A Jackpot C-H Activation Protocol Using Simple Ruthenium Catalyst in Deep Eutectic Solvents

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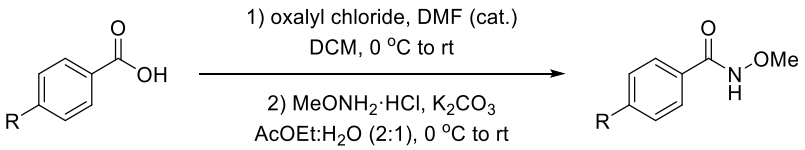
I. Synthetic Procedures

General. Solvents and reagents were used as obtained from commercial sources and without purification. ^{1}H NMR (300 MHz/400 MHz) spectra were recorded on Bruker AC-300/Bruker AC-400 NMR spectrometers respectively in proton coupled mode. ^{13}C NMR (75 MHz/101 MHz) spectra were recorded on Bruker AC-300/Bruker AC-400 NMR spectrometers respectively in proton decoupled mode at 20 °C; chemical shifts are given in δ (parts per million) and coupling constants (*J*) in Hertz. Low-resolution mass spectra (EI) was obtained at 70 eV on an Agilent Technologies GC/MS-5973N spectrometer or Agilent 5973 Network with direct introduction of the sample (73DIP-1) to the ionic source using the SIS (Scientific Instrument Services), giving fragment ions in *m/z* with relative intensities (%) in parentheses. Infrared spectra were measured on a Jasco FT/IR-4100 Fourier Transform Infrared Spectometer. The chromatographic analyses (GC) were determined with a Younglin 6100 instrument equipped with a flame ionization detector and 30 m HP-5 capillary column (0.25 mm diam, 0.33 mm film thickness), using nitrogen (2 mL/min) as a carrier gas, $T_{injector}$ = 270 ºC, T_{column} = 60 ºC (3 min) and 60-270 ºC (15 ºC/min), P = 12 psi. Thin layer chromatography (TLC) was carried out on Schleicher & Schuell F1400/LS 254 plates coated with a 0.2 mm layer of silica gel; detection by UV_{254} light. Column chromatography was performed using silica gel 60 of 40-63 mesh.

General procedure for the preparation of DESs. A mixture of hydrogen-bond donor and hydrogen-bond acceptor, with the previously specified molar ratio, was added in a round bottom flask under an inert atmosphere. The mixture was stirred for 30 minutes in a T range between 65 and 80 °C obtaining the corresponding DES.

General procedure for the synthesis of *N*-methoxy amides



1) To a solution of aromatic carboxylic acid (5.0 mmol) in DCM (dry; 7 mL) under argon, oxalyl chloride (6.0 mmol) was added slowly at 0 ºC, followed by the addition of 2-3 drops of DMF. Then, the reaction was stirred at room temperature for 4 h. After the completion of the reaction, DMC was removed under reduced pressure to get crude acid chloride.

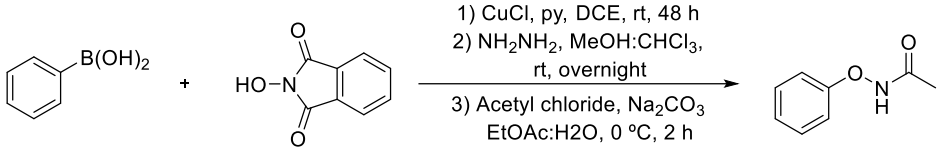
2) Methoxyamine hydrochloride salt (5.5 mmol) was added to a mixture of K_2CO_3 (10 mmol) in AcOEt:H_2O (2:1; 15 mL) at room temperature. To this solution crude acid

chloride (5.0 mmol) was added dropwise at 0 °C. After that, the reaction was stirred at room temperature overnight. The reaction mixture was extracted with AcOEt (3 x 10 mL). The organic phase was dried over $MgSO_4$, followed by evaporation under reduced pressure to afford the corresponding *N*-methoxybenzamide without further purification (80-95% yield).

General procedure for the synthesis of isoquinolones. *N*-methoxybenzamide derivative **1** (0.2 mmol), alkyne **2** (0.24 mmol), NaOAc (20 mol%) and $[RuCl_2(p\text{-cymene})]_2$ (3 mol%) were stirred in 1.0 mL DES at 70 °C for 16 h. The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Products **3** were purified by chromatography on silica gel (usually with 1/1 hexane/ethyl acetate elution) or by precipitation with Et_2O.

General procedure for *N*-methoxybenzamides olefination. *N*-methoxybenzamide derivative **1** (0.2 mmol), electron-poor olefin **4** (0.24 mmol), NaOAc (20 mol%) and $[RuCl_2(p\text{-cymene})]_2$ (3 mol%) were stirred in 1.0 mL DES at 70 °C for 16 h. The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Products **5** and **6** were purified by chromatography on silica gel (usually with 1/1 hexane/ethyl acetate elution).

General procedure for the synthesis of *N*-phenoxyacetamide



1) *N*-phenoxyacetamide was prepared following a published procedure reported in literature: In a reaction flask, a mixture of *N*-hydroxyphthalimide (1 equiv.), phenylboronic acid (2 equiv.), CuCl (1 equiv.), freshly activated 4-Å molecular sieves (250mg/mmol) and pyridine (1.1 equiv.) in 1,2-dichloroethane (0.2 M) were stirred at rt open to atmosphere. After 48 h, the reaction mixture became green as the reaction proceeded. The purification was performed by percolation on silica gel.

2) Hydrazine monohydrate (3 equiv.) was added to the solution of *N*-phenyloxyphthalimide (1 equiv.) in 10% MeOH in $CHCl_3$ (0.1 M). The reaction was stirred at rt overnight. The precipitate was filtered off and washed with DCM. The filtrate was concentrated to afford the corresponding *N*-phenyloxyamine.

3) *N*-Phenyloxyamine (1 equiv.) was added to a biphasic mixture of Na_2CO_3 (1.2 equiv.) in a 2:1 mixture of EtOAc:H_2O (0.6 M). The resulting solution was cooled to 0 °C, using

an ice/water bath, followed by dropwise addition of acetyl chloride (1 equiv.). After stirring at 0 ^{o}C for 2 h, the reaction was quenched with sat. $NaHCO_3$ and diluted with EtOAc. The organic phase was washed twice with sat. $NaHCO_3$, dried over $MgSO_4$, filtered and evaporated under reduced pressure. The crude product was used without any purification step.

General procedure for synthesis of benzofuran derivative. *N*-phenoxyacetamide **7** (0.2 mmol); diphenylacetylene **2a** (0.24 mmol), NaOAc (20 mol%) and $[RuCl_2(p\text{-cymene})]_2$ (3 mol%) were stirred in 1.0 mL DES at 70 ^{o}C for 16 h. The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Product **8** was purified by chromatography on silica gel (hexane elution).

General Procedure for Recycling Experiments. The reaction was performed according to the general procedure. Once the reaction was completed, the reaction mixture was cooled to room temperature, and 2-MeTHF (3 x 1 mL) was added to the reaction vessel. The biphasic mixture was stirred for 5 min, and the upper phase (VOC-phase, mainly unreacted organic reagents and products) was separated by decantation and analyzed by ^{1}H NMR using 1,3,5-trimethoxybeneze as the internal standard. The eutectic mixture was dried under vacuum and was charged again with fresh reagents, catalyst and base, repeating the process.

General procedure for benzoic acid derivatives olefination. Benzoic acid derivative **9** (0.2 mmol), electron-poor olefin **4** (0.4 mmol), $Cu(OAc)_2$ (10 mol%) and $[RuCl_2(p\text{-cymene})]_2$ (2 mol%) were stirred in 1.0 mL DES at 70 ^{o}C for 12 h under air atmosphere. The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Products **10** and **11** were purified by chromatography on silica gel (usually with 9/1 hexane/ethyl acetate elution).

General procedure for isochumarins synthesis. Benzoic acid derivative **9** (0.2 mmol), alkyne **2** (0.4 mmol), $Cu(OAc)_2$ (10 mol%.) and $[RuCl_2(p\text{-cymene})]_2$ (2 mol%) were stirred in 1.0 mL DES at 110 ^{o}C for 12 h. under air atmosphere The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Products **12** were purified by chromatography on silica gel (usually with 8/2 hexane/ethyl acetate elution).

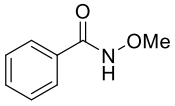
General procedure for gram scale reaction. Benzoic acid (8 mmol), acrylonitrile (16 mmol), $Cu(OAc)_2$ (10 mol%) and $[RuCl_2(p\text{-cymene})]_2$ (2 mol%) were stirred in 16 mL

DES at 70 °C for 12 h under air atmosphere. The mixture was quenched with water (20 mL) and a little amount of AcOEt (6 mL) and the desired product was isolated by filtration.

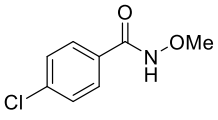
General procedure for thiophenecarboxylic acids olefination. Thiophenecarboxylic acid **13** (0.2 mmol), electron-poor olefin **4** (0.4 mmol) $Cu(OAc)_2$ (10 mol%.) and $[RuCl_2(p\text{-cymene})]_2$ (2 mol%) were stirred in 1.0 mL DES at 120 °C for 12 h under air atmosphere. The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Products **14** were purified by chromatography on silica gel (usually with 1/1 hexane/ethyl acetate elution).

General procedure for arylpyrazole olefination. Arylpyrazole derivative **15** (0.2 mmol), electron-poor olefin **4** (0.4 mmol), $Cu(OAc)_2$ (10 mol%.) and $[RuCl_2(p\text{-cymene})]_2$ (5 mol%) were stirred in 1.0 mL DES at 100 °C for 12 h under air atmosphere. The mixture was quenched with water and extracted with 2-MeTHF (3 x 5 mL). The combined organic phases were dried over $MgSO_4$, followed by evaporation under reduced pressure to remove the solvent. Products **16**, **17** and **18** were purified by chromatography on silica gel (usually with 8/2 hexane/ethyl acetate elution).

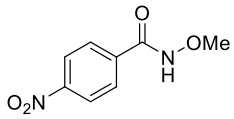
II. Characterization data



***N*-methoxybenzamide:**[1] White solid, R_f= 0.27 (Hexane/AcOEt 1/1); m.p. 63.2-64.8 °C; t_r = 8.29 min; ^{1}H NMR (400 MHz, $CDCl_3$): δ= 7.80-7.70 (m, 2H, ArH), 7.55-7.50 (m, 1H, ArH), 7.45-7.40 (m, 2H, ArH), 3.85 (s, 3H, OCH_3) ppm; ^{13}C NMR (101 MHz, $CDCl_3$): δ= 166.3, 132.1, 131.8, 128.8, 127.2, 64.5 ppm; IR (ATR): ν = 3220, 3062, 2989, 2938, 2896, 2811, 1646, 1515, 1477, 1299, 1149, 1022, 944, 875, 798, 713, 682 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 151 (M^+, 23%), 105 (100), 103 (16), 77 (48), 51 (14).

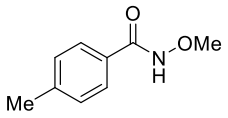


4-chloro-*N*-methoxybenzamide:[2] White solid, R_f= 0.47 (Hexane/AcOEt 1/1); m.p. 104.5-105.2 °C; t_r =11.26 min; ^{1}H NMR (400 MHz, $CDCl_3$): δ= 7.75-7.70 (m, 2H, ArH), 7.45-7.40 (m, 2H, ArH), 3.88 (s, 3H, OCH_3) ppm; ^{13}C NMR (101 MHz, $CDCl_3$): δ= 165.2, 138.4, 130.1, 129.0, 128.7, 64.4 ppm; IR (ATR): ν = 3212, 3023, 2985, 2938, 2900, 2819, 1643, 1519, 1473, 1311, 1091, 1037, 1010, 941, 875, 844, 755, 725 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 185 (M^+, 28%), 139 (100), 113 (11), 111 (32), 75 (17).

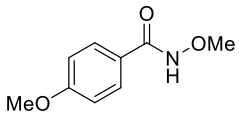


***N*-methoxy-4-nitrobenzamide:**[1] White solid, R_f= 0.17 (Hexane/AcOEt 1/1); m.p. 179.6-180.5 °C; t_r =143.67 min; ^{1}H NMR

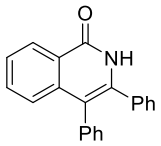
(400 MHz, DMSO-d_6): δ= 12.09 (s, 1H, NH), 8.31 (d, J = 8.9 Hz, 2H, ArH), 7.98 (d, J = 8.9 Hz, 2H, ArH), 3.74 (s, 3H, OCH_3) ppm; ^{13}C NMR (101 MHz, DMSO-d_6): δ= 162.2, 149.2, 137.9, 128.6, 123.7, 63.4 ppm; IR (ATR): ν = 3162, 3116, 2989, 2946, 2830, 1646, 1596, 1515, 1334, 1303, 1041, 933, 840 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 166 (M^+ - OMe, 77%), 150 (100), 120 (20), 104 (24), 92 (20), 76 (19), 65 (11), 50 (13).



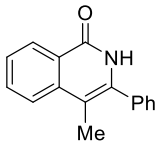
***N*-methoxy-4-methylbenzamide:**[1] White solid, R_f= 0.23 (Hexane/AcOEt 1/1); m.p. 62.8-63.3 °C; t_r =10.87 min; ^{1}H NMR (400 MHz, $CDCl_3$): δ= 7.66 (d, J = 8.2 Hz, 2H, ArH), 7.20 (d, J = 8.2 Hz, 2H, ArH), 3.84 (s, 3H, OCH_3), 2.37 (s, 3H, $ArCH_3$) ppm; ^{13}C NMR (101 MHz, $CDCl_3$): δ= 166.4, 142.6, 129.4, 128.9, 127.2, 64.5, 21.6 ppm; IR (ATR): ν = 3212, 3025, 2969, 2935, 2815, 1643, 1484, 1303, 1149, 1037, 944, 879, 836, 790, 748 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 165 (M^+, 22%), 119 (100), 91 (42), 65 (13).



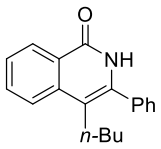
***N*,4-dimethoxybenzamide:**[1] White solid, R_f= 0.30 (Hexane/AcOEt 1/1); m.p. 100.0-102.1 °C; t_r =12.29 min; ^{1}H NMR (400 MHz; $CDCl_3$): δ= 7.73 (dd, J = 9.3, 2.4 Hz, 2H, ArH), 6.92 (dd, J = 9.3, 2.4 Hz, 2H, ArH), 3.86 (s, 3H, NHOCH_3), 3.84 (s, 3H, $ArOCH_3$) ppm; ^{13}C NMR (101 MHz, $CDCl_3$): δ= 166.2, 162.8, 129.1, 124.0, 114.1, 64.6, 55.6 ppm; IR (ATR): ν = 3170, 3000, 2958, 2838, 1643, 1492, 1299, 1253, 1153, 1052, 1014, 840, 671 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 181 (M^+, 24%), 135 (100), 134 (10), 92 (11), 77 (15).



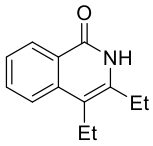
3,4-Diphenylisoquinolin-1(2*H*)-one (3a):[3] White solid, R_f= 0.36 (Hexane/AcOEt 1/1); m.p. 252.8-255.1 °C; ^{1}H NMR (400 MHz, DMSO-d_6): δ= 11.56 (s, 1H, NH), 8.32 (dd, J = 8.0, 1.1 Hz, 1H, ArH), 7.70-7.60 (m, 1H, ArH), 7.60-7.50 (m, 1H, ArH), 7.30-7.20 (m, 8H, ArH), 7.20-7.10 (m, 3H, ArH) ppm; ^{13}C NMR (75 MHz, DMSO-d_6): δ= 161.7, 138.5, 138.1, 135.8, 134.6, 132.5, 131.7, 129.8, 128.2 (2C), 127.7, 127.0, 126.8, 126.2, 125.0, 124.9, 115.5 ppm; IR (ATR): ν = 3155, 3023, 2888, 1643, 1608, 1346, 694 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 297 (M^+, 100%), 296 (46), 278 (13), 165 (11).



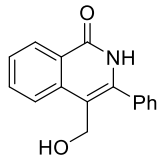
4-Methyl-3-phenylisoquinolin-1(2*H*)-one (3b):[4] White solid, R_f= 0.30 (Hexane/AcOEt 1/1); m.p. 208.6-210.2 °C; ^{1}H NMR (300 MHz, DMSO-d_6): δ= 11.26 (s, 1H, NH), 8.35-8.20 (m, 1H, ArH), 7.85-7.70 (m, 2H, ArH), 7.60-7.40 (m, 6H, ArH), 2.05 (s, 3H, CH_3) ppm; ^{13}C NMR (75 MHz, DMSO-d_6): δ= 161.4, 138.2, 137.8, 134.8, 132.5, 129.6, 128.6, 128.2, 126.9, 126.1, 125.4, 123.7, 107.1, 13.5 ppm; IR (ATR): ν = 3035, 2915, 1643, 1489. 1350, 1157, 759, 698 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 235 (M^+, 100%), 234 (72), 216 (16), 77 (13).



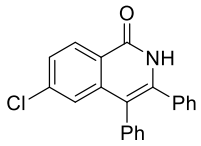
4-Butyl-3-phenylisoquinolin-1(2*H*)-one (3c):[3] White solid, R_f= 0.36 (Hexane/AcOEt 1/1); m.p. 153.5-154.8 °C; ^{1}H NMR (300 MHz, $CDCl_3$): δ= 8.79 (s, 1H, NH), 8.45-8.45 (m, 1H, ArH), 7.85-7.70 (m, 2H, ArH), 7.60-7.40 (m, 6H, ArH), 2.75-2.55 (m, 2H, C*H*$_2$(CH$_2$)$_2$CH$_3$), 1.60-1.50 (m, 2H, CH$_2$C*H*$_2$CH$_2$CH$_3$), 1.35-1.20 (m, 2H, (CH$_2$)$_2$C*H*$_2$CH$_3$), 0.90-0.75 (m, 3H, CH$_3$) ppm; ^{13}C NMR (101 MHz, DMSO): δ= 161.3, 138.2, 137.4, 135.0, 132.5, 129.3, 128.7, 128.3, 127.1, 126.0, 125.8, 123.7, 112.2, 32.2, 26.2, 22.1, 13.5 ppm; IR (ATR): ν = 3162, 2950, 2873, 1643, 1612, 1469, 1157, 760 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 277 (M$^+$, 33%), 236 (19), 235 (100), 216 (17).



3,4-Diethylisoquinolin-1(2*H*)-one (3d):[3] White solid, R_f= 0.40 (Hexane/AcOEt 1/1); m.p. 177.9-178.9 °C; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 11.09 (s, 1H, NH), 8.25-8.15 (m, 1H, ArH), 7.75-7.65 (m, 2H, ArH), 7.50-7.40 (m, 1H, ArH), 2.75-2.65 (m, 2H, C*H*$_2$CH$_3$), 2.60-2.50 (m, 2H, C*H*$_2$CH$_3$), 1.20-1.10 (m, 6H, CH$_2$C*H*$_3$ + CH$_2$C*H*$_3$) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 161.8, 139.9, 137.6, 132.3, 127.0, 125.1, 122.9, 111.8, 23.2, 18.8, 15.0, 14.2 (one signal missing due to overlap) ppm; IR (ATR): ν = 3162, 2965, 2923, 2857, 1639, 1469, 894, 771, 694 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 201 (M$^+$, 40%), 187 (14), 186 (100), 115 (11), 43 (20).

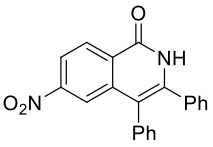


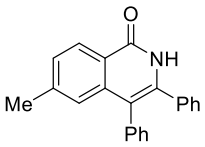
4-(Hydroxymethyl)-3-phenylisoquinolin-1(2*H*)-one (3e):[5] White solid, R_f= 0.13 (Hexane/AcOEt 1/1); m.p. >280 °C; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 11.30 (s, 1H, NH), 8.26 (dd, *J* = 8.0, 1.0 Hz, 1H, ArH), 8.00 (d, *J* = 8.0 Hz, 1H, ArH), 7.85-7.75 (m, 1H, ArH), 7.65-7.45 (m, 6H, ArH), 4.97 (t, *J* = 4.7 Hz, 1H, OH), 4.40 (d, *J* = 4.7 Hz, 2H, C*H*$_2$OH) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 161.7, 140.0, 137.8, 134.0, 132.4, 129.5, 129.0, 128.1, 126.7, 126.2, 125.5, 124.7, 111.8, 56.8 ppm; IR (ATR): ν = 3343, 3178, 3054, 1646, 1488, 1446, 1346, 995, 759, 690 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 251 (M$^+$, 100%), 250 (19), 236 (13), 235 (67), 234 (10), 233 (18), 222 (18), 216 (18), 204 (11), 178 (11), 89 (10), 77 (12).



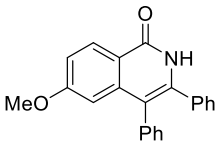
6-Chloro-3,4-diphenylisoquinolin-1(2*H*)-one (3f):[5] White solid, R_f= 0.43 (Hexane/AcOEt 1/1); m.p. 269.1-271.3 °C; ^{1}H NMR (300 MHz, DMSO-d$_6$): δ= 11.73 (s, 1H, NH), 8.31 (d, *J* = 8.6 Hz, 1H, ArH), 7.56 (dd, *J* = 8.6, 2.1 Hz, 1H, ArH), 7.40-7.20 (m, 8H, ArH), 7.17 (dd, *J* = 7.6, 2.0 Hz, 2H, ArH), 7.04 (d, *J* = 2.0 Hz, 1H, ArH) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 161.1, 140.3, 139.7, 137.6, 135.2, 134.2, 131.6, 129.8, 129.3, 128.4, 127.7, 127.4, 126.4, 123.8, 123.6, 114.5 (one signal missing due to overlap) ppm; IR (ATR): ν = 3158, 3023, 2938, 2900, 1643, 1596, 1446, 887, 775, 698 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 331 (M$^+$, 100%), 330 (41), 295 (12), 267 (11), 163 (11).

6-Nitro-3,4-diphenylisoquinolin-1(2*H*)-one (3g):[5] Orange-yellow solid, R_f= 0.40 (Hexane/AcOEt 1/1); m.p. 250.8-251.9 °C; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 12.02 (s, 1H, NH), 8.52 (d, J = 8.8 Hz, 1H, ArH), 8.23 (dd, J = 8.8, 2.2 Hz, 1H, ArH), 7.92 (d, J = 2.2 Hz, 1H, ArH), 7.40-7.15 (m, 10H, ArH) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 160.7, 149.9, 141.1, 138.8, 134.8, 133.9, 131.7, 129.8, 129.4, 128.7, 128.6, 127.8, 127.7, 120.1, 119.8, 115.3 (one signal missing due to overlap) ppm; IR (ATR): ν = 3162, 3027, 2919, 1654, 1519, 1342, 902, 698 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 342 (M$^+$, 100%), 295 (13), 268 (11), 267 (10), 190 (12), 165 (13), 43 (32).

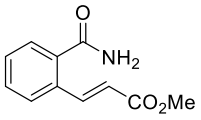




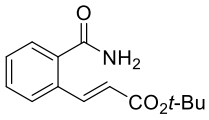
6-Methyl-3,4-diphenylisoquinolin-1(2*H*)-one (3h):[3] White solid, R_f= 0.30 (Hexane/AcOEt 1/1); m.p. 276.8-279.2 °C; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 11.45 (s, 1H, NH), 8.21 (d, J = 8.1 Hz, 1H, ArH), 7.34 (dd, J = 8.1, 1.1 Hz, 1H, ArH), 7.30-7.25 (m, 3H, ArH), 7.25-7.20 (m, 5H, ArH), 7.20-7.10 (m, 2H, ArH), 6.92 (s, 1H, ArH), 2.31 (s, 3H, CH_3) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 161.6, 142.5, 138.7, 138.2, 135.9, 134.7, 131.8, 129.8, 128.2, 128.2, 127.8, 127.7, 127.1, 126.9, 124.5, 122.9, 115.3, 21.6 ppm; IR (ATR): ν = 3166, 3023, 2857, 1639, 1619, 1488, 1149, 694 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 311 (M$^+$, 100%), 310 (47).



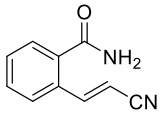
6-Methoxy-3,4-diphenylisoquinolin-1(2*H*)-one (3i):[5] White solid, R_f= 0.27 (Hexane/AcOEt 1/1); m.p. >225 °C (decomp.); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ 11.38 (s, 1H, NH), 8.25 (d, J = 8.8 Hz, 1H, ArH), 7.40-7.10 (m, 11H, ArH), 6.51 (d, J = 2.4 Hz, 1H, ArH), 3.67 (s, 3H, OCH_3) ppm; ^{13}C NMR (75 MHz, DMSO-d$_6$): δ= 162.3, 161.4, 140.1, 139.2, 135.9, 134.6, 131.7, 129.8, 129.2, 128.3, 128.2, 127.7, 127.1, 118.9, 115.1, 114.6, 107.2, 55.2 ppm; IR (ATR): ν = 3120, 3023, 2923, 2857, 1639, 1608, 1488, 1454, 1272, 1218, 1029, 694 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 327 (M$^+$, 100%).



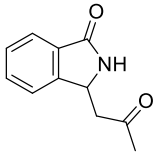
Methyl (*E*)-3-(2-carbamoylphenyl)acrylate (5a):[6] White solid, R_f= 0.13 (Hexane/AcOEt 1/1); m.p. 153.0-155.2 °C; t_r =14.69 min; ^{1}H NMR (300 MHz, DMSO-d$_6$): δ= 8.00-7.95 (m, 2H, *H*C=CHCO$_2$Me + NH), 7.95-7.85 (m, 1H, ArH), 7.70-7.55 (m, 1H, NH), 7.55-7.40 (m, 3H, ArH), 6.59 (d, J = 16.0 Hz, 1H, HC=C*H*CO$_2$Me), 3.72 (s, 1H, CO_2CH_3) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 170.1, 166.6, 142.3, 138.1, 131.5, 129.9, 129.8, 127.6, 126.8, 119.0, 51.6 ppm; IR (ATR): ν = 3378, 3197, 1693, 1654, 1623, 1388, 1299, 1253, 1207, 1033, 979, 759 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 205 (M$^+$, 14%), 177 (12), 146 (15), 145 (24), 132 (100), 104 (12).



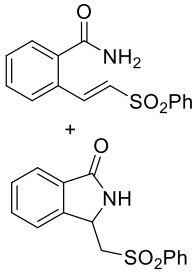
***tert*-Butyl (*E*)-3-(2-carbamoylphenyl)**acrylate **(5b):**[6] White solid, R_f= 0.16 (Hexane/AcOEt 1/1); m.p. 131-6-132.8 °C; t_r =15.79 min; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 8.00-7.80 (m, 3H, NH + *H*C=CHCO$_2$*t*-Bu + ArH), 7.59 (s, 1H, NH), 7.50-7.40 (m, 3H, ArH), 6.47 (d, J = 16.0 Hz, 1H, HC=C*H*CO$_2$*t*-Bu), 1.48 (s, 9H, CO$_2$C(CH$_3$)$_3$) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 170.1, 165.5, 141.3, 138.0, 131.6, 129.7 (2C), 127.5, 126.7, 120.9, 80.0, 27.8 ppm; IR (ATR): ν = 3370, 3181, 2977, 2931, 1704, 1639, 1145, 975, 759 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 247 (M$^+$, 0.3%), 147 (14), 146 (100), 57 (10).



(*E*)-2-(2-Cyanovinyl)benzamide (5c):[7] White solid, R_f= 0.40 (Hexane/AcOEt 1/4); m.p. 163.0-164.3 °C; t_r =14.56 min; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 8.02 (s, 1H, NH), 7.85 (d, J = 16.8 Hz, 1H, *H*C=CHCN), 7.85-7.80 (m, 1H, ArH), 7.63 (s, 1H, NH), 7.60-7.50 (m, 3H, ArH), 6.42 (d, J = 16.8 Hz, 1H, HC=C*H*CN) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 169.6, 148.5, 136.8, 131.6, 130.5, 130.1, 127.9, 126.4, 118.7, 98.2 ppm; IR (ATR): ν = 3367, 3174, 2923, 2857, 2213, 1627, 1403, 1130, 964, 755, 663 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 205 (M$^+$ - 2, 2%), 132 (100), 77 (12).

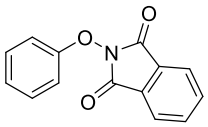


3-(2-oxopropyl)isoindolin-1-one (6a):[8] White solid, R_f= 0.37 (AcOEt); m.p. 132.5-134.0 °C; t_r =14.59 min; ^{1}H NMR (400 MHz, DMSO-d$_6$): δ= 8.53 (s, 1H, NH), 7.64 (d, J = 7.5 Hz, 1H, ArH), 7.0-7.50 (m, 2H, ArH), 7.47 (t, J = 7.3 Hz, 1H, ArH), 4.95-4.90 (m, 1H, C*H*CH$_2$COCH$_3$), 3.08 (dd, J = 17.5, 5.1 Hz, 1H, CHC*H*$_2$COCH$_3$), 2.73 (dd, J = 17.5, 7.9 Hz, 1H, CHC*H*$_2$COCH$_3$), 2.15 (s, 3H, CHCH$_2$COC*H*$_3$) ppm; ^{13}C NMR (101 MHz, DMSO-d$_6$): δ= 206.4, 169.1, 147.3, 132.2, 131.6, 128.1, 123.1, 122.8, 51.9, 47.9, 30.2 ppm; IR (ATR): ν = 3193, 3077, 2919, 2857, 1700, 1357, 1160, 736 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 189 (M$^+$, 38%), 161 (10), 160 (25), 146 (86), 132 (100), 104 (16), 77 (21).

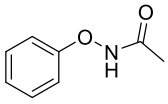


(*E*)-2-(2-(Phenylsulfonyl)vinyl)benzamide + 3-((phenylsulfonyl)methyl)isoindolin-1-one (5d + 6b): White solid, R_f= 0.43 (Hexane/AcOEt 1/4); t_r =19.68 min; ^{1}H NMR (400 MHz, DMSO-d$_6$) – an equilibrium between the acyclic and cyclic (aprox. 2:1) compounds was found: δ= 8.35 (s, 1H, NH), 8.05 (s, 2H, NH$_2$), 8.01 (d, J = 15.4 Hz, 2H, *H*C=CHSO$_2$Ph), 7.95-7.90 (m, 7H, ArH), 7.90-7.85 (m, 3H, ArH), 7.80-7.70 (m, 4H, ArH), 7.65-7.60 (m, 11H, ArH), 7.57 (d, J = 15.4 Hz, 2H, HC=C*H*SO$_2$Ph), 7.60-7.55 (m, 3H, ArH), 7.50-7.45 (m, 6H, ArH), 4.90 (dd, J = 7.8, 3.9 Hz, 1H, C*H*CH$_2$SO$_2$Ph), 4.07 (dd, J = 14.4, 4.1 Hz, 1H, CHC*H*$_2$SO$_2$Ph), 3.80-3.60 (m, 1H, CHC*H*$_2$SO$_2$Ph) ppm; ^{13}C NMR (75 MHz, DMSO-d$_6$): δ= 169.7, 169.0, 144.8, 140.6, 139.9, 139.3, 138.1, 134.0, 133.6, 131.9, 131.7, 130.6, 130.0, 129.9, 129.6, 129.5, 128.9, 128.6, 127.8, 127.8, 127.5, 127.1, 123.7, 122.9, 58.2,

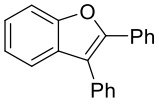
50.8 ppm; IR (ATR): ν = 3397, 3232, 3062, 2989, 2935, 1704, 1295, 1141, 728 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 145 (M^+ - SO_2Ph, 100%), 132 (47), 77 (21). HRMS (QTOF) calculated for M^+ -SO_2Ph 146.0606, found 145.9801.



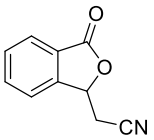
2-phenoxyisoindoline-1,3-dione:[9] White solid, R_f= 0.37 (Hexane / AcOEt 4/1); ^1H NMR (300 MHz, $CDCl_3$) δ= 7.90 (dt, *J* = 7.1, 3.6 Hz, 2H), 7.85 – 7.76 (m, 2H), 7.34 (tdd, *J* = 13.8, 8.2, 5.7 Hz, 2H), 7.21 – 7.10 (m, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 162.9, 158.9, 134.9, 129.8, 128.7, 124.6, 123.9, 114.7 ppm.



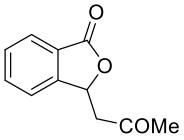
***N*-phenoxyacetamide:**[9] White solid, ^1H NMR (300 MHz, DMSO-d_6) δ= 11.69 (s, 1H, NHAc), 7.32 (t, *J* = 7.4 Hz, 2H, ArH), 7.01 (t, *J* = 7.4 Hz, 3H, ArH), 1.92 (s, 3H, COMe) ppm; ^{13}C NMR (101 MHz, DMSO-d_6) δ= 167.4, 159.6, 134.5, 130.2, 129.5, 122.9, 122.3, 112.9, 19.5 ppm.



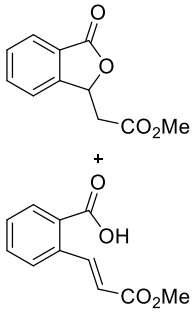
2,3-diphenylbenzofuran (8a):[9] White solid, R_f= 0.55 (Hexane); m.p. 110-114 ºC ; t_r = 17.26 min; ^1H NMR (400 MHz, $CDCl_3$) δ= 7.72 – 7.60 (m, 2H), 7.57 – 7.36 (m, 7H), 7.39 – 7.18 (m, 5H) ppm; ^{13}C NMR (75 MHz, CDCl3) δ= 154., 150.6, 132.9, 130.8, 130.4, 129.9, 129.1, 128.6, 128.5, 127.8, 127.2, 124.8, 123.0, 120.2, 117.6, 111.2 ppm; IR (ATR): ν = 2923, 2858, 1709, 1508, 1457 cm^{-1}, MS (70 eV, EI): *m*/*z* (%): 270 (M+, 100%), 239 (24).



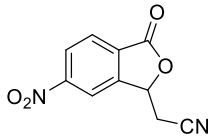
2-(3-oxo-1,3-dihydroisobenzofuran-1-yl)acetonitrile (10a):[10] White solid, R_f= 0.40 (Hexane/AcOEt 1/4); m.p. 110-114 ºC ; t_r = 13.25 min; ^1H NMR (400 MHz, $CDCl_3$) δ= 8.00 (d, *J* = 7.6 Hz, 1H, ArH), 7.80 (t, *J* = 7.5 Hz, 1H, ArH), 7.75 – 7.55 (m, 2H, ArH), 5.80 – 5.55 (m, 1H, C*H*CH_2CN), 3.13 (dd, *J* = 16.8, 5.2 Hz, 1H, CHC*H*$_2$CN), 2.96 (dd, *J* = 16.8, 7.0 Hz, 1H, CHC*H*$_2$CN) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 168.8, 146.7, 134.9, 130.7, 126.54, 125.9, 122.3, 114.8, 74.7, 24.0 ppm; IR (ATR): ν = 2923, 2854, 2360, 1762, 1053, 744 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 173 (M^+, 5%), 133 (100), 105 (16), 77 (12).



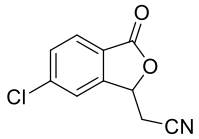
3-(2-oxopropyl)isobenzofuran-1(3H)-one (10b):[11] White solid, R_f= 0.57 (Hexane/AcOEt 1/1); m.p. 190-192 ºC; t_r = 14.45 min; ^1H NMR (300 MHz, $CDCl_3$) δ= 7.92 (d, *J* = 7.6 Hz, 1H, ArH), 7.69 (td, *J* = 7.5, 1.2 Hz, 1H, ArH), 7.60 – 7.45 (m, 2H, ArH), 5.96 (t, *J* = 6.6 Hz, 1H, C*H*CH_2COCH_3), 3.16 (dd, *J* = 17.5, 6.7 Hz, 1H, CHC*H*$_2COCH_3$), 2.93 (dd, *J* = 17.5, 6.4 Hz, 1H, CHC*H*$_2COCH_3$), 2.29 (s, 3H, $CHCH_2COC$*H*$_3$) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 204.7, 170.2, 149.5, 134.4, 129.6, 125.9, 122.5, 77.4, 48.3, 30.8 ppm; IR (ATR): ν = 2923, 2854, 1759, 1716, 748 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 190 (M+, 17%), 175 (10), 147 (100), 129 (17), 105 (38), 77 (27), 51 (11).



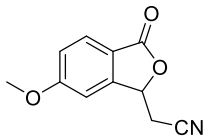
methyl 2-(3-oxo-1,3-dihydroisobenzofuran-1-yl)acetate + (E)-2-(3-methoxy-3-oxoprop-1-en-1-yl)benzoic acid (10c + 11c): [12] Yellowish oil; R_f= 0.60 (Hexane/AcOEt 1/1); t_r = 14.72 min; ^{1}H NMR (300 MHz, $CDCl_3$) an equilibrium between the acyclic and cyclic (aprox. 2:1) compounds was found: δ= 8.70 (d, J = 16.3 Hz, 3H), 7.92 (d, J = 7.6 Hz, 1H), 7.79 (d, J = 7.7 Hz, 3H), 7.75 – 7.65 (m, 1H), 7.57 (t, J = 7.5 Hz, 1H), 7.55 – 7.50 (m, 1H), 6.61 (d, J = 16.2 Hz, 3H), 5.89 (dt, J = 9.2, 6.6 Hz, 1H, C*H*$CH_2CO_2CH_3$), 3.84 (s, 8H), 3.77 (s, 3H, $CHCH_2CO_2CH_3$), 2.93 (d, J = 2.1 Hz, 1H, $CHCH_2CO_2CH_3$), 2.91 (d, J = 1.5 Hz, 1H, $CHCH_2CO_2CH_3$) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 170.0, 169.8, 169.6, 168.9, 166.7, 149.7, 148.7, 137.5, 134.9, 134.4, 129.6, 126.7, 125.8, 123.1, 122.6, 122.1, 76.1, 52.29, 52.2, 52.01, 39.3, 39.2 ppm; IR (ATR): ν = 2954, 2923, 2850, 1747 (broad signal), 1643, 1007, 733 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 206 (M^+, 11%), 146 (100), 133 (85), 105 (34), 77 (20), 51 (7).



2-(6-nitro-3-oxo-1,3-dihydroisobenzofuran-1-yl)acetonitrile (10d): Yellowish solid; R_f= 0.63 (Hexane/AcOEt 1/1); m.p. 200-203 ºC; t_r = 15.60 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.53 (dd, J = 10.0, 1.6 Hz, 2H, ArH), 8.18 (d, J = 8.6 Hz, 1H, ArH), 5.80 (t, J = 5.4 Hz, 1H, C*H*CH_2CN), 3.16 (dd, J = 5.5, 3.0 Hz, 2H, $CHCH_2CN$) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 166.2, 151.9, 147.3, 127.8, 126.2, 117.9, 74.6, 29.7, 23.7 ppm; IR (ATR): ν = 2950, 2920, 2854, 2360, 1755, 1645, 1543, 1369 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 167 (4%), 149 (100), 104 (6), 57 (10). HRMS (QTOF) calculated for M^+ -CH_2CN 178.0140, found 178.0182.

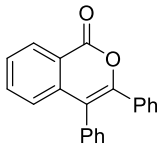


2-(6-chloro-3-oxo-1,3-dihydroisobenzofuran-1-yl)acetonitrile (10e): [10] White solid; R_f= 0.66 (Hexane/AcOEt 3/2); m.p. 204-206ºC; t_r = 15.43 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.91 (d, J = 8.1 Hz, 1H, ArH), 7.75 – 7.55 (m, 2H, ArH), 5.70 – 5.55 (m, 1H, C*H*CH_2CN), 3.11 (dd, J = 16.8, 5.0 Hz, 1H, $CHCH_2CN$), 2.97 (dd, J = 16.8, 6.8 Hz, 1H, $CHCH_2CN$) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 167.5, 148.0, 141.8, 131.4, 127.5, 124.2, 122.6, 114.3, 74.0, 23.7 ppm; ; IR (ATR): ν = 2958, 2920, 2360, 1747, 1049, 802 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 209 (M^++2, <10%), 207 (M^+, 11%), 169 (34), 167 (100), 139 (12), 111 (10).

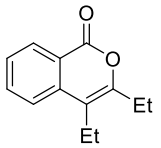


2-(6-methoxy-3-oxo-1,3-dihydroisobenzofuran-1-yl)acetonitrile (10e): [10] White solid; R_f= 0.33 (Hexane/AcOEt 1/1); m.p. 155-157 ºC; t_r = 15.95 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.86 (d, J = 8.5 Hz, 1H, ArH), 7.20 – 7.05 (m, 2H, ArH), 5.58 (dd, J = 7.0, 5.2 Hz, 1H, C*H*CH_2CN), 3.94 (s, 3H), 3.09 (dd, J = 16.8, 5.1 Hz, 1H, $CHCH_2CN$), 2.91 (dd, J = 16.7, 7.1 Hz, 1H, $CHCH_2CN$) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 168.6, 165.4, 149.6, 128.01,

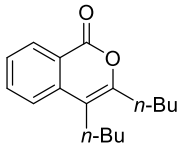
117.8 (2C), 115.0, 106.4, 74.0, 56.2, 24.0 ppm; IR (ATR): ν = 2958, 2923, 2360, 1739, 1604, 1257, 798 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 203 (M^+, 23%), 163 (100), 92 (6), 63 (6).



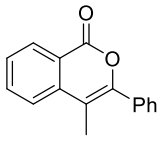
3,4-diphenyl-1H-isochromen-1-one (12a):[13] White solid, R_f= 0.60 (Hexane/AcOEt 4/1); m.p. 170-172 ºC ; t_r =18.70 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.41 (dd, *J* = 7.9, 1.1 Hz, 1H, ArH), 7.70 – 7.60 (m, 1H, ArH), 7.60 – 7.50 (m, 1H, ArH), 7.41 (dt, *J* = 4.7, 2.3 Hz, 3H, ArH), 7.40 – 7.30 (m, 2H, ArH), 7.30 – 7.15 (m, 6H, ArH) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 162.4, 151.0, 138.9, 134.8, 134.4, 133.0, 131.3, 129.67, 129.3, 129.2, 129.1, 128.2, 127.9, 125.5, 120.5, 117.0 ppm (some signals missing due to overlap); IR (ATR): ν = 2920, 2854, 1724, 1608, 1554, 910, 763, 690 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 298 (M^+, 100%), 270 (25), 221 (26), 165 (22), 105 (34), 77 (19).



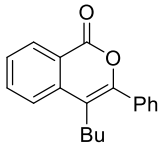
3,4-diethyl-1H-isochromen-1-one (12b):[13] Yellowish oil; R_f= 0.57 (Hexane/AcOEt 4/1); t_r =13.84 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.32 (dd, *J* = 7.9, 1.1 Hz, 1H, ArH), 7.75 (ddd, *J* = 8.4, 7.3, 1.4 Hz, 1H, ArH), 7.60 – 7.40 (m, 2H, ArH), 2.64 (tt, *J* = 7.5, 6.3 Hz, 4H, CH_2CH$_3$ (x2)), 1.29 (t, *J* = 7.5 Hz, 3H, CH$_2$CH_3), 1.21 (t, *J* = 7.5 Hz, 3H, CH$_2$CH_3) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 163.1, 154.9, 137.8, 134.6, 129.9, 127.1, 122.5, 120.8, 113.1, 24.1, 19.3, 14.3, 12.5 ppm; IR (ATR): ν = 2974, 2931, 2885, 1720, 1608, 771 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 202 (M+, 100%); 187 (91), 159 (9), 131 (70), 115 (46), 91 (21), 57 (8).



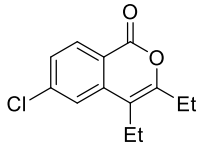
3,4-dibutyl-1H-isochromen-1-one (12c):[14] colorless oil; R_f= 0.67 (Hexane/AcOEt 9/1); t_r = 15.96 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.47 – 8.21 (m, 1H), 7.73 (ddd, *J* = 8.6, 7.2, 1.5 Hz, 1H), 7.48 (ddd, *J* = 12.1, 8.9, 4.6 Hz, 2H), 2.74 – 2.41 (m, 3H), 1.81 – 1.59 (m, 3H), 1.61 – 1.31 (m, 6H), 1.08 – 0.89 (m, 6H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 163.0, 154.2, 138.0, 134.5, 129.8, 127.0, 122.6, 120.8, 112.2, 31.8, 30.6, 30.00, 25.9, 22.9, 22.5, 13.9, 13.9 ppm; IR (ATR): ν = 2954, 2935, 2866, 1724, 1462 cm^{-1}; ; MS (70 eV, EI): *m*/*z* (%): 258 (M^+, 74%), 215 (56), 173 (100), 131 (37).



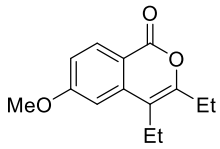
4-methyl-3-phenyl-1H-isochromen-1-one (12d):[15] White solid; R_f= 0.47 (Hexane/AcOEt 4/1); t_r = 16.70 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.38 (dd, *J* = 7.9, 1.0 Hz, 1H, ArH), 7.86 – 7.77 (m, 1H, ArH), 7.68 – 7.56 (m, 4H), 7.48 (dddd, *J* = 10.5, 9.3, 6.8, 5.4 Hz, 3H, ArH), 2.32 (s, 3H, CH_3) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 162.7, 151.3, 138.9, 134.9, 133.5, 133.3, 129.6, 129.5, 128.4, 123.5, 120.9, 109.3, 13.7 ppm; IR (ATR): ν = 2947, 2923, 2862, 1712, 1565 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 236 (M+, 96%), 208 (100), 178 (18), 105 (26), 77 (36).



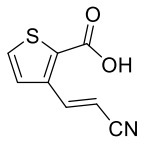
4-butyl-3-phenyl-1H-isochromen-1-one (12e):[15] Yellowish solid; R_f= 0.67 (Hexane/AcOEt 4/1); t_r = 17.87 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.39 (dd, J = 7.9, 1.0 Hz, 1H, ArH), 7.84 – 7.77 (m, 1H, ArH), 7.65 (d, J = 7.8 Hz, 1H, ArH), 7.60 – 7.51 (m, 3H, ArH), 7.50 – 7.43 (m, 3H, ArH), 2.73 – 2.63 (m, 2H, $CCH_2CH_2CH_2CH_3$), 1.64 (ddd, J = 9.7, 7.7, 4.8 Hz, 2H,$CCH_2CH_2CH_2CH_3$), 1.37 (dd, J = 14.8, 7.4 Hz, 2H, $CCH_2CH_2CH_2CH_3$), 0.89 (t, J = 7.3 Hz, 3H, $CCH_2CH_2CH_2CH_3$).^{13}C NMR (75 MHz, $CDCl_3$) δ= 162.6, 151.6, 138.0, 134.8, 133.6, 130.1, 129.9, 129.5, 129.2, 128.6, 128.5, 127.9, 123.6, 121.41, 114.2, 32.3, 26.7, 22.8, 13.9 ppm; IR (ATR): ν = 3058, 2950, 2862, 1708, 1608, 1488 cm^{-1}; MS (70 eV, EI): m/z (%): 278 (M^+, 75%), 235 (73), 207 (100), 178 (47), 105 (13), 77 (20).



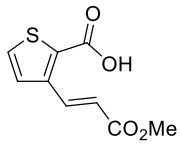
6-chloro-3,4-diethyl-1H-isochromen-1-one (12f):[16] White solid; R_f= 0.50 (Hexane/AcOEt 4/1); t_r = 13.60 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.24 (d, J = 8.5 Hz, 1H, ArH), 7.50 (d, J = 1.9 Hz, 1H, ArH), 7.42 (dd, J = 8.5, 1.9 Hz, 1H, ArH), 2.62 (q, J = 7.5 Hz, 4H, CH_2CH_3 x2), 1.28 (t, J = 7.5 Hz, 3H, CH_2CH_3), 1.20 (t, J = 7.6 Hz, 3H, CH_2CH_3) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 162.4, 156.6, 141.7, 139.4, 131.7, 127.7, 122.5, 119.2, 112.6, 24.3, 19.4, 14.3, 12.6 ppm; IR (ATR): ν = 2974, 2931, 1720, 1593, 783 cm^{-1}; MS (70 eV, EI): m/z (%): 238 (M^++2, 28%), 236 (M^+, 84), 223 (34), 221 (100), 165 (44), 115 (38).



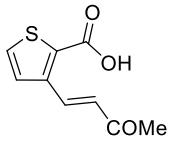
3,4-diethyl-6-methoxy-1H-isochromen-1-one (12g):[13] Yellowish solid; R_f= 0.37 (Hexane/AcOEt 4/1); t_r = 14.43 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 8.22 (d, J = 8.8 Hz, 1H, ArH), 7.02 (dd, J = 8.8, 2.4 Hz, 1H, ArH), 6.93 (d, J = 2.4 Hz, 1H, ArH), 3.94 (s, 3H, OCH_3), 2.61 (dq, J = 11.4, 3.8 Hz, 4H, CH_2CH_3 x2), 1.27 (t, J = 7.6 Hz, 3H, CH_2CH_3), 1.20 (t, J = 7.6 Hz, 3H, CH_2CH_3) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 165.2, 164.2, 155.7, 140.4, 132.4, 122.8, 118.9, 114.9, 113.7, 106.0, 55.8, 24.2, 19.5, 14.2, 12.5 ppm; IR (ATR): ν = 2977, 2943, 1693, 1492, 1072 cm^{-1}; MS (70 eV, EI): m/z (%): 232 (M^+, 97%), 217 (100), 175 (25), 161 (45).



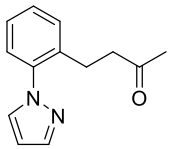
(*E*)-3-(2-cyanovinyl)thiophene-2-carboxylic acid (14a):[17] White solid; R_f= 0,67 (Hexane/AcOEt 1/1); t_r = 9.84 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.53 (dd, J = 2.9, 1.3 Hz, 1H, ArH), 7.47 – 7.33 (m, 2H, ArH and C*H*CHCN), 7.33 – 7.22 (m, 1H), 5.72 (d, J = 16.5 Hz, 1H, CHC*H*CN) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 143.9, 136.7, 128.6, 127.7, 124.2, 118.3, 95.7, 29.7 ppm; IR (ATR): ν = 2924, 2862, 1736 cm^{-1}; MS (70 eV, EI): m/z (%):135 (M^+-CO_2, 100%), 108 (28), 84 (18).



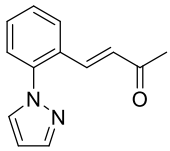
(*E*)-3-(3-methoxy-3-oxoprop-1-en-1-yl)thiophene-2-carboxylic acid (14b): Yellowish solid, R_f= 0.60 (Hexane/AcOEt 3/2); m.p. 68-70 ºC ; t_r =10.52 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.68 (d, J = 15.9 Hz, 1H, CHC*H*CO_2Me), 7.55 – 7.45 (m, 1H), 7.33 (tdd, J = 6.3, 4.3, 2.1 Hz, 2H), 6.27 (d, J = 15.9 Hz, 1H, C*H*CHCO$_2$Me), 3.80 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 167.7, 138.3, 137.5, 128.1, 126.9, 125.1, 117.4, 51.7 ppm; IR (ATR): ν = 3089, 1720, 1645, 1530 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 168 (M^+-CO_2, 70%), 137 (100), 109 (47). HRMS (QTOF) calculated for M^+-CO_2 167.0167, found 167.9067.



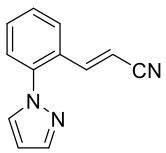
(*E*)-3-(3-oxobut-1-en-1-yl)thiophene-2-carboxylic acid (14c): yellowish solid, R_f=0.67 (Hexane/AcOEt 1/1); m.p. 65-67 ºC; t_r = 10.34 min; ^{1}H NMR (400 MHz, $CDCl_3$) δ= 7.56 – 7.48 (m, 2H, ArH + C*H*CHCOMe), 7.36 (ddd, J = 5.1, 2.9, 0.6 Hz, 1H, ArH), 7.32 (d, J = 0.9 Hz, 1H, ArH), 6.55 (d, J = 16.2 Hz, 1H, CHC*H*COMe), 2.36 (s, 3H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 198.8, 137.8, 137.0, 128.8, 127.3, 127.1, 125.3, 27.6 ppm; IR (ATR): ν = 3089, 2919, 2857, 1712, 1658, 1511 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 152 (M^+-CO_2, 62%), 137 (100), 109 (59). HRMS (QTOF) calculated for M^+-CO_2 152.0218, found 152.8318.



4-(2-(1H-pyrazol-1-yl)phenyl)butan-2-one (16):[17] Yellowish oil, R_f= 0.50 (Hexane/AcOEt 3/2); t_r = 13.29 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.72 (d, J = 1.6 Hz, 1H, ArH), 7.60 (d, J = 2.3 Hz, 1H, ArH), 7.36 – 7.25 (m, 4H, ArH), 6.45 (t, J = 2.1 Hz, 1H, ArH), 2.77 (t, J = 7.4 Hz, 2H, C*H*$_2$CH$_2$COMe), 2.64 – 2.55 (m, 2H, CH$_2$C*H*$_2$COMe), 2.04 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 208.2, 140.4, 139.5, 137.4, 130.7, 129.1, 127.2, 126.8, 120.6, 106.7, 44.4, 29.9, 25.9 ppm; IR (ATR): ν = 2931, 1708, 1512 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 214 (M^+, 10%), 171 (100).

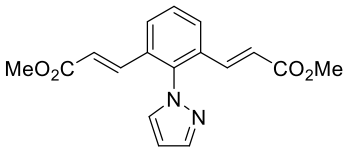


(*E*)-4-(2-(1H-pyrazol-1-yl)phenyl)but-3-en-2-one (17a): yelowish oil, R_f= 0.49 (Hexane/AcOEt 3/2); t_r = 14.169 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.85 – 7.69 (m, 3H, ArH), 7.59 – 7.42 (m, 4H, ArH), 6.69 – 6.52 (m, 2H, C*H*C*H*COCH$_3$), 2.29 (s, 1H, CHCHCOC*H*$_3$) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 198.6, 141.5, 140.1, 139.4, 130.9, 130.3, 129.6, 128.7, 127.8, 126.3, 107.6, 27.2 ppm; IR (ATR): ν = 2924, 2854, 1670, 1500 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 212 (M+, 10%), 169 (100); HRMS (QTOF) calculated for M^+ 212.0950, found 212.1950.

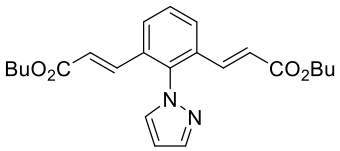


(*E*)-3-(2-(1H-pyrazol-1-yl)phenyl)acrylonitrile (17b):[18] yellowish oil; R_f= 0.29 (Hexane/AcOEt 4/1); t_r = 13.95 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.80 (s, 1H, ArH), 7.65 (dd, J = 7.6, 1.5 Hz, 2H, ArH), 7.59 – 7.41 (m,

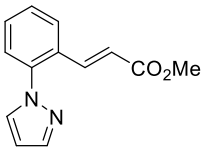
3H, ArH), 7.36 (d, *J* = 16.7 Hz, 1H, C*H*CHCN), 5.82 (d, *J* = 16.7 Hz, 1H, CHC*H*CN) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 146.5, 141.7, 139.3, 131.7, 129.4, 128.9, 127.1, 126.5, 117.9, 107.9, 98.9 ppm; IR (ATR): ν = 2360, 2318, 2213, 1511 729 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 195 (M^+, 60%), 194 (100), 169 (49), 140 (16).



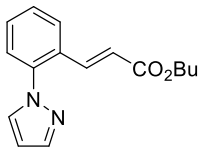
Dimethyl 3,3'-(2-(1H-pyrazol-1-yl)-1,3-phenylene)(2*E*,2'*E*)-diacrylate (18a): yellowish solid, R_f= 0.50 (Hexane/AcOEt 7/3); m.p. 48-50 ^{o}C ; t_r =18.03 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.85 (d, *J* = 1.5 Hz, 1H, ArH), 7.74 (d, *J* = 7.8 Hz, 2H, ArH), 7.60 – 7.45 (m, 2H, ArH), 7.11 (d, *J* = 16.1 Hz, 2H, C*H*CHCO$_2$Me x2), 6.62 – 6.52 (m, 1H, ArH), 6.29 (d, *J* = 16.1 Hz, 2H, CHC*H*CO$_2$Me x2), 3.73 (s, 6H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 166.7, 141.6, 138.9, 138.7, 133.7, 132.9, 129.8 (2C), 128.7(2C), 121.6, 107.6, 51.9 ppm; IR (ATR): ν = 3080, 2924, 2854, 1701, 1631, 1500 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 312 (M^+, <10%), 253 (100), 193 (75). HRMS (QTOF) calculated for M^+ 312.1115, found 312.1108.



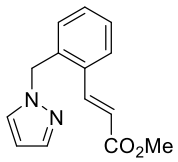
Dibutyl 3,3'-(2-(1H-pyrazol-1-yl)-1,3-phenylene)(2*E*,2'*E*)-diacrylate (18b):[18] yellowish solid; R_f= 0.35 (Hexane/AcOEt 4/1); m.p. 52-54 ^{o}C ; t_r = 24.95 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.84 (d, *J* = 1.6 Hz, 1H, ArH), 7.76 (d, *J* = 7.8 Hz, 2H, ArH), 7.59 – 7.48 (m, 2H, ArH), 7.10 (d, *J* = 16.0 Hz, 2H, C*H*CHCO$_2$Bu x2), 6.56 (t, *J* = 2.1 Hz, 1H, ArH), 6.32 (d, *J* = 16.0 Hz, 2H, CHC*H*CO$_2$Bu x2), 4.14 (t, *J* = 6.6 Hz, 4H, CO$_2$C*H*$_2$CH$_2$CH$_2$CH$_3$ x2), 1.68 – 1.56 (m, 4H, CO$_2$CH$_2$C*H*$_2$CH$_2$CH$_3$ x2), 1.45 – 1.30 (m, 4H, CO$_2$CH$_2$CH$_2$C*H*$_2$CH$_3$ x2), 0.94 (t, *J* = 7.4 Hz, 6H, CO$_2$CH$_2$CH$_2$CH$_2$C*H*$_3$ x2) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 166.3, 141.5, 138.7, 133.7, 133.0, 129.7, 128.4, 121.9, 107.4, 64.6, 30.7, 19.2, 13.8 ppm; IR (ATR): ν = 2954, 2873, 1712, 1635, 1512 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 396 (M^+, <10%), 295 (100), 239 (10), 193 (12).



Methyl (*E*)-3-(2-(1H-pyrazol-1-yl)phenyl)acrylate (17c):[19] colorless solid; R_f= 0.45 (Hexane/AcOEt 4/1); m.p. 45-48 ^{o}C ; t_r = 14.41 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.80 (d, *J* = 1.5 Hz, 1H, ArH), 7.72 (d, *J* = 7.2 Hz, 1H, ArH), 7.65 (d, *J* = 2.2 Hz, 1H, ArH), 7.60 (d, *J* = 16.0 Hz, 1H, C*H*CHCO$_2$Me), 7.55 – 7.41 (m, 3H, ArH), 6.52 (t, *J* = 2.0 Hz, 1H, ArH), 6.38 (d, *J* = 16.0 Hz, 1H, CHC*H*CO$_2$Me), 3.77 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ= 167.0, 141.4, 140.4, 139.8, 131.6, 130.8, 130.1, 128.7, 127.9, 126.4, 120.5, 107.5, 51.9 ppm; IR (ATR): ν = 2954, 2919, 1701, 1516 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 228 (M+, <10%), 169 (100).



Butyl (*E*)-3-(2-(1H-pyrazol-1-yl)phenyl)acrylate (17d):[18] cololess oil; R_f= 0.50 (Hexane/AcOEt 4/1); t_r = 16.15 min; ^{1}H NMR (300 MHz, $CDCl_3$) δ= 7.78 (d, J = 1.5 Hz, 1H, ArH), 7.72 (d, J = 7.4 Hz, 1H, ArH), 7.64 (d, J = 2.1 Hz, 1H, ArH), 7.60 (d, J = 16.0 Hz, 1H, C*H*CHCO$_2$Bu), 7.52 – 7.41 (m, 3H, ArH), 6.50 (t, J = 2.0 Hz, 1H, ArH), 6.39 (d, J = 16.0 Hz, 1H, CHC*H*CO$_2$Bu), 4.16 (t, J = 6.6 Hz, 2H, CO$_2$C*H*$_2$CH$_2$CH$_2$CH$_3$), 1.70 – 1.57 (m, 2H, CO$_2$CH$_2$C*H*$_2$CH$_2$CH$_3$), 1.46 – 1.33 (m, 2H, CO$_2$CH$_2$CH$_2$C*H*$_2$CH$_3$), 0.94 (t, J = 7.3 Hz, 3H, CO$_2$CH$_2$CH$_2$CH$_2$C*H*$_3$) ppm; ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.5, 141.2, 139.9, 130.6, 128.5, 127.6, 126.2, 1209, 107.2, 64.5, 30.7, 19.2, 13.7 ppm; IR (ATR): ν = 2958, 1709, 1509 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 270 (M$^+$, <10%), 169 (100).



Methyl (E)-3-(2-((1H-pyrazol-1-yl)methyl)phenyl)acrylate (17e):[20] white solid, R_f= 0.50 (Hexane/AcOEt 4/1); m.p. 58-60 ºC; t_r = 15.10 min; ^{1}H NMR (400 MHz, $CDCl_3$) δ= 7.98 (d, J = 15.8 Hz, 1H, C*H*CHCO$_2$Me), 7.65 – 7.52 (m, 2H, ArH), 7.39 – 7.30 (m, 3H, ArH), 7.11 – 7.02 (m, 1H, ArH), 6.36 (d, J = 15.8 Hz, 1H, CHC*H*CO$_2$Me), 6.29 (t, J = 2.0 Hz, 1H, ArH), 5.49 (s, 2H, NCH$_2$), 3.81 (s, 3H, CO$_2$CH$_3$) ppm; ^{13}C NMR (101 MHz, $CDCl_3$) δ= 167.1, 140.9, 139.8, 135.4, 133.3, 130.6, 129.6, 129.5, 128.8, 127.2, 120.9, 106.3, 53.3, 51.9 ppm; IR (ATR): ν = 2943, 2854, 1709, 1511 cm^{-1}; MS (70 eV, EI): *m*/*z* (%): 242 (M$^+$, 30%), 183 (100), 169 (37), 115 (76).

III. References

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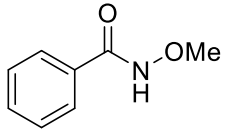
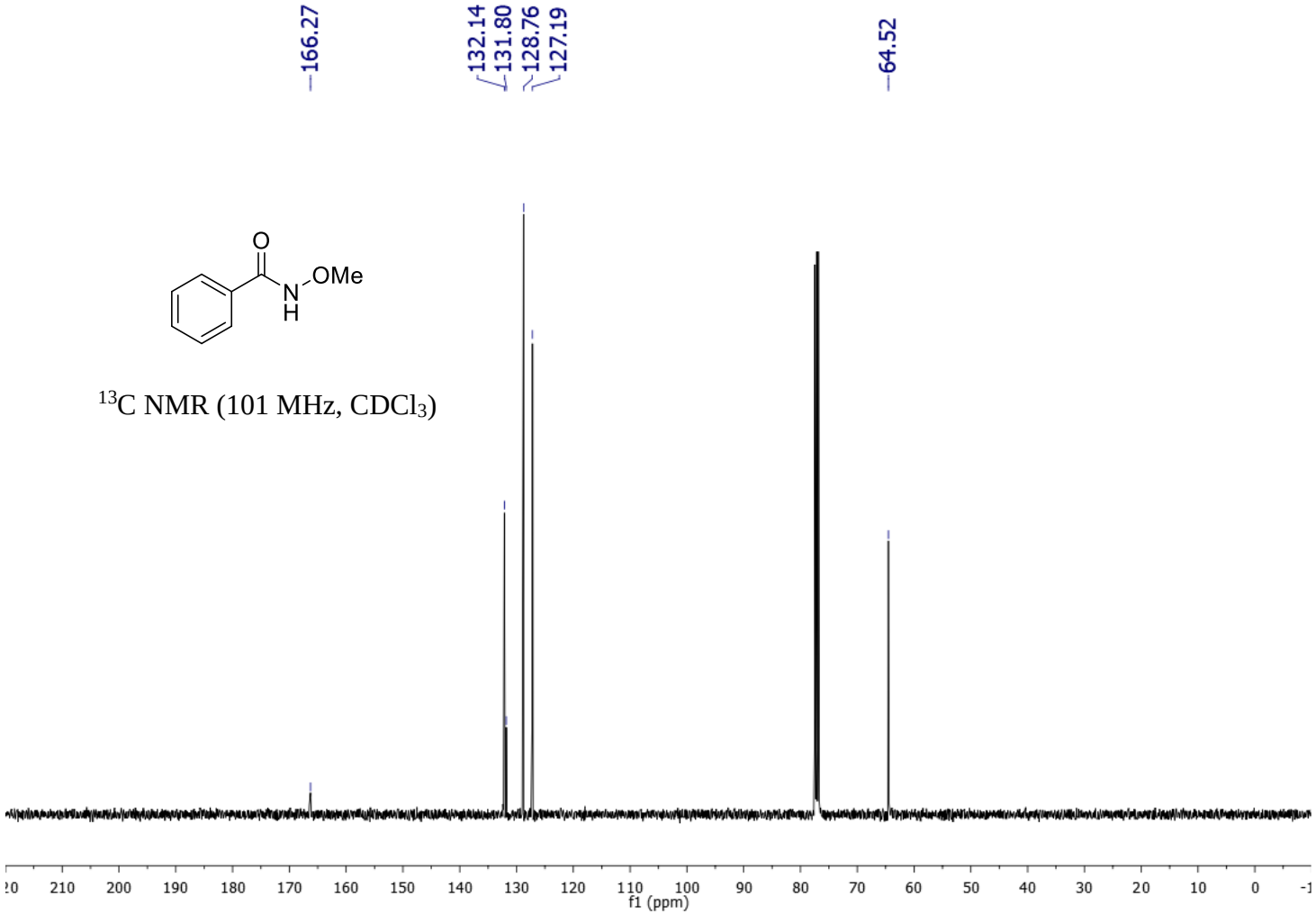
IV. Copies of ^{1}H and ^{13}C NMR



^{1}H NMR (400 MHz, $CDCl_3$)



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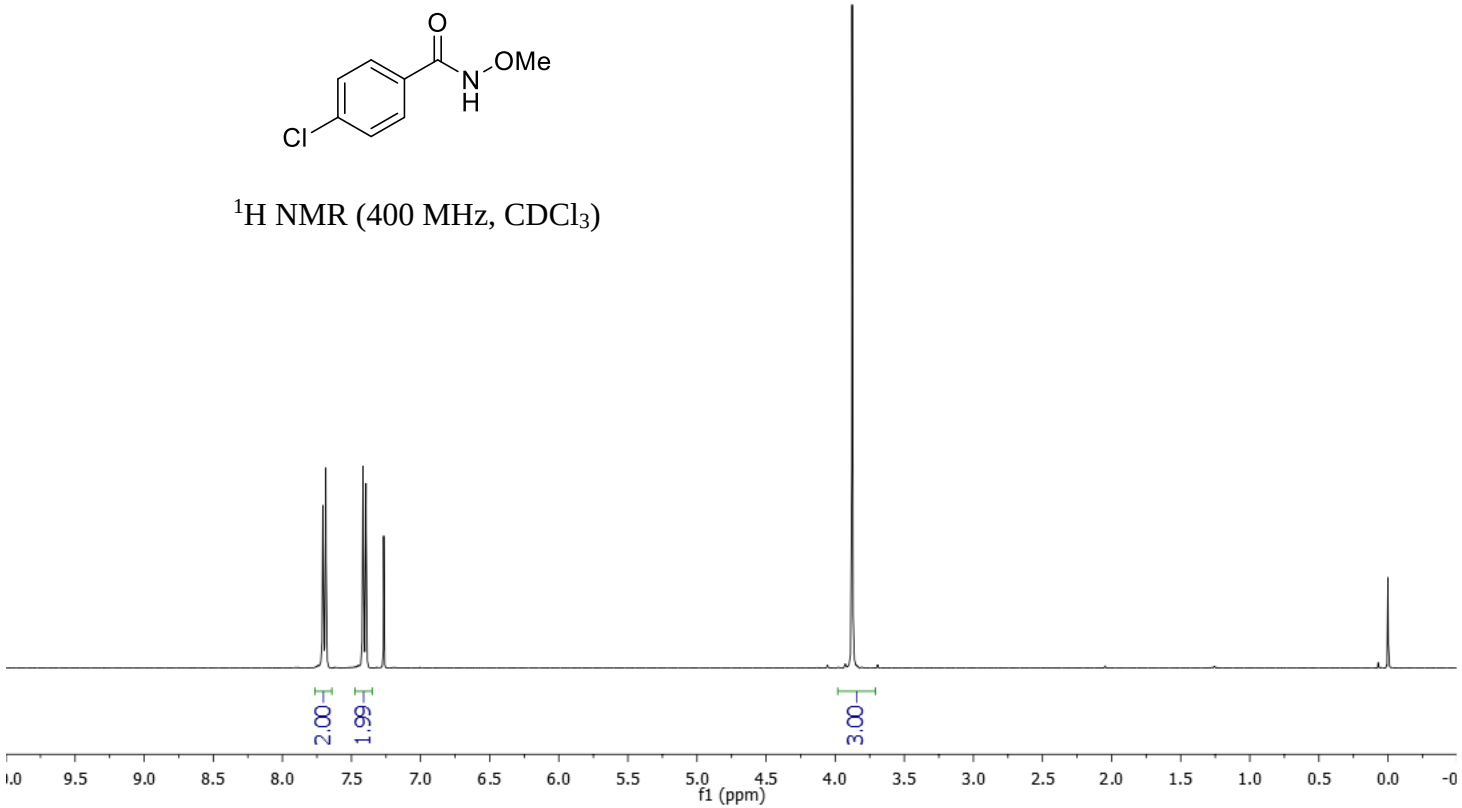

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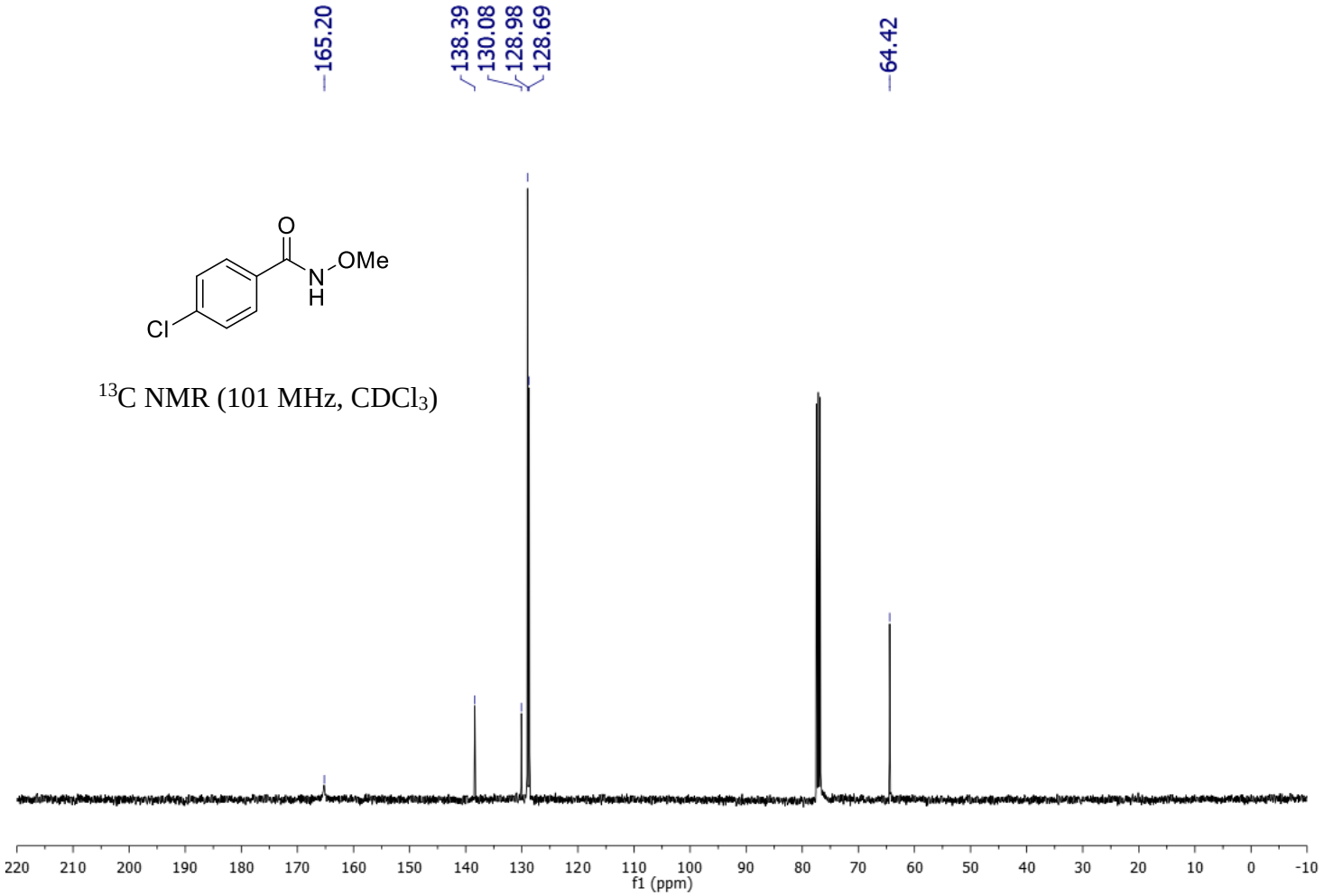

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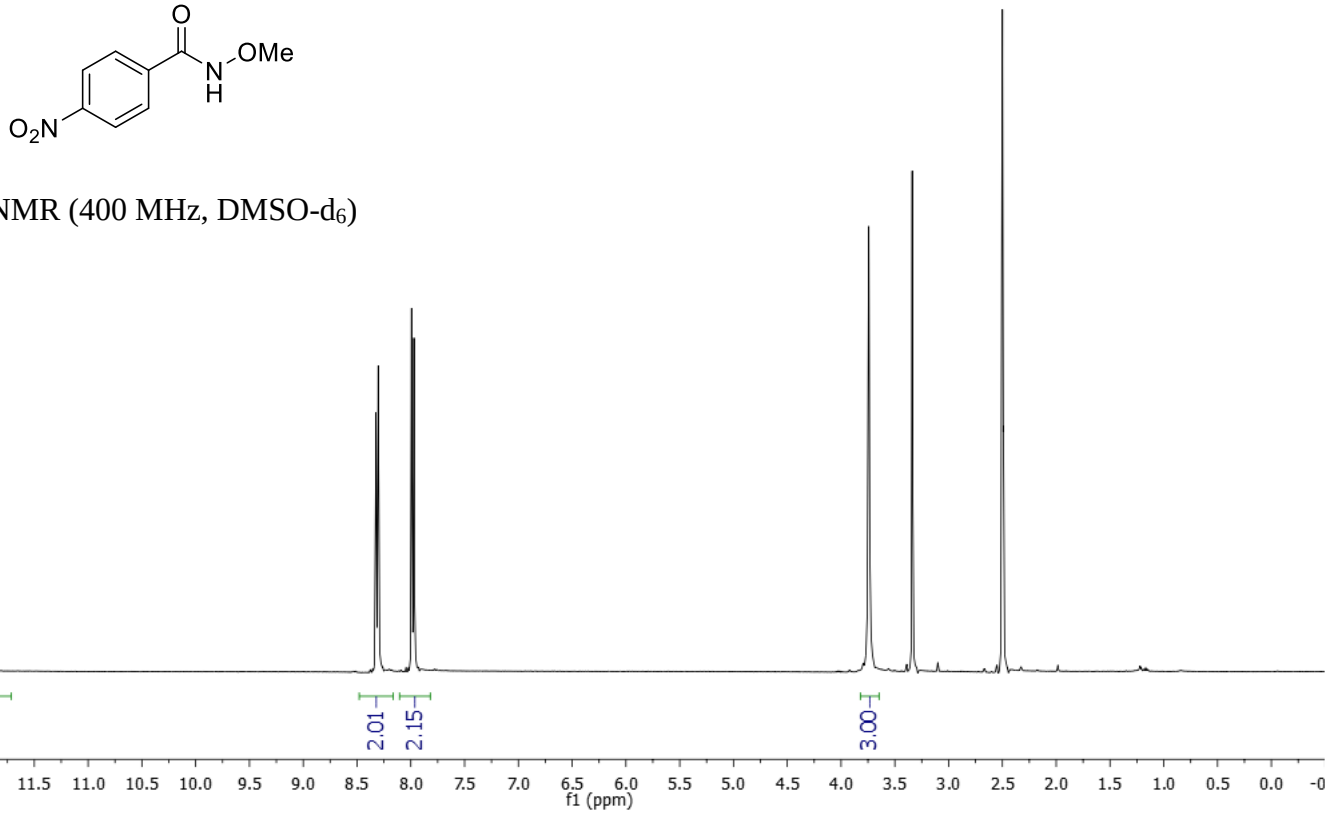

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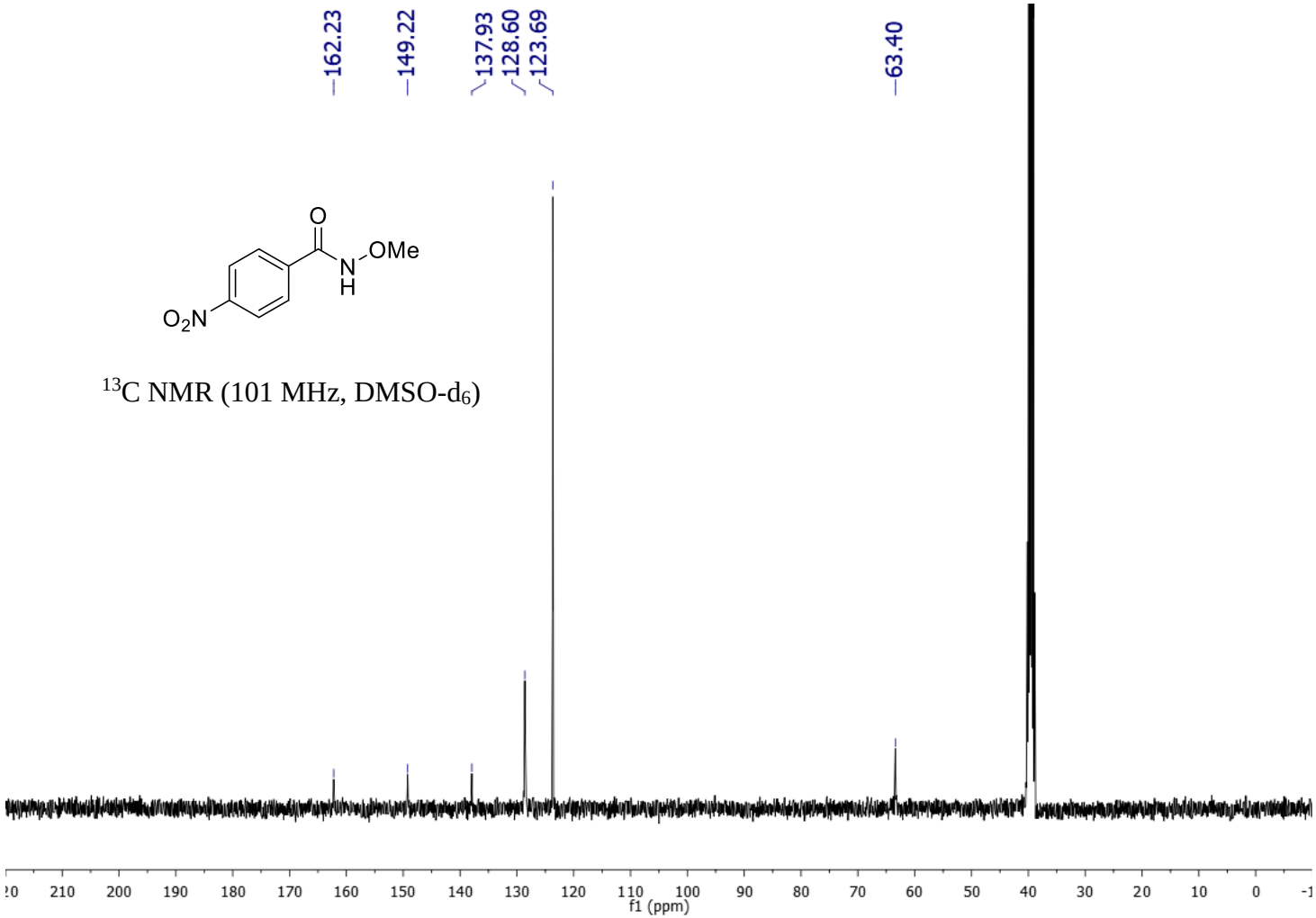

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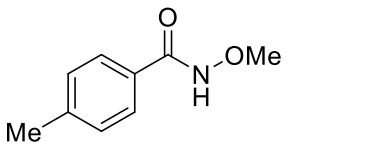

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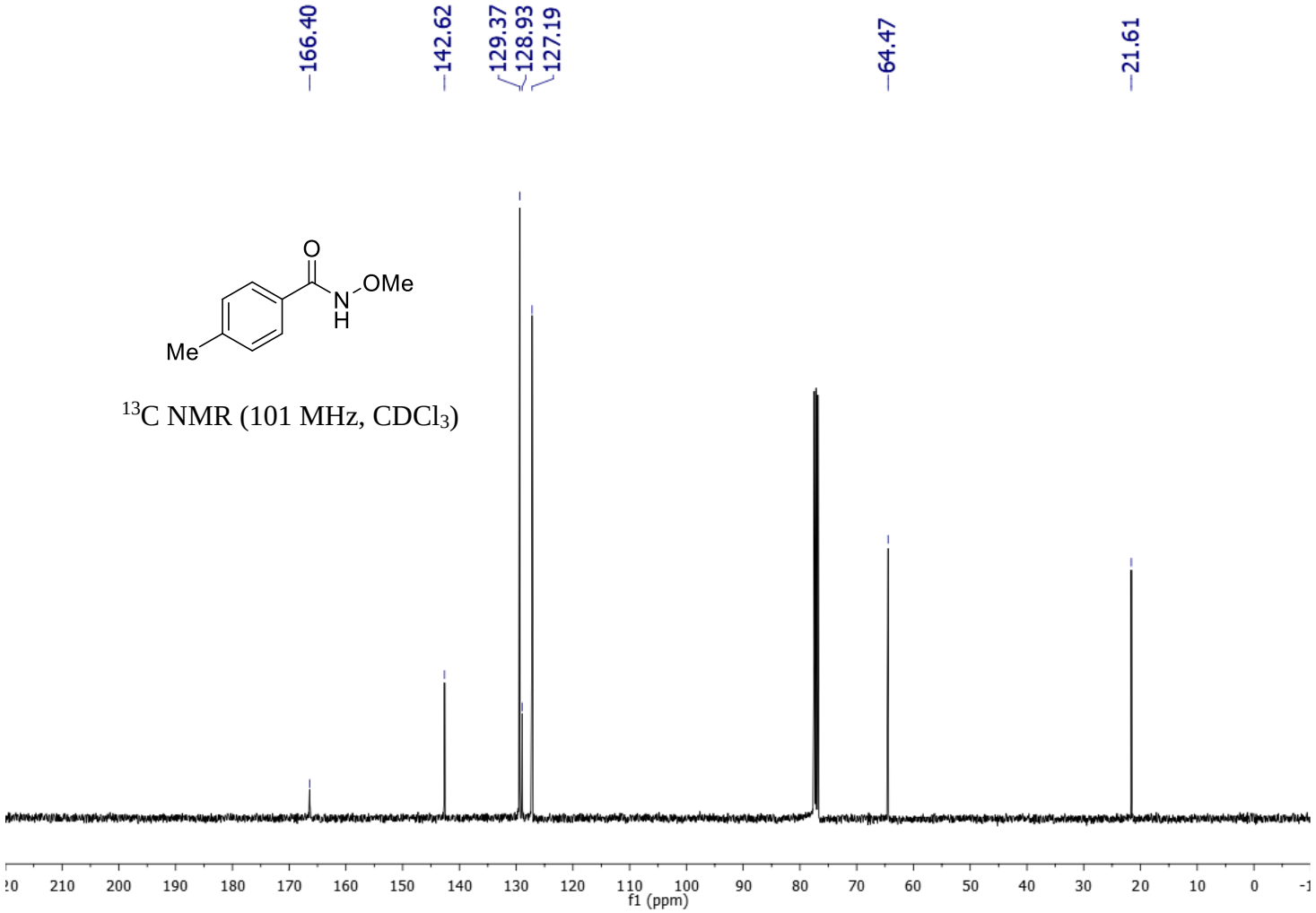

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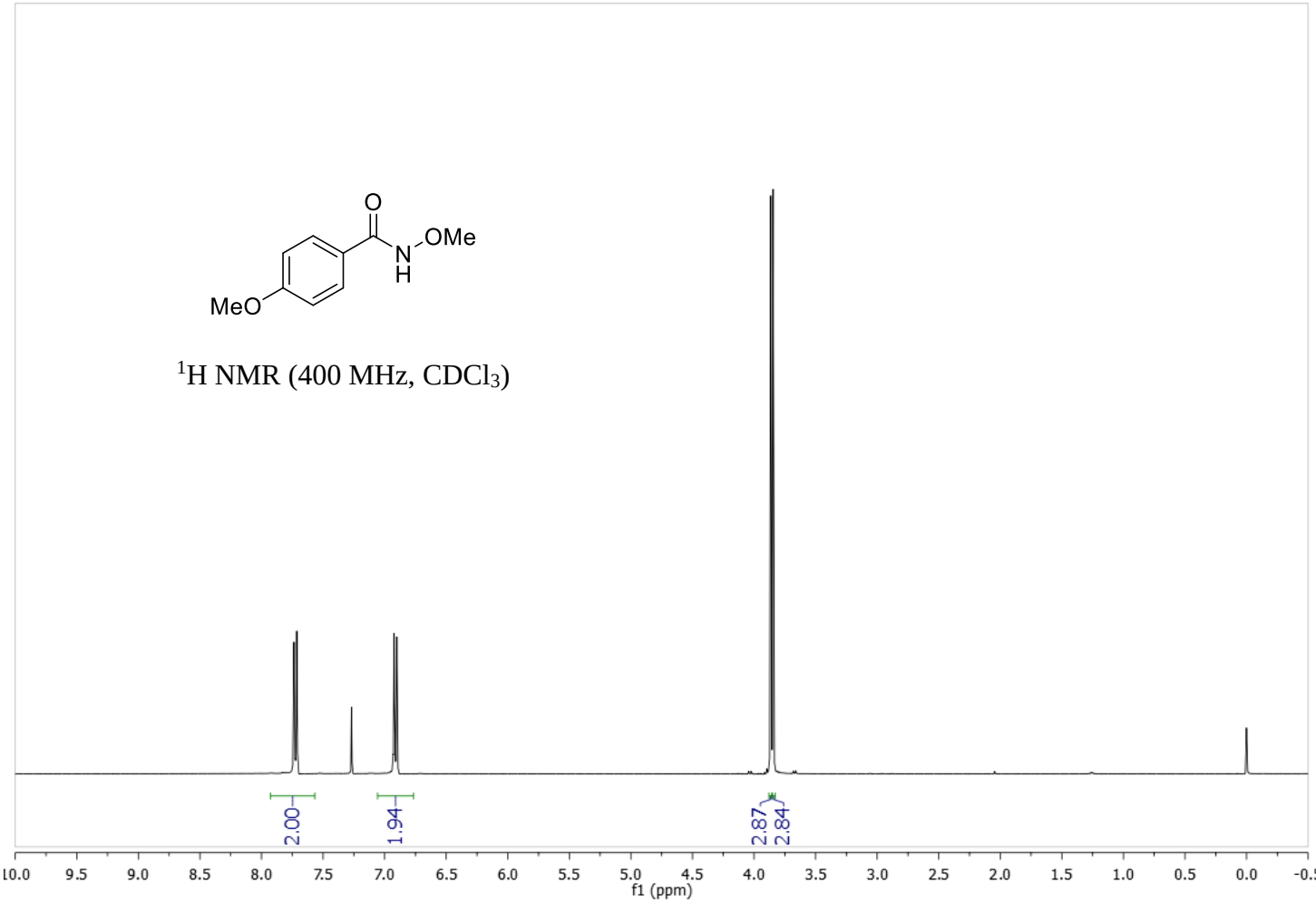

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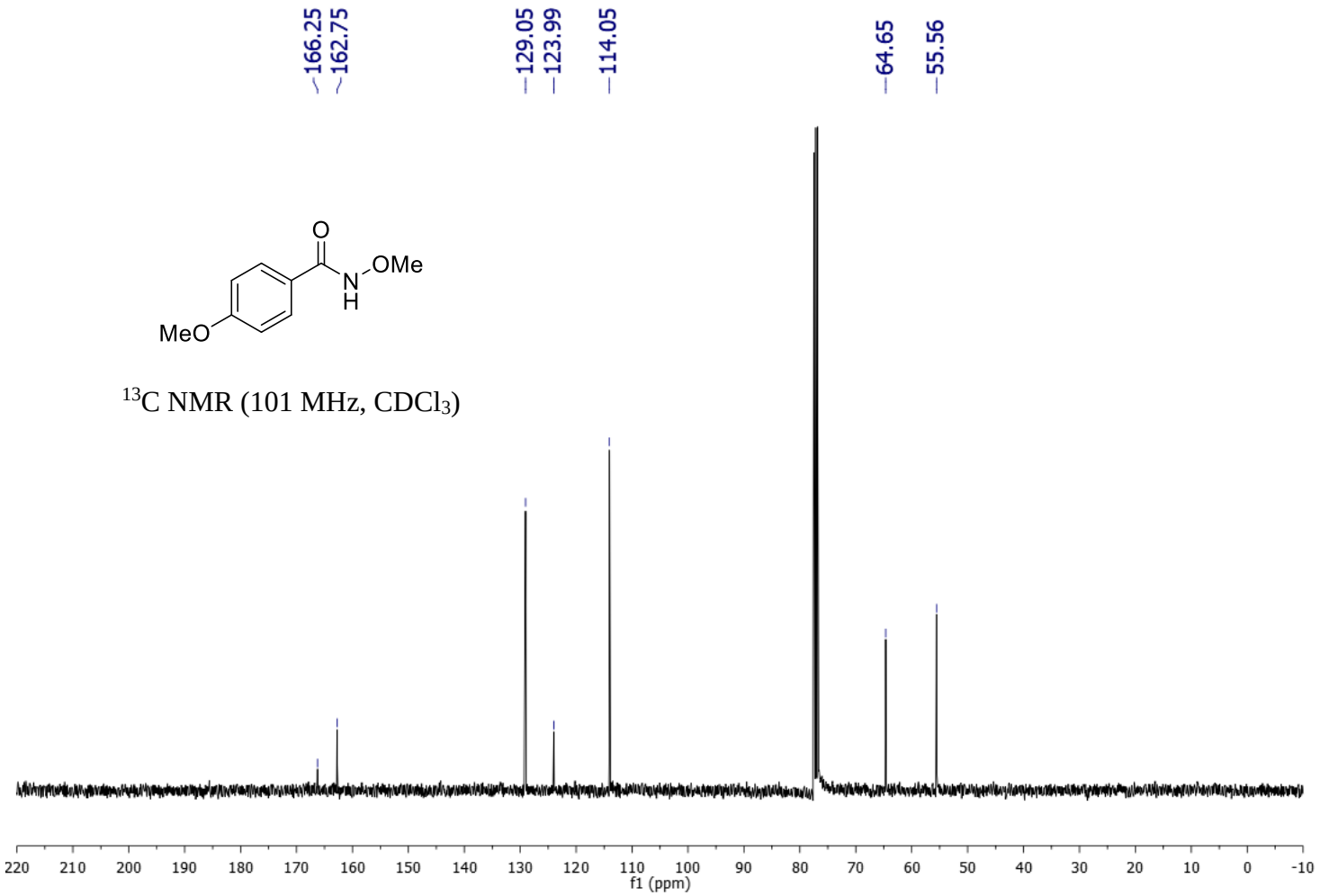

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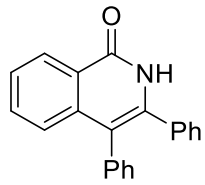
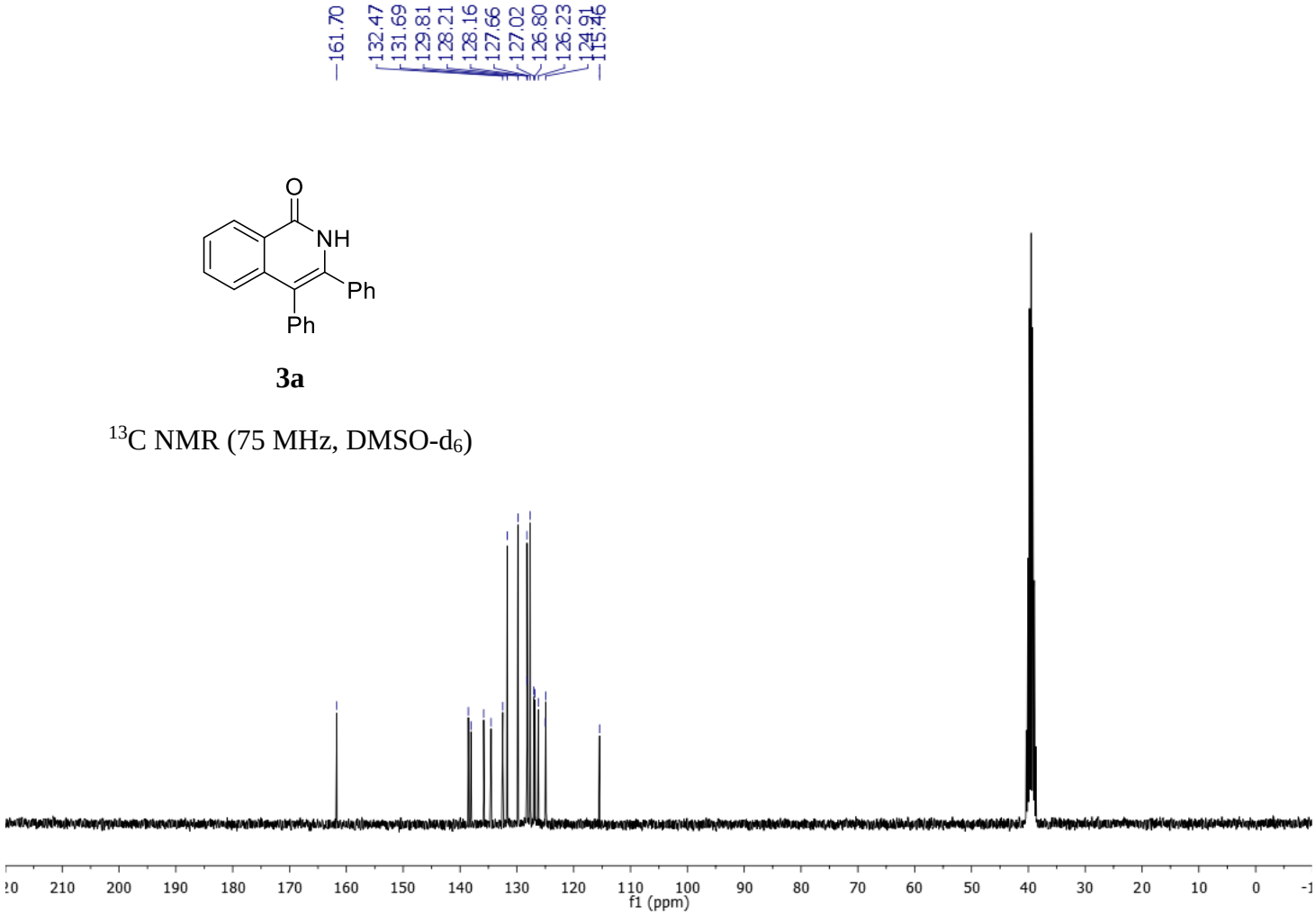


3a

^{1}H NMR (400 MHz, DMSO-d_6)



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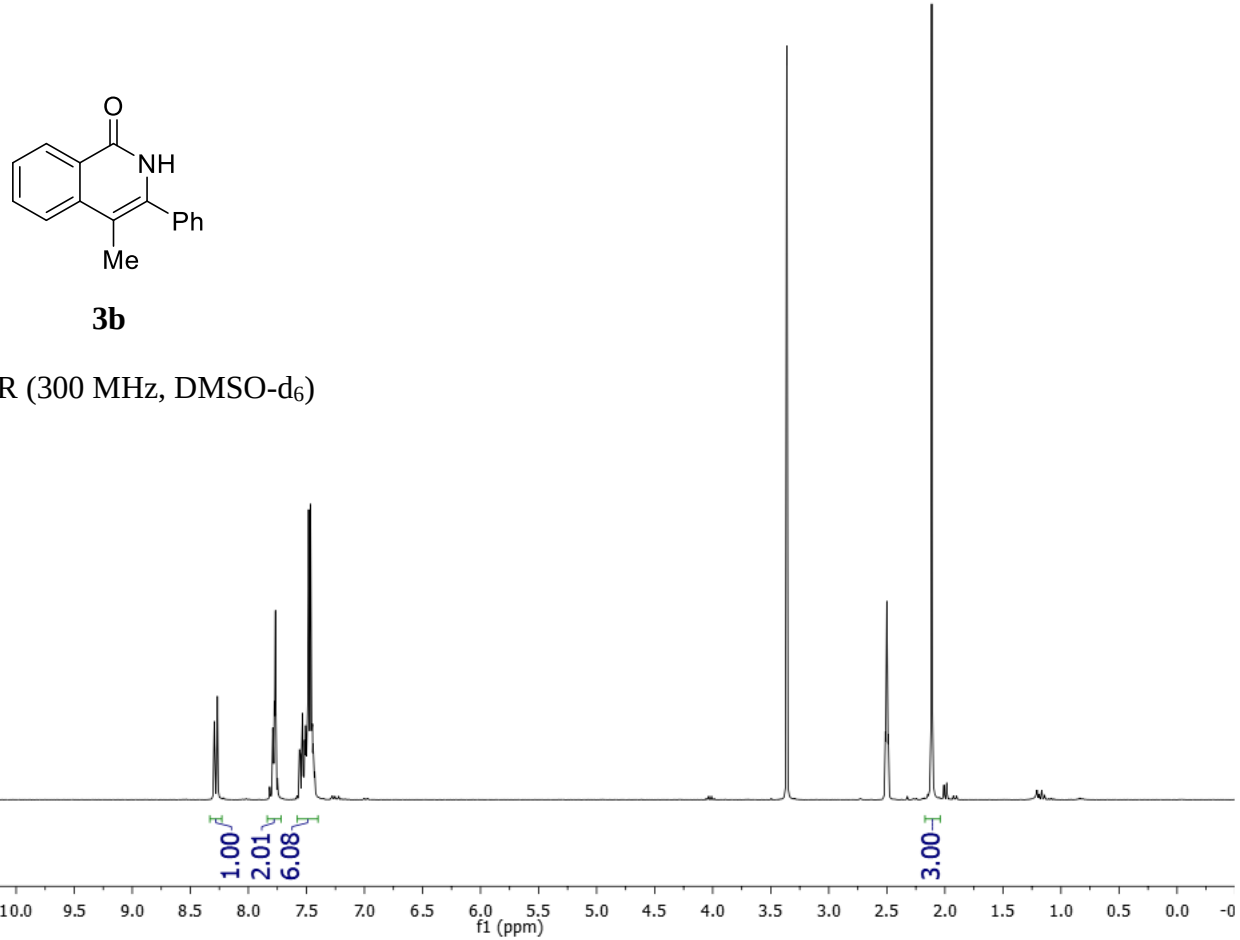

3b

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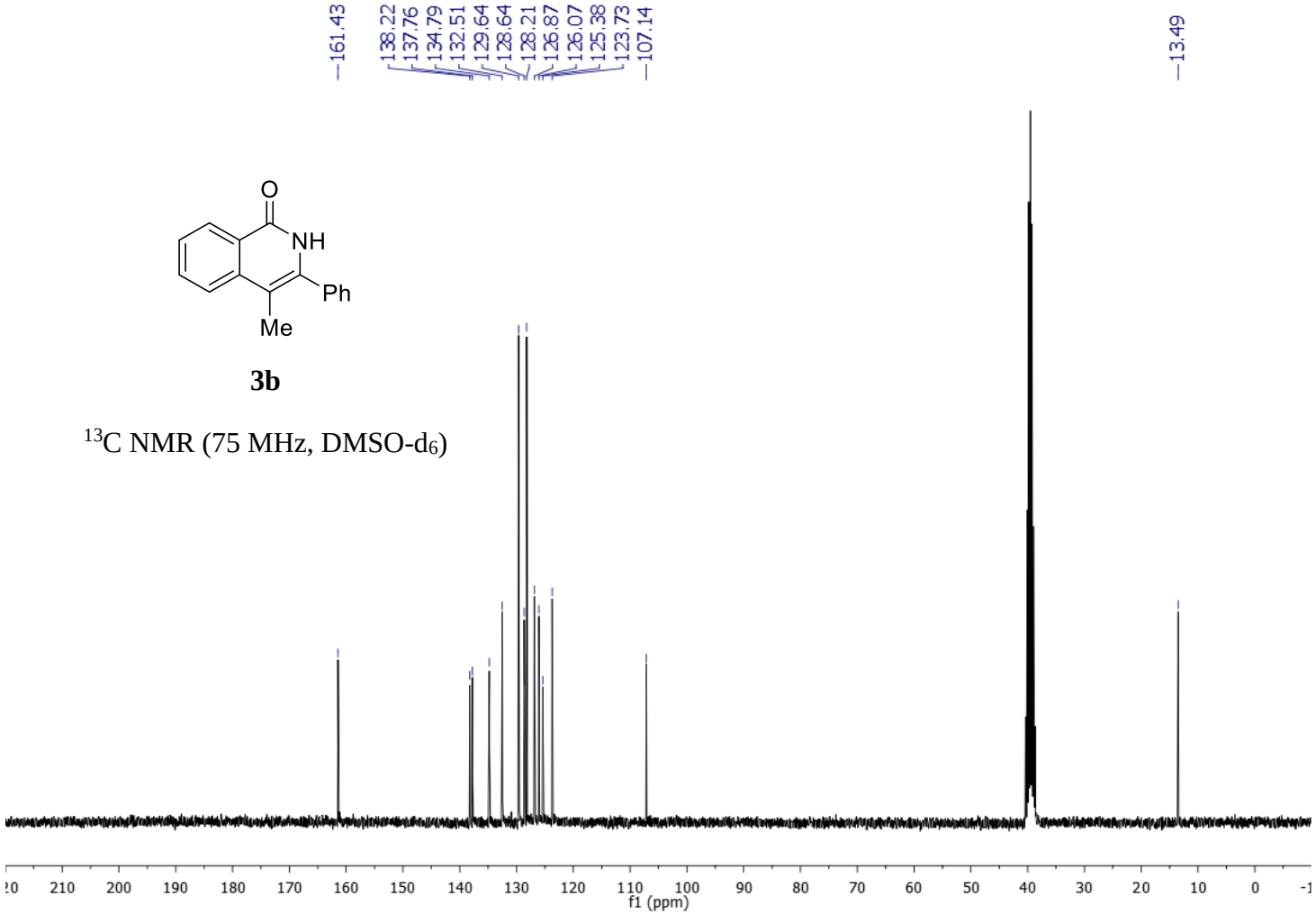

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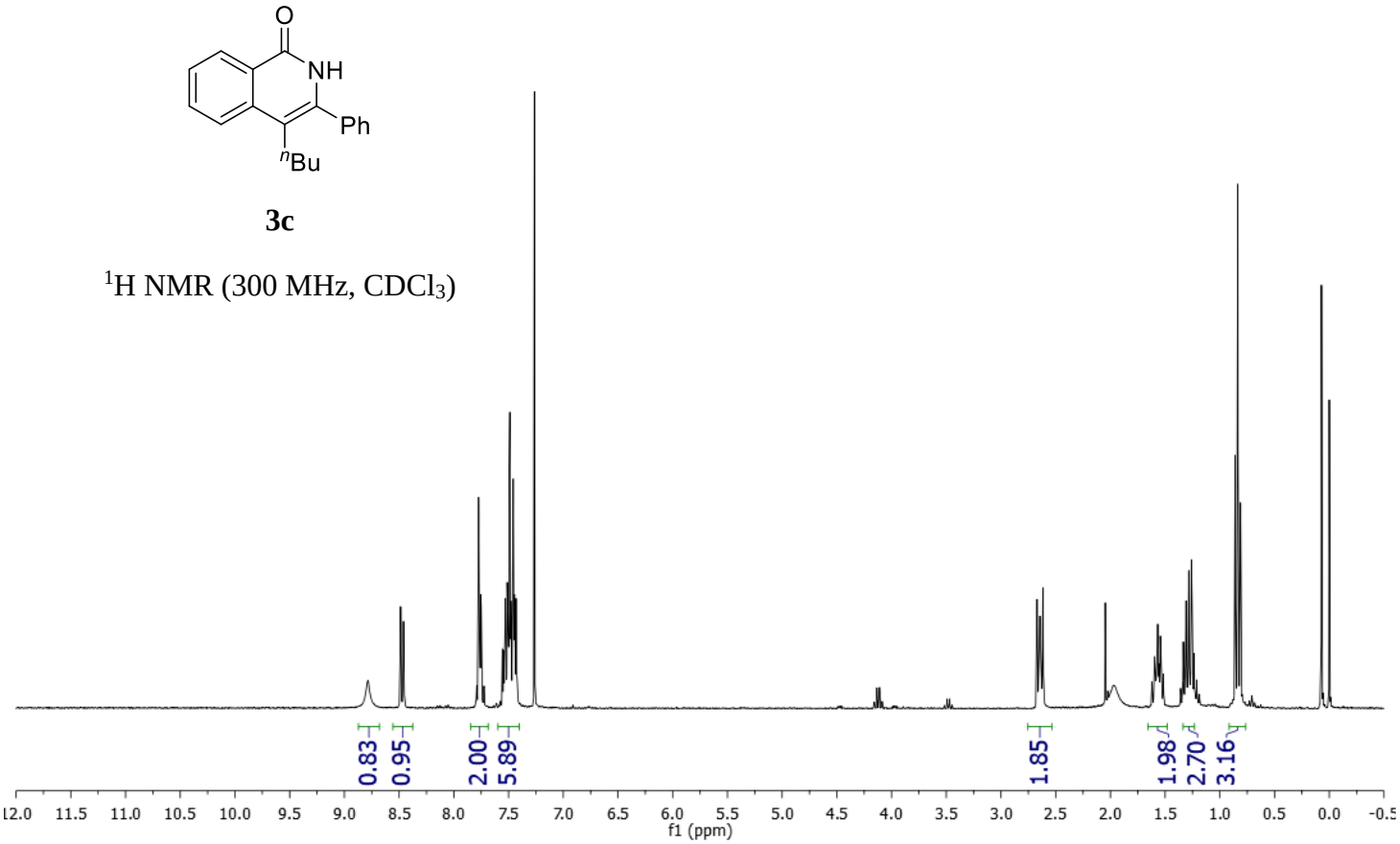

3c

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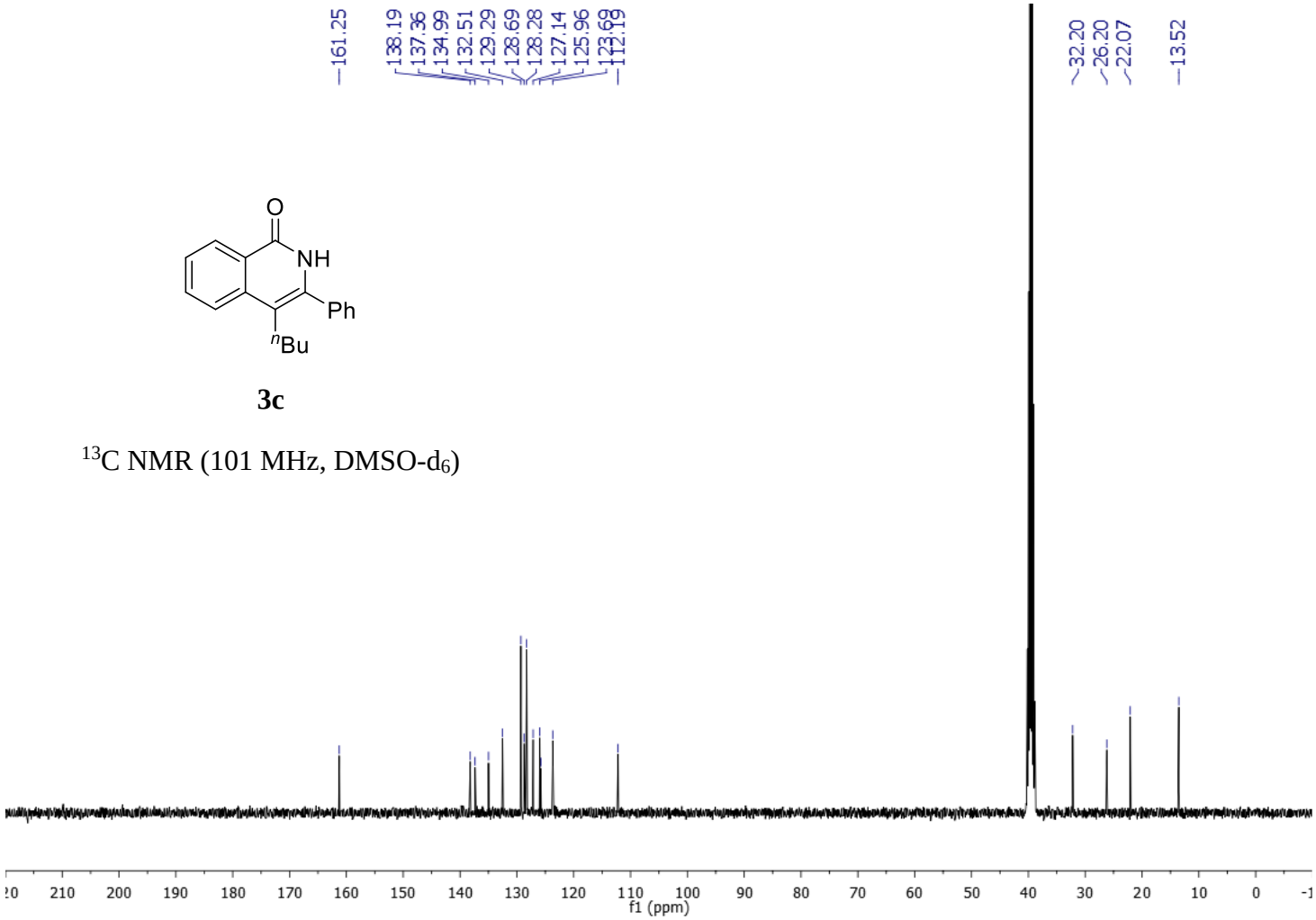

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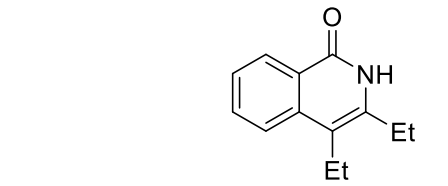

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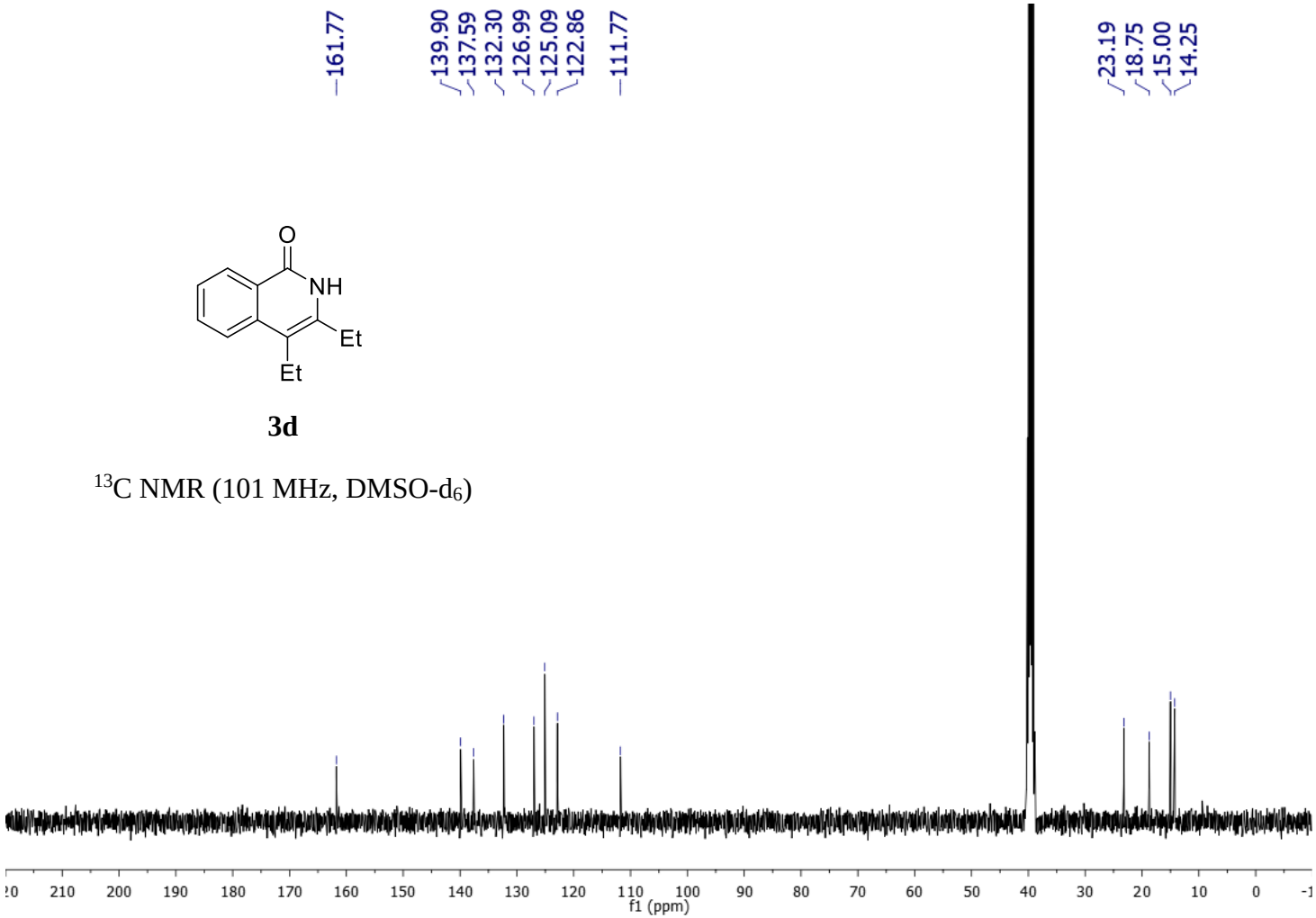

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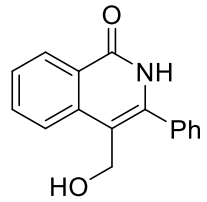

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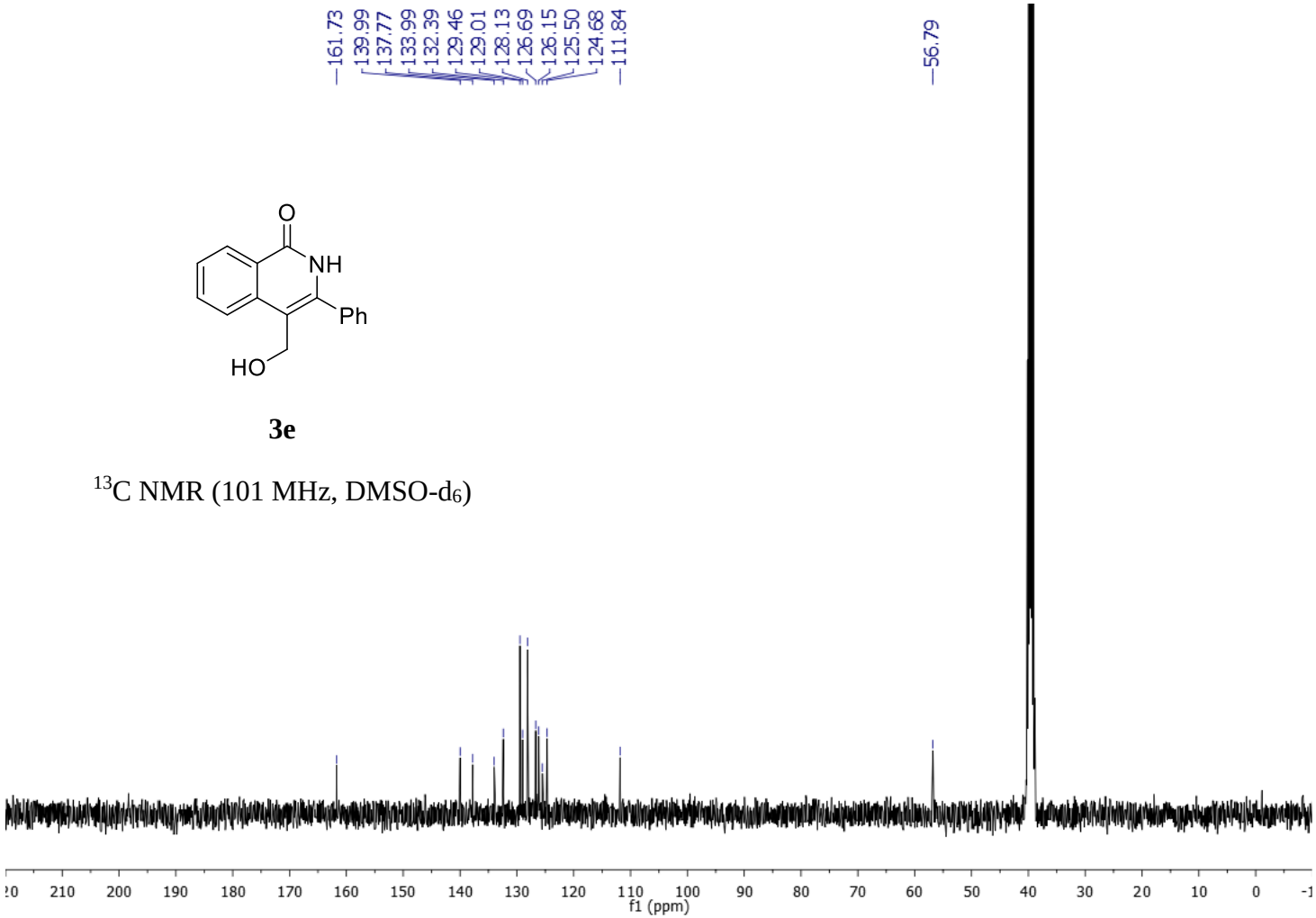

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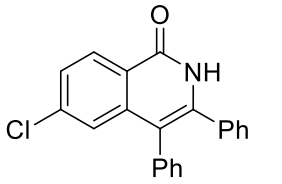

3f

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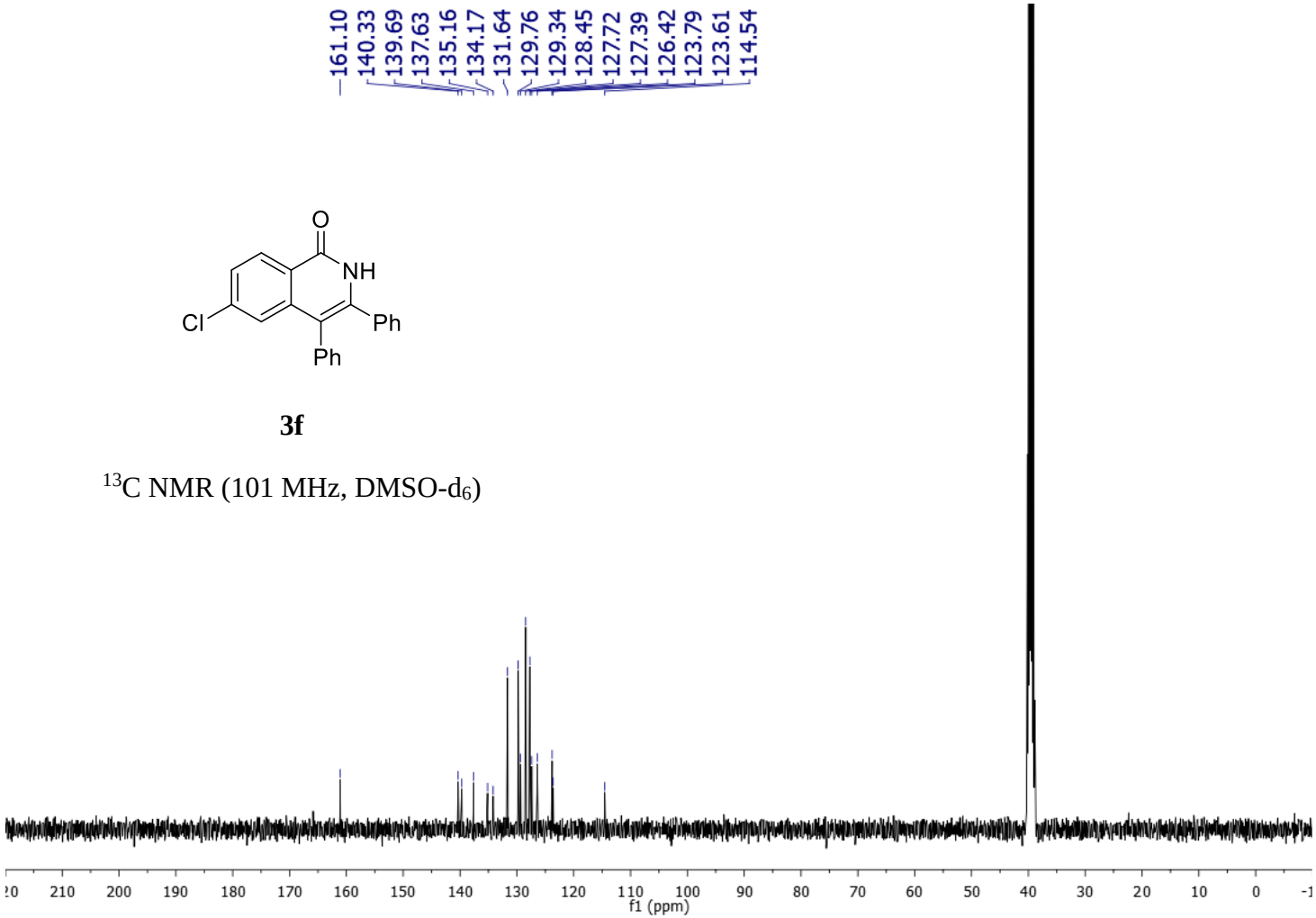

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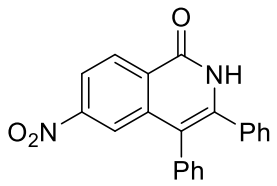

3g

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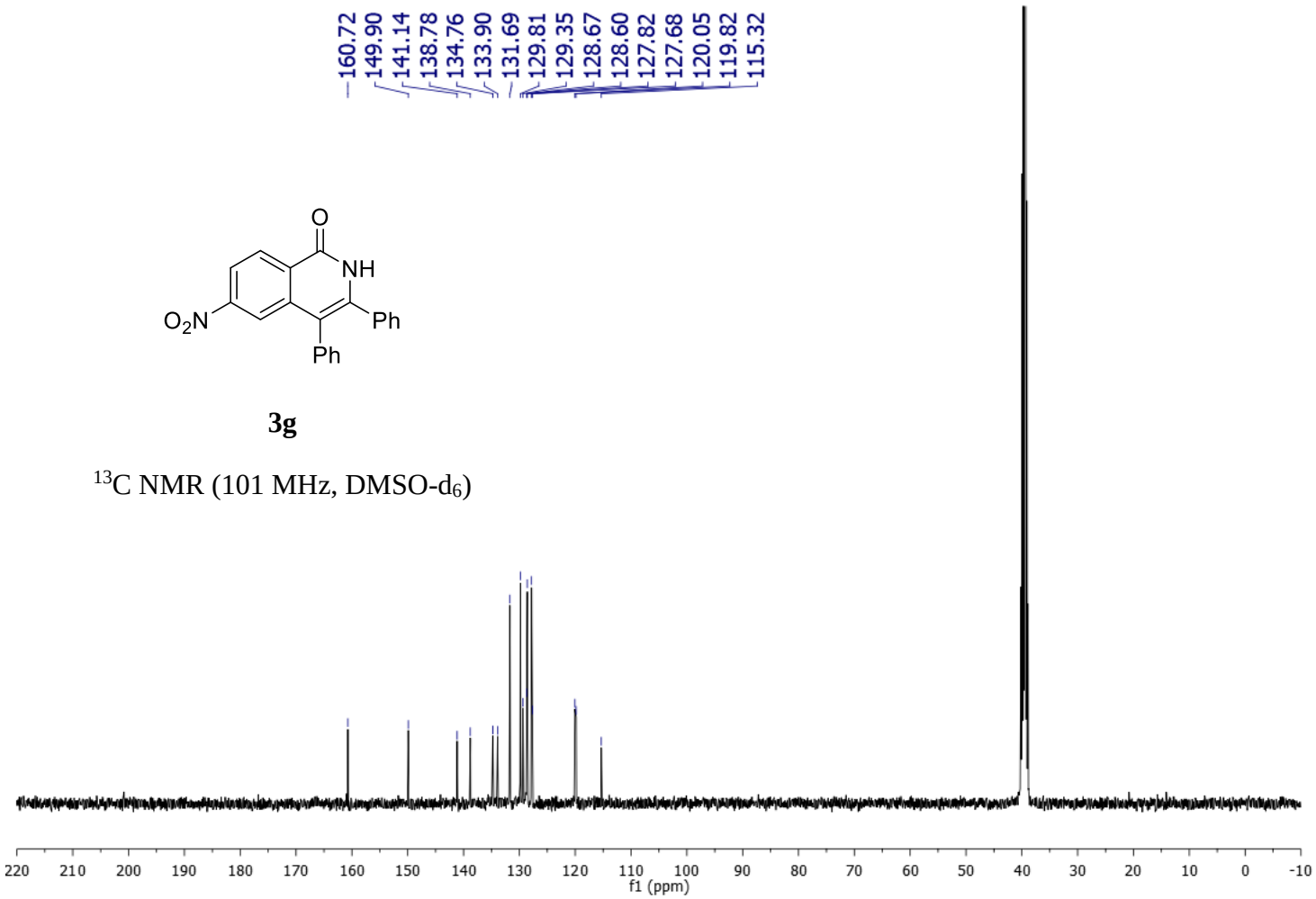

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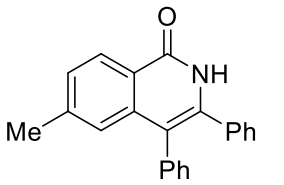

3h

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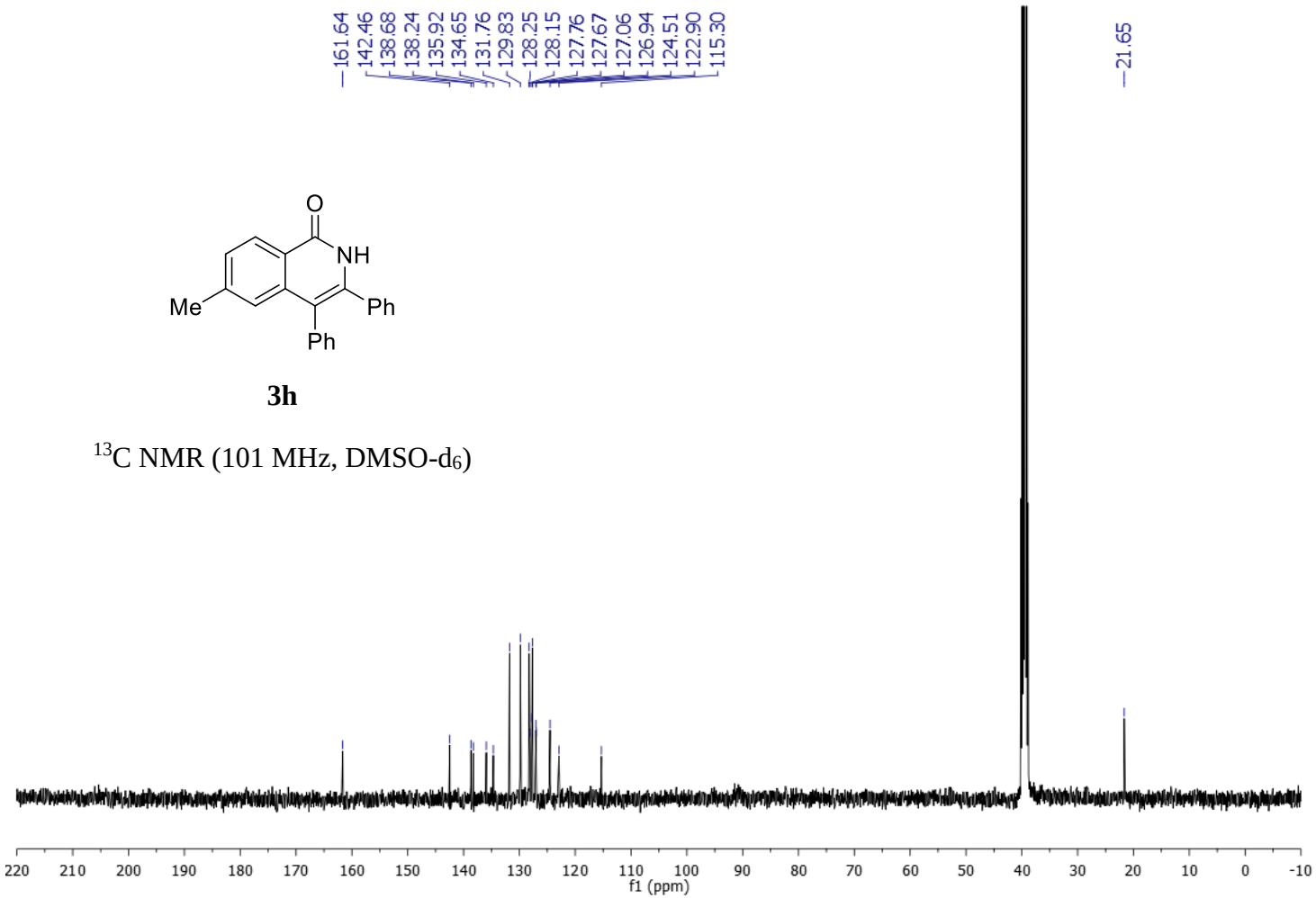

3h

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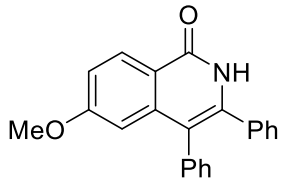

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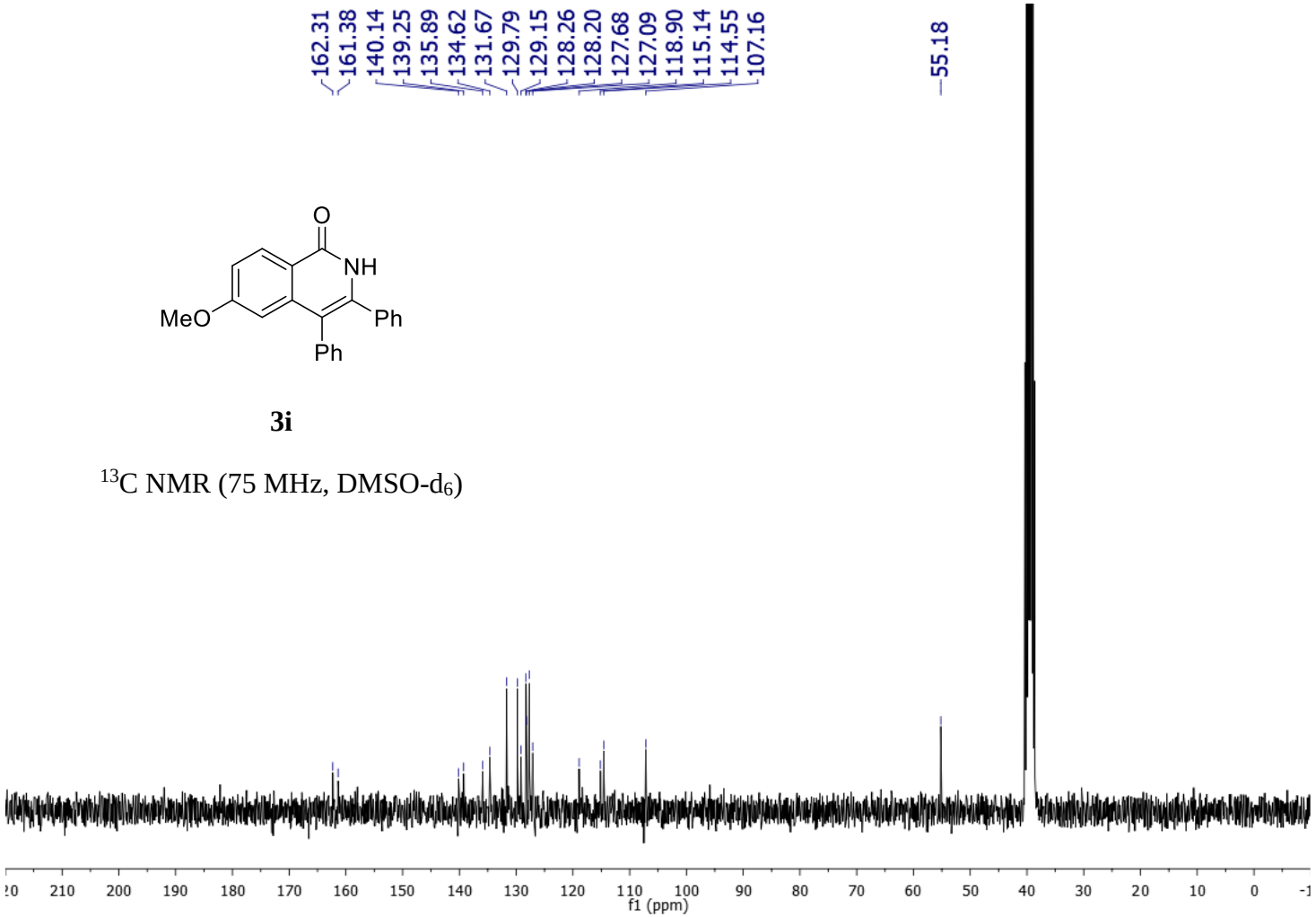

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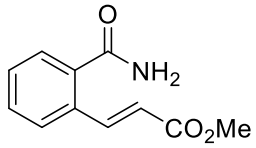
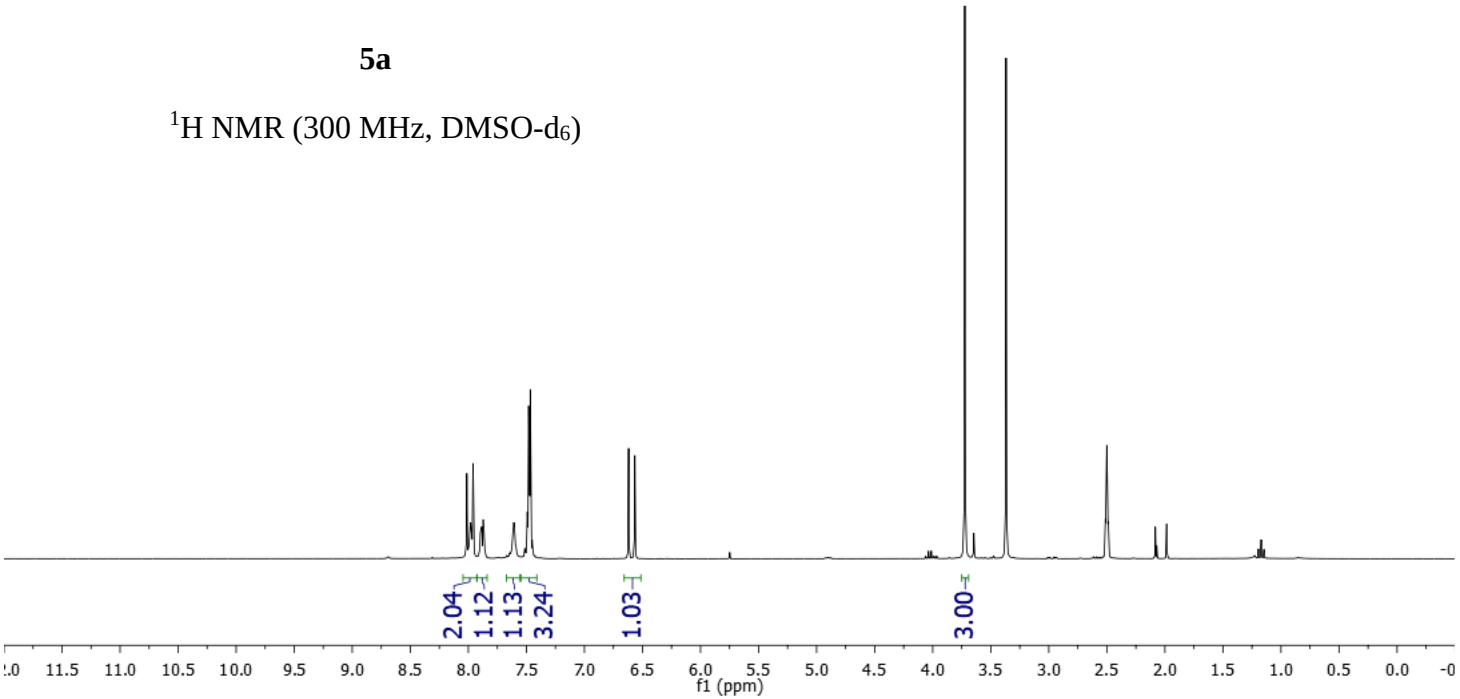
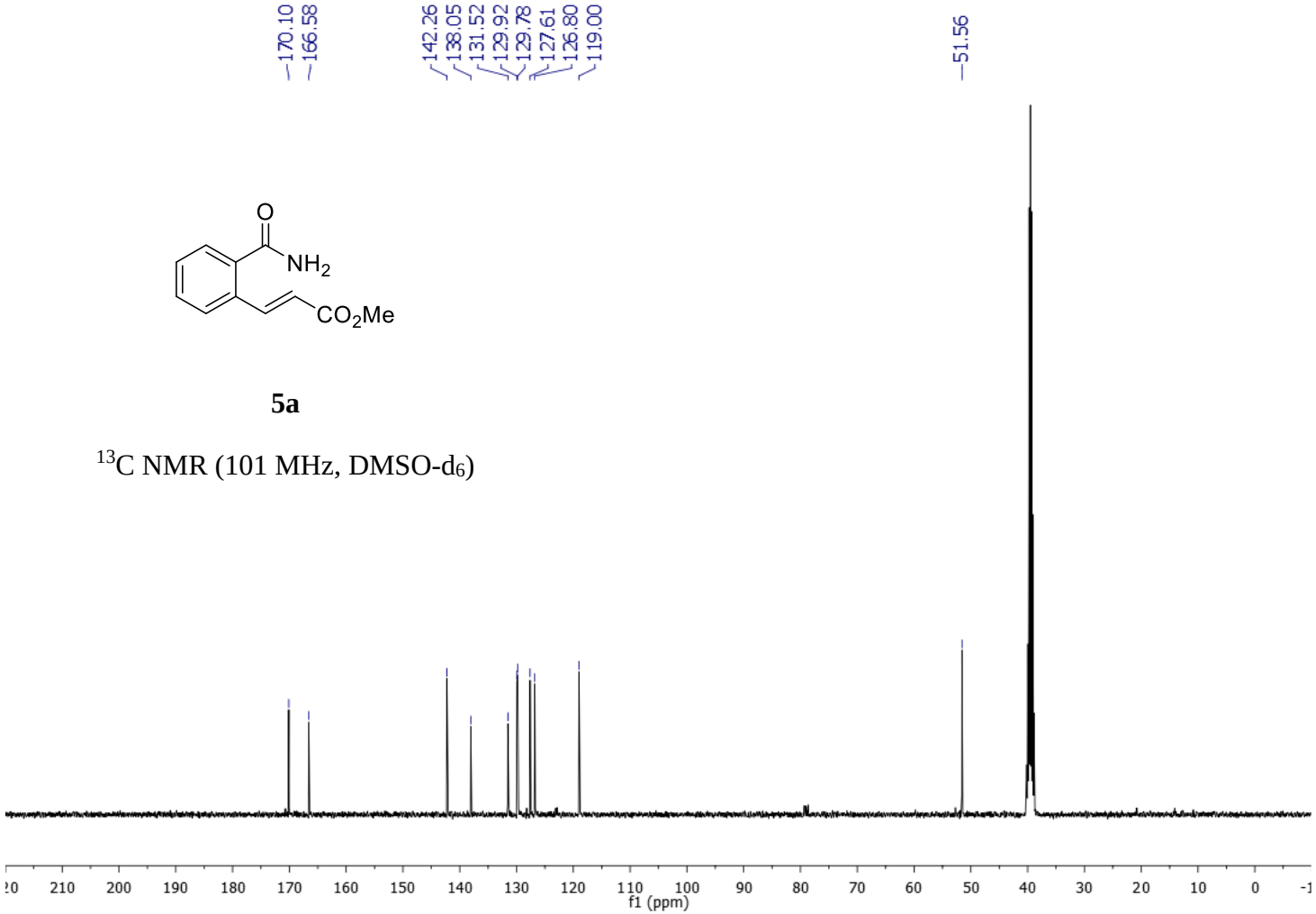


5a

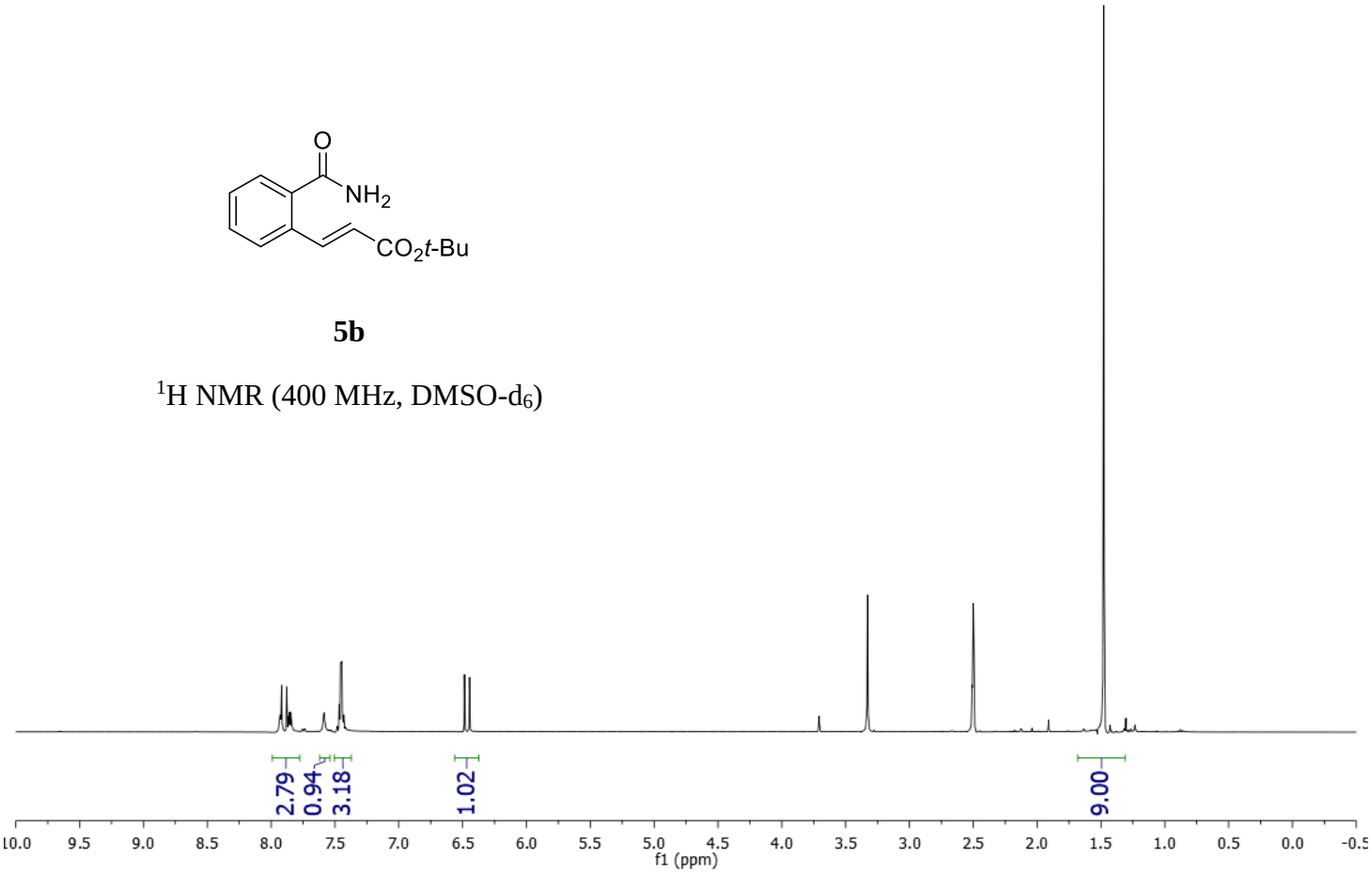
^{1}H NMR (300 MHz, DMSO-d_6)





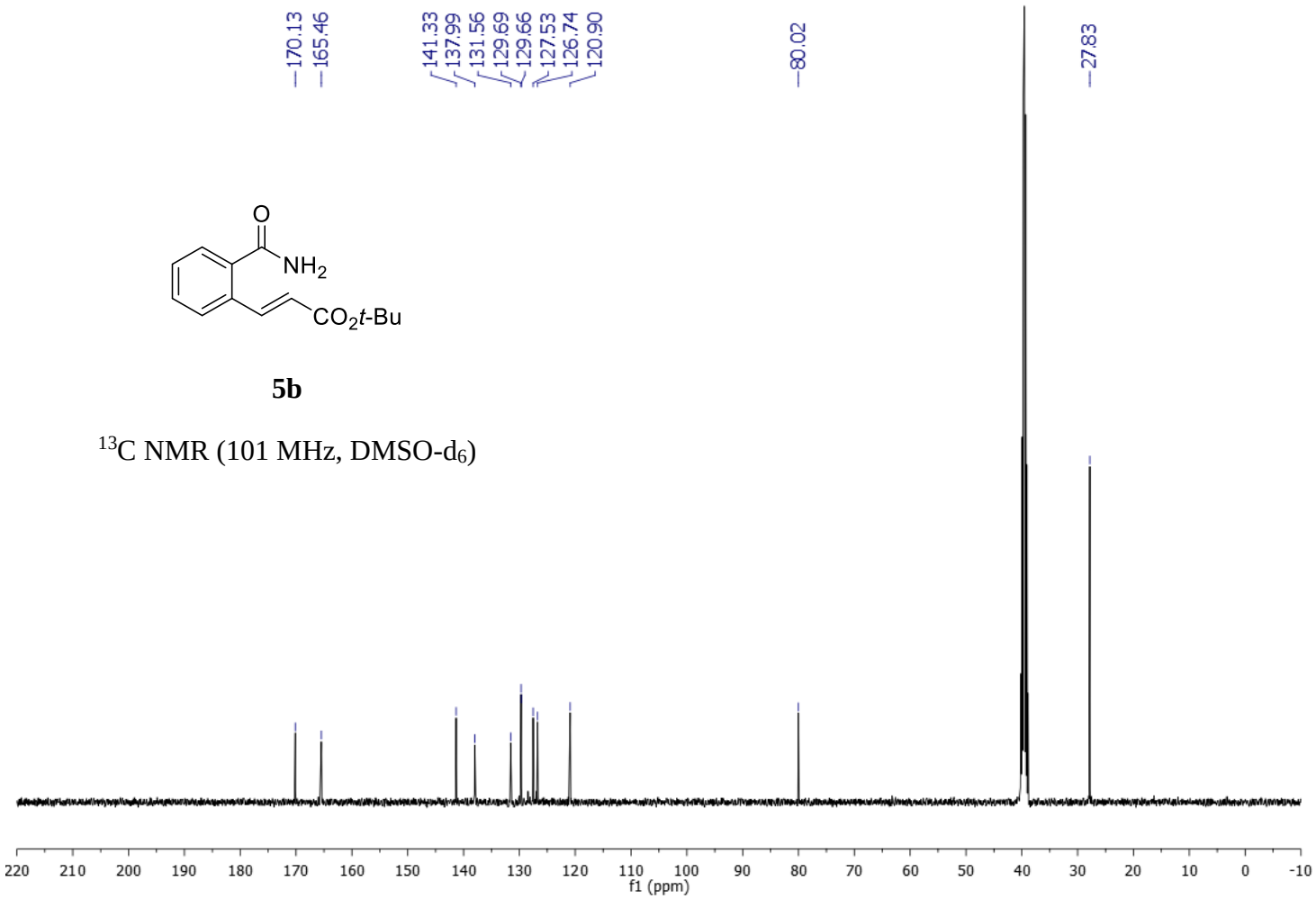
5a

^{13}C NMR (101 MHz, DMSO-d_6)



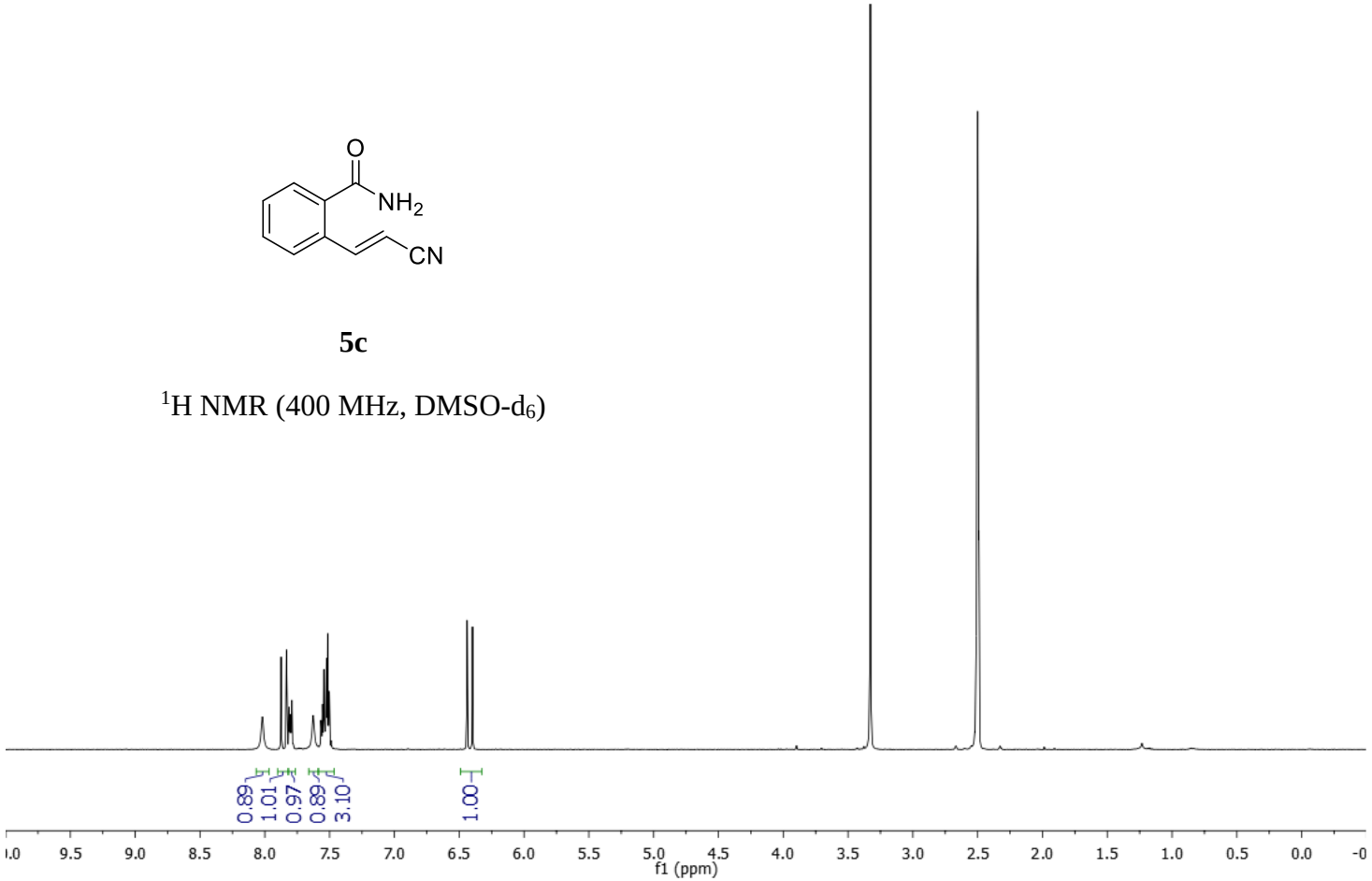
5b

^{1}H NMR (400 MHz, DMSO-d_6)



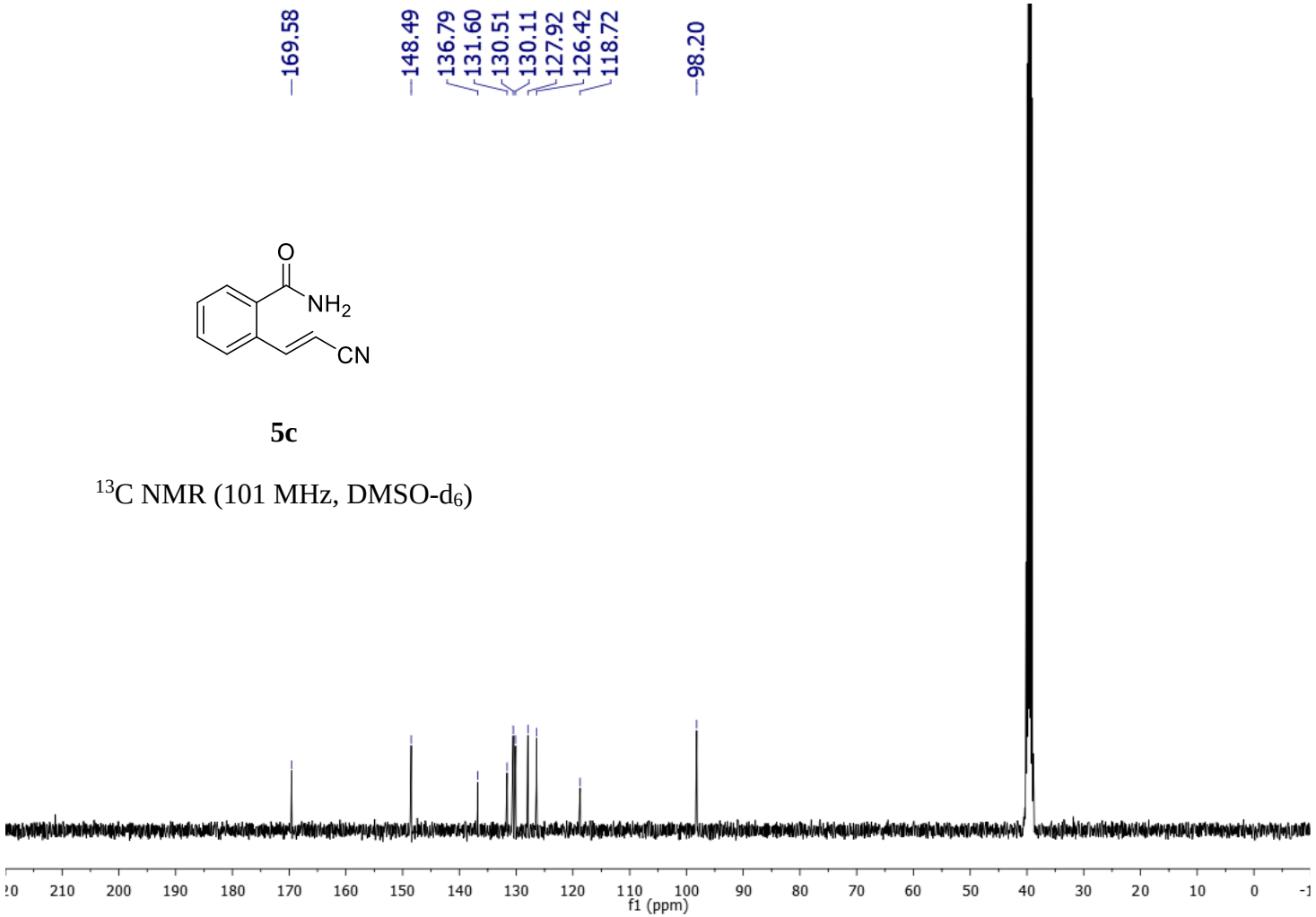
5b

^{13}C NMR (101 MHz, DMSO-d_6)



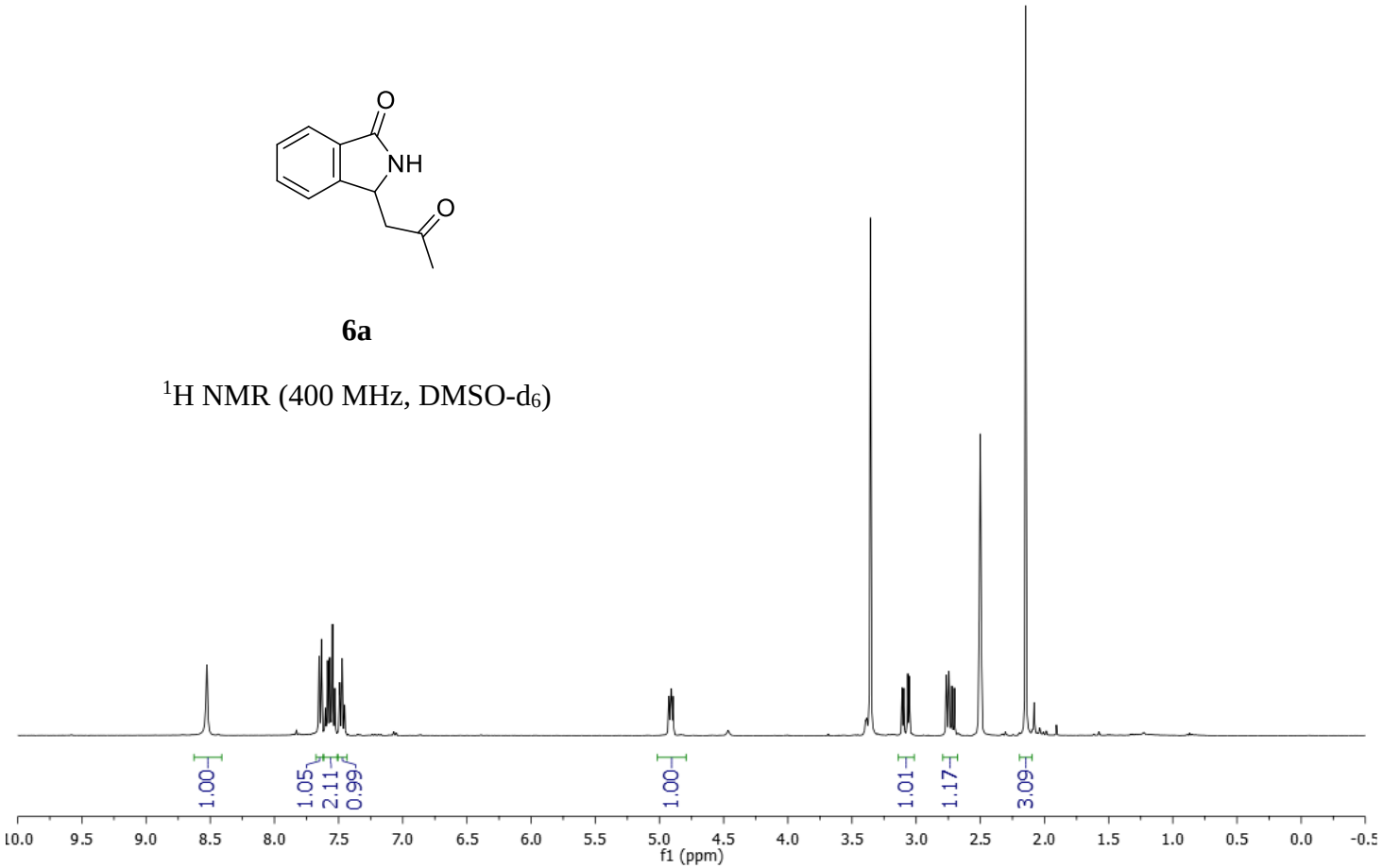
5c

^{1}H NMR (400 MHz, DMSO-d_6)



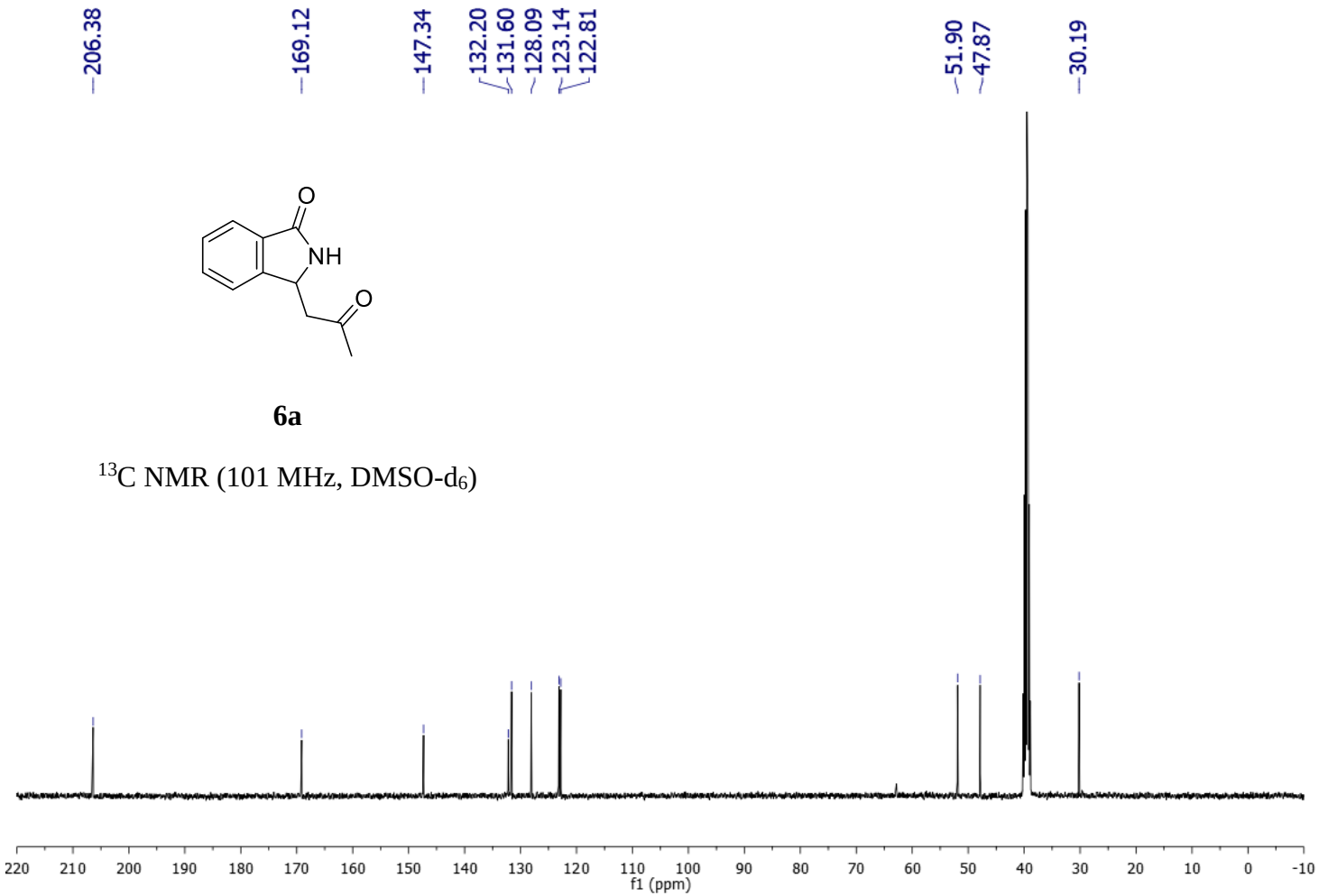
5c

^{13}C NMR (101 MHz, DMSO-d_6)



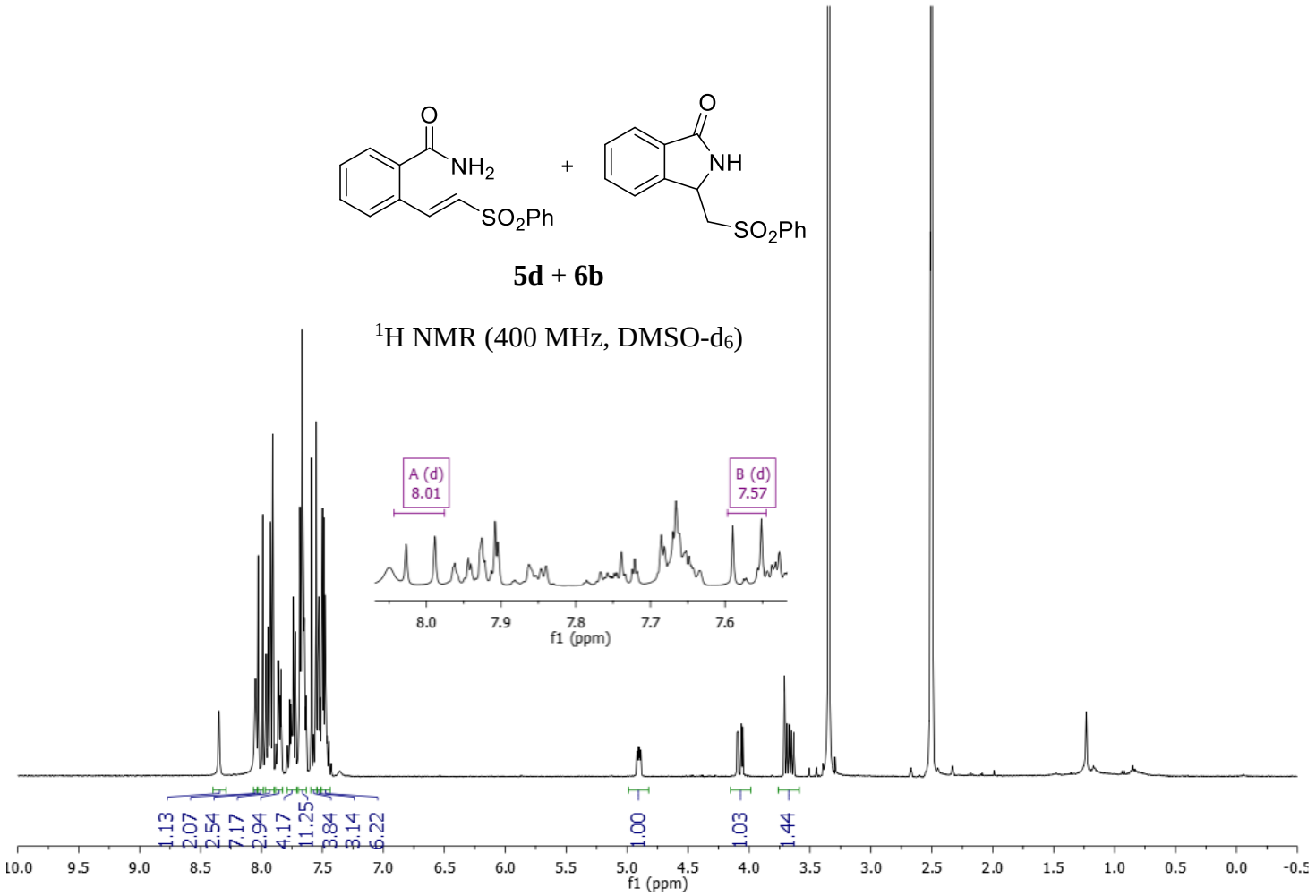
6a

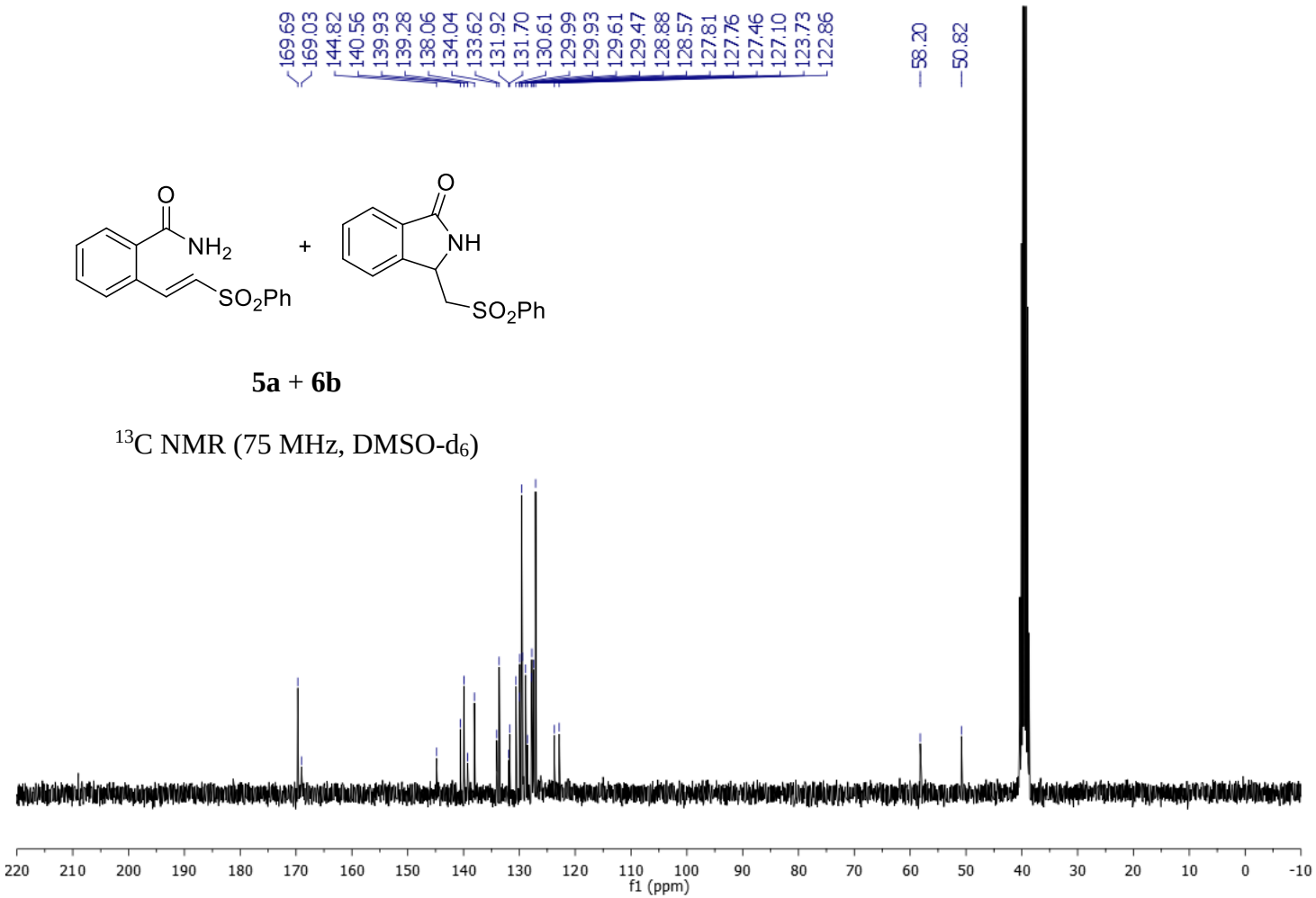
^{1}H NMR (400 MHz, DMSO-d_6)



6a

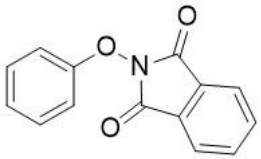
^{13}C NMR (101 MHz, DMSO-d_6)


O
NH2
SO2Ph
+
O
NH
SO2Ph
5d + 6b
1H NMR (400 MHz, DMSO-d6)
A (d)
8.01
B (d)
7.57
8.0
7.9
7.8
7.7
7.6
f1 (ppm)
1.13
2.07
2.54
7.17
2.94
4.17
11.25
3.84
3.14
6.22
1.00
1.03
1.44
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

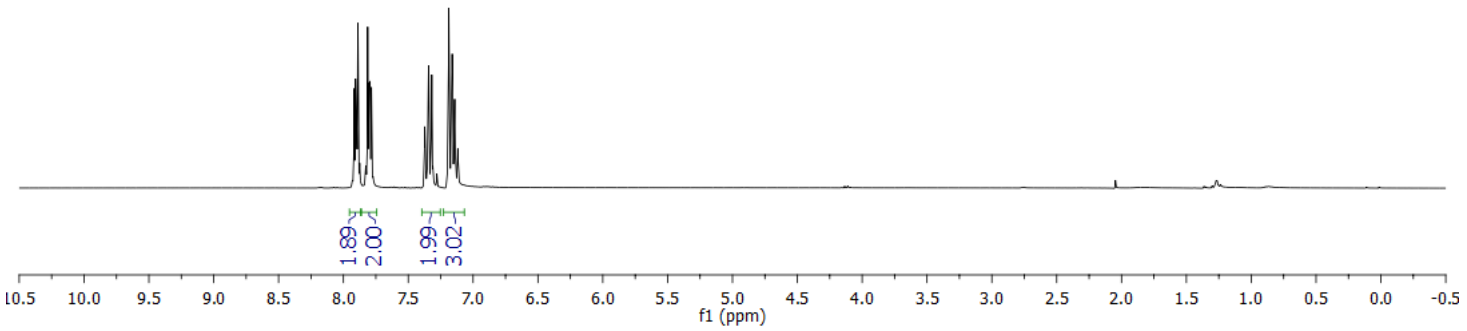


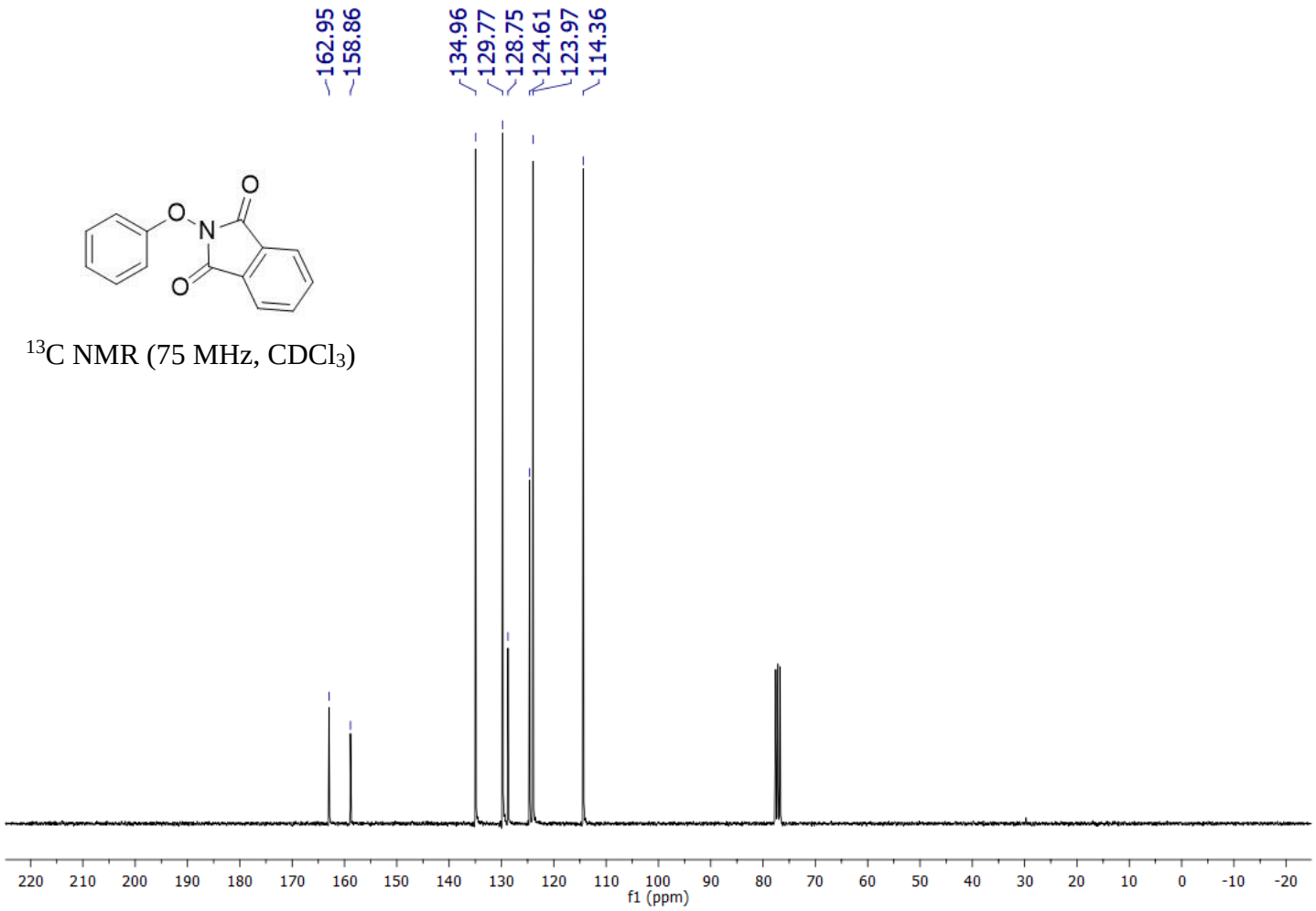
5a + **6b**

^{13}C NMR (75 MHz, DMSO-d_6)

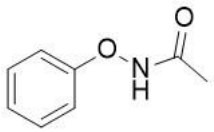


^{1}H NMR (300 MHz, $CDCl_3$)

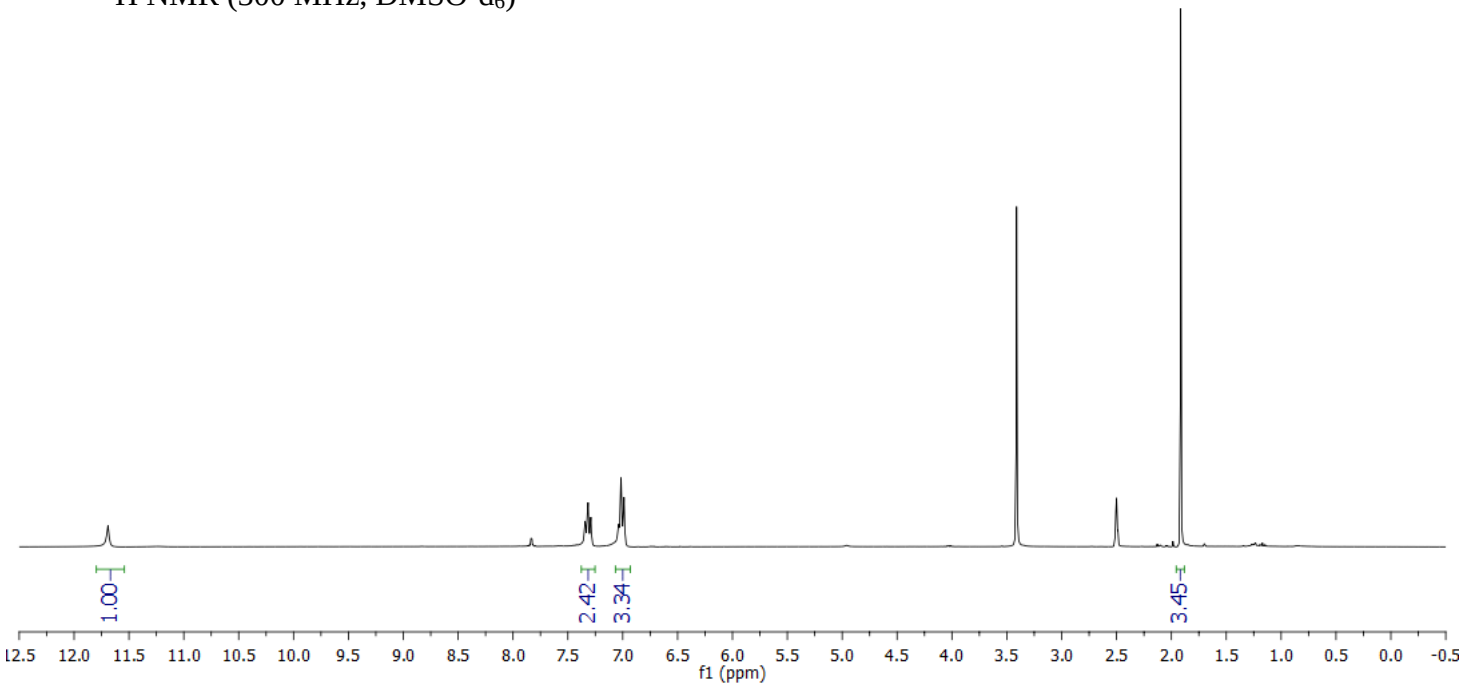


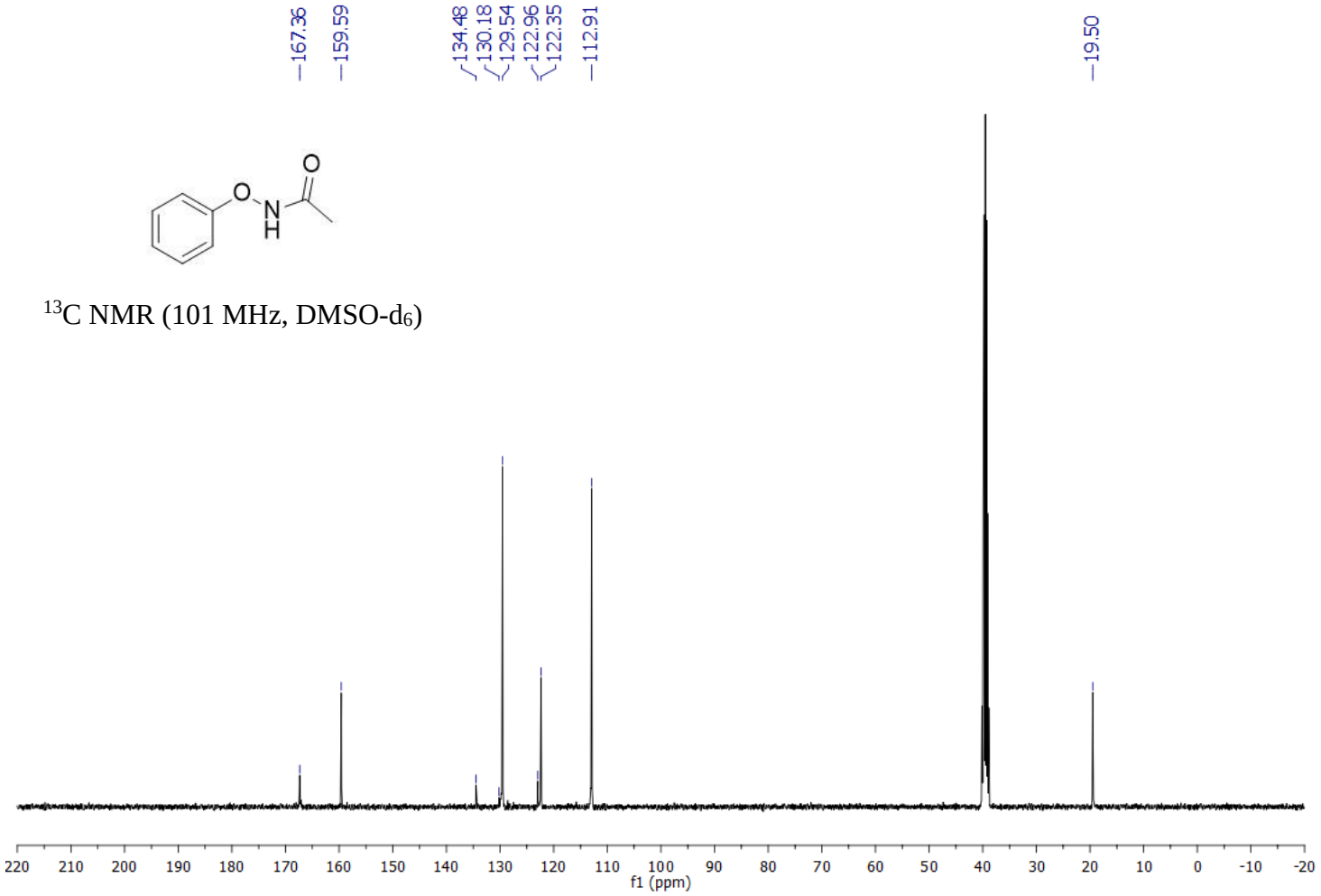


^{13}C NMR (75 MHz, $CDCl_3$)

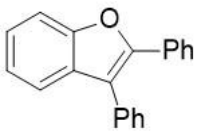


^{1}H NMR (300 MHz, DMSO-d_6)



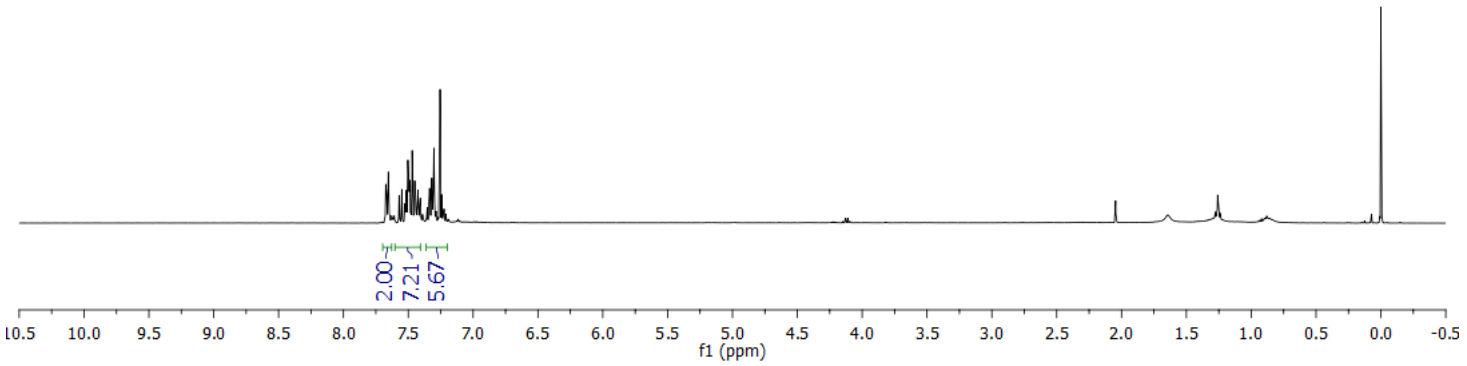


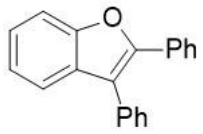
^{13}C NMR (101 MHz, DMSO-d_6)



8a

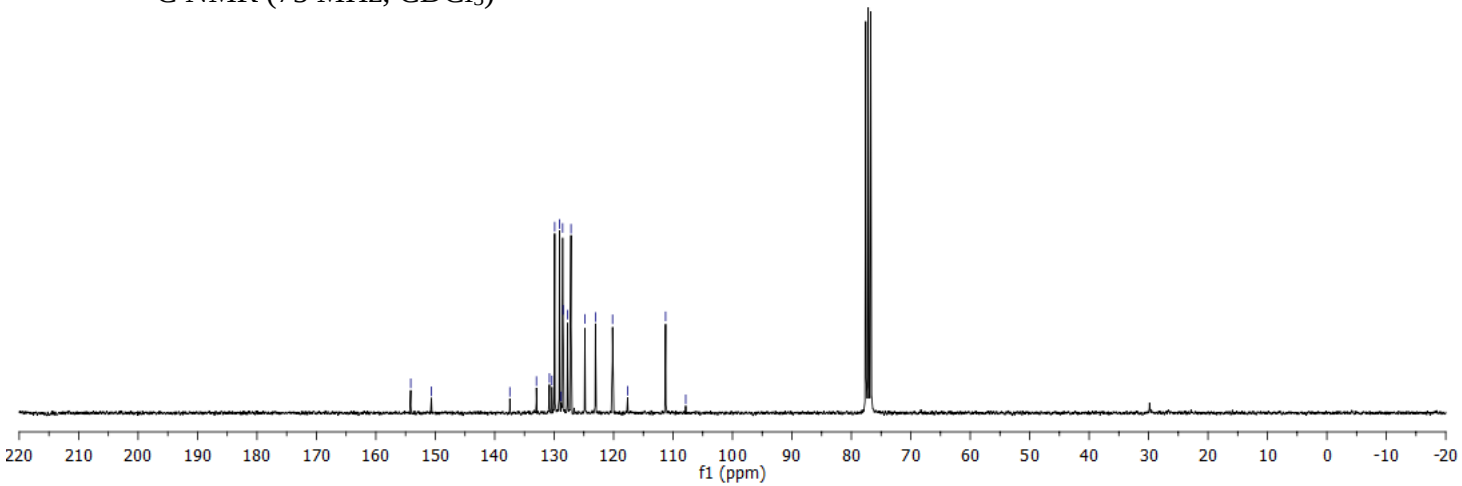
^{1}H NMR (400 MHz, $CDCl_3$)

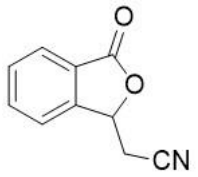




8a

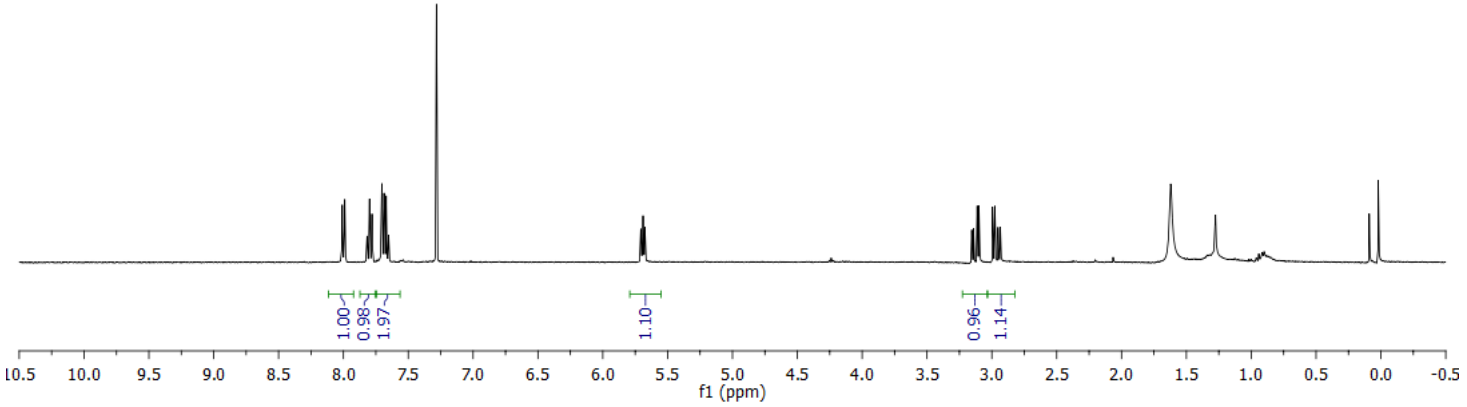
^{13}C NMR (75 MHz, $CDCl_3$)

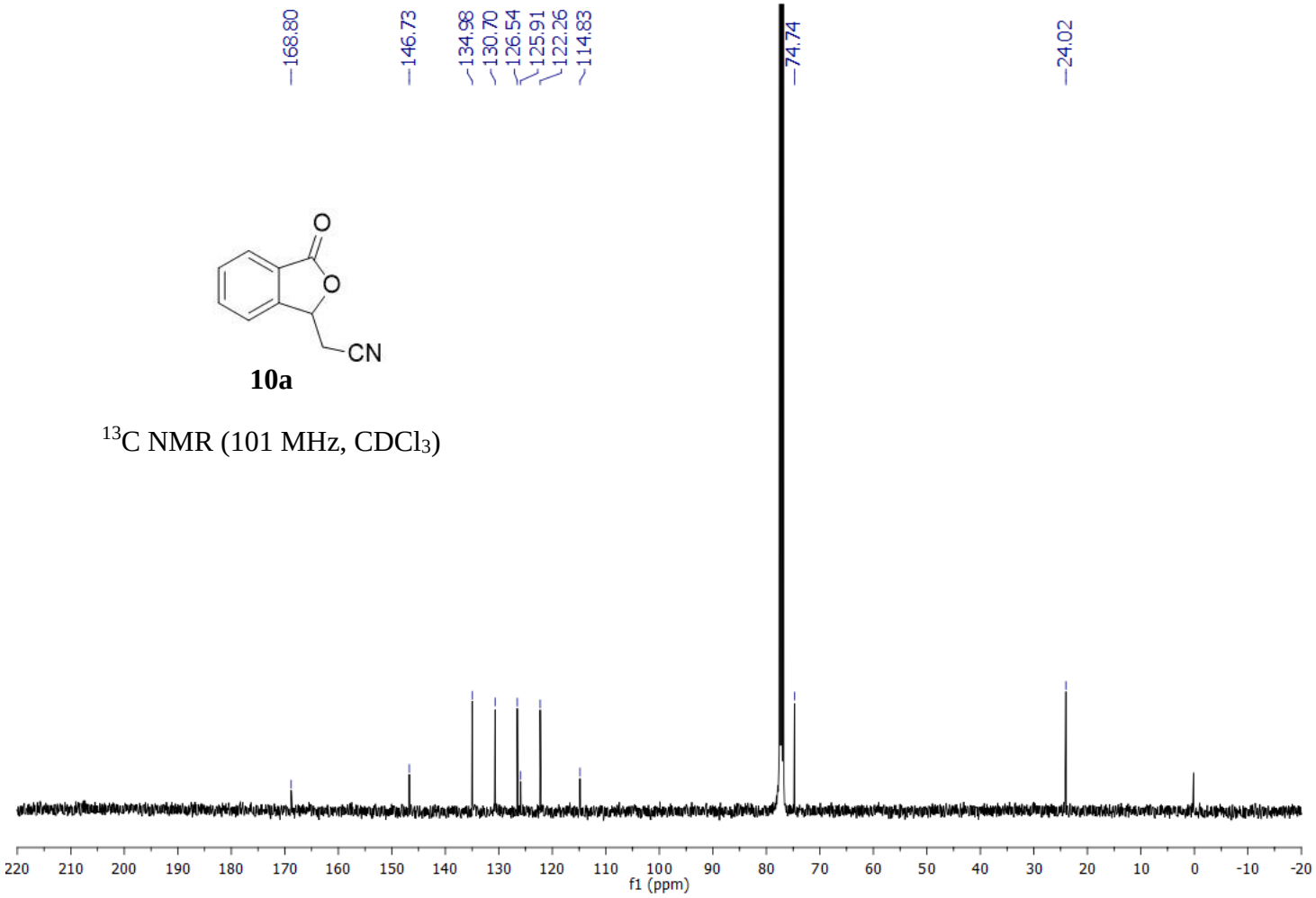




10a

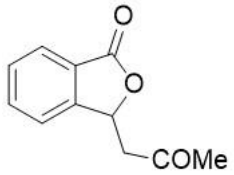
^{1}H NMR (400 MHz, $CDCl_3$)





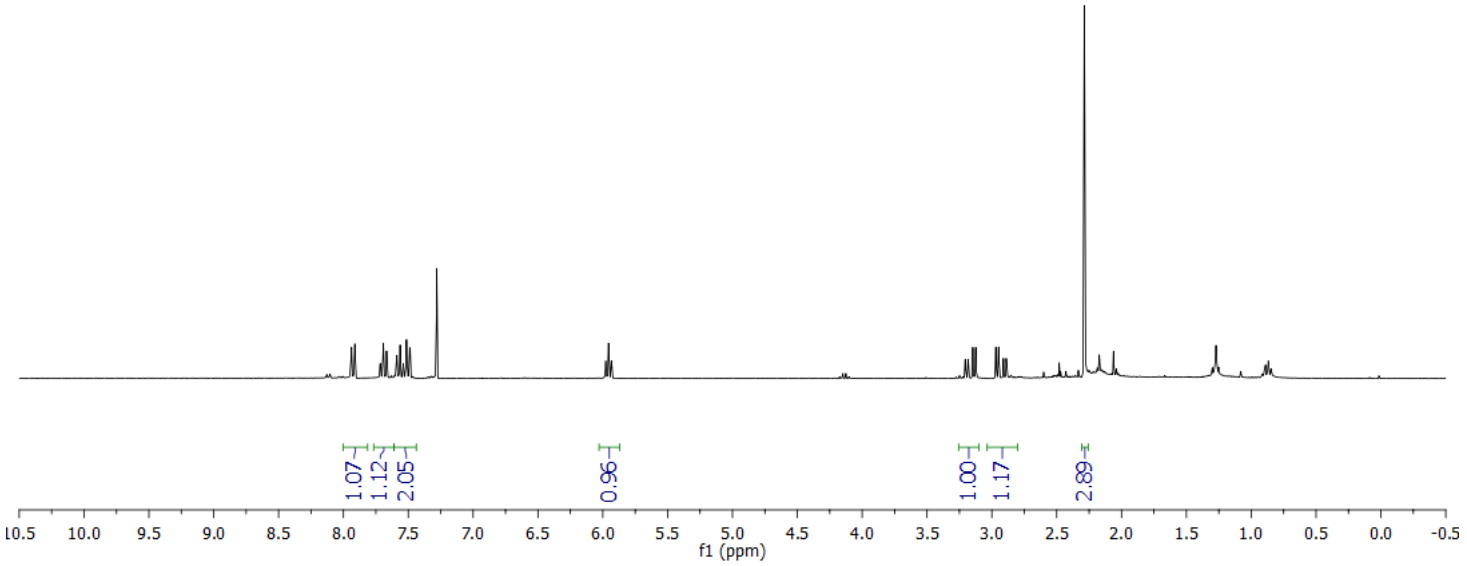
10a

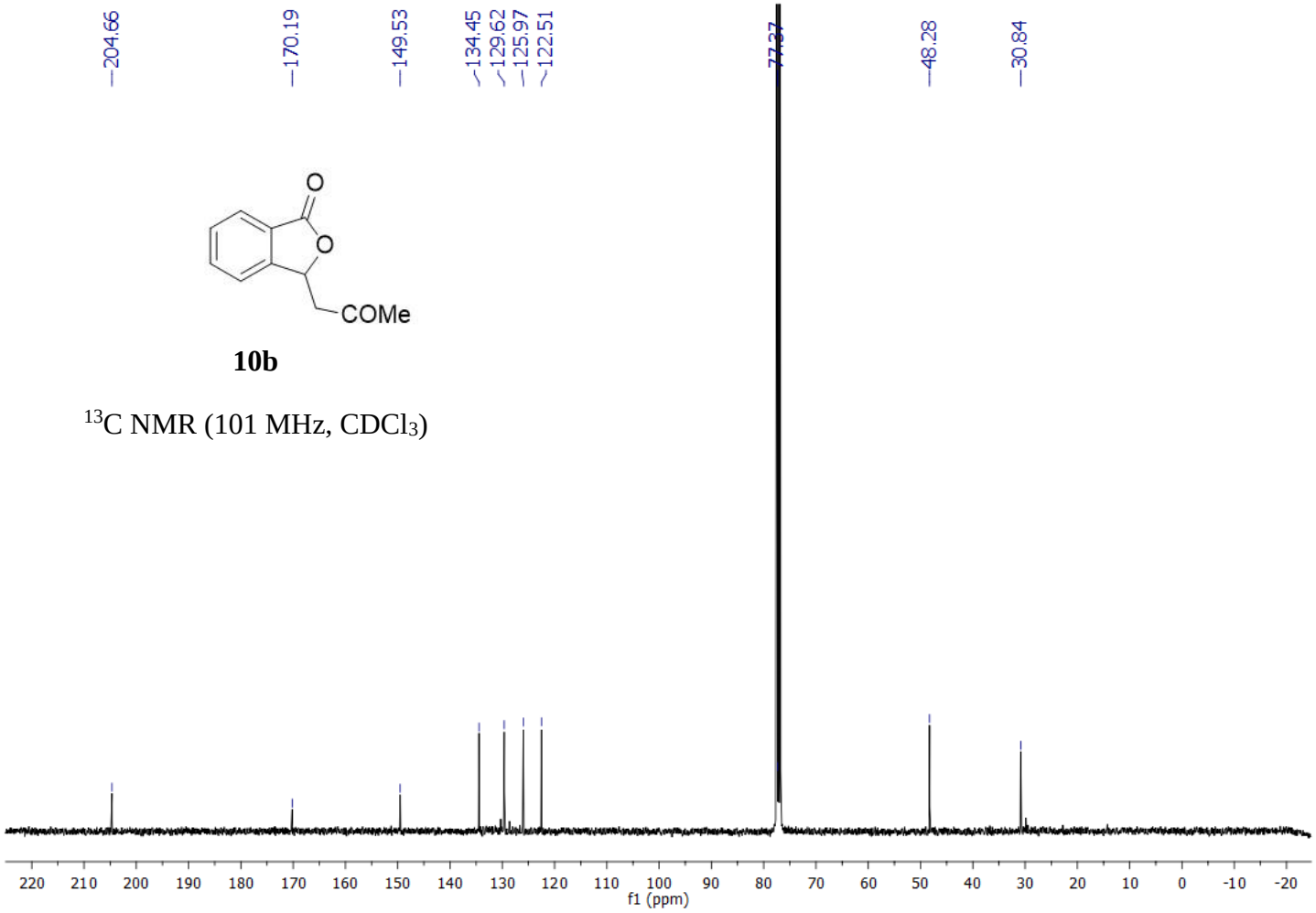
^{13}C NMR (101 MHz, $CDCl_3$)



10b

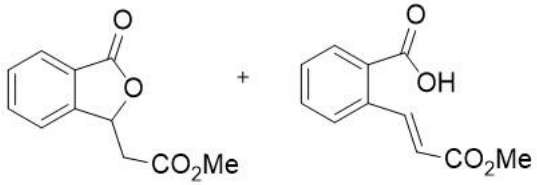
^{1}H NMR (300 MHz, $CDCl_3$)





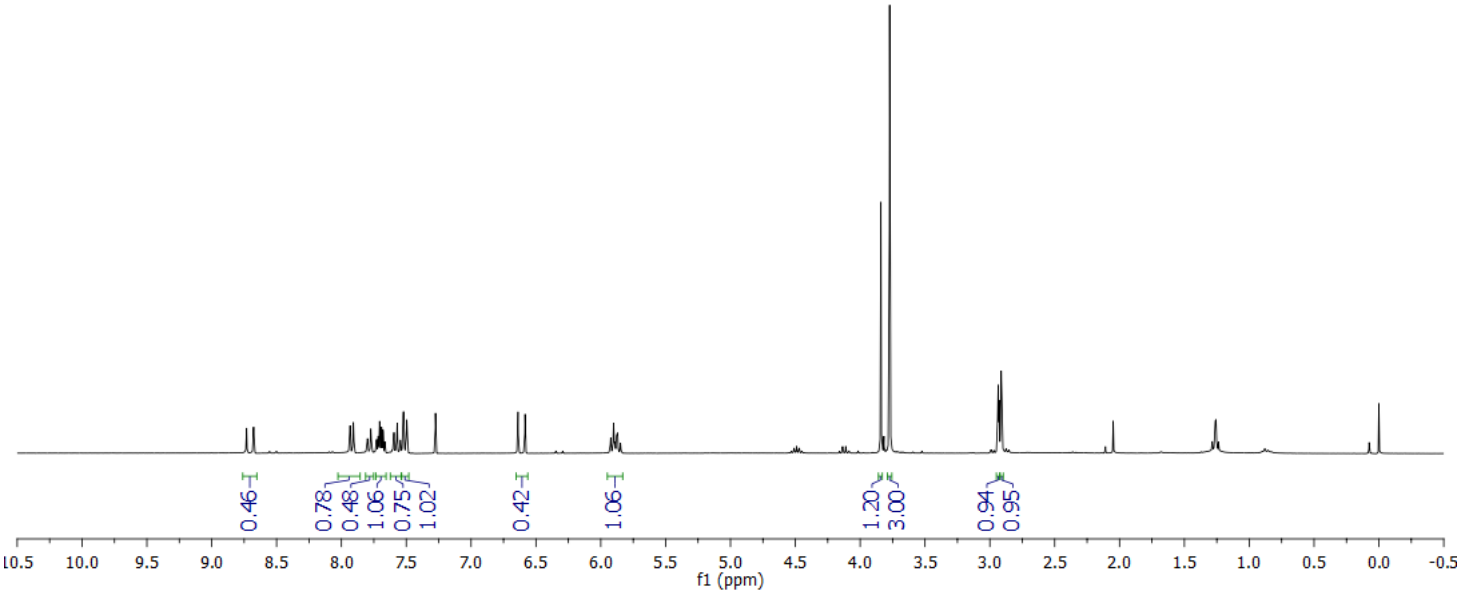
10b

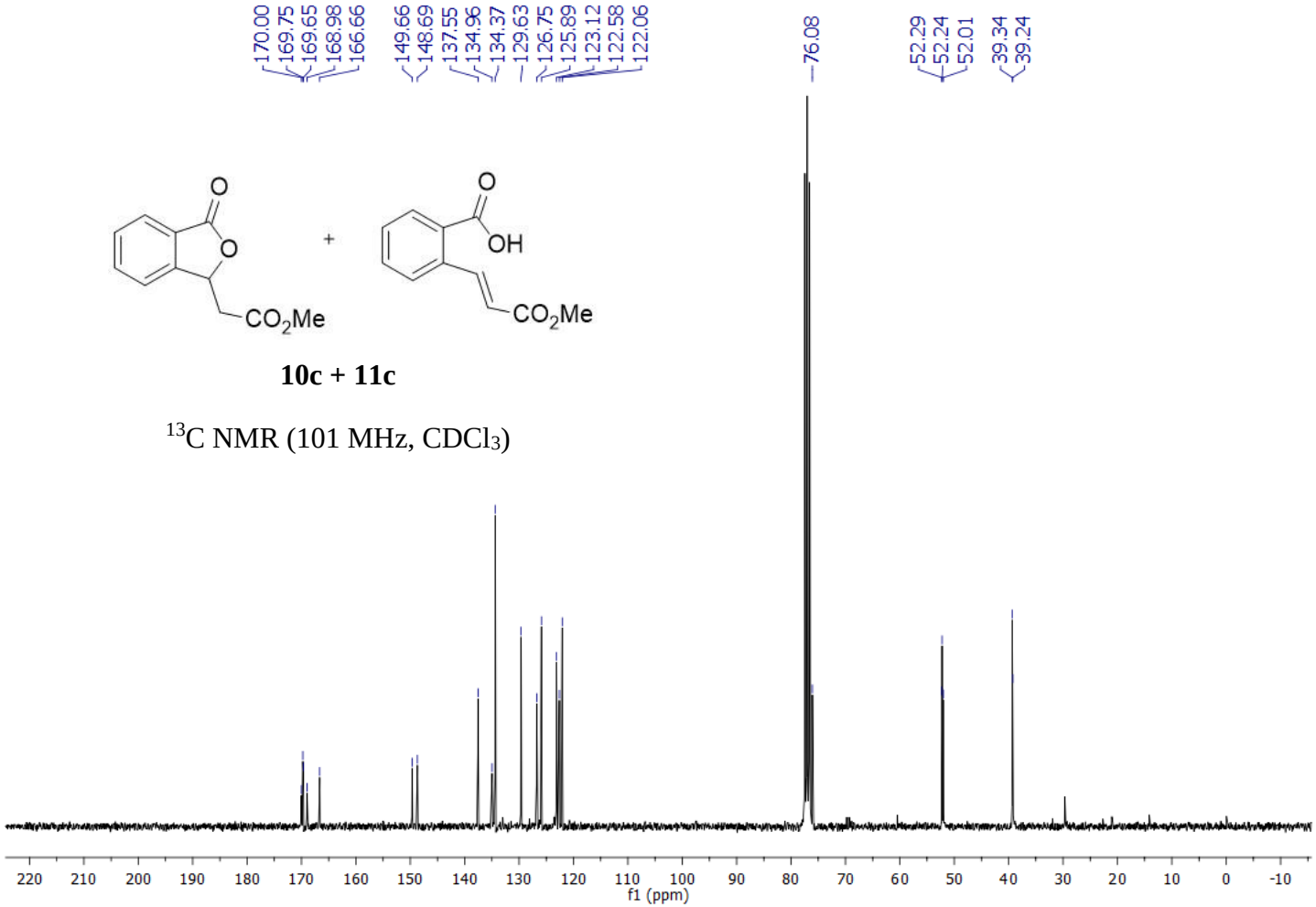
^{13}C NMR (101 MHz, $CDCl_3$)



10c + 11c

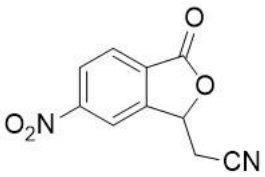
^{1}H NMR (300 MHz, $CDCl_3$)





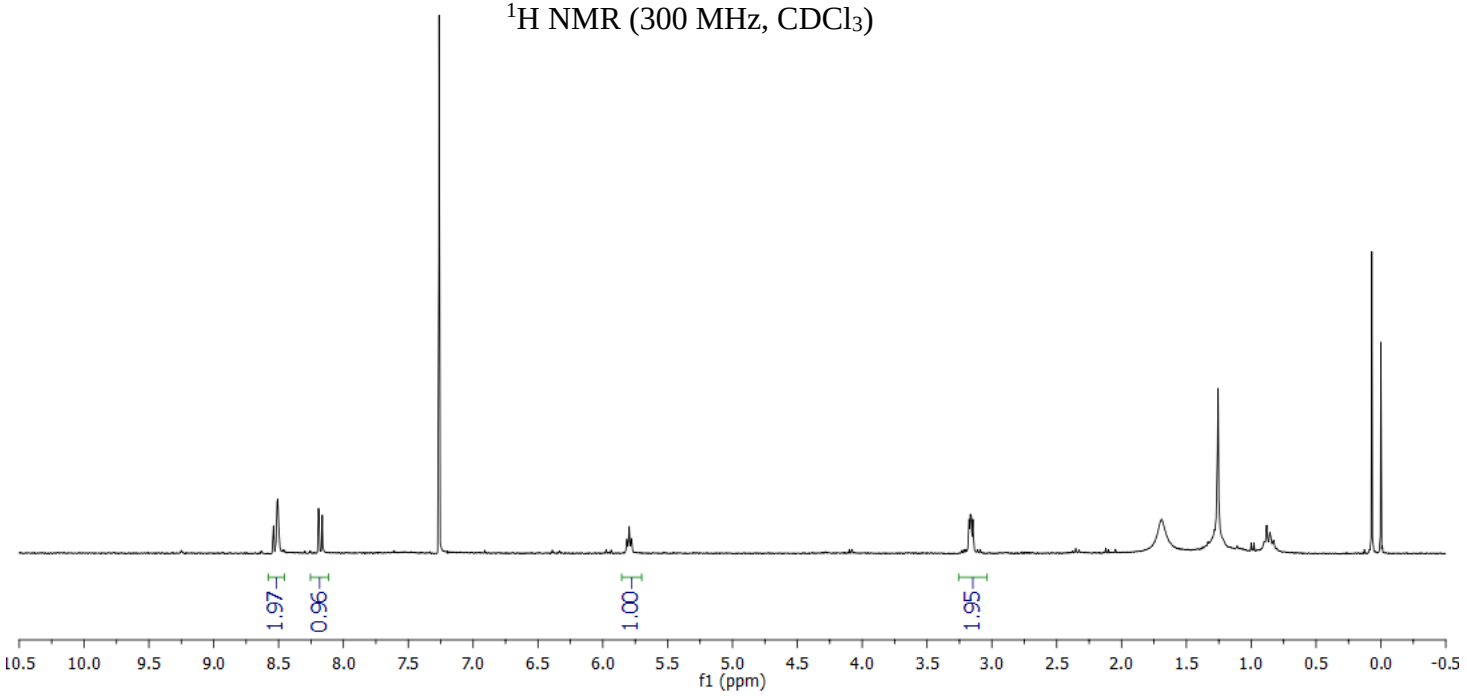
10c + 11c

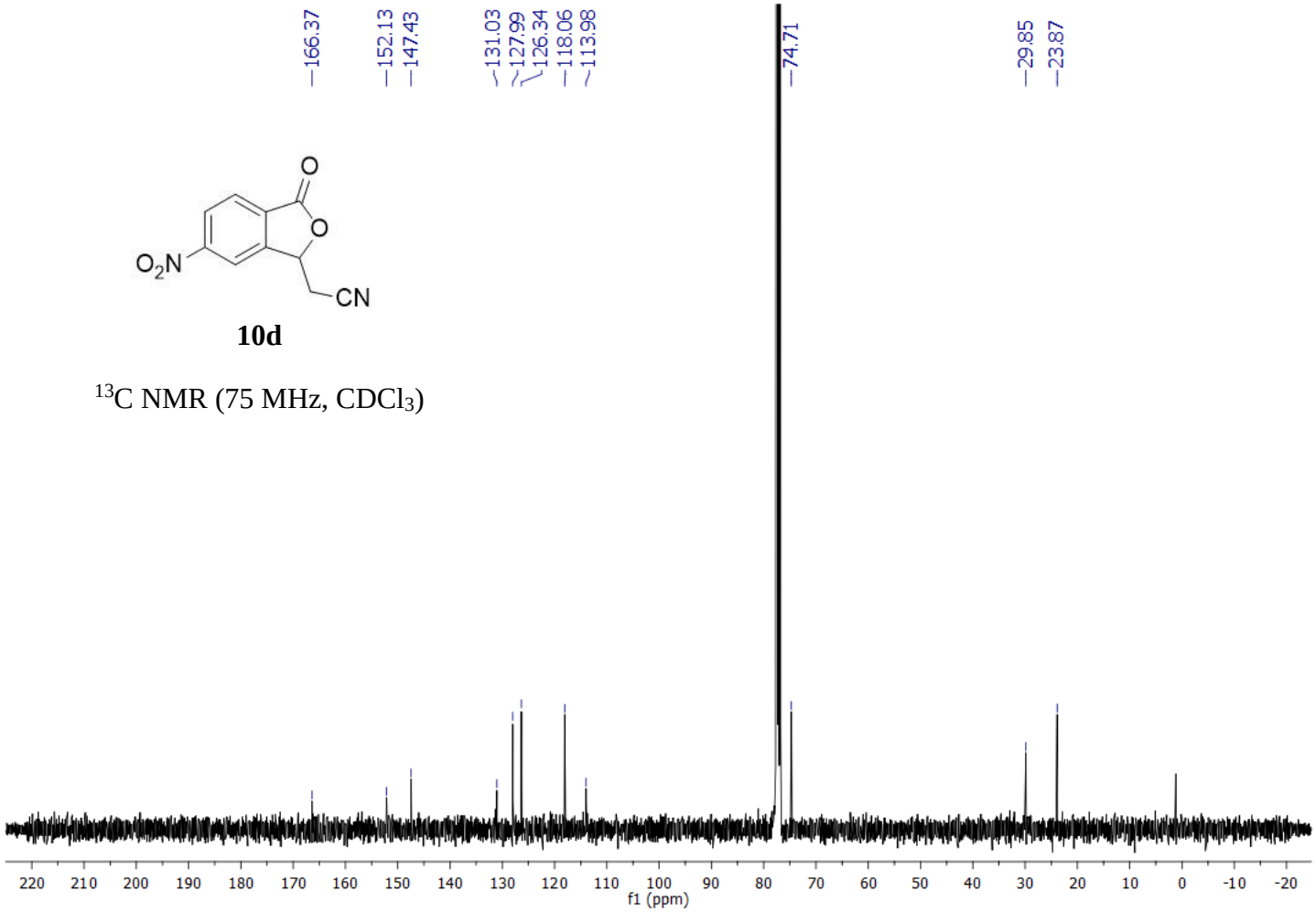
^{13}C NMR (101 MHz, $CDCl_3$)



10d

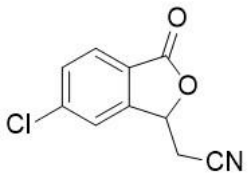
^{1}H NMR (300 MHz, $CDCl_3$)





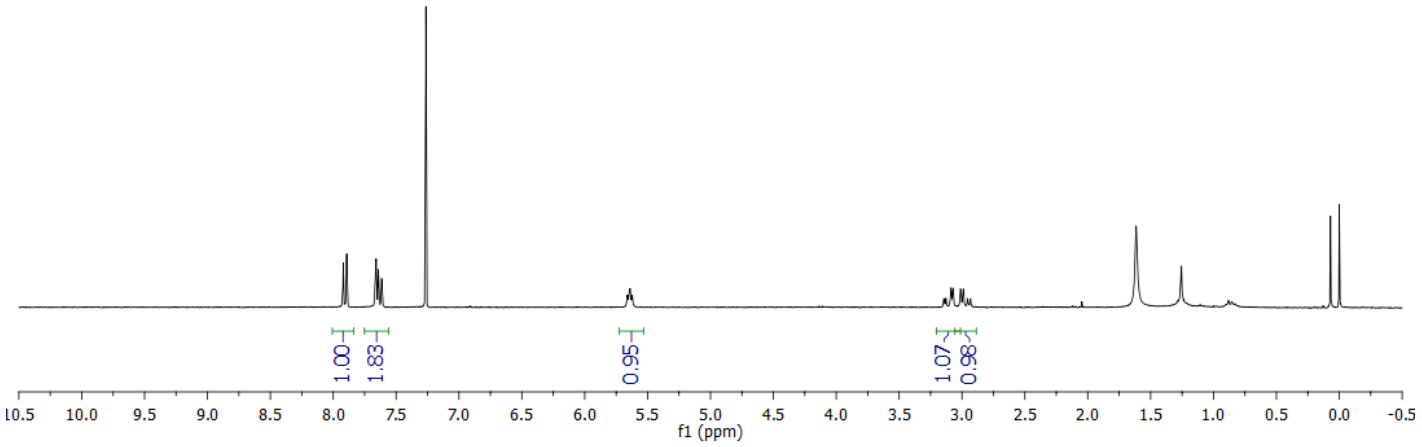
10d

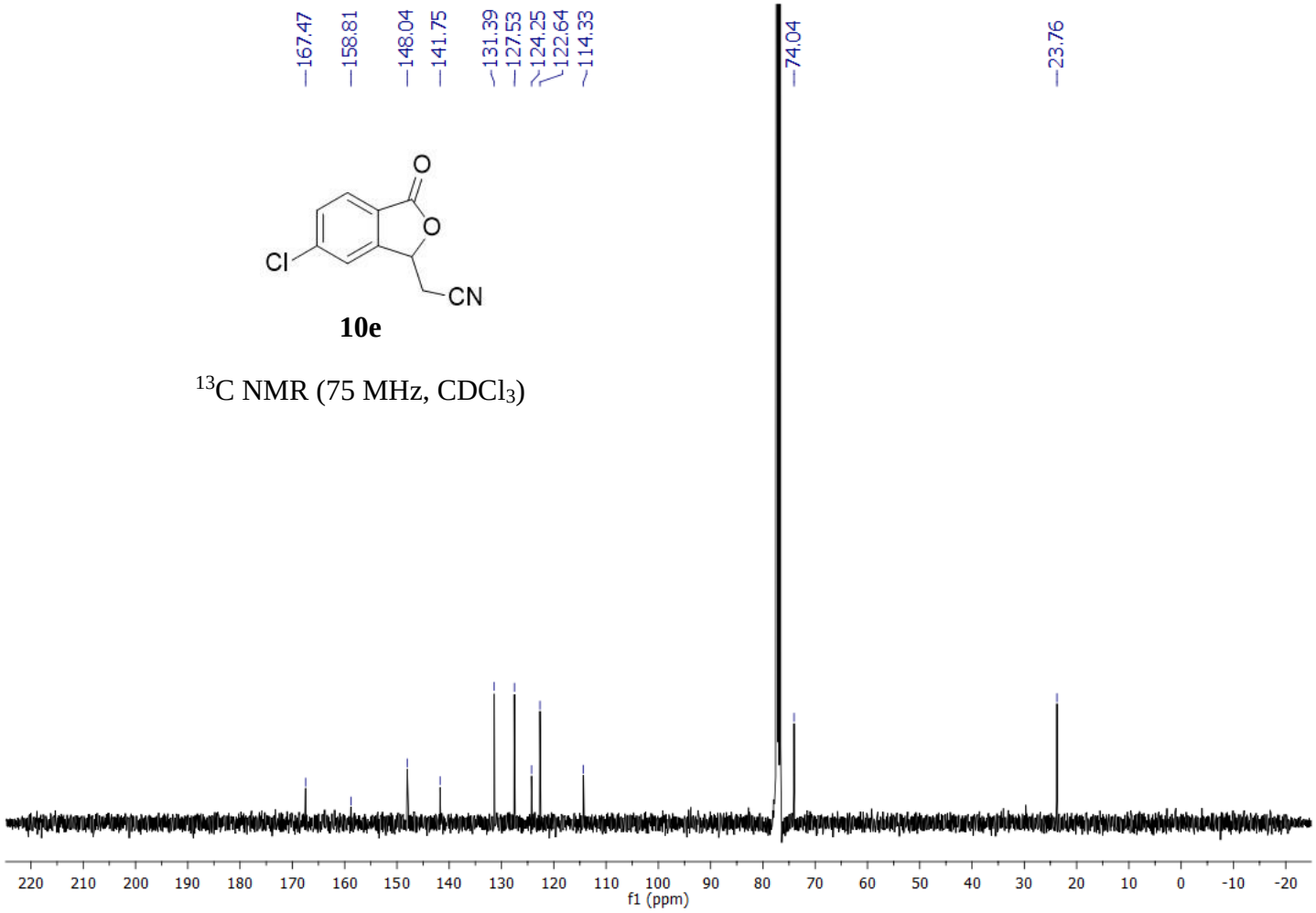
^{13}C NMR (75 MHz, $CDCl_3$)



10e

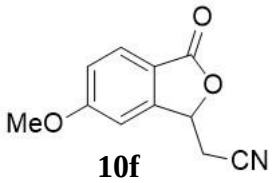
^{1}H NMR (300 MHz, $CDCl_3$)





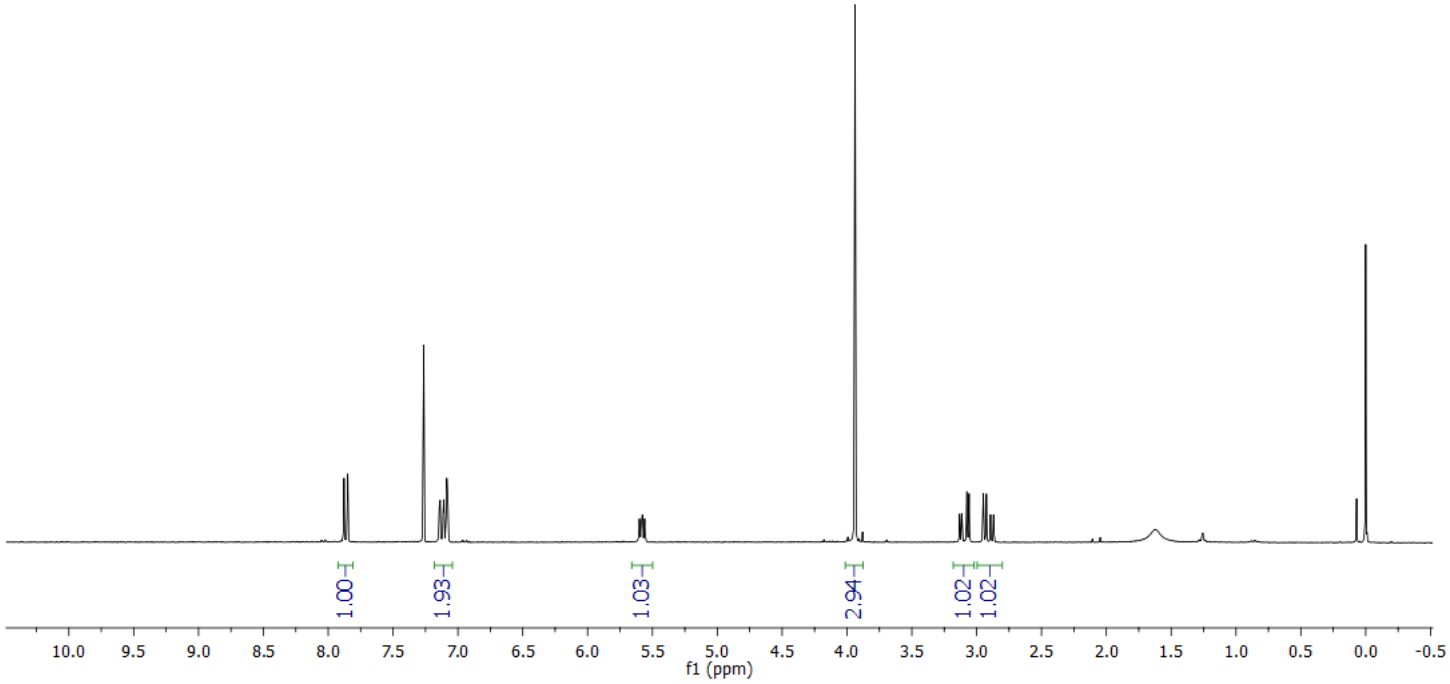
10e

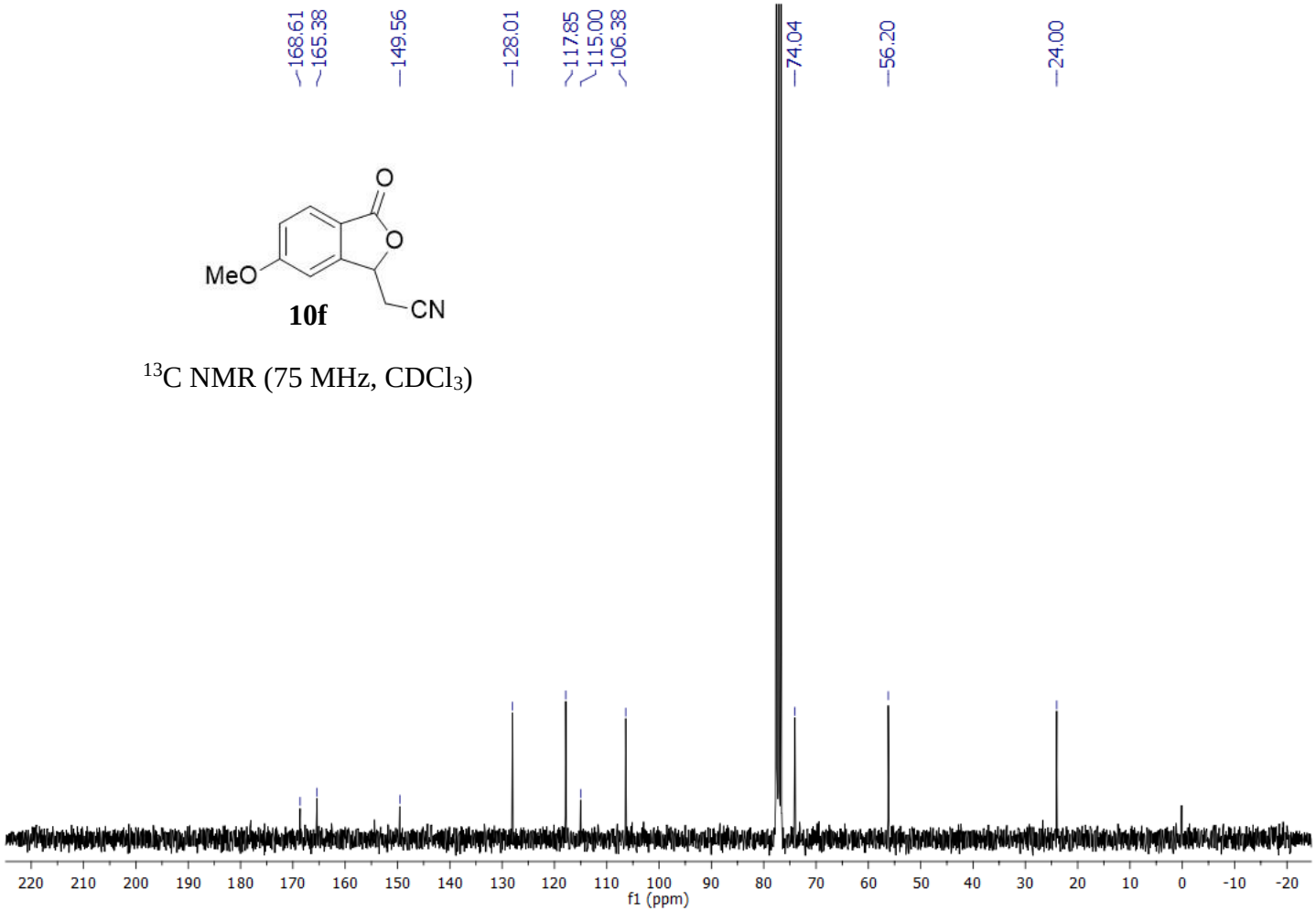
^{13}C NMR (75 MHz, $CDCl_3$)



10f

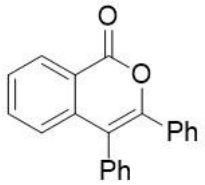
^{1}H NMR (300 MHz, $CDCl_3$)





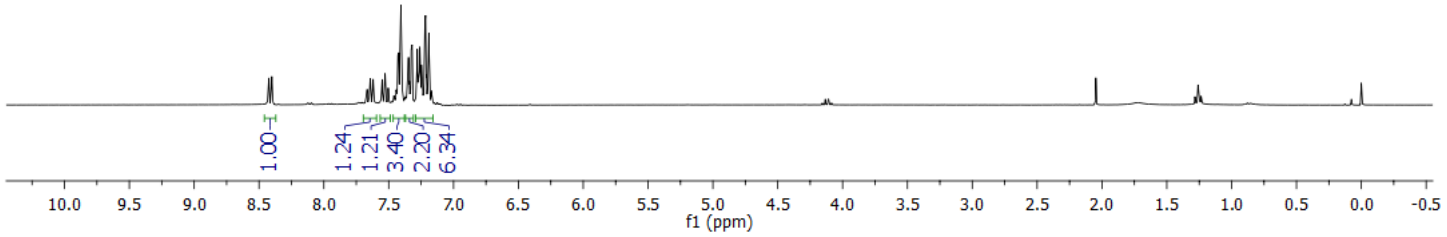
10f

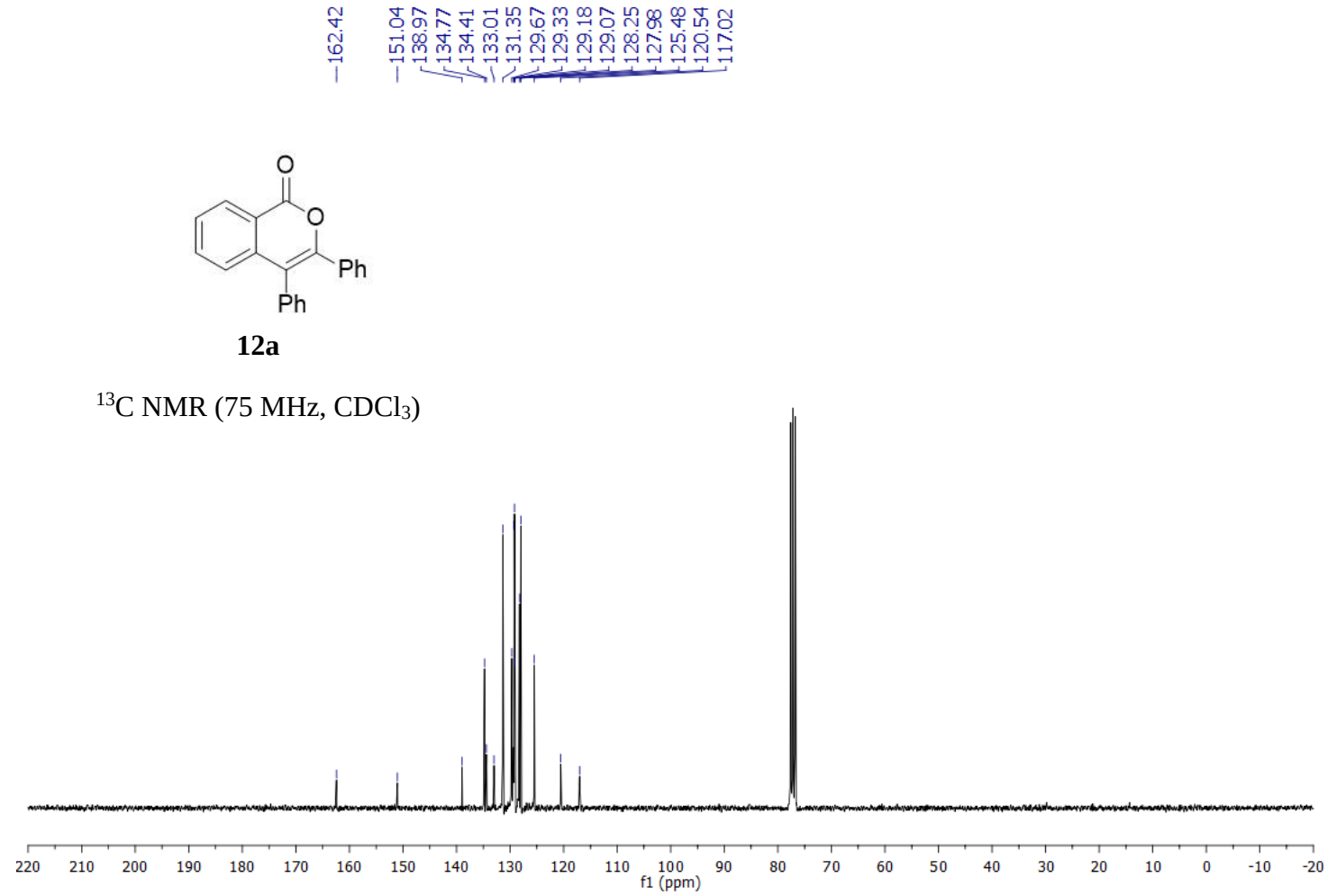
^{13}C NMR (75 MHz, $CDCl_3$)



12a

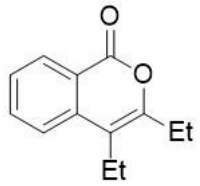
^{1}H NMR (300 MHz, $CDCl_3$)





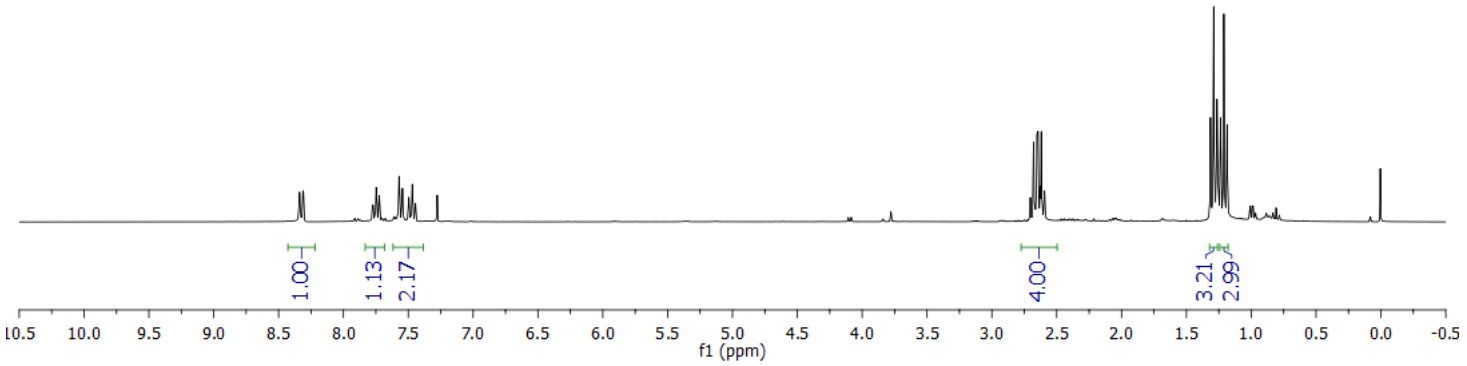
12a

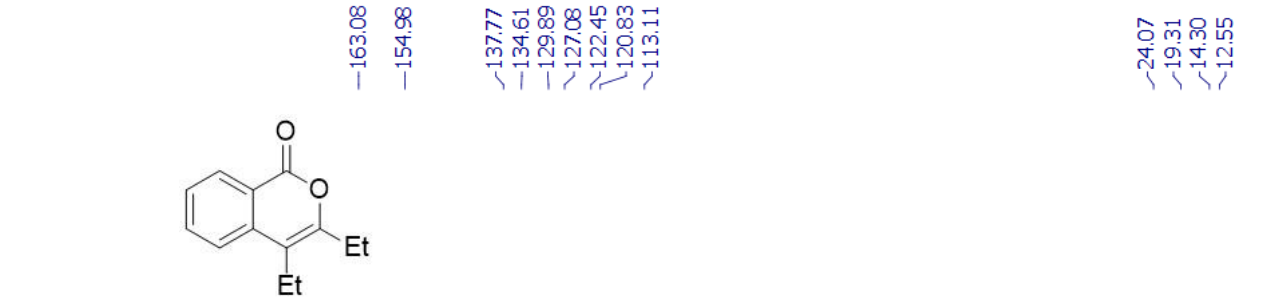
^{13}C NMR (75 MHz, $CDCl_3$)



12b

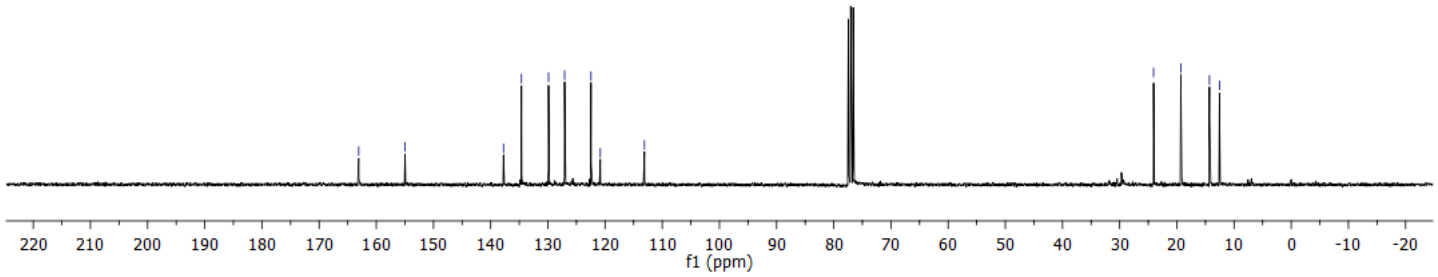
^{1}H NMR (300 MHz, $CDCl_3$)

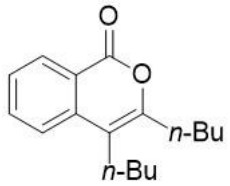




12b

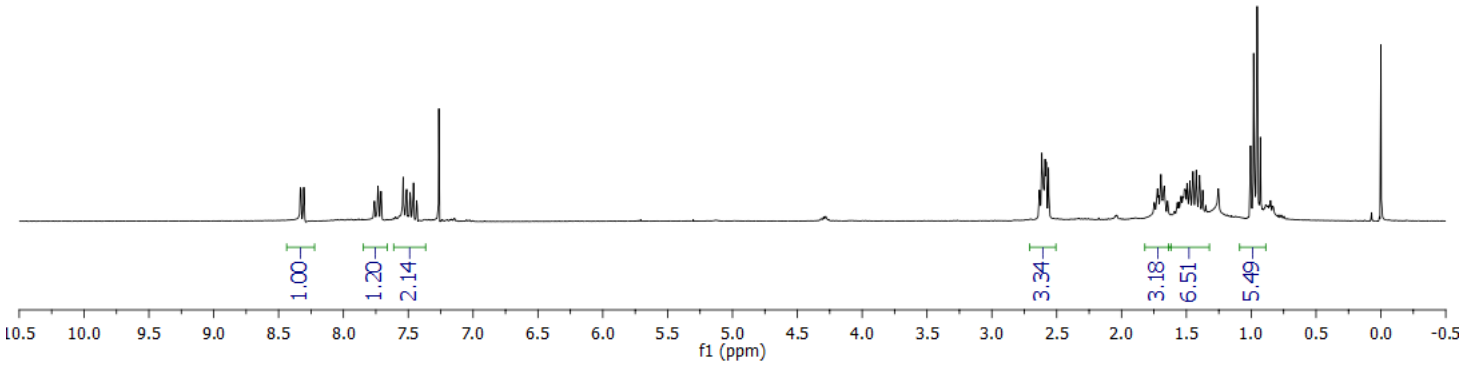
^{13}C NMR (75 MHz, $CDCl_3$)

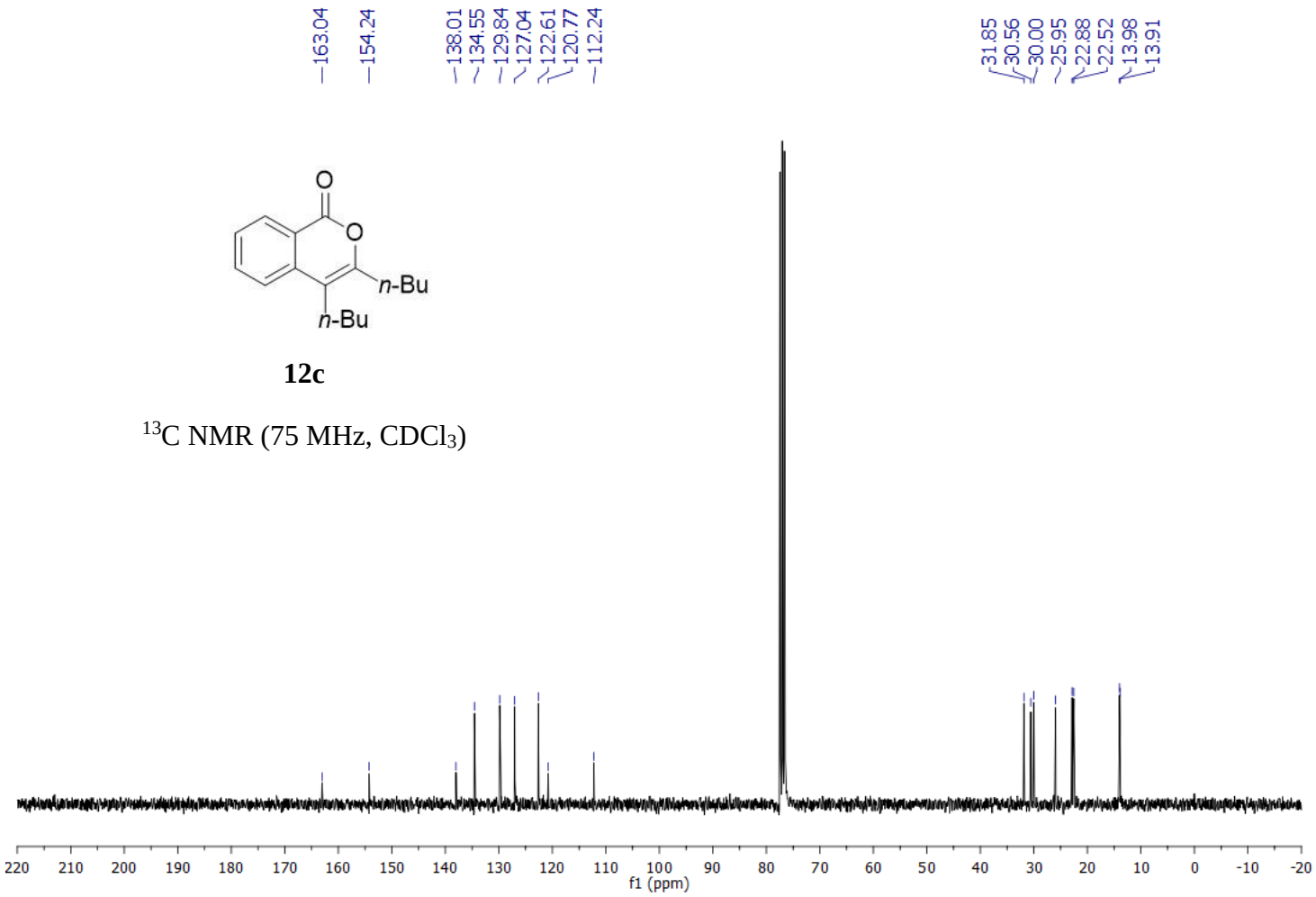




12c

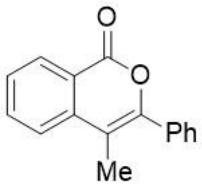
^{1}H NMR (300 MHz, $CDCl_3$)





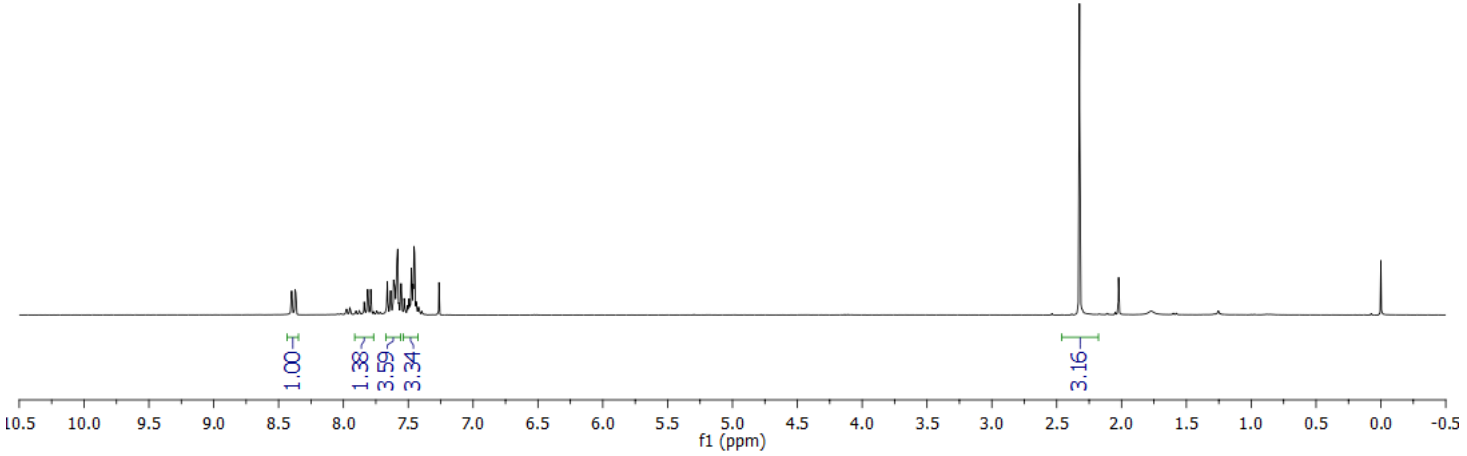
12c

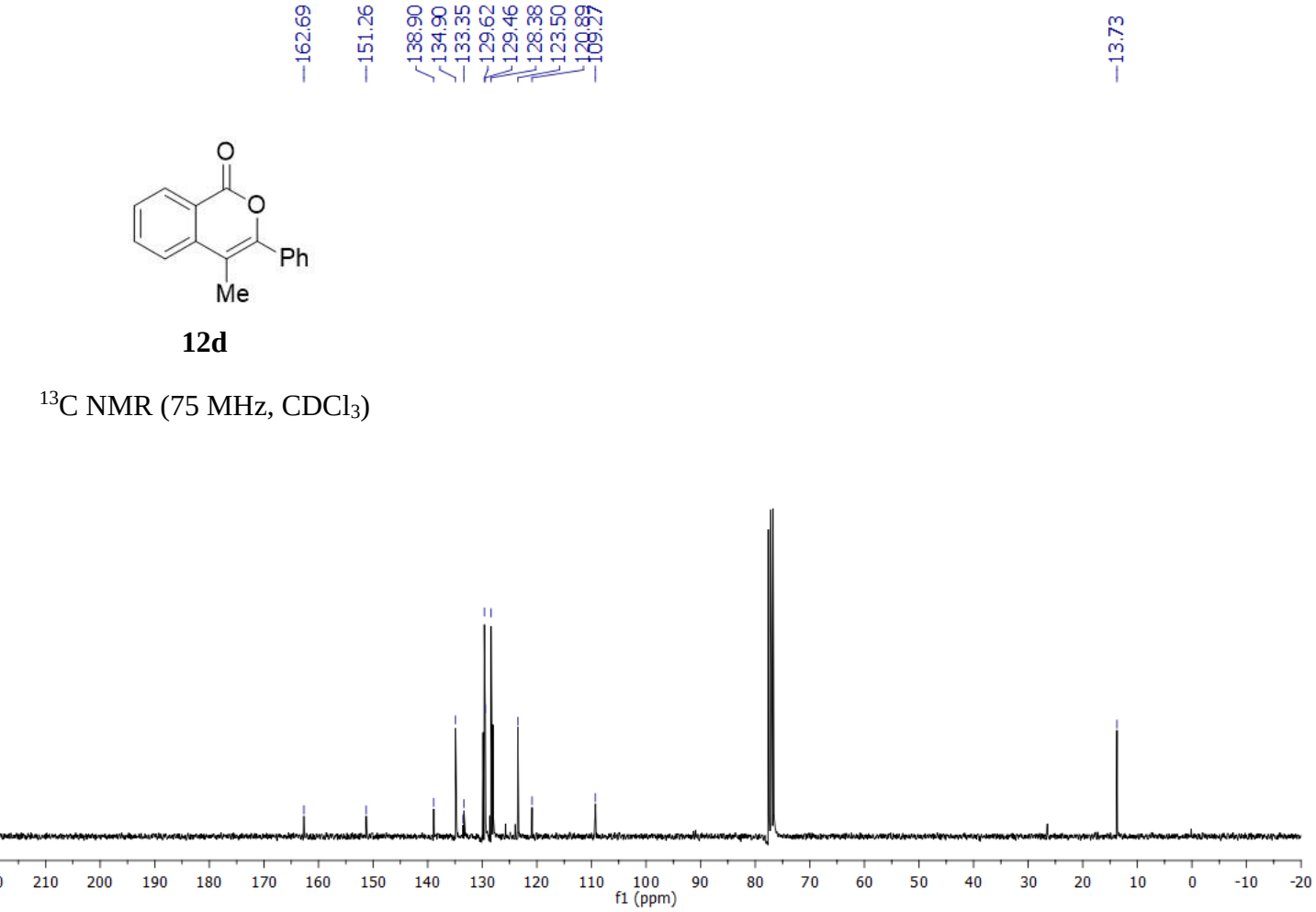
^{13}C NMR (75 MHz, $CDCl_3$)



12d

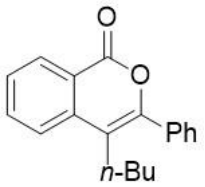
^{1}H NMR (300 MHz, $CDCl_3$)





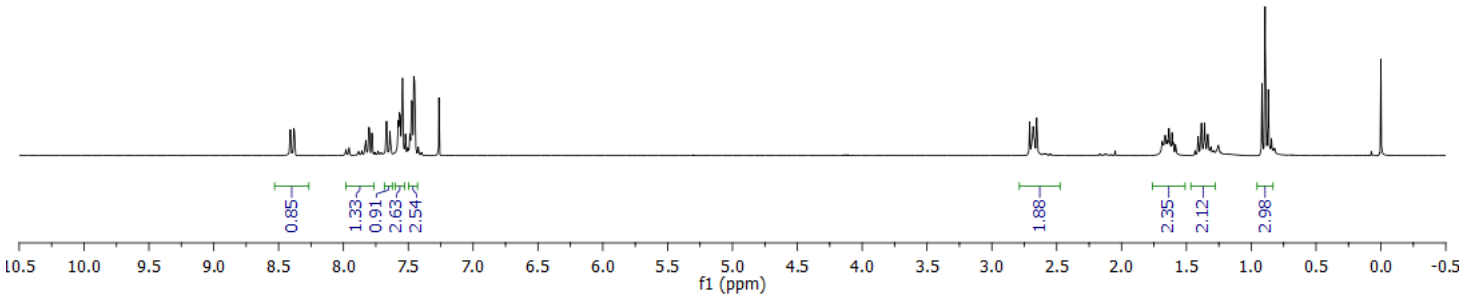
12d

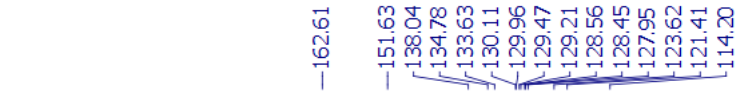
^{13}C NMR (75 MHz, $CDCl_3$)

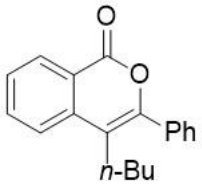


12e

^{1}H NMR (300 MHz, $CDCl_3$)

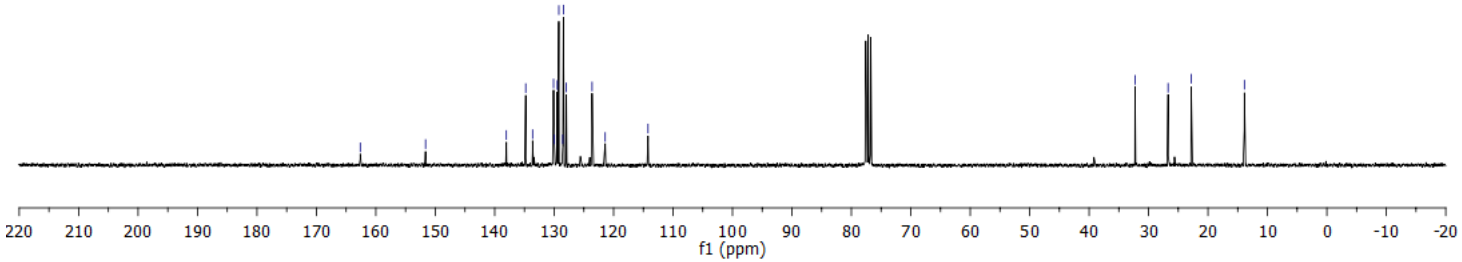


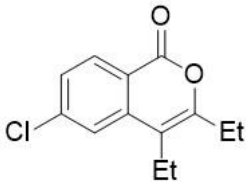




12e

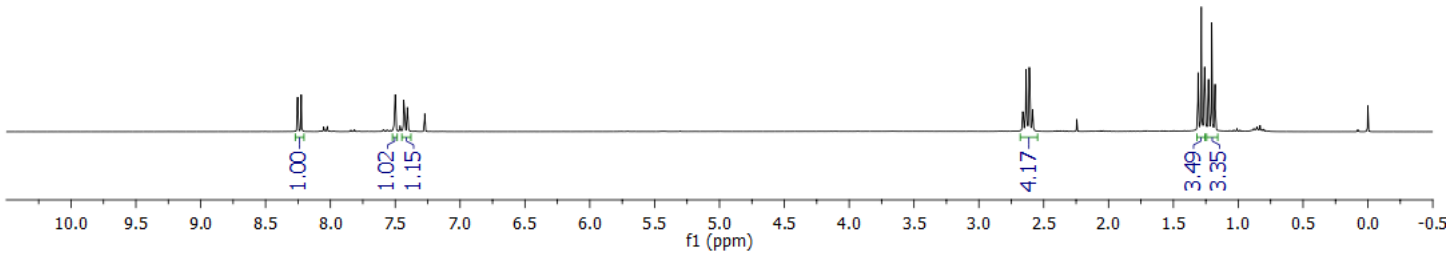
^{13}C NMR (75 MHz, $CDCl_3$)

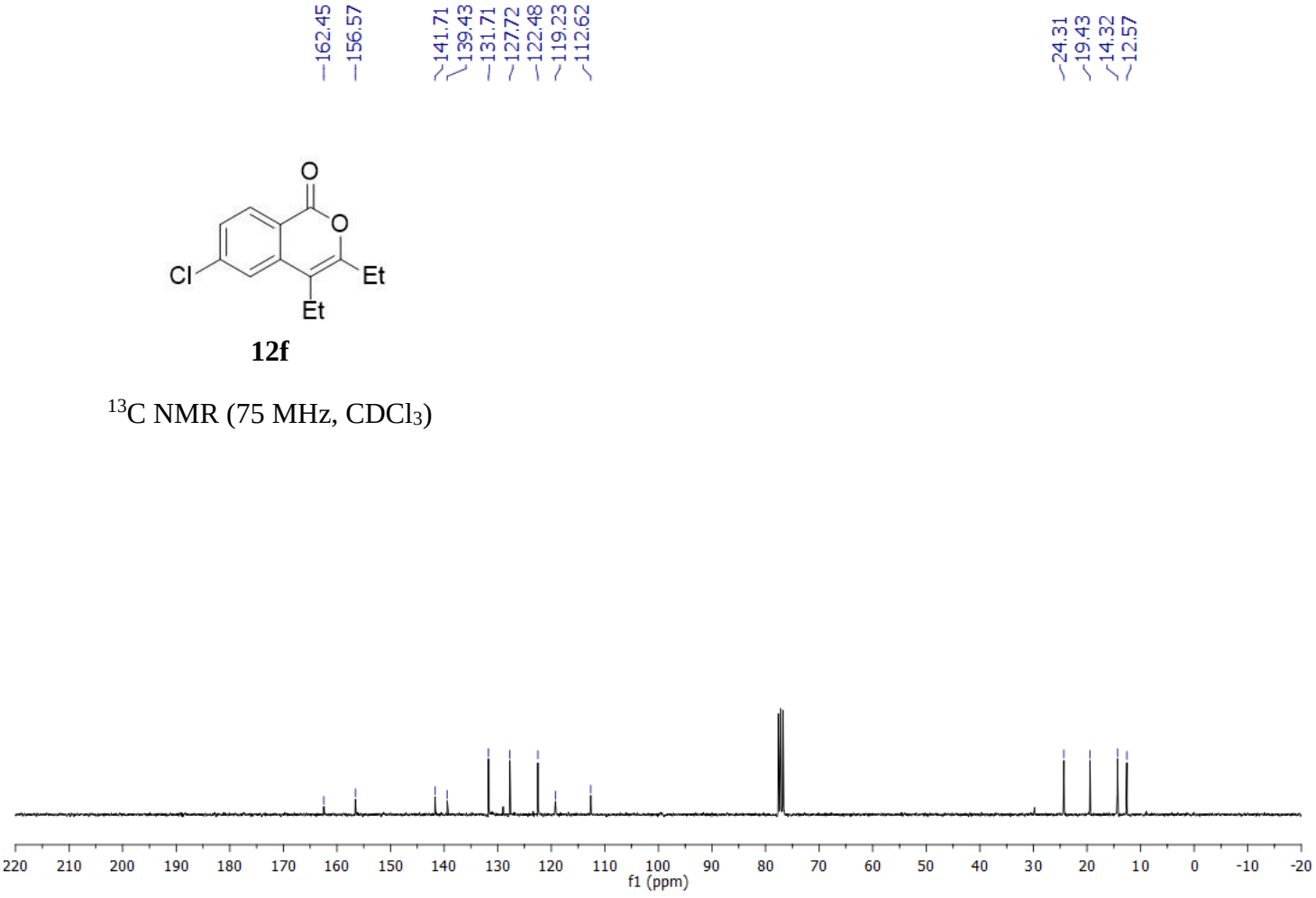




12f

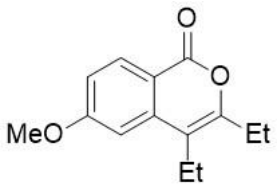
^{1}H NMR (300 MHz, $CDCl_3$)





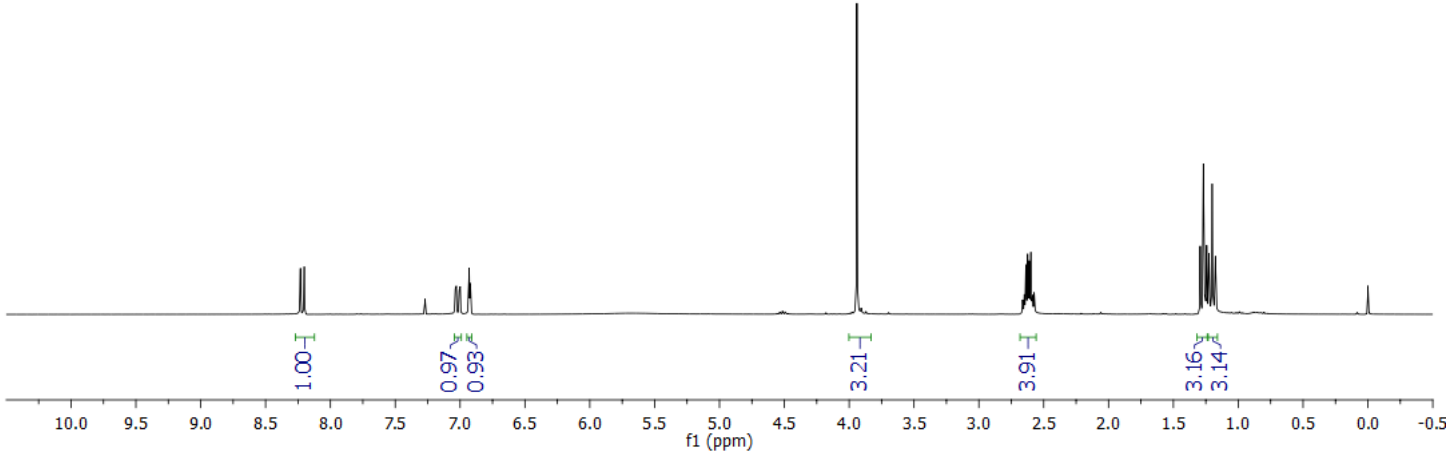
12f

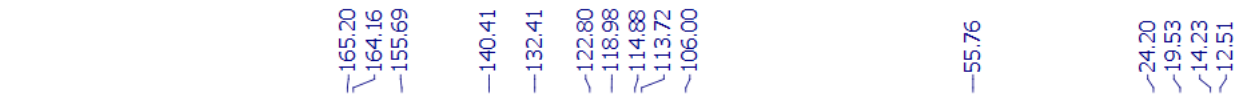
^{13}C NMR (75 MHz, $CDCl_3$)

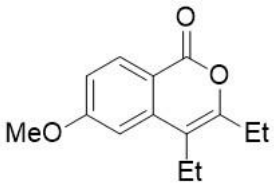


12g

^{1}H NMR (300 MHz, $CDCl_3$)

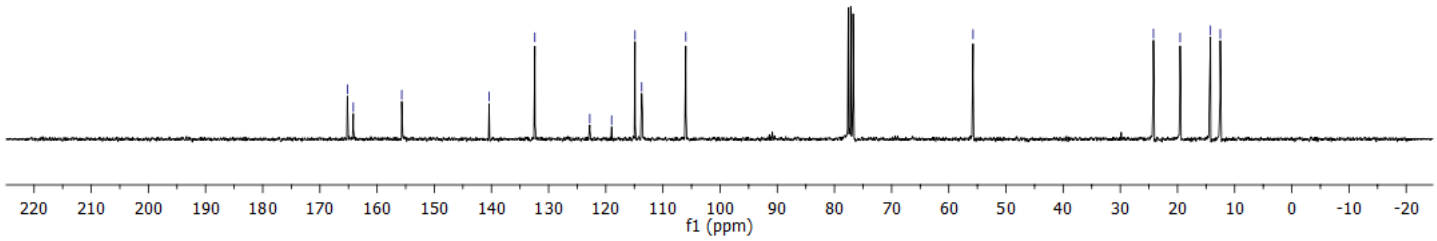


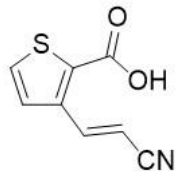




12g

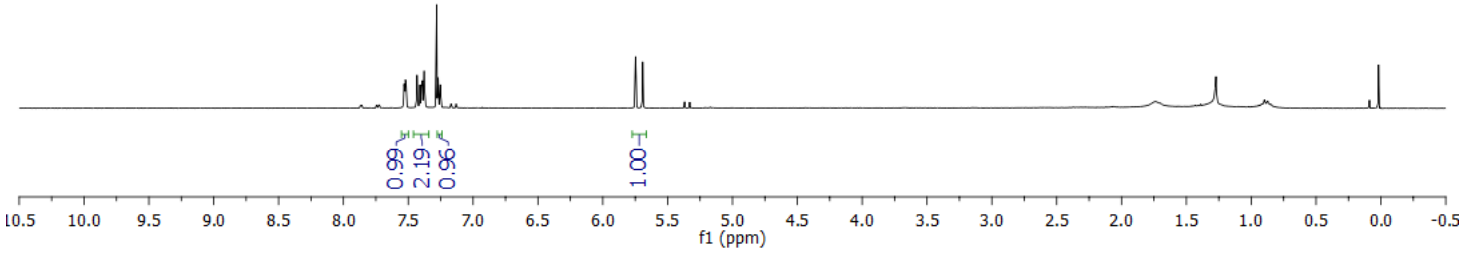
^{13}C NMR (75 MHz, $CDCl_3$)

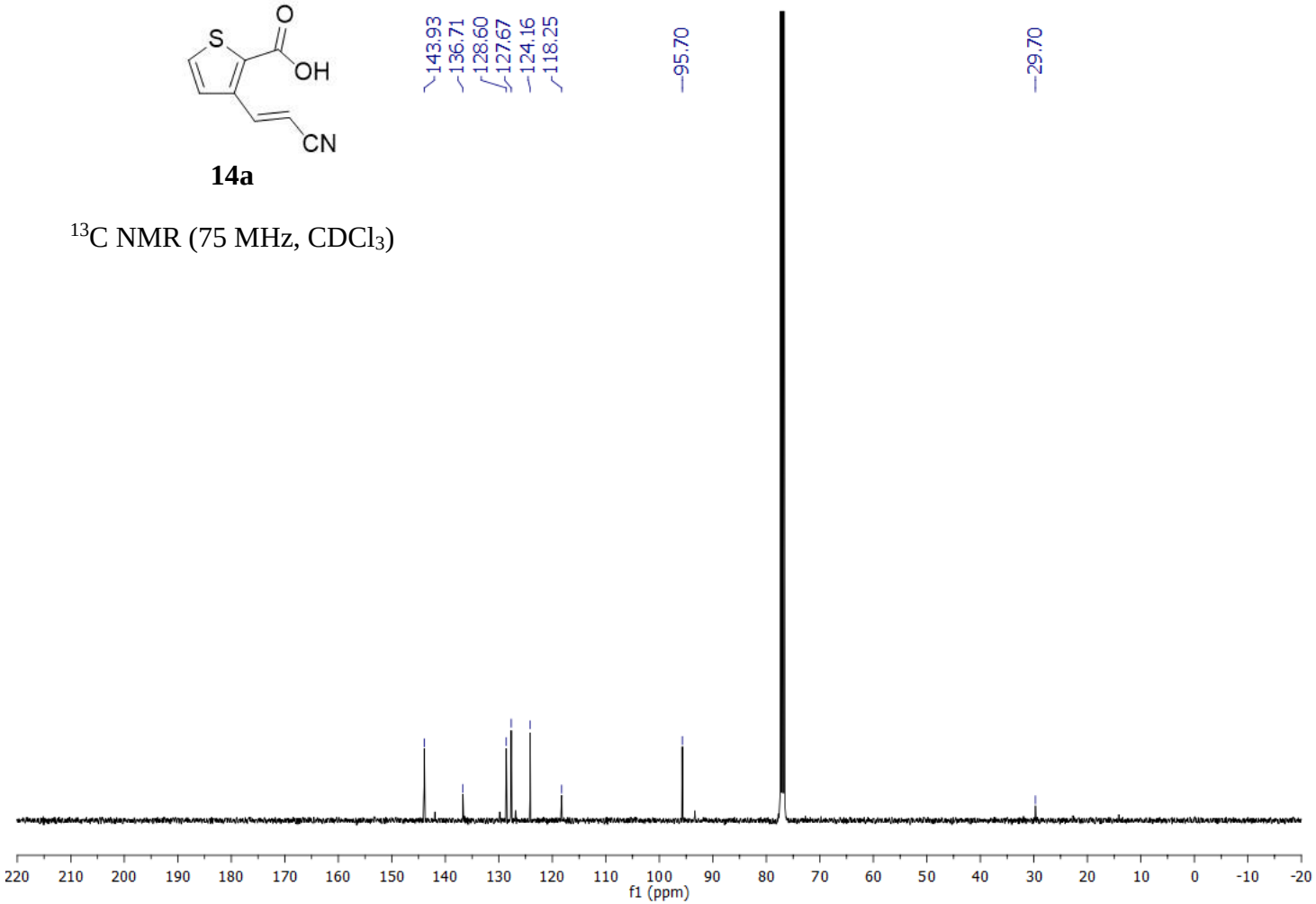




14a

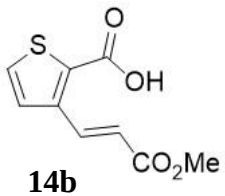
^{1}H NMR (300 MHz, $CDCl_3$)





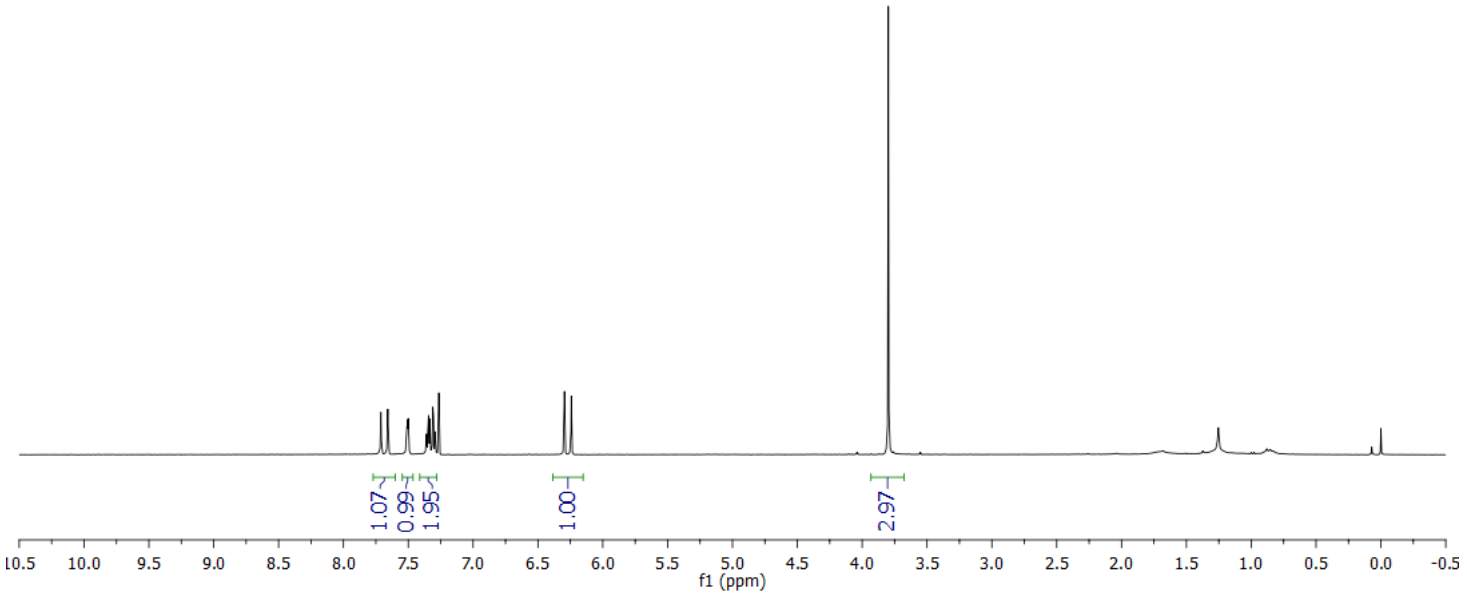
14a

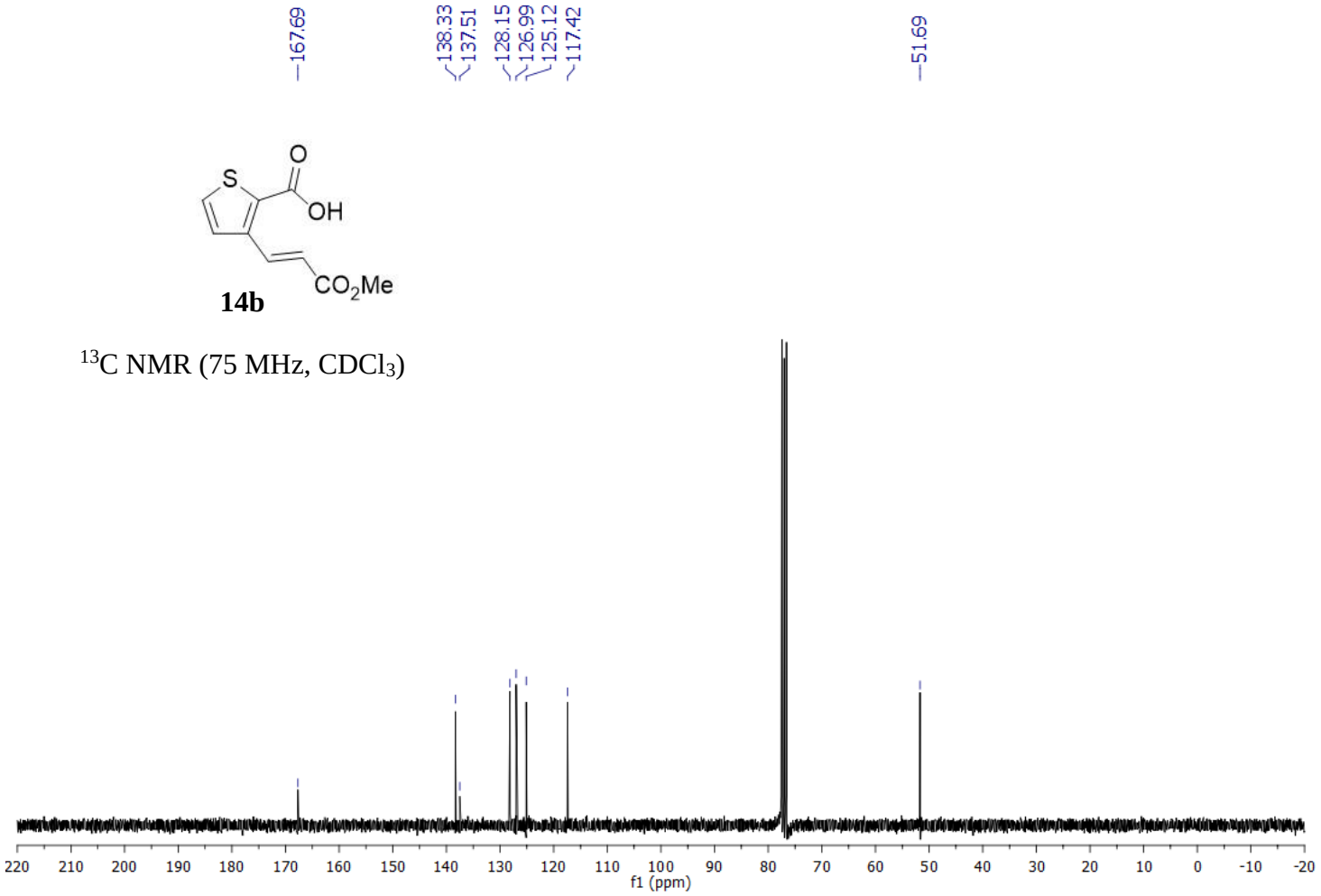
^{13}C NMR (75 MHz, $CDCl_3$)



14b

^{1}H NMR (300 MHz, $CDCl_3$)



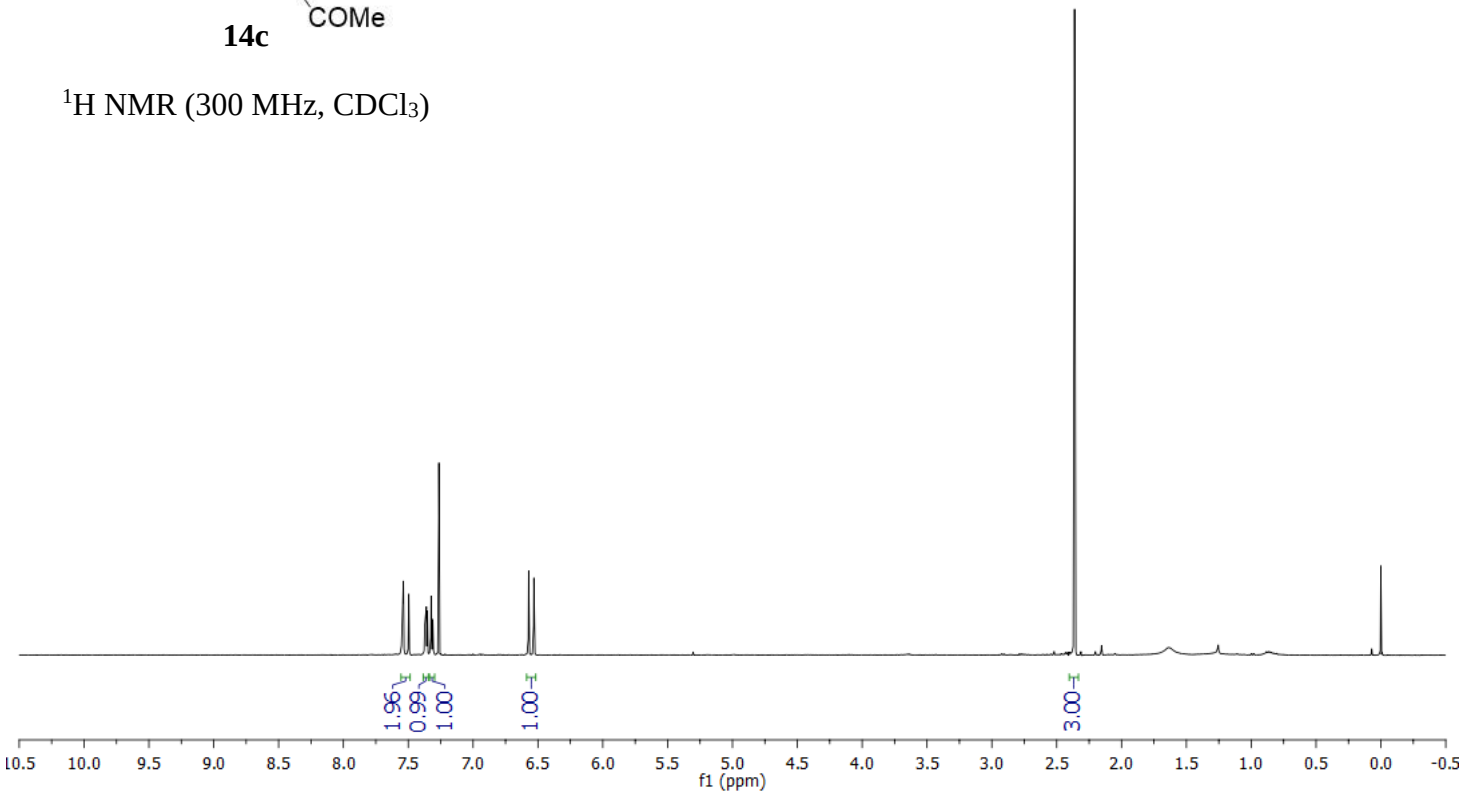


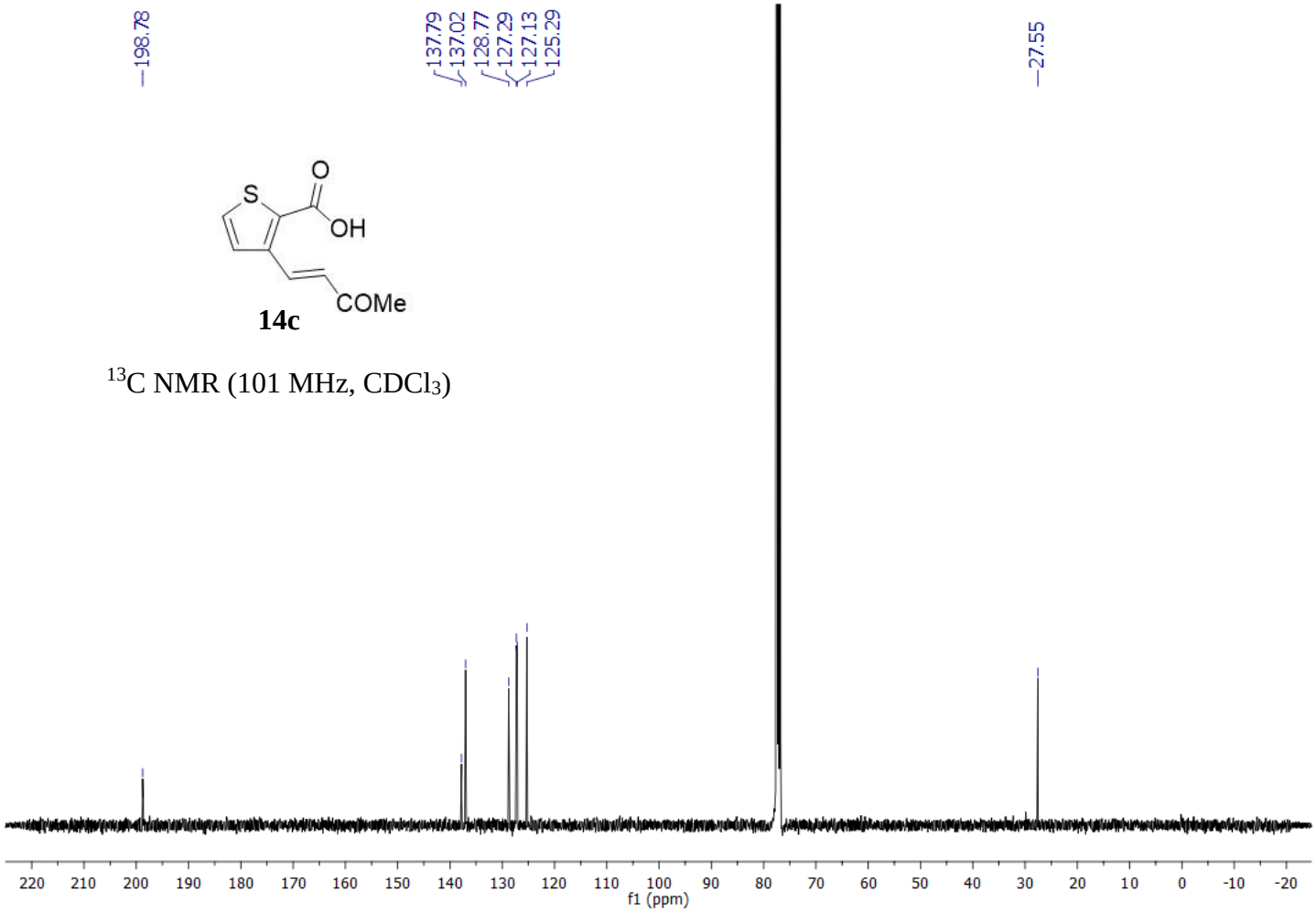
14b

^{13}C NMR (75 MHz, $CDCl_3$)

14c

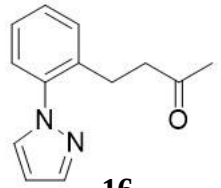
^{1}H NMR (300 MHz, $CDCl_3$)





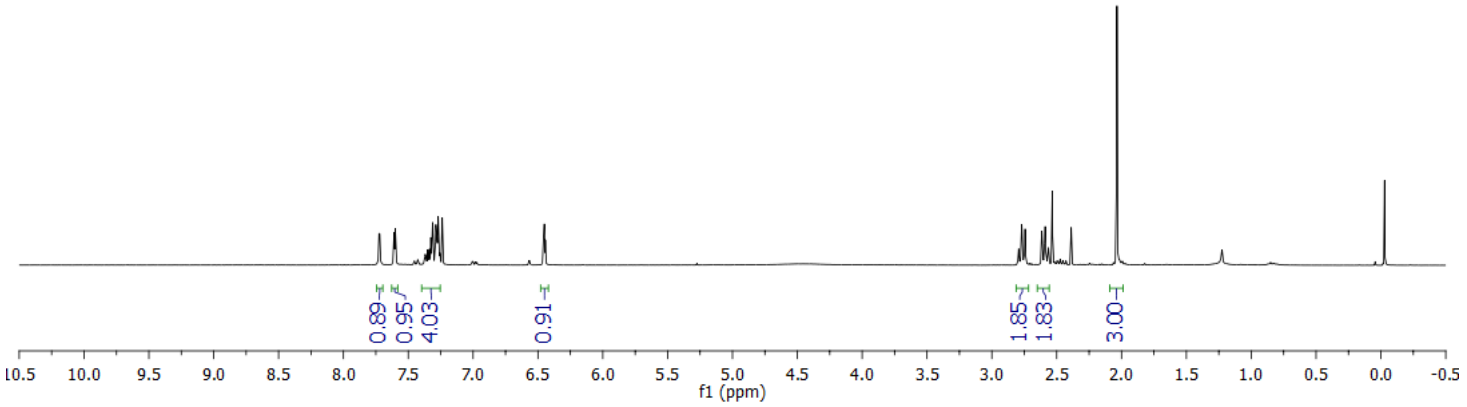
14c

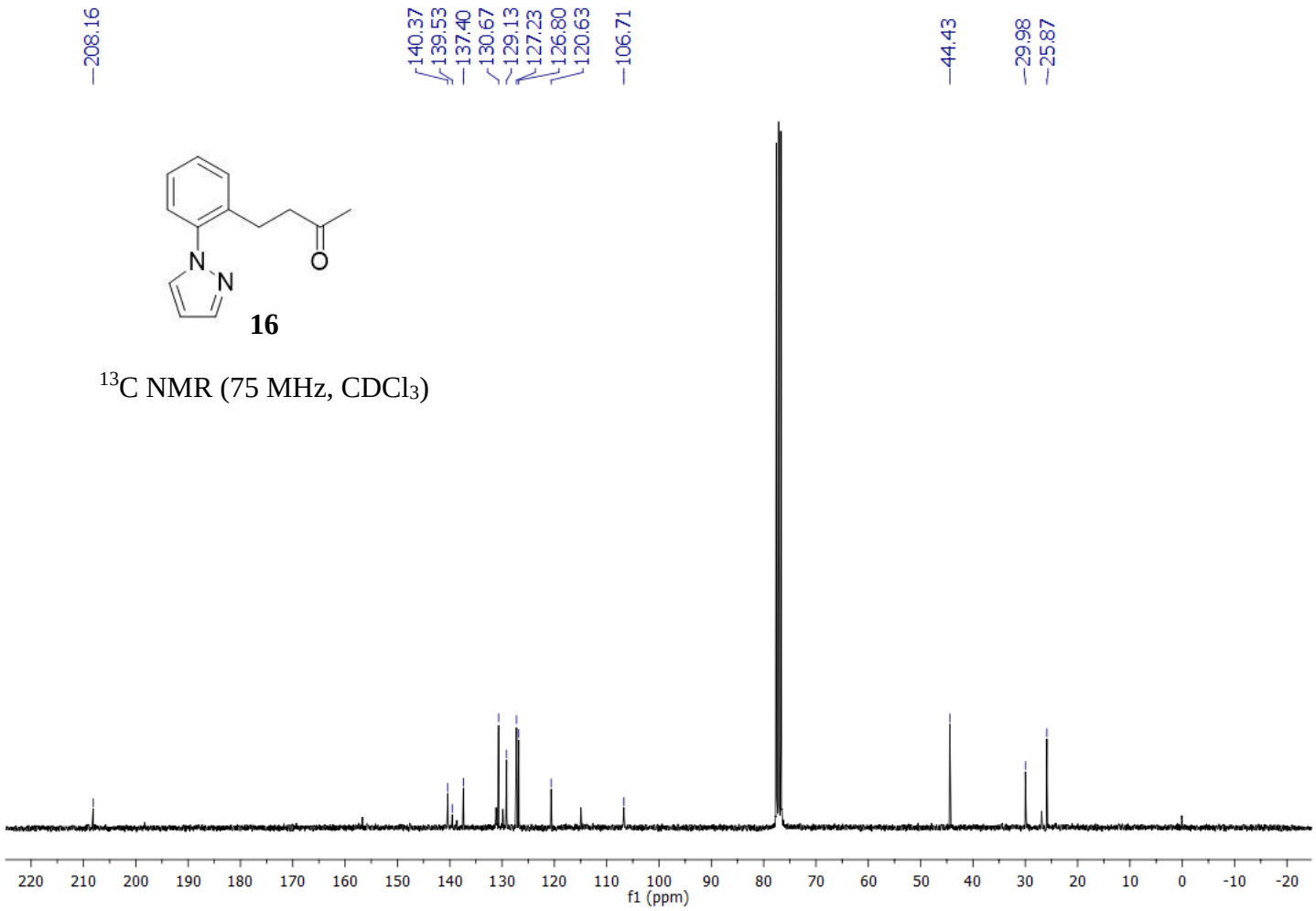
^{13}C NMR (101 MHz, $CDCl_3$)



16

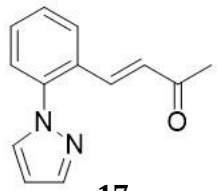
^{1}H NMR (300 MHz, $CDCl_3$)





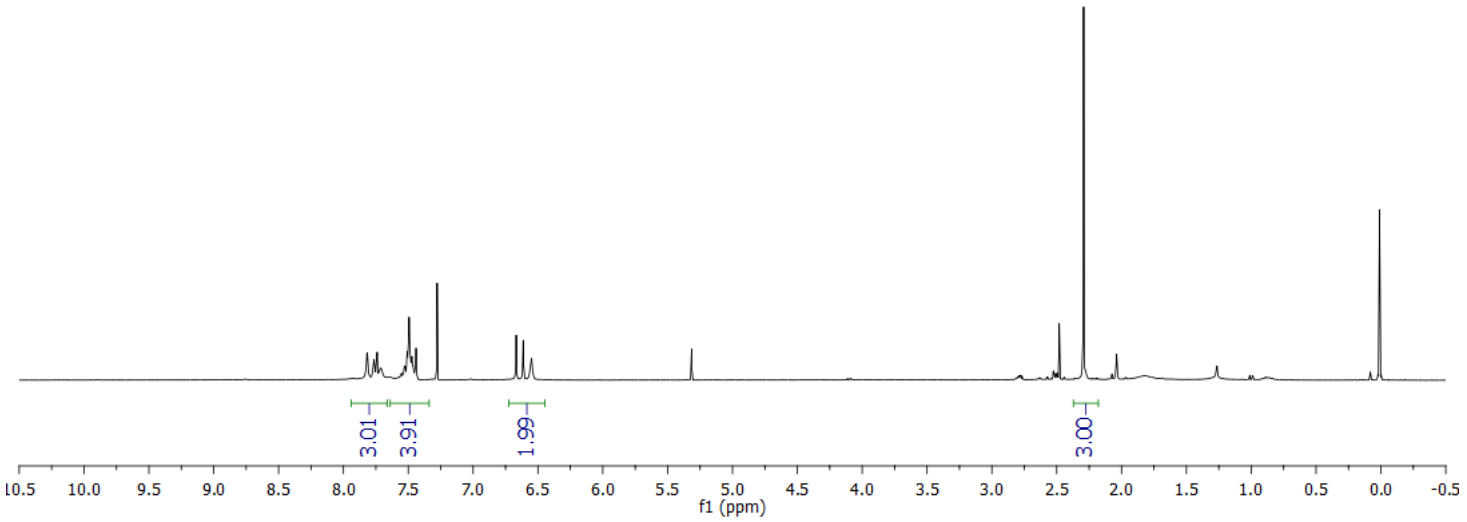
16

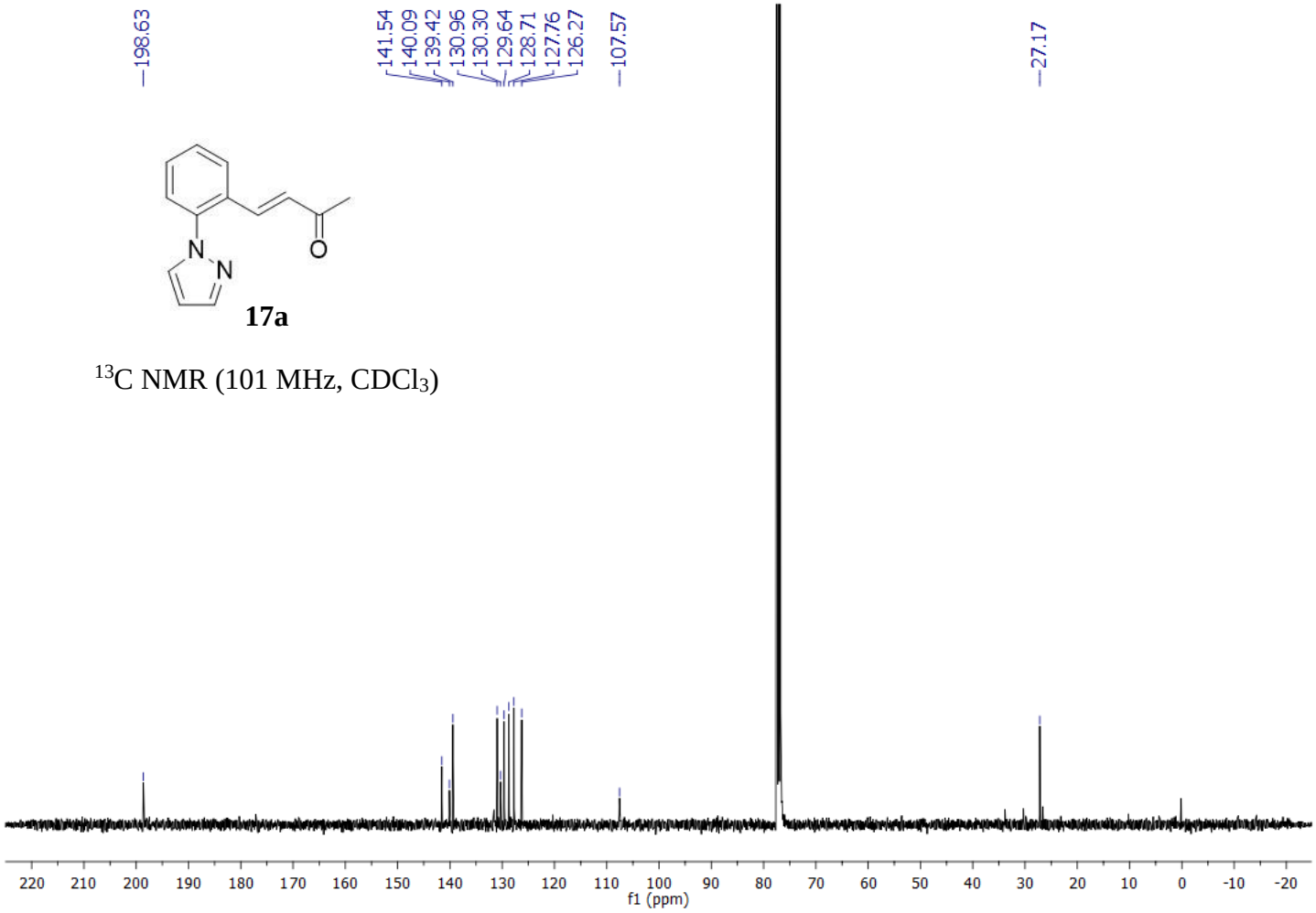
^{13}C NMR (75 MHz, $CDCl_3$)



17a

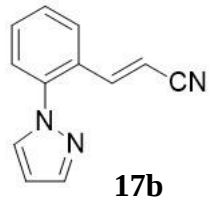
^{1}H NMR (300 MHz, $CDCl_3$)





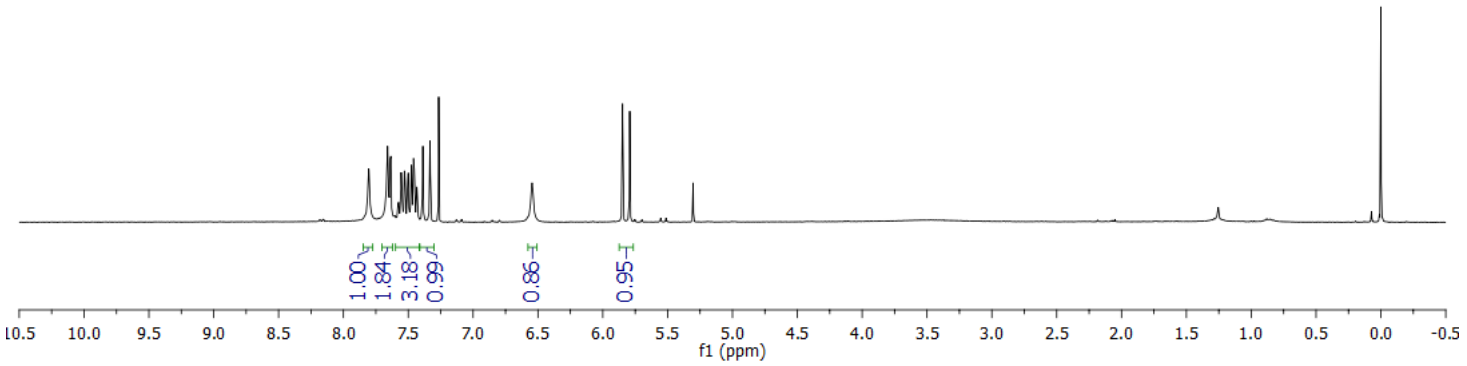
17a

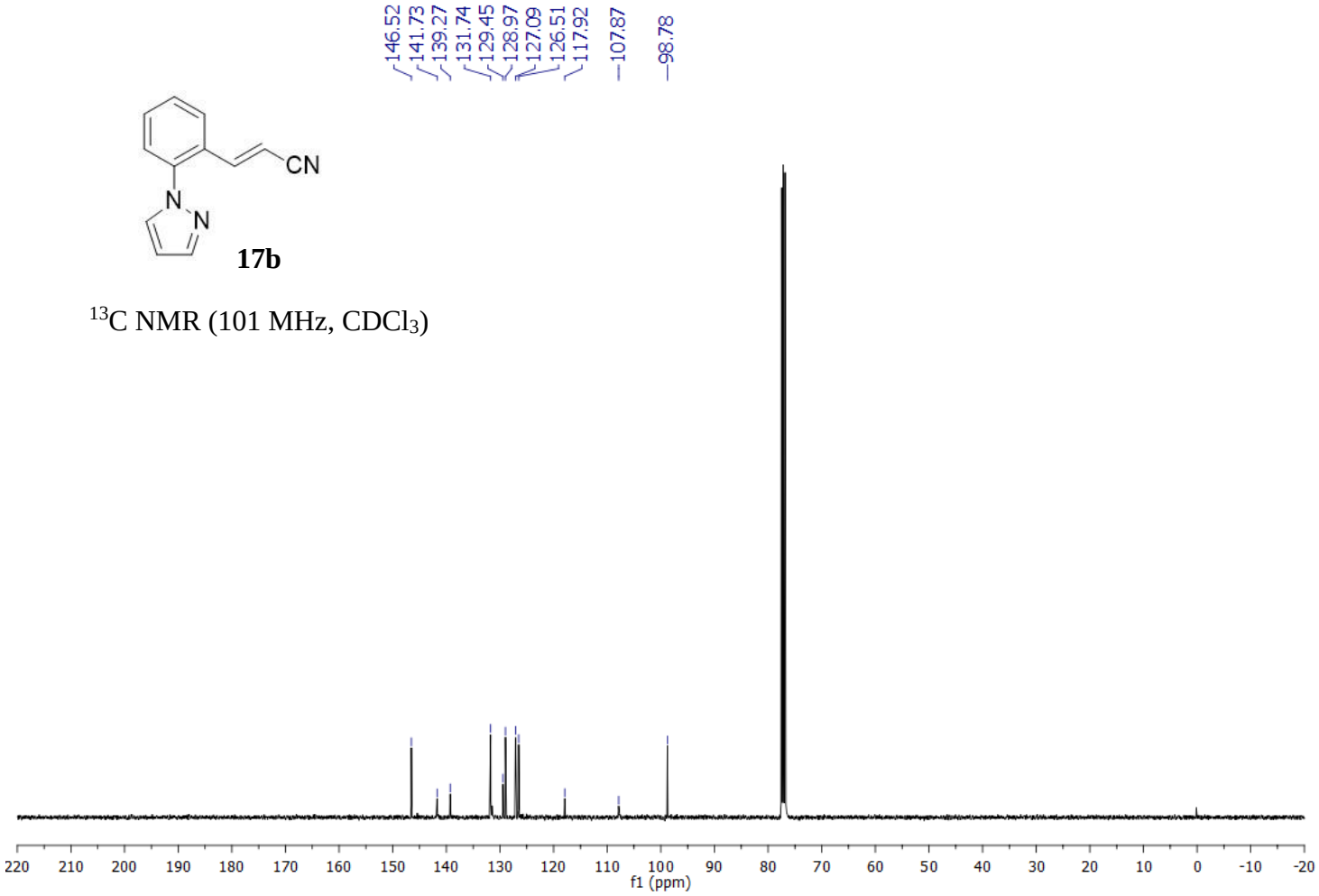
^{13}C NMR (101 MHz, $CDCl_3$)



17b

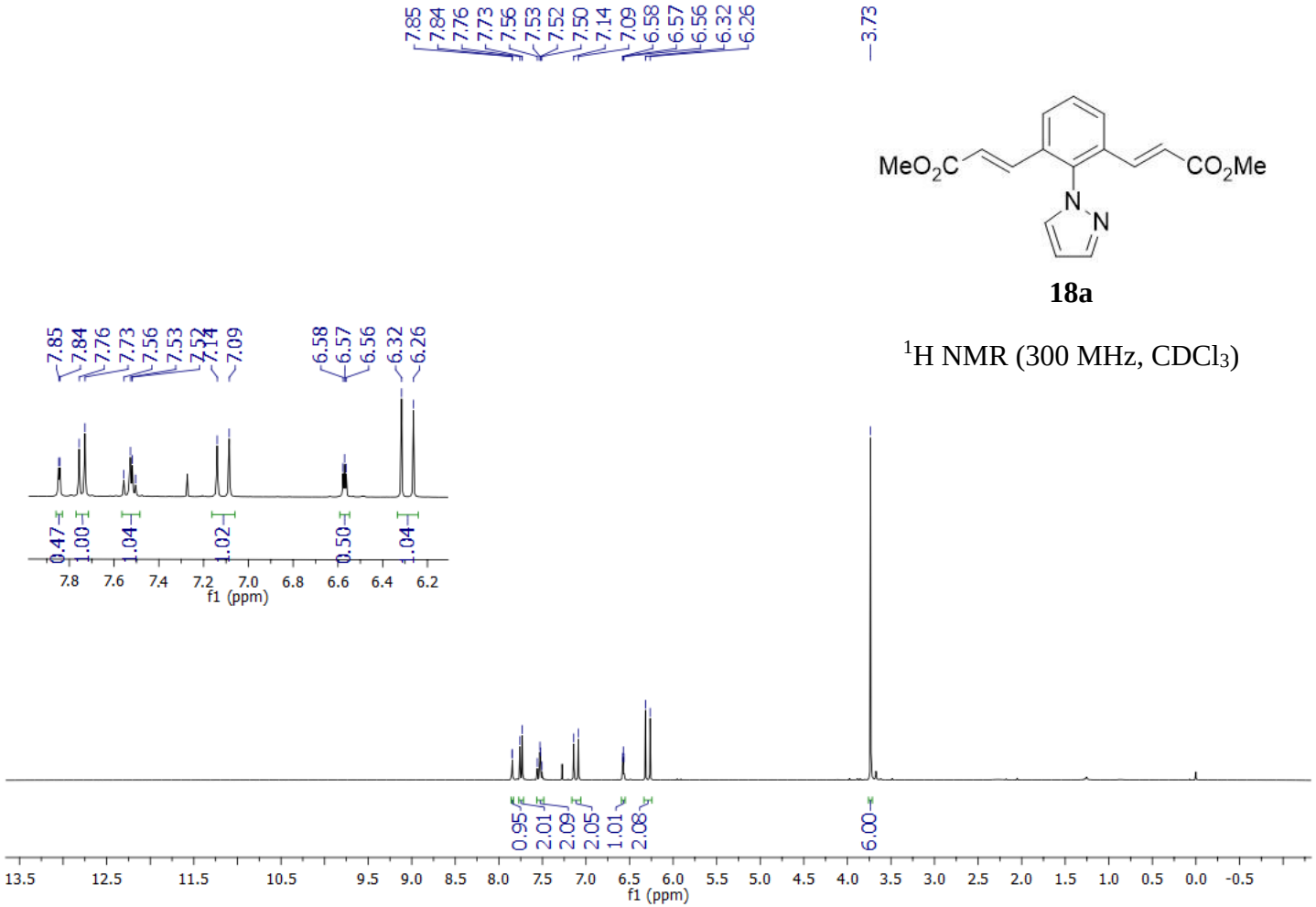
^{1}H NMR (300 MHz, $CDCl_3$)

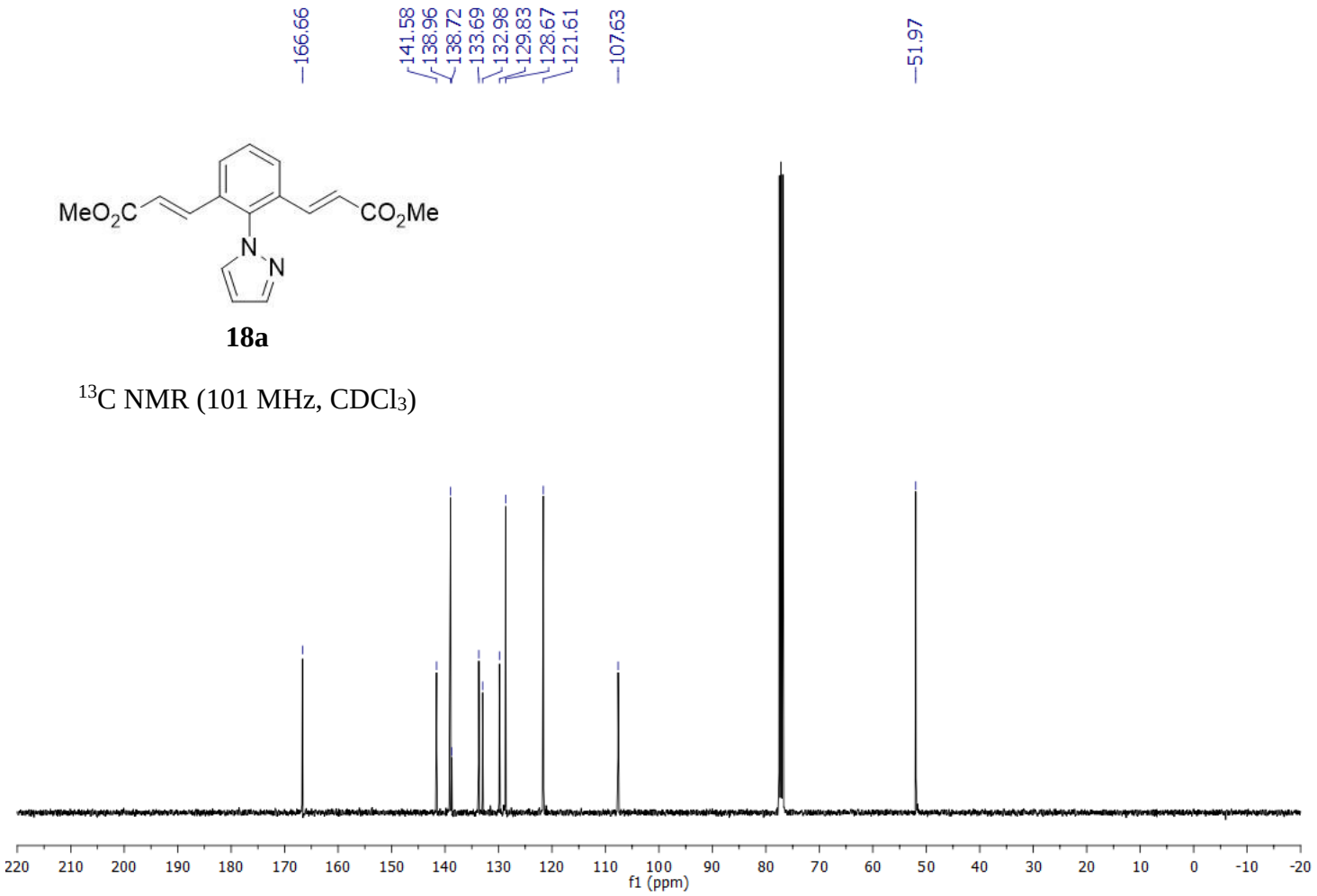




17b

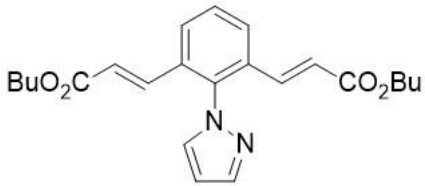
^{13}C NMR (101 MHz, $CDCl_3$)


7.85
7.84
7.76
7.73
7.56
7.53
7.52
7.50
7.14
7.09
6.58
6.57
6.56
6.32
6.26
3.73
MeO2C
CO2Me
N
N
18a
1H NMR (300 MHz, CDCl3)
0.47
1.00
1.04
1.02
0.50
1.04
0.95
2.01
2.09
2.05
1.01
2.08
6.00
f1 (ppm)



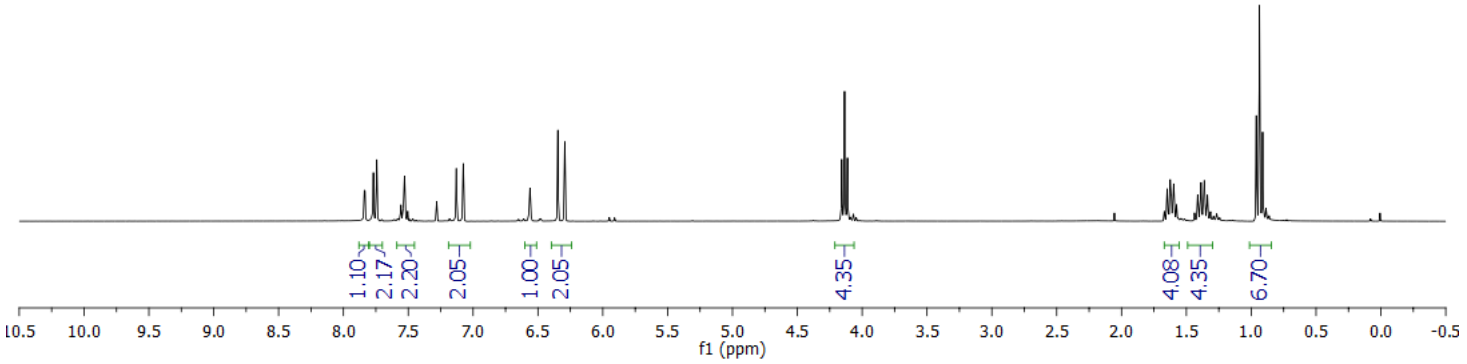
18a

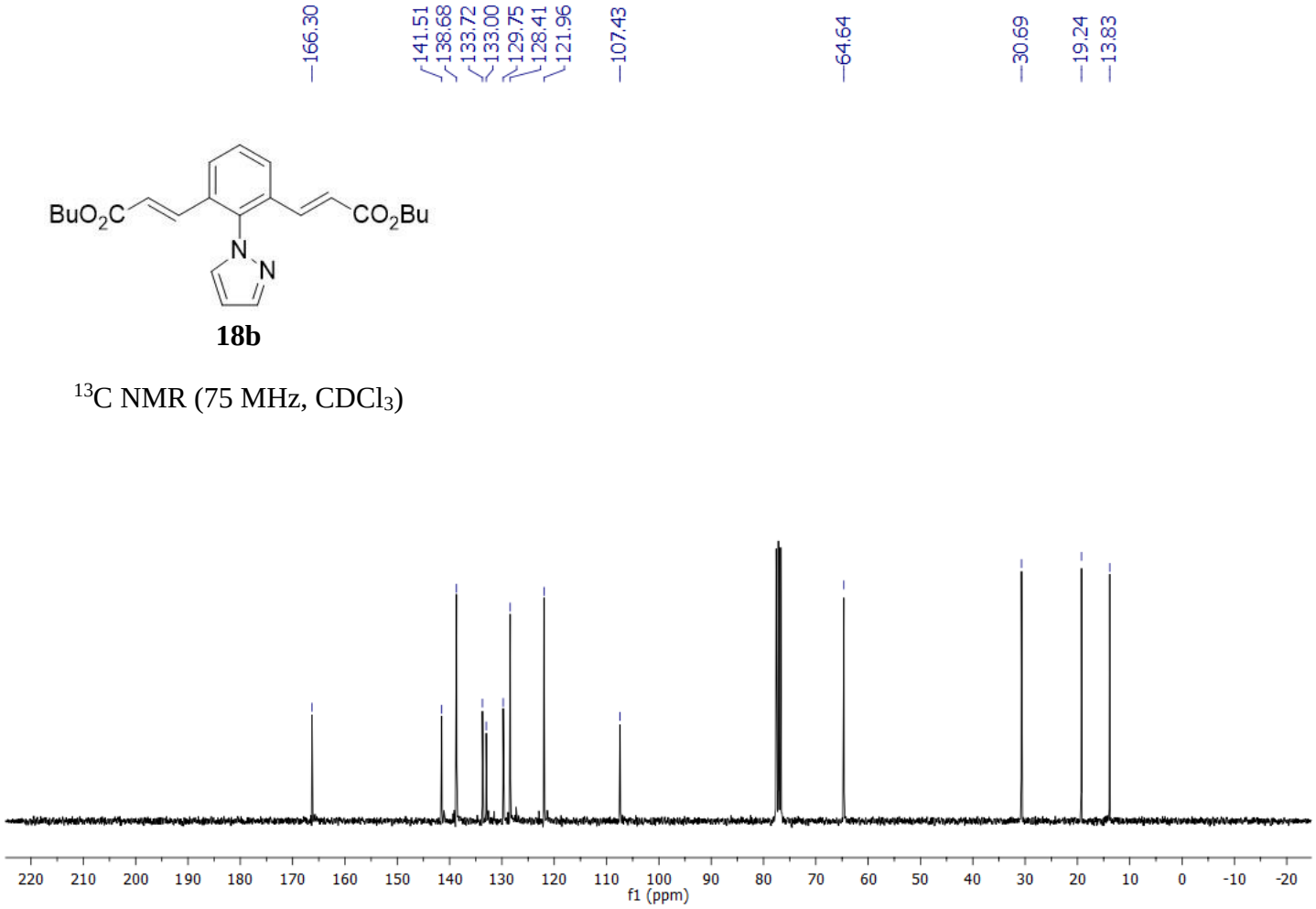
^{13}C NMR (101 MHz, $CDCl_3$)



18b

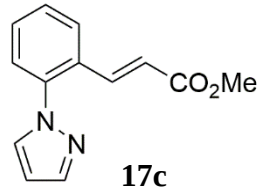
^{1}H NMR (300 MHz, $CDCl_3$)





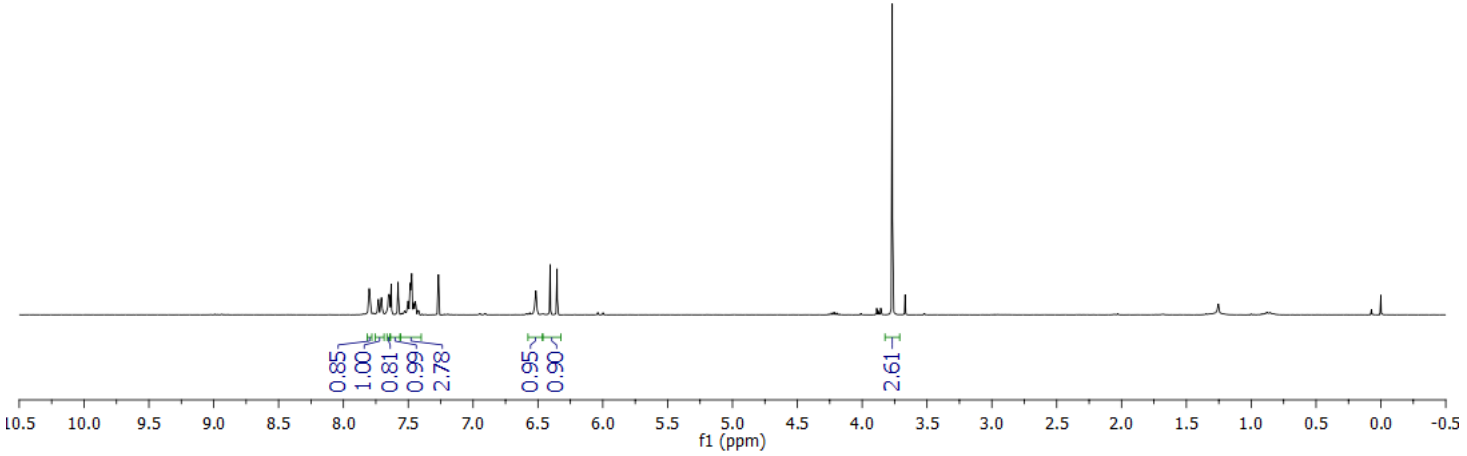
18b

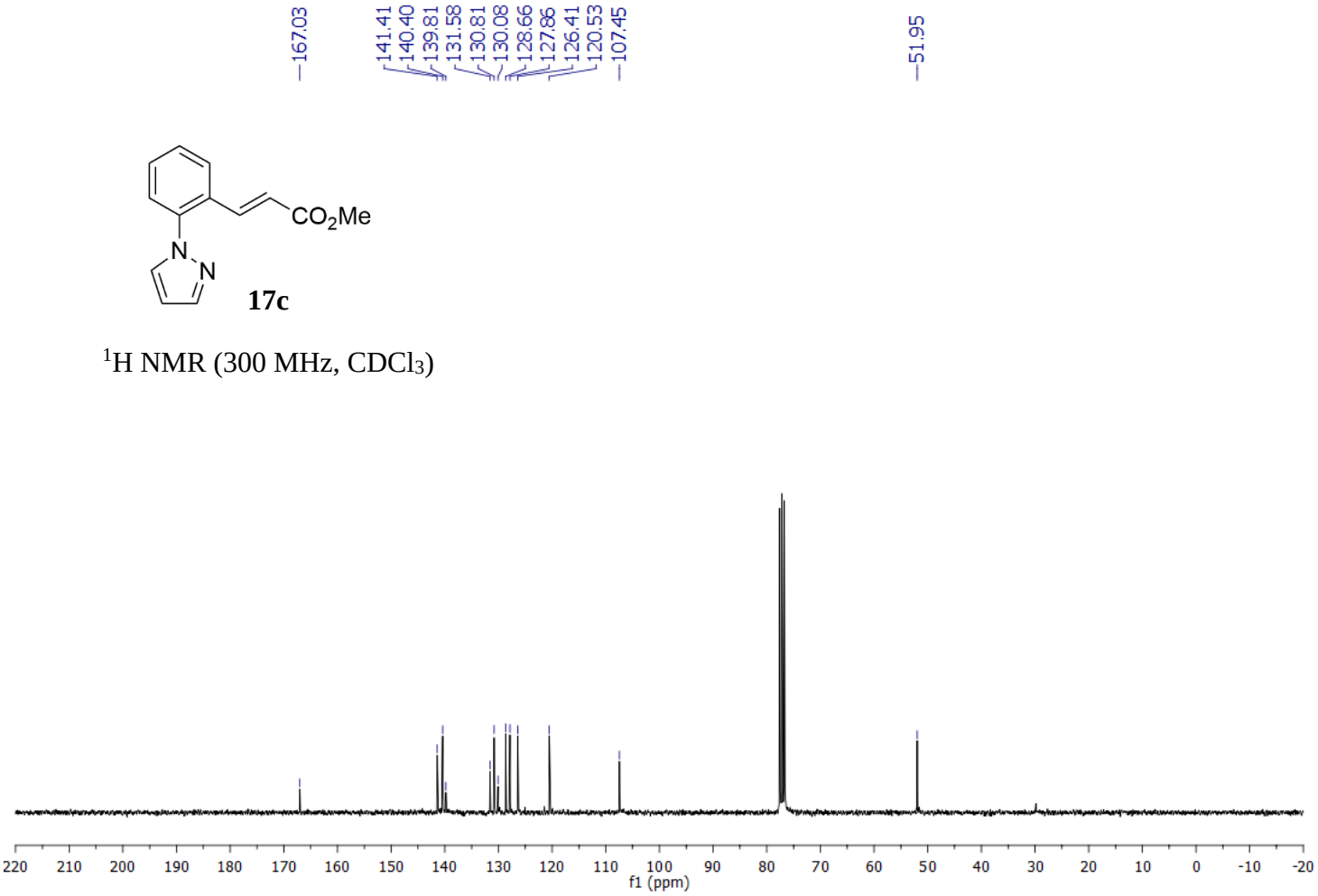
^{13}C NMR (75 MHz, $CDCl_3$)

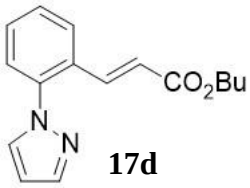


17c

^{1}H NMR (300 MHz, $CDCl_3$)

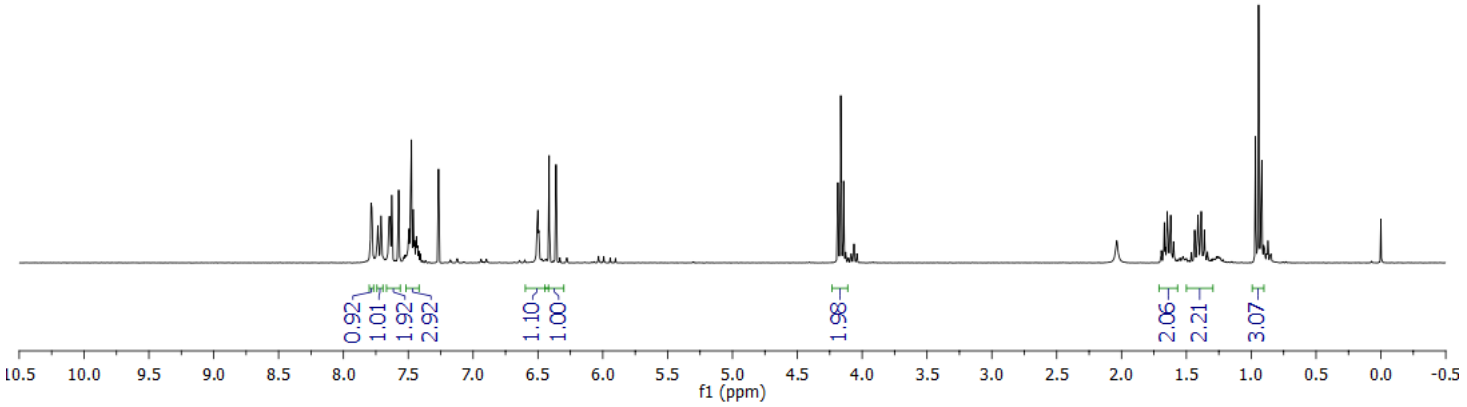


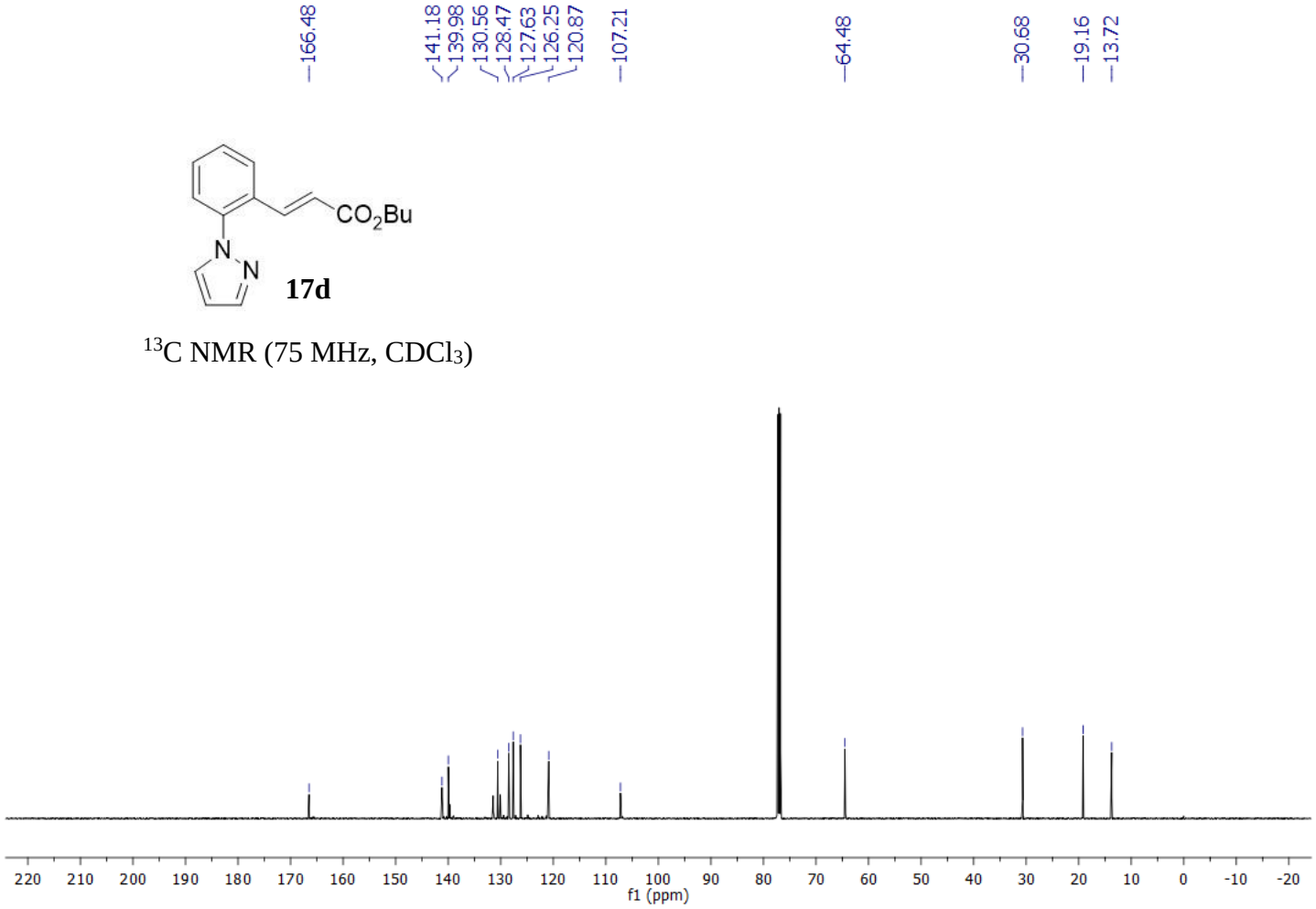

167.03
141.41
140.40
139.81
131.58
130.81
130.08
128.66
127.86
126.41
120.53
107.45
51.95
CO2Me
N
N
17c
1H NMR (300 MHz, CDCl3)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)



17d

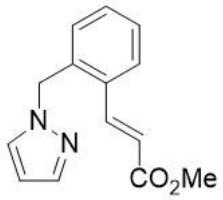
^{1}H NMR (300 MHz, $CDCl_3$)





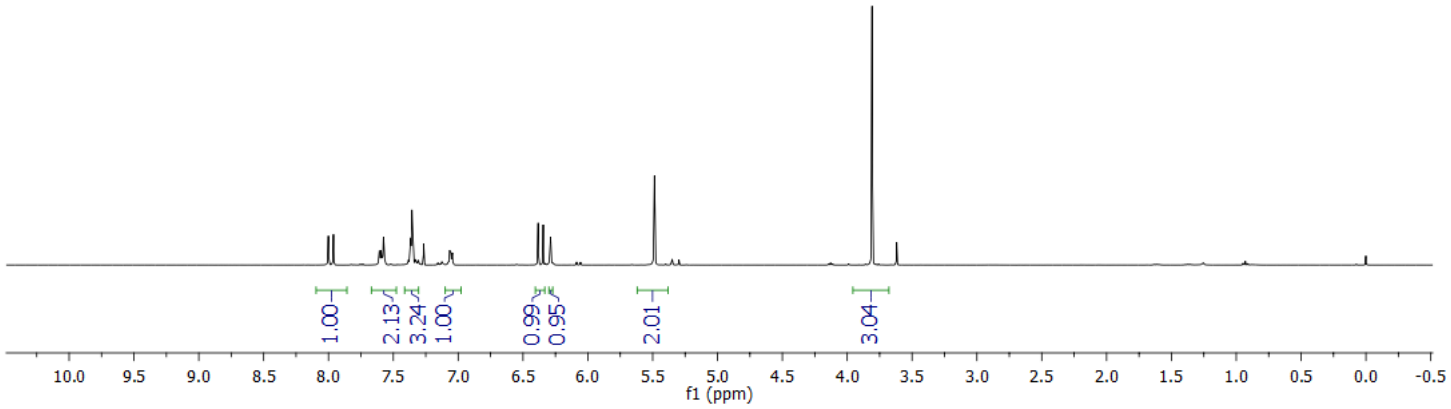
17d

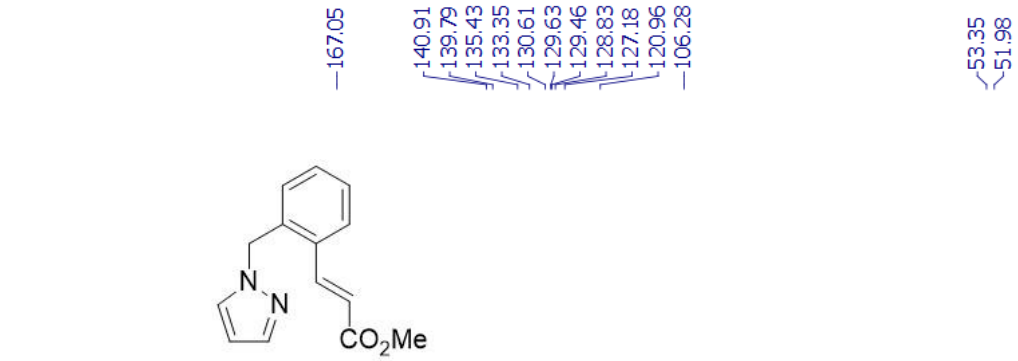
^{13}C NMR (75 MHz, $CDCl_3$)



17e

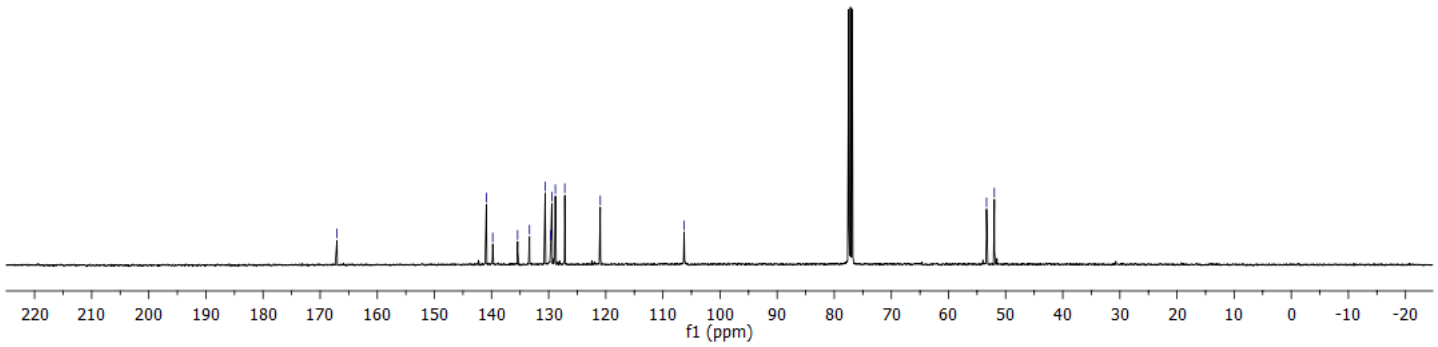
^{1}H NMR (400 MHz, $CDCl_3$)



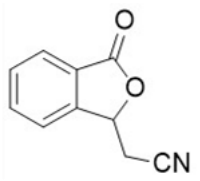


17e

^{13}C NMR (101 MHz, $CDCl_3$)

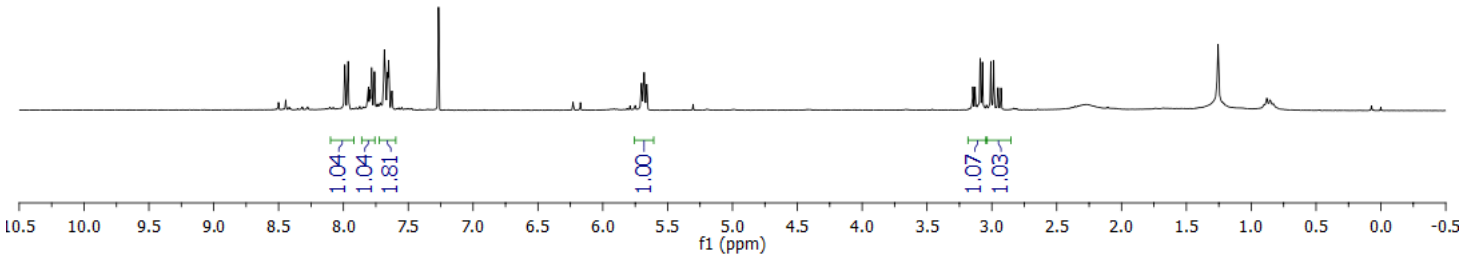


V. Gram scale experiment



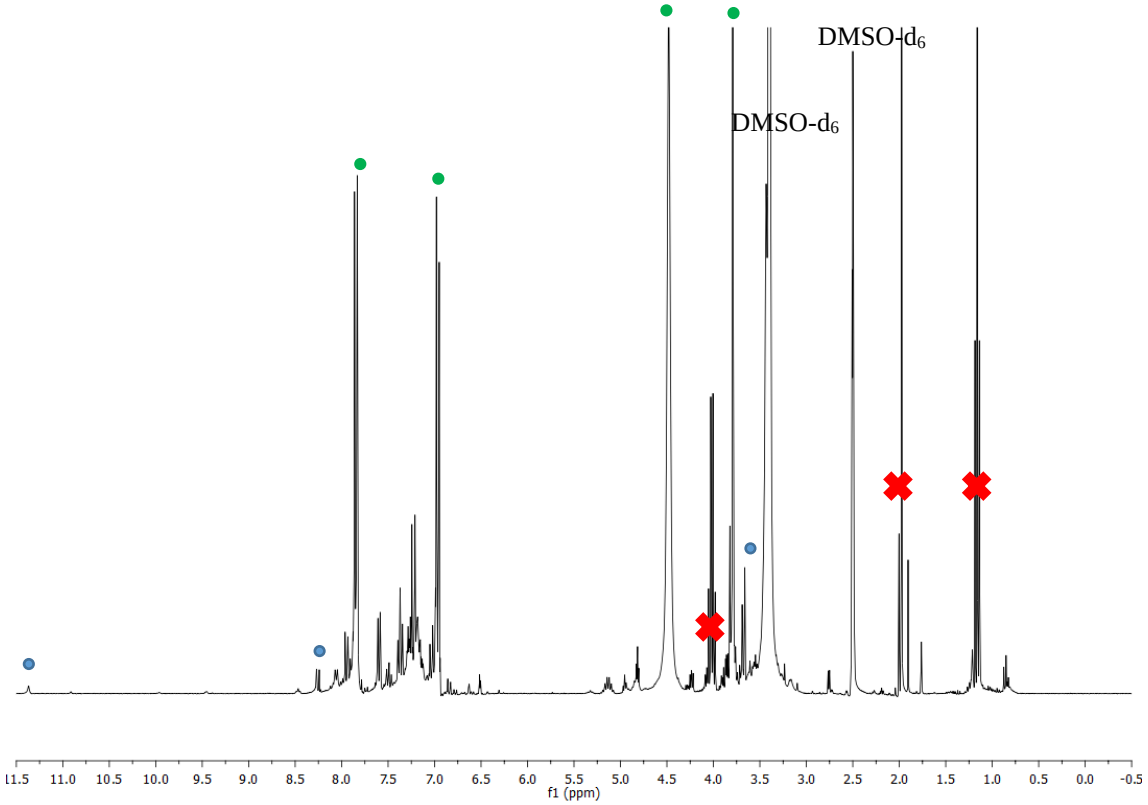
10a

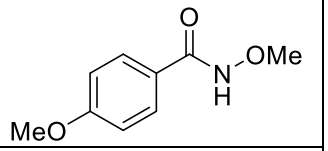
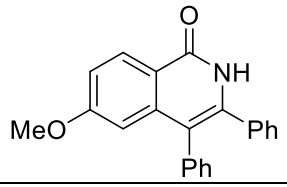
^{1}H NMR (400 MHz, $CDCl_3$)



VI. Studies of compound 3i

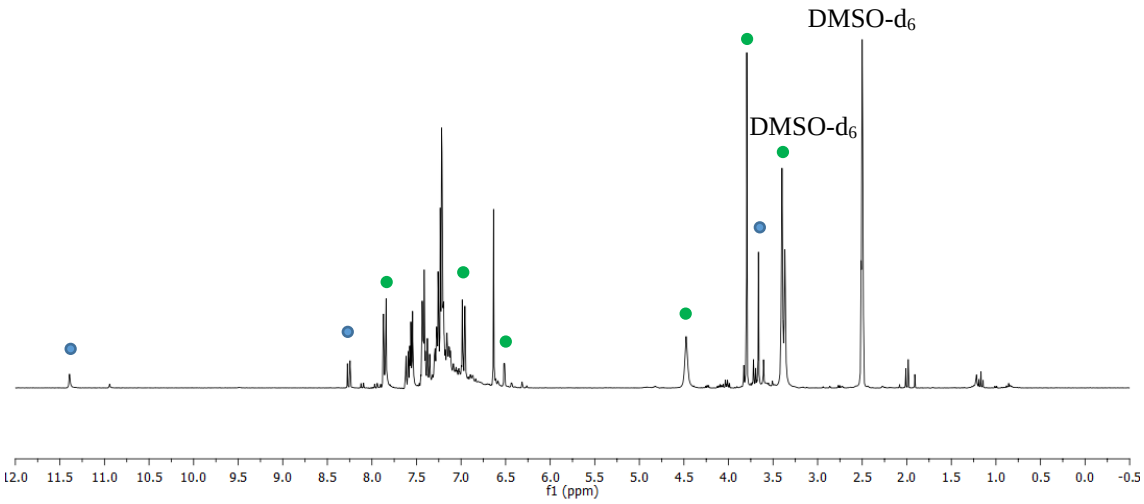
Crude of the reaction after 16 hours

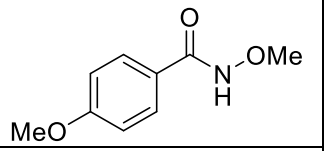
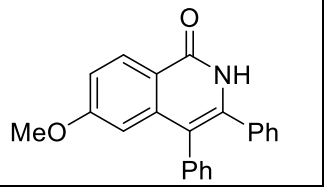


Colour	Molecule
	
	
✖	AcOEt

The rest of the signals correspond to diphenylacetylene, and the aromatic rings presented in all the compounds

Crude of the reaction after 48 hours



Colour	Molecule
	
	

The rest of the signals correspond to diphenylacetylene, and the aromatic rings presented in all the compounds