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Supporting Information

Synthesis of 3*C*-alkylated active methylene substituted 2*H*-indazole derivatives *via* sequential ring opening of donor acceptor cyclopropanes and reductive cyclization reaction

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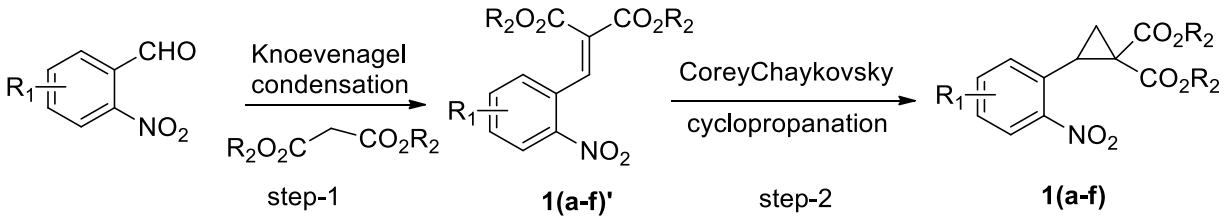
EXPERIMENTAL SECTION

General information:

All the reagents were of reagent grade (AR grade) and were used as purchased without further purification. Silica gel (60-120 mesh size) was used for column chromatography. Reactions were monitored by TLC on silica gel GF254 (0.25 mm). Melting points were recorded in an open capillary tube and are uncorrected. Fourier transform-infra red (FT-IR) spectra were recorded as neat liquid or KBr pellets. NMR spectra were recorded in $CDCl_3$ with tetramethylsilane as the internal standard for ^1H (600 MHz, 400 MHz) or ^{13}C (150 MHz, 100 MHz) NMR. Chemical shifts (δ) are reported in ppm and spin-spin coupling constants (*J*) are given in Hz. HRMS spectra were recorded using Q-TOF mass spectrometer.

General procedure for the synthesis of 1:

The corresponding starting materials were synthesized in a two-step procedure *i.e* Knoevenagal condensation followed by Corey-Chaykovsky cyclopropanation.



Scheme 14 starting material preparation

The starting material *o*-nitro DACs **1a′**,[1] **1f′**,[2] **1a**,[3] was prepared as per the literature procedure and the spectroscopic data are in good agreement with the literature one.

General procedure for the synthesis of 1b′-1e′:

To a solution of substituted *o*-nitrobenzaldehydes (2.2 mmol, 1.1 equiv.) in benzene (5 mL) at room temperature was added active methylene compound (2.0 mmol, 1.0 equiv.), piperidine (0.4

mmol, 0.2 equiv.) and AcOH (0.4 mmol, 0.2 equiv.) under nitrogen atmosphere. Then, the reaction was refluxed on an oil bath for 12 h. After completion of the reaction, the solvent was removed under reduced pressure and the crude was subjected to column chromatography over silica gel to give the corresponding product.

Dimethyl 2-(4-bromo-2-nitrobenzylidene)malonate (1b′):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 396 mg, 62%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (s, 1 H), 8.10 (s, 1 H), 7.77 (d, *J* = 8.0 Hz, 1 H), 7.30 (d, *J* = 8.0 Hz, 1 H), 3.88 (s, 3 H), 3.65 (s, 3 H).^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 165.3, 136.8, 147.7, 140.7, 137.0, 131.5, 129.3, 129.2, 128.4, 124.1, 53.2, 52.8. IR (KBr, neat) 2954, 1727, 1643, 1522, 1432, 1350, 1225, 1156, 1073, 981, 843, 739 cm^{-1}; HRMS (ESI) calcd. for $C_{12}H_{11}BrNO_6$ $(M + H)^+$ 343.9764, found 343.9759.

Dimethyl 2-(5-chloro-2-nitrobenzylidene)malonate (1c′):

Yellow gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 364 mg, 61%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (d, J = 8.4 Hz, 1 H), 8.13 (s, 1 H), 7.53 (dd, J = 8.4 and 2.0 Hz, 1 H), 7.39 (d, J = 2.0 Hz, 1 H), 3.88 (s, 3 H), 3.66 (s, 3 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 165.0, 163.6, 145.6, 140.6, 140.5, 132.2, 130.4, 130.0, 129.4, 126.7, 53.2, 52.8. IR (KBr, neat) 2957, 1724, 1605, 1565, 1435, 1343, 1220, 1181, 1071, 986, 844, 756 cm^{-1}; HRMS (ESI) calcd. for $C_{12}H_{11}ClNO_6$ $(M + H)^+$ 300.0269, found 300.0251.

Dimethyl 2-(4,5-dimethoxy-2-nitrobenzylidene)malonate (1d′):

Orange gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 389 mg, 60%; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.23 (s, 1 H), 7.77 (s, 1 H), 6.88 (s, 1 H), 3.99 (s, 3 H), 3.94 (s, 3 H), 3.88 (s, 3 H), 3.67 (s, 3 H). ^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) δ 166.2, 164.1, 153.5, 149.8, 142.0, 140.3, 127.9, 124.6, 111.6, 108.2, 56.8, 56.7, 53.0, 52.8. IR (KBr, neat) 2965, 1732, 1610, 1504, 1427, 1330, 1279, 1171,

1086, 946, 845, 742 cm^{-1}; HRMS (ESI) calcd. for $C_{14}H_{15}NO_8K$ $(M + K)^+$ 364.0429, found 364.0431.

Dimethyl 2-(5-methoxy-2-nitrobenzylidene)malonate (1e′):

Yellow gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 443 mg, 75%; ^1H NMR (500 MHz, CDCl3) δ 8.24 (d, *J* = 8.5 Hz, 2 H), 6.99 (dd, *J* = 8.5 and 2.5 Hz, 1H), 6.86 (d, *J* = 2.5 Hz, 1 H), 3.89 (s, 6 H), 3.64 (s, 3 H).$^{13}C\{^1H\}$ NMR (125 MHz, $CDCl_3$) δ 165.6, 164.0, 163.8, 142.5, 140.4, 133.2, 128.3, 128.0, 115.3, 114.9, 56.4, 53.1, 52.7 IR (KBr, neat) 2854, 1734, 1642, 1555, 1432, 1350, 1215, 1161, 1076, 956, 842, 742 cm^{-1}; HRMS (ESI) calcd. for $C_{13}H_{14}NO_7$ $(M + H)^+$ 296.0765, found 296.0764.

General procedure for the synthesis of 1b-1f:

Sodium hydride (1.2 mmol, 1.2 equiv.) was added slowly to a stirred solution of trimethyl sulfoxoniumiodide (TMSOI) (1.2 mmol, 1.2 equiv.) in dry DMF (4.0 mL/ mmol) under nitrogen atmosphere at room temperature. Thereafter, the mixture is continued to stir for another 1 h. After getting a clear solution, the condensation product **1′** (1.0 mmol, 1.0 equiv.) dissolved in dry DMF (1 mL/ mmol) was added at once to the mixture. The reaction was monitored by TLC. After completion of starting material, the reaction mixture was quenched with saturated ammonium chloride and diluted with ice cold water. The organic layer was extracted with ethyl acetate and washed with brine. The combined organic layer was dried over Na_2SO_4. The solvent was evaporated under reduced pressure. Finally, the crude mixture was purified by column chromatography over a silica gel to obtain the corresponding compound **1**.

Dimethyl 2-(4-bromo-2-nitrophenyl)cyclopropane-1,1-dicarboxylate (1b):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 213 mg, 60%; ^1H NMR (500 MHz, $CDCl_3$) δ 8.17 (s, 1 H), 7.68 (d, J = 8.5 Hz, 1 H), 7.24 (d, J = 8.5 Hz, 1 H), 3.82 (d, J = 1.5 Hz, 3 H), 3.63 (t,

J = 9.0 Hz, 1 H), 3.43 (d, J = 1.5 Hz, 3 H), 2.07 (dd, J = 8.5 and 5.5 Hz, 1 H), 1.90 – 1.87 (m, 1 H). $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) δ 169.5, 167.2, 150.8, 136.4, 132.8, 130.1, 128.1, 122.2, 53.3, 52.9, 35.9, 30.4, 19.6. IR (KBr, neat) 2954, 1729, 1527, 1440, 1343, 1285, 1133, 983, 891, 756 cm^{-1}; HRMS (ESI) calcd. for $C_{13}H_{13}BrNO_6$ $(M + H)^+$ 357.9921, found 357.9920.

Dimethyl 2-(5-chloro-2-nitrophenyl)cyclopropane-1,1-dicarboxylate (1c):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 197 mg, 63%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, J = 8.8 Hz, 1 H), 7.41 (dd, J = 8.8 and 2.0 Hz, 1 H), 7.34 (d, J = 2.0 Hz, 1 H), 3.83 (s, 3 H), 3.69 (t, J = 8.8 Hz, 1 H), 3.44 (s, 3 H), 2.07 (dd, J = 8.4 and 5.6 Hz, 1 H), 1.90 (dd, J = 8.4 and 5.6 Hz, 1 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 169.5, 167.2, 148.7, 139.9, 133.2, 131.6, 129.1, 126.6, 53.4, 52.9, 35.9, 30.7, 19.8. IR (KBr, neat) 2954, 1724, 1602, 1522, 1437, 1340, 1275, 1128, 1063, 931, 881, 754 cm^{-1}; HRMS (ESI) calcd. for $C_{13}H_{12}ClNNaO_6$ $(M + Na)^+$ 336.0245, found 336.0260.

Dimethyl 2-(4,5-dimethoxy-2-nitrophenyl)cyclopropane-1,1-dicarboxylate (1d):

Yellow gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 221 mg, 65%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (s, 1 H), 6.74 (s, 1 H), 3.97 (s, 3 H), 3.95 (s, 3 H), 3.83 (s, 3 H), 3.78 – 3.72 (m, 1 H), 3.43 (s, 3 H), 2.11 (dd, *J* = 8.4 and 5.2 Hz, 1 H), 1.90 (dd, *J* = 8.4 and 5.2 Hz, 1 H).$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 169.9, 167.5, 153.0, 148.5, 142.9, 125.5, 112.7, 108.4, 56.6, 56.5, 53.2, 52.8, 36.0, 31.7, 20.2. IR (KBr, neat) 2932, 1727, 1517, 1435, 1333, 1218, 1063, 871, 794 cm^{-1}; HRMS (ESI) calcd. for $C_{15}H_{18}NO_8$ $(M + H)^+$ 340.1027, found 340.1028.

Dimethyl 2-(5-methoxy-2-nitrophenyl)cyclopropane-1,1-dicarboxylate (1e):

Colourless gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 200 mg, 65%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 8.8 Hz, 1 H), 6.88 (dd, *J* = 8.8 and 2.8 Hz, 1 H), 6.80 (d, *J* = 2.8 Hz, 1 H), 3.89 (s, 3 H), 3.83 (s, 3 H), 3.77 (t, *J* = 8.8 Hz, 1 H), 3.41 (s, 3 H), 2.10 (dd, *J* = 8.8 and 5.6 Hz, 1 H), 1.88

(dd, *J* = 8.8 and 5.6 Hz, 1 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 169.9, 167.4, 163.4, 143.3, 133.9, 127.8, 116.9, 113.0, 56.1, 53.2, 52.8, 35.9, 31.7, 19.9. IR (KBr, neat) 2987, 1714, 1605, 1517, 1437, 1345, 1280, 1136, 1038, 749 cm^{-1}; HRMS (ESI) calcd. for $C_{14}H_{19}N_2O_7$ $(M + NH_4)^+$ 327.1187, found 327.1186.

Diethyl 2-(2-nitrophenyl)cyclopropane-1,1-dicarboxylate (1f):

Colourless gum; R_f (hexane/EtOAc, 4:1) 0.45; Yield 218 mg, 71%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 8.0 Hz, 1 H), 7.55 (t, *J* = 7.6 Hz, 1 H), 7.43 (t, *J* = 7.6 Hz, 1 H), 7.35 (d, *J* = 8.0 Hz, 1 H), 4.29 – 4.22 (m, 2 H), 3.89-3.82 (m, 1 H), 3.81 – 3.71 (m, 2 H), 2.11 (dd, *J* = 8.8 and 5.2 Hz, 1 H), 1.84 (dd, *J* = 8.8 and 5.2 Hz, 1 H), 1.30 (t, *J* = 7.2 Hz, 3 H), 0.91 (t, *J* = 7.2 Hz, 3 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 166.9, 150.5, 133.4, 131.2, 131.1, 128.8, 125.1, 62.1, 61.8, 36.4, 30.6, 19.2, 14.3, 13.8. IR (KBr, neat) 2984, 1727, 1612, 1530, 1370, 1275, 1136, 1031,850, 786 cm^{-1}; HRMS (ESI) calcd. for $C_{15}H_{18}NO_6$ $(M + H)^+$ 308.1129, found 308.1128.

Experimental procedure for the synthesis of 3aa′:

To a solution of $Ni(ClO_4)_2.6H_2O$ (9 mg, 0.025 mmol) in DCM (5 mL) at room temperature was added dimethyl 2-(2-nitrophenyl)cyclopropane-1,1-dicarboxylate (**1a**) (140 mg, 0.5 mmol) and aniline (56 mg, 0.6 mmol). Then, the reaction was refluxed for 12 h. After completion of the reaction, the solvent was removed under reduced pressure. The crude was subjected to column chromatography over silica gel to give the corresponding product **3aa′** in 93% yield (172 mg).

Dimethyl 2-(2-(2-nitrophenyl)-2-(phenylamino)ethyl)malonate (3aa′):

Colourless gum; R_f (hexane/EtOAc, 4:1) 0.40; Yield 172 mg, 93%; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.4 Hz, 1 H), 7.66 (d, *J* = 7.8 Hz, 1 H), 7.57 (t, *J* = 7.8 Hz, 1 H), 7.41 (t, *J* = 7.8 Hz, 1 H), 7.09 (t, *J* = 8.4 Hz, 2 H), 6.68 (t, *J* = 7.8 Hz, 1 H), 6.45 (d, *J* = 7.8 Hz, 2 H), 5.20 (t, *J* = 6.6 Hz, 1 H), 4.43 (d, *J* = 6.6 Hz, 1 H), 3.79 (s, 3 H), 3.74 (s, 3 H), 2.52 - 2.47 (m, 1 H), 2.45 - 2.37

(m, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 170.5, 169.5, 148.9, 146.1, 139.0, 134.1, 129.6, 128.6, 128.1, 125.3, 118.5, 113.3, 53.2, 53.1, 52.7, 50.3, 36.7, IR (KBr, neat) 2953, 1750, 1729, 1605, 1520, 1350, 1277, 1155, 852, 753 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{21}N_2O_6(M + H)^+$ 373.1394, found 373.1395.

General procedure for the synthesis of 3:

To a solution of $Ni(ClO_4)_2.6H_2O$ (0.015 mmol, 0.05 equiv.) in DCM (3 mL) at room temperature was added o-*nitro* having DACs **1** (0.3 mmol, 1.0 equiv.) and primary arylamines **2** (0.36 mmol, 1.2 equiv.). Then, the reaction was refluxed for 12 h. After completion of the reaction as indicated by TLC analysis, the solvent was removed under reduced pressure and the crude was used for further reaction without any purification. In continuation, to a solution of $SnCl_2.2H_2O$ (0.6 mmol, 2.0 equiv.) in dry MeOH (3 mL) at room temperature was added the crude product isolated earlier under nitrogen atmosphere and refluxed till the starting material consumes completely. The reaction mixture was then quenched with saturated NH_4Cl solution, organic layer was extracted with ethyl acetate and washed with brine. The combined organic layer was dried over Na_2SO_4. The solvent was evaporated under reduced pressure. Finally the crude mixture was purified by column chromatography over a silica gel to obtain the corresponding compound **3**.

Dimethyl 2-((2-phenyl-2*H*-indazol-3-yl)methyl)malonate (3aa):

Orange gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 70 mg, 70%; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.5 Hz, 1 H), 7.65 (d, *J* = 8.5 Hz, 1 H), 7.53 (m, 5 H), 7.30 (t, *J* = 8.5 Hz, 1 H), 7.09 (t, *J* = 8.5 Hz, 1 H), 3.70 (d, J = 7.8 Hz, 2 H), 3.59 (d, *J* = 7.8 Hz, 1 H), 3.55 (s, 6 H).; $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) δ 168.5, 148.8, 139.9, 131.8, 129.6, 129.5, 126.9, 126.5, 122.0, 121.6, 120.0, 118.0, 52.9, 50.9, 24.7; IR (KBr, neat) 2954, 1734, 1595, 1435, 1375, 1265, 1118, 1021, 731, 696 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{19}N_2O_4$ $(M + H)^+$ 339.1339, found 339.1352.

Dimethyl 2-((2-(*p*-tolyl)-2*H*-indazol-3-yl)methyl)malonate (3ab):

Orange gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 62 mg, 59%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.5 Hz, 1 H), 7.65 (d, *J* = 8.5 Hz, 1 H), 7.42 (d, *J* = 8.4 Hz, 2 H), 7.35 (d, *J* = 8.4 Hz, 2 H), 7.31 (t, *J* = 6.8 Hz, 1 H), 7.10 (t, *J* = 6.8 Hz, 1 H), 3.69 (d, J = 7.6 Hz, 2 H), 3.61 (d, J = 7.6 Hz, 1 H), 3.57 (s, 6 H), 2.46 (s, 3 H).; ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.6, 148.7, 139.6, 137.3, 131.7, 130.1, 126.8, 126.2, 121.8, 121.5, 119.9, 117.9, 52.9, 50.9, 24.7, 21.4; IR (KBr, neat) 2957, 1734, 1520, 1435, 1378, 1245, 1161, 1043, 821, 749 cm^{-1}; HRMS (ESI) calcd. for $C_{20}H_{21}N_2O_4$ (M + H)$^+$ 353.1496, found 353.1497.

Dimethyl 2-((2-(4-ethylphenyl)-2*H*-indazol-3-yl)methyl)malonate (3ac):

Brown solid; R_f (hexane/EtOAc, 4:1) 0.50; mp 98-100 ^{o}C Yield 66 mg, 60%; ^{1}H NMR (500 MHz, CDCl3) δ 7.69 (d, *J* = 8.5 Hz, 1 H), 7.64 (d, *J* = 8.5 Hz, 1 H), 7.43 (d, *J* = 8.5 Hz, 2 H), 7.36 (d, *J* = 8.5 Hz, 2 H), 7.29 (t, *J* = 7.5 Hz, 1 H), 7.09 (t, *J* = 7.5 Hz, 1 H), 3.69 (d, *J* = 8.0 Hz, 2 H), 3.61 (t, *J* = 8.0 Hz, 1 H), 3.56 (s, 6 H), 2.76 (q, *J* = 7.5 Hz, 2 H), 1.30 (t, *J* = 7.5 Hz, 3 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.7, 148.8, 145.9, 137.5, 131.7, 129.0, 126.8, 126.3, 121.9, 121.6, 120.0, 118.0, 52.9, 51.0, 28.8, 24.7, 15.6.; IR (KBr, neat) 2957, 1732, 1625, 1520, 1435, 1380, 1225, 1153, 1016, 844, 741 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_4$(M + H)$^+$ 367.1652, found 367.1650.

Dimethyl 2-((2-(4-butylphenyl)-2*H*-indazol-3-yl)methyl)malonate (3ad):

Yellow gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 60 mg, 50%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.8 Hz, 1 H), 7.66 (d, *J* = 8.4 Hz, 1 H), 7.44 (d, *J* = 8.0 Hz, 2 H), 7.37 (d, J = 8.4 Hz, 2 H), 7.31 (t, J = 6.8 Hz, 1 H), 7.1 (t, J = 6.8 Hz, 1 H), 3.71 (d, *J* = 7.6 Hz, 2 H), 3.62 (dd, *J* = 8.4 and 6.8 Hz, 1 H), 3.58 (s, 6 H), 2.73 (t, *J* = 7.6 Hz, 2 H), 1.71 – 1.64 (m, 2 H), 1.41 (q, *J* = 14.8 and 7.2 Hz, 2 H), 0.97 (t, *J* = 7.2 Hz, 3 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.6, 148.7, 144.6,

137.5, 131.7, 129.5, 126.8, 126.2, 121.9, 121.5, 120.0, 117.9, 52.9, 50.9, 35.5, 33.6, 24.7, 22.4, 14.1.; IR (KBr, neat) 2932, 1737, 1627, 1517, 1435, 1268, 1153, 1046, 916, 734 cm^{-1}; HRMS (ESI) calcd. for $C_{23}H_{27}N_2O_4(M + H)^+$ 395.1965, found 395.1979.

Dimethyl 2-((2-(4-(*tert*-butyl)phenyl)-2*H*-indazol-3-yl)methyl)malonate (3ae):

Orange gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 74 mg, 63%; ^1H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 1 H), 7.66 (d, *J* = 8.4 Hz, 1 H), 7.57 (d, *J* = 8.4 Hz, 2 H), 7.46 (d, *J* = 8.4 Hz, 2 H), 7.32 (t, *J* = 6.8 Hz, 1 H), 7.11 (t, *J* = 6.8 Hz, 1 H), 3.72 (d, *J* = 7.2 Hz, 2 H), 3.68-3.64 (m, 1 H), 3.58 (s, 6 H), 1.40 (s, 9 H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 152.8, 148.8, 137.3, 131.7, 126.8, 126.6, 126.0, 122.0, 121.5, 120.0, 117.9, 53.0, 50.9, 35.1, 31.5, 24.7.; IR (KBr, neat) 2952, 1734, 1623, 1520, 1435, 1378, 1220, 1153, 1106, 841, 746 cm^{-1}; HRMS (ESI) calcd. for $C_{23}H_{27}N_2O_4(M + H)^+$ 395.1965, found 395.1968.

Dimethyl 2-((2-(4-methoxyphenyl)-2*H*-indazol-3-yl)methyl)malonate (3af):

Orange Solid; R_f (hexane/EtOAc, 4:1) 0.40; mp 97-99 ºC Yield 66 mg, 60%; ^1H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 1 H), 7.65 (d, *J* = 8.4 Hz, 1 H), 7.46 (d, *J* = 8.8 Hz, 2 H), 7.30 (dd, *J* = 15.6 and 6.8 Hz, 1 H), 7.12 (t, *J* = 7.2 Hz, 1 H), 7.06 (d, *J* = 8.8 Hz, 2 H), 3.91 (s, 3 H), 3.68 (d, *J* = 6.8 Hz, 2 H), 3.62 (t, *J* = 6.8 Hz, 1 H), 3.59 (s, 6 H).; $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 160.4, 148.7, 132.8, 131.8, 127.7, 126.8, 121.9, 121.5, 120.0, 117.9, 114.8, 55.8, 53.0, 50.1, 24.7.; IR (KBr, neat) 2957, 1732, 1620, 1510, 1437, 1383, 1245, 1023, 836, 749 cm^{-1}; HRMS (ESI) calcd. for $C_{20}H_{21}N_2O_5$ $(M + H)^+$ 369.1445, found 369.1441.

Dimethyl 2-((2-(4-(methylthio)phenyl)-2*H*-indazol-3-yl)methyl)malonate (3ag):

Brown solid; R_f (hexane/EtOAc, 4:1) 0.40; mp 85-87 ºC Yield 82 mg, 70%; ^1H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.8 Hz, 1 H), 7.65 (d, *J* = 8.4 Hz, 1 H), 7.47 (d, *J* = 8.8 Hz, 2 H), 7.41 (d, *J* = 8.4 Hz, 2 H), 7.32 (t, *J* = 7.2 Hz, 1 H), 7.11 (t, *J* = 7.2 Hz, 1 H), 3.70 (d, *J* = 6.8 Hz, 2 H), 3.64

(dd, *J* = 6.8 and 2.4 Hz, 1 H), 3.59 (s, 6 H), 2.57 (s, 3 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 148.9, 140.9, 136.7, 131.8, 127.0, 126.9, 126.7, 122.0, 121.6, 120.0, 118.0, 53.0, 50.9, 24.7, 15.8.; IR (KBr, neat) 2952, 1734, 1520, 1435, 1378, 1223, 1151, 1093, 834, 744 cm^{-1}; HRMS (ESI) calcd. for $C_{20}H_{21}N_2O_4S$ $(M + H)^+$ 385.1217, found 385.1219.

Dimethyl 2-((2-(3,4-dimethylphenyl)-2*H*-indazol-3-yl)methyl)malonate (3ah):

Orange gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 66 mg, 60%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.4 Hz, 1 H), 7.65 (d, *J* = 8.4 Hz, 1 H), 7.34 – 7.24 (m, 4 H), 7.14 – 7.08 (t, *J* = 7.2 Hz, 1 H), 3.71 (d, *J* = 7.2 Hz, 2 H), 3.63 (dd, *J* = 7.2 and 2.0 Hz, 1 H), 3.59 (s, 6 H), 2.37 (d, *J* = 4.4 Hz, 6 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 148.7, 138.3, 137.6, 131.6, 130.5, 127.4, 126.8, 123.5, 121.8, 121.5, 120.0, 118.0, 52.9, 50.9, 24.7, 20.0, 19.8. IR (KBr, neat) 2952, 1732, 1627, 1505, 1435, 1380, 1210, 1153, 1062, 903, 824, 744 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_4$ $(M + H)^+$ 367.1652, found 367.1653.

Dimethyl 2-((2-(2,4-dimethoxyphenyl)-2*H*-indazol-3-yl)methyl)malonate (3ai):

Orange gum; R_f (hexane/EtOAc, 7:3) 0.60; Yield 67 mg, 56%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 (d, J = 8.4 Hz, 1 H), 7.66 (d, J = 8.4 Hz, 1 H), 7.35 (d, J = 8.4 Hz, 1 H), 7.32-7.29 (m, 1 H), 7.09 (t, J = 8.4 Hz, 1 H), 6.66 – 6.62 (m, 2 H), 3.91 (s, 3 H), 3.77 (s, 3 H), 3.65 – 3.57 (m, 7 H), 3.54 (d, J = 1.0 Hz, 2 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 168.9, 162.1, 155.6, 149.0, 133.7, 130.0, 126.6, 121.8, 121.5, 121.0, 120.2, 118.0, 105.0, 99.7, 56.1, 55.9, 52.9, 50.8, 24.7.; IR (KBr, neat) 2952, 1732, 1612, 1517, 1435, 1375, 1243, 1158, 1023, 918, 836, 744 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_6(M + H)^+$ 399.1551, found 399.1548.

Dimethyl 2-((2-(3,4-dimethoxyphenyl)-2*H*-indazol-3-yl)methyl)malonate (3aj):

Orange gum; R_f (hexane/EtOAc, 7:3) 0.60; Yield 67 mg, 66%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.4 Hz, 1 H), 7.66 (d, *J* = 8.4 Hz, 1 H), 7.33 (t, *J* = 7.6 Hz, 1 H), 7.13 – 7.09 (m, 3 H), 7.02

– 6.99 (m, 1 H), 3.99 (s, 3 H), 3.95 (s, 3 H), 3.71-3.69 (m, 2 H), 3.66-3.62 (m, 1 H), 3.60 (s, 6 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 150.1, 149.7, 148.7, 132.9, 131.9, 126.9, 122.0, 121.5, 120.0, 118.7, 117.9, 111.2, 110.3, 56.5, 56.4, 53.0, 50.9, 24.8; IR (KBr, neat) 2837, 1734, 1627, 1517, 1437, 1375, 1235, 1026, 898, 746 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_6(M + H)^+$ 399.1551, found 399.1554.

Dimethyl 2-((2-(3,5-dimethoxyphenyl)-2*H*-indazol-3-yl)methyl)malonate (3ak):

Orange gum; R_f (hexane/EtOAc, 7:3) 0.60; Yield 62 mg, 52%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 1 H), 7.65 (d, *J* = 8.4 Hz, 1 H), 7.32 (t, *J* = 7.2 Hz, 1 H), 7.10 (t, *J* = 7.2 Hz, 1 H), 6.70 (d, *J* = 2.4 Hz, 2 H), 6.61 (t, *J* = 2.4 Hz, 1 H), 3.86 (s, 6 H), 3.73 (d, *J* = 8.4 Hz, 2 H), 3.68 (dd, *J* = 8.4 and 6.8 Hz, 1 H), 3.60 (s, 6 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 161.3, 148.7, 141.3, 131.7, 127.0, 122.0, 121.6, 120.0, 118.0, 104.9, 101.9, 55.9, 53.0, 50.9, 24.8.; IR (KBr, neat) 2954, 1732, 1612, 1432, 1343, 1205, 1153, 1063, 839, 749 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_6(M + H)^+$ 399.1551, found 399.1548.

Dimethyl 2-((2-(benzo[*d*][1,3]dioxol-5-yl)-2*H*-indazol-3-yl)methyl)malonate (3al):

Brown solid; R_f (hexane/EtOAc, 7:3) 0.60; mp 93-95 ^{o}C Yield 57 mg, 50%; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.5 Hz, 1 H), 7.62 (d, J = 8.5 Hz, 1 H), 7.29 (t, *J* = 8.5 Hz, 1 H), 7.08 (t, *J* = 7.5 Hz, 1 H), 6.98 (t, *J* = 7.5 Hz, 2 H), 6.92 (d, *J* = 8.5 Hz, 1 H), 6.09 (s, 2 H), 3.68 – 3.62 (m, 3 H), 3.58 (s, 6 H). $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) δ 168.6, 148.7, 148.5, 140.1, 133.7, 131.9, 127.0, 122.0, 121.4, 120.3, 120.0, 118.0, 108.5, 107.9, 102.3, 53.0, 50.9, 24.7.; IR (KBr, neat) 2902, 1729, 1625, 1500, 1435, 1343, 1213, 1038, 931, 744, 639 cm^{-1}; HRMS (ESI) calcd. for $C_{20}H_{19}N_2O_6(M + H)^+$ 383.1238, found 383.1233.

Dimethyl 2-((2-(4-chlorophenyl)-2*H*-indazol-3-yl)methyl)malonate (3am):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 67 mg, 60%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 1 H), 7.65 (d, *J* = 8.4 Hz, 1 H), 7.55 (d, *J* = 8.8 Hz, 2 H), 7.51 (d, *J* = 8.8 Hz, 2 H), 7.33 (t, *J* = 7.2 Hz, 1 H), 7.12 (t, *J* = 7.2 Hz, 1 H), 3.70 (d, *J* = 6.8 Hz, 2 H), 3.66-.362 (m, 1 H), 3.60 (s, 6 H). ^{13}C{^{1}H} NMR (100 MHz, CDCl3) δ 168.5, 149.0, 138.4, 135.5, 131.9, 129.8, 127.8, 127.2, 122.2, 121.6, 119.9, 118.0, 53.0, 51.9, 24.7.; IR (KBr, neat) 2952, 1737, 1625, 1500, 1435, 1378, 1275, 1153, 1091, 839, 749 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{18}ClN_2O_4(M + H)^+$ 373.0950, found 373.0955.

Dimethyl 2-((2-(4-bromophenyl)-2*H*-indazol-3-yl)methyl)malonate (3an):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 71 mg, 57%; ^{1}H NMR (500 MHz, $CDCl_3$) 7.68 (d, *J* = 8.0 Hz, 3 H), 7.62 (d, *J* = 8.5 Hz, 1 H), 7.43 (d, *J* = 8.5 Hz, 2 H), 7.30 (t, *J* = 7.5 Hz, 1 H), 7.09 (t, *J* = 7.5 Hz, 1 H), 3.68 (d, *J* = 8.0 Hz, 2 H), 3.62 (dd, *J* = 6.5 and 8.0 Hz 1 H), 3.57 (s, 6 H). ^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) δ 168.4, 149.0, 138.9, 132.8, 131.8, 128.0, 127.2, 123.6, 122.2, 121.6, 120.0, 118.0, 53.0, 50.9, 24.7.; IR (KBr, neat) 2952, 1740, 1625, 1495, 1380, 1223, 1181, 1071, 834, 744 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{18}BrN_2O_4(M + H)^+$ 417.0444, found 417.0442.

Dimethyl 2-((2-(4-fluorophenyl)-2*H*-indazol-3-yl)methyl)malonate (3ao):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 62 mg, 58%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 1 H), 7.66 (d, *J* = 8.4 Hz, 1 H), 7.57 – 7.53 (m, 2 H), 7.34 (t, *J* = 7.2 Hz, 1 H), 7.30 – 7.25 m, 2 H), 7.13 (t, *J* = 7.2 Hz, 1 H), 3.70 – 3.68 (m, 2 H), 3.66 – 3.62 (m, 1 H), 3.61 (s, 6 H). ^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) δ 168.5, 163.0 (d, *J* = 249.0 Hz), 148.8, 135.9 (d, *J* = 3.2 Hz) , 131.9, 128.4 (d, *J* = 8.8 Hz), 127.1, 122.2, 121.5, 119.9, 118.0, 116.6 (d, *J* = 23.5 Hz), 53.0, 50.8, 24.6. ^{19}F NMR (471 MHz, C_6F_6/$CDCl_3$) δ 50.6; IR (KBr, neat) 2954, 1740, 1627, 1515, 1437, 1223, 1153, 1091, 846, 749 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{18}FN_2O_4$ $(M + H)^+$ 357.1245, found 357.1254.

Dimethyl 2-((2-(3-fluorophenyl)-2*H*-indazol-3-yl)methyl)malonate (3ap):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 62 mg, 58%; ^{1}H NMR (400 MHz, CDCl3) δ 7.71 (d, *J* = 8.4 Hz, 1 H), 7.66 (d, *J* = 8.4 Hz, 1 H), 7.59 – 7.51 (m, 1 H), 7.39 – 7.31 (m, 3 H), 7.29 – 7.23 (m, 1 H), 7.15 (t, *J* = 6.8 Hz, 1 H), 3.73 (d, *J* = 7.2 Hz, 2 H), 3.66 (dd, *J* = 8.4 and 6.8 Hz, 1 H), 3.60 (s, 6 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.5, 163.0 (d, *J* = 247.8 Hz), 149.0, 141.2(d, *J* = 9.8 Hz), 131.9, 130.9 (d, *J* = 8.9 Hz), 127.3, 122.3, 122.2 (d, *J* = 3.3 Hz), 121.7, 120.0, 118.1, 116.7 (d, *J* = 20.8 Hz), 114.4 (d, *J* = 24.1 Hz), 53.0, 50.9, 24.7. ^{19}F NMR (377 MHz, C_6F_6/$CDCl_3$) δ 51.5.; IR (KBr, neat) 2952, 1729, 1607, 1497, 1435, 1345, 1268, 1188, 1023, 896, 741 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{18}FN_2O_4(M + H)^+$ 357.1245, found 357.1247.

Dimethyl 2-((2-(3-(trifluoromethyl)phenyl)-2*H*-indazol-3-yl)methyl)malonate (3aq):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.45; Yield 55 mg, 45%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (s, 1 H), 7.81 (t, *J* = 8.4 Hz, 2 H), 7.74 (dd, *J* = 7.2 and 6.8 Hz, 2 H), 7.68 (d, *J* = 8.4 Hz, 1 H), 7.36 (t, *J* = 6.8 Hz, 1 H), 7.15 (t, *J* = 7.2 Hz, 1 H), 3.76 – 3.65 (m, 3 H), 3.61 (s, 6 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.5, 149.3, 140.5, 132.3 (q, *J* = 35 Hz), 130.3, 129.8, 127.5, 126.3 (q, *J* = 3.7 Hz), 125.0, 123.8 (q, *J* = 3.7 Hz), 122.5, 122.2, 121.7, 120.0, 118.1, 53.1, 51.0, 24.8. ^{19}F NMR (471 MHz, C_6F_6/$CDCl_3$) δ 99.1.; IR (KBr, neat) 2954, 1734, 1612, 1530, 1437, 1330, 1278, 1128, 1071, 906, 751 cm^{-1}; HRMS (ESI) calcd. for $C_{20}H_{18}F_3N_2O_4(M + H)^+$ 407.1213, found 407.1219.

Dimethyl 2-((2-(4-(methoxycarbonyl)phenyl)-2*H*-indazol-3-yl)methyl)malonate (3ar):

Orange gum; R_f (hexane/EtOAc, 1:4) 0.40; Yield 93 mg, 78%; ^{1}H NMR (400 MHz, $CDCl_3$) 8.25 (d, *J* = 8.4 Hz, 2 H), 7.72 (d, *J* = 8.4 Hz, 1 H), 7.69-7.64 (m, 3 H), 7.33 (t, *J* = 7.6 Hz, 1 H), 7.12 (t, *J* = 7.6 Hz, 1 H), 3.98 (s, 3 H), 3.74 (d, *J* = 8.0 Hz, 2 H), 3.62 (t, *J* = 8.0 Hz, 1 H), 3.58 (s, 6 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.4, 166.3, 149.2, 143.6, 131.9, 131.1, 131.0, 127.4, 126.3,

122.4, 121.9, 120.0, 118.1, 53.0, 52.7, 50.9, 24.8; IR (KBr, neat) 2957, 1729, 1605, 1517, 1437, 1373, 1275, 1108, 866, 750 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{21}N_2O_6(M + H)^+$ 397.1394, found 397.1409.

Dimethyl 2-((6-bromo-2-phenyl-2*H*-indazol-3-yl)methyl)malonate (3ba):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 75 mg, 60%; ^1H NMR (400 MHz, CDCl3) δ 7.89 (s, 1 H), 7.58 – 7.51 (m, 6 H), 7.18 (d, *J* = 8.0 Hz, 1 H), 3.67 (d, *J* = 8.0 Hz, 2 H), 3.58 (s, 6 H), 3.54 (t, *J* = 8.0 Hz, 1 H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 149.4, 139.5, 132.6, 129.9, 129.8, 126.4, 125.9, 121.6, 121.1, 120.4, 120.2, 53.1, 50.8, 24.6. IR (KBr, neat) 2954, 1734, 1622, 1502, 1435, 1373, 1258, 1181, 1036, 918, 764, 696 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{18}BrN_2O_4$ $((M+2) + H)^+$ 419.0444, found 419.0427.

Dimethyl 2-((5-chloro-2-phenyl-2*H*-indazol-3-yl)methyl)malonate (3ca):

Orange gum; R_f (hexane/EtOAc, 9:1) 0.50; Yield 61 mg, 55%; ^1H NMR (400 MHz, CDCl3) δ 7.65 (d, *J* = 8.8 Hz, 2 H), 7.59 – 7.51 (m, 5 H), 7.27 – 7.23 (m, 1 H), 3.65 (d, *J* = 8.0 Hz, 2 H), 3.60 (s, 6 H), 3.55 (t, *J* = 8.0 Hz, 1 H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.4, 147.2, 139.6, 131.7, 129.8, 129.7, 128.4, 127.7, 126.4, 122.0, 119.7, 118.8, 53.1, 50.9, 24.6. IR (KBr, neat) 2952, 1734, 1600, 1505, 1437, 1340, 1268, 1156, 1043, 916, 801, 766 cm^{-1}; HRMS (ESI) calcd. for $C_{19}H_{18}ClN_2O_4$ $(M + H)^+$ 373.0950, found 373.0946.

Dimethyl 2-((5,6-dimethoxy-2-phenyl-2*H*-indazol-3-yl)methyl)malonate (3da):

Brown gum; R_f (hexane/EtOAc, 7:3) 0.40; Yield 30 mg, 25%; ^1H NMR (400 MHz, $CDCl_3$) δ 7.58 – 7.49 (m, 5 H), 6.98 (s, 1 H), 6.85 (s, 1 H), 3.97 (d, *J* = 2.0 Hz, 6 H), 3.65 (d, *J* = 8.0 Hz, 2 H), 3.59 (s, 6 H), 3.52 (t, *J* = 8.0 Hz, 1 H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.8, 152.2, 148.2, 145.6, 140.1, 130.5, 129.6, 129.2, 126.4, 116.3, 97.0, 95.9, 56.3, 56.1, 53.0, 50.9, 24.7. IR (KBr,

neat) 2929, 1732, 1596, 1510, 1437, 1330, 1218, 1166, 1013, 769 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_6$ $(M + H)^+$ 399.1551, found 399.1552.

Dimethyl 2-((5-methoxy-2-(4-methoxyphenyl)-2*H*-indazol-3-yl)methyl)malonate (3ef):

Colourless liquid; R_f (hexane/EtOAc, 7:3) 0.45; Yield 36 mg, 30%; ^1H NMR (500 MHz, $CDCl_3$) δ 7.59 (d, *J* = 9.0 Hz, 1 H), 7.42 (d, *J* = 8.5 Hz, 2 H), 7.04 (d, *J* = 8.5 Hz, 2 H), 7.01 (dd, *J* = 9.0 and 2.0 Hz, 1 H), 6.82 (s, 1 H), 3.89 (s, 3 H), 3.87 (s, 3 H), 3.61 (d, *J* = 7.5 Hz, 2 H), 3.58 (s, 6 H), 3.53 (t, *J* = 7.5 Hz, 1 H). $^{13}C\{^1H\}$ NMR (125 MHz, $CDCl_3$) δ 168.8, 160.3, 155.2, 145.5, 132.9, 130.6, 127.7, 121.9, 121.4, 119.3, 114.7, 96.1, 55.8, 55.7, 53.0, 50.8, 24.7. IR (KBr, neat) 2942, 1755, 1737, 1596, 1581, 1436, 1330, 1216, 1024, 842, 769 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_6$ $(M + H)^+$ 399.1551, found 399.1548.

Diethyl 2-((2-phenyl-2*H*-indazol-3-yl)methyl)malonate (3fa):

Colourless gum; R_f (hexane/EtOAc, 4:1) 0.50; Yield 55 mg, 50%; ^1H NMR (400 MHz, $CDCl_3$) δ 7.69 (dd, *J* = 13.6 and 8.8 Hz, 2 H), 7.59 – 7.52 (m, 5 H), 7.31 (t, *J* = 7.2 Hz, 1 H), 7.10 (t, *J* = 7.2 Hz, 1 H), 4.06 – 3.96 (m, 4 H), 3.70 (d, *J* = 8.0 Hz, 2 H), 3.55 (t, *J* = 8.0 Hz, 1 H), 1.08 (t, *J* = 7.2 Hz, 6 H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.3, 148.9, 140.0, 132.0, 129.7, 129.5, 127.0, 126.5, 121.9, 121.7, 120.2, 118.0, 62.0, 51.1, 24.6, 14.0. IR (KBr, neat) 2984, 1729, 1597, 1502, 1455, 1370, 1273, 1156, 1028, 856, 746 cm^{-1}; HRMS (ESI) calcd. for $C_{21}H_{23}N_2O_4$ $(M + H)^+$ 367.1652, found 367.1654.

Experimental procedure for the synthesis of 4 and 5:

To a stirred solution of LiCl (65 mg, 1.5 mmol) in DMSO (2 mL) and H_2O (10 µL) at room temperature was added compound **3aa** (100 mg, 0.3 mmol) under nitrogen atmosphere. Then, the reaction was refluxed for 10 h. After completion of starting material, the reaction was cooled to room temperature; diluted with cold water and then extracted with DCM (3x 20 mL). The

combined organic layers were dried over Na_2SO_4 and concentrated in rotary evaporator. The crude was subjected to column chromatography over silica gel to give the corresponding products **4** and **5** in 60% and 30% yield respectively.

Methyl 3-(2-phenyl-2*H*-indazol-3-yl)propanoate (4):

Colourless gum; R_f (hexane/EtOAc, 4:1) 0.60; Yield 51 mg, 60%; ^{1}H NMR (400 MHz, CDCl3) δ 7.72 (dd, *J* = 17.6 and 8.8 Hz, 2 H), 7.59 – 7.51 (m, 5 H), 7.34 (t, *J* = 8.0 Hz, 1 H), 7.2 (t, *J* = 8.0 Hz, 1 H), 3.62 (s, 3 H), 3.42 (t, *J* = 8.0 Hz, 2 H), 2.64 (t, *J* = 8.0 Hz, 2 H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 172.5, 148.9, 140.1, 134.5, 129.6, 129.4, 127.0, 126.4, 121.7, 121.2, 120.1, 118.0, 52.1, 33.5, 21.0. IR (KBr, neat) 2952, 1732, 1597, 1437, 1373, 1198, 1073, 916, 744 cm^{-1}; HRMS (ESI) calcd. for $C_{17}H_{17}N_2O_2$ $(M + H)^+$ 281.1285, found 281.1284.

Experimental procedure for the synthesis of 5 from 4:

To a stirred solution of compound **4** (84 mg, 0.3 mmol) in THF (5 mL) was added a solution of $LiOH.H_2O$ (72 mg, 3.0 mmol) in MeOH and H_2O (4:1, 5 mL) and the resulting mixture was allowed to stir at room temperature for overnight. After complete consumption of starting material, the reaction mixture was quenched with 1N HCl and pH 1-2 was maintained, and then organic layer was extracted with DCM. Thereafter, the organic layer was washed brine solution 2-3 times. The combined organic layers were dried over Na_2SO_4 and concentrated in rotary evaporator. The crude was subjected to column chromatography over silica gel to obtain the corresponding product **5** in 90% yield.

3-(2-Phenyl-2*H*-indazol-3-yl)propanoic acid (5):

White solid; R_f (EtOAc, 100%) 0.80; mp 187-18888 ^{o}C Yield 24 mg, 30%; ^{1}H NMR (400 MHz, DMSO-d_6) δ 12.23 (bs, 1 H), 7.82 (d, *J* = 8.4 Hz, 1 H), 7.65 – 7.56 (m, 6 H), 7.30 (t, *J* = 8.0 Hz, 1 H), 7.07 (t, *J* = 8.0 Hz, 1 H), 3.30 (t, *J* = 7.6 Hz, 2 H), 2.57 (t, *J* = 7.6 Hz, 2 H). ^{13}C{^{1}H} NMR (100

MHz, DMSO-d_6) δ 173.5, 148.4, 140.1, 135.4, 129.8, 129.5, 126.9, 126.6, 121.2, 121.1, 117.6, 33.2, 21.0. IR (KBr, neat) 3319, 2949, 2830, 1667, 1457, 1250, 1021, 819, 759 cm^{-1}; HRMS (ESI) calcd. for $C_{16}H_{15}N_2O_2$ $(M + H)^+$ 267.1128, found 267.1116.

Experimental procedure for the synthesis of 6:

To a stirred solution of LAH (45 mg, 1.2 mmol) in THF (5 mL) kept at 0 °C, compound **4** (84 mg, 0.3 mmol) was added dropwise. The reaction mixture was slowly brought to room temperature and allowed to stir for 4 h. After complete consumption of starting material, the reaction mixture was diluted with EtOAc and washed with saturated NH_4Cl solution. The organic layer was extracted, dried over Na_2SO_4 and concentrated in rotary evaporator. The crude was subjected to column chromatography over silica gel to obtain the corresponding product **6** in 82% yield.

3-(2-Phenyl-2*H*-indazol-3-yl)propan-1-ol (6):

Colourless gum; R_f (hexane/EtOAc, 1:1) 0.40; Yield 62 mg, 82%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73-7.68 (m, 2 H), 7.52-7.50 (m, 5 H), 7.34 (t, *J* = 7.6 Hz, 1 H), 7.09 (t, *J* = 7.6 Hz, 1 H), 3.56-3.53 (m, 2 H), 3.20-3.12 (m, 2 H), 2.02 (bs, 1 H), 1.89 – 1.80 (m, 2 H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 148.8, 140.1, 136.4, 129.4, 129.2, 127.0, 126.4, 121.3, 120.3, 117.8, 61.6, 32.2, 21.8. IR (KBr, neat) 3069, 2937, 1627, 1600, 1505, 1457, 1375, 1280, 1181, 1066, 936, 744 cm^{-1}; HRMS (ESI) calcd. for $C_{16}H_{17}N_2O$ $(M + H)^+$ 253.1335, found 253.1336.

Experimental procedure for the synthesis of 7:

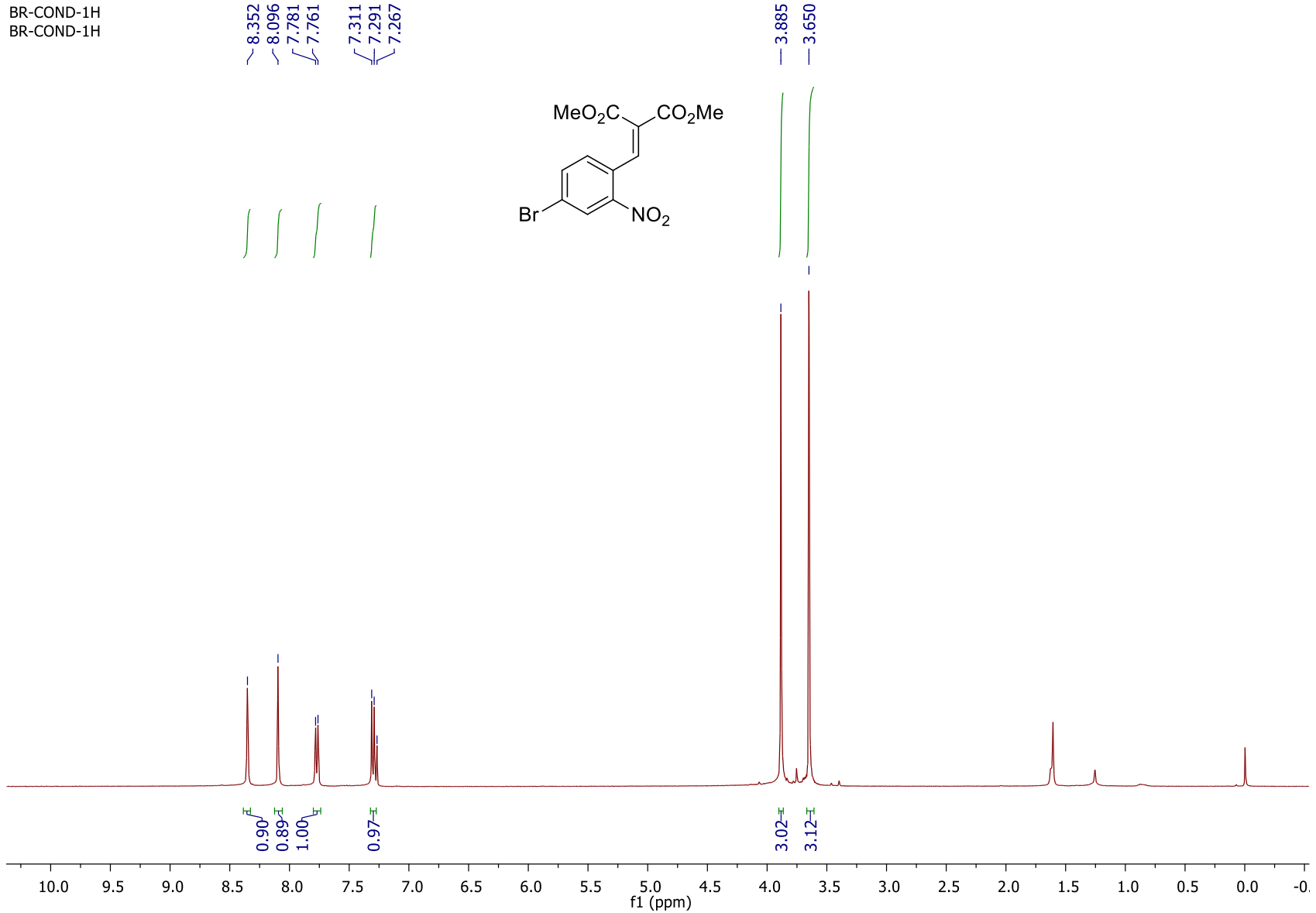
Compound **7** was prepared as per literature,[4] to a stirred solution of compound **5** (45 mg, 0.3 mmol), DIPEA (45 mg, 0.66 mmol) in DCM (5 mL), NosylOXY (45 mg, 0.3 mmol) was added. The reaction mixture was stirred for 15 min followed by addition of aniline (84 mg, 0.3 mmol) dropwise. Stirring of the reaction mixture was continued till 6 h. After completion of the reaction, the reaction mixture was diluted with 50 mL of ethyl acetate; the organic phase was washed with

1N HCl (3 × 10 mL) and saturated $NaHCO_3$ (3 × 10 mL). The organic layer was extracted, dried over Na_2SO_4 and concentrated in rotary evaporator. The crude was subjected to column chromatography over silica gel to obtain the corresponding product **7** in 50% yield.

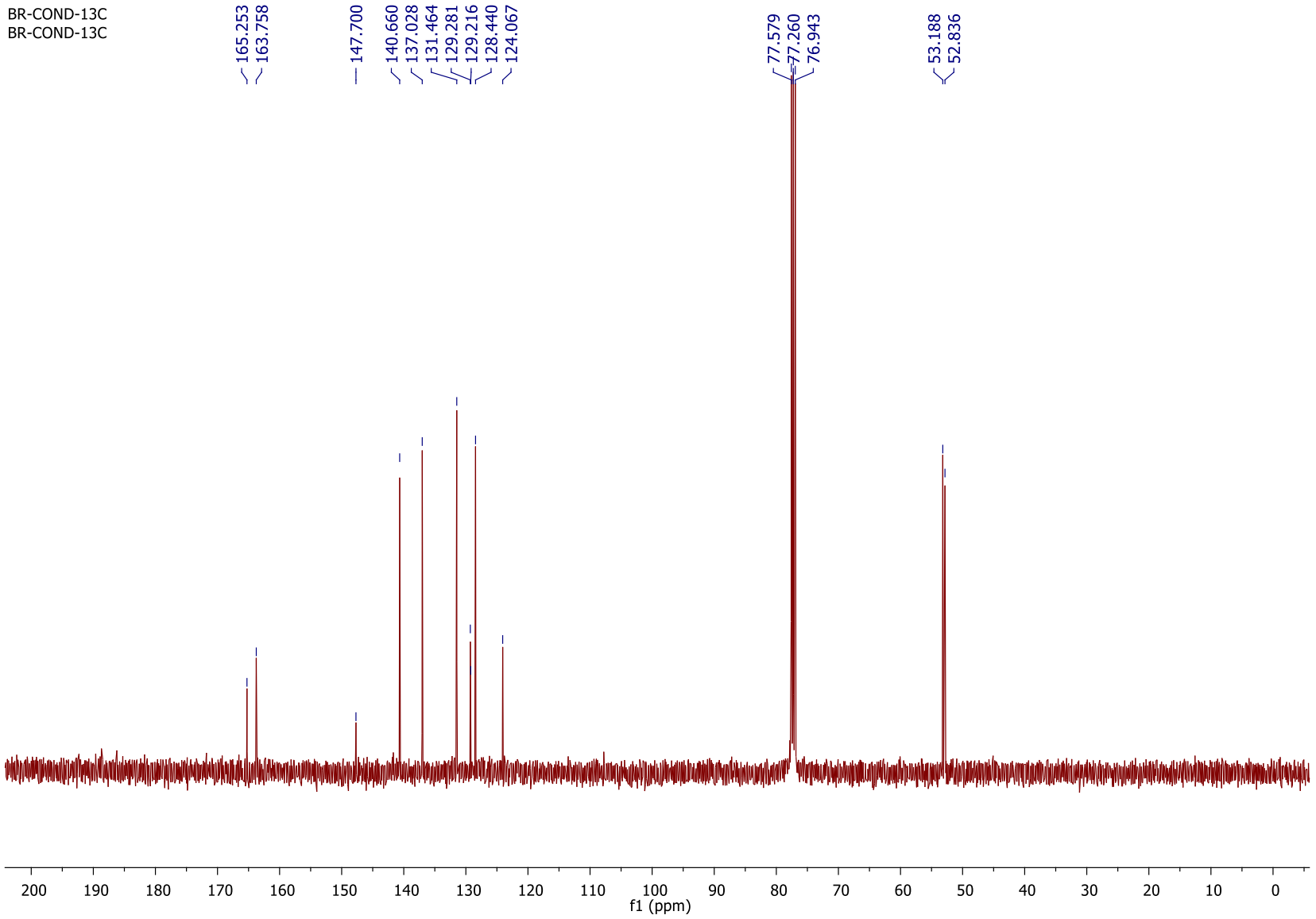
***N*-phenyl-3-(2-phenyl-2*H*-indazol-3-yl)propanamide (7):**

Orange gum; R*f* (hexane/EtOAc, 2:3) 0.40; mp 185-187 ^oC Yield 52 mg, 50%; ^1H NMR (500 MHz, $CDCl_3$) δ 7.70-7.65 (m, 2 H), 7.42 – 7.31 (m, 7 H), 7.27 – 7.23 (m, 3 H), 7.10 – 7.05 (m, 2 H), 3.46 – 3.36 (m, 2 H), 2.54 – 2.43 (m, 2 H). $^{13}C\{^1H\}$ NMR (125 MHz, $CDCl_3$) δ 169.4, 148.9, 139.7, 138.0, 135.5, 129.6, 129.4, 129.1, 127.3, 126.2, 124.5, 121.8, 121.2, 120.4, 120.1, 117.7, 36.6, 21.0. IR (KBr, neat) 3193, 2902, 1684, 1598, 1499, 1441, 1378, 1249, 1046, 751, 695 cm^{-1}; HRMS (ESI) calcd. for $C_{22}H_{20}N_3O$ $(M + H)^+$ 342.1601, found 342.1596.

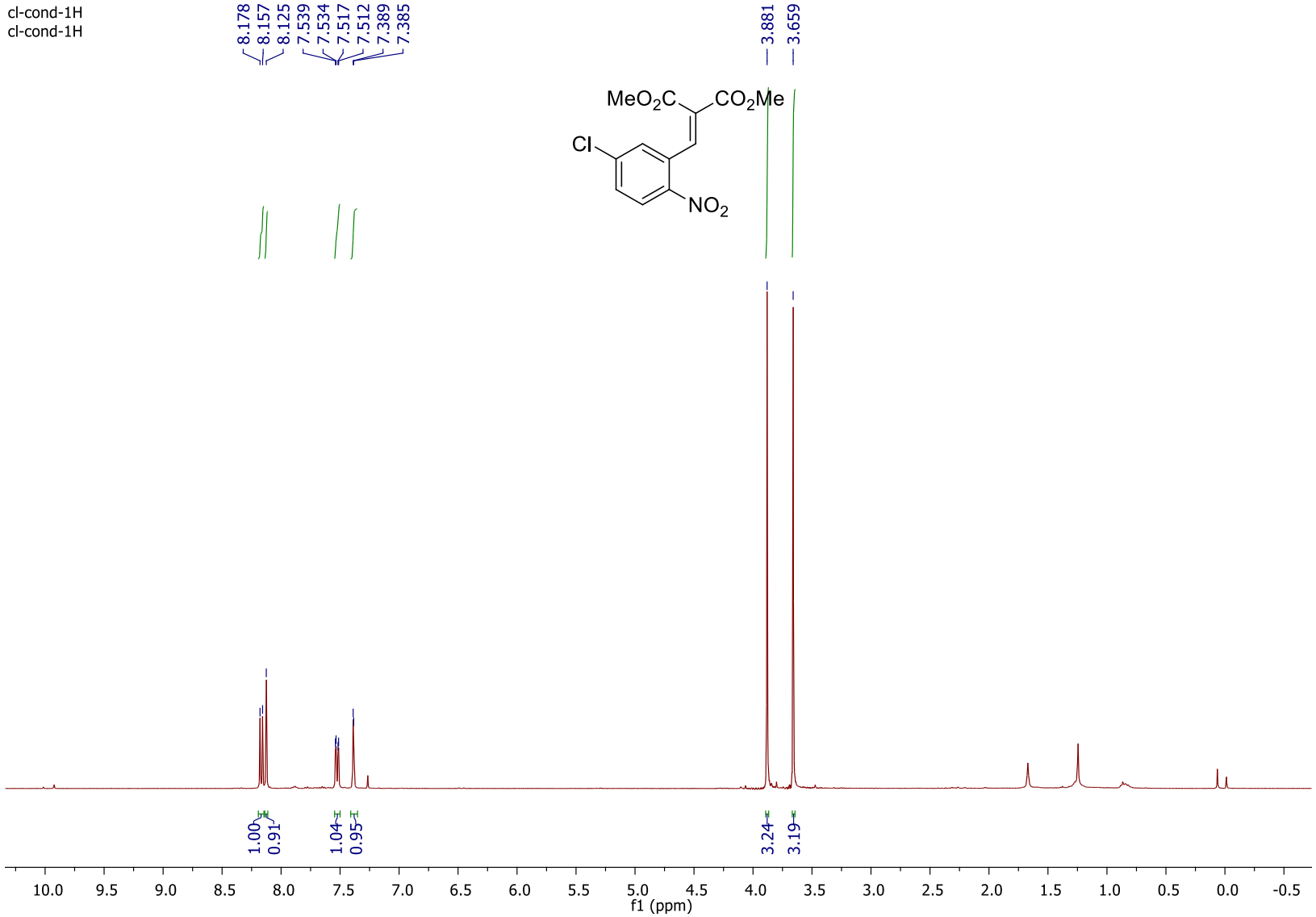
^{1}H spectrum of compound **1b′** (400 MHz, $CDCl_3$)



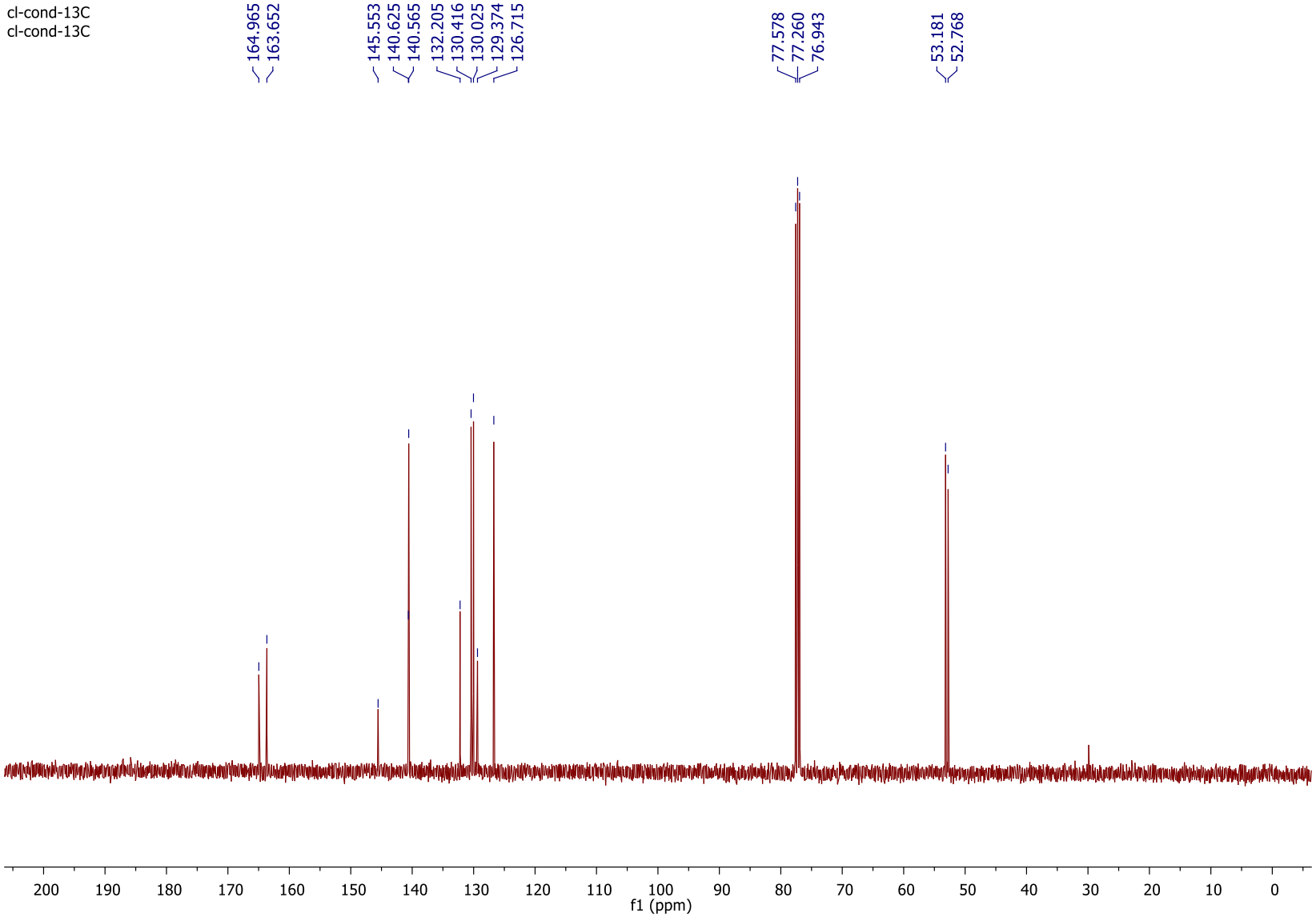
^{13}C spectrum of compound **1b′** (100 MHz, $CDCl_3$)



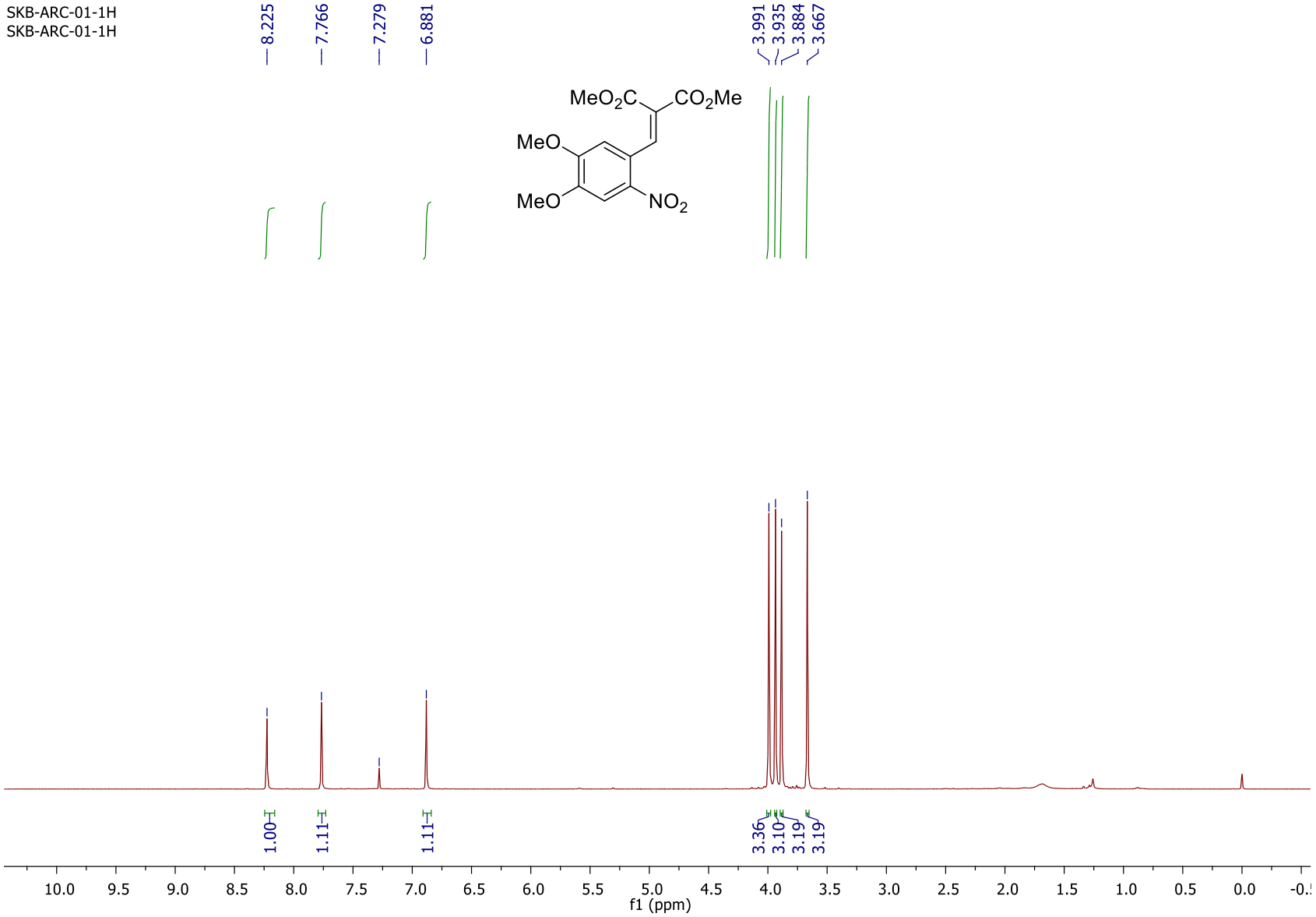
^{1}H spectrum of compound **1c′** (400 MHz, $CDCl_3$)



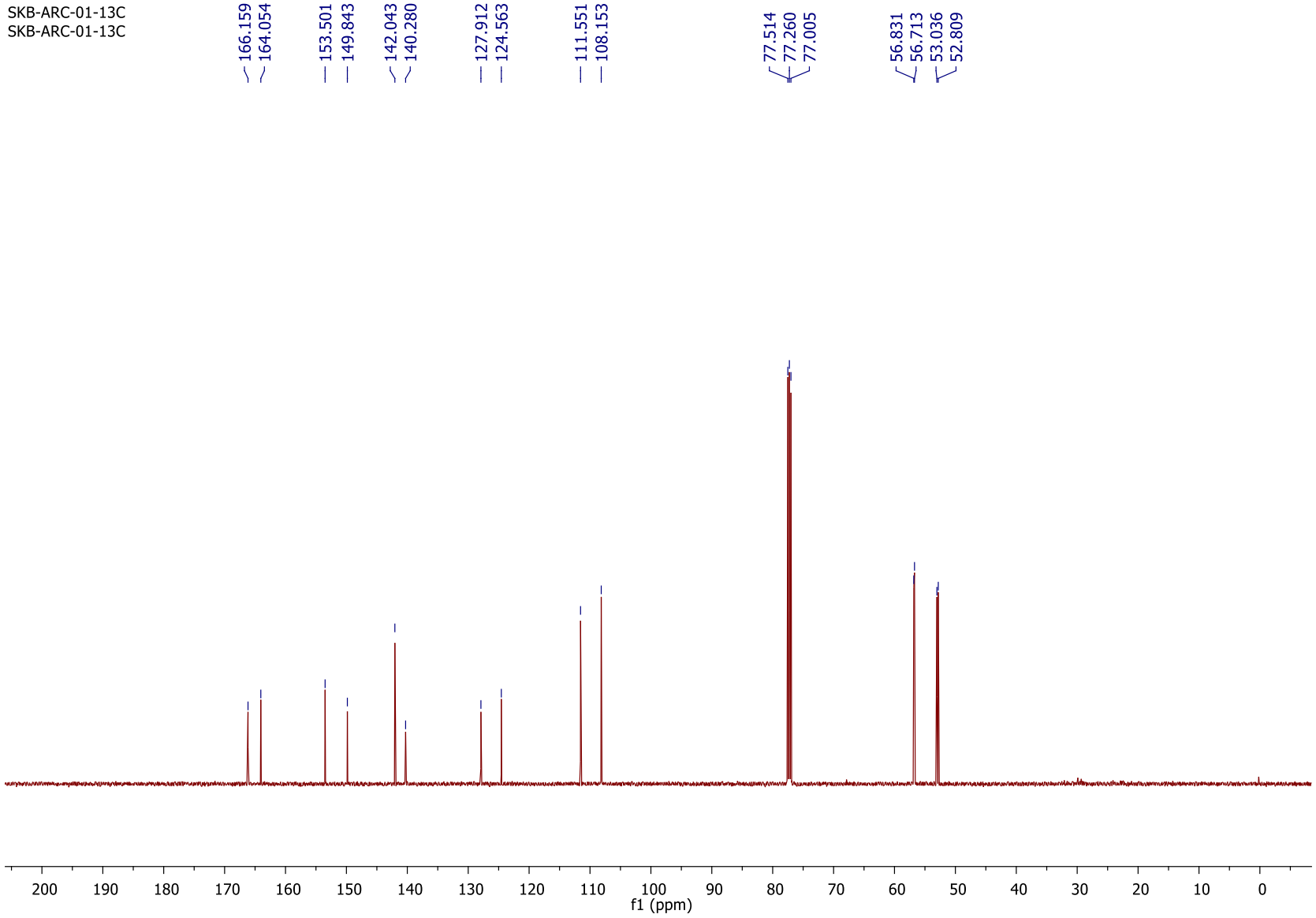
^{13}C spectrum of compound **1c′** (100 MHz, $CDCl_3$)



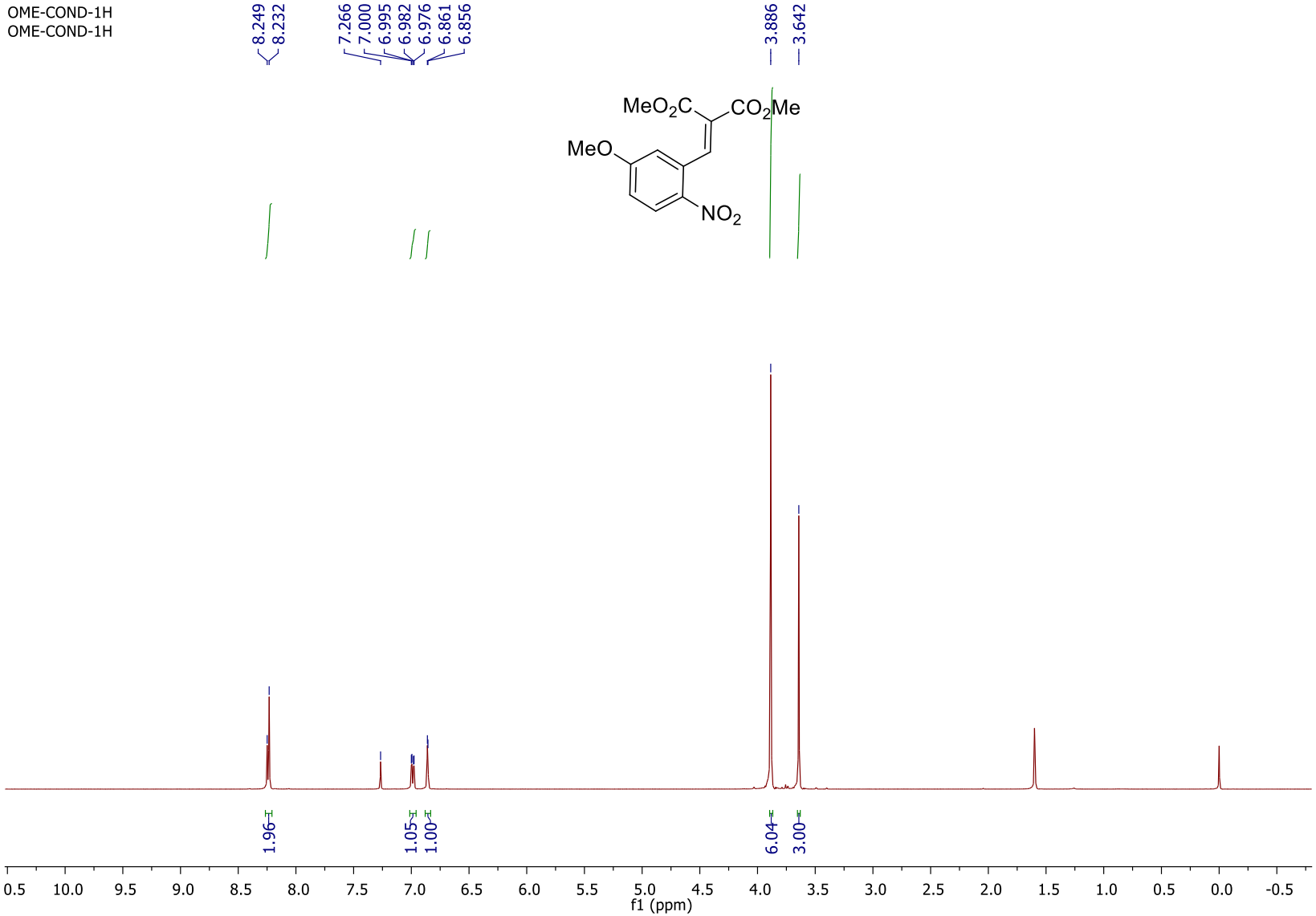
^{1}H spectrum of compound **1d′** (500 MHz, $CDCl_3$)



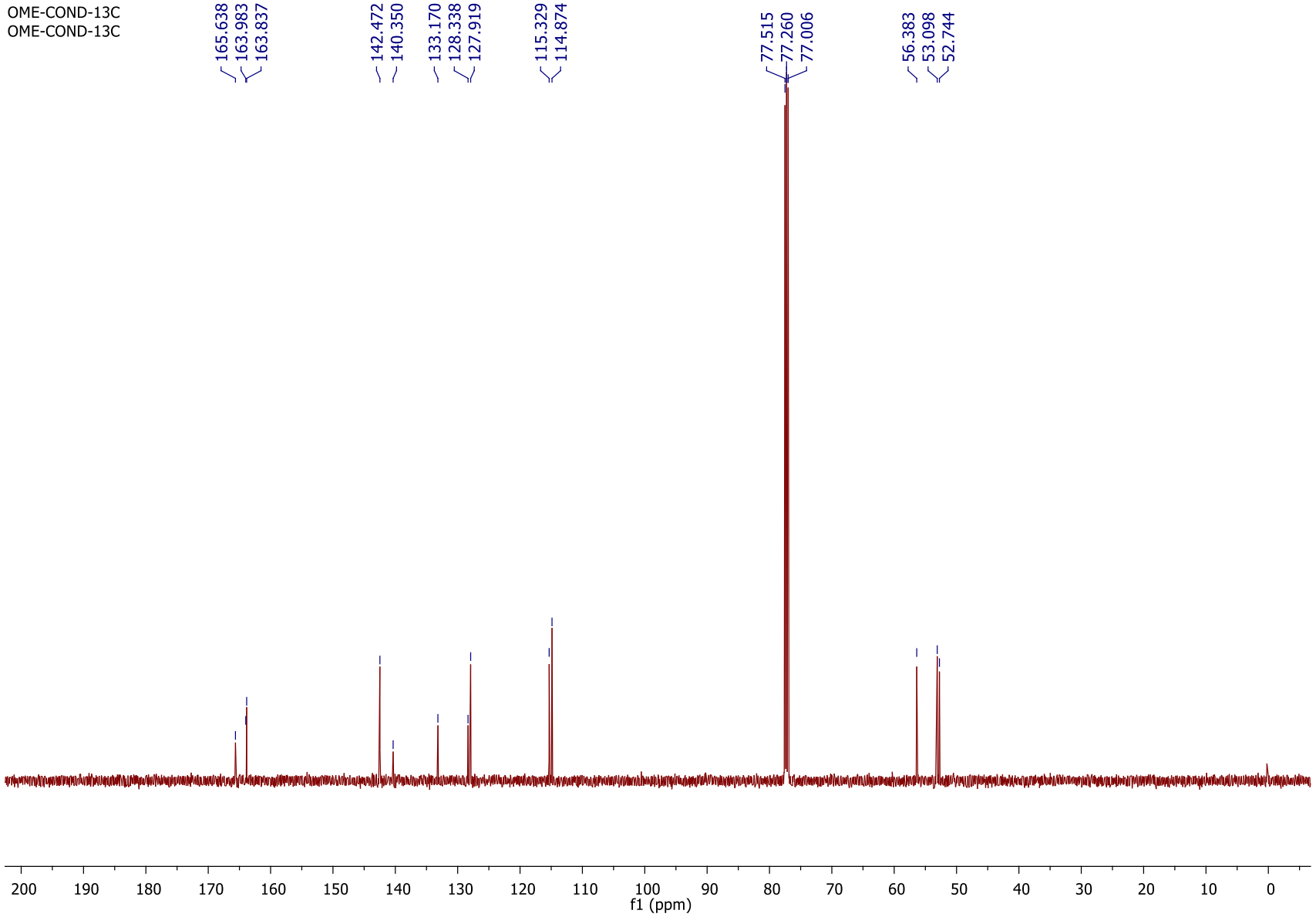
^{13}C spectrum of compound **1d′** (125 MHz, $CDCl_3$)



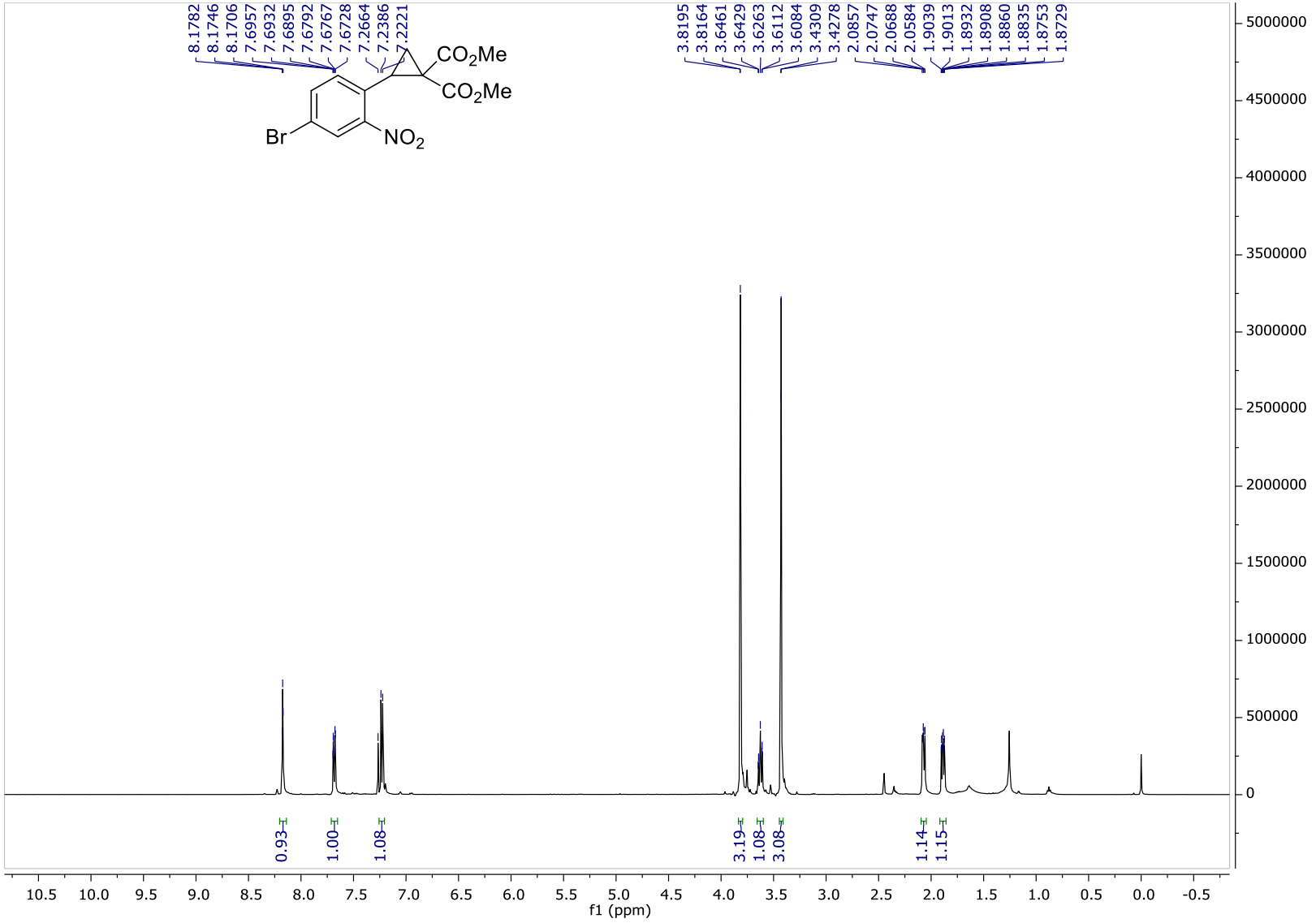
^{1}H spectrum of compound **1e′** (500 MHz, $CDCl_3$)



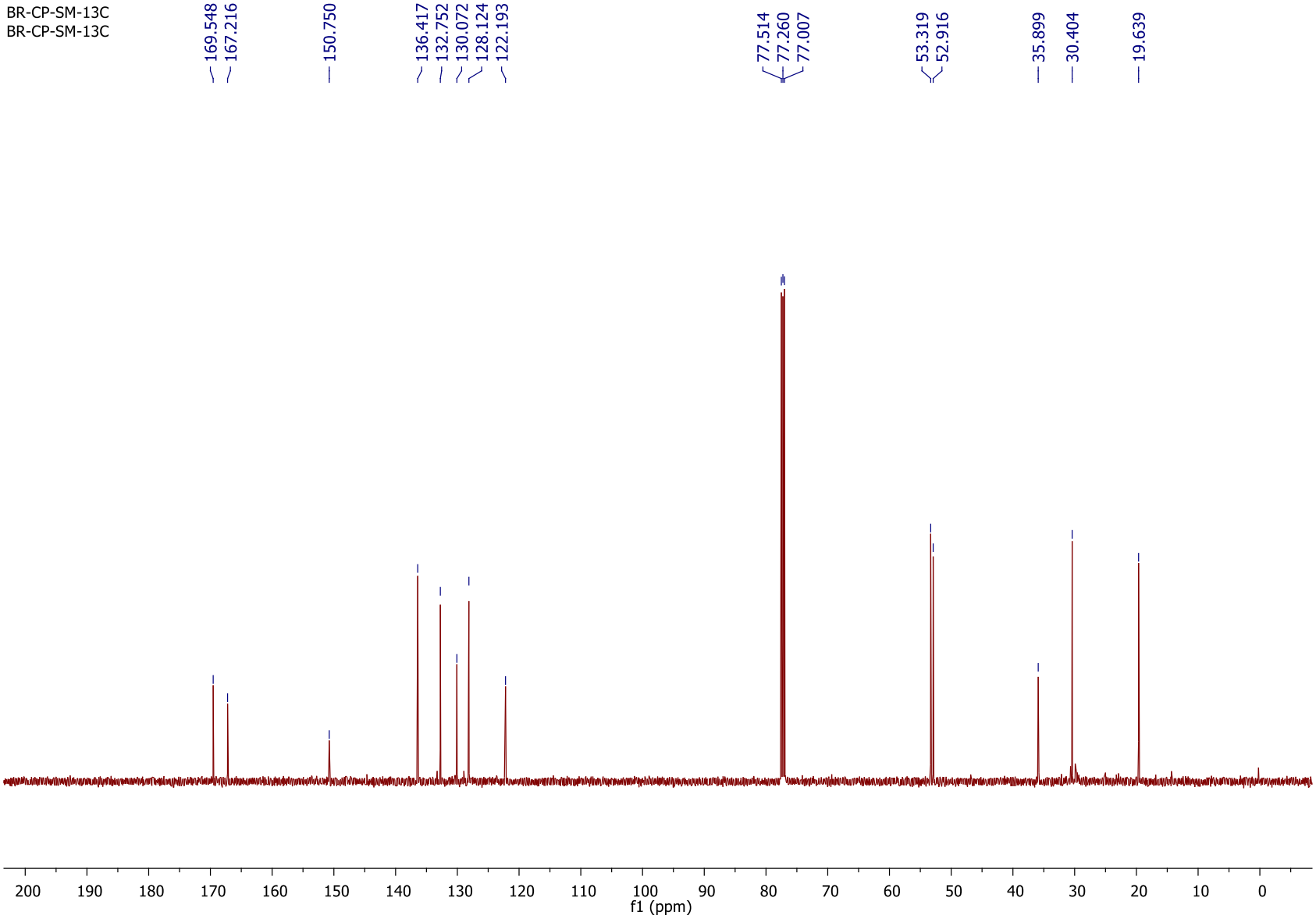
^{13}C spectrum of compound **1e′** (125 MHz, $CDCl_3$)



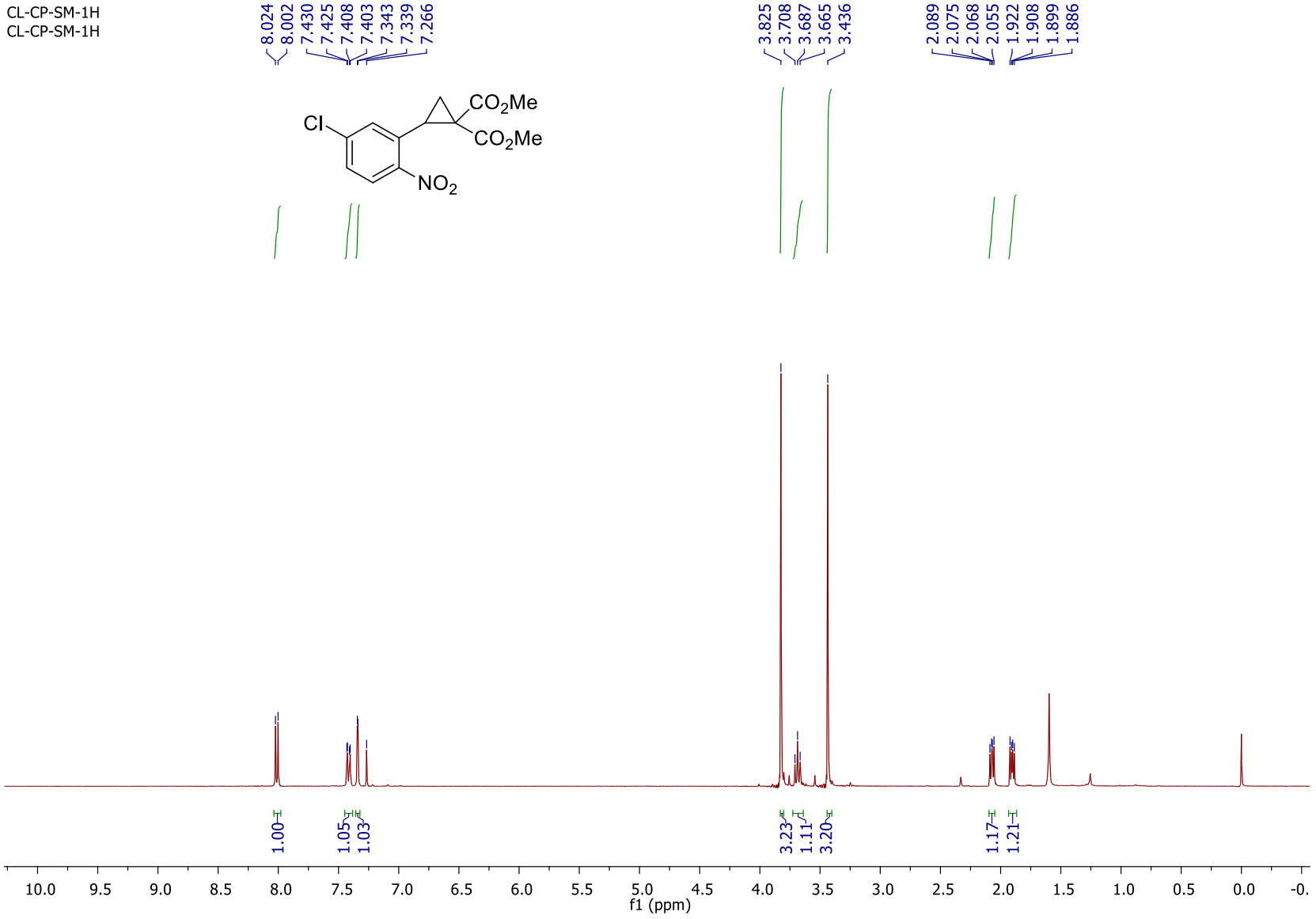
^{1}H spectrum of compound **1b** (500 MHz, $CDCl_3$)



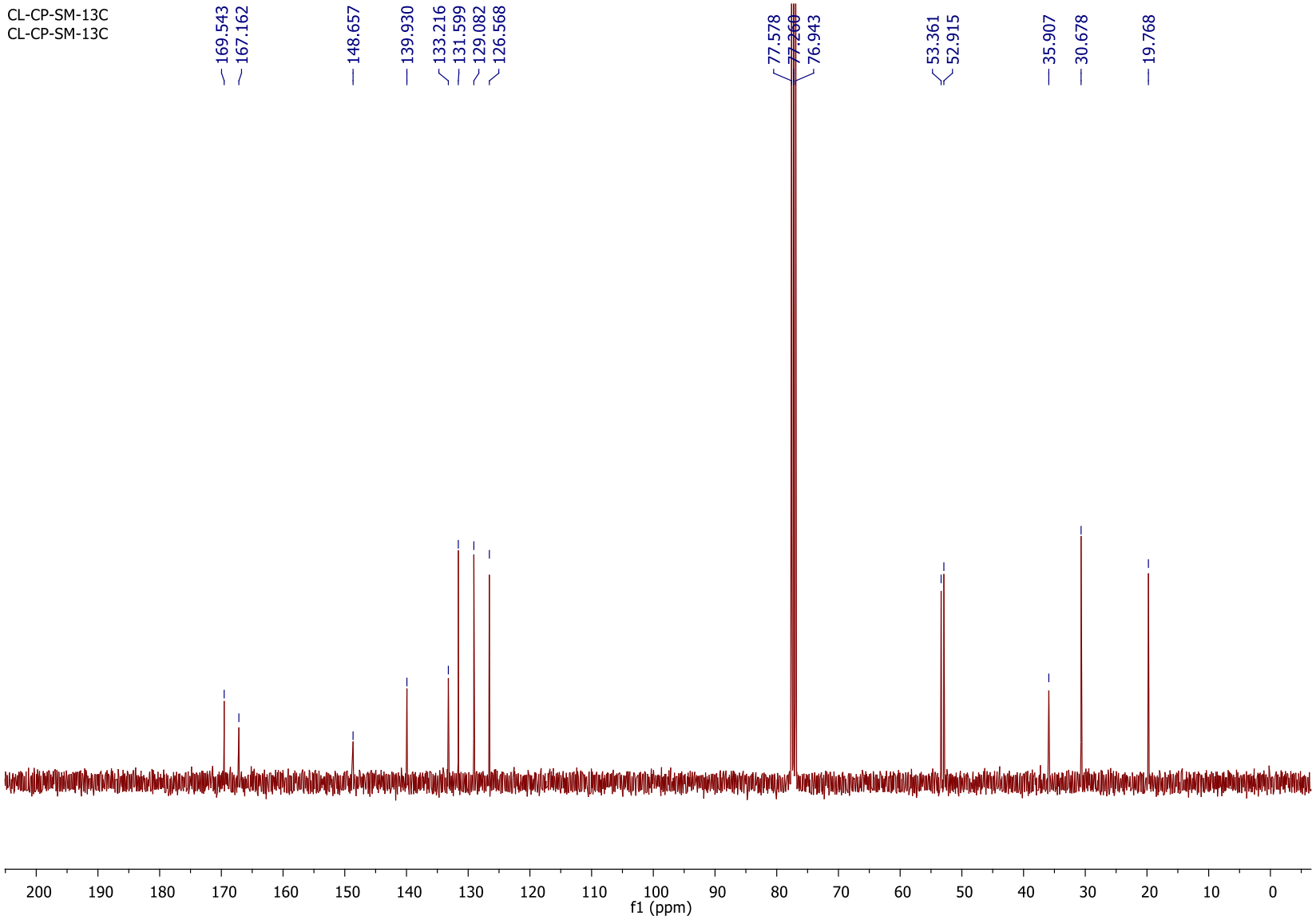
^{13}C spectrum of compound **1b** (125 MHz, $CDCl_3$)



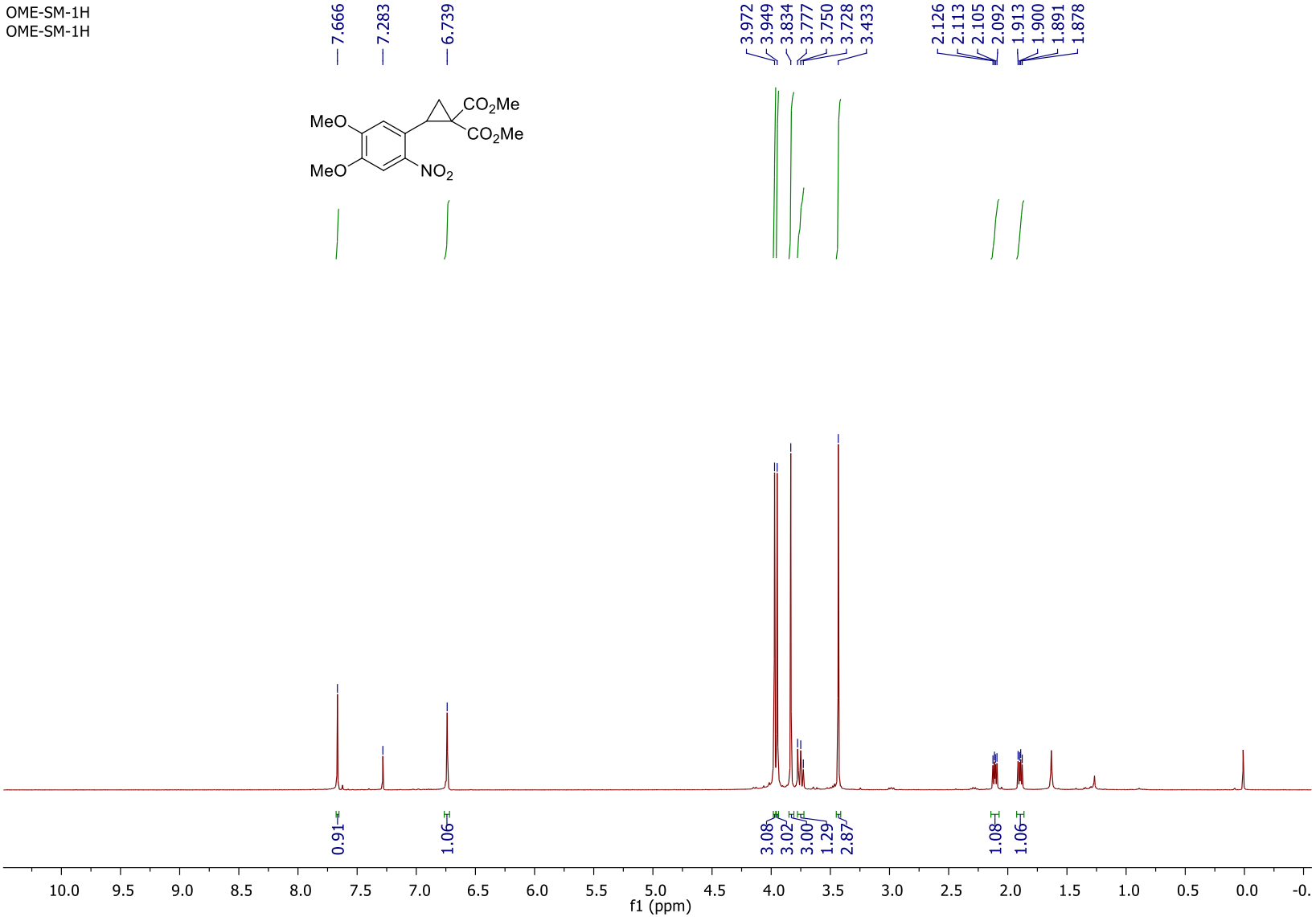
^{1}H spectrum of compound **1c** (400 MHz, $CDCl_3$)



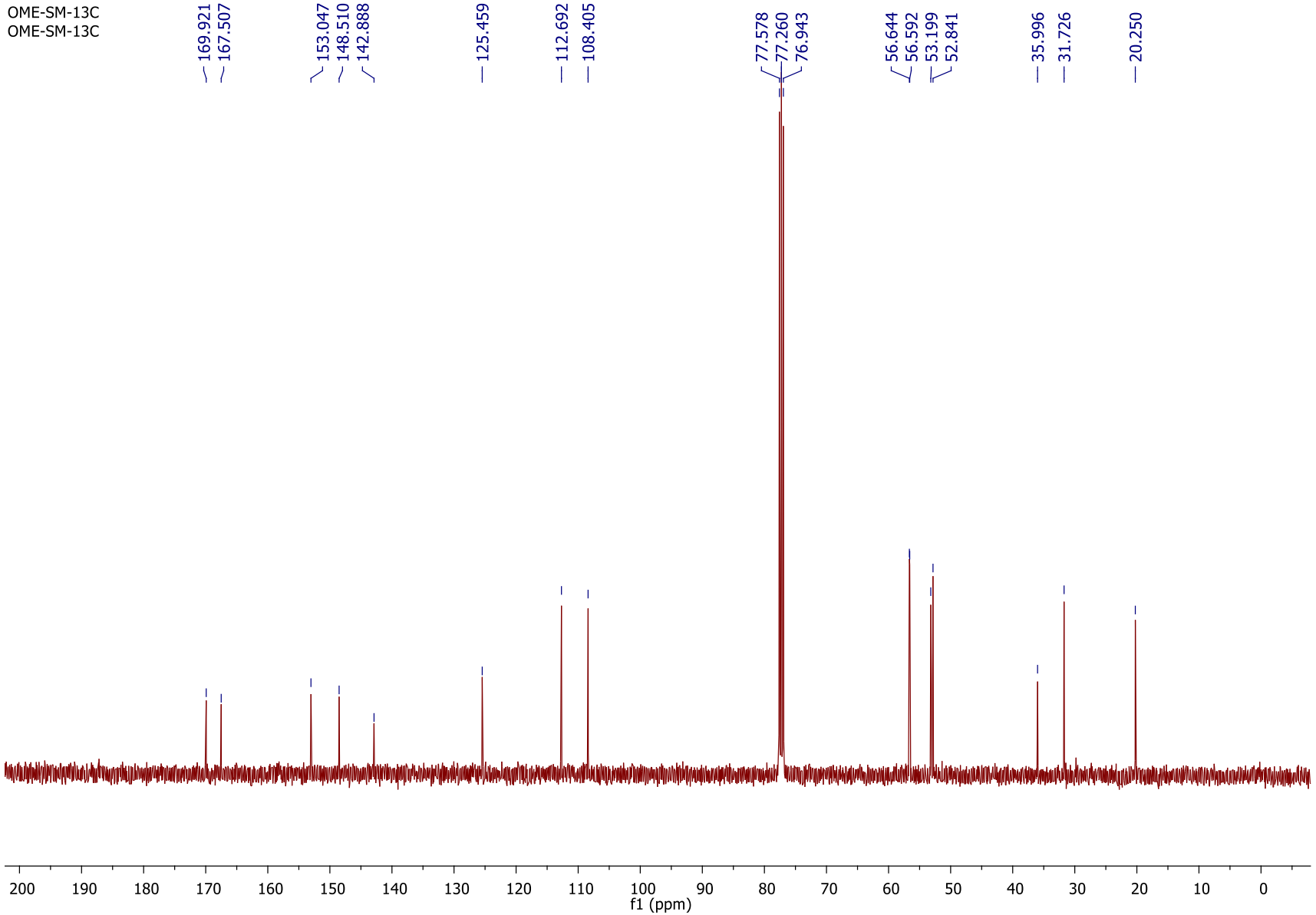
^{13}C spectrum of compound **1c** (400 MHz, $CDCl_3$)



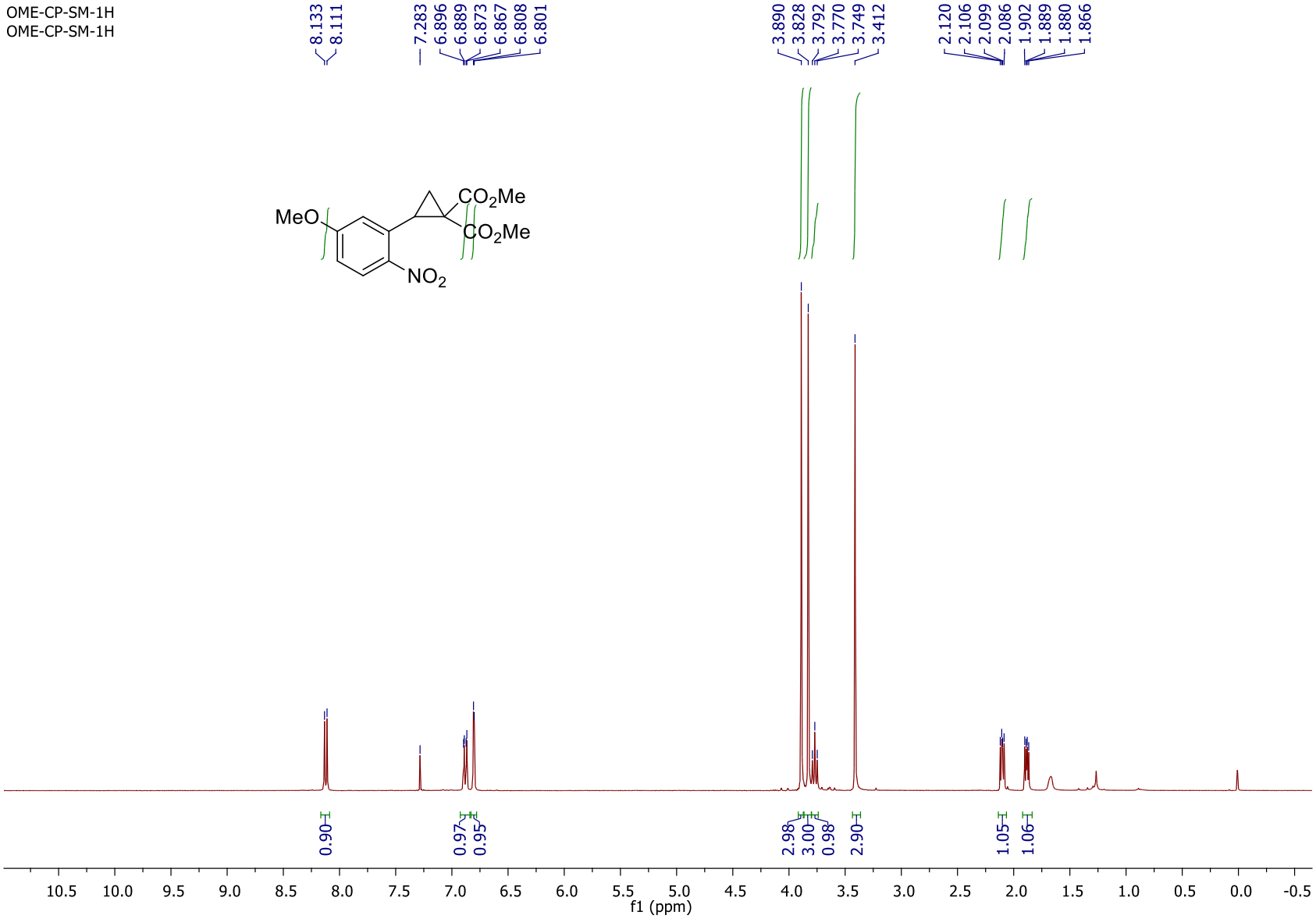
^{1}H spectrum of compound **1d** (400 MHz, $CDCl_3$)



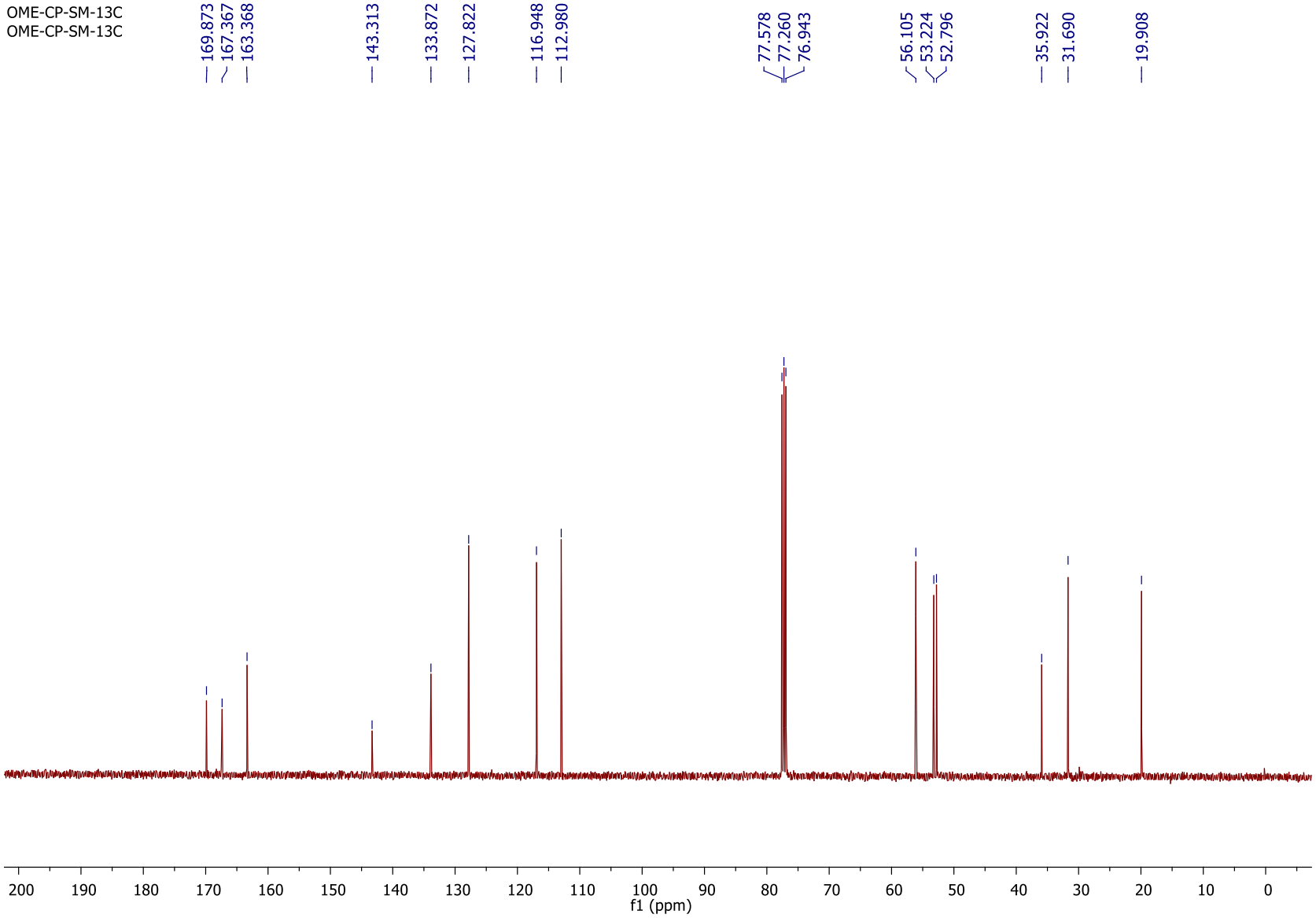
^{13}C spectrum of compound **1d** (100 MHz, $CDCl_3$)



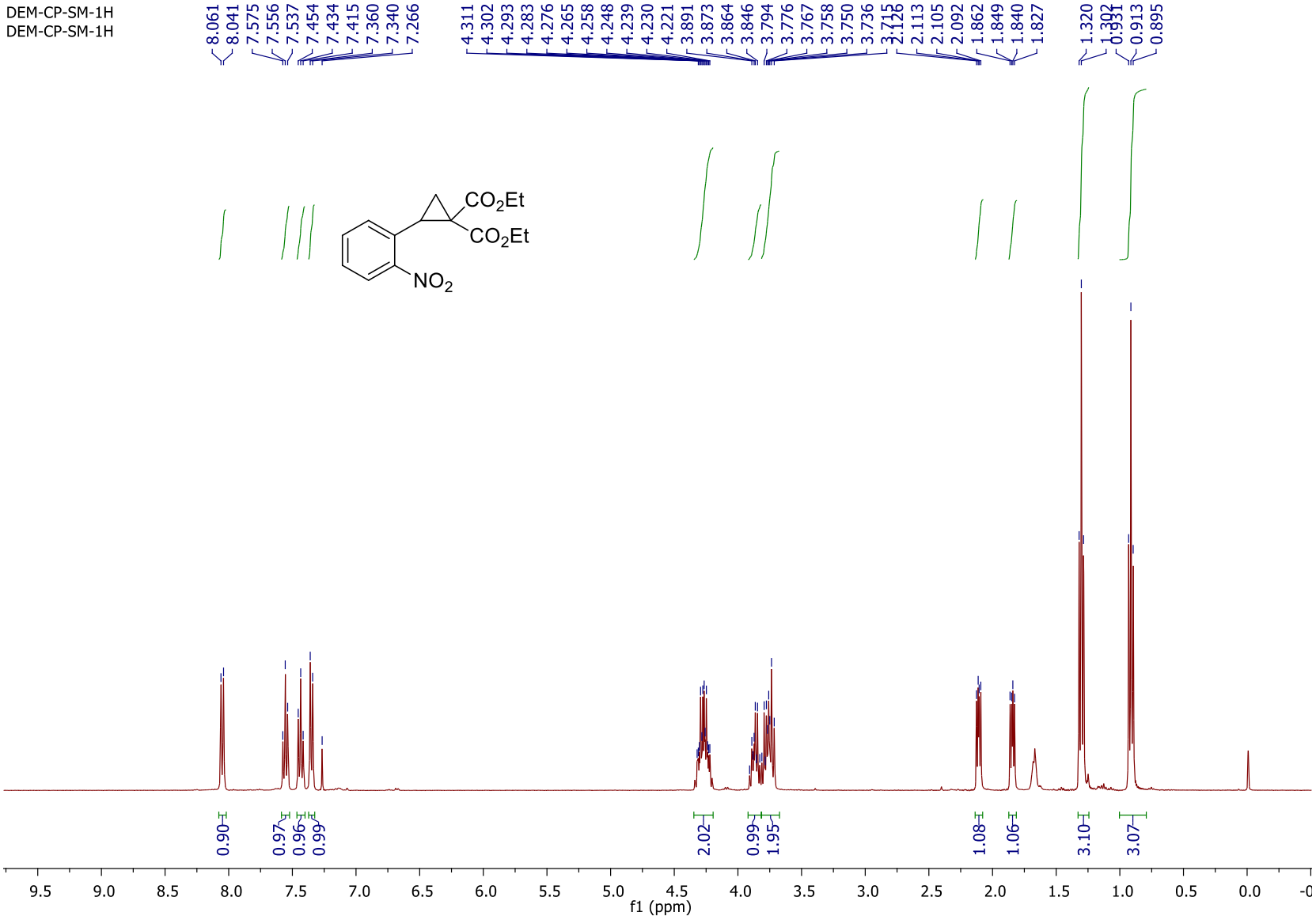
^{1}H spectrum of compound **1e** (400 MHz, $CDCl_3$)



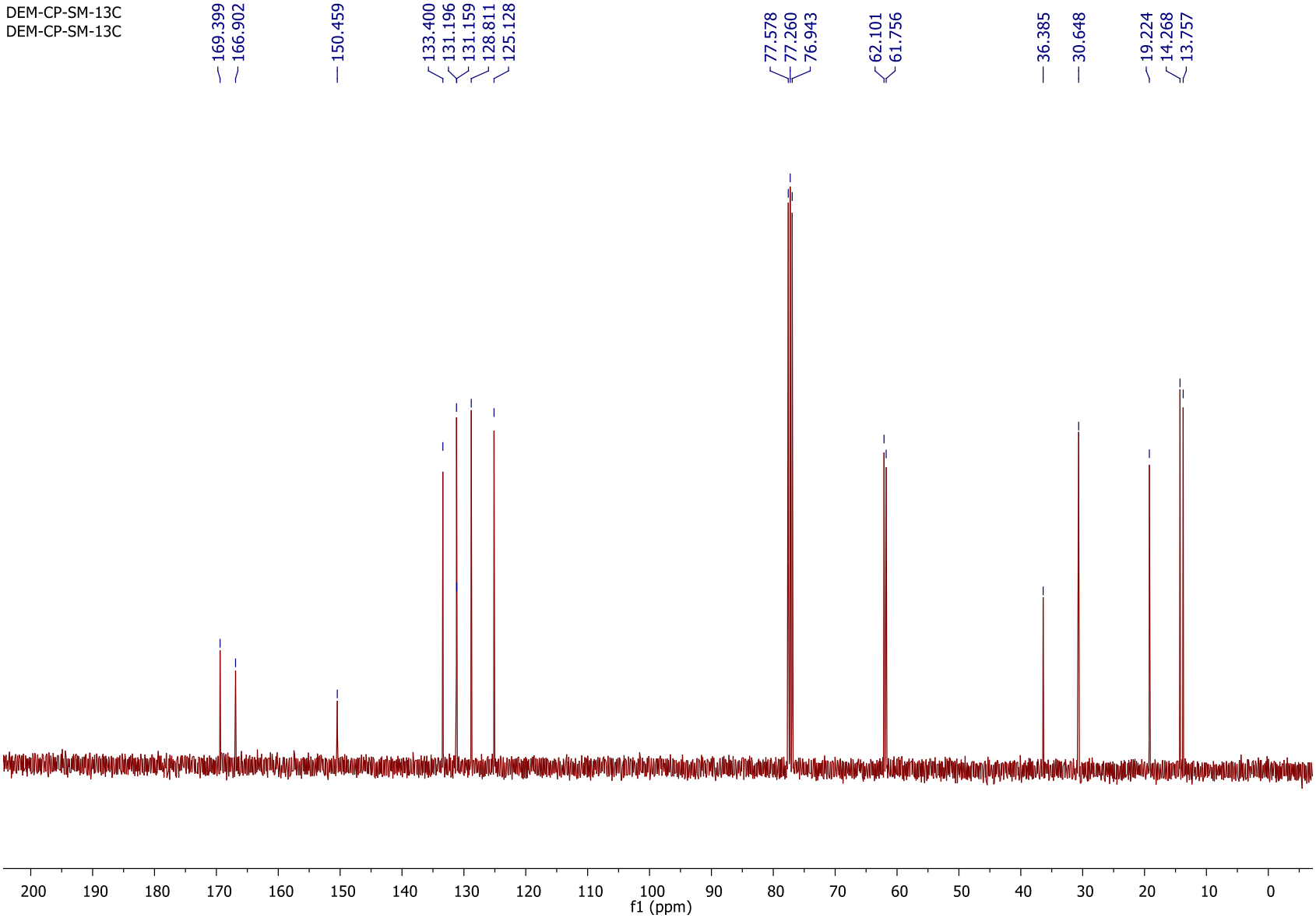
^{13}C spectrum of compound **1e** (100 MHz, $CDCl_3$)



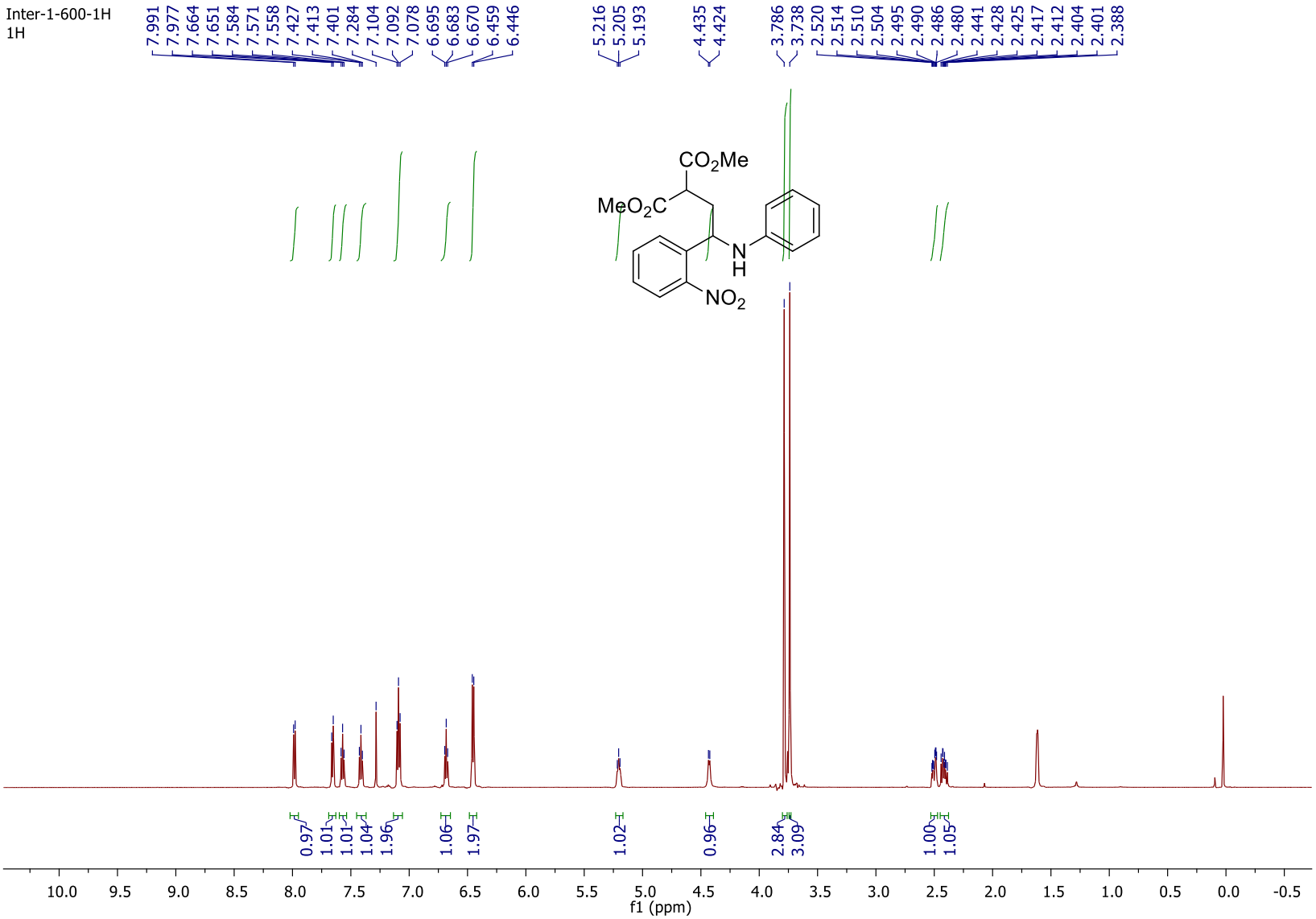
^{1}H spectrum of compound **1f** (400 MHz, $CDCl_3$)



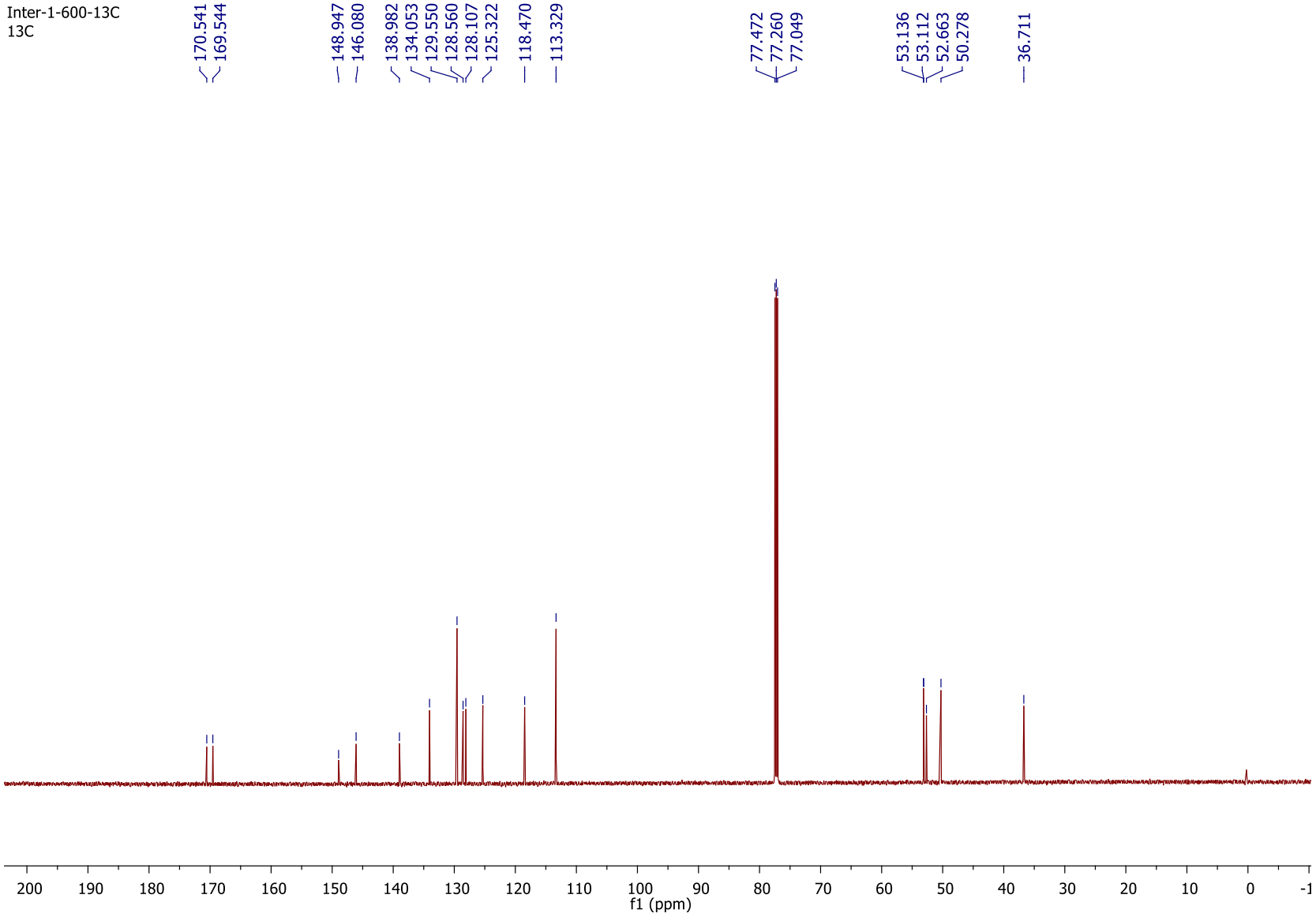
^{13}C spectrum of compound **1f** (400 MHz, $CDCl_3$)



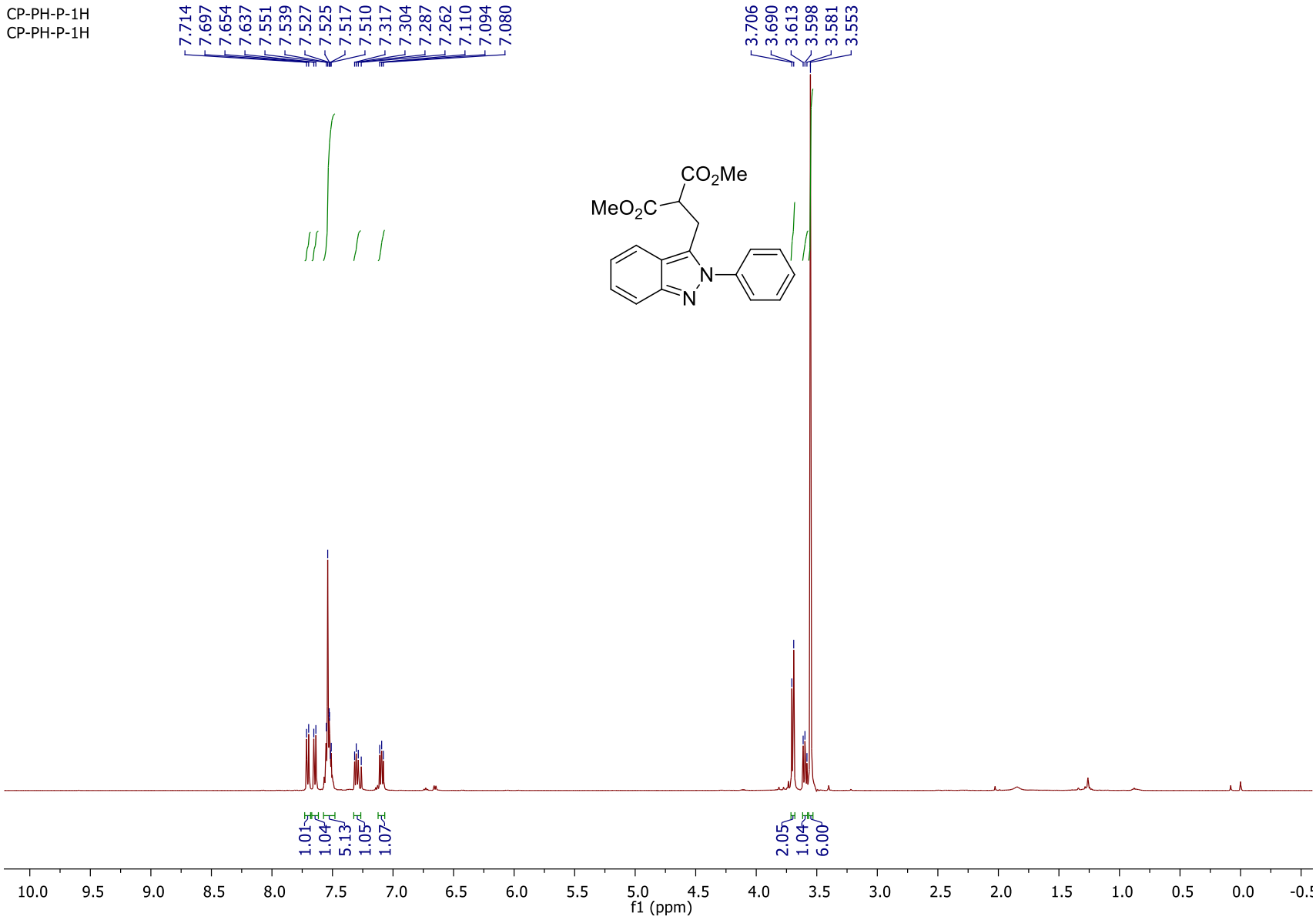
^{1}H spectrum of compound **3aa′** (600 MHz, $CDCl_3$)



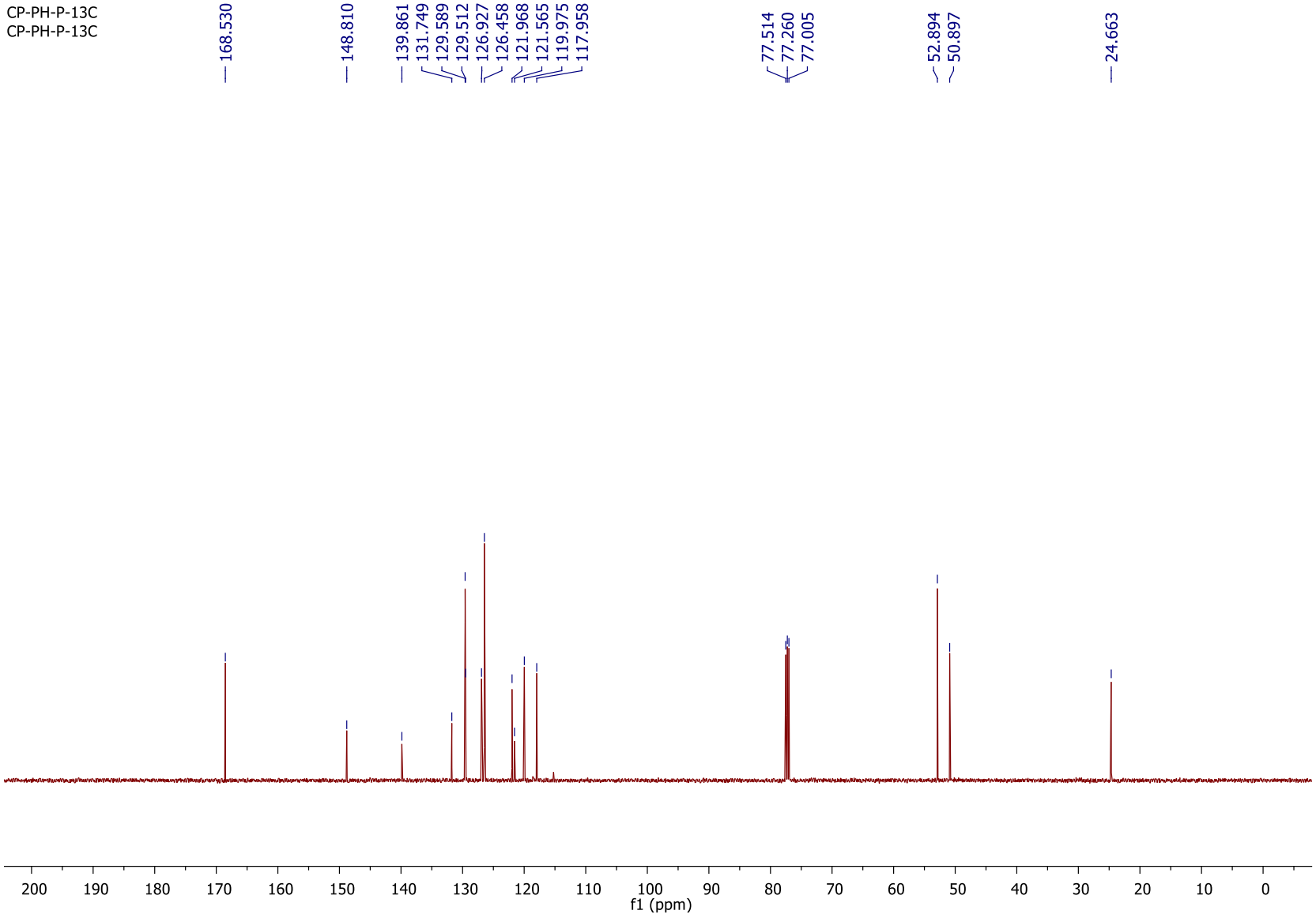
^{13}C spectrum of compound **3aa′** (150 MHz, $CDCl_3$)



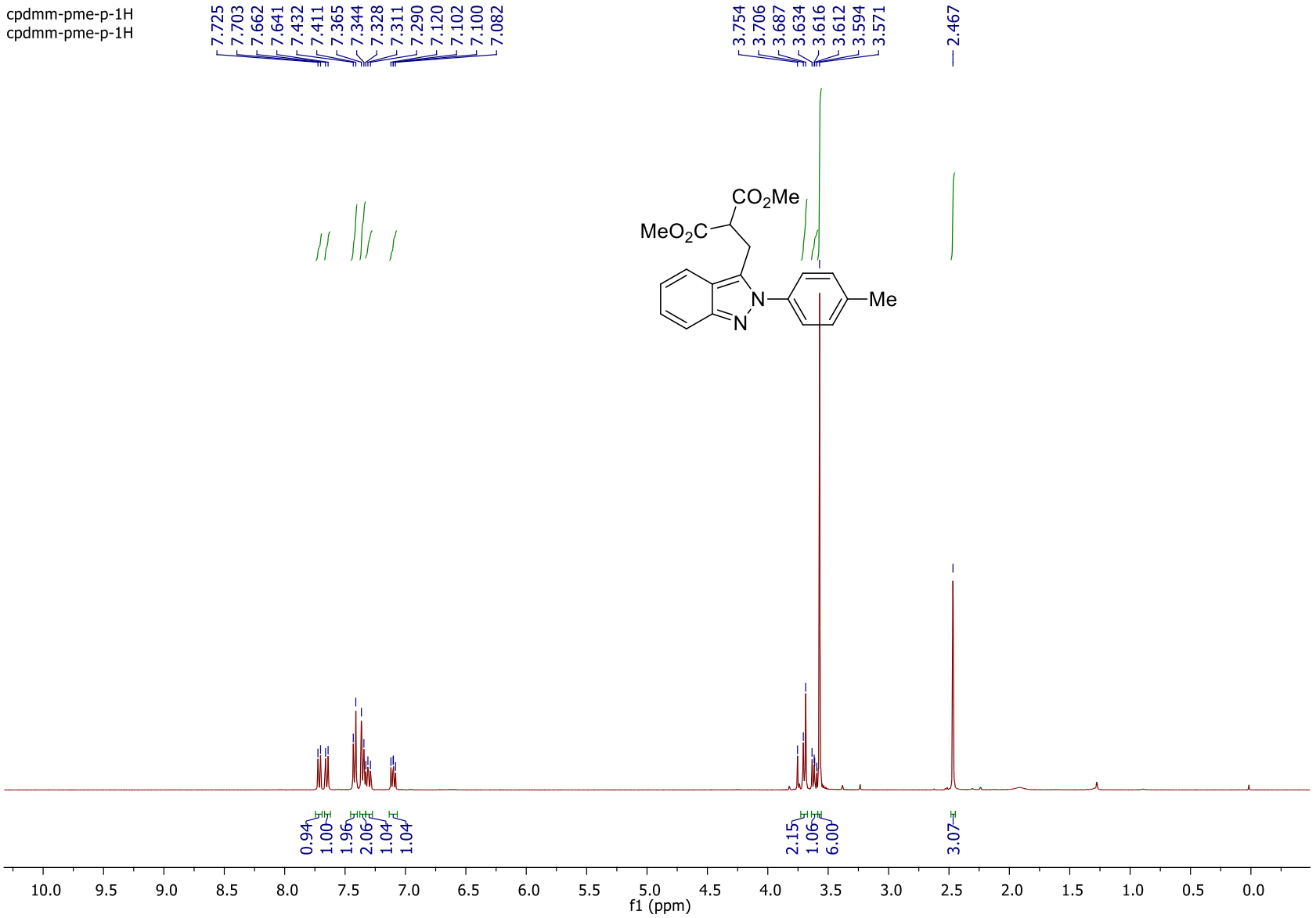
^{1}H spectrum of compound **3aa** (500 MHz, $CDCl_3$)



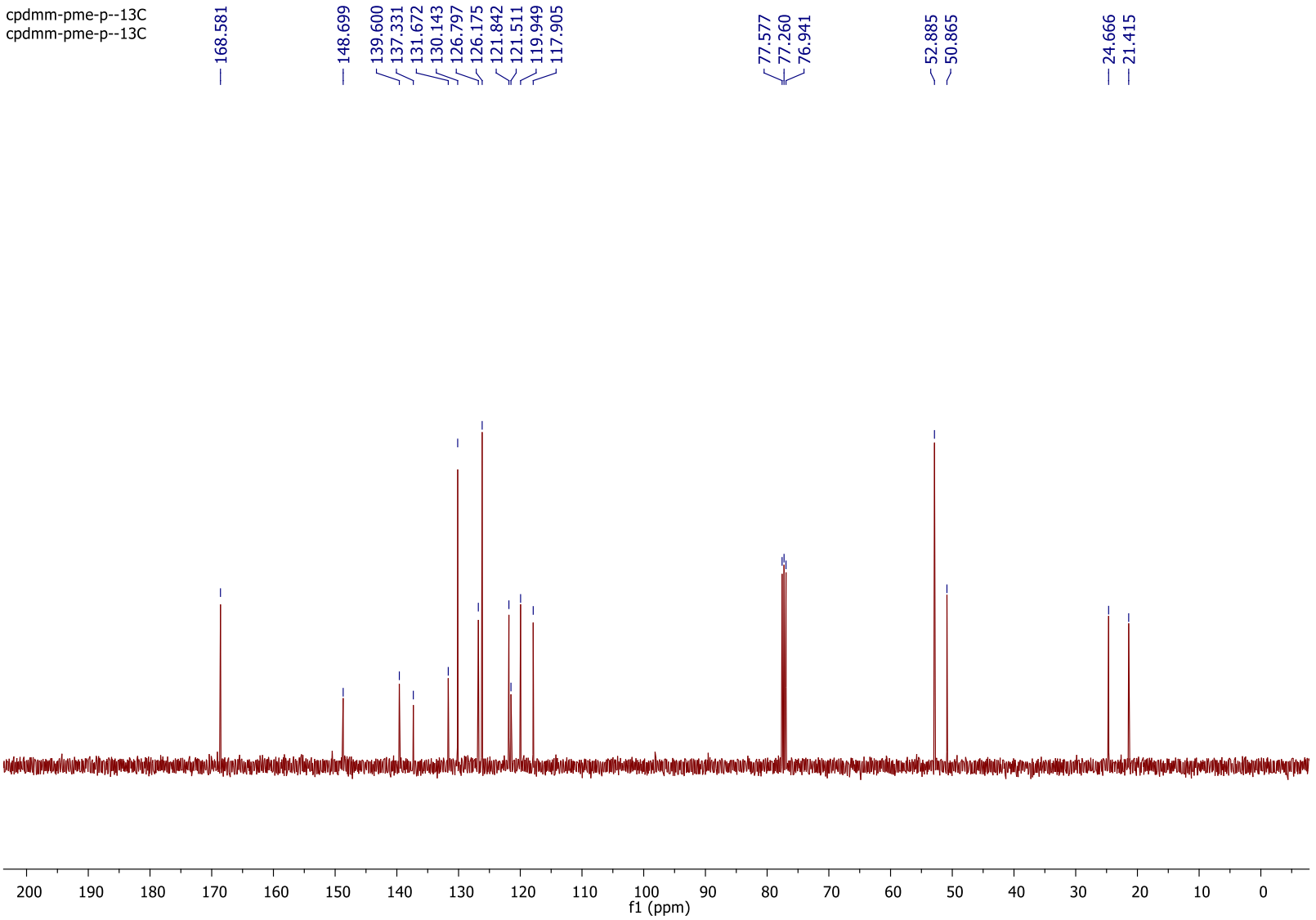
^{13}C spectrum of compound **3aa** (125 MHz, $CDCl_3$)



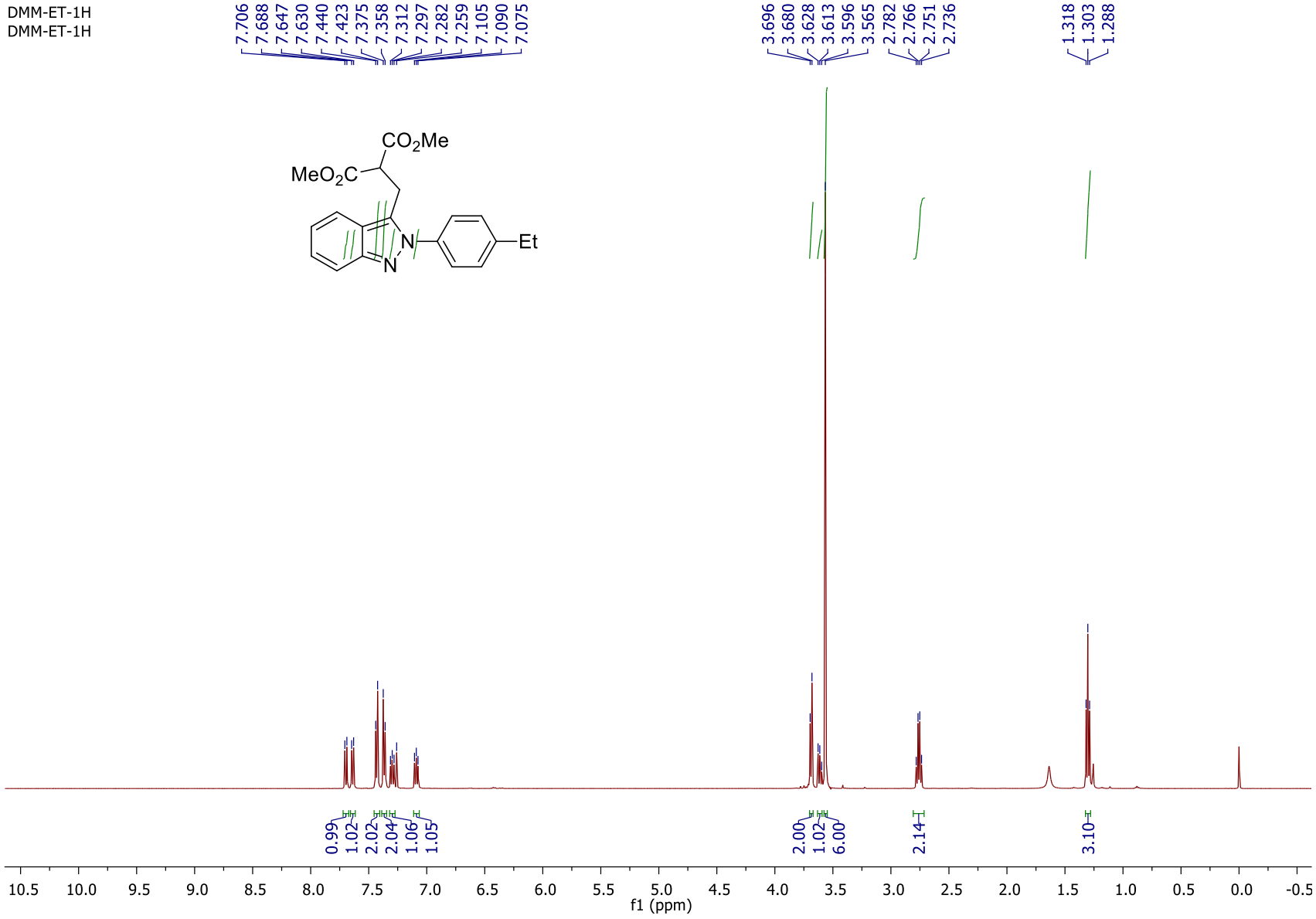
^{1}H spectrum of compound **3ab** (400 MHz, $CDCl_3$)



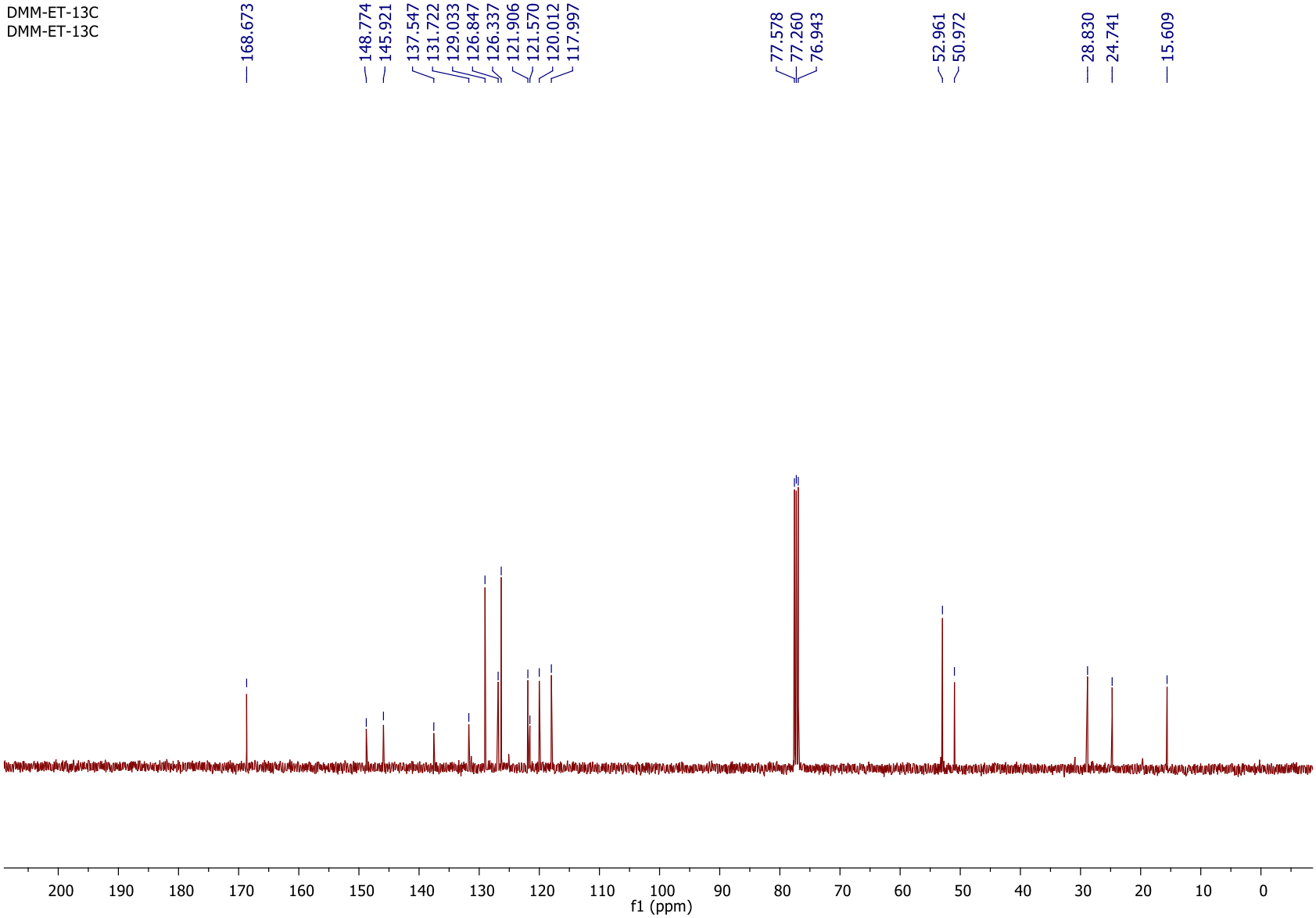
^{13}C spectrum of compound **3ab** (100 MHz, $CDCl_3$)



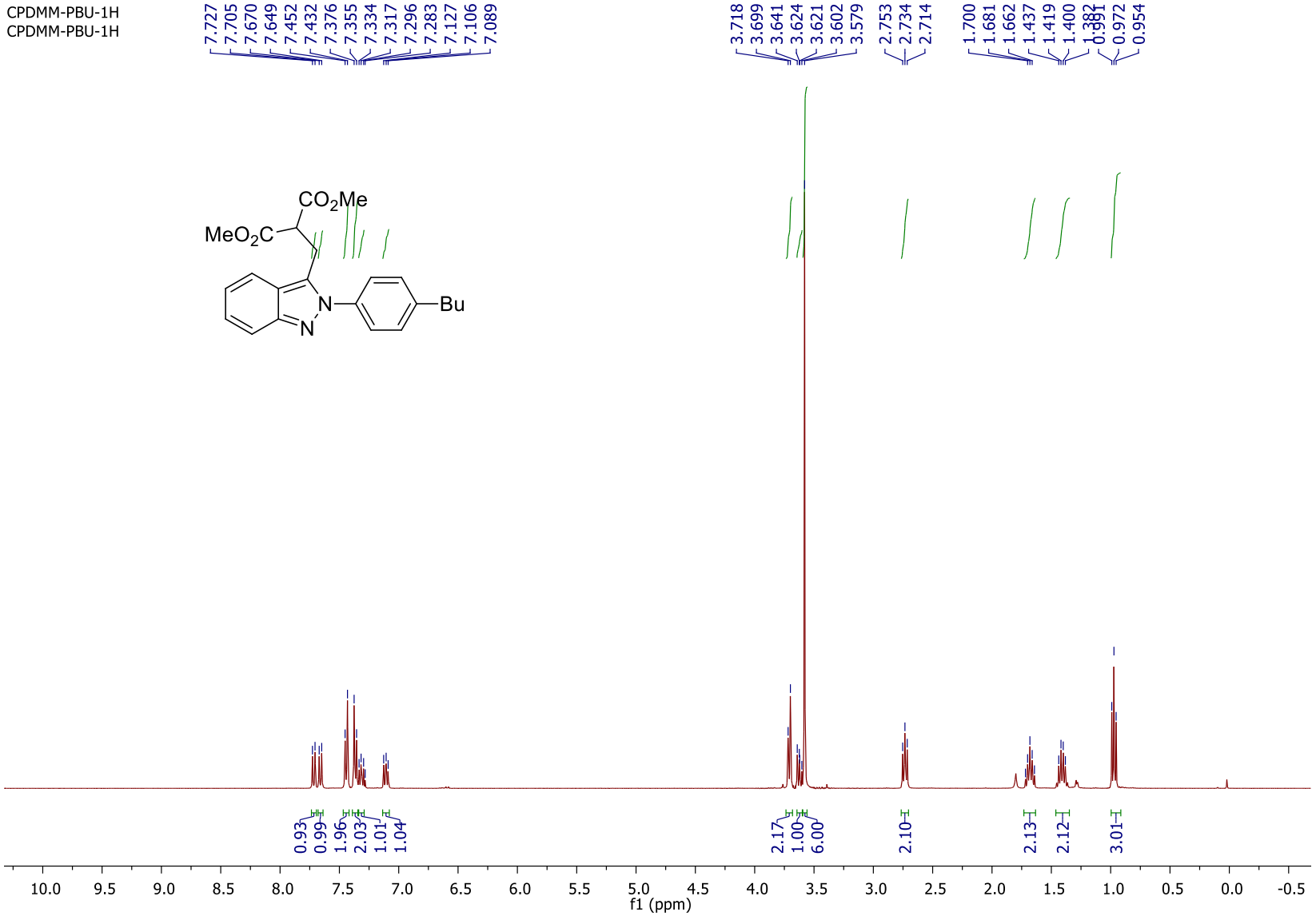
^{1}H spectrum of compound **3ac** (500 MHz, $CDCl_3$)



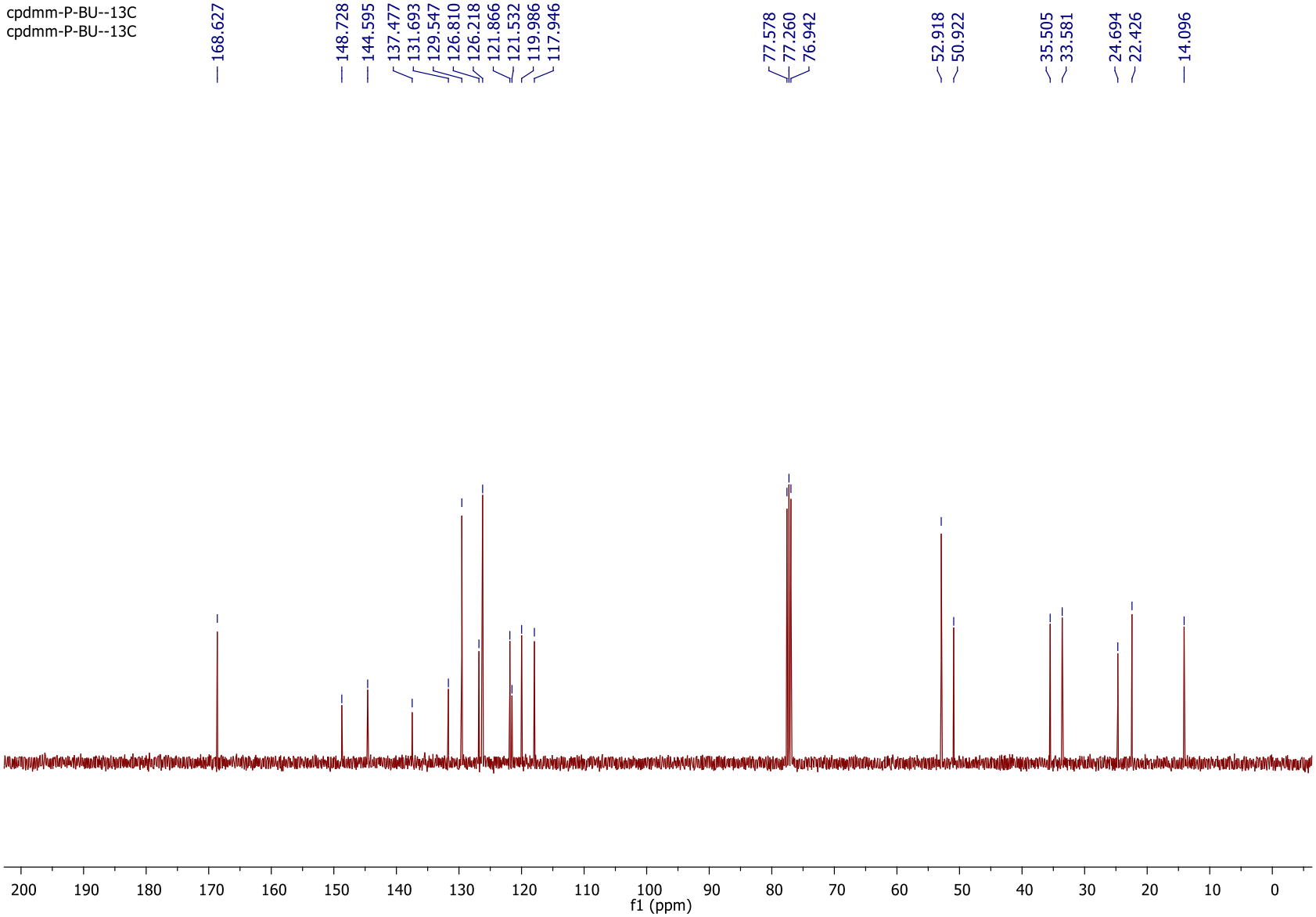
^{13}C spectrum of compound **3ac** (100 MHz, $CDCl_3$)



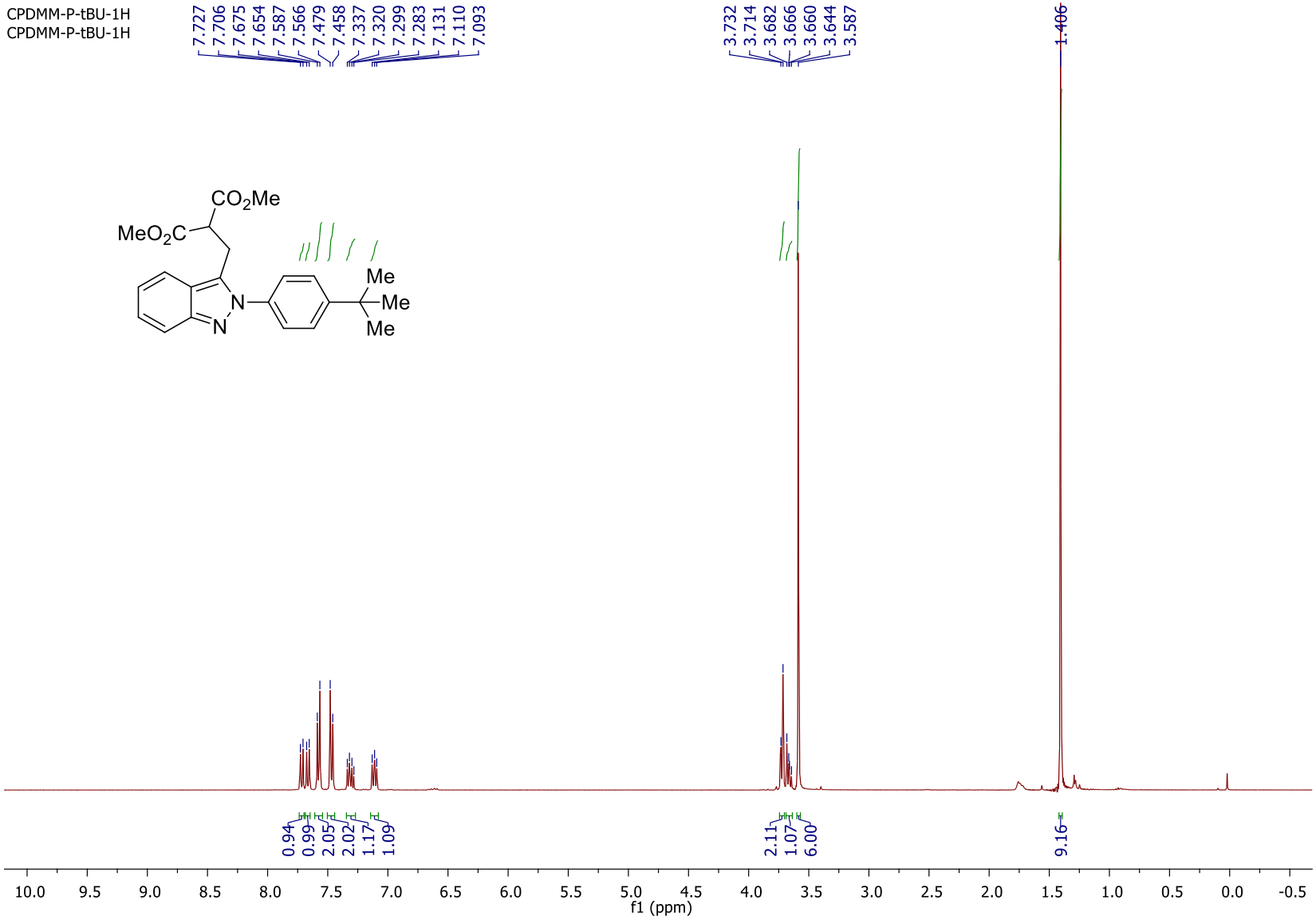
^{1}H spectrum of compound **3ad** (400 MHz, $CDCl_3$)



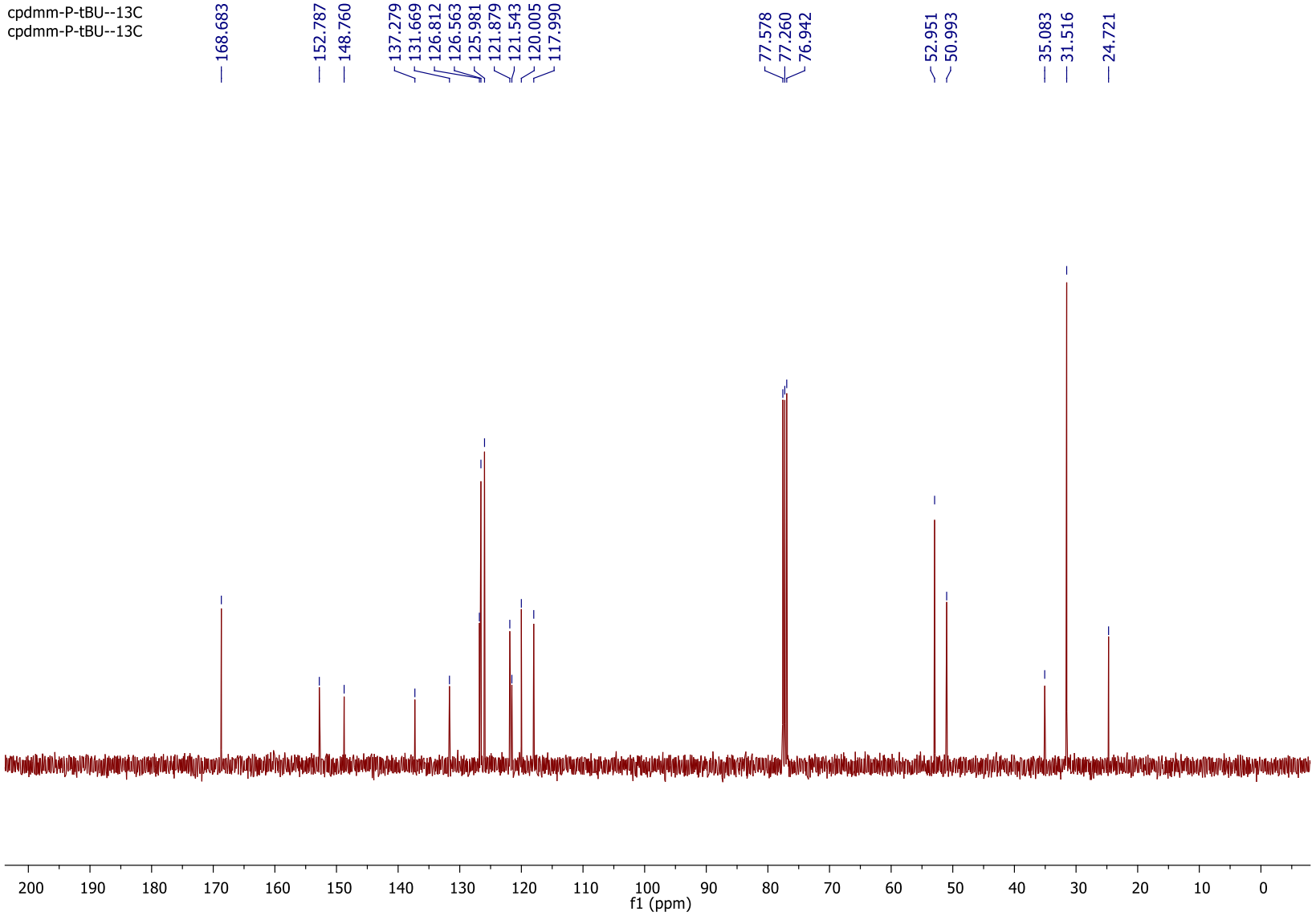
^{13}C spectrum of compound **3ad** (100 MHz, $CDCl_3$)



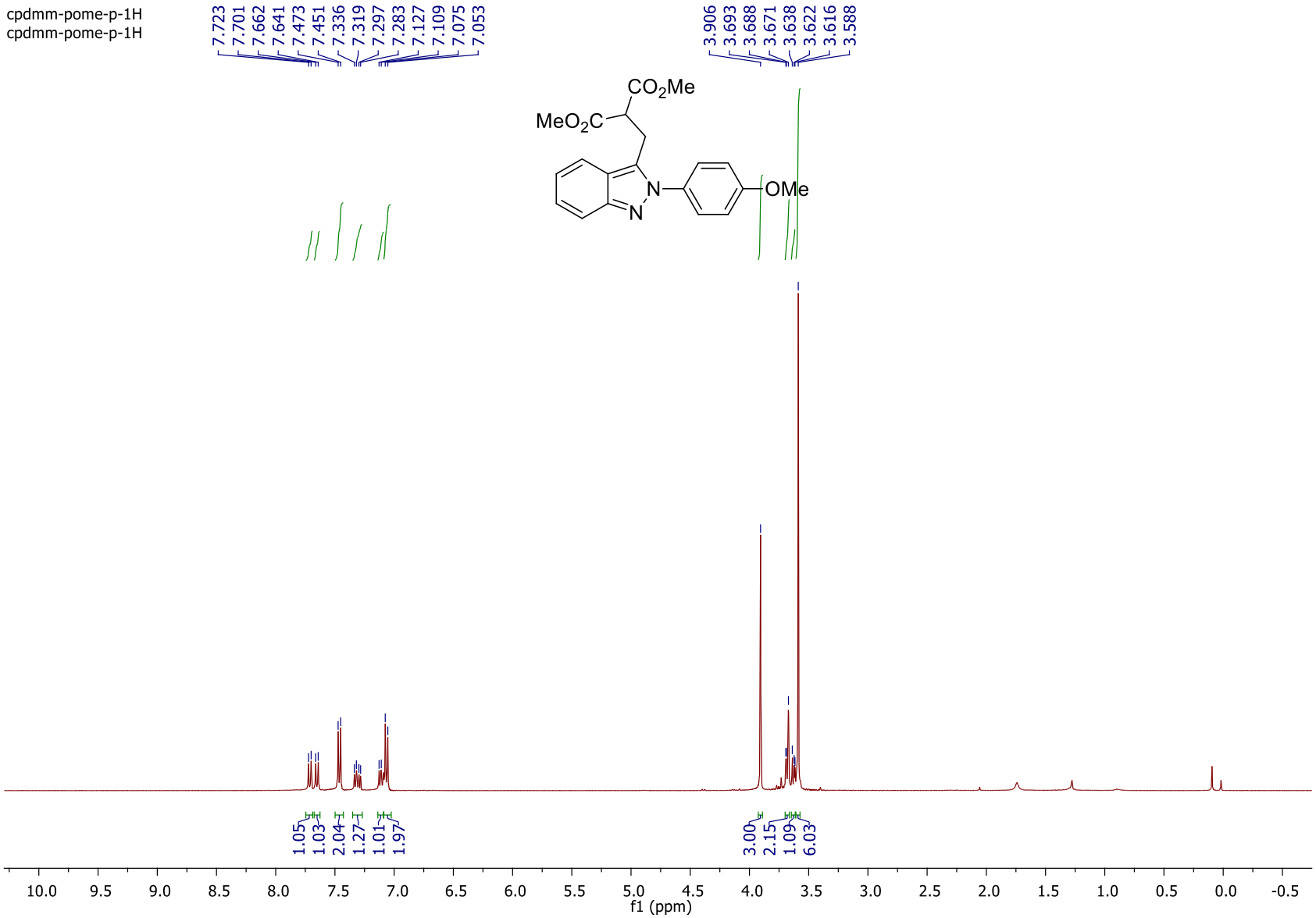
^{1}H spectrum of compound **3ae** (400 MHz, $CDCl_3$)



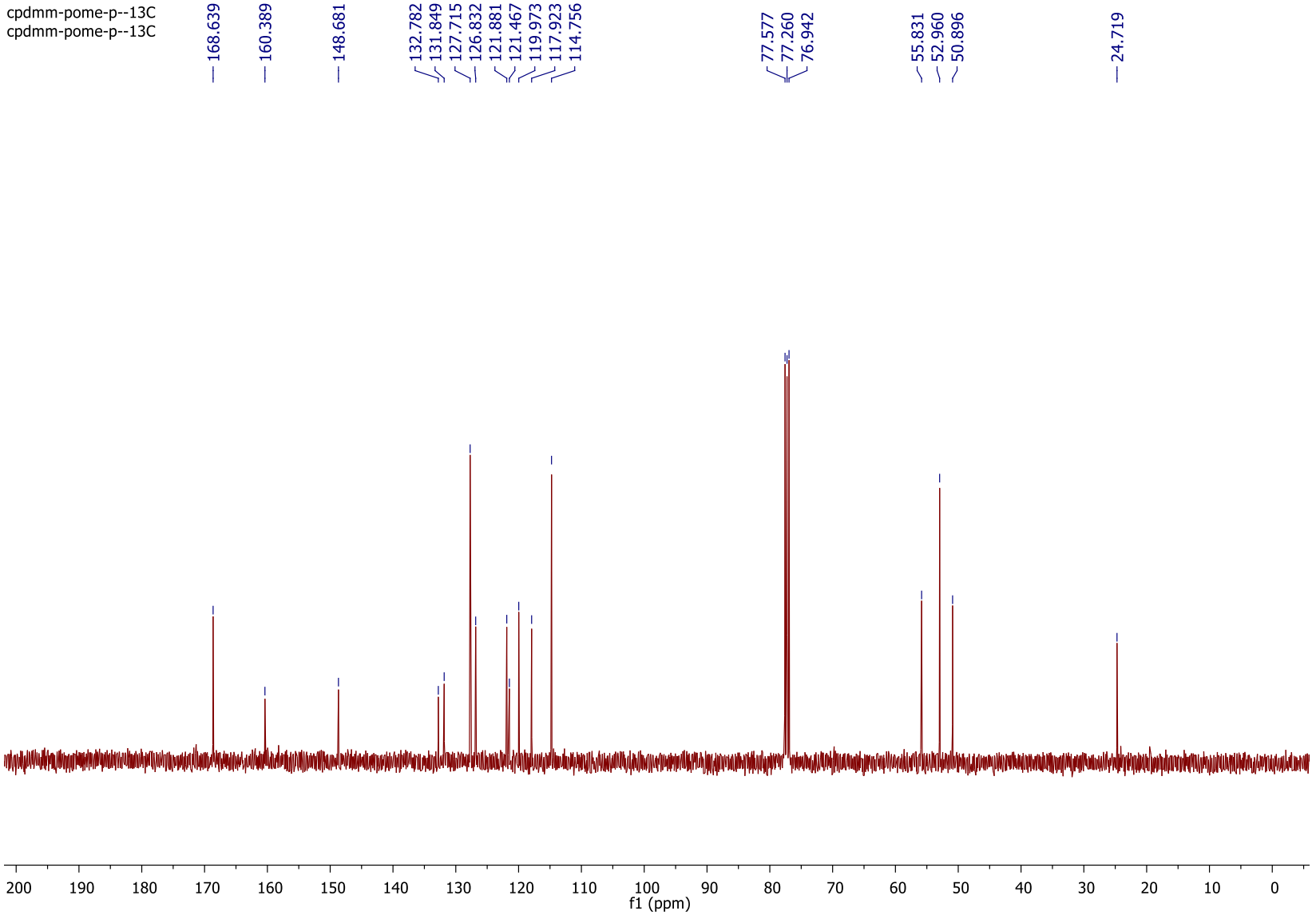
^{13}C spectrum of compound **3ae** (100 MHz, $CDCl_3$)



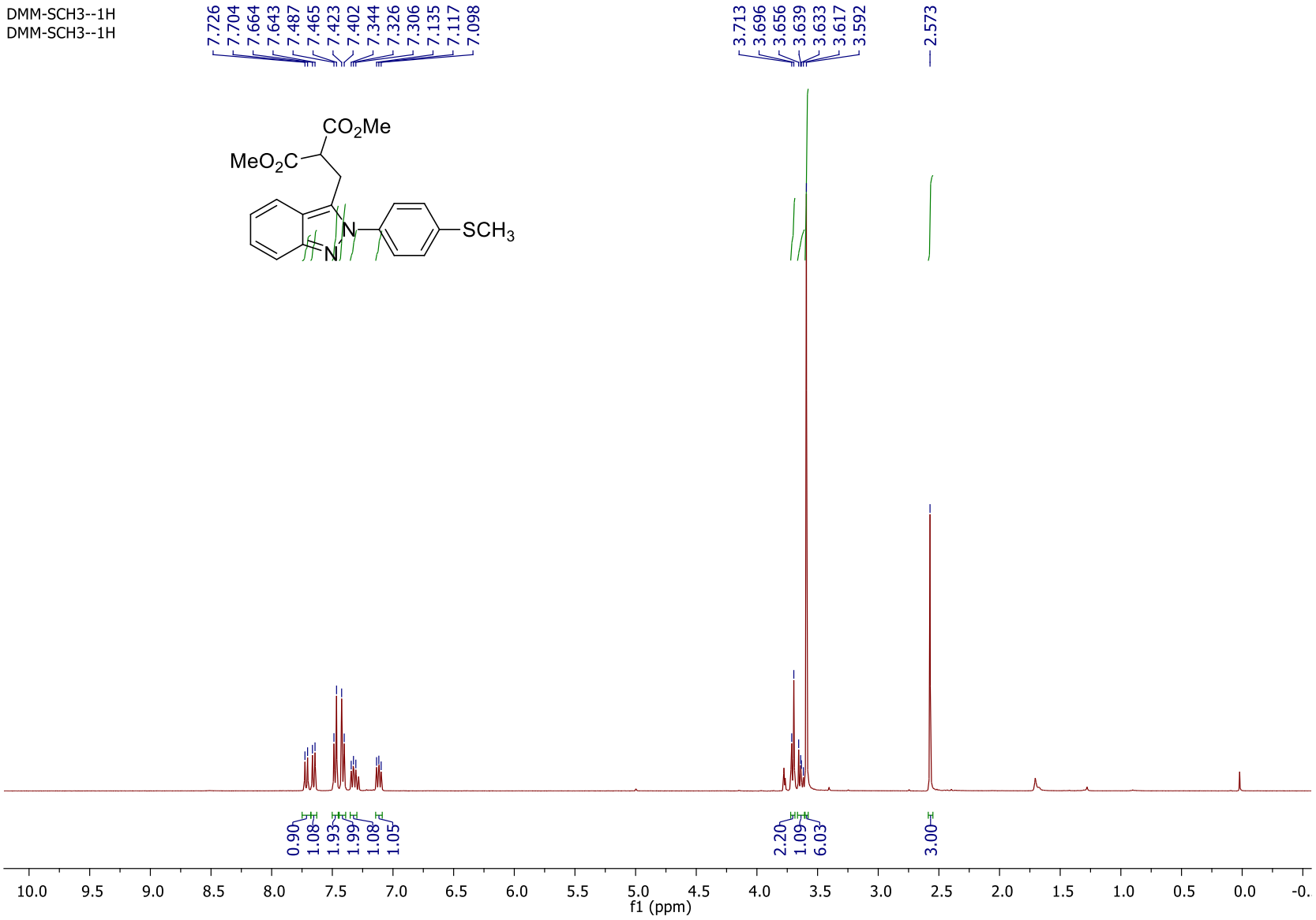
^{1}H spectrum of compound **3af** (400 MHz, $CDCl_3$)



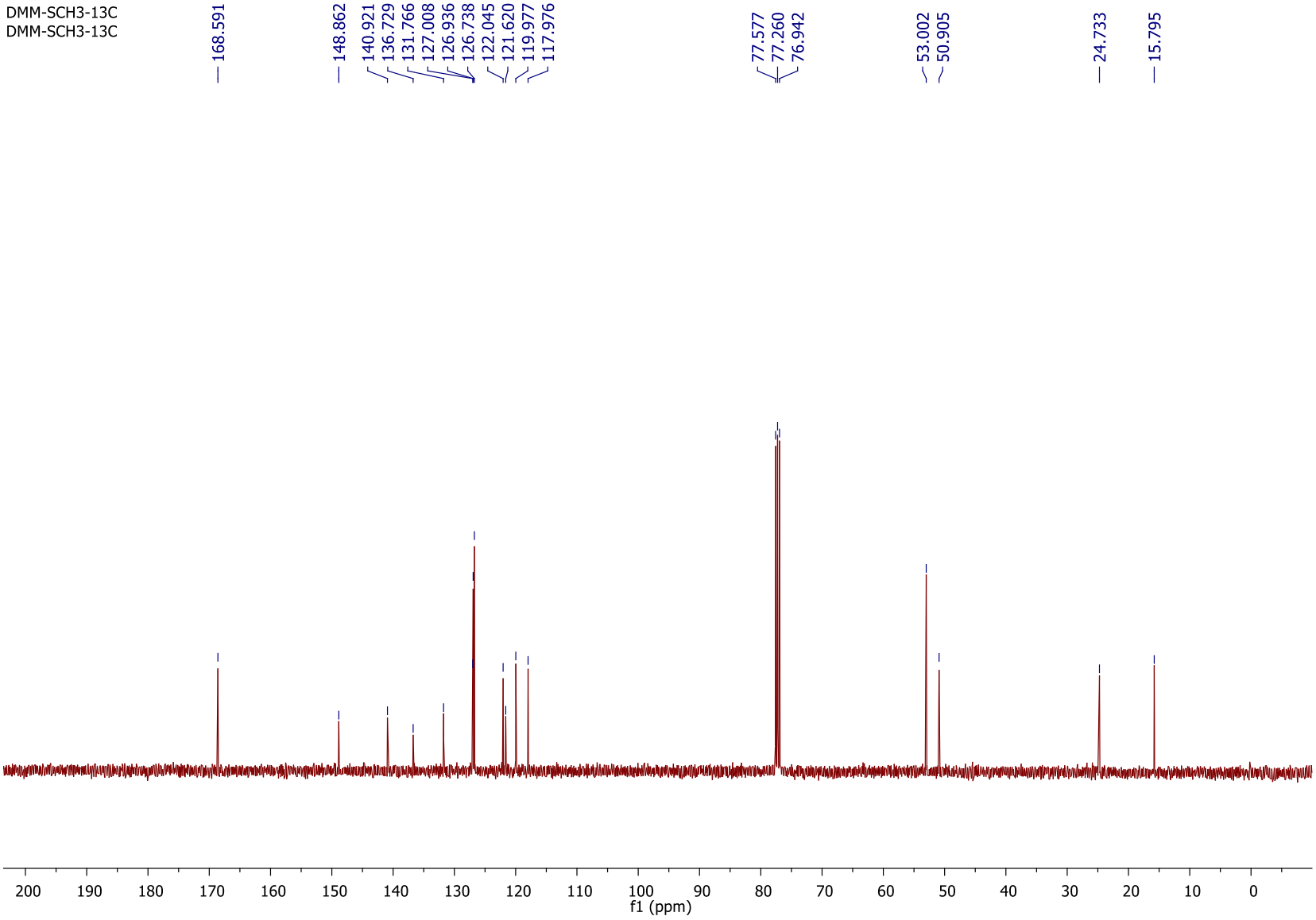
^{13}C spectrum of compound **3af** (100 MHz, $CDCl_3$)



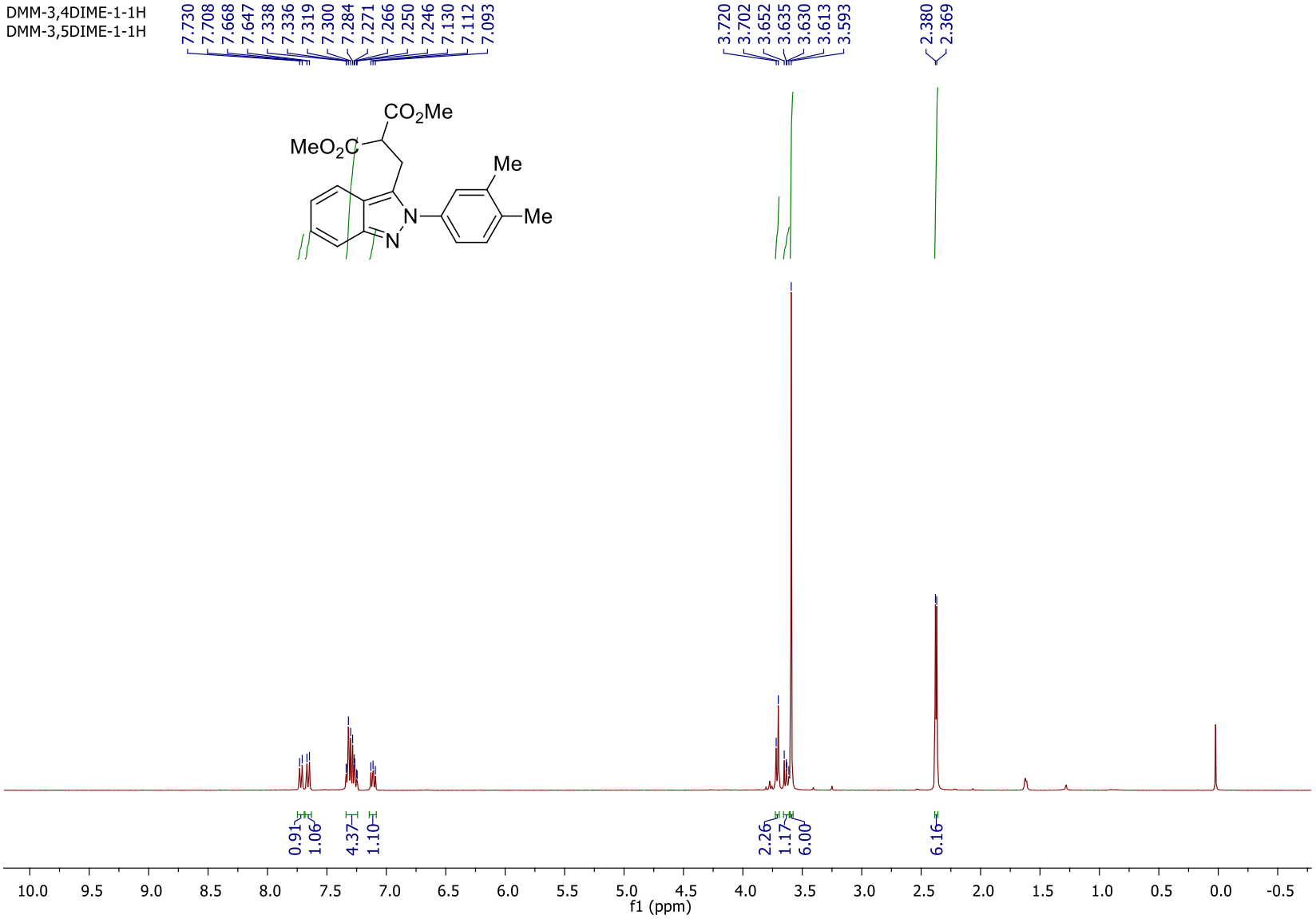
^{1}H spectrum of compound **3ag** (400 MHz, $CDCl_3$)



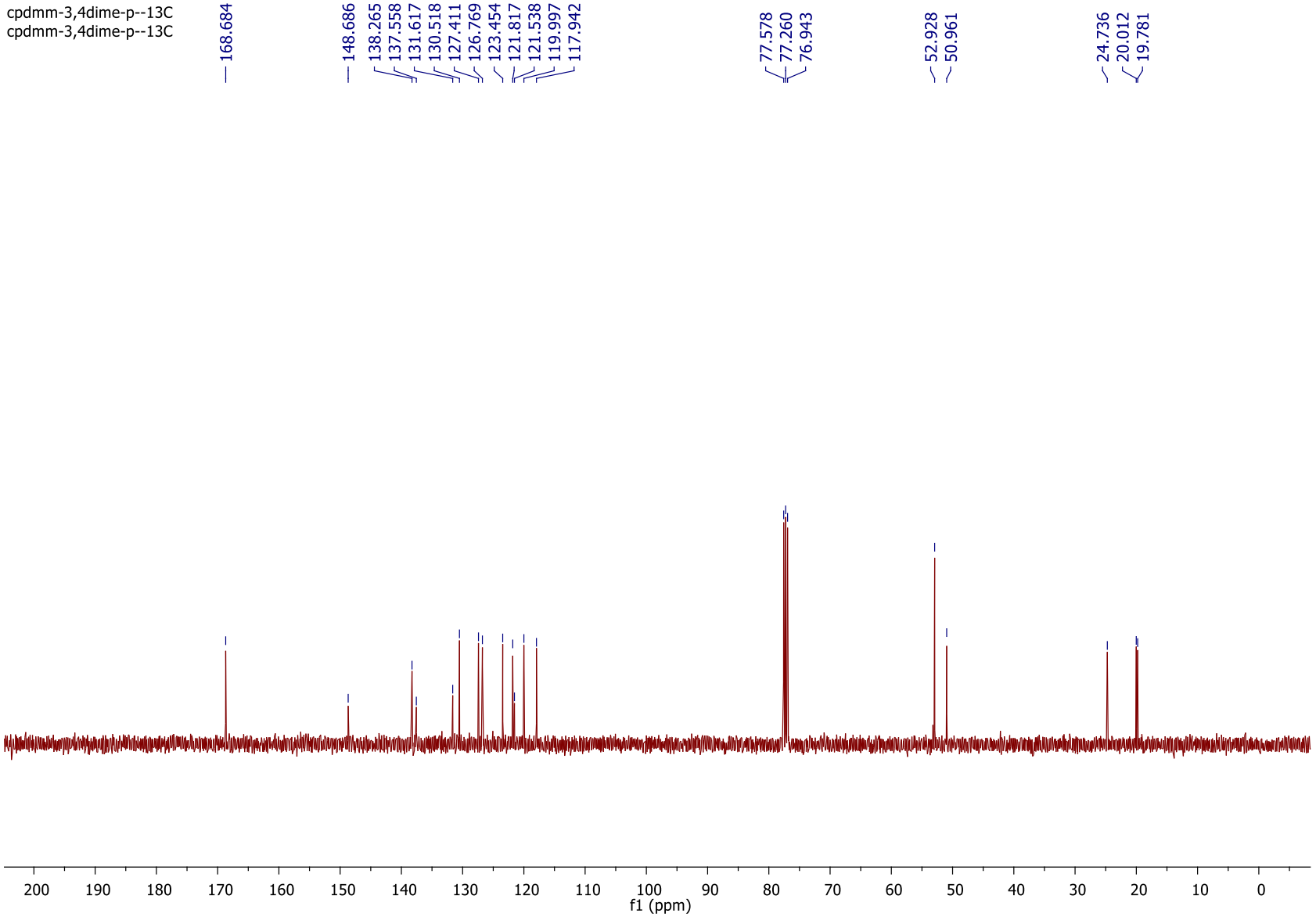
^{13}C spectrum of compound **3ag** (100 MHz, $CDCl_3$)



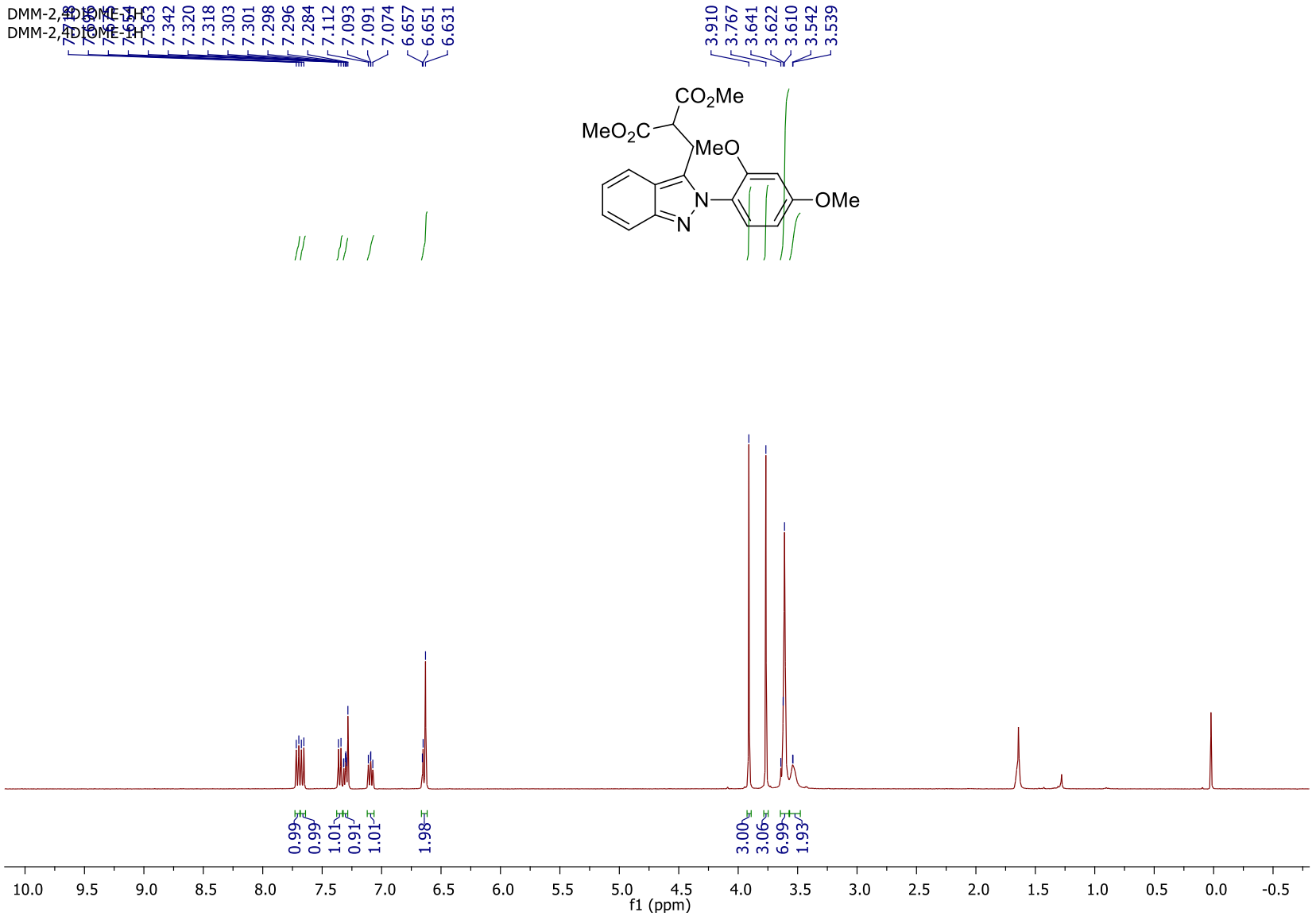
^{1}H spectrum of compound **3ah** (400 MHz, $CDCl_3$)



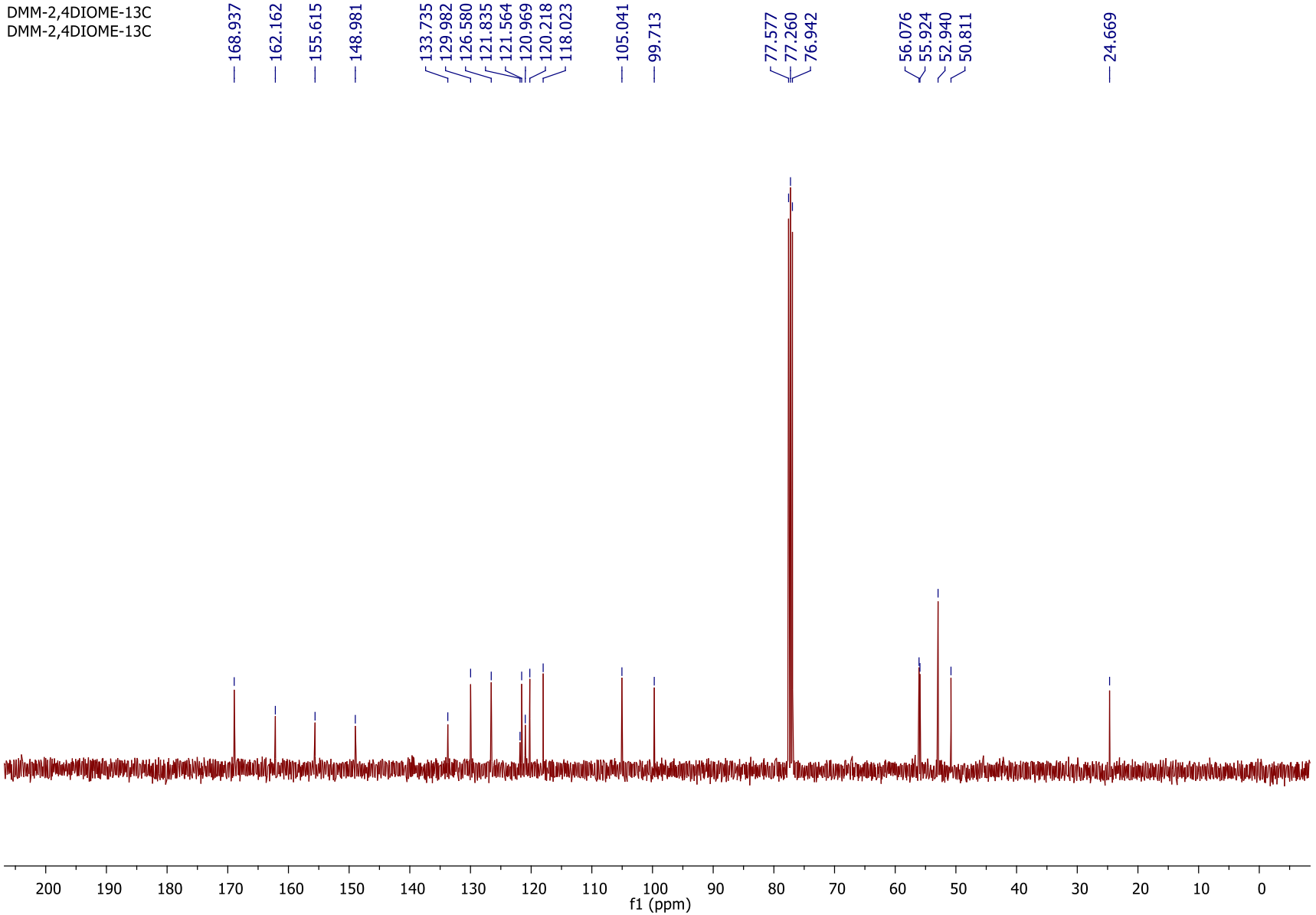
^{13}C spectrum of compound **3ah** (100 MHz, $CDCl_3$)



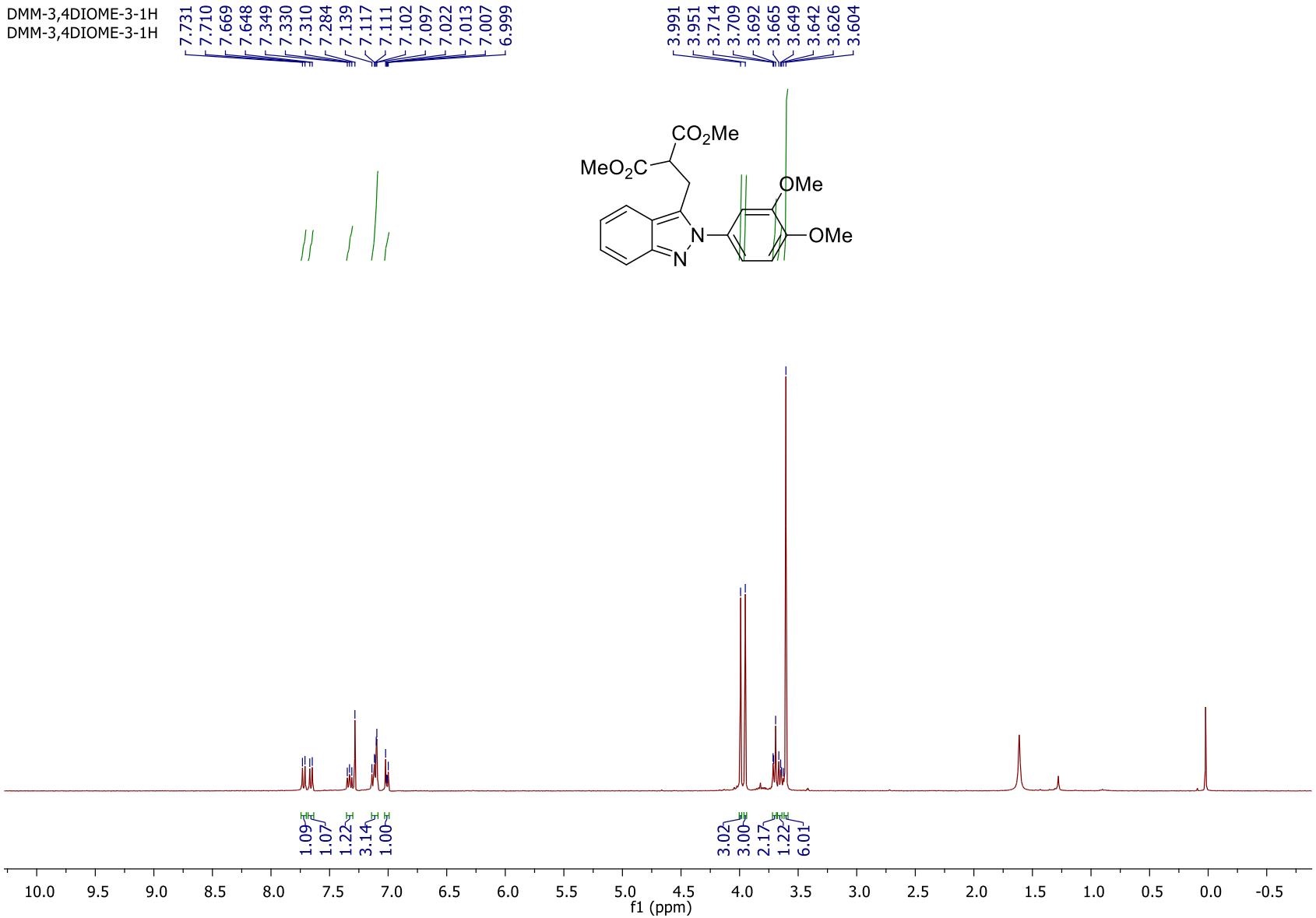
^{1}H spectrum of compound **3ai** (400 MHz, $CDCl_3$)



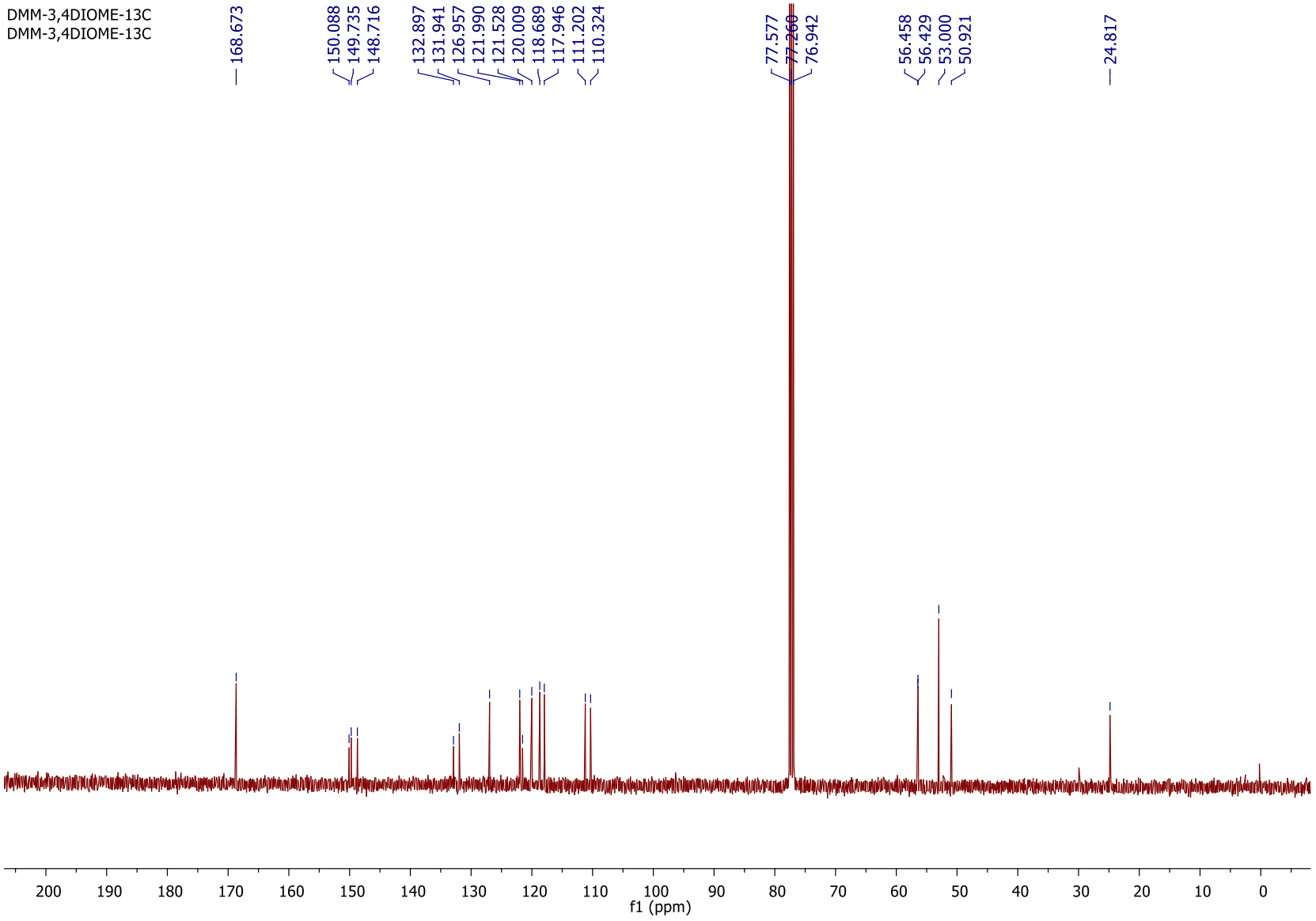
^{13}C spectrum of compound **3ai** (100 MHz, $CDCl_3$)



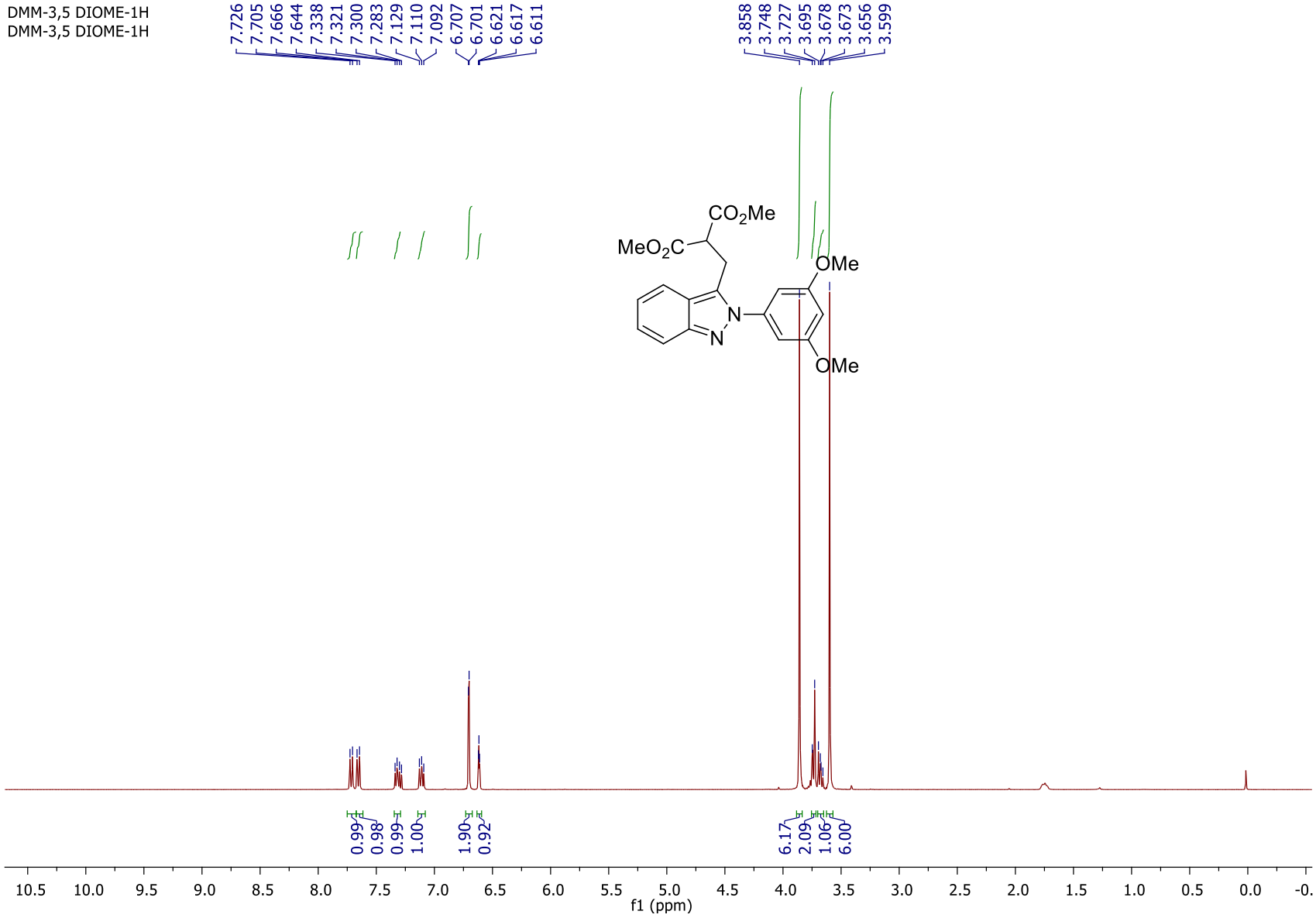
^{1}H spectrum of compound **3aj** (400 MHz, $CDCl_3$)



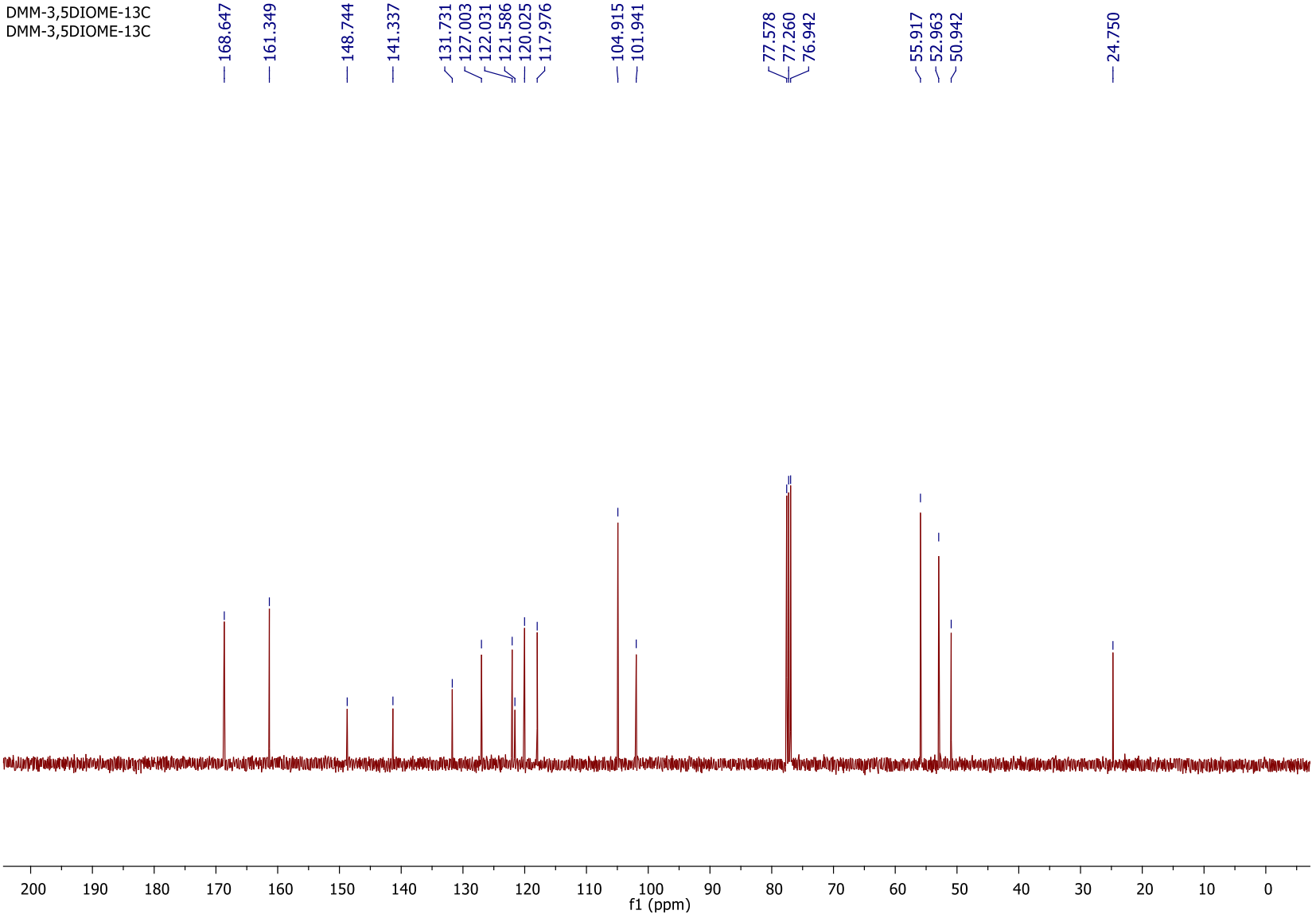
^{13}C spectrum of compound **3aj** (100 MHz, $CDCl_3$)



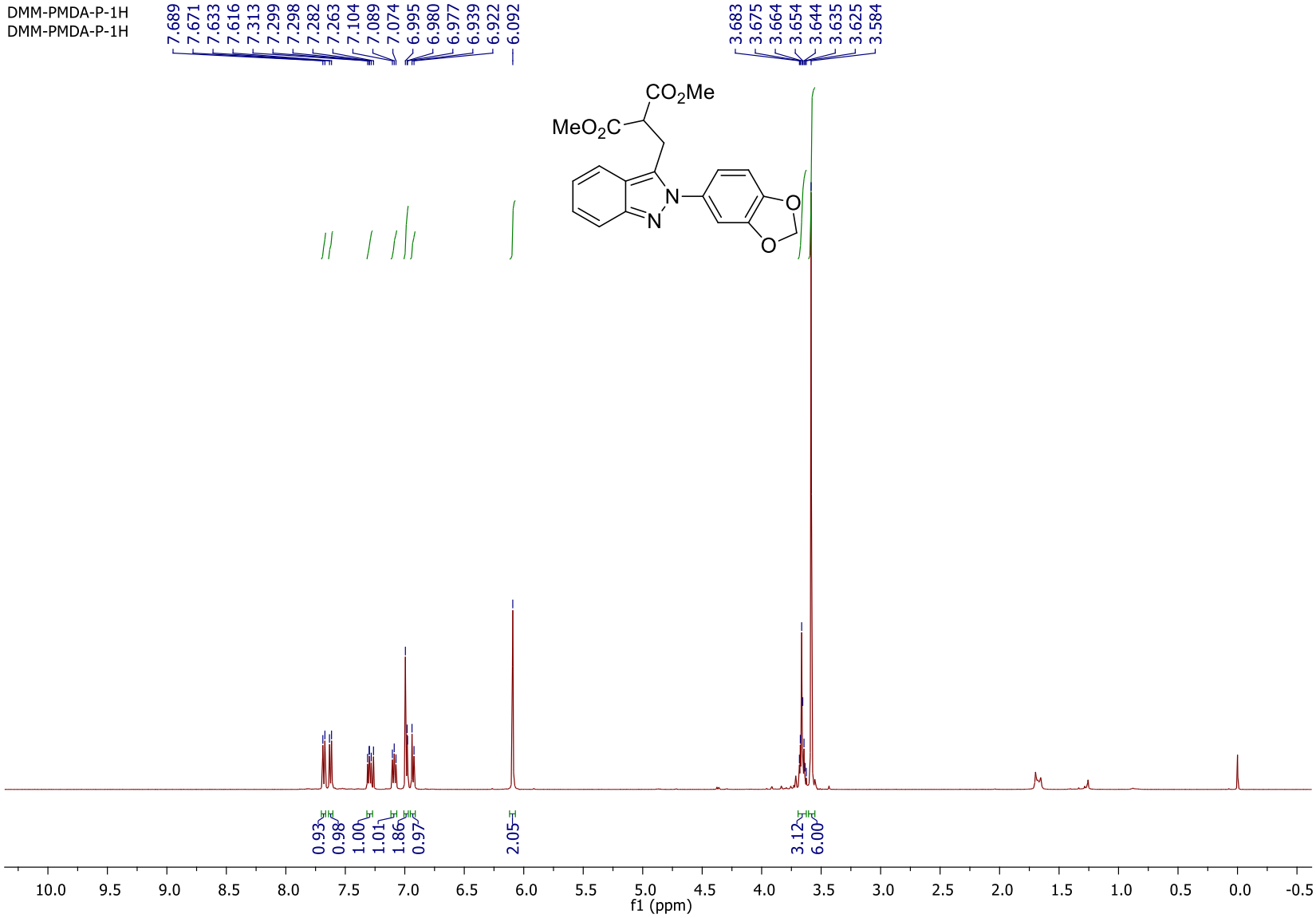
^{1}H spectrum of compound **3ak** (400 MHz, $CDCl_3$)



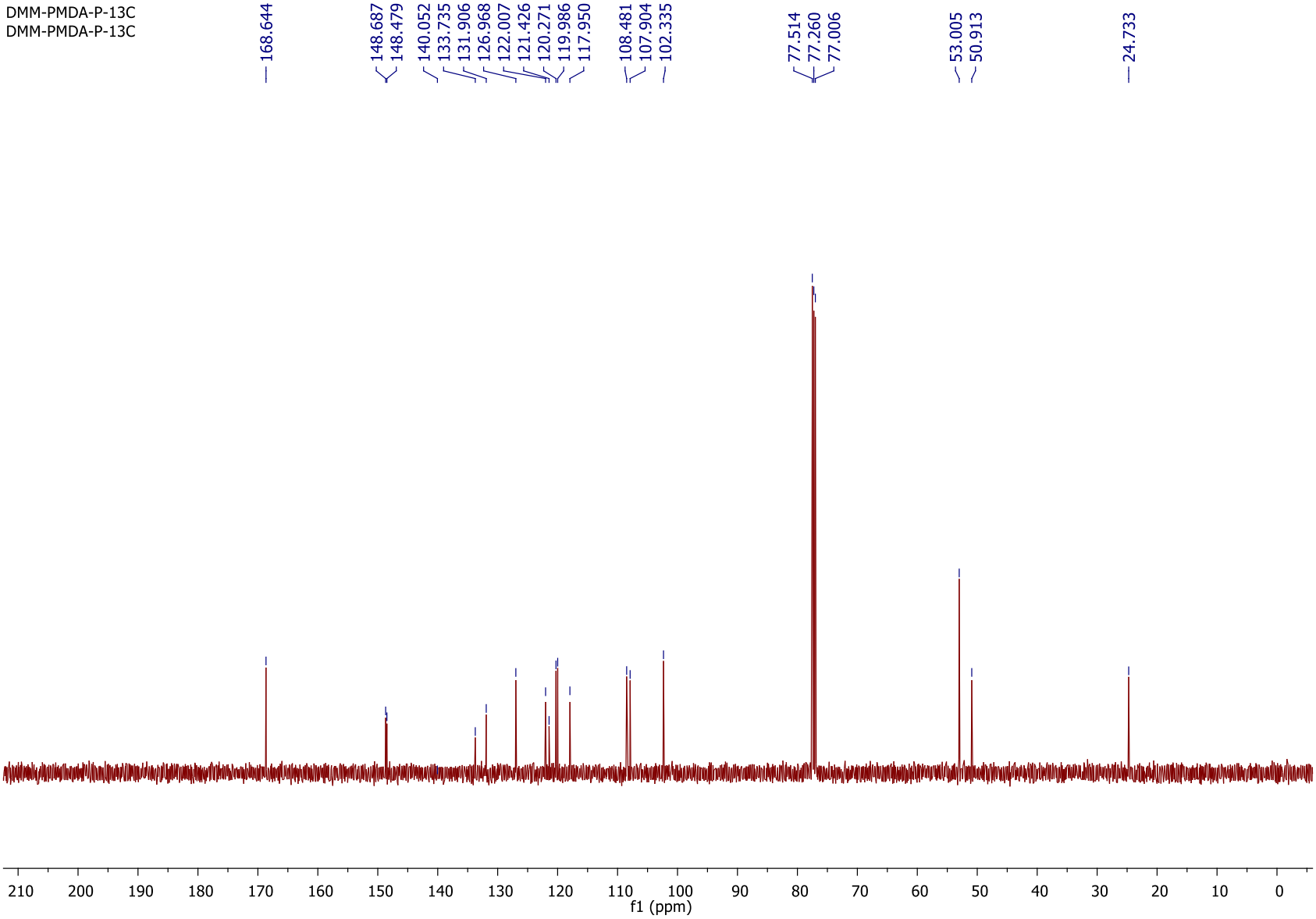
^{13}C spectrum of compound **3ak** (100 MHz, $CDCl_3$)



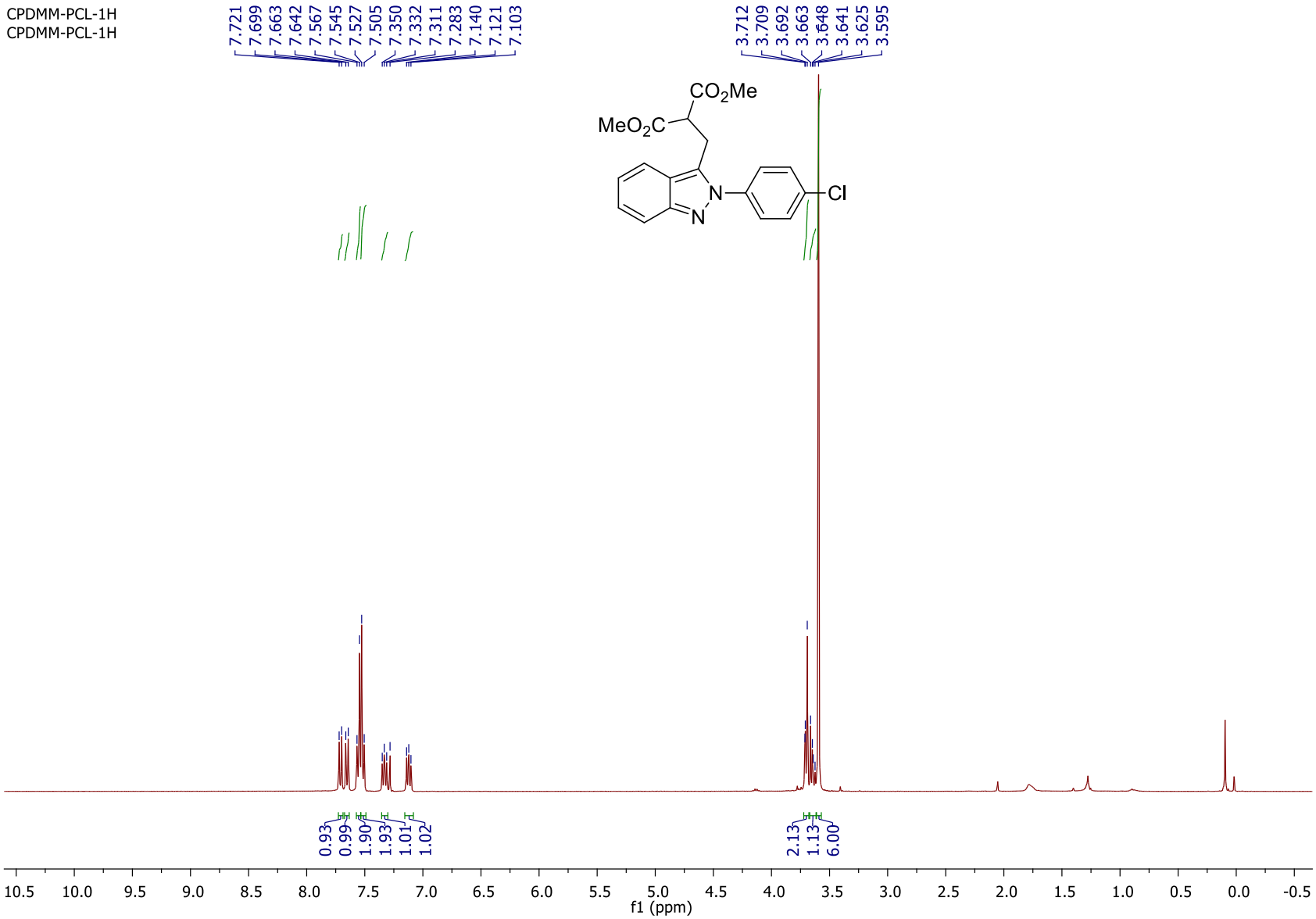
^{1}H spectrum of compound **3al** (500 MHz, $CDCl_3$)



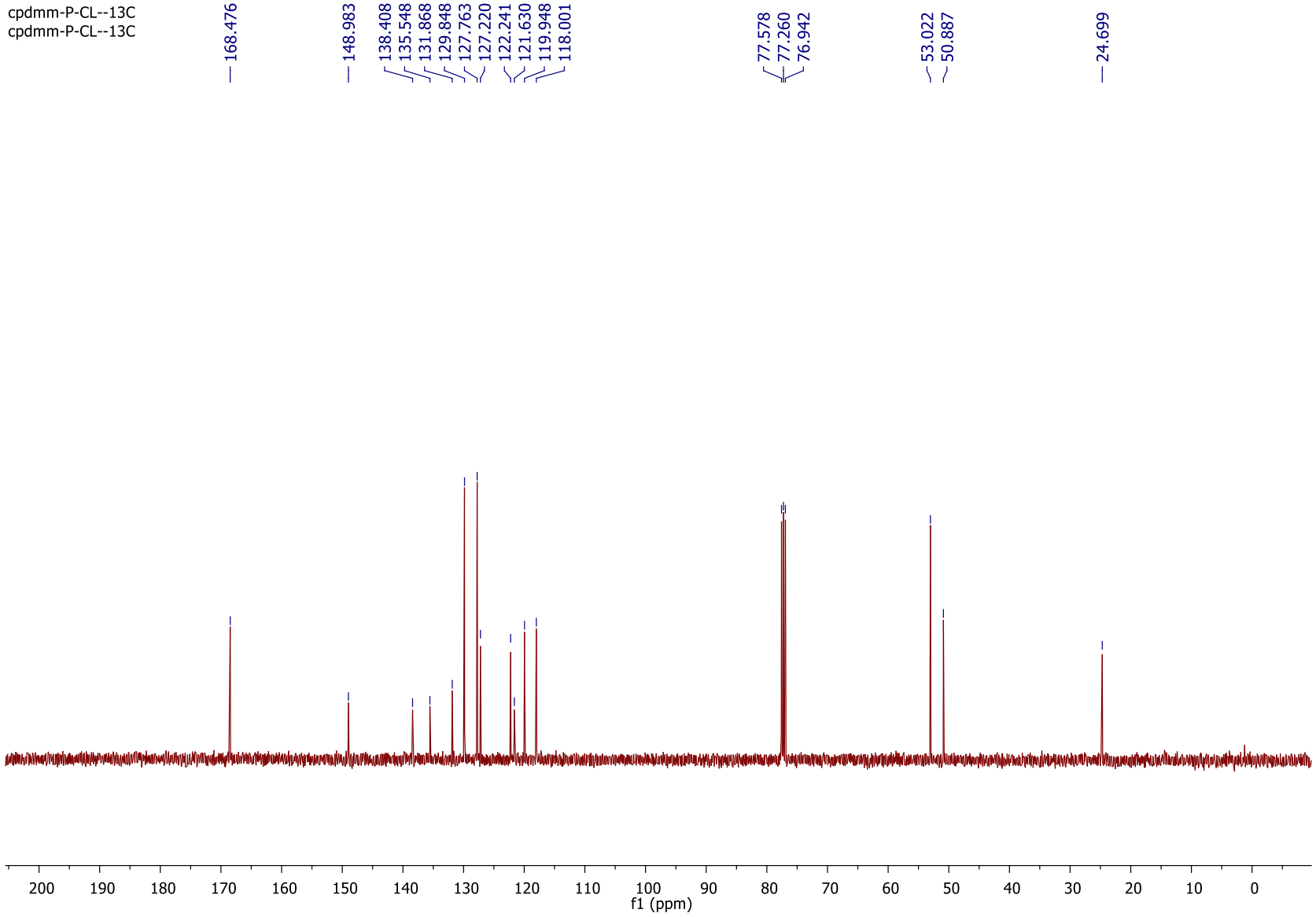
^{13}C spectrum of compound **3al** (125 MHz, $CDCl_3$)



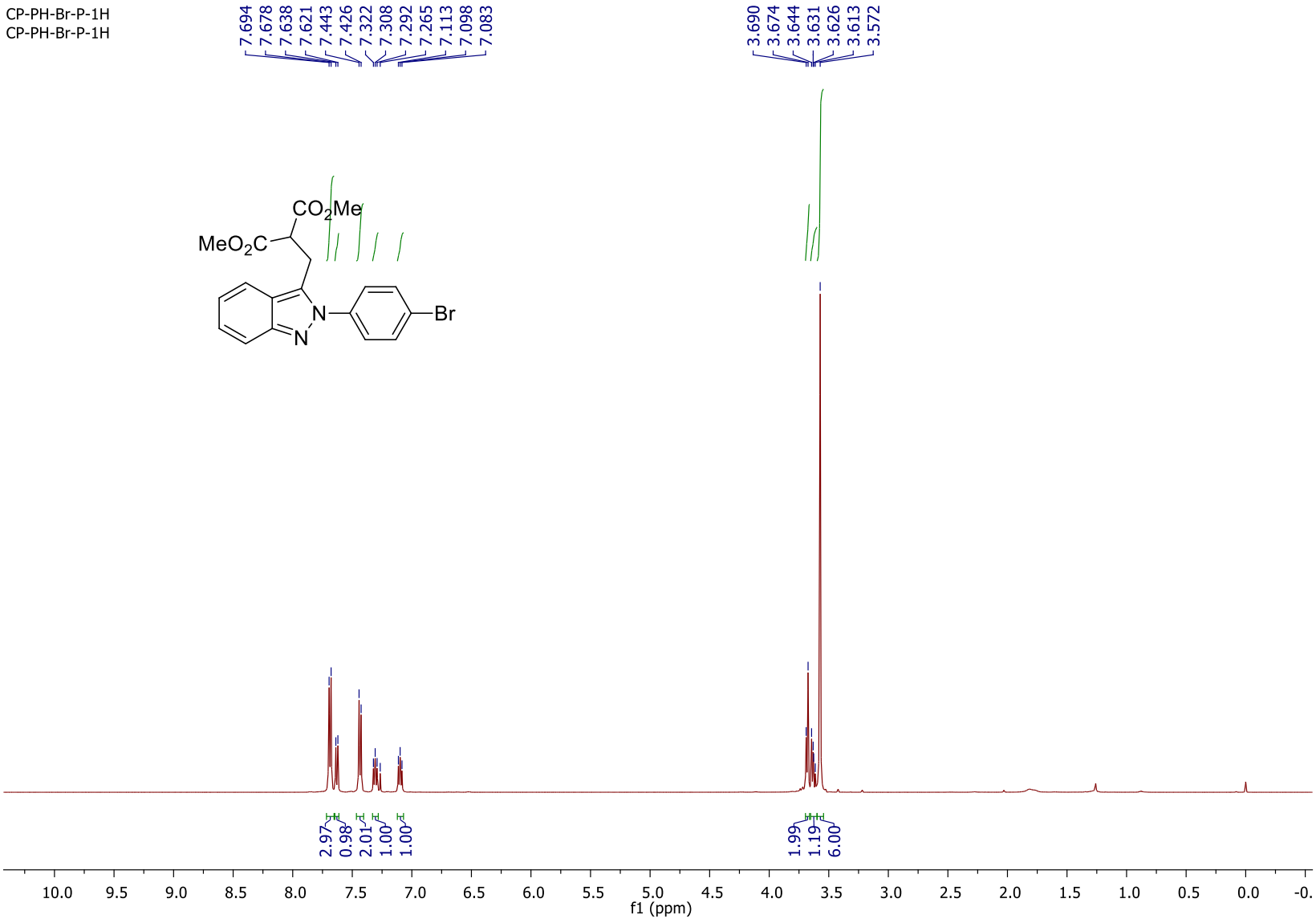
^{1}H spectrum of compound **3am** (400 MHz, $CDCl_3$)



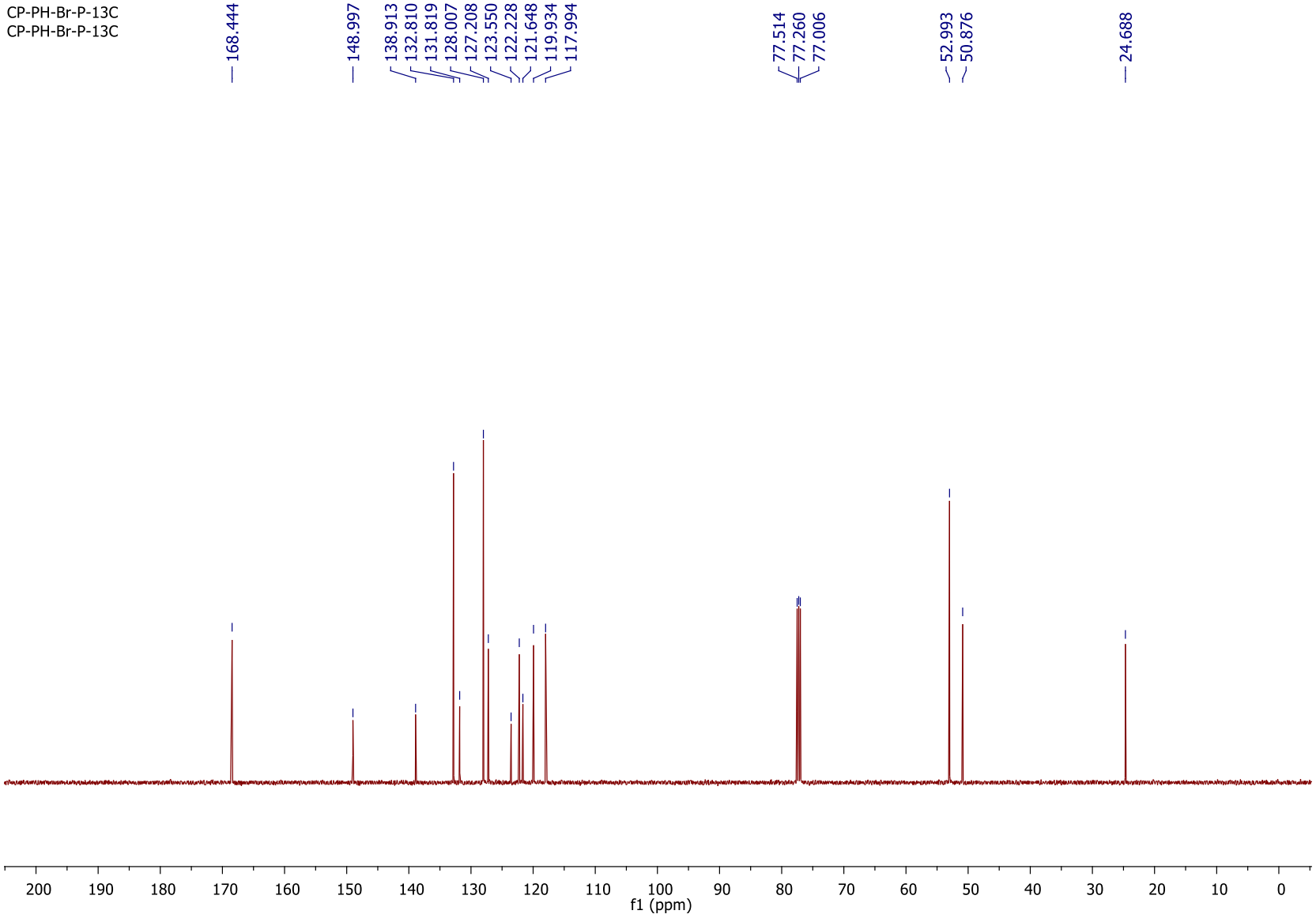
^{13}C spectrum of compound **3am** (100 MHz, $CDCl_3$)



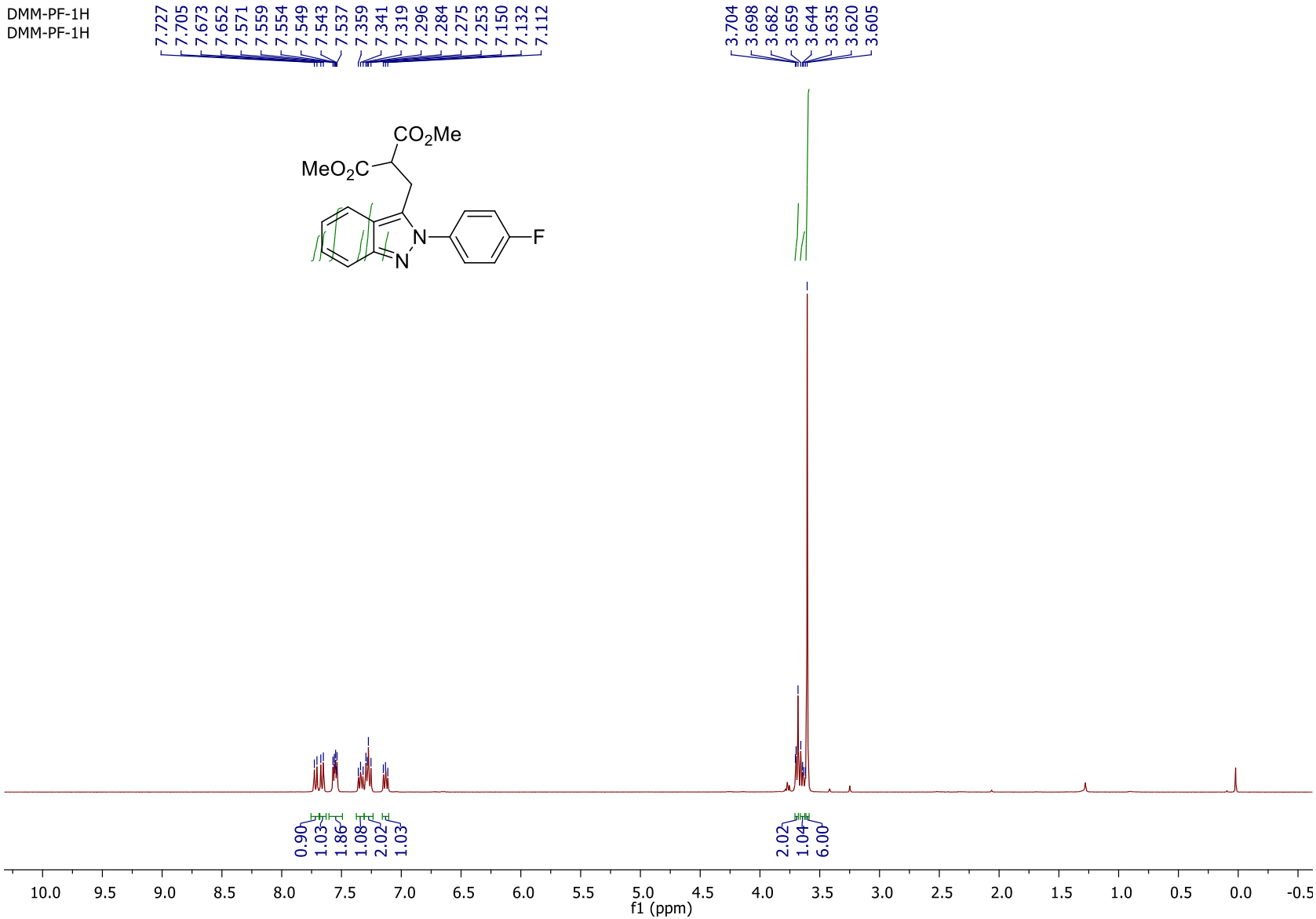
^{1}H spectrum of compound **3an** (500 MHz, $CDCl_3$)



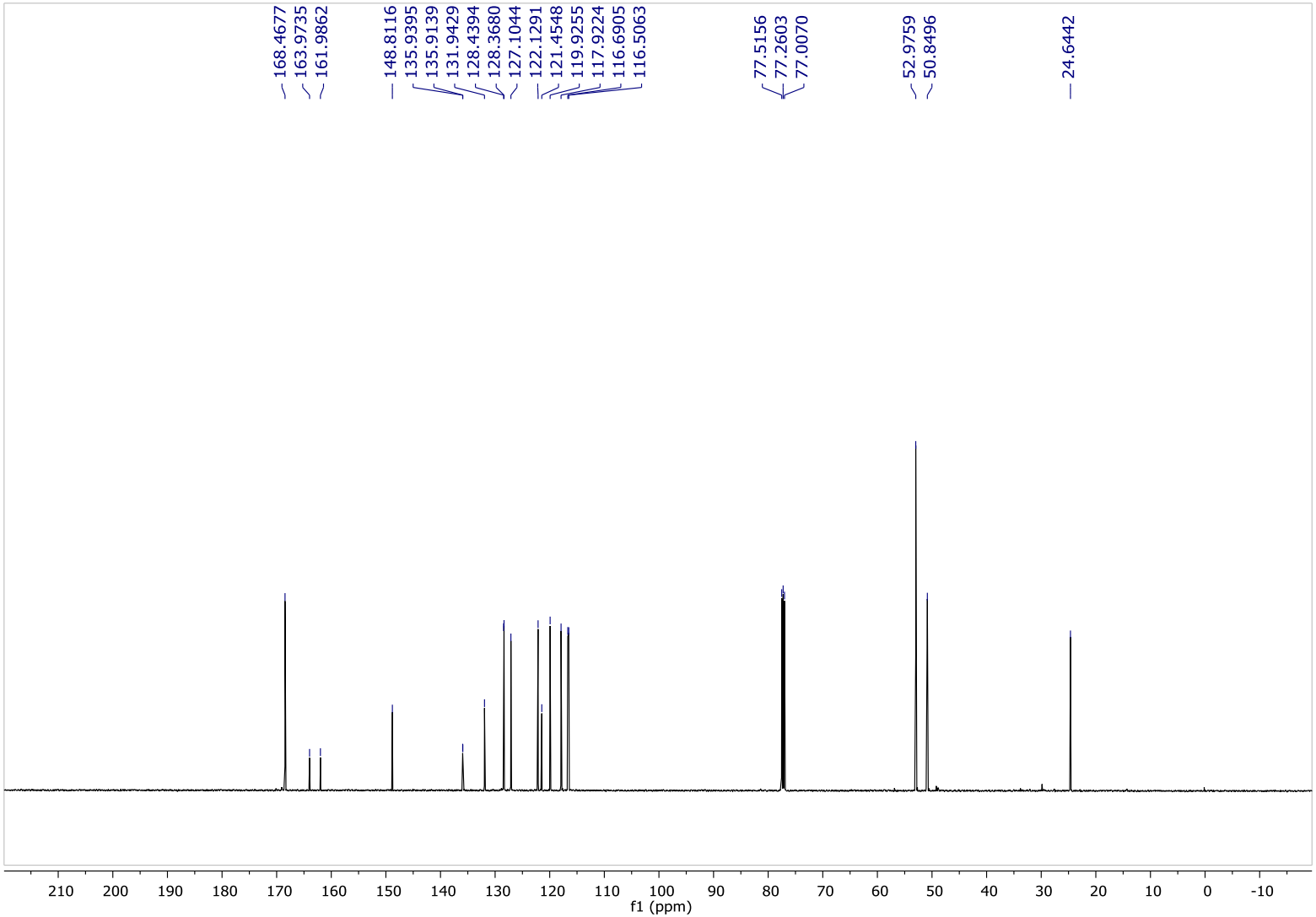
^{1}H spectrum of compound **3an** (125 MHz, $CDCl_3$)



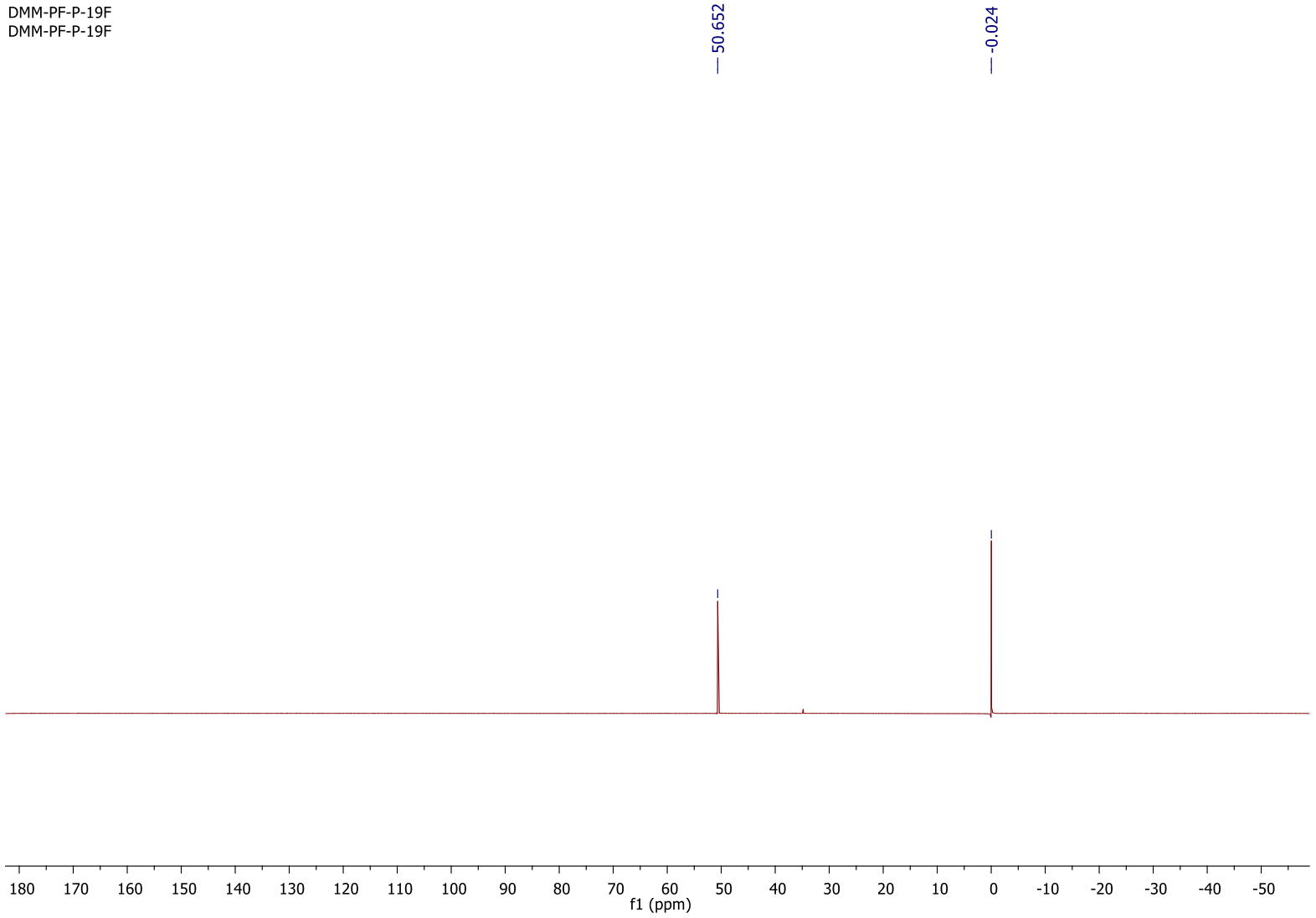
^{1}H spectrum of compound **3ao** (400 MHz, $CDCl_3$)



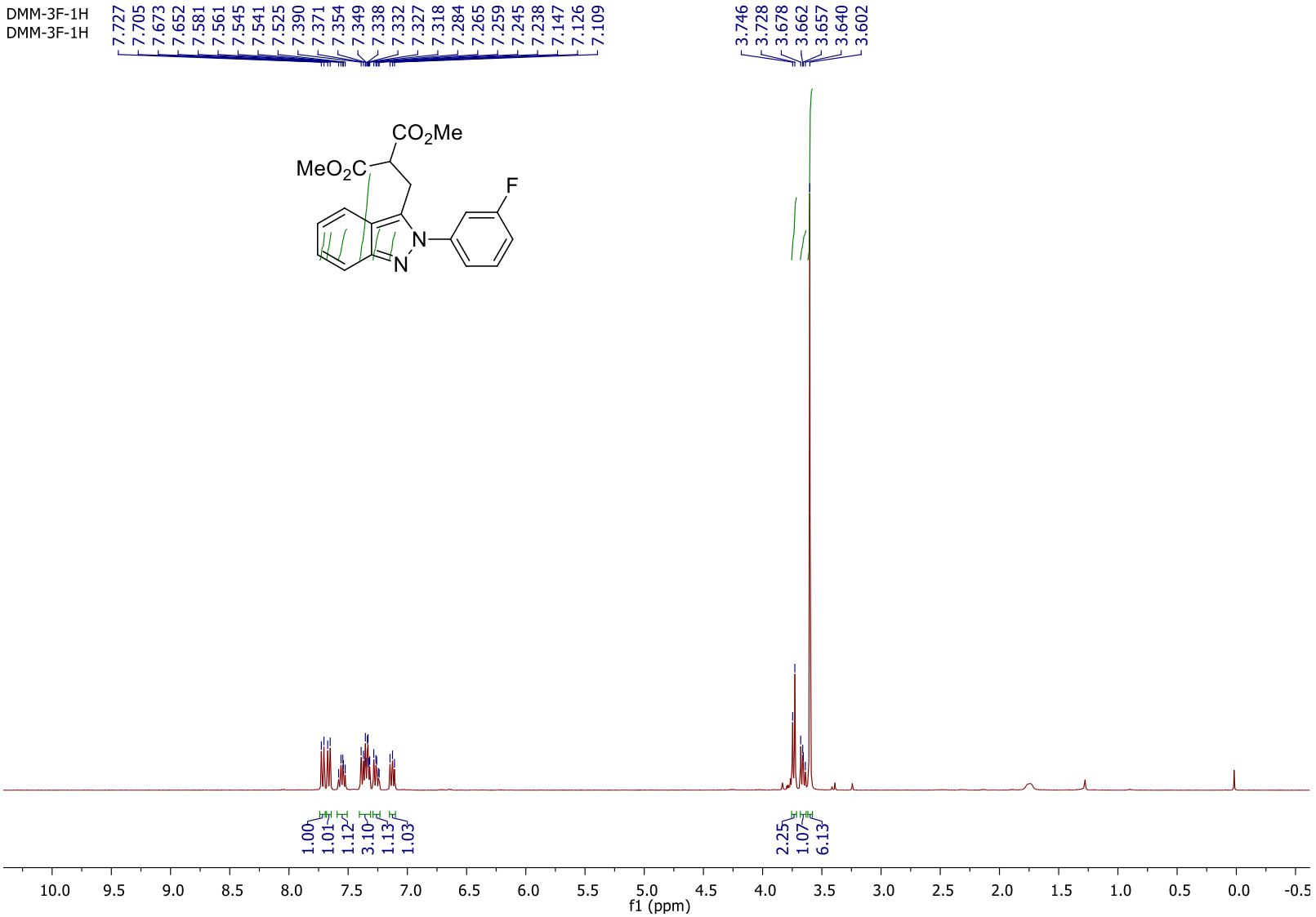
^{13}C spectrum of compound **3ao** (125 MHz, $CDCl_3$)



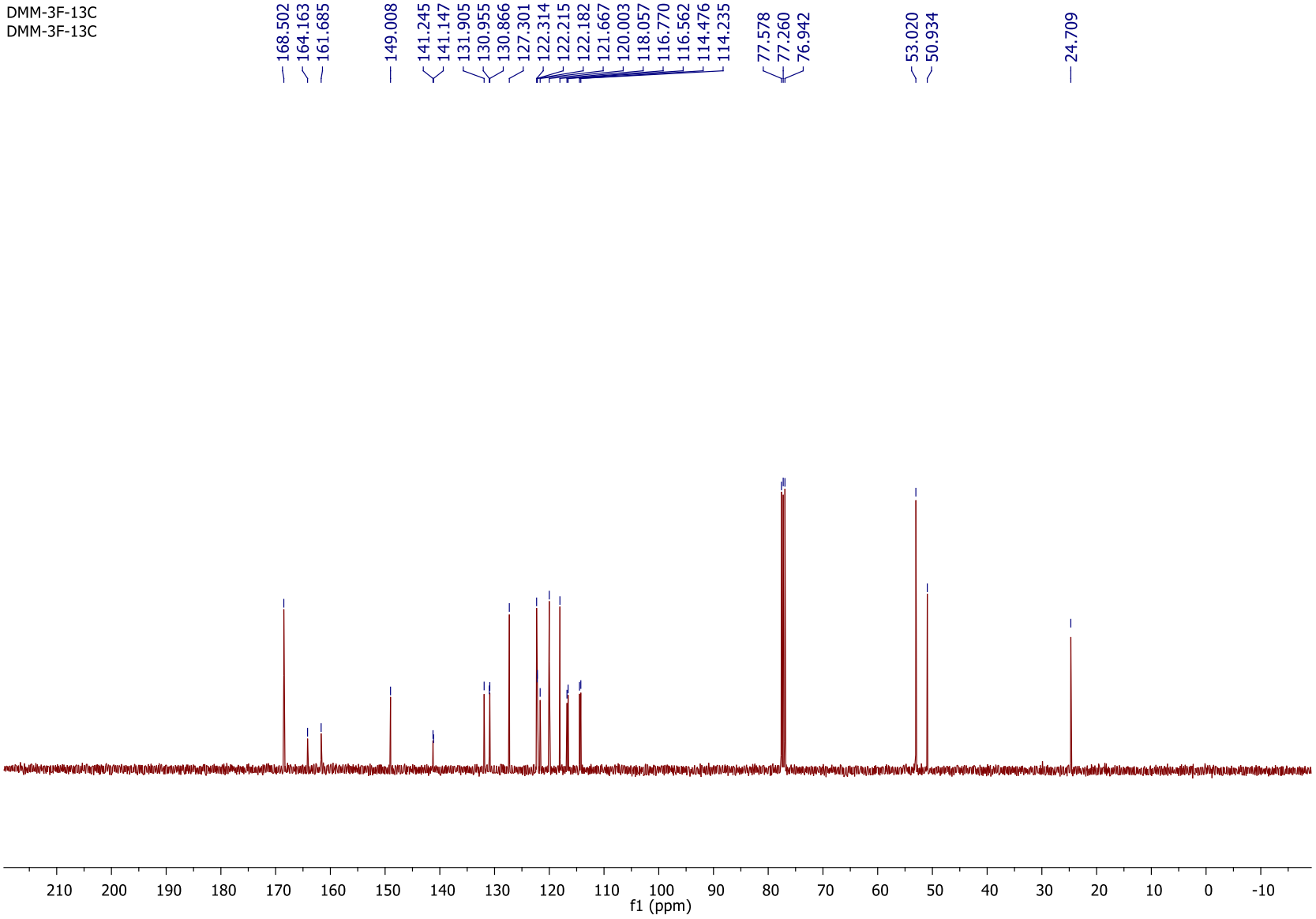
^{19}F spectrum of compound **3ao** (471 MHz, $CDCl_3$)



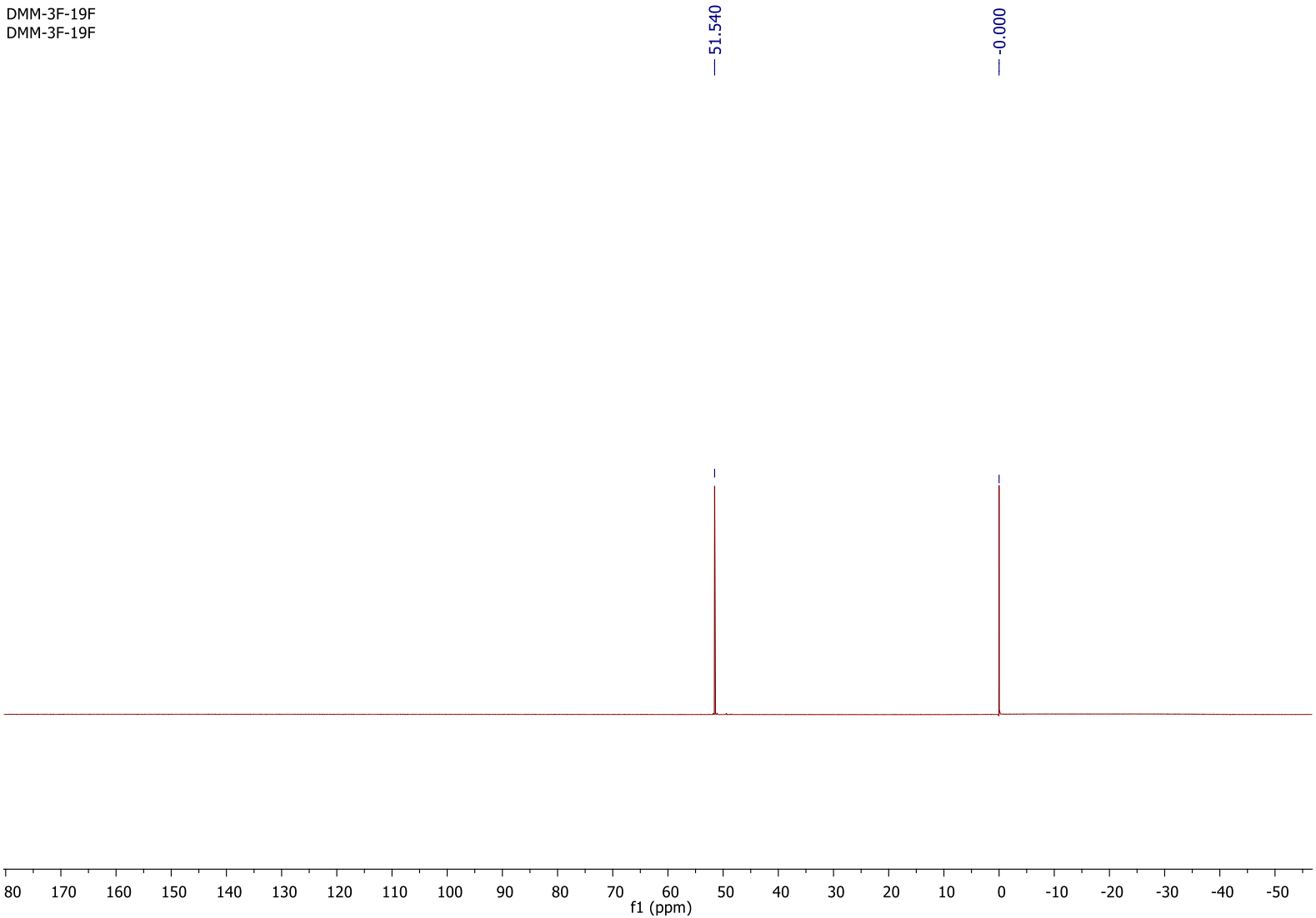
^{1}H spectrum of compound **3ap** (400 MHz, $CDCl_3$)



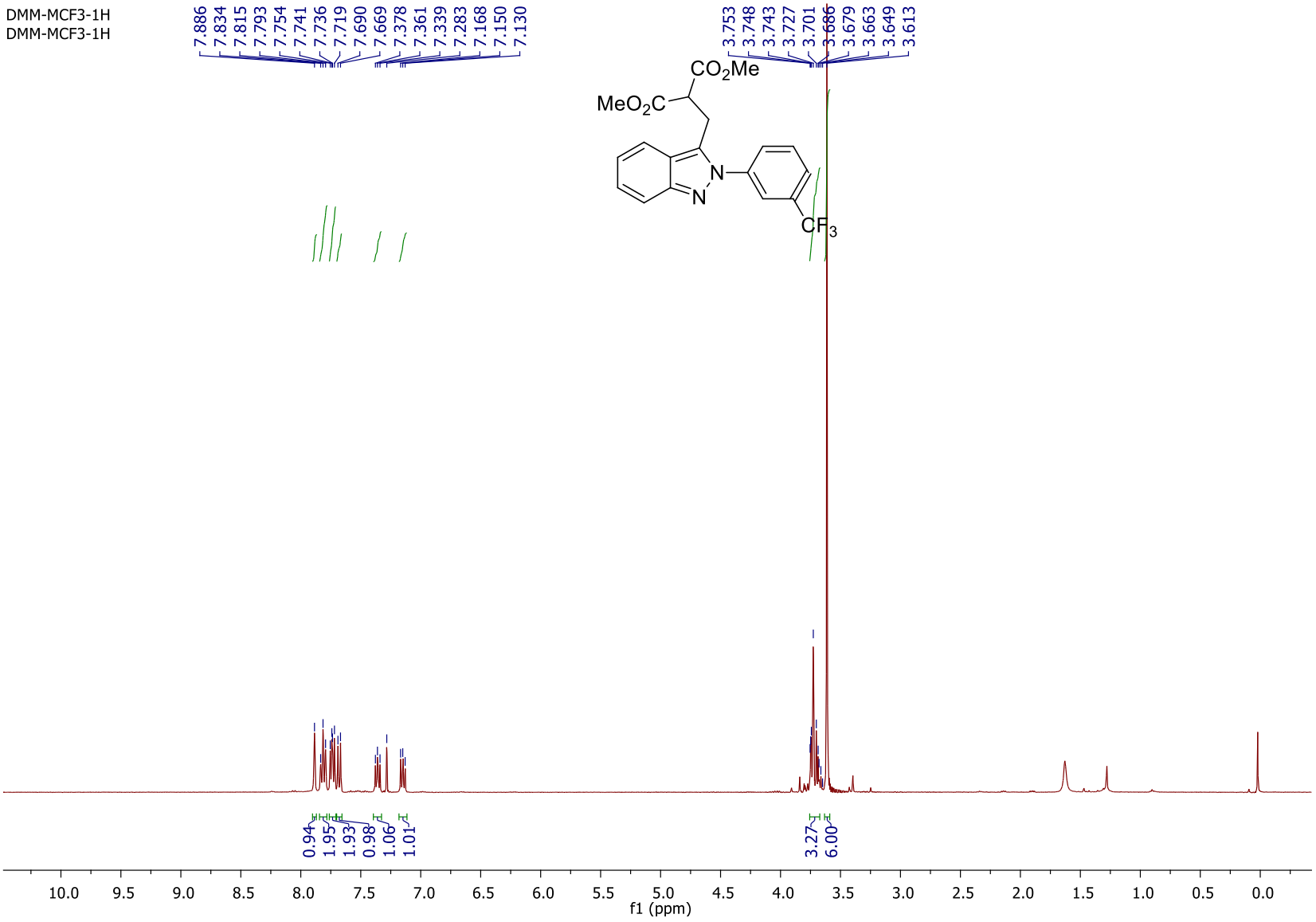
^{13}C spectrum of compound **3ap** (100 MHz, $CDCl_3$)



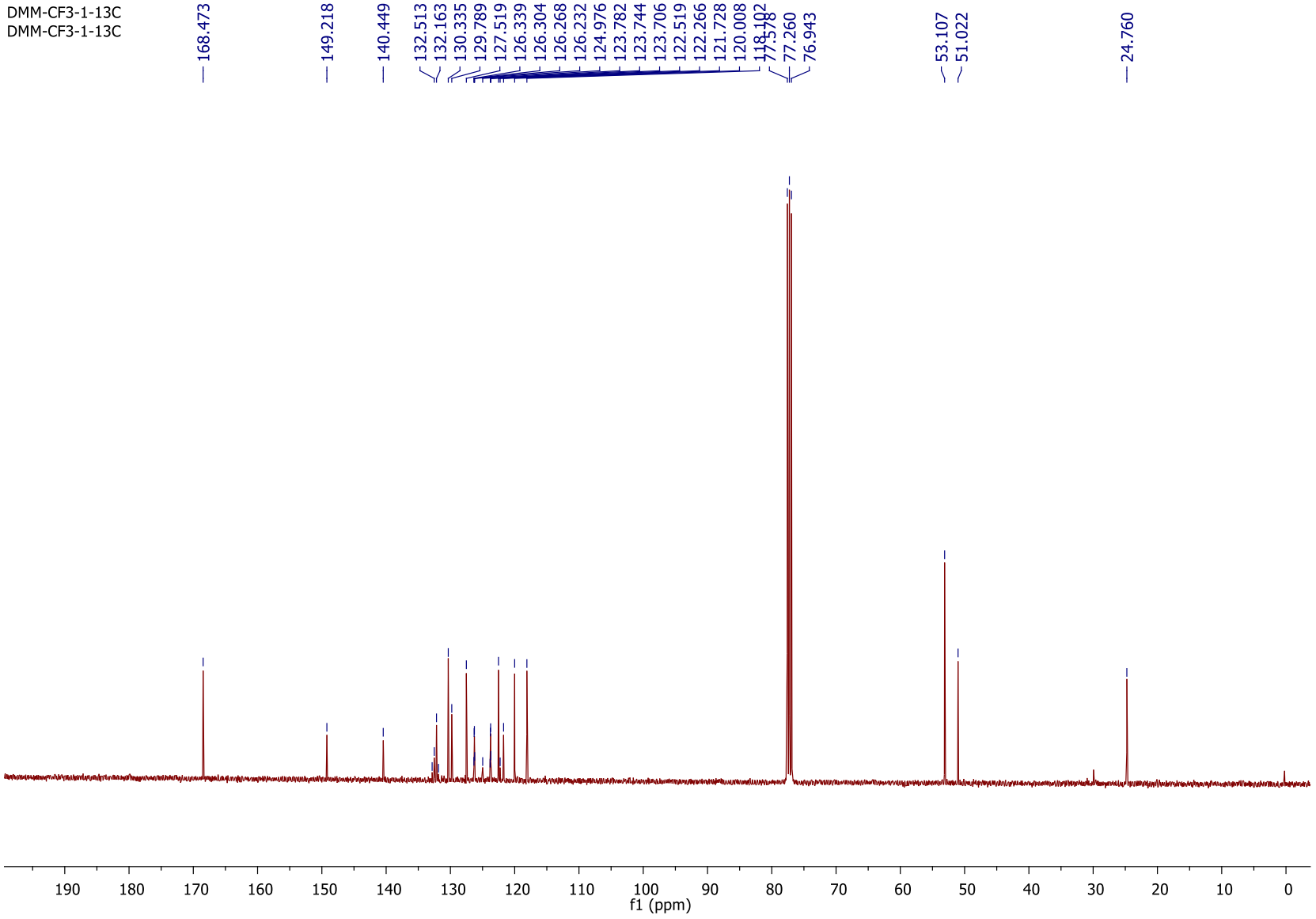
^{19}F spectrum of compound **3ap** (371 MHz, $C_6F_6/CDCl_3$)



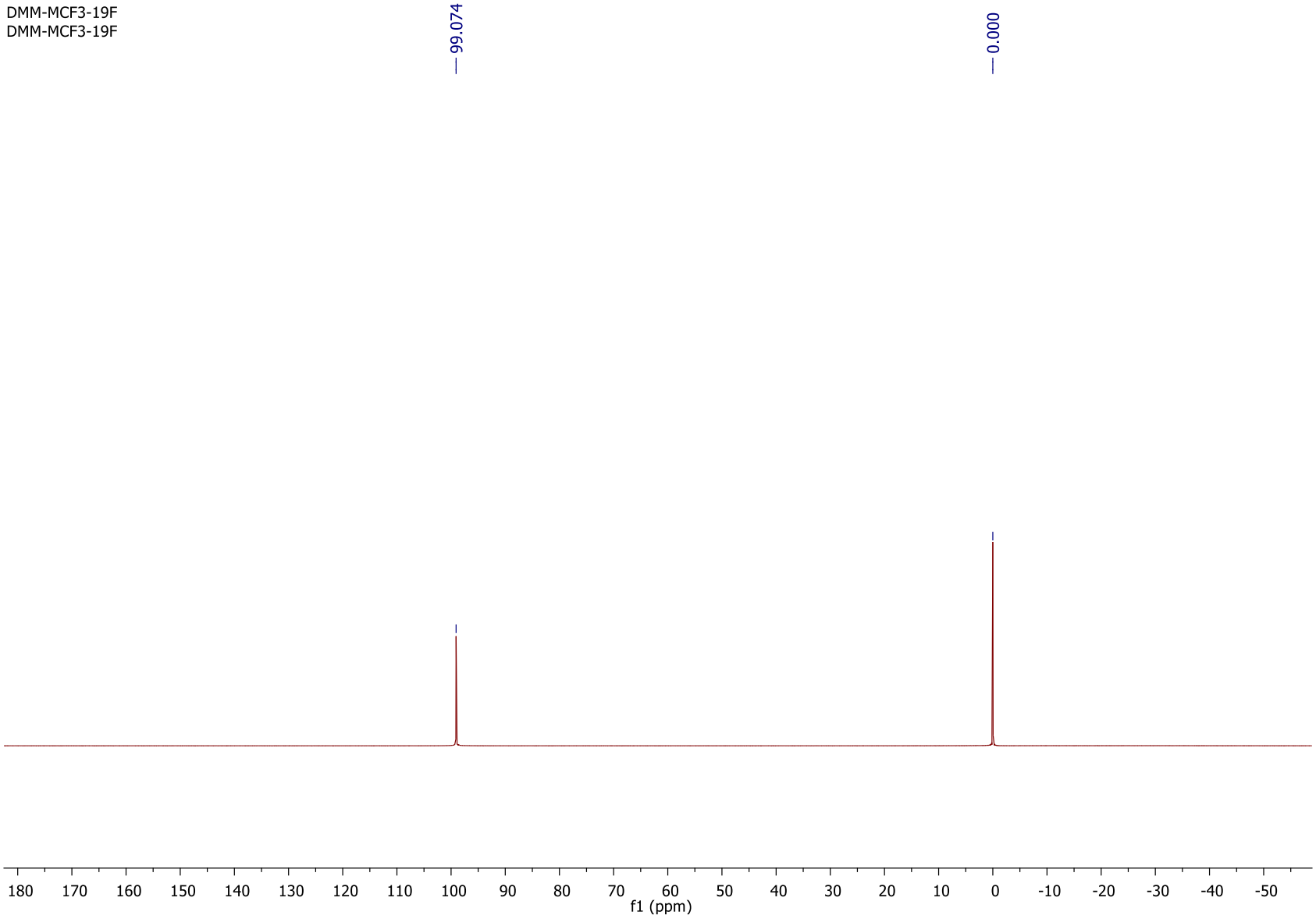
^{1}H spectrum of compound **3aq** (400 MHz, $CDCl_3$)



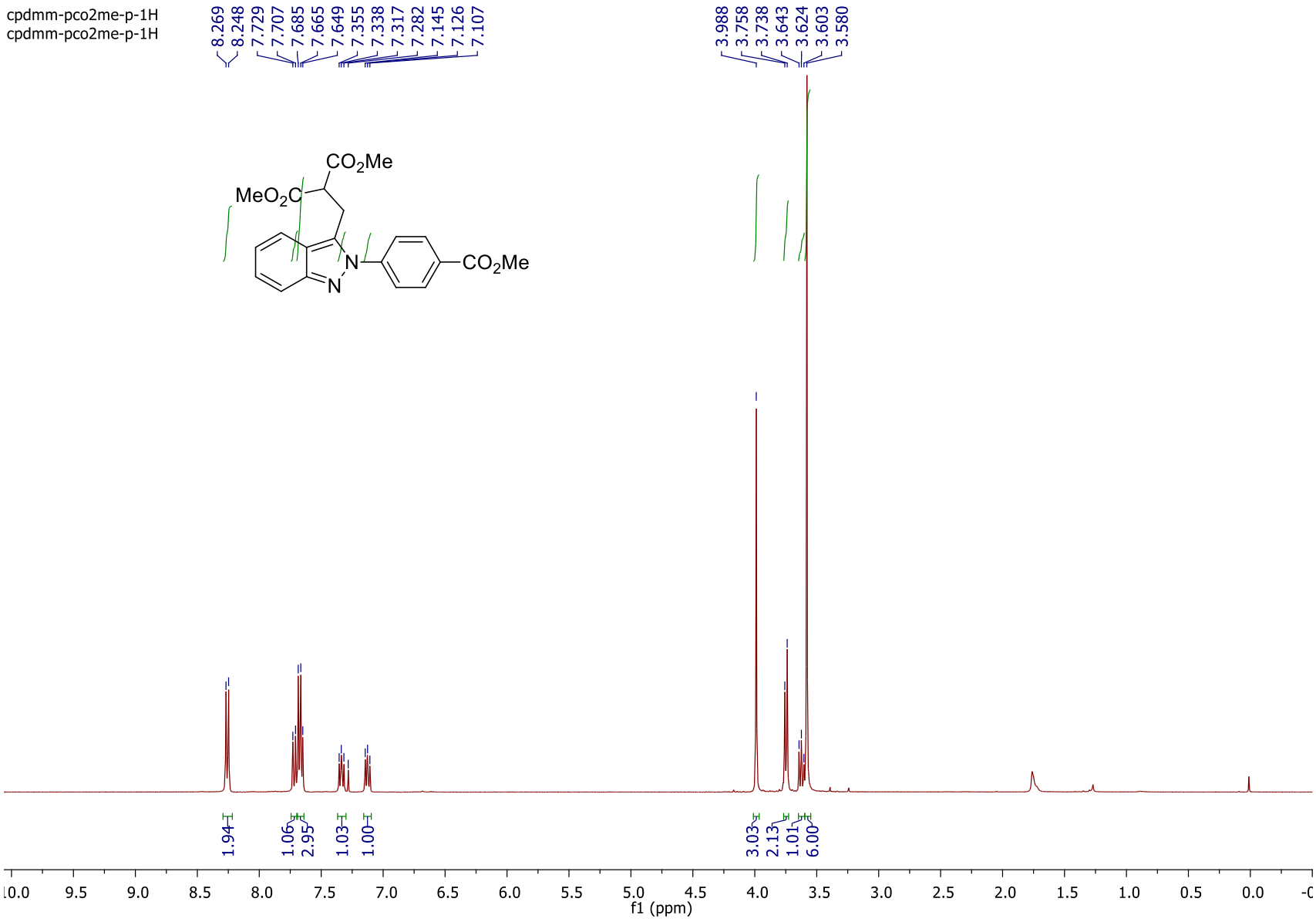
^{13}C spectrum of compound **3aq** (100 MHz, $CDCl_3$)



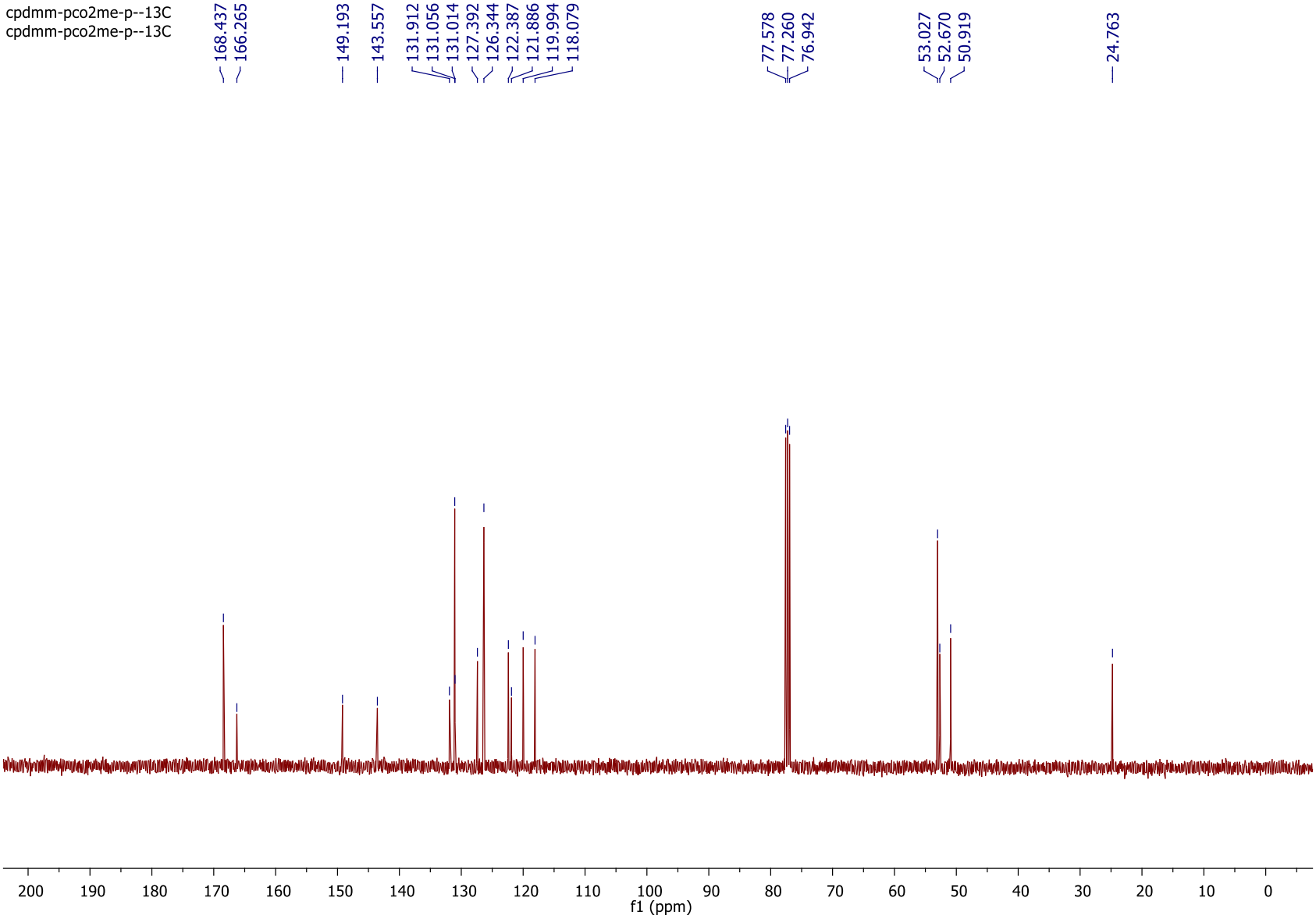
^{19}F spectrum of compound **3aq** (471 MHz, $C_6F_6/CDCl_3$)



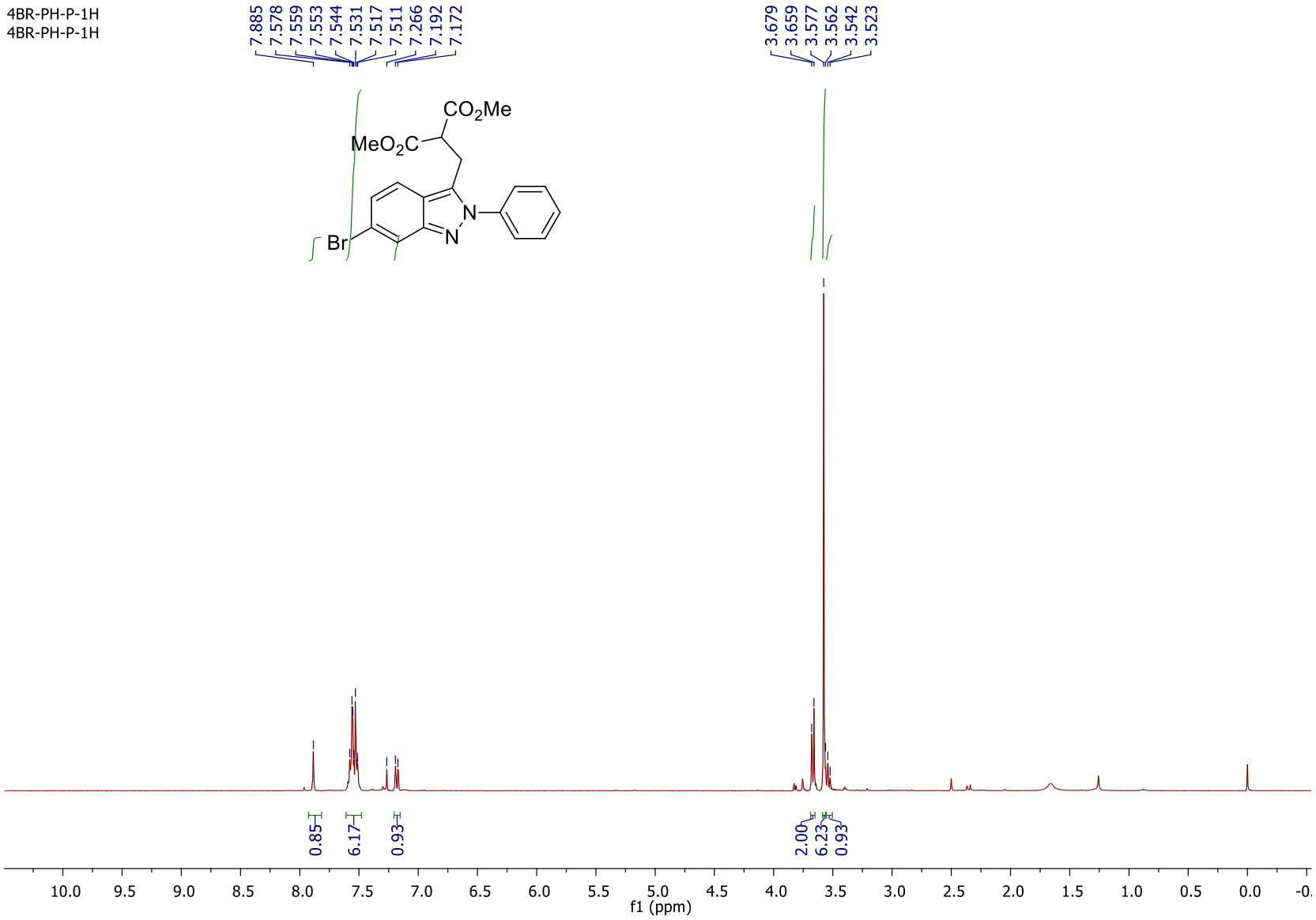
^{1}H spectrum of compound **3ar** (400 MHz, $CDCl_3$)



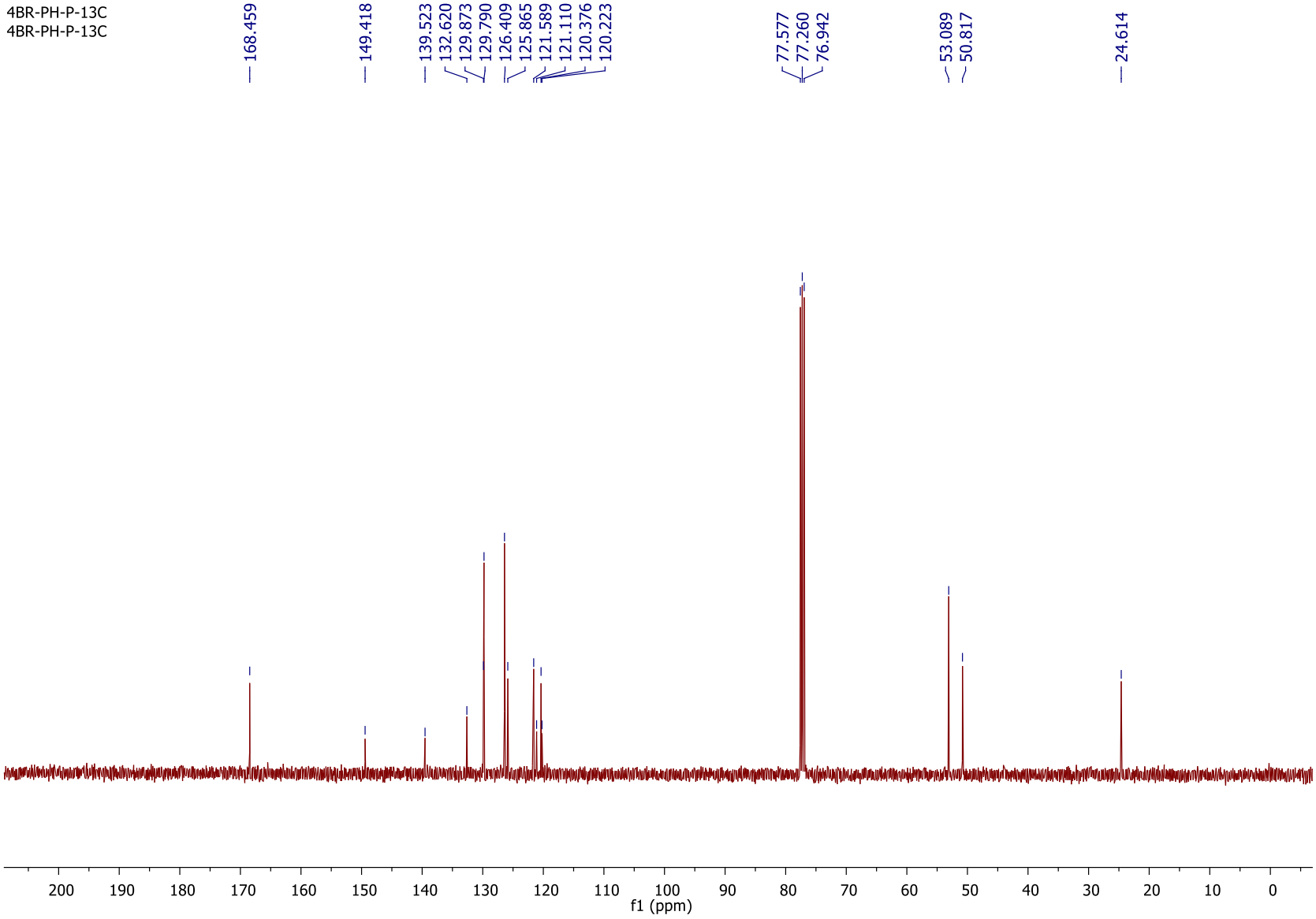
^{13}C spectrum of compound **3ar** (100 MHz, $CDCl_3$)



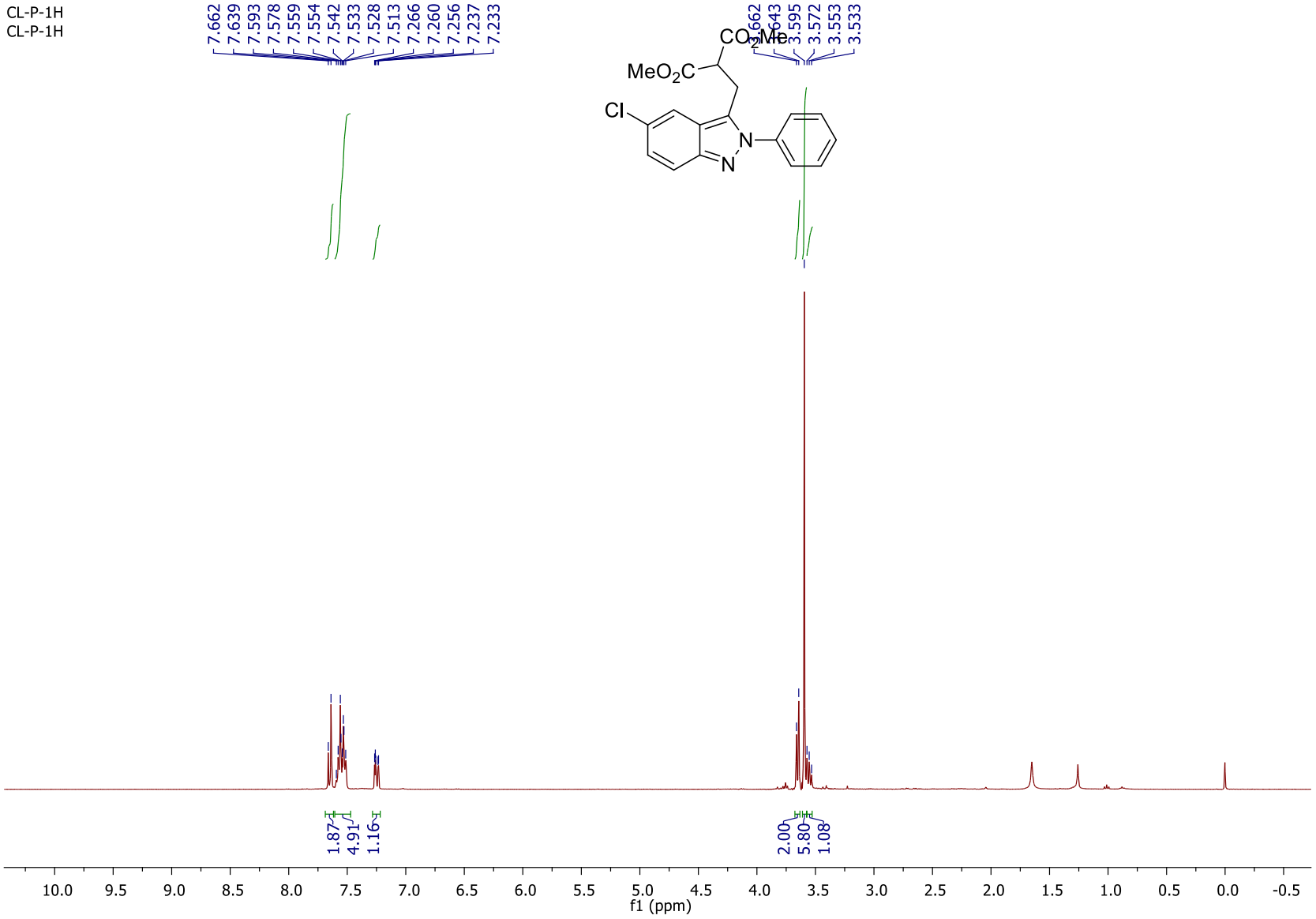
^{1}H spectrum of compound **3ba** (400 MHz, $CDCl_3$)



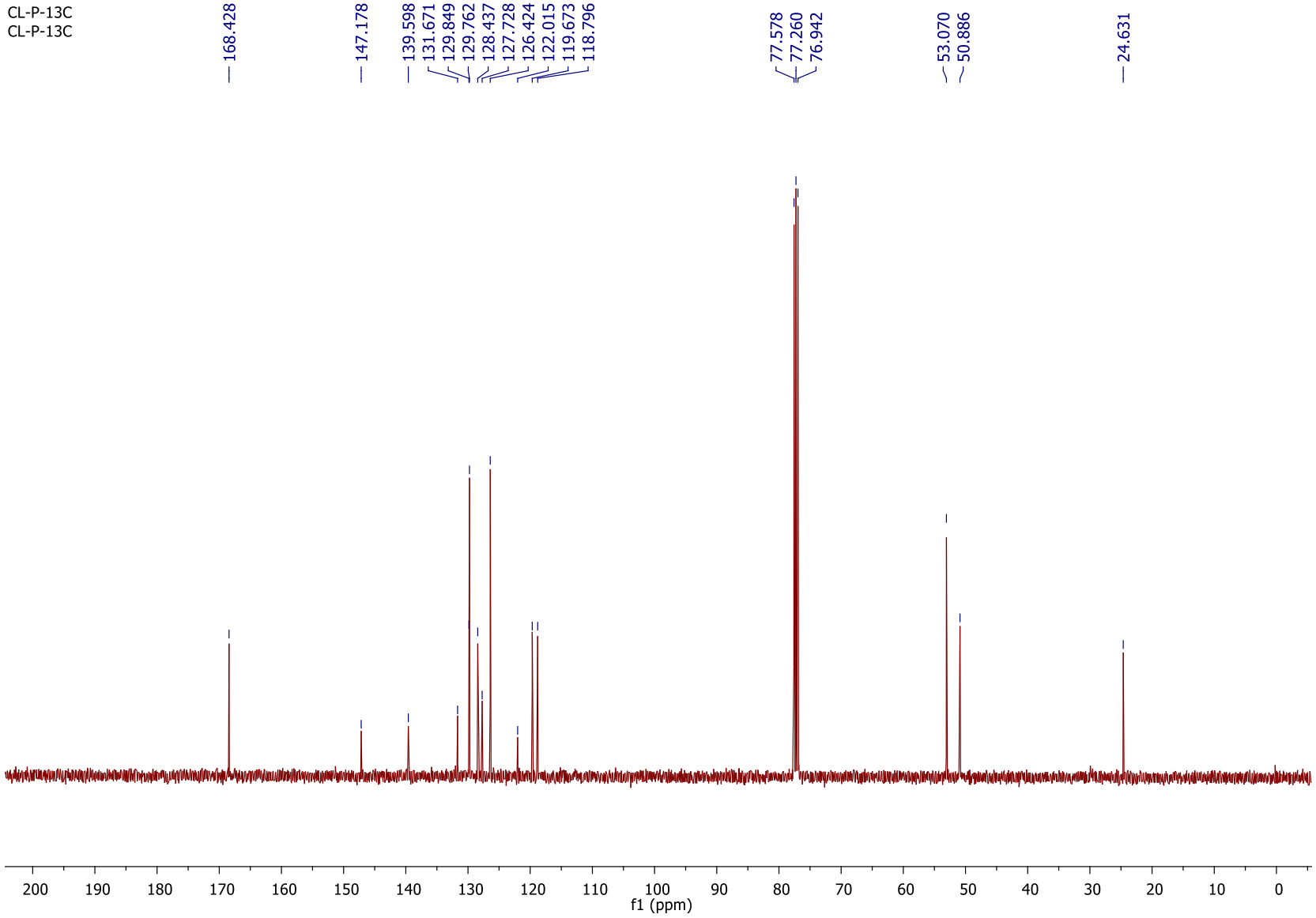
^{13}C spectrum of compound **3ba** (100 MHz, $CDCl_3$)



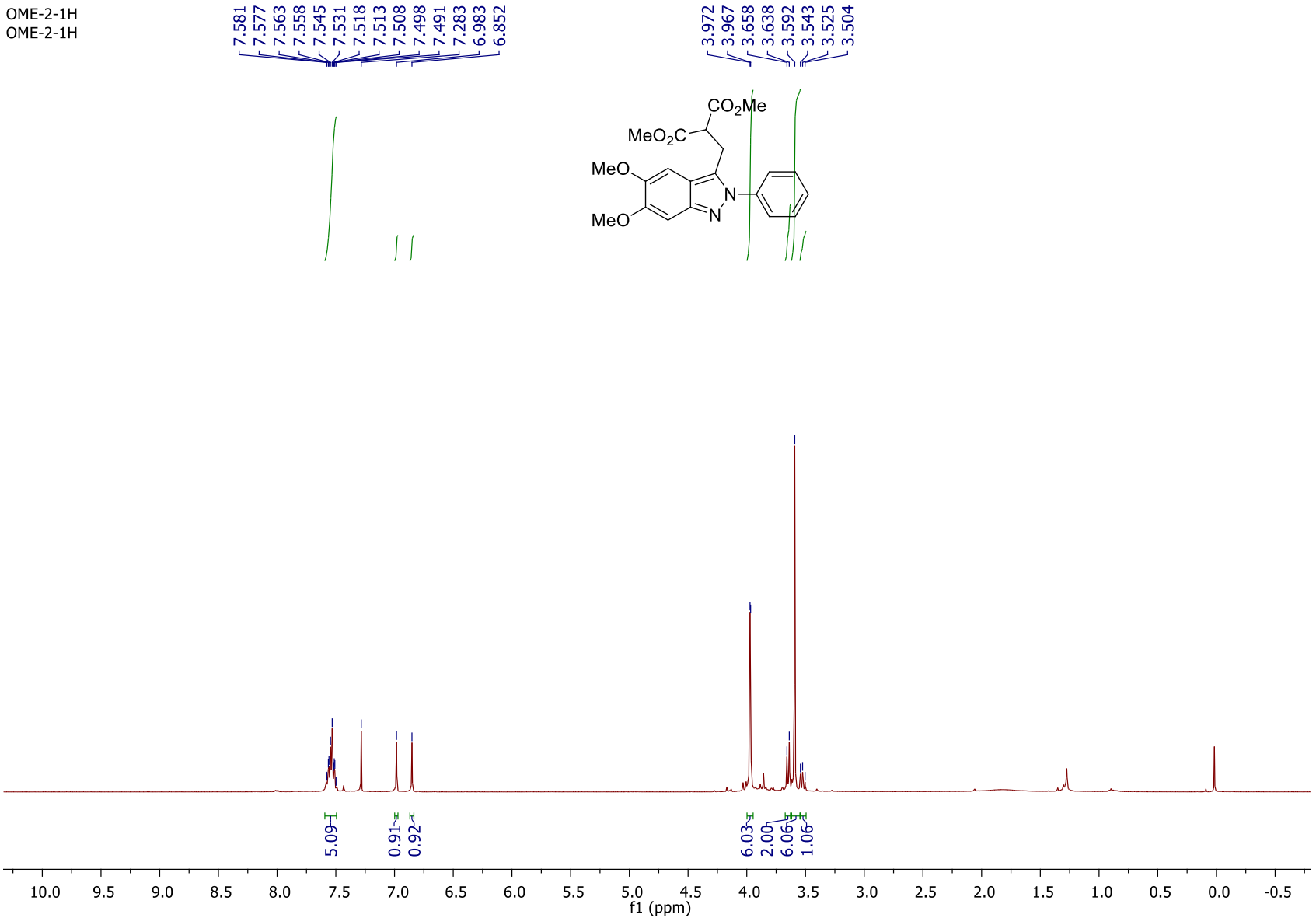
^{1}H spectrum of compound **3ca** (400 MHz, $CDCl_3$)



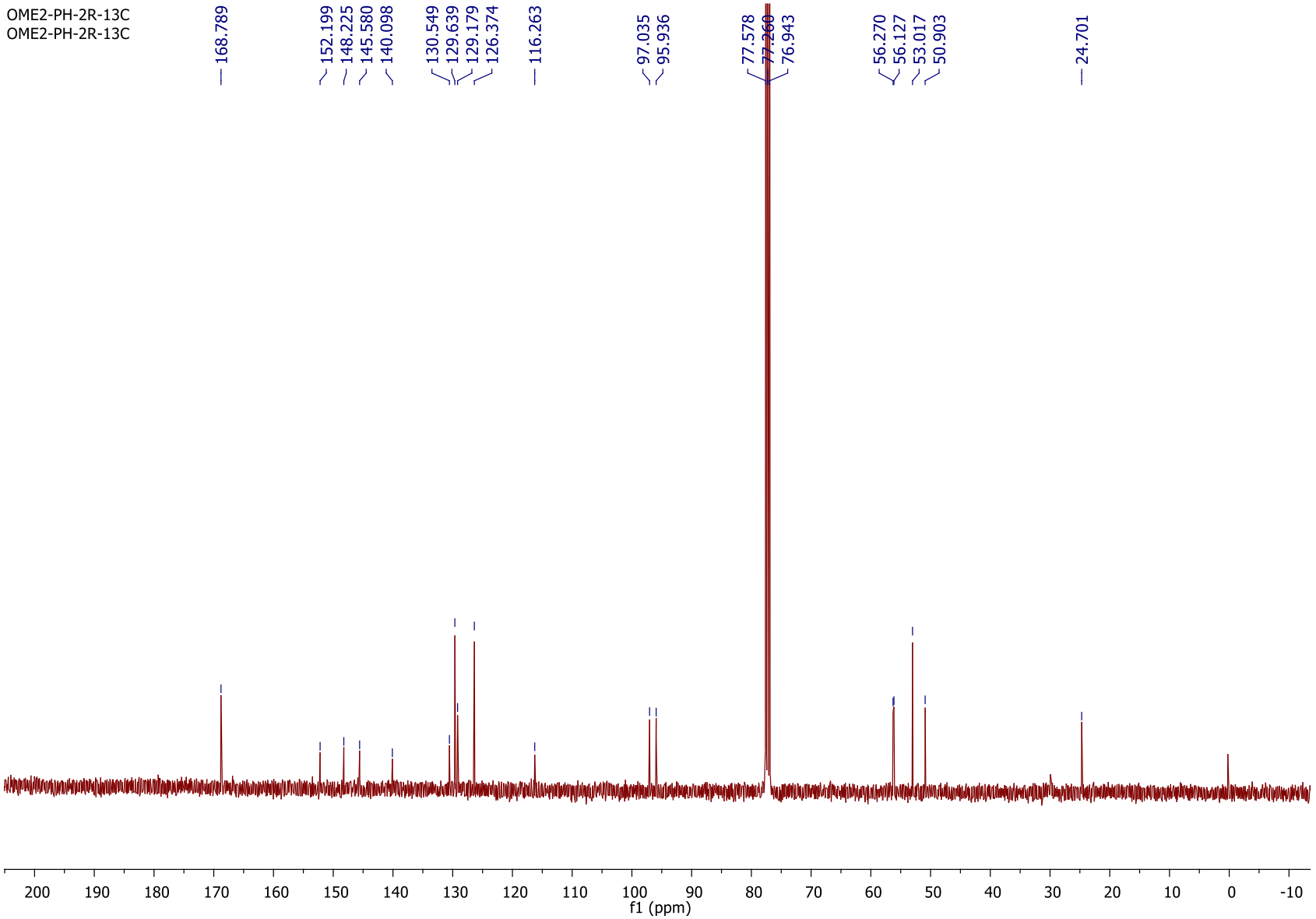
^{13}C spectrum of compound **3ca** (100 MHz, $CDCl_3$)



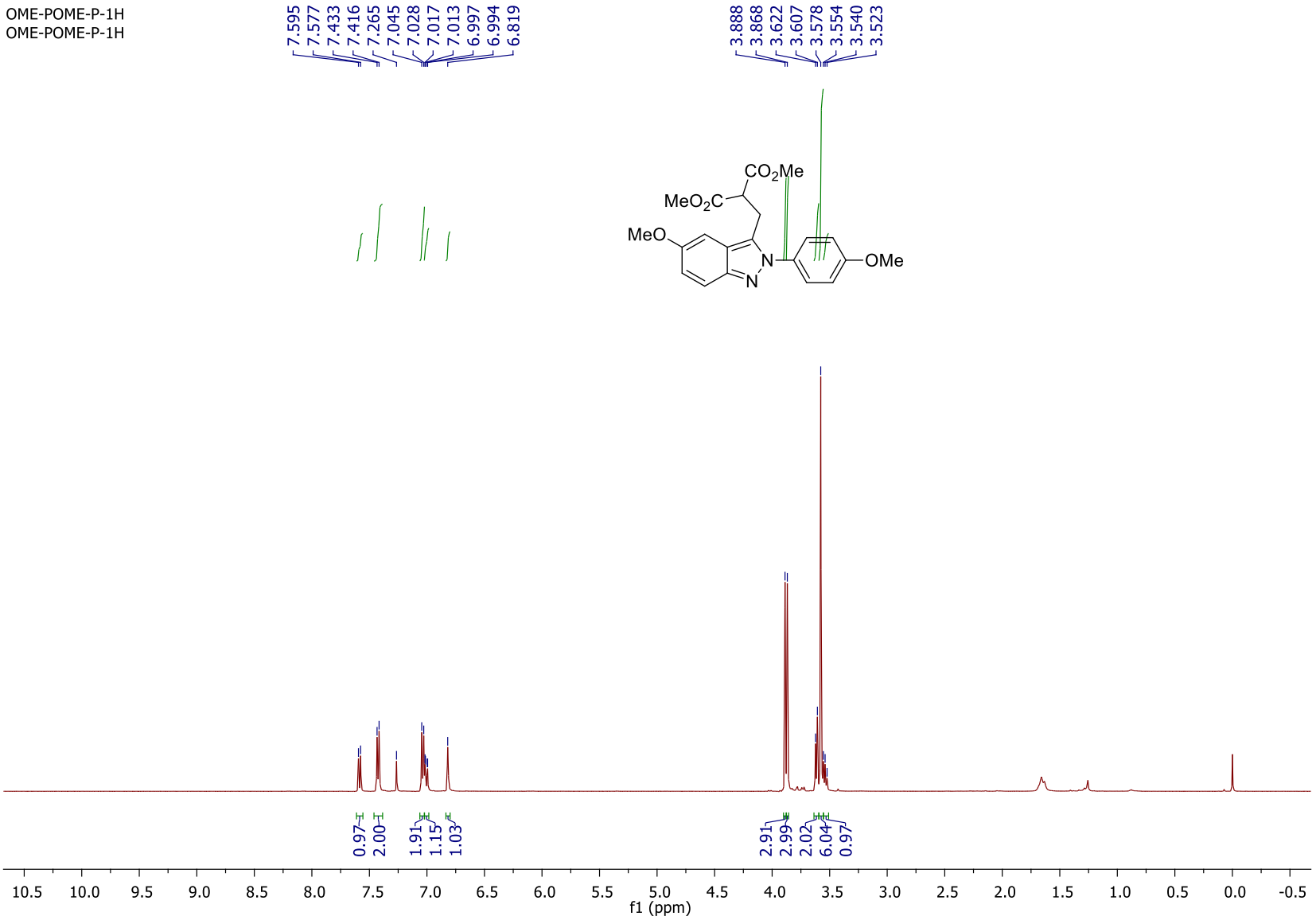
^{1}H spectrum of compound **3da** (400 MHz, $CDCl_3$)



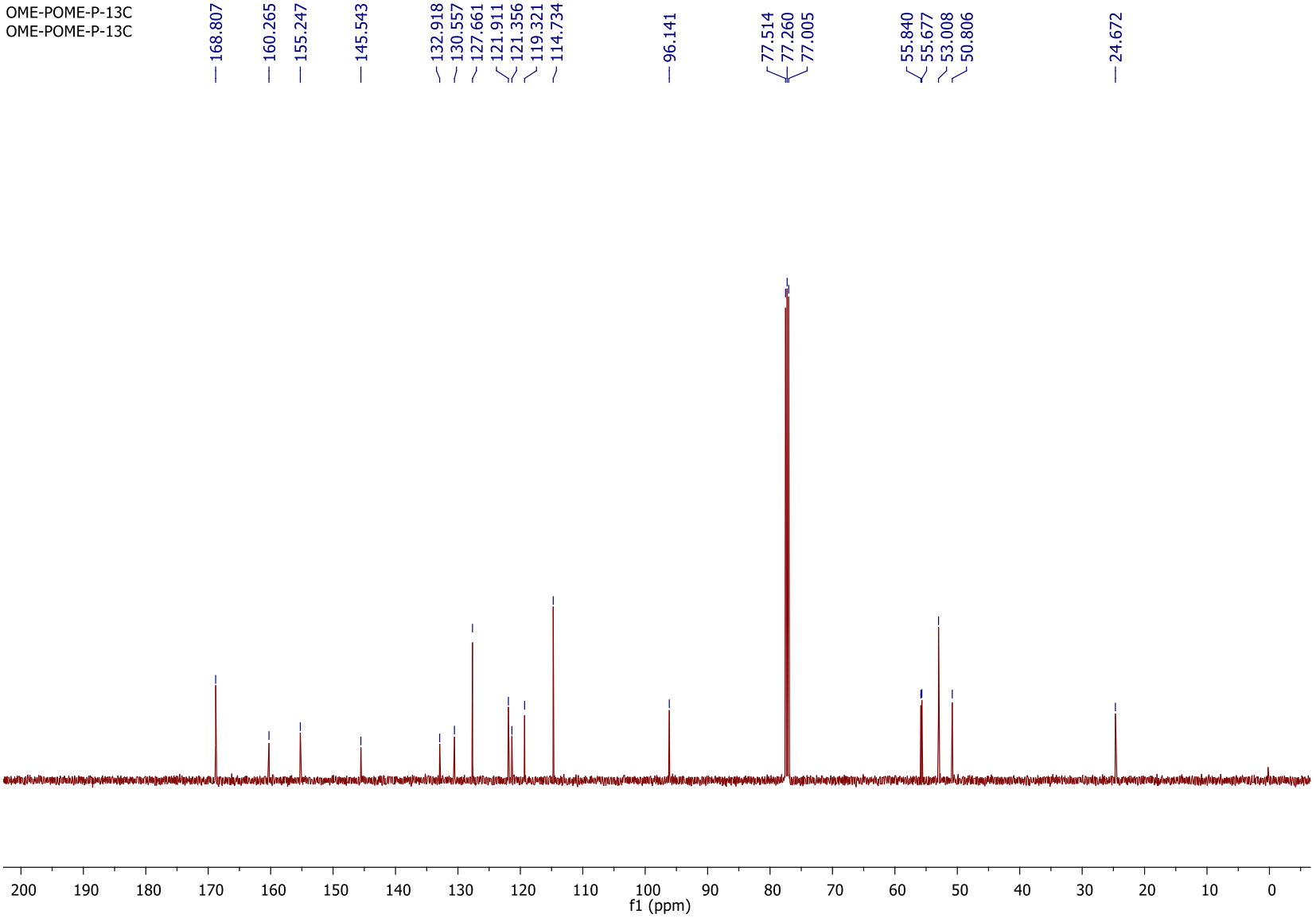
^{13}C spectrum of compound **3da** (100 MHz, $CDCl_3$)



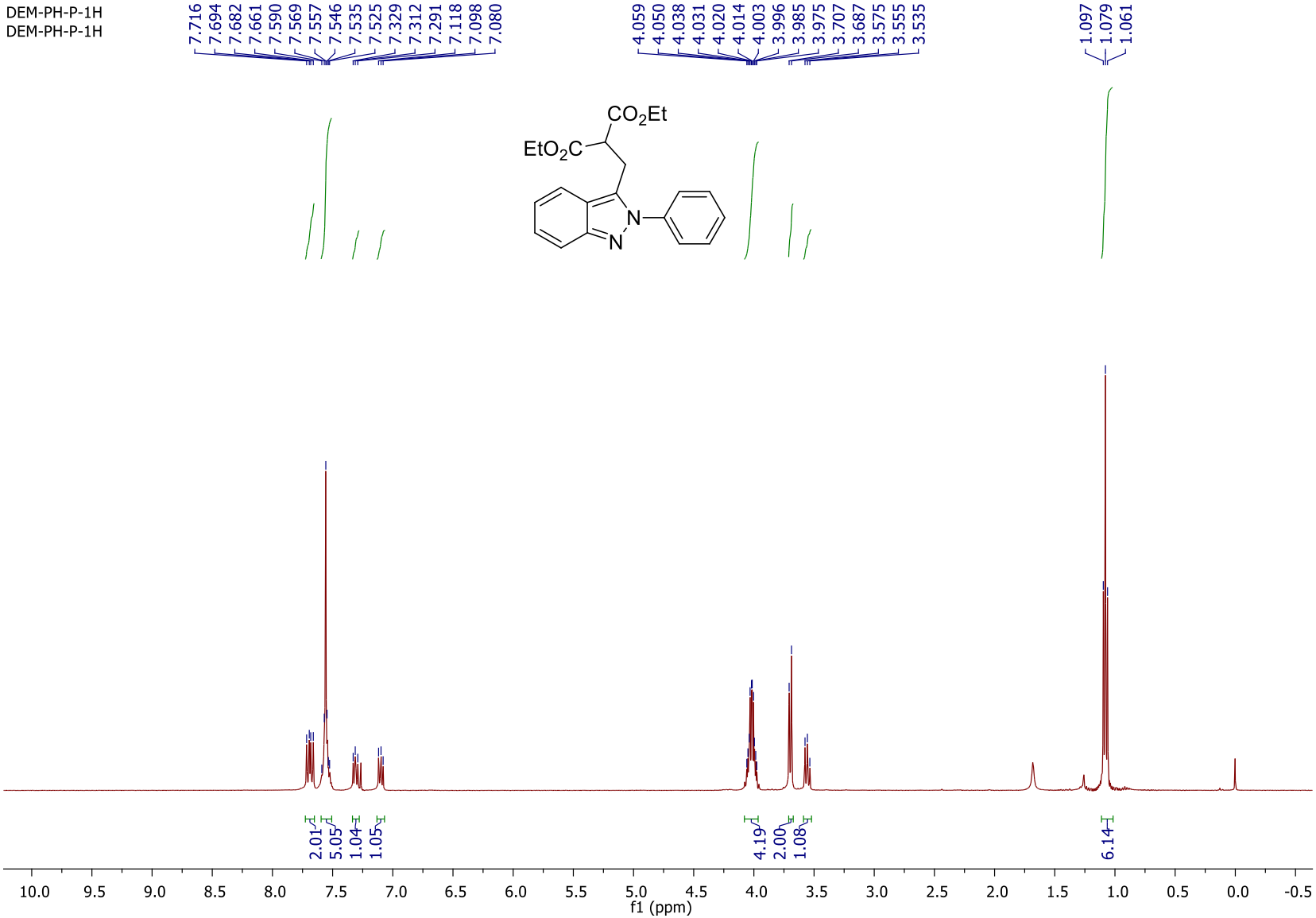
^{1}H spectrum of compound **3ef** (500 MHz, $CDCl_3$)



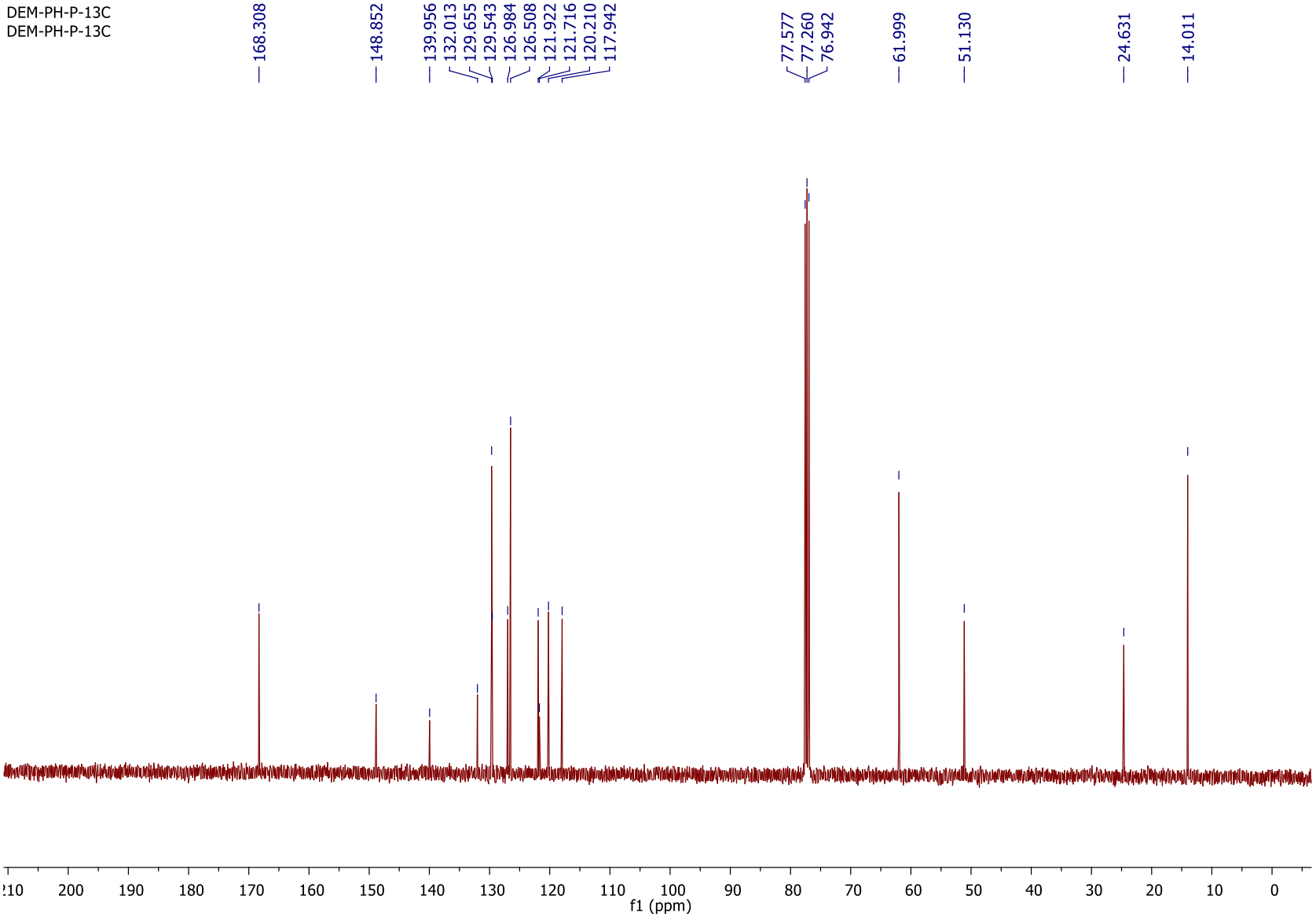
^{13}C spectrum of compound **3ef** (125 MHz, $CDCl_3$)



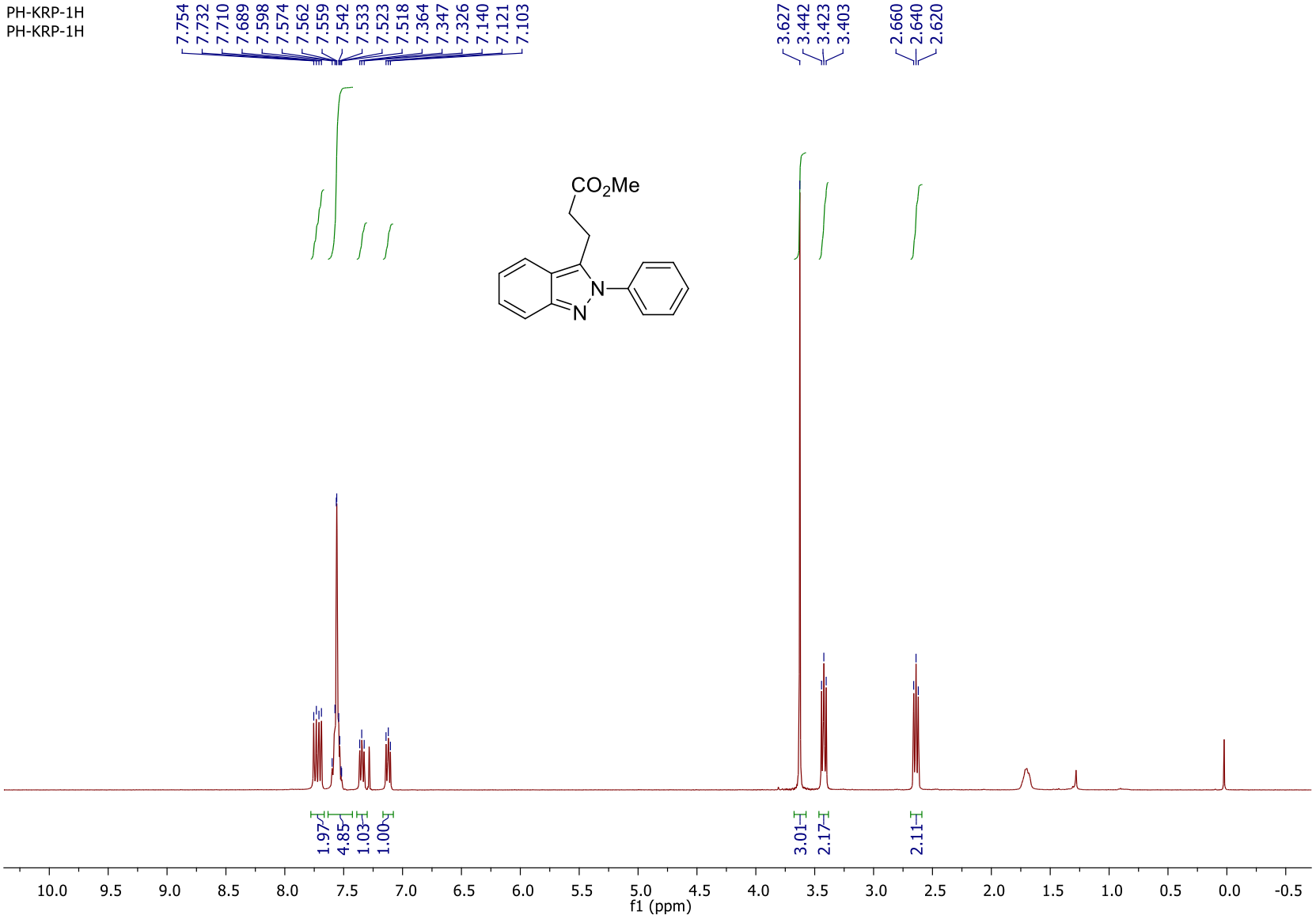
^{1}H spectrum of compound **3fa** (400 MHz, $CDCl_3$)



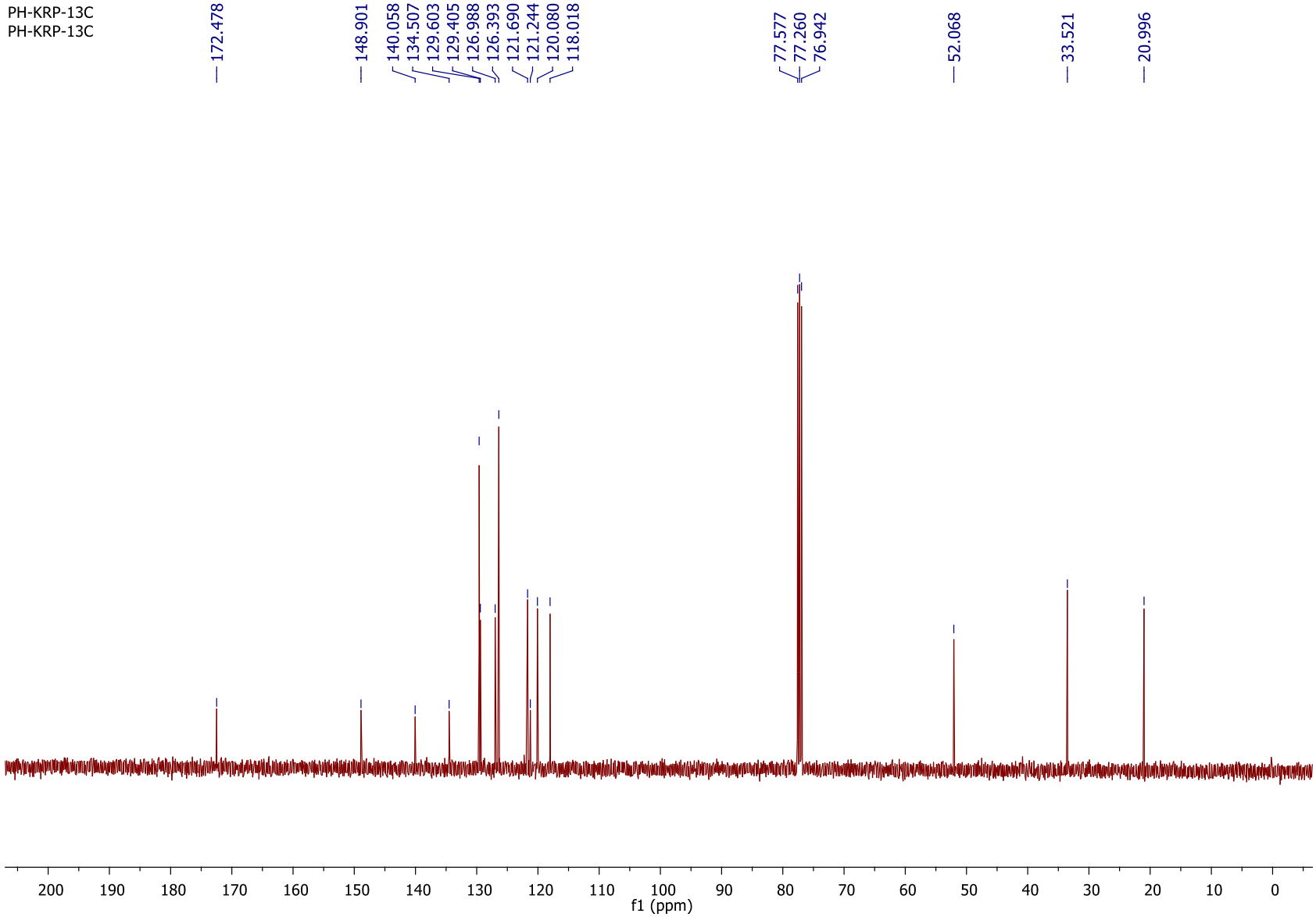
^{13}C spectrum of compound **3fa** (100 MHz, $CDCl_3$)



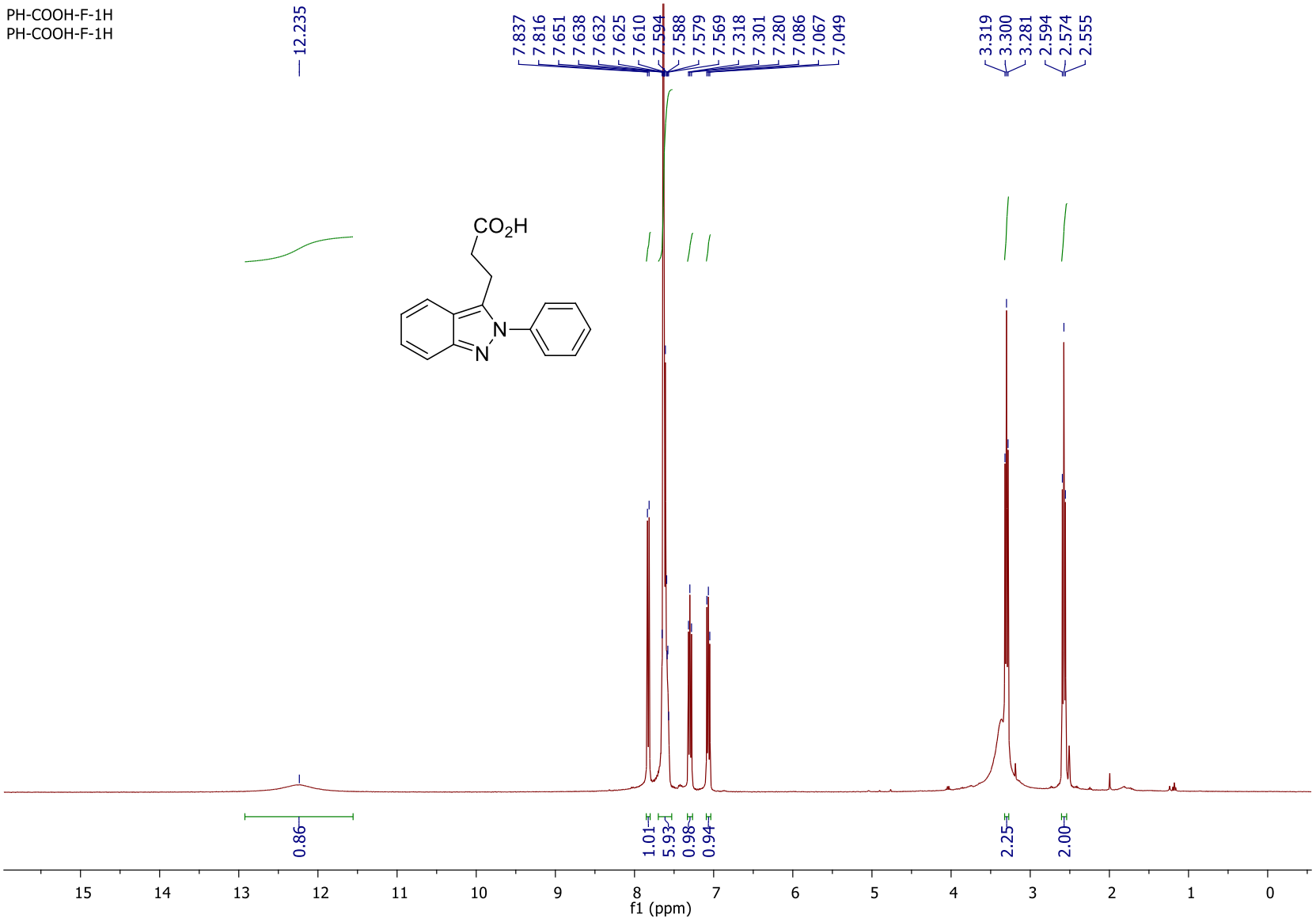
^{1}H spectrum of compound **4** (400 MHz, $CDCl_3$)



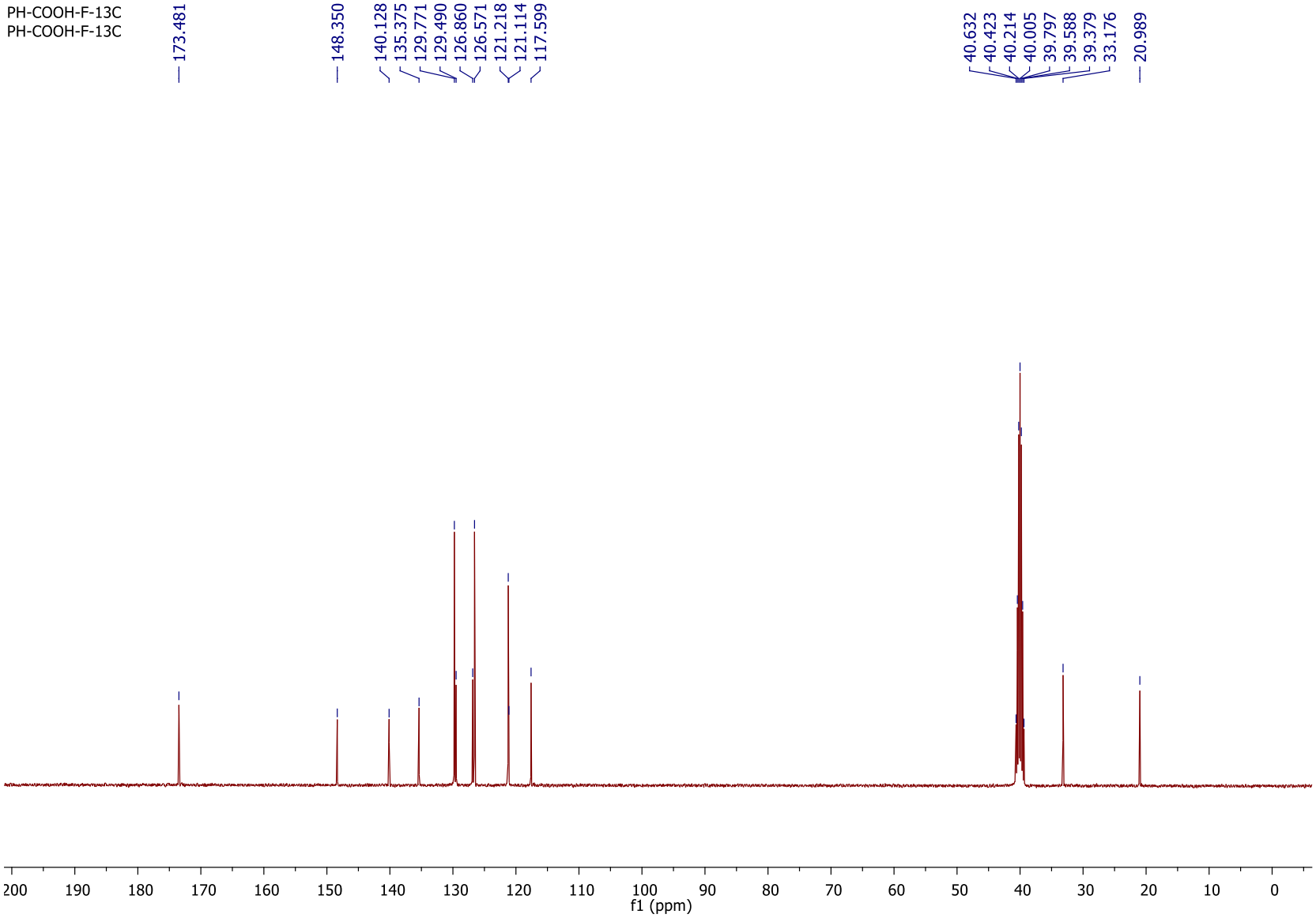
^{13}C spectrum of compound **4** (100 MHz, $CDCl_3$)



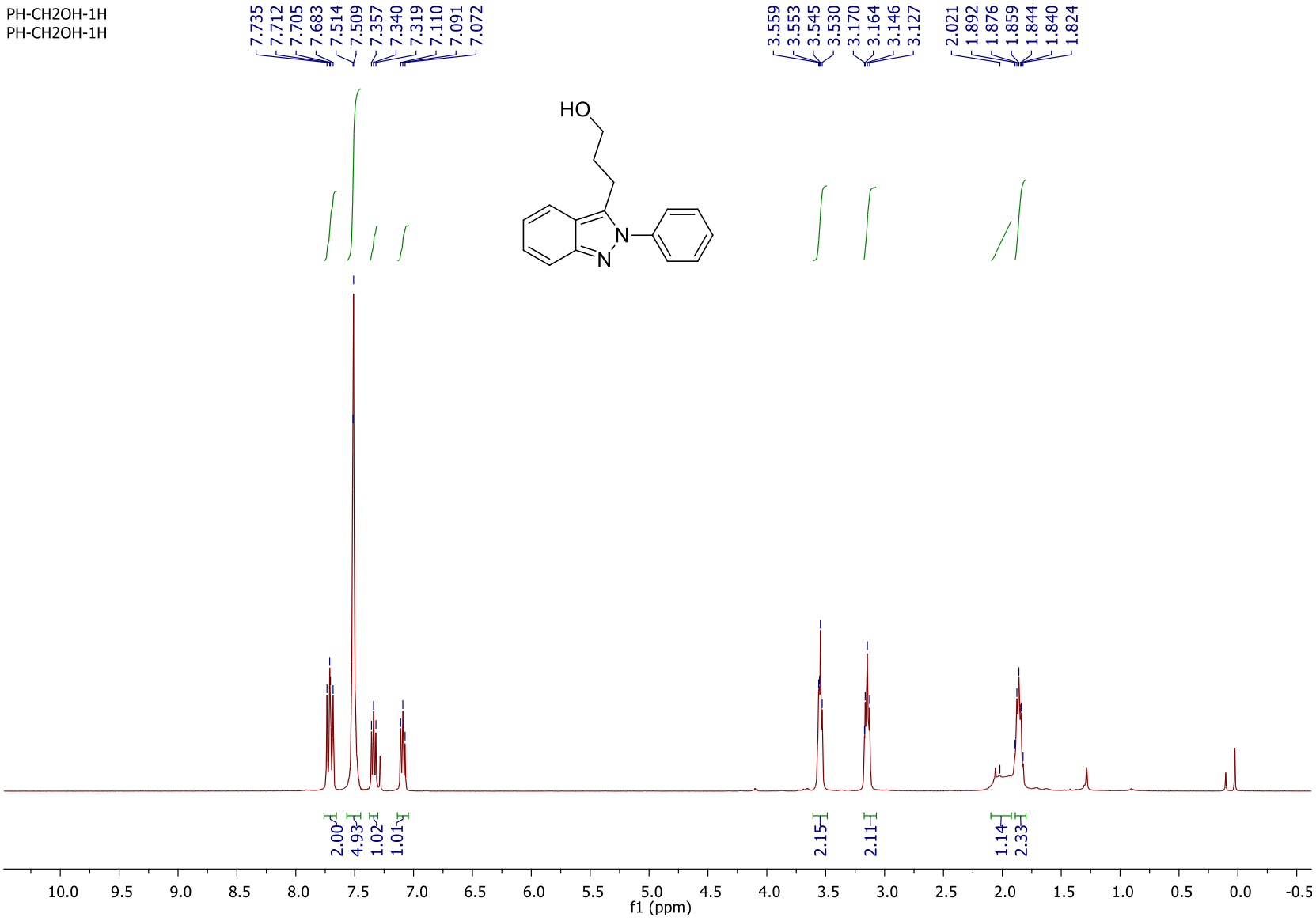
^{1}H spectrum of compound **5** (400 MHz, DMSO-d_6)



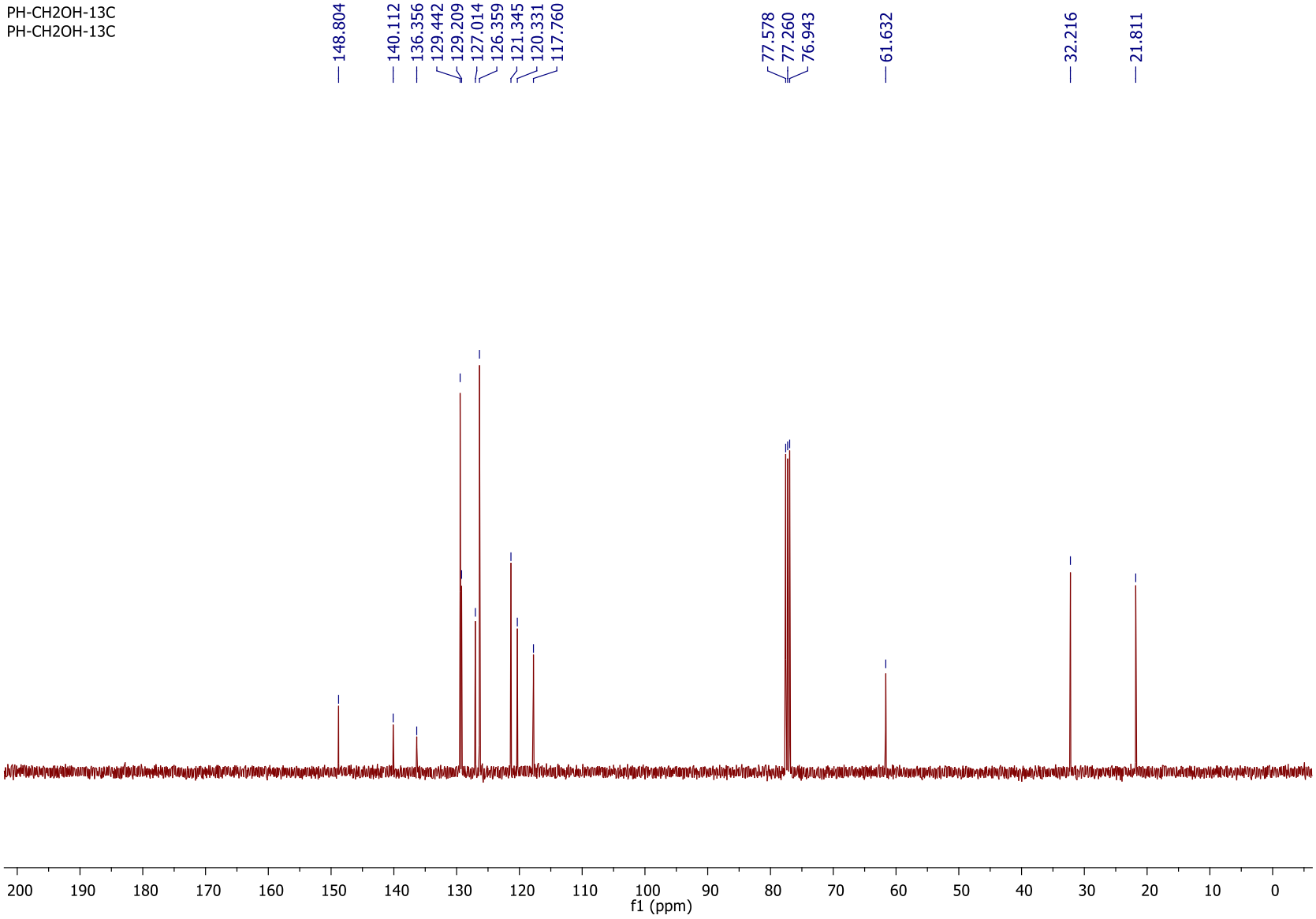
^{13}C spectrum of compound **5** (100 MHz, DMSO-d_6)



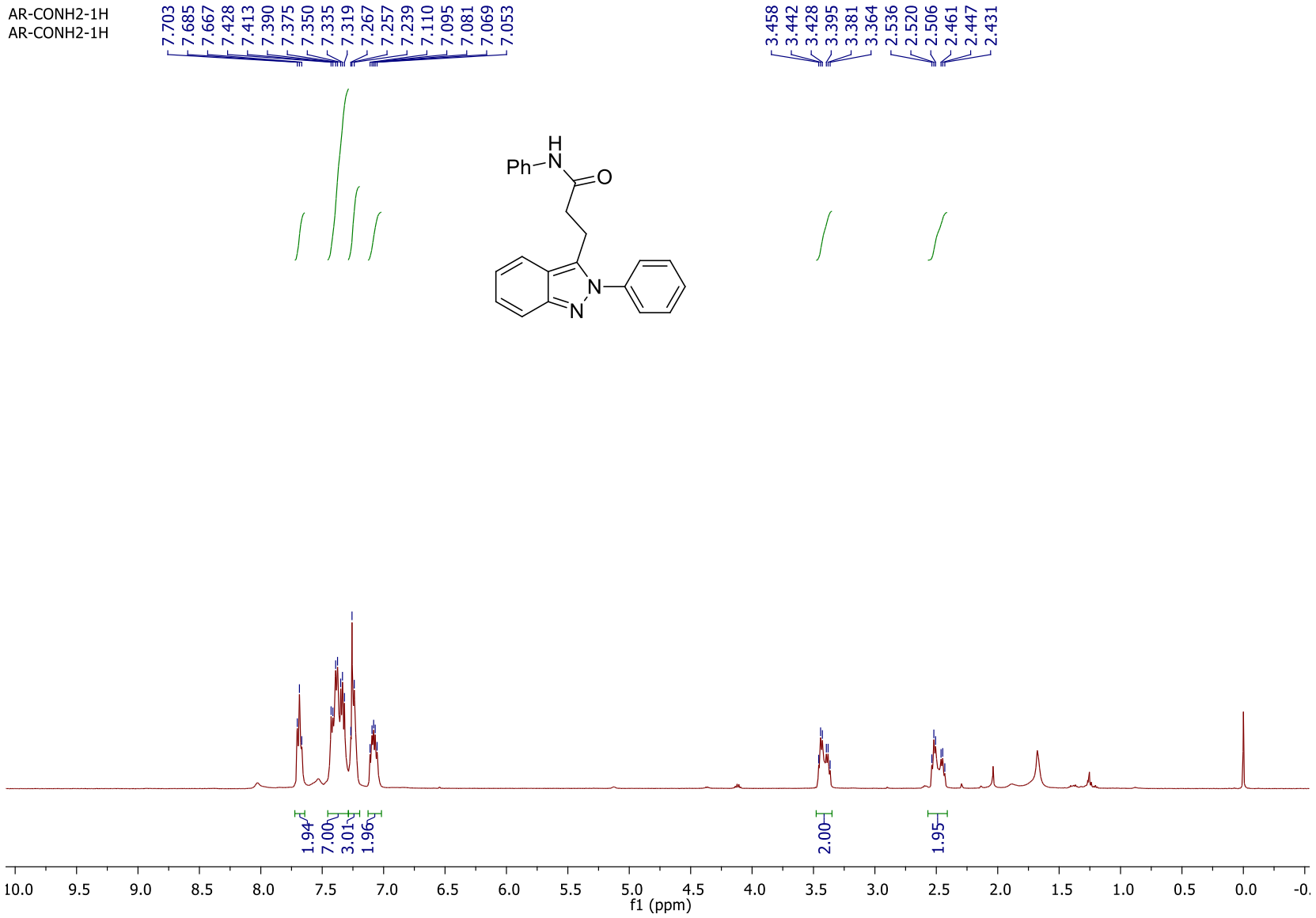
^{1}H spectrum of compound **6** (400 MHz, $CDCl_3$)



^{13}C spectrum of compound **6** (100 MHz, $CDCl_3$)



^{1}H spectrum of compound **7** (500 MHz, $CDCl_3$)



^{13}C spectrum of compound **7** (125 MHz, $CDCl_3$)

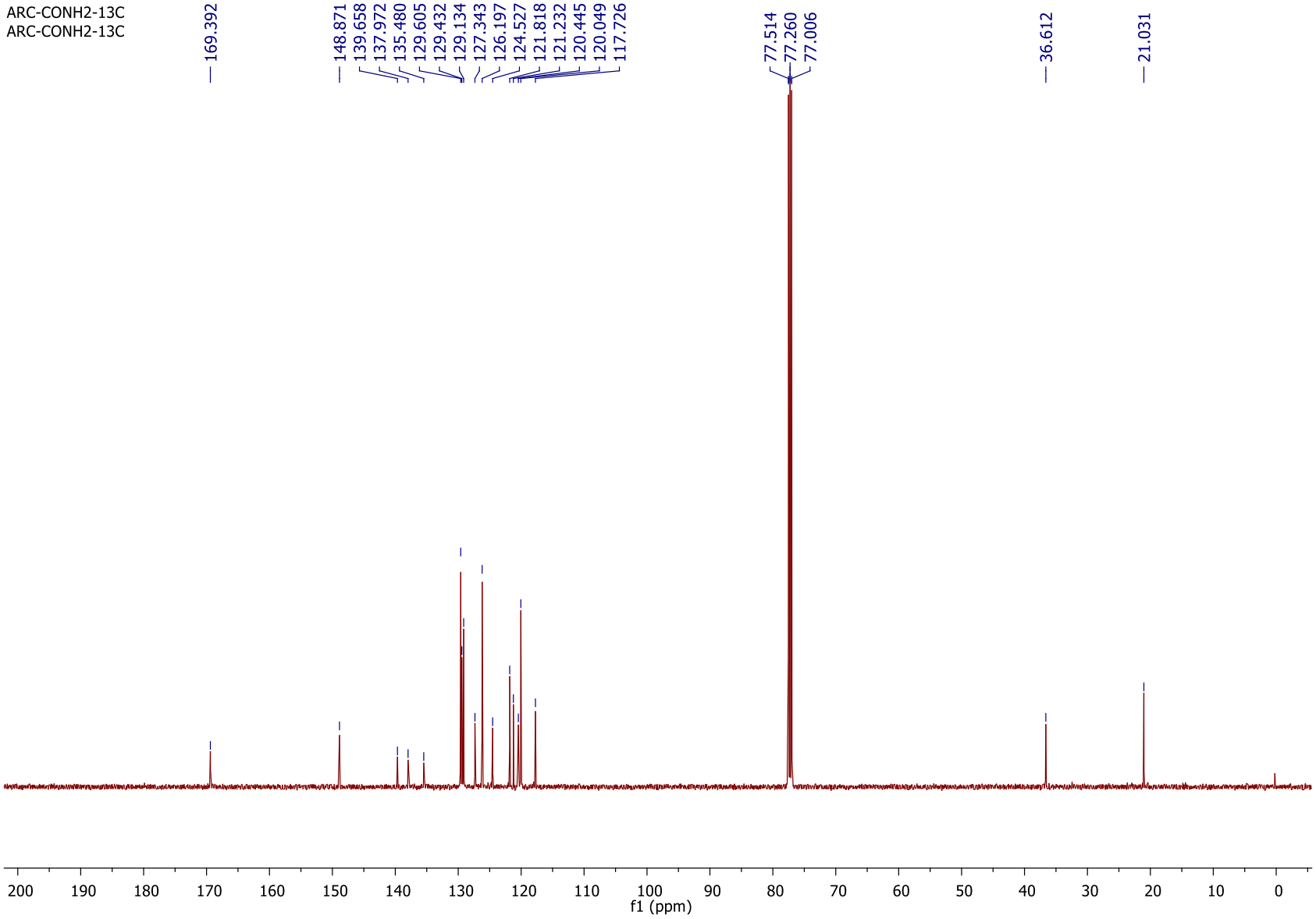


Table S96: The crystal parameters of compound 3ag

	CCDC 2130146
Formula	$C_{20}H_{20}N_2O_4S$
Formula weight	384.44
T/K	273(2)
Crystal system	monoclinic
Space group	P 21
a/Å	5.2570(8)
b/Å	13.741(2)
c/Å	13.614(2)
α/°	90
β/°	94.765(4)
γ/°	90
V/Å^3	980.0(3)
Z	2
Abs. Coeff./mm^{-1}	0.193
Abs. Correction	none
GOF on F^2	1.318
Final *R* indices [$I > 2\sigma(I)$]	*R1* = 0.0892 *wR2* = 0.1055
R indices [all data]	*R1* = 0.1953 *wR2* = 0.2045

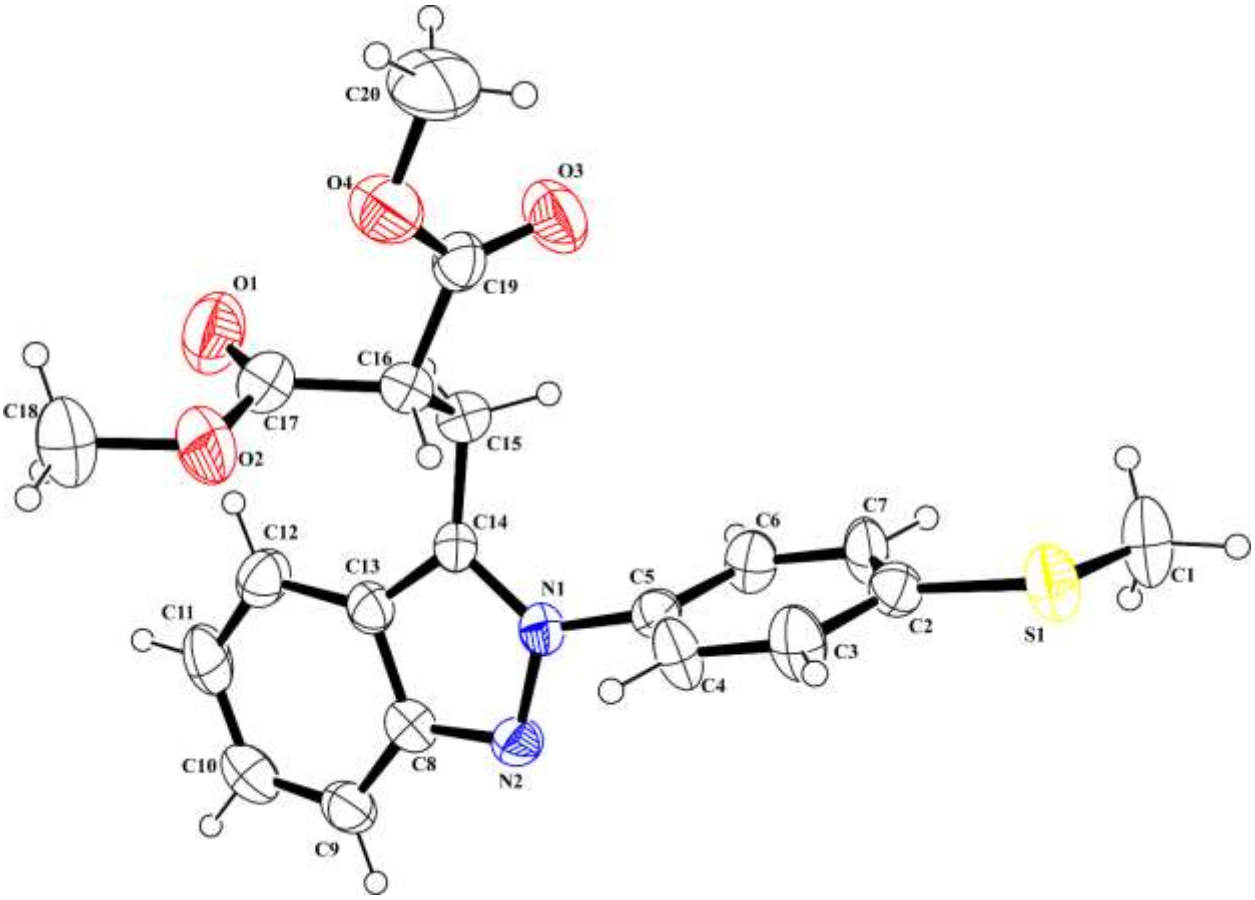


Figure S97: ORTEP diagram of compound 3ag using thermal ellipsoids of 35% probability

References

1. H. Cui, X. Peng, J. Liu, C. Ma, Y. Ji, W. Zhang, M. Geng and Y. Li, *Bioorg. Med. Chem. Lett*. 2016, **26**, 4483–4486.
2. J. S. Stover, J. Shi, W. Jin, P. K. Vogt and D. L. Boger, *J. Am. Chem. Soc*.2009, **131**, 3342–3348.
3. K. L. Ivanov, M. Y. Melnikov and E. M. Budynina, *Org. Lett*. 2019, **21**, 4464−4468.
4. D. Dev, N. B. Palakurthy, K. Thalluri, J. Chandra and B. Mandal, *J. Org. Chem.* 2014, **79**, 5420-5431.