

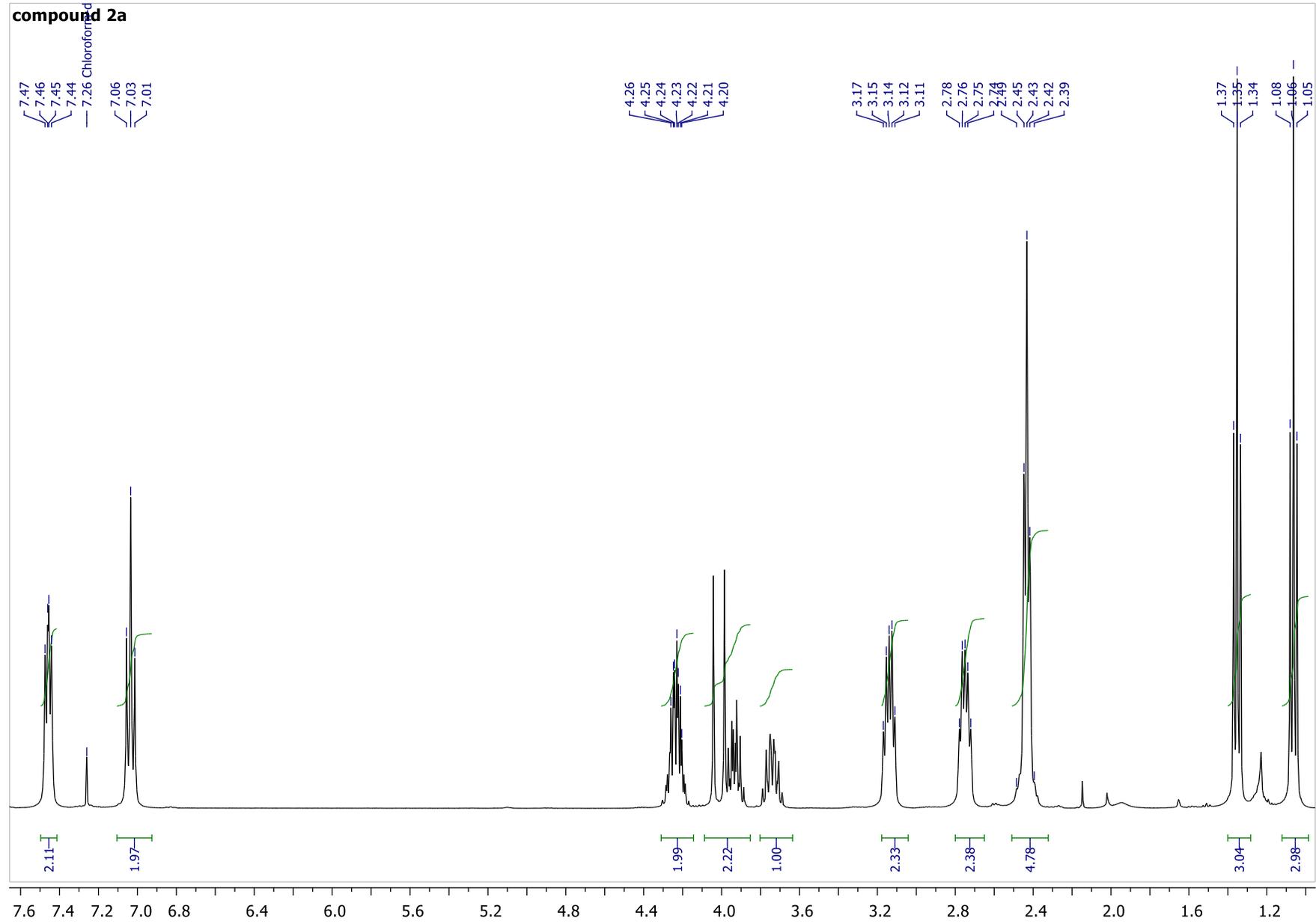
Synthesis of diethyl (aryl)(4-oxopiperidin-1-yl)methylphosphonates

Mikhail V. Makarov, Evgenii A. Skvortsov and Valery K. Brel

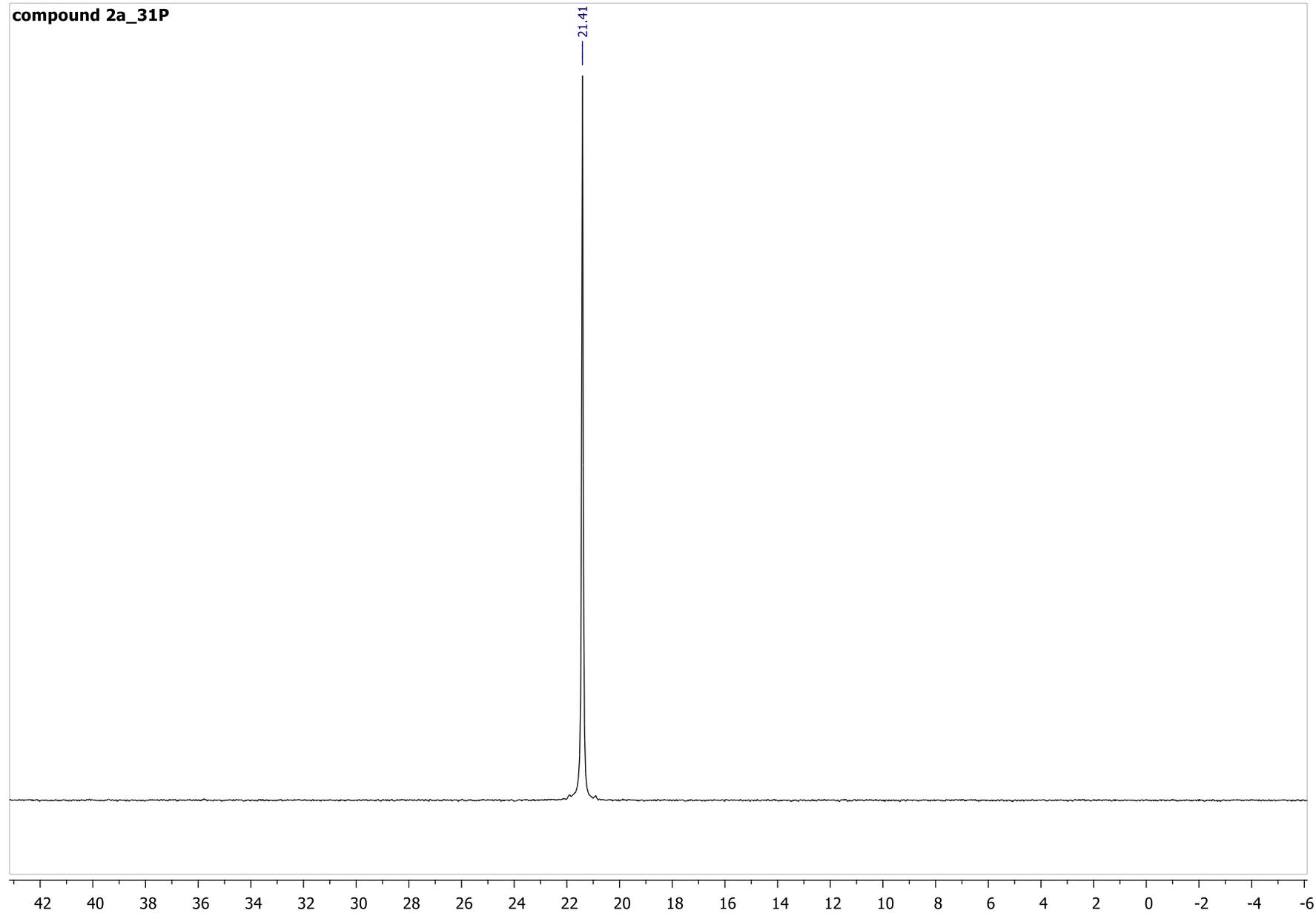
Diethyl (2,3-dimethoxyphenyl)(4-oxopiperidin-1-yl)methylphosphonate 2e: white solid, mp 88.2–90.2 °C, yield 39%. ^1H NMR (400 MHz, CDCl_3): δ 1.00 and 1.33 (two t, 3H, $^3J_{\text{HH}}$ 7.1 Hz, POCH_2CH_3), 2.31–2.39 (m, 4H, $\text{N}(\text{CH}_2)_2$), 2.73–2.79 (m, 2H), 3.08–3.14 (m, 2H), 3.69–3.73 (m, 1H, 0.5 POCH_2), 3.77 (s, 3H, OMe), 3.81 (s, 3H, OMe), 3.86–3.95 (m, 1H, 0.5 POCH_2), 4.16–4.31 (m, 2H, POCH_2), 4.69 (d, 1H, $^2J_{\text{PH}}$ 23.6 Hz, PCH), 6.85 (d, 1H, $^3J_{\text{HH}}$ 8.0 Hz, C_6H_3), 7.00 (t, 1H, $^3J_{\text{HH}}$ 8.0 Hz, C_6H_3), 7.32 (d, 1H, $^3J_{\text{HH}}$ 7.8 Hz, C_6H_3). ^{13}C NMR (100 MHz, CDCl_3): δ 16.11 and 16.58 (two d, $^3J_{\text{PC}}$ 5.4 Hz, POCH_2CH_3), 41.73 (NCH_2CH_2), 51.02 (d, $^3J_{\text{PC}}$ 9.5 Hz, NCH_2CH_2), 55.59 (OMe), 57.83 (d, $^1J_{\text{PC}}$ 166 Hz, PCH), 60.82 (OMe), 62.19 and 62.98 (two d, $^2J_{\text{PC}}$ 7.3 Hz, POCH_2), 112.29, 122.56 (d, $^4J_{\text{PC}}$ 3.7 Hz), 123.38 (d, $^3J_{\text{PC}}$ 1.5 Hz), 125.65 (d, $^2J_{\text{PC}}$ 5.7 Hz), 147.84 (d, $^3J_{\text{PC}}$ 11.7 Hz, $\text{C}_{\text{Ph}}\text{-OMe}$), 152.52 ($\text{C}_{\text{Ph}}\text{-OMe}$), 208.62 (C=O). ^{31}P NMR (162 MHz, CDCl_3): δ 22.55. Found (%): C, 56.14; H, 7.11; N, 3.64. Calc. for $\text{C}_{18}\text{H}_{28}\text{NO}_6\text{P}$ (%): C, 56.10; H, 7.32; N, 3.63.

Diethyl (2,3,4-trimethoxyphenyl)(4-oxopiperidin-1-yl)methylphosphonate 2f: viscous liquid, yield 44%. ^1H NMR (400 MHz, CDCl_3): δ 1.01 and 1.35 (two t, 3H, $^3J_{\text{HH}}$ 7.1 Hz, POCH_2CH_3), 2.33–2.42 (m, 4H, $\text{N}(\text{CH}_2)_2$), 2.71–2.77 (m, 2H), 3.07–3.13 (m, 2H), 3.68–3.76 (m, 1H, 0.5 POCH_2), 3.81 (s, 3H, OMe), 3.82 (s, 3H, OMe), 3.83 (s, 3H, OMe), 3.88–3.95 (m, 1H, 0.5 POCH_2), 4.19–4.30 (m, 2H, POCH_2), 4.59 (d, 1H, $^2J_{\text{PH}}$ 24.2 Hz, PCH), 6.63 (d, 1H, $^3J_{\text{HH}}$ 8.9 Hz, C_6H_2), 7.43 (d, 1H, $^3J_{\text{HH}}$ 8.6 Hz, C_6H_2). ^{13}C NMR (100 MHz, CDCl_3): δ 15.89 and 16.32 (two d, $^3J_{\text{PC}}$ 5.6 Hz, POCH_2CH_3), 41.50 (NCH_2CH_2), 50.71 (d, $^3J_{\text{PC}}$ 9.2 Hz, NCH_2CH_2), 55.56 (OMe), 57.36 (d, $^1J_{\text{PC}}$ 166 Hz, PCH), 60.41 (OMe), 60.83 (OMe), 61.93 and 62.70 (two d, $^2J_{\text{PC}}$ 7.1 Hz, POCH_2), 106.35 (PCH- C_{Ph} - C_{Ph} H- C_{Ph} H), 117.28 (d, $^2J_{\text{PC}}$ 5.8 Hz, PCH- C_{Ph}), 125.25 (d, $^3J_{\text{PC}}$ 4.0 Hz, PCH- C_{Ph} - C_{Ph} H), 141.65 ($\text{C}_{\text{Ph}}\text{-OMe}$), 152.38 (d, $^3J_{\text{PC}}$ 11.3 Hz, $\text{C}_{\text{Ph}}\text{-OMe}$), 153.39 ($\text{C}_{\text{Ph}}\text{-OMe}$), 208.46 (C=O). ^{31}P NMR (162 MHz, CDCl_3): δ 22.74. Found (%): C, 54.71; H, 7.04; N, 3.39. Calc. for $\text{C}_{19}\text{H}_{30}\text{NO}_7\text{P}$ (%): C, 54.93; H, 7.28; N, 3.37.

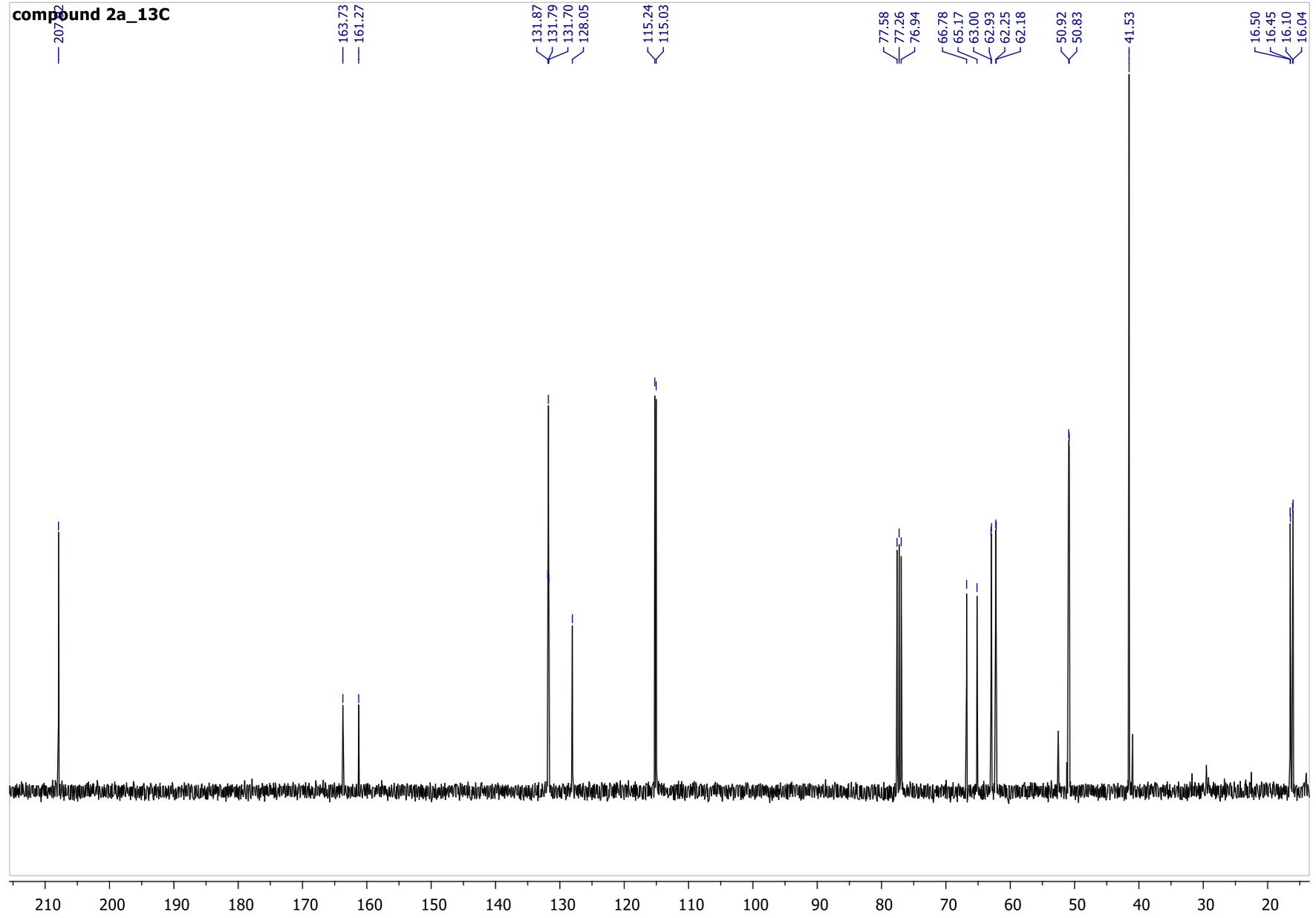
compound 2a



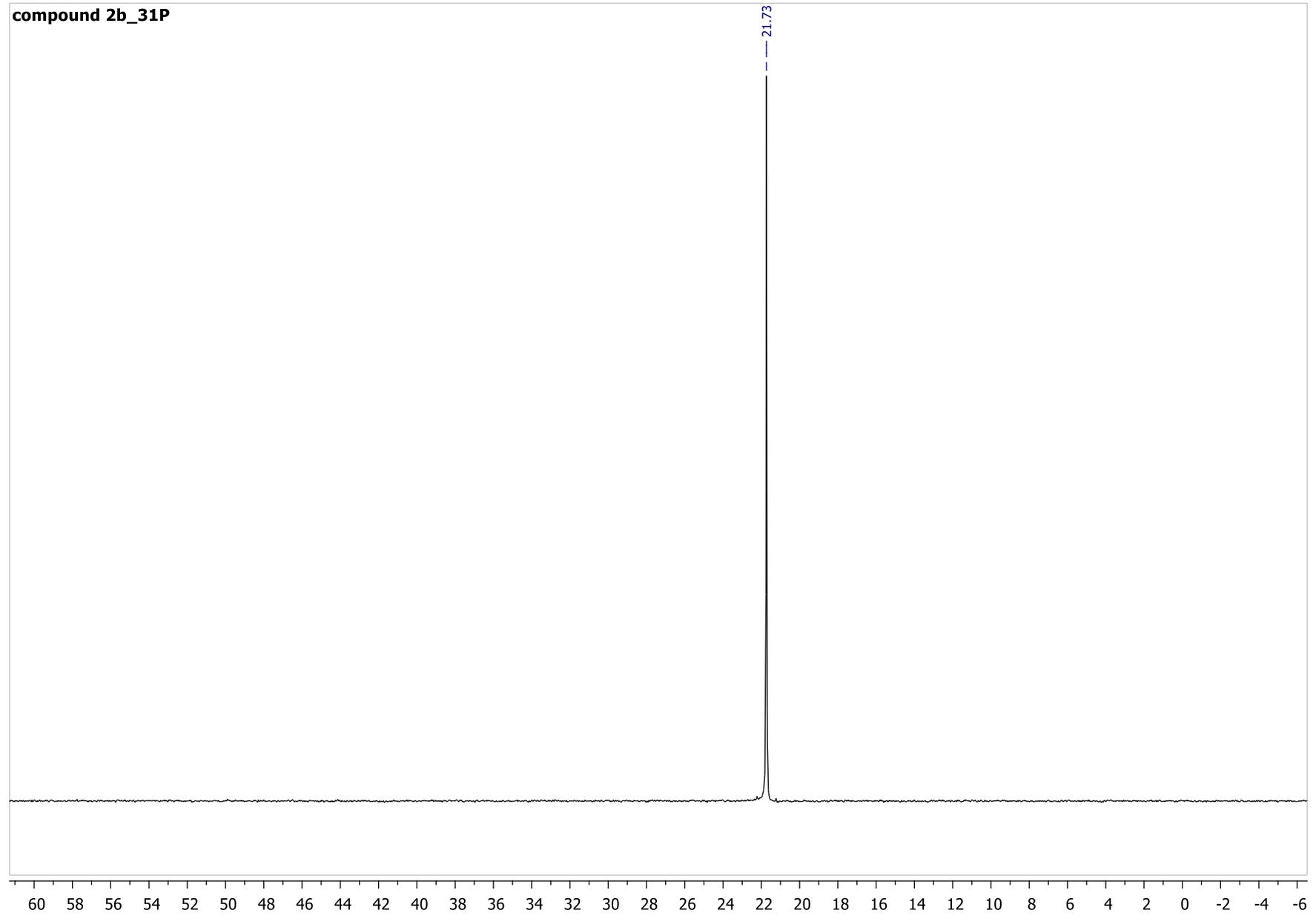
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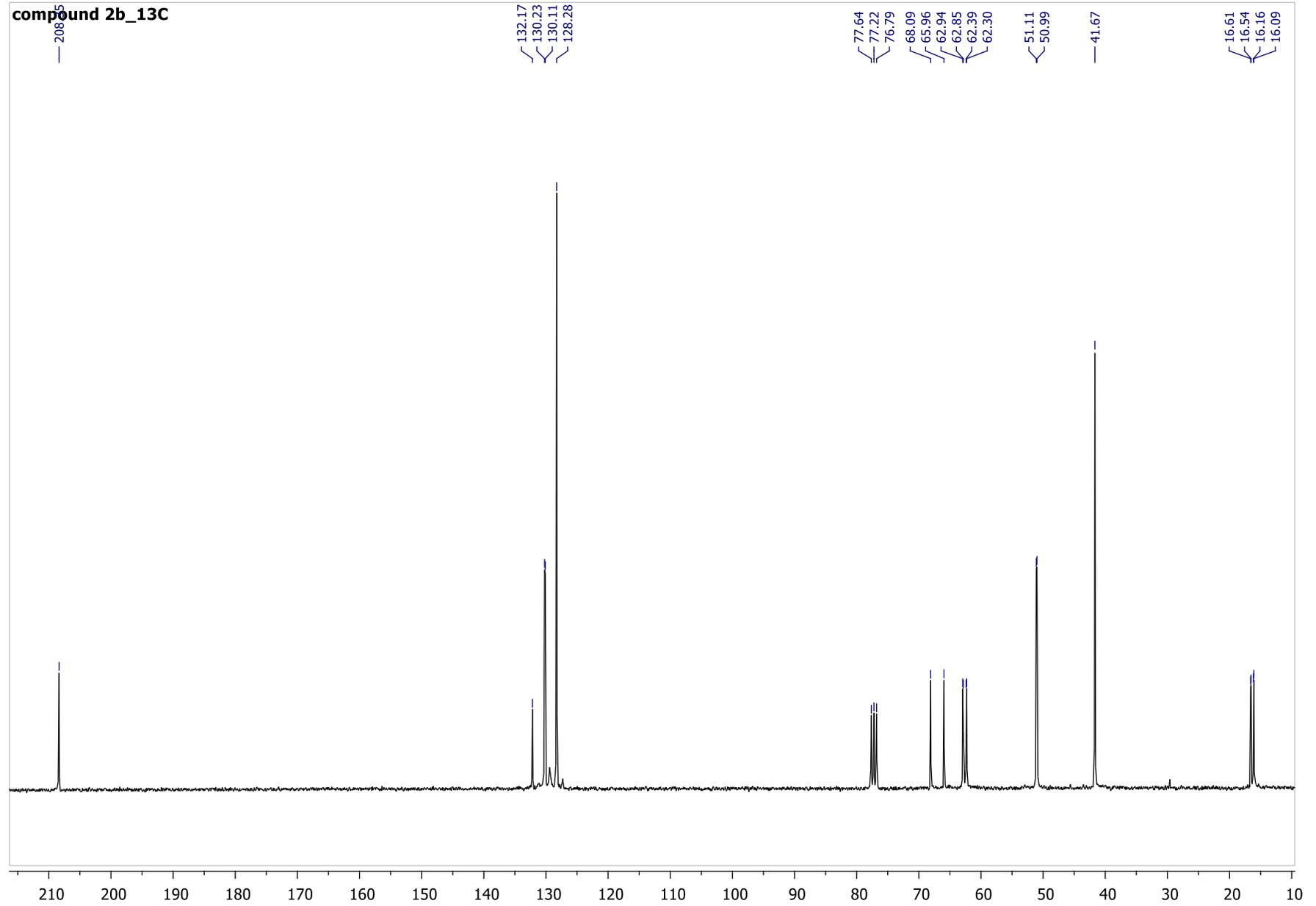
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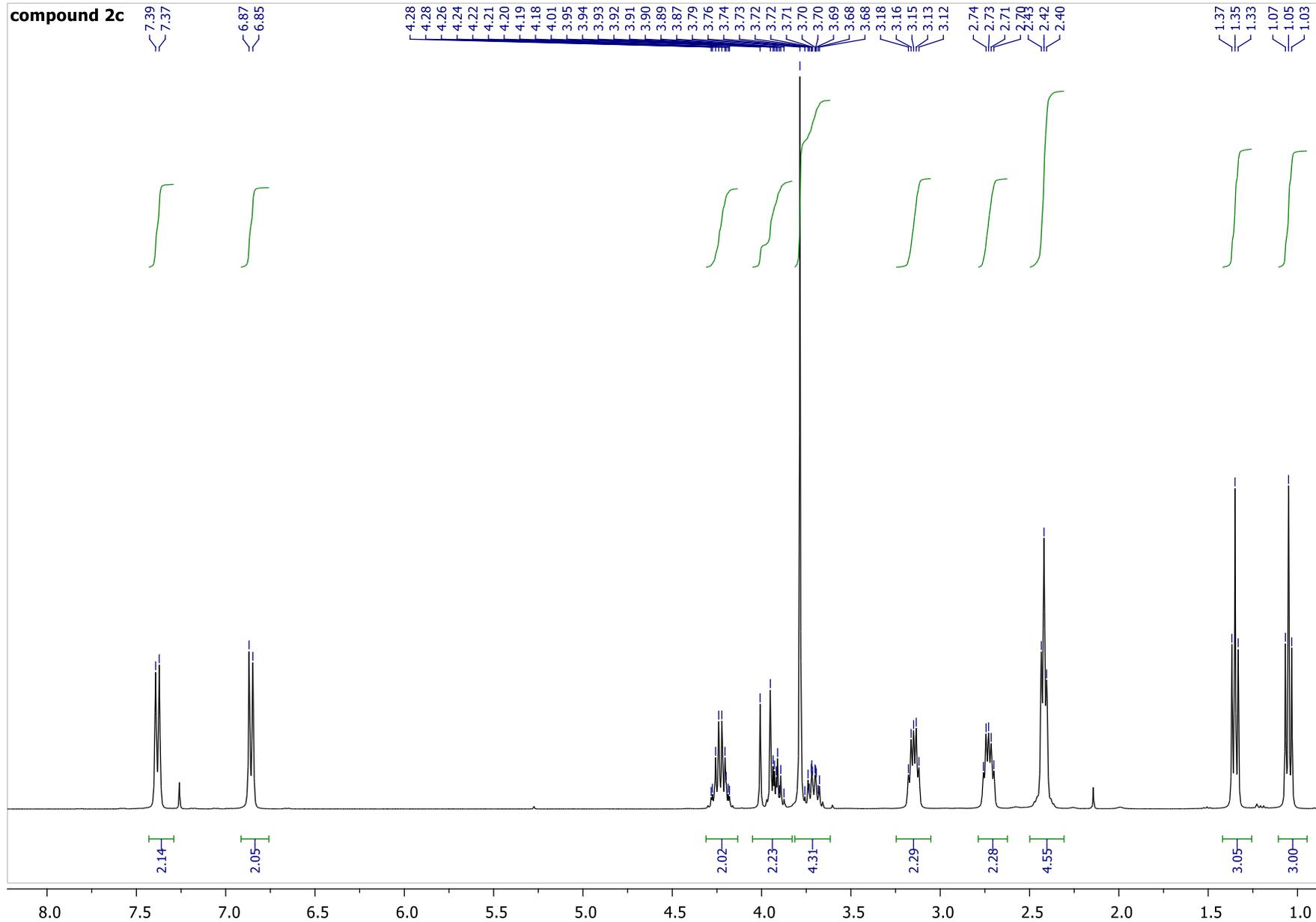
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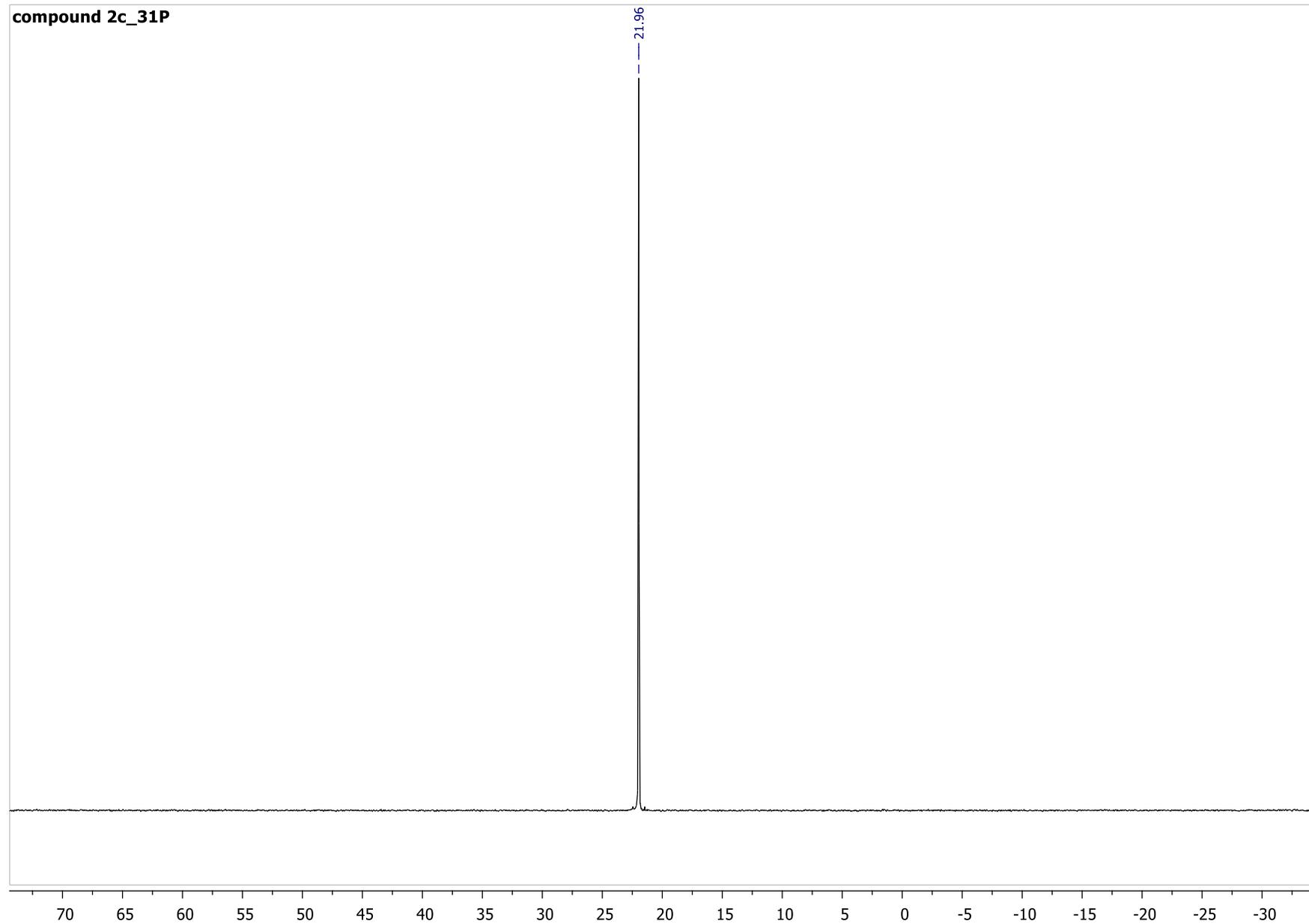
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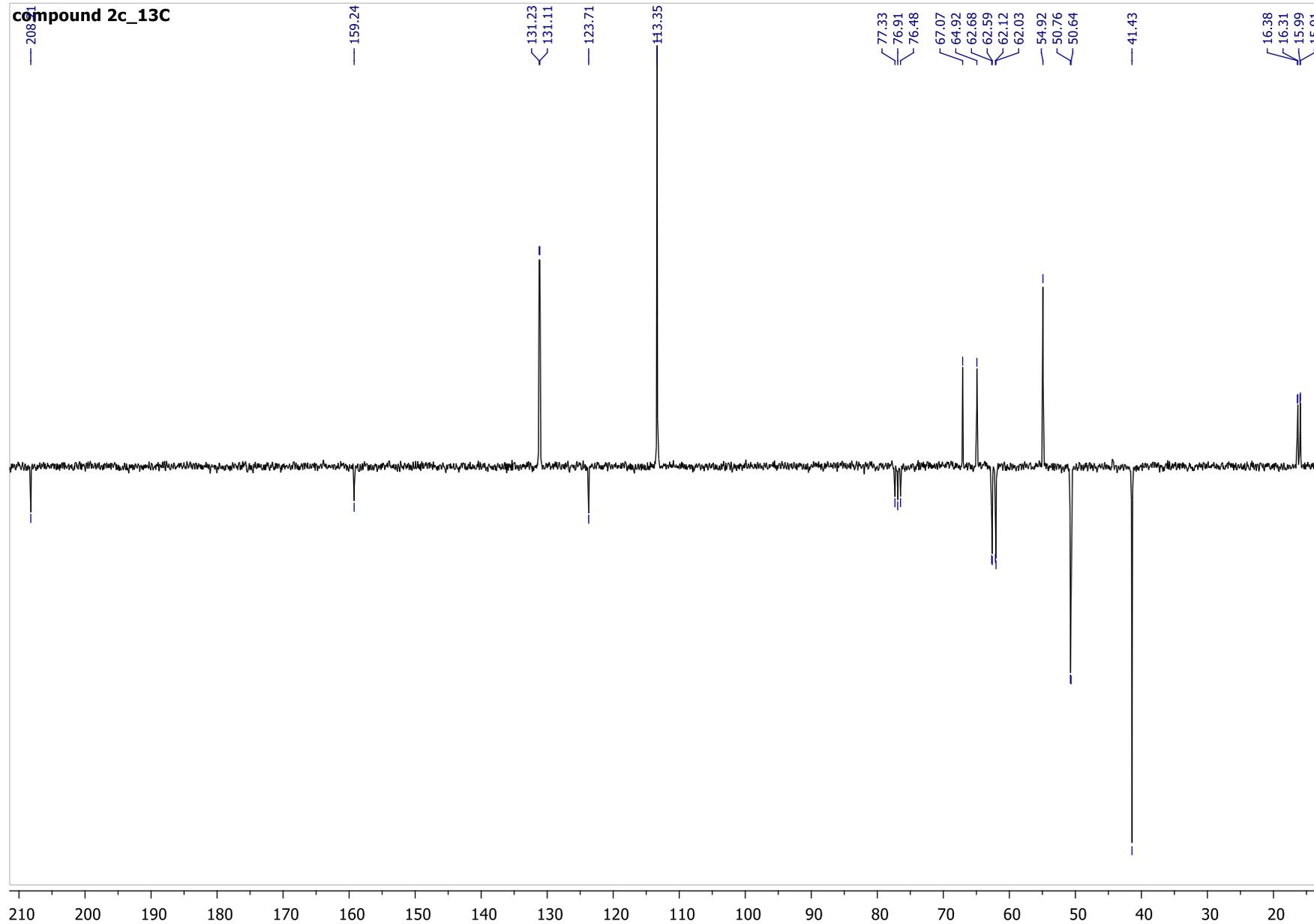
compound 2c



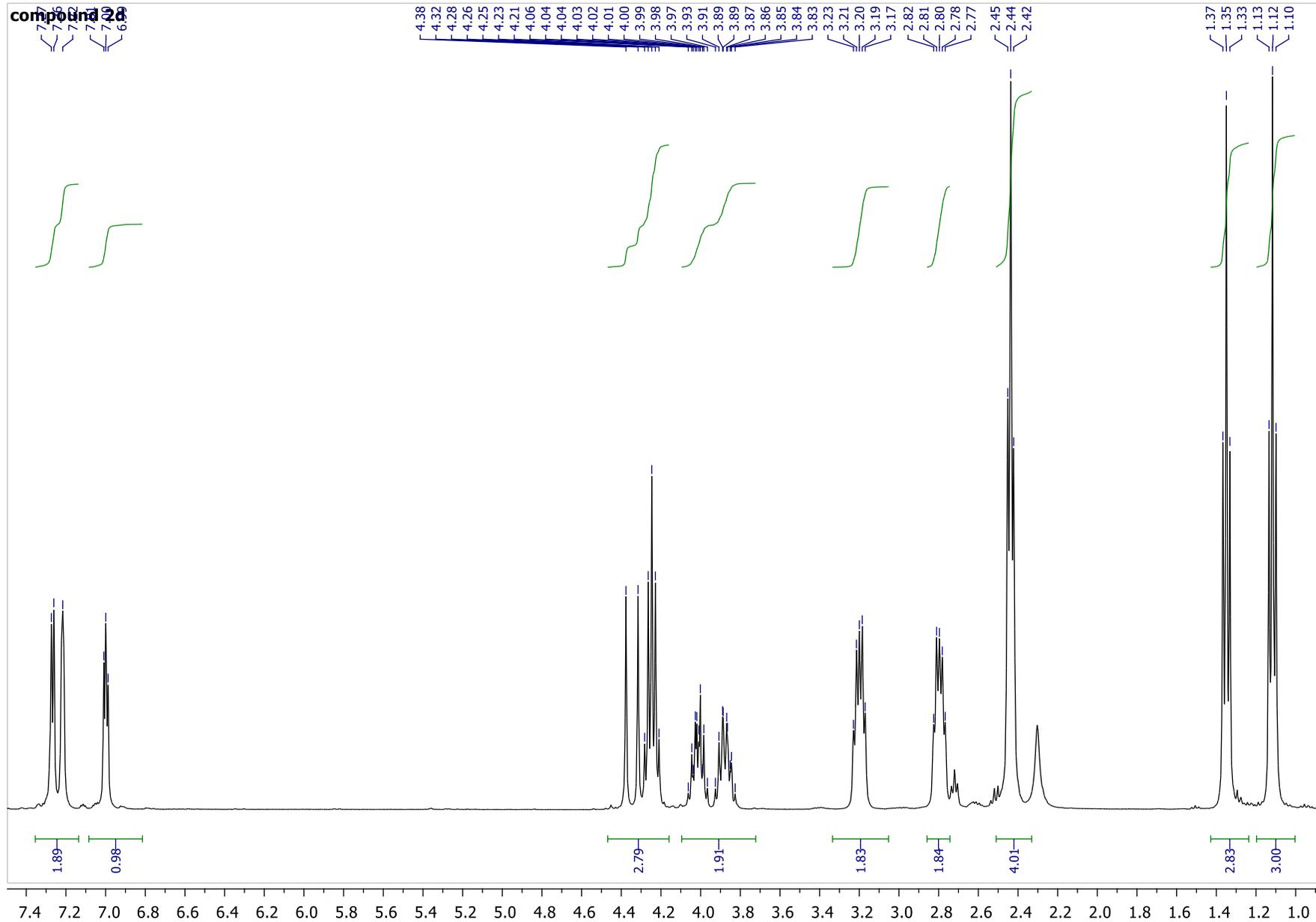
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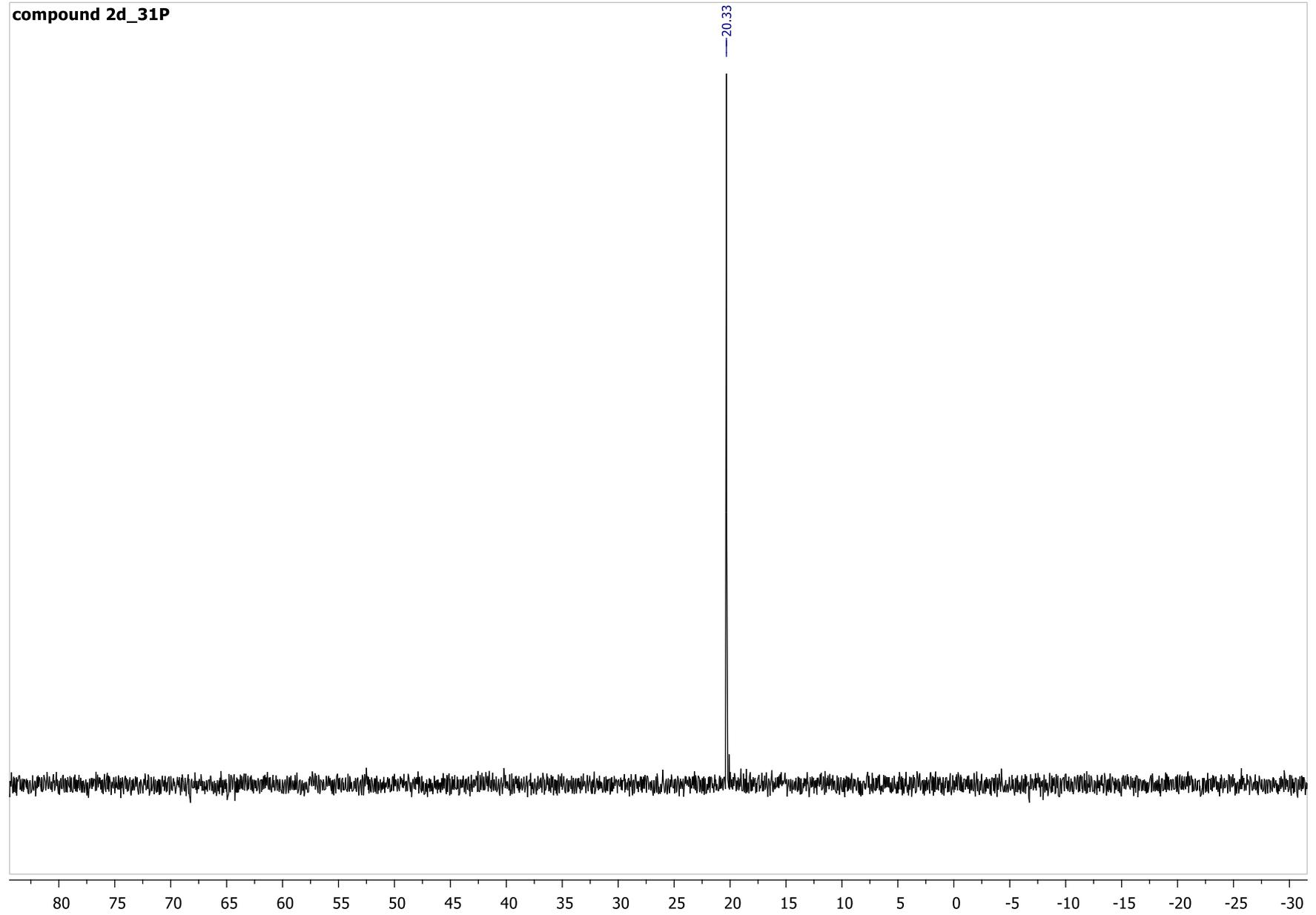
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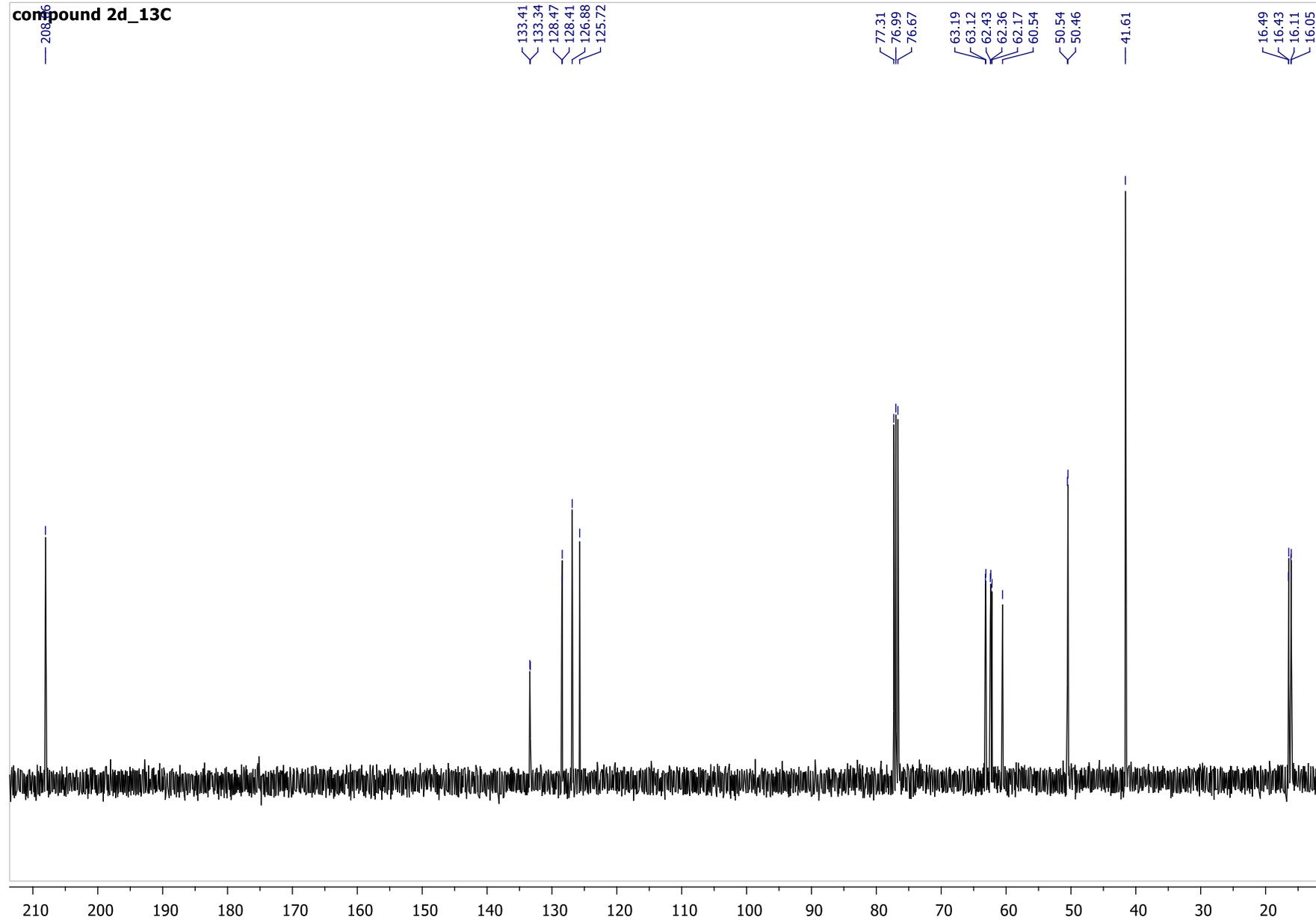
compound 2d



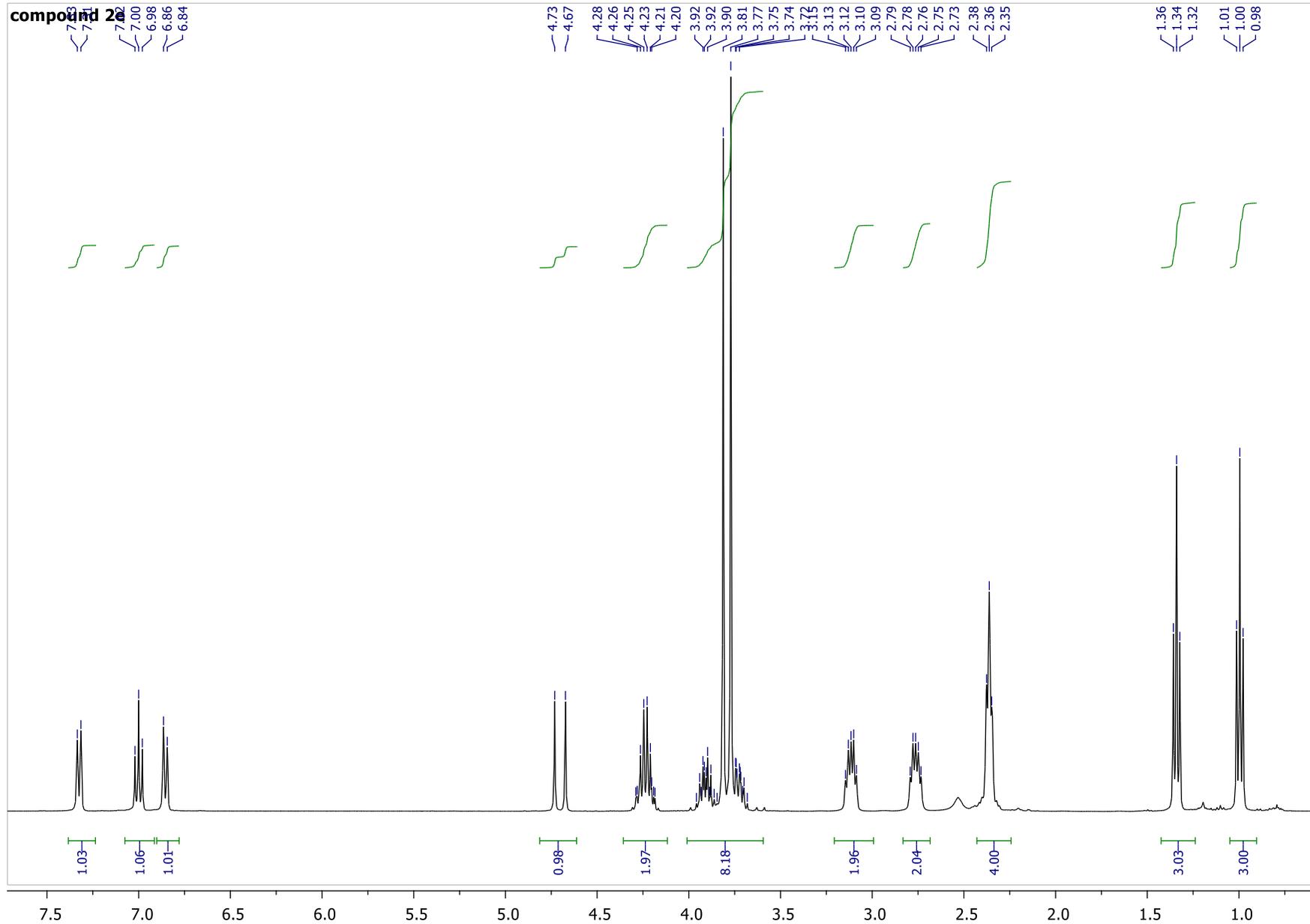
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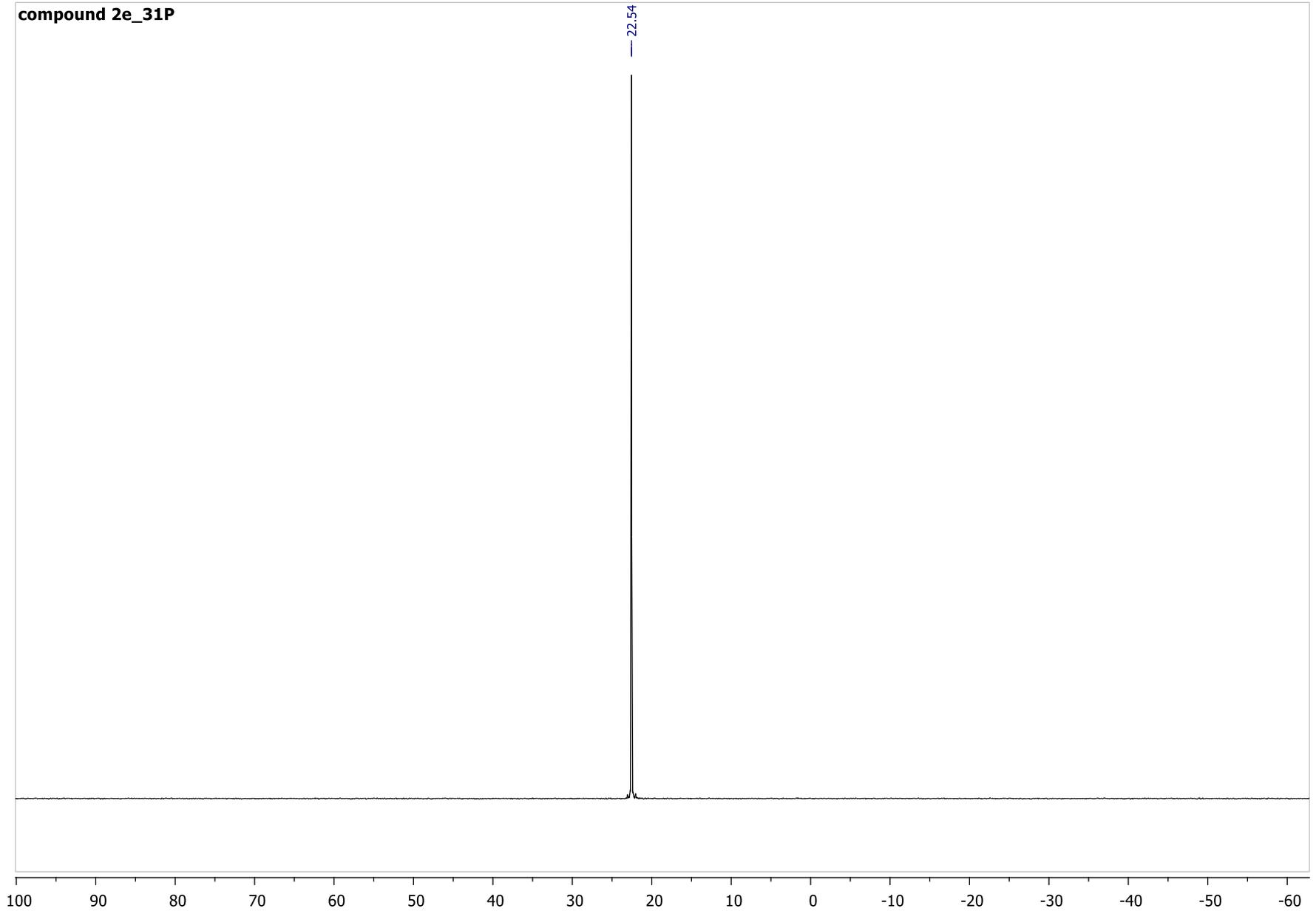
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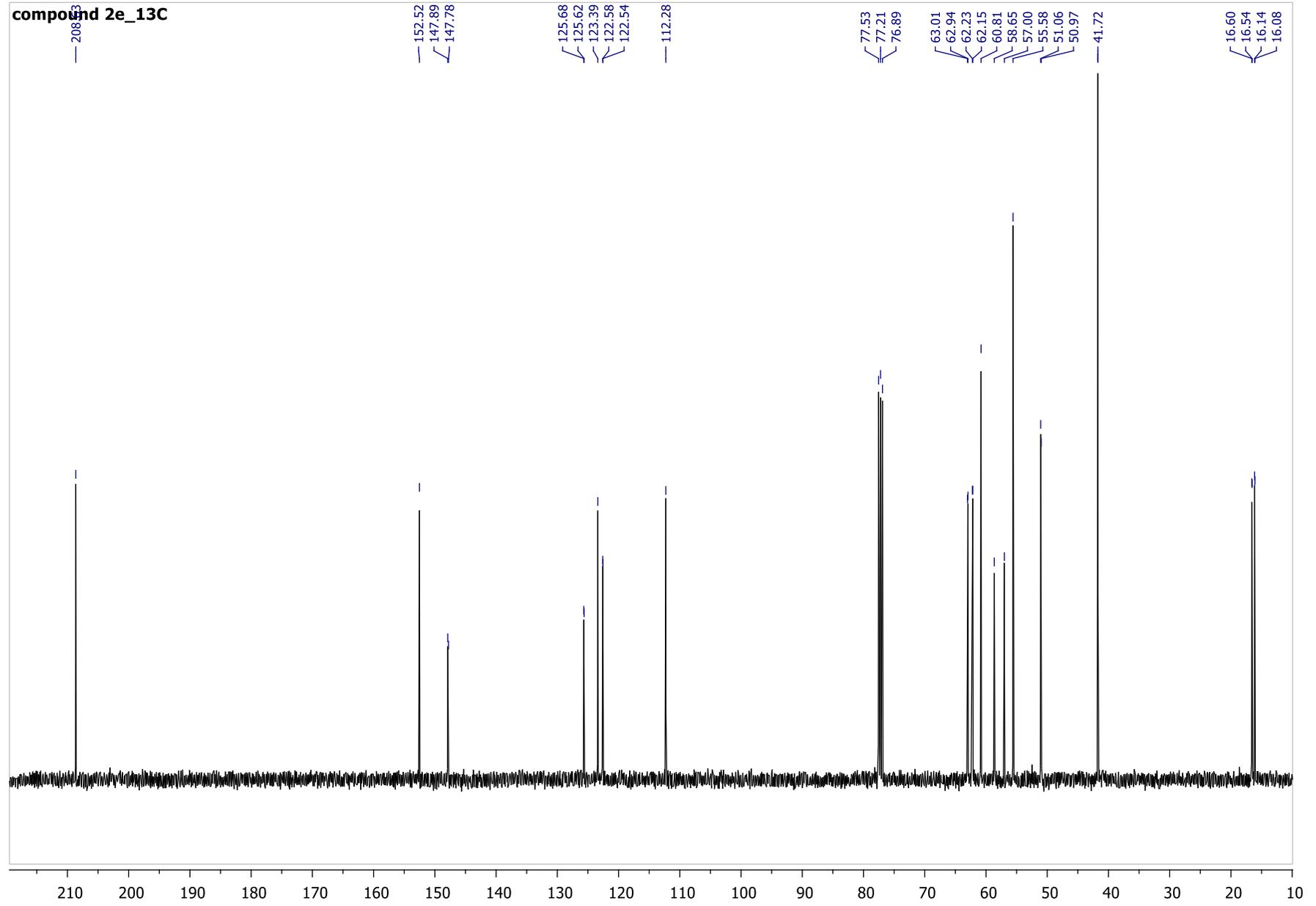
compound 2a



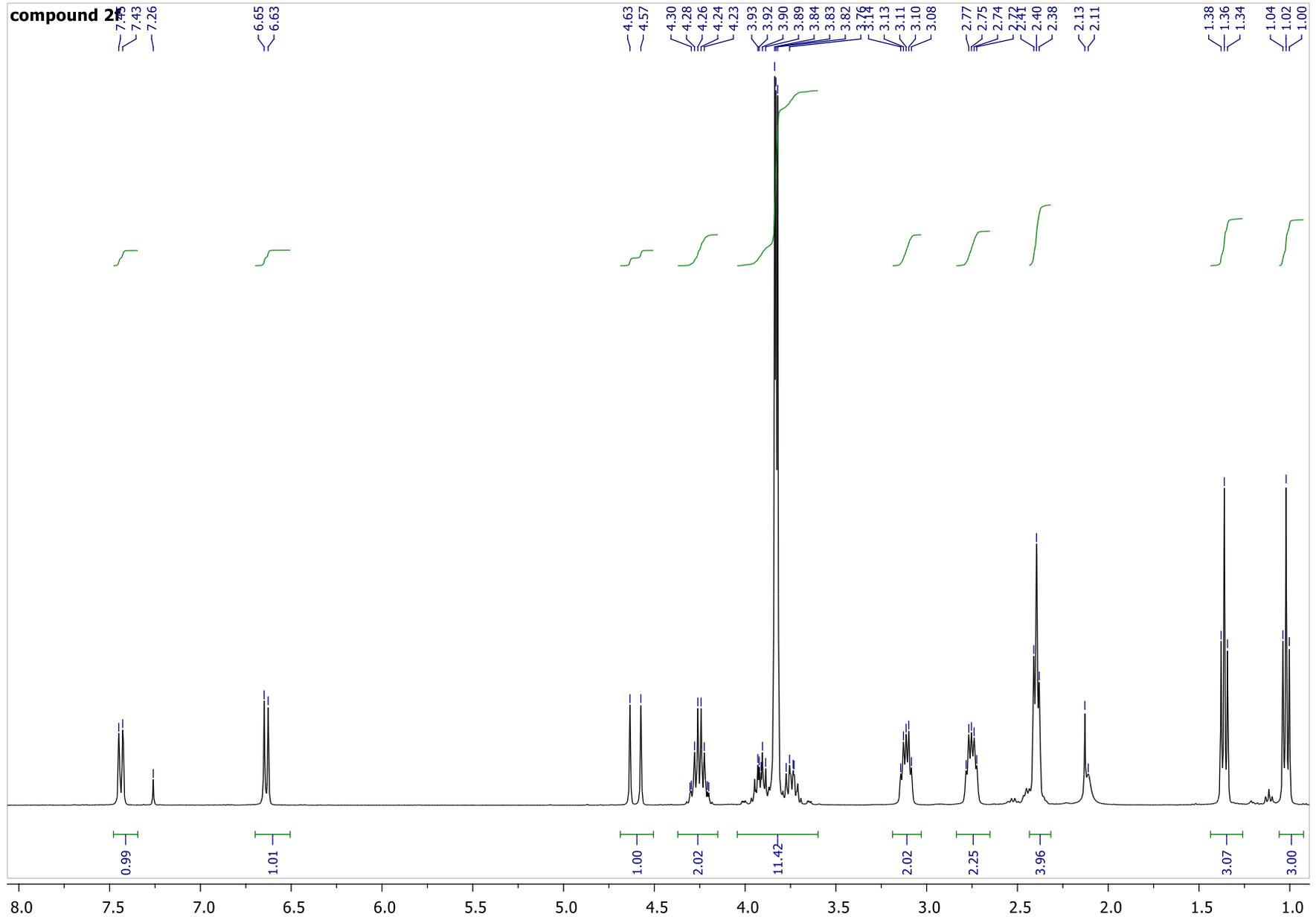
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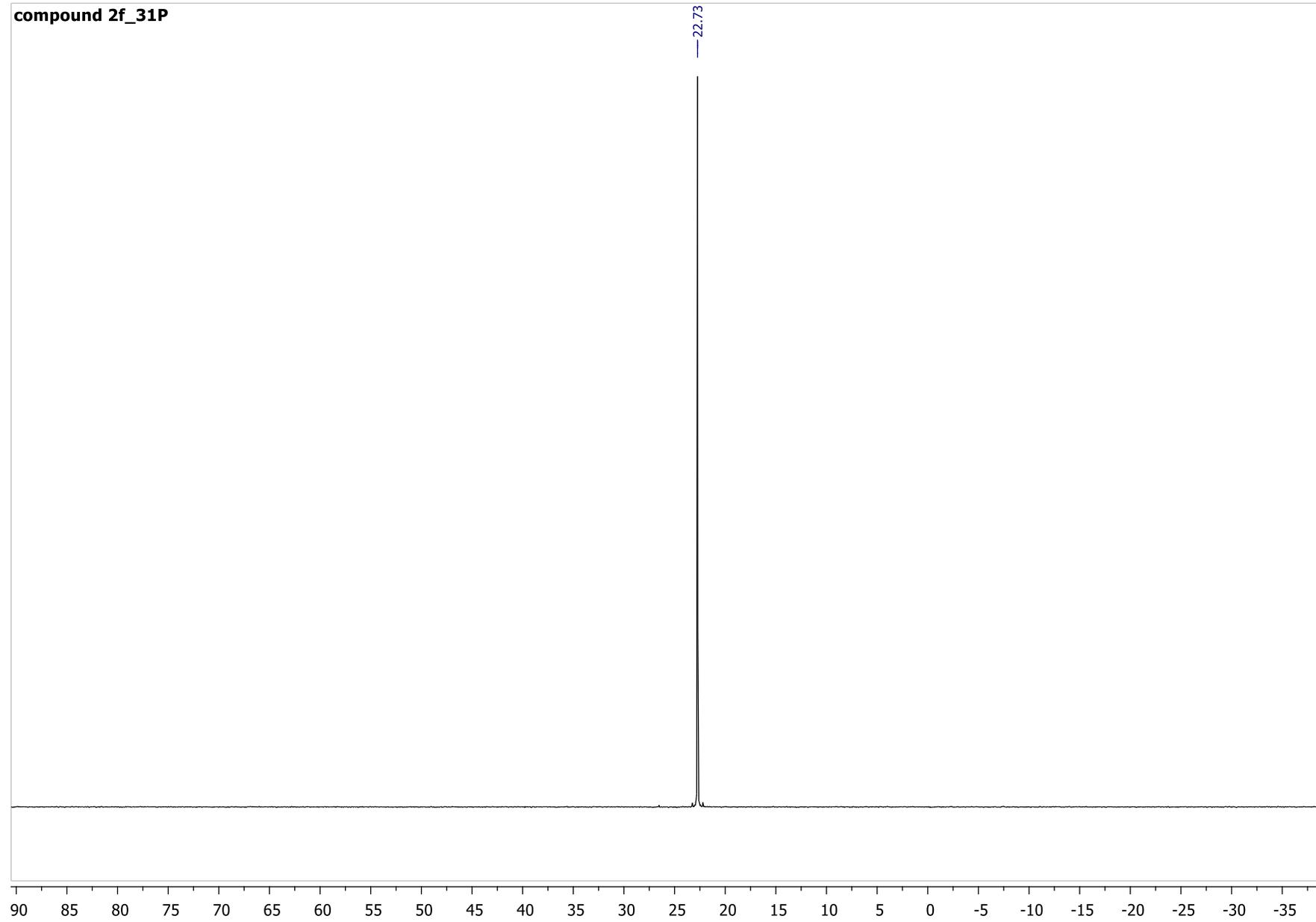
compound 2e_13C



compound 2



compound 2f_31P



compound 2f 13C

