

A library of seleno-compounds and Leishmania species: Rising evidences towards novel agents

Álvaro Martín-Montes¹, Daniel Plano^{2,3}, Rubén Martín-Escolano¹, Verónica Alcolea^{2,3}, Marta Díaz^{2,3}, Silvia Pérez-Silanes⁴, Socorro Espuelas³, Esther Moreno³, Clotilde Marín¹, Ramón Gutiérrez-Sánchez⁵, Carmen Sanmartín^{2,3*}, Manuel Sánchez-Moreno^{1,*}

¹*Universidad de Granada. Departamento de Parasitología. Facultad de Ciencias, Severo Ochoa s/n Granada, Spain. Instituto de Investigación Biosanitaria (ibs. Granada). Hospitales Universitarios De Granada*

²*Universidad de Navarra, Departamento de Química Orgánica y Farmacéutica, Facultad de Farmacia y Nutrición, Campus Universitario, 31080, Pamplona, Spain. IdiSNA, Instituto de Investigación Sanitaria de Navarra.*

³*Institute of Tropical Health, University of Navarra, 31008, Pamplona, Spain.*

⁴*Department of Organic and Pharmaceutical Chemistry, Institute of Tropical Health, University of Navarra. 31008, Pamplona, Spain*

⁵*Department of Statistics, University of Granada, Severo Ochoa s/n, E-18071 Granada, Spain*

AUTHOR INFORMATION

Corresponding Authors

* Carmen Sanmartín Grijalba. Phone: (+34)948425600; e-mail: sanmartin@unav.es.

* Manuel Sanchez Moreno. Phone (+34)958242369; e-mail msanchem@ugr.es.

Table S1. Physical constants and spectroscopic data for the presented compounds.

Comp.	IR (KBr; cm ⁻¹)	¹ H NMR (400 MHz, DMSO-d ₆ , δ, <i>J</i> in Hz)	¹³ C NMR (100 MHz, DMSO-d ₆ , δ)	CHN analysis (%) calcd/found
1	2149 (s, C≡N)	4.29 (s, 2H, CH ₂), 7.33 (d, 2H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 8.0, H ₂ +H ₆); 7.5 (d, 2H, H ₃ +H ₅)	32.6 (1C, CH ₂); 105.7 (1C, CN); 121.9 (1C, C ₄ -benzyl); 132.5 (4C, C ₂ +C ₃ +C ₅ +C ₆ -benzyl); 138.8 (1C, C ₁ -benzyl)	C: 34.92/35.42; H: 2.18/2.49; N: 5.09/4.74
2	1008 (s, C-Br), 710 (m, Se-Se)	3.93 (s, 4H, 2CH ₂); 7.19 (d, 4H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 8.4, H ₂ +H ₆ +H ₂ +H ₆); 7.51 (d, 4H, H ₃ +H ₅ +H ₃ +H ₅)	31.4 (2C, CH ₂); 120.9 (2C, C ₄ , C ₄ '-benzyl); 131.9 (4C, C ₂ +C ₆ +C ₂ +C ₆ '-benzyl); 132.1 (4C, C ₃ +C ₅ +C ₃ +C ₅ '-benzyl); 139.6 (2C, C ₁ +C ₁ '-benzyl)	C: 33.73/33.37; H: 2.41/2.31
3	2146 (s, C≡N)	4.31 (s, 2H, CH ₂), 7.29-7.32 (m, 1H, H ₄); 7.37-7.38 (m, 4H, H ₂ +H ₃ +H ₅ +H ₆)	33.5 (1C, CH ₂); 105.8 (1C, CN); 129.3, 129.6, 129.9 (5C, C ₂ +C ₃ +C ₄ +C ₅ +C ₆ -benzyl); 139.2 (1C, C ₁ -benzyl)	C: 48.98/48.90; H: 3.57/3.80; N: 7.14/6.68
4	754 (m, Se-Se)	3.91 (s, 4H, 2CH ₂); 7.23-7.24 (m, 10H, H ₂ +H ₃ +H ₄ +H ₅ +H ₆ +H ₂ +H ₃ +H ₄ +H ₅ +H ₆)	32.4 (2C, CH ₂); 127.2, 128.3, 128.7, 129.2, 129.7, 130.5 (10C, C ₂ +C ₃ +C ₄ +C ₅ +C ₆ +C ₂ +C ₃ +C ₄ +C ₅ +C ₆ '-benzyl); 140.0 (2C, C ₁ +C ₁ '-benzyl)	C: 49.41/49.43; H: 4.12/4.24
5	2147 (s, C≡N), 1518 (s, NO ₂)	4.41 (s, 2H, CH ₂), 7.64 (d, 2H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 8.0, H ₂ +H ₆); 8.25 (d, 2H, H ₃ +H ₅)	32.0 (1C, CH ₂); 105.7 (1C, CN); 124.6, 124.8 (2C, C ₃ +C ₅ -benzyl); 131.0 (2C, C ₂ +C ₆ -benzyl); 147.4 (2C, C ₁ +C ₆ -benzyl)	C: 39.83/39.96; H: 2.49/2.50; N: 11.62/11.56
6	1516 (s, NO ₂), 741 (m, Se-Se)	4.12 (s, 4H, 2CH ₂); 7.47 (d, 4H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 8.5, H ₂ +H ₆ +H ₂ +H ₆); 8.17 (d, 4H, H ₃ +H ₅ +H ₃ +H ₅)	30.9 (2C, CH ₂); 124.3 (4C, C ₃ +C ₅ +C ₃ +C ₅ '-benzyl); 130.9 (4C, C ₂ +C ₆ +C ₂ +C ₆ '-benzyl); 147.1 (2C, C ₁ +C ₁ '-benzyl); 148.5 (2C, C ₄ +C ₄ '-benzyl)	C: 39.07/39.09; H: 2.79/2.78; N: 6.51/6.37
7	2155 (s, C≡N), 1326 (s, C-F)	4.37 (s, 2H, CH ₂); 7.59 (d, 2H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 8.1, H ₂ +H ₆); 7.75 (d, 2H, H ₃ +H ₅)	32.3 (1C, CH ₂); 105.7 (1C, CN); 124.1 (1C, CF ₃); 126.4 (2C, C ₃ +C ₅ -benzyl); 129.2 (1C, C ₄ -benzyl); 130.5 (2C, C ₂ +C ₆ -benzyl); 144.2 (1C, C ₁ -benzyl)	C: 40.90/41.10; H: 2.27/2.27; N: 5.30/4.94
8	1325 (s, C-F), 746 (w, Se-Se)	4.04 (s, 4H, 2CH ₂); 7.43 (d, 4H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 7.9, H ₂ +H ₆ +H ₂ +H ₆); 7.67 (d, 4H, H ₃ +H ₅ +H ₃ +H ₅)	31.2 (2C, CH ₂); 123.8 (2C, CF ₃); 126.0 (4C, C ₃ +C ₅ +C ₃ +C ₅ '-benzyl); 128.2 (2C, C ₄ +C ₄ '-benzyl); 130.5 (4C, C ₂ +C ₆ +C ₂ +C ₆ '-benzyl); 145.1 (2C, C ₁ +C ₁ '-benzyl)	C: 40.34/40.84; H: 2.52/2.53
9	2143 (s, C≡N), 1490 (s, S-CH ₃)	2.47 (s, 3H, CH ₃); 4.29 (s, 2H, CH ₂); 7.24 (d, 2H, <i>J</i> ₂₋₃ = <i>J</i> ₆₋₅ = 8.2, H ₂ +H ₆); 7.31 (d, 2H, H ₃ +H ₅)	15.4 (1C, SCH ₃); 33.4 (1C, CH ₂); 105.8 (1C, CN); 126.7 (2C, C ₃ +C ₅ -benzyl); 130.3 (2C, C ₂ +C ₆ -benzyl); 135.6 (1C, C ₁ -benzyl); 138.8 (1C, C ₄ -benzyl)	C: 44.62/44.63; H: 3.71/3.80; N: 5.78/5.55
10	1491 (s, S-CH ₃), 718 (w, Se-Se)	2.45 (s, 6H, 2CH ₃); 3.90 (s, 4H, 2CH ₂); 7.19 (s, 8H, H ₂ +H ₂ +H ₃ +H ₃ +H ₅ +H ₅ +H ₆ +H ₆)	15.6 (2C, SCH ₃); 32.1 (2C, CH ₂); 126.7 (4C, C ₃ +C ₅ +C ₃ +C ₅ '-benzyl); 130.4 (4C, C ₂ +C ₆ +C ₂ +C ₆ '-benzyl); 136.5 (2C, C ₁ +C ₁ '-benzyl); 137.6 (2C, C ₄ +C ₄ '-benzyl)	C: 44.44/44.12; H: 4.16/4.20
11	2149 (s, C≡N)	2.30 (s, 3H, CH ₃); 4.29 (s, 2H, CH ₂), 7.17 (d, 2H, <i>J</i> ₃₋₂ = <i>J</i> ₅₋₆ = 8.0, H ₃ +H ₅); 7.26 (d, 2H, H ₂ +H ₆)	21.5 (1C, CH ₃); 33.5 (1C, CH ₂); 105.8 (1C, CN); 129.1, 129.6, 130.2, 130.5 (4C, C ₂ +C ₃ +C ₅ +C ₆ -benzyl); 136.1, 138.0 (2C, C ₁ +C ₄ -benzyl)	C: 51.43/51.54; H: 4.29/4.42; N: 6.67/6.42
12	739 (w, Se-Se)	2.27 (s, 6H, 2CH ₃); 3.90 (s, 4H, 2CH ₂); 7.12 (s, 8H, H ₂ +H ₃ +H ₅ +H ₆ +H ₂ +H ₃ +H ₅ +H ₆)	21.6 (2C, CH ₃); 32.4 (2C, CH ₂); 129.6, 130.4 (10C, C ₂ +C ₃ +C ₄ +C ₅ +C ₆ +C ₂ +C ₃ +C ₄ +C ₅ +C ₆ '-benzyl); 137.0 (2C, C ₁ +C ₁ '-benzyl)	C: 52.17/52.13; H: 4.89/4.77

13	2229 (s, C≡N), 2144 (s, C≡N)	4.36 (s, 2H, CH ₂); 7.56 (d, 2H, $J_{2,3}=J_{6,5}=8.3$, H ₂ +H ₆); 7.85 (d, 2H, H ₃ +H ₅)	32.5 (1C, CH ₂); 105.6 (1C, SeCN); 111.3 (1C, C ₄ -benzyl); 119.5 (1C, CN); 130.7 (2C, C ₂ +C ₆ -benzyl); 133.4 (2C, C ₃ +C ₅ -benzyl); 145.2 (1C, C ₁ -benzyl)	C: 49.05/48.95; H: 2.76/2.69; N: 12.47/12.33
14	2229 (s, C≡N), 729 (w, Se-Se)	4.02 (s, 4H, 2CH ₂); 7.40 (d, 4H, $J_{2,3}=J_{6,5}=8.2$, H ₂ +H ₆ +H _{2'} +H _{6'}); 7.77 (d, 4H, H ₃ +H ₅ +H _{3'} +H _{5'})	31.3 (2C, CH ₂); 110.3 (2C, C ₄ , C _{4'} -benzyl); 119.8 (2C, CN); 130.7 (4C, C ₂ +C ₆ +C _{2'} +C _{6'} -benzyl); 133.1 (4C, C ₃ +C ₅ +C _{3'} +C _{5'} -benzyl); 146.2 (2C, C ₁ +C _{1'} -benzyl)	C: 49.23/49.04; H: 3.07/3.11; N: 7.18/7.07
15	2146 (m, C≡N), 1515 (s, C-NO ₂)	4.60 (s, 2H, CH ₂); 7.60-7.64 (m, 1H, H ₄); 7.67 (d, 1H, $J_{6,5}=7.6$, H ₆); 7.77-7.81 (m, 1H, H ₅); 8.12 (d, 1H, $J_{3,4}=8.2$, H ₃)	29.6 (1C, CH ₂); 104.9 (1C, CN); 126.3 (1C, C ₃ -benzyl); 130.5 (1C, C ₄ -benzyl); 133.5 (1C, C ₆ -benzyl); 133.9 (1C, C ₁ - benzyl); 135.1 (1C, C ₅ -benzyl); 148.0 (1C, C ₂ -benzyl)	C: 39.83/39.56; H: 2.49/2.54; N: 11.62/11.40
16	1511 (s, C-NO ₂), 741 (m, Se-Se)	4.27, (s, 4H, 2CH ₂); 7.36 (d, 2H, $J_{6,5}=J_{6',5'}=7.3$, H ₆ +H _{6'}); 7.51-7.55 (m, 2H, H ₄ +H _{4'}); 7.66-7.69 (m, 2H, H ₅ +H _{5'}); 8.05 (d, 2H, $J_{3,4}=J_{3',4'}=8.0$, H ₃ +H _{3'})	30.4 (2C, CH ₂); 126.2 (2C, C ₃ +C _{3'} -benzyl); 129.6 (2C, C ₄ +C _{4'} -benzyl); 133.1 (2C, C ₆ +C _{6'} -benzyl); 134.6 (2C, C ₁ +C _{1'} - benzyl); 135.5 (2C, C ₅ +C _{5'} -benzyl); 148.0 (2C, C ₂ +C _{2'} -benzyl)	C: 39.07/39.08; H: 2.79/2.76; N: 6.51/6.56
17	2147 (m, C≡N), 1520 (s, C-NO ₂)	4.44 (s, 2H, CH ₂); 7.67-7.71 (m, 1H, H ₅); 7.83 (d, 1H, $J_{6,5}=7.7$, H ₆); 8.18 (d, 1H, $J_{4,5}=8.1$, H ₄); 8.27 (s, 1H, H ₂)	31.9 (1C, CH ₂); 105.6 (1C, CN); 123.5 (1C, C ₄ -benzyl); 124.3 (1C, C ₂ -benzyl); 131.1 (1C, C ₅ -benzyl); 136.3 (1C, C ₆ - benzyl); 141.8 (1C, C ₁ -benzyl); 148.6 (1C, C ₃ -benzyl)	C: 39.83/39.95; H: 2.49/2.60; N: 11.62/11.24
18	1521 (s, C-NO ₂), 737 (m, Se-Se)	4.13 (s, 4H, 2CH ₂); 7.58-7.62 (m, 2H, H ₅ +H _{5'}); 7.67 (d, 2H, $J_{6,5}=J_{6',5'}=7.7$, H ₆ +H _{6'}); 8.05 (s, 2H, H ₂ +H _{2'}); 8.09 (d, 2H, $J_{4,5}=J_{4',5'}=8.2$, H ₄ +H _{4'})	30.5 (2C, CH ₂); 122.6 (2C, C ₄ +C _{4'} -benzyl); 124.1 (2C, C ₂ +C _{2'} -benzyl); 130.6 (2C, C ₅ +C _{5'} -benzyl); 136.3 (2C, C ₆ +C _{6'} - benzyl); 142.7 (2C, C ₁ +C _{1'} -benzyl); 148.4 (2C, C ₃ +C _{3'} -benzyl)	C: 39.07/39.25; H: 2.79/2.73; N: 6.51/6.46
19	2230 (s, C≡N), 2151 (s, C≡N)	4.47 (s, 1H, CH ₂); 7.49-7.53, (m, 1H, H ₄); 7.63 (d, 1H, $J_{6,5}=7.7$, H ₆); 7.71-7.75, (m, 1H, H ₅); 7.86 (d, 1H, $J_{3,4}=7.6$, H ₃)	30.5 (1C, CH ₂); 104.9 (1C, SeCN); 112.3 (1C, C ₂ -benzyl); 117.9 (1C, CN); 129.6 (1C, C ₄ -benzyl); 131.7 (1C, C ₆ -benzyl); 134.1 (1C, C ₃ -benzyl); 134.3 (1C, C ₅ -benzyl); 142.2 (1C, C ₁ - benzyl)	C: 49.05/48.83; H: 2.76/2.80; N: 12.47/12.40
20	2224 (s, C≡N); 762 (w, Se-Se)	4.18 (s, 4H, 2CH ₂); 7.43-7.48 (m, 4H, H ₄ +H ₆ +H _{4'} +H _{6'}); 7.65-7.69 (m, 2H, H ₅ +H _{5'}); 7.82 (d, 2H, $J_{3,4}=J_{3',4'}=7.9$, H ₃ +H _{3'})	30.0 (2C, CH ₂); 112.2 (2C, C ₂ +C _{2'} -benzyl); 118.5 (2C, CN); 128.8 (2C, C ₄ +C _{4'} -benzyl); 131.2 (2C, C ₆ +C _{6'} -benzyl); 133.9 (2C, C ₃ +C _{3'} -benzyl); 134.1 (2C, C ₅ +C _{5'} -benzyl); 143.4 (2C, C ₁ +C _{1'} -benzyl)	C: 49.23/49.63; H: 3.07/3.11; N: 7.18/7.07
21	2226 (s, C≡N), 2150 (s, C≡N)	4.35 (s, 2H, CH ₂); 7.59-7.62 (m, 1H, H ₅); 7.72 (d, 1H, $J_{6,5}=8.2$, H ₆); 7.78 (d, 1H, $J_{4,5}=7.7$, H ₄); 7.80 (s, 1H, H ₂)	32.0 (1C, CH ₂); 105.6 (1C, SeCN); 112.3 (1C, C ₃ -benzyl); 119.4 (1C, CN); 130.8 (1C, C ₅ -benzyl); 132.4 (1C, C ₄ -benzyl); 133.1 (1C, C ₂ -benzyl); 134.7 (1C, C ₆ -benzyl); 141.2 (1C, C ₁ - benzyl)	C: 49.05/48.83; H: 2.76/2.68; N: 12.47/12.26
22	2223 (s, C≡N); 687 (w, Se-Se)	4.01 (s, 4H, 2CH ₂); 7.51-7.55 (m, 2H, H ₅ +H _{5'}); 7.57 (d, 2H, $J_{6,5}=J_{6',5'}=8.0$, H ₆ +H _{6'}); 7.64 (s, 2H, H ₂ +H _{2'}); 7.72 (d, 2H, $J_{4,5}=J_{4',5'}=7.3$, H ₄ +H _{4'})	30.6 (2C, CH ₂); 112.0 (2C, C ₃ +C _{3'} -benzyl); 119.5 (2C, CN); 130.5 (2C, C ₅ +C _{5'} -benzyl); 131.0 (2C, C ₄ +C _{4'} -benzyl); 133.0 (2C, C ₂ +C _{2'} -benzyl); 134.6 (2C, C ₆ +C _{6'} -benzyl); 141.9 (2C, C ₁ +C _{1'} -benzyl)	C: 49.23/48.88; H: 3.07/3.27; N: 7.18/7.29
23	2150 (s, C≡N);	4.36 (s, 2H, CH ₂ -Se); 6.10 (s, 2H, O-CH ₂ -O);	34.3 (CH ₂ -Se); 103.5 (O-CH ₂ -O); 105.9 (CN); 111.3 (C ₆);	C: 33.86/34.02; H: 1.88/2.05;

	1033 (s, C-Br)	7.11 (s, 1H, H ₆); 7.27 (s, 1H, H ₃)	113.8 (C ₄); 115.1 (C ₃); 130.6 (C ₅); 148.2 (C ₂); 149.4 (C ₁)	N: 4.39/4.13
24	766 (s, Se-Se)	4.03 (s, 4H, CH ₂ -Se+CH ₂ -Se); 6.00 (s, 4H, O-CH ₂ -O+O-CH ₂ -O); 6.77 (s, 2H, H ₆ +H ₆); 7.01 (s, 2H, H ₃ +H ₃)	33.3 (CH ₂ -Se); 103.1 (O-CH ₂ -O); 111.6 (C ₆ +C ₆); 113.7 (C ₄ +C ₄); 115.2 (C ₃ +C ₃); 132.9 (C ₅ +C ₅); 147.0 (C ₂ +C ₂); 148.8 (C ₁ +C ₁)	C: 32.76/32.99; H: 2.04/2.02
25	2138 (s, C≡N); 1593 (f, C=N)	4.89 (s, 2H, CH ₂ -Se); 7.58-7.63 (m, 2H, H ₆ +H ₇); 7.88 (m, 1H, H ₃); 7.97 (dd, 1H, J ₅₋₆ =8.1, J ₅₋₇ =1.6, H ₅); 8.44 (dd, 1H, J ₄₋₃ =8.4, J ₄₋₂ =2.2, H ₄); 8.94 (dd, 1H, J ₂₋₃ =4.3, J ₂₋₄ =2.2, H ₂)	29.5 (CH ₂ -Se); 106.1 (CN); 123.6 (C ₃); 127.3 (C ₇); 129.5 (C ₅ +C ₆); 131.7 (C ₈); 136.0 (C ₉); 138.1 (C ₄); 146.9 (C ₂)	C: 53.44/53.35; H: 3.33/3.49; N: 11.33/11.06
26	1591 (s, C=C); 790 (s, Se-Se)	4.58 (s, 4H, 2CH ₂ -Se); 7.43-7.48 (m, 4H, H ₆ +H ₇ +H ₆ +H ₇); 7.57 (dd, 2H, J ₃₋₄ =8.1, J ₃₋₂ =4.6, H ₃ +H ₃); 7.89 (dd, 2H, J ₅₋₆ =8.1, J ₅₋₇ =2.5, H ₅ +H ₅); 8.38 (dd, 2H, J ₄₋₃ =8.1, J ₄₋₂ =2.5, H ₄ +H ₄); 8.97 (dd, 2H, J ₂₋₃ =4.6, J ₂₋₄ =2.5, H ₂ +H ₂)	30.2 (CH ₂ -Se); 122.5 (C ₃ +C ₃); 127.1 (C ₇ +C ₇); 128.0 (C ₅ +C ₆ +C ₅ +C ₆); 130.7 (C ₈ +C ₈); 137.9 (C ₉ +C ₉); 138.4 (C ₄ +C ₄); 146.2 (C ₂ +C ₂); 150.1 (C ₁₀ +C ₁₀)	C: 54.30/54.80; H: 3.62/4.00; N: 6.33/6.10
27	2142 (m, C≡N); 1591 (m, C=N)	4.73 (s, 4H, 2CH ₂); 7.62 (t, 2H, J ₆₋₅ =J ₇₋₈ =11.0, H ₆ +H ₇); 7.79 (d, 1H, J ₃₋₄ =9.4, H ₃); 7.98 (dd, 2H, J ₅₋₆ =J ₈₋₇ =11.0, J ₅₋₇ =J ₈₋₆ =9.4, H ₅ +H ₈); 8.41 (d, 1H, J ₄₋₃ =9.4, H ₄)	35.8 (CH ₂ -Se); 105.9 (CN); 122.6 (C ₃); 127.3 (C ₅ +C ₇); 129.0 (C ₆ +C ₉); 131.7 (C ₈); 138.2 (C ₄); 147.8 (C ₁₀); 158.0 (C ₂)	C: 53.44/53.52; H: 3.33/3.62; N: 11.33/11.10
28	2145 (m, C≡N); 1625 (d, C=N)	5.47 (s, 2H, CH ₂ -Se); 7.69 (t, 2H, J ₂₋₁ =J ₇₋₈ =9.3, H ₂ +H ₇); 7.87 (t, 2H, J ₃₋₄ =J ₆₋₅ =9.1, H ₃ +H ₆); 8.19 (d, 2H, J ₄₋₃ =J ₅₋₆ =9.1, H ₄ +H ₅); 8.58 (d, 2H, J ₁₋₂ =J ₈₋₇ =9.3, H ₁ +H ₈)	24.4 (CH ₂ -Se); 104.0 (CN); 124.9 (C ₁₂ +C ₁₄); 125.3 (C ₁ +C ₁₁); 127.0 (C ₂ +C ₁₀); 130.7 (C ₄ +C ₈); 132.2 (C ₃ +C ₉); 142.1 (C ₁₃); 149.4 (C ₅ +C ₇)	C: 60.60/60.74; H: 3.36/3.36; N: 9.42/9.13
29	2153 (s, C≡N); 1608 (m, C=N)	4.91 (s, 4H, CH ₂ -Se); 7.87-7.89 (m, 2H, H ₆ +H ₇); 8.06-8.08 (m, 2H, H ₅ +H ₈)	32.3 (CH ₂ -Se); 105.0 (CN); 129.9 (C ₆ +C ₉); 132.2 (C ₇ +C ₈); 141.3 (C ₅ +C ₁₀); 151.0 (C ₂ +C ₃)	C: 39.34/39.16; H: 2.18/2.17; N: 15.30/15.06
30	2150 (m, C≡N); 1709 (s, C=O)	3.83 (s, 3H, OCH ₃); 3.87 (s, 3H, OCH ₃); 4.42 (s, 2H, CH ₂ -Se); 6.33 (s, 1H, CH-CO); 7.10 (s, 1H, H ₅); 7.43 (s, 1H, H ₈)	29.5 (CH ₂ -Se); 56.3 (OCH ₃); 58.7 (OCH ₃); 100.1 (C ₉); 102.7 (CN); 107.8 (C ₆); 110.0 (C ₃); 114.6 (C ₅); 147.2 (C ₁₀); 150.3 (C ₇); 152.2 (C ₈); 154.1 (C ₄); 161.5 (CO)	C: 48.15/48.02; H: 3.40/3.40; N: 4.32/4.20
31	1666 (s, C=O); 710 (m, Se-Se)	4.21 (s, 4H, CH ₂ -Se, CH ₂ -Se); 7.70 (d, 2H, J ₃₋₄ =8.1, H ₃ +H ₃); 7.86-7.89 (m, 4H, H ₅ +H ₈ +H ₅ +H ₈); 7.95 (s, 2H, H ₁ +H ₁); 8.06 (d, 2H, J ₄₋₃ =8.1, H ₄ +H ₄); 8.09-8.11 (m, 4H, H ₆ +H ₇ +H ₆ +H ₇)	31.4 (CH ₂ -Se); 127.6 (C ₁ +C ₄ +C ₈ +C ₁₁ +C ₁ +C ₄ +C ₈ +C ₁₁); 133.2 (C ₃ +C ₃); 134.1 (C ₉ +C ₁₀ +C ₉ +C ₁₀); 135.3 (C ₅ +C ₇ +C ₁₂ +C ₁₄ +C ₅ +C ₇ +C ₁₂ +C ₁₄); 148.0 (C ₂ +C ₂); 183.2 (CO)	C: 59.11/59.12; H: 3.12/3.44
32	2149 (s, C≡N); 1678 (s, C=O)	1.63-1.67 (m, 6H, CH ₂ -CH); 1.80-1.81 (m, 6H, CH ₂ -C-CO); 1.99 (s, 3H, CH); 4.63 (s, 2H, CH ₂ -Se)	27.1 (CH ₂ -Se); 29.0 (CH); 36.7 (CH ₂ -CH); 38.4 (CH ₂ -C-CO); 47.1 (C-CO); 104.5 (CN); 210.2 (CO)	C: 55.31/55.38; H: 6.03/6.19; N: 4.96/4.70
33	3252 (m, N-H)	7.03 (d, 4H, J ₃₋₂ =J ₅₋₆ =7.1, A+A', H ₃ +H ₅); 7.43	121.6 (4C, A+A', C ₃ +C ₅); 126.0 (2C, A+A', C ₁); 127.9	C: 34.80/35.27; H: 2.36/2.32;

	1160 (s, SO ₂), 816 (w, Se-Se)	(d, 4H, $J_{2,3}=J_{6,5}=7.1$, A+A', H ₂ +H ₆); 7.67 (d, 4H, $J_{3,2}=J_{5,6}=7.3$, B+B', H ₃ +H ₅); 7.78 (d, 4H, $J_{2,3}=J_{HF-HF}=7.3$, B+B', H ₂ +H ₆); 10.36 (s, 2H, 2NH)	(2C, B+B', C ₄); 129.5 (4C, B+B', C ₂ +C ₆); 133.3 (4C, B+B', C ₃ +C ₅); 134.0 (4C, A+A', C ₂ +C ₆); 138.4 (2C, A+A', C ₄); 139.4 (2C, B+B', C ₁)	N: 3.26/3.42
34	3254 (m, N-H), 1158 (s, SO ₂), 806 (w, Se-Se)	7.02 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.43 (d, 4H, $J_{2,3}=J_{6,5}=8.6$, A+A', H ₂ +H ₆); 7.63 (d, 4H, $J_{3,2}=J_{5,6}=8.5$, B+B', H ₃ +H ₅); 7.75 (d, 4H, $J_{2,3}=J_{6,5}=8.5$, B+B', H ₂ +H ₆); 10.57 (s, 2H, 2NH)	121.8 (4C, A+A', C ₃ +C ₅); 125.9 (2C, A+A', C ₁); 129.5 (4C, B+B', C ₂ +C ₆); 130.4 (4C, B+B', C ₃ +C ₅); 134.1 (4C, A+A', C ₂ +C ₆); 138.4 (2C, B+B', C ₄); 138.6 (2C, A+A', C ₄); 138.9 (2C, B+B', C ₁)	C: 41.68/41.46; H: 2.60/2.68; N: 4.05/3.96
35	3279 (m, N-H), 1164 (s, SO ₂), 814 (w, Se-Se)	7.01 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.36 (d, 4H, $J_{2,3}=J_{6,5}=8.6$, A+A', H ₂ +H ₆); 7.62 (d, 2H, $J_{3,4}=3.7$, B+B', H ₃); 8.05 (d, 4H, $J_{6,5}=7.8$, B+B', H ₆); 10.82 (s, 2H, 2NH)	120.5 (4C, A+A', C ₃ +C ₅); 125.4 (2C, A+A', C ₁); 128.6 (2C, B+B', C ₅); 131.5 (2C, B+B', C ₆); 132.5 (2C, B+B', C ₃); 132.8 (2C, B+B', C ₂); 134.2 (4C, A+A', C ₂ +C ₆); 135.7 (2C, B+B', C ₄); 137.1 (2C, A+A', C ₄); 138.2 (2C, B+B', C ₁)	C: 41.68/41.61; H: 2.60/3.01; N: 4.05/3.71
36	3279 (m, N-H), 1157 (s, SO ₂), 816 (w, Se-Se)	7.03 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.37-7.43 (m, 8H, A+A', H ₂ +H ₆ , B+B', H ₃ +H ₅); 7.82 (m, 4H, B+B', H ₂ +H ₆); 10.52 (s, 2H, 2NH)	116.8 (4C, B+B', C ₃ +C ₅); 122.1 (4C, A+A', C ₃ +C ₅); 125.8 (2C, A+A', C ₁); 130.7 (4C, B+B', C ₂ +C ₆); 133.6 (4C, A+A', C ₂ +C ₆); 136.5 (2C, B+B', C ₁); 138.6 (2C, A+A', C ₄); 166.5 (2C, B+B', C ₄)	C: 43.76/43.31; H: 2.73/2.83; N: 4.25/4.21
37	3237 (s, N-H), 1160 (s, SO ₂), 816 (m, Se-Se)	7.03 (d, 4H, $J_{3,2}=J_{5,6}=7.9$, A+A', H ₃ +H ₅); 7.37-7.44 (m, 8H, A+A', H ₂ +H ₆ , B+B', H ₃ +H ₅); 7.67-7.71 (m, 2H, B+B', H ₄); 7.82-7.87 (m, 2H, B+B', H ₆); 10.82 (s, 2H, 2NH)	118.1 (2C, B+B', C ₃); 120.9 (4C, A+A', C ₃ +C ₅); 125.7 (2C, A+A', C ₁); 127.6 (2C, B+B', C ₅); 131.3 (2C, B+B', C ₁); 134.1 (4C, A+A', C ₂ +C ₆); 137.0 (2C, B+B', C ₆); 138.2 (2C, A+A', C ₄); 157.7 (2C, B+B', C ₄); 160.2 (2C, B+B', C ₂)	C: 43.76/44.23; H: 2.74/3.20; N: 4.25/4.23
38	3251 (s, N-H), 1156 (s, SO ₂), 822 (m, Se-Se)	3.79 (s, 6H, 2OCH ₃); 7.02 (d, 4H, $J_{3,2}=J_{5,6}=8.7$, A+A', H ₃ +H ₅); 7.05 (d, 4H, $J_{3,2}=J_{5,6}=9.0$, B+B', H ₃ +H ₅); 7.40 (d, 4H, $J_{2,3}=J_{6,5}=8.7$, A+A', H ₂ +H ₆); 7.70 (d, 4H, $J_{2,3}=J_{6,5}=9.0$, B+B', H ₂ +H ₆); 10.36 (s, 2H, 2NH)	56.5 (1C, OCH ₃); 115.3 (4C, B+B', C ₃ +C ₅); 121.0 (4C, A+A', C ₃ +C ₅); 125.3 (2C, A+A', C ₁); 129.7 (4C, B+B', C ₂ +C ₆); 131.7 (2C, B+B', C ₁); 134.1 (4C, A+A', C ₂ +C ₆); 139.0 (2C, A+A', C ₄); 163.4 (2C, B+B', C ₄)	C: 45.75/45.36; H: 3.52/3.82; N: 4.10/3.75
39	3268 (s, N-H), 1164 (s, SO ₂), 835 (m, Se-Se)	7.05 (d, 4H, $J_{3,2}=J_{5,6}=8.7$, A+A', H ₃ +H ₅); 7.45 (d, 4H, $J_{2,3}=J_{6,5}=8.7$, A+A', H ₂ +H ₆); 8.00 (d, 4H, $J_{2,3}=J_{6,5}=8.9$, B+B', H ₂ +H ₆); 8.37 (d, 4H, $J_{3,2}=J_{5,6}=8.9$, B+B', H ₃ +H ₅); 10.81 (s, 2H, 2NH)	121.7 (4C, A+A', C ₃ +C ₅); 125.6 (2C, A+A', C ₁); 128.4 (4C, B+B', C ₃ +C ₅); 129.1 (4C, B+B', C ₂ +C ₆); 133.9 (4C, A+A', C ₂ +C ₆); 137.9 (2C, A+A', C ₄); 145.5 (2C, B+B', C ₁); 150.8 (2C, B+B', C ₄)	C: 40.45/40.62; H: 2.53/2.78; N: 7.87/7.90
40	3251 (s, N-H), 1159 (s, SO ₂), 834 (m, Se-Se)	7.03 (d, 4H, $J_{3,2}=J_{5,6}=8.5$, A+A', H ₃ +H ₅); 7.44 (d, 4H, $J_{2,3}=J_{6,5}=8.5$, A+A', H ₂ +H ₆); 7.92 (d, 4H, $J_{3,2}=J_{5,6}=8.4$, B+B', H ₃ +H ₅); 8.05 (d, 4H, $J_{2,3}=J_{6,5}=8.4$, B+B', H ₂ +H ₆); 10.76 (s, 2H, 2NH)	116.4 (2C, B+B', C ₄); 118.3 (2C, CN); 121.6 (4C, A+A', C ₃ +C ₅); 126.3 (2C, A+A', C ₁); 128.3 (4C, B+B', C ₂ +C ₆); 133.9 (4C, A+A', C ₂ +C ₆); 134.4 (4C, B+B', C ₃ +C ₅); 138.0 (2C, A+A', C ₄); 144.2 (2C, B+B', C ₁)	C: 45.20/45.33; H: 2.75/2.74; N: 8.11/7.90
41	3238 (s, N-H),	7.02 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.38	121.1 (4C, A+A', C ₃ +C ₅); 125.6 (2C, A+A', C ₁); 127.5	C: 46.30/46.21; H: 3.21/3.62;

	1160 (s, SO ₂), 820 (m, Se-Se)	(d, 4H, $J_{2,3}=J_{6,5}=8.6$, A+A', H ₂ +H ₆); 7.56 (t, 4H, B+B', H ₃ +H ₅); 7.61 (dd, 2H, $J_{4,3}=7.4$, $J_{4,2}=1.2$, B+B', H ₄); 7.77 (dd, 4H, $J_{2,3}=J_{6,5}=7.4$, $J_{2,4}=J_{6,4}=1.2$, B+B', H ₂ +H ₆); 10.50 (s, 2H, 2NH)	(4C, B+B', C ₂ +C ₆); 130.2 (4C, B+B', C ₃ +C ₅); 133.9 (4C, A+A', C ₂ +C ₆); 134.2 (2C, B+B', C ₄); 138.8 (2C, A+A', C ₄); 140.1 (2C, B+B', C ₁)	N: 4.50/4.46
42	3256 (s, N-H), 1161 (s, SO ₂), 840 (m, Se-Se)	7.04 (d, 4H, , $J_{3,2}=J_{5,6}=8.3$, A+A', H ₃ +H ₅); 7.44 (d, 4H, $J_{2,3}=J_{6,5}=8.3$, A+A', H ₂ +H ₆); 7.96 (s, 8H, B+B', H ₂ +H ₃ +H ₅ +H ₆); 10.72 (s, 2H, 2NH)	121.5 (4C, A+A', C ₃ +C ₅); 122.8 (2C, CF ₃); 125.5 (2C, A+A', C ₁); 126.2 (4C, B+B', C ₃ +C ₅); 127.5 (4C, B+B', C ₂ +C ₆); 128.5 (2C, B+B', C ₄); 134.1 (4C, A+A', C ₂ +C ₆); 138.2 (2C, A+A', C ₄); 144.1 (2C, B+B', C ₁)	C: 41.16/41.46; H: 2.37/2.53; N: 3.69/3.48
43	3235 (s, N-H), 1159 (s, SO ₂), 812 (m, Se-Se)	2.33 (s, 6H, 2CH ₃); 7.02 (d, 4H, $J_{3,2}=J_{5,6}=8.7$, A+A', H ₃ +H ₅); 7.34 (d, 4H, $J_{3,2}=J_{5,6}=8.2$, B+B', H ₃ +H ₅); 7.38 (d, 4H, $J_{2,3}=J_{6,5}=8.7$, A+A', H ₂ +H ₆); 7.64 (d, 4H, $J_{2,3}=J_{6,5}=8.2$, B+B', H ₂ +H ₆); 10.43 (s, 2H, 2NH)	21.8 (1C, CH ₃); 121.1 (4C, A+A', C ₃ +C ₅); 125.4 (2C, A+A', C ₁); 127.6 (4C, B+B', C ₂ +C ₆); 130.6 (4C, B+B', C ₃ +C ₅); 134.1 (4C, A+A', C ₂ +C ₆); 137.3 (2C, A+A', C ₄); 138.9 (2C, B+B', C ₁); 144.3 (2C, B+B', C ₄)	C: 48.00/47.77; H: 3.69/4.09; N: 4.30/4.20
44	3249 (s, N-H), 1158 (s, SO ₂), 806 (m, Se-Se)	7.04 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.33 (d, 4H, $J_{2,3}=J_{6,5}=8.6$, A+A', H ₂ +H ₆); 7.61-7.68 (m, 4H, B+B', H ₄ +H ₅); 7.75 (dd, 2H, $J_{8,7}=8.0$, $J_{8,2}=2.0$, B+B', H ₈); 7.99 (d, 2H, $J_{7,8}=8.0$, B+B', H ₇); 8.09 (dd, 4H, $J_{3,4}=J_{6,5}=13.6$, $J_{3,5}=J_{6,4}=8.4$, B+B', H ₃ +H ₆); 8.45 (s, 2H, B+B', H ₂); 10.59 (s, 2H, 2NH)	120.6 (4C, A+A', C ₃ +C ₅); 122.7 (2C, B+B', C ₃); 125.8 (2C, A+A', C ₁); 128.7 (2C, B+B', C ₁); 129.8 (2C, B+B', C ₆); 130.0 (2C, B+B', C ₉); 130.1 (2C, B+B', C ₇); 130.3 (2C, B+B', C ₈); 130.5 (2C, B+B', C ₄); 132.3 (2C, B+B', C ₁₀); 133.5 (4C, A+A', C ₂ +C ₆); 134.6 (2C, B+B', C ₂); 135.1 (2C, B+B', C ₅); 138.7 (2C, A+A', C ₄)	C: 51.87/51.63; H: 3.37/3.77; N: 3.78/3.96
45	3268 (s, N-H), 1164 (s, SO ₂), 835 (m, Se-Se)	6.95 (d, 4H, $J_{3,2}=J_{5,6}=8.5$, A+A', H ₃ +H ₅); 7.17 (d, 4H, $J_{2,3}=J_{6,5}=8.5$, A+A', H ₂ +H ₆); 7.68-7.72 (m, 4H, B+B', H ₆ +H ₃); 8.27 (dd, 2H, $J_{5,6}=8.2$, $J_{5,7}=1.3$, B+B', H ₅); 8.37 (dd, 2H, $J_{7,6}=7.3$, $J_{7,5}=1.3$, B+B', H ₇); 8.50 (dd, 2H, $J_{4,3}=8.4$, $J_{4,0}=1.7$, B+B', H ₄); 9.11 (dd, 2H, $J_{2,3}=4.2$, $J_{2,4}=1.7$, B+B', H ₂); 10.30 (s, 2H, 2NH)	120.2 (2C, B+B', C ₃); 121.6 (4C, A+A', C ₃ +C ₅); 123.5 (2C, B+B', C ₈); 125.0 (2C, A+A', C ₁); 126.5 (2C, B+B', C ₇); 129.2 (2C, B+B', C ₅); 133.2 (4C, A+A', C ₂ +C ₆); 134.4 (2C, B+B', C ₆); 135.8 (2C, B+B', C ₄); 138.9 (2C, A+A', C ₄); 143.5 (2C, B+B', C ₉); 151.9 (2C, B+B', C ₁₀); 152.7 (2C, B+B', C ₂)	C: 49.72/49.56; H: 3.03/3.11; N: 7.73/7.69
46	3250 (s, N-H), 1157 (s, SO ₂), 806 (m, Se-Se)	7.07 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.43 (d, 4H, $J_{2,3}=J_{6,5}=8.6$, A+A', H ₂ +H ₆); 7.47 (m, 6H, B ₂ +B ₂ ', H ₃ +H ₄ +H ₅); 7.69 (dd, 4H, $J_{2,3}=J_{6,5}=7.1$, $J_{2,4}=J_{6,4}=1.5$, B ₂ +B ₂ ', H ₂ +H ₆); 7.84-7.87 (m, 8H, B ₁ +B ₁ ', H ₂ +H ₃ +H ₅ +H ₆); 10.57 (s, 2H, 2NH)	121.8 (4C, A+A', C ₃ +C ₅); 125.6 (2C, A+A', C ₁); 127.9 (4C, B ₁ +B ₁ ', C ₃ +C ₅); 129.0 (2C, B ₂ +B ₂ ', C ₄); 129.4 (4C, B ₁ +B ₁ ', C ₂ +C ₆); 129.6 (4C, B ₂ +B ₂ ', C ₂ +C ₆); 130.3 (4C, B ₂ +B ₂ ', C ₃ +C ₅); 133.7 (4C, A+A', C ₂ +C ₆); 134.6 (2C, B ₁ +B ₁ ', C ₄); 138.8 (2C, A+A', C ₄); 139.0 (2C, B ₁ +B ₁ ', C ₁); 145.3 (2C, B ₂ +B ₂ ', C ₁)	C: 55.81/55.35; H: 3.62/3.51; N: 3.61/3.58
47	3249 (m, N-H), 1145 (s, SO ₂), 825 (m, Se-Se)	3.80 (s, 6H, N-CH ₃); 7.02 (s, 2H, B+B', H ₄), 7.10 (d, 4H, $J_{3,2}=J_{5,6}=8.1$, A+A', H ₃ +H ₅); 7.41 (s, 2H, B+B', H ₅); 7.47 (d, 4H, $J_{2,3}=J_{6,5}=8.1$,	35.4 (2C, N-CH ₃); 121.5 (4C, A+A', C ₃ +C ₅); 125.8 (2C, A+A', C ₁); 127.5 (2C, B+B', C ₅); 128.7 (2C, B+B', C ₄); 133.9 (4C, A+A', C ₂ +C ₆); 138.2 (2C, A+A', C ₄); 142.5	C: 36.99/36.90; H: 3.15/3.51; N: 12.94/12.52

		A+A', H ₂ +H ₆); 10.99 (s, 2H, 2NH)	(2C, B+B', C ₂)	
48	3246 (m, N-H), 1154 (s, SO ₂), 814 (w, Se-Se)	7.08 (d, 4H, $J_{3,2}=J_{5,6}=8.6$, A+A', H ₃ +H ₅); 7.12 (dd, 2H, $J_{4,3}=4.9$, $J_{4,5}=3.8$, B+B', H ₄); 7.45 (d, 4H, $J_{2,3}=J_{6,5}=8.6$, A+A', H ₂ +H ₆); 7.56 (dd, 2H, $J_{5,4}=3.8$, $J_{5,3}=1.3$, B+B', H ₅); 7.90 (dd, 2H, $J_{3,4}=4.9$, $J_{3,5}=1.3$, B+B', H ₃)	121.6 (4C, A+A', C ₃ +C ₅); 126.0 (2C, A+A', C ₁); 128.5 (2C, B+B', C ₅); 133.5 (4C, A+A', C ₂ +C ₆); 134.2 (2C, B+B', C ₄); 134.4 (2C, B+B', C ₃); 138.6 (2C, A+A', C ₄); 140.6 (2C, B+B', C ₂)	C: 37.85/38.02; H: 2.52/2.86; N: 4.41/4.09

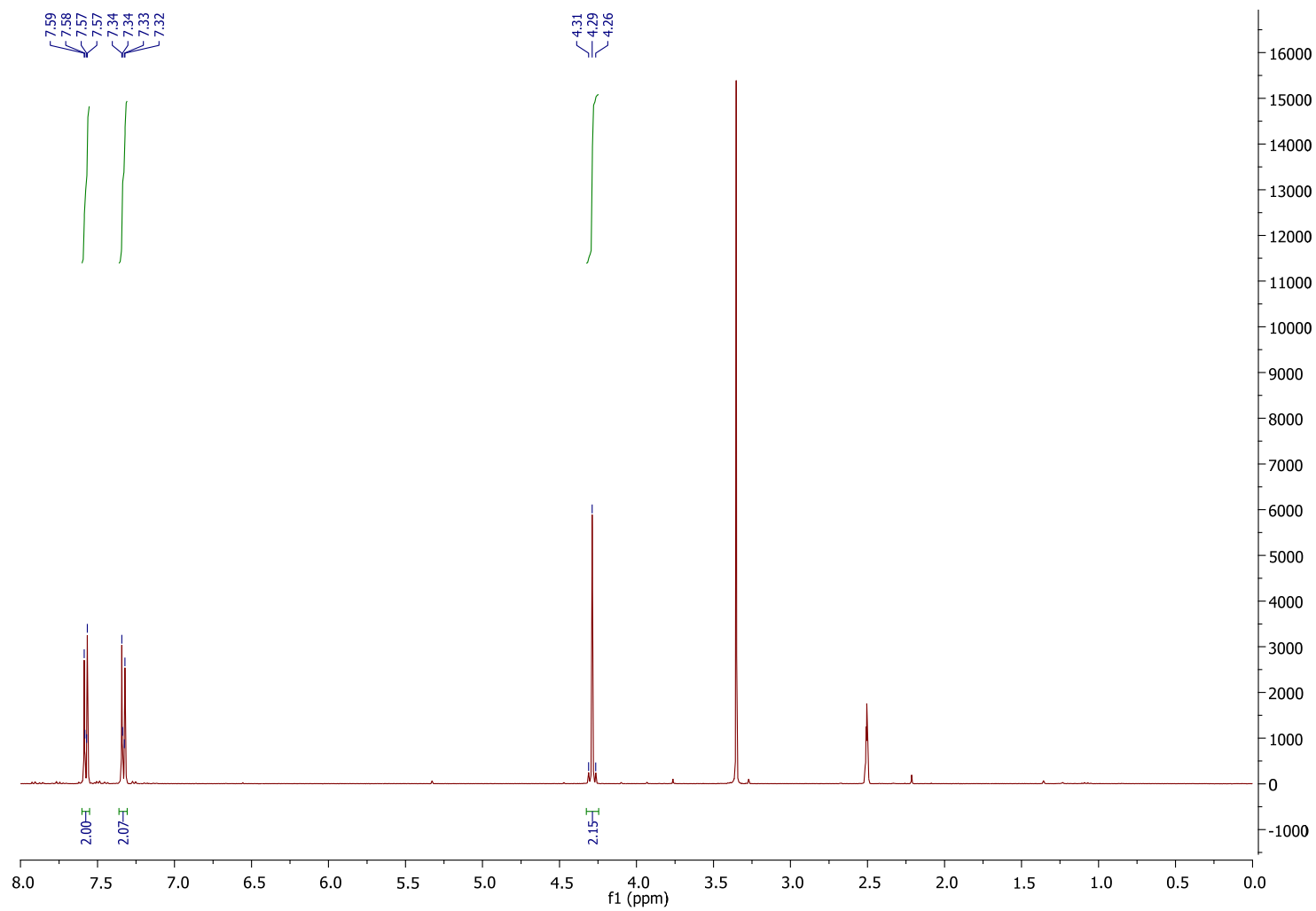


Figure S1. $^1\text{H-NMR}$ spectrum for compound **1**.

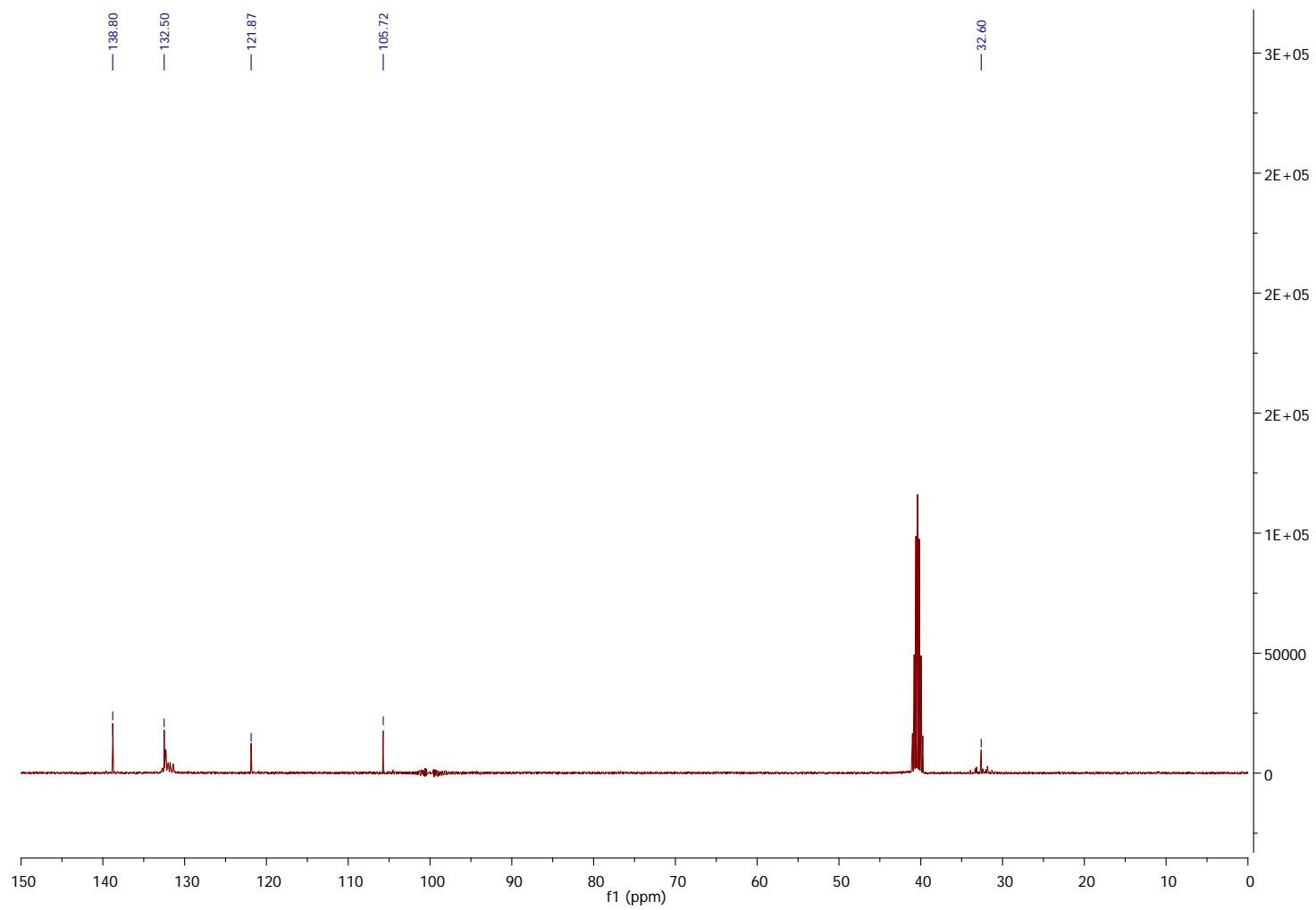


Figure S2. ^{13}C -NMR spectrum for compound **1**.

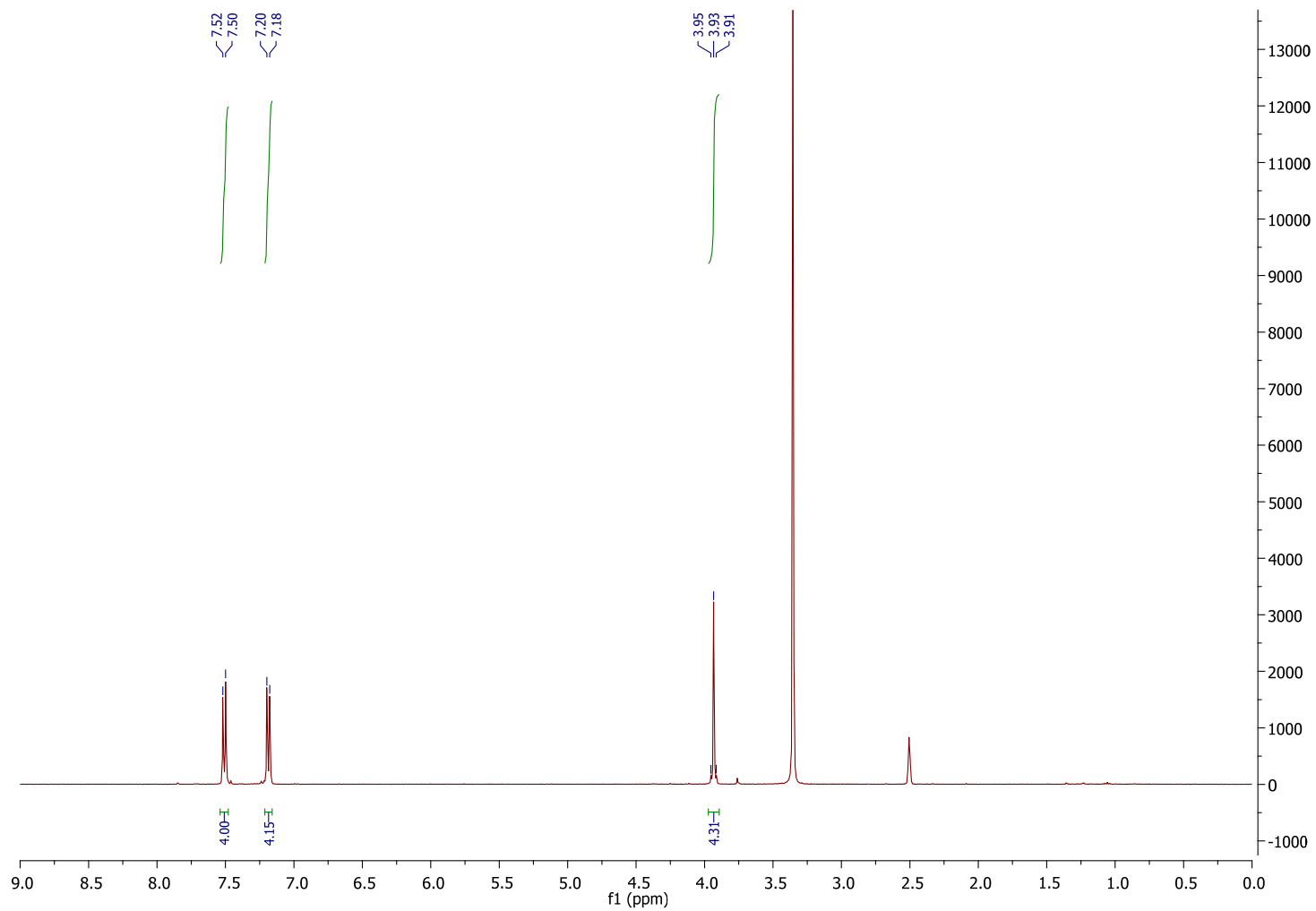


Figure S3. ¹H-NMR spectrum for compound **2**.

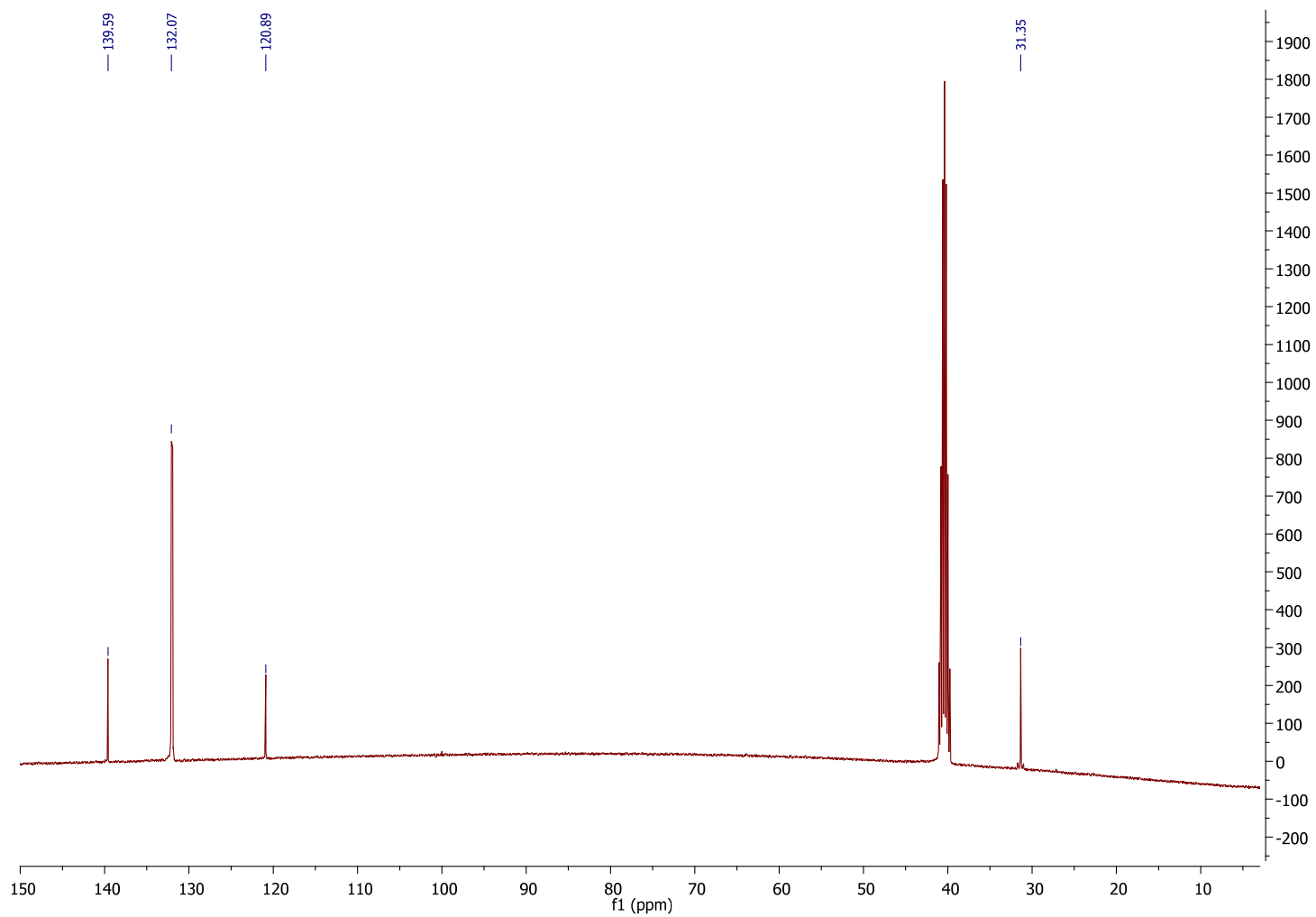


Figure S4. ^{13}C -NMR spectrum for compound 2.

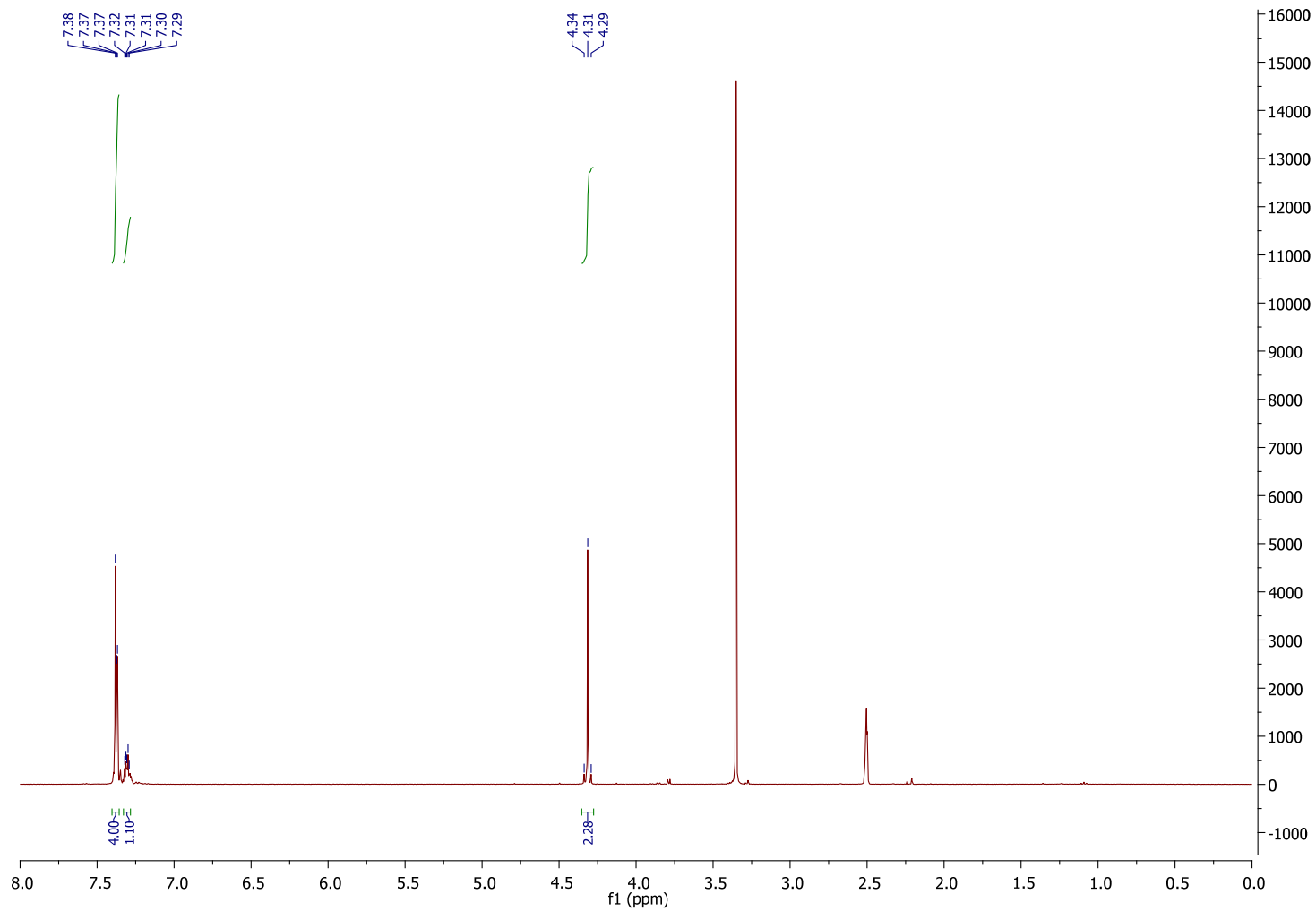


Figure S5. $^1\text{H-NMR}$ spectrum for compound **3**.

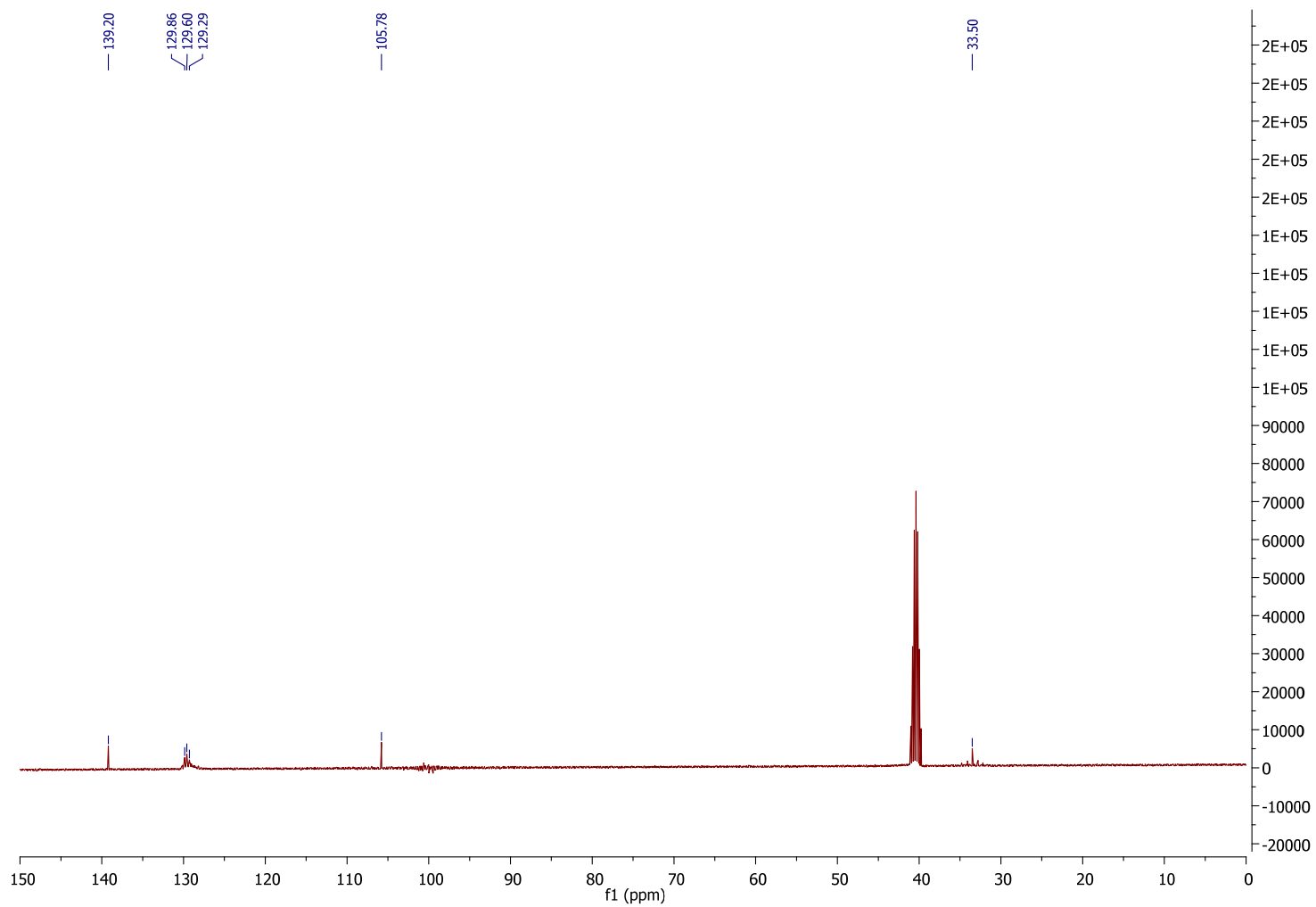


Figure S6. ^{13}C -NMR spectrum for compound 3.

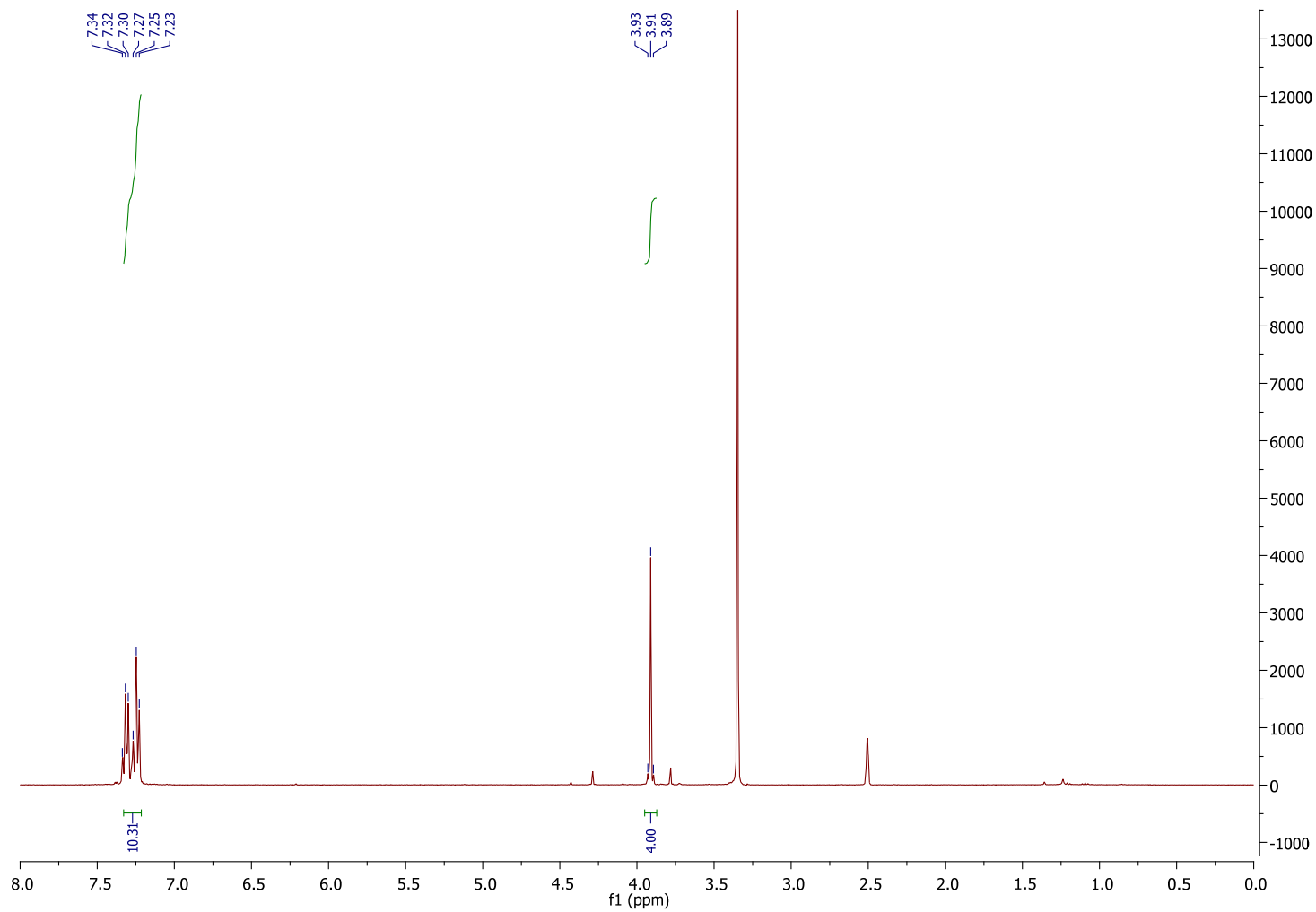


Figure S7. ¹H-NMR spectrum for compound **4**.

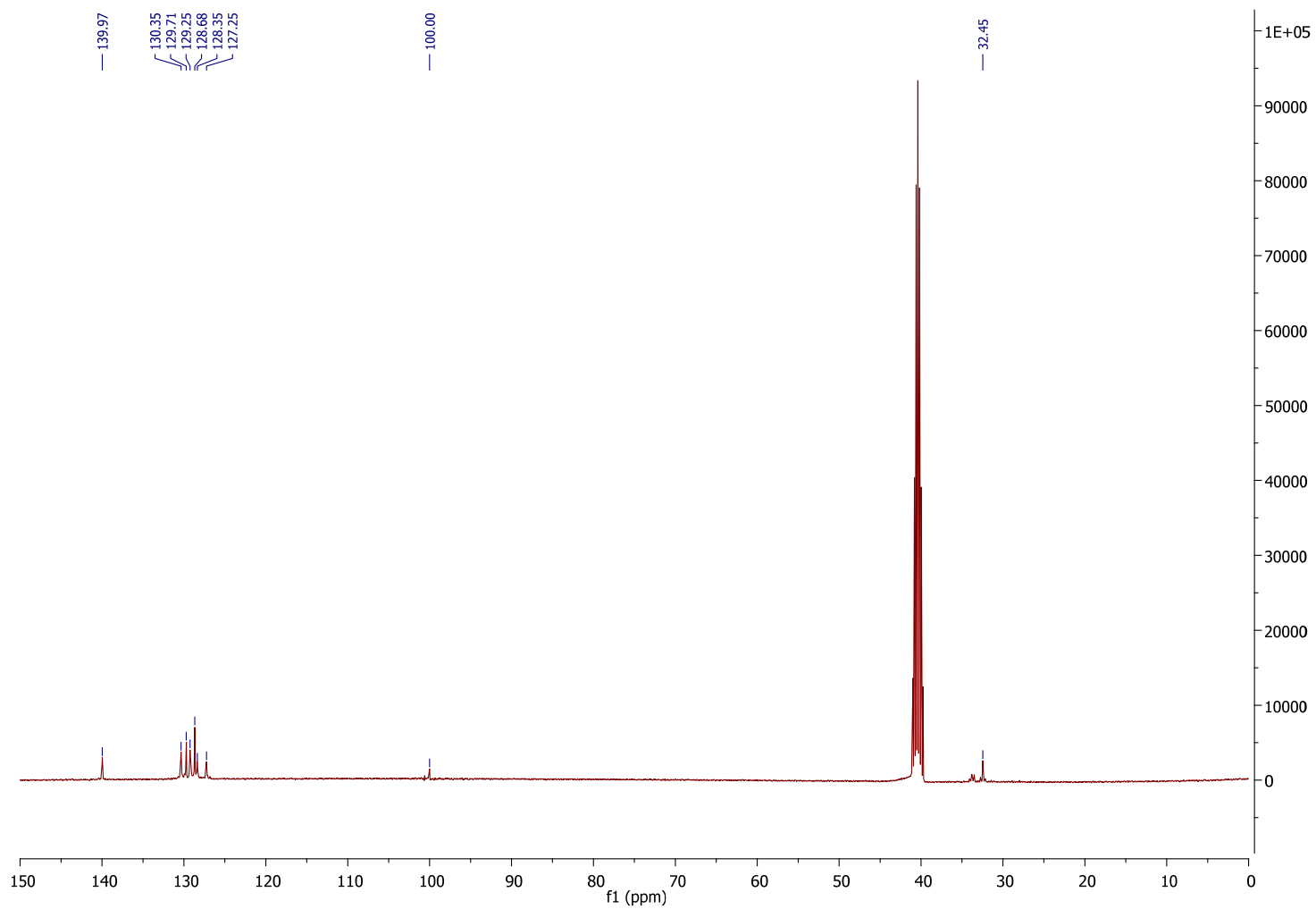


Figure S8. ^{13}C -NMR spectrum for compound **4**.

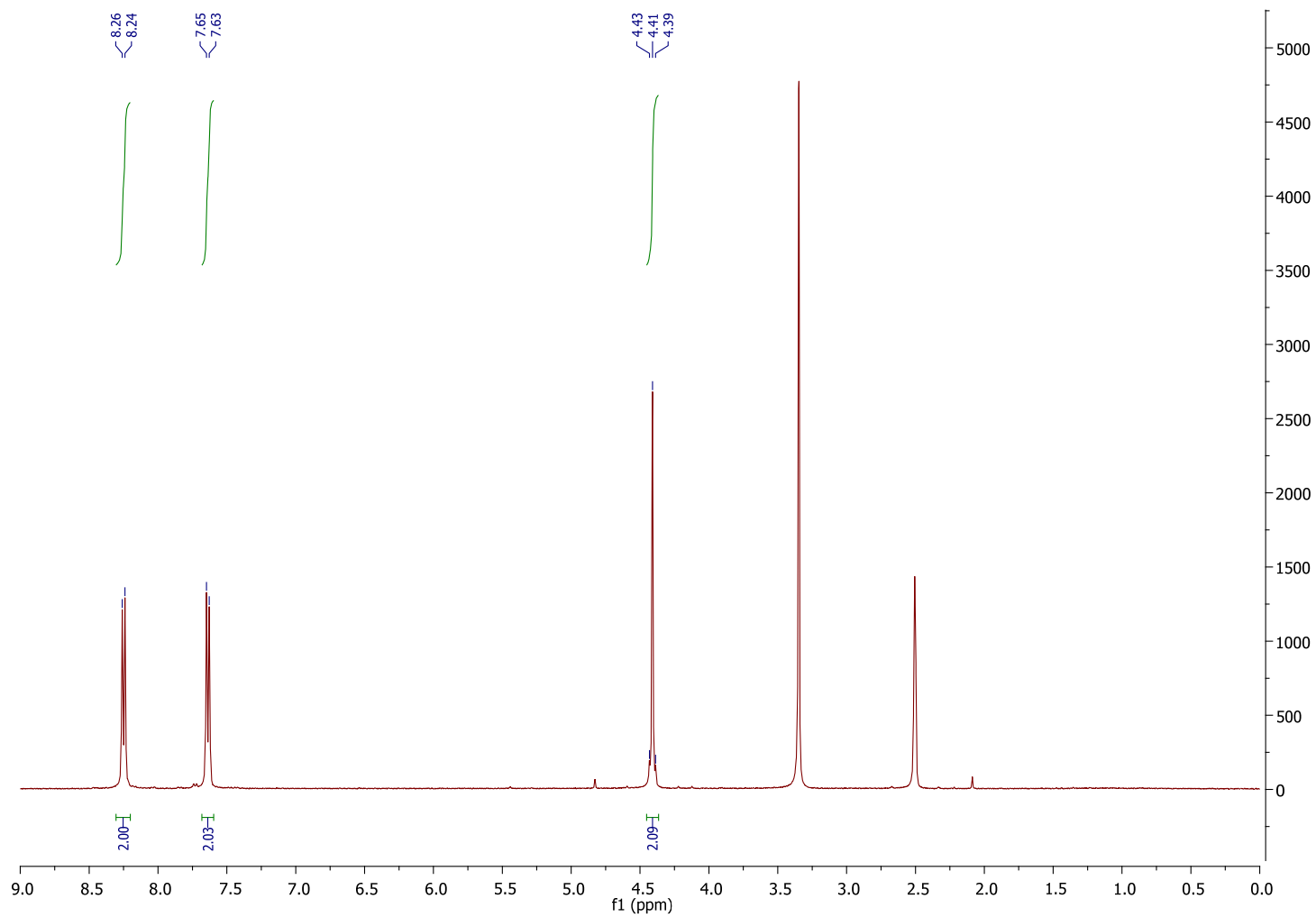


Figure S9. ¹H-NMR spectrum for compound **5**.

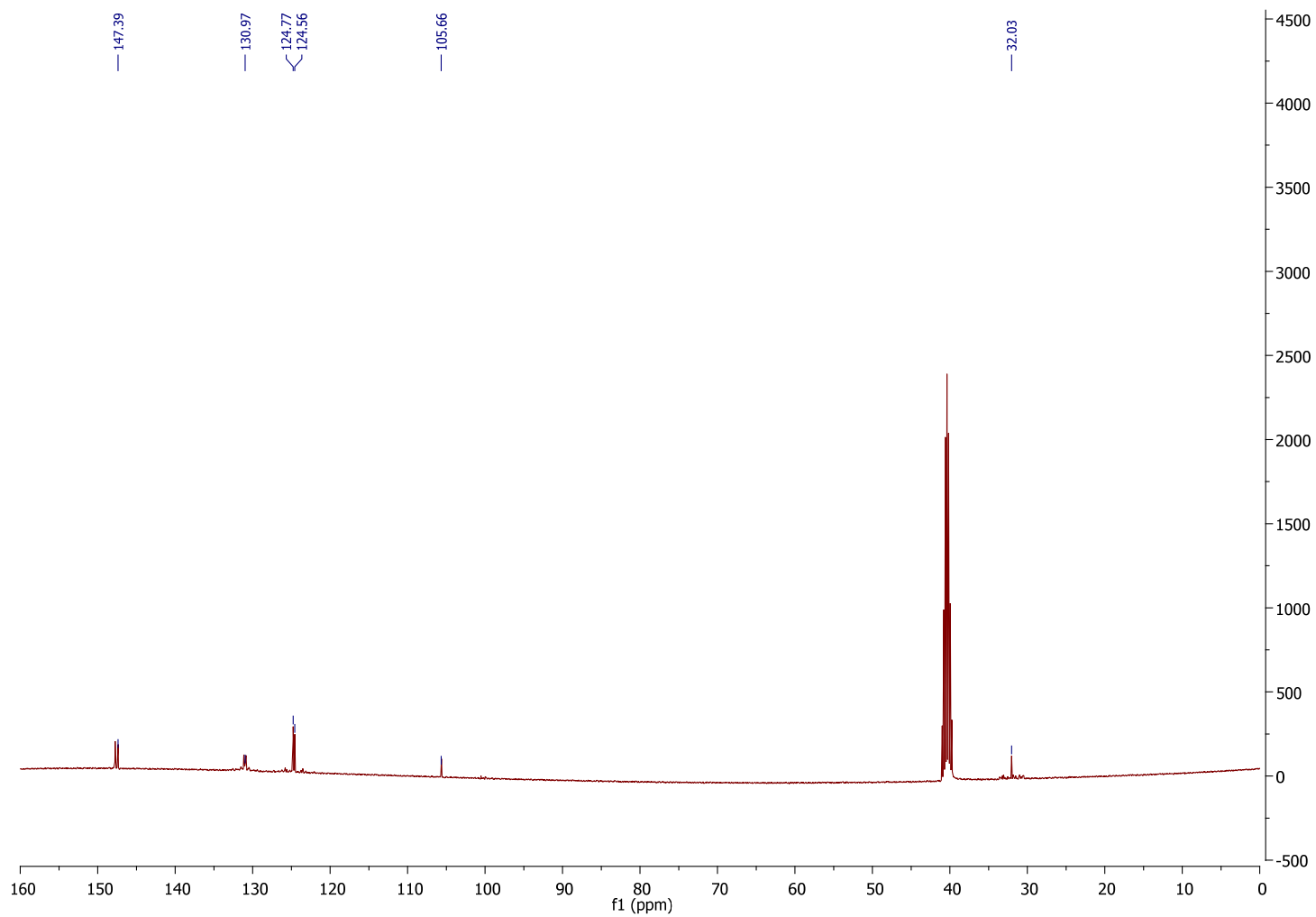


Figure S10. ^{13}C -NMR spectrum for compound 5.

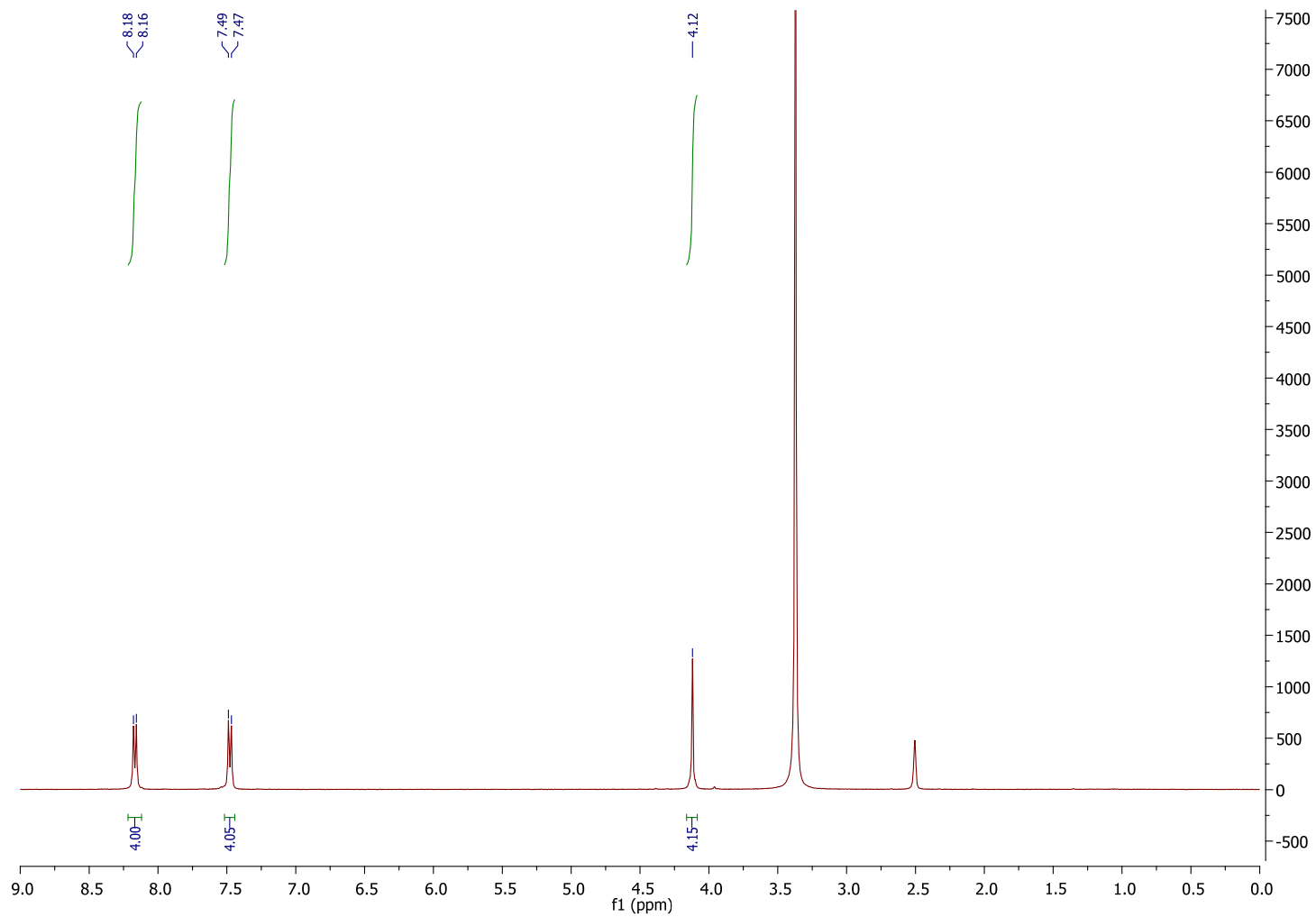


Figure S11. $^1\text{H-NMR}$ spectrum for compound **6**.

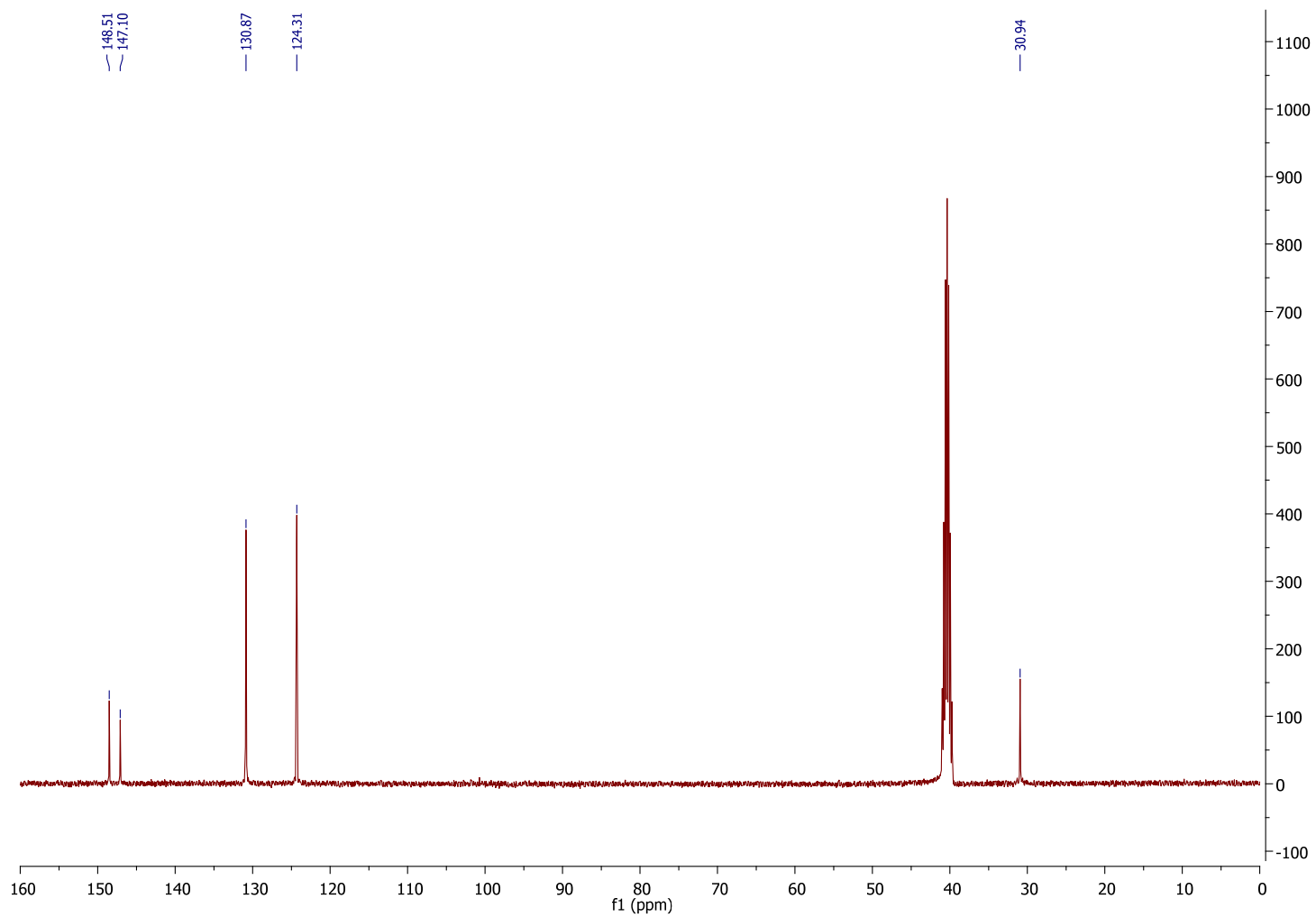


Figure S12. ^{13}C -NMR spectrum for compound **6**.

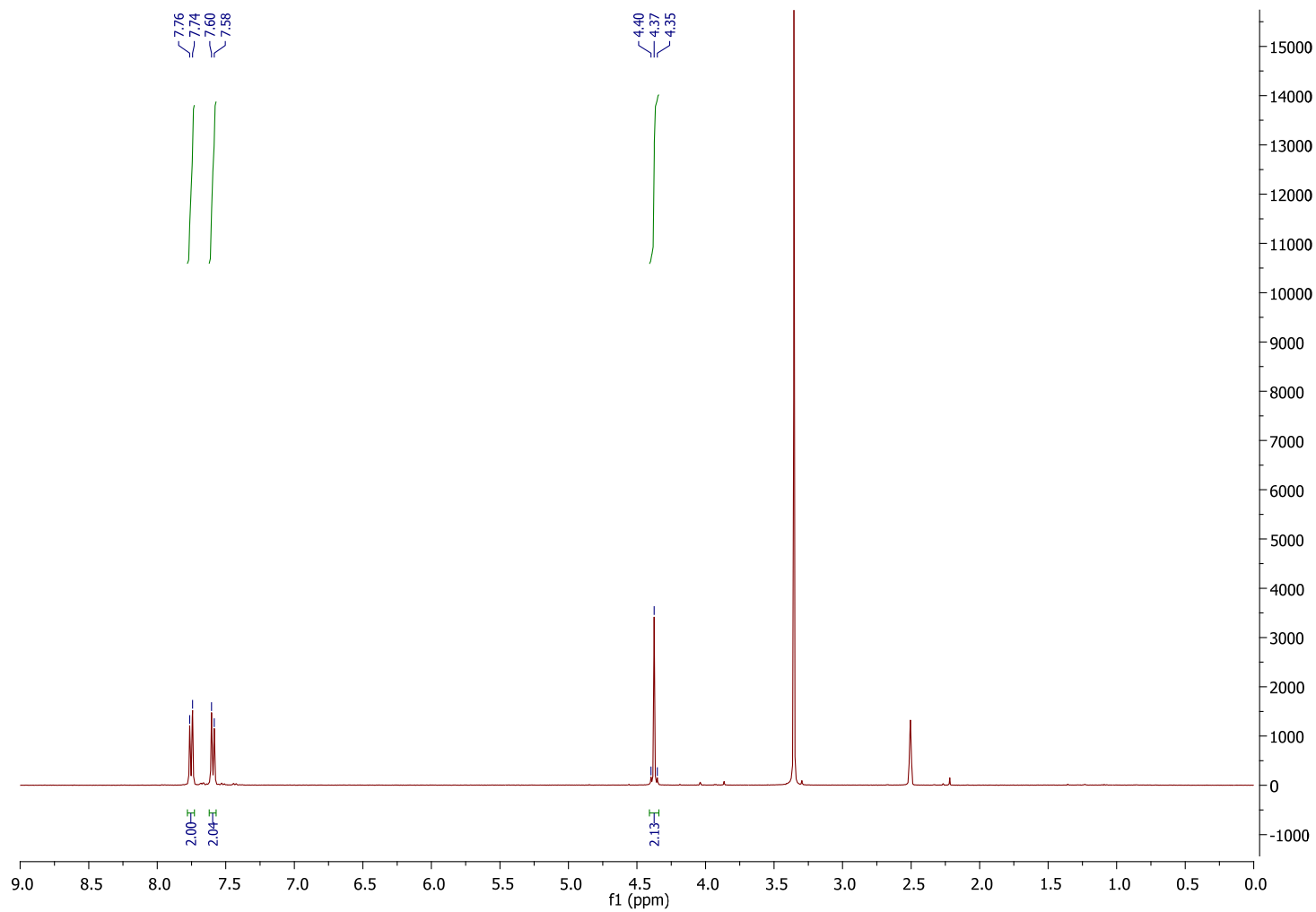


Figure S13. ¹H-NMR spectrum for compound 7.

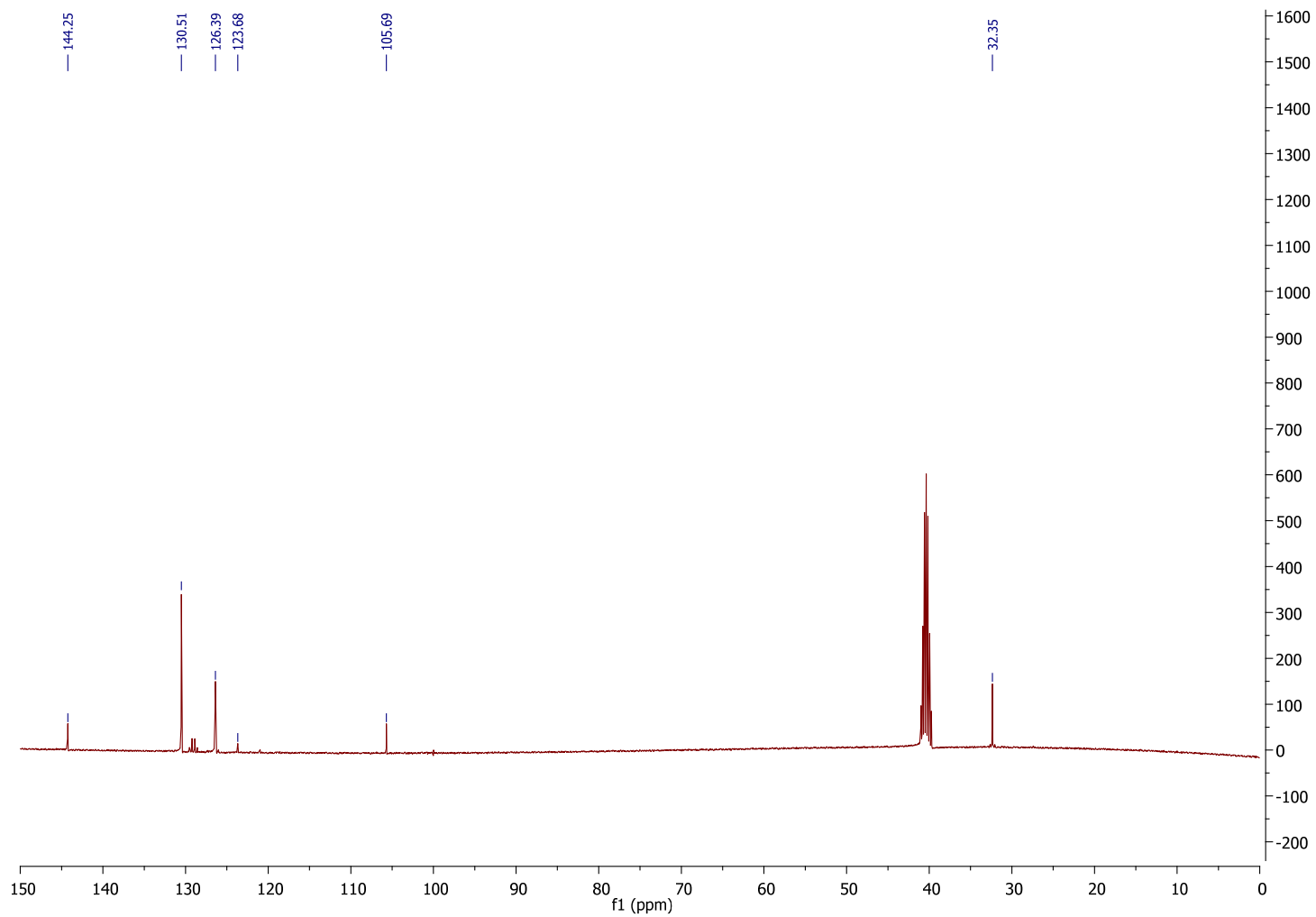


Figure S14. ^{13}C -NMR spectrum for compound 7.

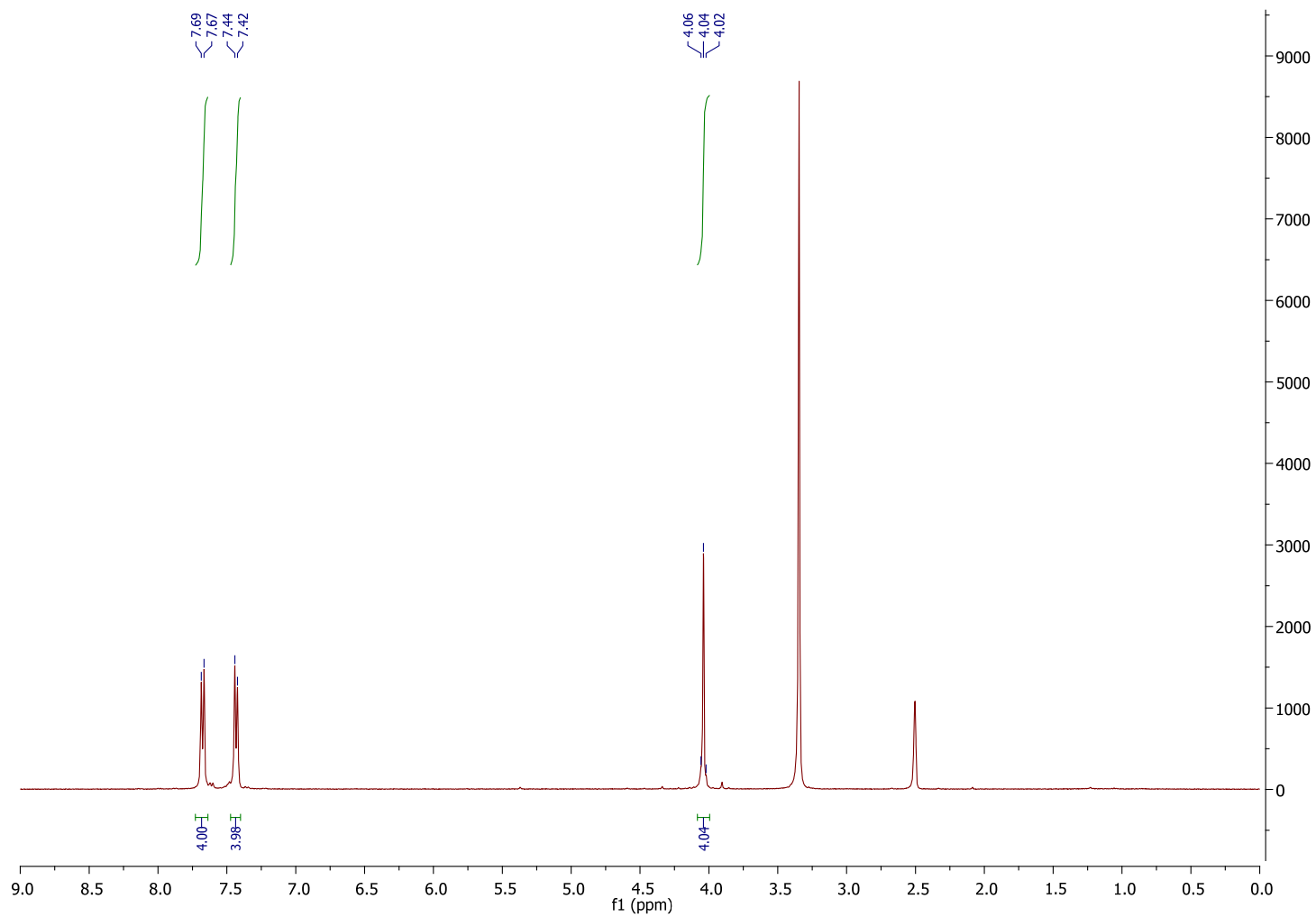


Figure S15. ¹H-NMR spectrum for compound **8**.

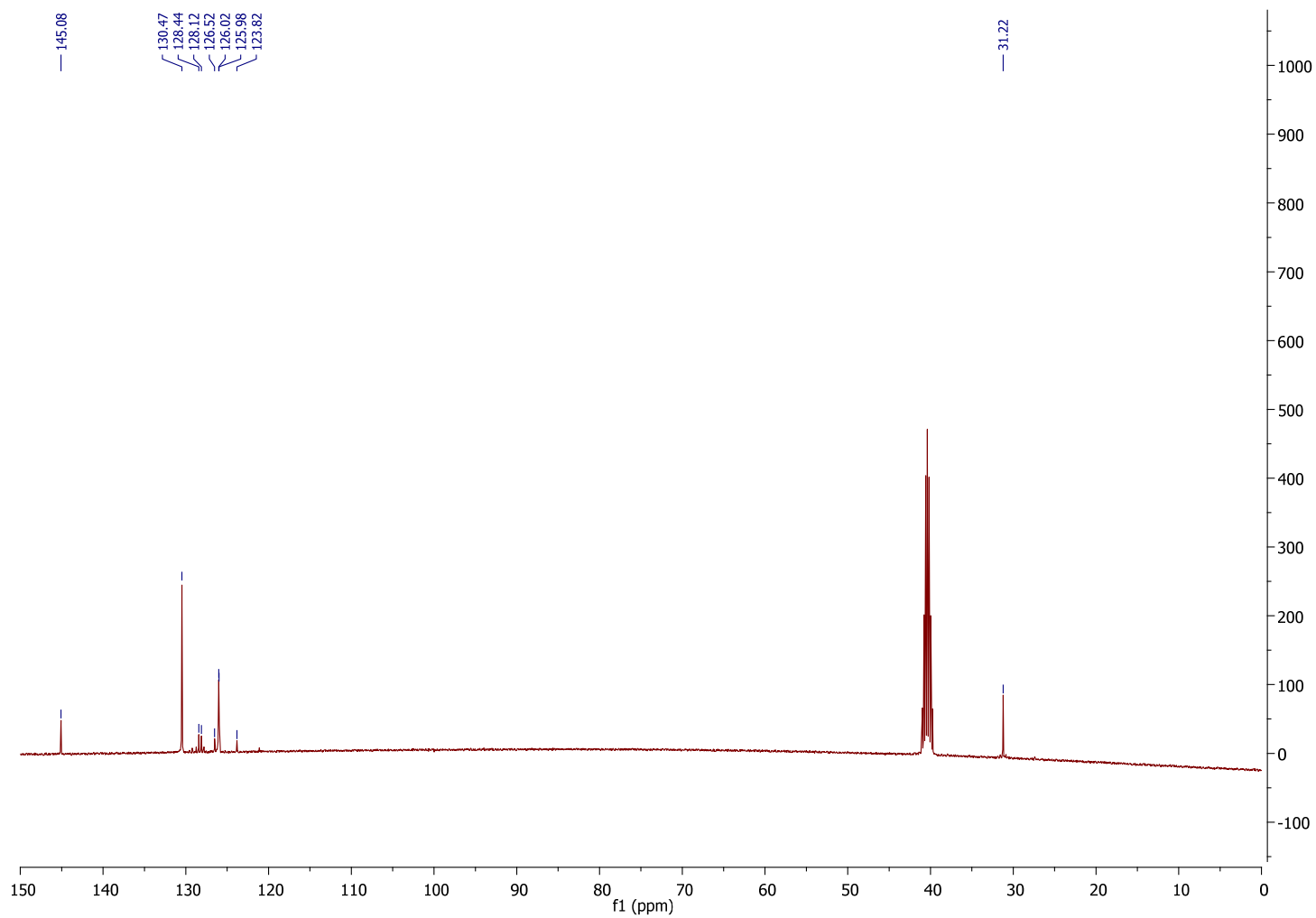


Figure S16. ^{13}C -NMR spectrum for compound **8**.

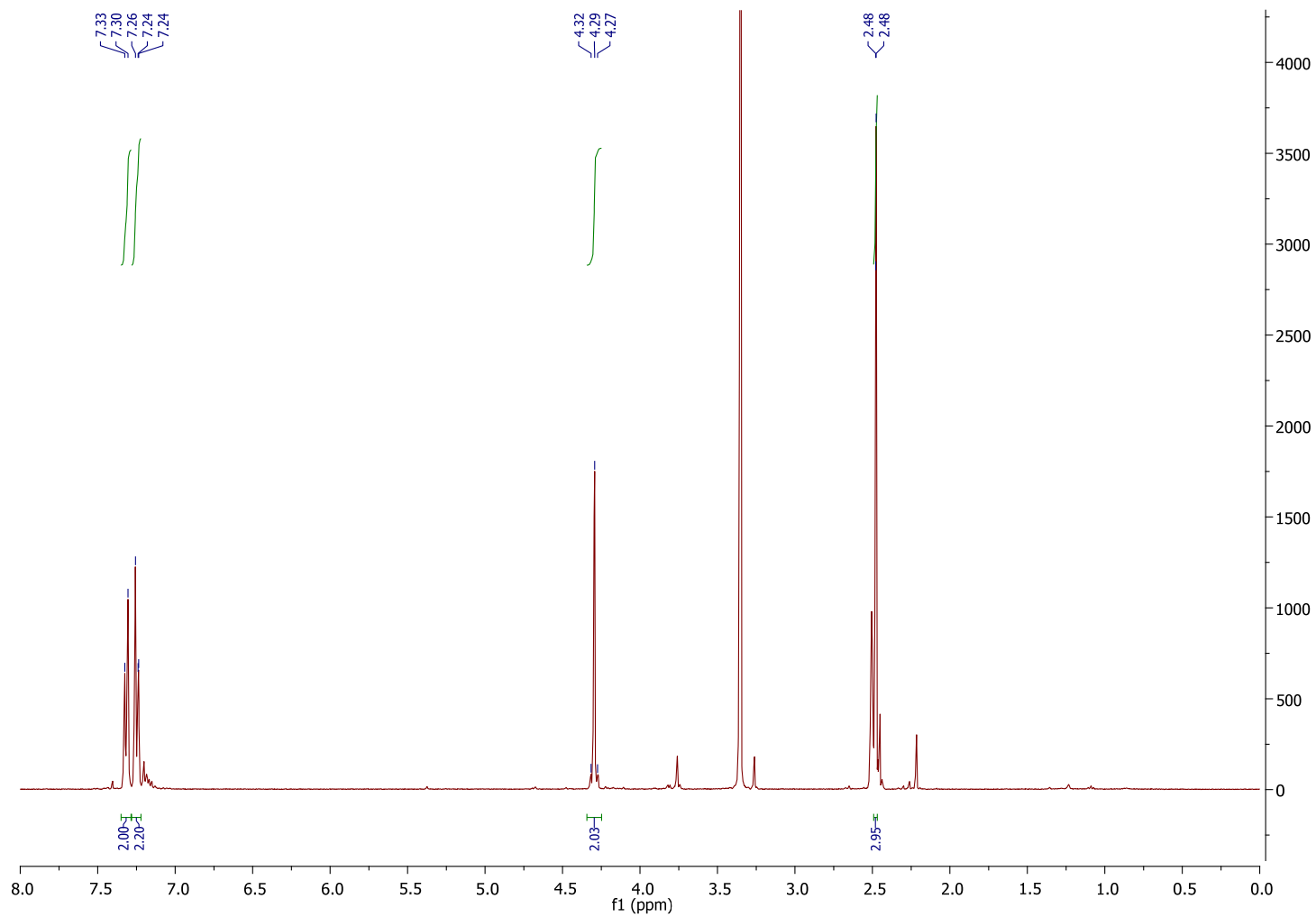


Figure S17. ¹H-NMR spectrum for compound **9**.

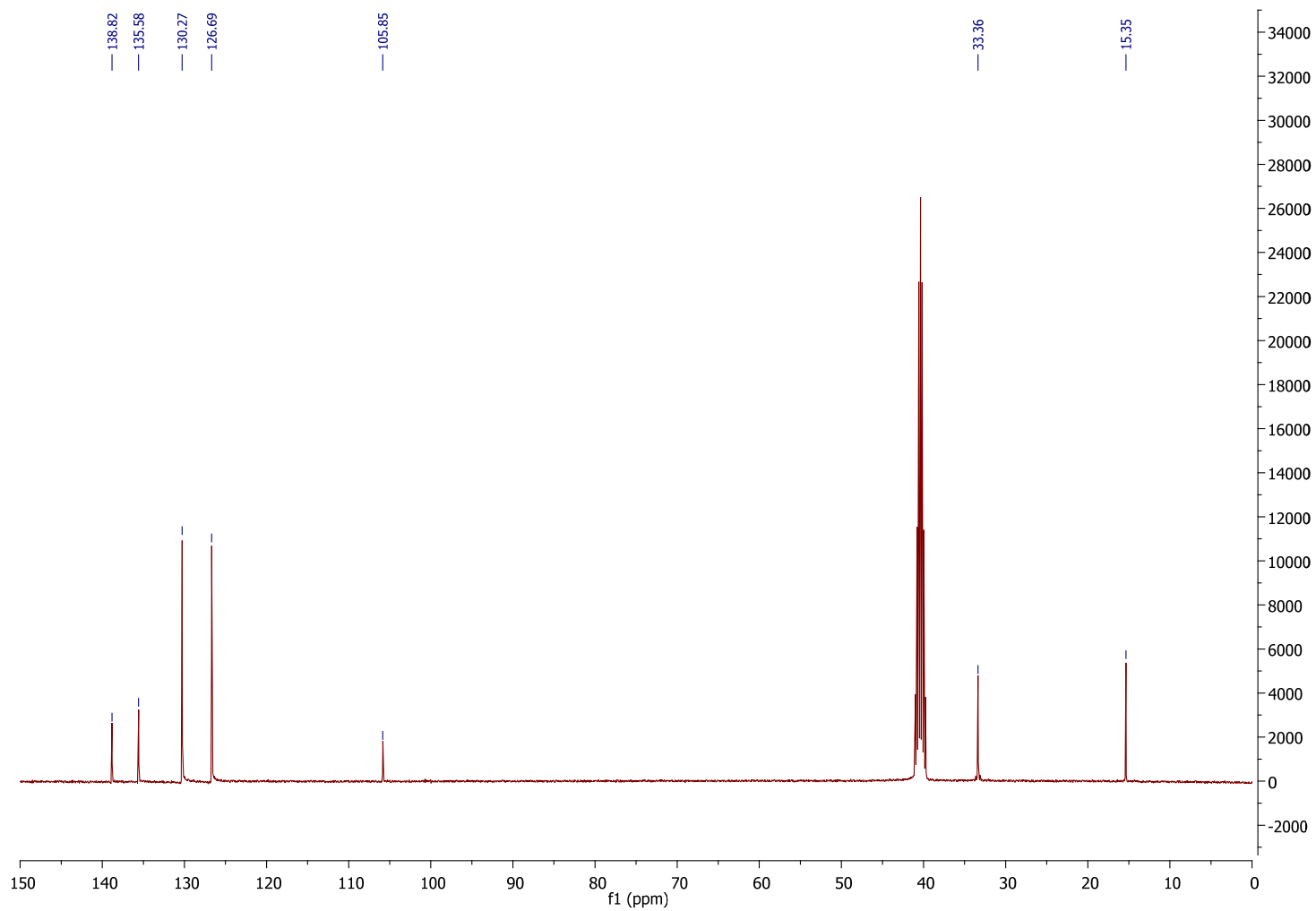


Figure S18. ^{13}C -NMR spectrum for compound **9**.

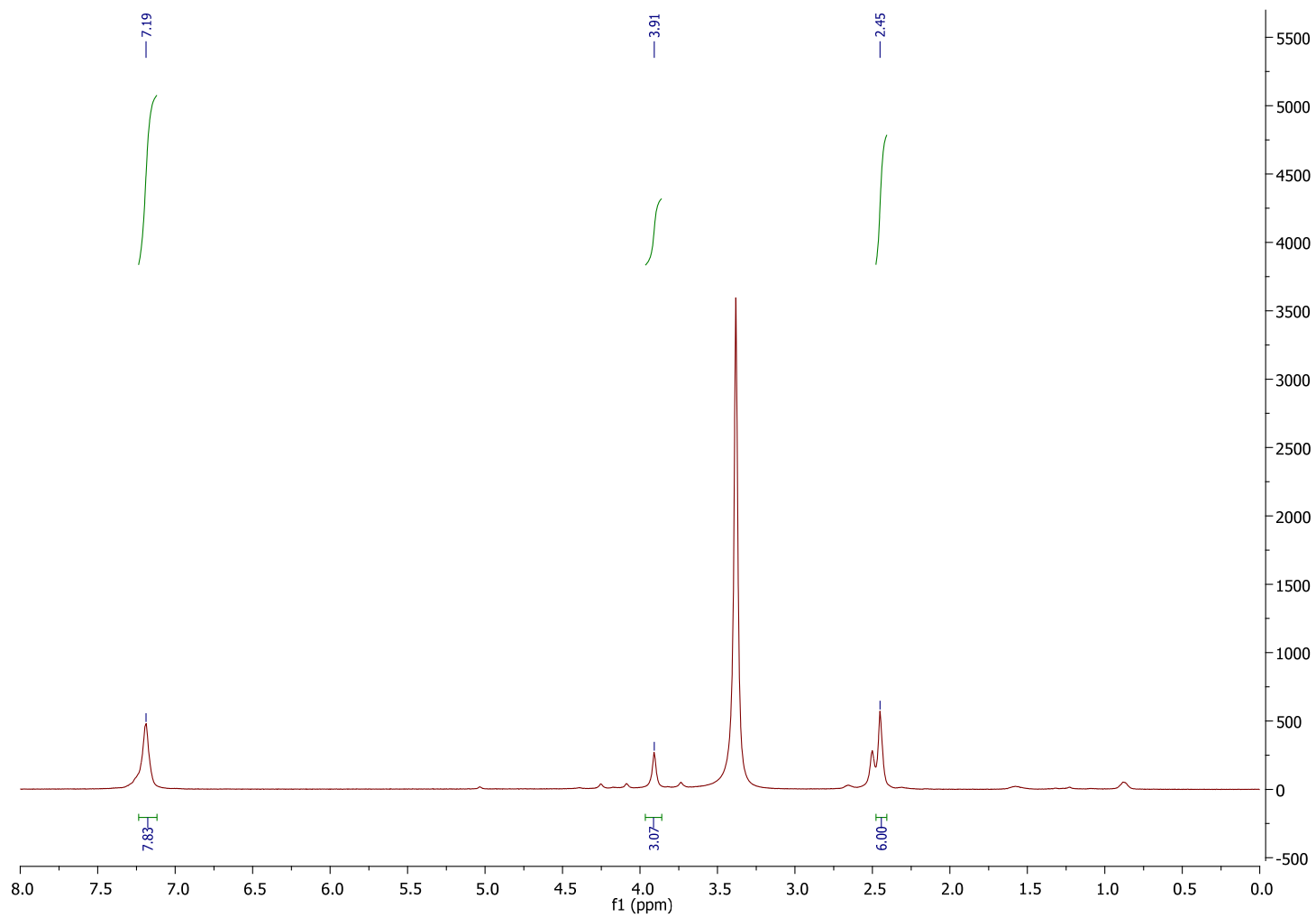


Figure S19. ¹H-NMR spectrum for compound **10**.

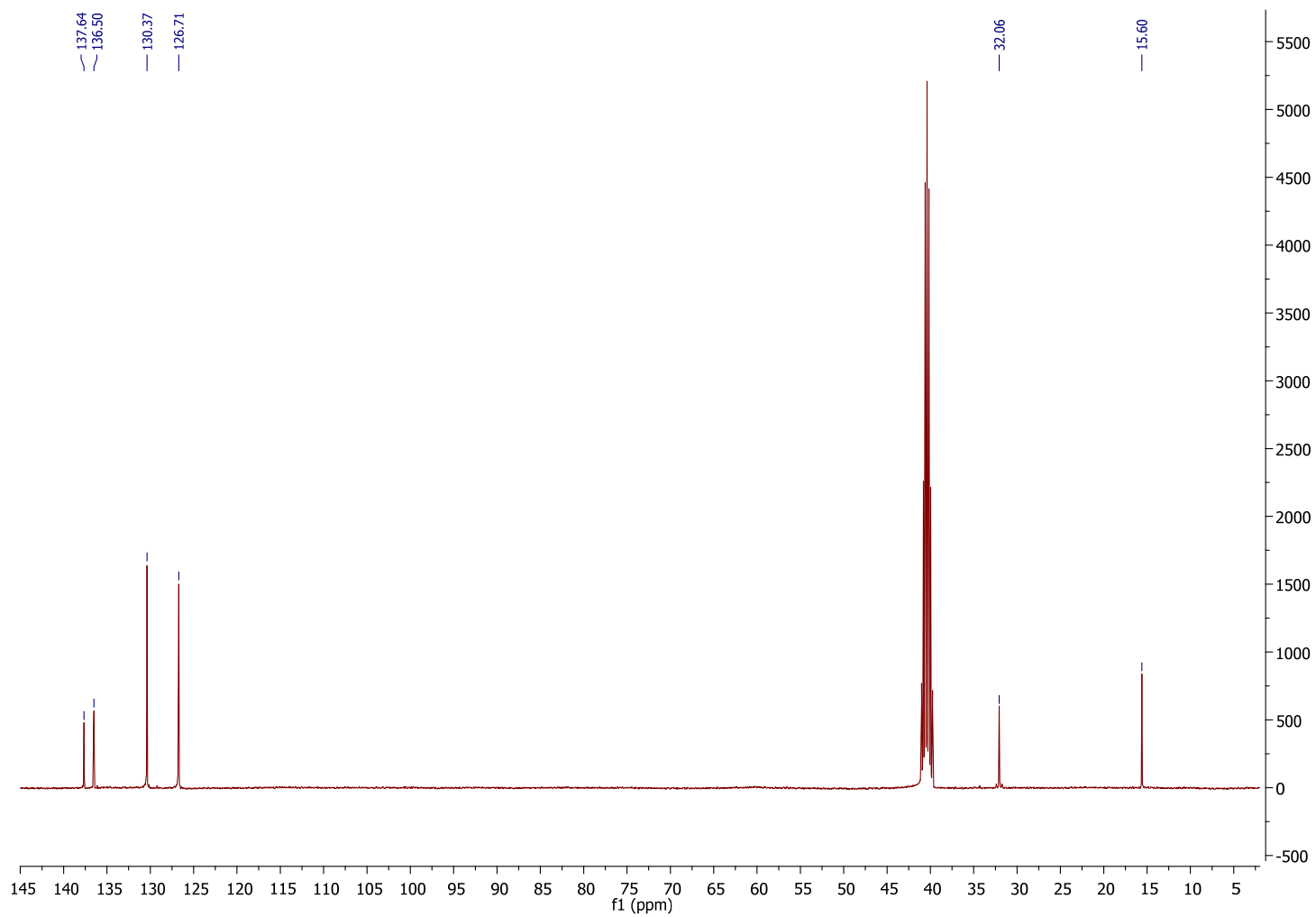


Figure S20. ^{13}C -NMR spectrum for compound **10**.

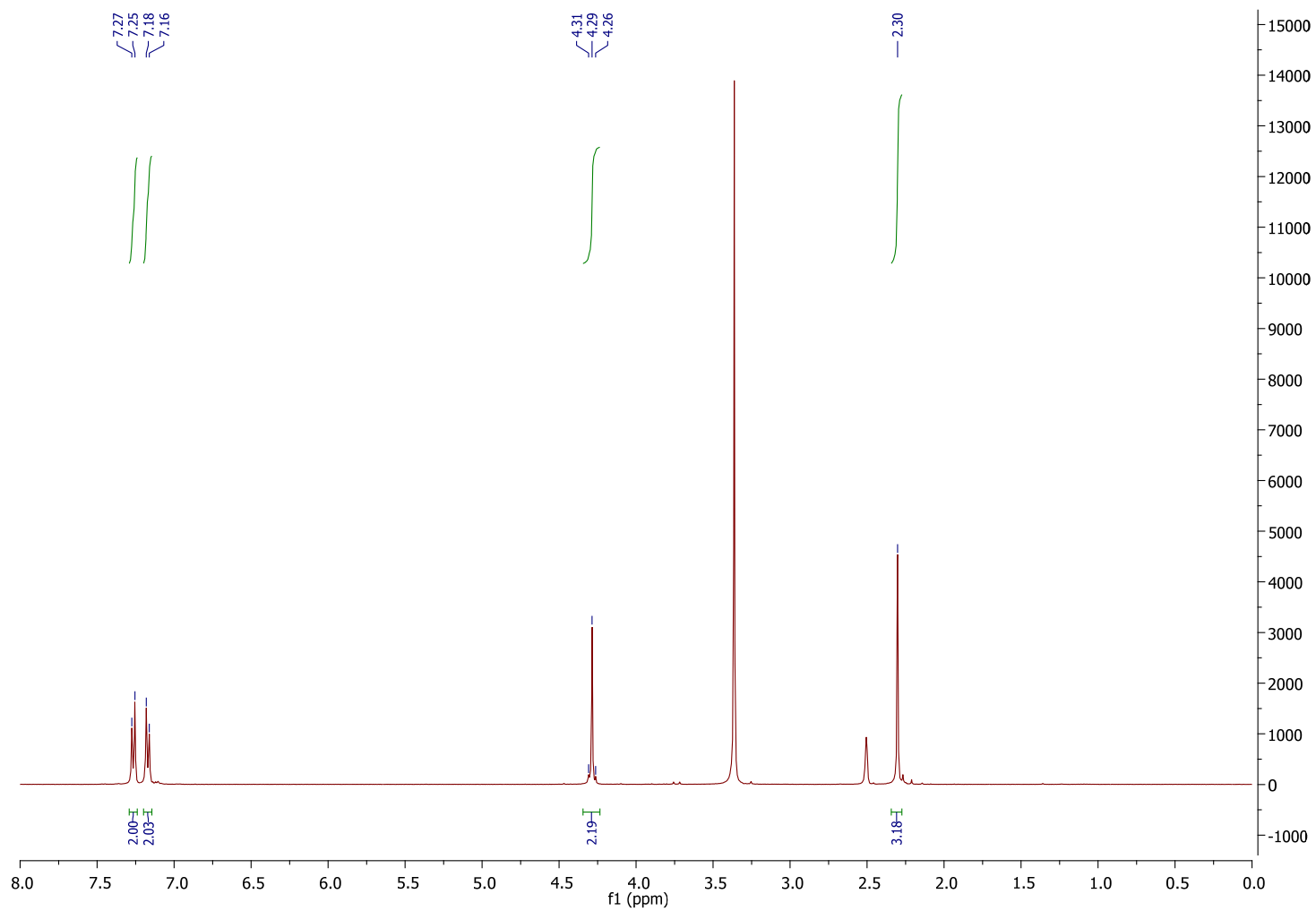


Figure S21. ¹H-NMR spectrum for compound **11**.

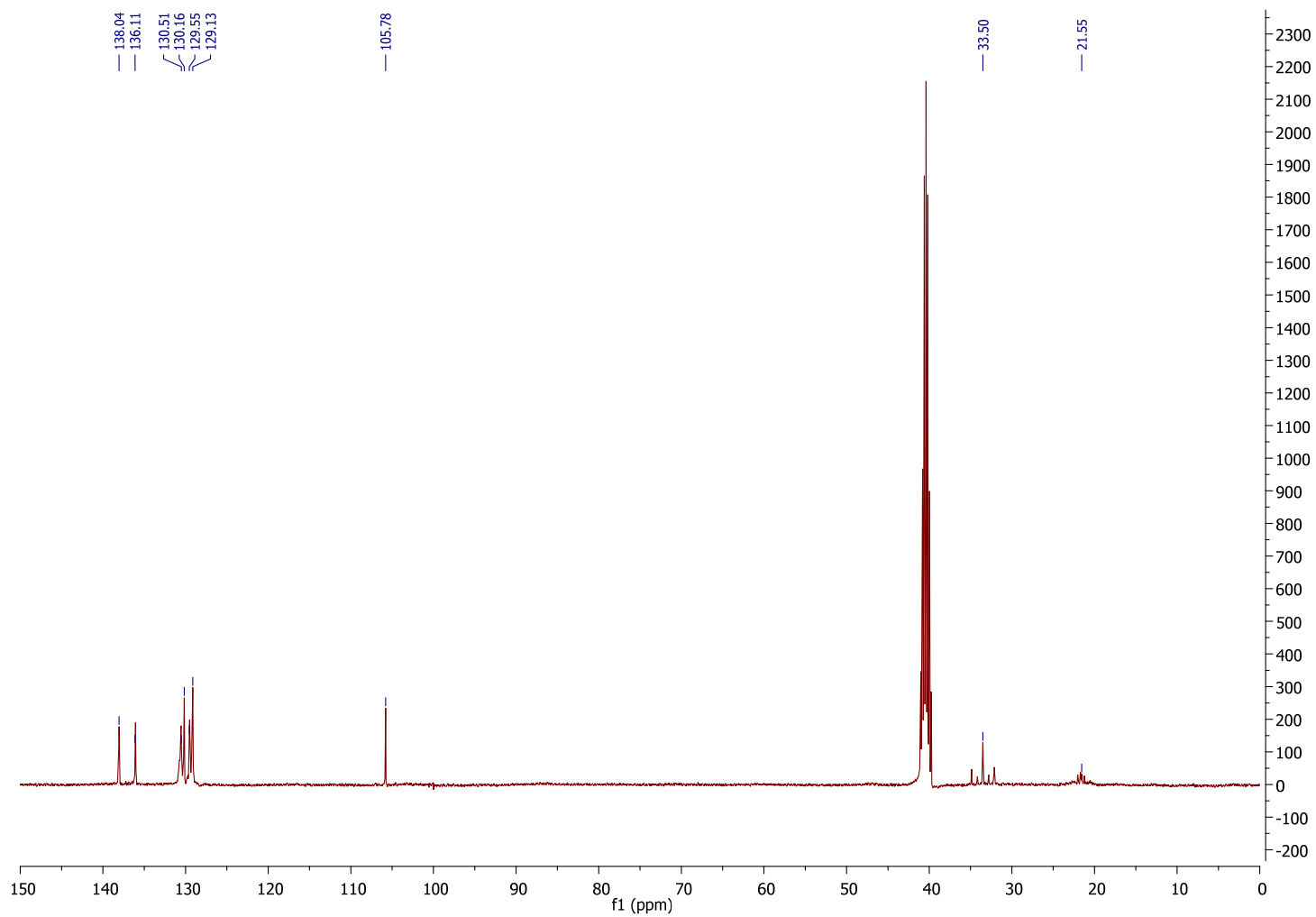


Figure S22. ^{13}C -NMR spectrum for compound **11**.

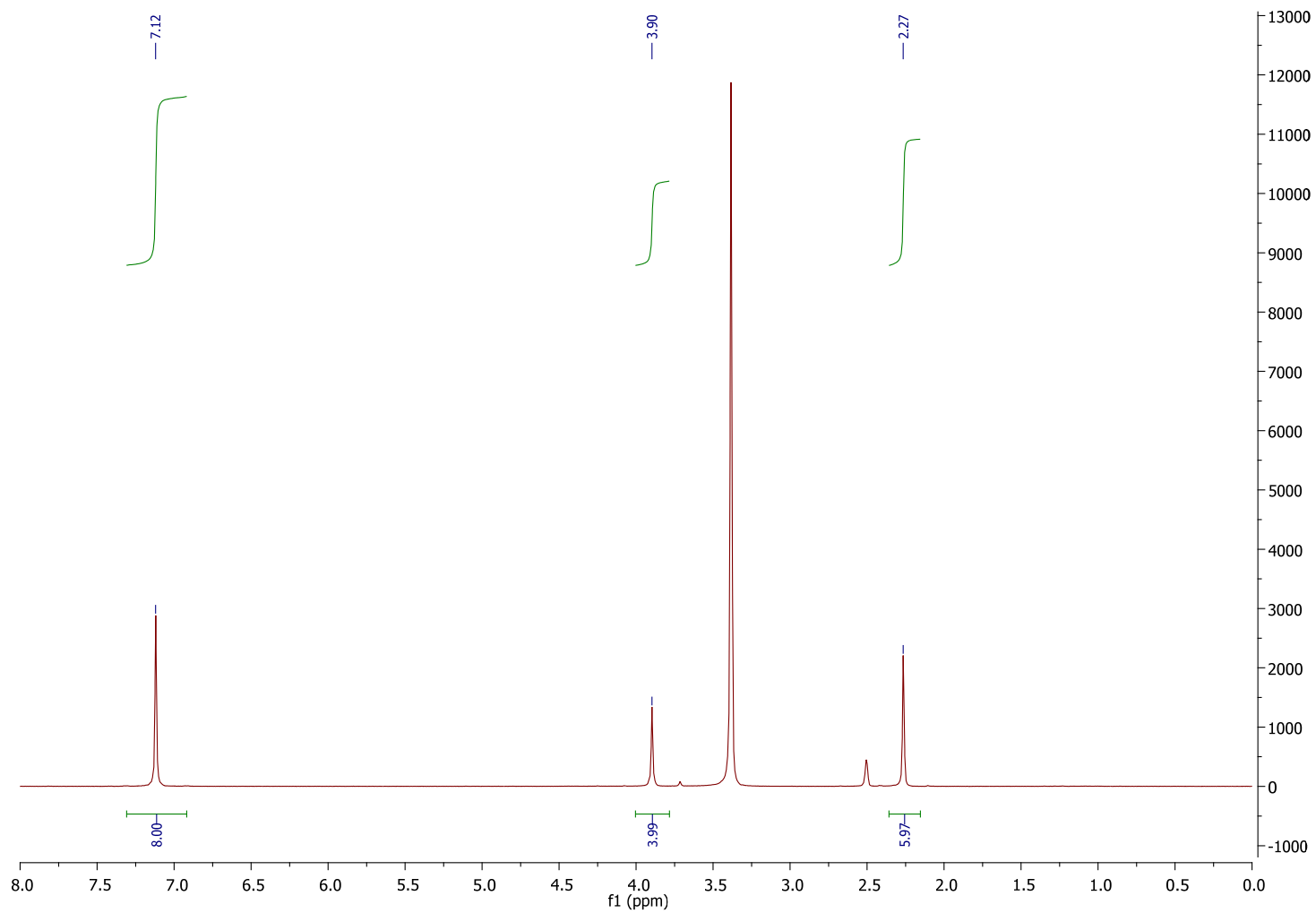


Figure S23. ¹H-NMR spectrum for compound **12**.

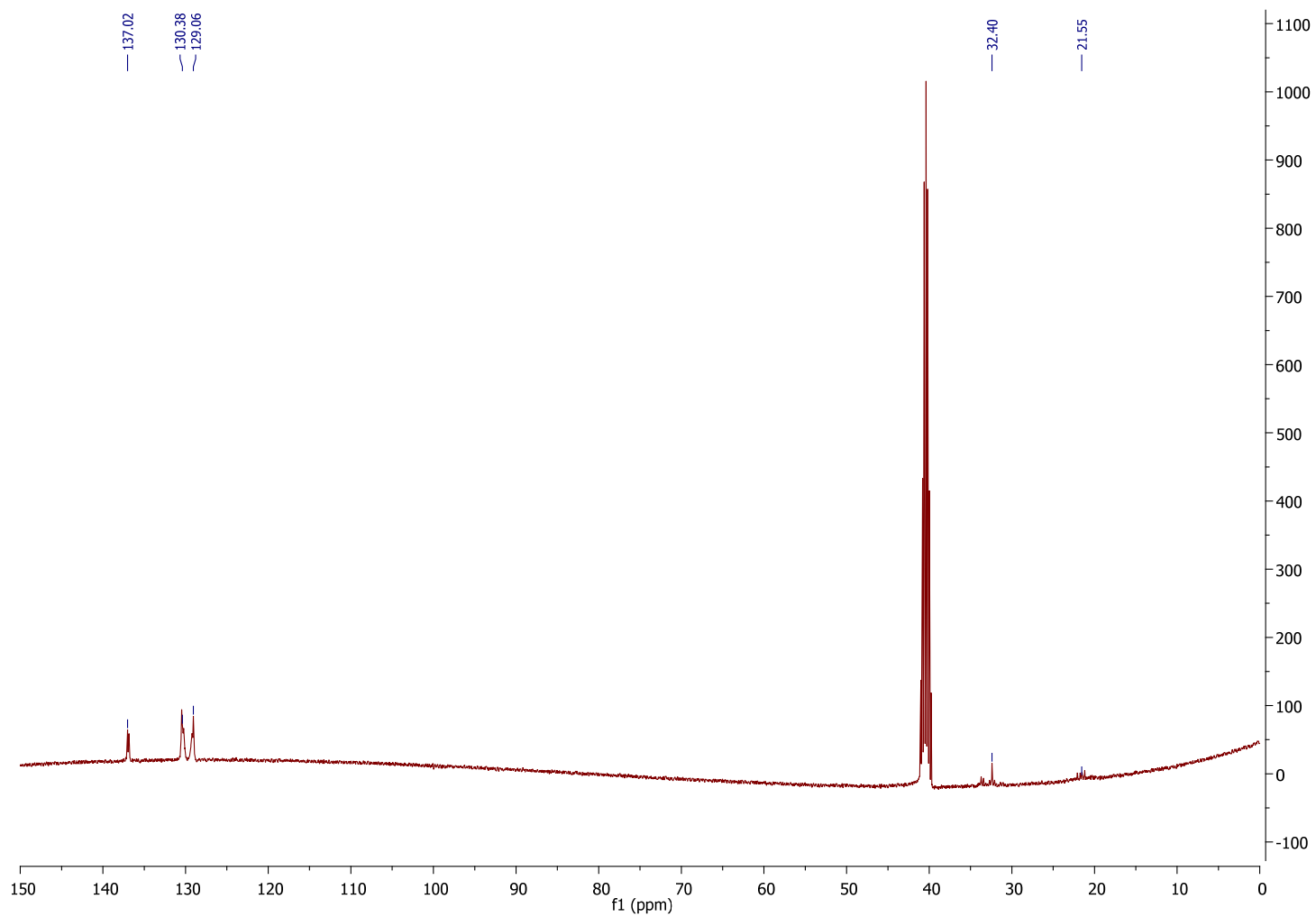


Figure S24. ^{13}C -NMR spectrum for compound **12**.

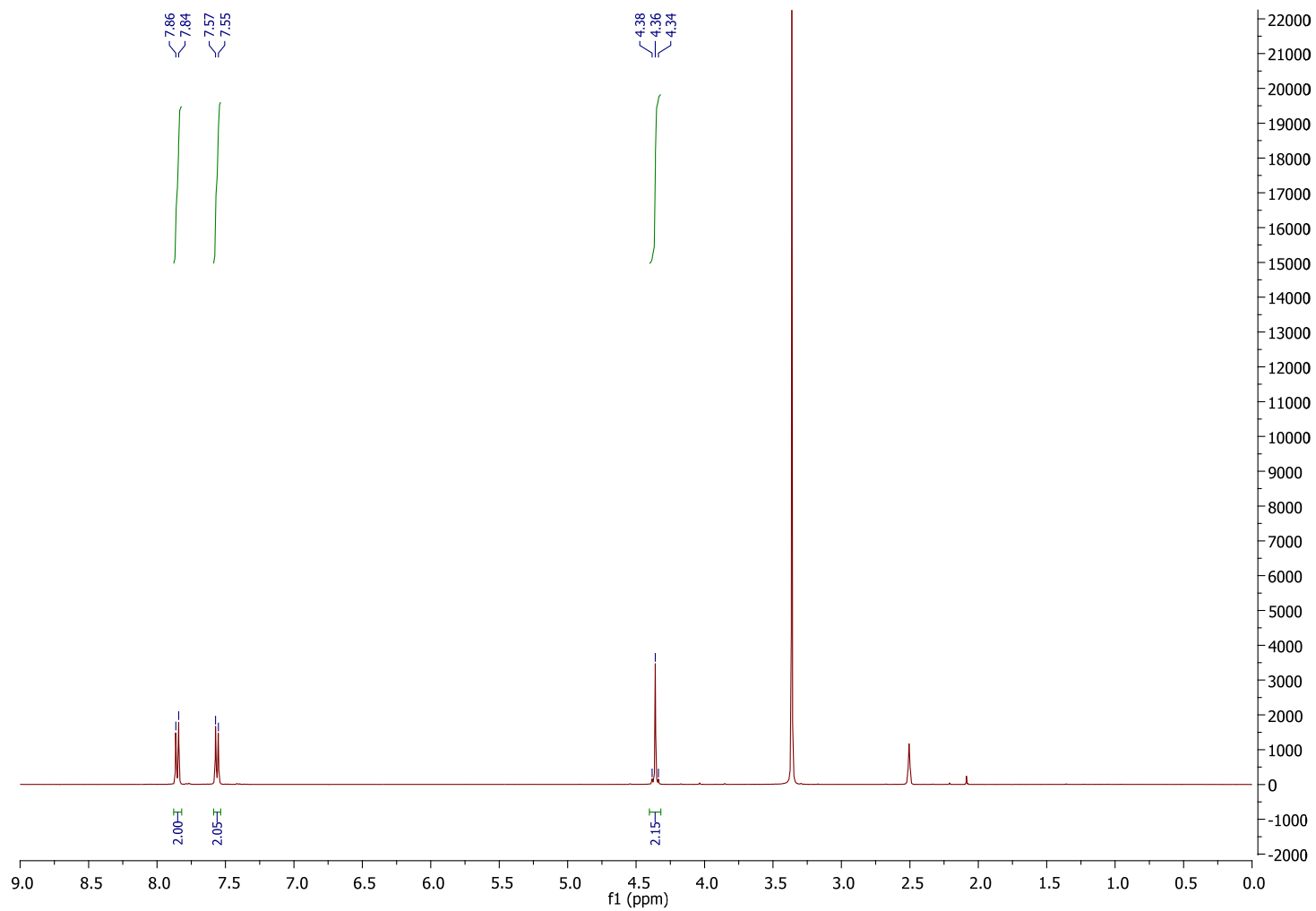


Figure S25. $^1\text{H-NMR}$ spectrum for compound **13**.

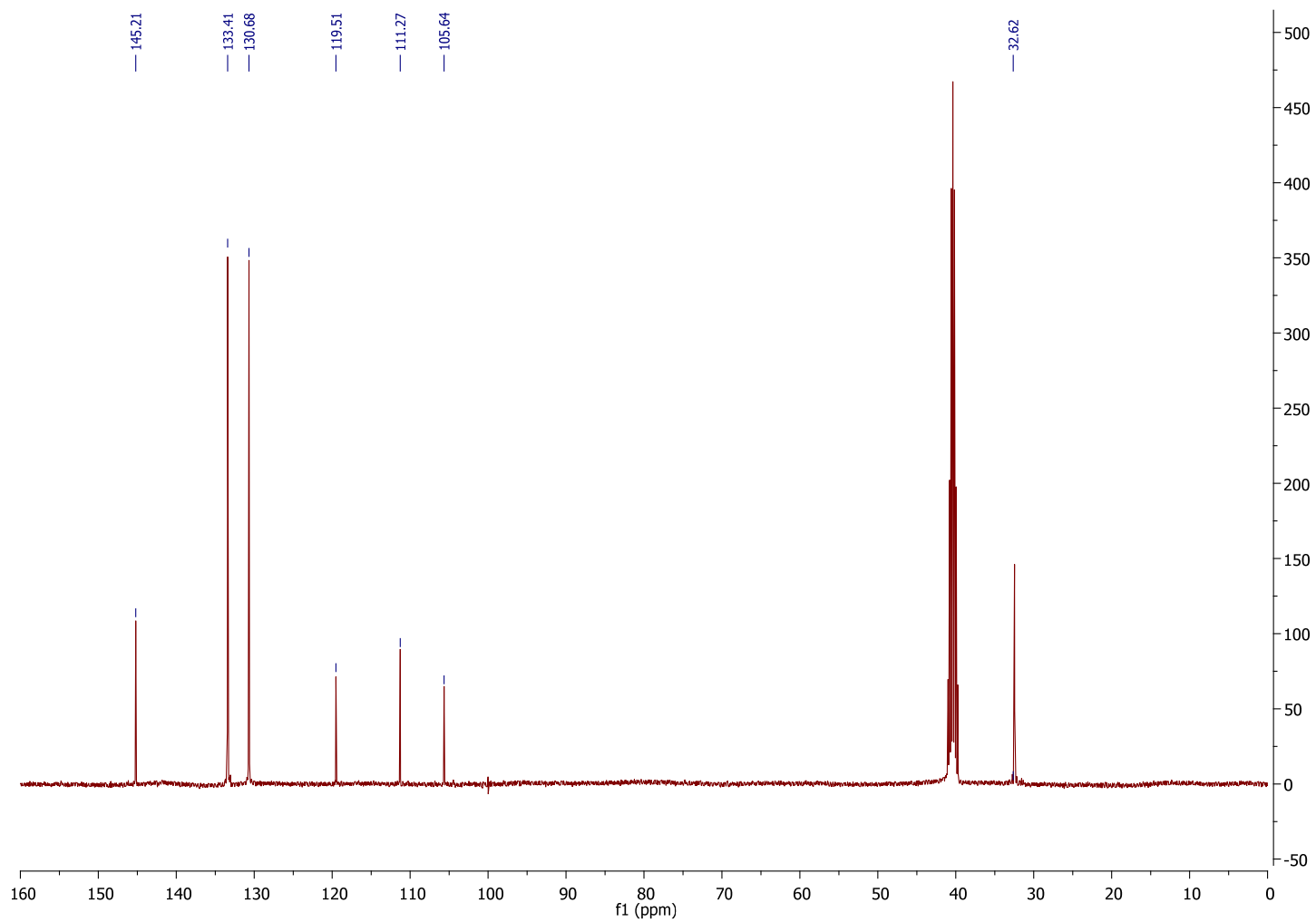


Figure S26. ^{13}C -NMR spectrum for compound **13**.

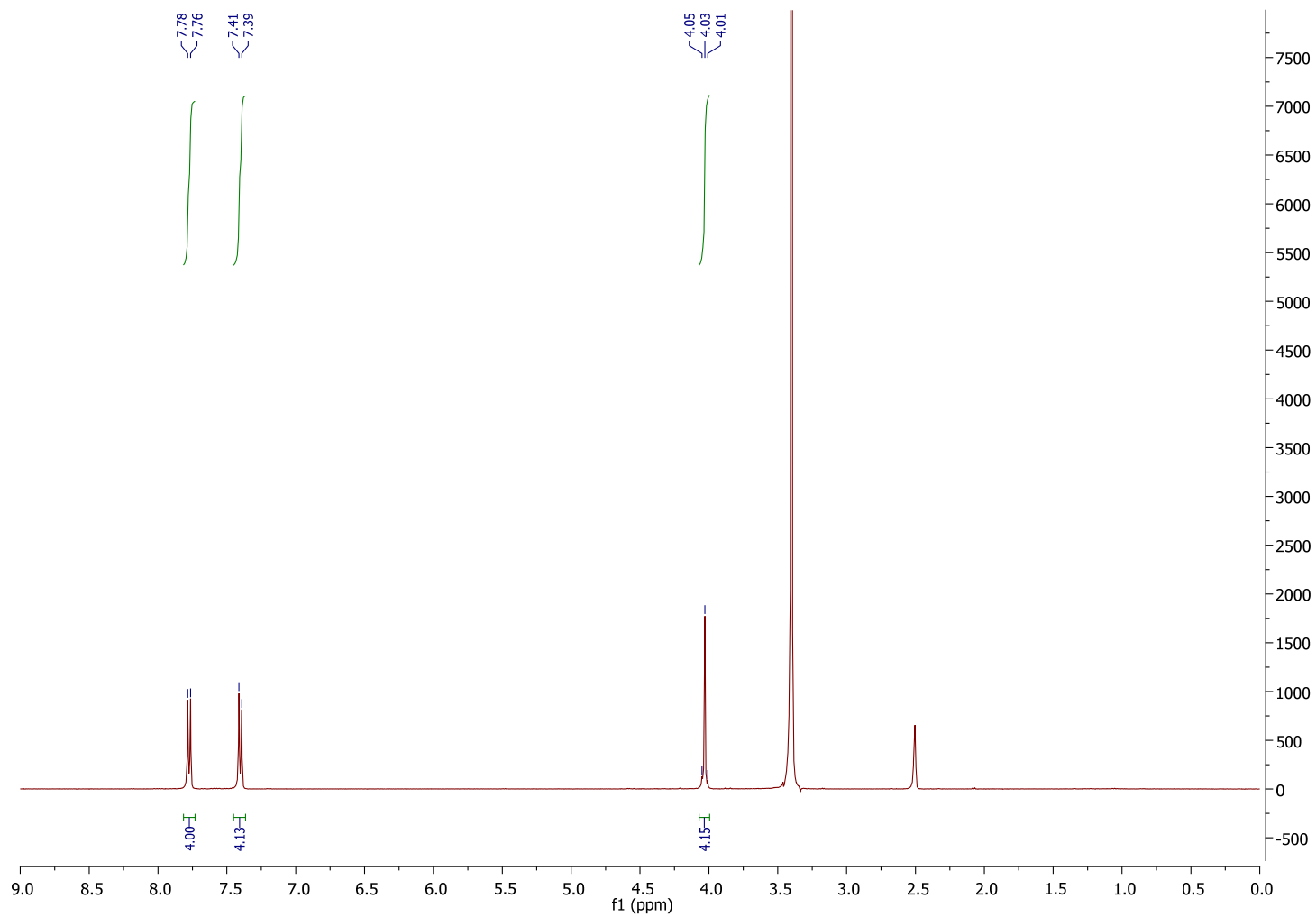


Figure S27. ¹H-NMR spectrum for compound **14**.

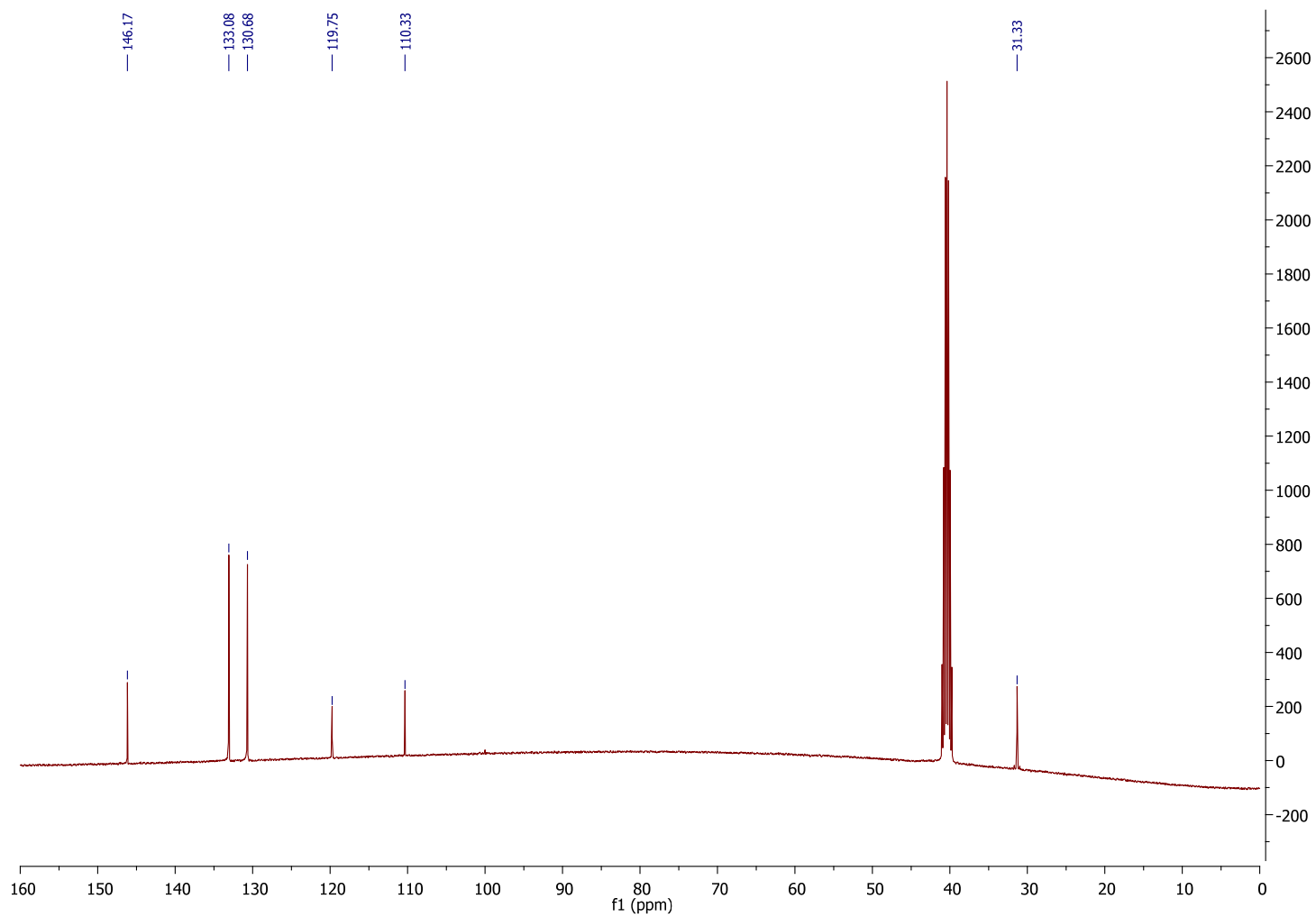


Figure S28. ^{13}C -NMR spectrum for compound **14**.

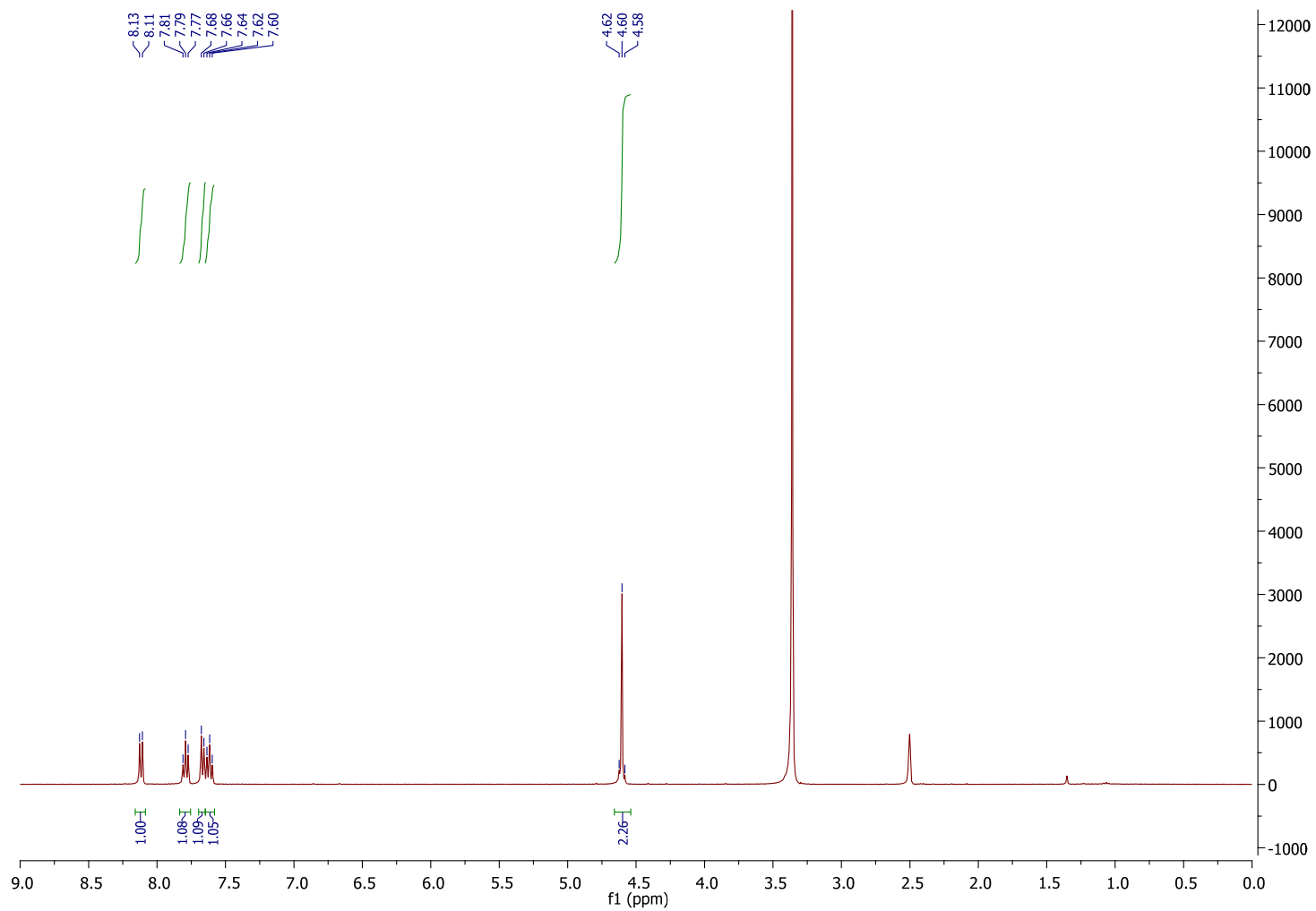


Figure S29. $^1\text{H-NMR}$ spectrum for compound **15**.

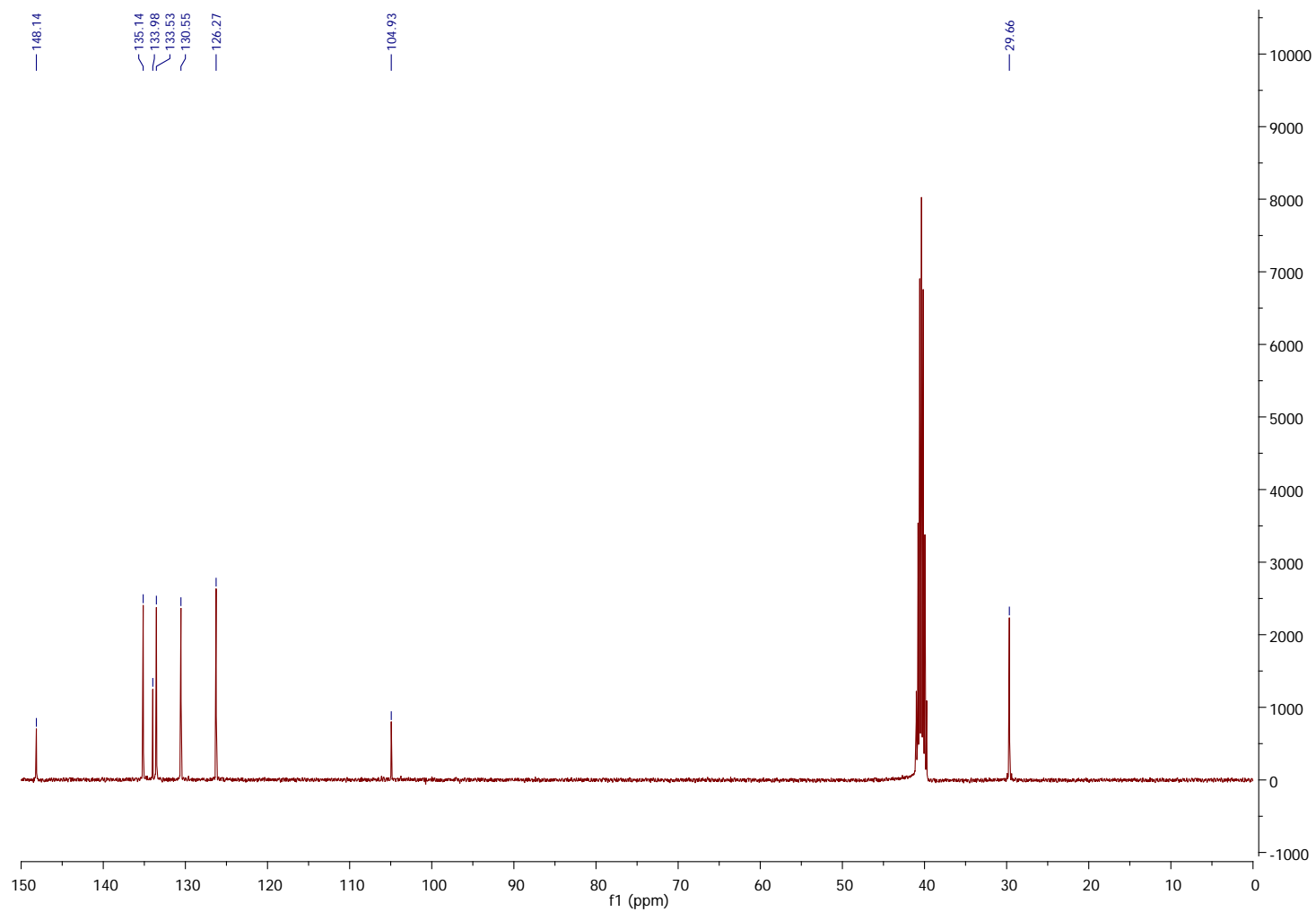


Figure S30. ^{13}C -NMR spectrum for compound **15**.

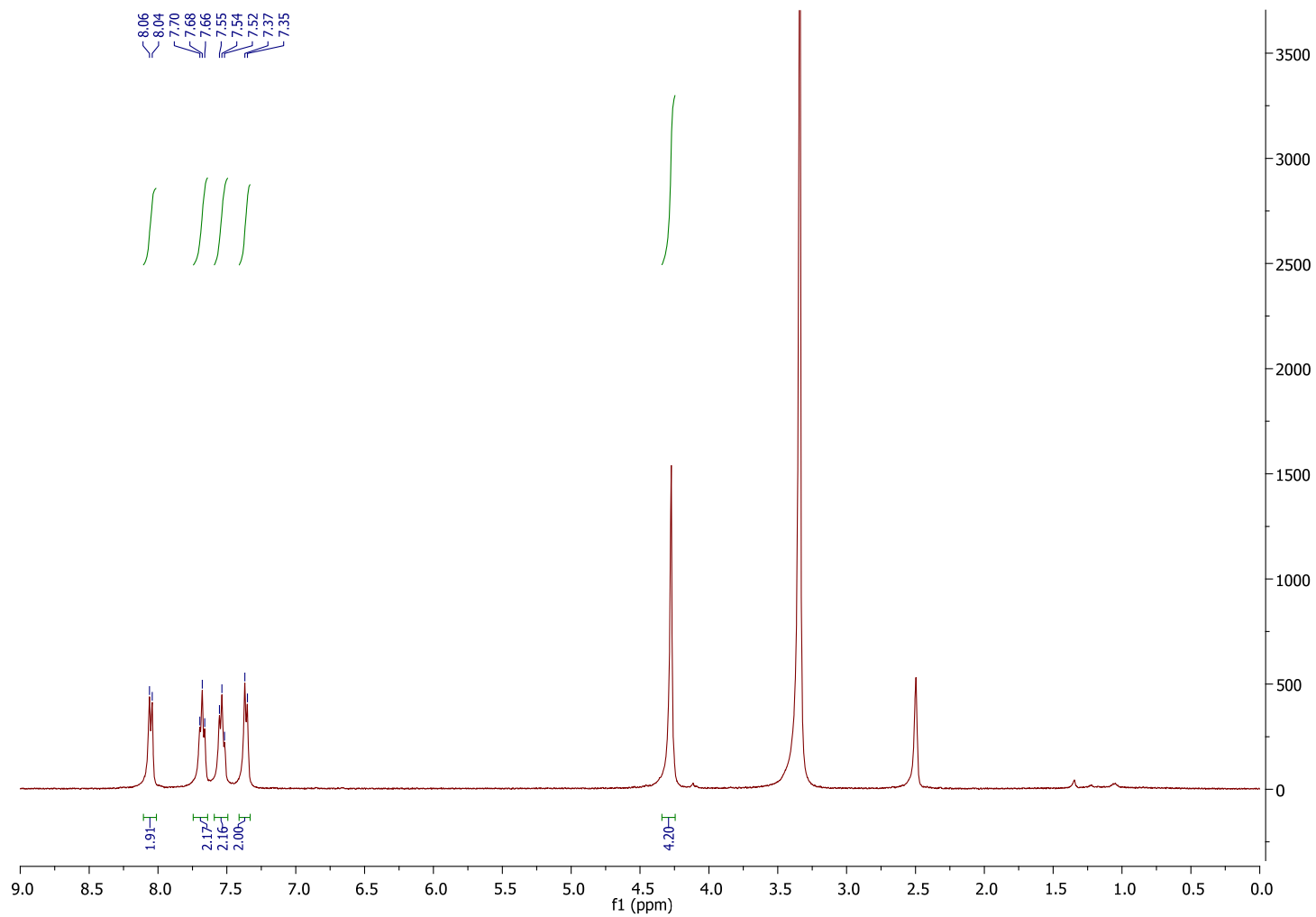


Figure S31. ¹H-NMR spectrum for compound **16**.

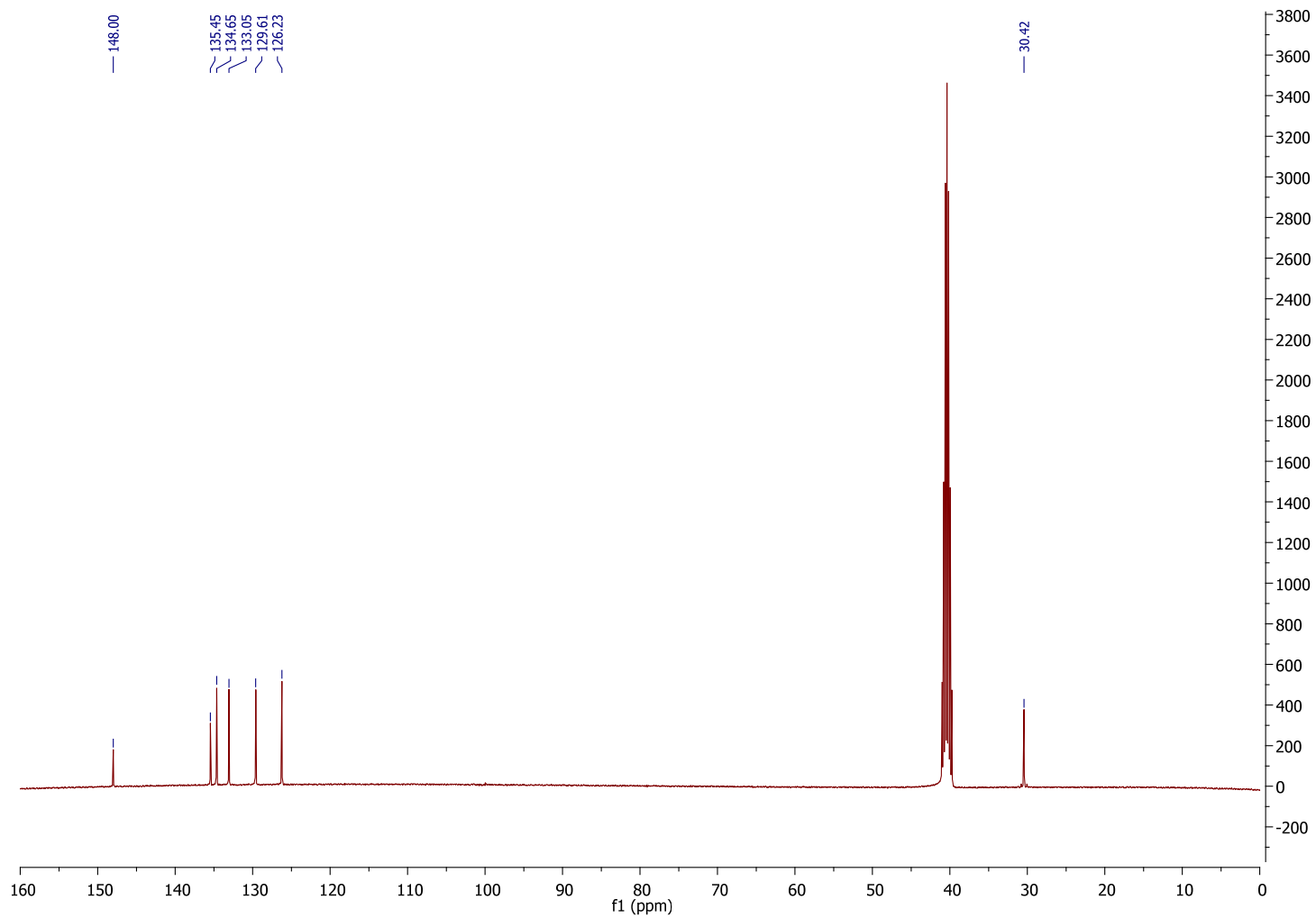


Figure S32. ^{13}C -NMR spectrum for compound **16**.

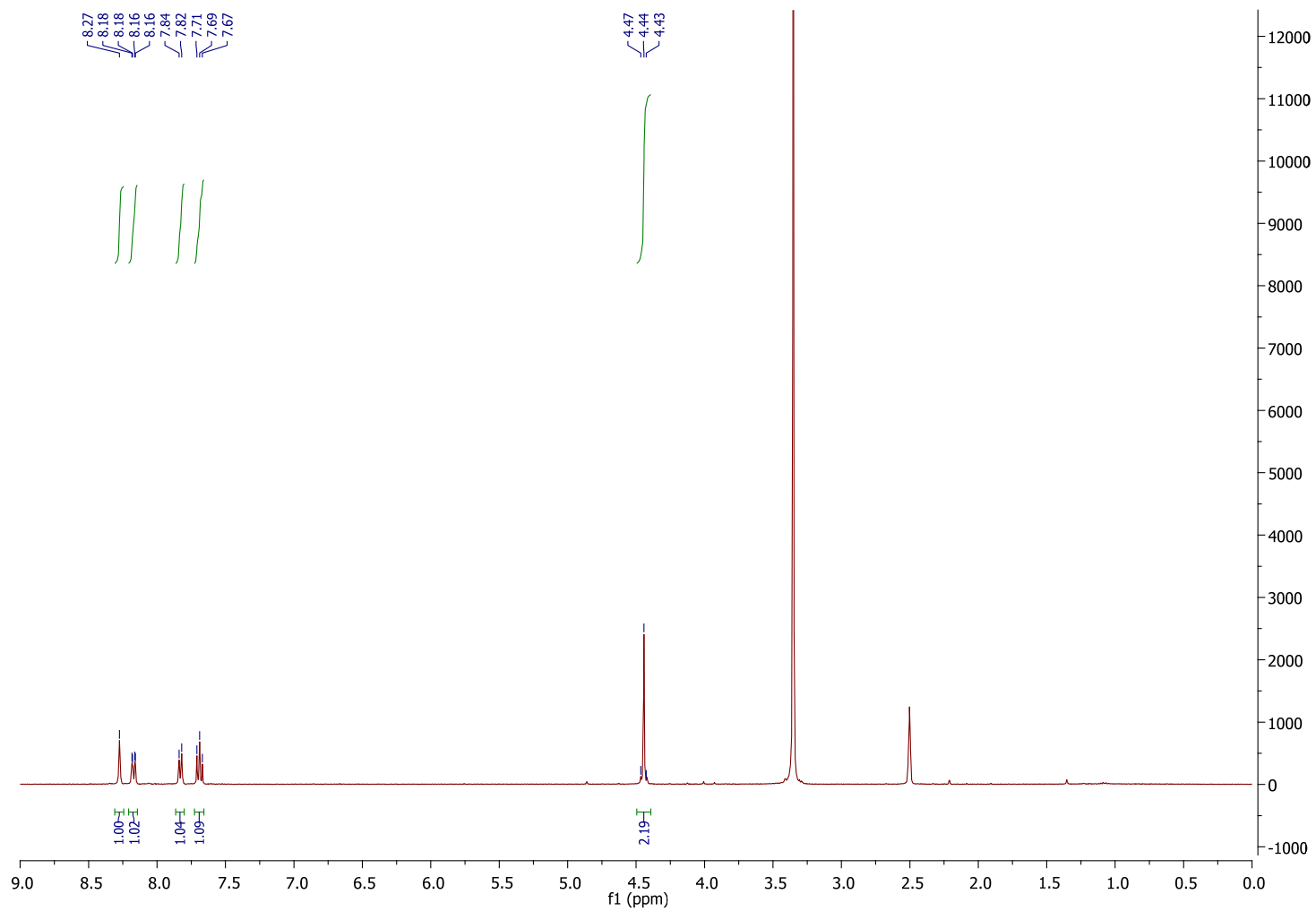


Figure S33. $^1\text{H-NMR}$ spectrum for compound **17**.

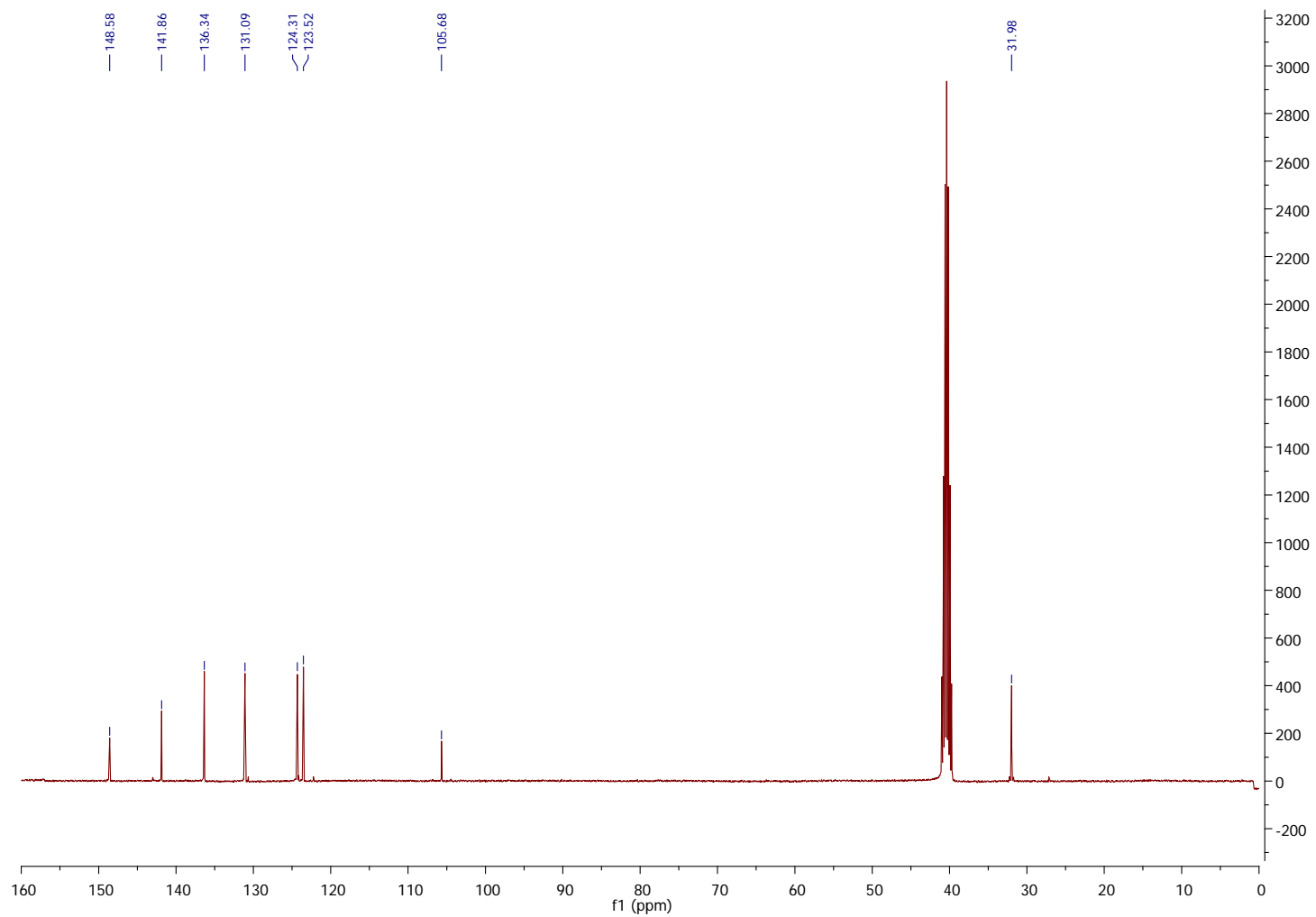


Figure S34. ^{13}C -NMR spectrum for compound **17**.

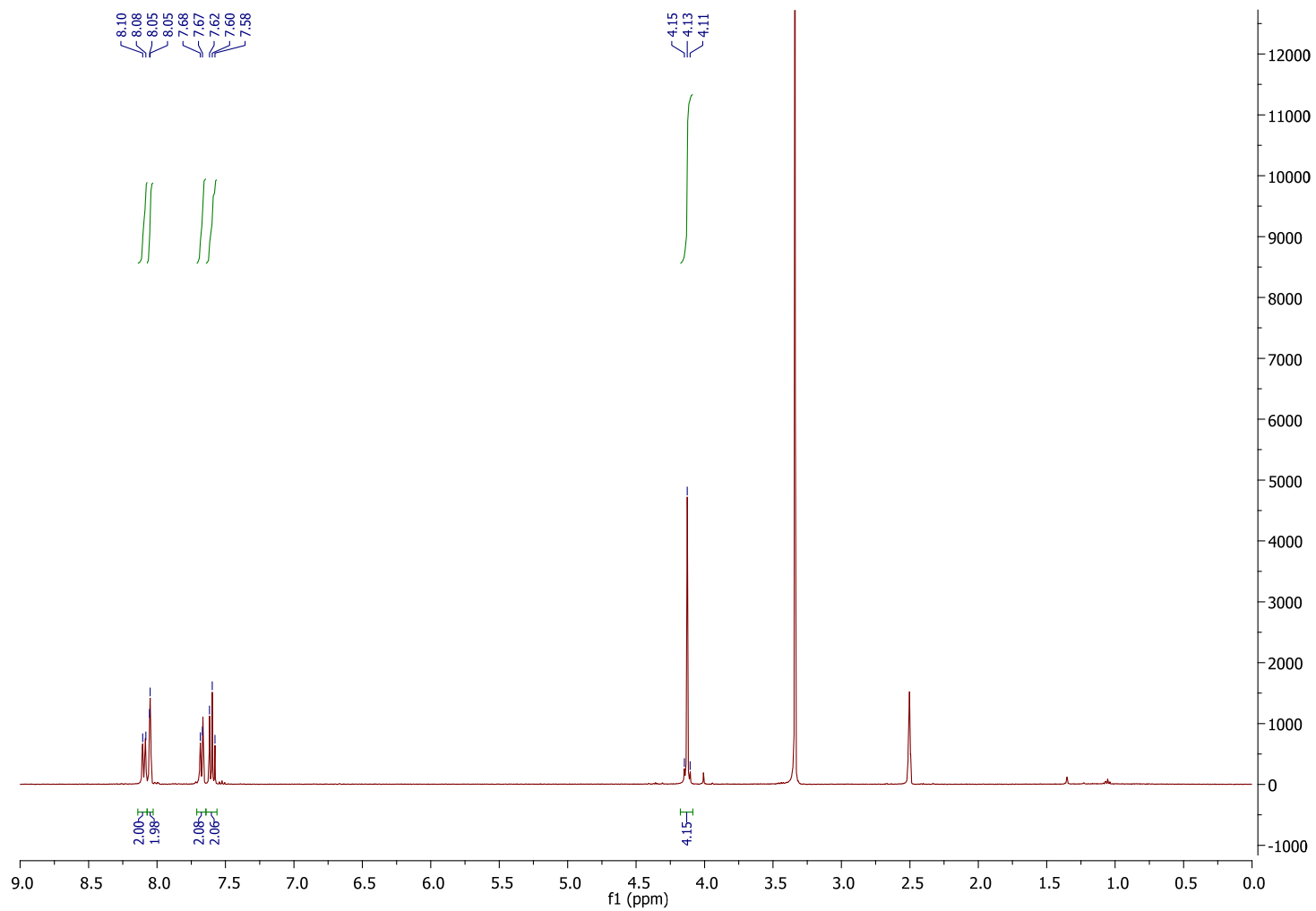


Figure S35. ¹H-NMR spectrum for compound **18**.

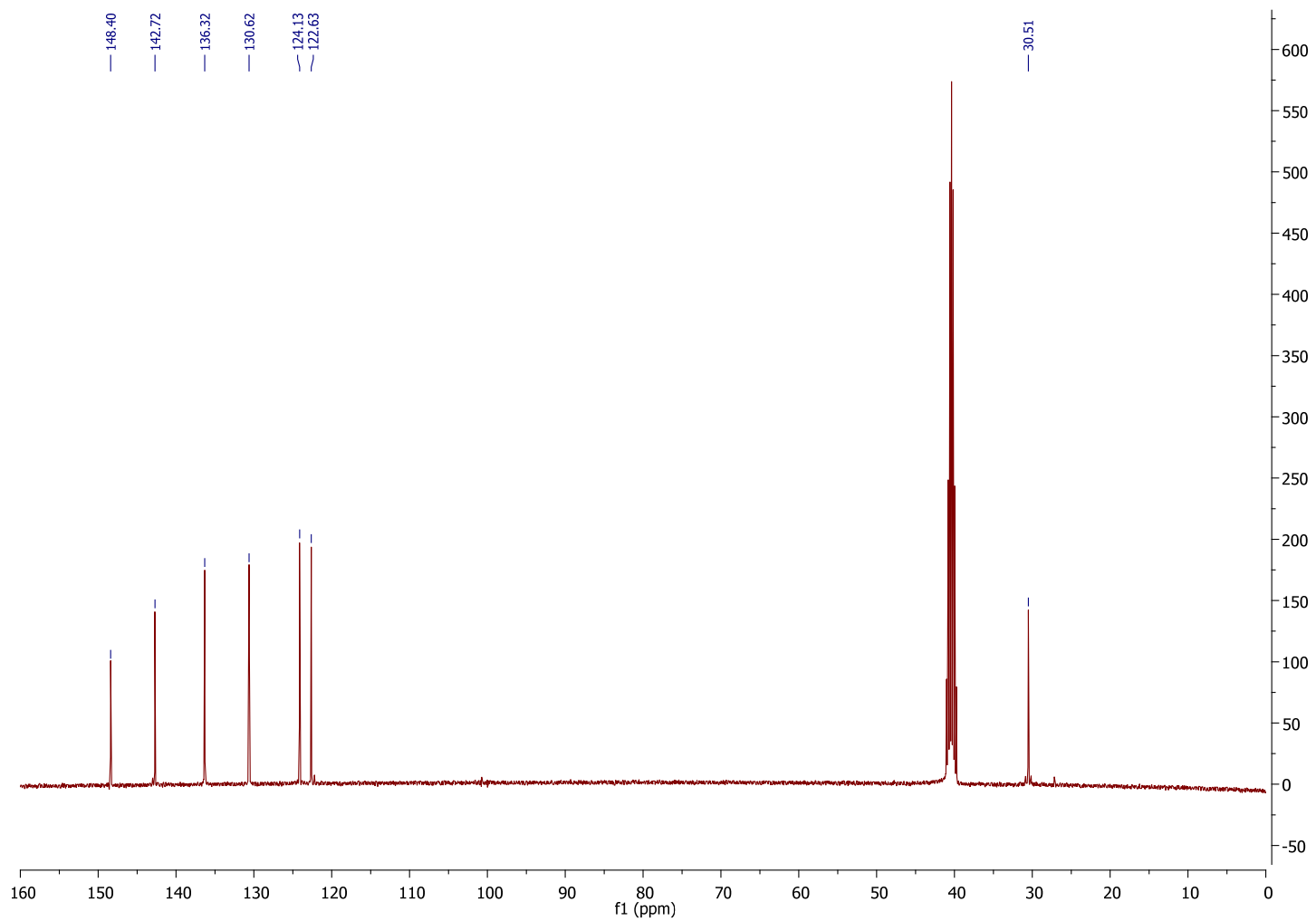


Figure S36. ^{13}C -NMR spectrum for compound **18**.

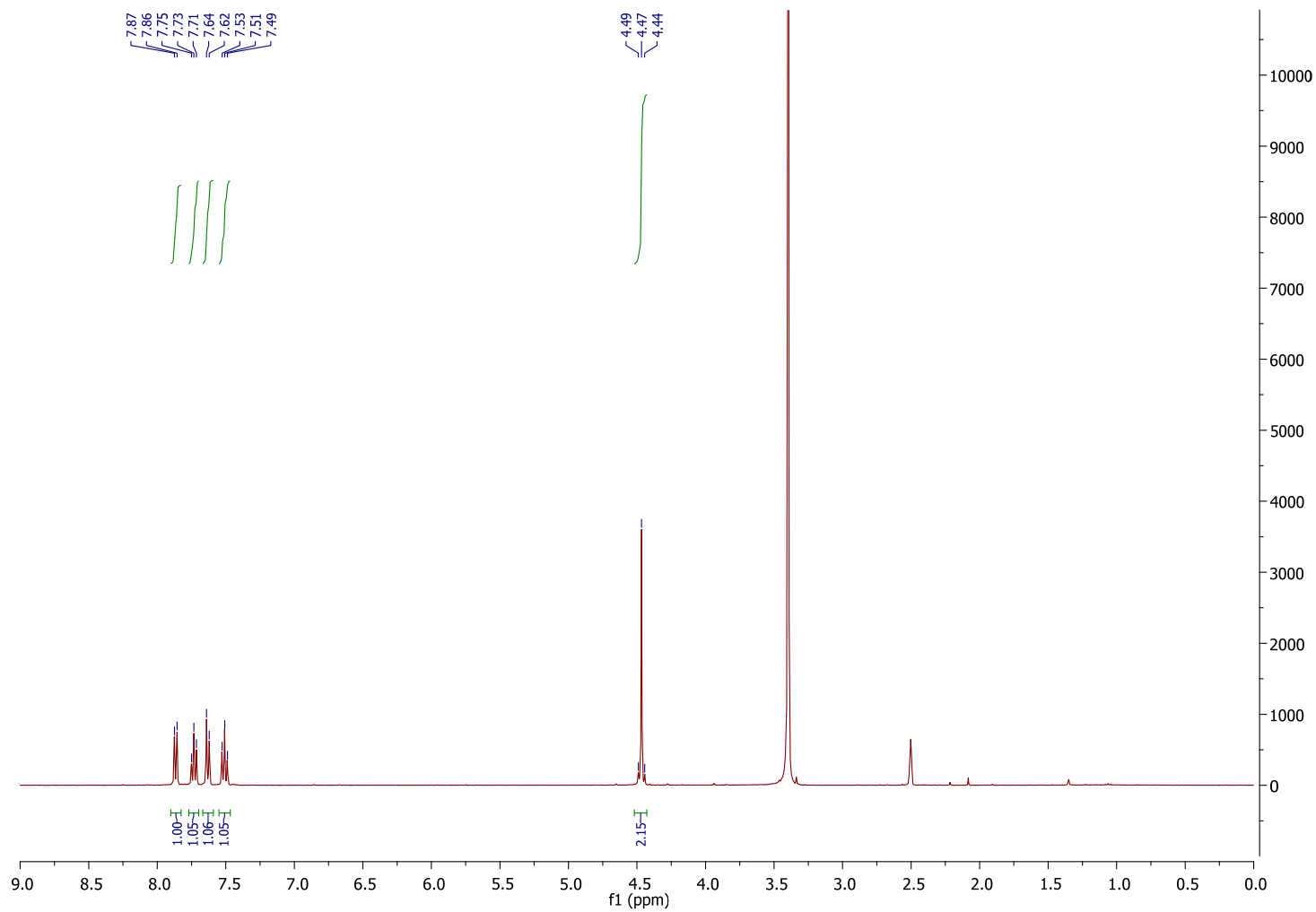


Figure S37. ¹H-NMR spectrum for compound **19**.

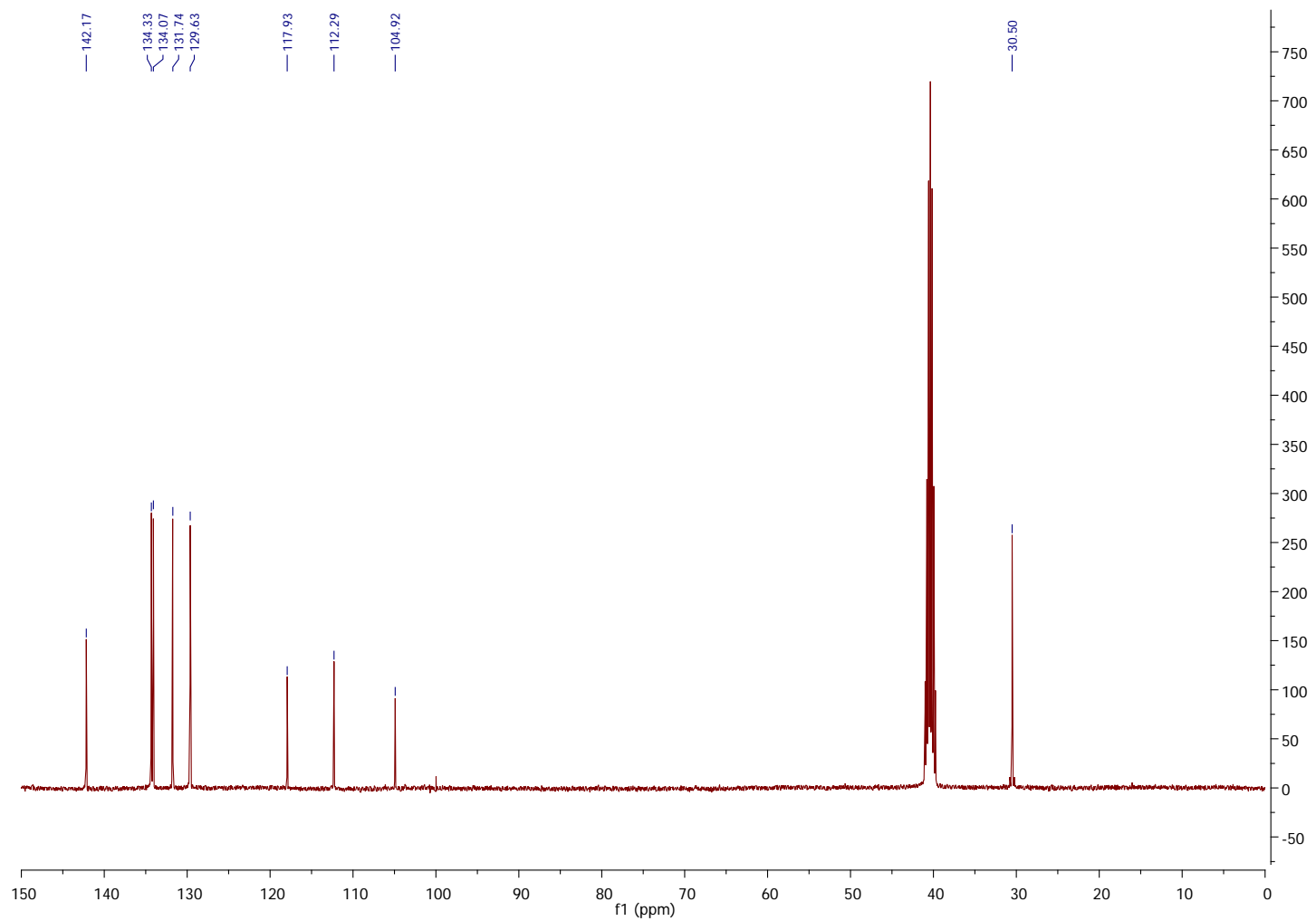


Figure S38. ¹³C-NMR spectrum for compound **19**.

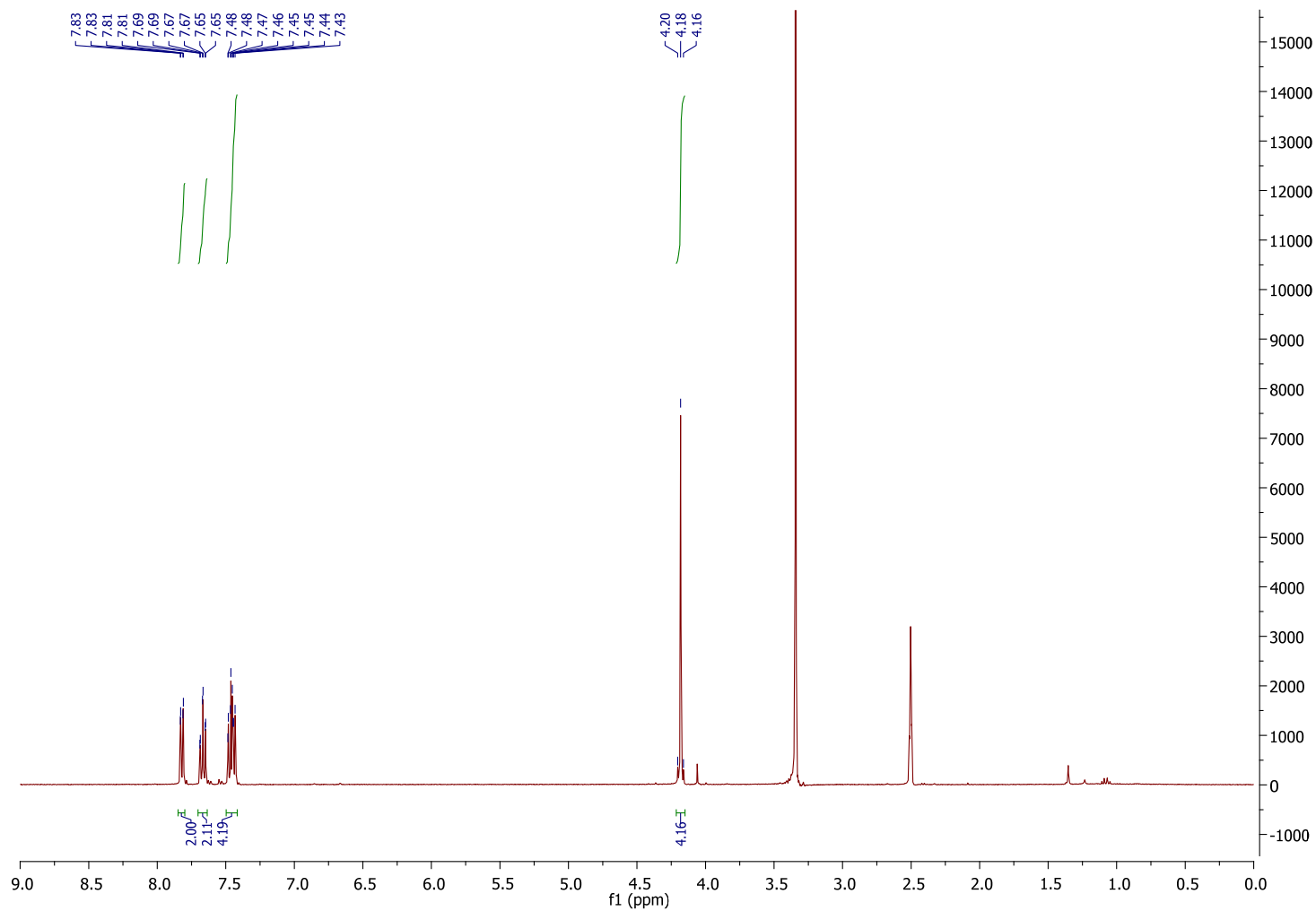


Figure S39. ¹H-NMR spectrum for compound **20**.

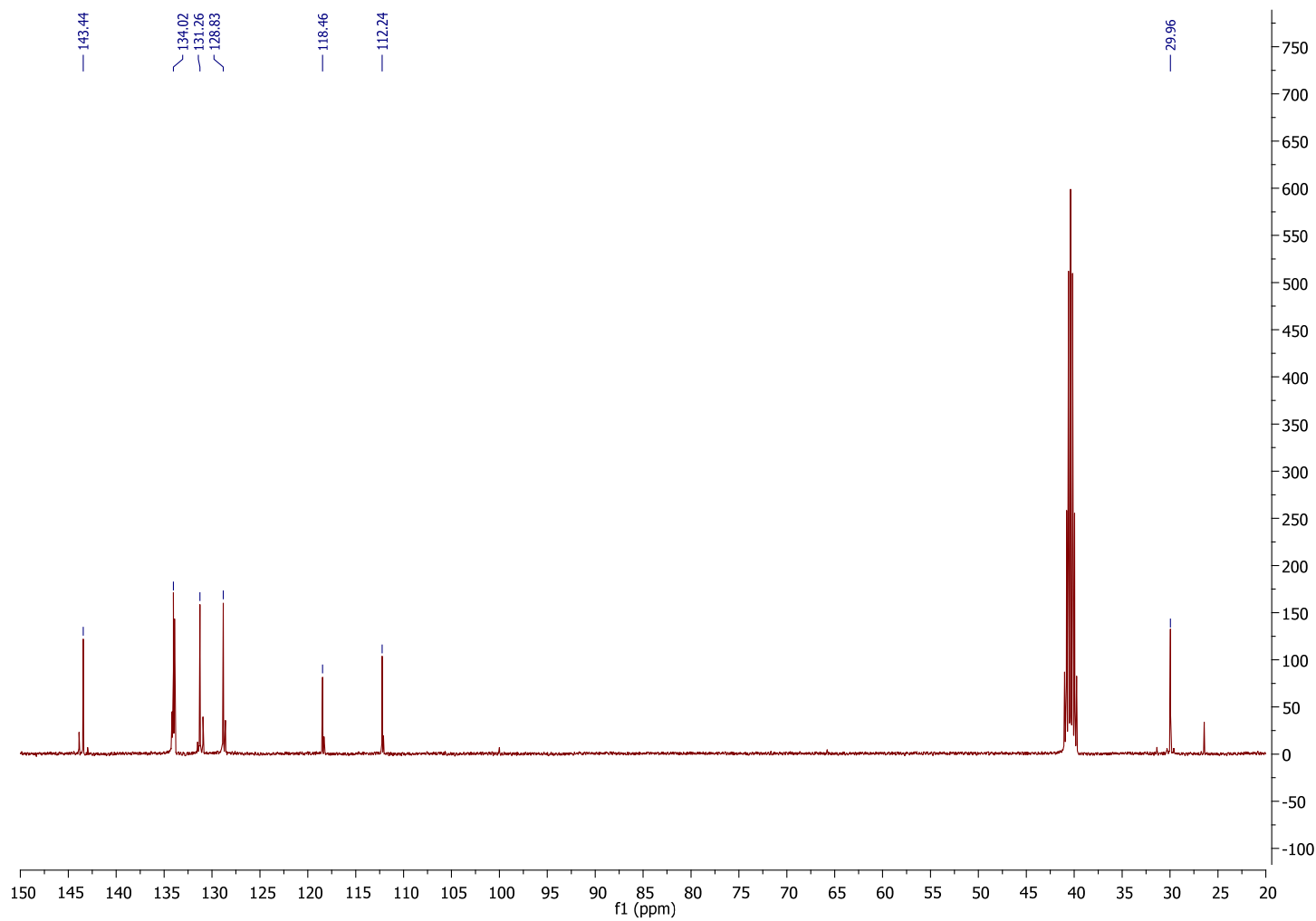


Figure S40. ¹³C-NMR spectrum for compound **20**.

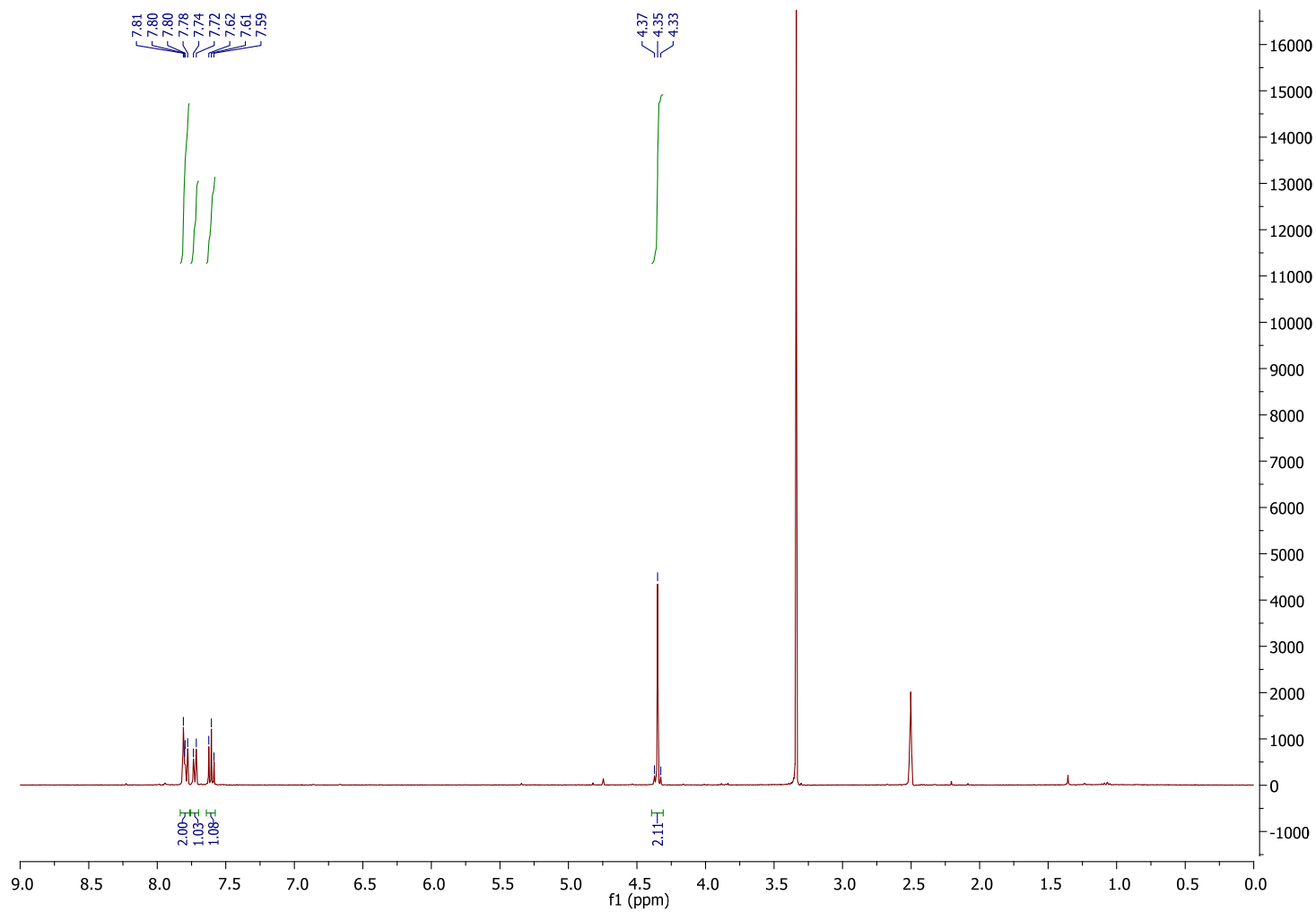


Figure S41. ¹H-NMR spectrum for compound **21**.

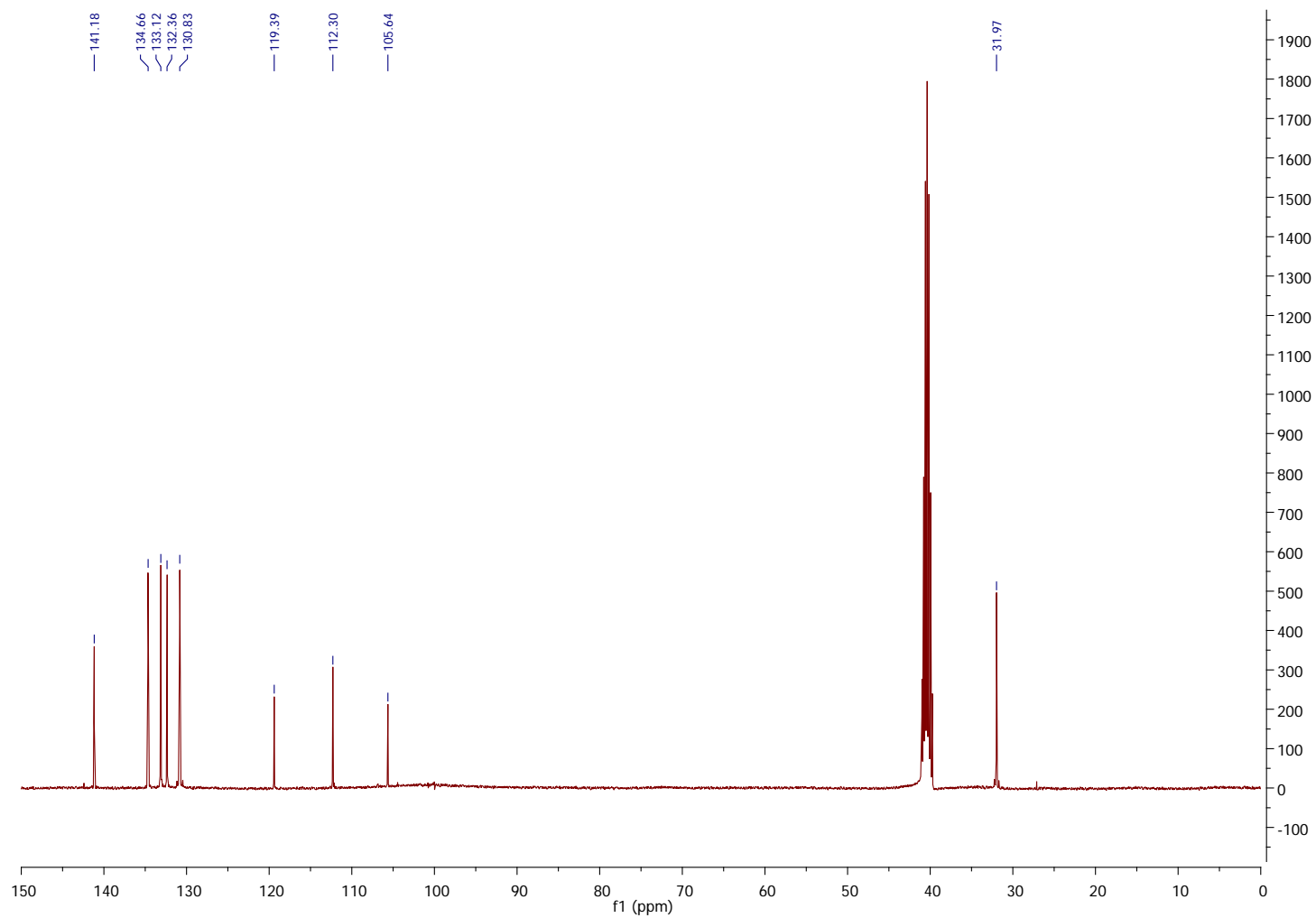


Figure S42. ^{13}C -NMR spectrum for compound **21**.

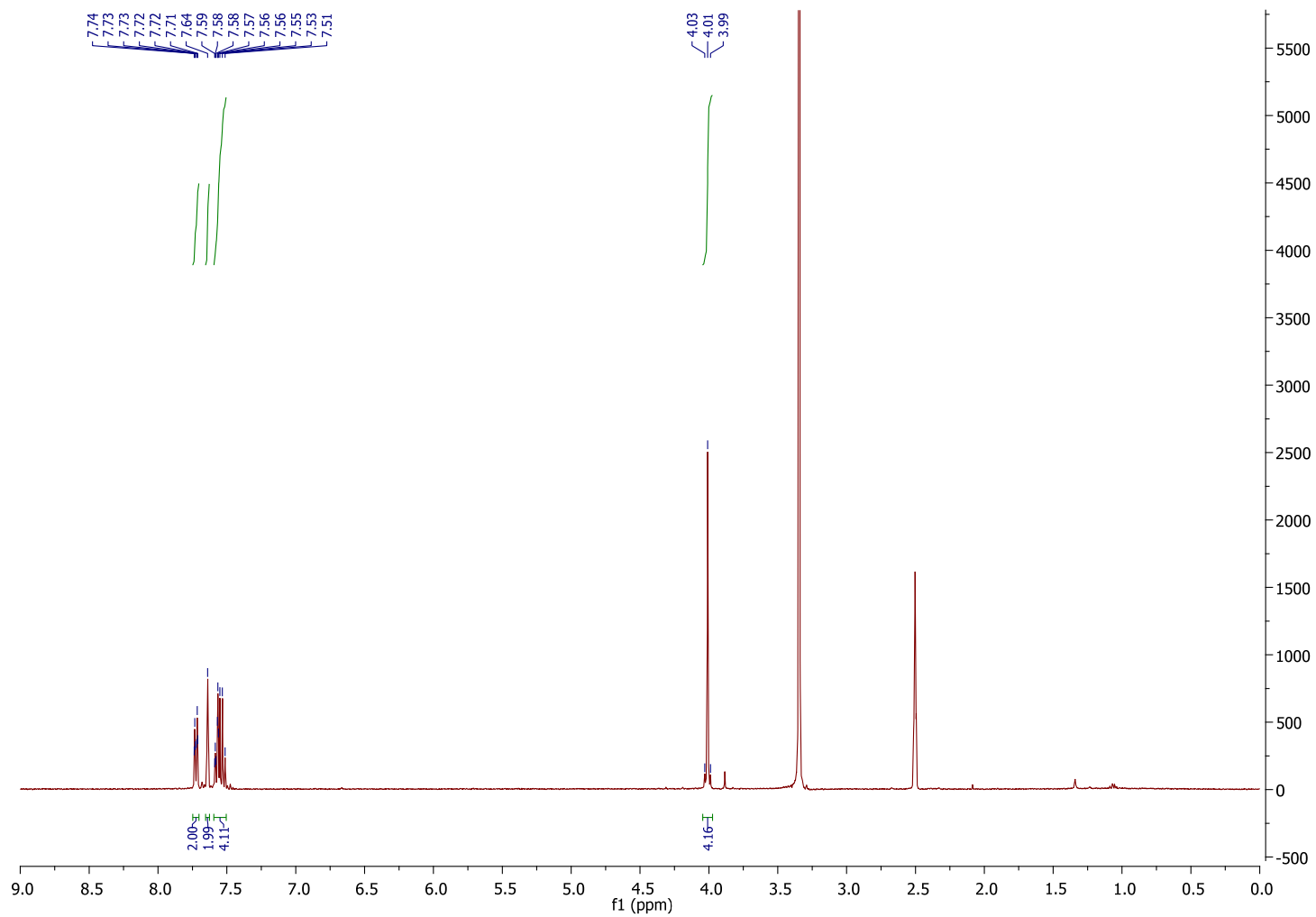


Figure S43. $^1\text{H-NMR}$ spectrum for compound **22**.

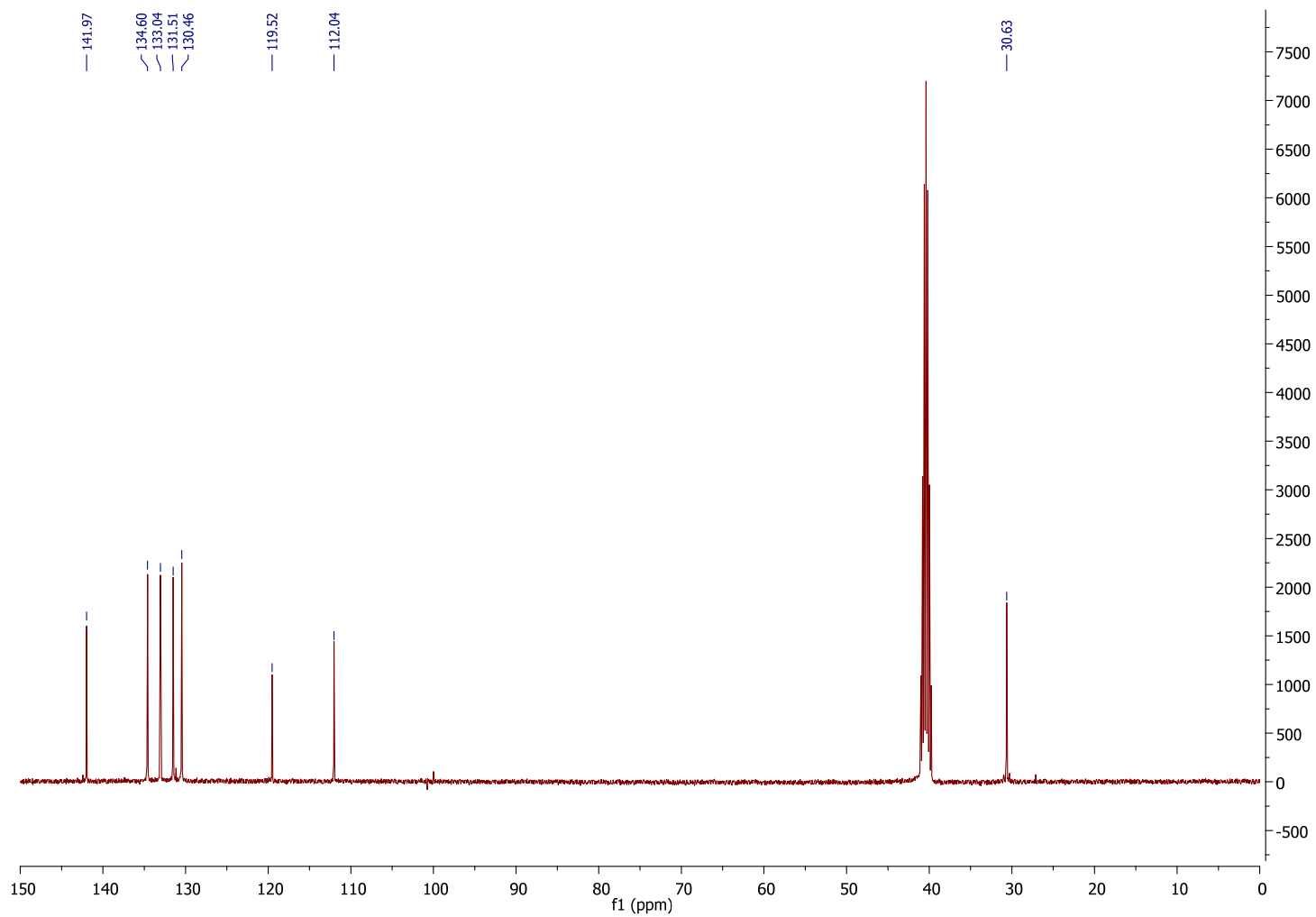


Figure S44. ^{13}C -NMR spectrum for compound **22**.

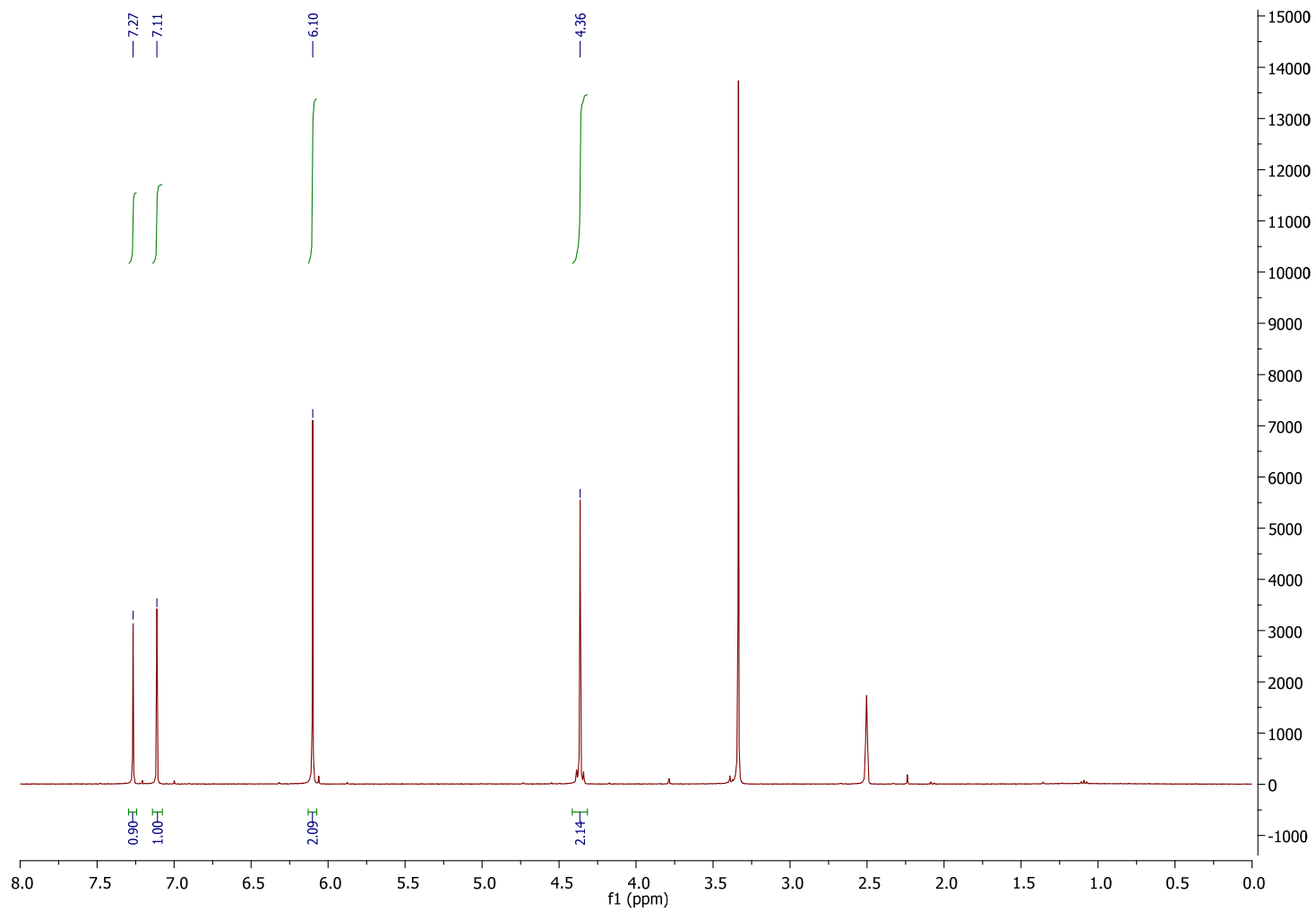


Figure S45. ¹H-NMR spectrum for compound **23**.

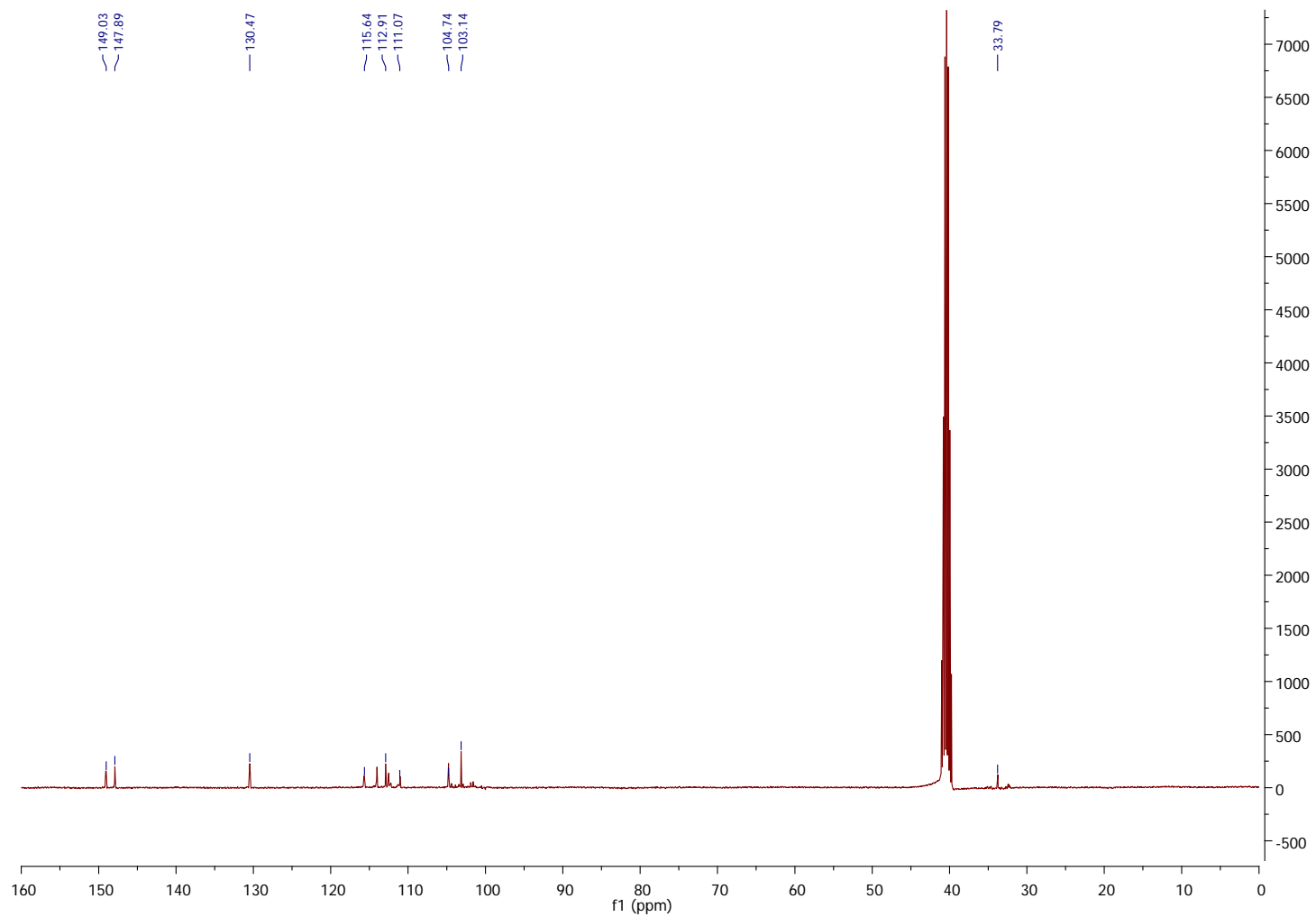


Figure S46. ^{13}C -NMR spectrum for compound **23**.

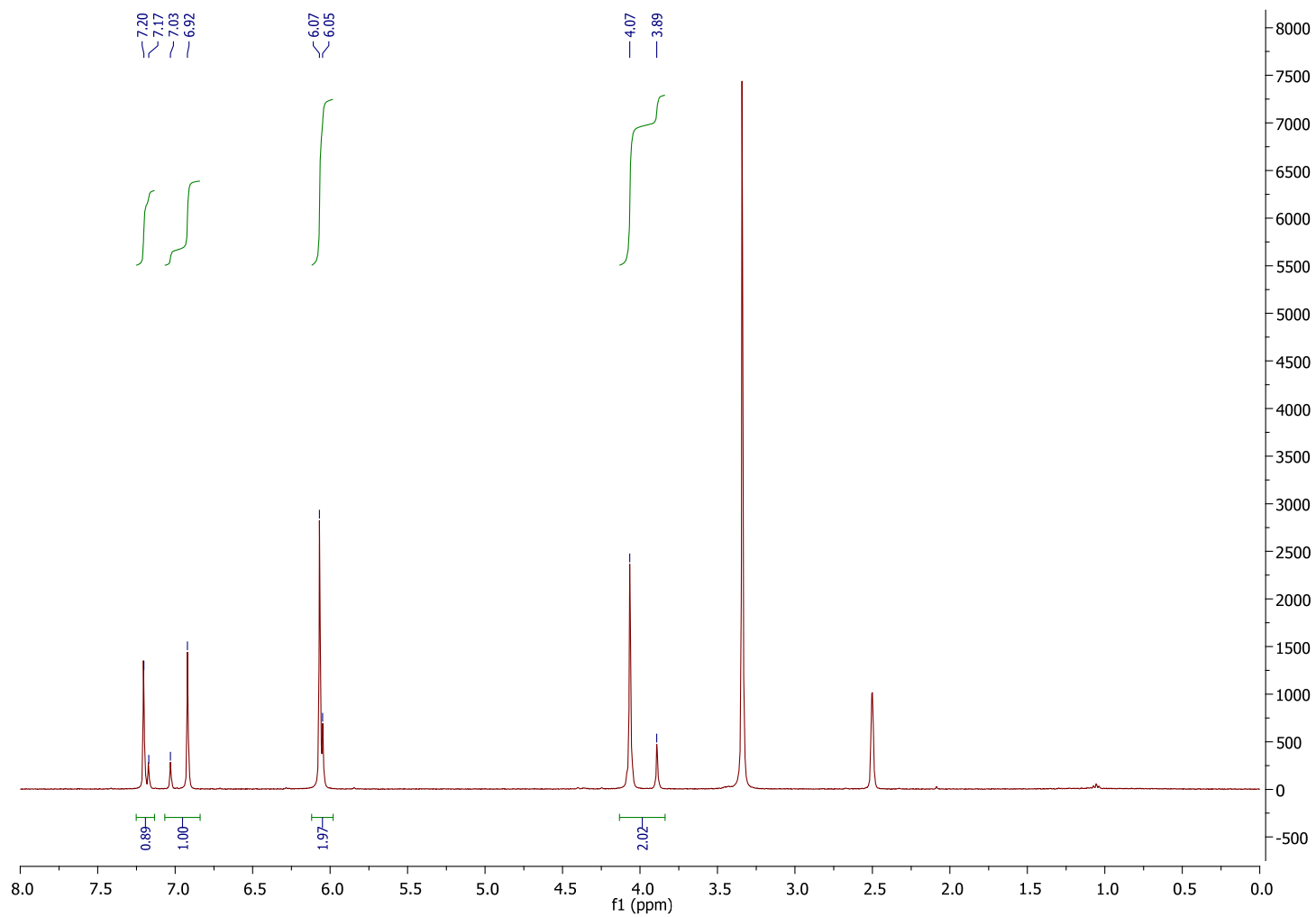


Figure S47. ¹H-NMR spectrum for compound **24**.

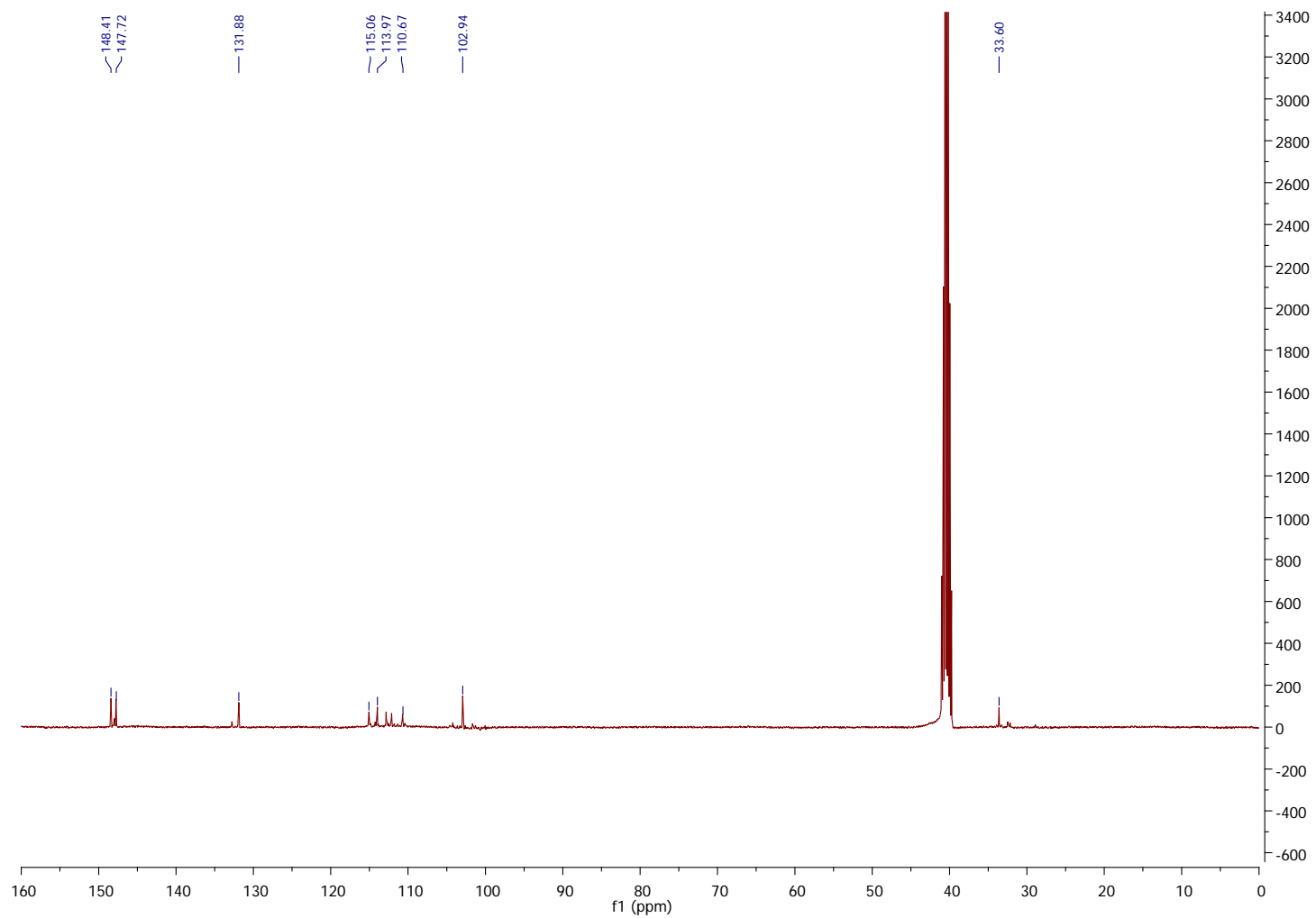


Figure S48. ^{13}C -NMR spectrum for compound **24**.

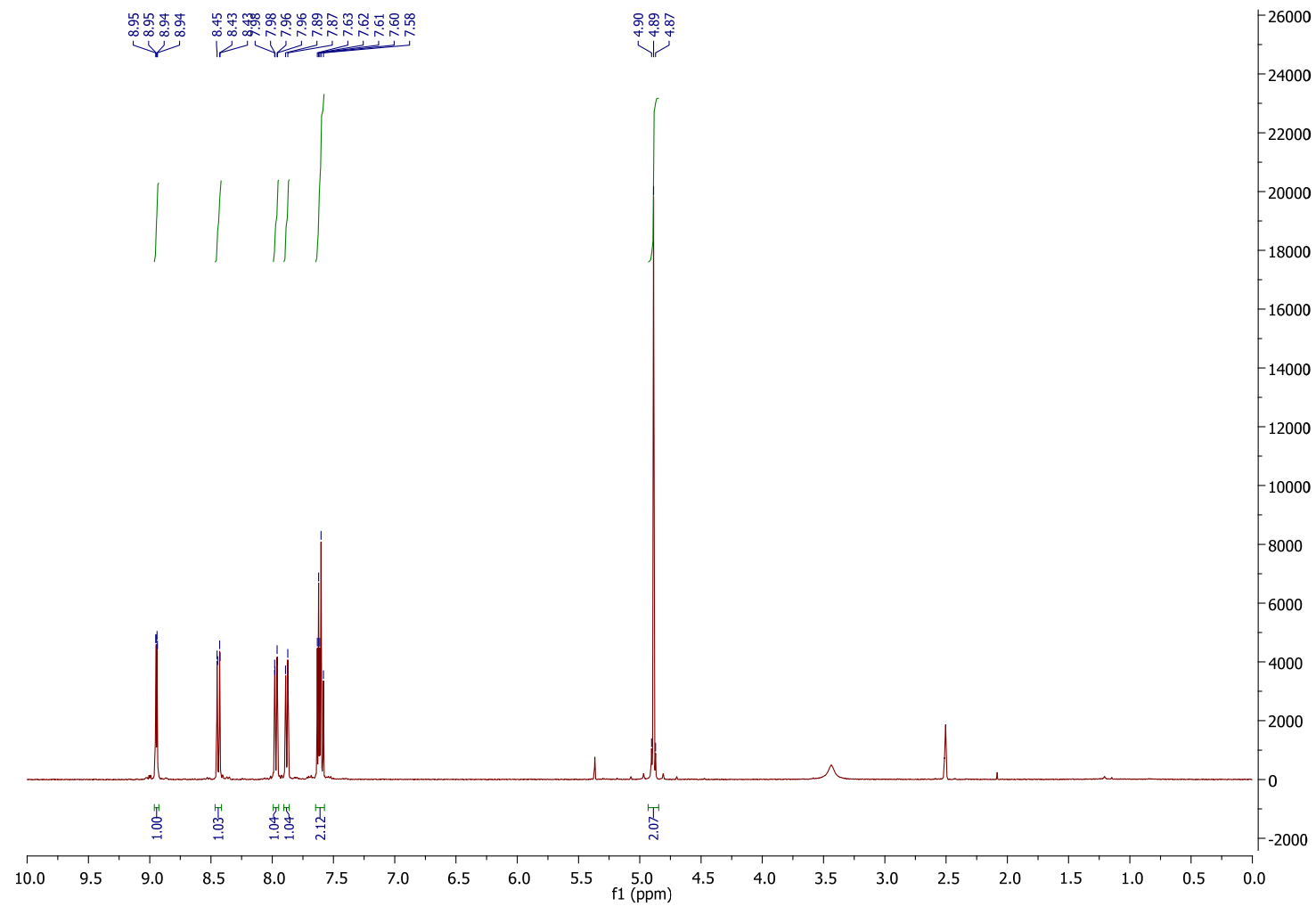


Figure S49. $^1\text{H-NMR}$ spectrum for compound **25**.

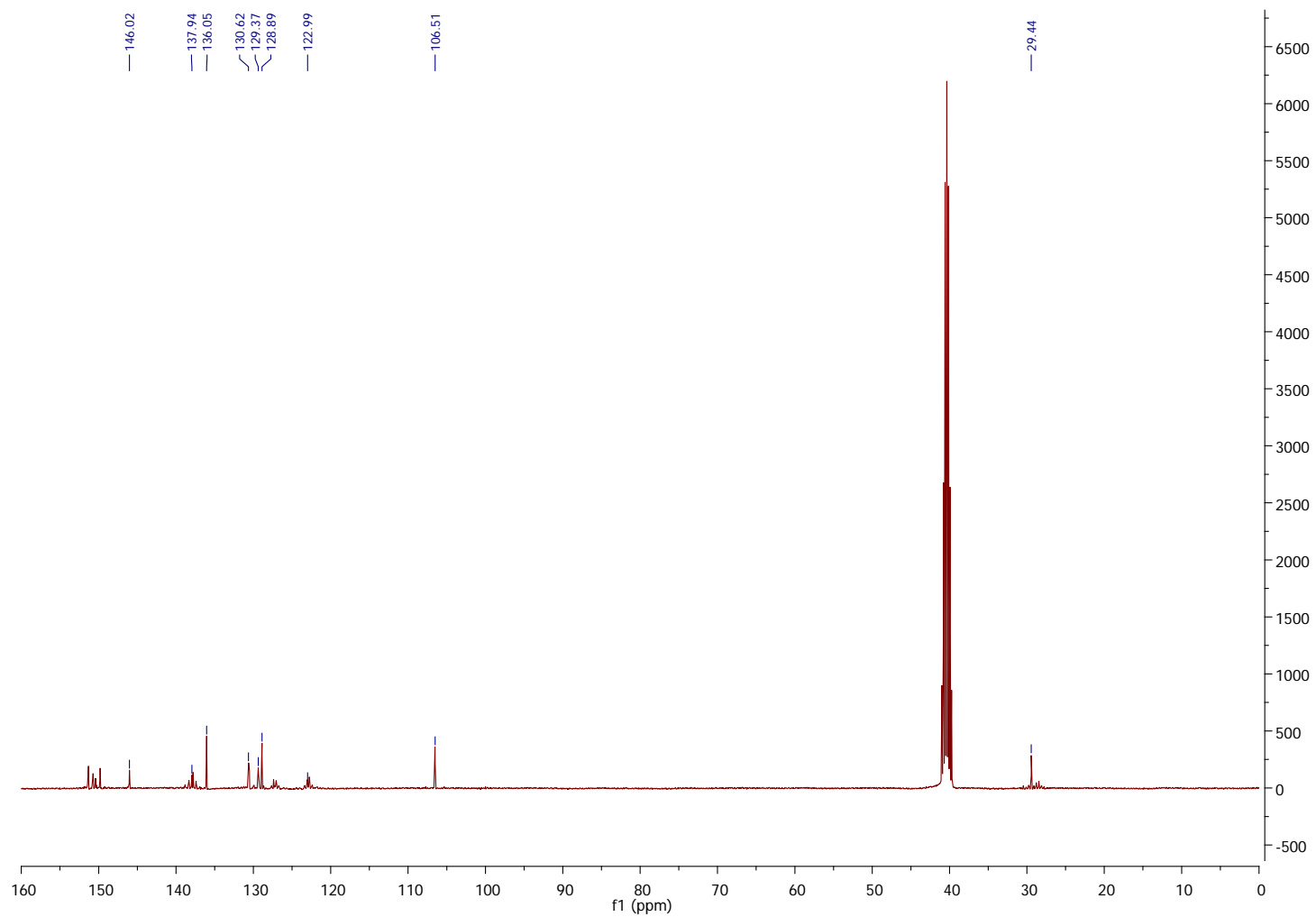


Figure S50. ^{13}C -NMR spectrum for compound **25**.

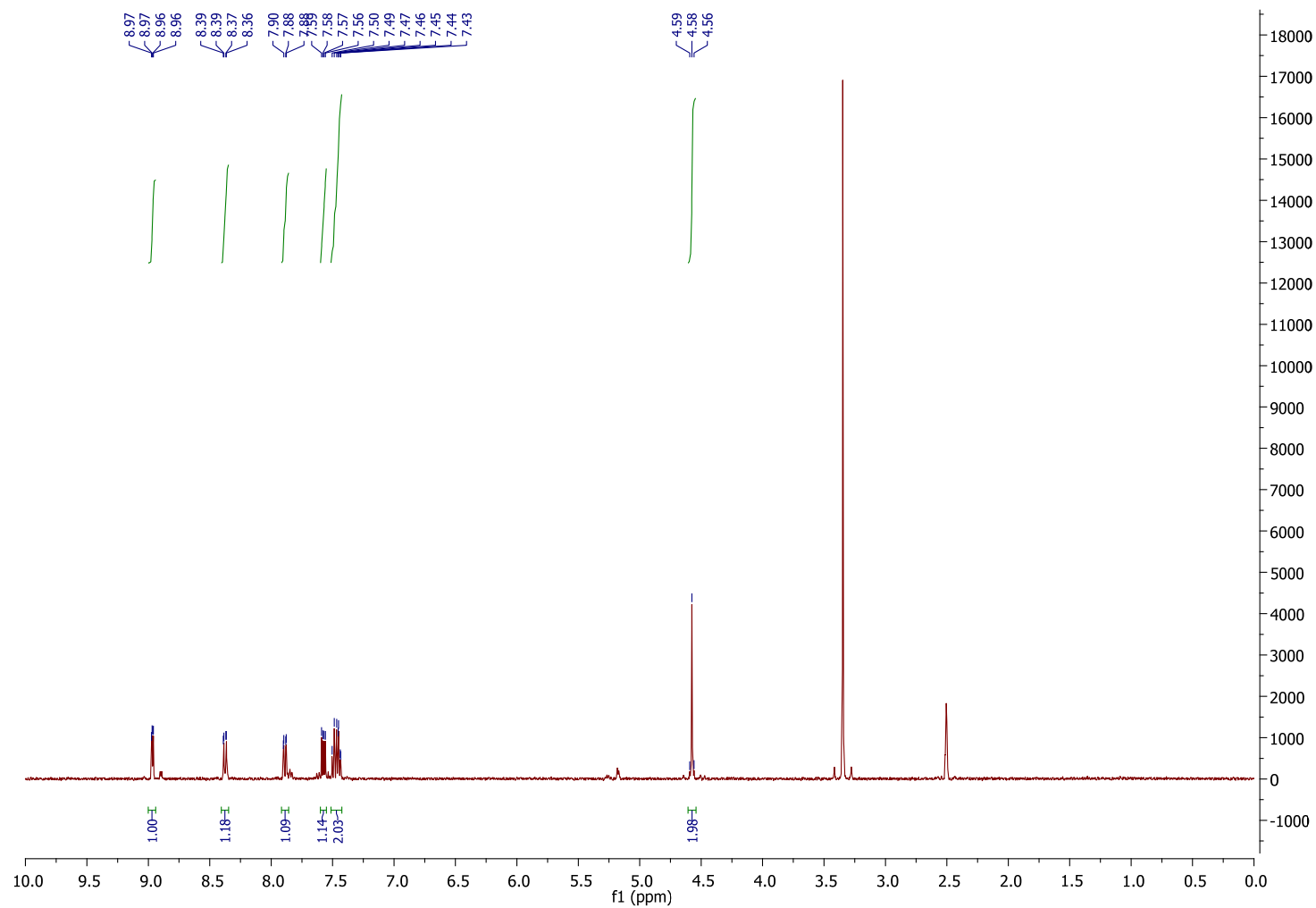


Figure S51. ¹H-NMR spectrum for compound **26**.

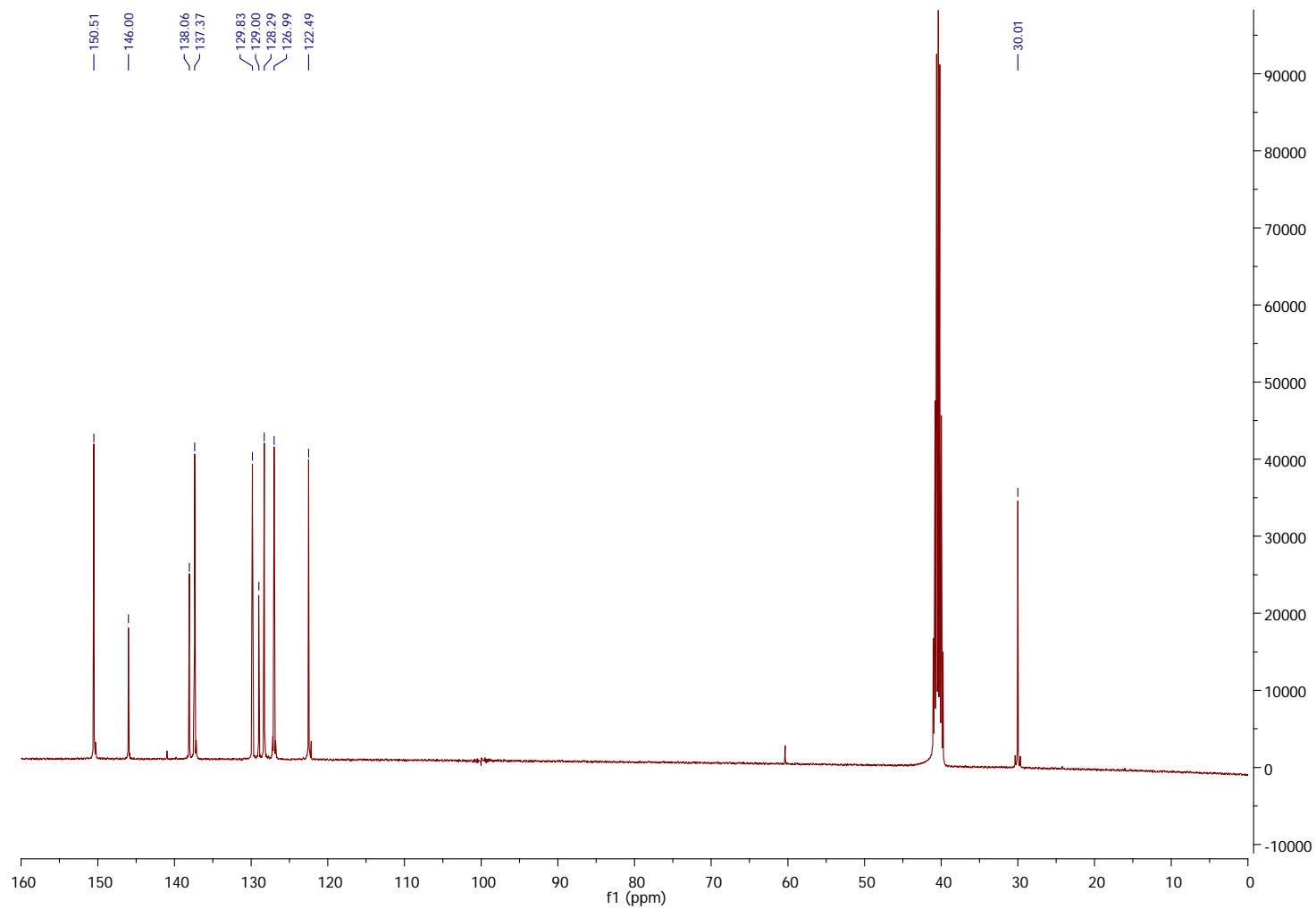


Figure S52. ^{13}C -NMR spectrum for compound **26**.

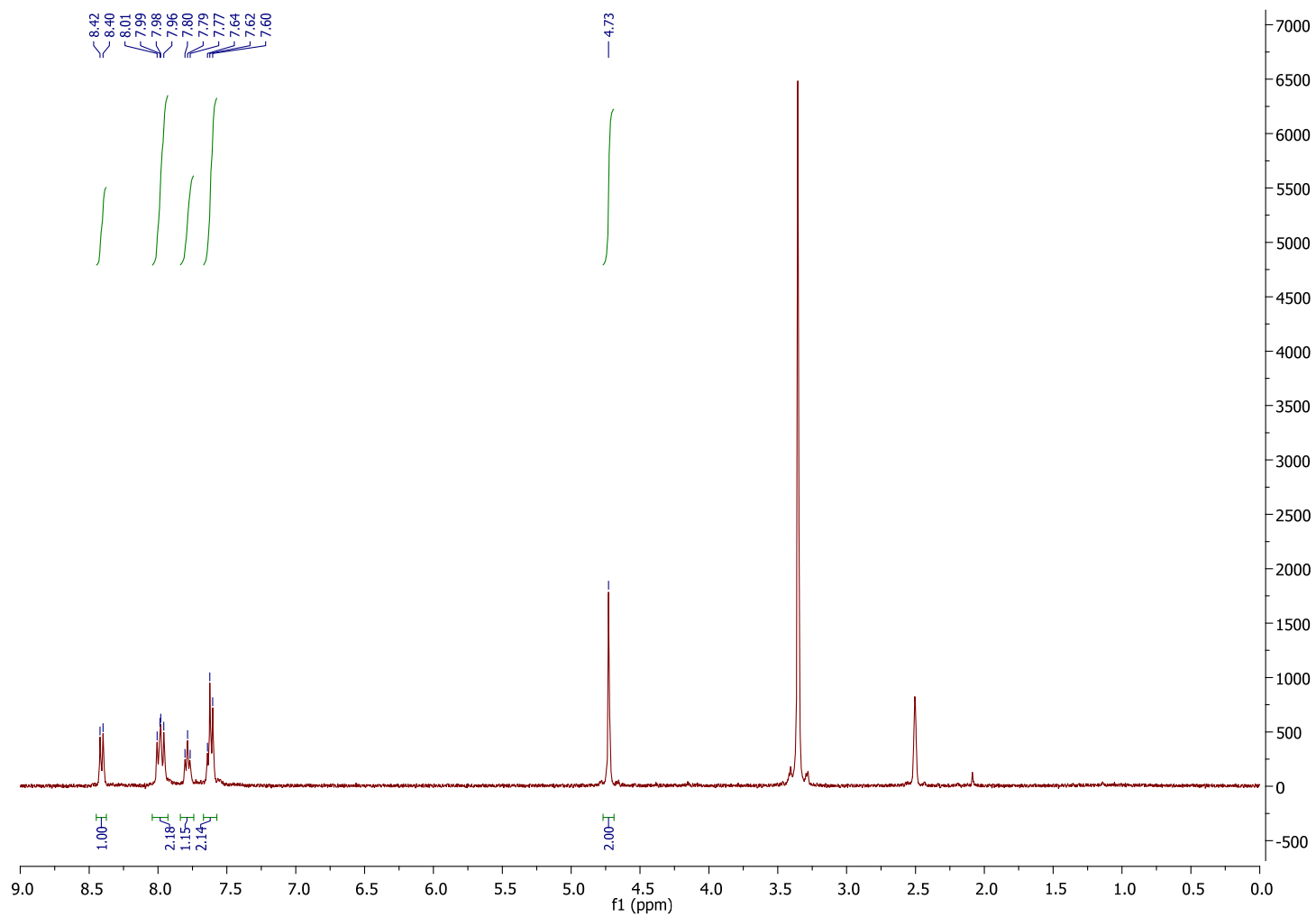


Figure S53. ^1H -NMR spectrum for compound **27**.

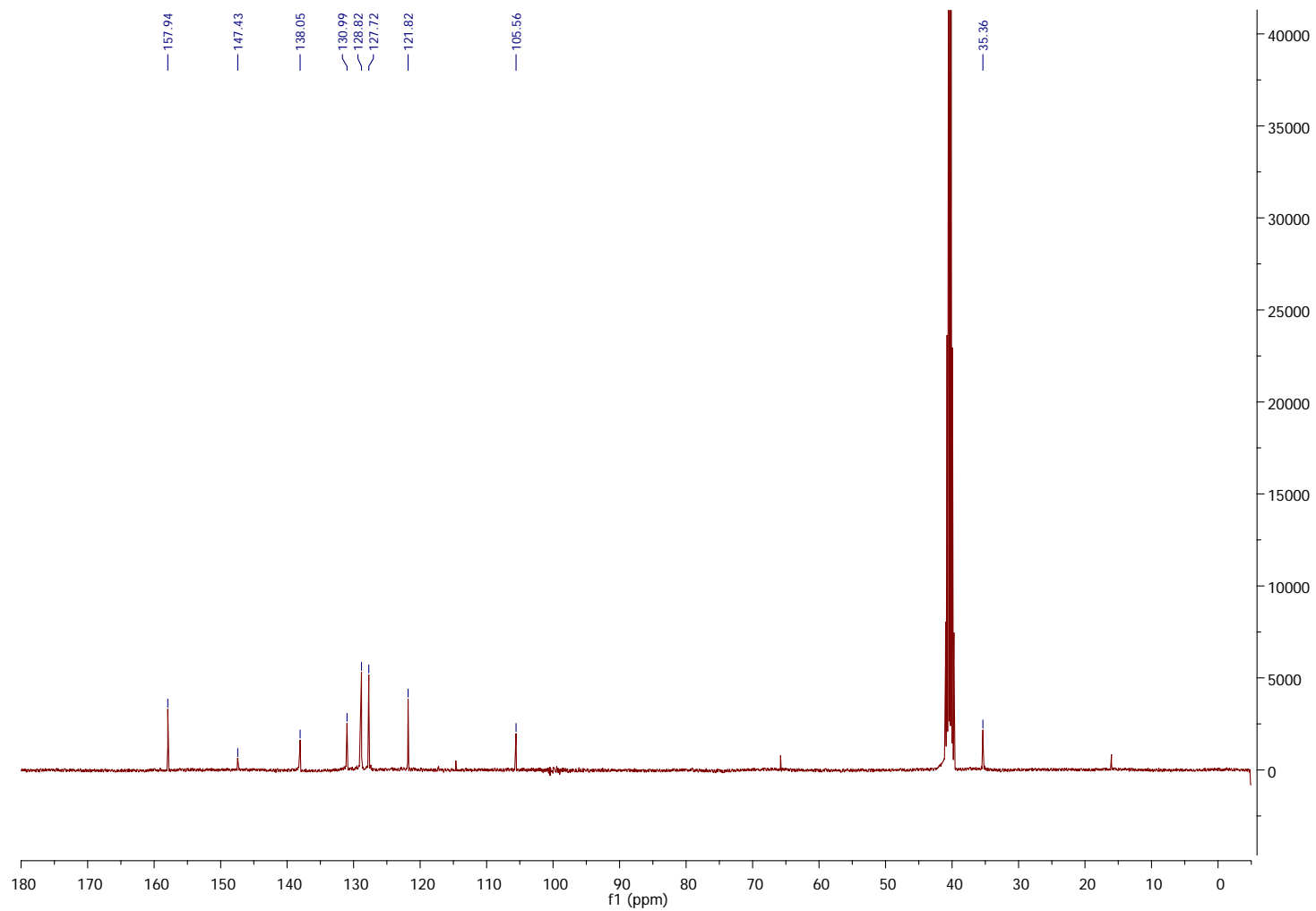


Figure S54. ^{13}C -NMR spectrum for compound 27.

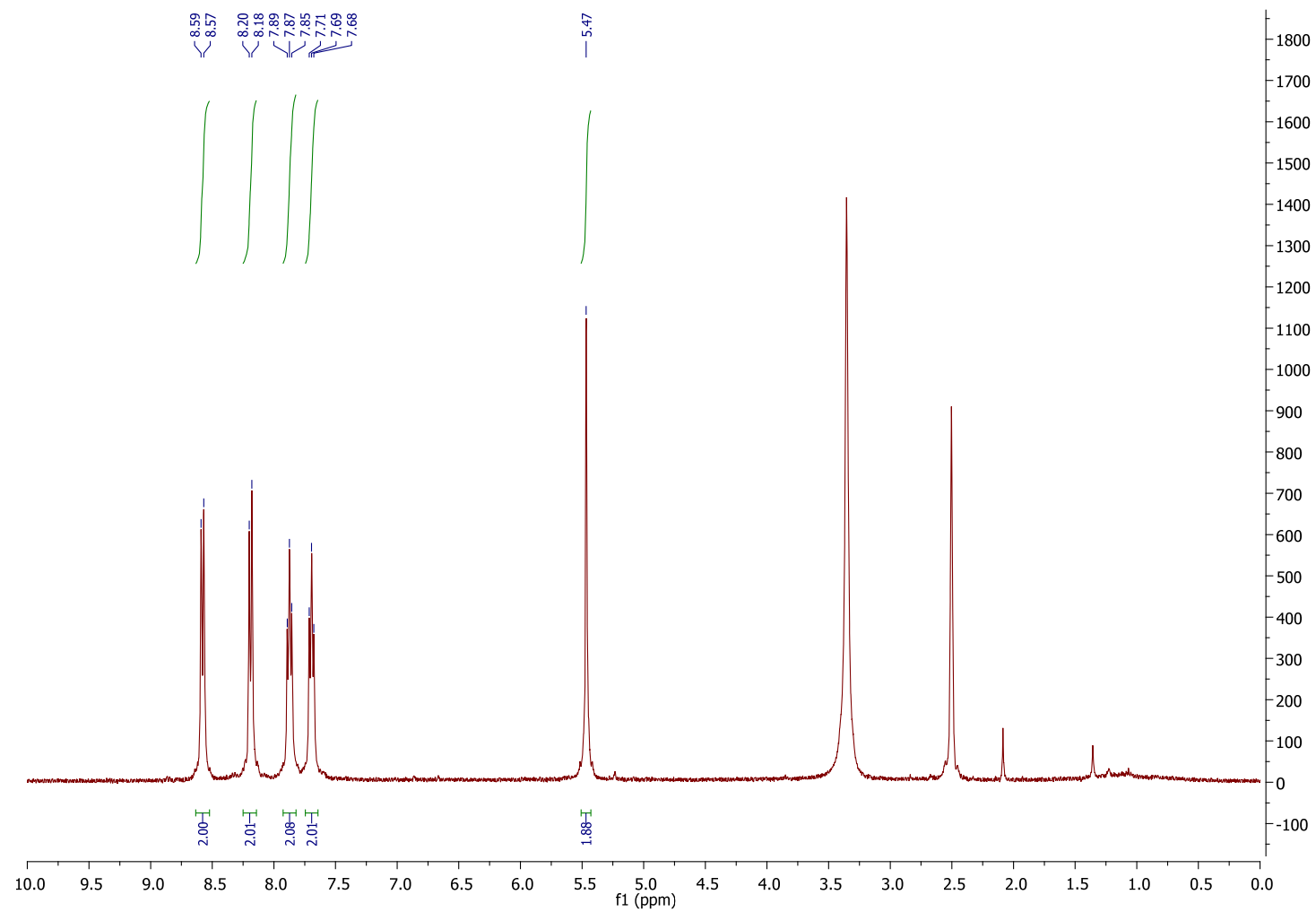


Figure S55. ^1H -NMR spectrum for compound **28**.

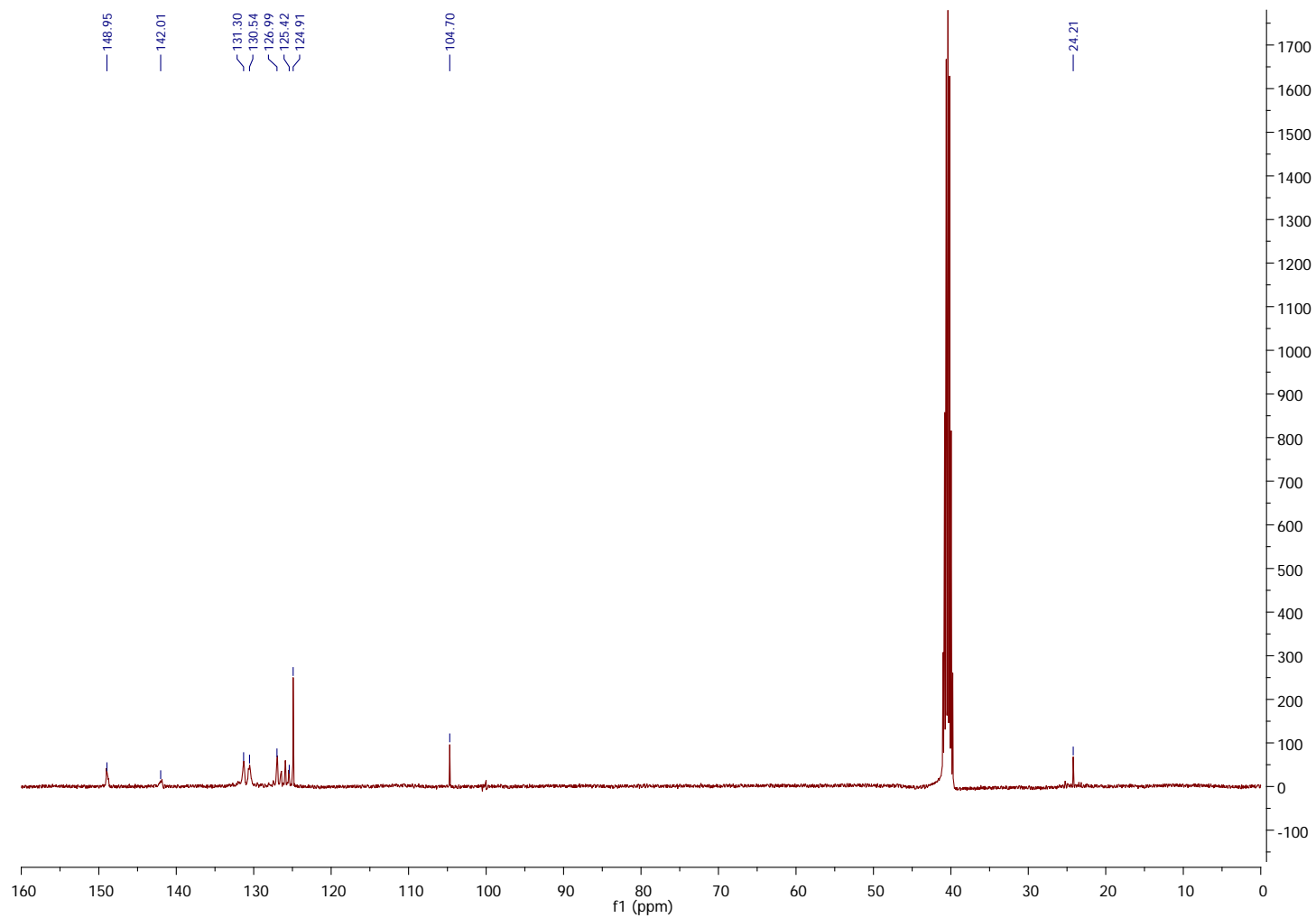


Figure S56. ^{13}C -NMR spectrum for compound **28**.

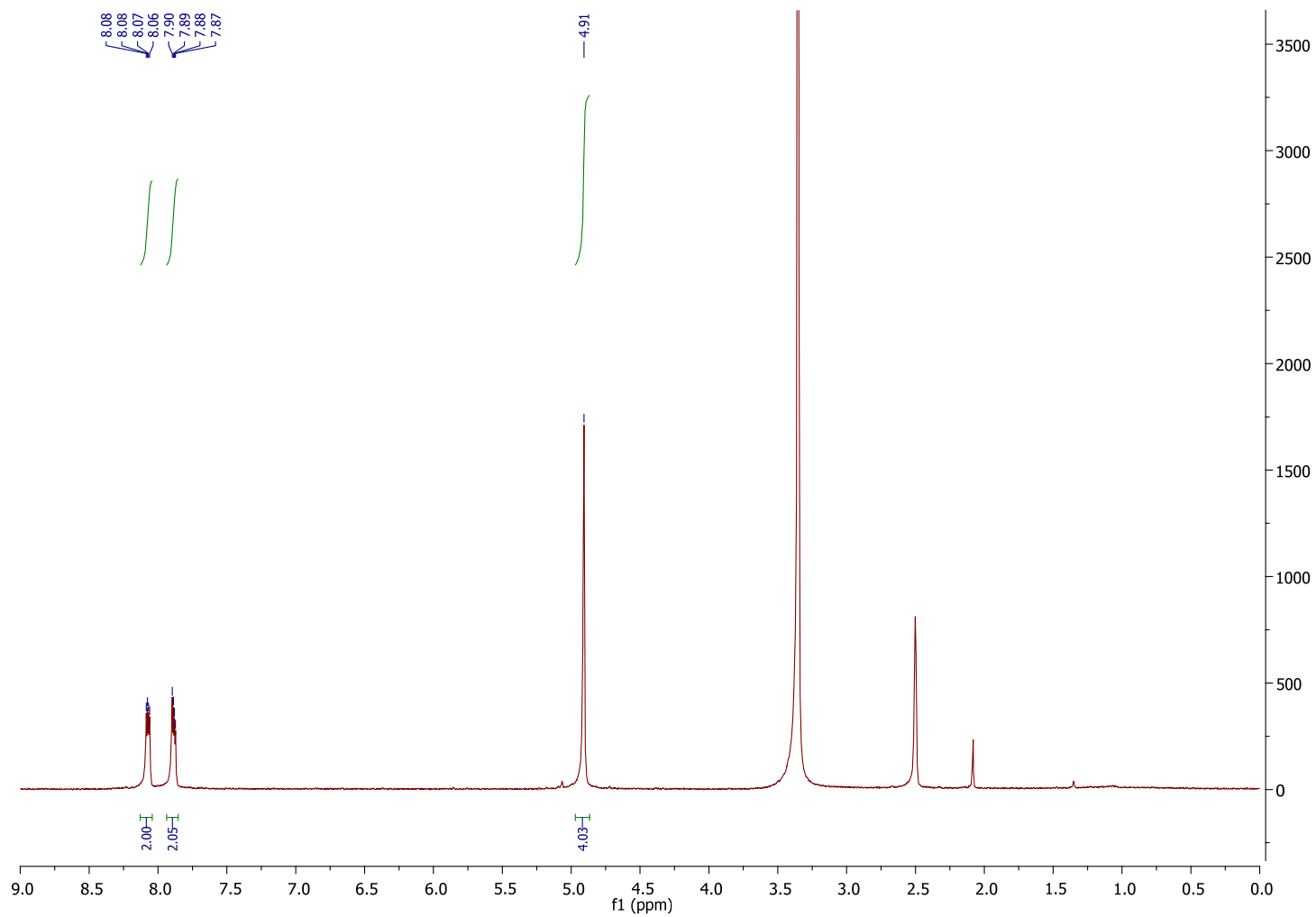


Figure S57. ^1H -NMR spectrum for compound **29**.

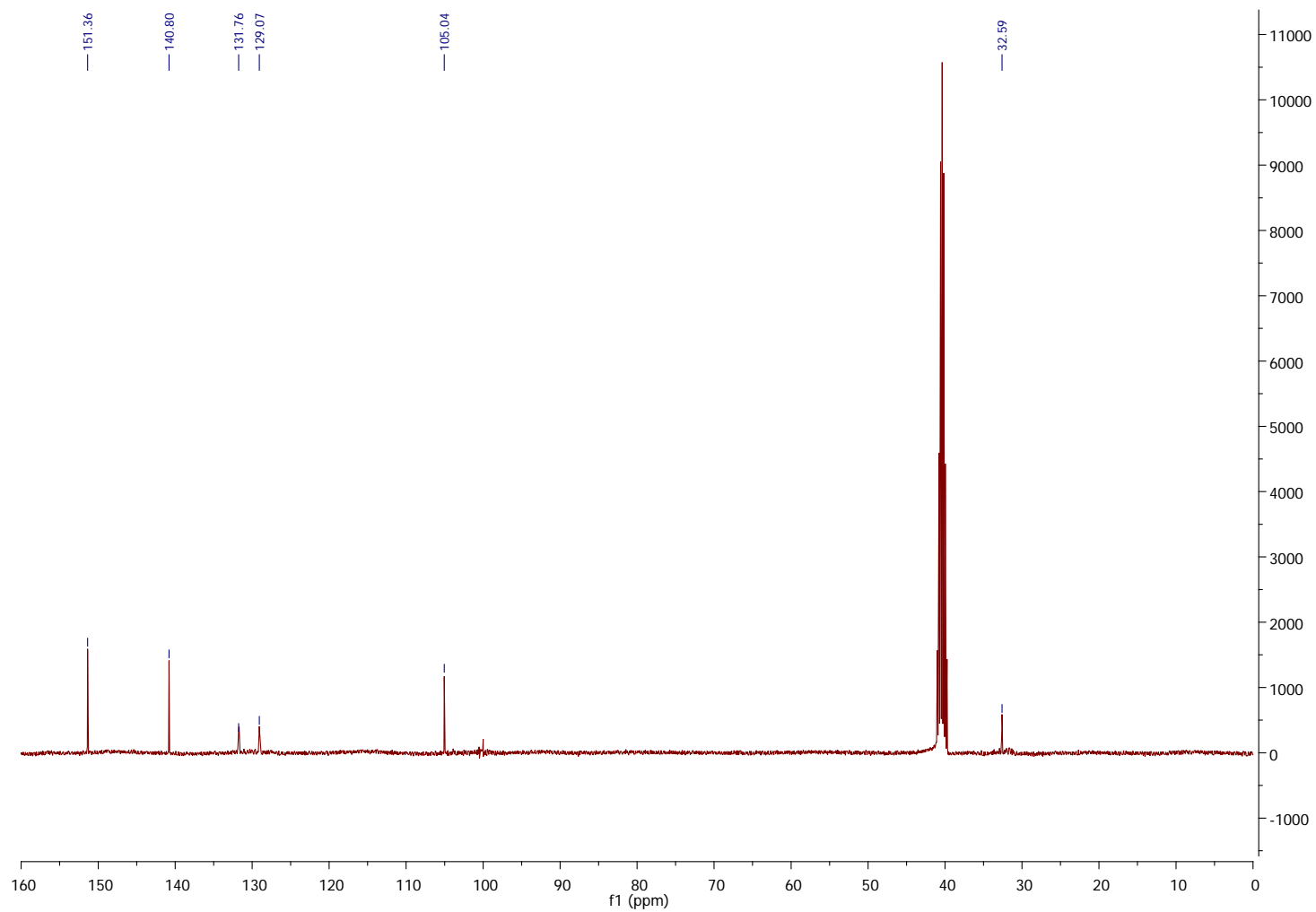


Figure S58. ^{13}C -NMR spectrum for compound **29**.

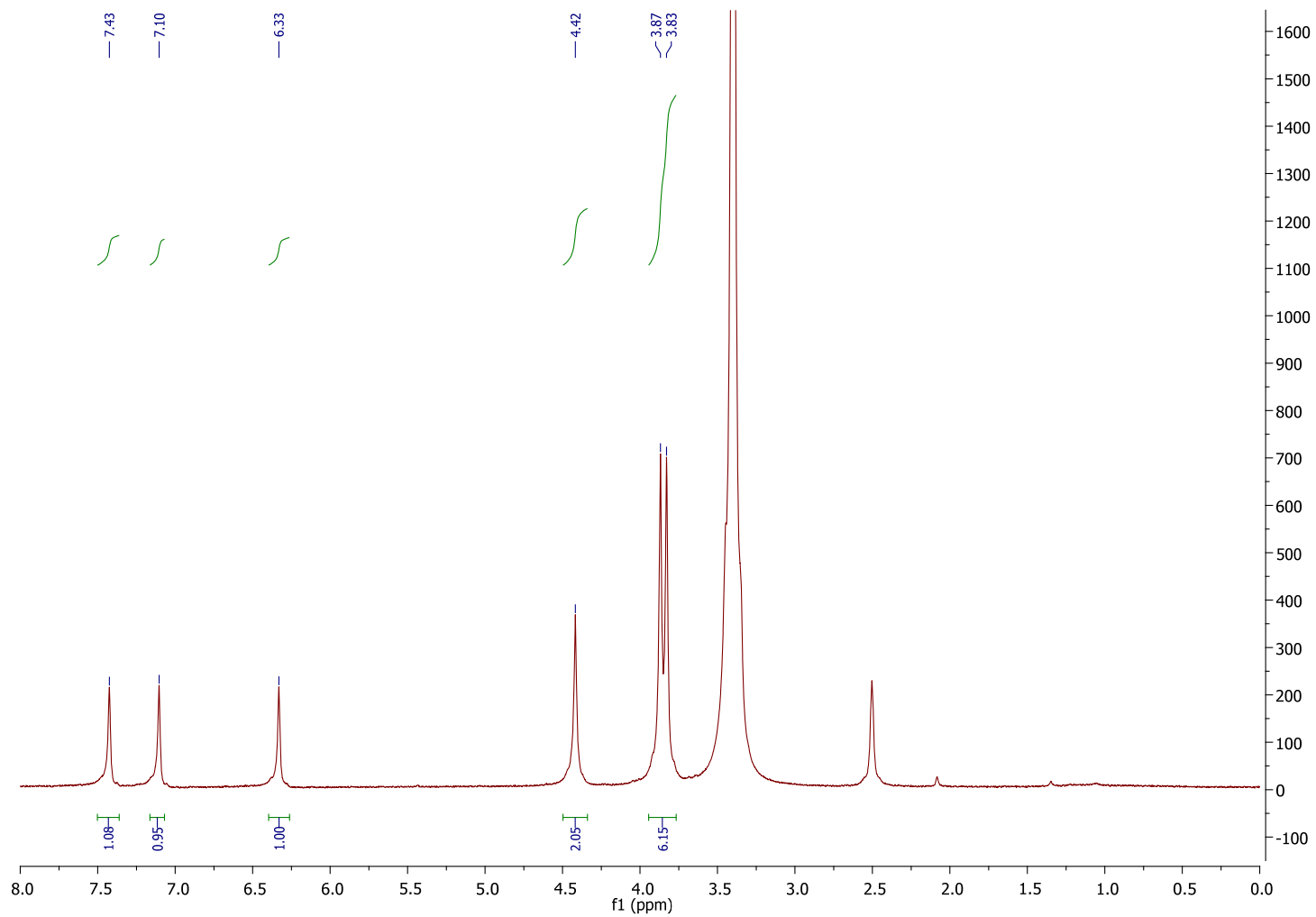


Figure S59. ¹H-NMR spectrum for compound **30**.

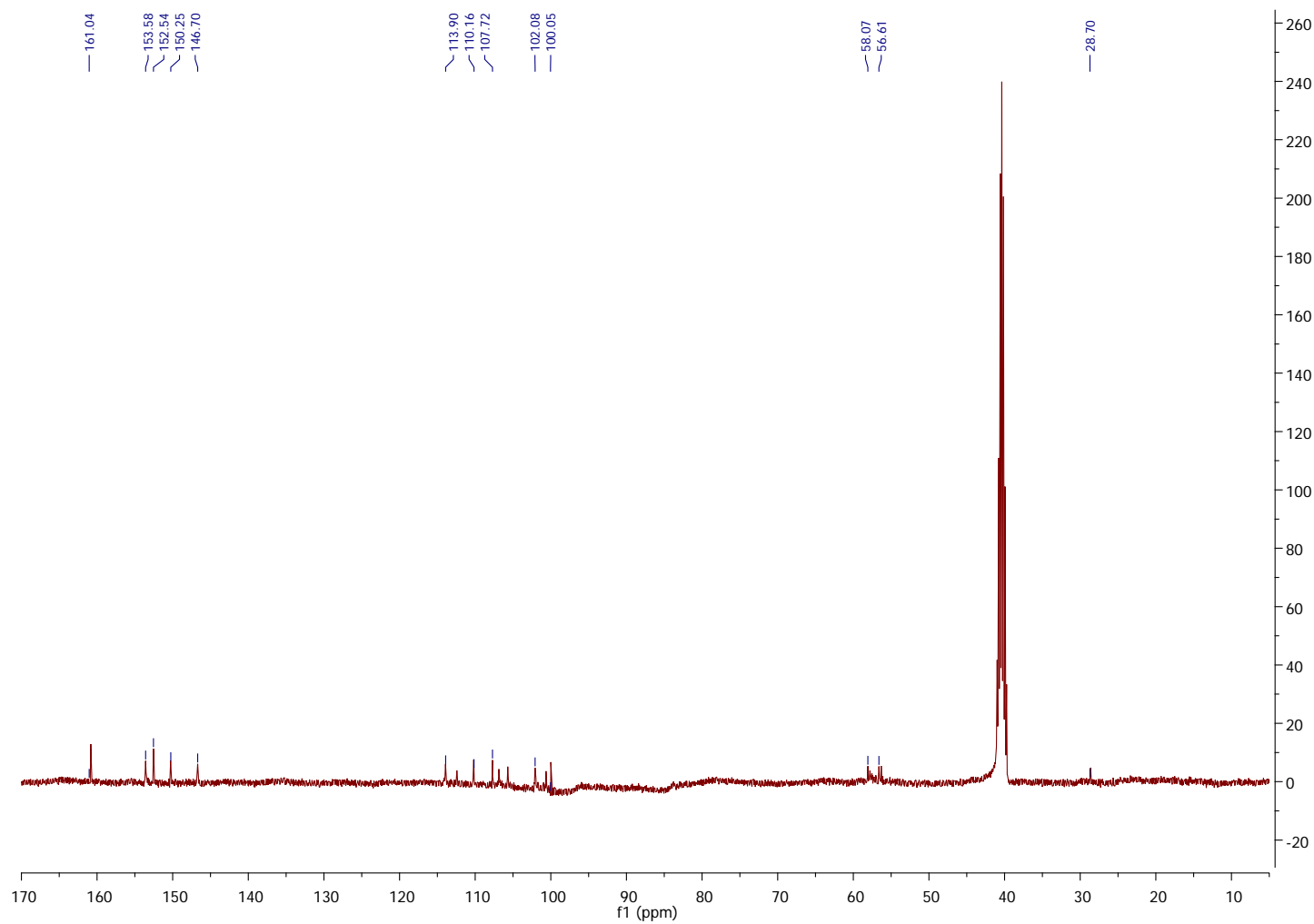


Figure S60. ^{13}C -NMR spectrum for compound **30**.

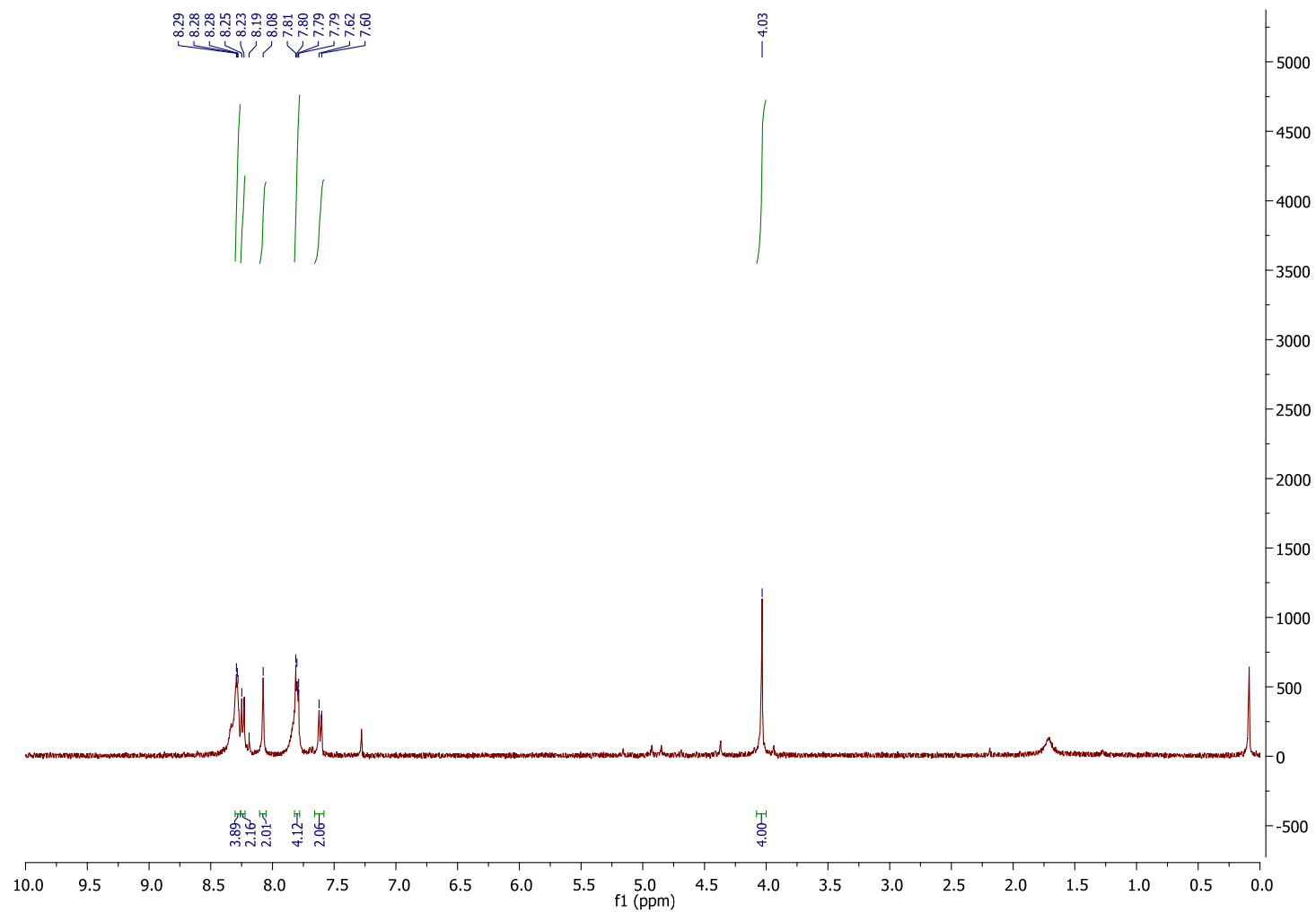


Figure S61. $^1\text{H-NMR}$ spectrum for compound 31.

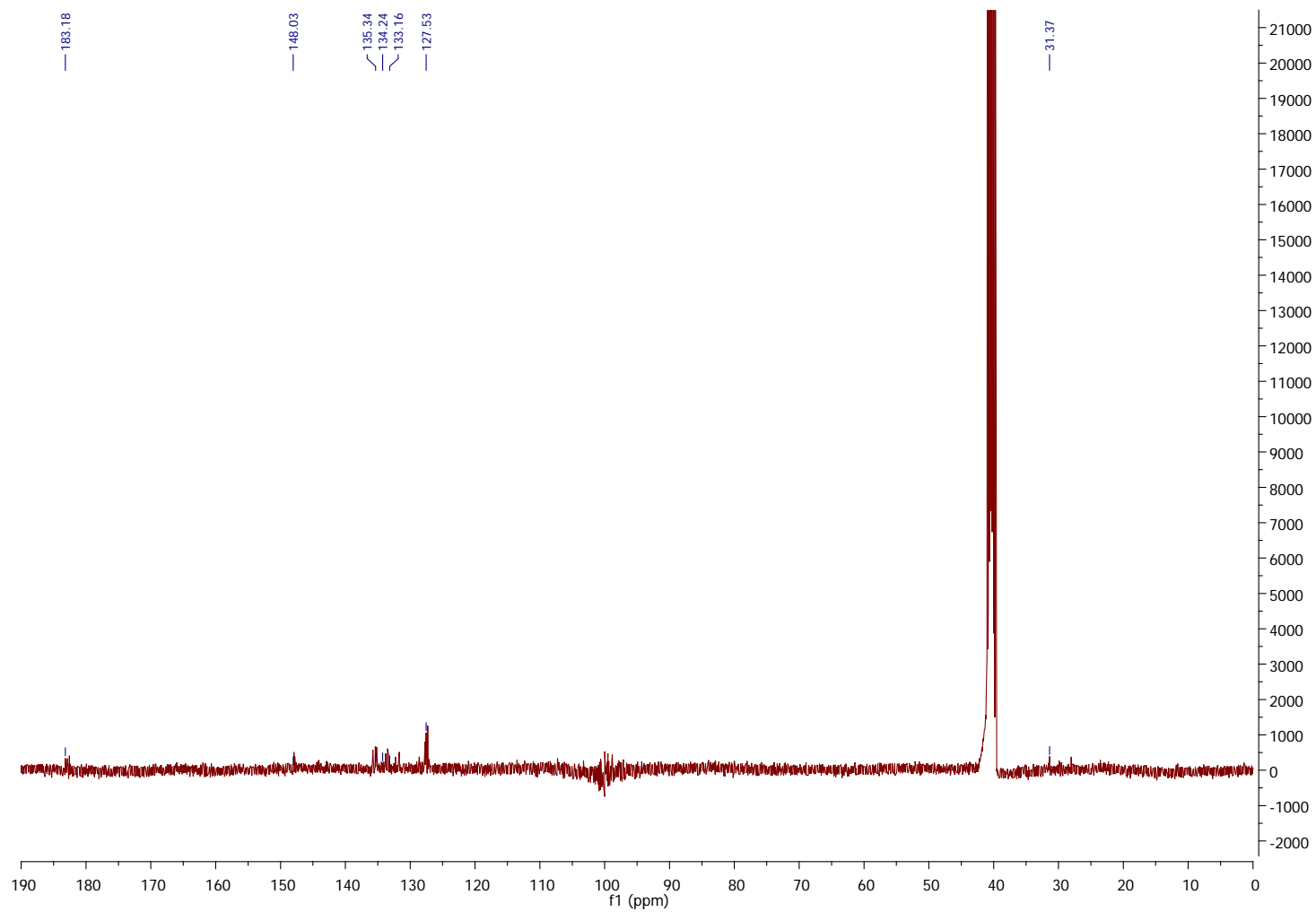


Figure S62. ^{13}C -NMR spectrum for compound **31**.

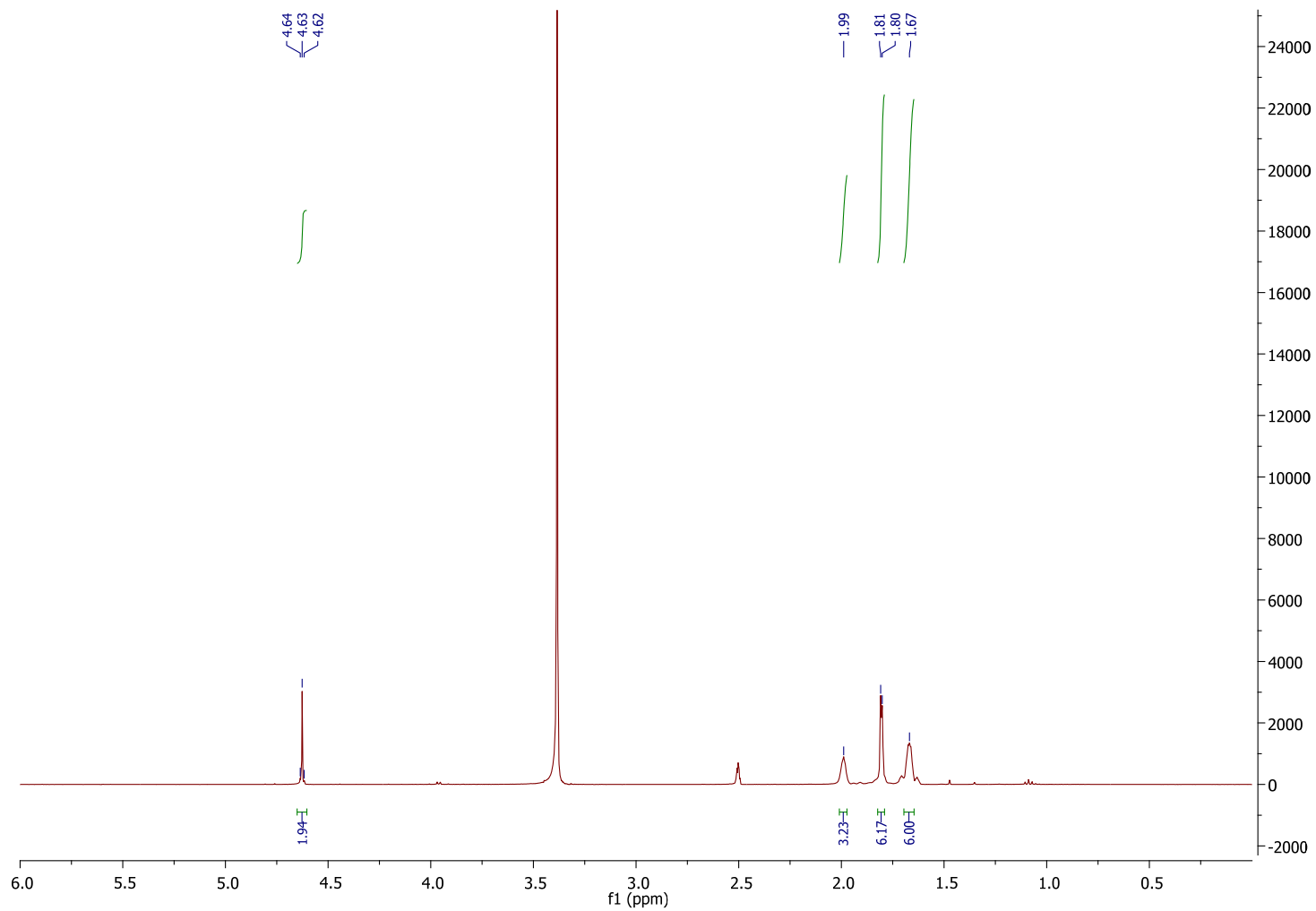


Figure S63. ¹H-NMR spectrum for compound 32.

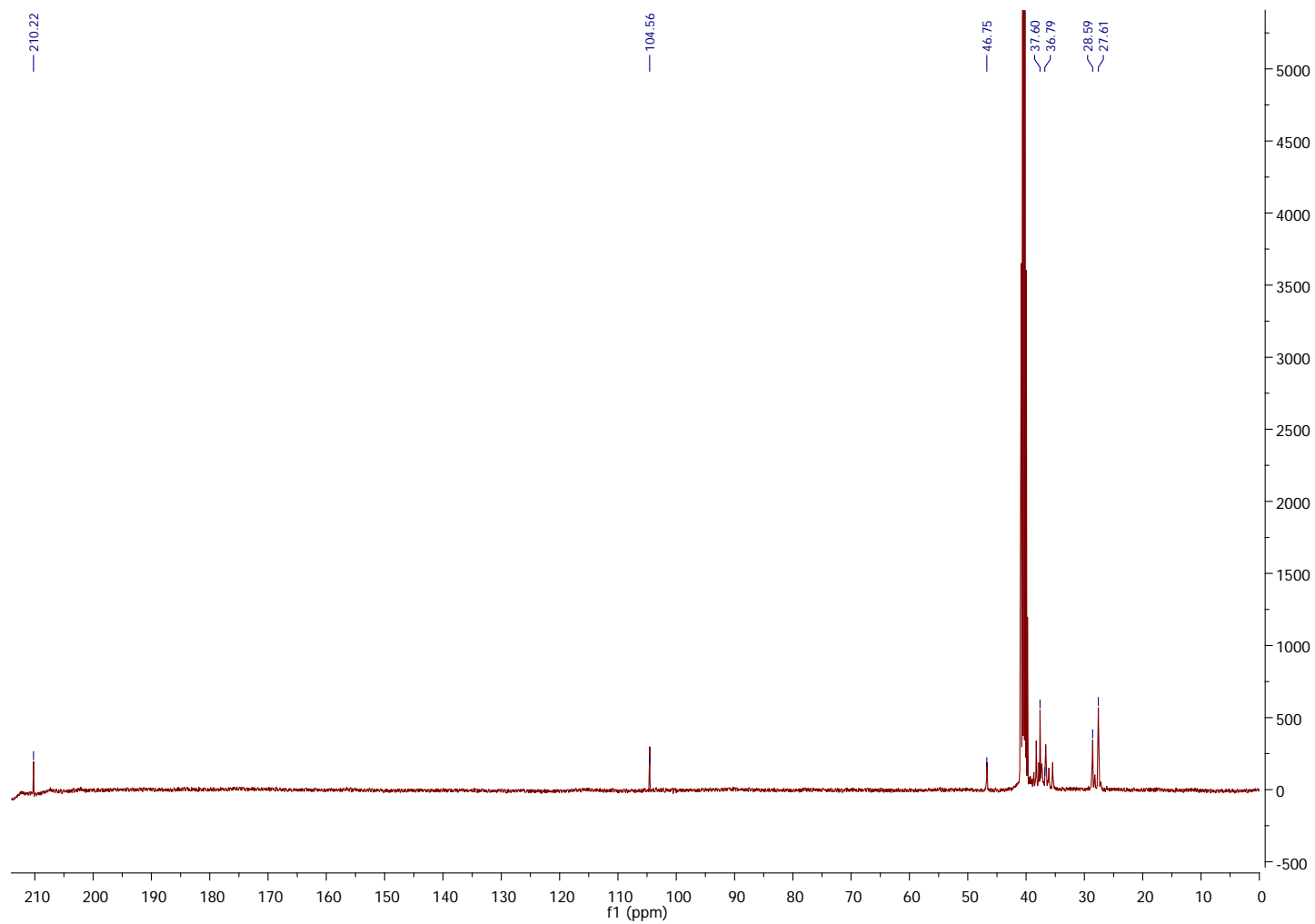


Figure S64. ^{13}C -NMR spectrum for compound **32**.

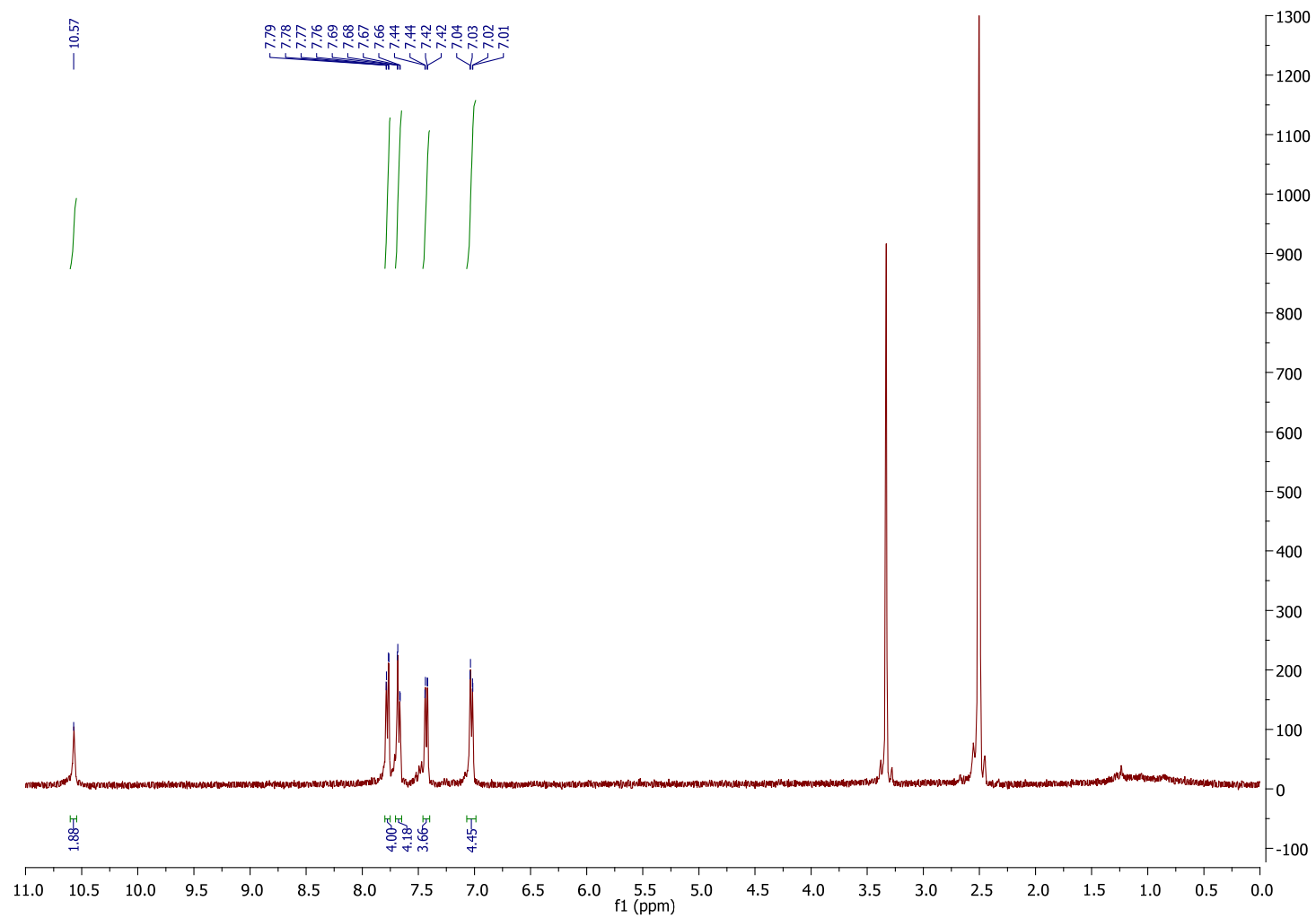


Figure S65. $^1\text{H-NMR}$ spectrum for compound 33.

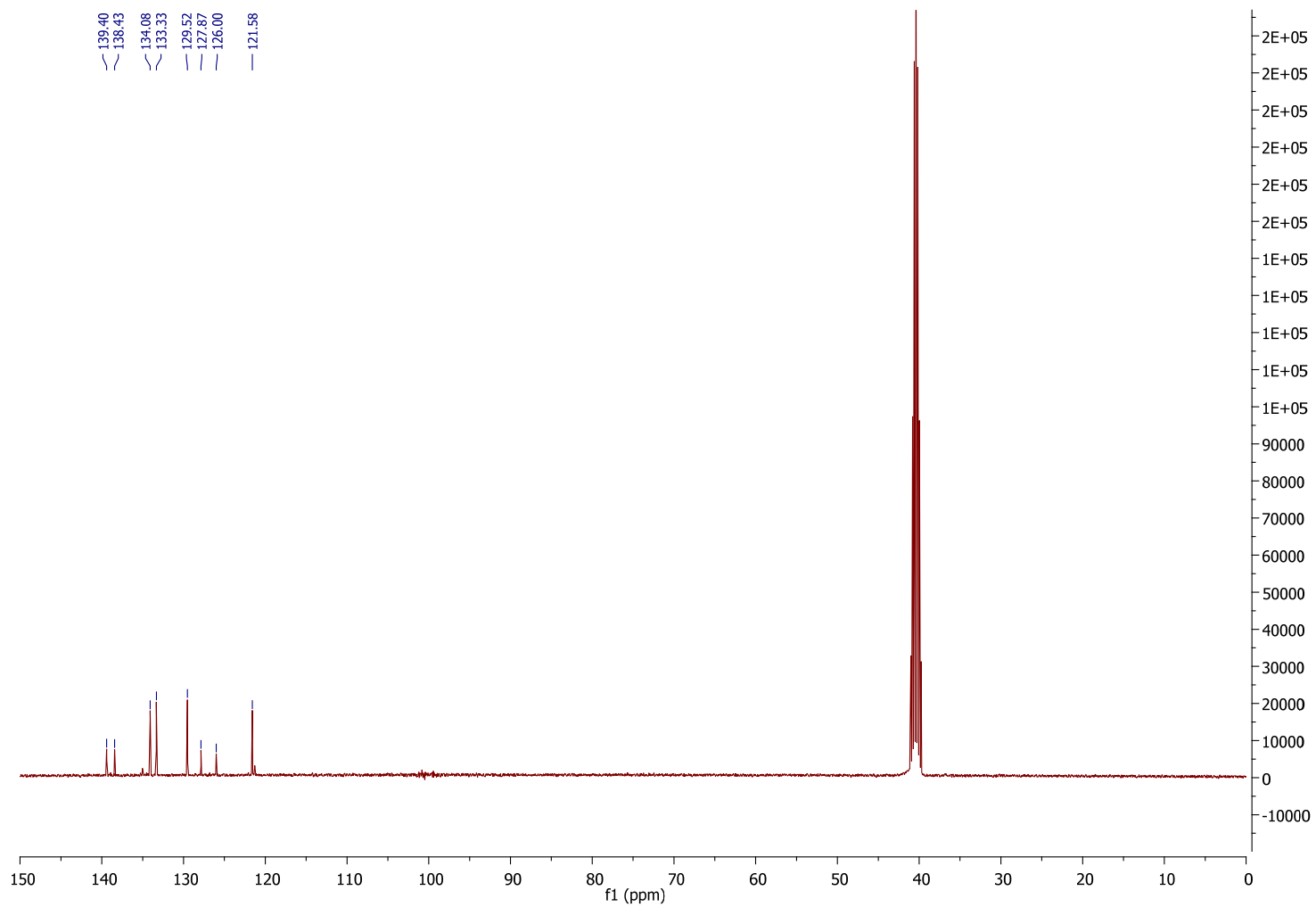


Figure S66. ^{13}C -NMR spectrum for compound **33**.

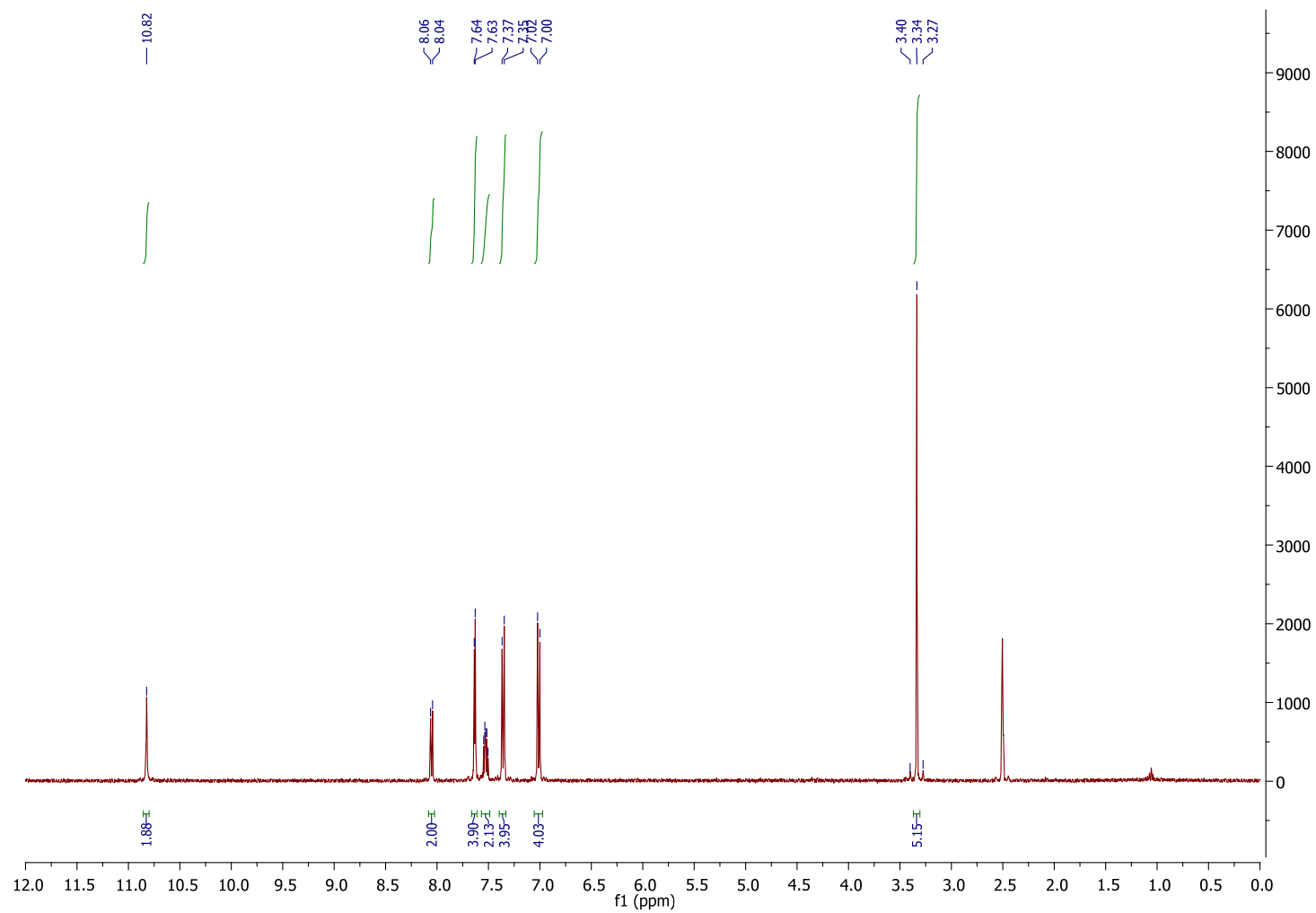


Figure S67. ¹H-NMR spectrum for compound 34.

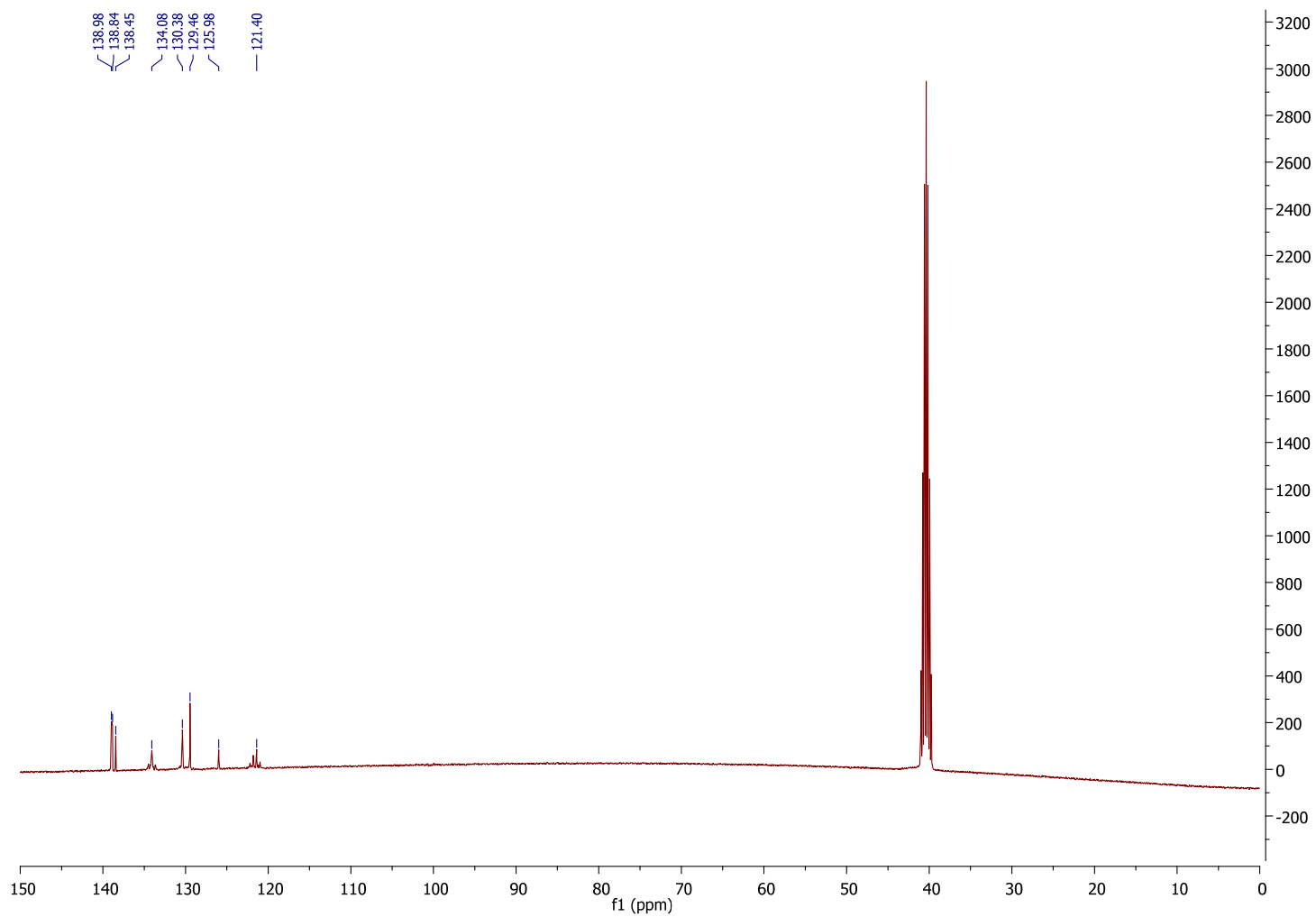


Figure S68. ^{13}C -NMR spectrum for compound **34**.

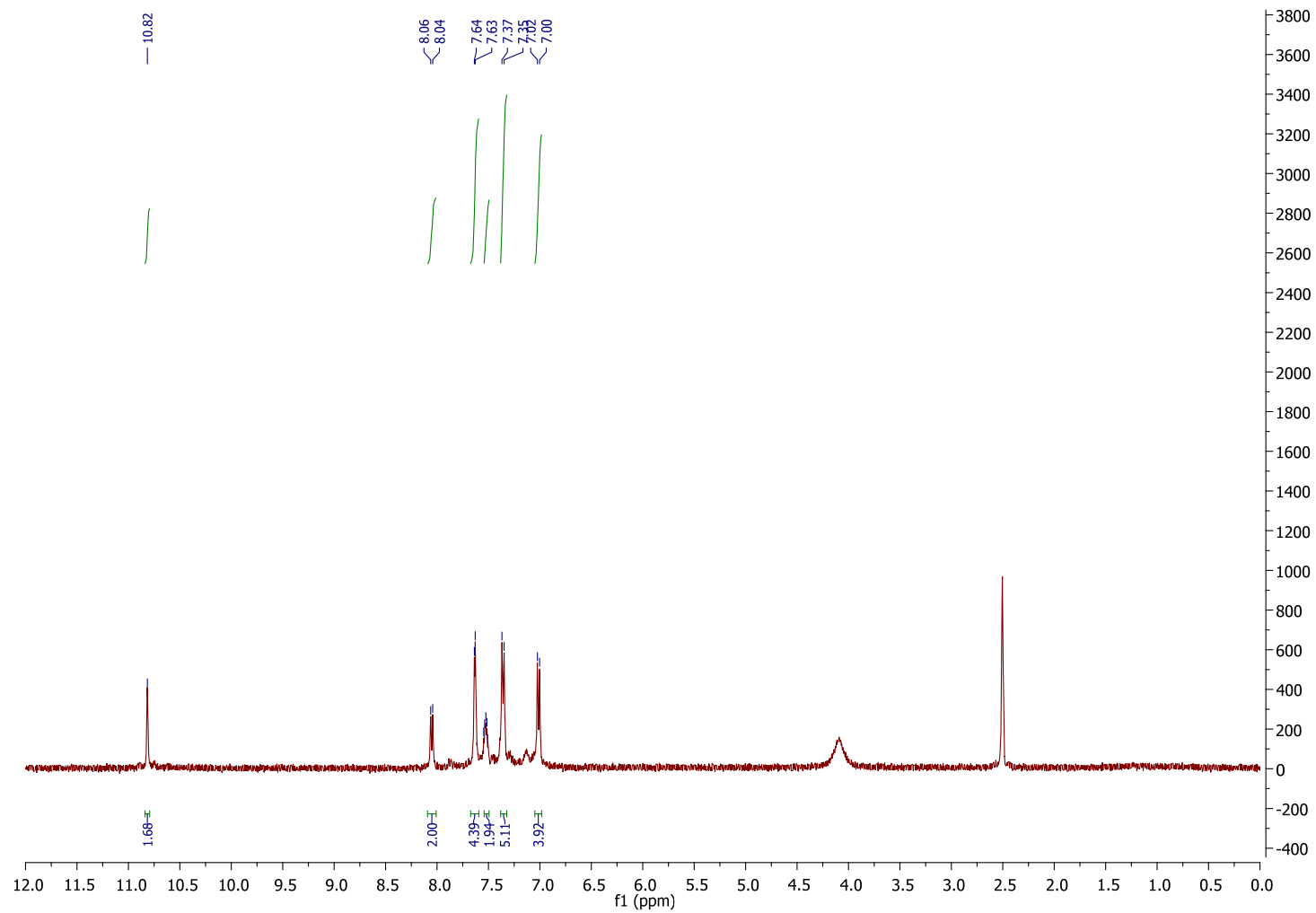


Figure S69. ¹H-NMR spectrum for compound 35.

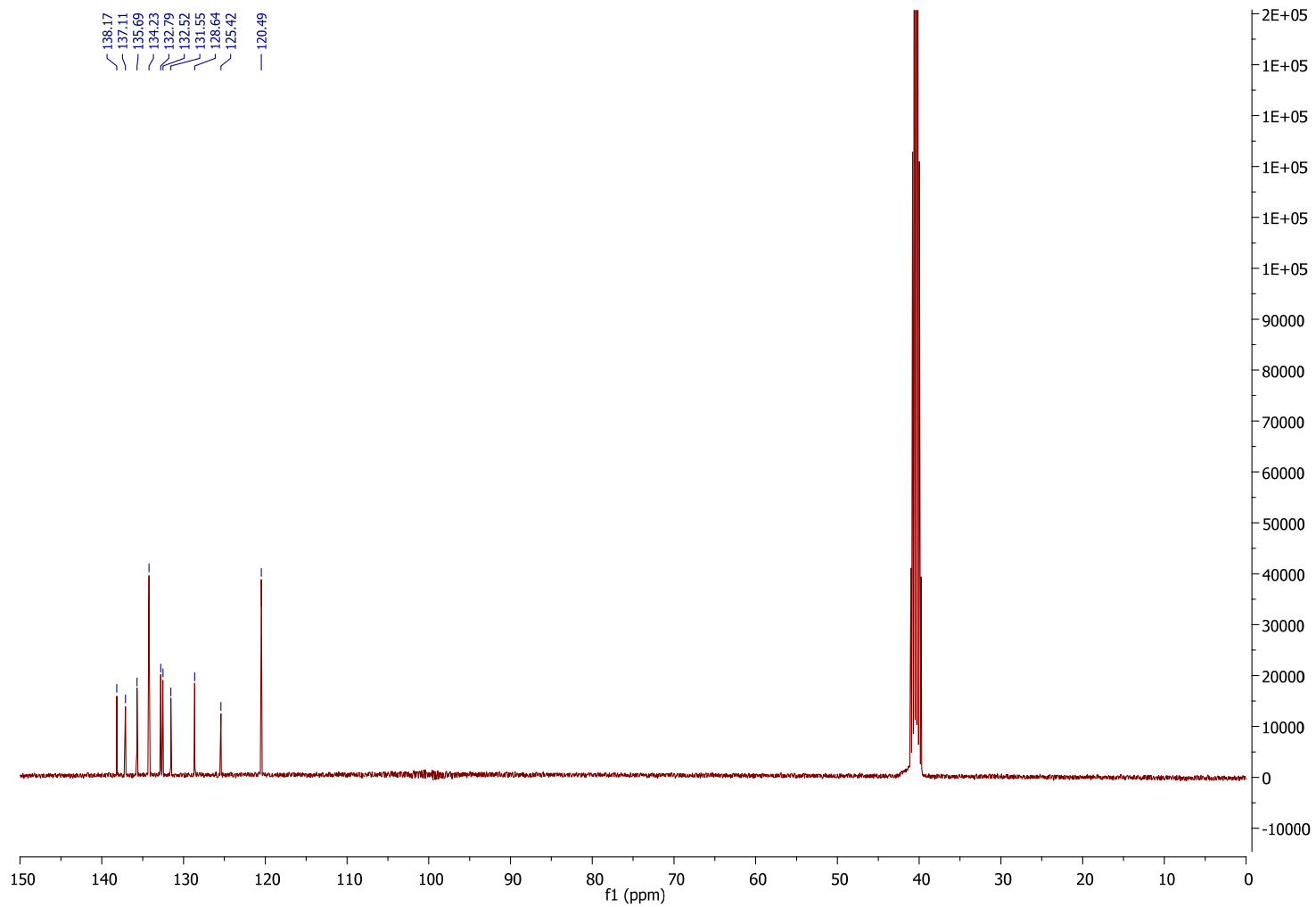


Figure S70. ^{13}C -NMR spectrum for compound 35.

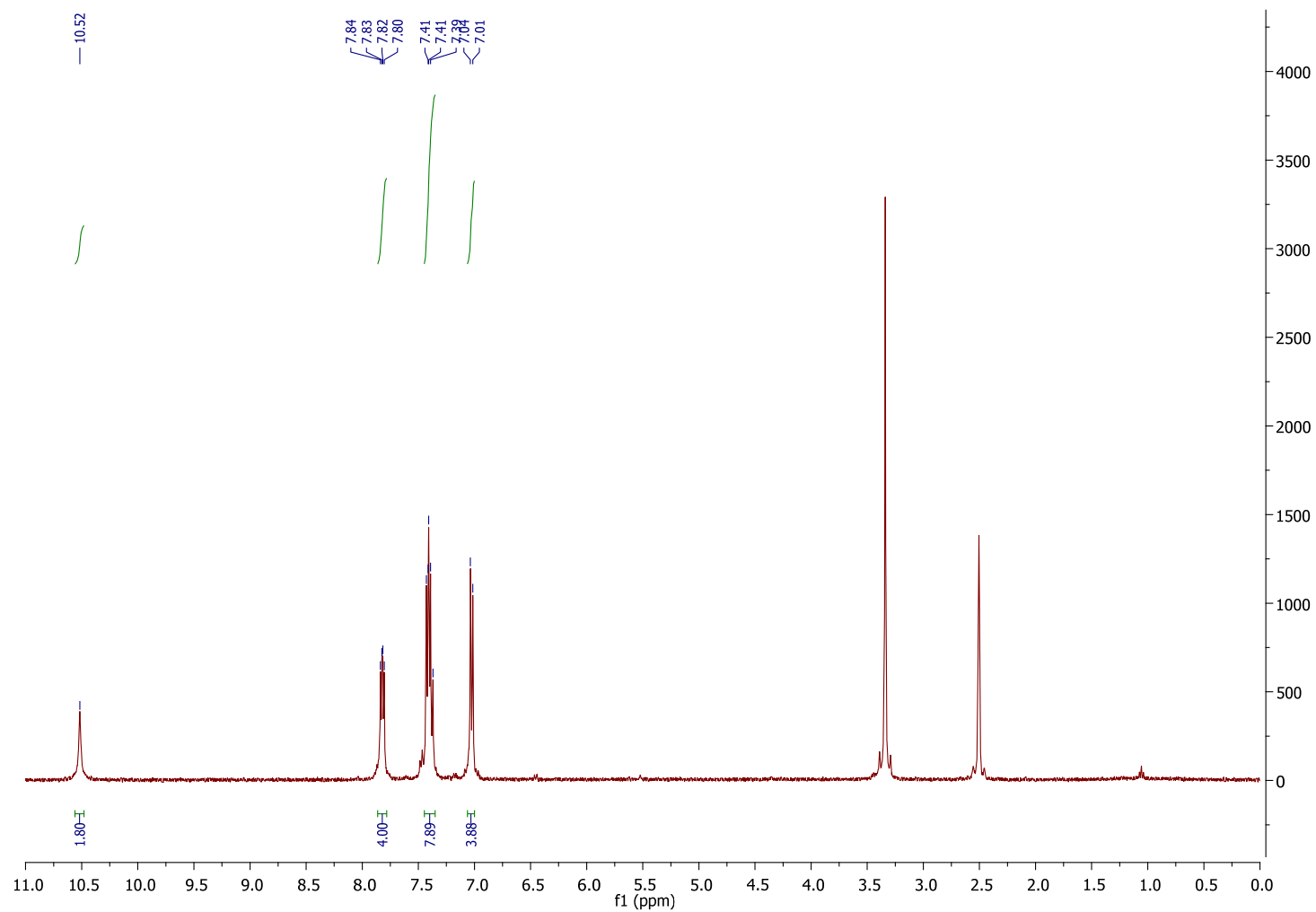


Figure S71. ¹H-NMR spectrum for compound 36.

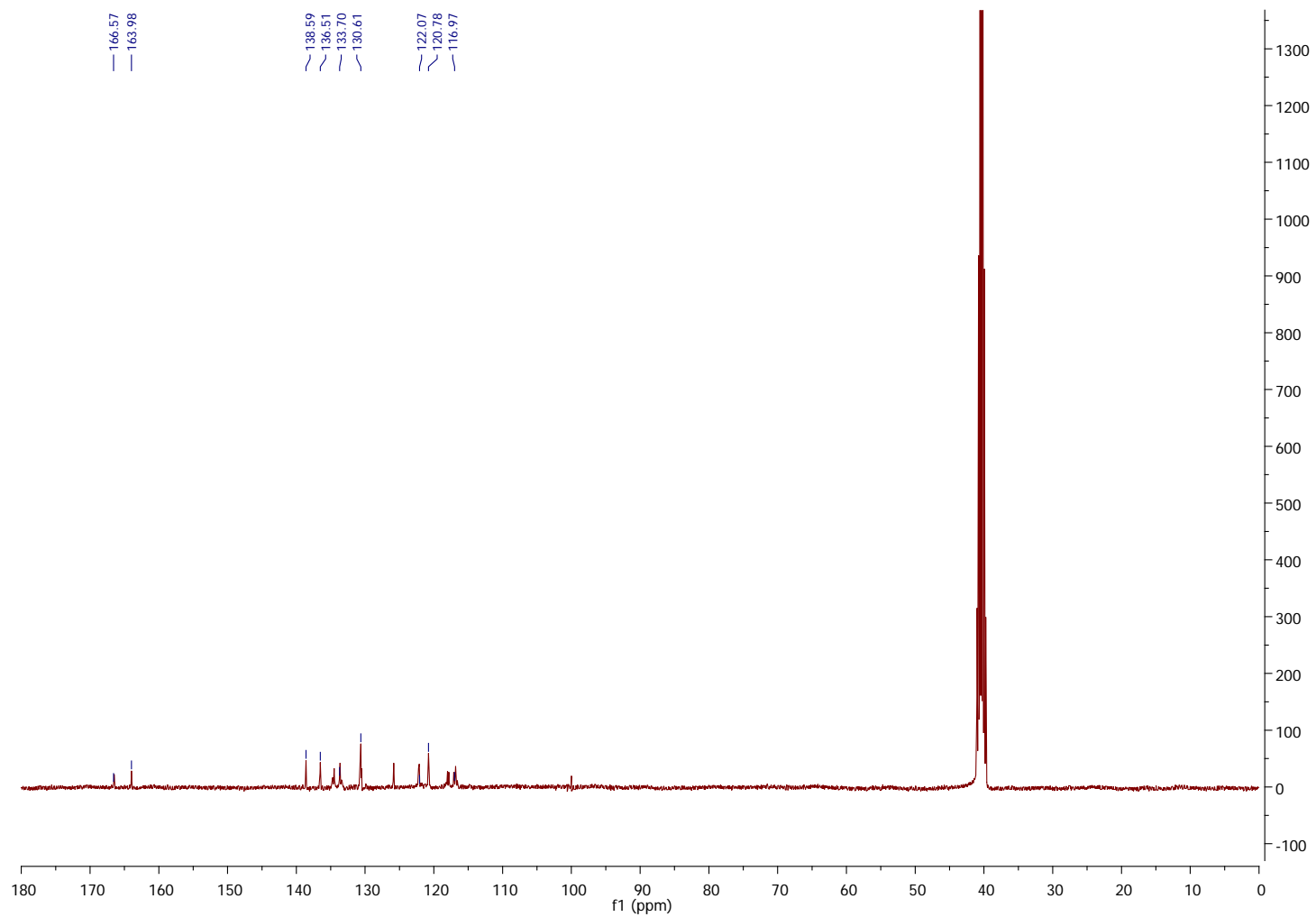


Figure S72. ^{13}C -NMR spectrum for compound **36**.

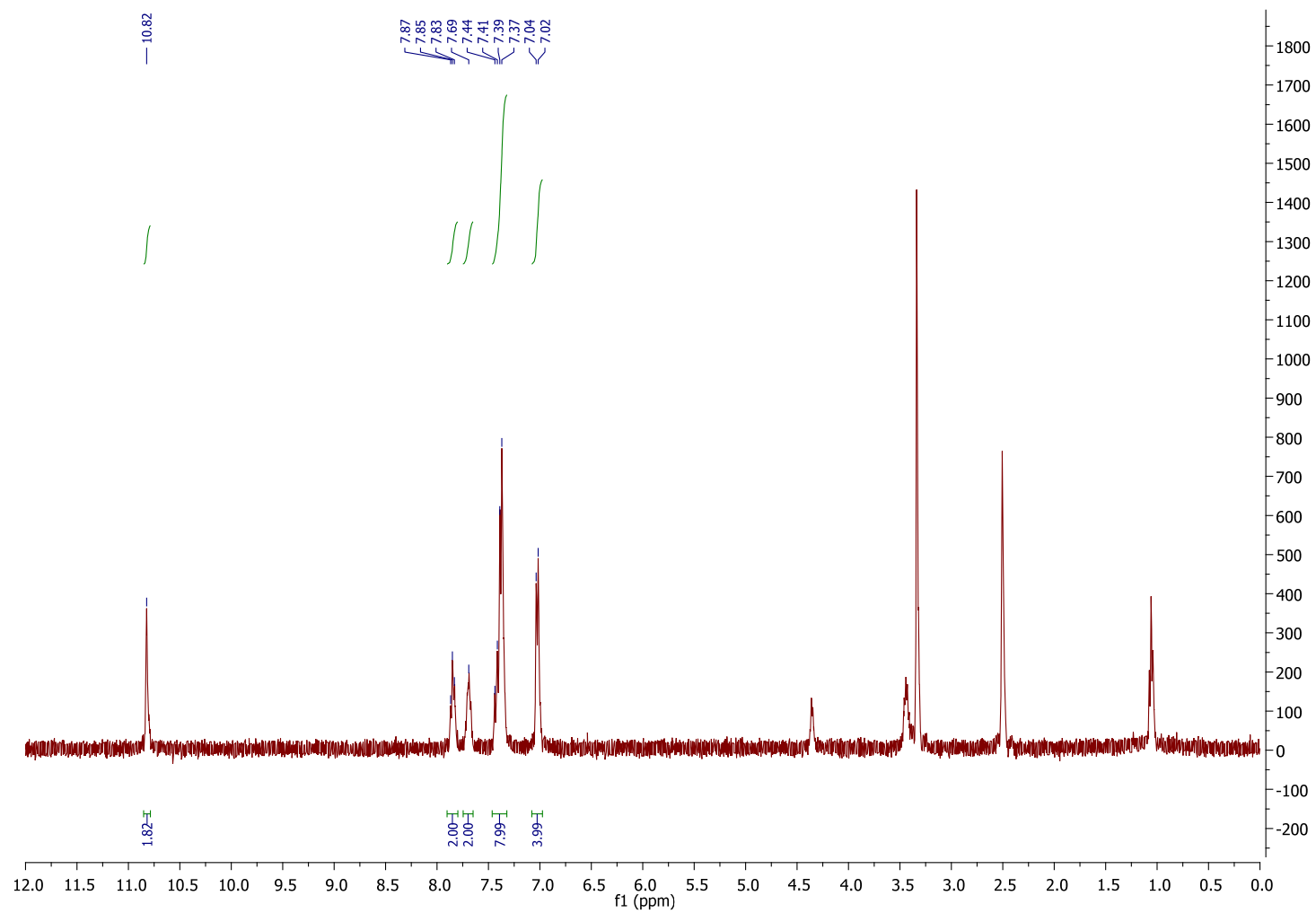


Figure S73. ¹H-NMR spectrum for compound 37.

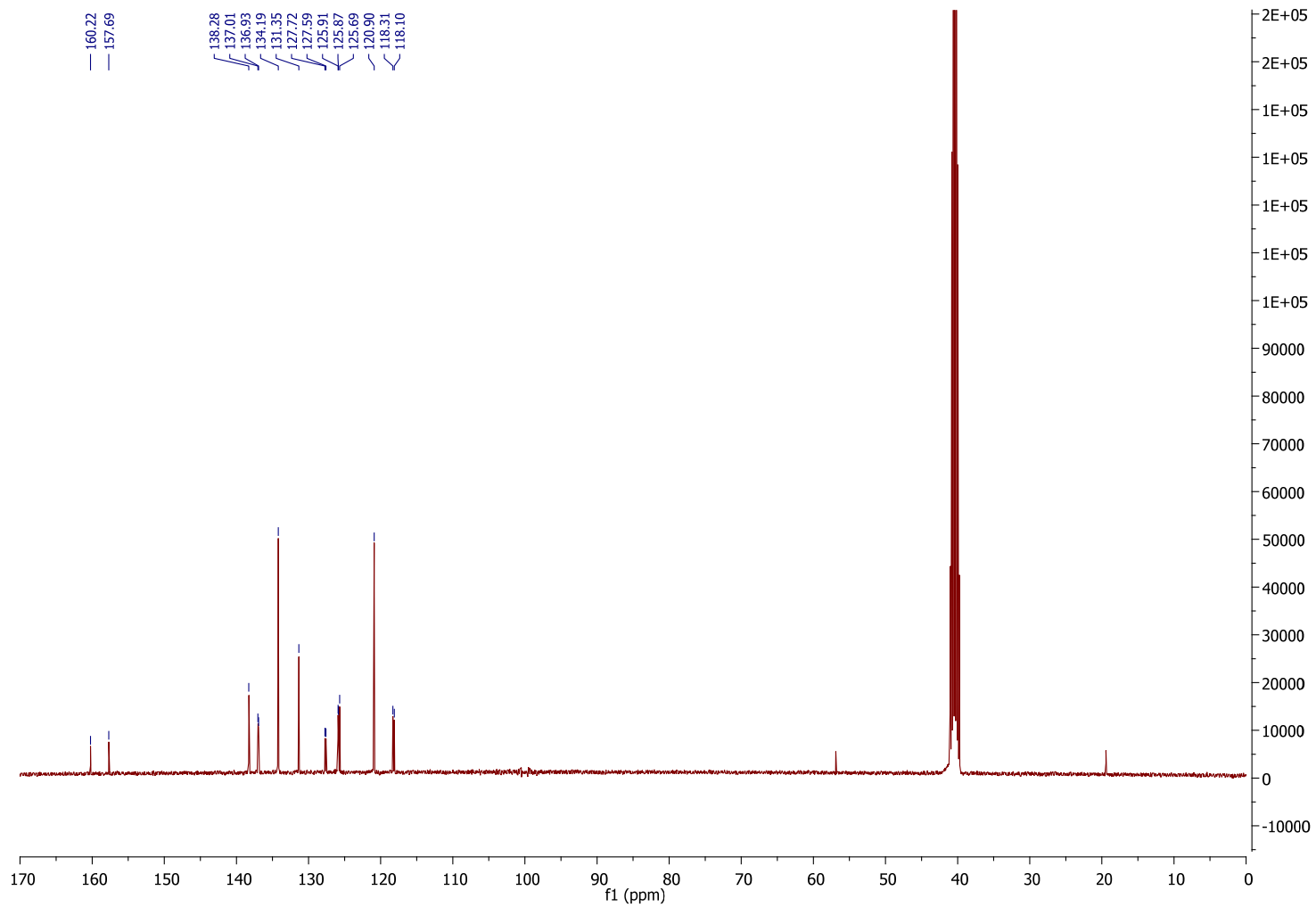


Figure S74. ^{13}C -NMR spectrum for compound 37.

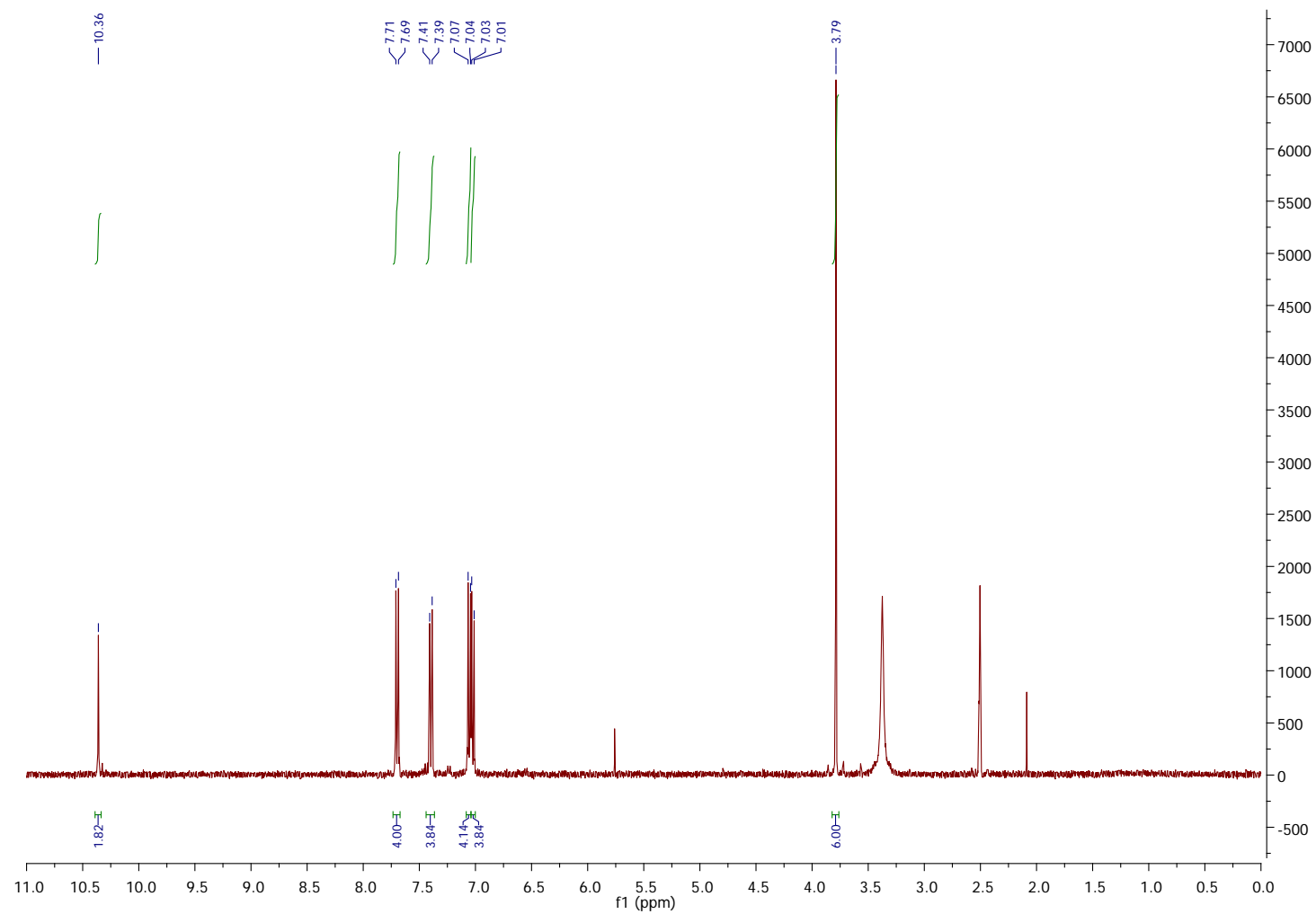


Figure S75. ¹H-NMR spectrum for compound 38.

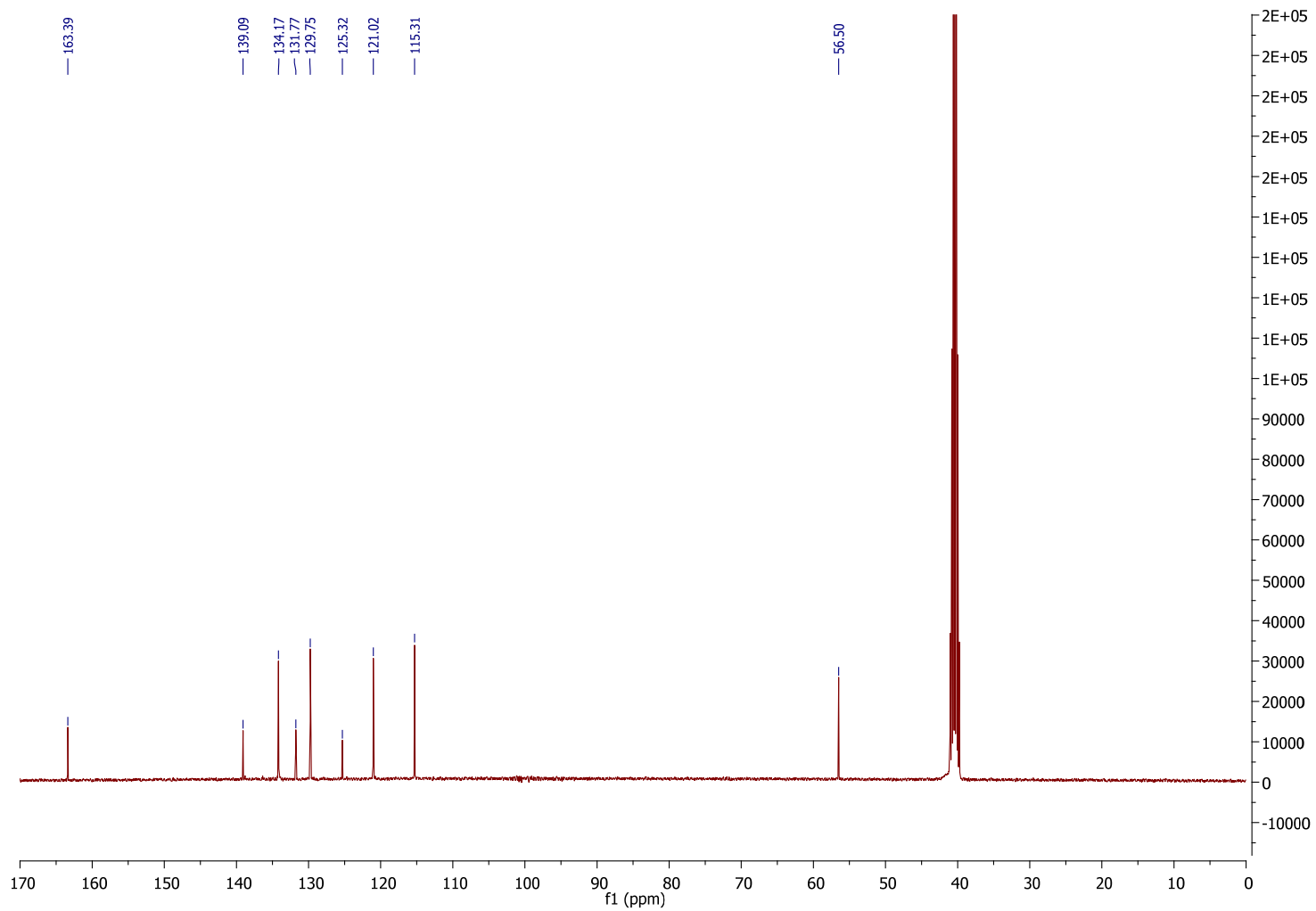


Figure S76. ^{13}C -NMR spectrum for compound **38**.

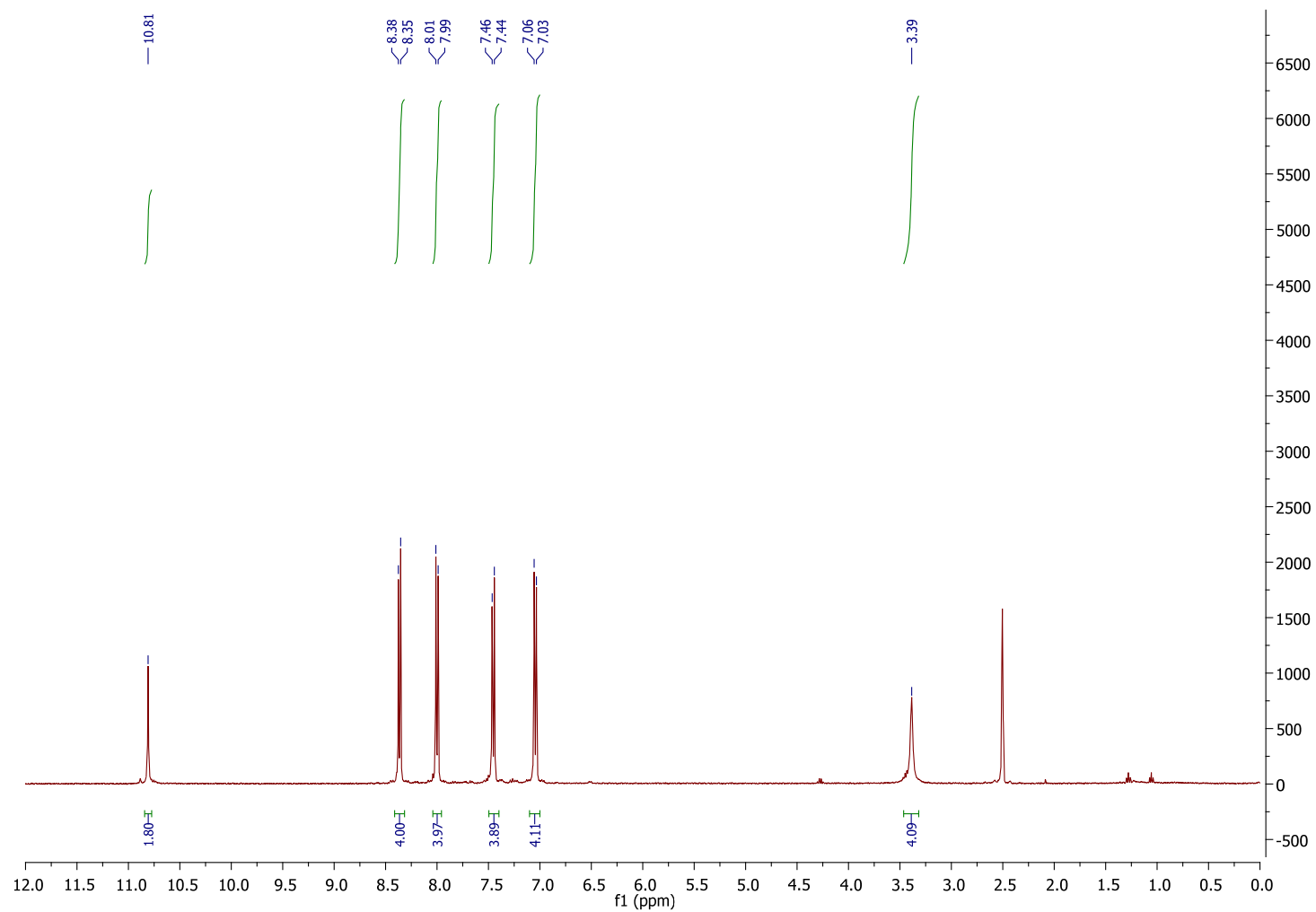


Figure S77. ¹H-NMR spectrum for compound 39.

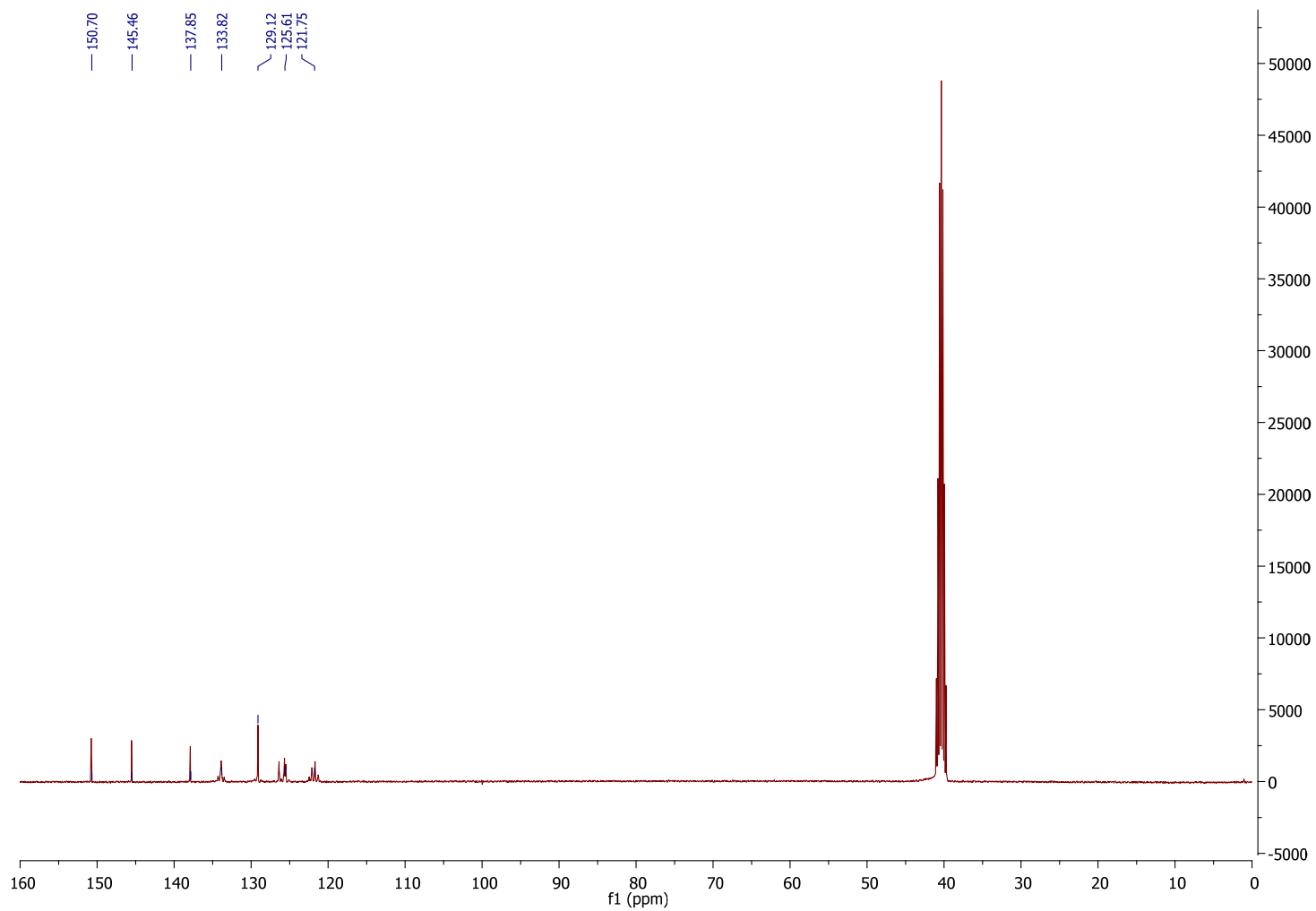


Figure S78. ^{13}C -NMR spectrum for compound **39**.

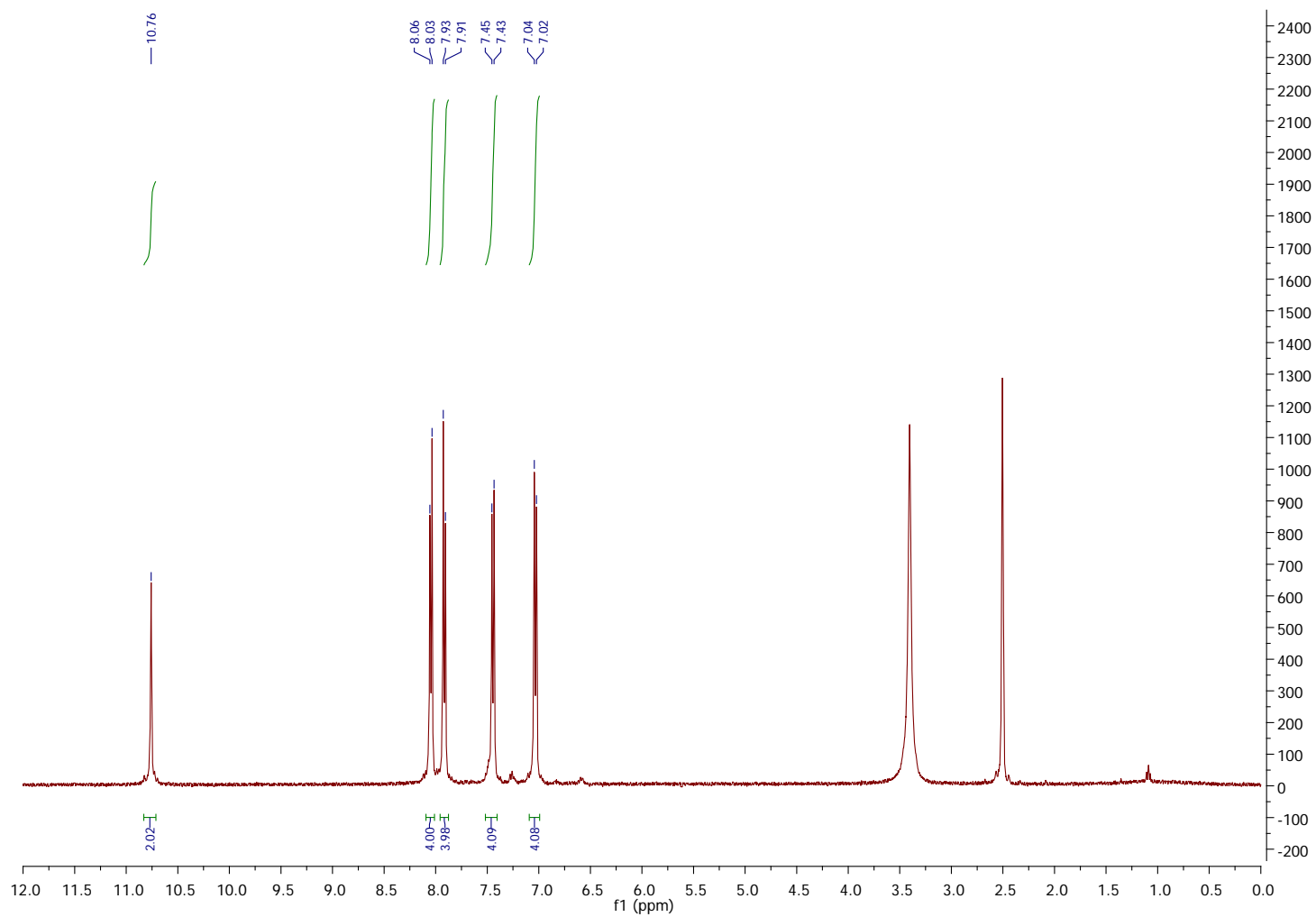


Figure S79. ¹H-NMR spectrum for compound 40.

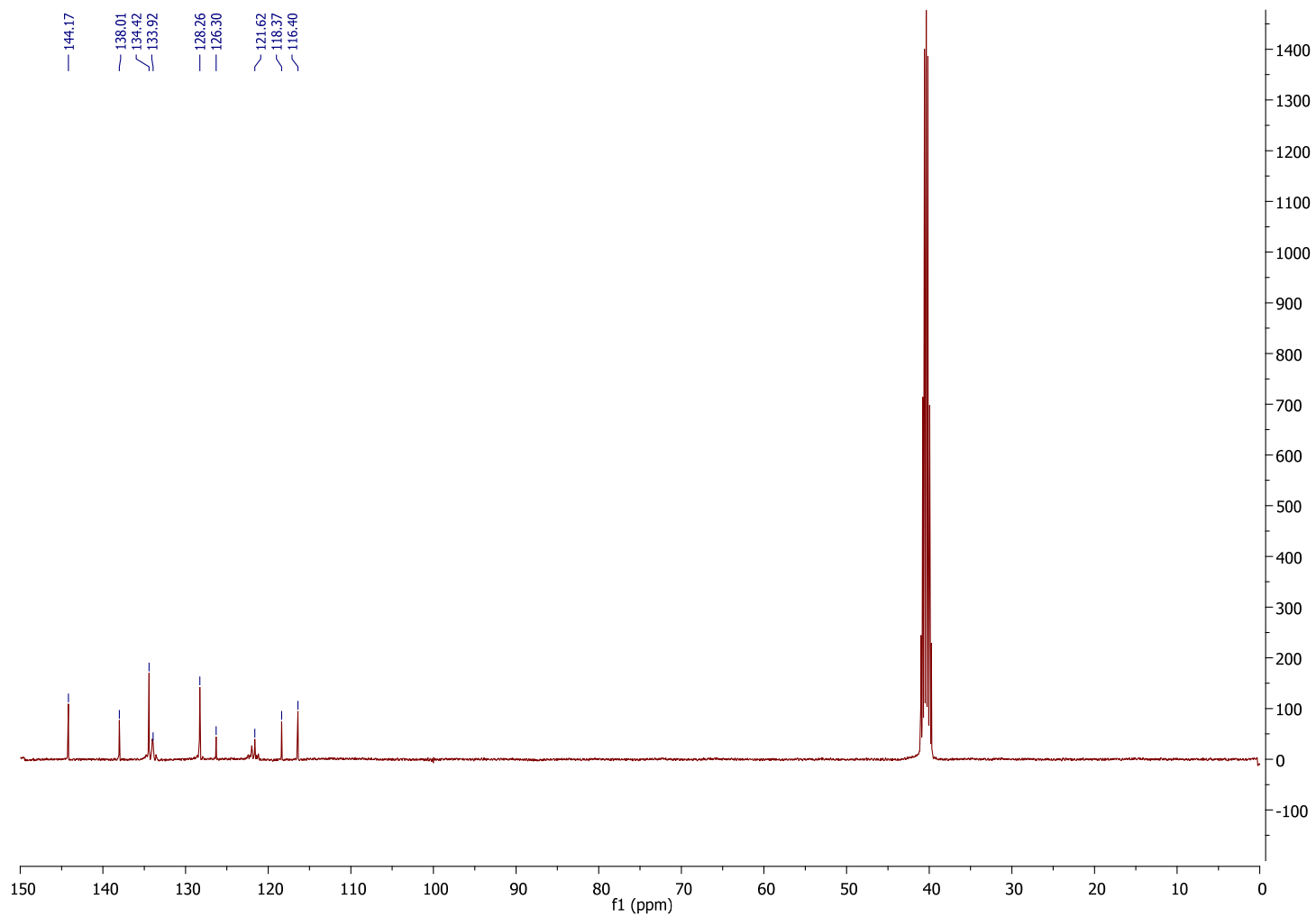


Figure S80. ^{13}C -NMR spectrum for compound **40**.

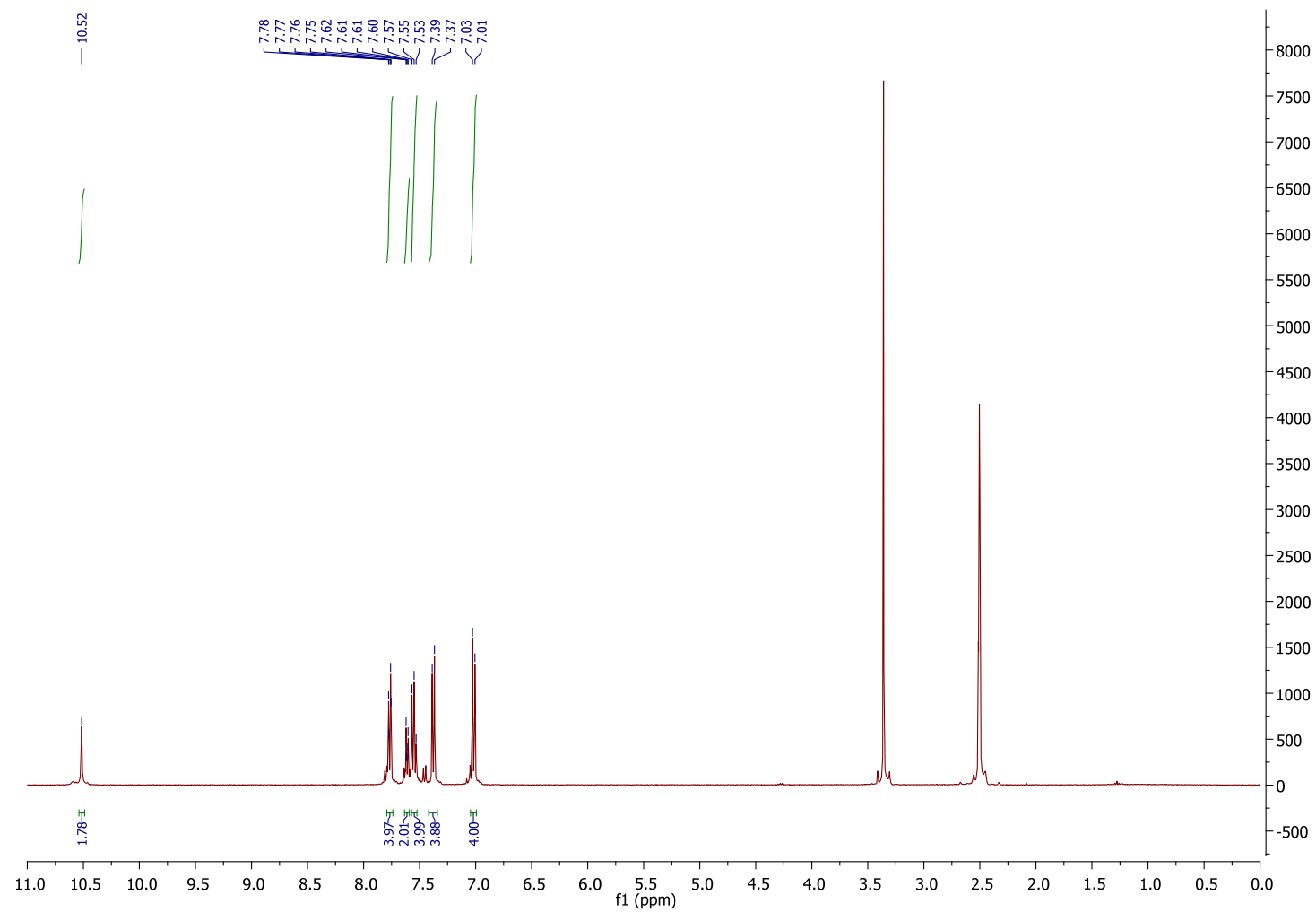


Figure S81. ¹H-NMR spectrum for compound **41**.

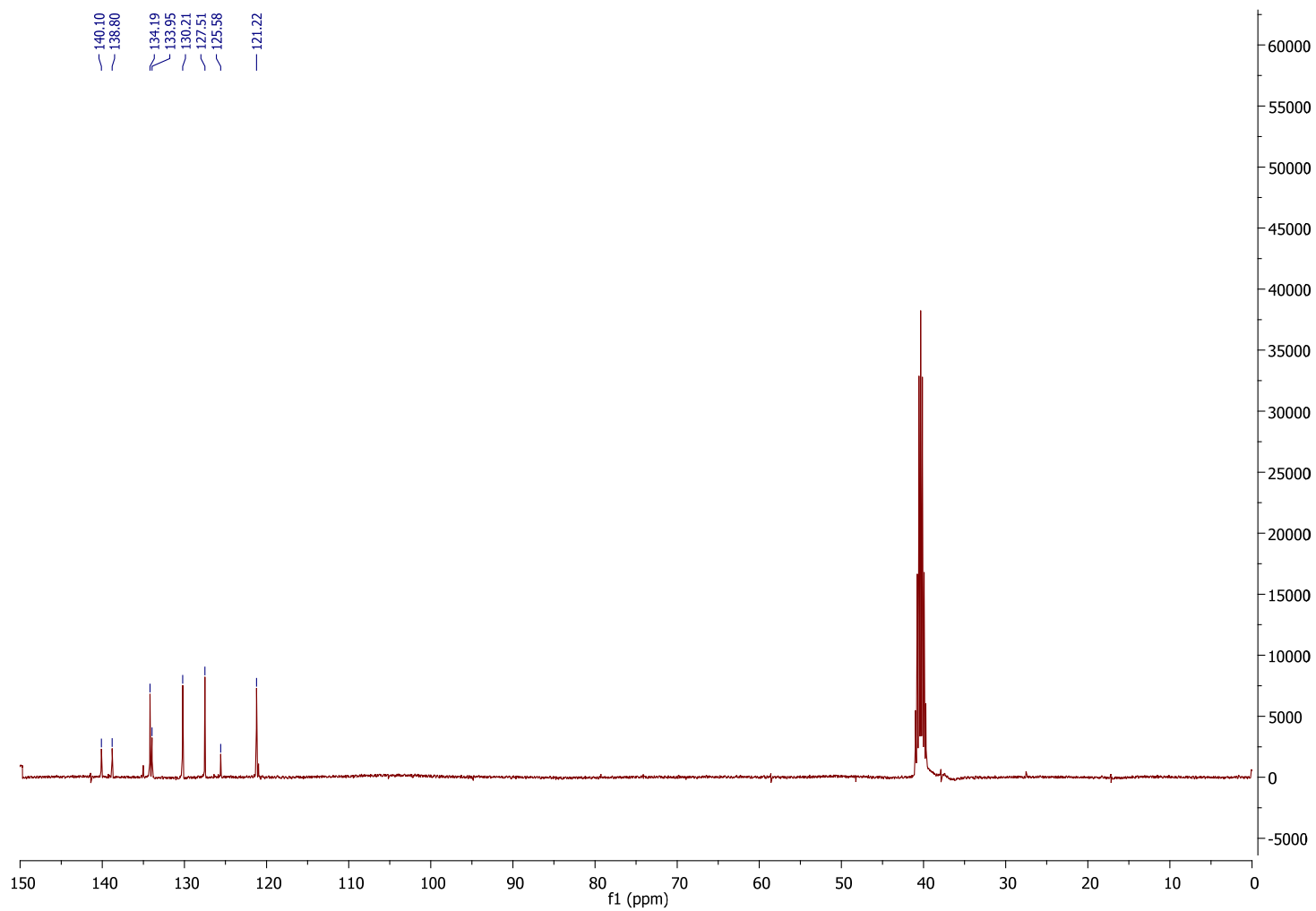


Figure S82. ^{13}C -NMR spectrum for compound **41**.

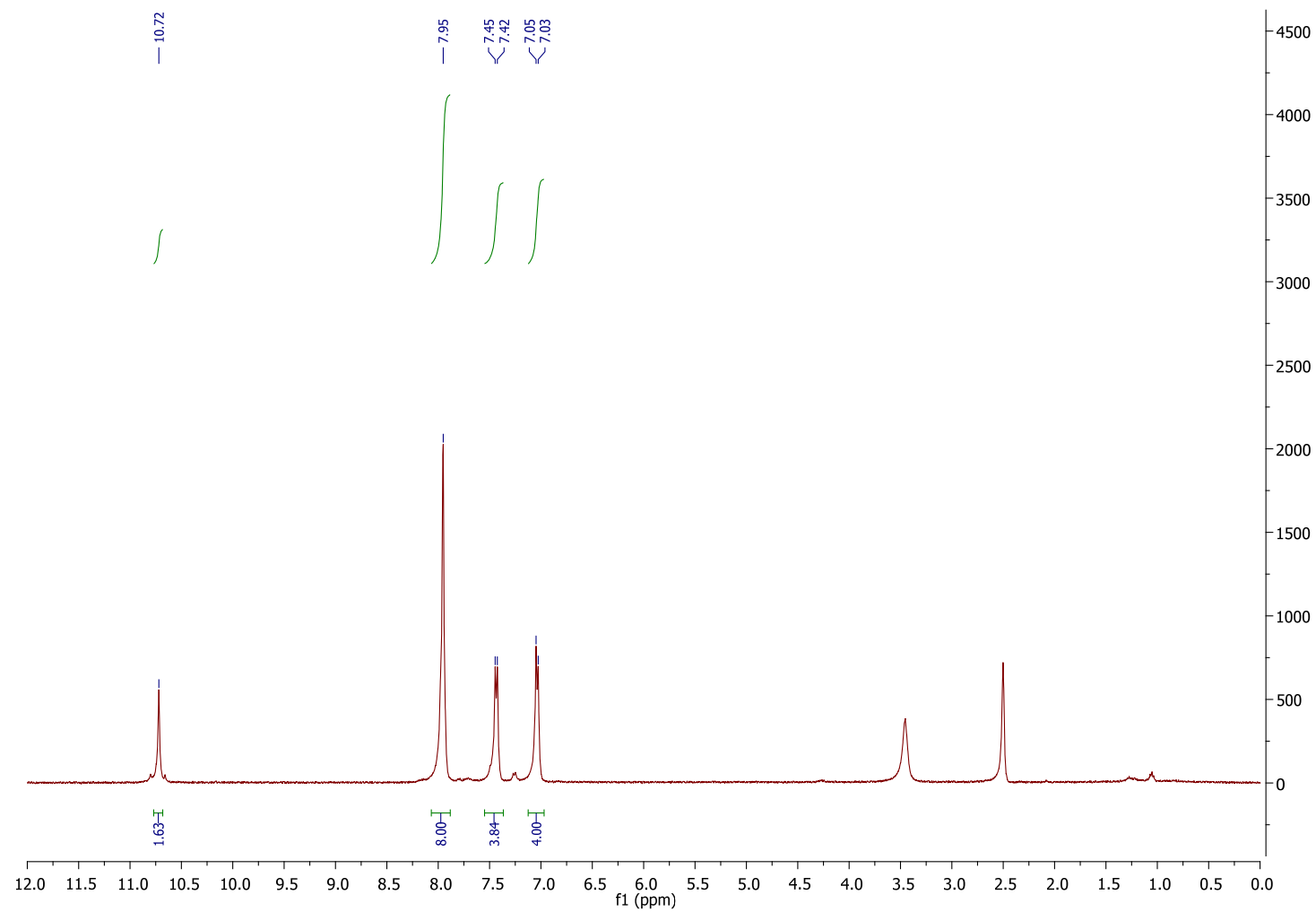


Figure S83. ¹H-NMR spectrum for compound **42**.

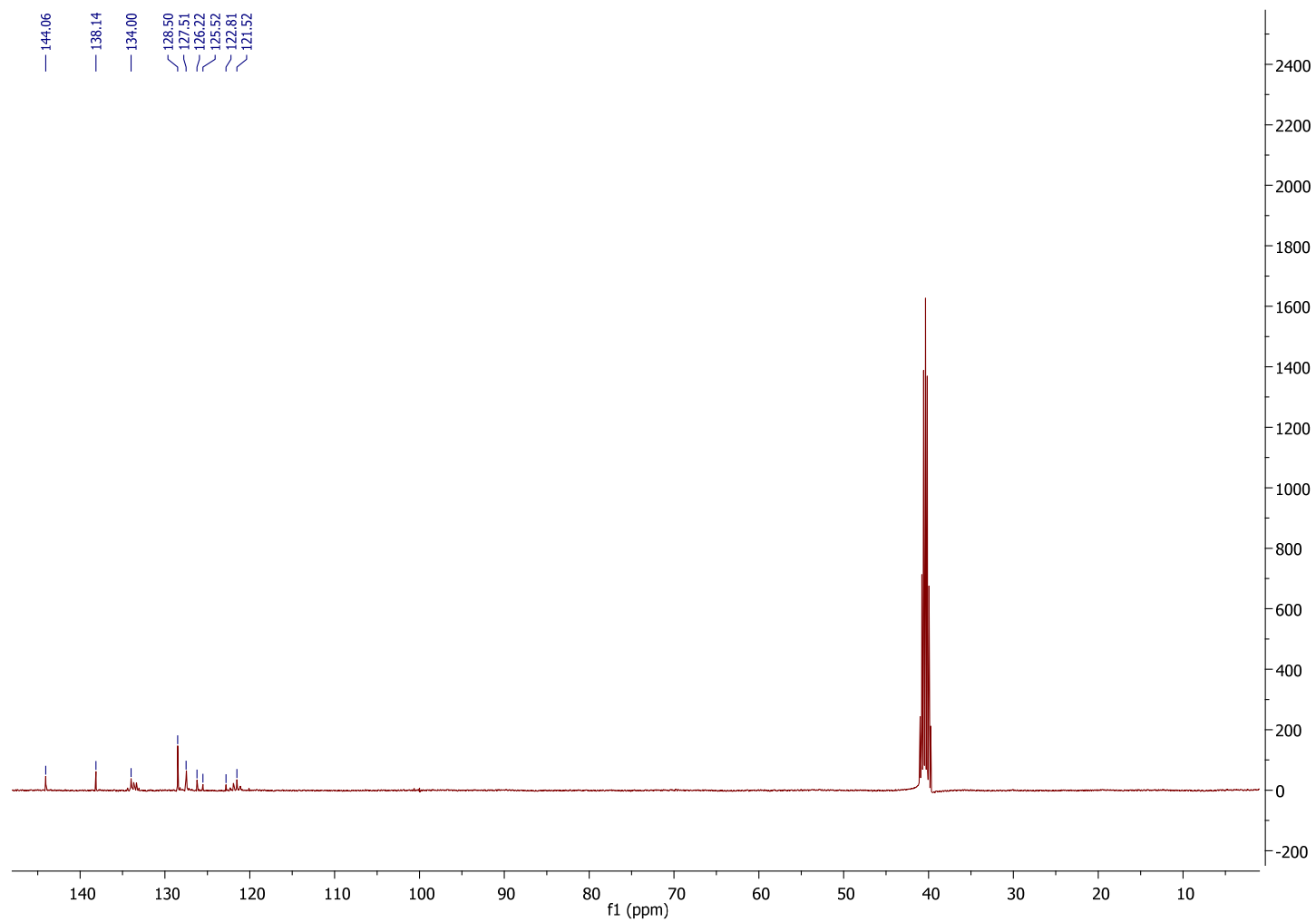


Figure S84. ^{13}C -NMR spectrum for compound **42**.

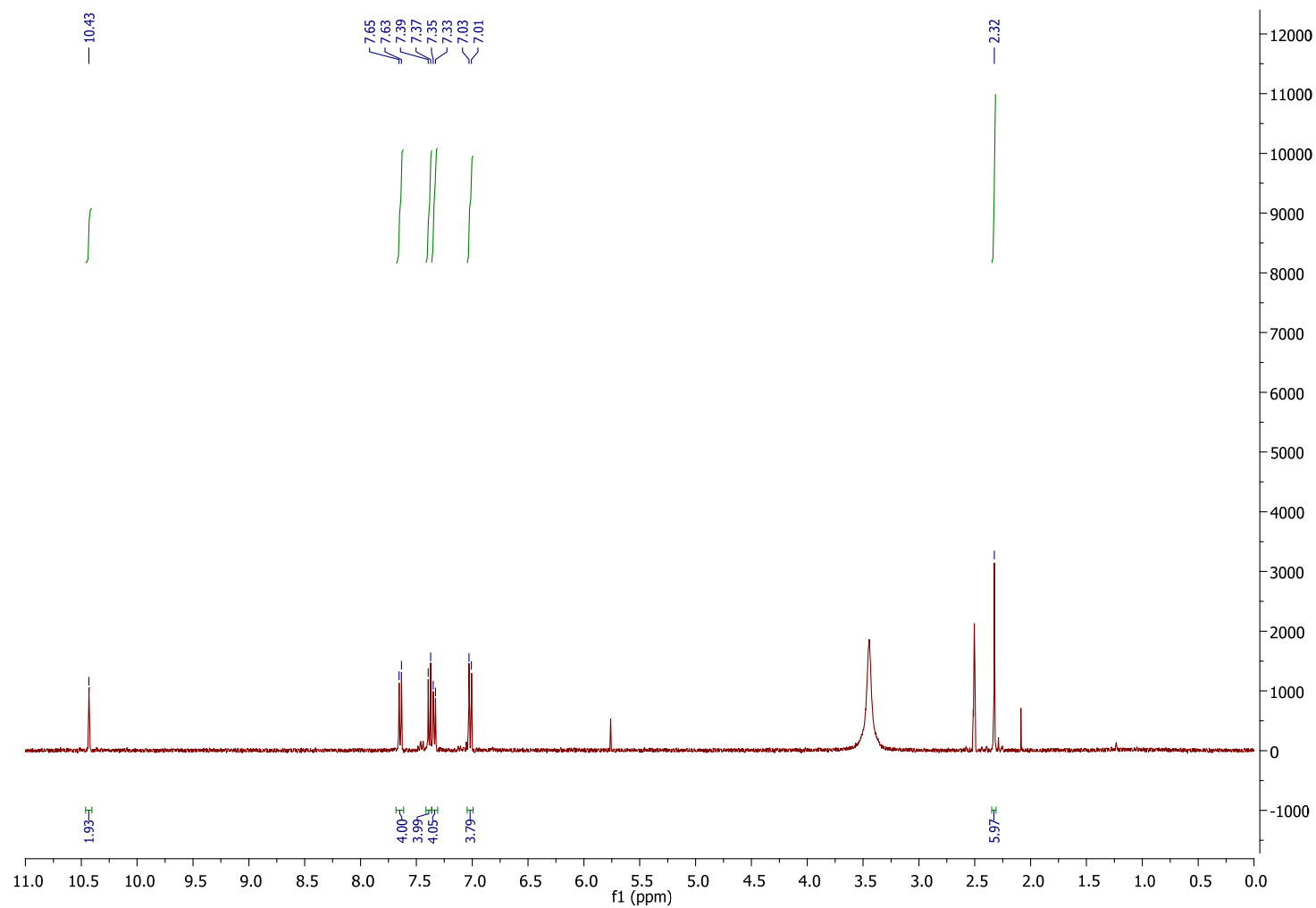


Figure S85. ¹H-NMR spectrum for compound 43.

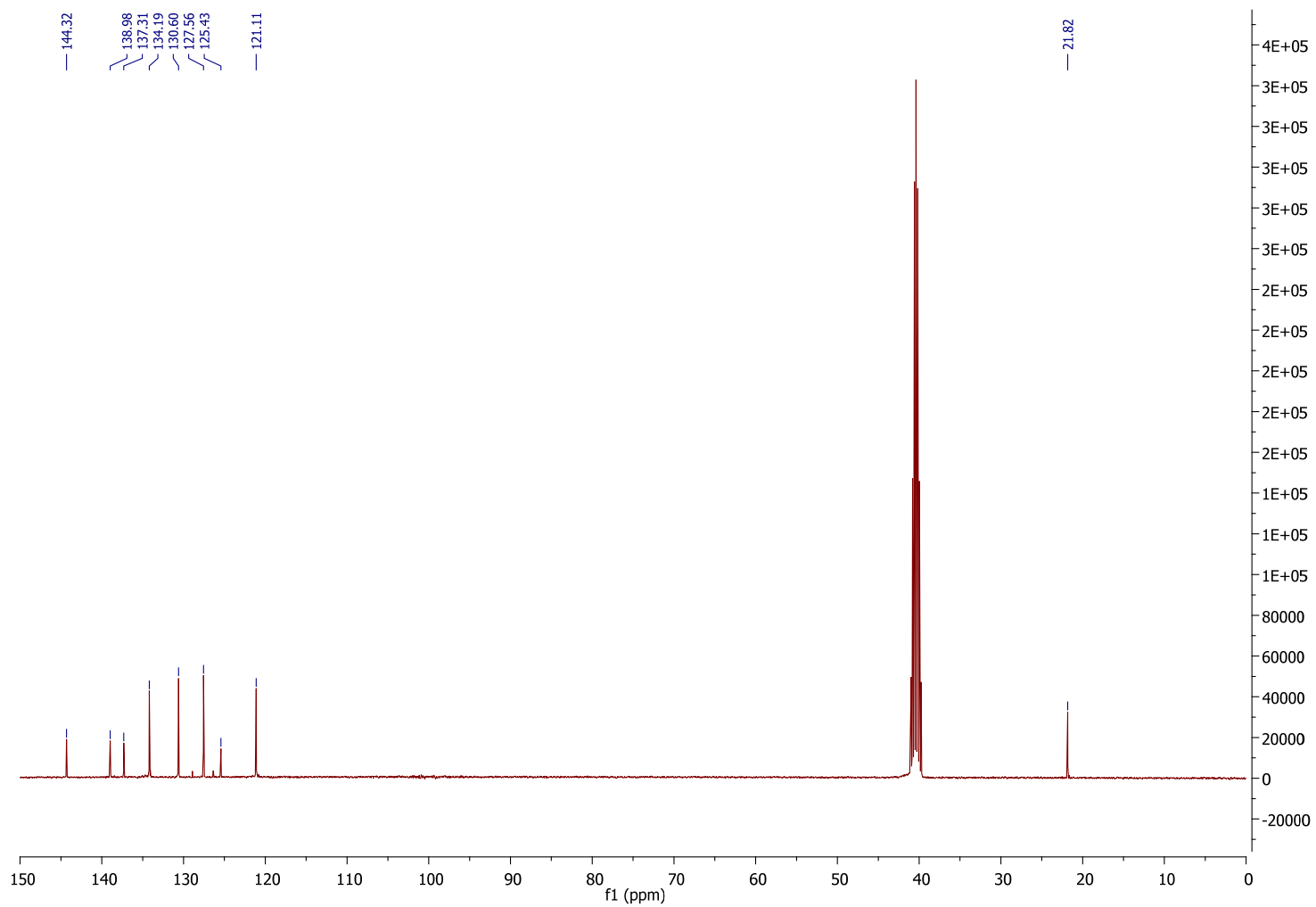


Figure S86. ¹³C-NMR spectrum for compound 43.

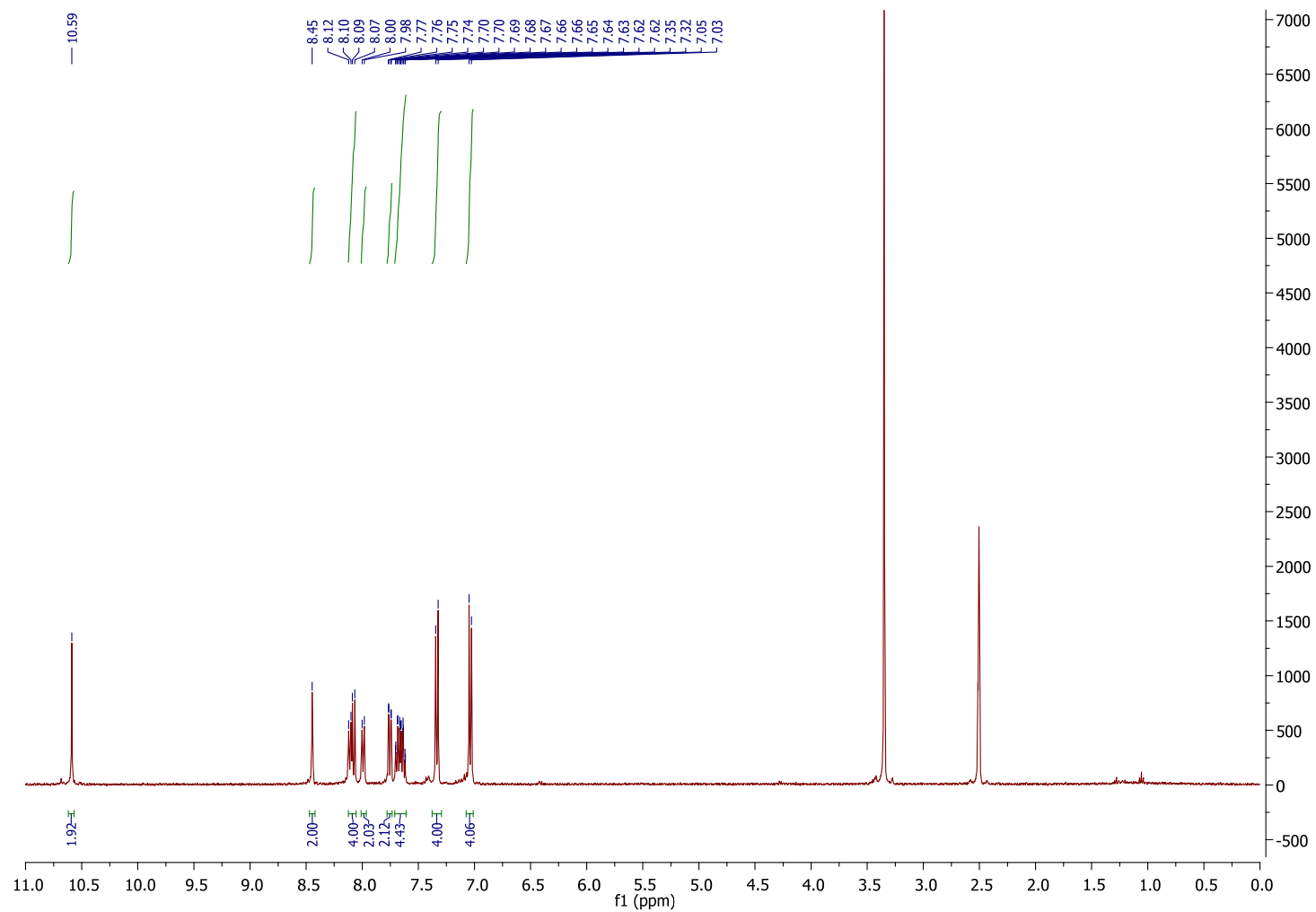


Figure S87. $^1\text{H-NMR}$ spectrum for compound **44**.

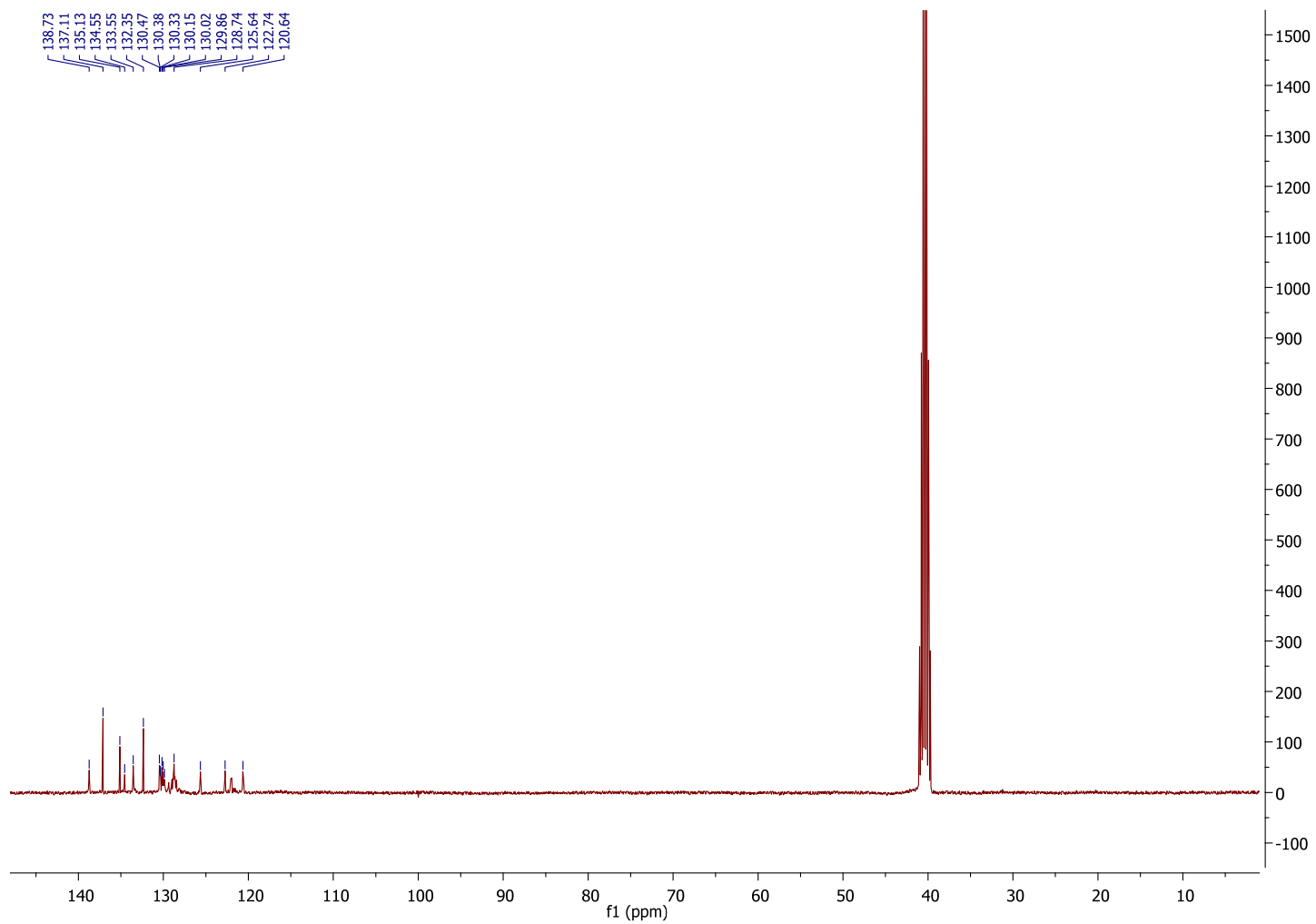


Figure S88. ^{13}C -NMR spectrum for compound **44**.

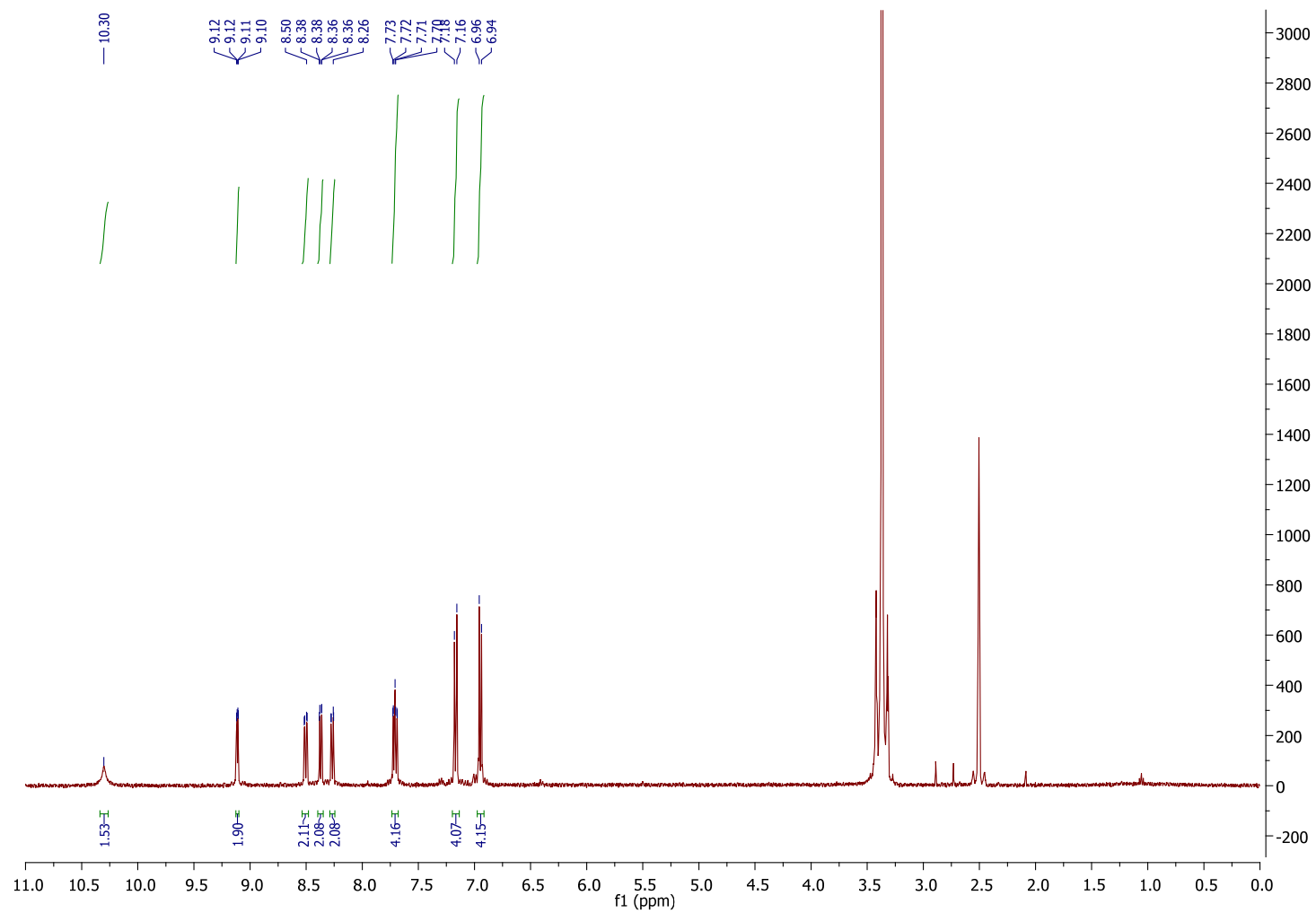


Figure S89. ¹H-NMR spectrum for compound 45.

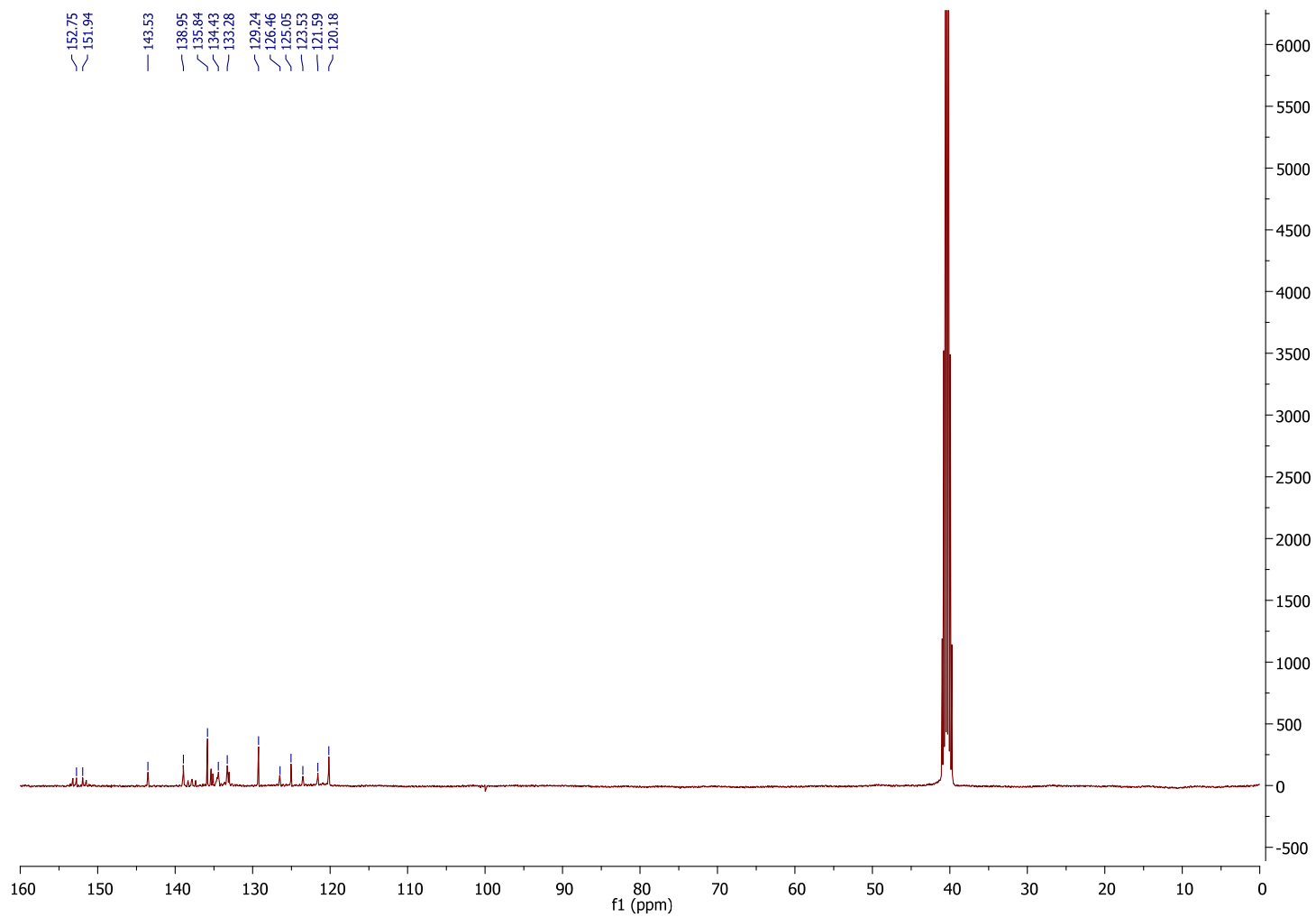


Figure S90. ^{13}C -NMR spectrum for compound **45**.

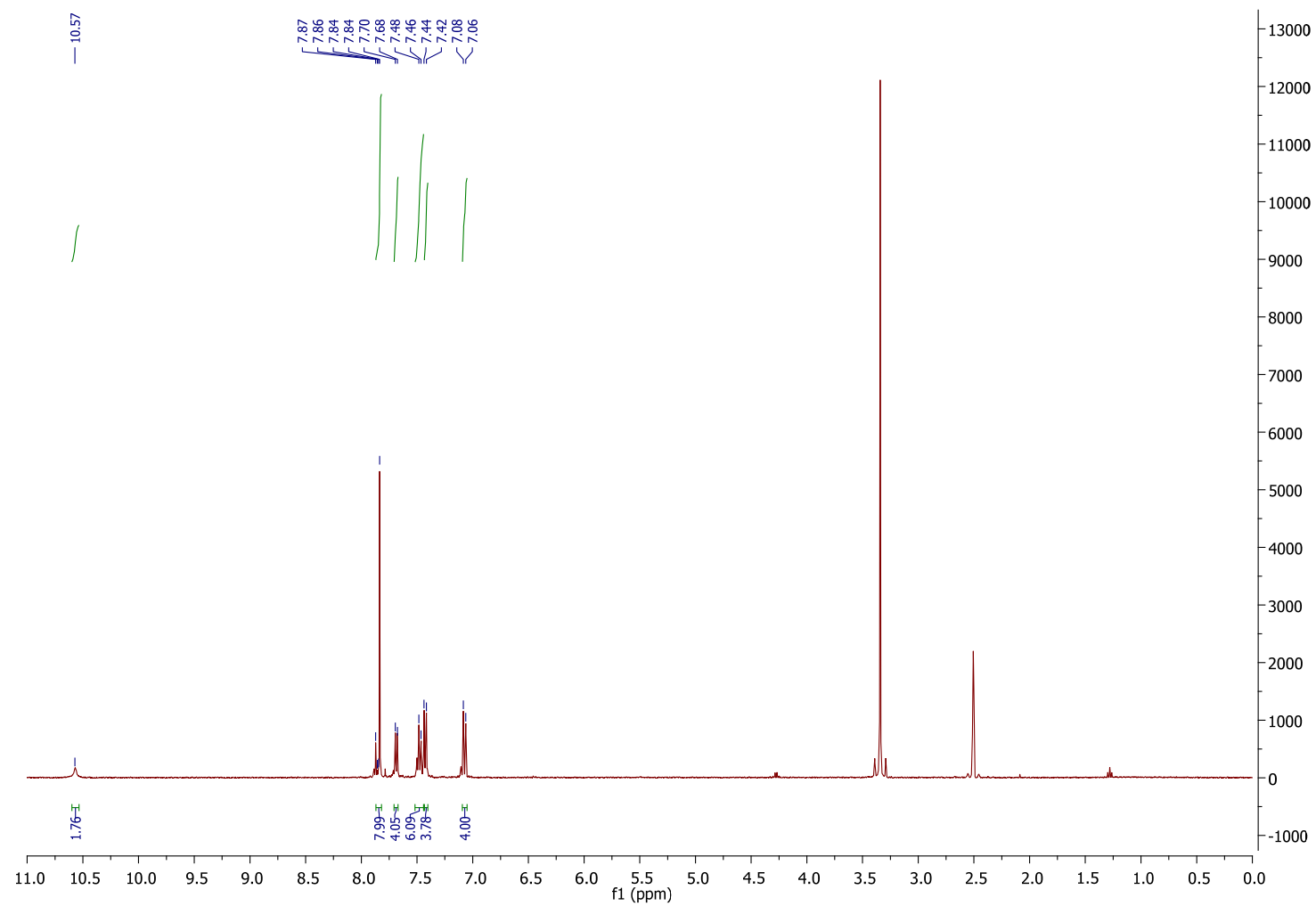


Figure S91. ¹H-NMR spectrum for compound 46.

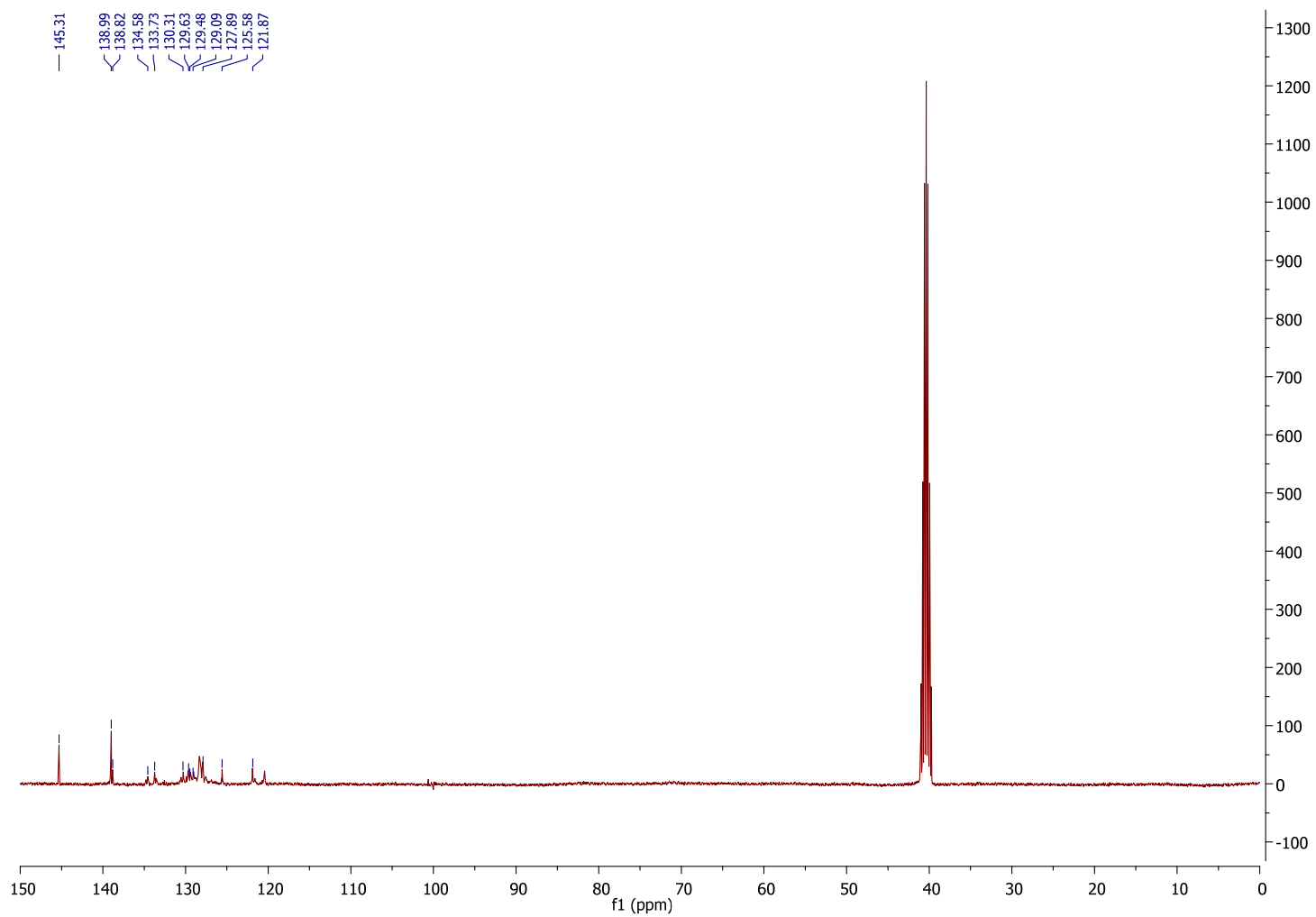


Figure S92. ^{13}C -NMR spectrum for compound **46**.

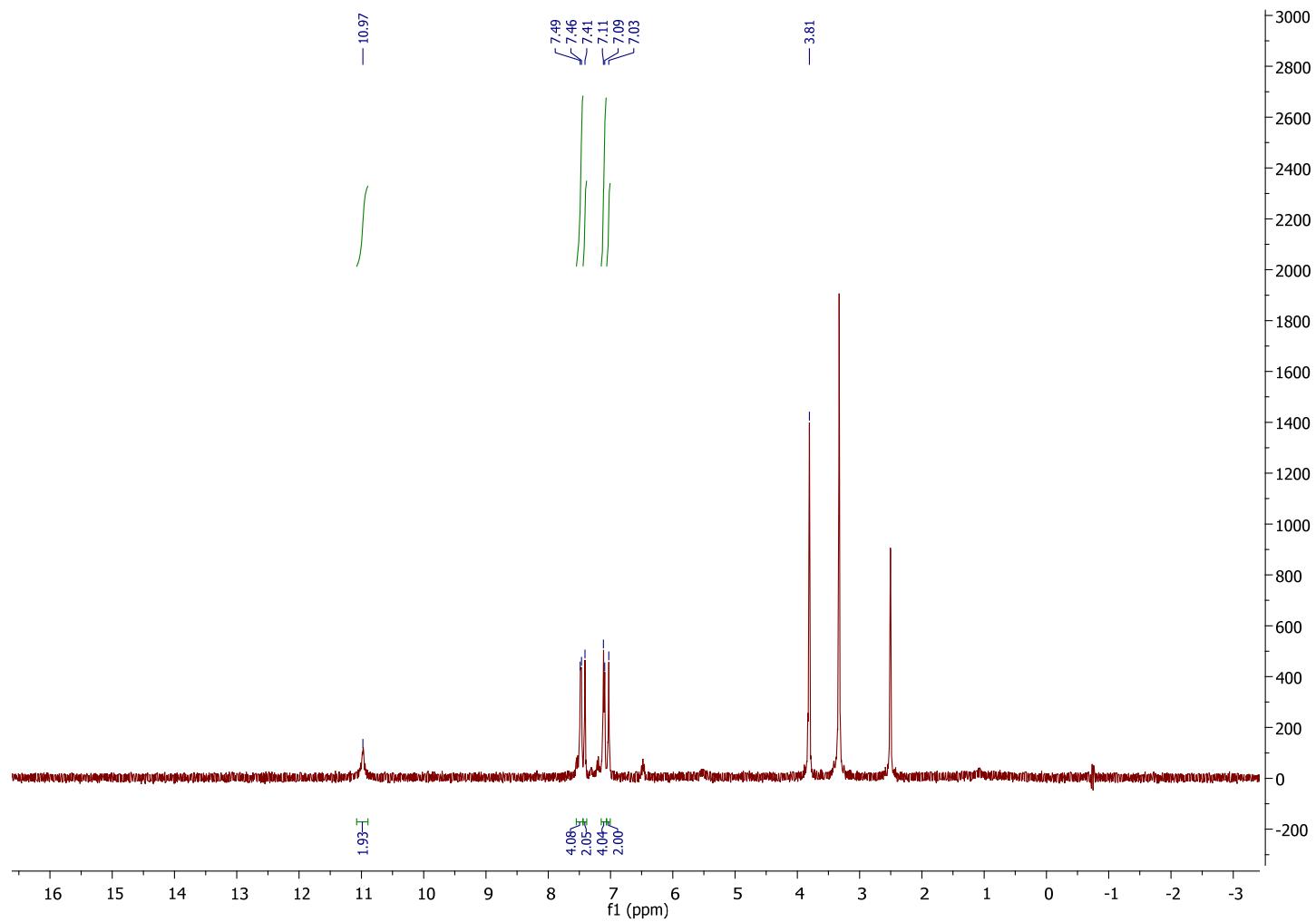


Figure S93. ¹H-NMR spectrum for compound 47.

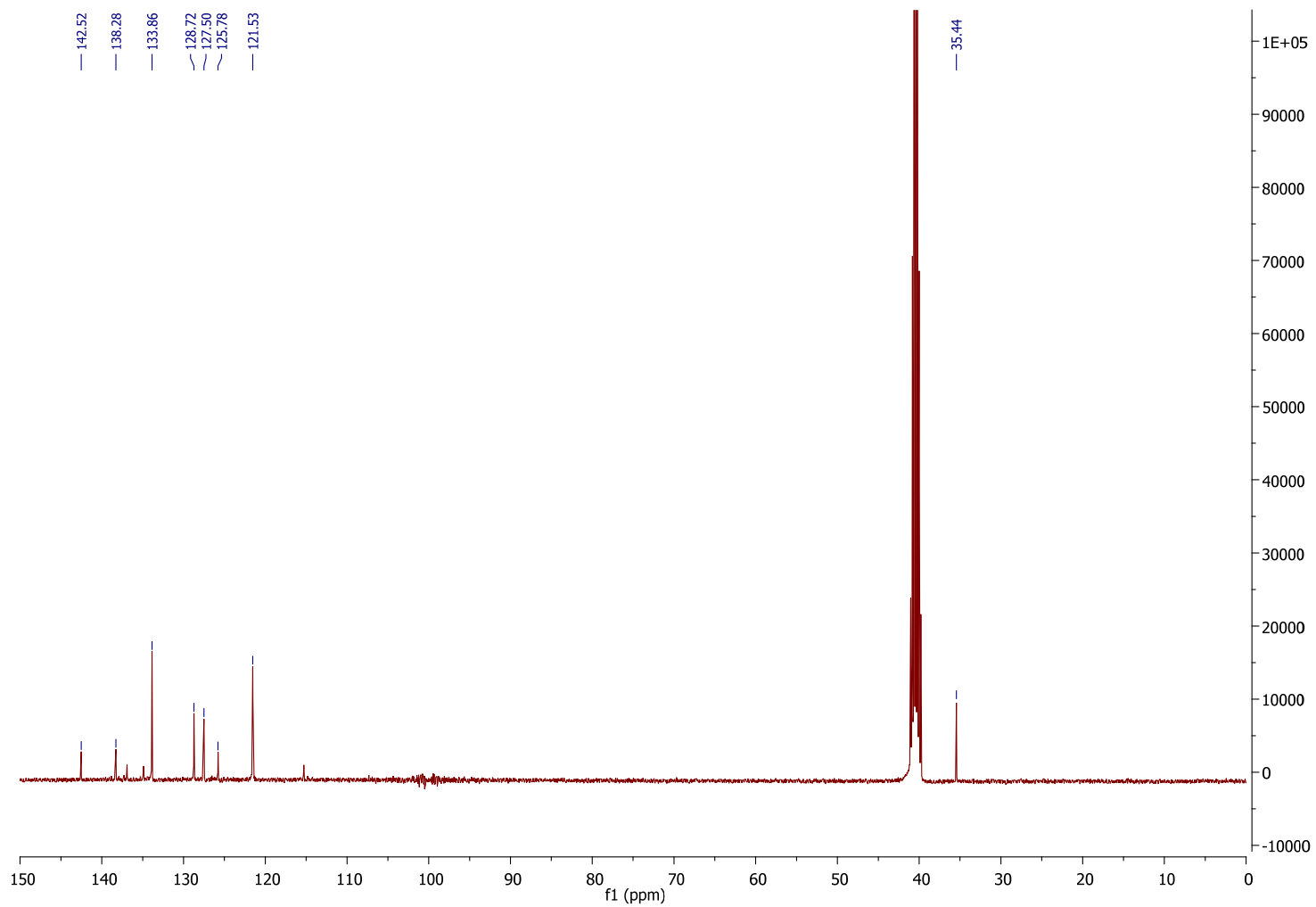


Figure S94. ¹³C-NMR spectrum for compound 47.

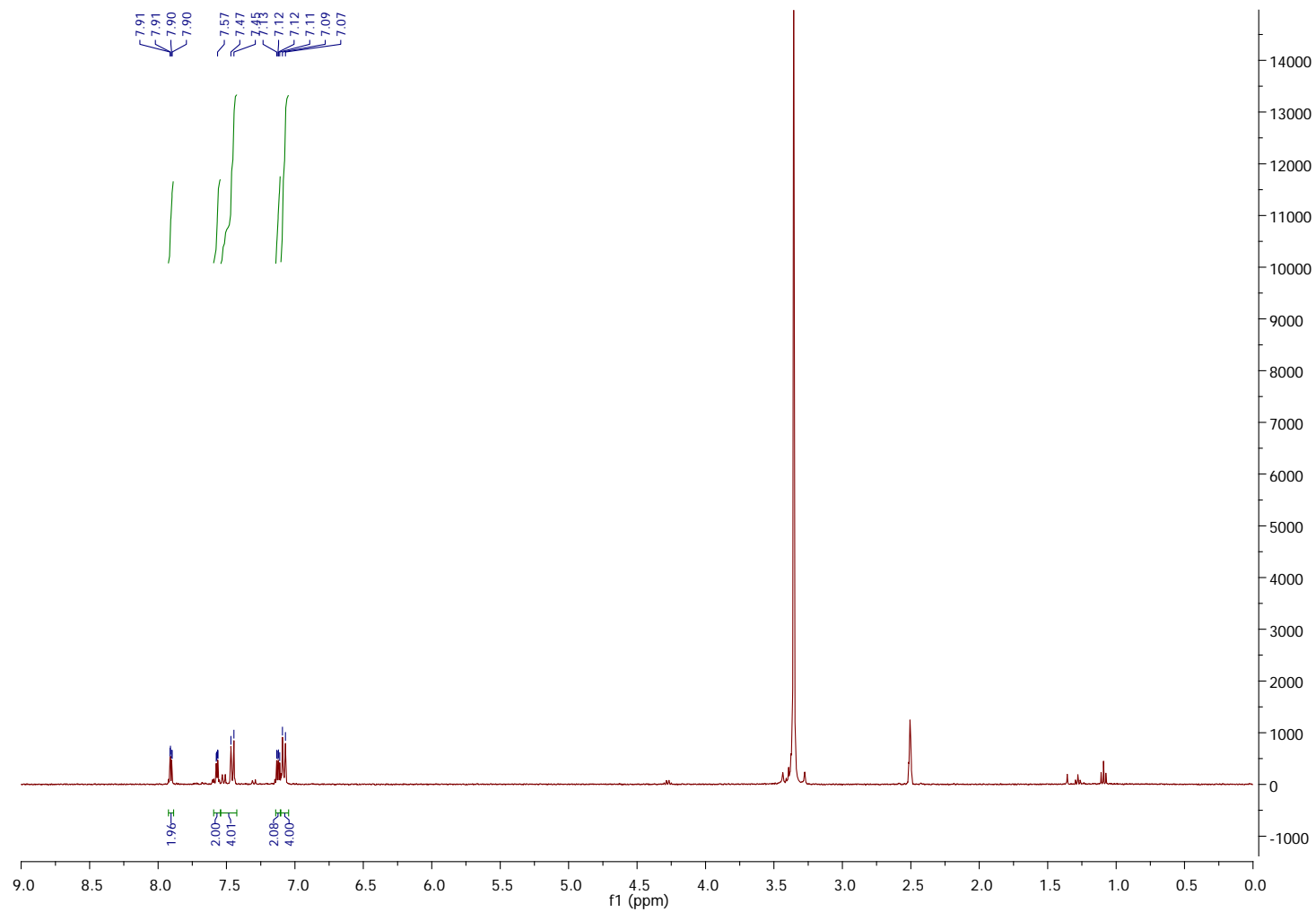


Figure S95. ¹H-NMR spectrum for compound 48.

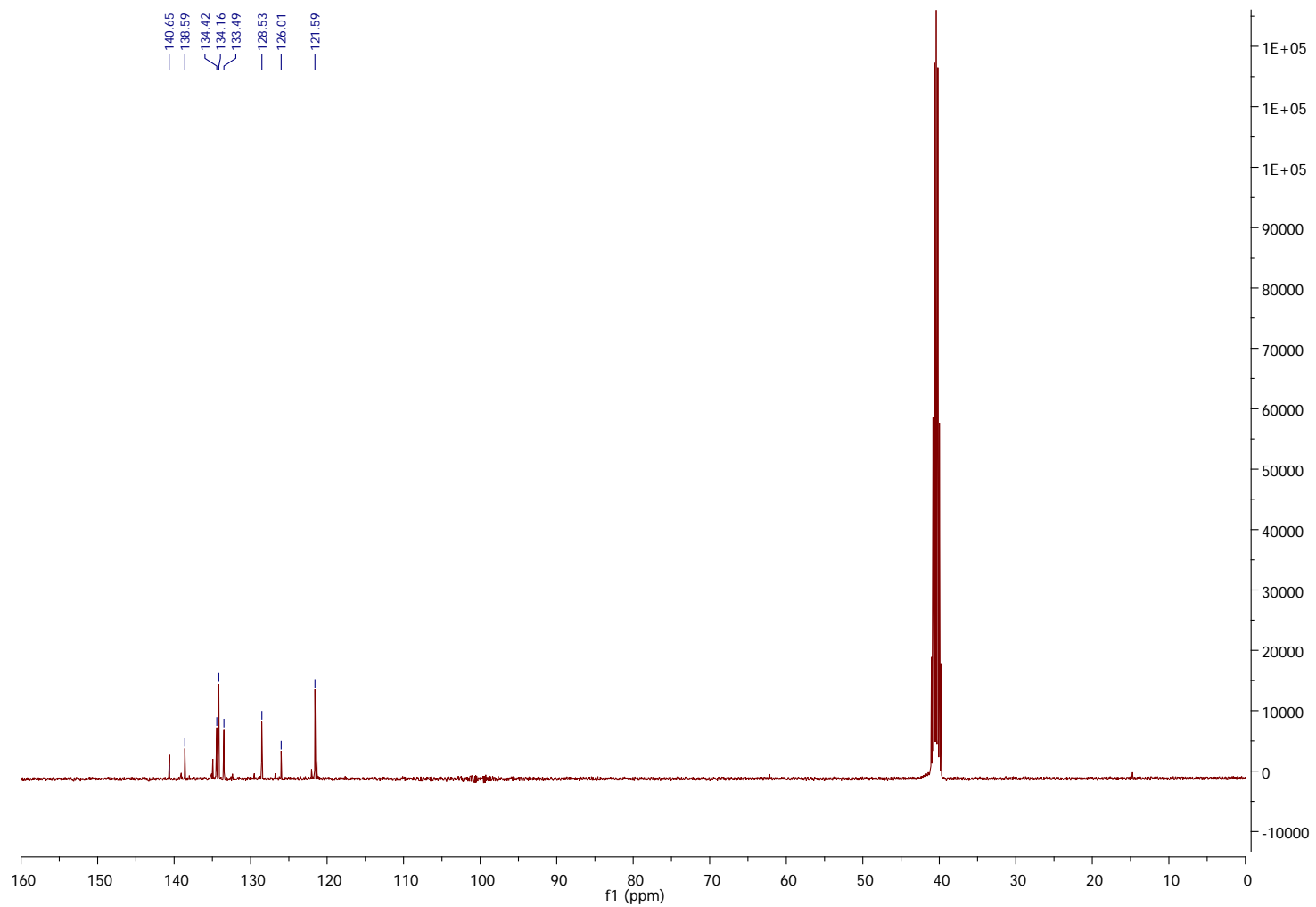


Figure S96. ^{13}C -NMR spectrum for compound 48.