

Supporting Information for:

Highly Regioselective Iodination of Arenes via Iron(III)-Catalyzed Activation of *N*-Iodosuccinimide

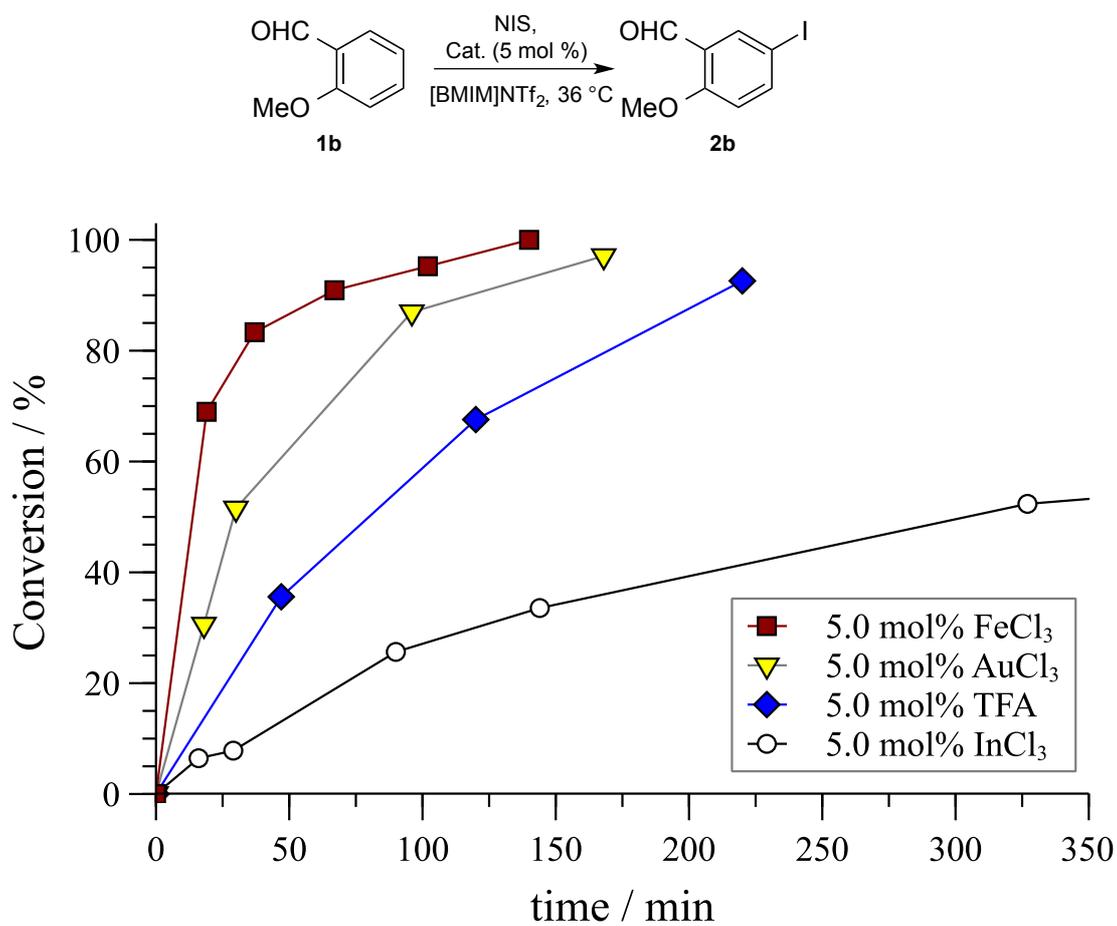
Daugirdas T. Racys,[†] Catherine E. Warrilow,[†] Sally L. Pimlott[§] and Andrew Sutherland*[†]

[†] *WestCHEM, School of Chemistry, The Joseph Black Building, University of Glasgow, Glasgow G12 8QQ, UK.* [§] *West of Scotland Radionuclide Dispensary, University of Glasgow and North Glasgow University Hospital NHS Trust, Glasgow G11 6NT, UK.*
Email: Andrew.Sutherland@glasgow.ac.uk; Fax: 0141 330 4888; Tel: 0141 330 5936.

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1. Rate Plot of Iodination of 1b with Various Catalysts in [BMIM]NTf₂ (measured by ¹H NMR spectroscopy).

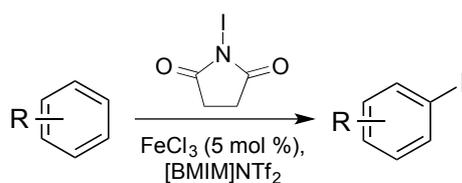


2. General Experimental

All reagents and starting materials were obtained from commercial sources and used as received. All dry solvents were purified using a PureSolv 500 MD solvent purification system. All reactions were performed under an atmosphere of argon unless otherwise stated. Brine is defined as a saturated solution of aqueous sodium chloride. Flash column chromatography was performed using silica gel 60 (35–70 mm). Aluminium-backed plates pre-coated with silica gel 60F₂₅₄ were used for thin layer chromatography and were visualized with a UV lamp or by staining with potassium permanganate. ¹H NMR spectra were recorded on a NMR spectrometer at either 400 or 500 MHz and data are reported as follows: chemical shift in ppm relative to tetramethylsilane as the internal standard, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet or overlap of nonequivalent resonances, integration). ¹³C NMR spectra were recorded on a NMR spectrometer at either 101 or 126 MHz and data are reported as follows: chemical shift in ppm relative to tetramethylsilane or the solvent as internal standard (CDCl₃, δ 77.0 ppm or DMSO-*d*₆, δ 39.5 ppm), multiplicity with respect to hydrogen (deduced from DEPT experiments, C, CH, CH₂ or CH₃). Infrared spectra were recorded on a FTIR spectrometer; wavenumbers are indicated in cm⁻¹. Mass spectra were recorded using electron impact, chemical ionization or electrospray techniques. HRMS spectra were recorded using a dual-focusing magnetic analyzer mass spectrometer. Melting points are uncorrected.

3. Experimental Procedures and Spectroscopic Data for All Compounds

General Iodination Procedure



To a small, dry vial (1.75 mL) fitted with a magnetic stirrer were added *N*-iodosuccinimide (110 mg, 1.0–1.1 equiv.), iron trichloride (3.6 mg, 5 mol%) and [BMIM]NTf₂ ionic liquid (0.2 mL) under an atmosphere of air. The mixture was stirred at room temperature for at least 0.15–0.5 h.[†] Substrate (1.0 equiv.) was added at once either neat or as solution in [BMIM]NTf₂ (0.1–0.4 mL) and the reaction mixture was stirred at the required temperature. The reaction progress was monitored by ¹H NMR spectroscopy. The reactions were stopped once all substrate was consumed.

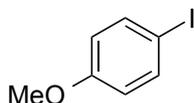
Workup Procedure:

Products soluble in hexane or hexane-ethyl acetate mixtures. The reaction mixture was extracted into hexane (3×100 mL) with the help of sonication in a water bath for 0.1 h; up to 2–5% ethyl acetate was added if the product was poorly soluble in hexane. The suspension was washed with an aqueous solution of 1 M sodium thiosulfate and brine, dried over MgSO_4 and then filtered through a pad of Celite®. The solvent was removed under reduced pressure. If necessary, the crude product was purified by column chromatography or by recrystallization.

Carboxylic acids and phenol derivatives. The reaction mixture was diluted with dichloromethane (40 mL) and extracted into an aqueous solution of 1 M sodium hydroxide or 1 M sodium hydrogencarbonate. The aqueous phase was separated and then acidified with 1 M hydrochloric acid, and extracted into dichloromethane or toluene (2×100 mL). The organic phase was dried over MgSO_4 and the solvent was removed under reduced pressure. If necessary, the crude product was purified by column chromatography or by recrystallization.

† Most substrates were added 0.5 h after premixing the iron trichloride with the ionic liquid. This ensures formation of the iron tris-triflimide species and reduces conversion times; the premixing of iron trichloride and the ionic liquid is critically important for aniline derivatives and other electron-rich and reactive substrates.

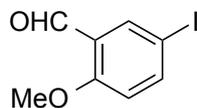
4-Iodoanisole (2a)¹ and recycling of [BMIM]NTf₂.



The initial reaction was performed as described in the general procedure using anisole (0.265 mL, 2.45 mmol), NIS (550 mg, 2.45 mmol), iron trichloride (18 mg, 0.11 mmol) and [BMIM]NTf₂ (1.0 mL). The reaction mixture was heated to 36 °C for 1.6 h and then the product was extracted into 2% ethyl acetate in hexane solution (4×70 mL) with the help of sonication in a water bath for 0.1 h. The resulting solution was filtered, washed with an aqueous solution of 1 M sodium thiosulfate, sodium hydrogen carbonate and brine, dried over MgSO_4 and then filtered through a pad of Celite®. The solvent was removed under reduced pressure to give an inseparable mixture of 4-iodoanisole and 2-iodoanisole, 93:7 (509 mg, 89%) as a white solid. Mp 40–43 °C. (lit.¹ 43–45 °C). The spectroscopic data are reported only for the major isomer; ¹H NMR (400 MHz, CDCl₃) δ 3.78 (s, 3H), 6.65–6.72 (m, 2H), 7.52–7.58 (m, 2H); ¹³C NMR (101 MHz, CDCl₃) δ 55.3 (CH₃), 82.7 (C), 116.4 (2 \times CH), 138.2 (2 \times CH), 159.5 (C); MS (EI) m/z 234 (M⁺, 96), 219 (55), 191 (12), 84 (100), 49 (66). The separated ionic liquid residue was dissolved in ethyl acetate, washed with

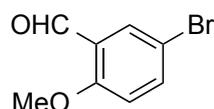
distilled water (3 × 50 mL), and then dried under reduced pressure at 75 °C for 6 h to give light brown viscous oil. The reaction was repeated twice using the recovered ionic liquid as described above. Yield of iodoanisole (**2a**): 91% (run 2), 90% (run 3).

2-Methoxy-5-iodobenzaldehyde (**2b**)²



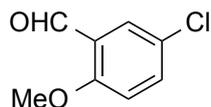
The reaction was performed as described in the general procedure using 2-methoxybenzaldehyde (**1b**) (30 mg, 0.22 mmol) and NIS (55 mg, 0.24 mmol). The reaction mixture was heated to 36 °C for 2.5 h and 2-methoxy-5-iodobenzaldehyde (**2b**) (50 mg, 88%) was isolated as a white solid. Mp 141–142 °C (lit.² 140–141 °C); ¹H NMR (500 MHz, CDCl₃) δ 3.91 (s, 3H), 6.78 (d, *J* 8.8 Hz, 1H), 7.81 (dd, *J* 8.8, 2.4 Hz, 1H), 8.09 (d, *J* 2.4 Hz, 1H), 10.34 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 55.9 (CH₃), 83.0 (C), 114.1 (CH), 126.6 (C), 137.1 (CH), 144.1 (CH), 161.4 (C), 188.2 (CH); MS (ESI) *m/z* 284 (MNa⁺, 35), 236 (100), 218 (10).

2-Methoxy-5-bromobenzaldehyde (**3b**)³



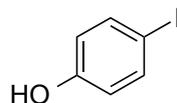
To a small, dry vial (1.75 mL) fitted with a magnetic stirrer were added *N*-bromosuccinimide (80 mg, 0.45 mmol), iron trichloride (3.7 mg, 0.023 mmol, 5 mol%) and [BMIM]NTf₂ ionic liquid (0.15 mL) under an atmosphere of air. The mixture was stirred at room temperature for 0.5 h before 2-methoxybenzaldehyde (**1b**) (59.6 mg, 0.44 mmol) in ionic liquid (0.10 mL) was added. The reaction mixture was heated to 36 °C for 1.5 h and the product (**3b**) (83 mg, 88%) was isolated as described in the general procedure as a white crystalline solid. Mp 112–114 °C (lit.³ 116–117 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.93 (s, 3H), 6.90 (d, *J* 8.9 Hz, 1H), 7.64 (dd, *J* 8.9, 2.6 Hz, 1H), 7.92 (d, *J* 2.6 Hz, 1H), 10.39 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 56.0 (CH₃), 113.5 (C), 113.7 (CH), 126.1 (C), 131.1 (CH), 138.3 (CH), 160.7 (C), 188.3 (CH); MS (EI) *m/z* 214 (M⁺, 100), 170 (30), 143 (20), 135 (8), 118 (24), 92 (10), 75 (27), 63 (30), 50 (12).

2-Methoxy-5-chlorobenzaldehyde (**4b**)⁴



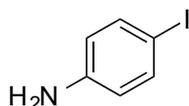
To a small, dry vial (1.75 mL) fitted with a magnetic stirrer were added *N*-chlorosuccinimide (77 mg, 0.57 mmol), iron trichloride (3.6 mg, 0.022 mmol, 5 mol%) and [BMIM]NTf₂ ionic liquid (0.20 mL) under an atmosphere of air. The mixture was stirred at room temperature for 0.5 h before 2-methoxybenzaldehyde (**1b**) (59.5 mg, 0.44 mmol) in anhydrous acetonitrile (80 μL) was added. The reaction mixture was heated to 70 °C for 18 h and the product (**4b**) (51 mg, 68%) was isolated as described in the general procedure as a white crystalline solid. Mp 78–79 °C (lit.⁴ 80–81 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.93 (s, 3H), 6.95 (d, *J* 8.9 Hz, 1H), 7.50 (dd, *J* 8.9, 2.8 Hz, 1H), 7.79 (d, *J* 2.8 Hz, 1H), 10.41 (s, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 56.0 (CH₃), 113.3 (CH), 125.7 (C), 126.4 (C), 128.0 (CH), 135.4 (CH), 160.3 (C), 188.5 (CH); MS (EI) *m/z* 170 (M⁺, 17), 153 (6), 84 (100), 49 (79), 44 (32).

4-Iodophenol (**2c**)⁵



The reaction was performed as described in the general procedure using phenol (**1c**) (94 mg, 0.48 mmol) and NIS (109 mg, 0.48 mmol). The reaction mixture was stirred at 20 °C for 0.5 h and 4-iodophenol (**2c**) (152 mg, 69%) was isolated as waxy solid. The data were consistent with the literature.⁵ ¹H NMR (400 MHz, CDCl₃) δ 4.68 (s, 1H), 6.63 (d, *J* 8.8 Hz, 2H), 7.52 (d, *J* 8.8 Hz, 2H); ¹³C NMR (126 MHz, CDCl₃) δ 82.7 (C), 117.8 (2 × CH), 138.5 (2 × CH), 155.3 (C); MS (EI) *m/z* 220 (M⁺, 100), 191 (3), 127 (6), 110 (5), 93 (37), 65 (20).

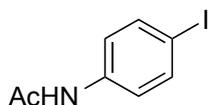
4-Iodoaniline (**2d**)⁶



The reaction was performed as described in the general procedure using aniline (**1d**) (45 μL, 0.49 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was stirred at 20 °C for 2 h and 4-iodoaniline (**2d**) (84 mg, 79%) was isolated as a white crystalline solid. Mp 53–55 °C (lit.⁶ 55–56.5 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.67 (s, 2H), 6.44–6.49 (m, 2H), 7.38–7.43 (m, 2H); ¹³C NMR

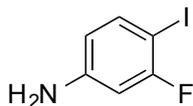
(101 MHz, CDCl₃) δ 79.4 (C), 117.3 (2 \times CH), 137.9 (2 \times CH), 146.0 (C); MS (EI) m/z 219 (M⁺, 100), 191 (3), 127 (12), 92 (43), 65 (31).

***N*-(4-Iodophenyl)acetamide (2e)**⁷



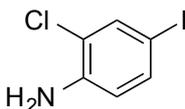
The reaction was performed as described in the general procedure using *N*-phenylacetamide (**1e**) (59 mg, 0.44 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 3 h and *N*-(4-iodophenyl)acetamide (**2e**) (83 mg, 73%) was isolated as a white solid. Mp 174–176 °C (lit.⁷ 178–180 °C); ¹H NMR (400 MHz, CDCl₃) δ 2.17 (s, 3H), 7.12 (br s, 1H), 7.29 (d, J 8.7 Hz, 2H), 7.62 (d, J 8.7 Hz, 2H); ¹³C NMR (101 MHz, CDCl₃) δ 24.7 (CH₃), 87.4 (C), 121.6 (2 \times CH), 137.6 (C), 137.9 (2 \times CH), 168.2 (C); MS (EI) m/z 261 (M⁺, 100), 219 (93), 92 (26), 65 (12).

3-Fluoro-4-iodoaniline (2f)⁸



The reaction was performed as described in the general procedure using 3-fluoroaniline (**1f**) (46 μ L, 0.48 mmol) and NIS (109 mg, 0.48 mmol). The reaction mixture was stirred at 20 °C for 2 h and 3-fluoro-4-iodoaniline (**2f**) (71 mg, 62%) was isolated as a white crystalline solid. Mp 67–69 °C (lit.⁸ 67–68.5 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.81 (br s, 2H), 6.27 (ddd, J 8.5, 2.5, 0.5 Hz, 1H), 6.42 (dd, J 9.9, 2.5 Hz, 1H), 7.41 (dd, J 8.5, 7.2 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 65.6 (d, ² J_{CF} 26.1 Hz, C), 102.5 (d, ² J_{CF} 27.1 Hz, CH), 112.9 (d, ⁴ J_{CF} 2.5 Hz, CH), 139.2 (d, ³ J_{CF} 3.4 Hz, CH), 148.6 (d, ³ J_{CF} 10.1 Hz, C), 162.3 (d, ¹ J_{CF} 242.9 Hz, C); MS (EI) m/z 237 (M⁺, 100), 224 (40), 183 (41), 165 (31), 155 (42), 125 (23), 110 (26), 91 (20), 83 (19), 63 (10).

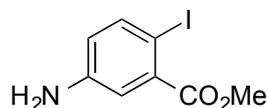
2-Chloro-4-iodoaniline (2g)⁹



The reaction was performed as described in the general procedure using 2-chloroaniline (**1g**) (51 μ L, 0.49 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was stirred at 20 °C for 1.3 h and 2-chloro-4-iodoaniline (**2g**) (95 mg, 77%) was isolated as a white crystalline solid. Mp 68–70 °C (lit.⁹ 68–70 °C); ¹H NMR (400 MHz, CDCl₃) δ 4.07 (s, 2H), 6.52 (d, J 8.4 Hz, 1H), 7.31 (dd, J

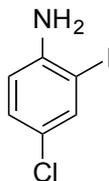
8.4, 2.0 Hz, 1H), 7.53 (d, *J* 2.0 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 77.9 (C), 117.4 (CH), 120.2 (C), 136.3 (CH), 137.2 (CH), 142.7 (C); MS (EI) *m/z* 253 (M⁺, 100), 126 (27), 90 (21), 63 (12).

Methyl 3-amino-6-iodobenzoate (**2h**)¹⁰



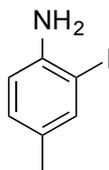
The reaction was performed as described in the general procedure using methyl 3-aminobenzoate (**1h**) (73 mg, 0.48 mmol) and NIS (108 mg, 0.48 mmol). The reaction mixture was stirred at 20 °C for 1 h. Dichloromethane (~ 20 μL) was added and the reaction mixture was stirred for a further 2 h. Methyl 3-amino-6-iodobenzoate (**2h**) (75 mg, 63%) was isolated as a light brown oil. The data were consistent with the literature.¹⁰ ¹H NMR (400 MHz, CDCl₃) δ 3.79 (s, 2H), 3.91 (s, 3H), 6.52 (dd, *J* 8.4, 2.7 Hz, 1H), 7.14 (d, *J* 2.7 Hz, 1H), 7.68 (d, *J* 8.4 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 52.5 (CH₃), 78.8 (C), 117.6 (CH), 119.7 (CH), 135.6 (C), 141.6 (CH), 146.3 (C), 167.1 (C); MS (EI) *m/z* 277 (M⁺, 100), 246 (33), 218 (16), 133 (19), 91 (13), 77 (9).

2-Iodo-4-chloroaniline (**2i**)¹¹



The reaction was performed as described in the general procedure using 4-chloroaniline (**1i**) (62 mg, 0.49 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was stirred at 20 °C for 4.7 h and 2-iodo-4-chloroaniline (**2i**) (99 mg, 79%) was isolated as an off-white solid. Mp 38–40 °C (lit.¹¹ 39 °C); ¹H NMR (500 MHz, CDCl₃) δ 4.09 (s, 2H), 6.66 (d, *J* 8.5 Hz, 1H), 7.10 (dd, *J* 8.5, 2.3 Hz, 1H), 7.60 (d, *J* 2.3 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 83.5 (C), 115.0 (CH), 123.2 (C), 129.2 (CH), 137.8 (CH), 145.6 (C); MS (CI) *m/z* 254 (MH⁺, 100), 169 (10), 128 (39), 85 (30), 69 (50).

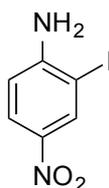
2-Iodo-4-methylaniline (**2j**)¹²



The reaction was performed as described in the general procedure using 4-methylaniline (**1j**) (52 mg, 0.48 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was stirred at 20 °C for 10

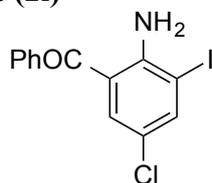
min and 2-iodo-4-methylaniline (**2j**) (74 mg, 65%) was isolated as a brown oil. The data were consistent with the literature.¹² ¹H NMR (500 MHz, CDCl₃) δ 2.20 (s, 3H), 3.93 (br s, 2H), 6.65 (d, *J* 8.0 Hz, 1H), 6.94 (dd, *J* 8.0, 1.4 Hz, 1H), 7.47 (d, *J* 1.4 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 19.8 (CH₃), 84.3 (C), 114.7 (CH), 129.5 (C), 130.1 (CH), 139.0 (CH), 144.3 (C); MS (CI) *m/z* 234 (MH⁺, 100), 149 (5), 108 (12), 85 (7), 69 (11).

2-Iodo-4-nitroaniline (**2k**)¹³



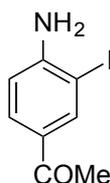
The reaction was performed as described in the general procedure using 4-nitroaniline (**1k**) (71 mg, 0.51 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 30 °C for 2 h and 2-iodo-4-nitroaniline (**2k**) (99 mg, 73%) was isolated as a yellow solid. Mp 99–100 °C (lit.¹³ 103–104 °C); ¹H NMR (400 MHz, CDCl₃) δ 4.83 (br s, 2H), 6.70 (d, *J* 9.0 Hz, 1H), 8.06 (dd, *J* 9.0, 2.5 Hz, 1H), 8.57 (d, *J* 2.5 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 80.5 (C), 112.3 (CH), 125.7 (CH), 135.5 (CH), 139.3 (C), 152.3 (C); MS (EI) *m/z* 264 (M⁺, 100), 234 (38), 218 (11), 127 (5), 91 (31).

2-Amino-3-iodo-5-chlorobenzophenone (**2l**)



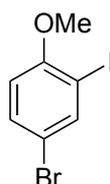
The reaction was performed as described in the general procedure using 2-amino-5-chlorobenzophenone (**1l**) (109 mg, 0.47 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 14 h and 2-amino-3-iodo-5-chlorobenzophenone (**2l**) (147 mg, 88%) was isolated as a bright yellow solid. Mp 88–90 °C; IR (neat) 3396, 3289, 1634, 1596, 1564, 1518, 1226, 952, 880 cm⁻¹; ¹H NMR (500 MHz, CDCl₃) δ 6.66 (br s, 2H), 7.44 (d, *J* 2.4 Hz, 1H), 7.46–7.51 (m, 2H), 7.55–7.64 (m, 3H), 7.81 (d, *J* 2.4 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 86.7 (C), 118.4 (C), 120.2 (C), 128.4 (2 × CH), 129.2 (2 × CH), 131.9 (CH), 133.8 (CH), 138.7 (C), 143.0 (CH), 148.7 (C), 197.3 (C); MS (EI) *m/z* 357 (M⁺, 100), 280 (12), 229 (13), 125 (14), 105 (21), 77 (23); HRMS (EI) calcd for C₁₃H₉³⁵ClINO (M⁺), 356.9417, found 356.9419.

3-Iodo-4-aminoacetophenone (**2m**)¹⁴



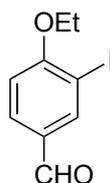
The reaction was performed as described in the general procedure using 4-aminoacetophenone (**1m**) (66 mg, 0.48 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 24 h and 3-iodo-4-aminoacetophenone (**2m**) (90 mg, 72%) was isolated as yellowish oil. The data were consistent with the literature.¹⁴ ¹H NMR (500 MHz, CDCl₃) δ 2.49 (s, 3H), 4.62 (br s, 2H), 6.71 (d, *J* 8.4 Hz, 1H), 7.76 (dd, *J* 8.4, 2.0 Hz, 1H), 8.27 (d, *J* 2.0 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 26.0 (CH₃), 82.6 (C), 113.1 (CH), 129.3 (C), 130.3 (CH), 140.3 (CH), 150.9 (C), 195.1 (C); MS (CI) *m/z* 262 (MH⁺, 100), 136 (48), 85 (10), 69 (18).

2-Iodo-4-bromoanisole (**2n**)¹⁵



The reaction was performed as described in the general procedure using 4-bromoanisole (**1n**) (56 μL, 0.44 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 6 h and 2-iodo-4-bromoanisole (**2n**) (122 mg, 88%) was isolated as light brown oil. The data were consistent with the literature.¹⁵ ¹H NMR (500 MHz, CDCl₃) δ 3.86 (s, 3H), 6.69 (d, *J* 8.7 Hz, 1H), 7.41 (dd, *J* 8.7, 2.4 Hz, 1H), 7.88 (d, *J* 2.4 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 56.6 (CH₃), 86.7 (C), 112.0 (CH), 113.4 (C), 132.2 (CH), 141.2 (CH), 157.5 (C); MS (EI) *m/z* 312 (M⁺, 100), 297 (44), 269 (13), 170 (26), 127 (6), 63 (19).

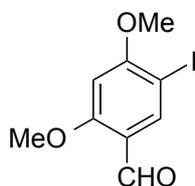
3-Iodo-4-ethoxybenzaldehyde (**2o**)¹⁶



The reaction was performed as described in the general procedure using 4-ethoxybenzaldehyde (**1o**) (30 μL, 0.22 mmol) and NIS (55 mg, 0.24 mmol). The reaction mixture was heated to 36 °C for 24 h and 3-iodo-4-ethoxybenzaldehyde (**2o**) (49 mg, 81%) was isolated as a white solid. Mp 78–81 °C (lit.¹⁶ 81 °C); ¹H NMR (500 MHz, CDCl₃) δ 1.53 (t, *J* 6.9 Hz, 3H), 4.19 (q, *J* 6.9 Hz, 2H), 6.88 (d, *J*

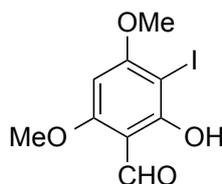
8.5 Hz, 1H), 7.83 (dd, *J* 8.5, 2.0 Hz, 1H), 8.31 (d, *J* 2.0 Hz, 1H), 9.81 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 14.5 (CH₃), 65.4 (CH₂), 87.0 (C), 111.3 (CH), 131.2 (C), 131.9 (CH), 141.2 (CH), 162.3 (C), 189.4 (CH); MS (EI) *m/z* 276 (M⁺, 42), 261 (72), 246 (100), 218 (10), 119 (11), 91 (24).

2,4-Dimethoxy-5-iodobenzaldehyde (**2p**)¹⁷



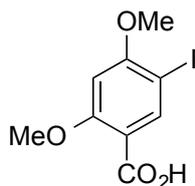
The reaction was performed as described in the general procedure using 2,4-dimethoxybenzaldehyde (**1p**) (74 mg, 0.44 mmol) and NIS (110 mg, 0.49 mmol) and a co-solvent system of ionic liquid (0.37 mL) and dichloromethane (0.2 mL). The reaction mixture was stirred at 20 °C for 2 h and 2,4-dimethoxy-5-iodobenzaldehyde (**2p**) (87 mg, 67%) was isolated as a white solid. Mp 171–172 °C (lit.¹⁷ 170–172 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.95 (s, 3H), 3.97 (s, 3H), 6.40 (s, 1H), 8.22 (s, 1H), 10.20 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 55.9 (CH₃), 56.6 (CH₃), 75.6 (C), 94.8 (CH), 120.5 (C), 139.3 (CH), 163.8 (C), 164.1 (C), 186.9 (CH); MS (EI) *m/z* 292 (M⁺, 100), 246 (15), 148 (13), 84 (29), 49 (27).

2,4-Dimethoxy-5-iodo-6-hydroxybenzaldehyde (**2q**)



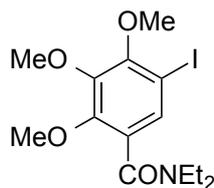
The reaction was performed as described in the general procedure using 2,4-dimethoxy-6-hydroxybenzaldehyde (**1q**) (84 mg, 0.46 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was stirred at 20 °C for 6 h and 2,4-dimethoxy-5-iodo-6-hydroxybenzaldehyde (**2q**) (112 mg, 80%) was isolated as an off-white solid. Mp 205–208 °C (decomp.); IR (neat) 3022, 2943, 1635, 1603, 1462, 1449, 1293, 1233, 1210, 1177, 1127, 1080, 977, 783 cm⁻¹; ¹H NMR (400 MHz, CDCl₃) δ 3.94 (s, 3H), 3.98 (s, 3H), 6.00 (s, 1H), 10.00 (s, 1H), 13.22 (s, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 56.0 (CH₃), 56.7 (CH₃), 65.7 (C), 86.7 (CH), 106.4 (C), 164.0 (C), 164.8 (C), 166.0 (C), 191.5 (C); MS (EI) 308 (M⁺, 100), 277 (13), 246 (11), 163 (20), 91 (8), 69 (7); HRMS (EI) calcd for C₉H₉IO₄ (M⁺), 307.9546, found 307.9547.

2,4-Dimethoxy-5-iodobenzoic acid (**2r**)¹⁸



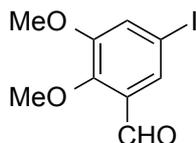
The reaction was performed as described in the general procedure using 2,4-dimethoxybenzoic acid (**1r**) (79 mg, 0.44 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 4 h and 2,4-dimethoxy-5-iodobenzoic acid (**2r**) (99 mg, 74%) was isolated as a white solid. Mp 204–205 °C (lit.¹⁸ 209.5–210.5 °C); ¹H NMR (500 MHz, DMSO-*d*₆) δ 3.87 (s, 3H), 3.93 (s, 3H), 6.70 (s, 1H), 8.04 (s, 1H); ¹³C NMR (126 MHz, DMSO-*d*₆) δ 56.6 (CH₃), 57.3 (CH₃), 74.1 (C), 97.7 (CH), 114.9 (C), 141.6 (CH), 161.7 (C), 162.2 (C), 165.7 (C); MS (EI) *m/z* 308 (M⁺, 100), 291 (16), 261 (14), 233 (10), 152 (11), 95 (7).

N,N-Diethyl-2,3,4-trimethoxy-5-iodobenzamide (**2s**)



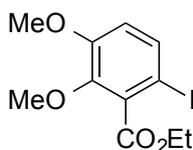
The reaction was performed as described in the general procedure using *N,N*-diethyl-2,3,4-trimethoxybenzamide (**1s**) (111 mg, 0.42 mmol) and NIS (106 mg, 0.47 mmol). The reaction mixture was heated to 50 °C for 1 h and *N,N*-diethyl-2,3,4-trimethoxy-5-iodobenzamide (**2s**) (123 mg, 75%) was isolated as colorless oil. IR (neat) 2973, 1626, 1580, 1455, 1394, 1292, 1220, 1070, 999 cm⁻¹; ¹H NMR (400 MHz, CDCl₃) δ 1.07 (t, *J* 7.2 Hz, 3H), 1.24 (t, *J* 7.2 Hz, 3H), 3.17 (q, *J* 7.2 Hz, 2H), 3.43 (br s, 1H), 3.66 (br s, 1H), 3.88 (s, 3H), 3.89 (s, 3H), 3.91 (s, 3H), 7.33 (s, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 12.8 (CH₃), 14.0 (CH₃), 39.0 (CH₂), 43.1 (CH₂), 60.9 (CH₃), 61.1 (CH₃), 61.7 (CH₃), 85.6 (C), 129.8 (C), 130.3 (CH), 146.6 (C), 150.6 (C), 154.1 (C), 166.6 (C); MS (EI) *m/z* 393 (M⁺, 56), 321 (100), 266 (10), 195 (5), 105 (8), 73 (7); HRMS (EI) calcd for C₁₄H₂₀INO₄ (M⁺), 393.0437, found 393.0435.

2,3-Dimethoxy-5-iodobenzaldehyde (**2t**)¹⁹



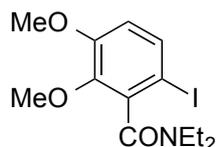
The reaction was performed as described in the general procedure using 2,3-dimethoxybenzaldehyde (**1t**) (68 mg, 0.41 mmol) and NIS (102 mg, 0.45 mmol). The reaction mixture was heated to 36 °C for 4.5 h. Purification by silica column chromatography eluting with 5% ethyl acetate in petroleum ether (40–60 °C) afforded 2,3-dimethoxy-5-iodobenzaldehyde (**2t**) (68 mg, 58%) as a white solid. Mp 97–98 °C (lit.¹⁹ 97–98 °C); ¹H NMR (500 MHz, CDCl₃) δ 3.90 (s, 3H), 3.98 (s, 3H), 7.38 (d, *J* 2.0 Hz, 1H), 7.73 (d, *J* 2.0 Hz, 1H), 10.30 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 56.3 (CH₃), 62.4 (CH₃), 87.0 (C), 126.7 (CH), 128.2 (CH), 130.9 (C), 152.6 (C), 153.8 (C), 188.5 (CH); MS (EI) *m/z* 292 (M⁺, 100), 277 (17), 234 (10), 161 (9), 132 (9).

Ethyl 2,3-dimethoxy-6-iodobenzoate (**2u**)



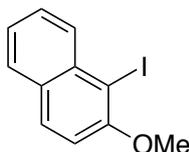
The reaction was performed as described in the general procedure using ethyl 2,3-dimethoxybenzoate (**1u**) (93 mg, 0.44 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 5 h and ethyl 2,3-dimethoxy-6-iodobenzoate (**2u**) (104 mg, 70%) was isolated as lightly yellow oil. IR (neat) 2939, 1728, 1570, 1471, 1260, 1051, 1000 cm⁻¹; ¹H NMR (500 MHz, CDCl₃) δ 1.41 (t, *J* 7.1 Hz, 3H), 3.85 (s, 6H), 4.43 (q, *J* 7.1 Hz, 2H), 6.70 (d, *J* 8.7 Hz, 1H), 7.46 (d, *J* 8.7 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 14.2 (CH₃), 56.0 (CH₃), 61.7 (CH₃), 61.9 (CH₂), 79.5 (C), 115.2 (CH), 134.3 (CH), 135.7 (C), 146.8 (C), 153.0 (C), 166.9 (C); MS (EI) *m/z* 336 (M⁺, 100), 291 (63), 261 (9), 233 (10), 165 (4); HRMS (EI) calcd for C₁₁H₁₃IO₄ (M⁺), 335.9859, found 335.9858.

N,N-Diethyl-2,3-dimethoxy-6-iodobenzamide (**2v**)²⁰



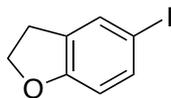
The reaction was performed as described in the general procedure using *N,N*-diethyl-2,3-dimethoxybenzamide (**1v**) (89 mg, 0.44 mmol) and NIS (105 mg, 0.47 mmol). The reaction mixture was heated to 50 °C for 4 h and *N,N*-diethyl-2,3-dimethoxy-6-iodobenzamide (**2v**) (62 mg, 68%) was isolated as colorless oil. The data were consistent with the literature.²⁰ ¹H NMR (400 MHz, CDCl₃) δ 1.11 (t, *J* 7.2 Hz, 3H), 1.29 (t, *J* 7.1 Hz, 3H), 3.04–3.22 (m, 2H), 3.39–3.50 (m, 1H), 3.67–3.79 (m 1H), 3.84 (s, 3H), 3.86 (s, 3H), 6.66 (d, *J* 8.7 Hz, 1H), 7.48 (d, *J* 8.7 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 12.4 (CH₃), 13.7 (CH₃), 38.8 (CH₂), 42.9 (CH₂), 55.9 (CH₃), 61.8 (CH₃), 81.2 (C), 114.0 (CH), 134.6 (CH), 137.8 (C), 145.8 (C), 153.2 (C), 167.4 (C); MS (EI) *m/z* 363 (M⁺, 39), 323 (17), 291 (100), 236 (50), 165 (15), 121 (9).

1-Iodo-2-methoxynaphthalene (**2w**)²¹



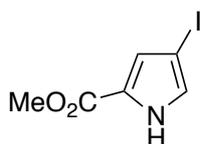
The reaction was performed as described in the general procedure using 2-methoxynaphthalene (**1w**) (76 mg, 0.48 mmol), dichloromethane (60 μL) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 1 h and 1-iodo-2-methoxynaphthalene (108 mg, 79%) was isolated as a light yellow solid. Mp 84–86 °C (lit.²¹ 86–87 °C); ¹H NMR (400 MHz, CDCl₃) δ 4.03 (s, 3H), 7.22 (d, *J* 8.9 Hz, 1H), 7.38 (ddd, *J* 8.1, 6.9, 1.2 Hz, 1H), 7.54 (ddd, *J* 8.6, 6.9, 1.2 Hz, 1H), 7.74 (ddd, *J* 8.1, 1.2, 0.6 Hz, 1H), 7.83 (d, *J* 8.9 Hz, 1H), 8.14 (ddd, *J* 8.6, 1.2, 0.6 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 57.3 (CH₃), 87.7 (C), 112.9 (CH), 124.4 (CH), 128.1 (CH), 128.2 (CH), 129.9 (C), 130.4 (CH), 131.2 (CH), 135.6 (C), 156.6 (C); MS (EI) *m/z* 284 (M⁺, 52), 241 (21), 142 (20), 114 (23), 84 (24), 44 (100).

5-Iodo-2,3-dihydrobenzofuran (**2x**)²²



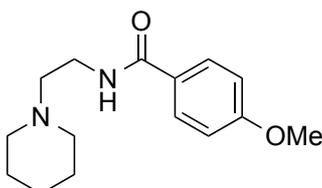
The reaction was performed as described in the general procedure using 2,3-dihydrobenzofuran (**1x**) (54 μ L, 0.48 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 1 h and 5-iodo-2,3-dihydrobenzofuran (**2x**) (107 mg, 91%) was isolated as a white solid. Mp 61–63 °C (lit.²² 64–65 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.20 (br t, *J* 8.7 Hz, 2H), 4.56 (t, *J* 8.7 Hz, 2H), 6.57 (d, *J* 8.4 Hz, 1H), 7.38 (ddt, *J* 8.4, 1.9, 0.7 Hz, 1H), 7.47 (dt, *J* 1.9, 1.1 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 29.5 (CH₂), 71.4 (CH₂), 81.6 (C), 111.7 (CH), 130.1 (C), 133.7 (CH), 136.7 (CH), 160.0 (C); MS (EI) *m/z* 246 (M⁺, 89), 232 (10), 117 (20), 91 (41), 84 (39), 44 (100).

Methyl 4-iodo-1H-pyrrole-2-carboxylate (**2y**)²³



The reaction was performed as described in the general procedure using methyl 1H-pyrrole-2-carboxylate (**1y**) (60.5 mg, 0.48 mmol) and NIS (110 mg, 0.49 mmol). The reaction mixture was heated to 36 °C for 1.1 h and methyl 4-iodo-1H-pyrrole-2-carboxylate (**2y**) (93 mg, 76%) was isolated as a white solid. Mp 87–90 °C (lit.²³ 87–89 °C); ¹H NMR (400 MHz, CDCl₃) δ 3.86 (s, 3H), 6.98 (dd, *J* 2.7, 1.5 Hz, 1H), 7.00 (dd, *J* 2.7, 1.5 Hz, 1H), 9.10 (br s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 51.8 (CH₃), 61.7 (C), 121.7 (CH), 124.4 (C), 127.6 (CH), 160.5 (C); MS (EI) *m/z* 251 (M⁺, 100), 219 (70), 192 (11), 124 (5), 93 (6), 65 (8), 44 (10).

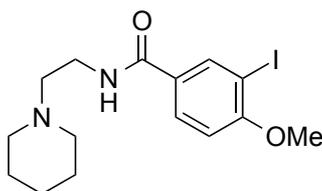
N-[2'-(1''-Piperidinyl)ethyl]-4-methoxybenzamide (**5**)²⁴



1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (1.44 g, 7.5 mmol), hydroxybenzotriazole (1.08 g, 8.0 mmol) and 4-methoxybenzoic acid (761 mg, 5.0 mmol) were dissolved in anhydrous dichloromethane (20 mL). *N,N*-Diisopropylethylamine (2.8 mL, 16 mmol)

was added and the mixture was stirred at room temperature for 1 h. 2-(1'-Piperidyl)ethylamine (1.00 mL, 5.0 mmol) was added and the reaction mixture was stirred at room temperature for 24 h. The mixture was diluted with dichloromethane (100 mL) and extracted with 1 M hydrochloric acid (100 mL). The aqueous layer was neutralized with 1 M sodium hydroxide (~120 mL) and extracted with dichloromethane (3 × 100 mL). The organic layer was dried over MgSO₄ and concentrated under reduced pressure to give a crude yellow oil. Purification by column chromatography eluting with 5 to 10% methanol in dichloromethane gave *N*-[2'-(1''-piperidinyl)ethyl]-4-methoxybenzamide (**5**) (916 mg, 70%) as a colorless solid. Mp 71–73 °C; The data were consistent with the literature.²⁴ ¹H NMR (500 MHz, CDCl₃) δ 1.42–1.51 (m, 2H), 1.57–1.66 (m, 4H), 2.39–2.49 (br m, 4H), 2.55 (t, *J* 6.1 Hz, 2H), 3.51 (td, *J* 6.1, 4.7 Hz, 2H), 3.85 (s, 3H), 6.86 (br s, 1H), 6.91–6.97 (m, 2H), 7.73–7.78 (m, 2H); ¹³C NMR (126 MHz, CDCl₃) δ 24.4 (CH₂), 26.1 (2 × CH₂), 36.4 (CH₂), 54.2 (2 × CH₂), 55.4 (CH₃), 57.0 (CH₂), 113.7 (2 × CH), 127.1 (C), 128.7 (2 × CH), 162.0 (C), 166.8 (C); MS (ESI) *m/z* 263 (MH⁺, 75), 178 (100).

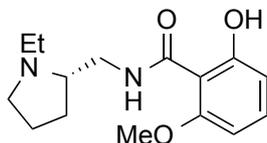
***N*-[2'-(1''-Piperidinyl)ethyl]-3-iodo-4-methoxybenzamide (**6**)²⁴**



N-[2'-(1''-Piperidinyl)ethyl]-4-methoxybenzamide (**5**) (50 mg, 0.19 mmol) was suspended in methanol (2 mL) and then tetrafluoroboric acid (25.0 μL, 0.19 mmol, 48% wt in water) was added at room temperature. The resulting solution was concentrated to a yellowish gum under reduced pressure. The salt was mixed with NIS (57 mg, 0.25 mmol), iron trichloride (1.6 mg, 5 mol%), acetonitrile (80 μL) and [BMIM]NTf₂ (0.30 mL). The reaction mixture was heated to 36 °C for 3.2 h. The reaction mixture was diluted with dichloromethane (30 mL), washed with 1 M sodium hydrogencarbonate (3 × 50 mL), 1 M sodium thiosulfate (100 mL), brine (100 mL) and sodium carbonate (100 mL), then dried over MgSO₄ and concentrated under reduced pressure. The crude gum was extracted with a 1% ethyl acetate in hexane solution (4 × 100 mL) under sonication, filtered through a bed of Celite® and concentrated under reduced pressure to give *N*-[2'-(1''-piperidinyl)ethyl]-3-iodo-4-methoxybenzamide (**6**) (62 mg, 84%) as a viscous colorless oil. The data were consistent with the literature.²⁴ ¹H NMR (500 MHz, CDCl₃) δ 1.42–1.51 (m, 2H), 1.56–1.64 (m, 4H), 2.35–2.48 (br m, 4H), 2.54 (t, *J* 6.1 Hz, 2H), 3.49 (td, *J* 6.1, 4.7 Hz, 2H), 3.93 (s, 3H), 6.80 (br s, 1H), 6.84 (d, *J* 8.6 Hz, 1H), 7.77 (dd, *J* 8.6, 2.2 Hz, 1H), 8.21 (d, *J* 2.2 Hz, 1H); ¹³C

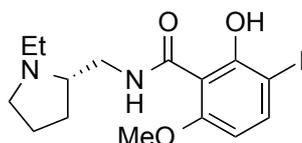
NMR (126 MHz, CDCl₃) δ 24.4 (CH₂), 26.1 (2 \times CH₂), 36.5 (CH₂), 54.3 (2 \times CH₂), 56.5 (CH₃), 57.0 (CH₂), 85.7 (C), 110.1 (CH), 128.7 (CH), 128.9 (C), 138.5 (CH), 160.3 (C), 165.5 (C); MS (ESI) m/z 389 (MH⁺, 100), 304 (43).

(2'*S*)-2-Hydroxy-6-methoxy-*N*-[(1'-ethyl-2'-pyrrolidinyl)methyl]benzamide (7)²⁵



1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (494 mg, 2.57 mmol), hydroxybenzotriazole (371 mg, 2.75 mmol) and 2-hydroxy-6-methoxybenzoic acid (289 mg, 1.72 mmol) were dissolved in anhydrous dichloromethane (5 mL). *N,N*-Diisopropylethylamine (747 μ L, 4.29 mmol) was added and the mixture was stirred at room temperature for 0.1 h. (*S*)-(-)-1-Ethyl-2-aminomethylpyrrolidine (239 μ L, 1.72 mmol) was added and the reaction mixture was stirred at room temperature for 24 h. The mixture was diluted with dichloromethane (50 mL) and washed with 1 M sodium hydroxide (50 mL), dried (MgSO₄) and concentrated under reduced pressure. Purification by column chromatography eluting with 0 to 3.5% methanol in dichloromethane gave (*2'S*)-2-hydroxy-6-methoxy-*N*-[(1'-ethyl-2'-pyrrolidinyl)methyl]benzamide (7) (363 mg, 76%) as a colorless oil. The data were consistent with the literature.²⁵ $[\alpha]_D^{23}$ -78.0 (*c* 2.0, acetone); ¹H NMR (500 MHz, CDCl₃) δ 1.13 (t, *J* 7.2 Hz, 3H), 1.63 (dt, *J* 12.6, 5.9 Hz, 1H), 1.67–1.76 (m, 2H), 1.91 (dq, *J* 12.6, 8.5 Hz, 1H), 2.17–2.29 (m, 2H), 2.65 (m, 1H), 2.85 (dq, *J* 13.5, 7.2 Hz, 1H), 3.17–3.33 (m, 2H), 3.70 (ddd, *J* 13.8, 7.2, 2.5 Hz, 1H), 3.92 (s, 3H), 6.39 (dd, *J* 8.3, 1.0 Hz, 1H), 6.62 (dd, *J* 8.4, 1.0 Hz, 1H), 7.26 (dd, *J* 8.4, 8.3 Hz, 1H), 8.92 (br s, 1H), 14.14 (s, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 14.2 (CH₃), 23.0 (CH₂), 28.5 (CH₂), 40.7 (CH₂), 47.9 (CH₂), 53.6 (CH₂), 55.9 (CH₃), 61.9 (CH), 100.8 (CH), 104.2 (C), 111.6 (CH), 133.0 (CH), 158.8 (C), 164.5 (C), 170.3 (C); MS (EI) m/z 278 (M⁺, 4), 151 (41), 136 (10), 98 (100), 70 (22).

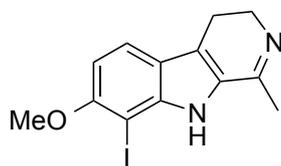
(2'*S*)-2-Hydroxy-3-iodo-6-methoxy-*N*-[(1'-ethyl-2'-pyrrolidinyl)methyl]benzamide (8)²⁵



(*2'S*)-2-Hydroxy-6-methoxy-*N*-[(1'-ethyl-2'-pyrrolidinyl)methyl]benzamide (7) (69 mg, 0.25 mmol) was suspended in ethanol (2 mL) and tetrafluoroboric acid (32.4 μ L, 0.25 mmol, 48% wt in

water) was added at room temperature. After 0.5 h, the resulting solution was concentrated to a yellowish gum under reduced pressure. The salt was mixed with NIS (59 mg, 0.25 mmol), iron trichloride (2.2 mg, 5 mol%), acetonitrile (0.1 mL) and [BMIM]NTf₂ (0.40 mL). The reaction mixture was heated to 36 °C for 0.7 h. The mixture was diluted with dichloromethane (50 mL), washed with 1 M sodium thiosulfate (50 mL), then dried (MgSO₄) and concentrated under reduced pressure. The crude gum was extracted with a 1% ethyl acetate in hexane solution (3 × 80 mL) under sonication, filtered through a bed of Celite® and concentrated under reduced pressure. Purification by column chromatography eluting with 0 to 10% methanol in dichloromethane gave (2'*S*)-2-hydroxy-3-iodo-6-methoxy-*N*-[(1'-ethyl-2'-pyrrolidiny)methyl]benzamide (**8**) (47 mg, 47%) as a yellowish gum. The data were consistent with the literature.²⁵ [α]_D²⁴ -47.3 (*c* 1.0 in acetone); ¹H NMR (500 MHz, CD₃OD) δ 1.19 (t, *J* 7.3 Hz, 3H), 1.62–1.72 (m, 1H), 1.74–1.88 (m, 2H), 2.01 (dq, *J* 12.7, 8.3 Hz, 1H), 2.35–2.50 (m, 2H), 2.83–2.91 (m, 1H), 3.01 (dq, *J* 12.2, 7.3 Hz, 1H), 3.26–3.33 (m, 1H), 3.41 (dd, *J* 13.8, 5.6 Hz, 1H), 3.63 (dd, *J* 13.8, 4.0 Hz, 1H), 3.95 (s, 3H), 6.43 (d, *J* 8.8 Hz, 1H), 7.74 (d, *J* 8.8 Hz, 1H); ¹³C NMR (126 MHz, CD₃OD) δ 12.3 (CH₃), 22.2 (CH₂), 28.0 (CH₂), 40.9 (CH₂), 48.5 (CH₂), 53.4 (CH₂), 55.8 (CH₃), 63.2 (CH), 75.7 (C), 103.5 (CH), 103.9 (C), 142.2 (CH), 159.4 (C), 162.1 (C), 169.8 (C); MS (EI) *m/z* 404 (M⁺, 3), 277 (22), 261 (9), 234 (5), 149 (8), 98 (100), 70 (14).

8-Iodoharmaline (**10**)²⁶



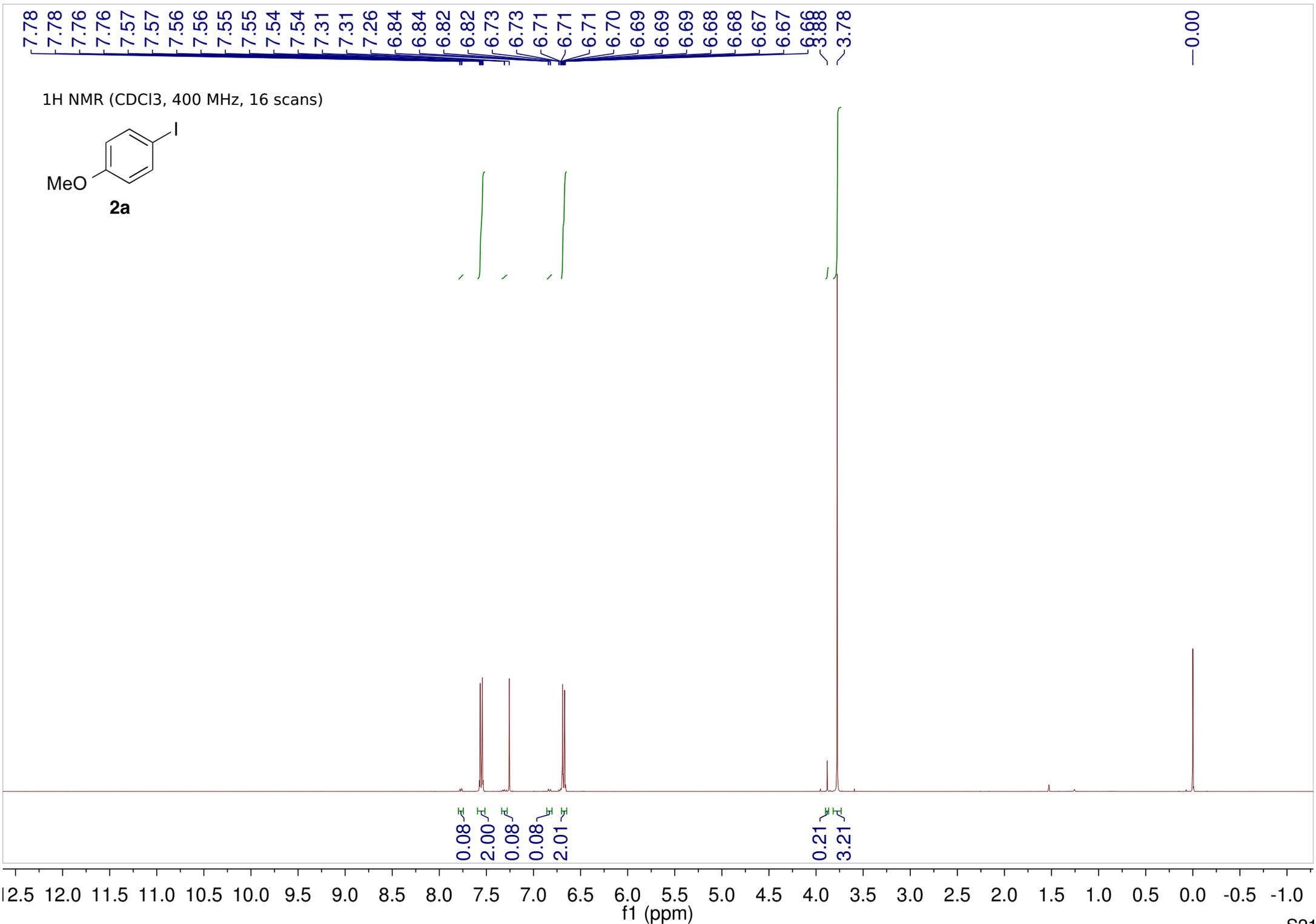
Harmaline (**9**) (76 mg, 0.36 mmol) was suspended in 1:1 mixture of ethanol and acetonitrile (2 mL), and then tetrafluoroboric acid solution (46.3 μ L, 0.36 mmol, 48% wt in water) was added at room temperature. The resulting solution was concentrated to a yellow solid under reduced pressure. The salt **9** was mixed with NIS (96 mg, 0.43 mmol), iron trichloride (3.3 mg, 5 mol%) and [BMIM]NTf₂ (0.40 mL) to give a thick slurry. The reaction mixture was heated to 36 °C for 0.8 h, when acetonitrile (0.15 mL) was added. The heating was continued for a further 1.3 h. The reaction mixture was diluted with dichloromethane (50 mL), washed with 1 M sodium thiosulfate (50 mL), 1 M sodium hydroxide (50 mL) and brine (50 mL), then dried over MgSO₄ and concentrated under reduced pressure. Purification by column chromatography eluting with 0 to 5% methanol in dichloromethane gave 8-iodoharmaline (**10**) (88 mg, 73%) as a bright yellow solid. Mp 132–133 °C; IR (neat) 2926, 1622, 1541, 1269, 1242, 1171, 1071, 791 cm⁻¹; ¹H NMR (500 MHz, DMSO-*d*₆) δ 2.78 (s, 3H), 3.18 (t, *J* 8.8 Hz, 2H), 3.87 (t, *J* 8.8 Hz, 2H), 3.96 (s, 3H), 7.09 (d, *J* 8.9 Hz, 1H),

7.81 (d, *J* 8.9 Hz, 1H), 11.61 (s, 1H); ¹³C NMR (126 MHz, DMSO-*d*₆) δ 19.4 (CH₂), 19.8 (CH₃), 41.9 (CH₂), 57.7 (CH₃), 67.5 (C), 109.1 (CH), 120.1 (C), 123.7 (CH), 126.6 (C), 126.9 (C), 144.8 (C), 159.6 (C), 166.9 (C); HRMS (ESI) calcd for C₁₃H₁₄IN₂O (MH⁺), 341.0145, found 341.0133.

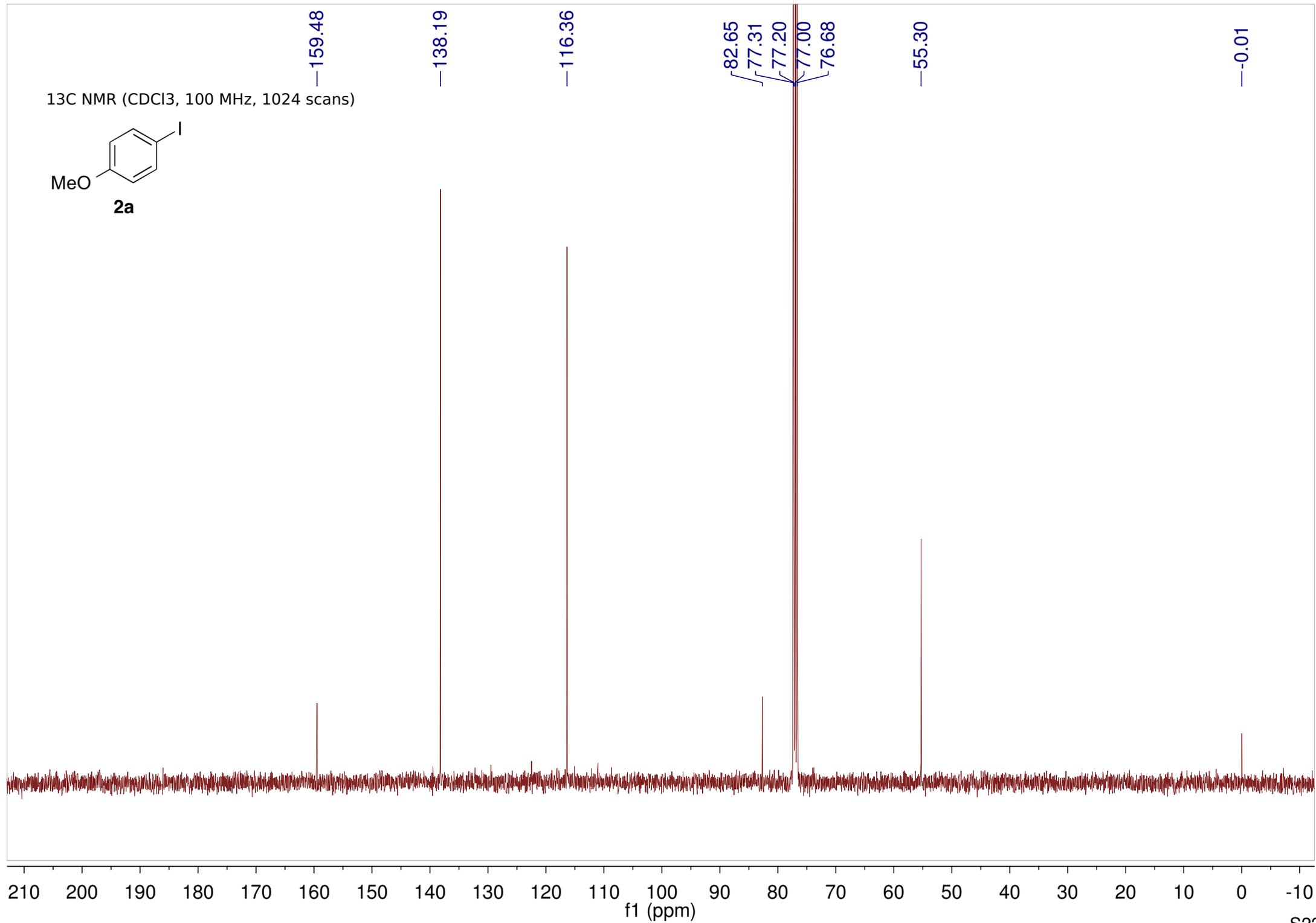
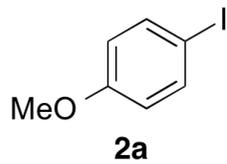
4. References

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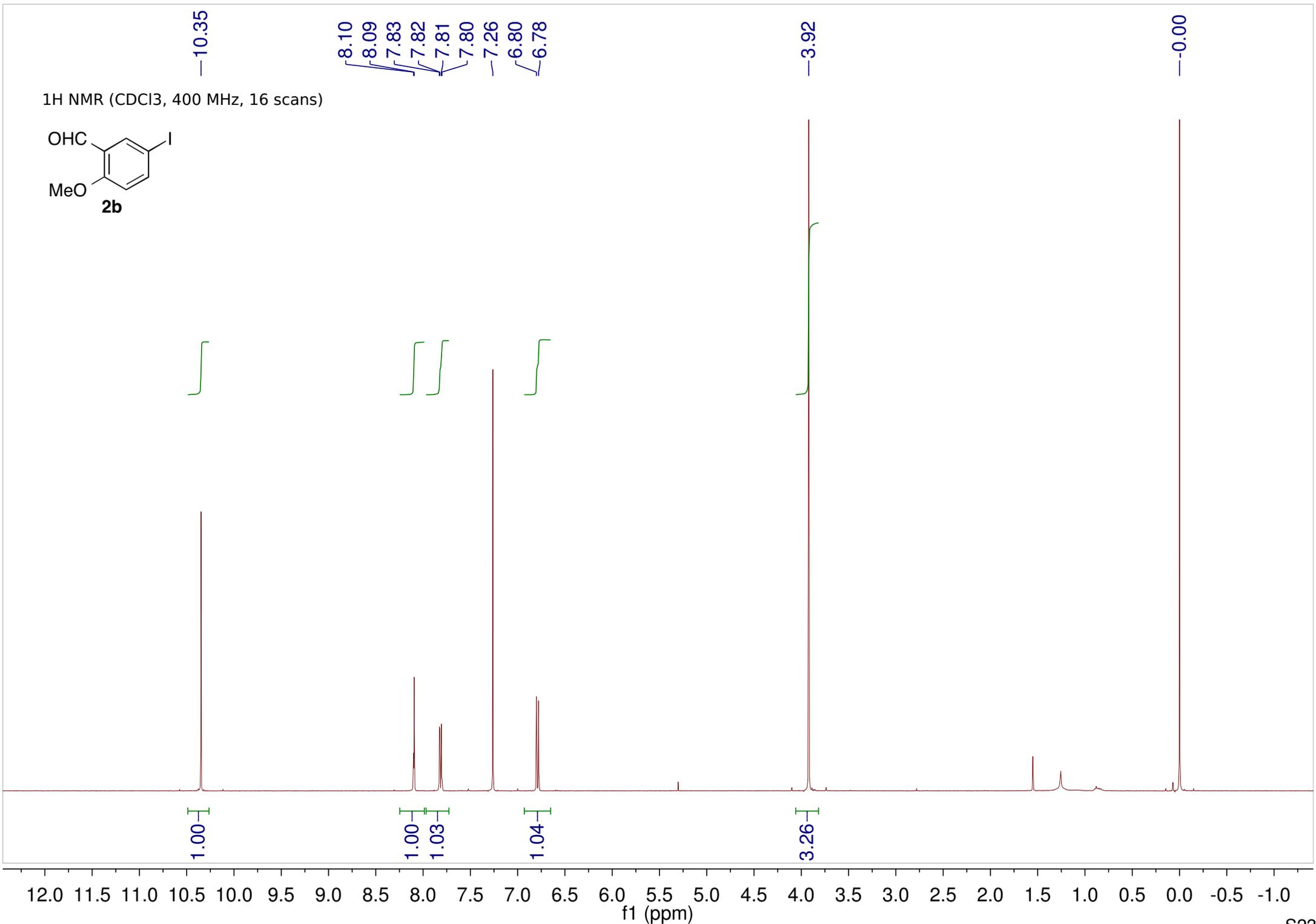
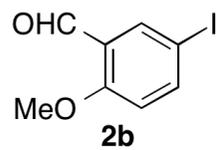
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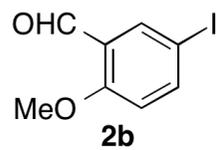
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¹H NMR (CDCl₃, 400 MHz, 16 scans)



¹³C NMR (CDCl₃, 125 MHz, 256 scans)



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—144.11

—137.09

—126.55

—114.15

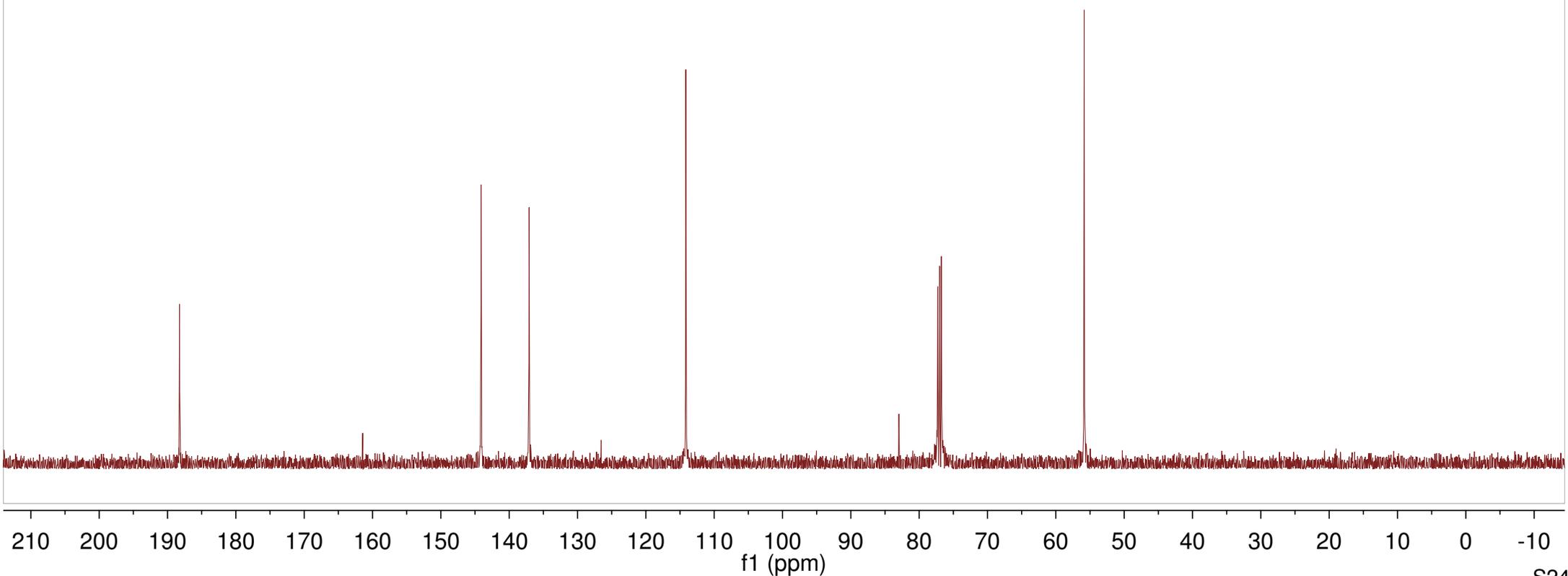
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77.26

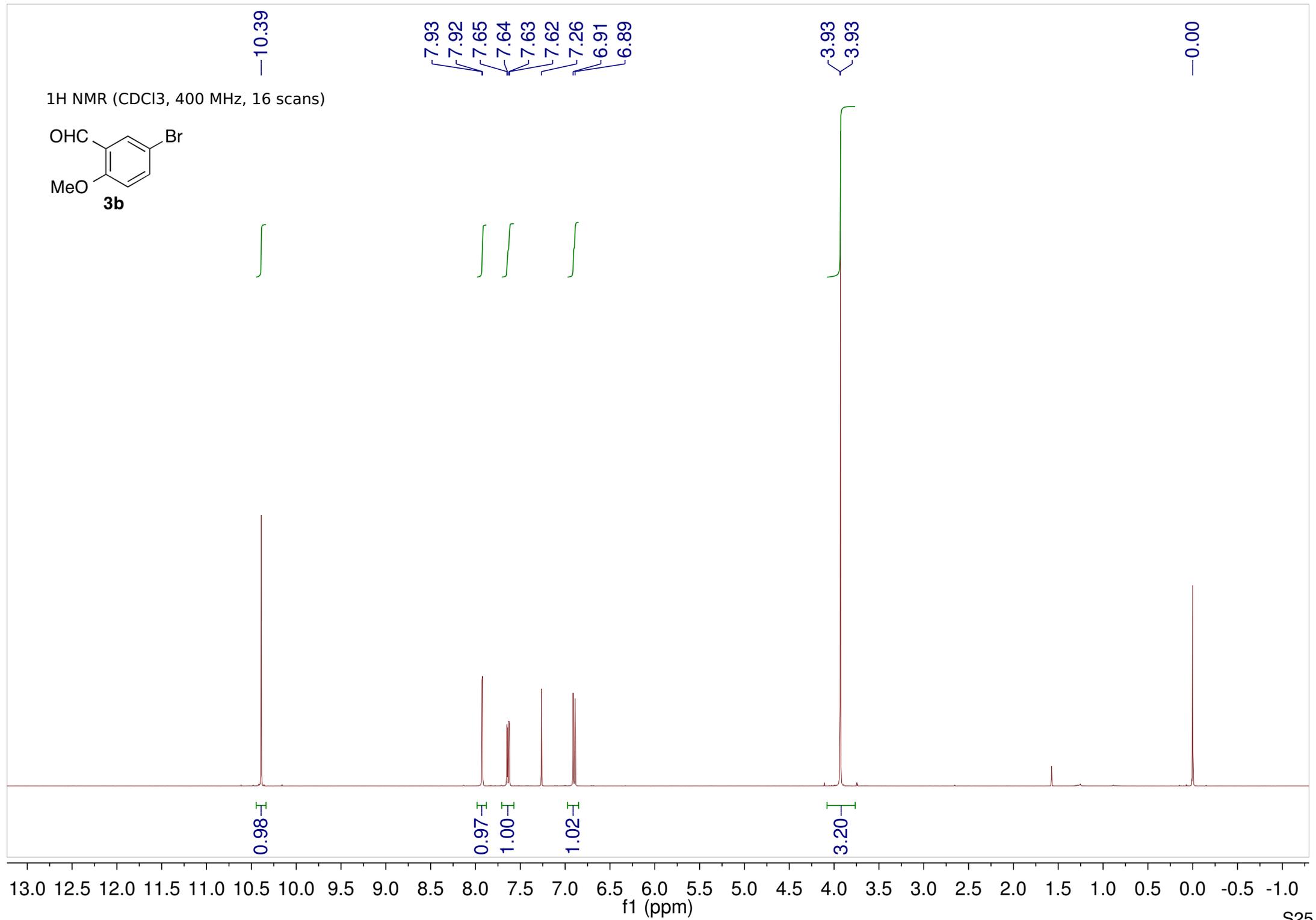
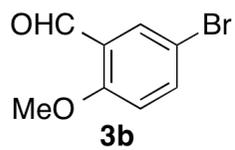
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76.75

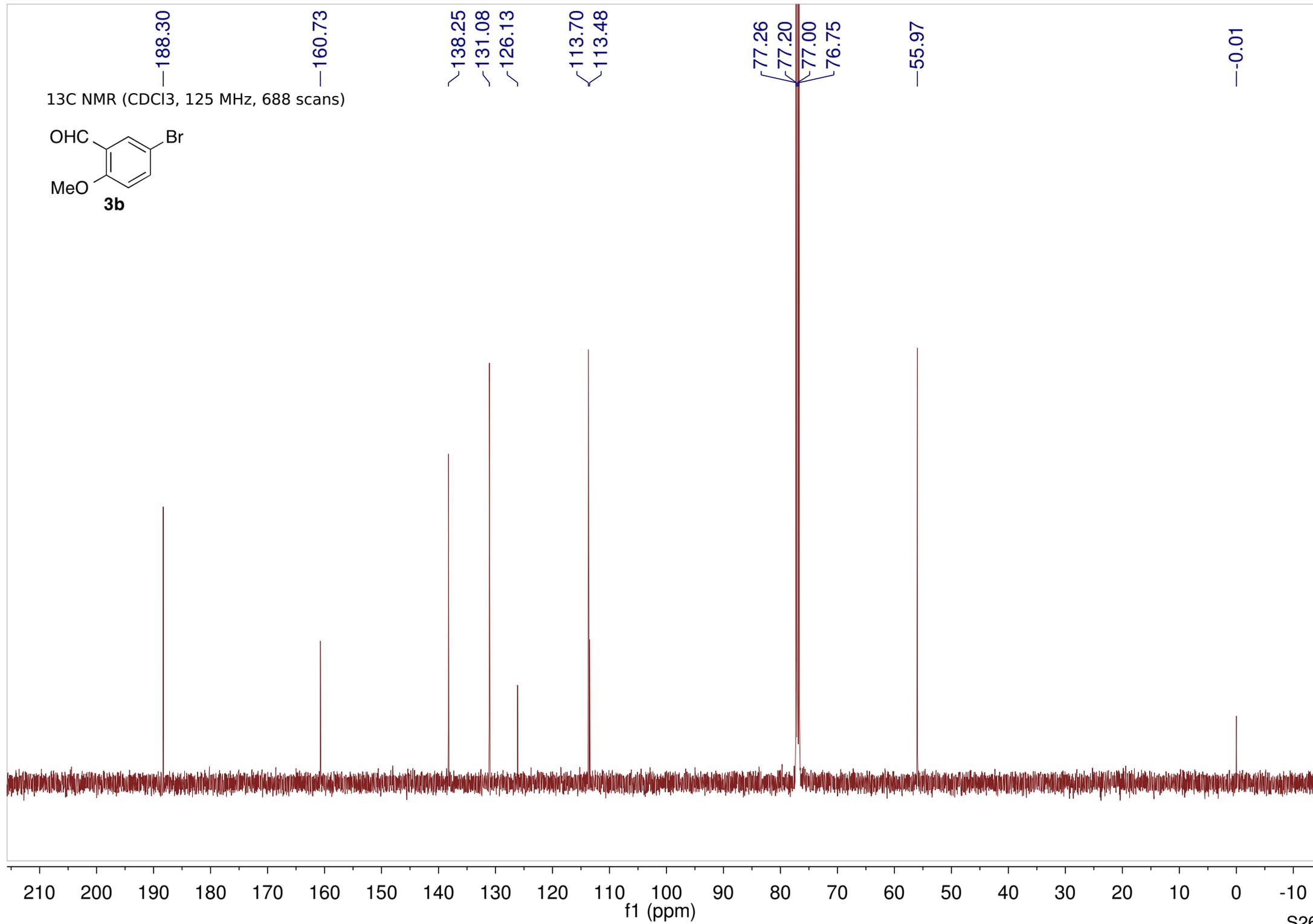
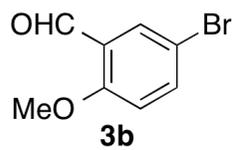
—55.86



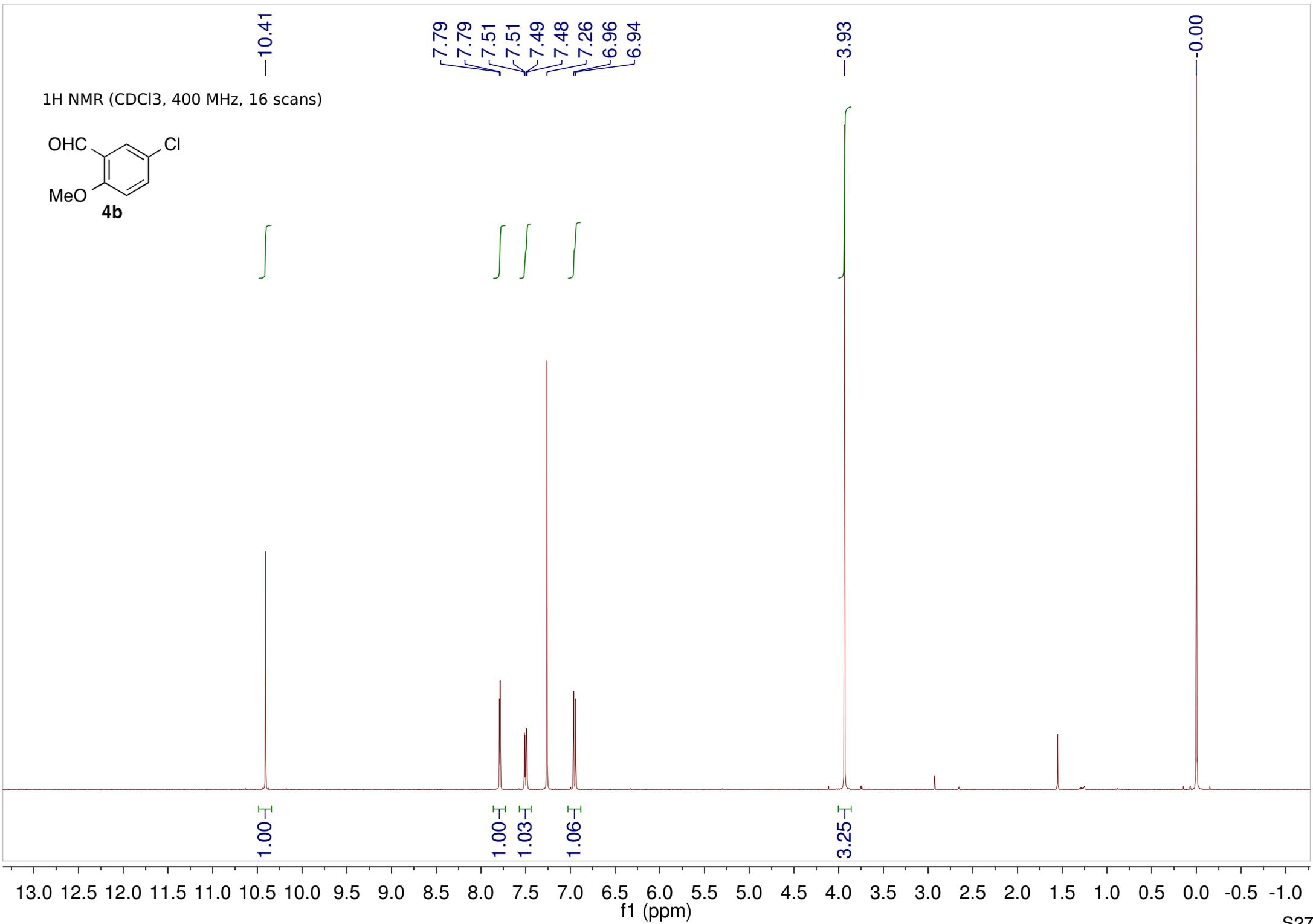
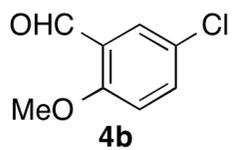
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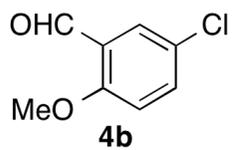
¹³C NMR (CDCl₃, 125 MHz, 688 scans)



¹H NMR (CDCl₃, 400 MHz, 16 scans)



¹³C NMR (CDCl₃, 100 MHz, 256 scans)



188.49

160.27

135.41

128.03

126.37

125.65

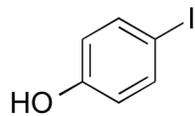
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56.02

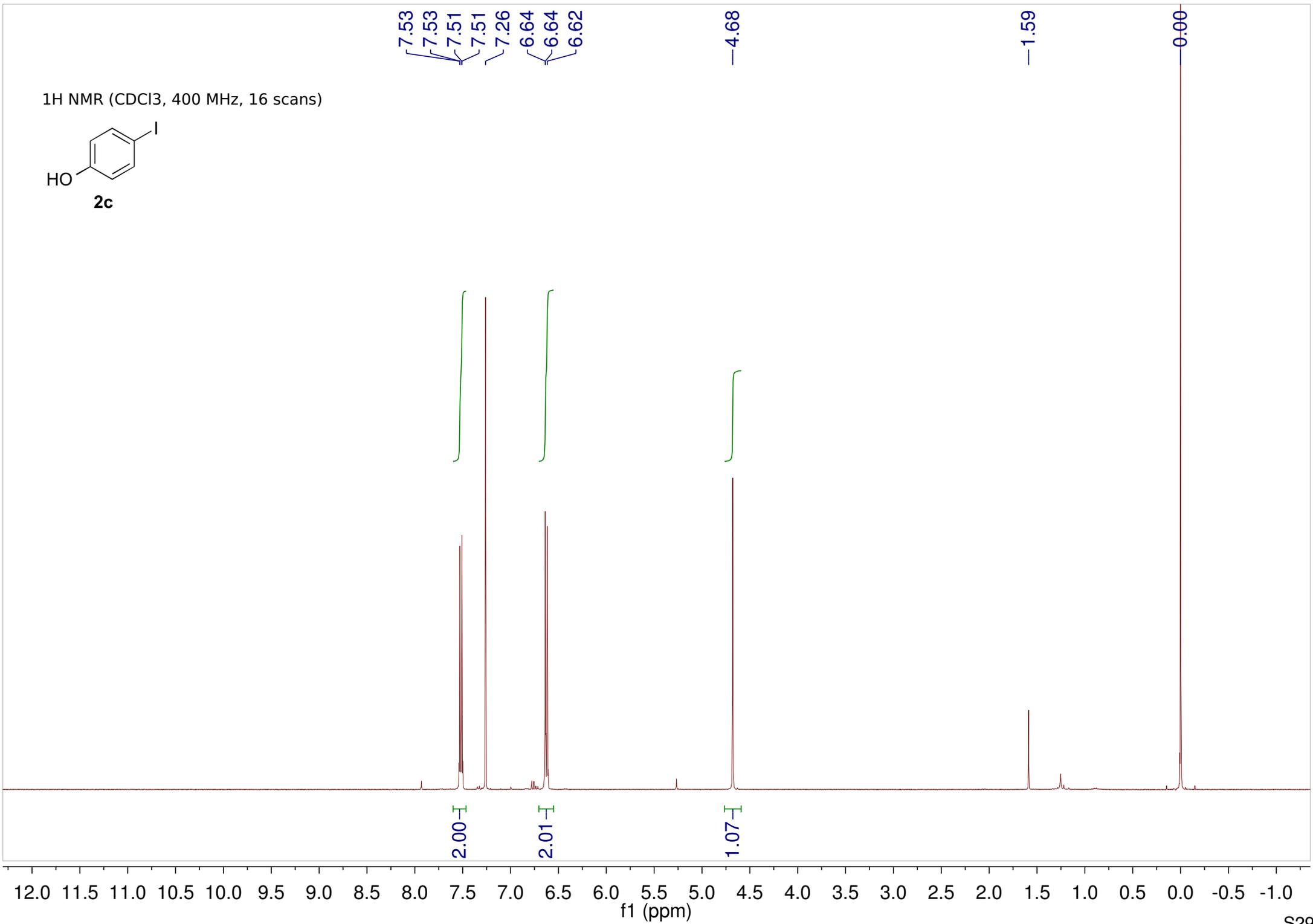
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f1 (ppm)

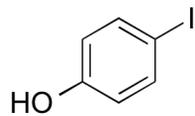
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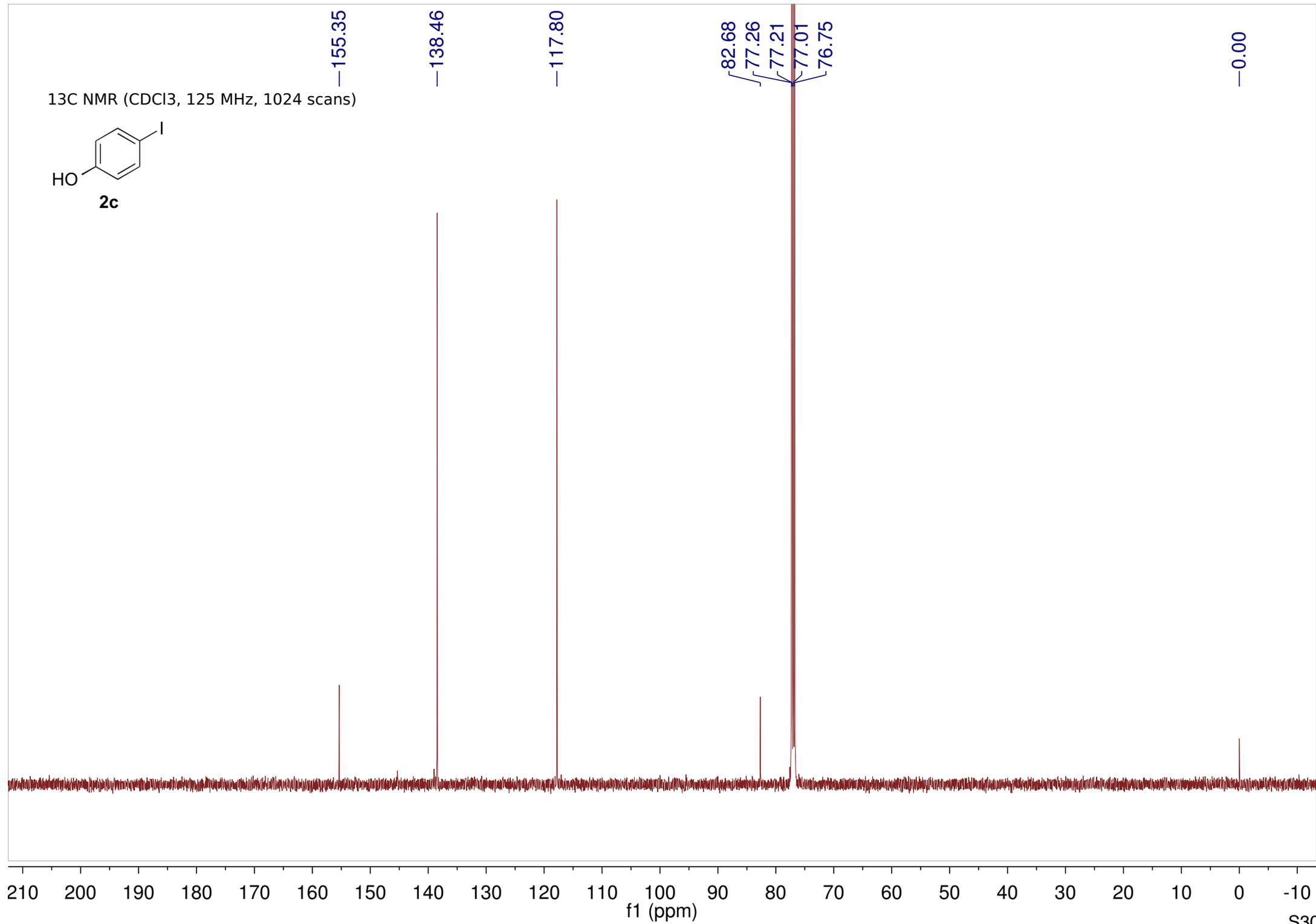
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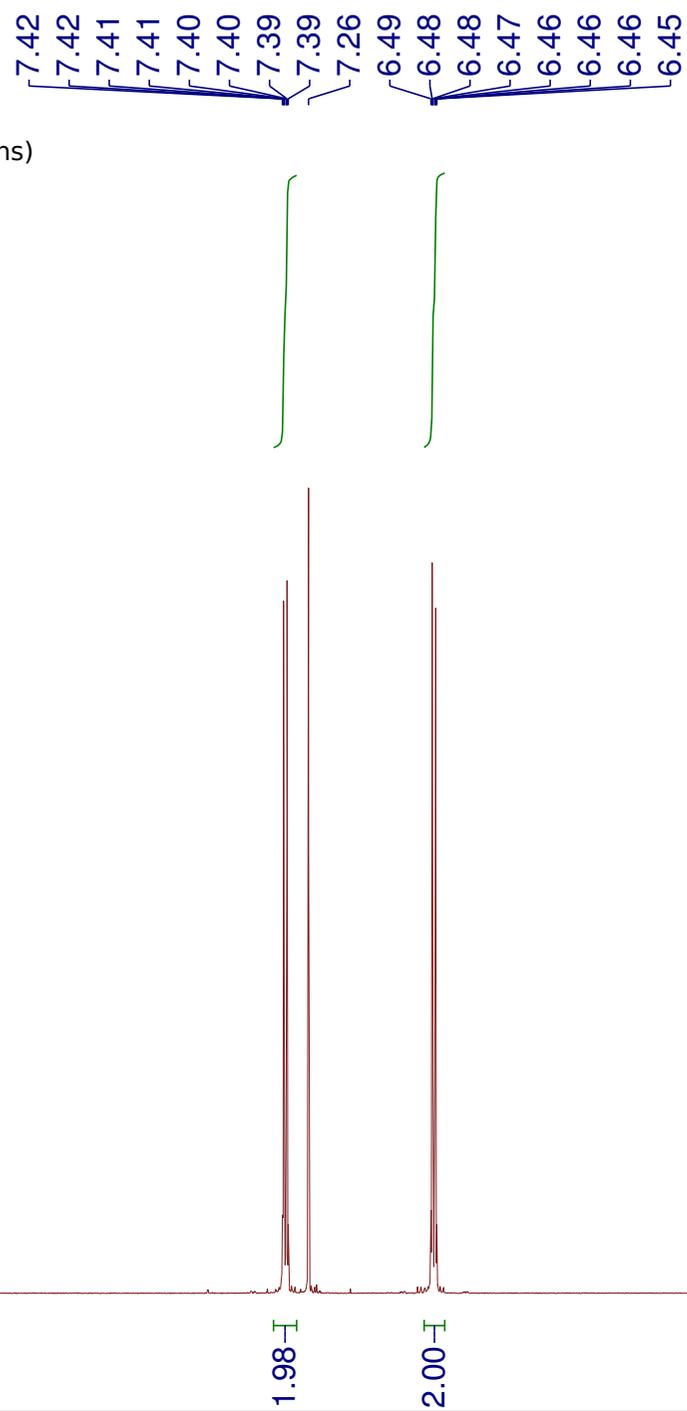
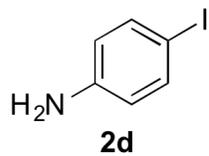
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2c

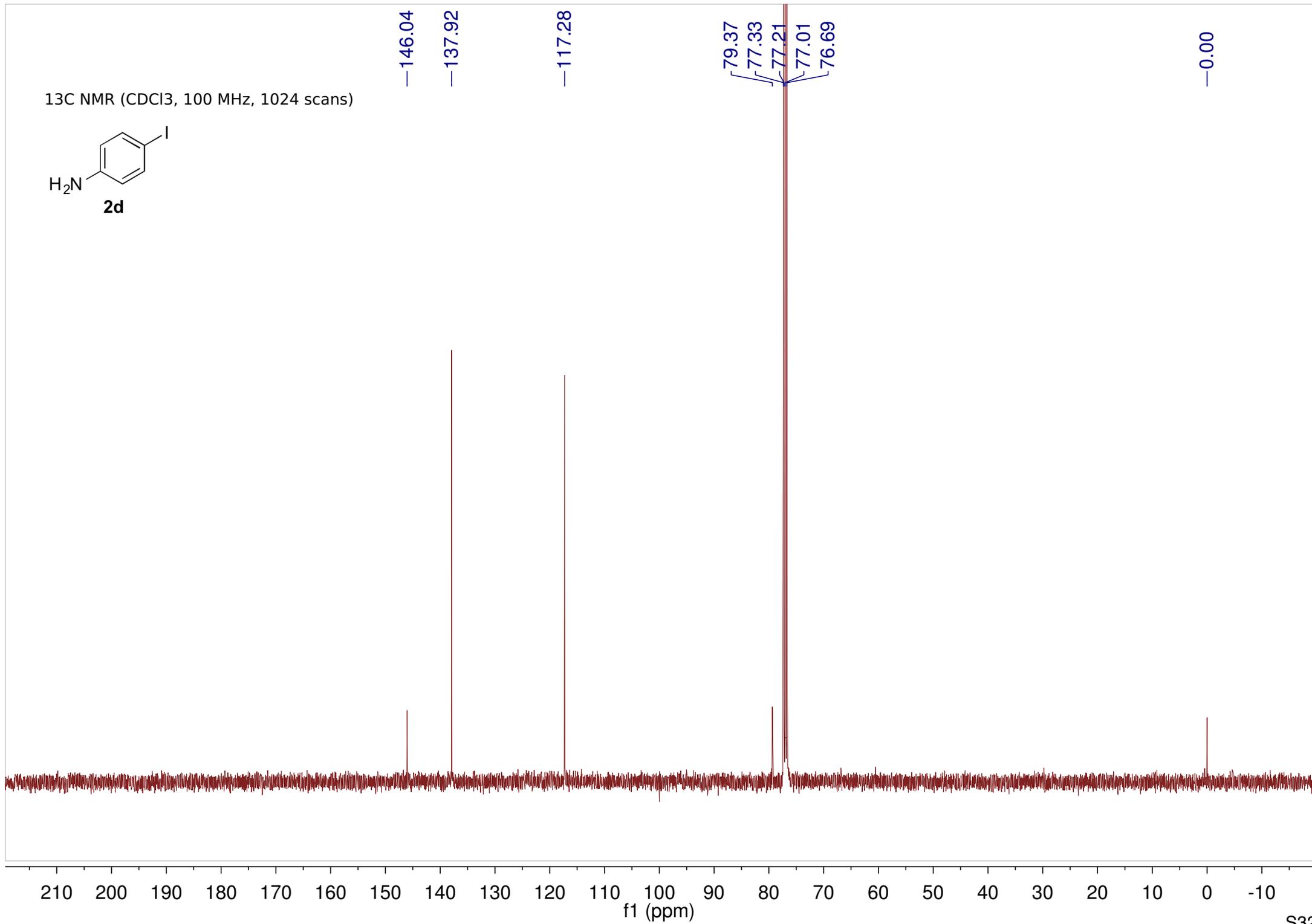
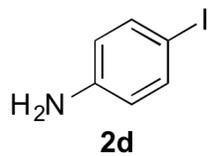


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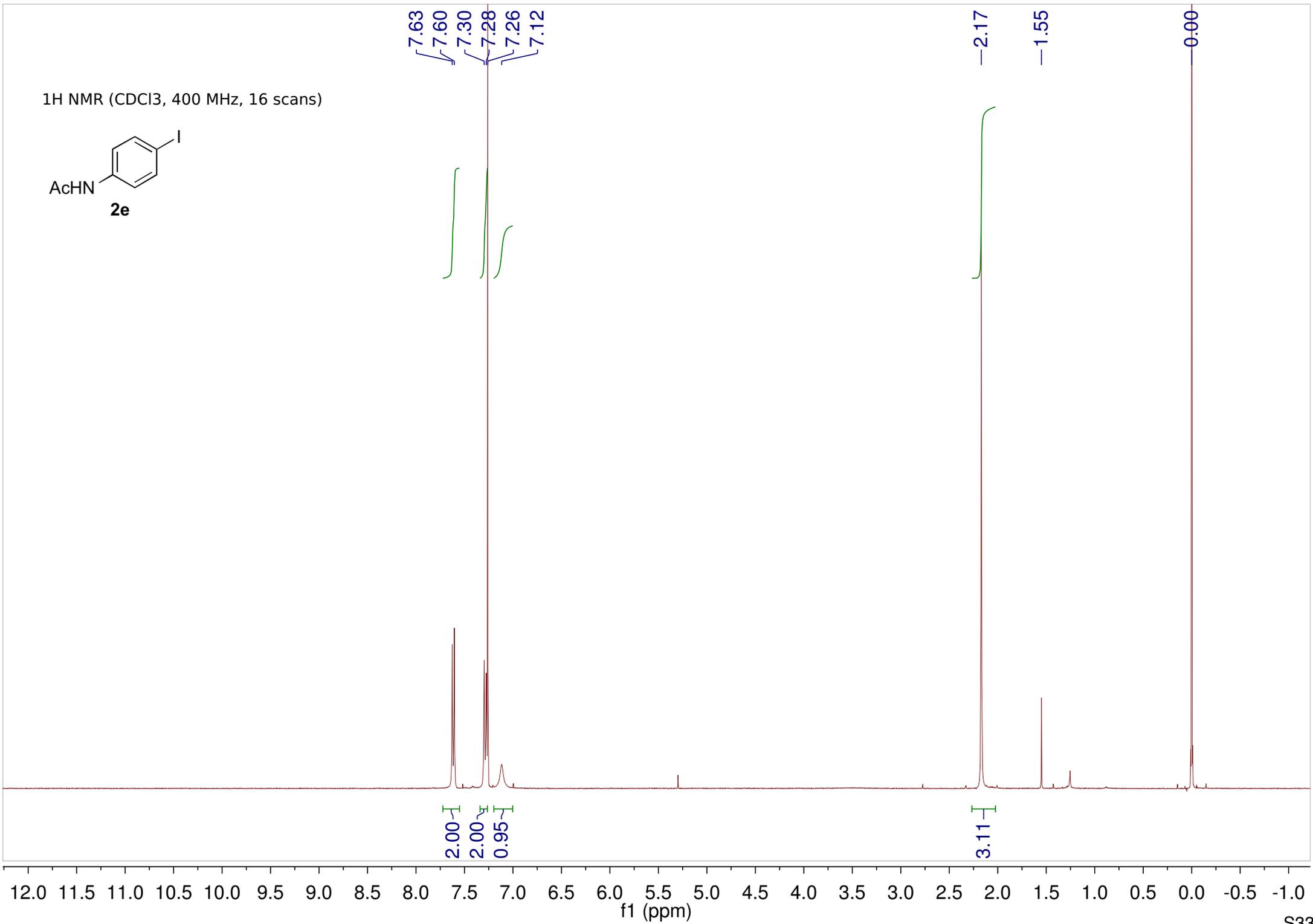
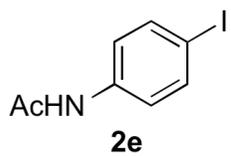


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f1 (ppm)

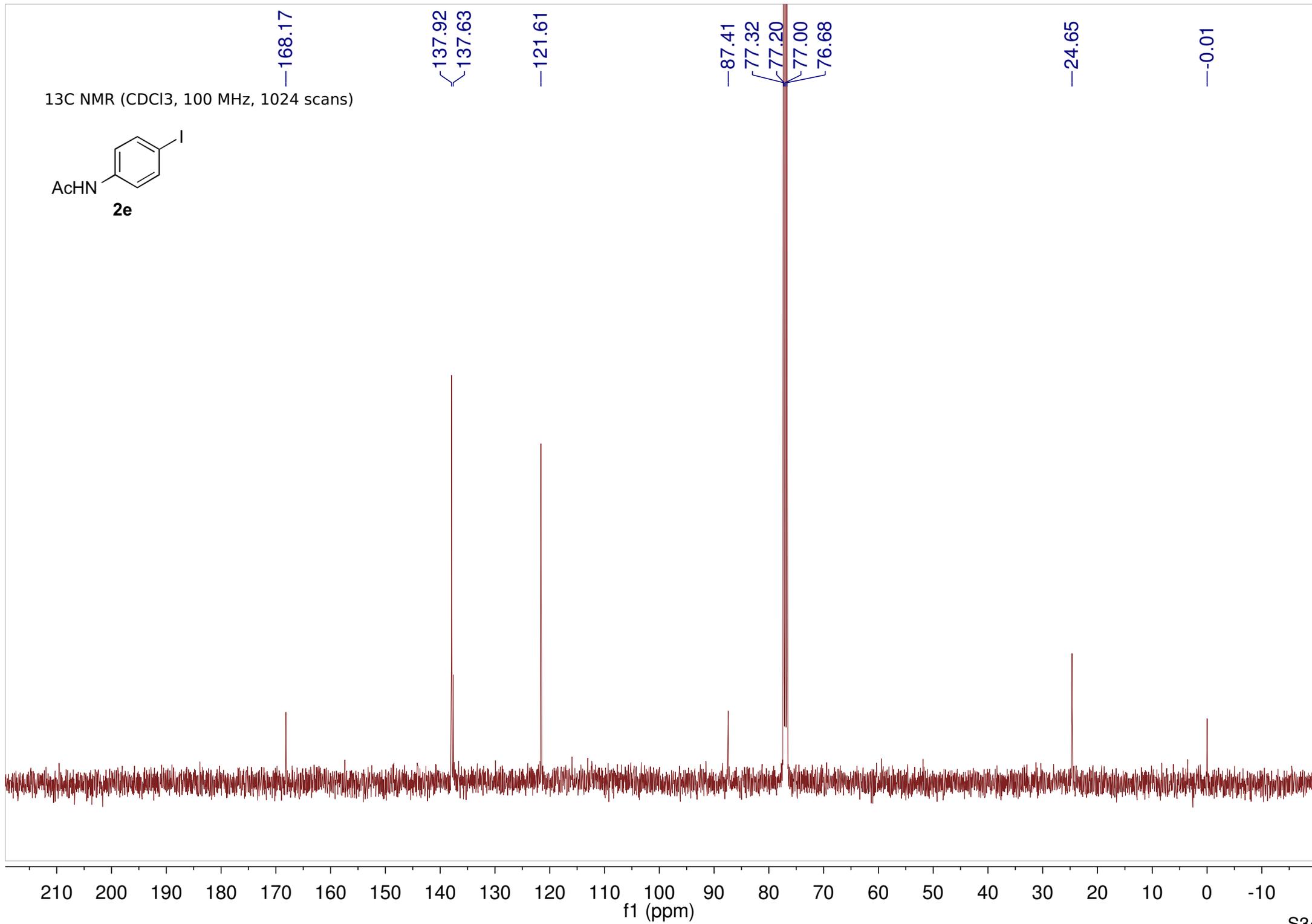
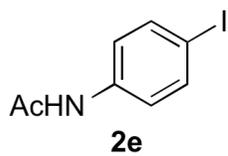
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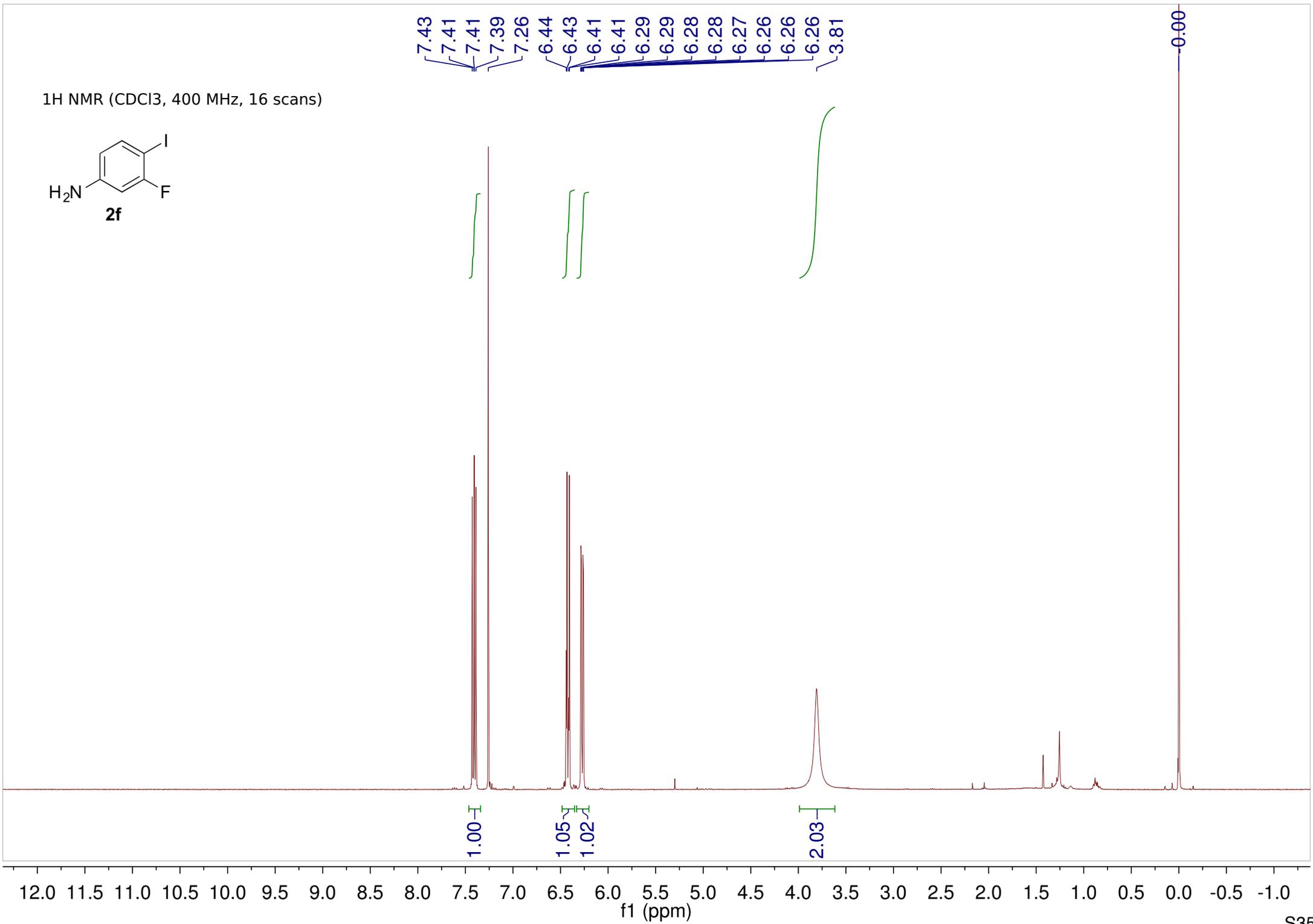
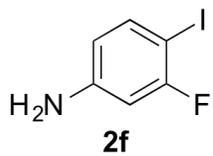
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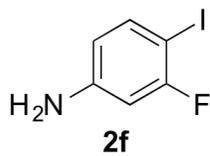
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¹³C NMR (CDCl₃, 100 MHz, 1024 scans)



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139.16

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102.39

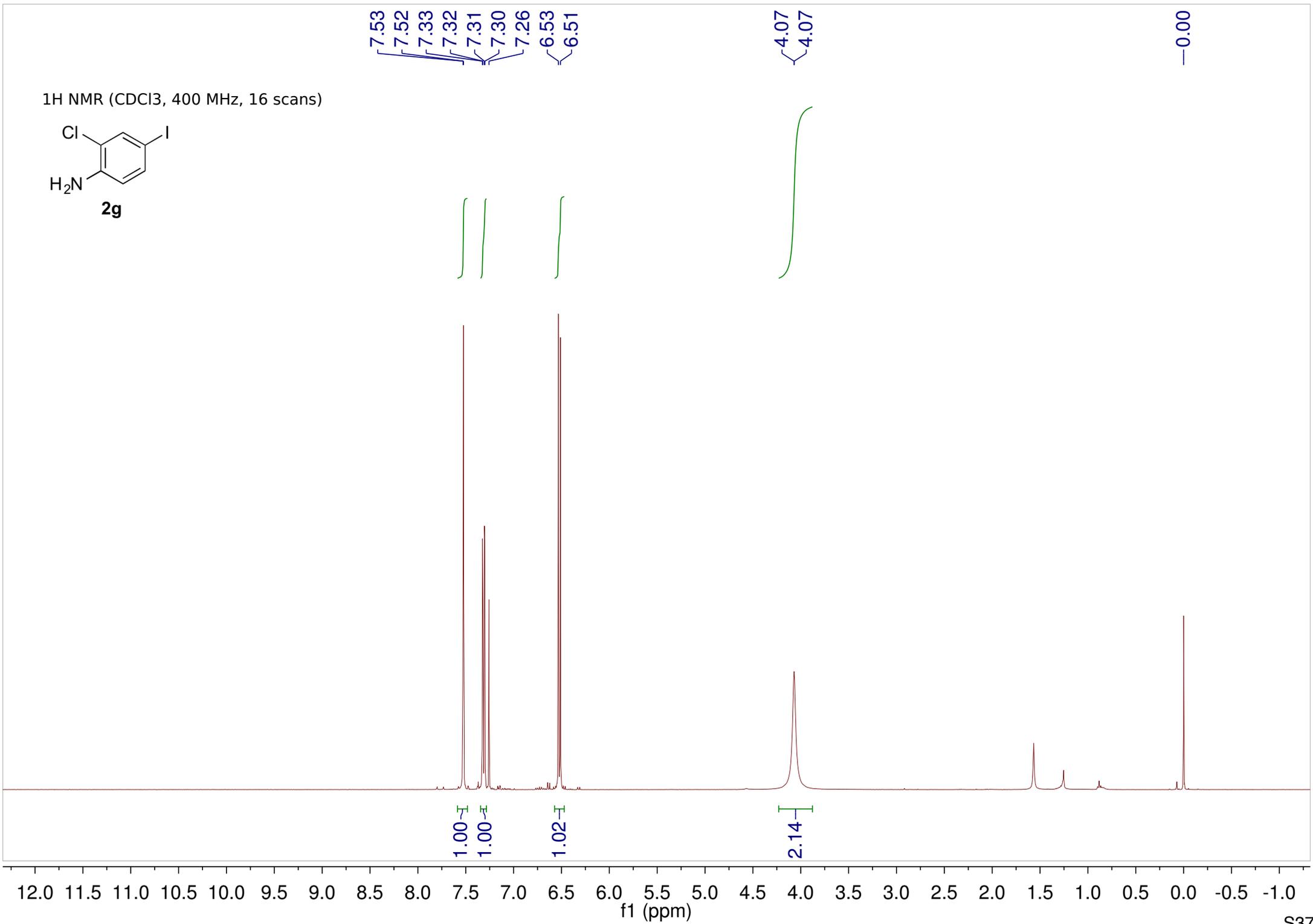
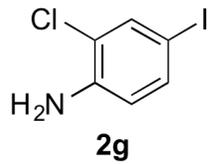
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0.00

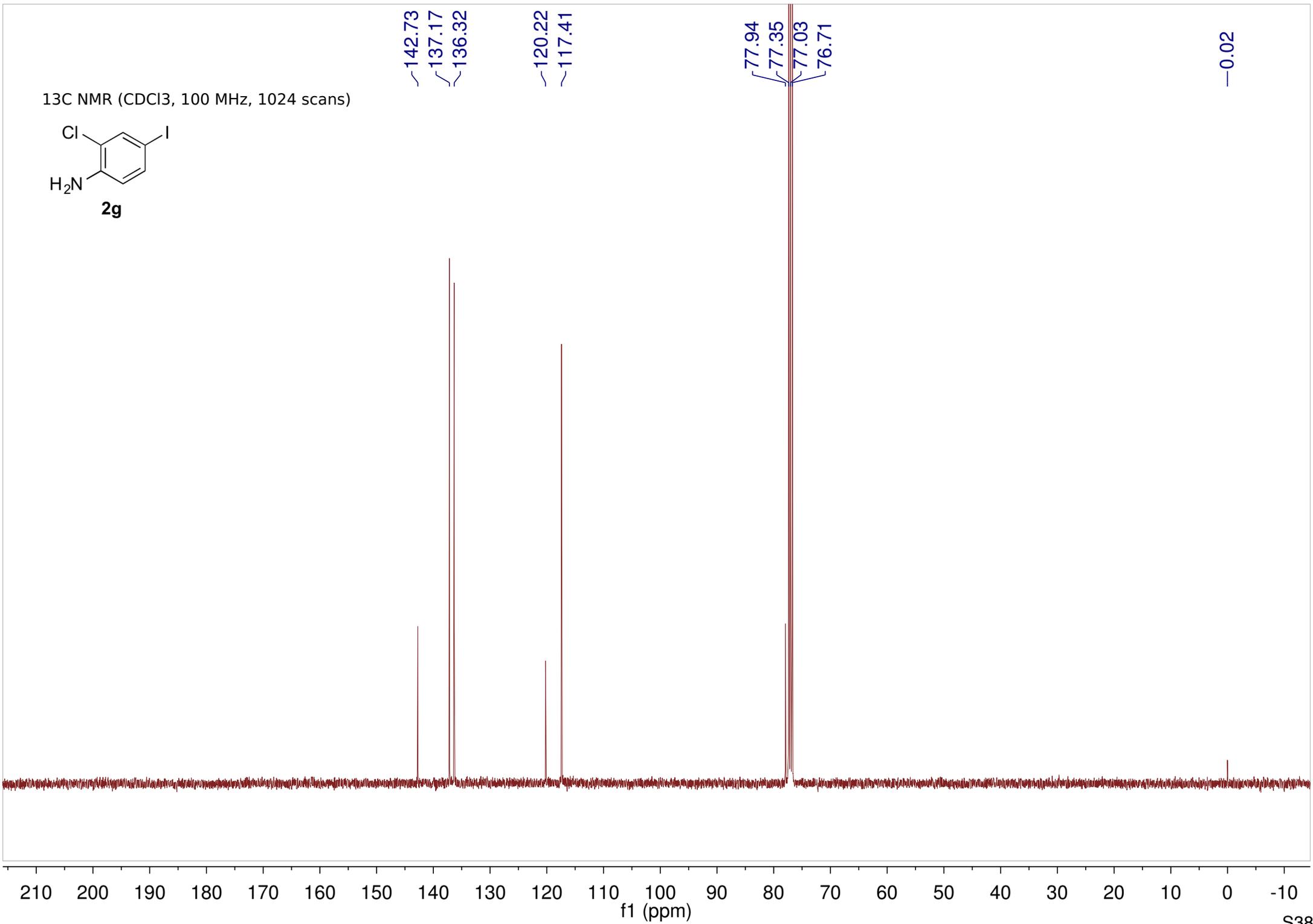
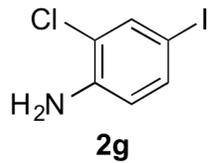
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f1 (ppm)

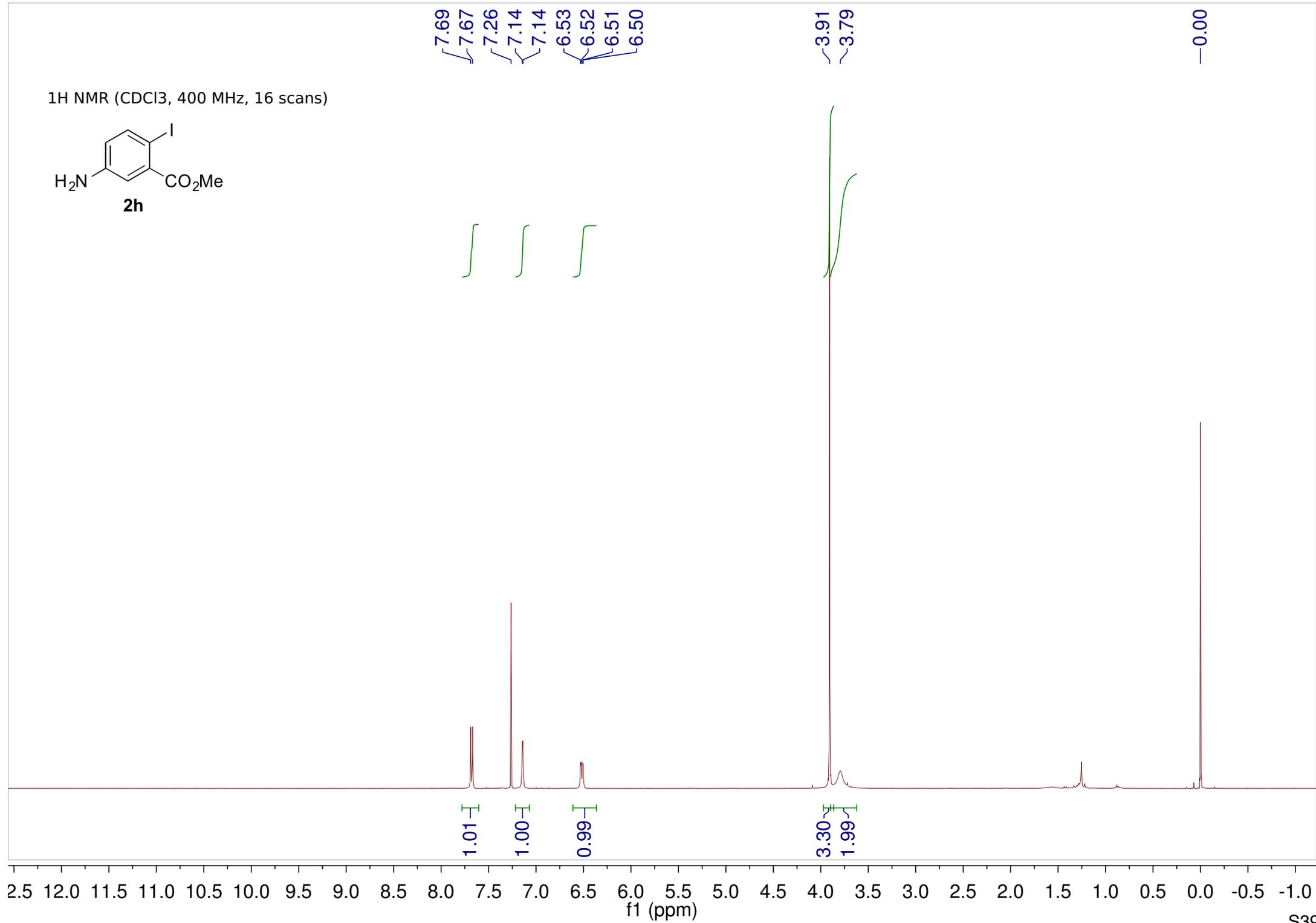
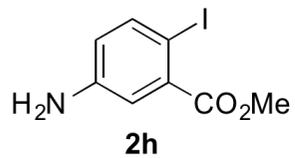
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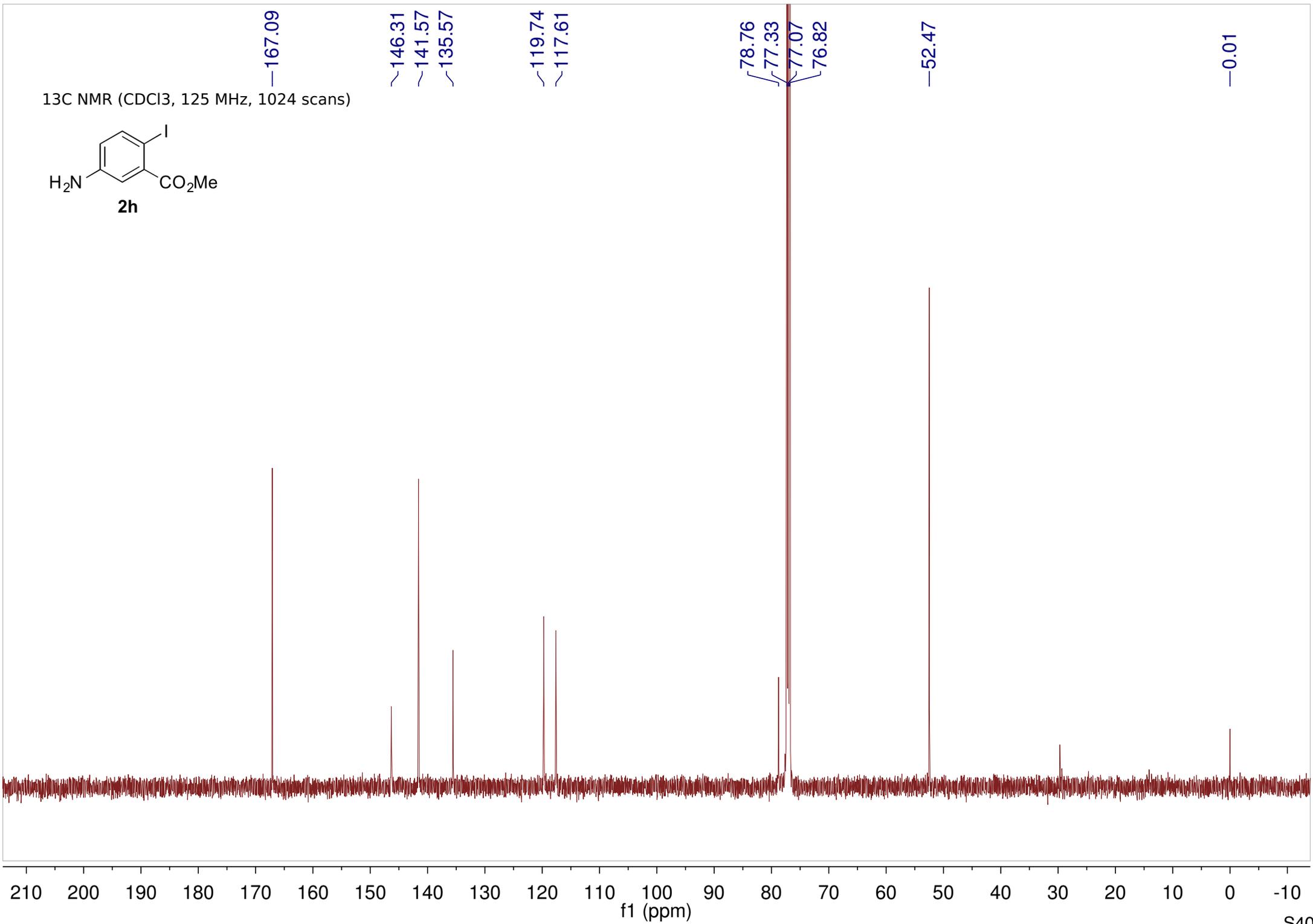
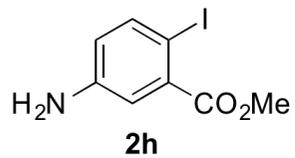
¹³C NMR (CDCl₃, 100 MHz, 1024 scans)



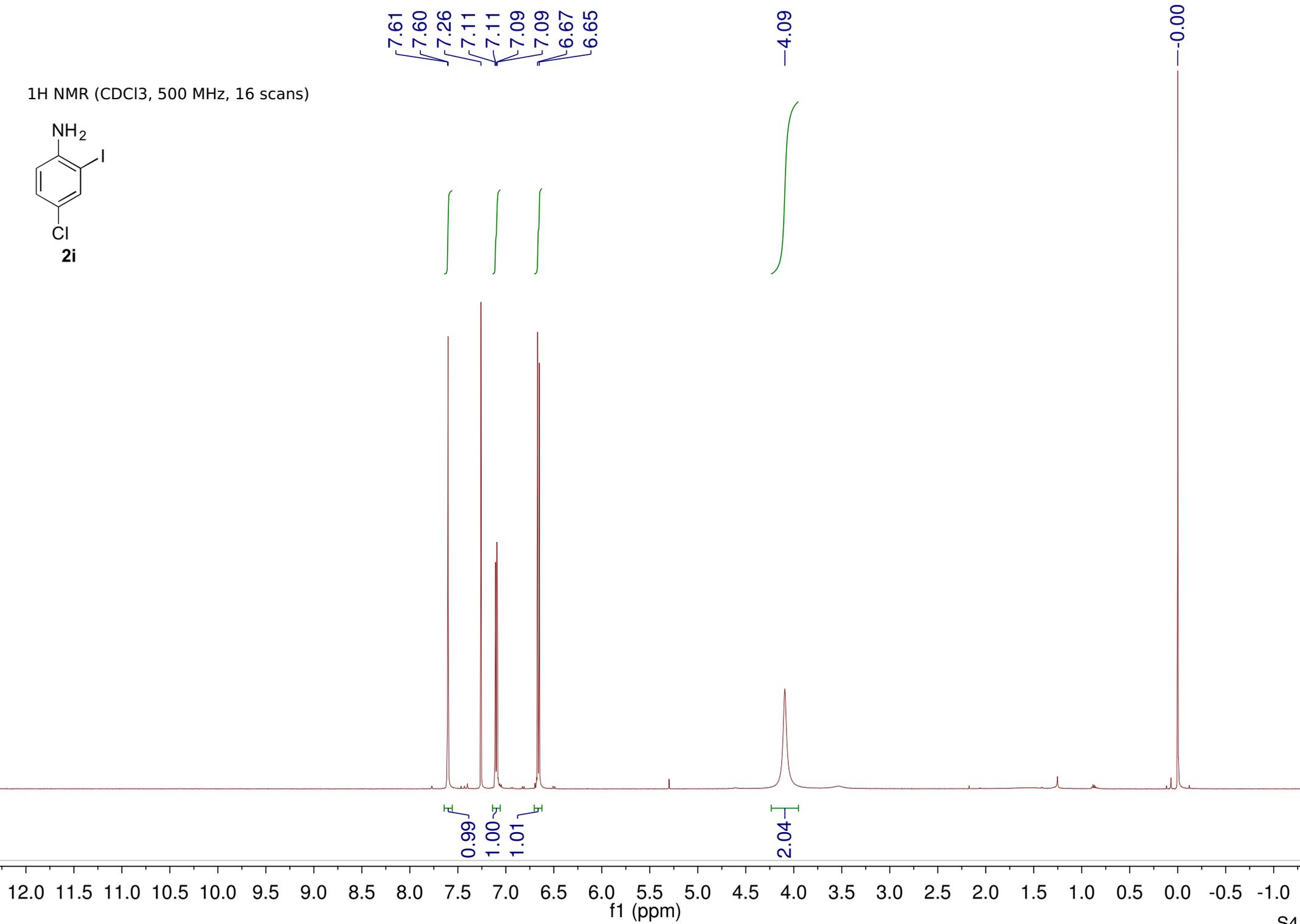
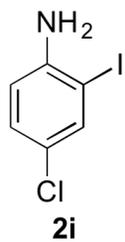
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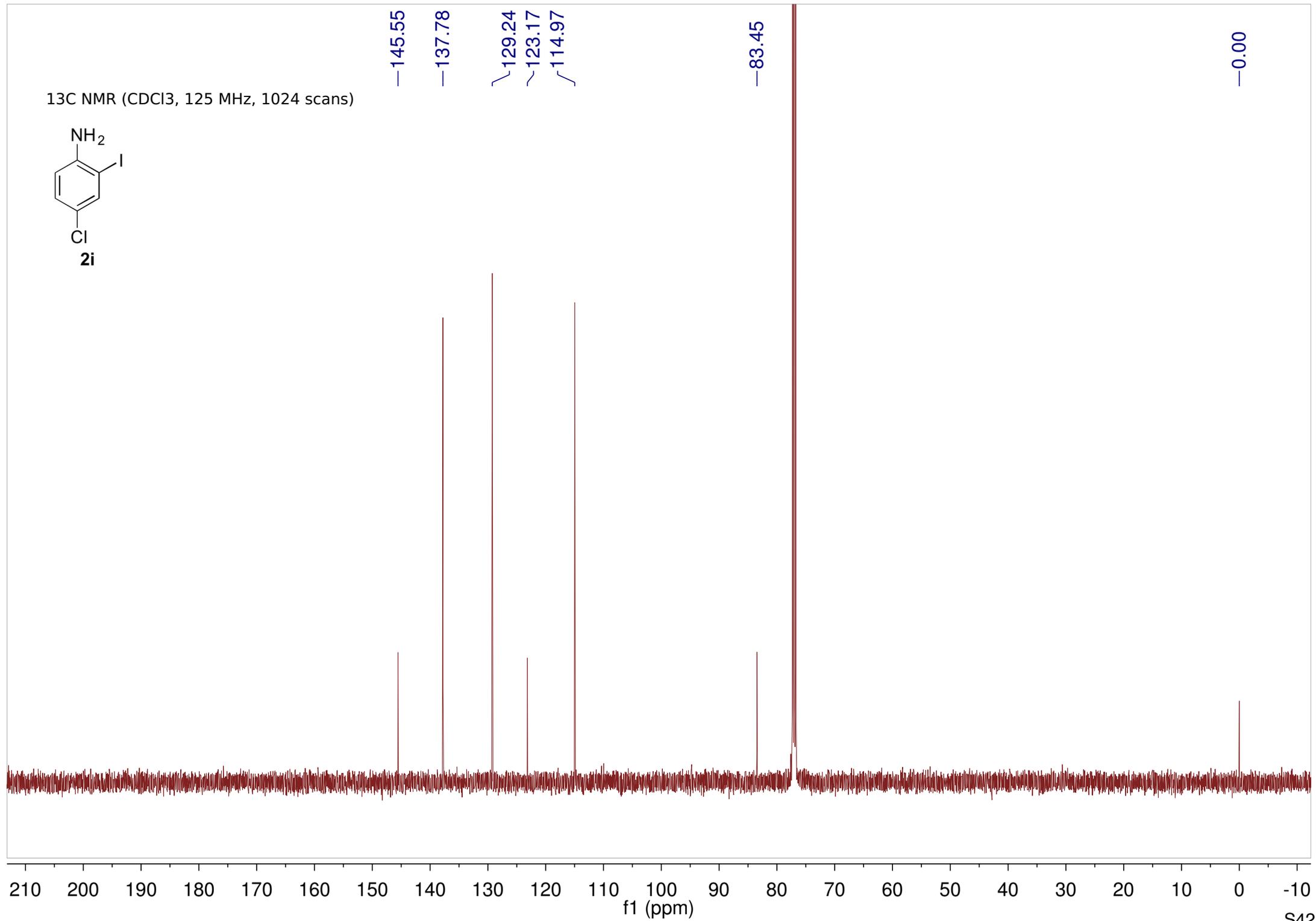
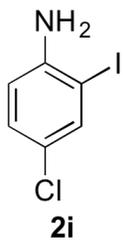
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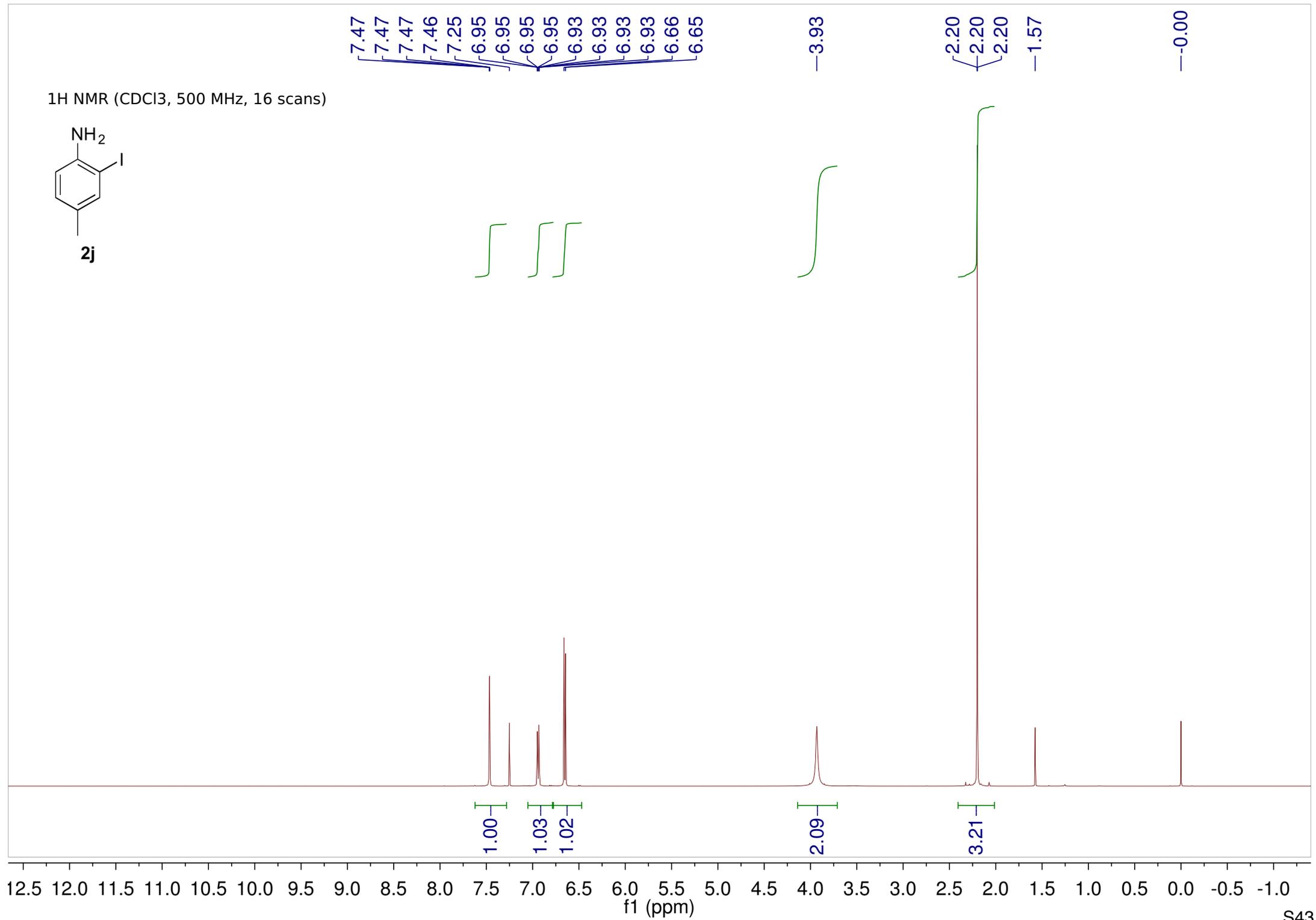
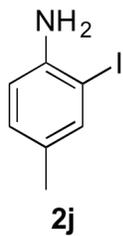
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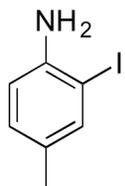
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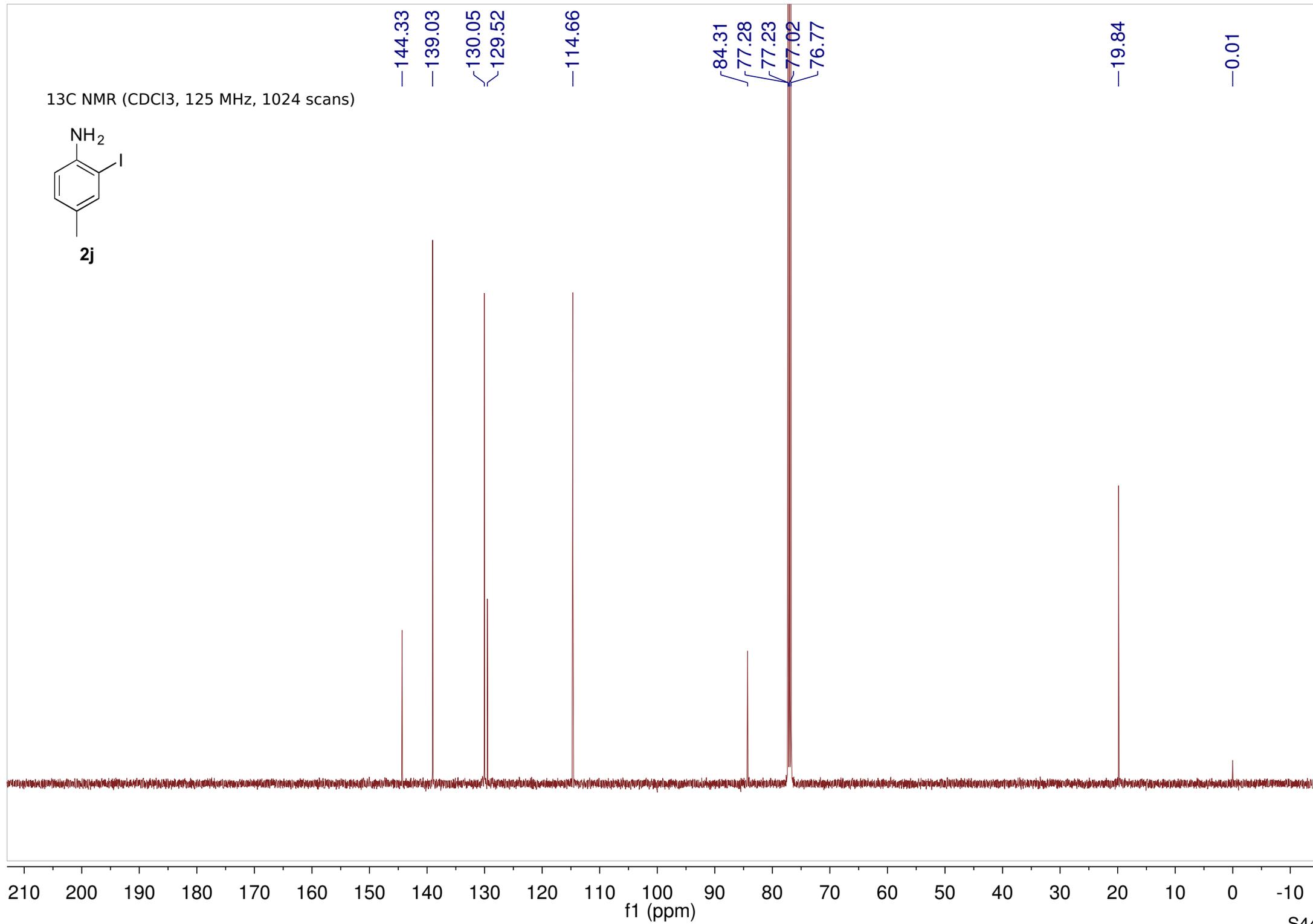
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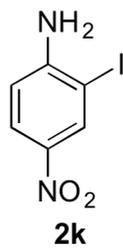
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2j



¹H NMR (CDCl₃, 400 MHz, 16 scans)

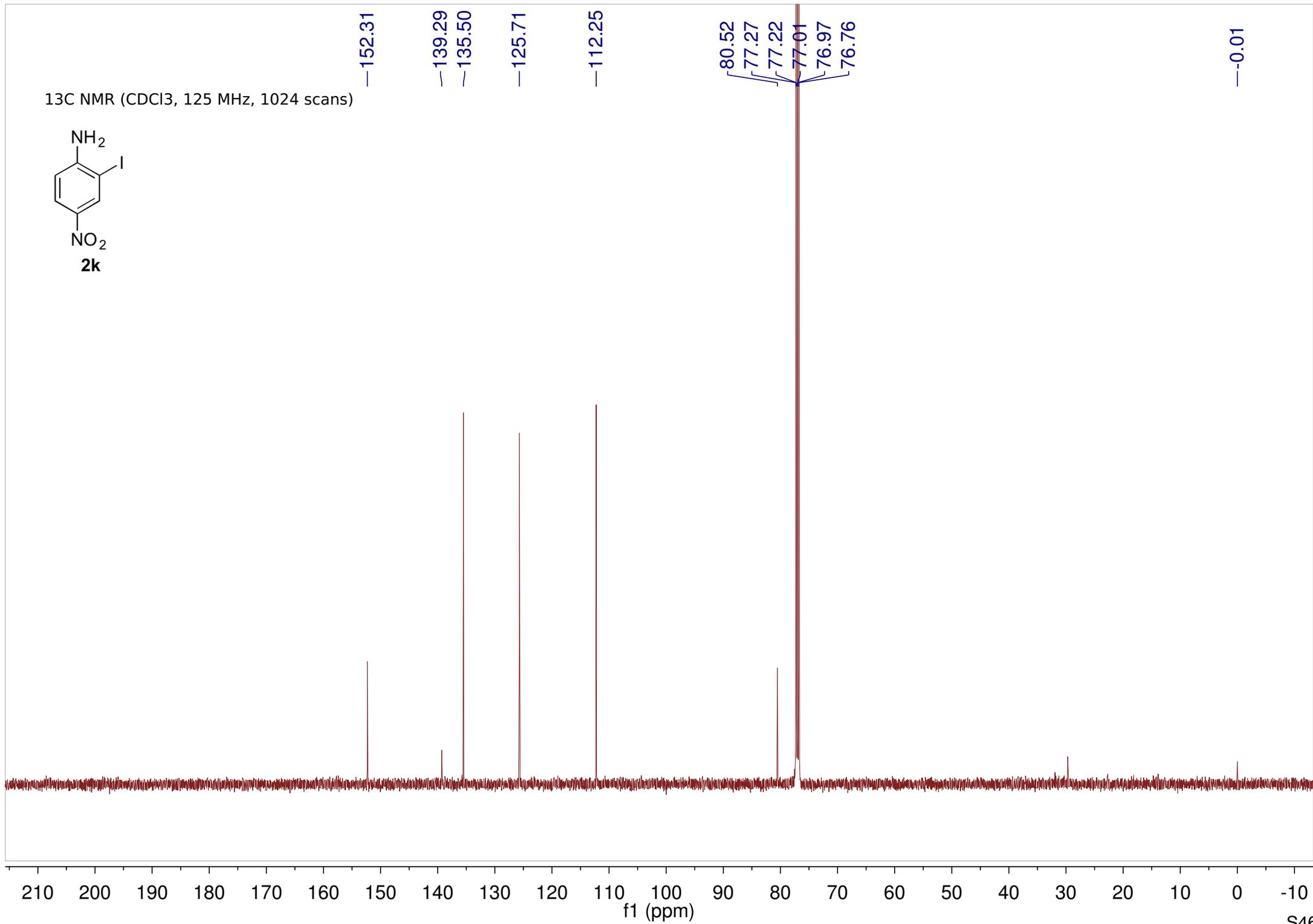
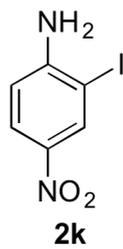


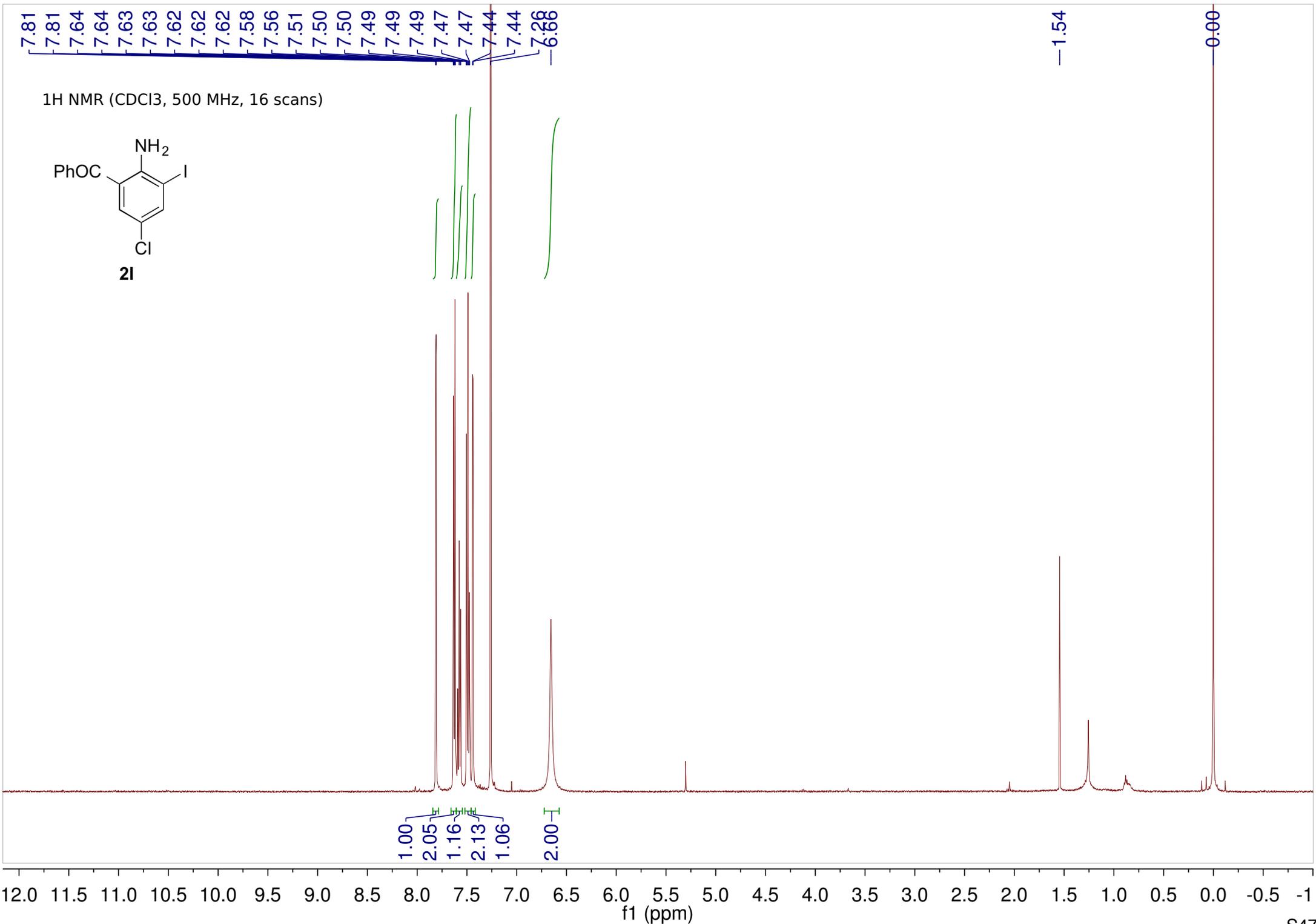
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0.00

1.01
0.99
1.00
2.02

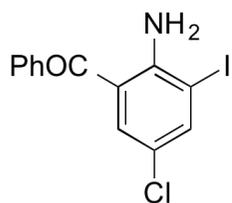
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f1 (ppm)

¹³C NMR (CDCl₃, 125 MHz, 1024 scans)

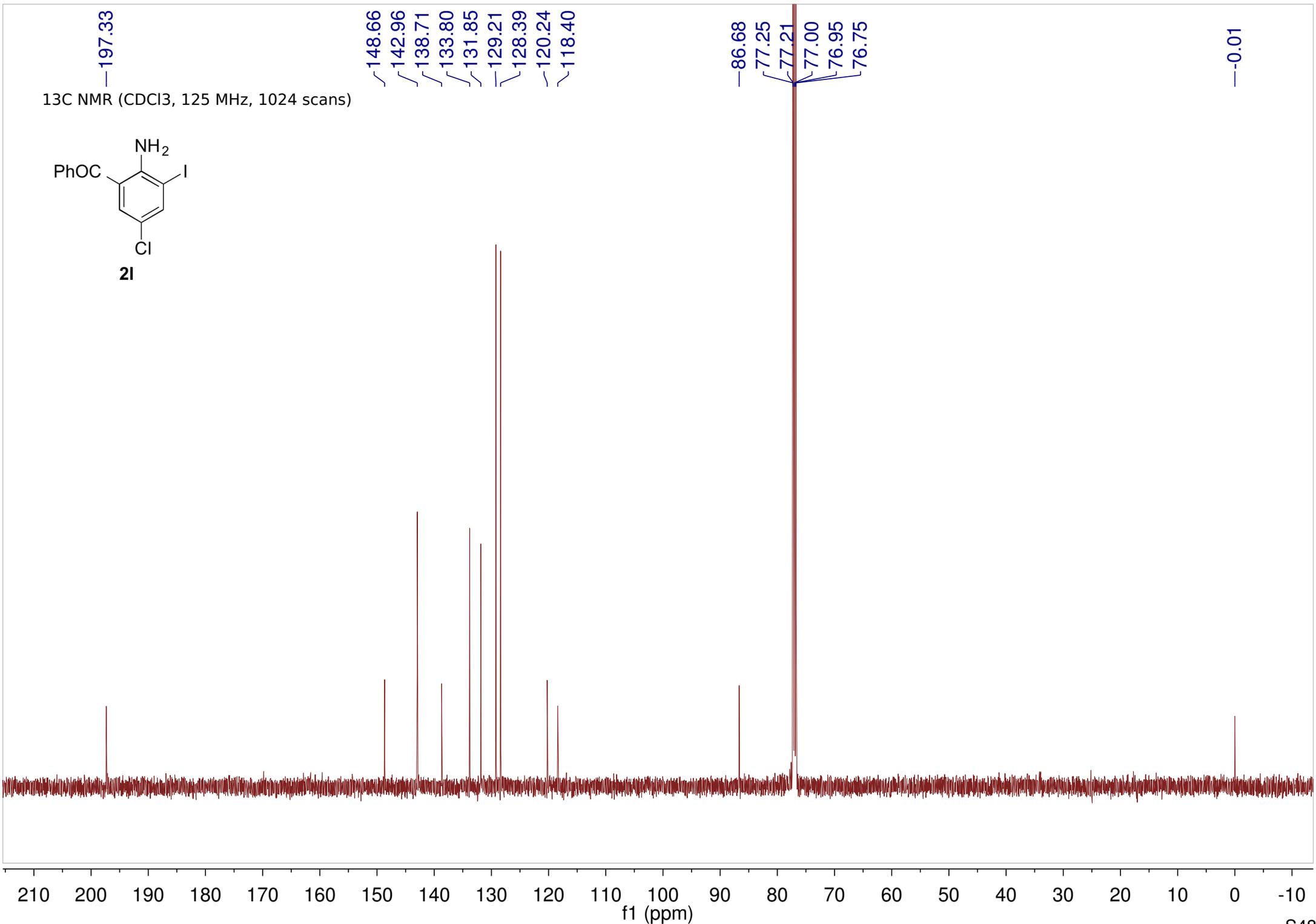




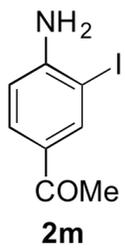
¹³C NMR (CDCl₃, 125 MHz, 1024 scans)



2I



¹H NMR (CDCl₃, 500 MHz, 16 scans)



8.28
8.27
7.77
7.77
7.76
7.75
7.27
6.72
6.71

4.62
4.62

-2.49

-0.00

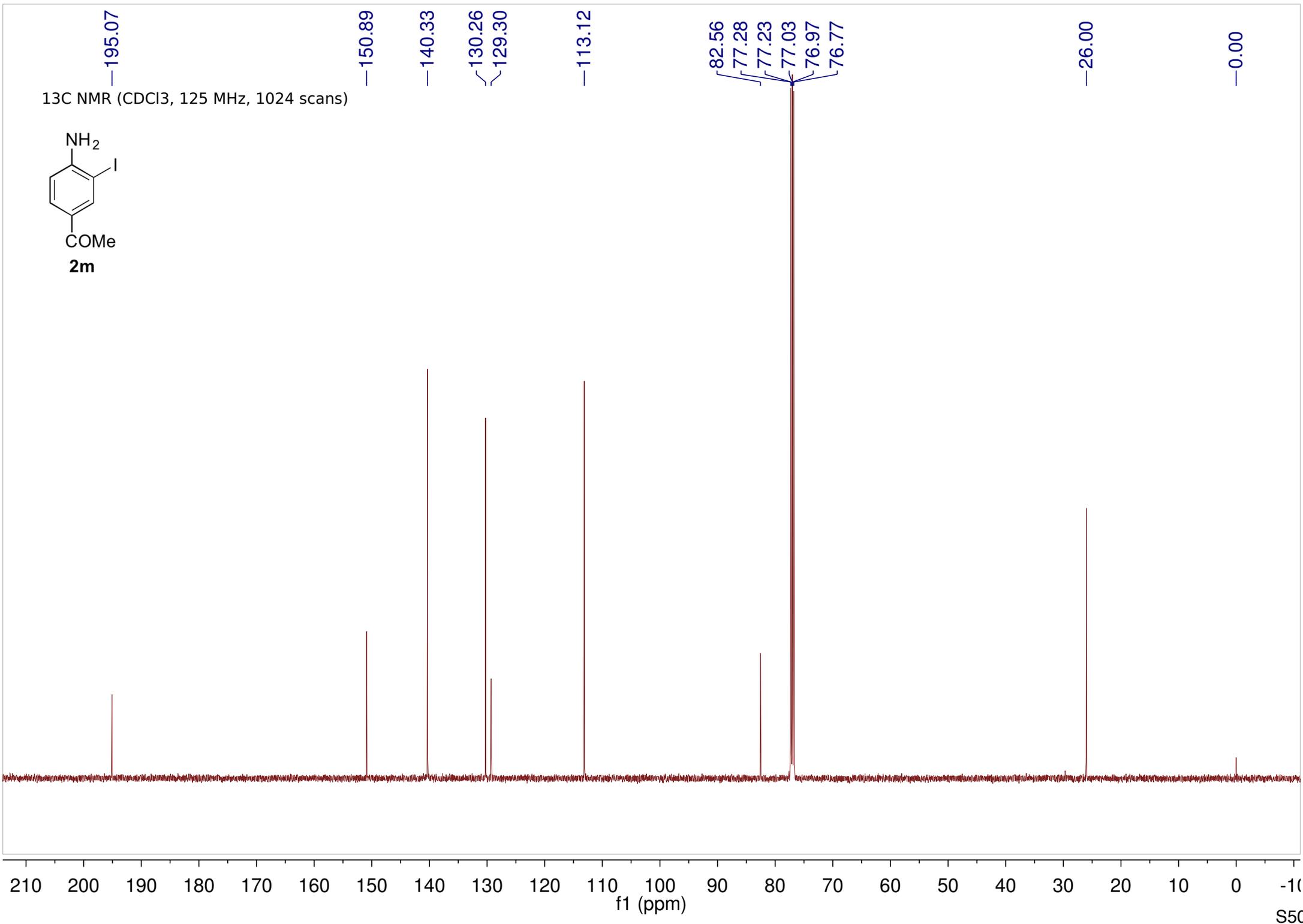
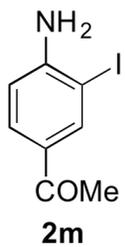


0.98
1.00
1.02
2.14
3.18

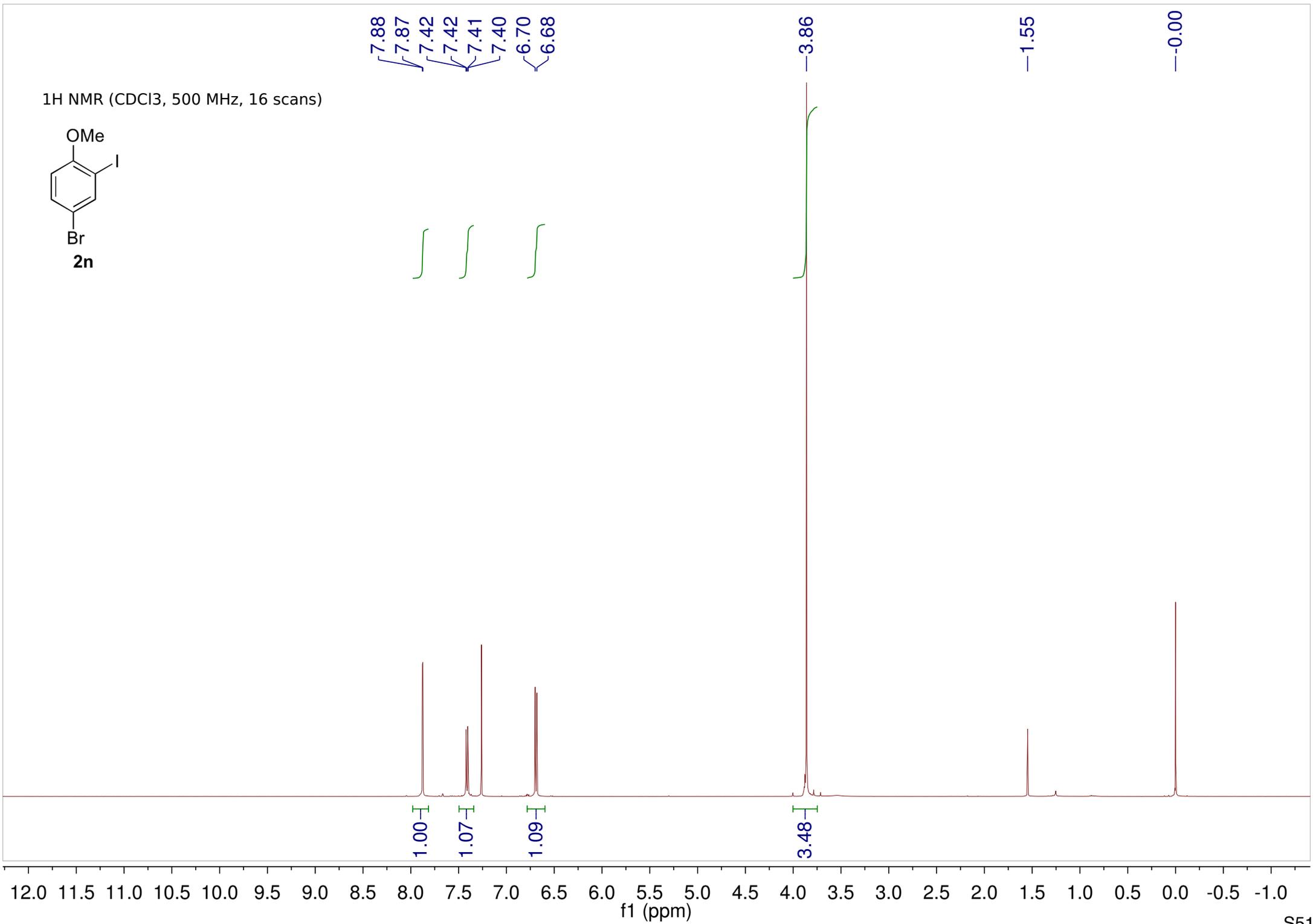
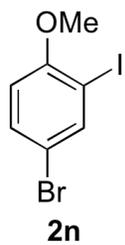
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0

f1 (ppm)

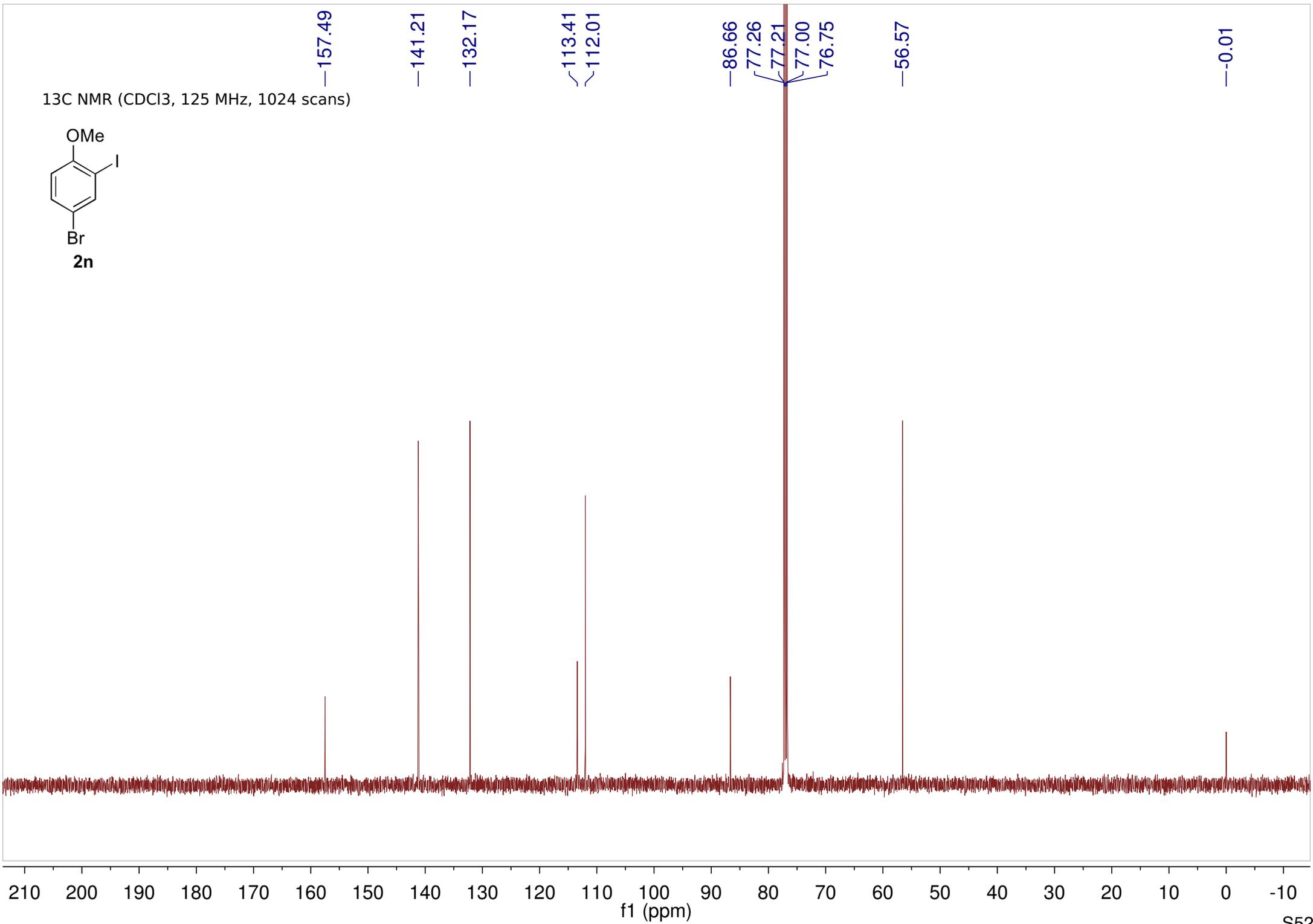
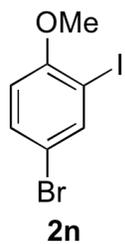
¹³C NMR (CDCl₃, 125 MHz, 1024 scans)



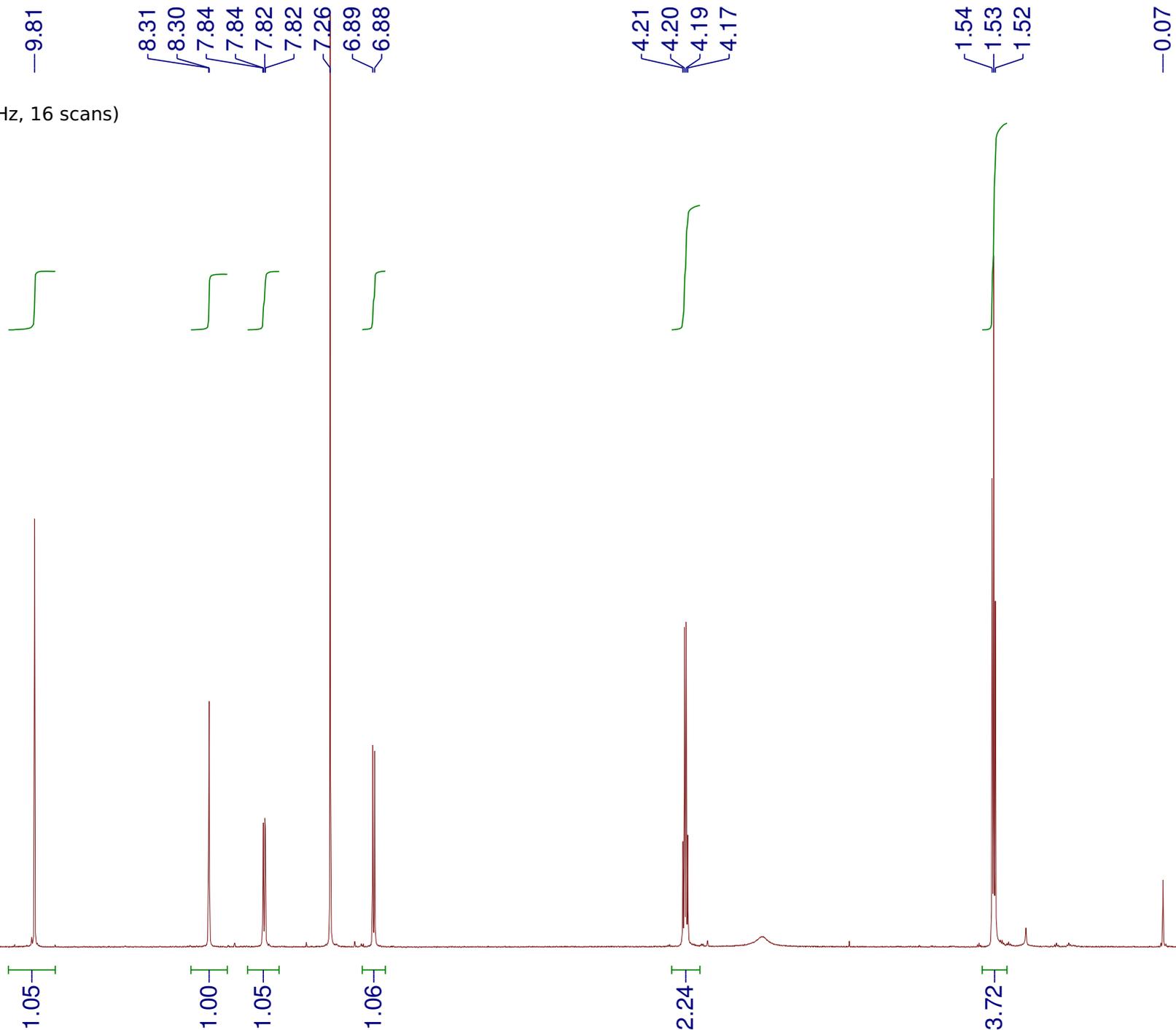
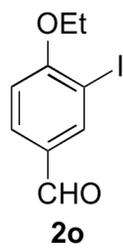
¹H NMR (CDCl₃, 500 MHz, 16 scans)



¹³C NMR (CDCl₃, 125 MHz, 1024 scans)

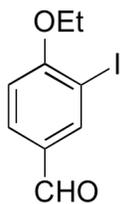


¹H NMR (CDCl₃, 500 MHz, 16 scans)

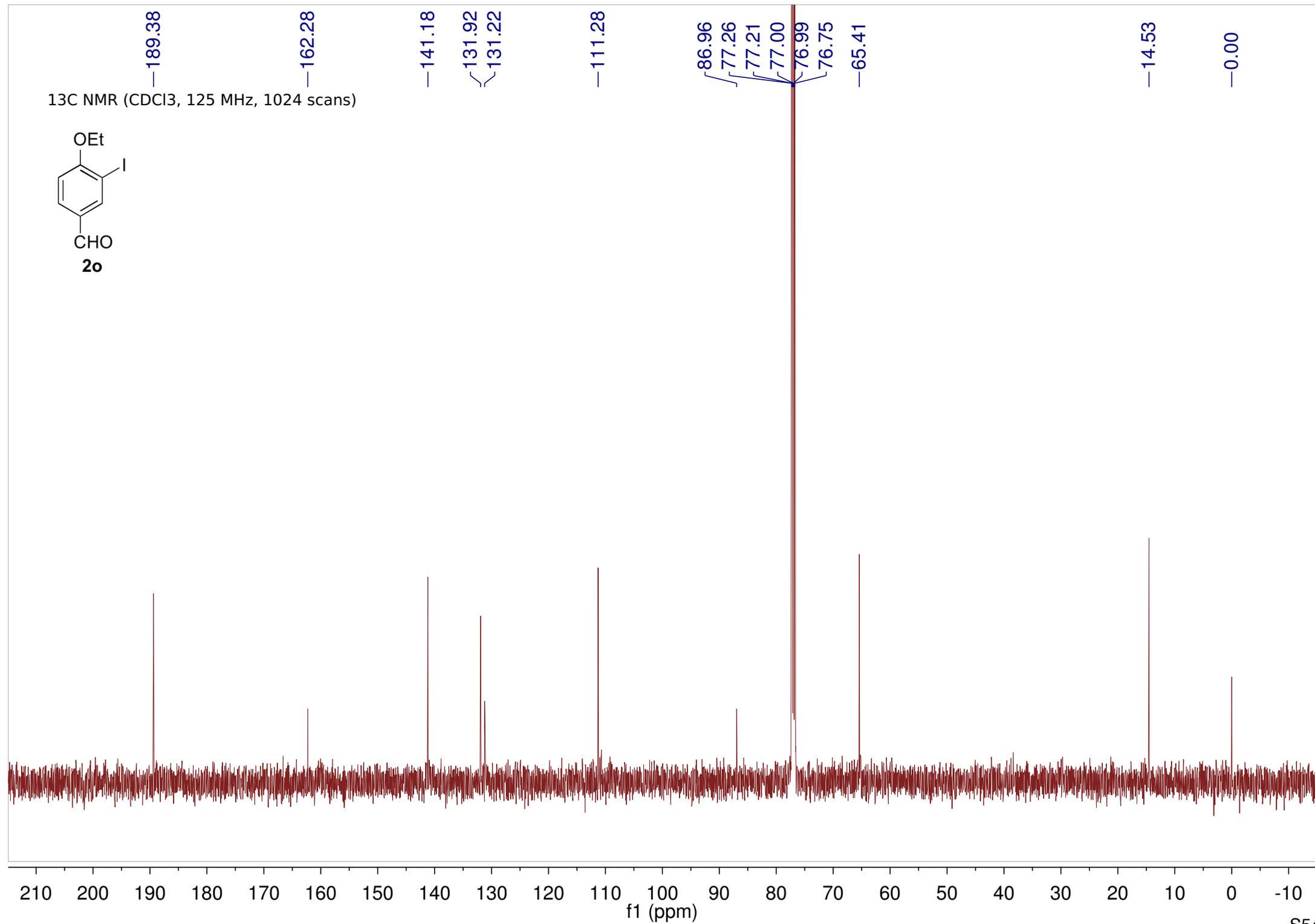


12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0

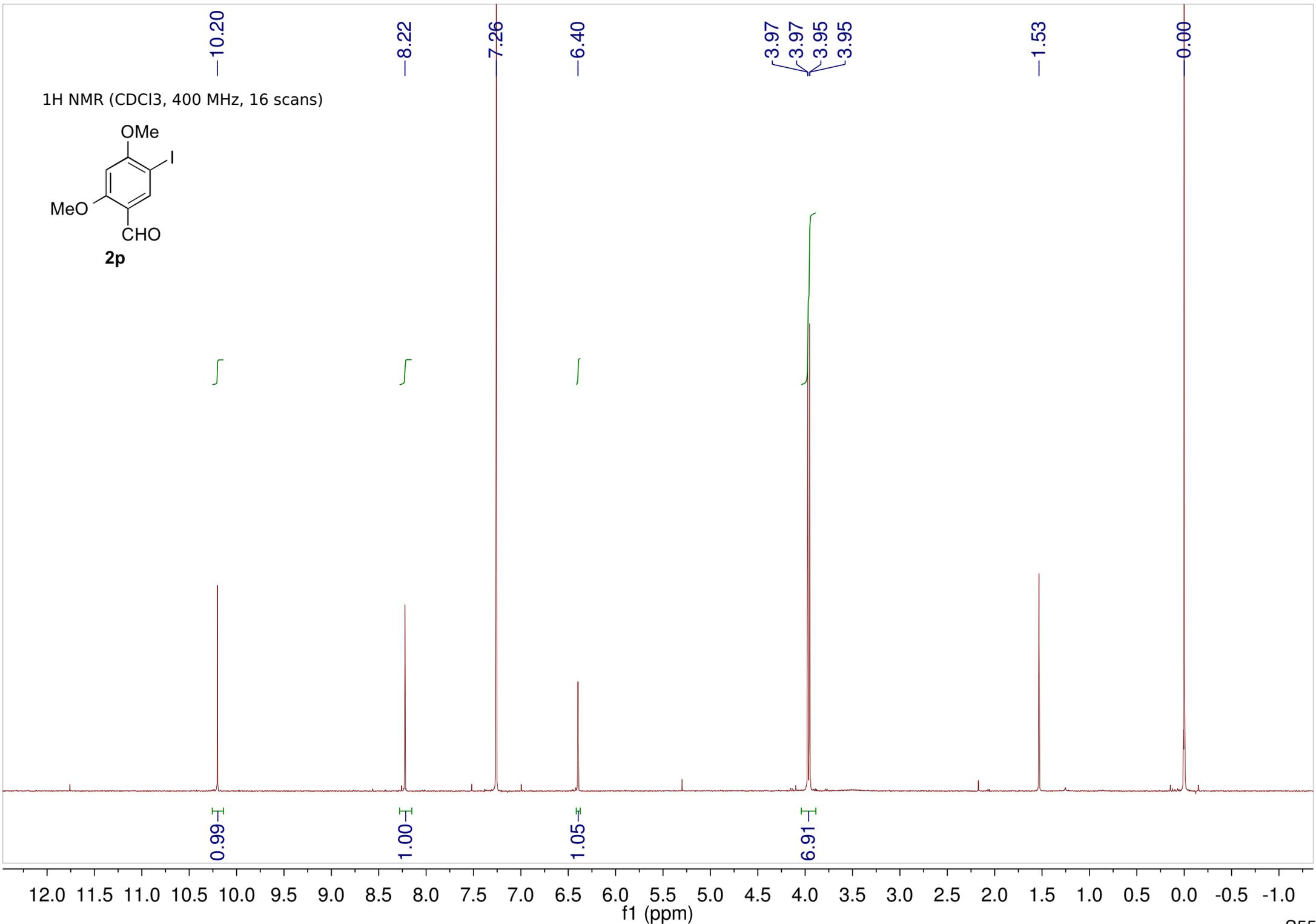
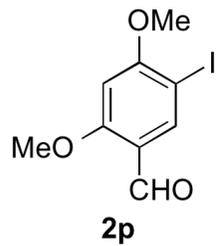
¹³C NMR (CDCl₃, 125 MHz, 1024 scans)



2o



¹H NMR (CDCl₃, 400 MHz, 16 scans)



10.20
0.99

8.22
1.00

7.26
1.05

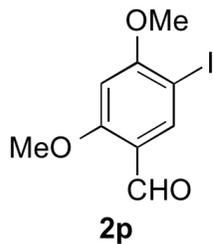
6.40
1.05

3.97
3.97
3.95
3.95
6.91

1.53

0.00

¹³C NMR (CDCl₃, 125 MHz, 1024 scans)



186.93

164.06

163.81

139.33

120.45

94.80

77.24

77.19

76.99

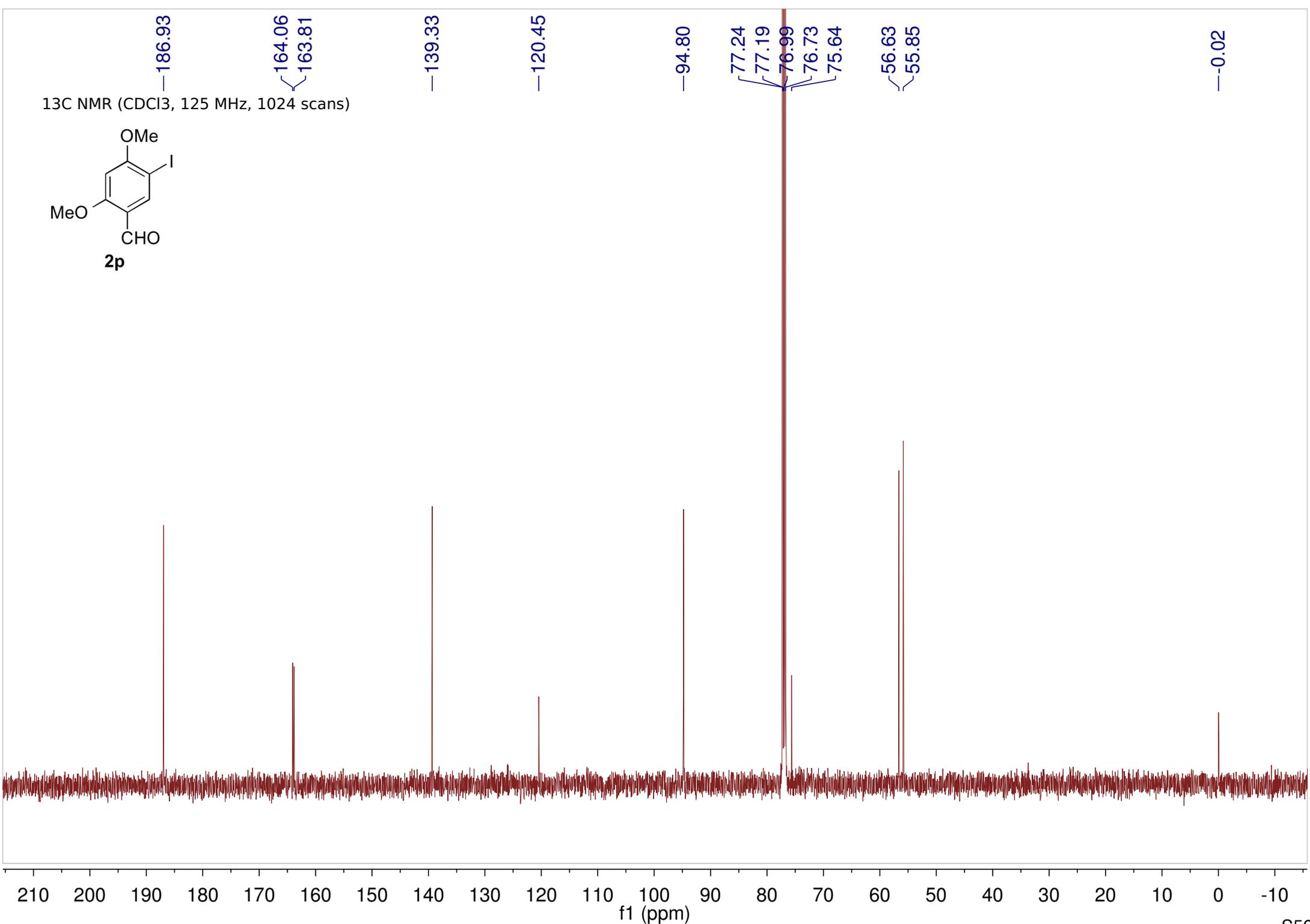
76.73

75.64

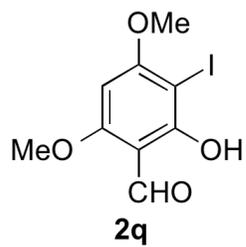
56.63

55.85

-0.02

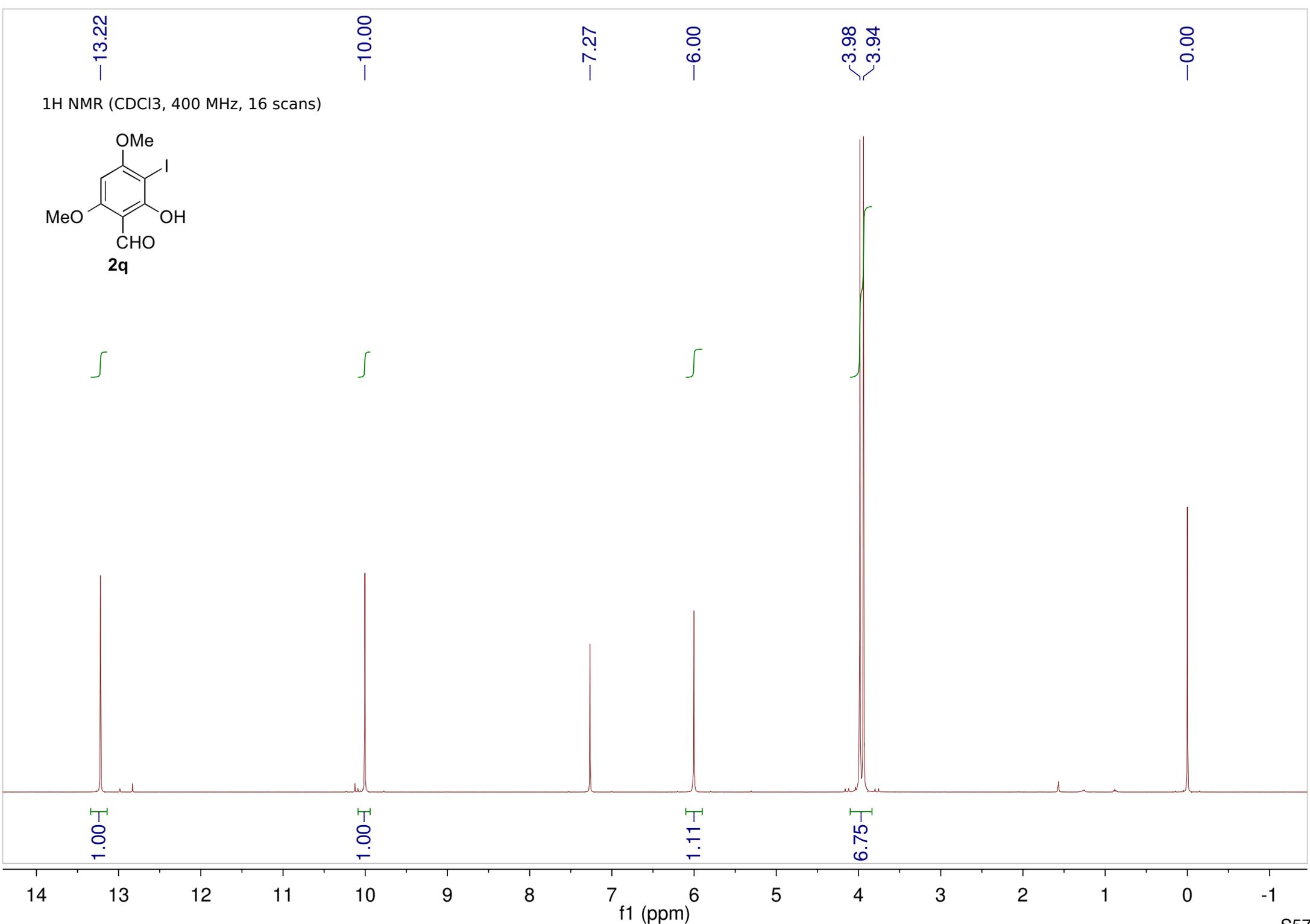


1H NMR (CDCl3, 400 MHz, 16 scans)

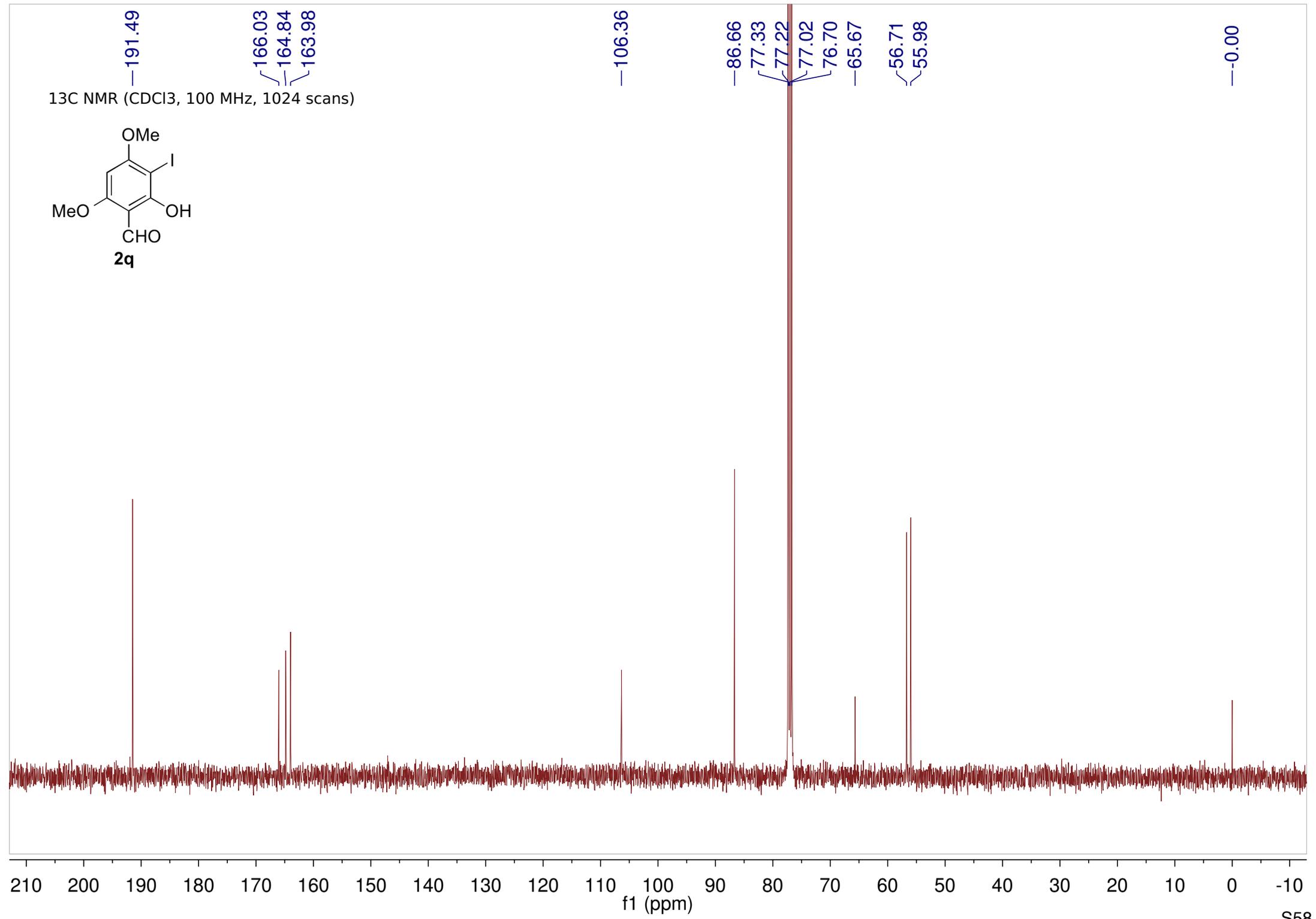
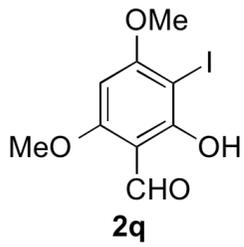


13.22 10.00 7.27 6.00 3.98 3.94 0.00

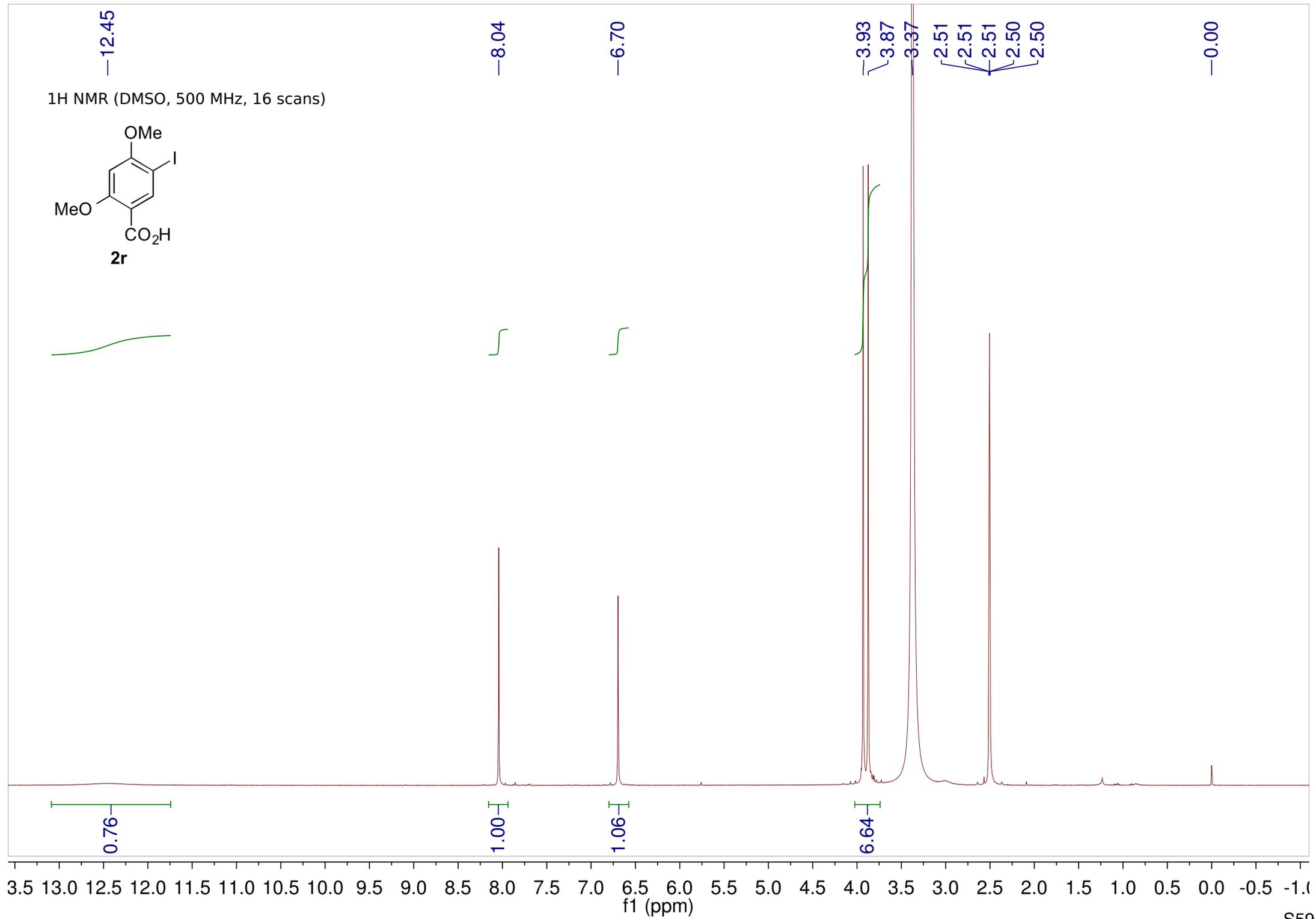
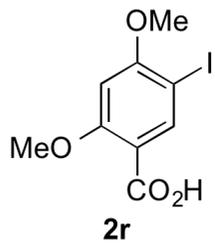
Integration values: 1.00, 1.00, 1.11, 6.75



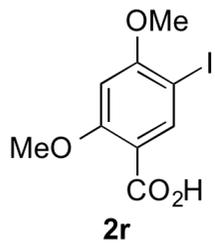
¹³C NMR (CDCl₃, 100 MHz, 1024 scans)



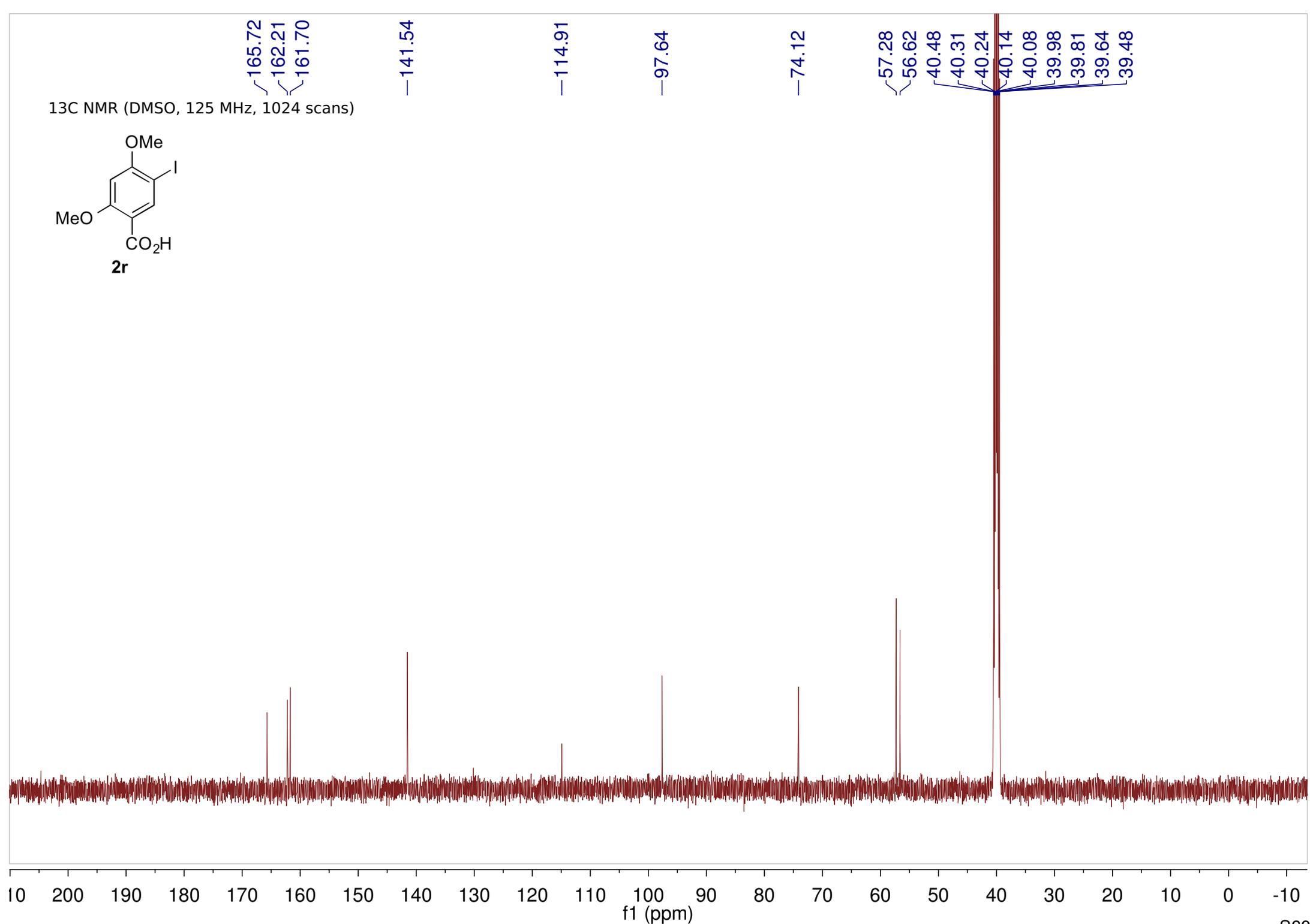
1H NMR (DMSO, 500 MHz, 16 scans)



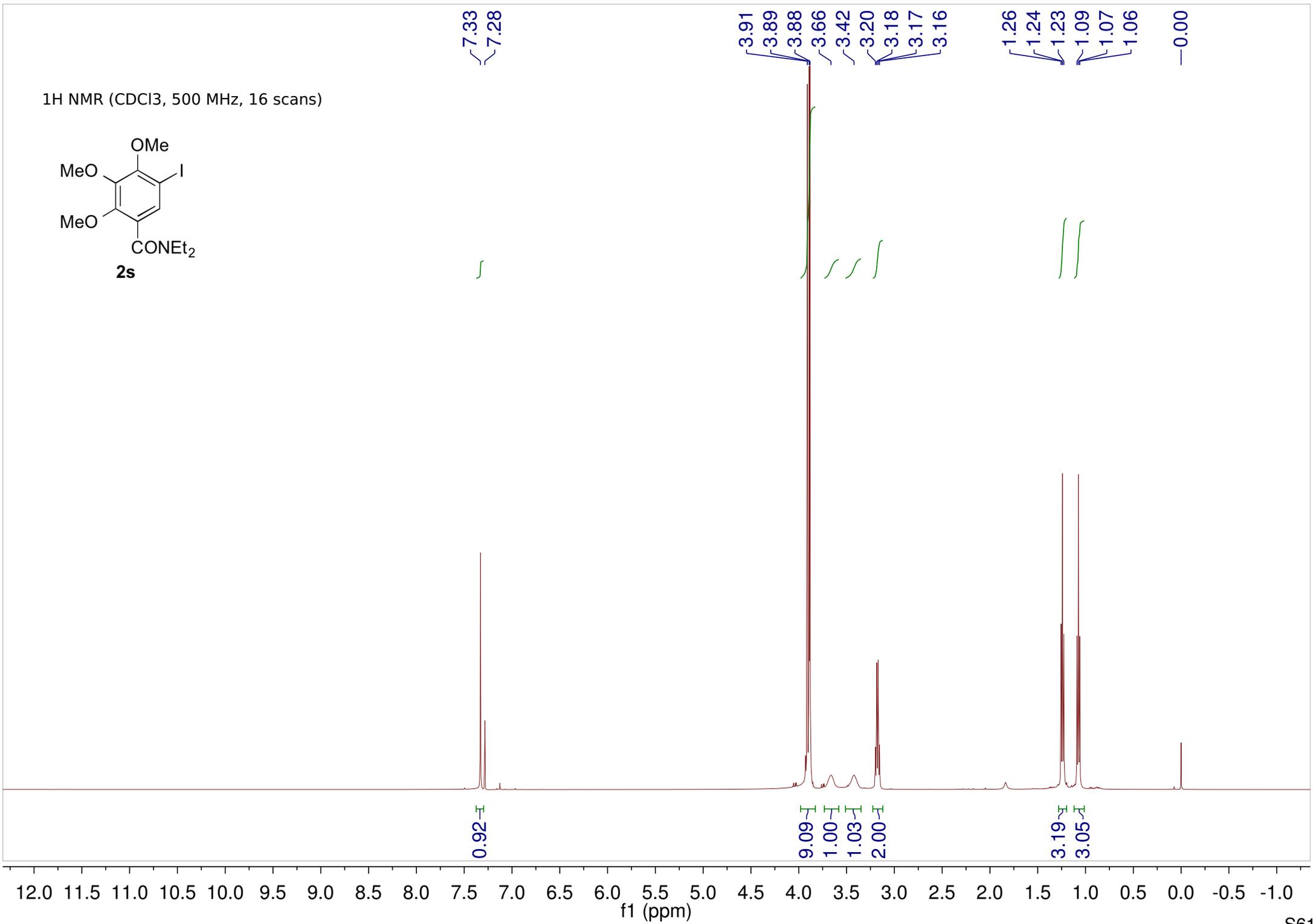
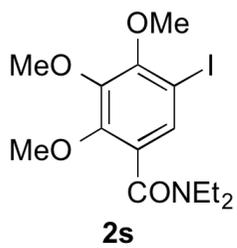
¹³C NMR (DMSO, 125 MHz, 1024 scans)



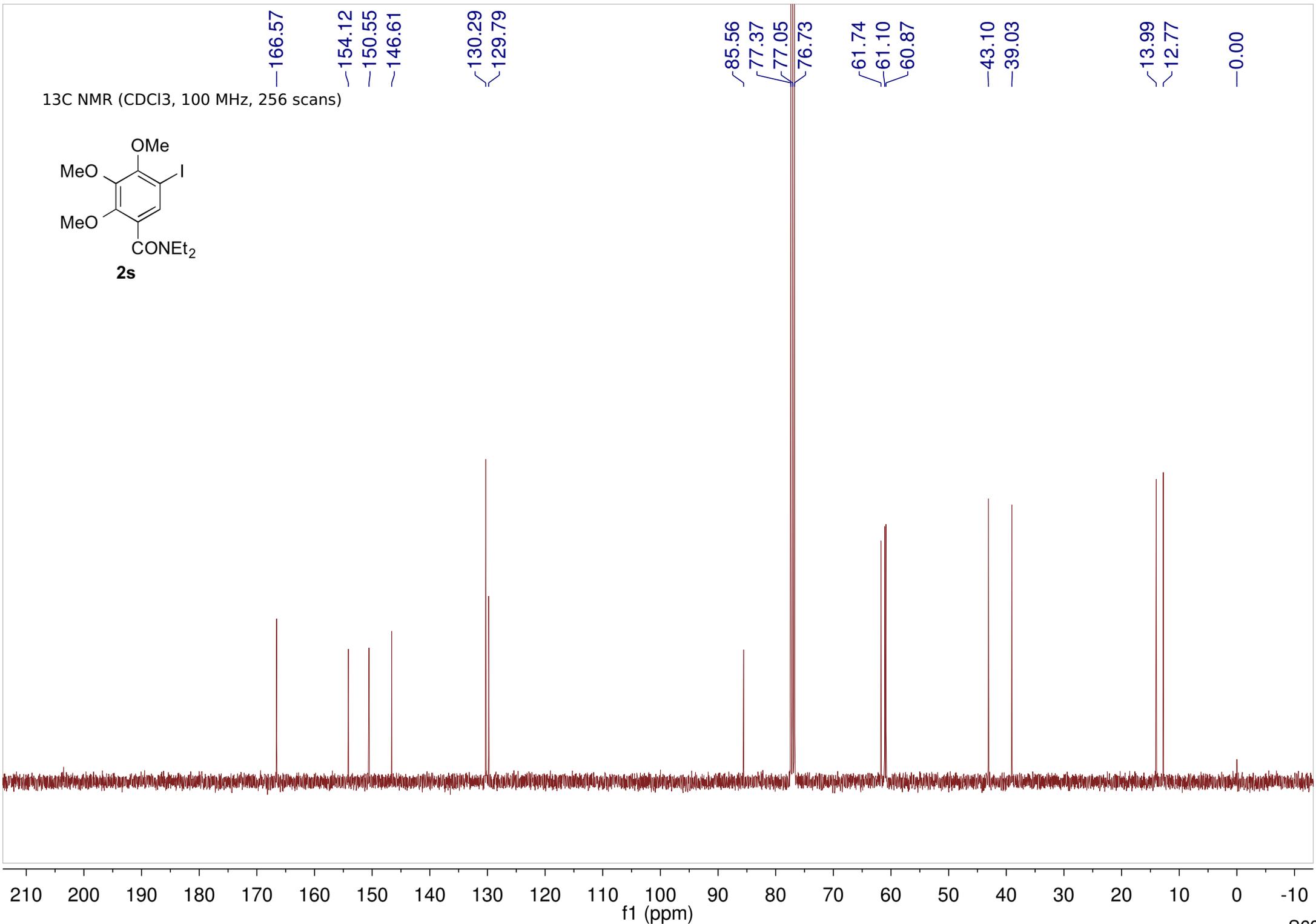
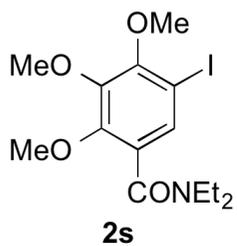
165.72
162.21
161.70
—141.54
—114.91
—97.64
—74.12
57.28
56.62
40.48
40.31
40.24
40.14
40.08
39.98
39.81
39.64
39.48



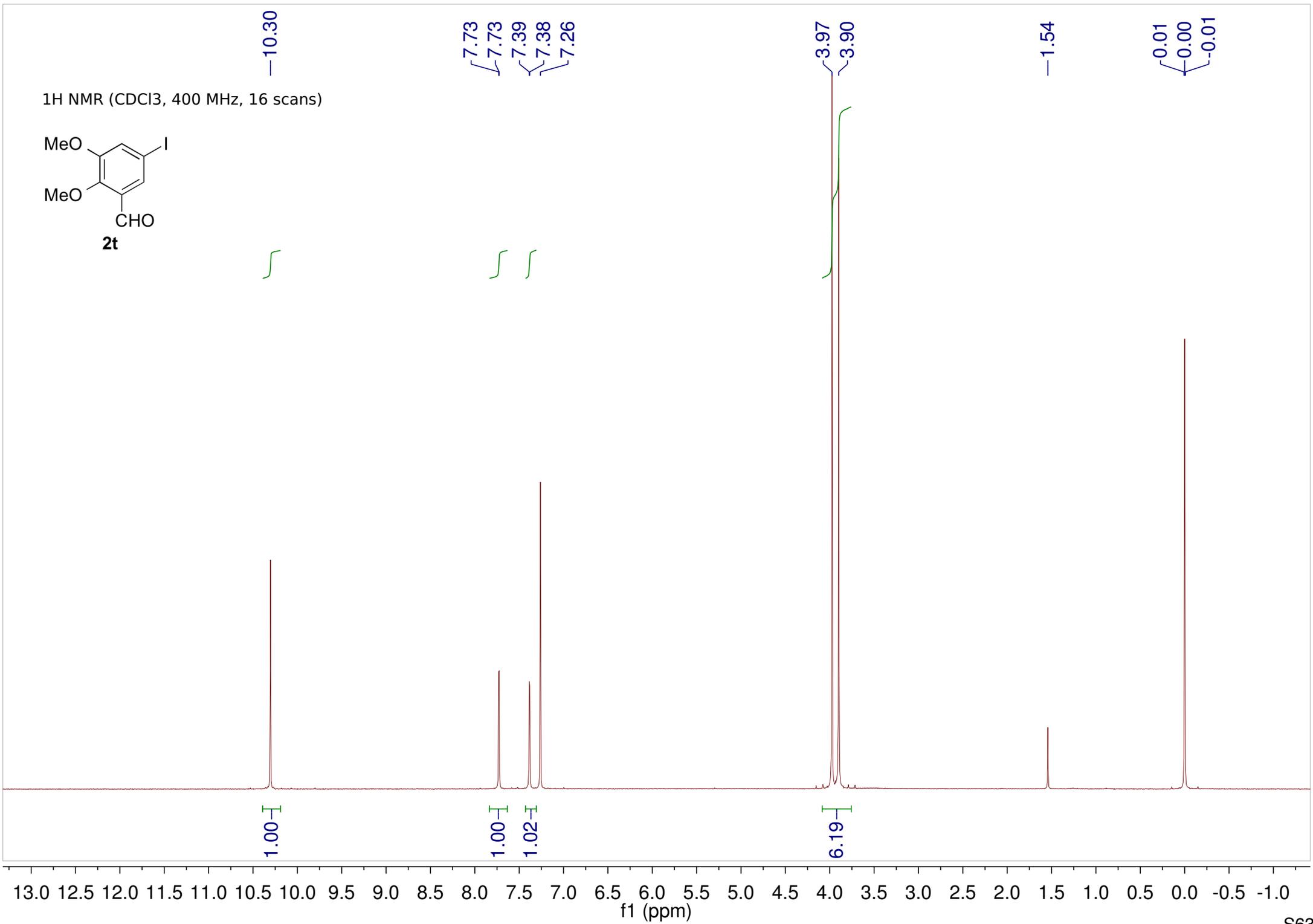
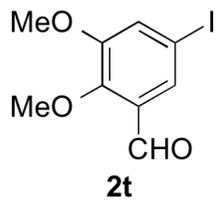
¹H NMR (CDCl₃, 500 MHz, 16 scans)



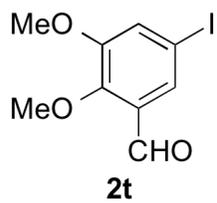
¹³C NMR (CDCl₃, 100 MHz, 256 scans)



¹H NMR (CDCl₃, 400 MHz, 16 scans)



¹³C NMR (CDCl₃, 125 MHz, 1024 scans)



188.49

153.75

152.62

130.90

128.21

126.69

86.95

77.27

77.21

77.01

76.76

62.35

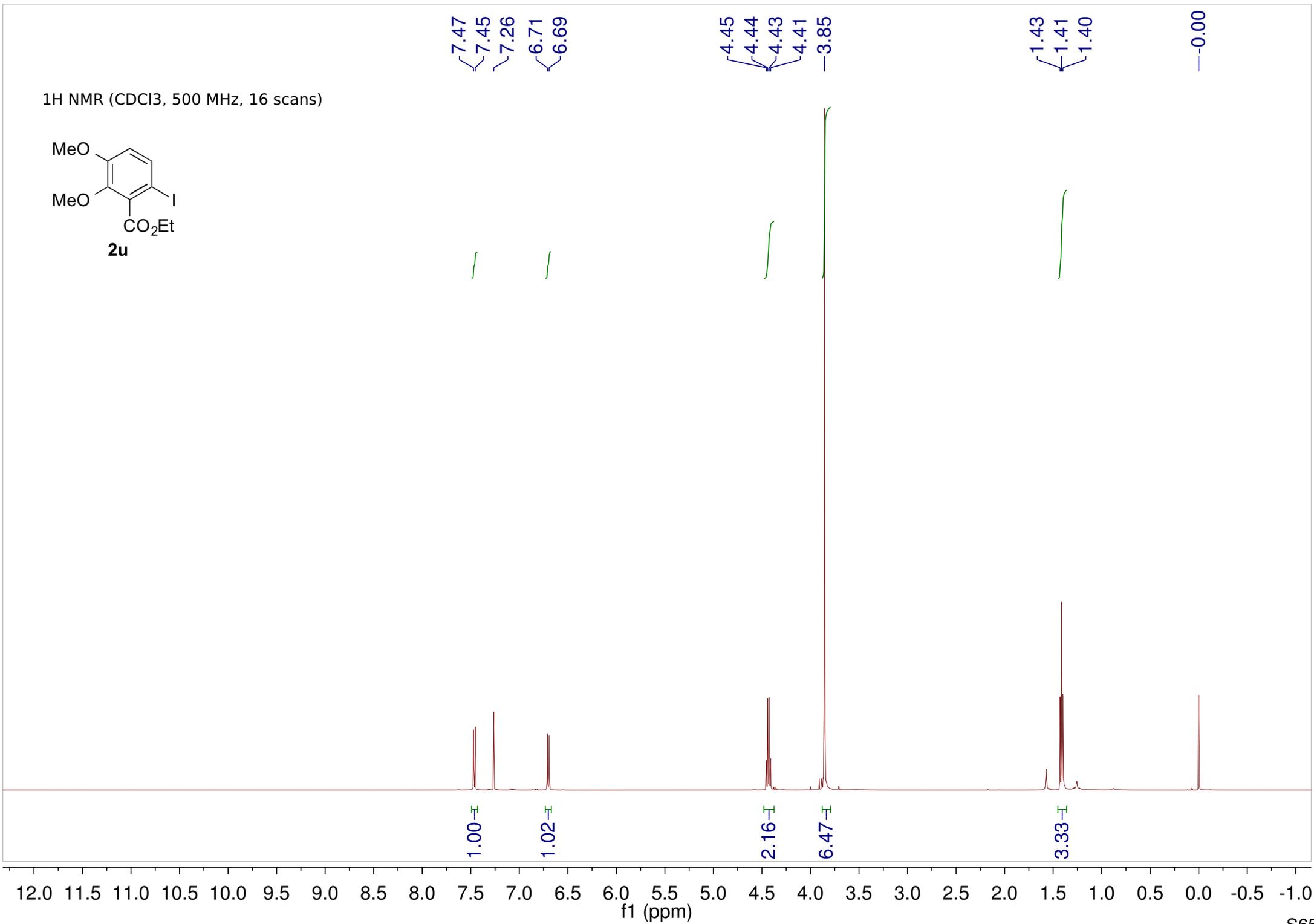
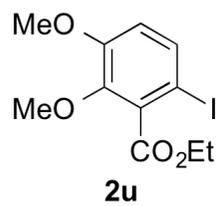
56.34

-0.01

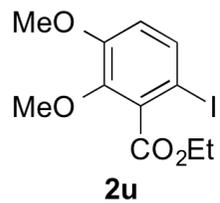
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10

f1 (ppm)

¹H NMR (CDCl₃, 500 MHz, 16 scans)



¹³C NMR (CDCl₃, 125 MHz, 1024 scans)



166.93

153.01

146.82

135.65

134.33

115.16

79.51

77.57

77.26

77.20

77.00

76.75

61.92

61.67

56.04

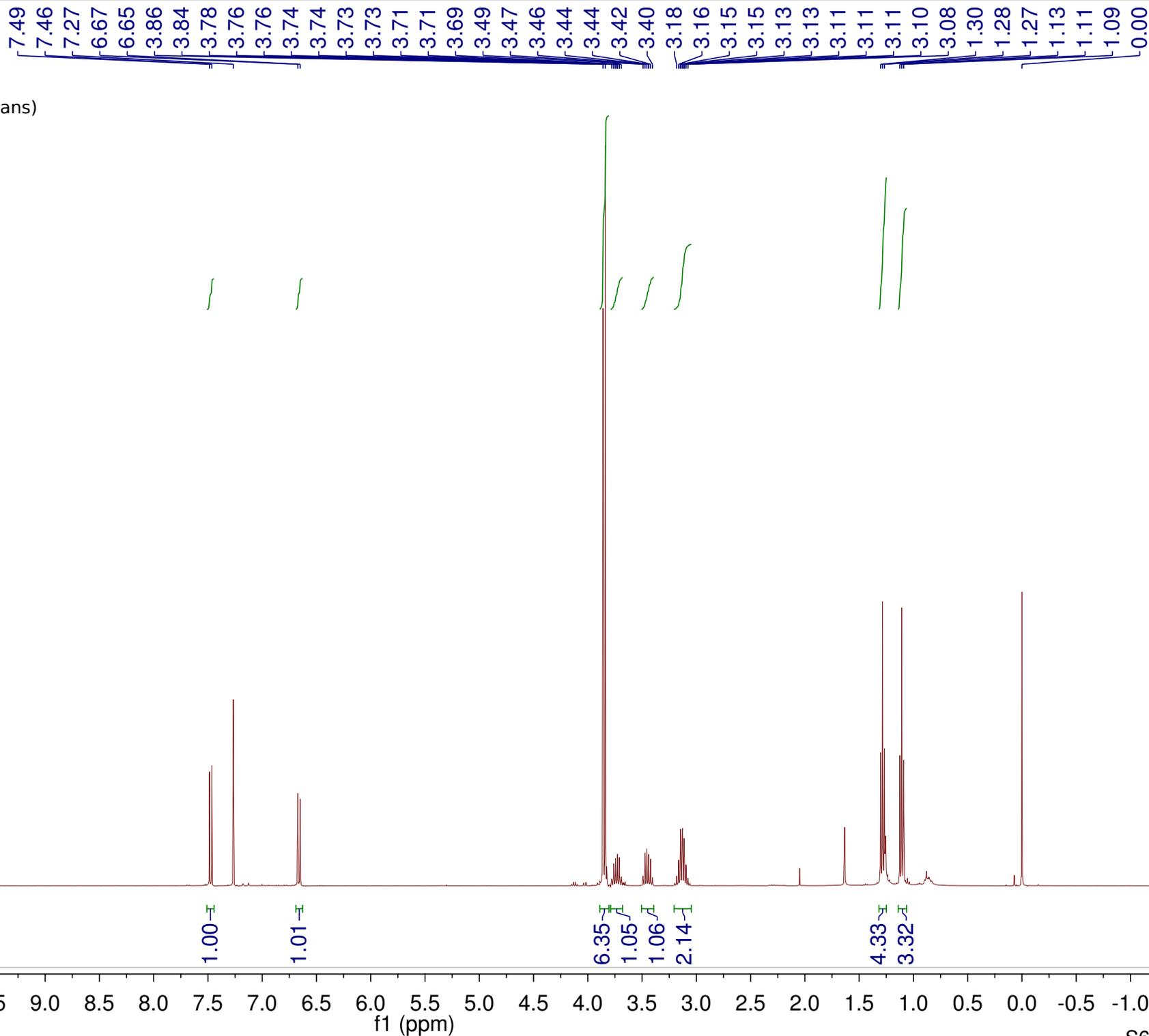
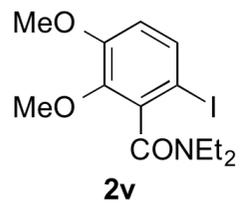
14.19

-0.02

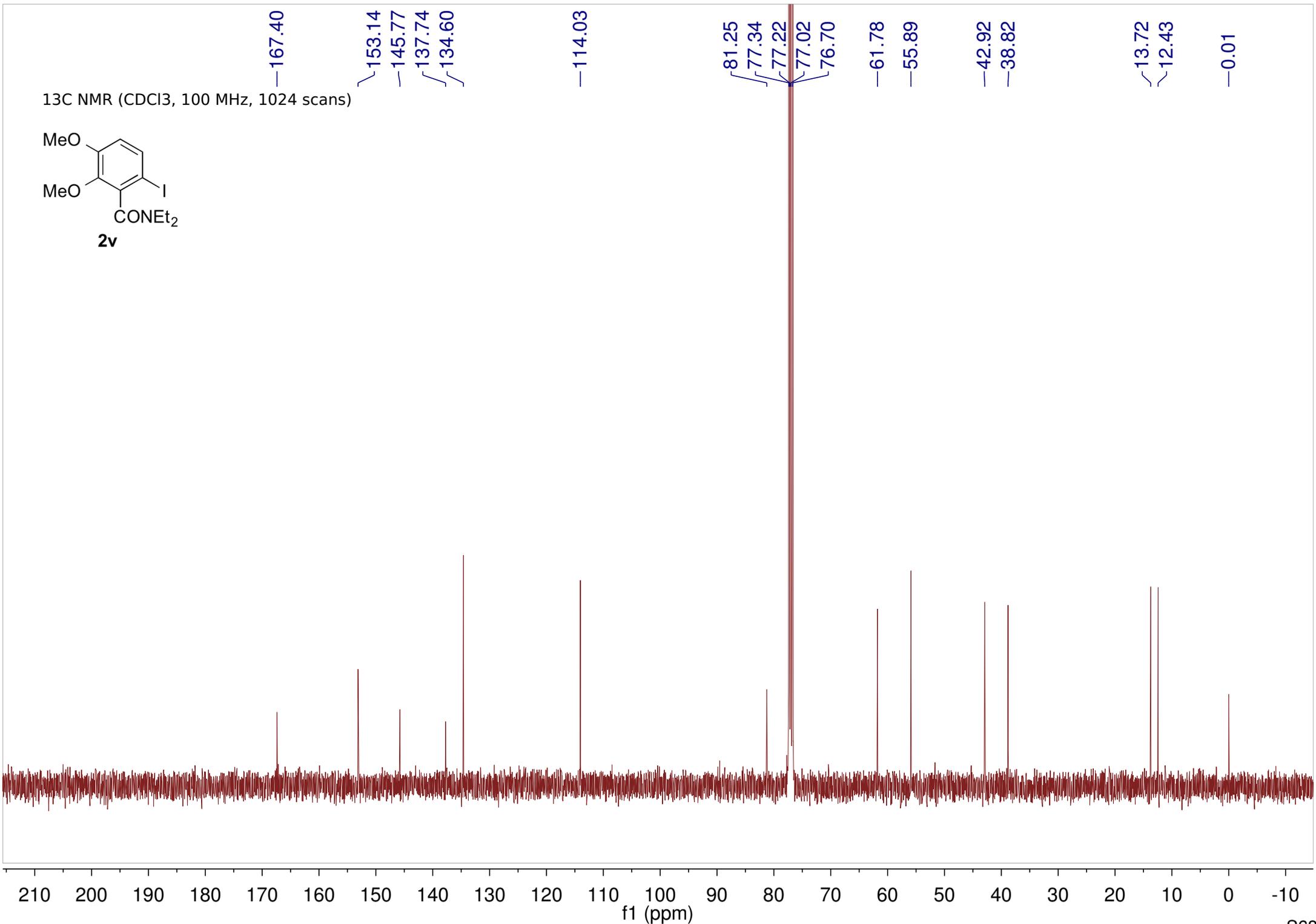
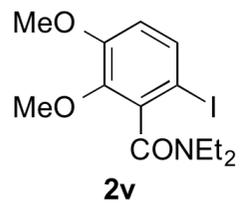
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10

f1 (ppm)

¹H NMR (CDCl₃, 400 MHz, 16 scans)

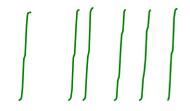
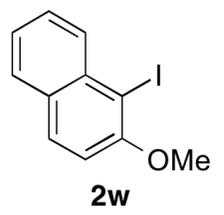


¹³C NMR (CDCl₃, 100 MHz, 1024 scans)



8.15
8.15
8.13
8.13
7.84
7.82
7.76
7.75
7.75
7.75
7.74
7.74
7.73
7.73
7.73
7.56
7.56
7.54
7.54
7.54
7.52
7.52
7.40
7.40
7.40
7.39
7.38
7.38
7.36
7.36
7.26
7.23
7.21
4.03
4.03

¹H NMR (CDCl₃, 400 MHz, 16 scans)

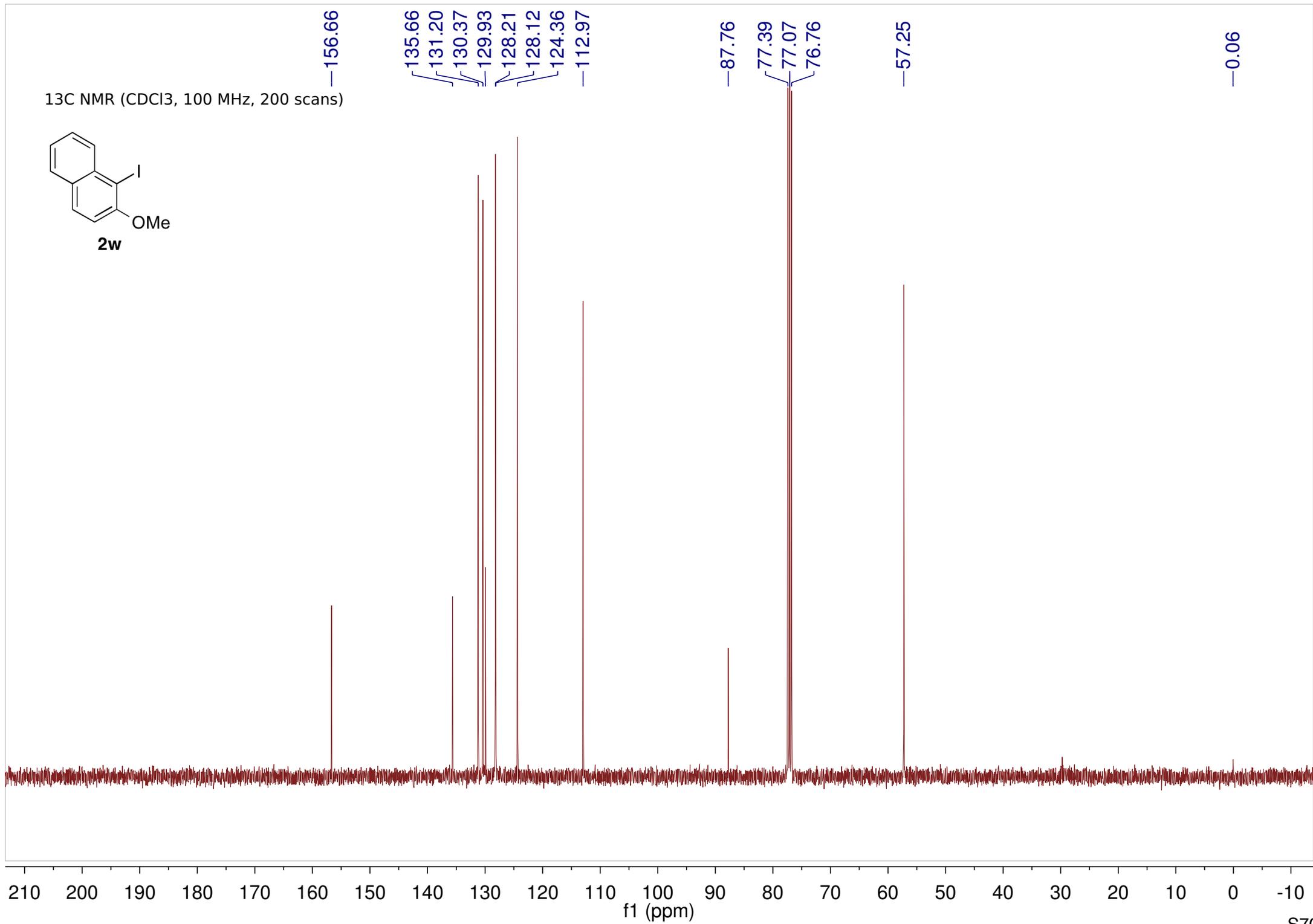
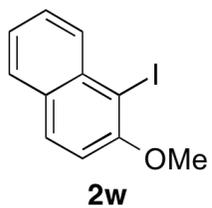


1.00
1.03
1.05
1.03
1.03
1.04
3.22
1

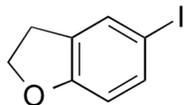
—1.53
—0.06
—0.00

12.0 11.5 11.0 10.5 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 -1.0
f1 (ppm)

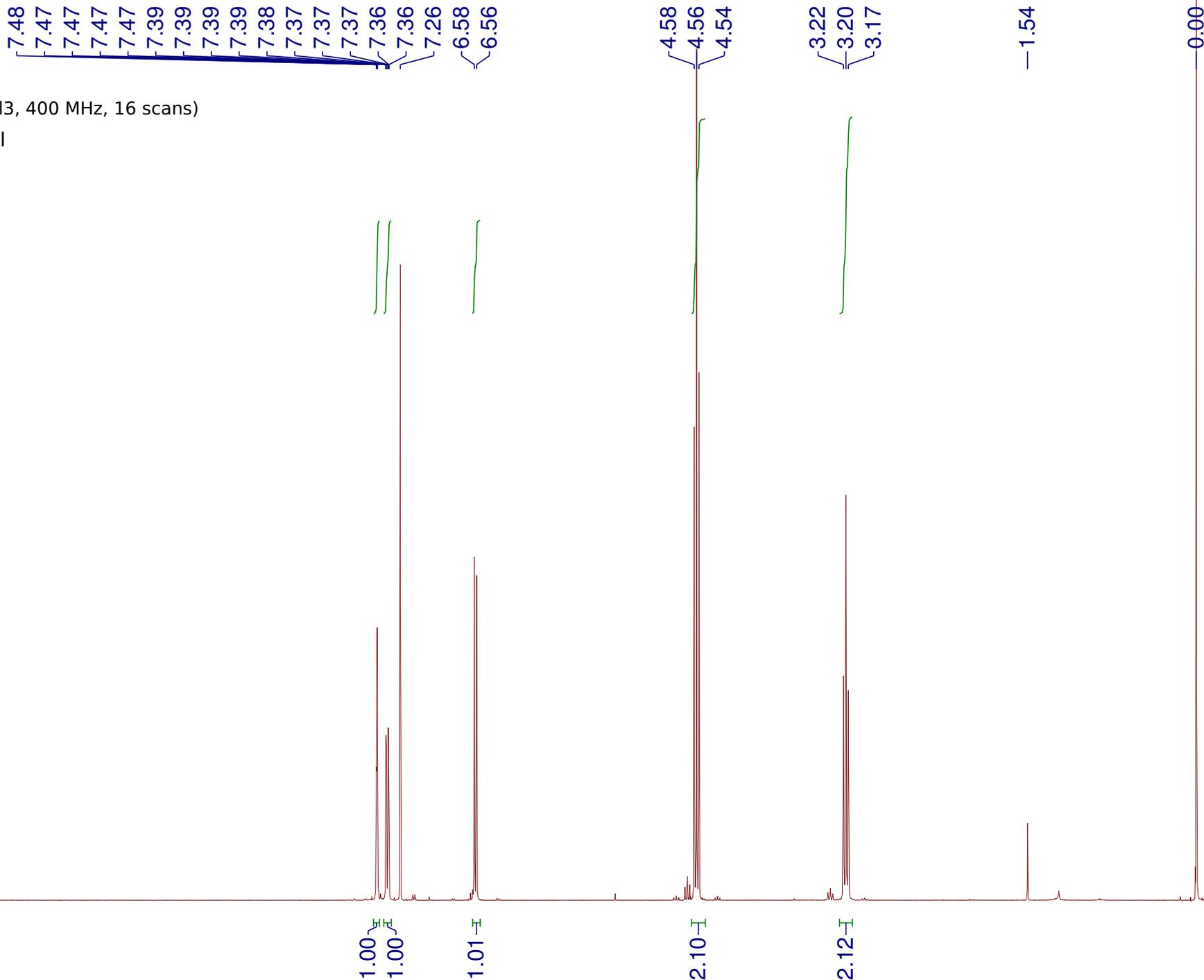
¹³C NMR (CDCl₃, 100 MHz, 200 scans)



1H NMR (CDCl3, 400 MHz, 16 scans)

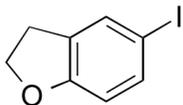


2x

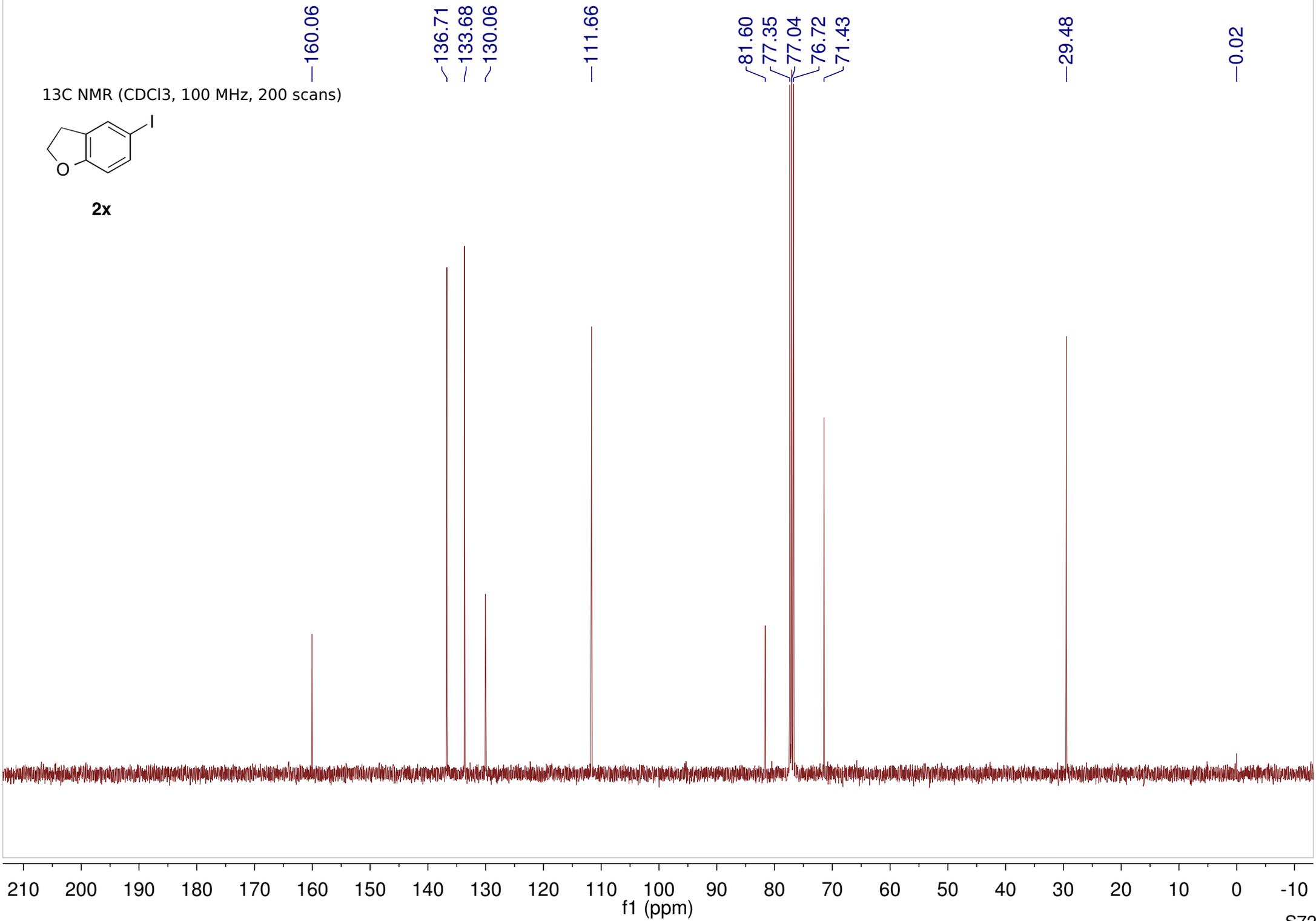


12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

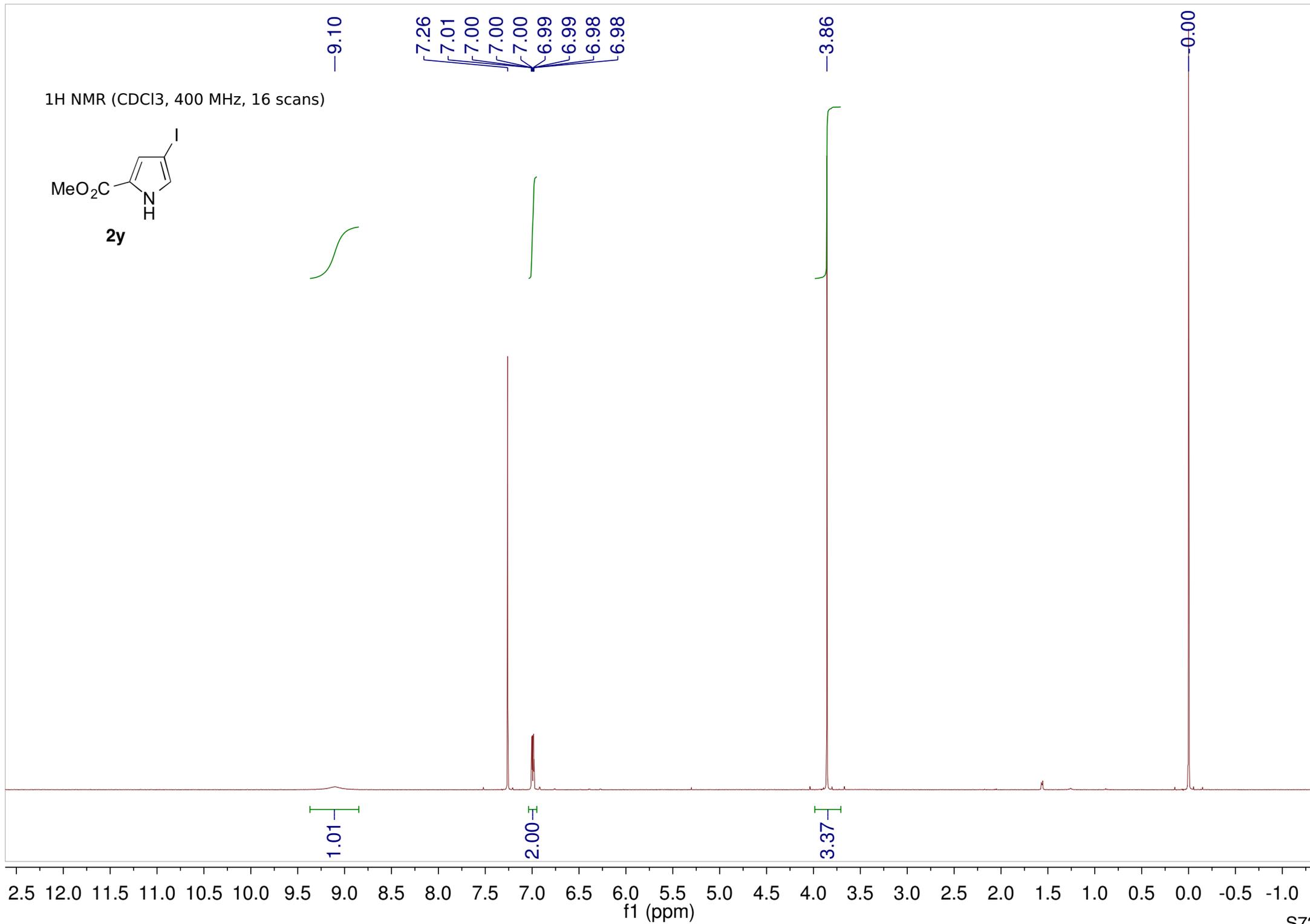
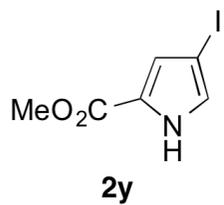
¹³C NMR (CDCl₃, 100 MHz, 200 scans)



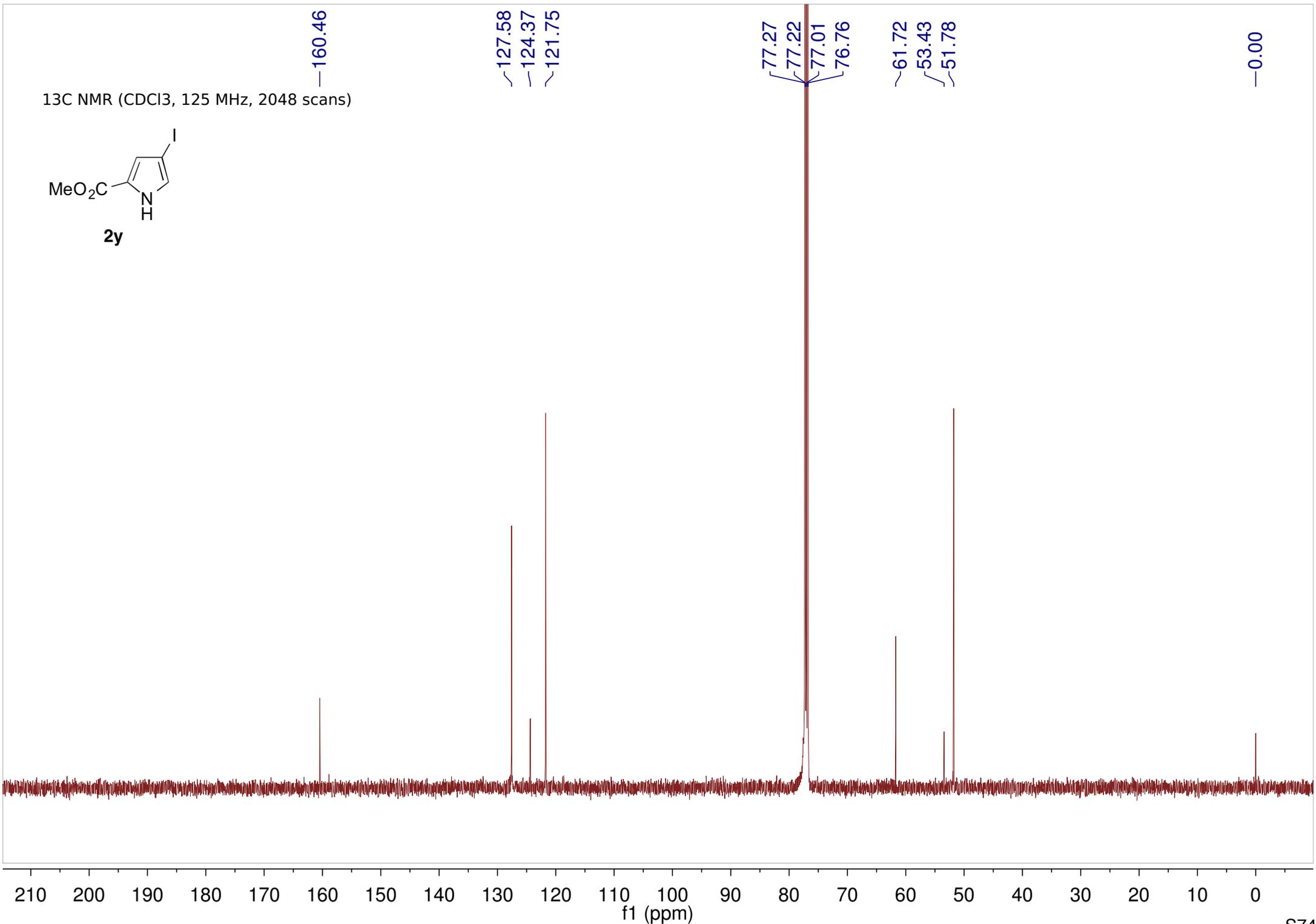
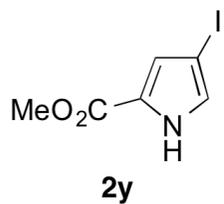
2x



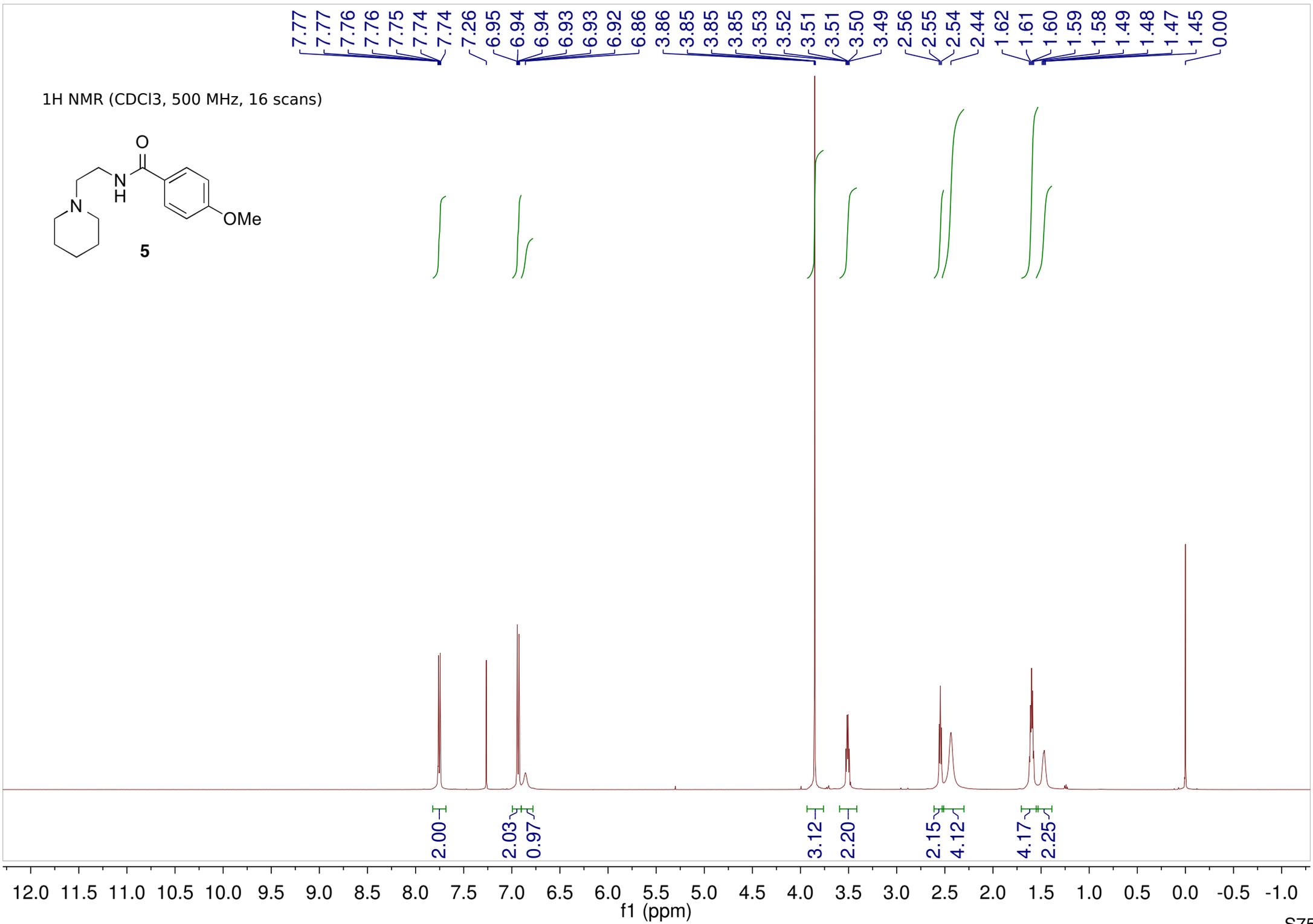
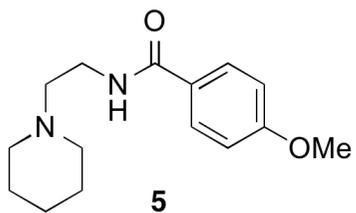
¹H NMR (CDCl₃, 400 MHz, 16 scans)



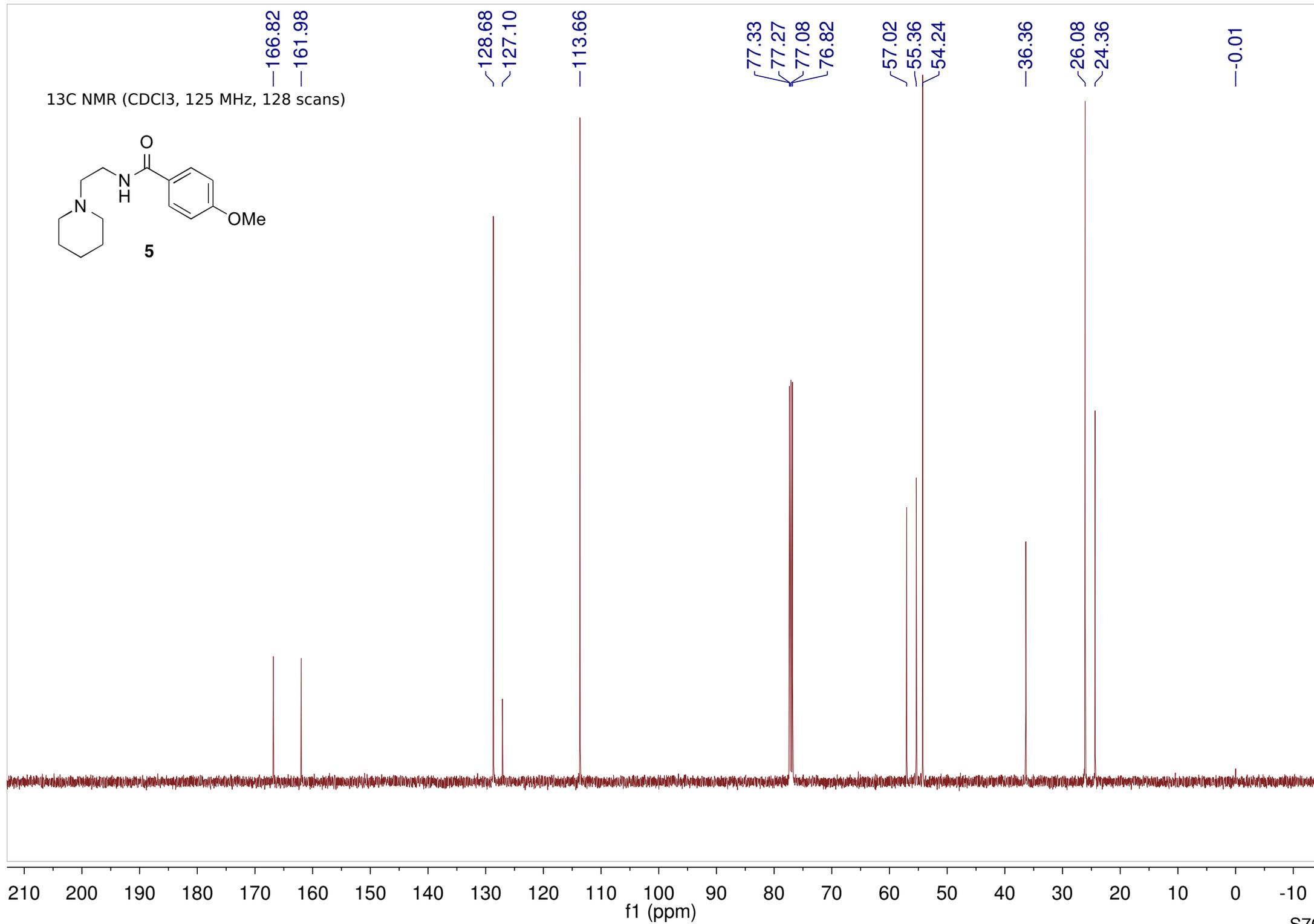
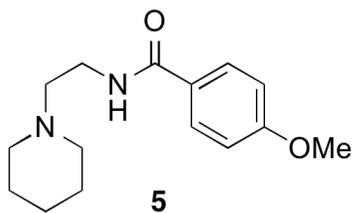
¹³C NMR (CDCl₃, 125 MHz, 2048 scans)



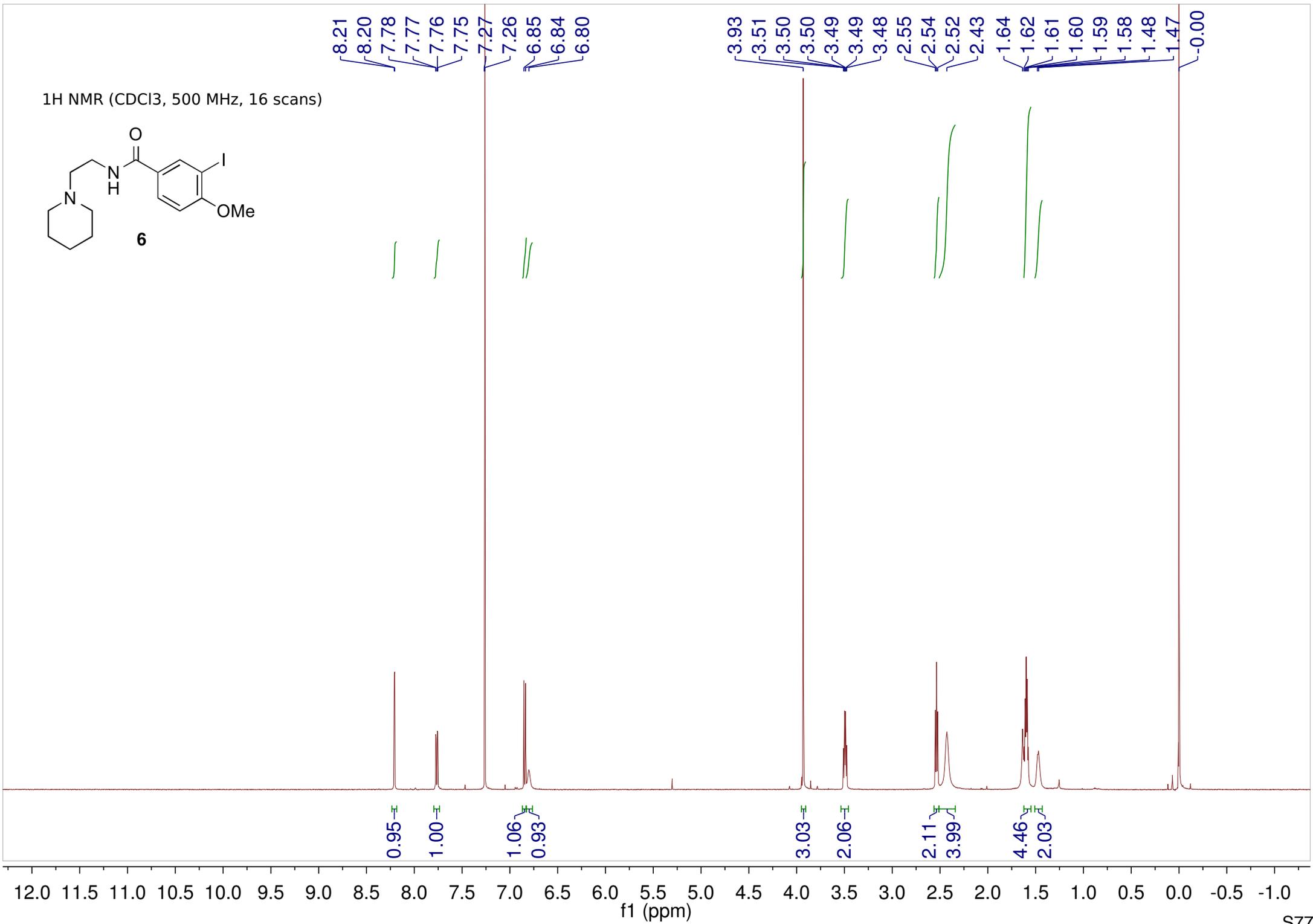
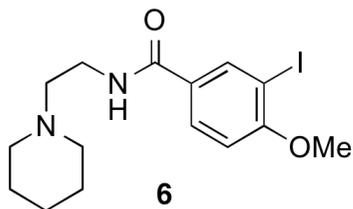
¹H NMR (CDCl₃, 500 MHz, 16 scans)



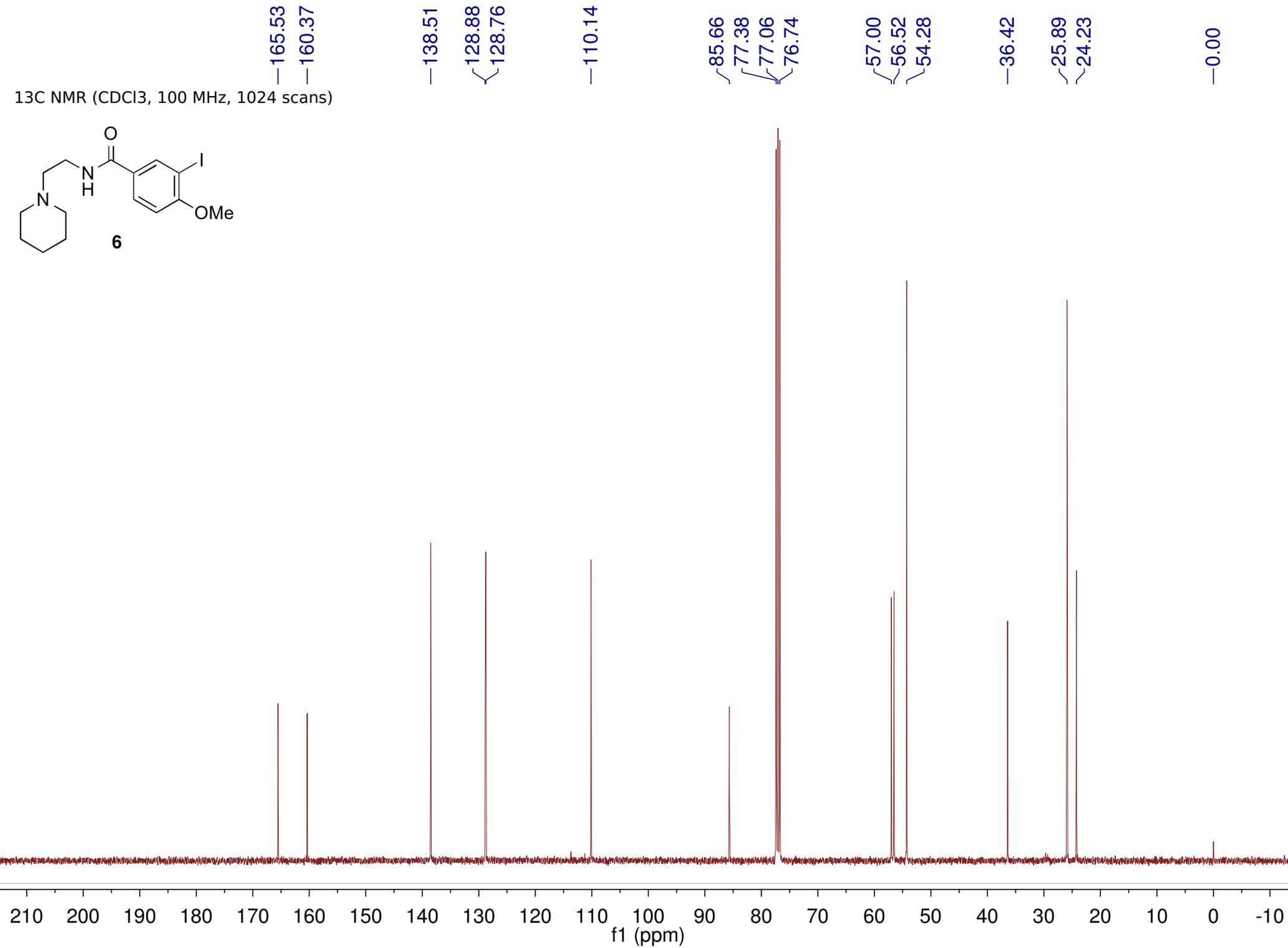
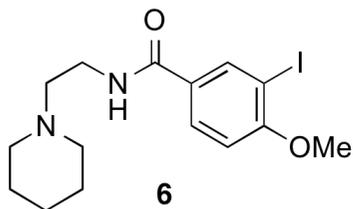
¹³C NMR (CDCl₃, 125 MHz, 128 scans)

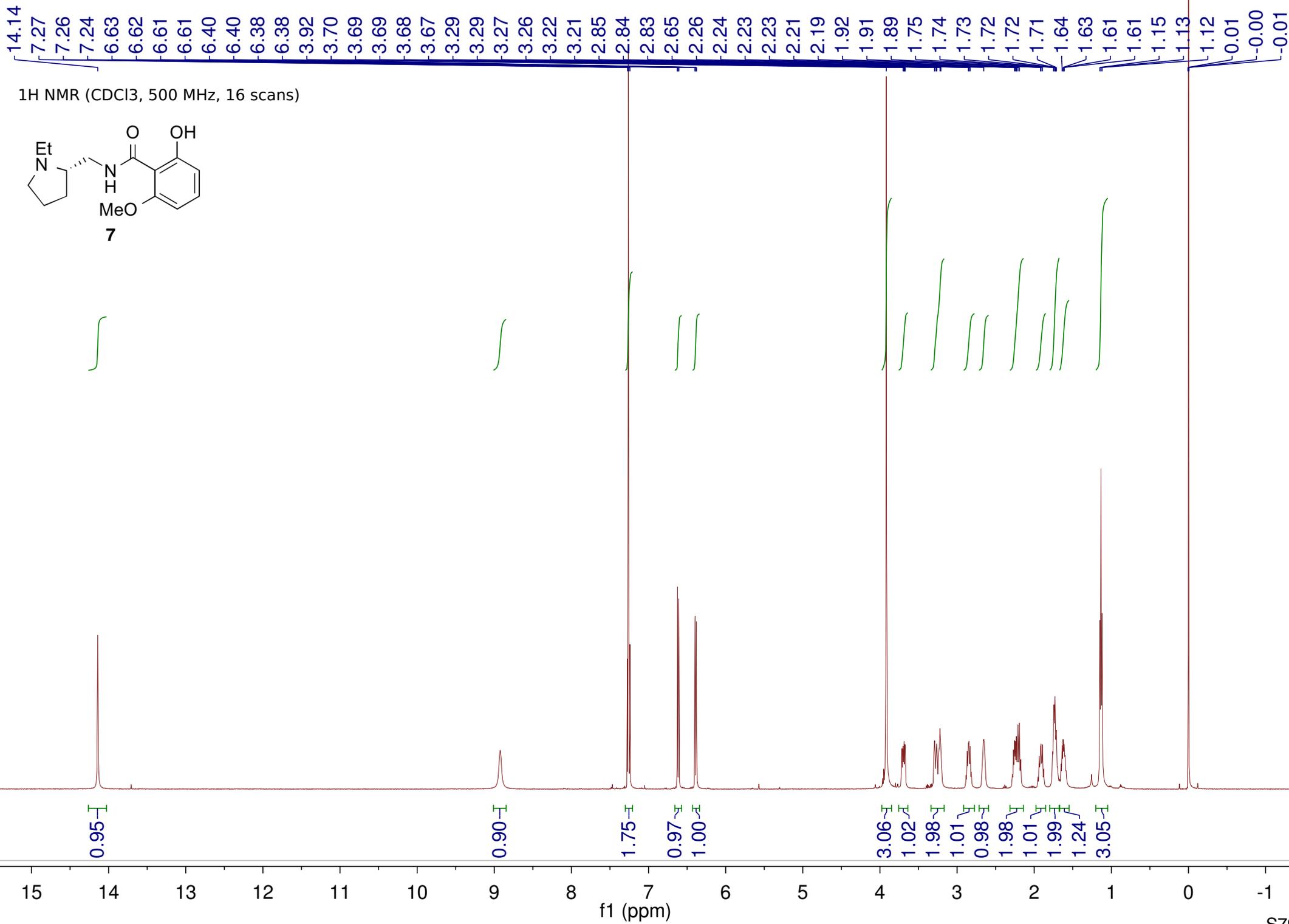


¹H NMR (CDCl₃, 500 MHz, 16 scans)

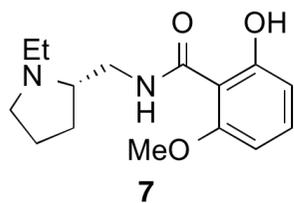


¹³C NMR (CDCl₃, 100 MHz, 1024 scans)





¹³C NMR (CDCl₃, 100 MHz, 200 scans)



170.29
164.45
158.83

133.01

111.62
104.16
100.82

77.36
77.24
77.04
76.72

61.94
55.92
53.64
47.85
40.70

28.50

22.98

14.21

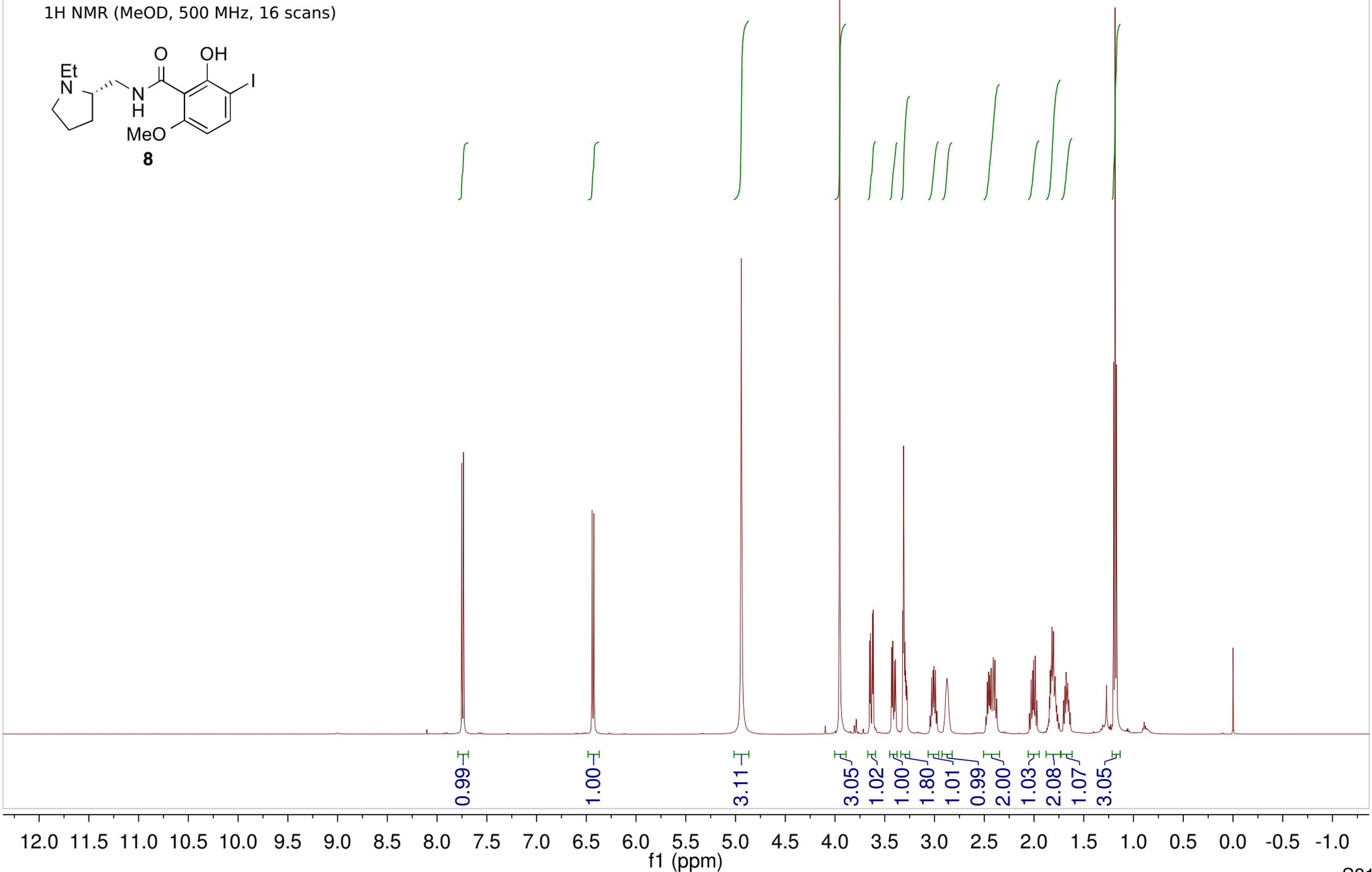
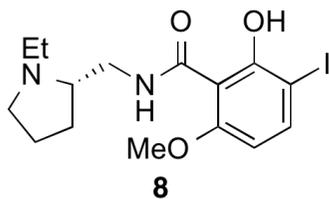
0.00

210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10

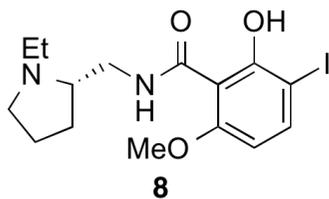
f1 (ppm)

7.75
7.73
6.44
6.42
4.94
3.95
3.65
3.64
3.62
3.62
3.43
3.42
3.40
3.39
3.32
3.31
3.31
3.30
3.30
3.29
3.28
3.03
3.02
3.01
2.99
2.88
2.46
2.45
2.43
2.41
2.39
2.03
2.01
2.00
1.99
1.84
1.83
1.83
1.82
1.82
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1.79
1.79
1.68
1.20
1.19
1.17
-0.00

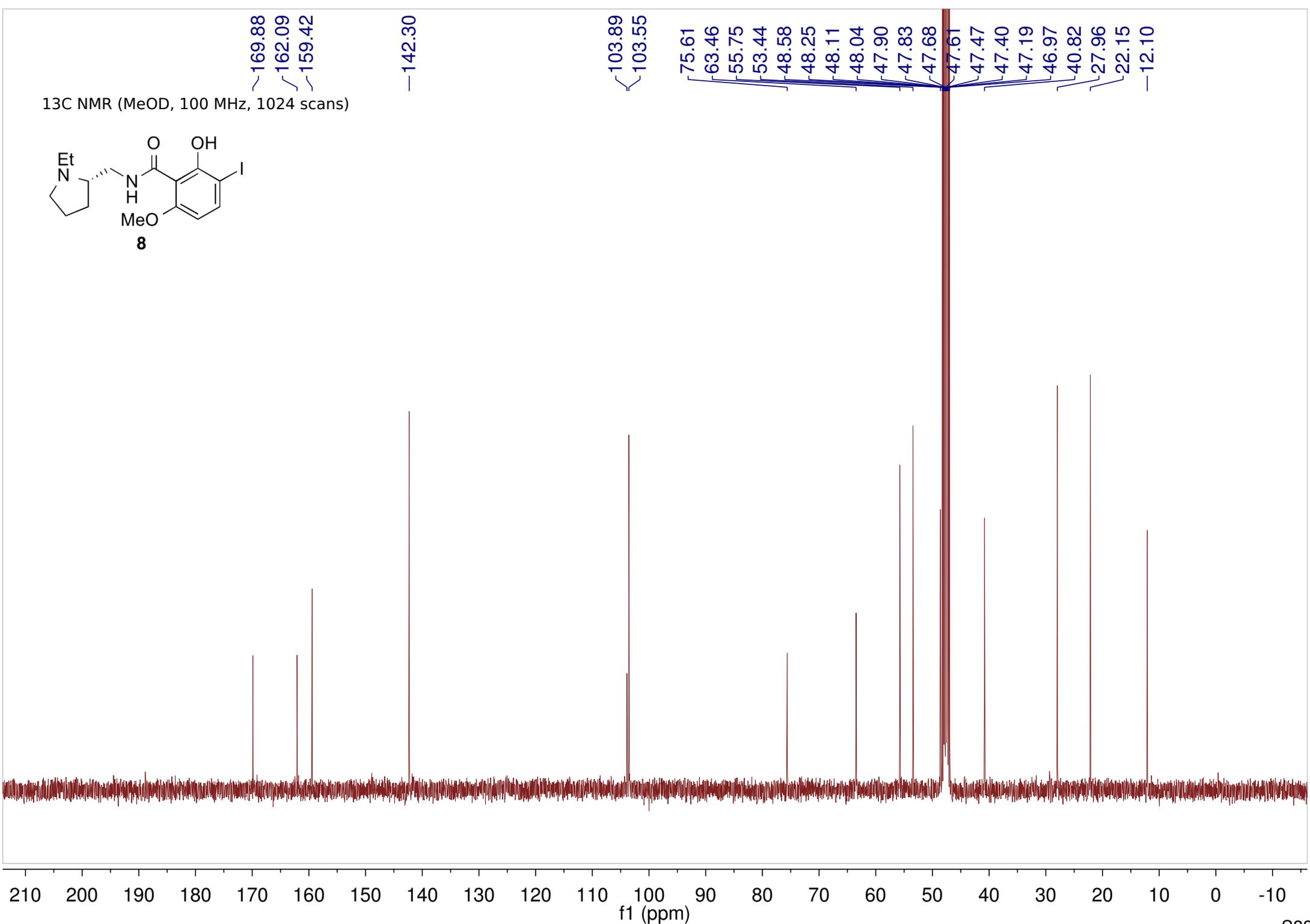
¹H NMR (MeOD, 500 MHz, 16 scans)



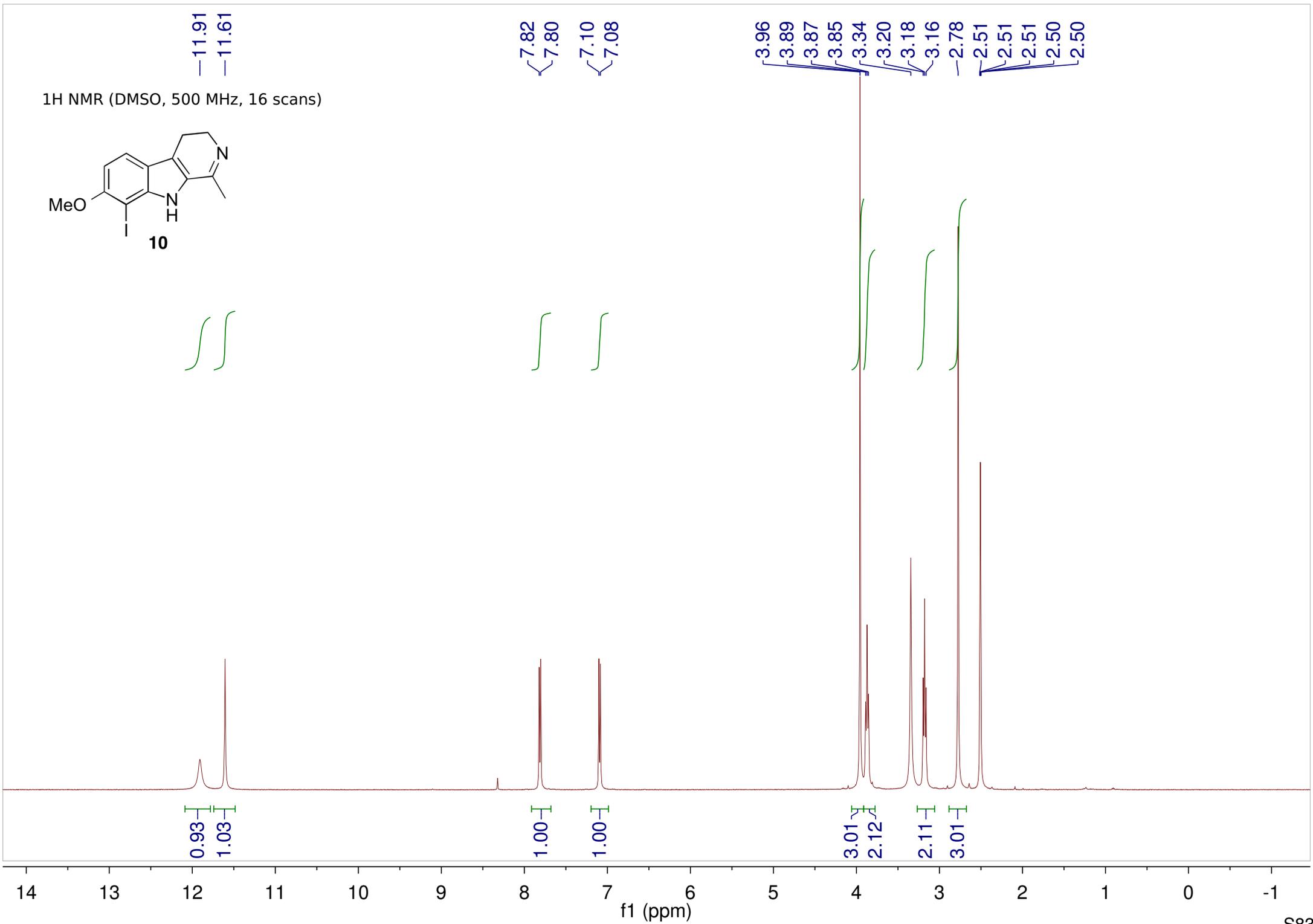
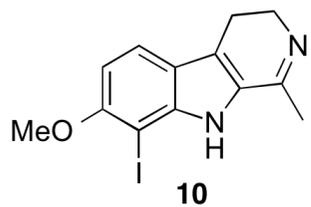
¹³C NMR (MeOD, 100 MHz, 1024 scans)



169.88
162.09
159.42
142.30
103.89
103.55
75.61
63.46
55.75
53.44
48.58
48.25
48.11
48.04
47.90
47.83
47.68
47.61
47.47
47.40
47.19
46.97
40.82
27.96
22.15
12.10



¹H NMR (DMSO, 500 MHz, 16 scans)



¹³C NMR (DMSO, 125 MHz, 256 scans)

