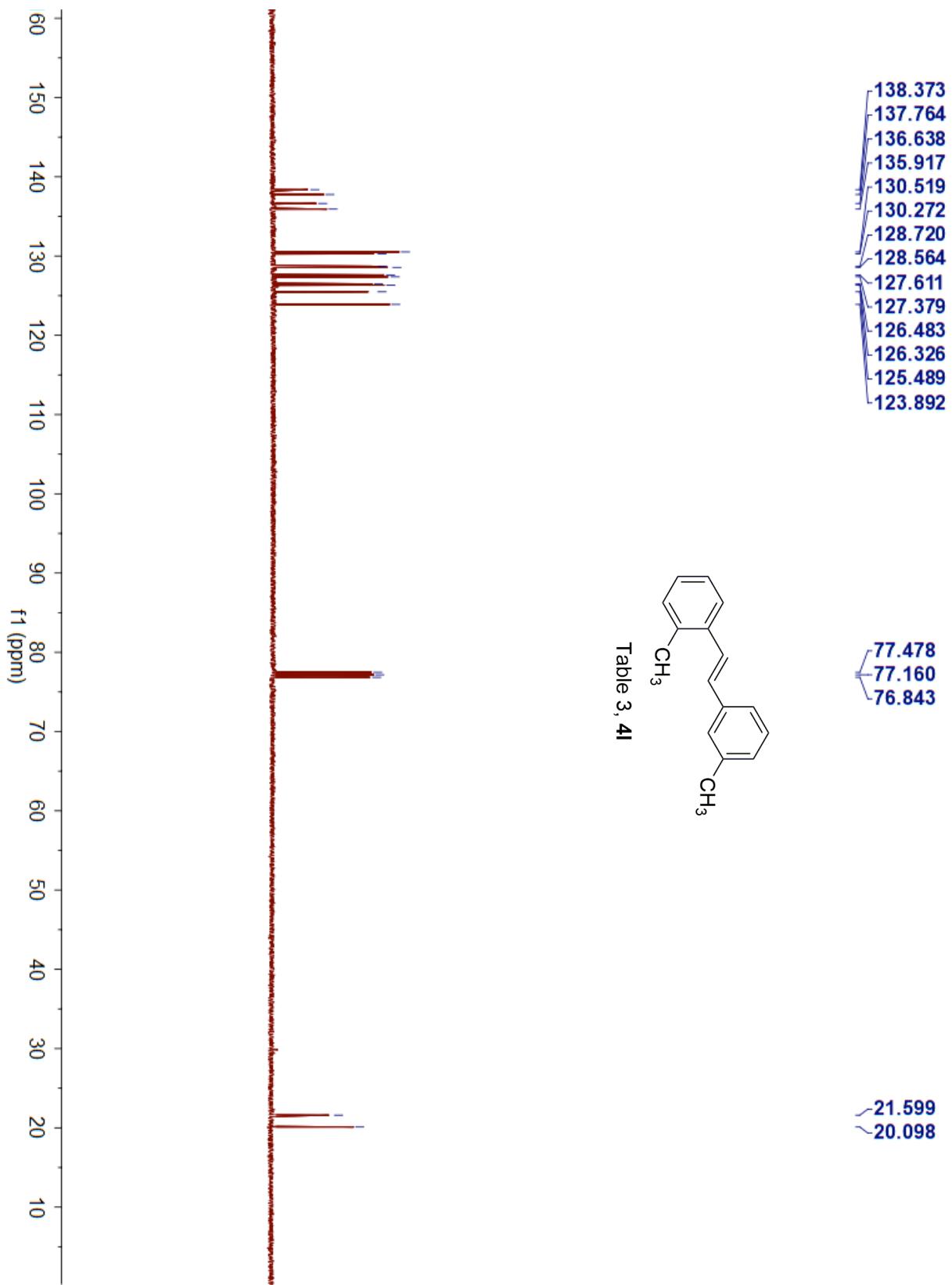


Table 3, **4k**





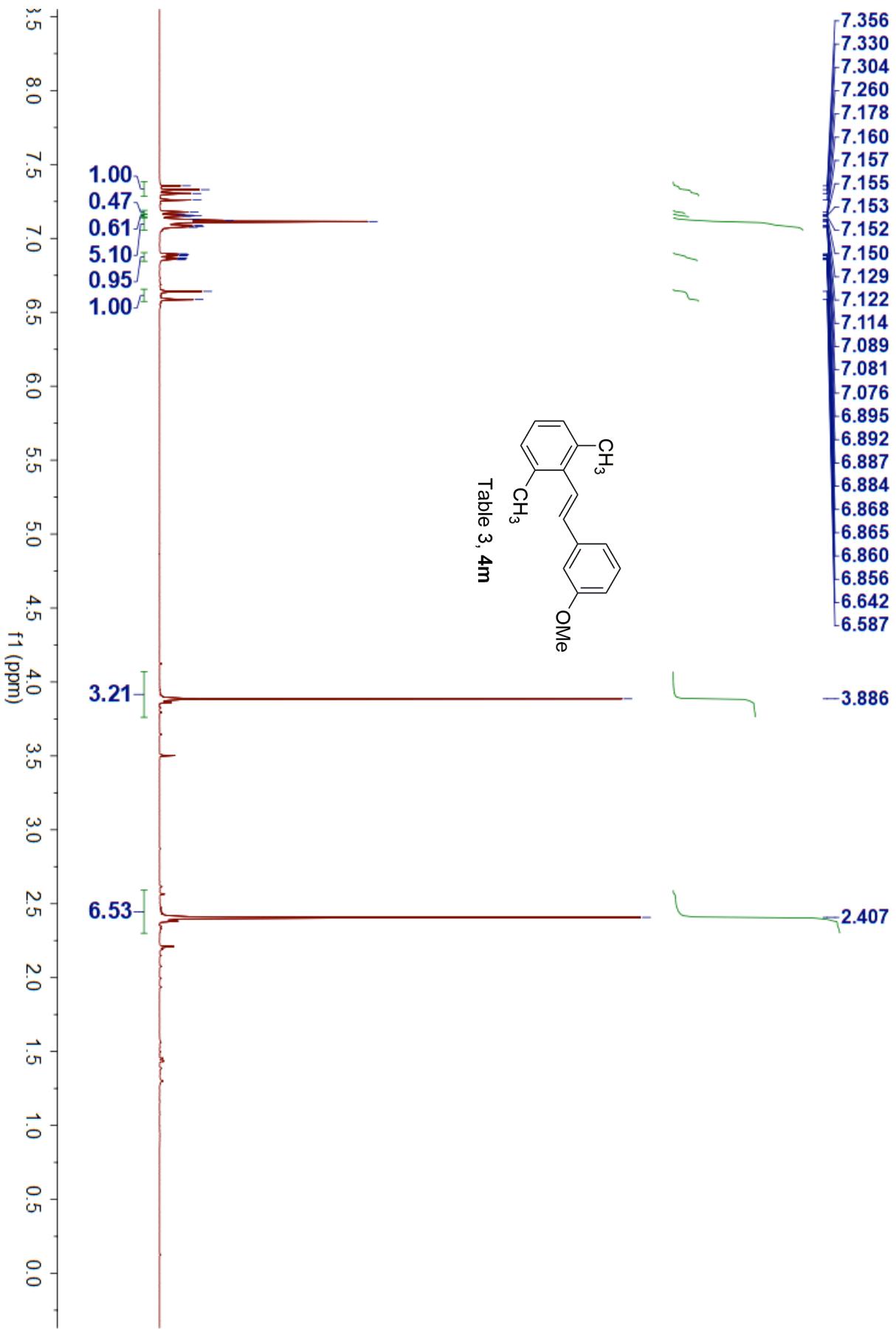
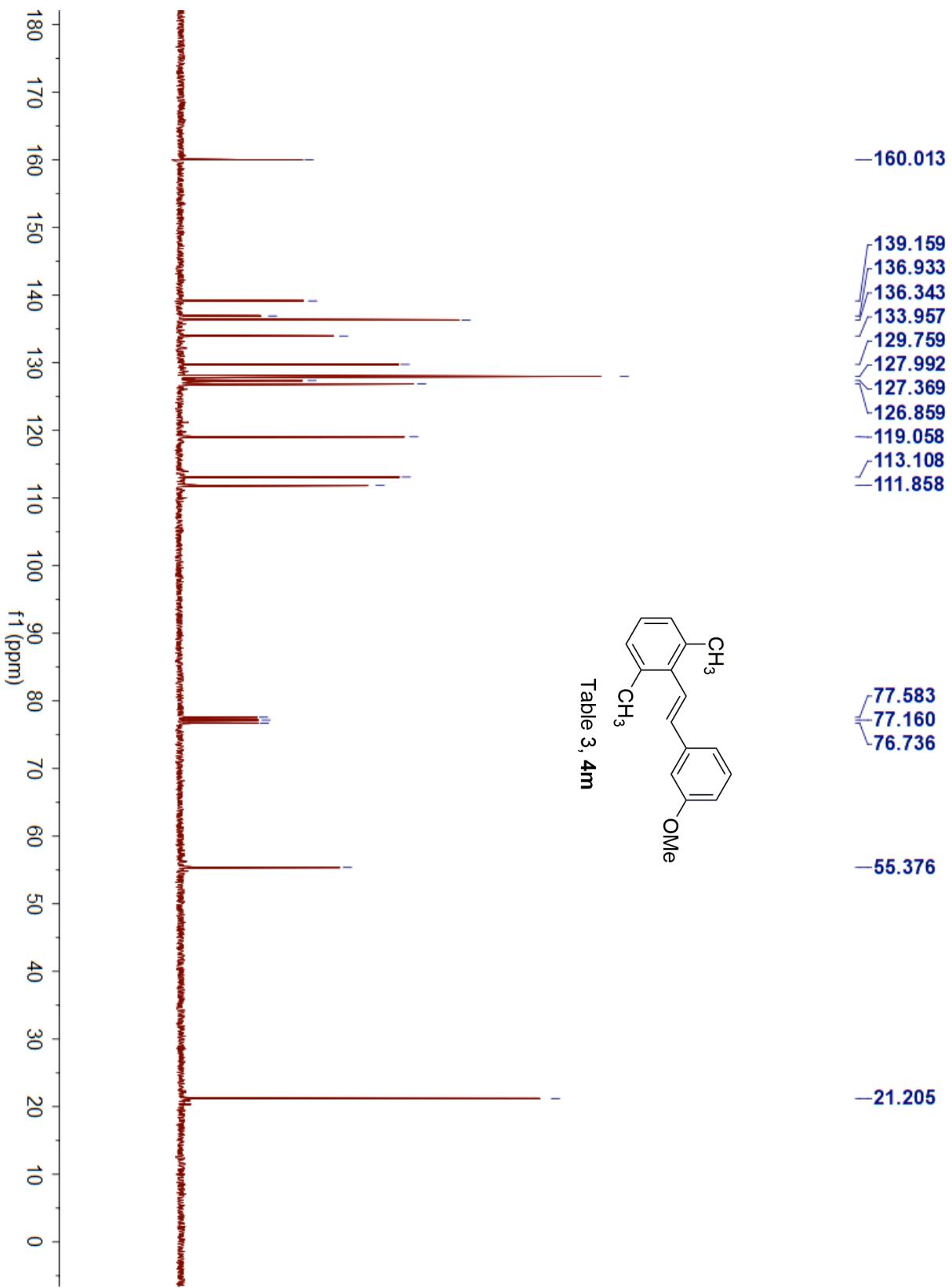
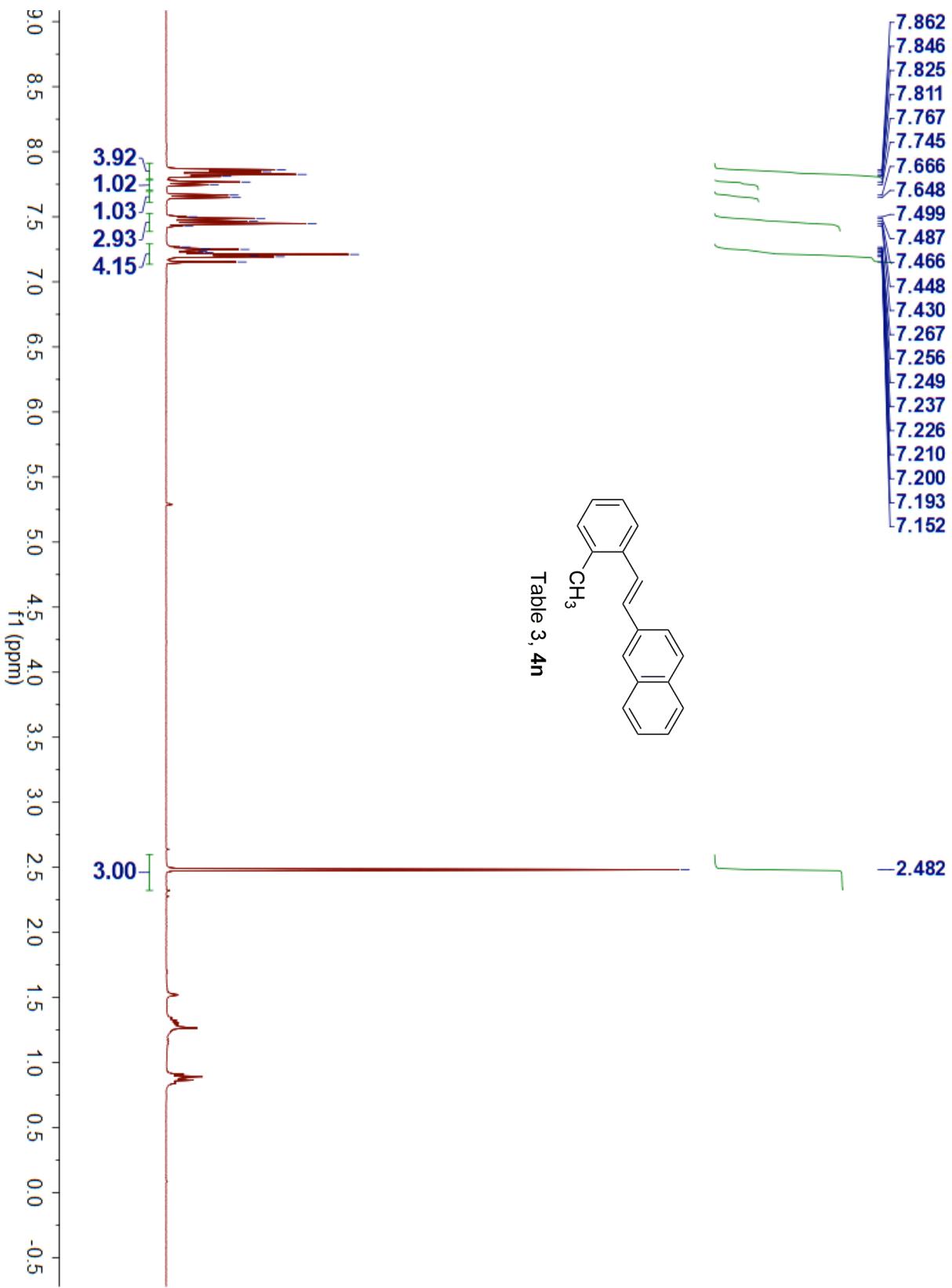
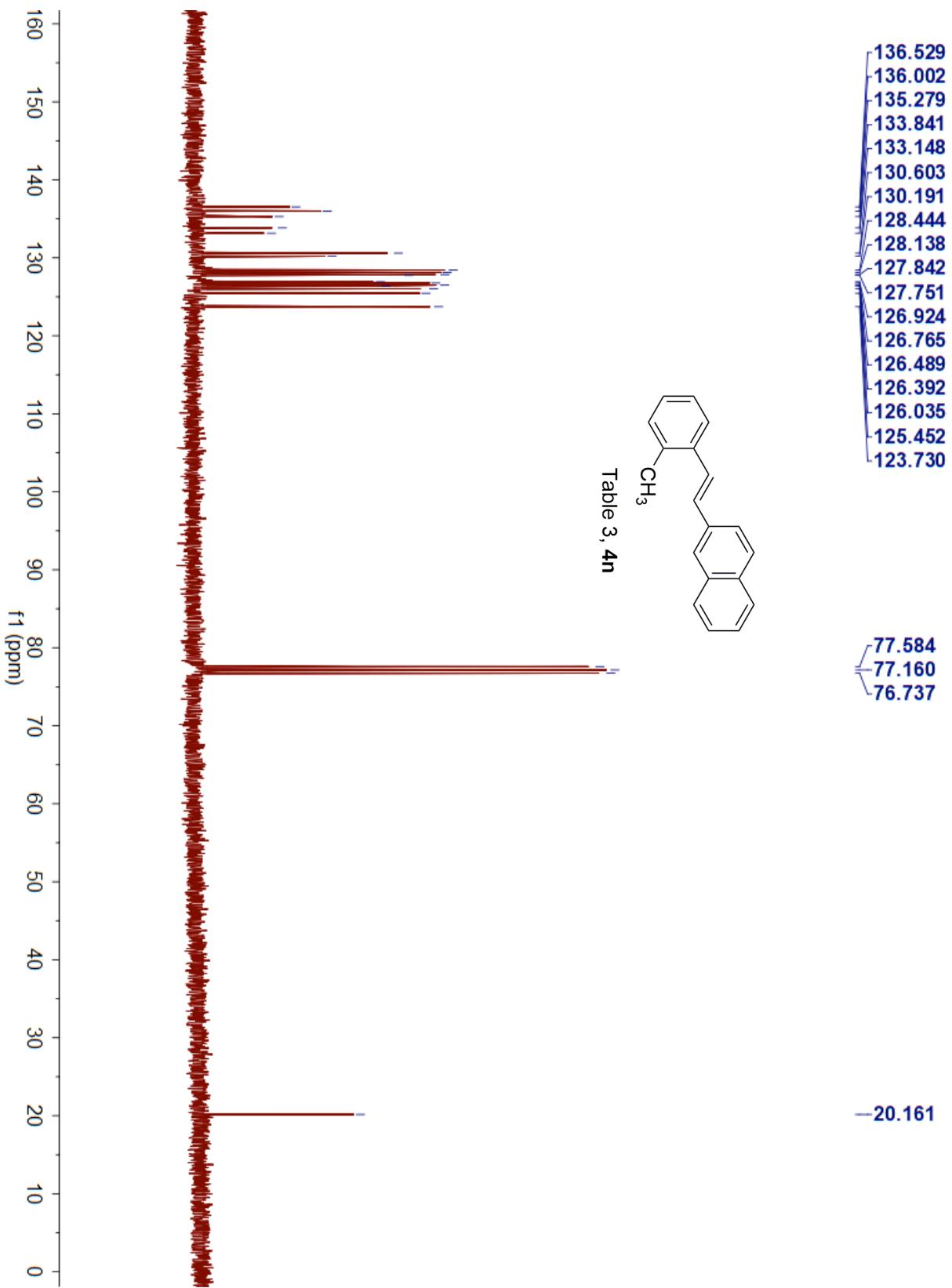
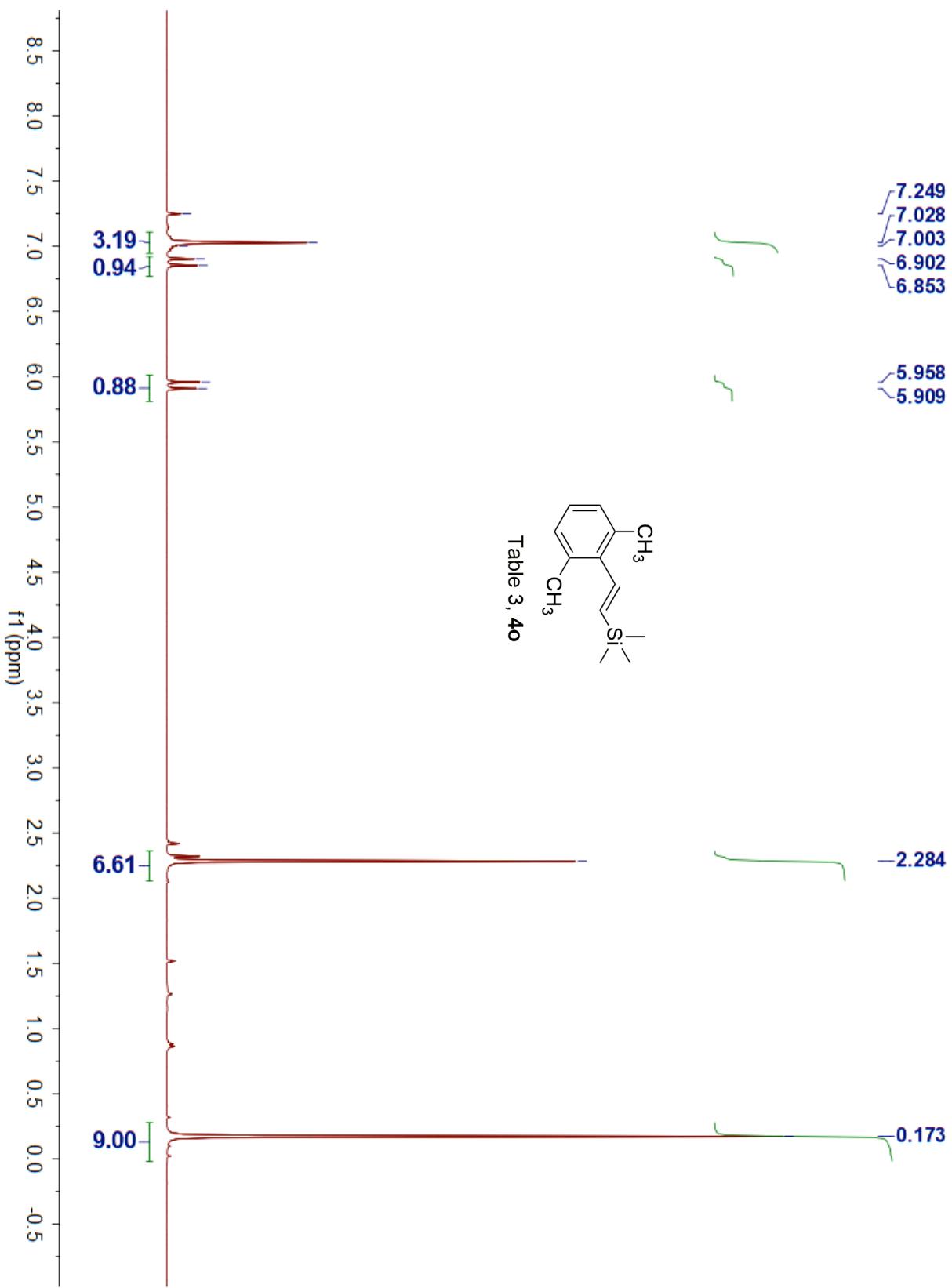


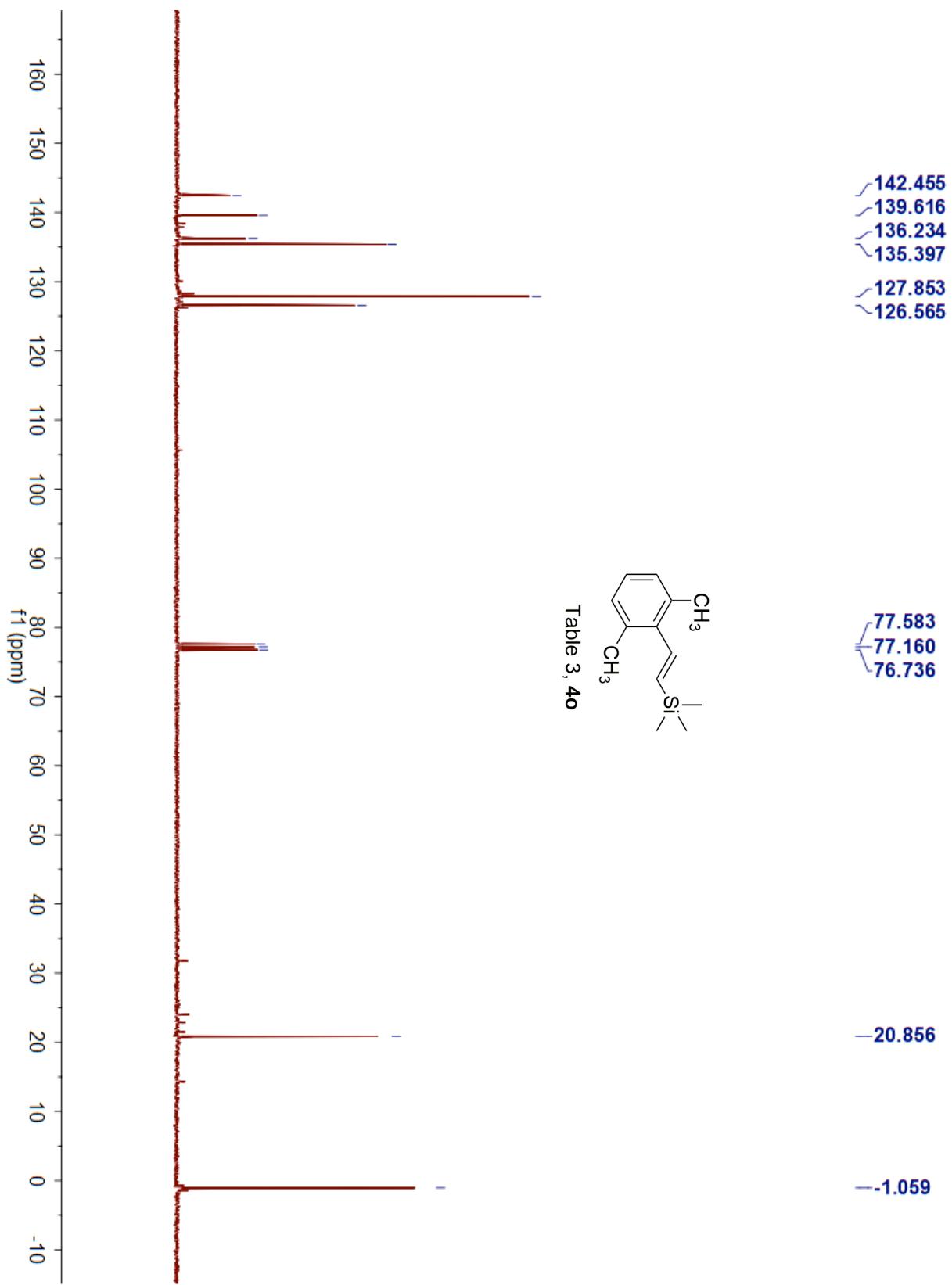
Table 3, 4m

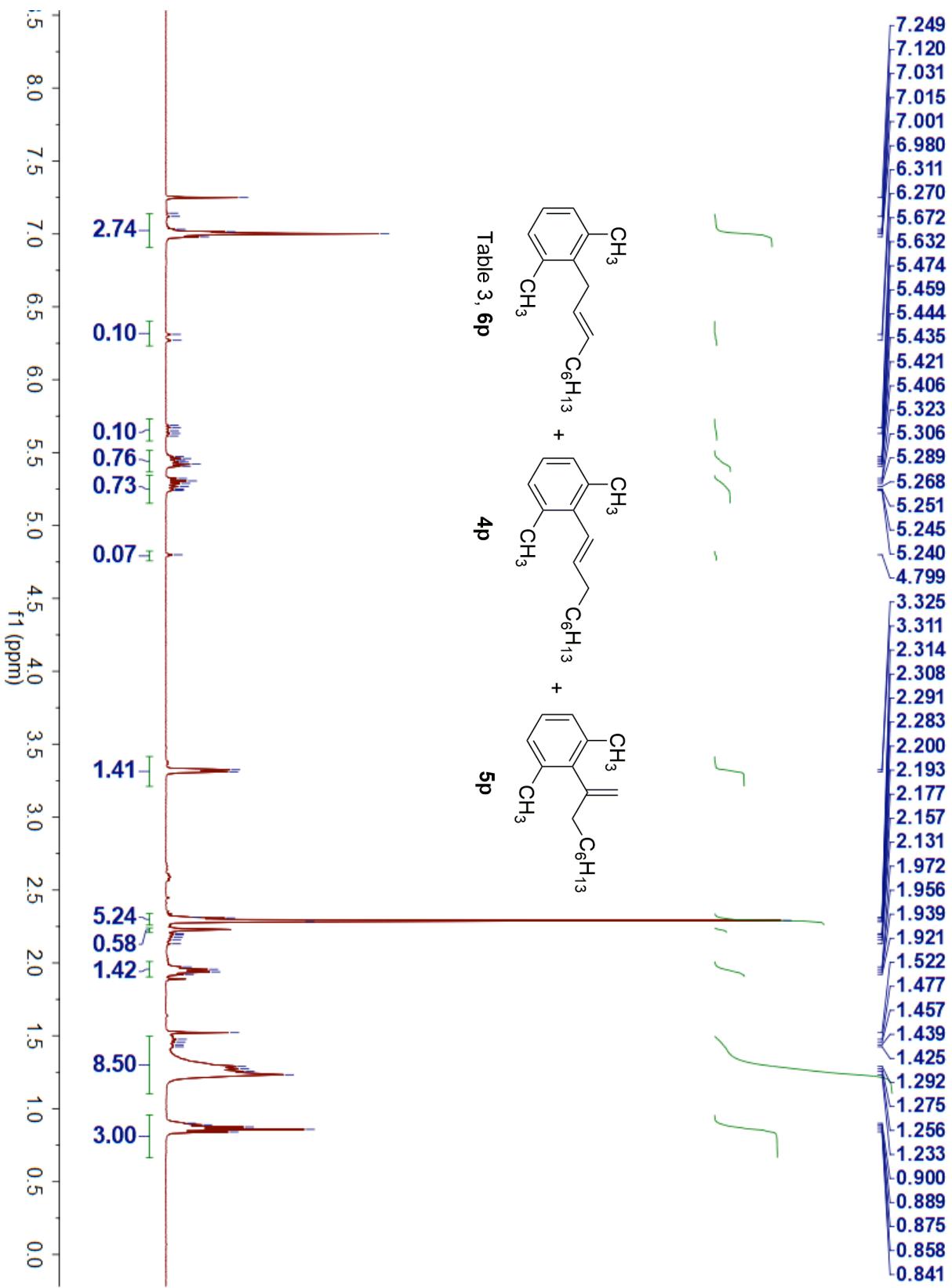












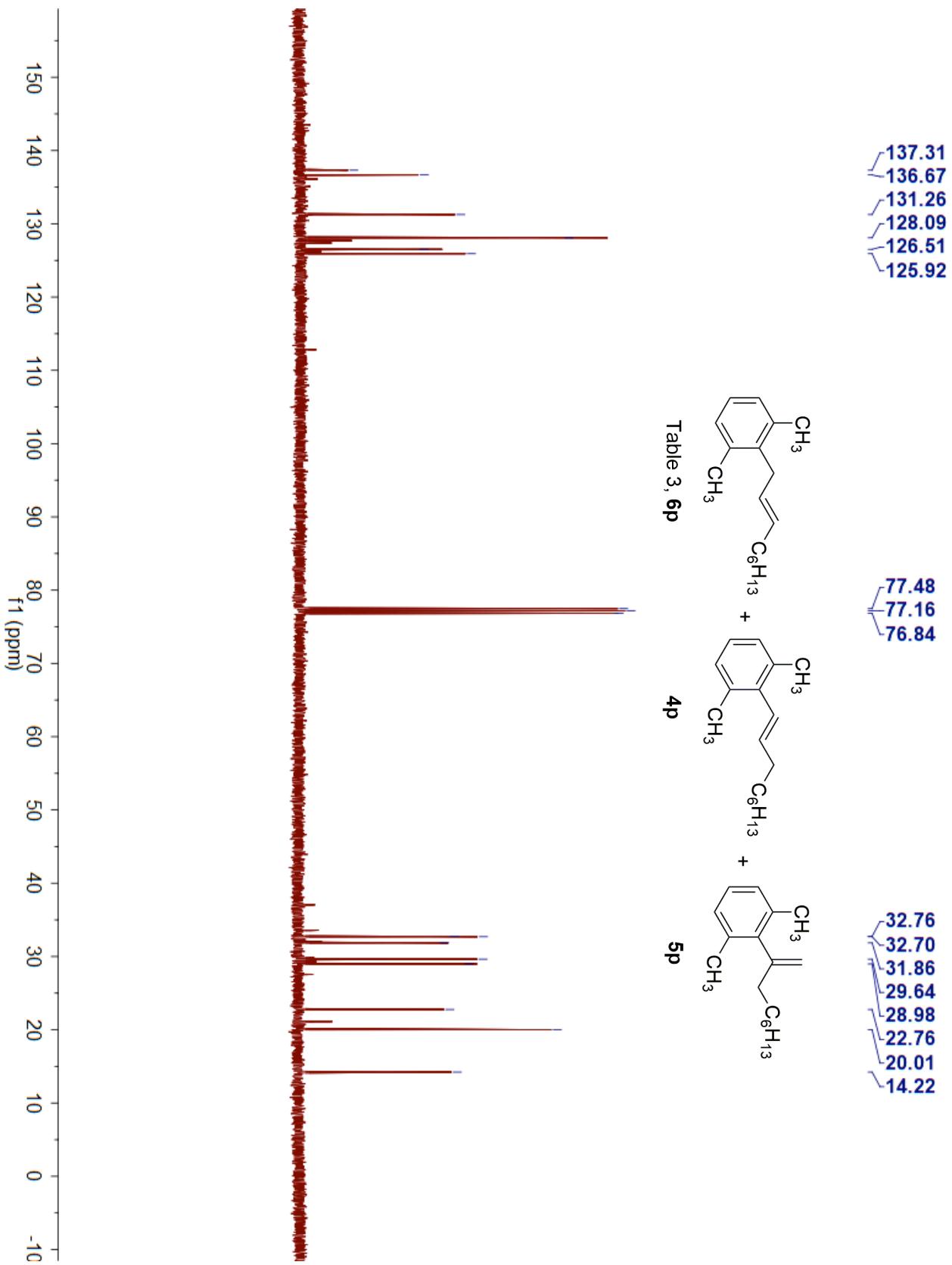
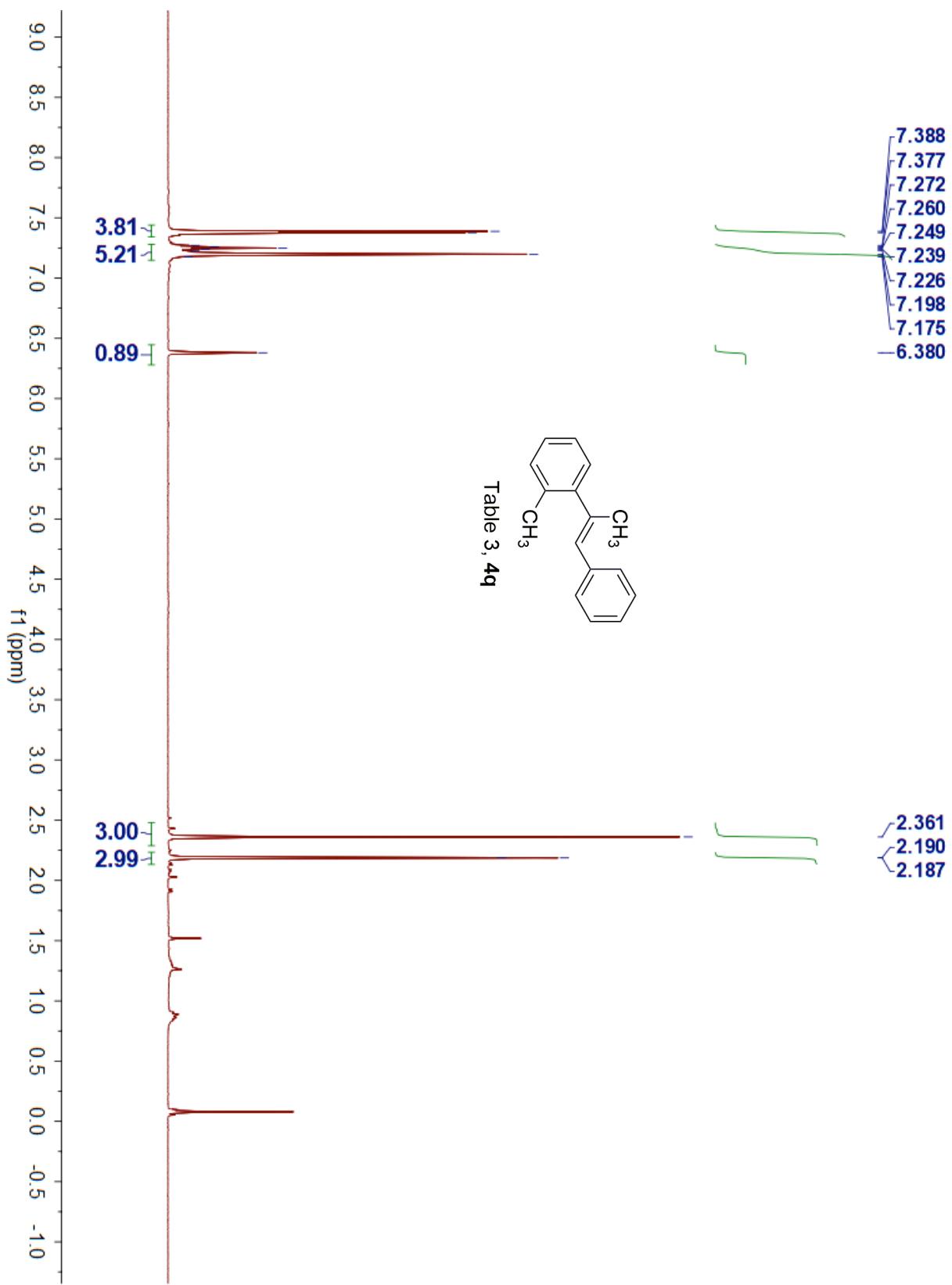
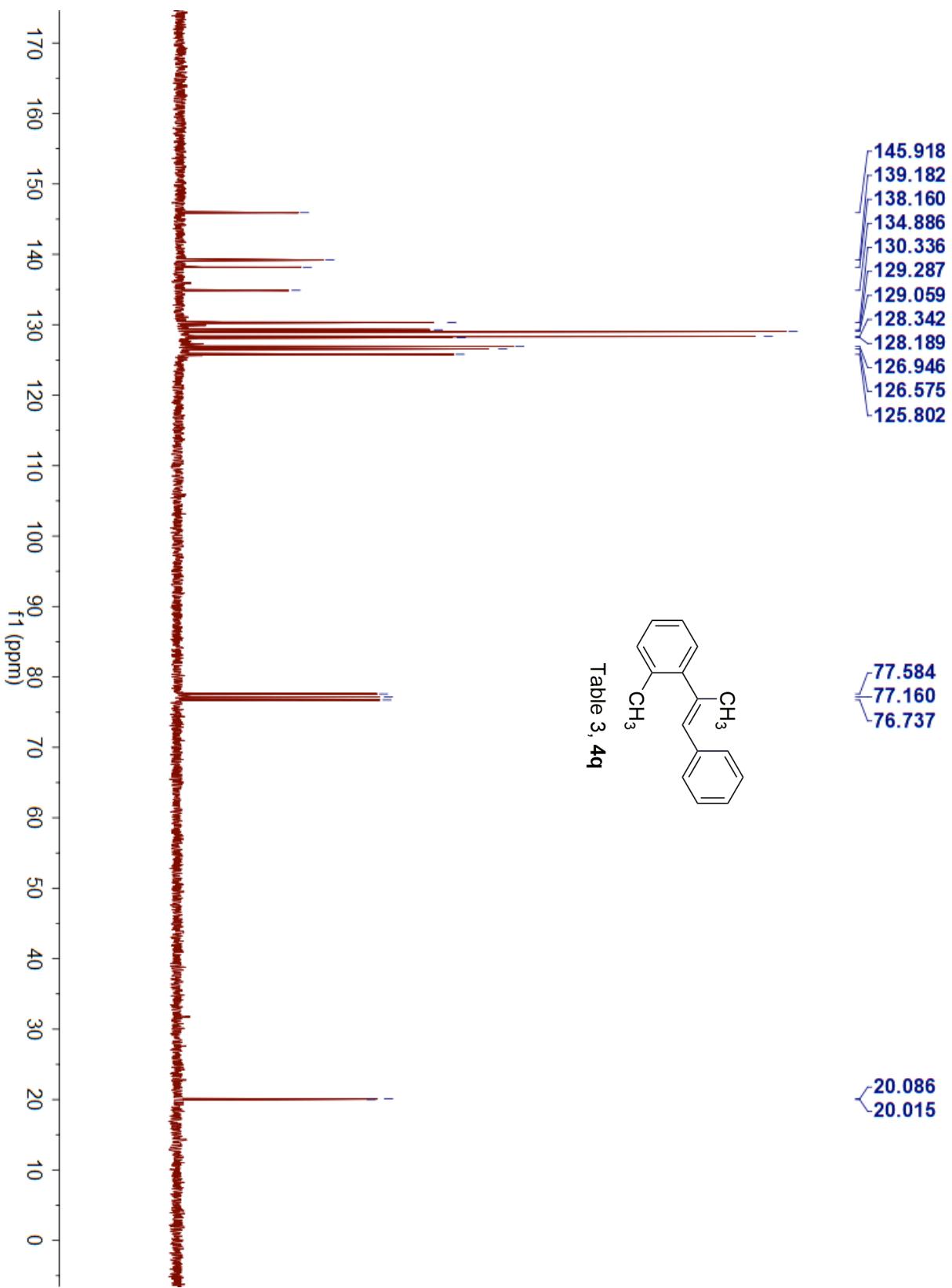


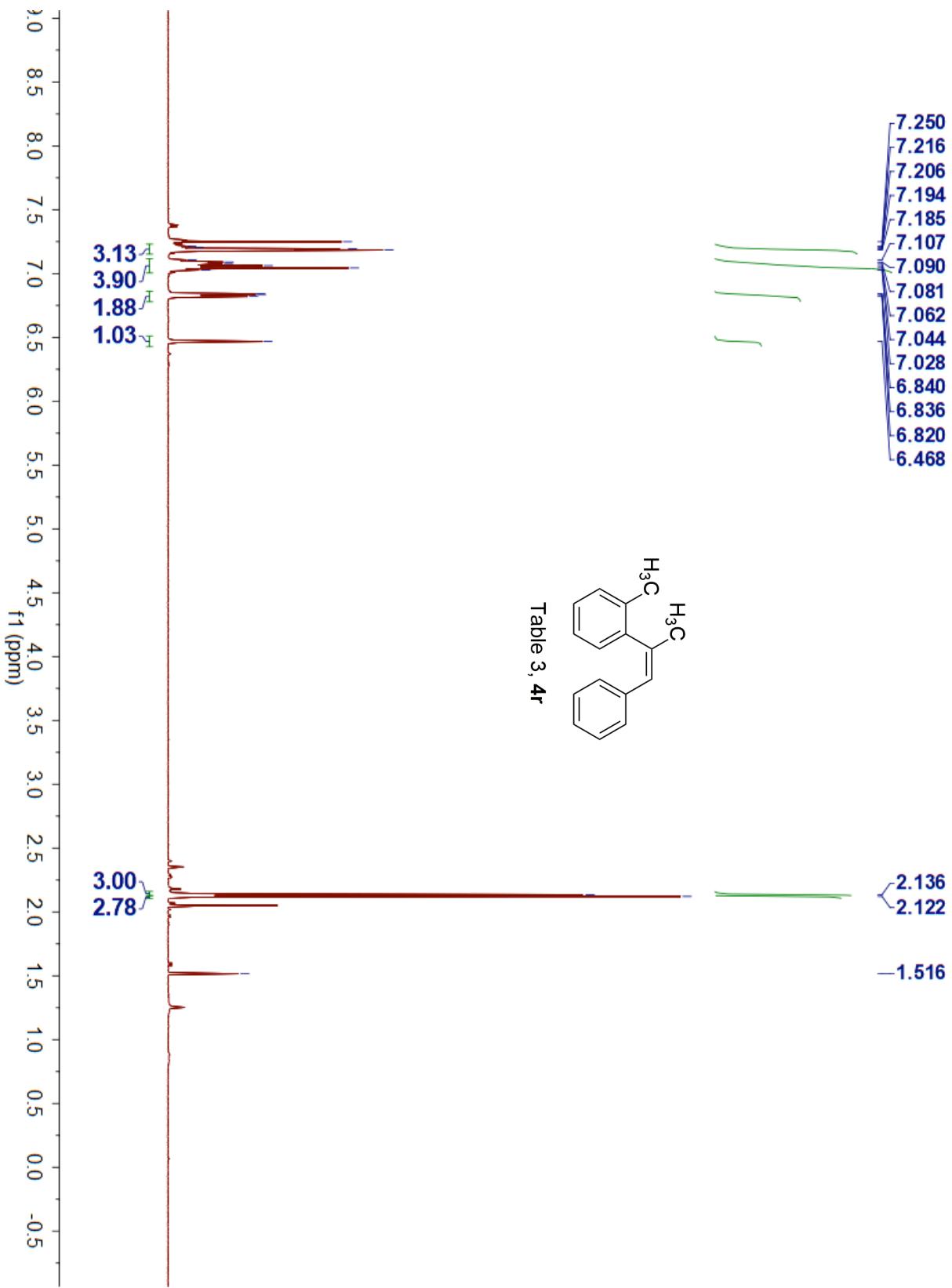
Table 3, 6p

4p

5p







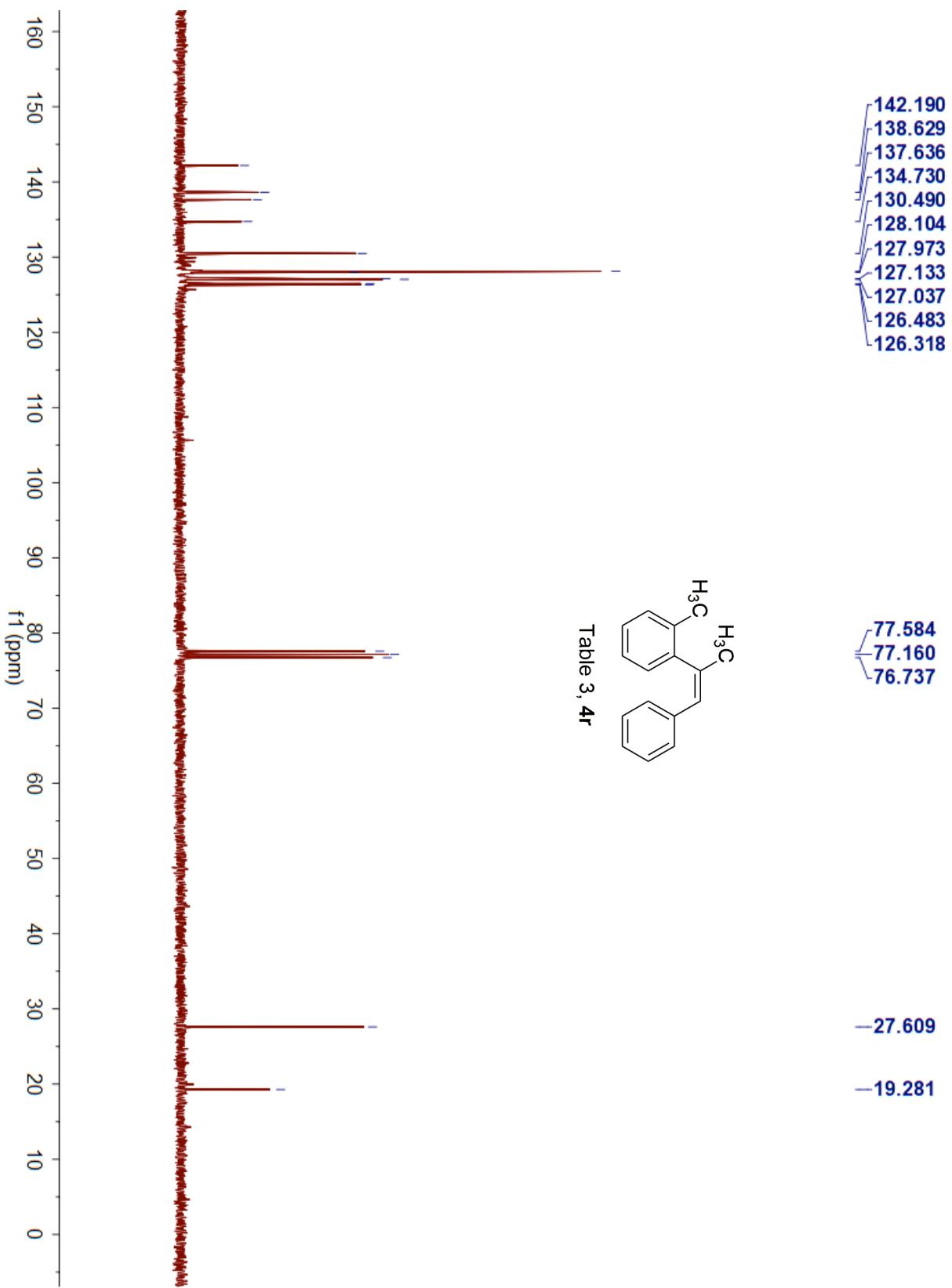


Table 3, 4r

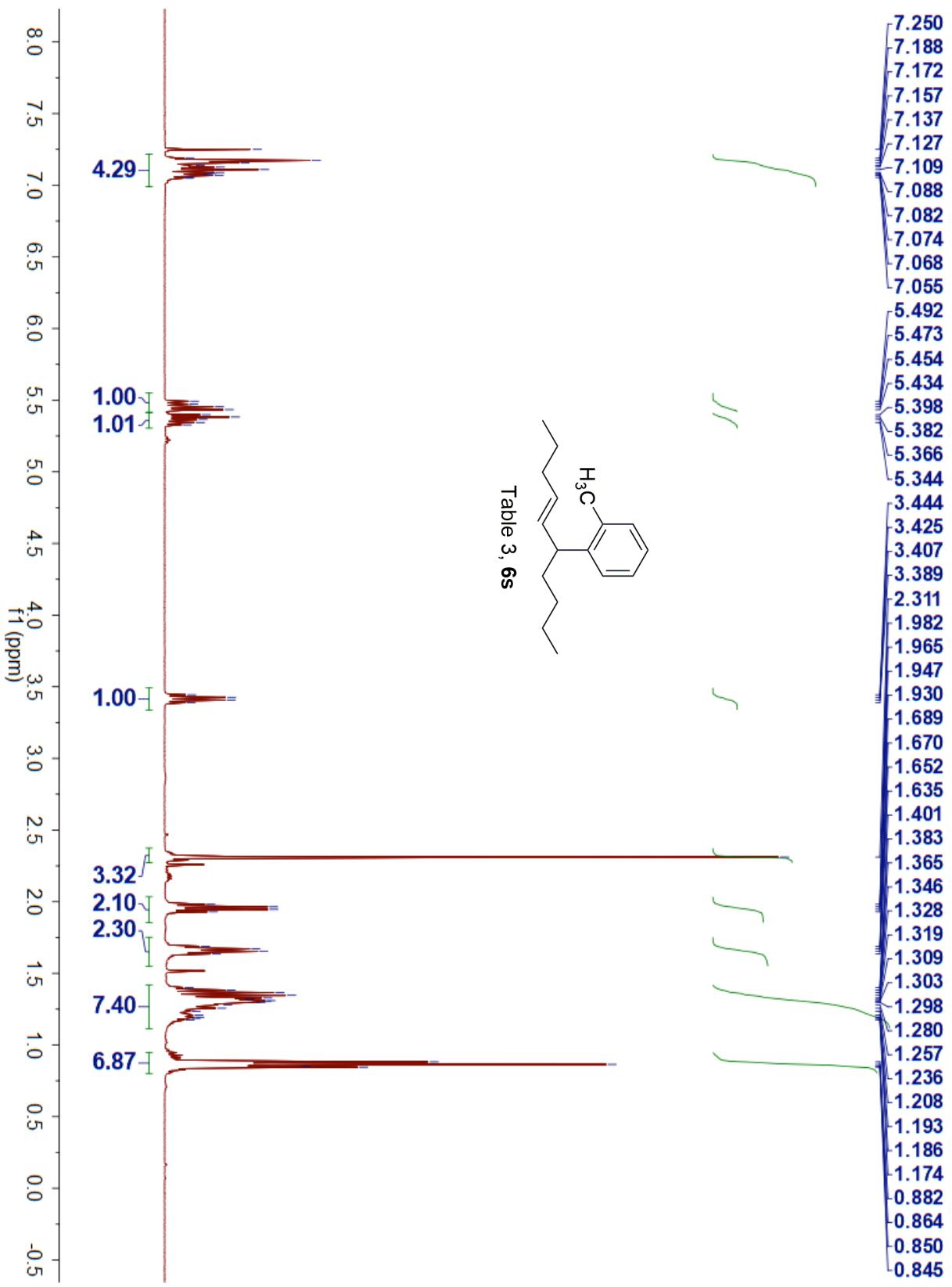


Table 3, **6s**

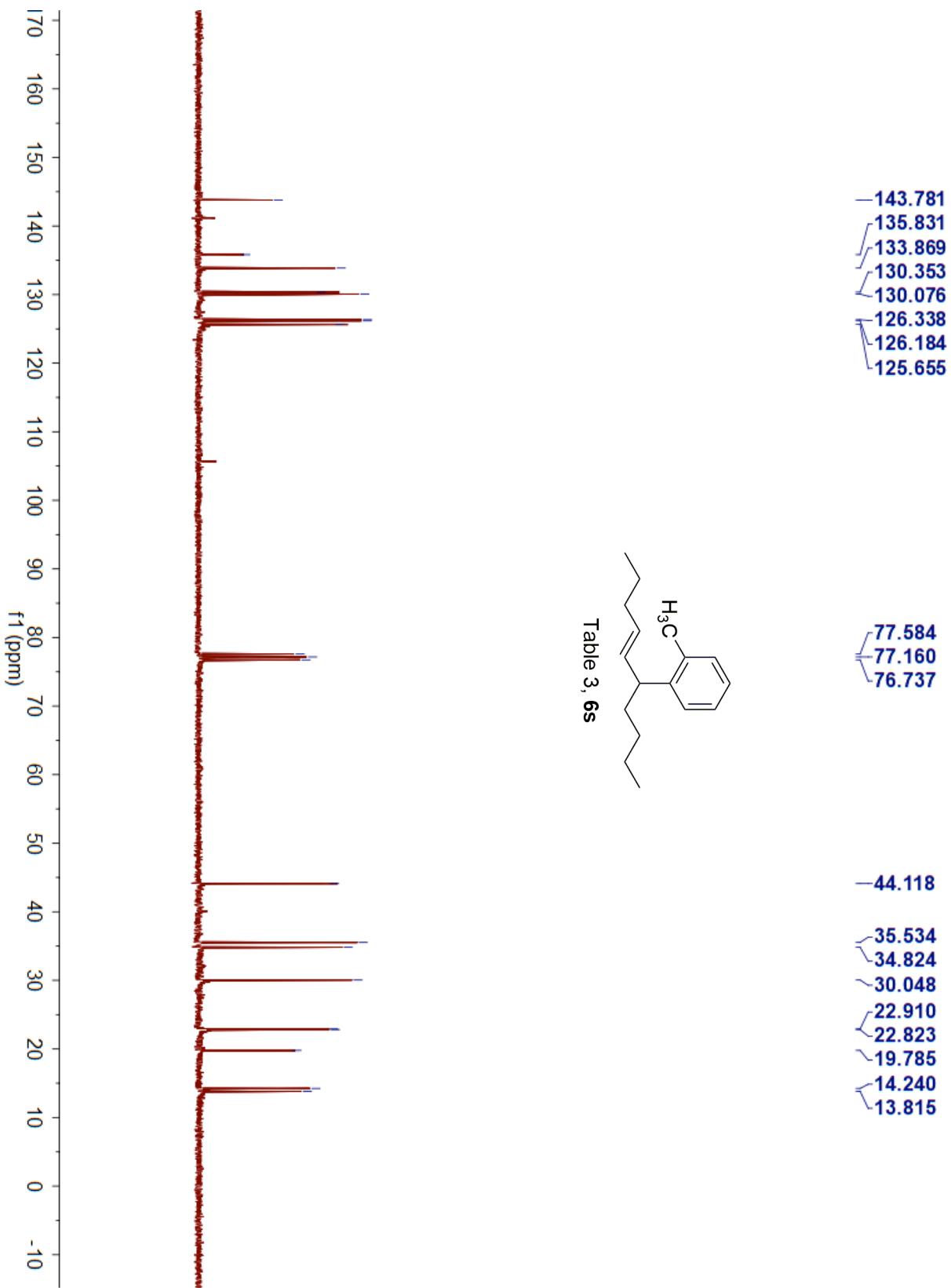


Table 3, **6s**

