Supporting Information

Decarboxylative acylation of *N*-free indoles enabled by catalytic amount of copper catalysis and liquid-assisted grinding

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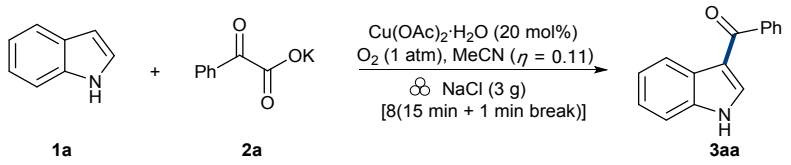
Table of contents

1. General considerations

Unless otherwise stated, all reagents were purchased from commercial suppliers and used without purification. Compounds **2a-2n** were prepared according to the reported procedure.[S1] A high-energy ball mill (Fritsch GmbH Planet Mill pulverisette 7) was employed. All of the HSBM reactions were performed in 45 mL or 80 mL stainless-steel grinding vessels and milled with stainless-steel balls. TLC (Thin-Layer Chromatography) analysis was performed using precoated glass plates. Melting points (mp) were obtained on a digital melting point apparatus (OptiMelt MPA100) and are uncorrected. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker Advance 400 spectrometer at ambient temperature with C_2D_6OS as the solvent and tetramethylsilane (TMS) as the internal standard. The abbreviations used are: s = singlet, d = doublet, t = triplet, dd = doublet of doublet, m = multiplet. Coupling constants (*J*) are given in Hz. Mass spectra were recorded with a high-resolution MS instrument (Bruker Daltonics micro TOF II) and a low-resolution MS instrument (Finnigan Trace DSQ) using an ESI ion source.

2. Mechanical Parameters Screening

The combined evaluation of the rotation speed (v_{rot}) and the milling-ball filling degree (Φ_{MB}) was conducted by using two sizes of milling balls under standard chemical conditions (see Table 1), and the corresponding results were shown in Figure S1.



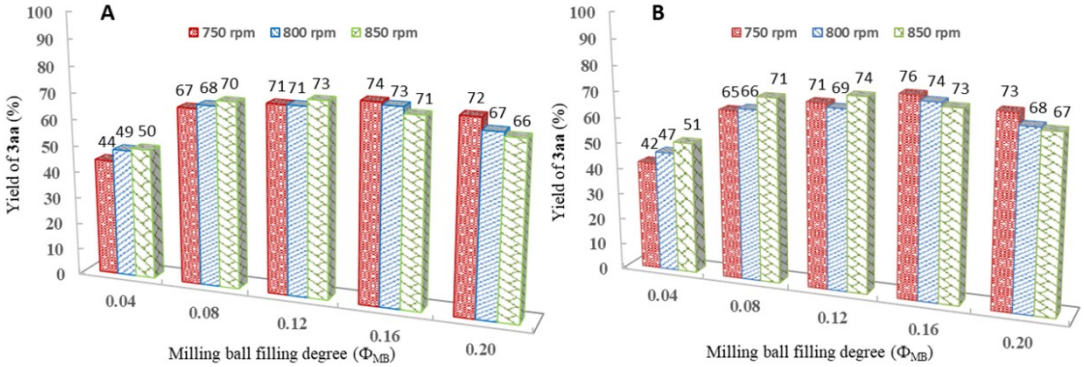


Figure S1. The influences of milling ball filling degree (Φ_{MB}), rotation speed (v_{rot}), and milling-ball size (d_{MB}) on the reaction. Reaction conditions: **1a** (1.0 mmol), **2a** (2.0 mmol), $Cu(OAc)_2 \cdot H_2O$ (20 mol%), MeCN (η = 0.11, η = V (liquid, μL)/m (reagents, mg), NaCl (3.0 g), O_2 atmosphere, 6 mm (d_{MB}) stainless-steel (**A**), 4 mm (d_{MB}) stainless-steel balls (**B**), 45 mL stainless steel vial, [8(15 min + 1 min break)].

3. Experimental Procedures

General procedure for copper-catalyzed decarboxylative C3-acylation of *N*-H indoles

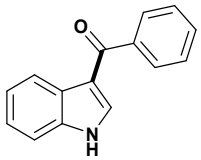
A mixture of *N*-H indoles **1** (1.0 mmol), *α*-ketonates **2** (2.0 mmol), $Cu(OAc)_2 \cdot H_2O$ (20 or 30 mol%), MeCN [η = 0.11 μL/mg, η = V (liquid, μL)/m (reagents; mg)] and NaCl (3 g) were added in a 45 mL stainless steel vial. The vial was flushed with O_2 (1 atm) through the lid with a gas inlet, screwed tightly and then placed on planet mill, milling at 750 or 800 rpm for the indicated milling cycles (see Table 2-3), using 225 stainless-steel grinding balls (d_{MB} = 4 mm, Φ_{MB} = 0.16). At the end of the experiment, the reaction mixture was scratched off from the vessel and dissolved in methanol, filtered and concentrated in vacuo to give a residue, which was purified by column chromatography on silica gel (hexane /EtOAc) to give the desired product **3**.

The device of the planet mill, stainless steel vial (involving stainless-steel grinding balls and reaction mixtures after ball milling) and its lid with gas inlet/outlet were showed in the following picture.

Scale-up procedures for copper-catalyzed decarboxylative C3-acylation of *N*-H indole

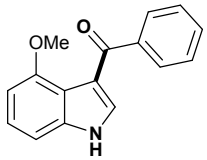
A mixture of *N*-H indoles **1a** (1.053 g, 9 mmol), potassium 2-oxo-2-phenylacetate **2a** (3.384 g, 18 mmol), $Cu(OAc)_2 \cdot H_2O$ (0.179 g, 10 mol%), MeCN (3.5 mL, η = 0.11 μL/mg) and NaCl (27 g) were added in a 80 mL stainless steel vial. The vial was flushed with O_2 (1 atm) through the lid with a gas inlet, screwed tightly and then placed on planet mill, milling at 750 rpm for 8 milling cycles (15 min + 1 min break), using 151 stainless-steel grinding balls (d_{MB} = 6 mm, Φ_{MB} = 0.22). At the end of the experiment, the reaction mixture was scratched off from the vessel and dissolved in methanol, filtered and concentrated in vacuo to give a residue, which was purified by column chromatography on silica gel (hexane /EtOAc) to give the desired product **3aa** (1.532 g, 77%).

4. Characterization Data for Indole Ketones



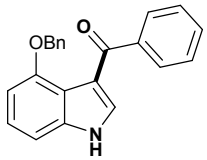
(1H-indol-3-yl)(phenyl)methanone (**3aa**)[S2]

Grey solid (168.4 mg, 76%), mp 241–243 °C (lit.,[S2] 244–246 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.08 (brs, 1H), 8.25 (d, J = 7.2 Hz, 1H), 7.94 (s, 1H), 7.78 (d, J = 7.2 Hz, 2H), 7.62–7.58 (m, 1H), 7.57–7.51 (m, 3H), 7.30–7.21 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 190.0, 140.5, 136.7, 135.8, 131.1, 128.4 (4C), 126.3, 123.2, 121.9, 121.5, 115.0, 112.3.



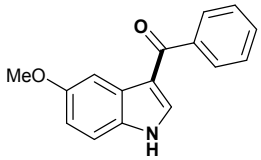
(4-methoxy-1H-indol-3-yl)(phenyl)methanone (**3ba**)

White solid (206.1 mg, 82%), mp 189–190 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.89 (brs, 1H), 7.73 (s, 1H), 7.71–7.69 (m, 2H), 7.59–7.55 (m, 1H), 7.49–7.44 (m, 2H), 7.17–7.09 (m, 2H), 6.60 (d, J = 7.2, 1H), 3.53 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 190.0, 153.4, 140.4, 138.2, 131.7, 131.5, 129.0 (2C), 127.9 (2C), 123.7, 116.3, 115.6, 105.3, 102.0, 54.9. **HRMS (ESI)** *m/z* calcd for $C_{16}H_{12}NO_2$ [M–H]$^-$: 250.0874, found: 250.0878.



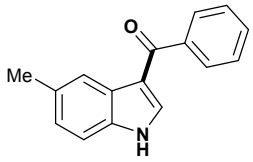
(4-(benzyloxy)-1H-indol-3-yl)(phenyl)methanone (**3ca**)

Grey solid (203.0 mg, 62%), mp 128–129 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.89 (brs, 1H), 7.75 (d, J = 7.6 Hz, 2H), 7.68 (d, J = 2.4 Hz, 1H), 7.56 (t, J = 7.2 Hz, 1H), 7.45 (t, J = 7.6 Hz, 2H), 7.28–7.21 (m, 5H), 7.17–7.11 (m, 2H), 6.72 (dd, J = 6.4, 1.6 Hz, 1H), 5.03 (s, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 190.0, 152.4, 140.1, 138.3, 137.3, 131.7, 131.6, 129.2 (2C), 128.1 (2C), 128.0 (2C), 127.2, 126.9 (2C), 123.7, 116.3, 115.8, 105.5, 103.2, 69.1; **HRMS (ESI)** *m/z* calcd for $C_{22}H_{16}NO_2$ [M–H]$^-$: 326.1187, found: 326.1180.



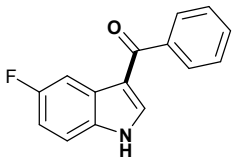
(5-methoxy-1H-indol-3-yl)(phenyl)methanone (**3da**)[S2]

White solid (170.9 mg, 68%), mp 220–222 °C (lit.,[S2] 223–224 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.98 (brs, 1H), 7.88 (s, 1H), 7.81–7.75 (m, 3H), 7.62–7.57 (m, 1H), 7.56–7.51 (m, 2H), 7.42 (dd, J = 8.8, 2.0 Hz, 2H), 6.90 (d, J = 8.8 Hz, 1H), 3.81 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 155.6, 140.7, 136.0, 131.6, 131.0 128.4 (2C), 128.3 (2C), 127.1, 114.8, 113.06, 113.01, 103.2, 55.3.



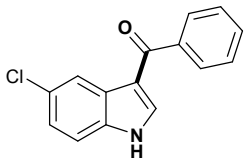
(5-methyl-1H-indol-3-yl)(phenyl)methanone (**3ea**)[S2]

Grey solid (169.4 mg, 72%), mp 226–227 °C (lit.,[S2] 227–228 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.96 (brs, 1H), 8.08 (s, 1H), 7.86 (d, J = 2.8 Hz, 1H), 7.79–7.75 (m, 2H), 7.62–7.58 (m, 1H), 7.56–7.51 (m, 2H), 7.40 (d, J = 8.0 Hz, 1H), 7.09 (dd, J = 8.0, 1.2 Hz, 1H), 2.44 (s, 3H, Me); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 140.7, 135.8, 135.0, 131.0, 130.8, 128.37 (2C), 128.34 (2C), 126.5, 124.6, 121.2, 114.6, 111.9, 21.4.



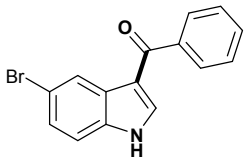
(5-fluoro-1H-indol-3-yl)(phenyl)methanone (**3fa**)[S3]

White solid (186.6 mg, 78%), mp 254–255 °C (lit.,[S3] 263 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.20 (brs, 1H), 8.03 (s, 1H), 7.94 (dd, J = 10.0, 2.4 Hz, 1H), 7.80 (d, J = 7.2 Hz, 2H), 7.64–7.59 (m, 1H), 7.56–7.52 (m, 3H), 7.16–7.10 (m, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.8, 158.7 (d, J_1 = 235.3), 140.2, 137.2, 133.3, 131.2, 128.5 (2C), 128.4 (2C), 126.9 (d, J_3 = 11.1 Hz), 115.0 (d, J_4 = 4.0 Hz), 113.5 (d, J_3 = 10.1 Hz), 111.3 (d, J_2 = 26.3 Hz), 106.3 (d, J_2 = 24.2 Hz).



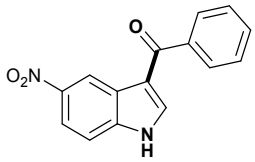
(5-chloro-1H-indol-3-yl)(phenyl)methanone (**3ga**)[S4]

Grey solid (204.6 mg, 80%), mp 270–271 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.27 (brs, 1H), 8.26 (d, J = 1.6 Hz, 1H), 8.04 (s, 1H), 7.80 (d, J = 7.2 Hz, 2H), 7.64–7.52 (m, 4H), 7.29 (dd, J = 8.4, 1.6 Hz, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.8, 140.1, 137.1, 135.2, 131.3, 128.5 (2C), 128.4 (2C), 127.5, 126.7, 123.2, 120.6, 114.5, 113.9.



(5-bromo-1H-indol-3-yl)(phenyl)methanone (**3ha**)[S2]

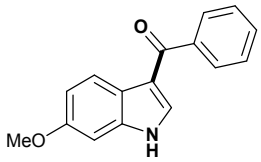
White solid (219.1 mg, 73%), mp 268–269 °C (lit.,[S2] 265–266 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.28 (brs, 1H), 8.41 (s, 1H), 8.03 (s, 1H), 7.80 (d, J = 7.2 Hz, 2H), 7.67–7.46 (m, 4H), 7.40 (d, J = 8.0, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.8, 140.0, 136.9, 135.5, 131.3, 128.5 (2C), 128.4 (2C), 128.1, 125.8, 123.6, 114.7, 114.40, 114.37.



(5-nitro-1H-indol-3-yl)(phenyl)methanone (**3ia**)[S2]

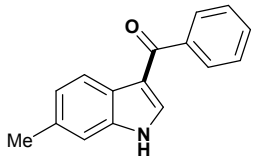
Yellow solid (186.4 mg, 70%), mp 295–297 °C (lit.,[S2] 292–294 °C); **^{1}H NMR** (400 MHz, DMSO-d_6,

ppm) δ 12.68 (brs, 1H), 9.14 (d, *J* = 2.0 Hz, 1H), 8.27 (s, 1H), 8.17 (dd, *J* = 9.2, 2.0 Hz, 1H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.72 (d, *J* = 9.2 Hz, 1H), 7.69–7.63 (m, 1H), 7.61–7.55 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 142.8, 139.9, 139.6, 139.1, 131.7, 128.62 (2C), 128.55 (2C), 125.8, 118.6, 117.9, 116.2, 113.1.



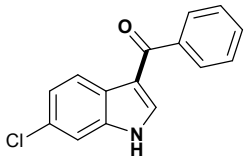
(6-methoxy-1H-indol-3-yl)(phenyl)methanone (**3ja**)[S2]

Grey solid (186.0 mg, 74%), mp 228–230 °C (lit.,[S2] 226–228 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.88 (brs, 1H), 8.12 (d, *J* = 8.8 Hz, 1H), 7.82–7.75 (m, 3H), 7.62–7.50 (m, 3H), 7.01 (s, 1H), 6.89 (d, *J* = 8.4 Hz, 1H), 3.80 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 156.6, 140.5, 137.6, 134.9, 131.0, 128.38 (2C), 128.35 (2C), 122.1, 120.2, 115.1, 111.7, 95.2, 55.2.



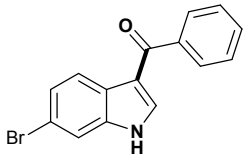
(6-methyl-1H-indol-3-yl)(phenyl)methanone (**3ka**)

White solid (71.8 mg, 61%), mp 252–253 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.94 (brs, 1H), 8.12 (d, *J* = 8.0 Hz, 1H), 7.85 (s 1H), 7.79–7.75 (m, 2H), 7.62–7.57 (m, 1H), 7.55–7.51 (m, 2H), 7.31 (s, 1H), 7.07 (d, *J* = 8.4 Hz, 1H), 2.43 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 140.6, 137.2, 135.4, 132.4, 131.0, 128.36 (2C), 128.35 (2C), 124.1, 123.6, 121.2, 115.0, 112.0, 21.3. **HRMS (ESI)** *m/z* calcd for $C_{16}H_{12}NO$ [M–H]$^-$: 234.0924, found: 234.0921.



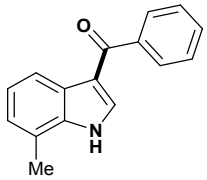
(6-chloro-1H-indol-3-yl)(phenyl)methanone (**3la**)[S4]

White solid (171.3 mg, 67%), mp 273–274 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.18 (brs, 1H), 8.24 (d, *J* = 8.4 Hz, 1H), 8.00 (s, 1H), 7.83–7.76 (m, 2H), 7.65–7.51 (m, 4H), 7.27 (dd, *J* = 8.4 Hz, 2.0 Hz, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.8, 140.1, 137.2, 136.7, 131.28, 128.46 (2C), 128.42 (2C), 127.7, 125.1, 122.8, 122.2, 114.9, 112.0.



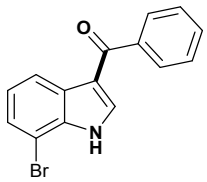
(6-bromo-1H-indol-3-yl)(phenyl)methanone (**3ma**)

White solid (219.1 mg, 73%), mp 273–274 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.17 (brs, 1H), 8.18 (d, *J* = 8.4 Hz, 1H), 7.99 (s, 1H), 7.79 (d, *J* = 7.2 Hz, 2H), 7.71 (s, 1H), 7.64–7.59 (m, 1H), 7.58–7.52 (m, 2H), 7.39 (d, *J* = 8.4 Hz, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 140.1, 137.6, 136.6, 131.3, 128.46 (2C), 128.42 (2C), 125.3, 124.8, 123.2, 115.7, 114.9; **HRMS (ESI)** *m/z* calcd for $C_{15}H_9{}^{79}BrNO$ [M–H]$^-$: 297.9873, found: 297.9864.



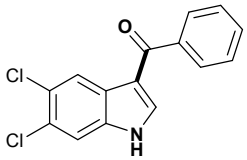
(7-methyl-1H-indol-3-yl)(phenyl)methanone (**3na**)[S3]

Grey solid (136.5 mg, 58%), mp 182–183 °C (lit.,[S3] 186 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.10 (brs, 1H), 8.10 (d, J = 7.6 Hz, 1H), 7.89 (d, J = 1.6 Hz, 1H), 7.80–7.77 (m, 2H), 7.63–7.58 (m, 1H), 7.57–7.52 (m, 2H), 7.17–7.12 (m, 1H), 7.06 (d, J = 7.2 Hz, H), 2.53 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 190.0, 140.6, 136.2, 135.3, 131.0, 128.4 (4C), 126.1, 123.7, 122.1, 121.5, 119.0, 115.4, 16.7.



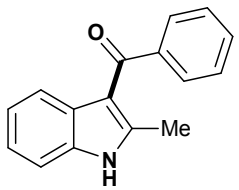
(7-bromol-1H-indol-3-yl)(phenyl)methanone (**3oa**)[S4]

Pale yellow solid (228.1 mg, 76%), mp 212–213 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.36 (brs, 1H), 8.27 (d, J = 8.0 Hz, 1H), 7.90 (s, 1H), 7.83–7.79 (m, 2H), 7.65–7.60 (m, 1H), 7.58–7.49 (m, 3H), 7.22–7.18 (m, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 190.0, 140.0, 136.1, 135.1, 131.4, 128.49 (2C), 128.46 (2C), 128.0, 125.9, 123.4, 120.9, 115.9, 104.7.



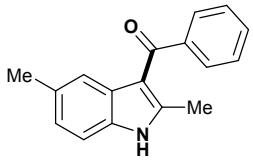
(5,6-dichloro-1H-indol-3-yl)(phenyl)methanone (**3pa**)

White solid (249.5 mg, 86%), mp 283–285°C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.33 (brs, 1H), 8.40 (s, 1H), 8.10 (s, 1H), 7.82–7.78 (m, 3H), 7.65–7.61 (m, 1H), 7.57–7.53 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.7, 139.8, 137.9, 135.7, 131.5, 128.5 (2C), 128.4 (2C), 126.2, 125.4, 124.7, 122.3, 114.4, 114.0; **HRMS (ESI)** *m/z* calcd for $C_{15}H_8{}^{35}Cl_2NO$ $[M–H]^–$: 287.9988, found: 287.9982.



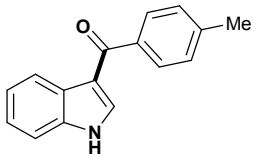
(2-methyl-1H-indol-3-yl)(phenyl)methanone (**3qa**)[S2]

Pale yellow solid (160.0 mg, 68%), mp 175–177 °C (lit.,[S2] 178–180 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.96 (brs, 1H), 7.63–7.56 (m, 3H), 7.54–7.48 (m, 2H), 7.39 (d, J = 8.0 Hz, 1H), 7.32 (d, J = 7.6 Hz, 1H), 7.12 (t, J = 8.0 Hz, 1H), 7.01 (t, J = 7.6 Hz, 1H), 2.38 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 191.7, 144.5, 141.7, 135.0, 131.0, 128.4 (2C), 128.0 (2C), 127.3, 121.8, 121.0, 120.0, 112.5, 111.3, 14.2.



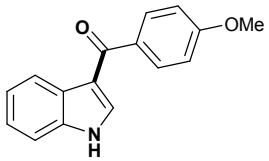
(2,5-dimethyl-1H-indol-3-yl)(phenyl)methanone (**3ra**)[S4]

Pale yellow solid (221.9 mg, 89%), mp 221–222 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.82 (brs, 1H), 7.61–7.57 (m, 3H), 7.53–7.47 (m, 2H), 7.26 (d, J = 8.2 Hz, 1H), 7.20 (s, 1H), 6.94 (d, J = 8.2 Hz, 1H), 2.32 (s, 3H), 2.27 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 191.7, 144.3, 141.8, 133.3, 130.9, 129.6, 128.3 (2C), 128.0 (2C), 127.6, 123.2, 120.0, 112.2, 110.9, 21.4, 14.3.



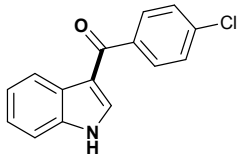
(1H-indol-3-yl)(p-tolyl)methanone (**3ab**)[S5]

Yellow solid (169.2 mg,72%), mp 186–187 °C (lit.,[S5] 179–180 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.06 (brs, 1H), 8.27 (d, J = 7.2 Hz, 1H), 7.94 (s, 1H), 7.71 (d, J = 7.6 Hz, 2H), 7.53 (d, J = 7.6 Hz, 1H), 7.33 (d, J = 7.2 Hz, 2H), 7.28–7.20 (m, 2H), 2.39 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.7, 141.0, 137.8, 136.7, 135.4, 128.9 (2C), 128.6 (2C), 126.3, 123.1, 121.8, 121.5, 115.1, 112.2, 21.1.



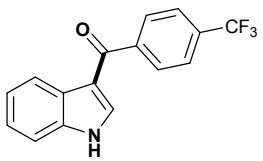
(1H-indol-3-yl)(4-methoxyphenyl)methanone (**3ac**)[S6]

Yellow solid (120.5 mg, 48%), mp 207–208 °C (lit.,[S6] 208 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.03 (brs, 1H), 8.23 (d, J = 6.0 Hz, 1H), 7.95 (s, 1H), 7.81 (d, J = 7.0 Hz, 2H), 7.52 (d, J = 6.8 Hz, 1H), 7.29–7.17 (m, 2H), 7.07 (d, J = 7.0 Hz, 2H), 3.85 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.8, 161.7, 136.6, 134.9, 132.9, 130.6 (2C), 126.4, 123.0, 121.7, 121.5, 115.0, 113.7 (2C), 112.2, 55.4.



(4-chlorophenyl)(1H-indol-3-yl)methanone (**3ad**)[S7]

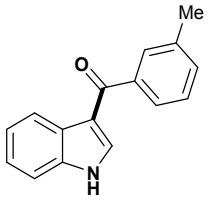
Pale yellow solid (197.0 mg, 77%), mp 243–245 °C (lit.,[S7] 239–242 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.14 (brs, 1H), 8.25 (d, J = 7.2 Hz, 1H), 7.98 (s, 1H), 7.81 (d, J = 8.4 Hz, 2H), 7.60 (d, J = 8.4 Hz, 2H), 7.52 (d, J = 7.6 Hz, 1H), 7.30–7.22 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.6, 139.1, 136.7, 136.0, 135.8, 130.3 (2C), 128.5 (2C), 126.2, 123.2, 122.0, 121.4, 114.8, 112.3.



(1H-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3ae**)[S7]

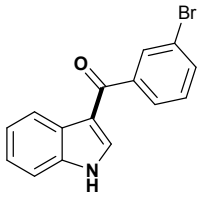
Pale yellow solid (216.8 mg, 75%), mp 258–260 °C, solv: ethyl acetate (lit.,[S7] 202–204 °C, solv:

acetone); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.22 (brs, 1H), 8.30–8.24 (m, 1H), 8.02–7.95 (m, 3H, including d, J = 8.0 Hz , 2H), 7.90 (d, J = 8.0 Hz, 2H), 7.57–7.50 (m, 1H), 7.31–7.24 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.8, 144.1, 136.8, 136.7, 130.7 (q, J_2 = 32 Hz), 129.1 (2C), 126.1, 125.4 (q, J_3 = 4 Hz, 2C), 125.41 (q, J = 273.2 Hz), 123.4, 122.2, 121.4, 114.8, 112.4.



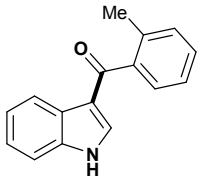
(1H-indol-3-yl)(m-tolyl)methanone (**3af**)[S8]

Yellow solid (297.4 mg, 84%), mp 240–242 °C (lit.,[S8] 240 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.05 (brs, 1H), 8.27–8.23 (m, 1H), 7.93 (d, J = 2.8 Hz, 1H), 7.60–7.56 (m, 2H), 7.54–7.50 (m, 1H), 7.44–7.40 (m, 2H), 7.29–7.21 (m, 2H), 2.41 (s, 3H); **^{13}C NMR** (100 MHz, DMSO) δ 190.1, 140.6, 137.7, 136.7, 135.8, 131.6, 128.8, 128.2, 126.3, 125.6, 123.1, 121.9, 121.5, 115.1, 112.2, 21.0.



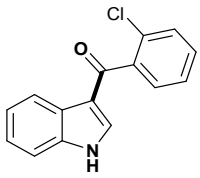
(3-bromophenyl)(1H-indol-3-yl)methanone (**3ag**)[S8]

Pale yellow solid (255.0 mg, 85%), mp 237–238 °C (lit.,[S8] 238 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.15 (brs, 1H), 8.27–8.21 (m, 1H), 7.98 (s, 1H), 7.90–7.87 (m, 1H), 7.83–7.76 (m, 2H), 7.56–7.48 (m, 2H), 7.30–7.22 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.2, 142.6, 136.8, 136.3, 133.7, 130.7, 130.6, 127.4, 126.1, 123.3, 122.1, 121.8, 121.4, 114.7, 112.3.



(1H-indol-3-yl)(o-tolyl)methanone (**3ah**)

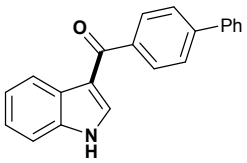
Pale yellow solid (105.9 mg, 45%), mp 189–190 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.04 (brs, 1H), 8.21–8.16 (m, 1H), 7.60 (d, J = 3.2 Hz, 1H), 7.51 (dd, J = 6.8, 1.6 Hz, 1H), 7.42–7.37 (m, 2H), 7.34–7.20 (m, 4H), 2.27 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 192.1, 141.0, 136.9, 136.4, 134.8, 130.6, 129.2, 127.2, 125.7, 125.3, 123.2, 122.1, 121.3, 116.6, 112.4, 19.2; **HRMS (ESI)** *m/z* calcd for $C_{16}H_{12}NO$ $[M–H]^-$: 234.0924, found: 234.0934.



(2-chlorophenyl)(1H-indol-3-yl)methanone (**3ai**)[S4]

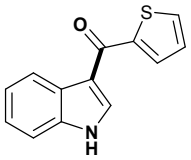
Grey solid (209.1 mg, 82%), mp 187–189 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.14 (brs, 1H), 8.15 (d, J = 7.6 Hz, 1H), 7.66 (s, 1H), 7.60–7.56 (m,1H), 7.55–7.44 (m, 4H), 7.30–7.22 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.2, 140.3, 137.03, 137.00, 130.7, 129.8, 129.6, 128.7, 127.1,

125.4, 123.4, 122.3, 121.2, 116.0, 112.5.



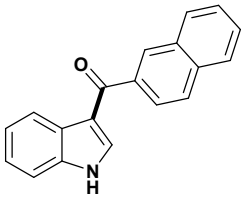
biphenyl-4-yl(1H-indol-3-yl)methanone (**3aj**)

Yellow solid (208.1 mg, 70%), mp 247–248 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.12 (brs, 1H), 8.32–8.26 (m, 1H), 8.03 (d, J = 2.8 Hz, 1H), 7.90 (d, J = 8.4 Hz, 2H), 7.83 (d, J = 8.4 Hz, 2H), 7.76 (d, J = 7.6 Hz, 2H), 7.56–7.49 (m, 3H), 7.46–7.40 (m, 1H), 7.31–7.22 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.5, 142.7, 139.34, 139.30, 136.7, 135.8, 129.2 (2C), 129.1 (2C), 128.1, 126.9 (2C), 126.7 (2C), 126.3, 123.2, 121.9, 121.5, 115.1, 112.3; **HRMS (ESI)** *m/z* calcd for $C_{21}H_{14}NO$ $[M–H]^-$: 296.1081, found: 296.1070.



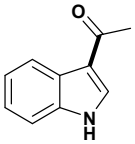
(1H-indol-3-yl)(thiophen-2-yl)methanone (**3ak**)[S7]

Grey solid (113.5 mg, 50%), mp 178–180 °C (lit.,[S7] 180–183 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.14 (brs, 1H), 8.36 (d, J = 3.2 Hz, 1H), 8.22 (d, J = 7.6 Hz, 1H), 7.94 (d, J = 4.0 Hz, 2H), 7.52 (d, J = 8.0 Hz, 1H), 7.30–7.20 (m, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 180.7, 145.2, 136.6, 134.2, 132.3, 131.4, 128.3, 126.4, 123.2, 121.9, 121.4, 114.6, 112.3.



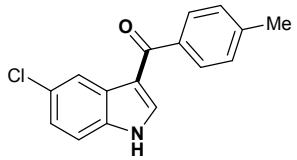
(1H-indol-3-yl)(naphthalen-2-yl)methanone (**3al**)[S6]

Pale yellow solid (195.1 mg, 72%), mp 246–248 °C (lit.,[S6] 257 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.12 (brs, 1H), 8.42 (s, 1H), 8.33–8.26 (m, 1H), 8.13 (d, J = 7.6 Hz, 1H), 8.09–8.00 (m, 3H), 7.88 (dd, J = 8.8, 1.6 Hz, 1H), 7.68–7.59 (m, 2H), 7.58–7.52 (m, 1H), 7.31–7.23 (m, 2H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.9, 137.7, 136.8, 136.1, 134.2, 132.2, 129.2, 129.0, 128.1, 127.7, 127.6, 126.7, 126.3, 125.3, 123.2, 122.0, 121.5, 115.2, 112.3.



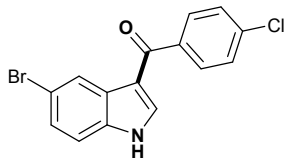
1-(1H-indol-3-yl)ethan-1-one (**3am**)[S9]

Grey solid (95.4 mg, 60%), mp 185–187 °C (lit.,[S9] 189–190 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.92 (brs, 1H), 8.30 (d, J = 2.8 Hz, 1H), 8.19–8.14 (m, 1H), 7.47–7.44 (m, 1H), 7.22–7.14 (m, 2H), 2.44 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 192.7, 136.7, 134.4, 125.3, 122.7, 121.7, 121.3, 116.8, 112.1, 27.3.



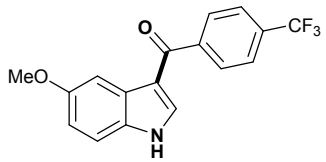
(5-chloro-1H-indol-3-yl)(p-tolyl)methanone (**3gb**)

White solid (169.6 mg, 63%), mp 250–252 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.22 (brs, 1H), 8.24 (d, J = 1.6 Hz, 1H), 8.04 (s, 1H), 7.71 (d, J = 7.8 Hz, 2H), 7.54 (d, J = 8.6 Hz, 1H), 7.35 (d, J = 7.8 Hz, 2H), 7.28 (dd, J = 8.6, 1.7 Hz, 1H), 2.41 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 189.5, 141.3, 137.4, 136.7, 135.2, 129.0 (2C), 128.6 (2C), 127.5, 126.5, 123.1, 120.6, 114.6, 113.9, 21.1; **HRMS (ESI)** *m/z* calcd for $C_{16}H_{11}{}^{35}ClNO$ [M–H]$^-$: 268.0535, found: 268.0546.



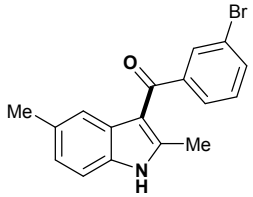
(5-bromo-1H-indol-3-yl)(4-chlorophenyl)methanone (**3hd**)[S2]

Pale yellow solid (226.4 mg, 68%), mp 262–263 °C (lit.,[S2] 250–251 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.32 (brs, 1H), 8.39 (d, J = 1.2 Hz, 1H), 8.06 (s, 1H), 7.82 (d, J = 8.4 Hz, 2H), 7.60 (d, J = 8.0 Hz, 2H), 7.50 (d, J = 8.4 Hz, 1H), 7.41 (dd, J = 8.4, 1.2 Hz, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.5, 138.7, 137.1, 136.1, 135.5, 130.3 (2C), 128.6 (2C), 128.0, 125.9, 123.6, 114.8, 114.4, 114.2.



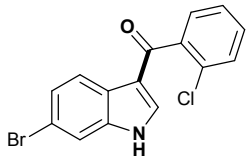
(5-methoxy-1H-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3de**)

White solid (236.1 mg, 74%), mp 219–220 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.10 (brs, 1H), 7.97–7.88 [m, 5H, including (7.92, s, 1H) and (7.95, 7.90, d, J = 8.0, 4H)], 7.80 (d, J = 2.2, 1H), 7.43 (d, J = 8.8, 1H), 6.92 (dd, J = 8.8, 2.2, 1H), 3.81 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.7, 155.8, 144.2, 136.7, 131.6, 130.7 (q, J_2 = 30.3), 129.0 (2C), 126.9, 125.4 (q, J_3 = 4.0, 2C), 124.1 (q, J_1 = 273.7), 114.7, 113.3, 113.1, 103.1, 55.3; **^{19}F NMR** (375 MHz, DMSO-d_6, ppm) δ 61.24; **HRMS (ESI)** *m/z* calcd for $C_{17}H_{11}F_3NO_2$ [M–H]$^-$: 318.0747, found: 318.0752.



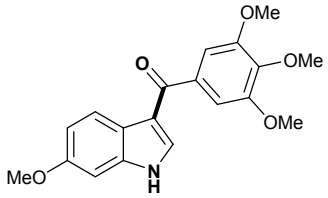
(3-bromophenyl)(2,5-dimethyl-1H-indol-3-yl)methanone (**3rf**)

Pale yellow solid (228.9 mg, 70%), mp 218–219 °C; **^{1}H NMR** (500 MHz, DMSO-d_6, ppm) δ 11.93 (brs, 1H), 7.80 –7.77 (m, 1H), 7.73–7.71 (m, 1H), 7.59–7.56 (m, 1H), 7.49–7.45 (m, 1H), 7.28 (d, J = 8.0 Hz, 1H), 7.21 (s, 1H), 6.96 (dd, J = 8.3, 1.3 Hz, 1H), 2.33 (s, 3H), 2.29 (s, 3H); **^{13}C NMR** (125 MHz, DMSO-d_6, ppm) δ 189.7, 145.0, 143.9, 133.5, 133.3, 130.6, 130.4, 129.9, 127.4, 127.0, 123.4, 121.6, 119.9, 111.8, 111.0, 21.4, 14.4; **HRMS (ESI)** *m/z* calcd for $C_{17}H_{13}{}^{79}BrNO$ [M–H]$^-$: 326.0186, found: 326.0181.



(6-bromo-1H-indol-3-yl)(2-chlorophenyl)methanone (**3ji**)

Pale yellow solid (230.9 mg, 69%), mp 222–223 °C; **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 12.23 (brs, 1H), 8.10 (d, J = 8.4 Hz, 1H), 7.73–7.68 (m, 2H), 7.60–7.51 (m, 3H), 7.49–7.44 (m, 1H), 7.40 (dd, J = 8.4, 1.6 Hz, 1H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ;188.3, 139.9, 137.9, 137.8, 130.9, 129.8, 129.6, 128.7, 127.1, 125.2, 124.4, 122.8, 116.0, 115.9, 115.2. **HRMS (ESI)** *m/z* calcd for $C_{15}H_8{}^{79}Br^{35}ClNO$ $[M–H]^-$: 331.9483, found: 331.9487.



(6-methoxy-1H-indol-3-yl)(3,4,5-trimethoxyphenyl)methanone (**3jn**, SCB01A)[S10]

White solid (187.6 mg, 55%), mp 184–186 °C (lit.,[S10] 185–187 °C); **^{1}H NMR** (400 MHz, DMSO-d_6, ppm) δ 11.84 (d, J = 2.0 Hz, 1H), 8.10 (d, J = 8.4 Hz, 1H), 7.97 (d, J = 3.2 Hz, 1H), 7.08 (s, 2H), 6.99 (d, J = 2.0 Hz, 1H), 6.88 (dd, J = 8.4, 2.0 Hz, 1H), 3.85 (s, 6H), 3.80 (s, 3H), 3.75 (s, 3H); **^{13}C NMR** (100 MHz, DMSO-d_6, ppm) δ 188.9, 156.6, 152.6 (2C), 134.0, 137.7, 135.8, 134.7, 122.2, 120.4, 115.0, 111.7, 106.0 (2C), 95.1, 60.1, 56.0 (2C), 55.2.

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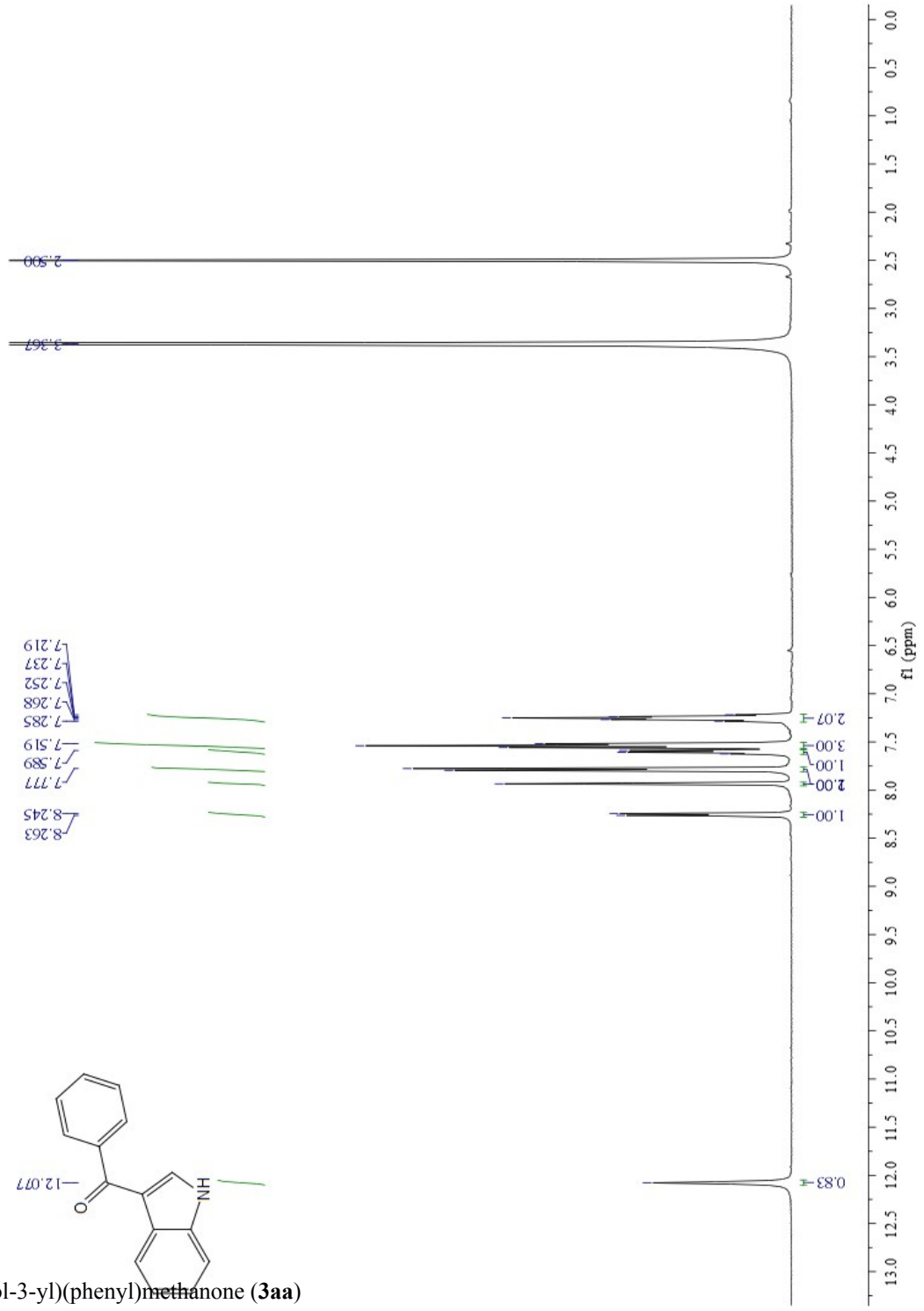
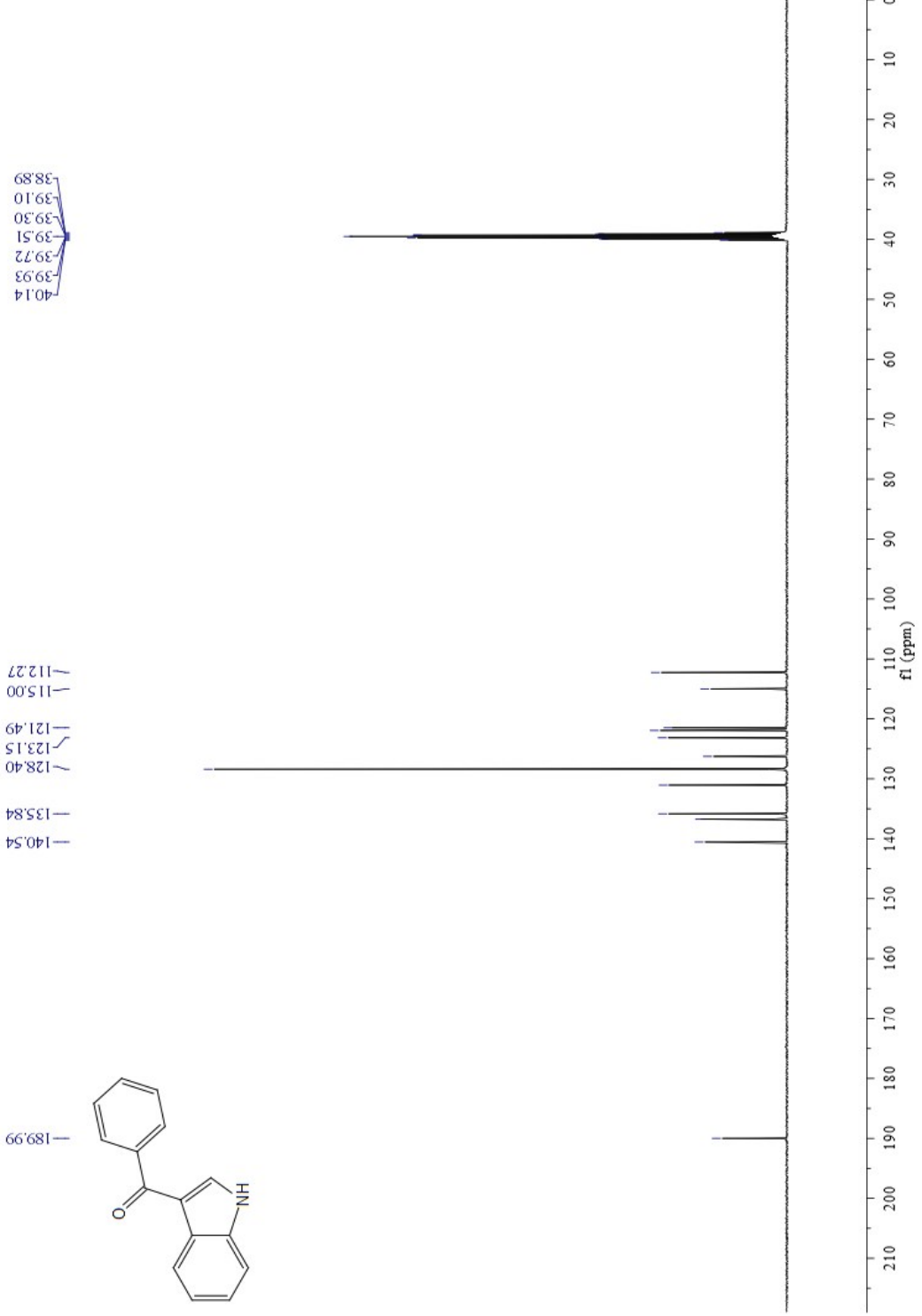
5. Copies of ^{1}H

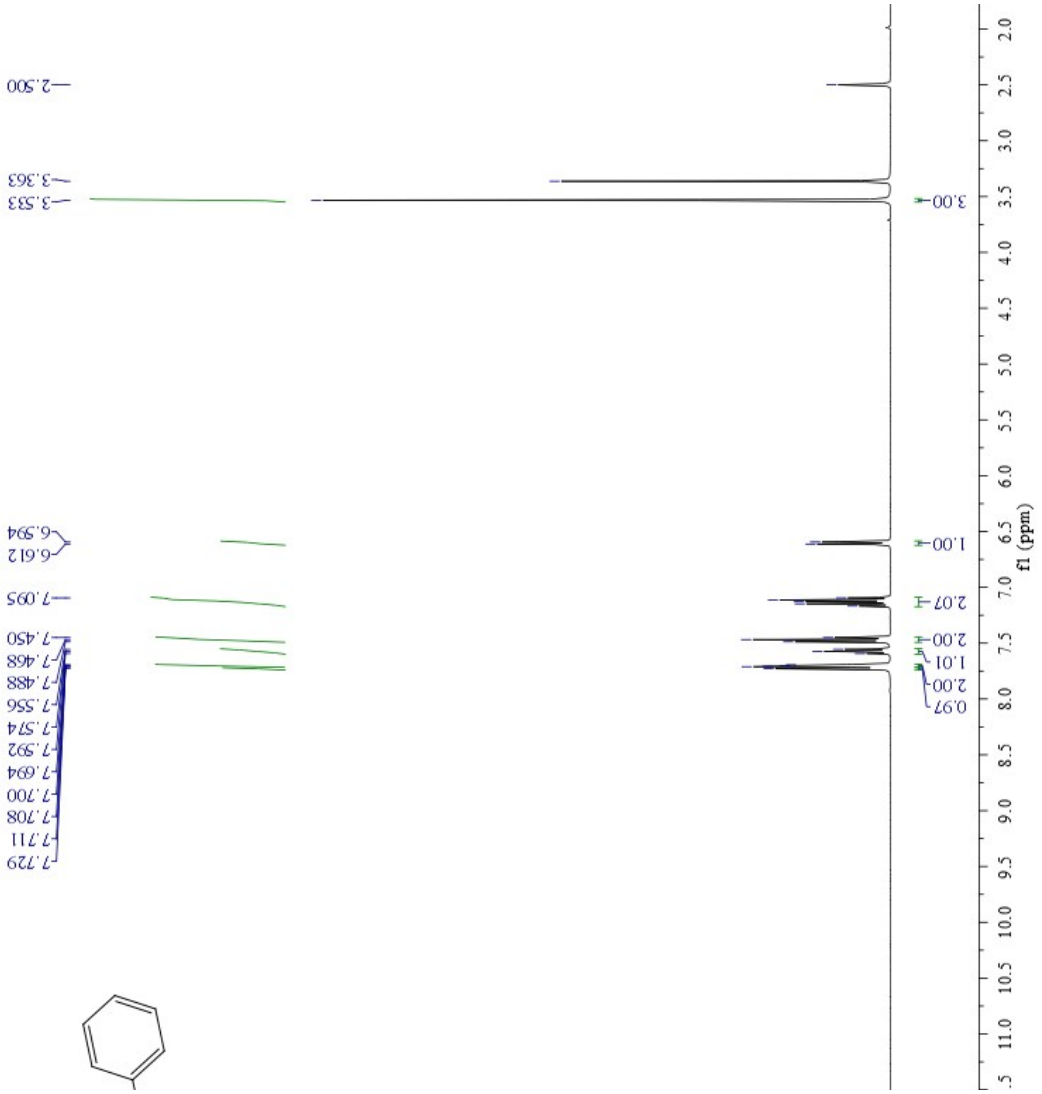
^{1}H NMR of (1*H*-indo



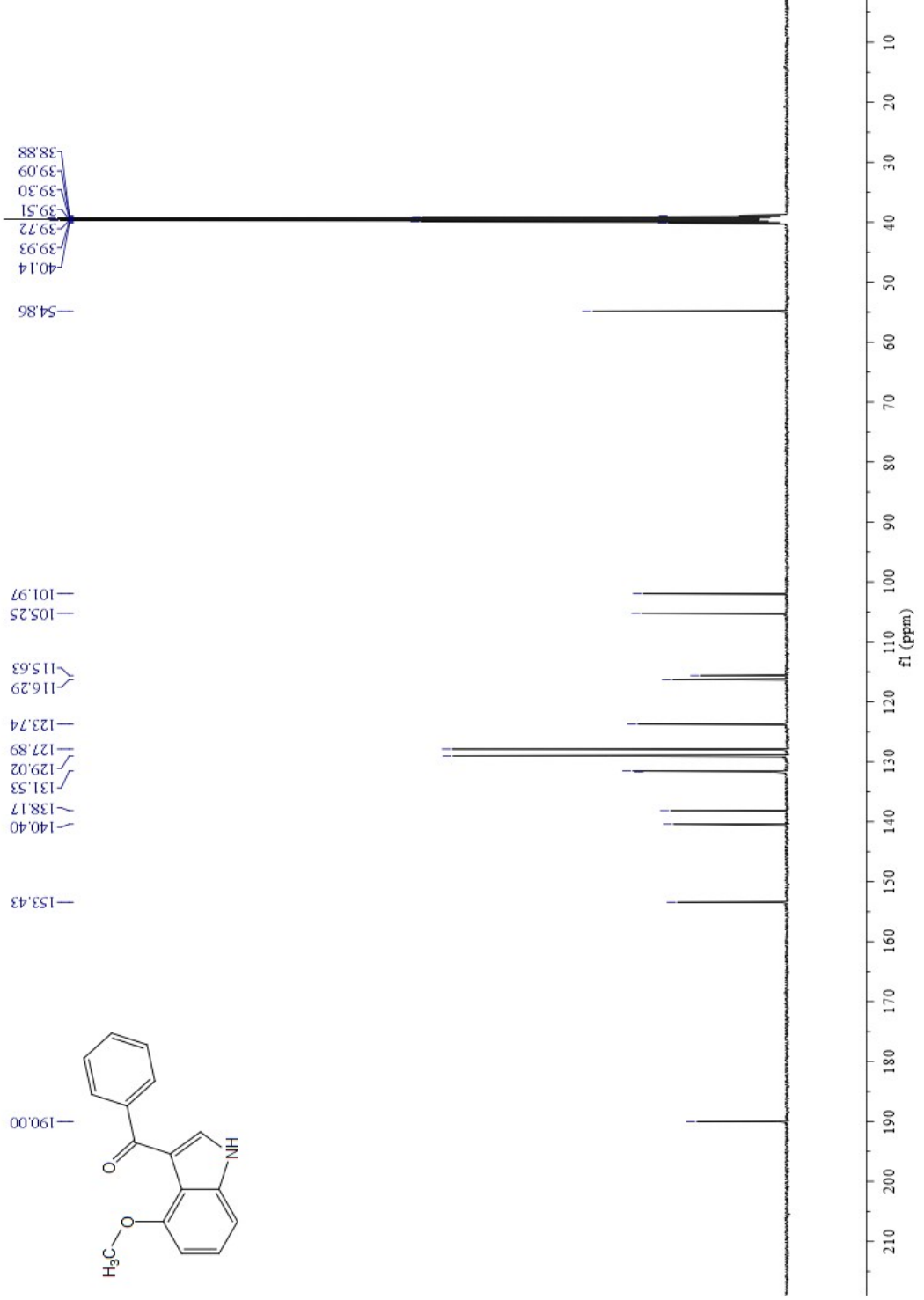
^{13}C NMR of (1*H*-indol-3-yl)(phenyl)methanone **(3aa)**



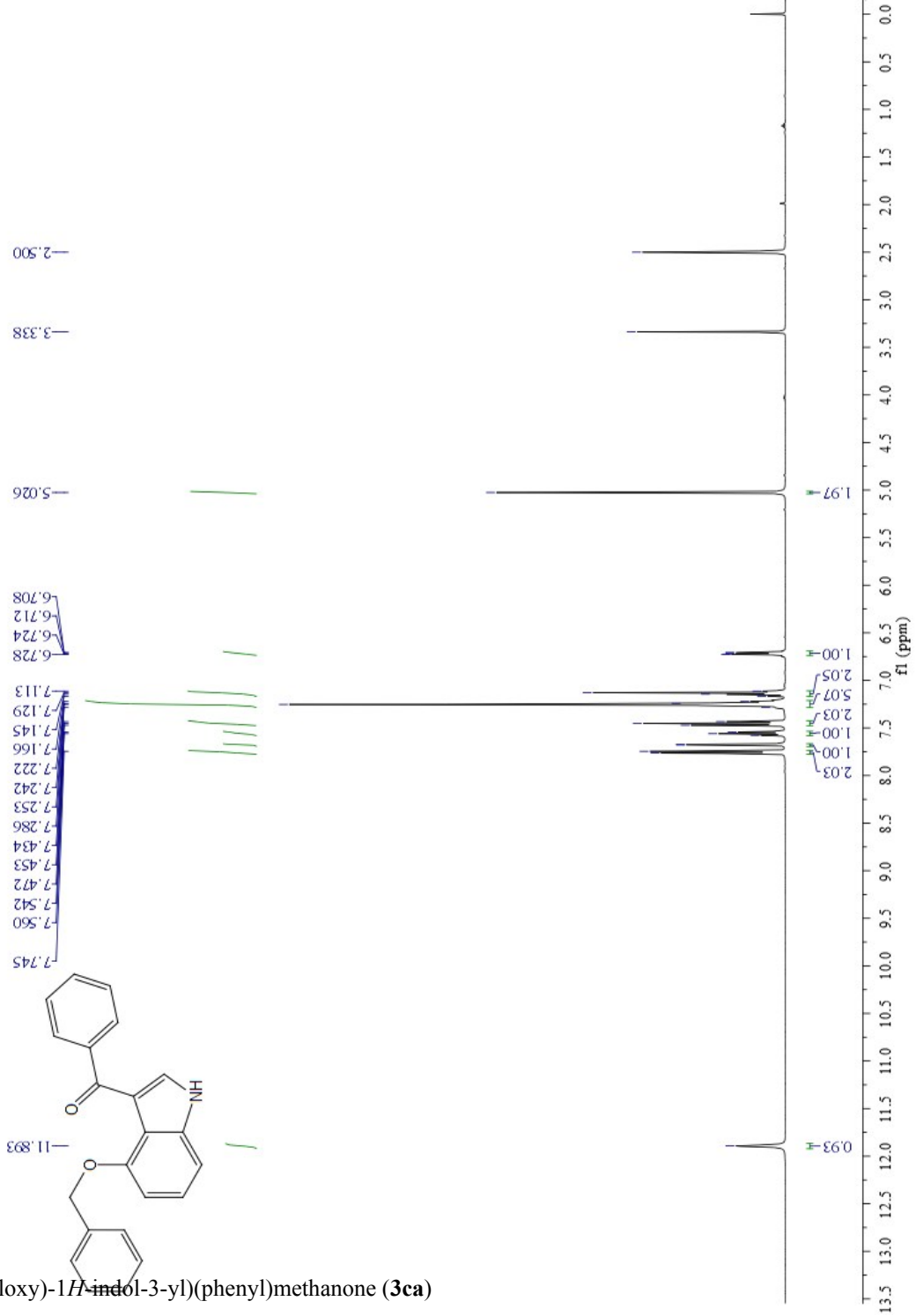
^{1}H NMR of (4-methoxy-1*H*-indol-3-yl)(phenyl)methanone (**3ba**)



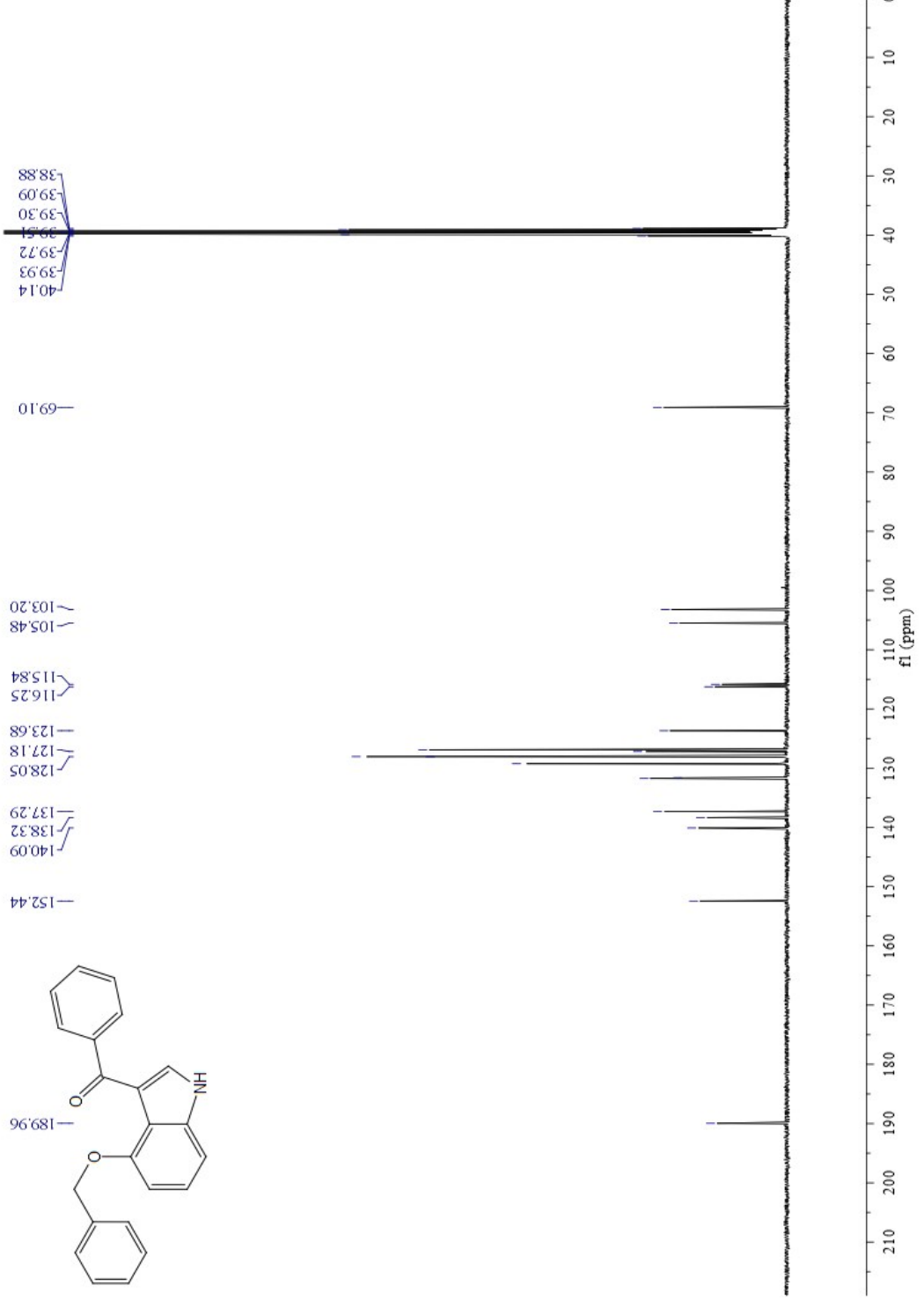
^{13}C NMR of (4-methoxy-1*H*-indol-3-yl)(phenyl)methanone (**3ba**)



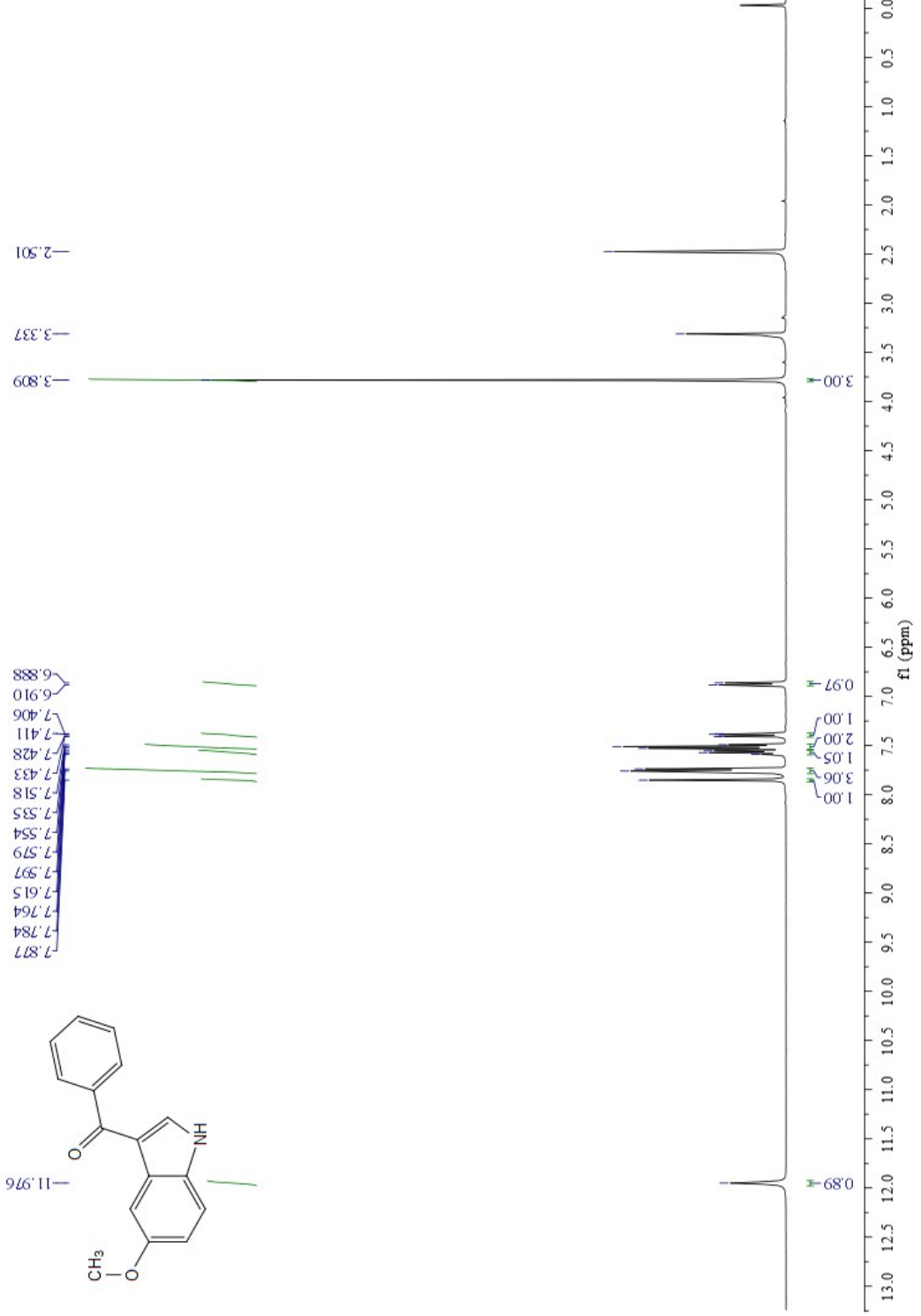
^{1}H NMR of (4-(benzyloxy)-1*H*-indol-3-yl)(phenyl)methanone (**3ca**)



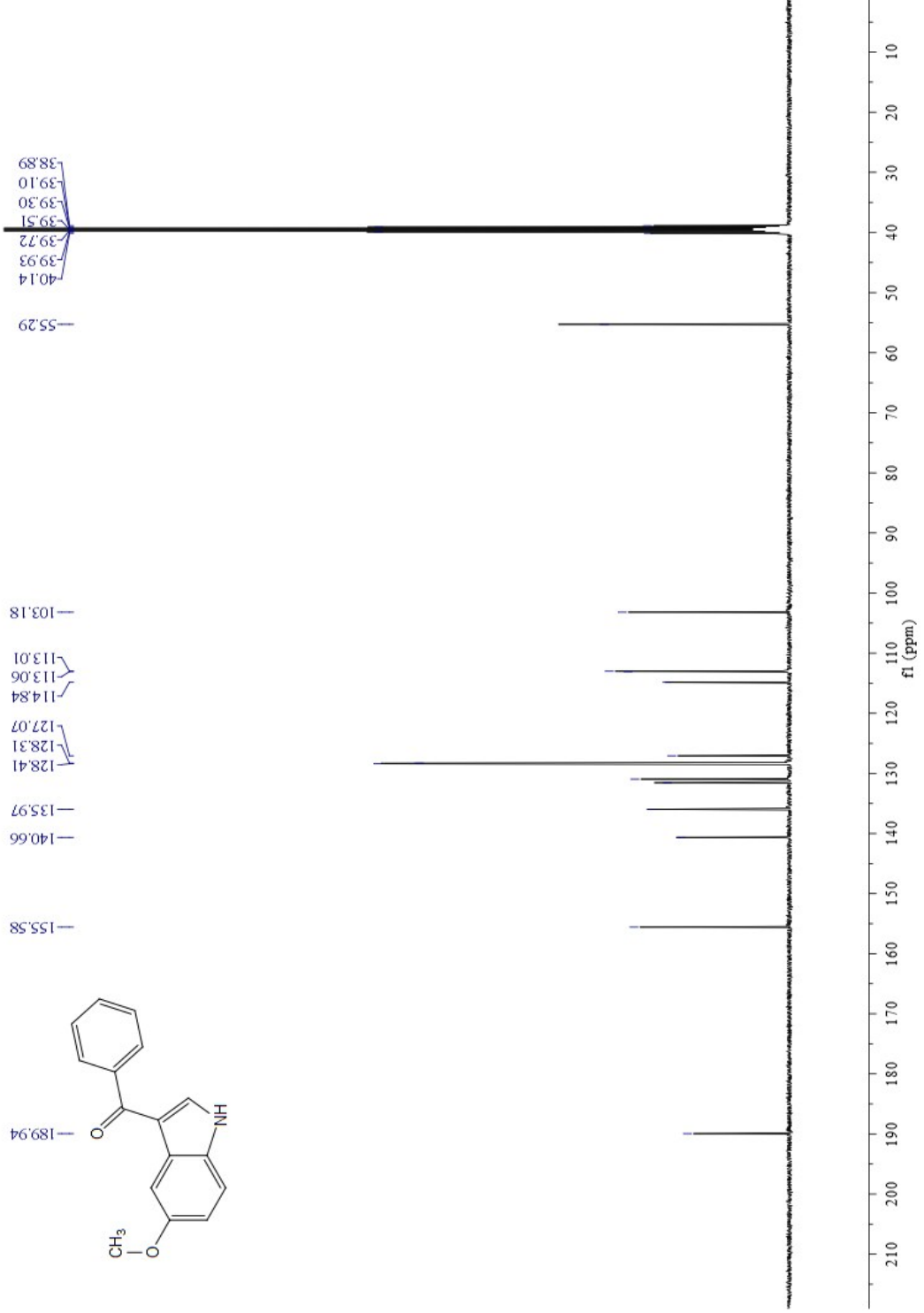
^{13}C NMR of (4-(benzyloxy)-1*H*-indol-3-yl)(phenyl)methanone (**3ca**)



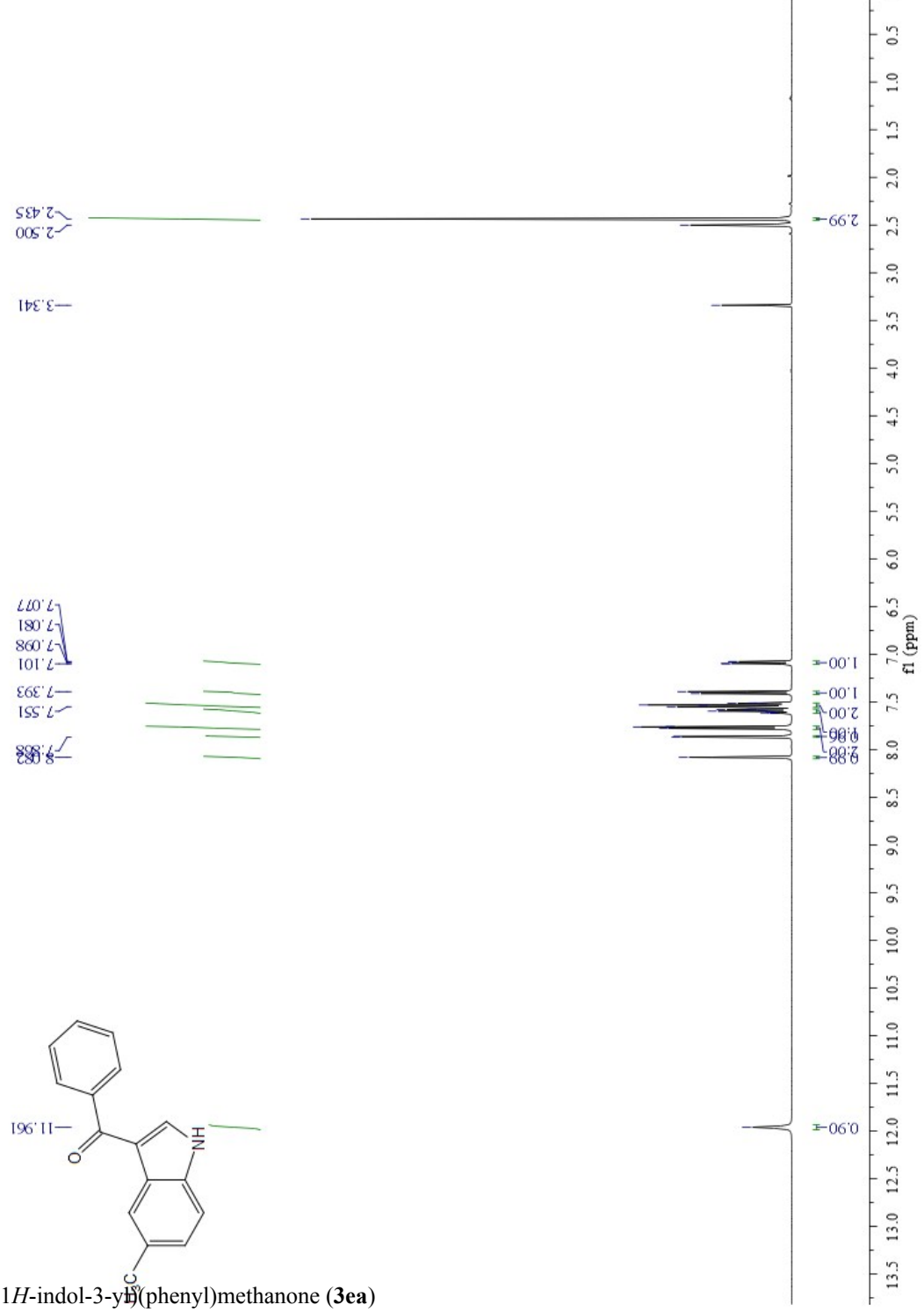
^{1}H NMR of (5-methoxy-1*H*-indol-3-yl)(phenyl)methanone (**3da**)



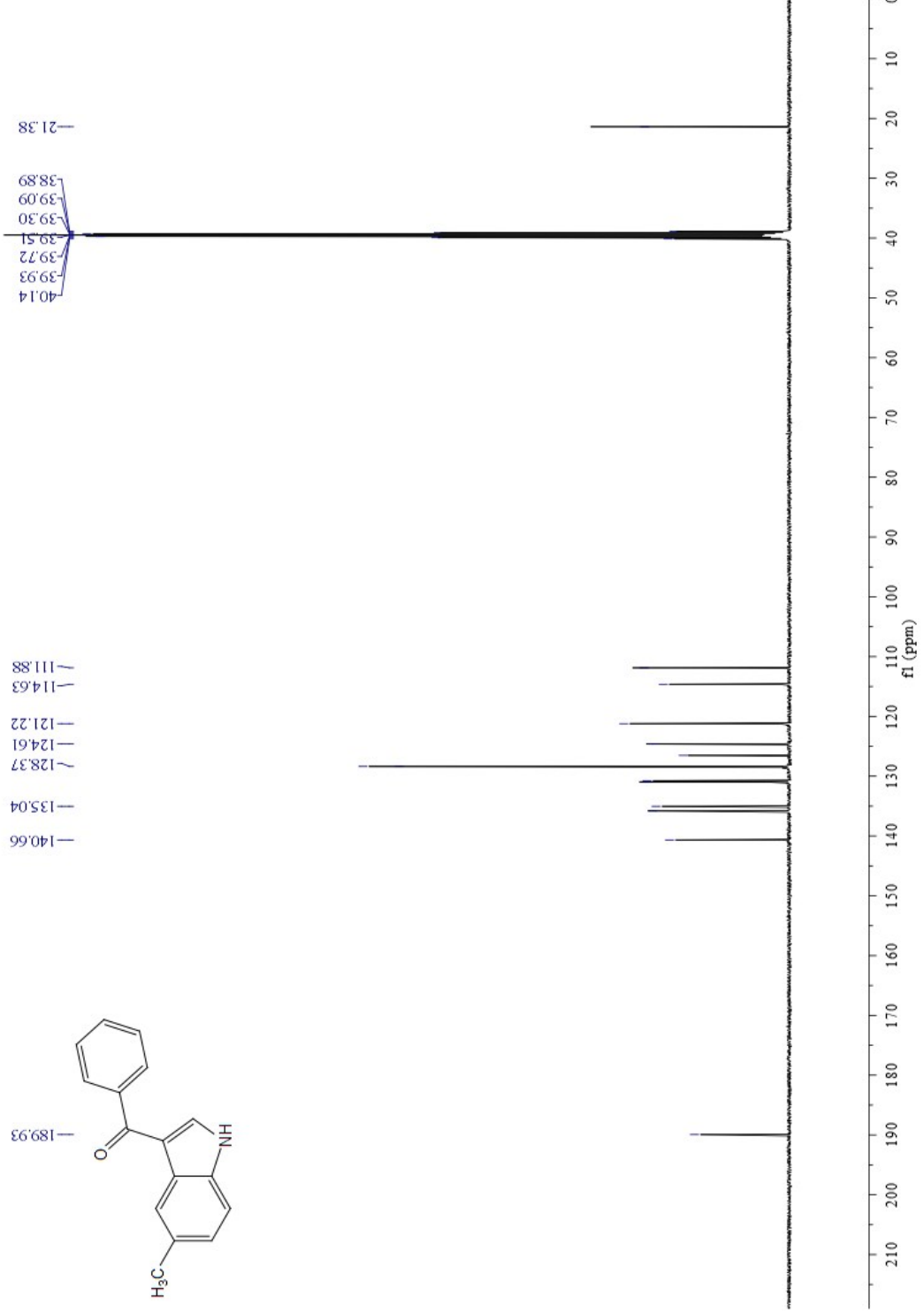
^{13}C NMR of (5-methoxy-1*H*-indol-3-yl)(phenyl)methanone (**3da**)



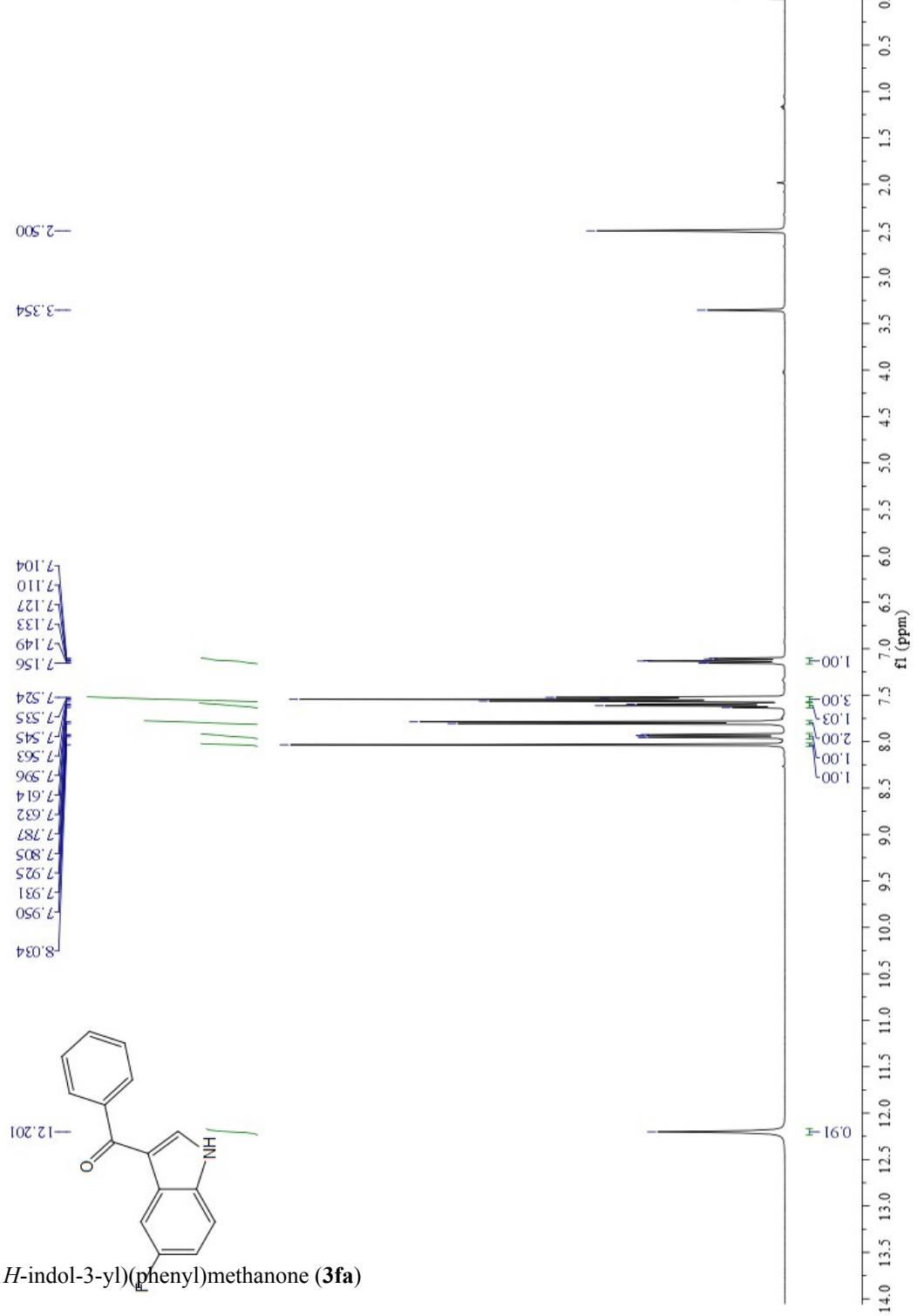
^{1}H NMR of (5-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3ea**)



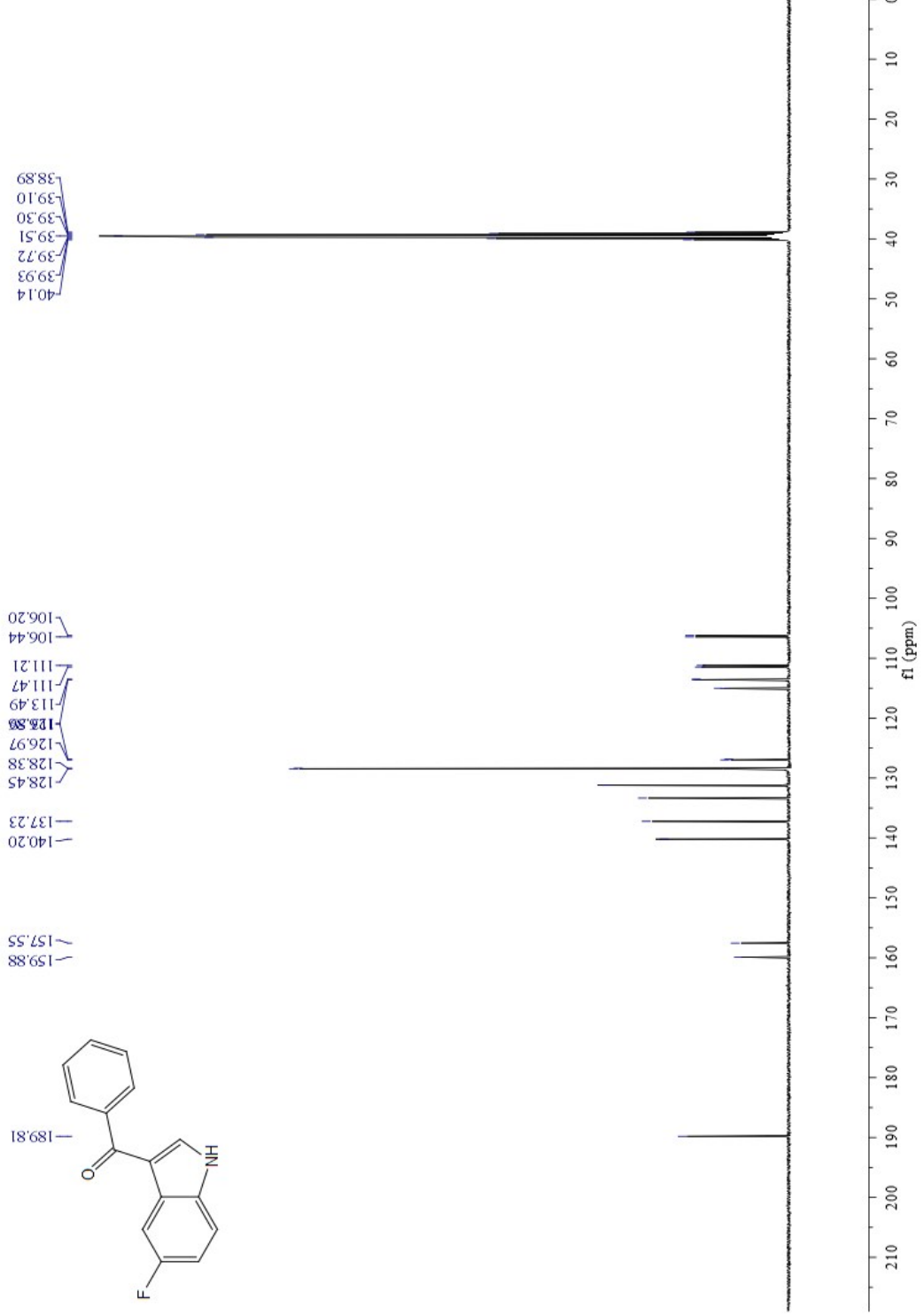
^{13}C NMR of (5-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3ea**)



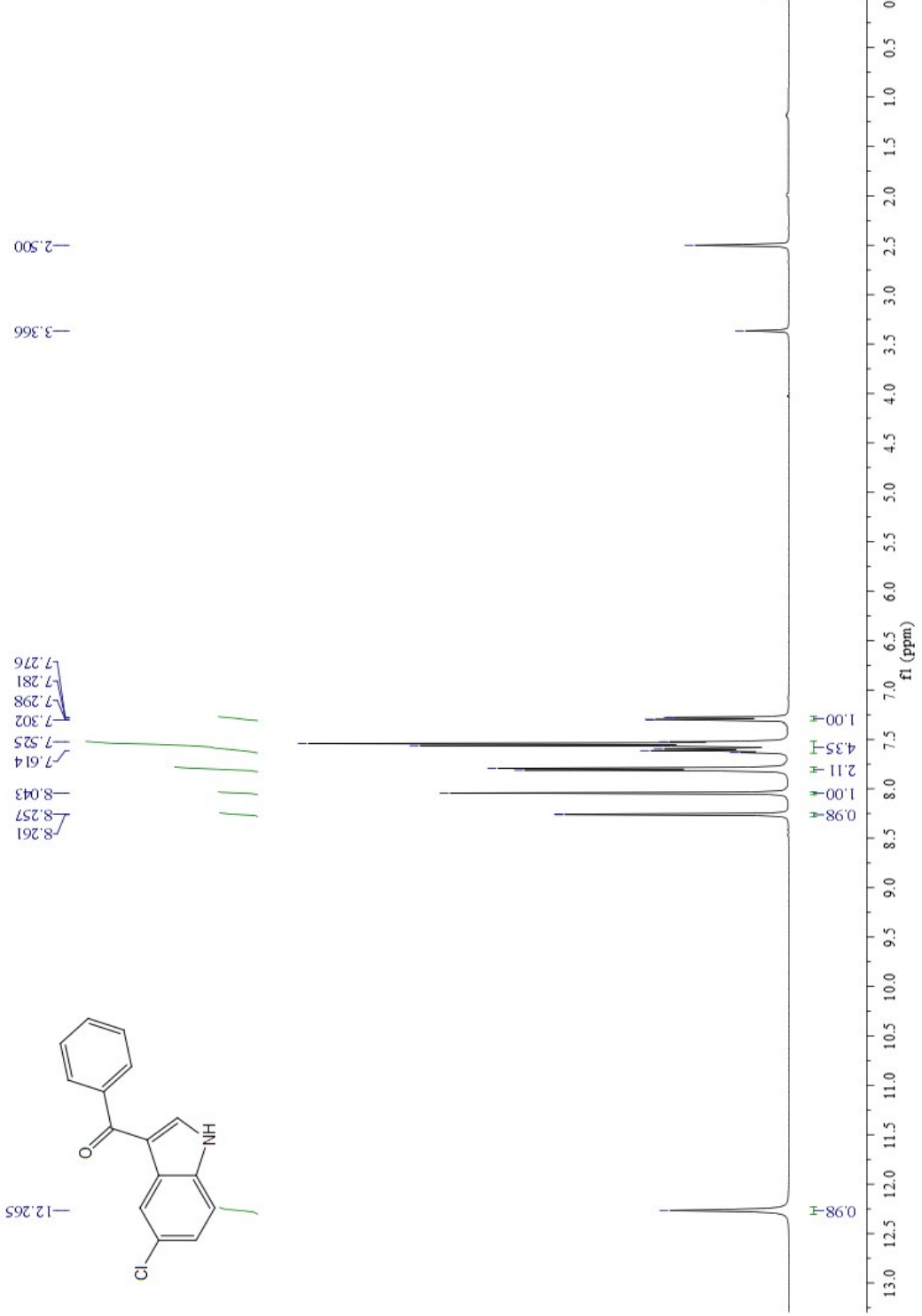
^{1}H NMR of (5-fluoro-1*H*-indol-3-yl)(phenyl)methanone (**3fa**)



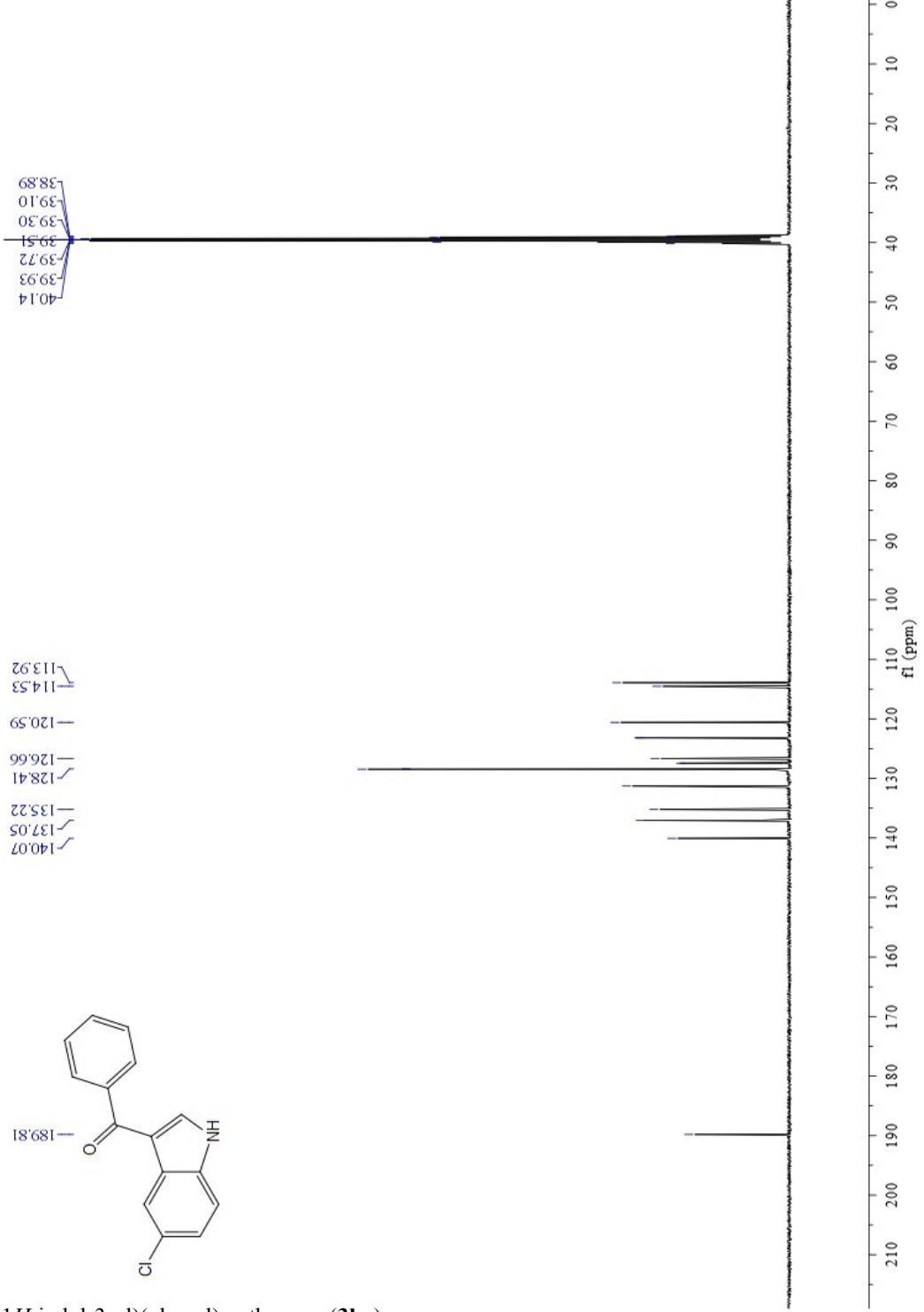
^{13}C NMR of (5-fluoro-1*H*-indol-3-yl)(phenyl)methanone (**3fa**)



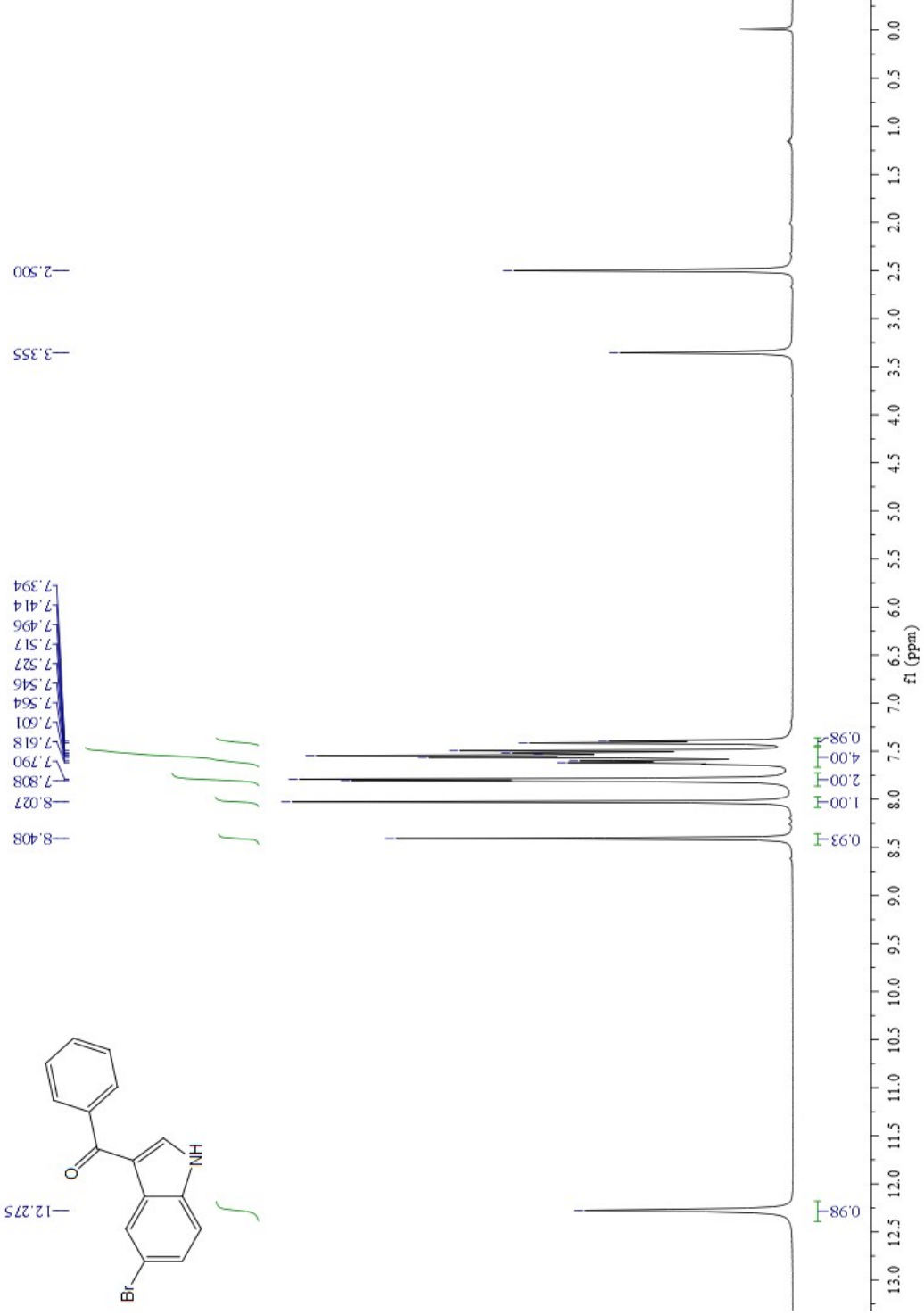
^{1}H NMR of (5-chloro-1*H*-indol-3-yl)(phenyl)methanone (**3ga**)



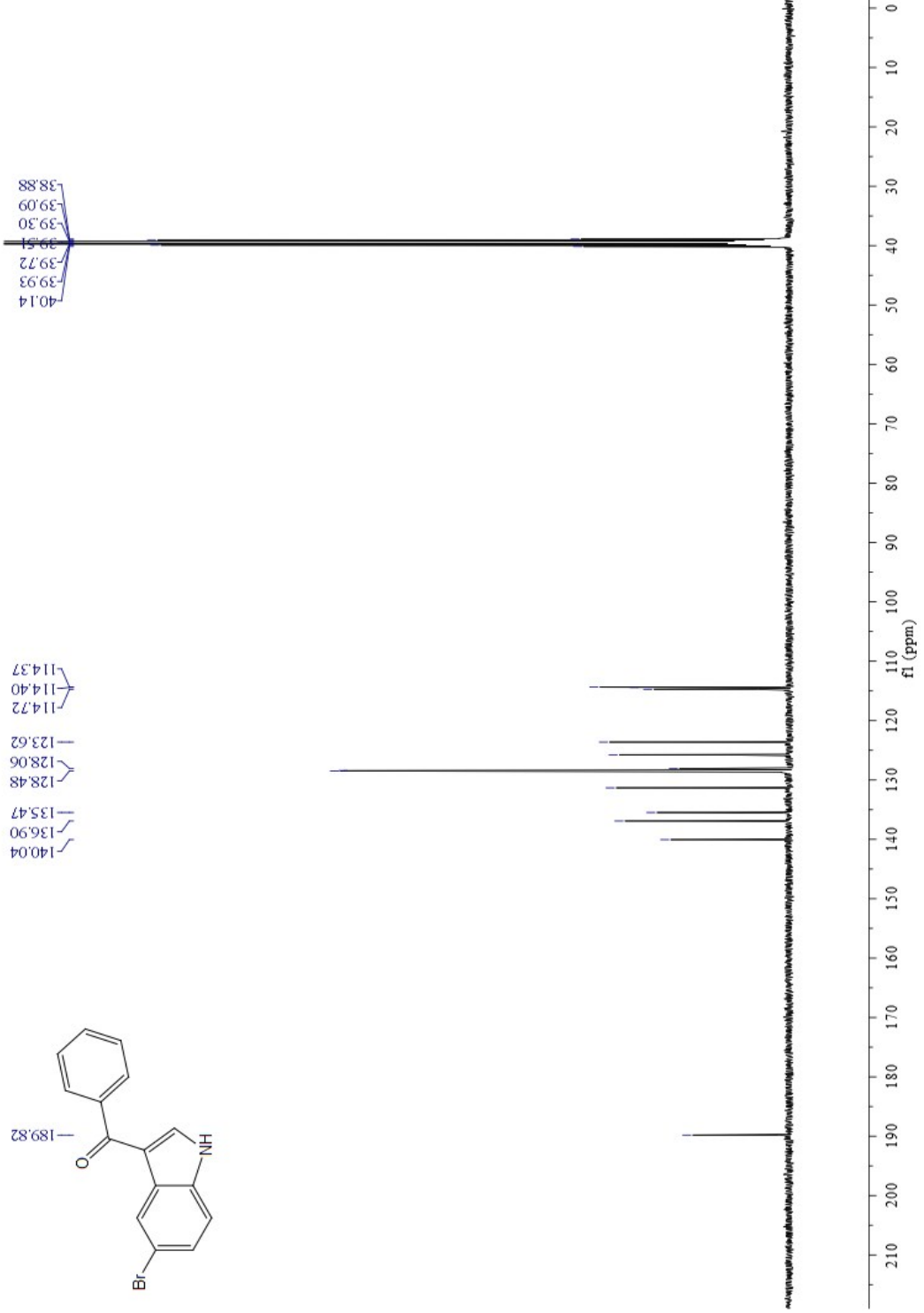
^{13}C NMR of (5-chloro-1*H*-indol-3-yl)(phenyl)methanone (**3ga**)



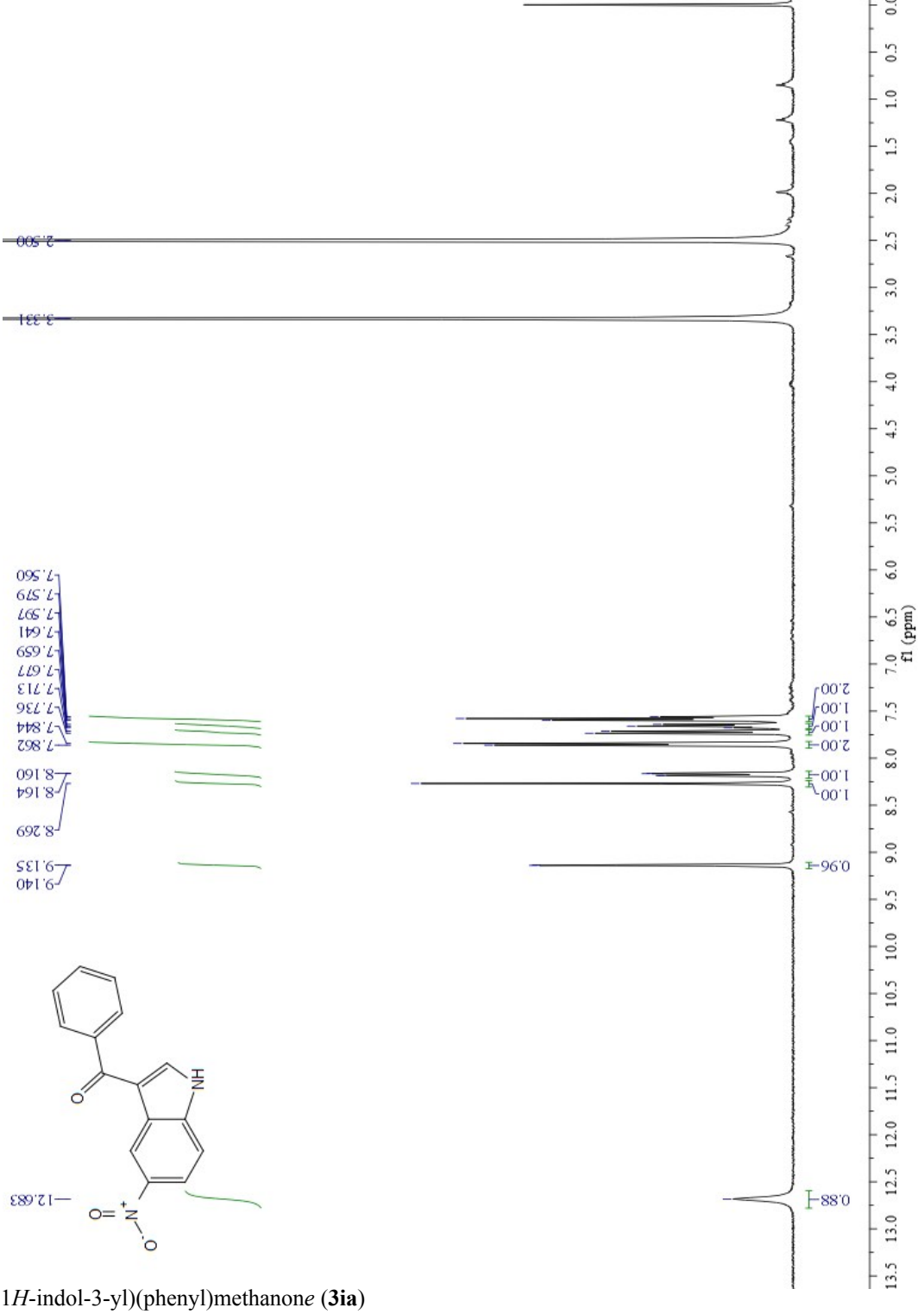
^{1}H NMR of (5-bromo-1*H*-indol-3-yl)(phenyl)methanone (**3ha**)



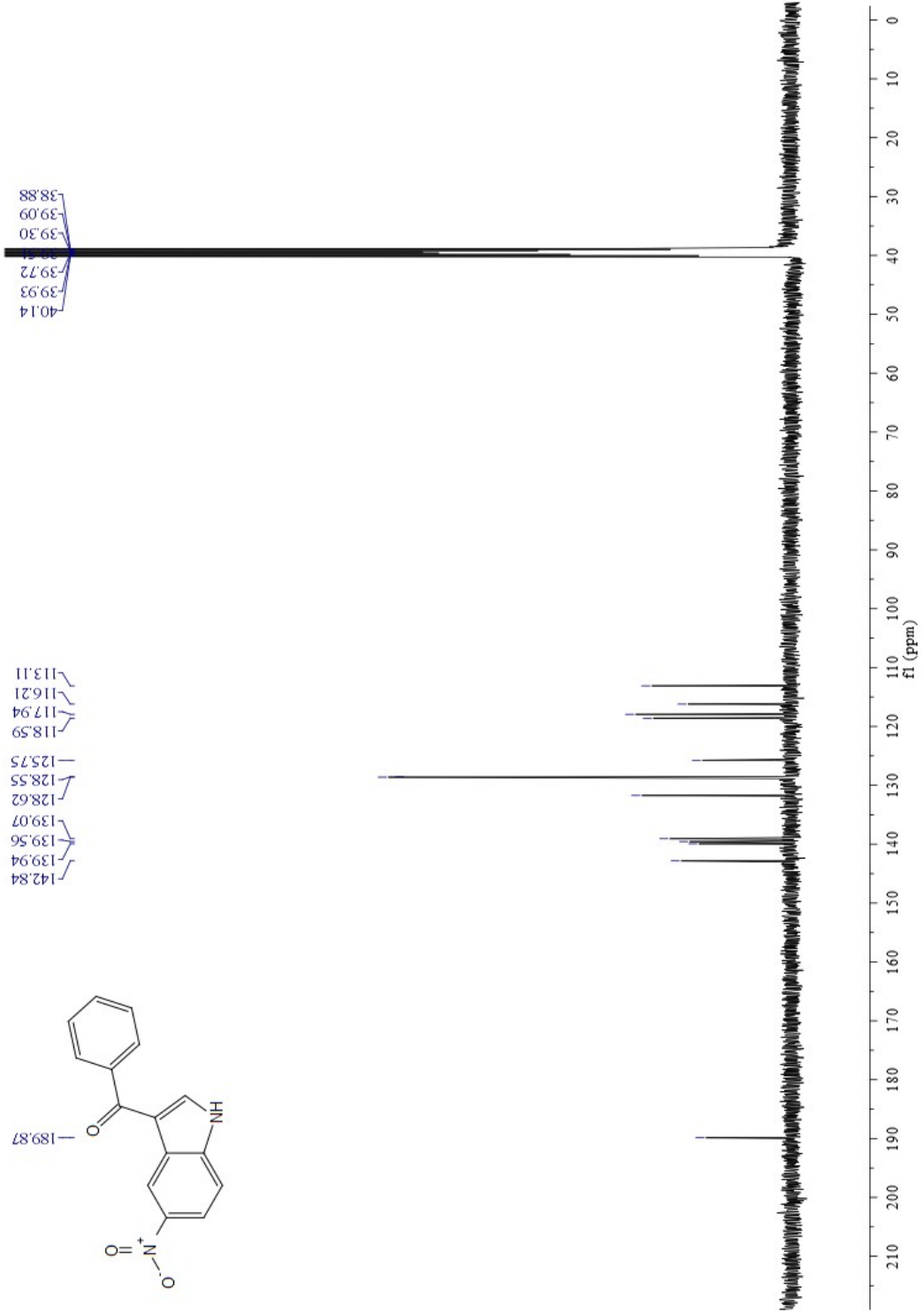
^{13}C NMR of (5-bromo-1*H*-indol-3-yl)(phenyl)methanone (**3ha**)



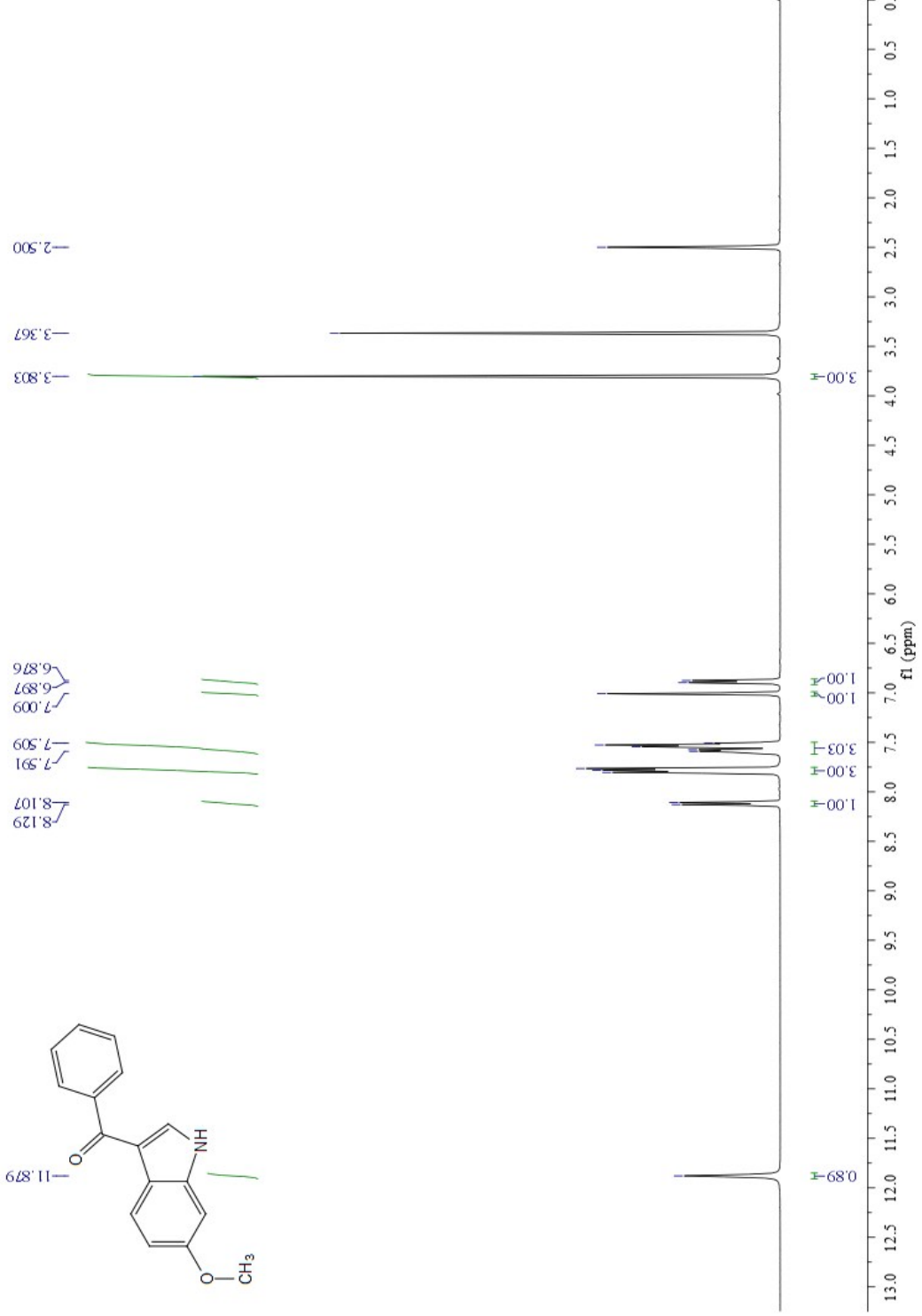
^{1}H NMR of (5-nitro-1*H*-indol-3-yl)(phenyl)methanon*e* (**3ia**)



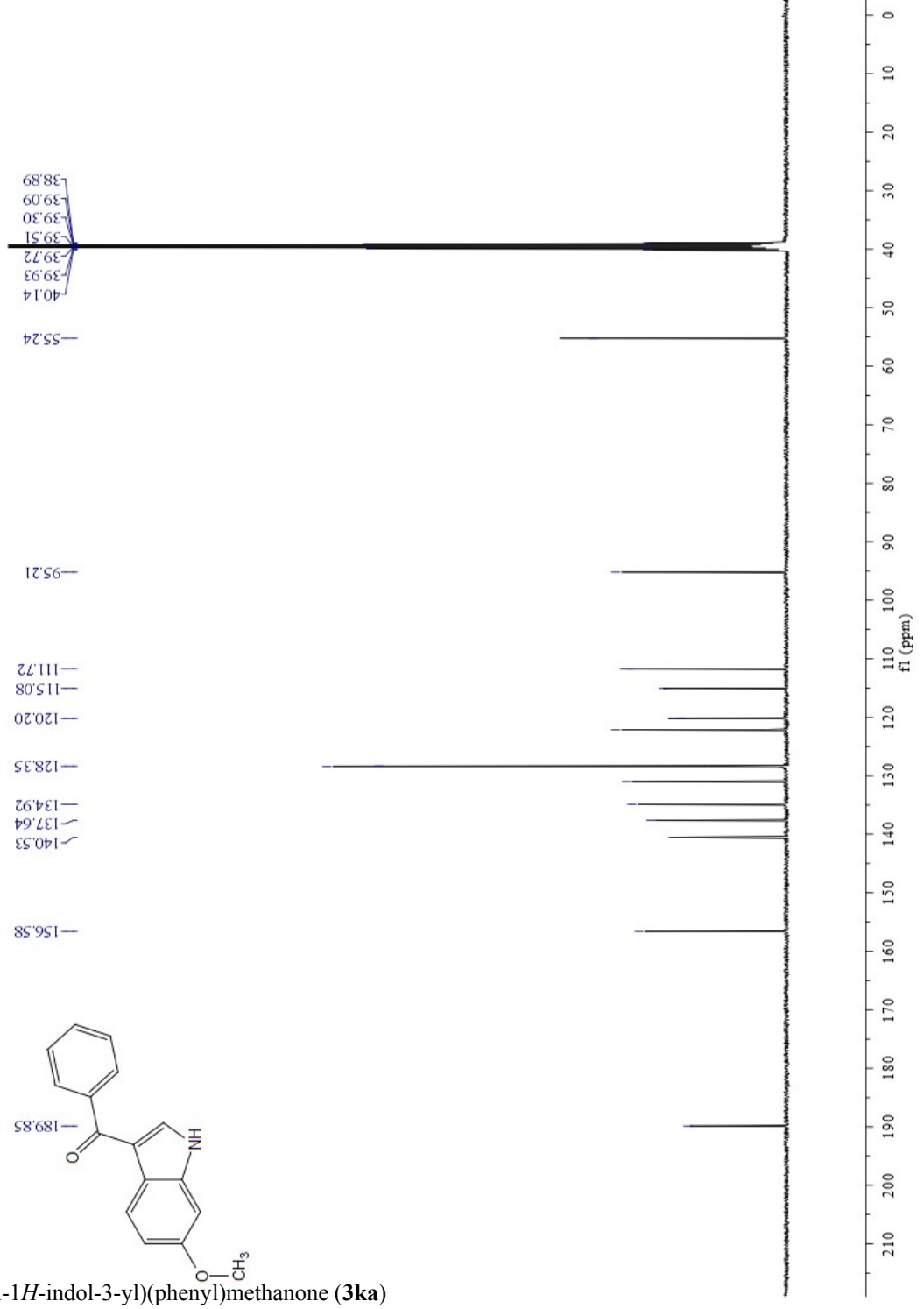
^{13}C NMR of (5-nitro-1*H*-indol-3-yl)(phenyl)methanon*e* (**3ia**)



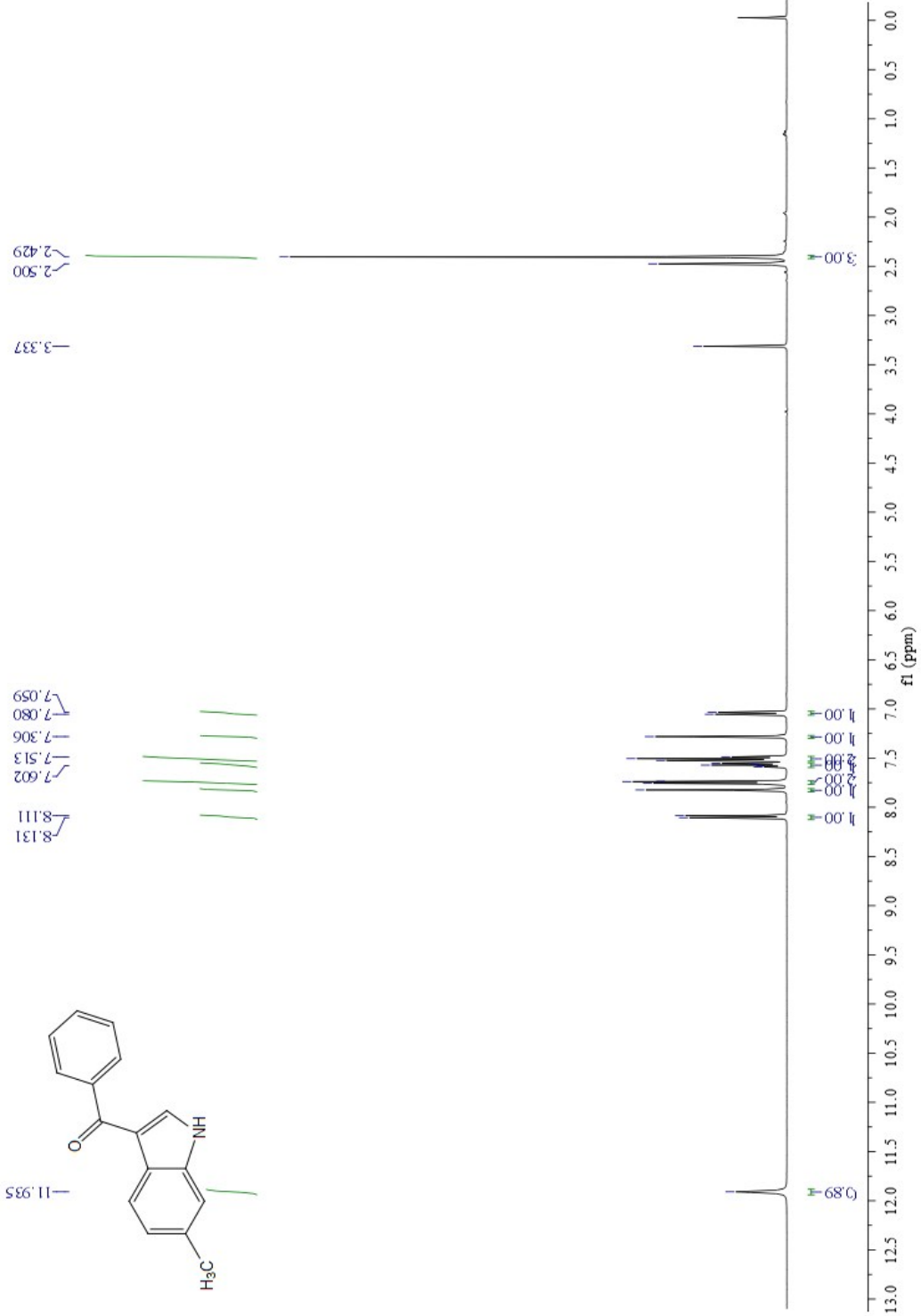
^{1}H NMR of (6-methoxy-1*H*-indol-3-yl)(phenyl)methanone (**3ja**)



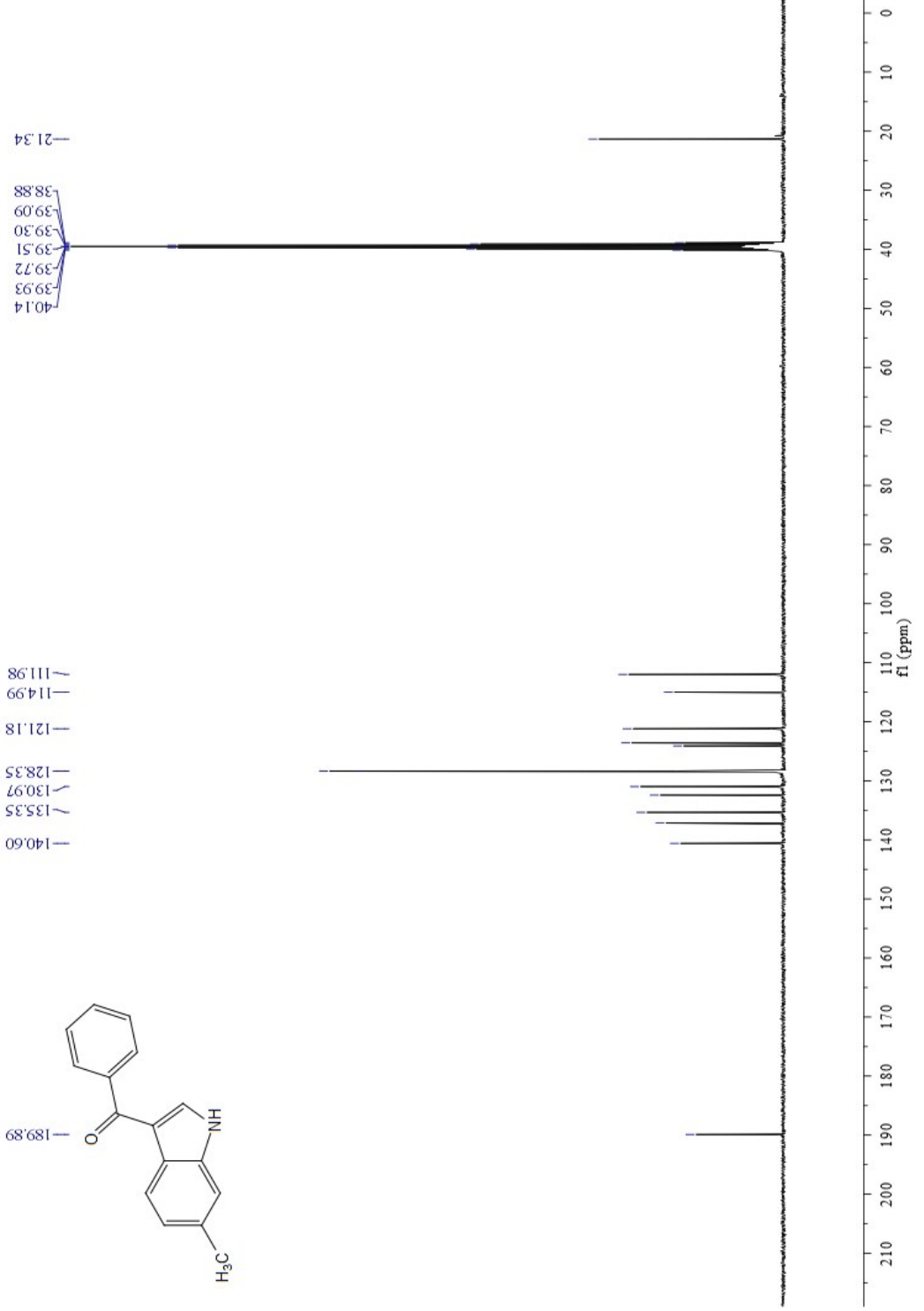
^{13}C NMR of (6-methoxy-1*H*-indol-3-yl)(phenyl)methanone (**3ja**)



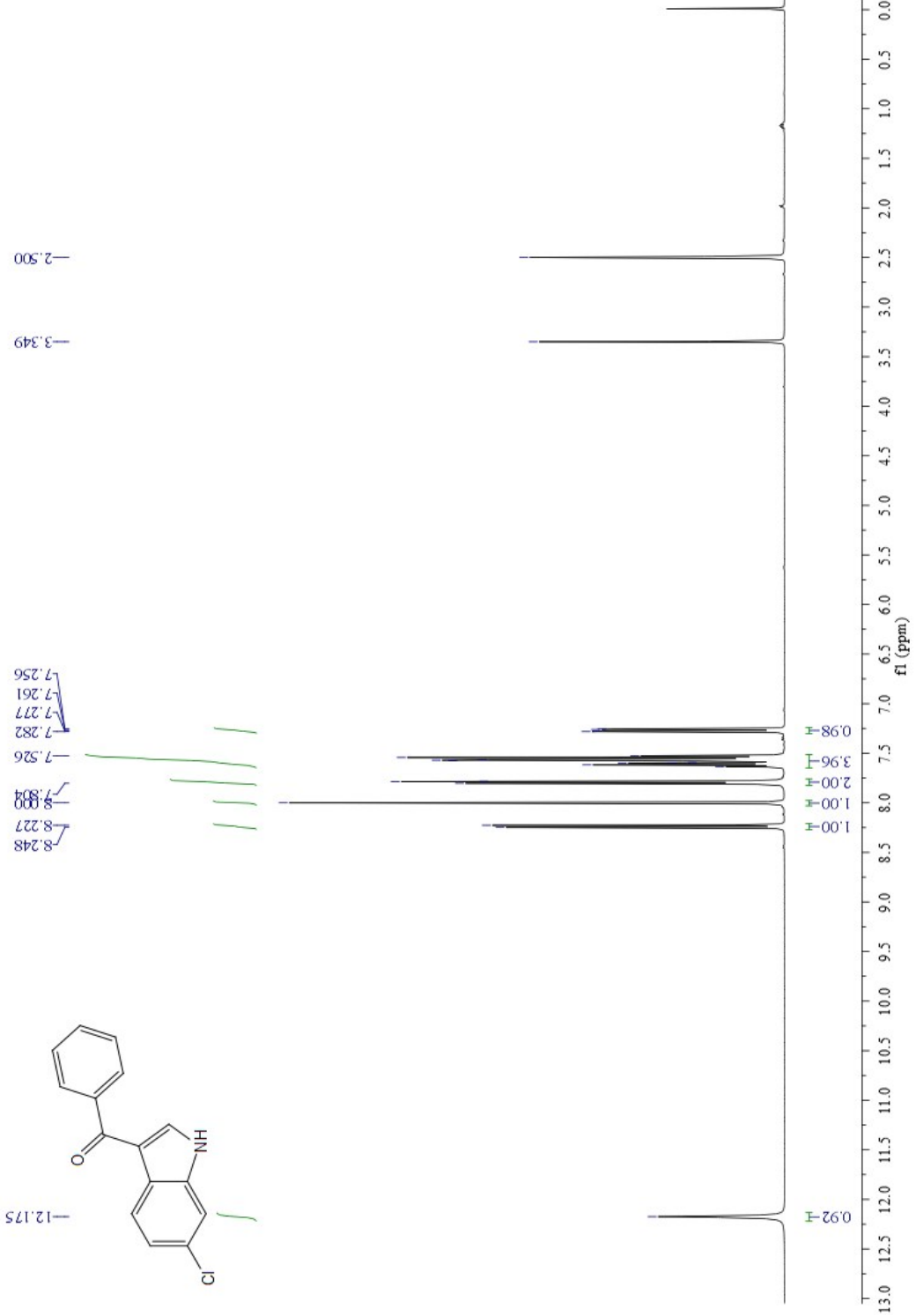
^{1}H NMR of (6-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3ka**)



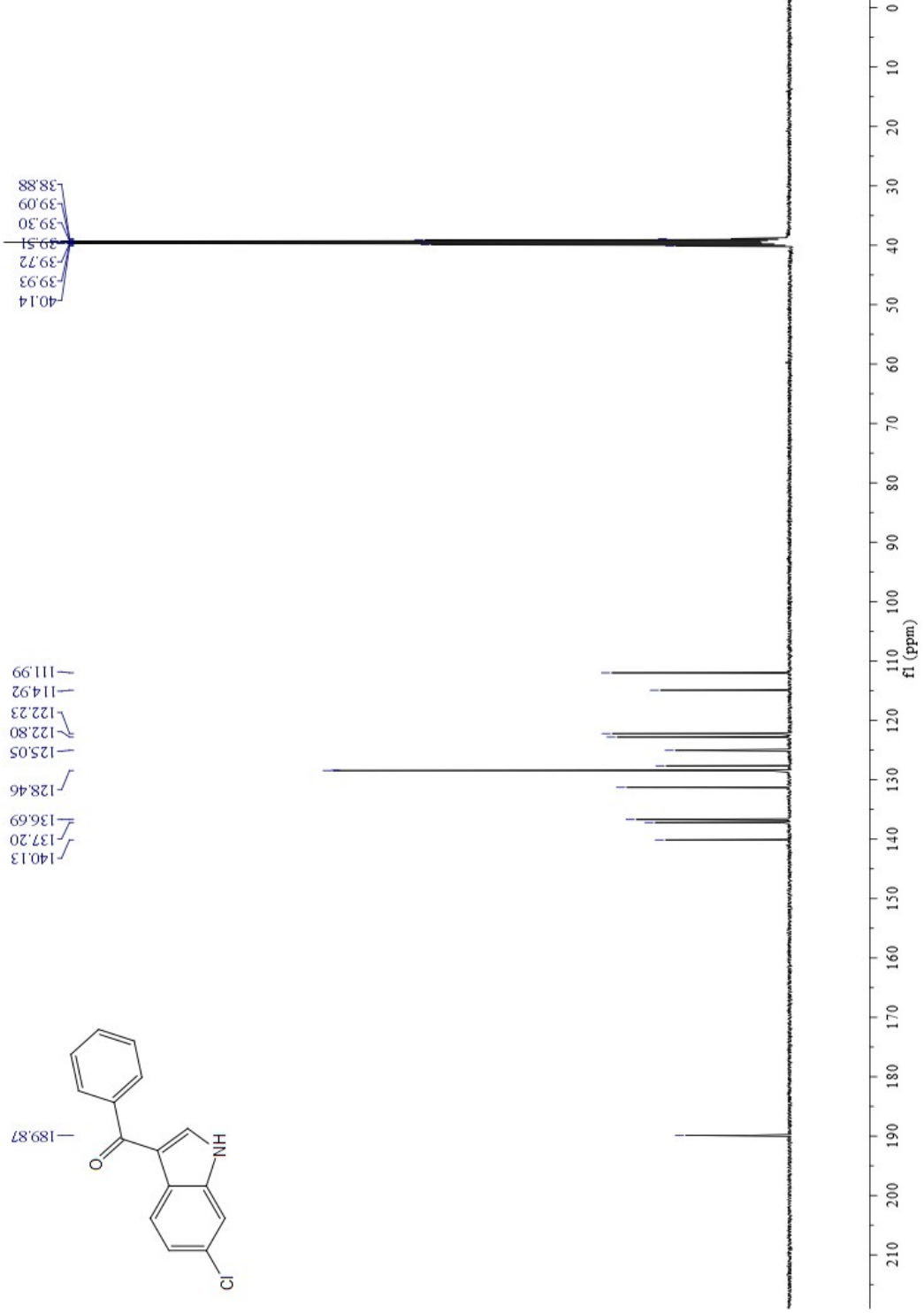
^{13}C NMR of (6-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3ka**)



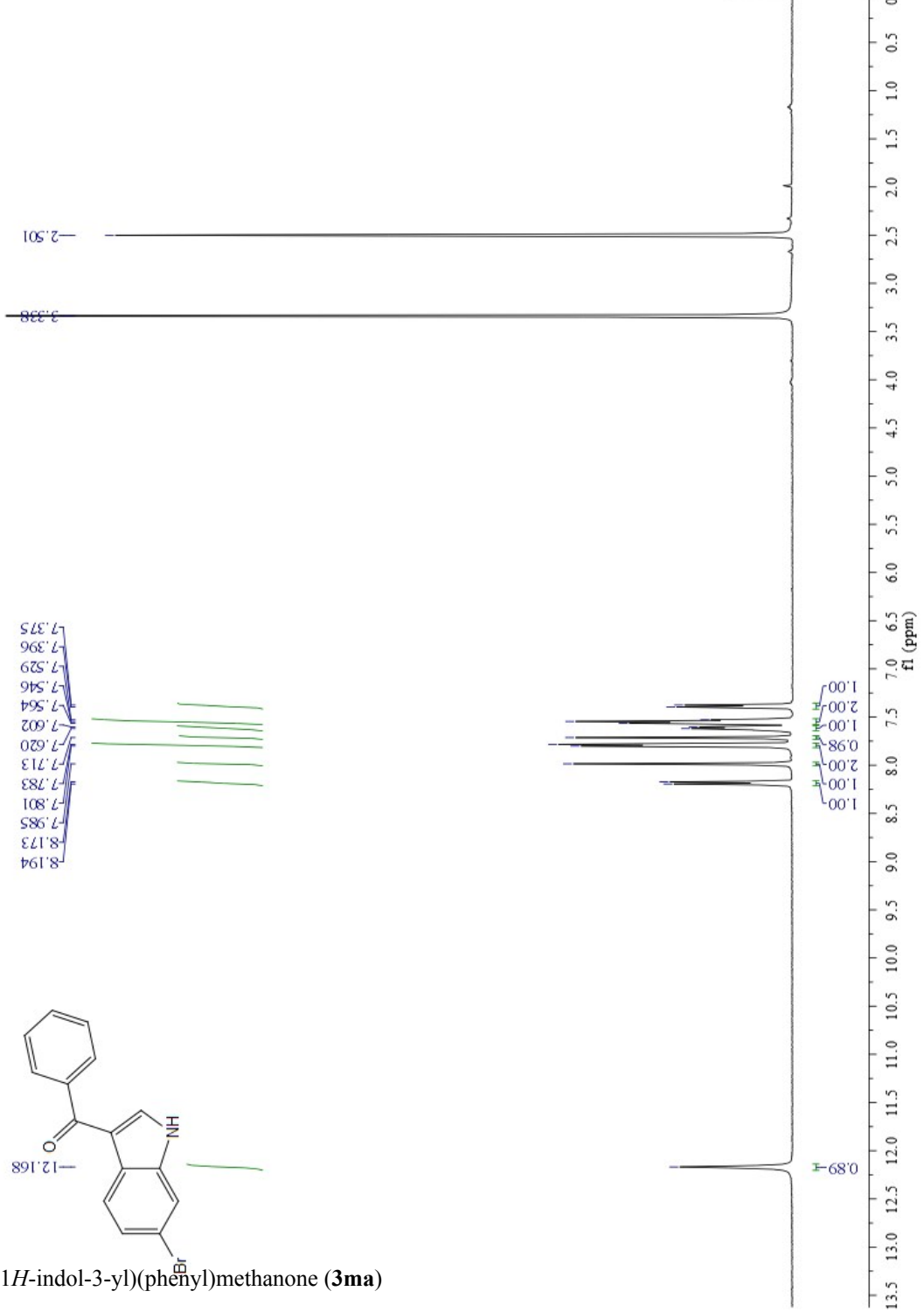
^{1}H NMR of (6-chloro-1*H*-indol-3-yl)(phenyl)methanone (**3la**)



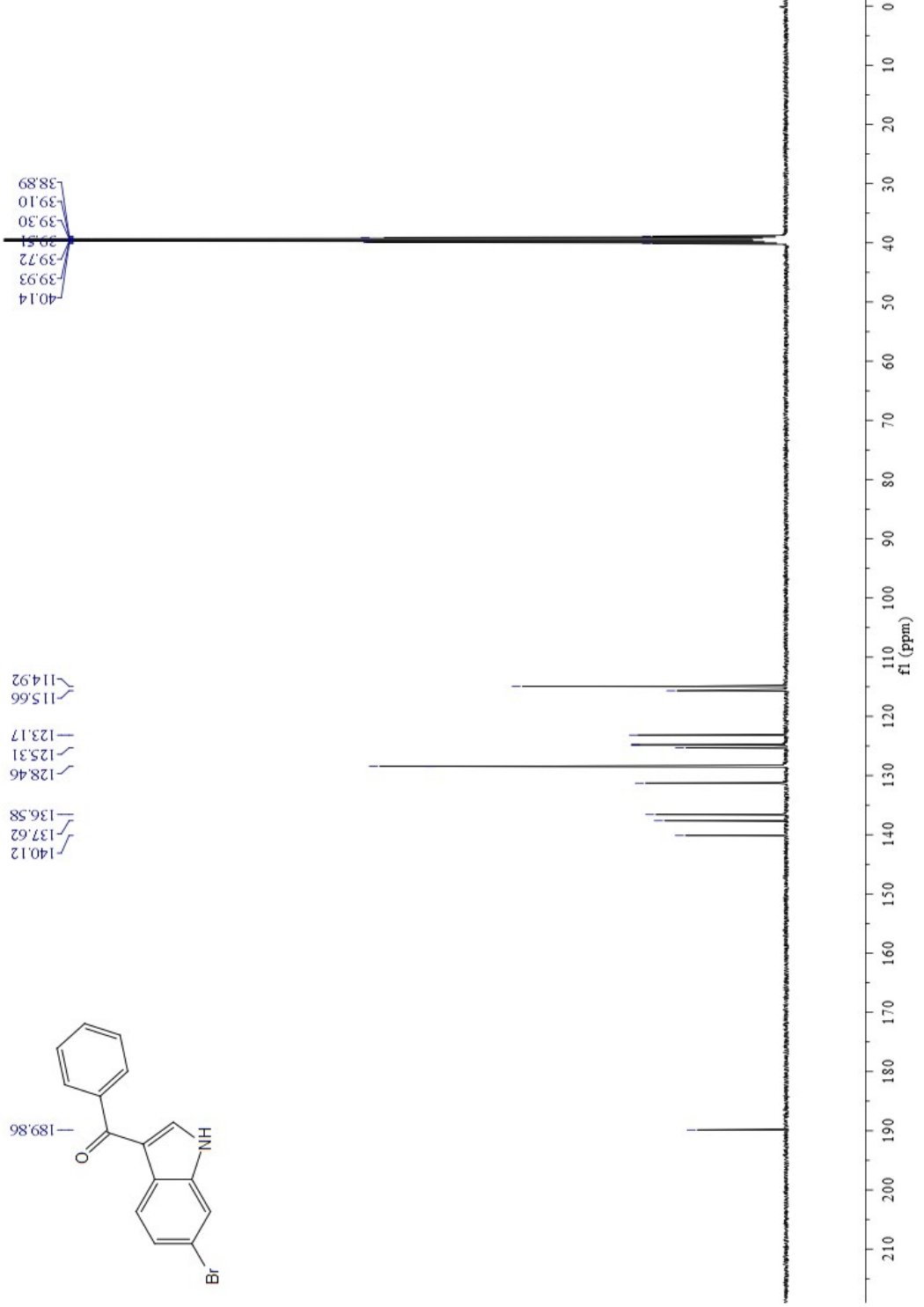
^{13}C NMR of (6-chloro-1*H*-indol-3-yl)(phenyl)methanone (**3la**)



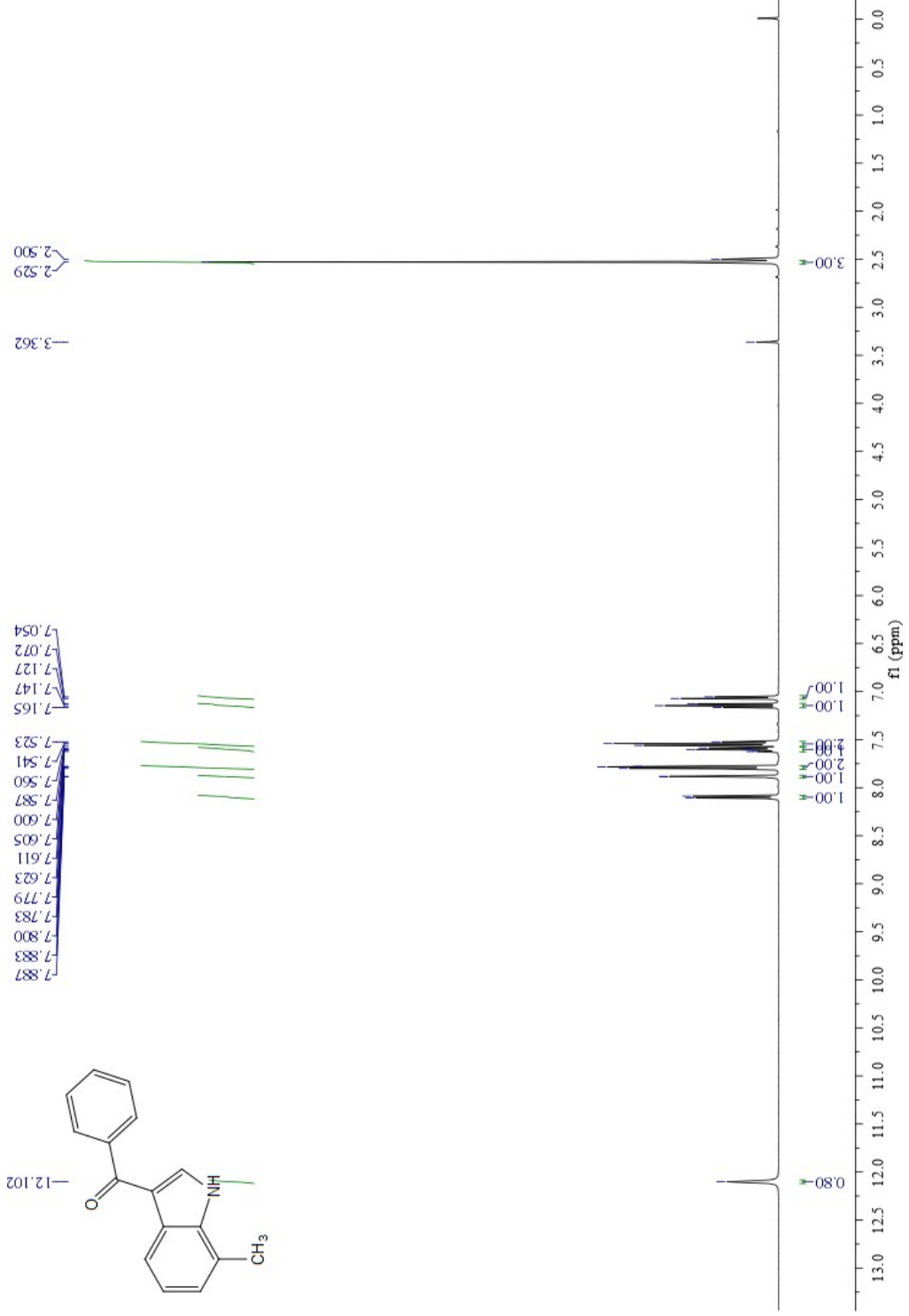
^{1}H NMR of (6-bromo-1*H*-indol-3-yl)(phenyl)methanone (**3ma**)



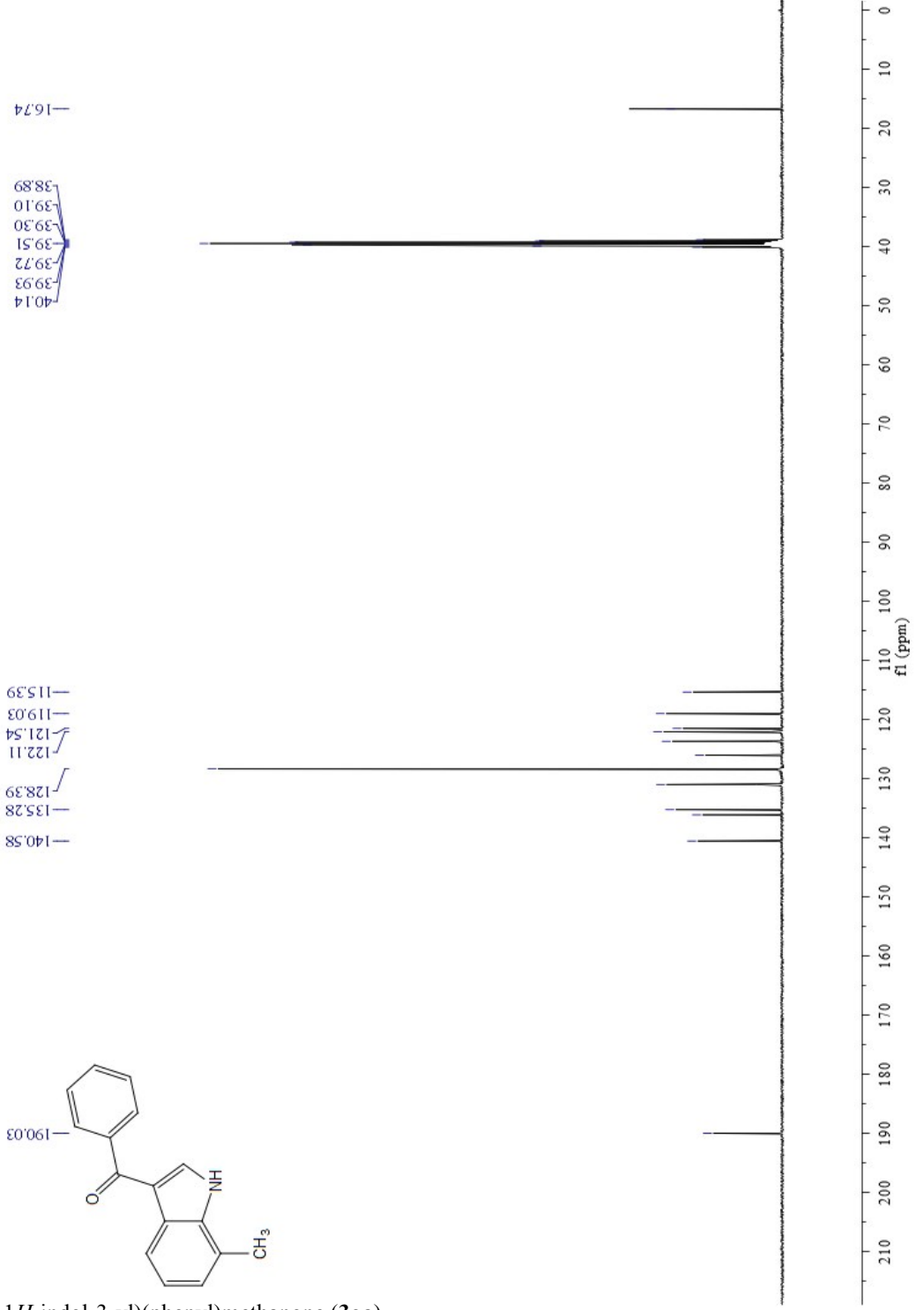
^{13}C NMR of (6-bromo-1*H*-indol-3-yl)(phenyl)methanone (**3ma**)



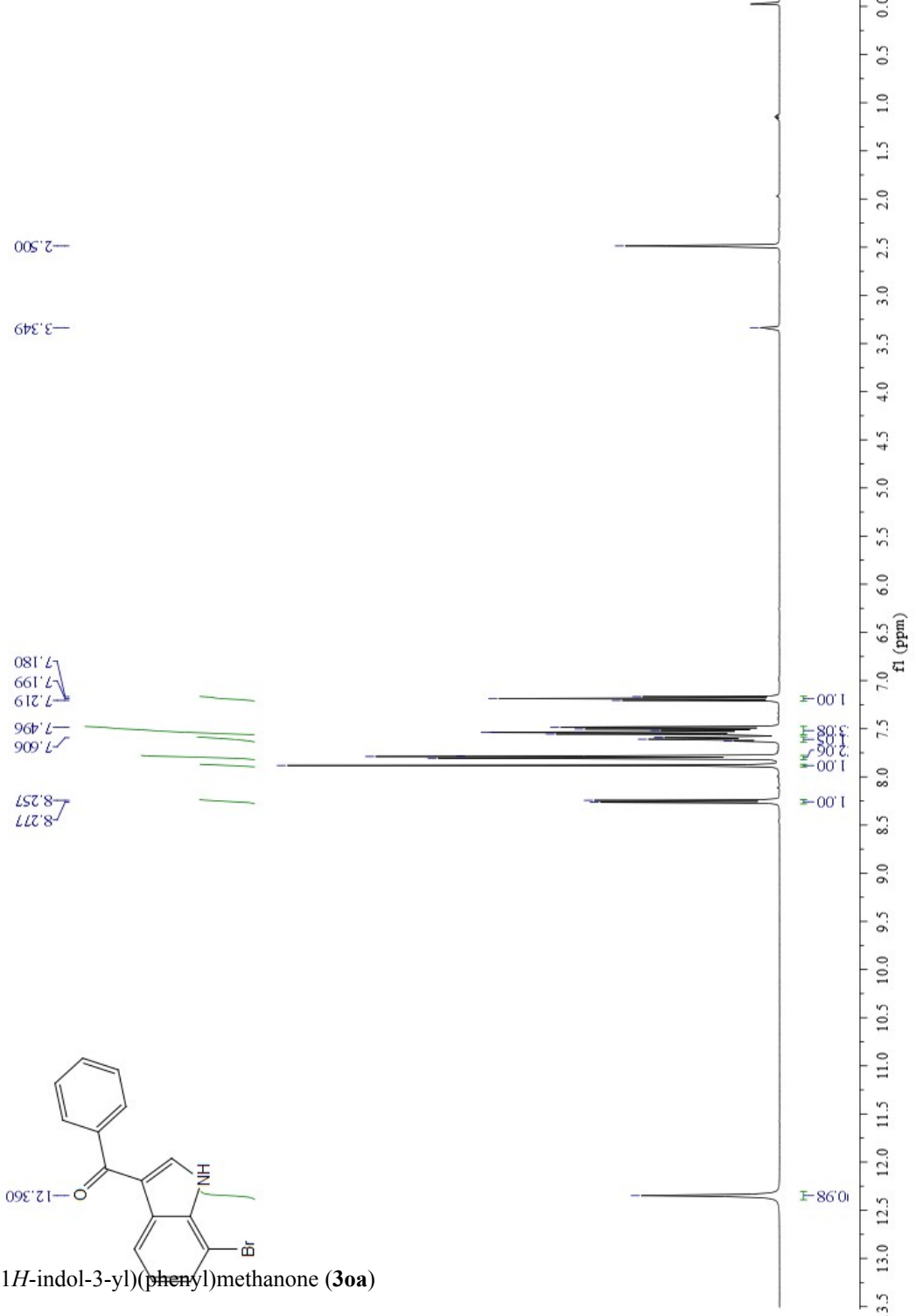
^{1}H NMR of (7-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3na**)



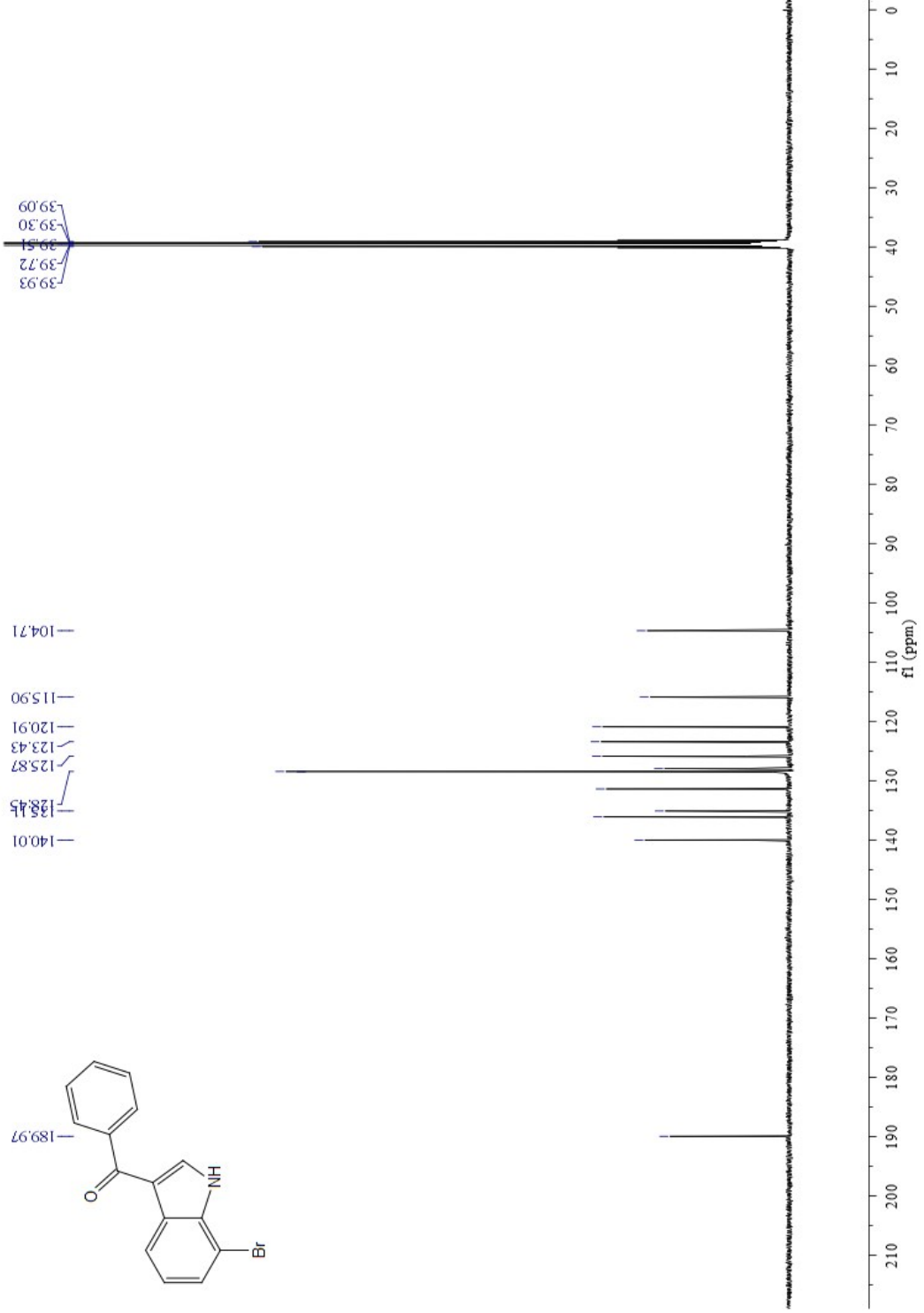
^{13}C NMR of (7-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3na**)



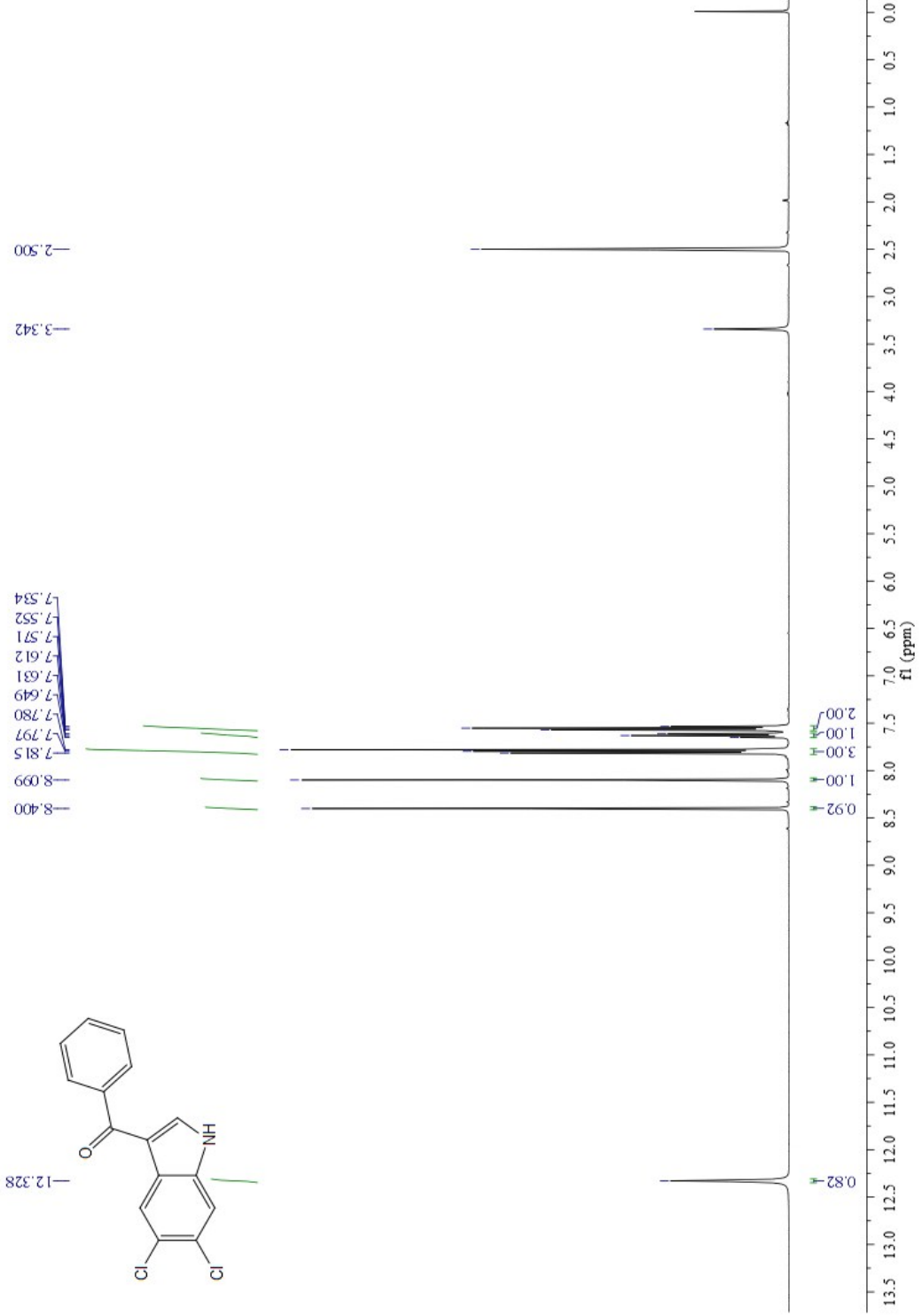
^{1}H NMR of (7-bromol-1*H*-indol-3-yl)(phenyl)methanone (**3oa**)



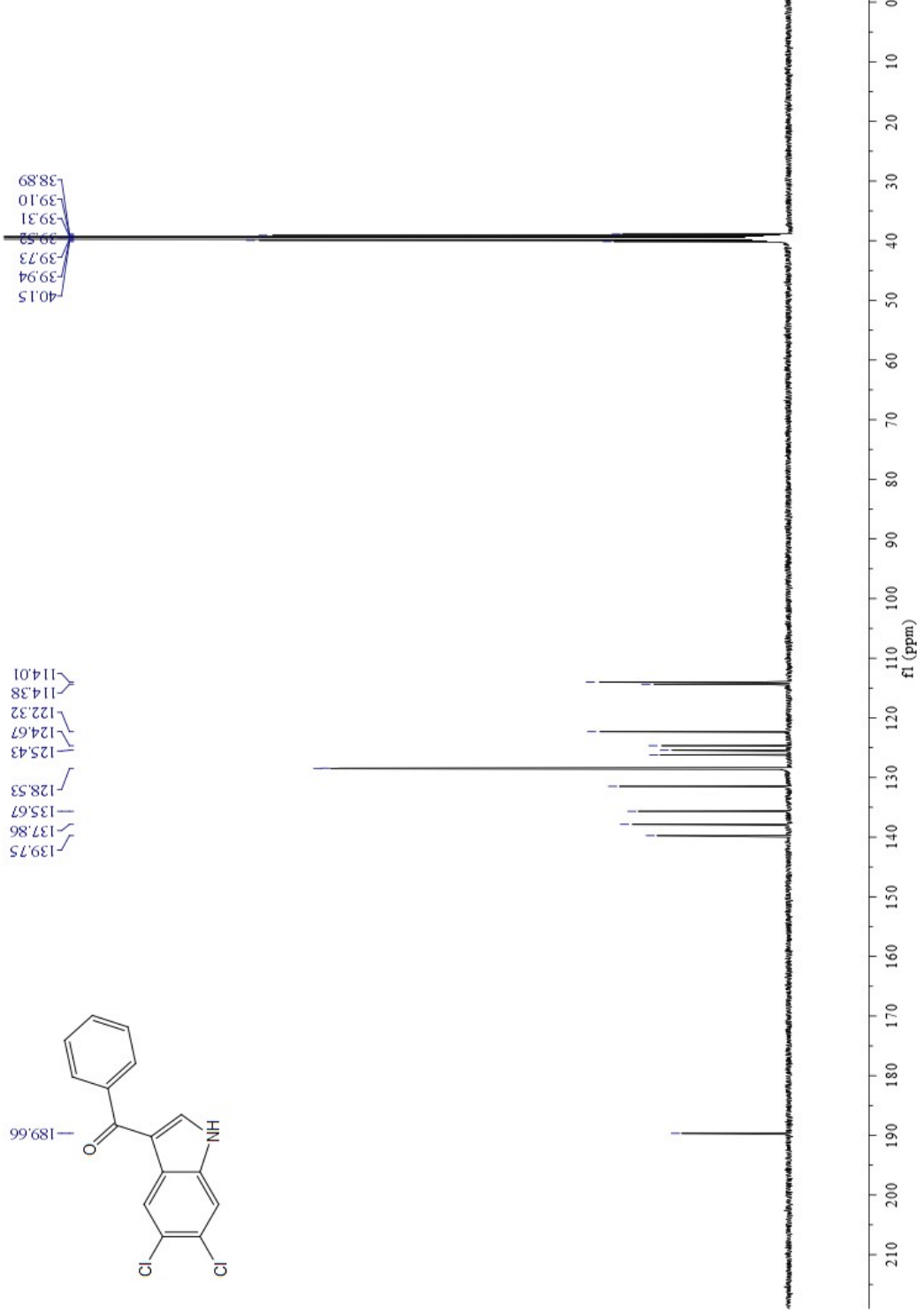
^{13}C NMR of (7-bromol-1*H*-indol-3-yl)(~~phen~~yl)methanone (**3oa**)



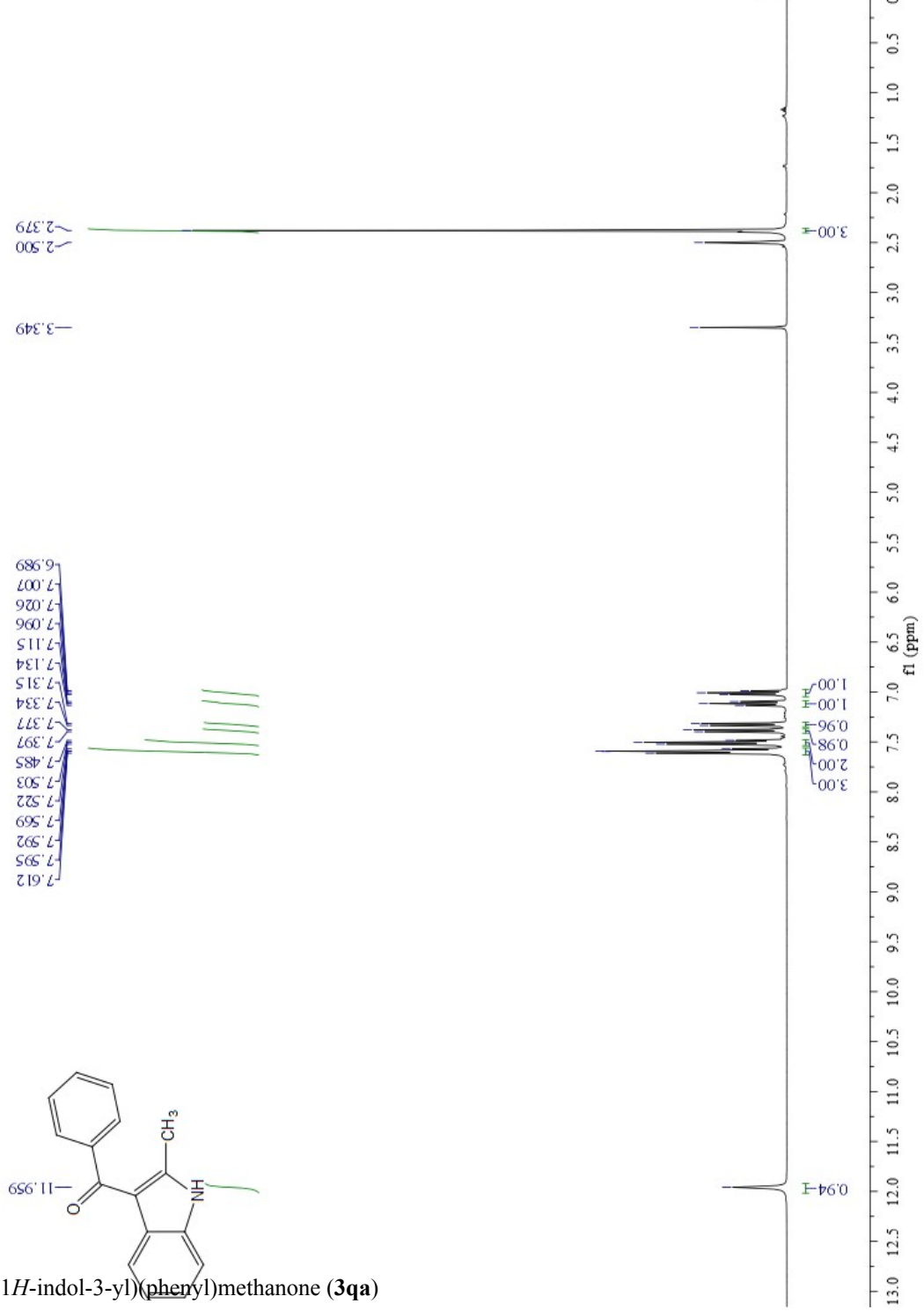
^{1}H NMR of (5,6-dichloro-1*H*-indol-3-yl)(phenyl)methanone (**3pa**)



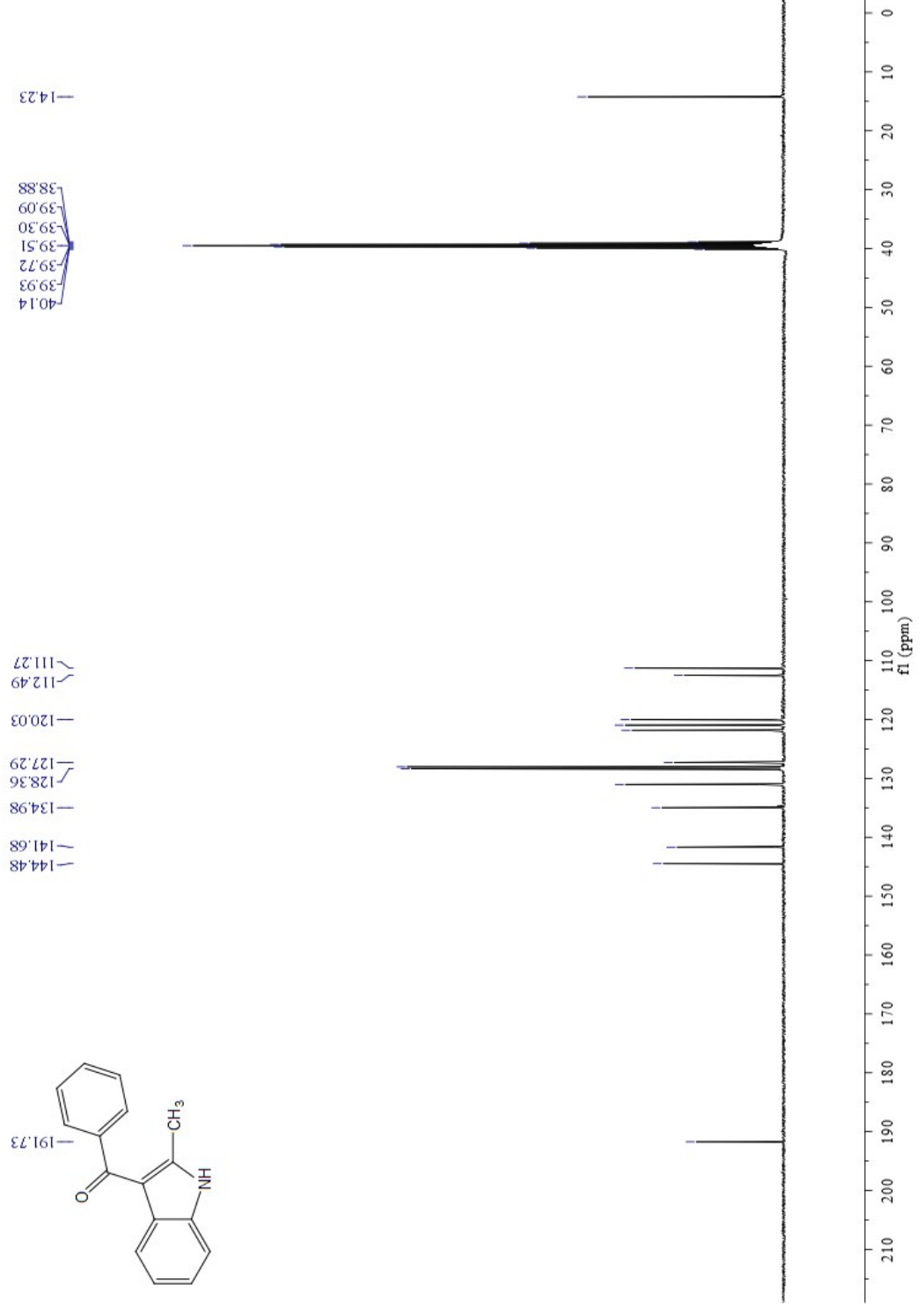
^{13}C NMR of (5,6-dichloro-1*H*-indol-3-yl)(phenyl)methanone (**3pa**)



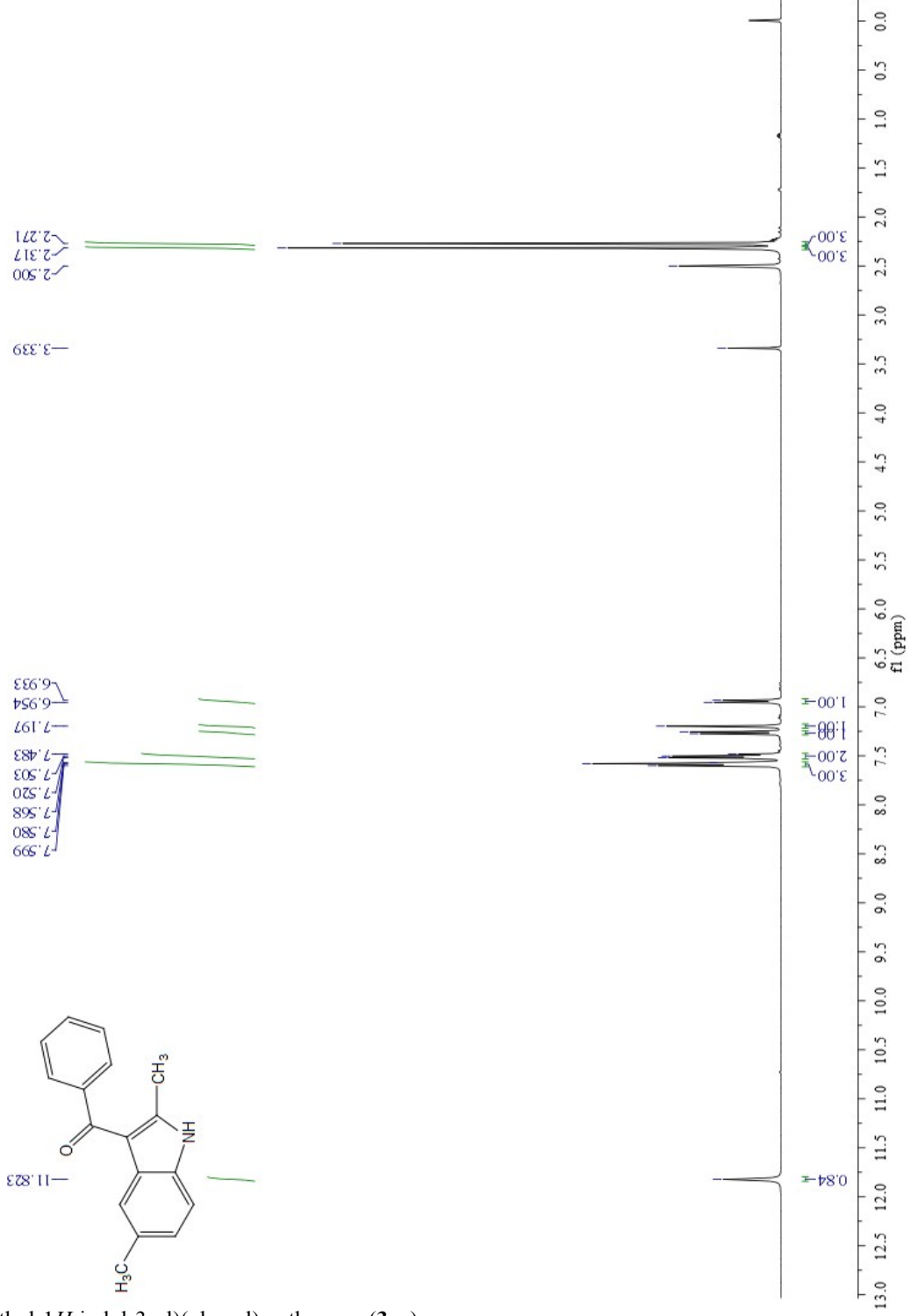
[1]H NMR of (2-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3qa**)



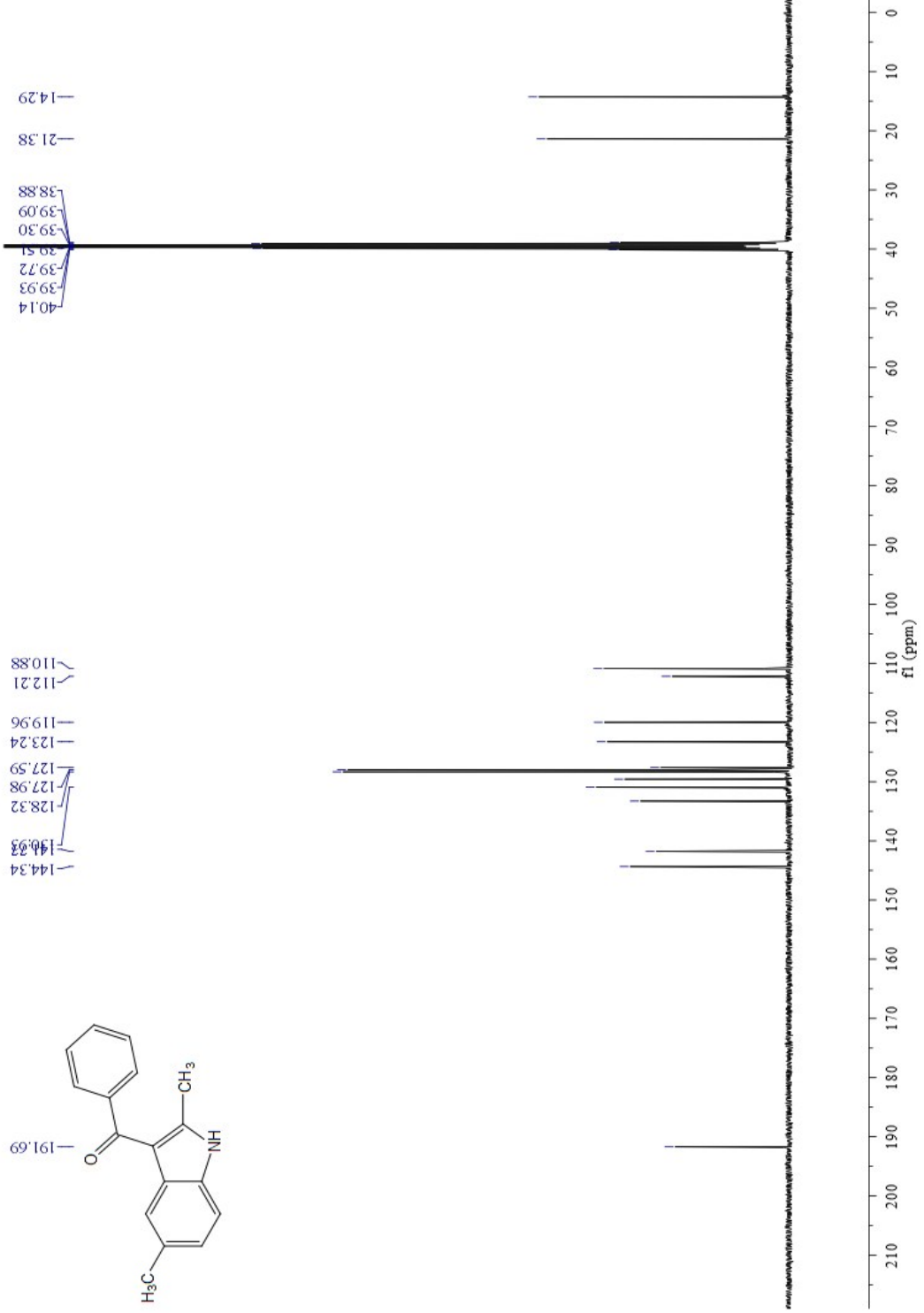
^{13}C NMR of (2-methyl-1*H*-indol-3-yl)(phenyl)methanone (**3qa**)



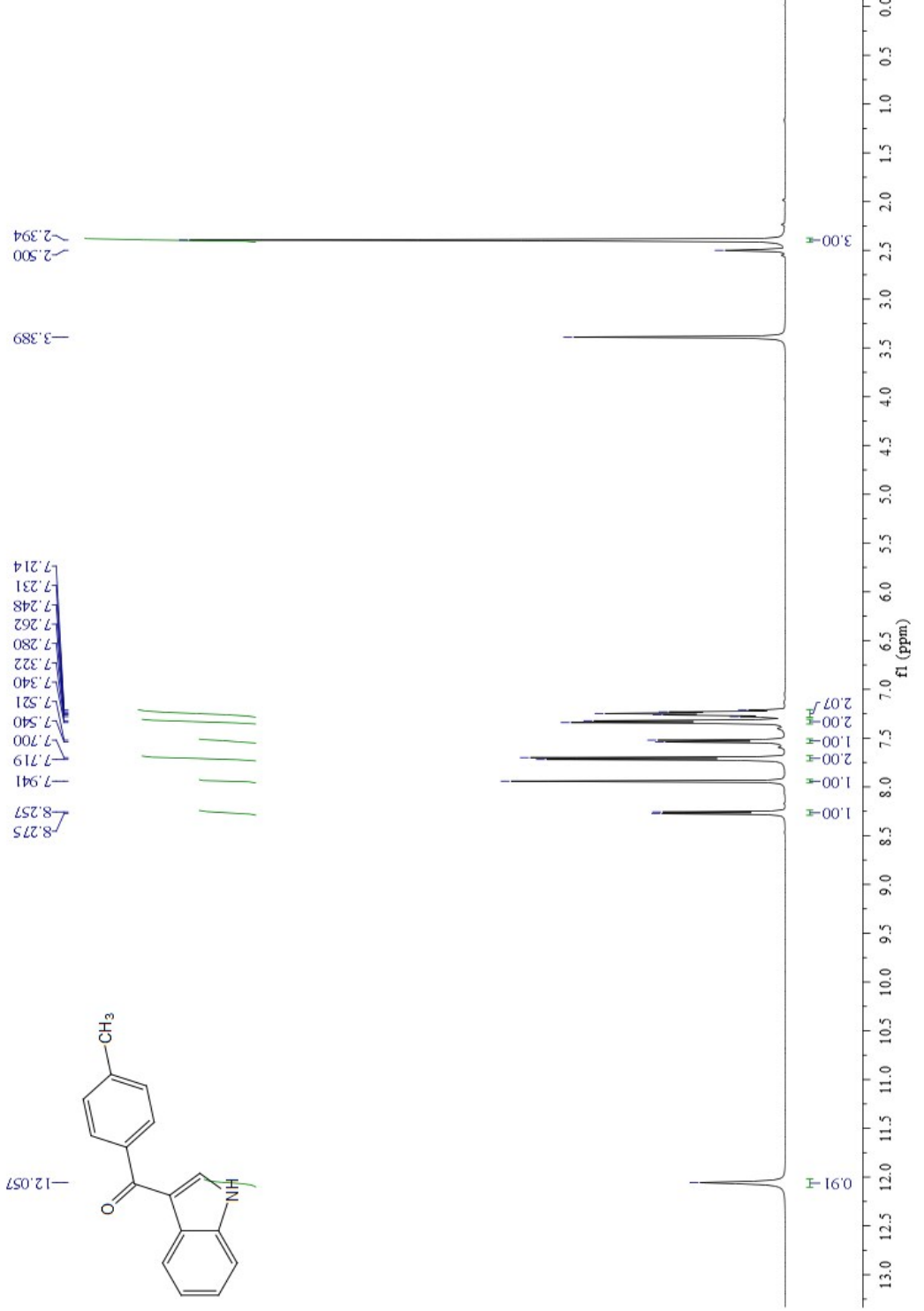
^{1}H NMR of (2,5-dimethyl-1*H*-indol-3-yl)(phenyl)methanone (**3ra**)



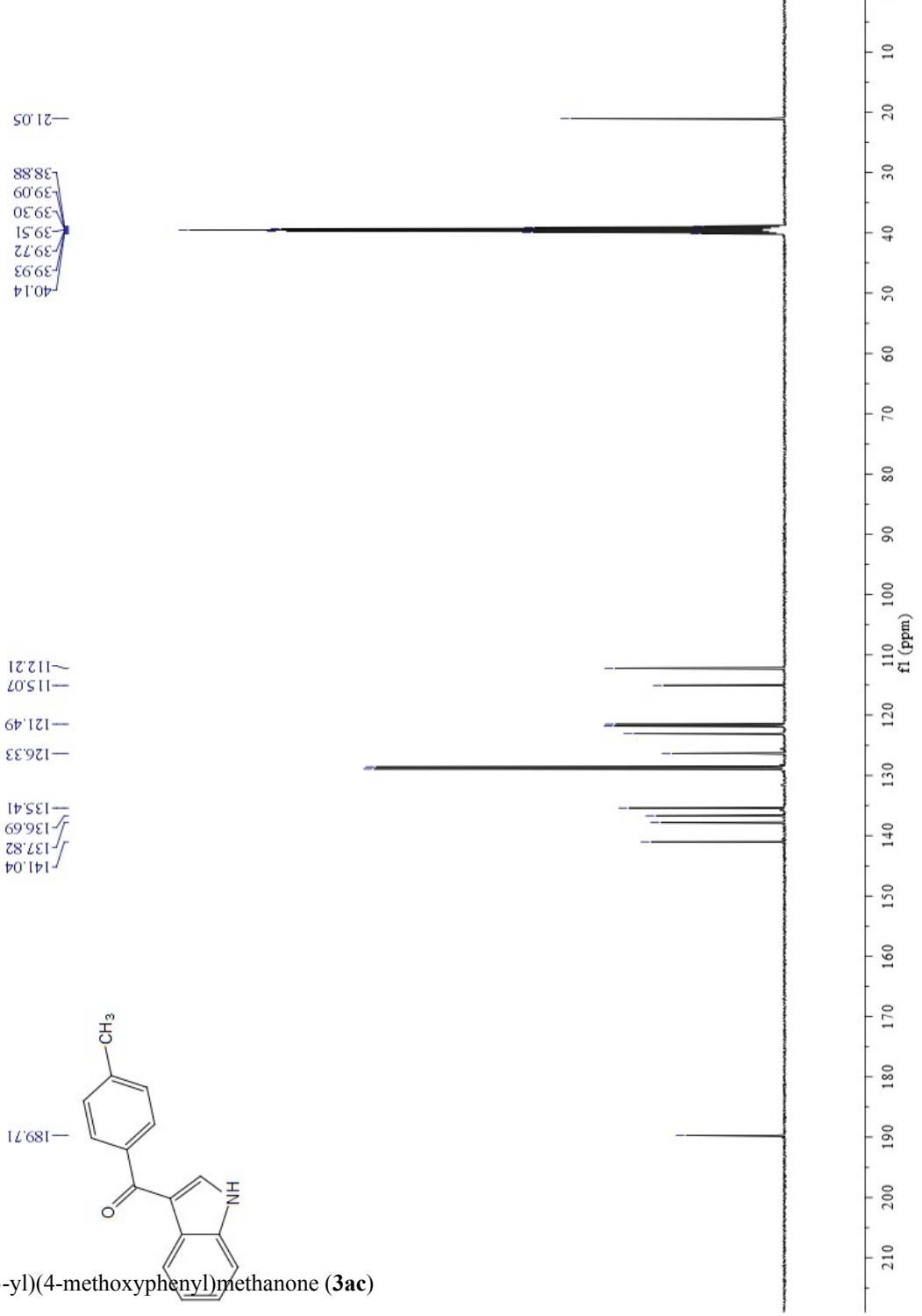
^{13}C NMR of (2,5-dimethyl-1*H*-indol-3-yl)(phenyl)methanone (**3ra**)



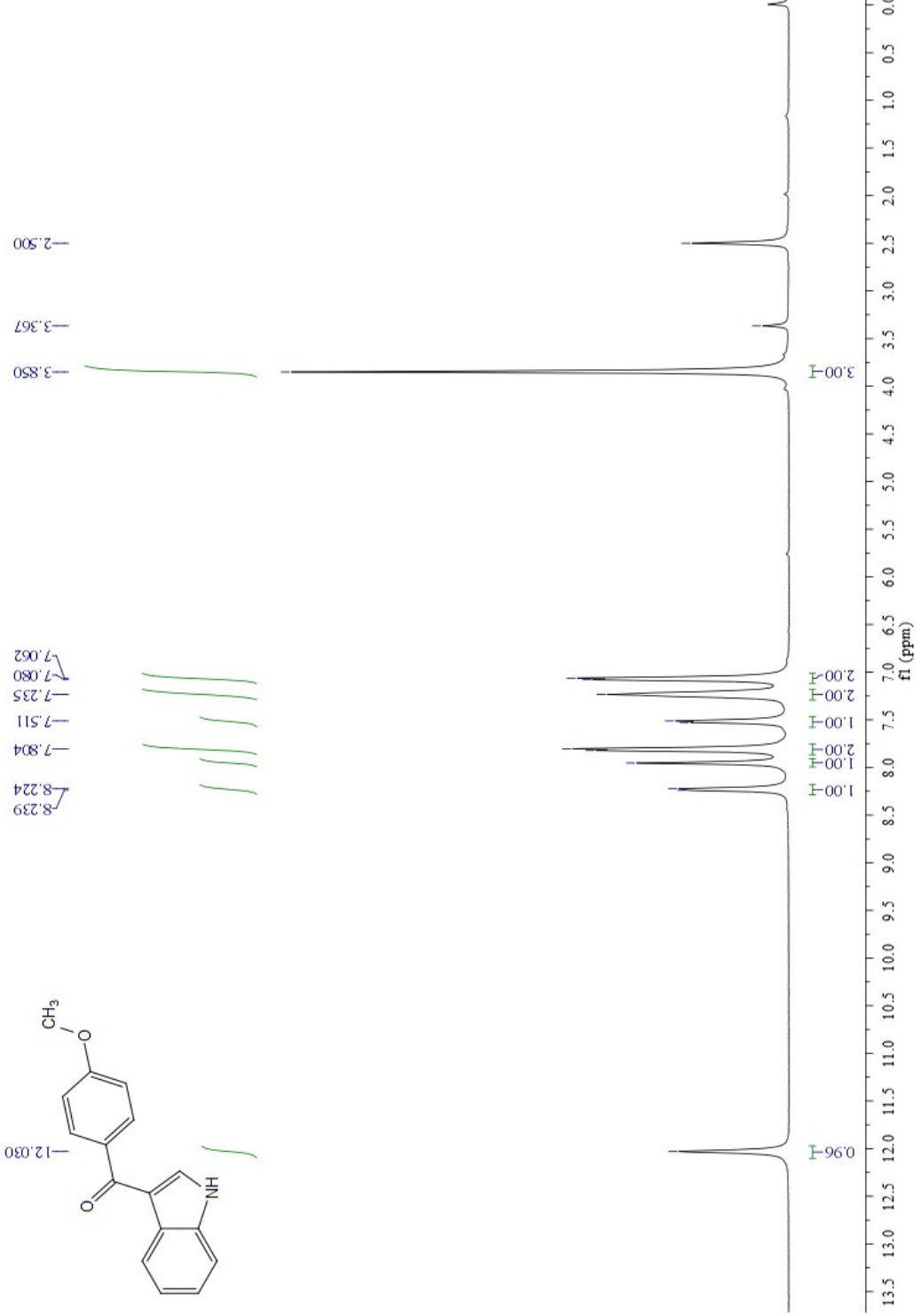
^{1}H NMR of (1*H*-indol-3-yl)(*p*-tolyl)methanone (**3ab**)



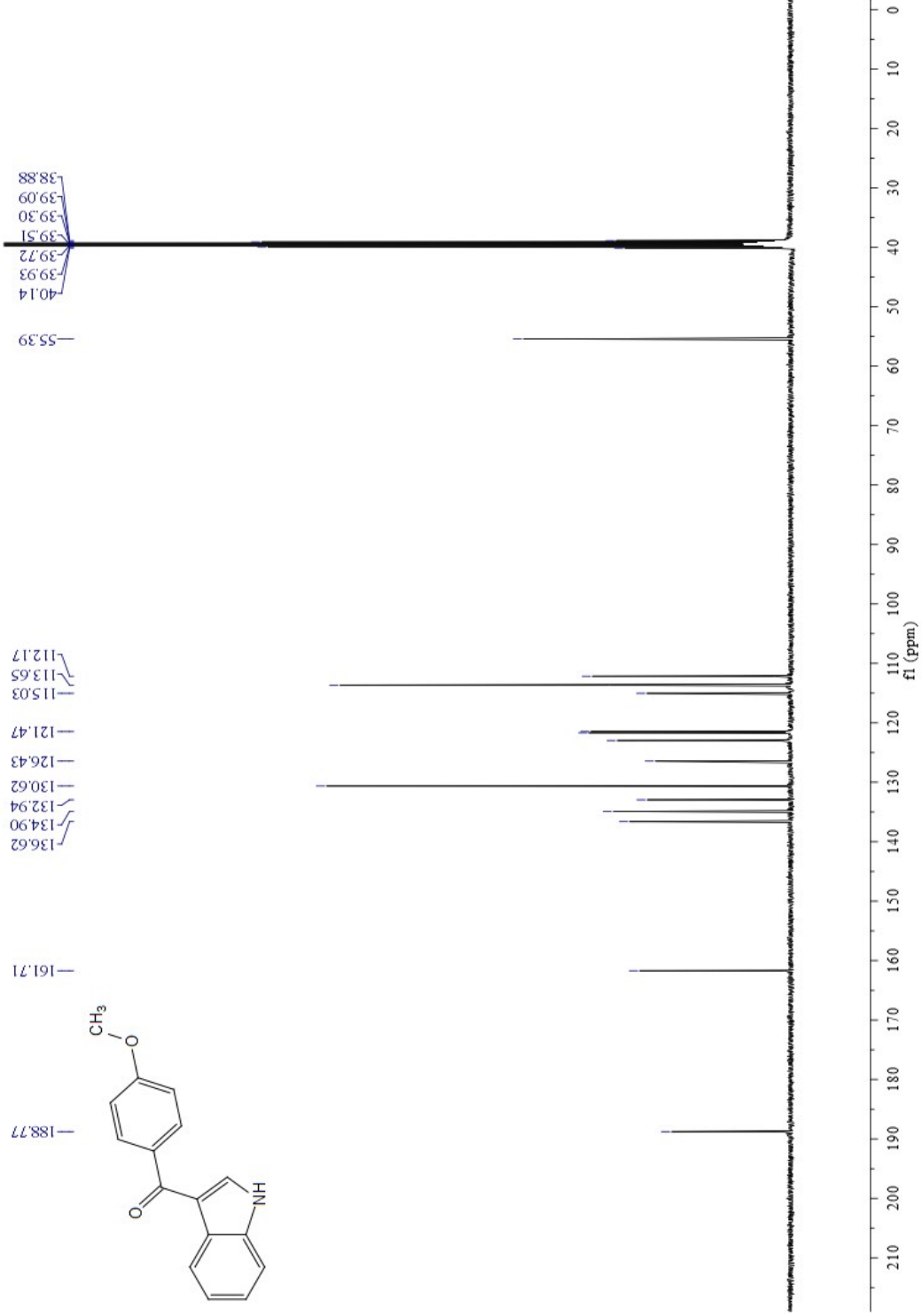
^{13}C NMR of (1*H*-indol-3-yl)(*p*-tolyl)methanone (**3ab**)



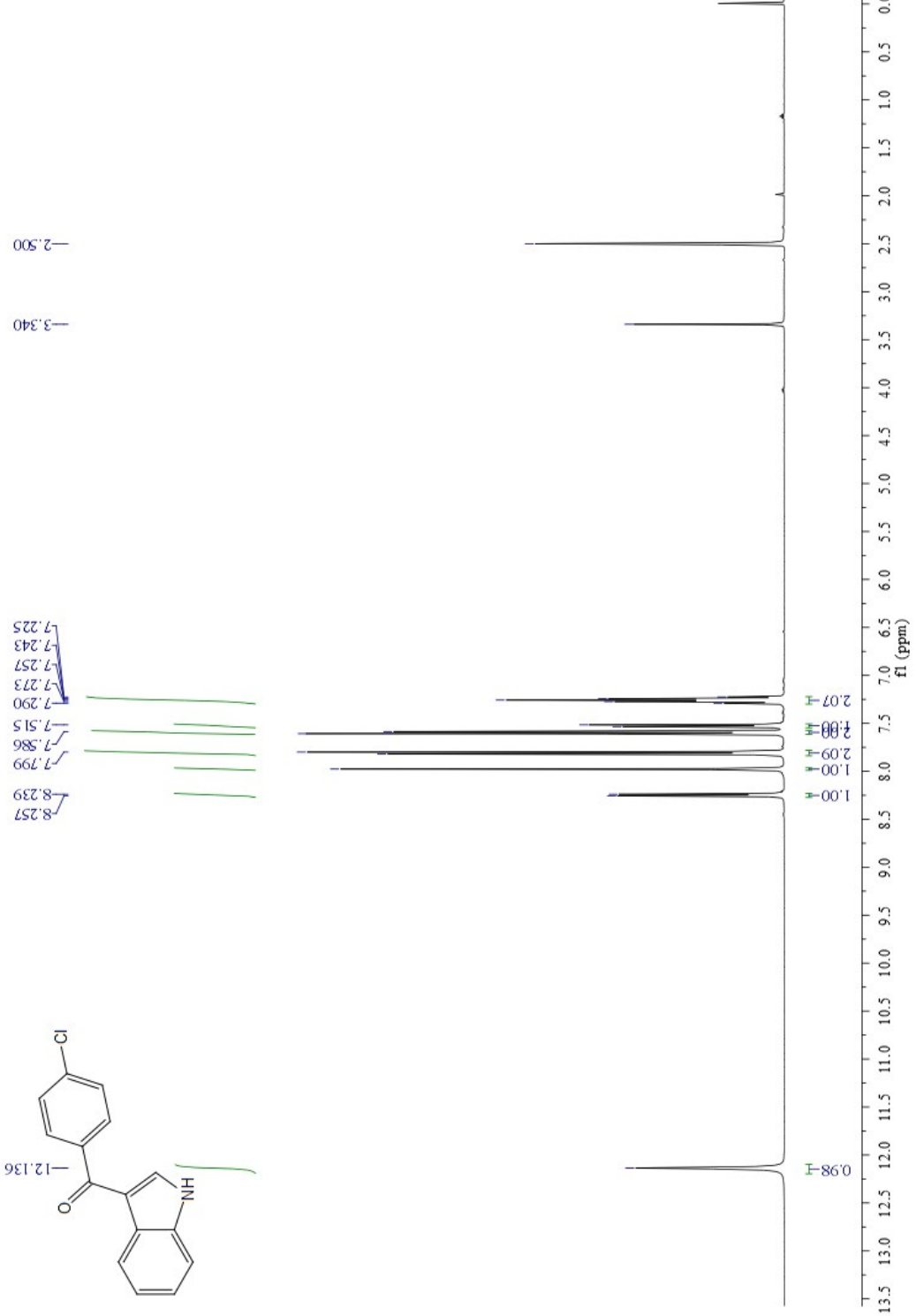
^{1}H NMR of (1*H*-indol-3-yl)(4-methoxyphenyl)methanone (**3ac**)



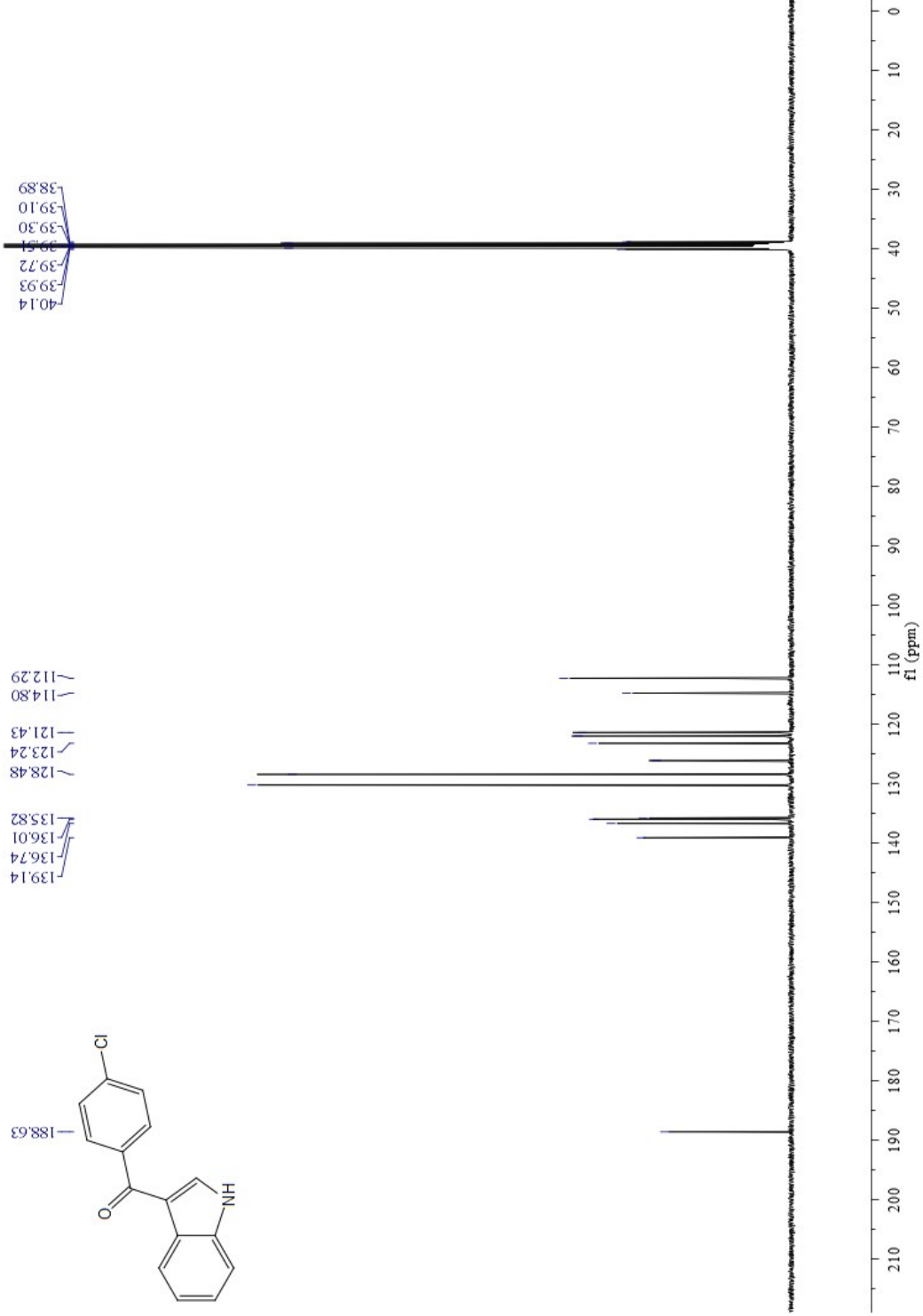
^{13}C NMR of (1*H*-indol-3-yl)(4-methoxyphenyl)methanone (**3ac**)



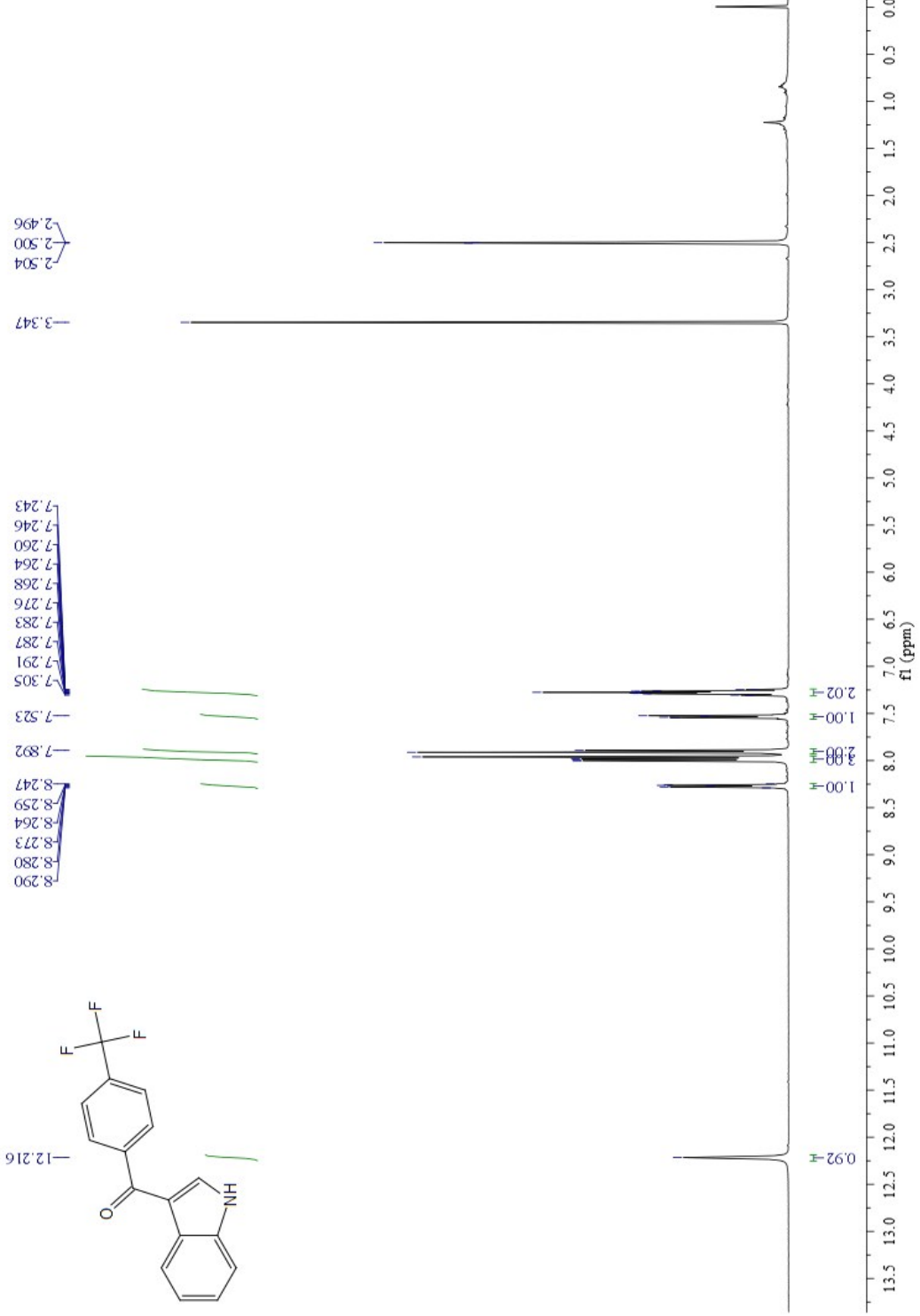
^{1}H NMR of (4-chlorophenyl)(1*H*-indol-3-yl)methanone (**3ad**)



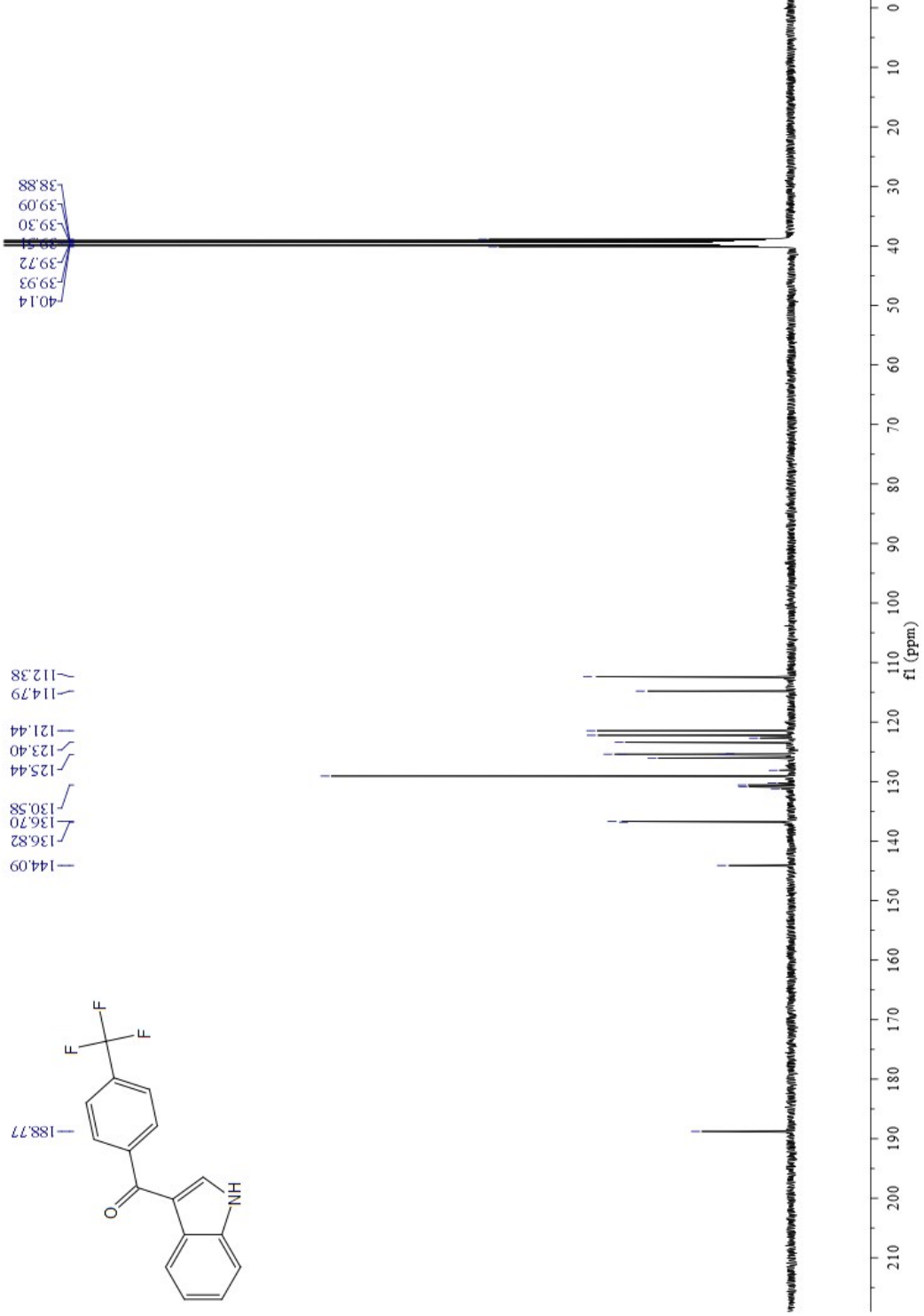
^{13}C NMR of (4-chlorophenyl)(1*H*-indol-3-yl)methanone (**3ad**)



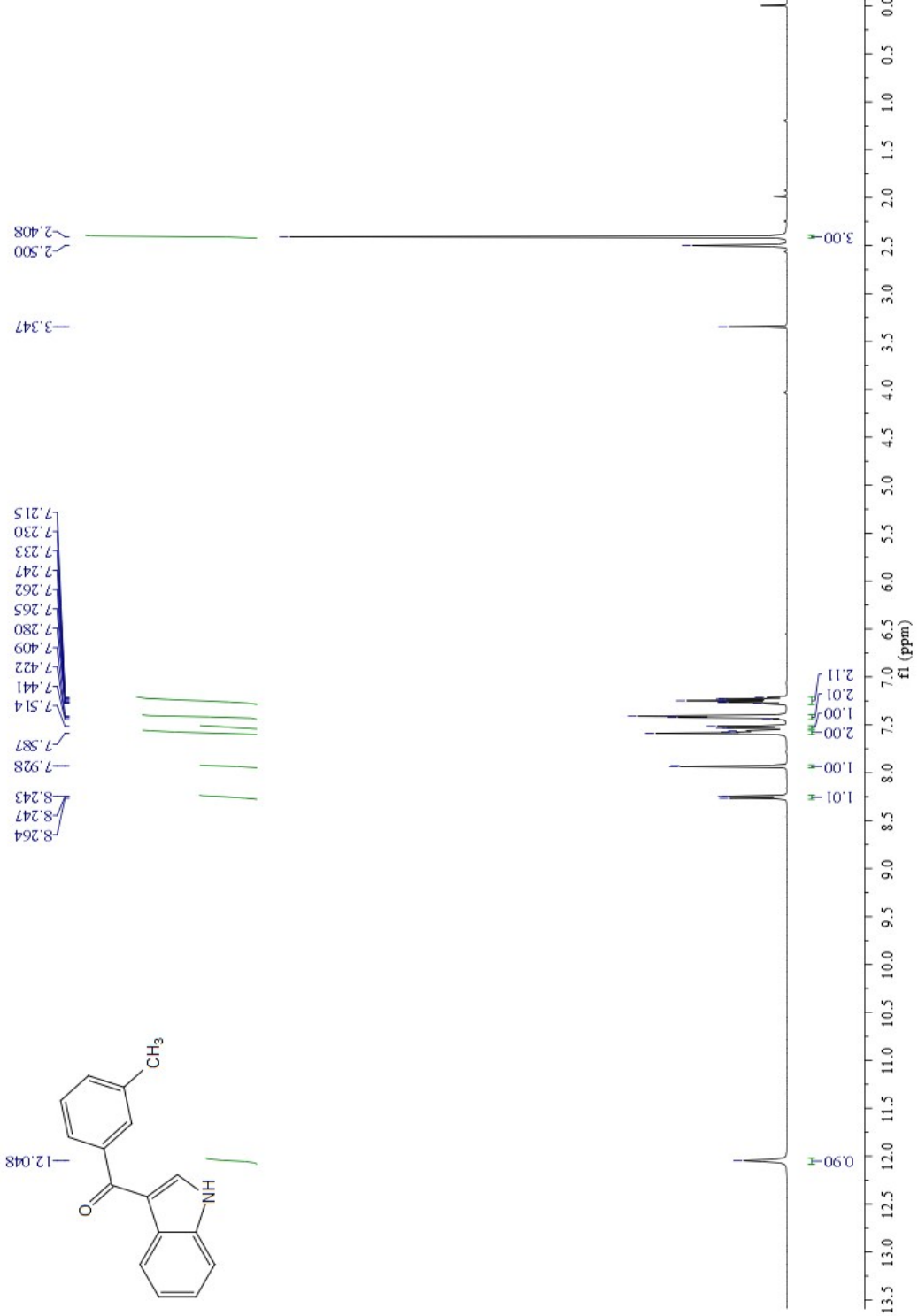
^{1}H NMR of (1*H*-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3ae**)



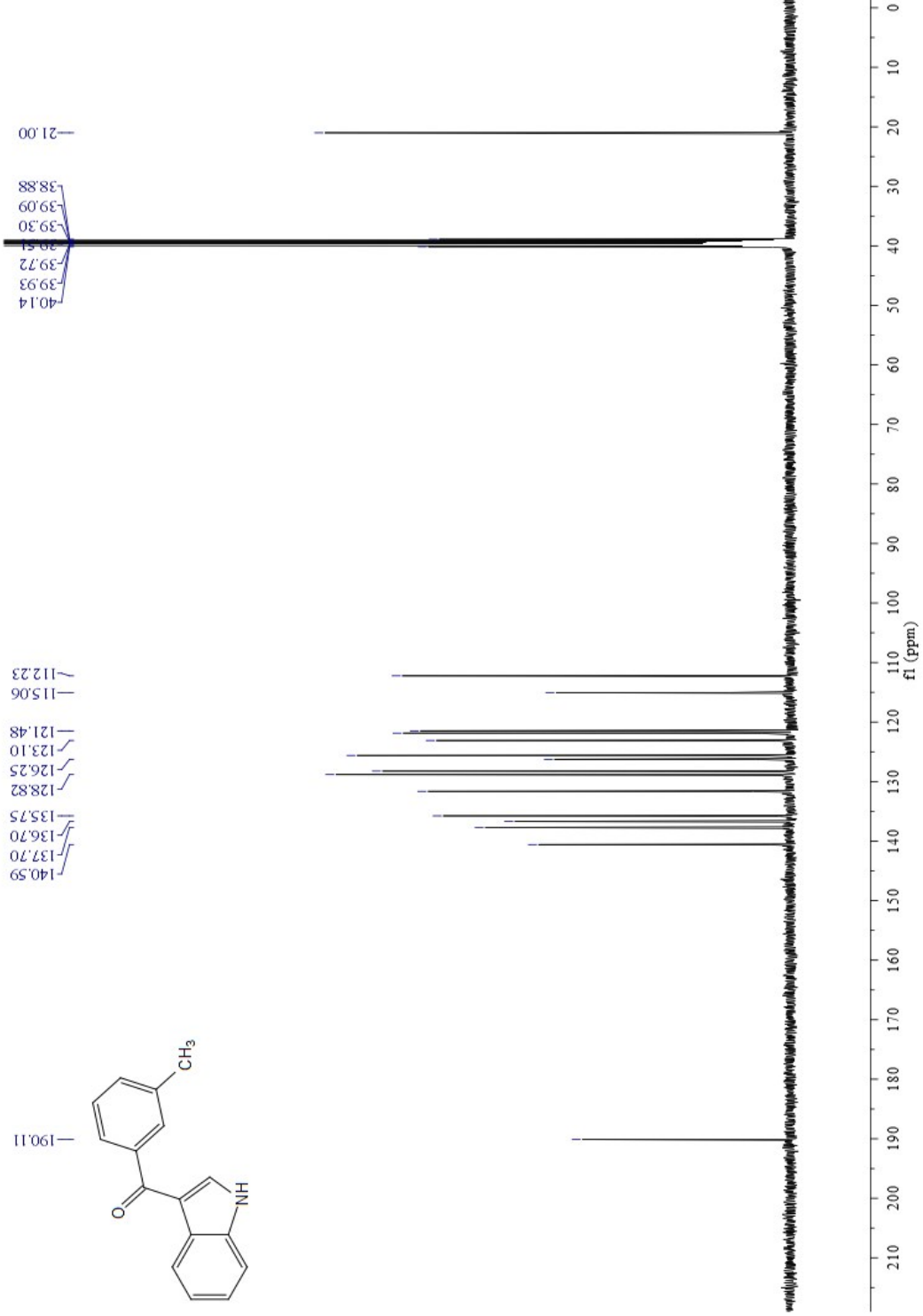
^{13}C NMR of (1*H*-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3ae**)



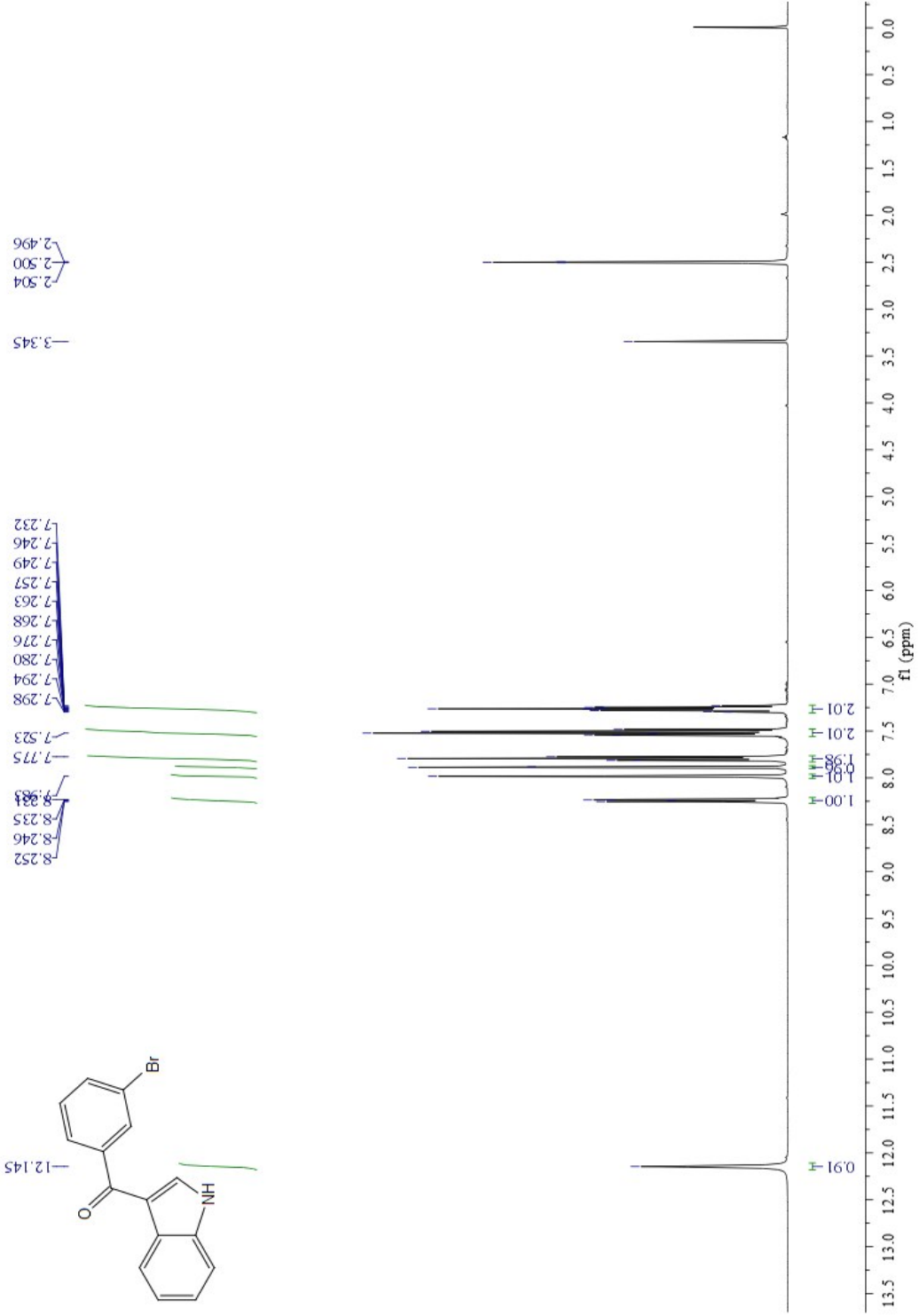
^{1}H NMR of (1*H*-indol-3-yl)(*m*-tolyl)methanone (**3af**)



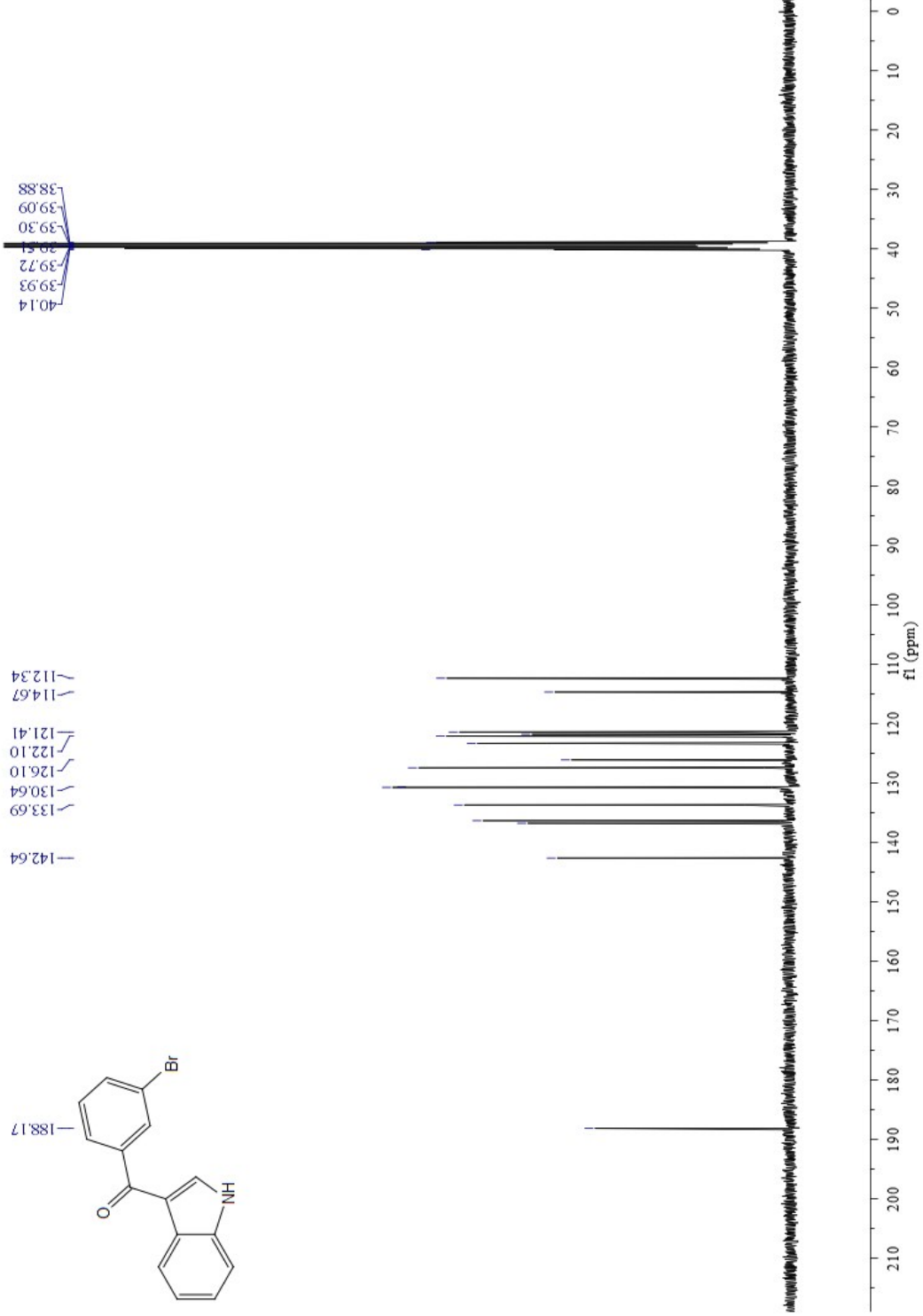
^{13}C NMR of (1*H*-indol-3-yl)(*m*-tolyl)methanone (**3af**)



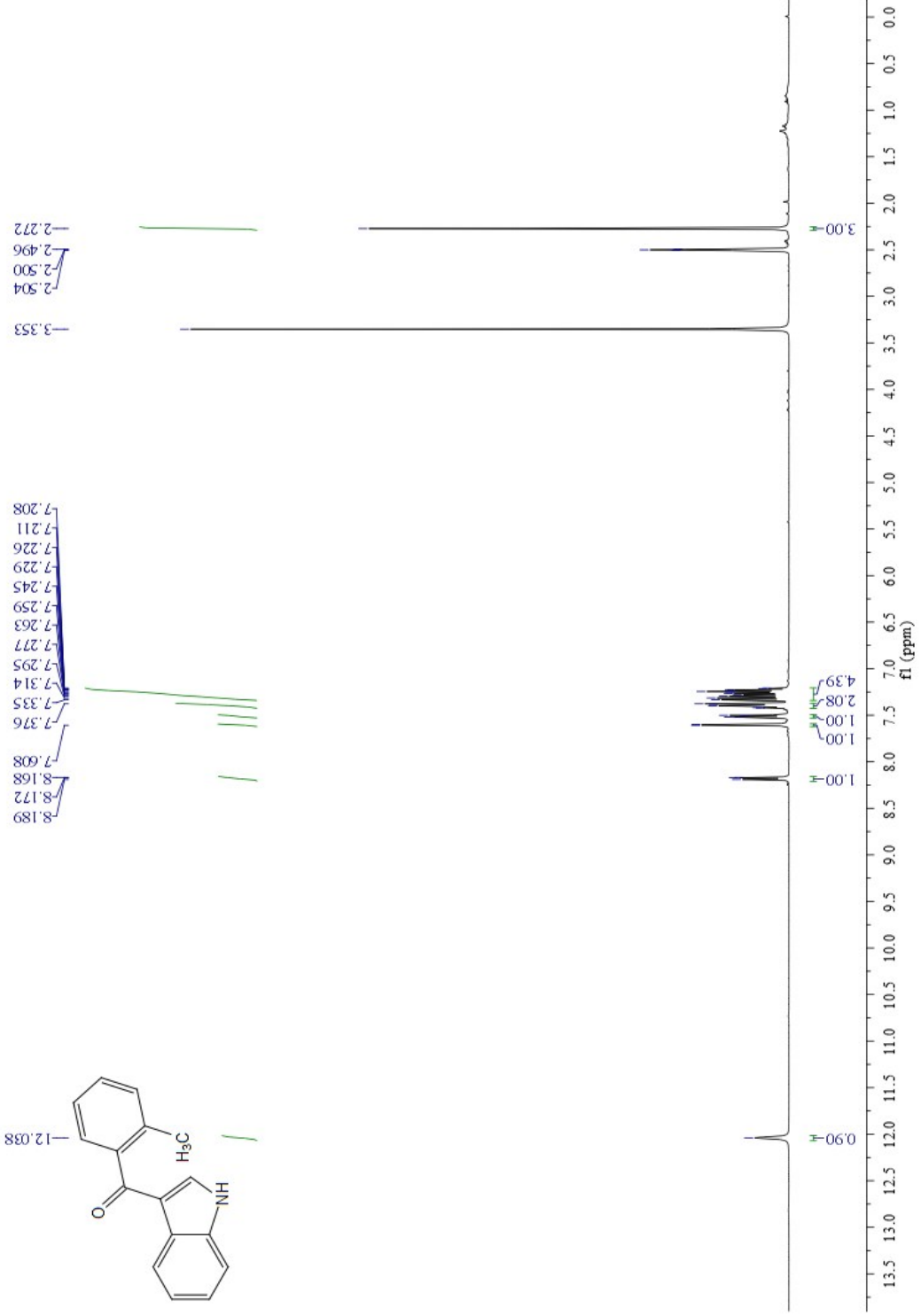
^{1}H NMR of (3-bromophenyl)(1*H*-indol-3-yl)methanone (**3ag**)



^{13}C NMR of (3-bromophenyl)(1*H*-indol-3-yl)methanone (**3ag**)

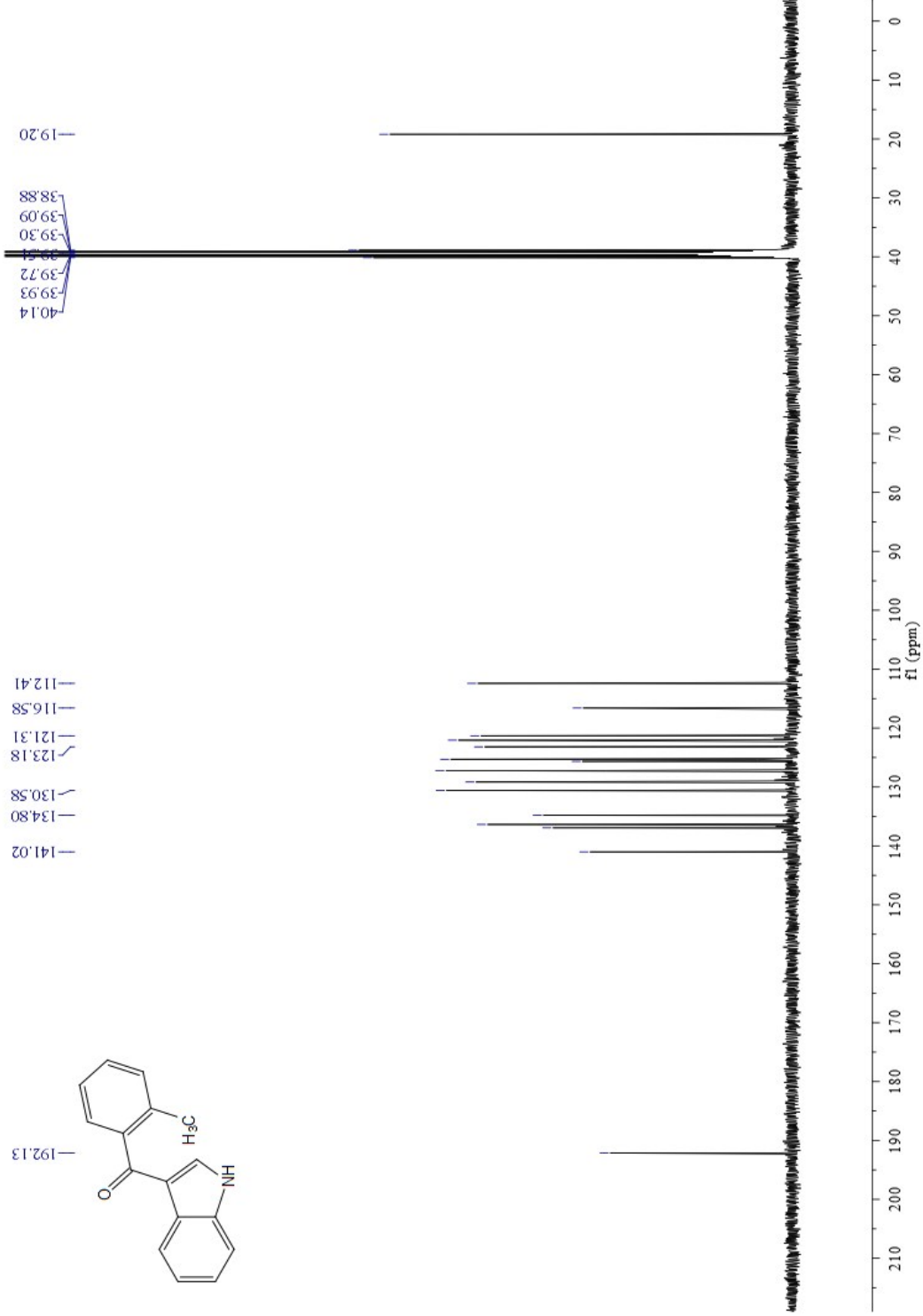


^{1}H NMR of (1*H*-indol-3-yl)(*o*-tolyl)methanone (**3ah**)

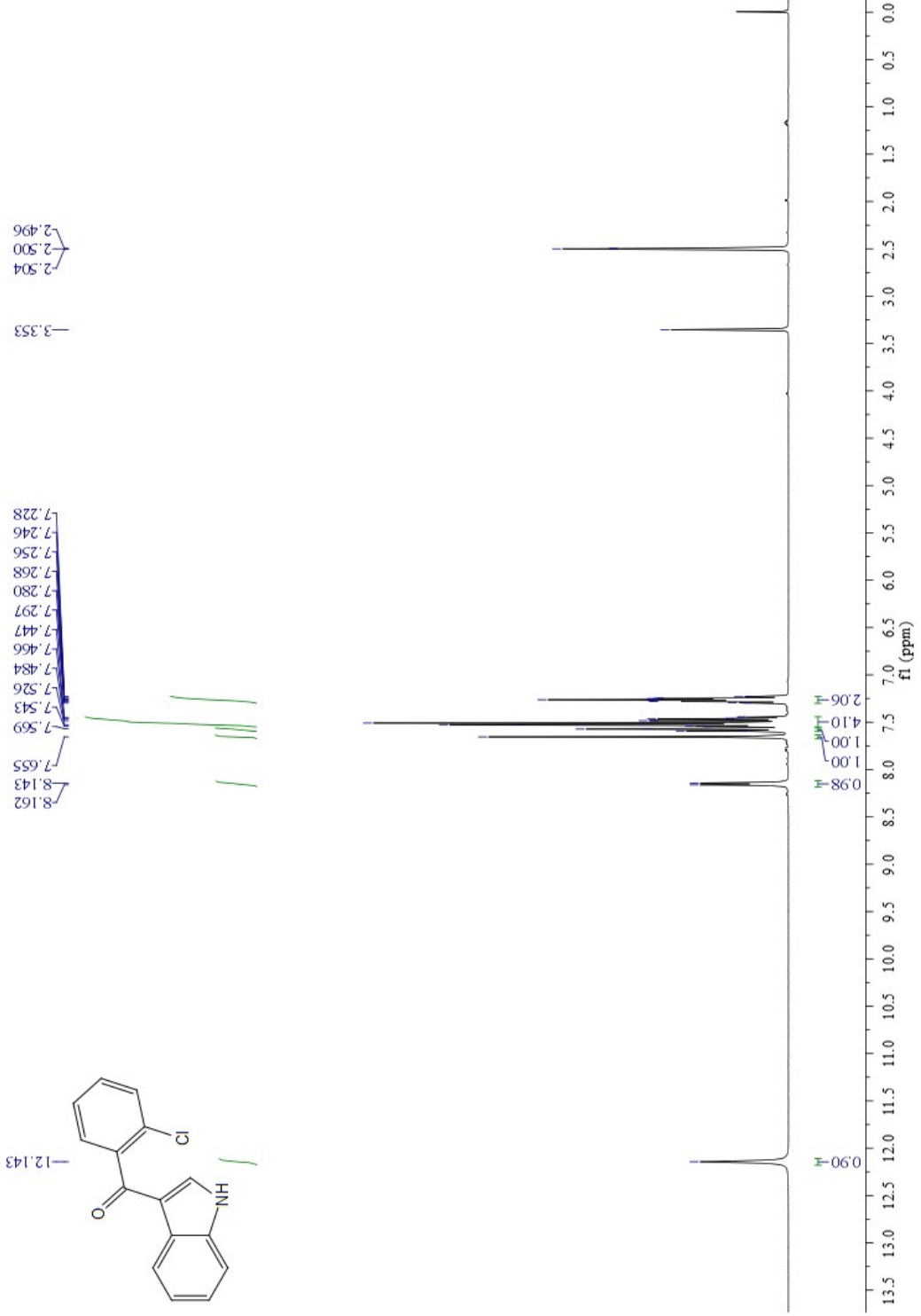


^{13}C NMR of (1*H*-indol-3-yl)(*o*-tolyl)methanone (**3ah**)

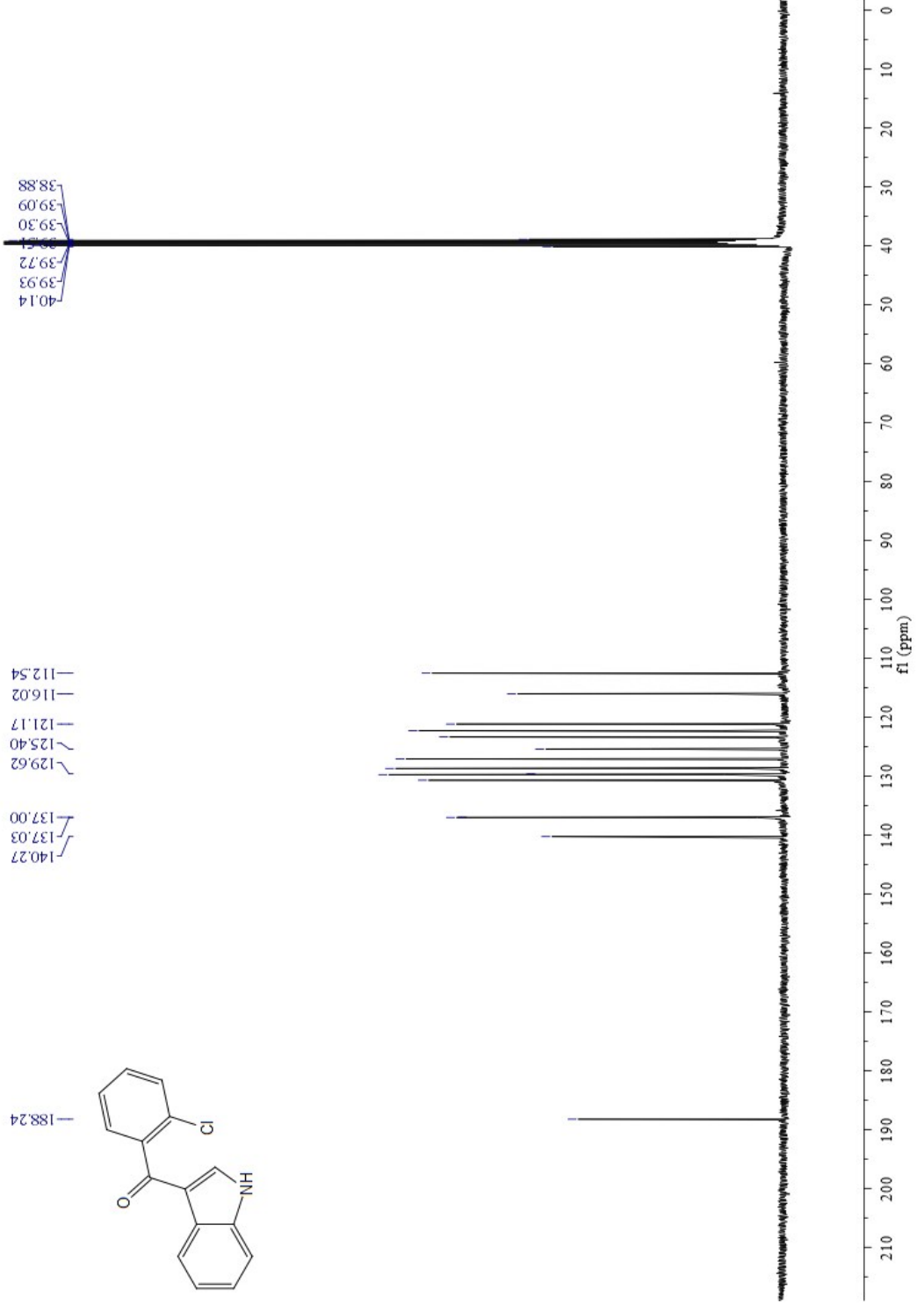
c



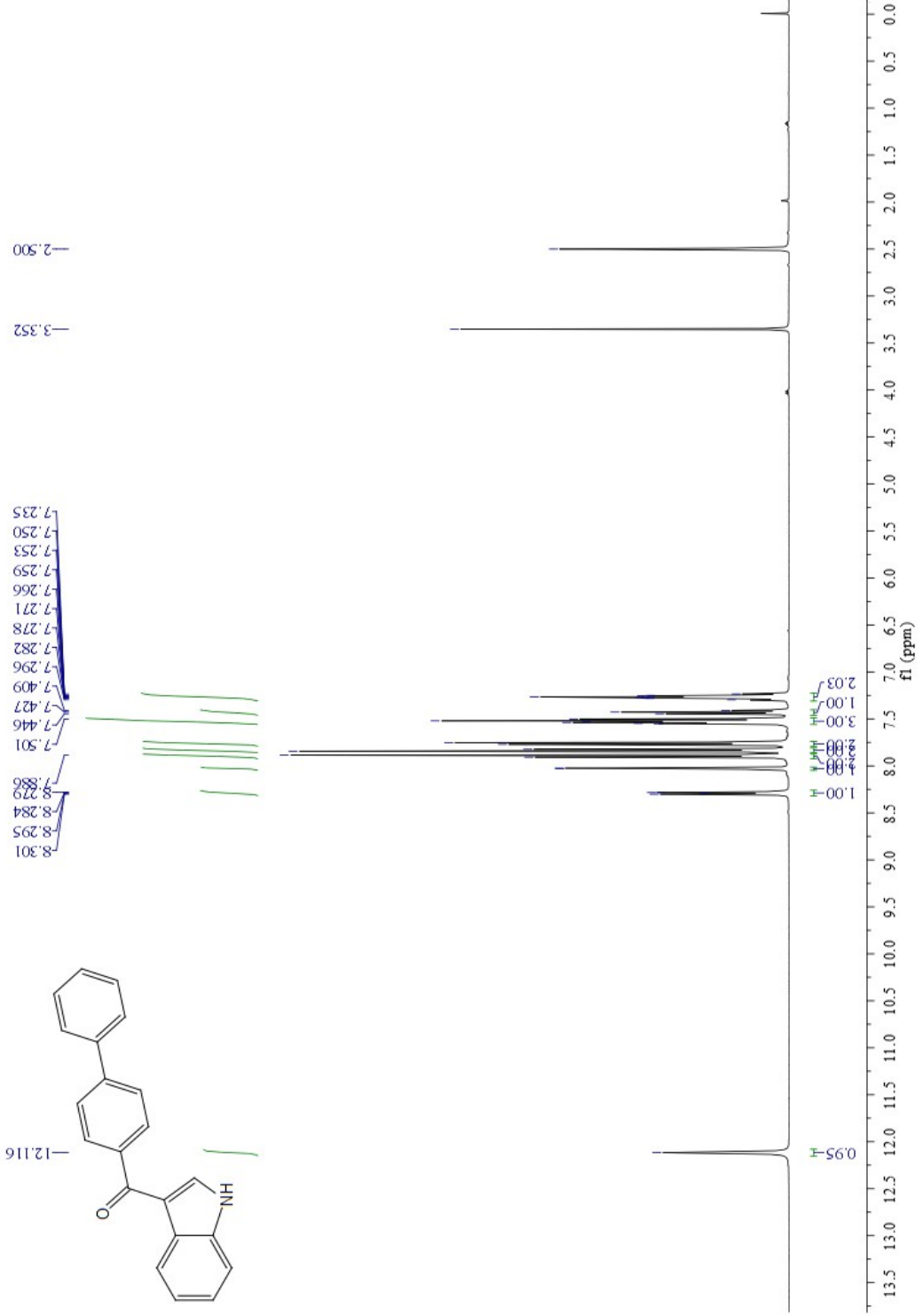
^{1}H NMR of (2-chlorophenyl)(1*H*-indol-3-yl)methanone (**3ai**)



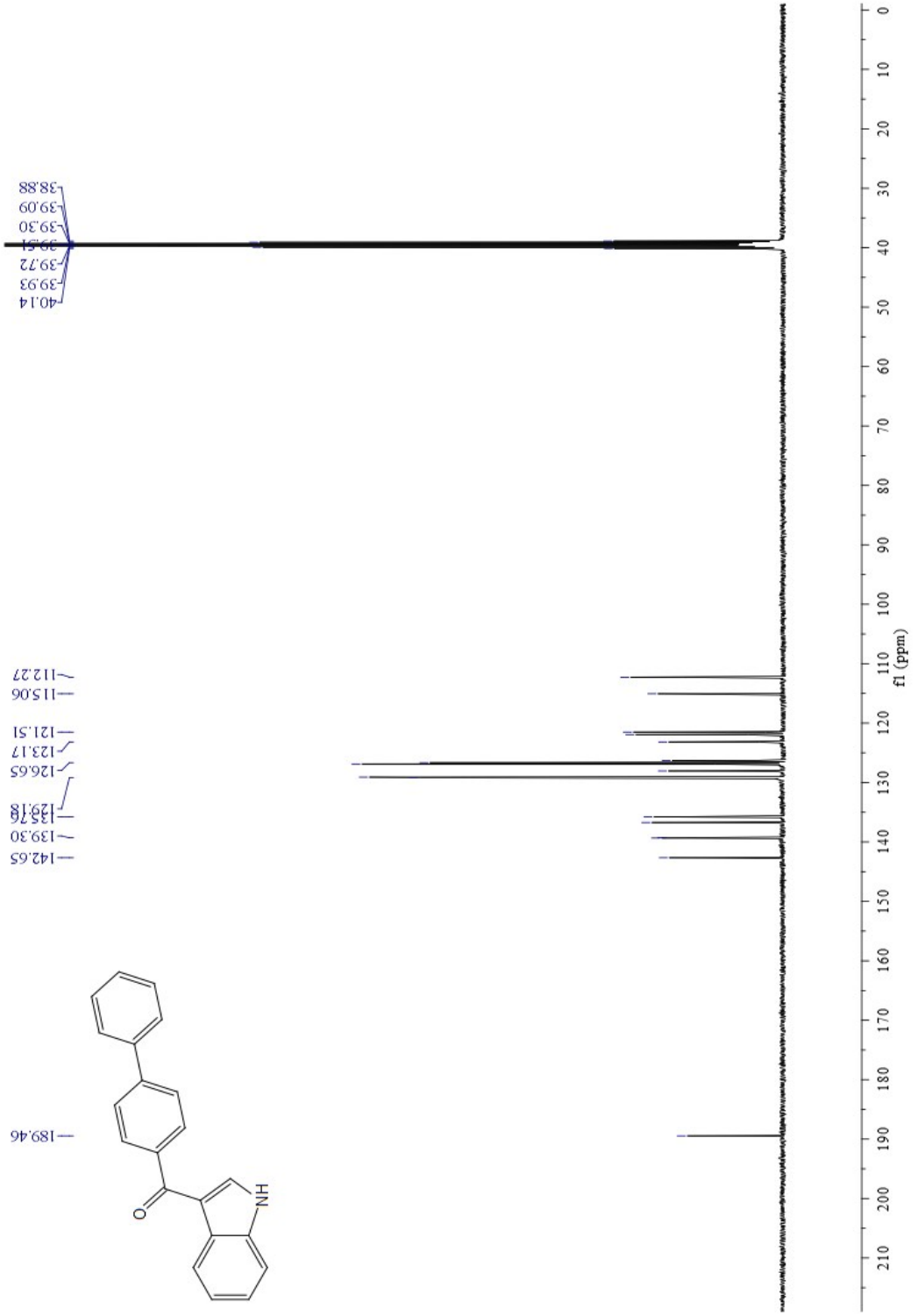
^{13}C NMR of (2-chlorophenyl)(1*H*-indol-3-yl)methanone (**3ai**)



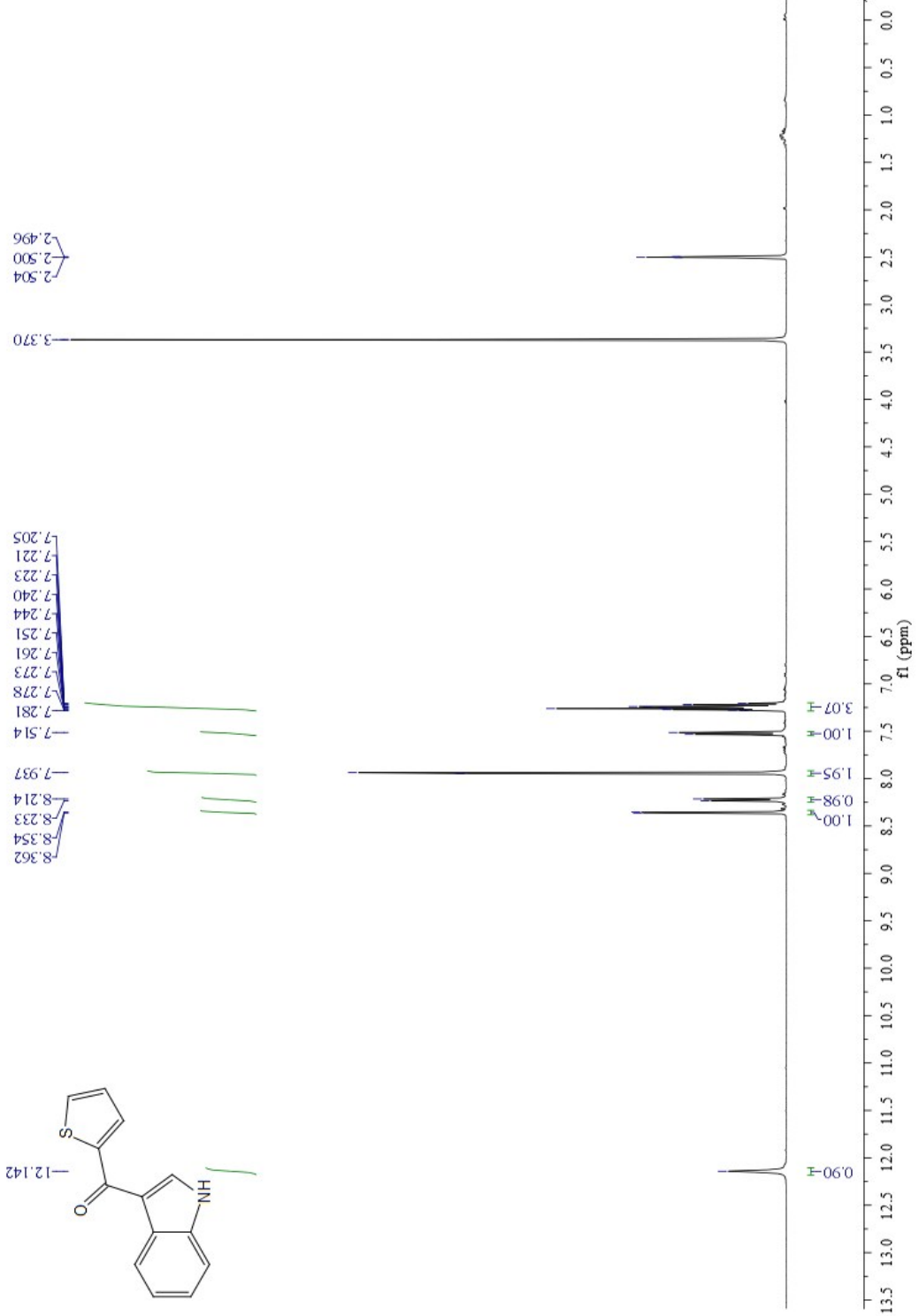
^{1}H NMR of biphenyl-4-yl(1*H*-indol-3-yl)methanone (**3aj**)



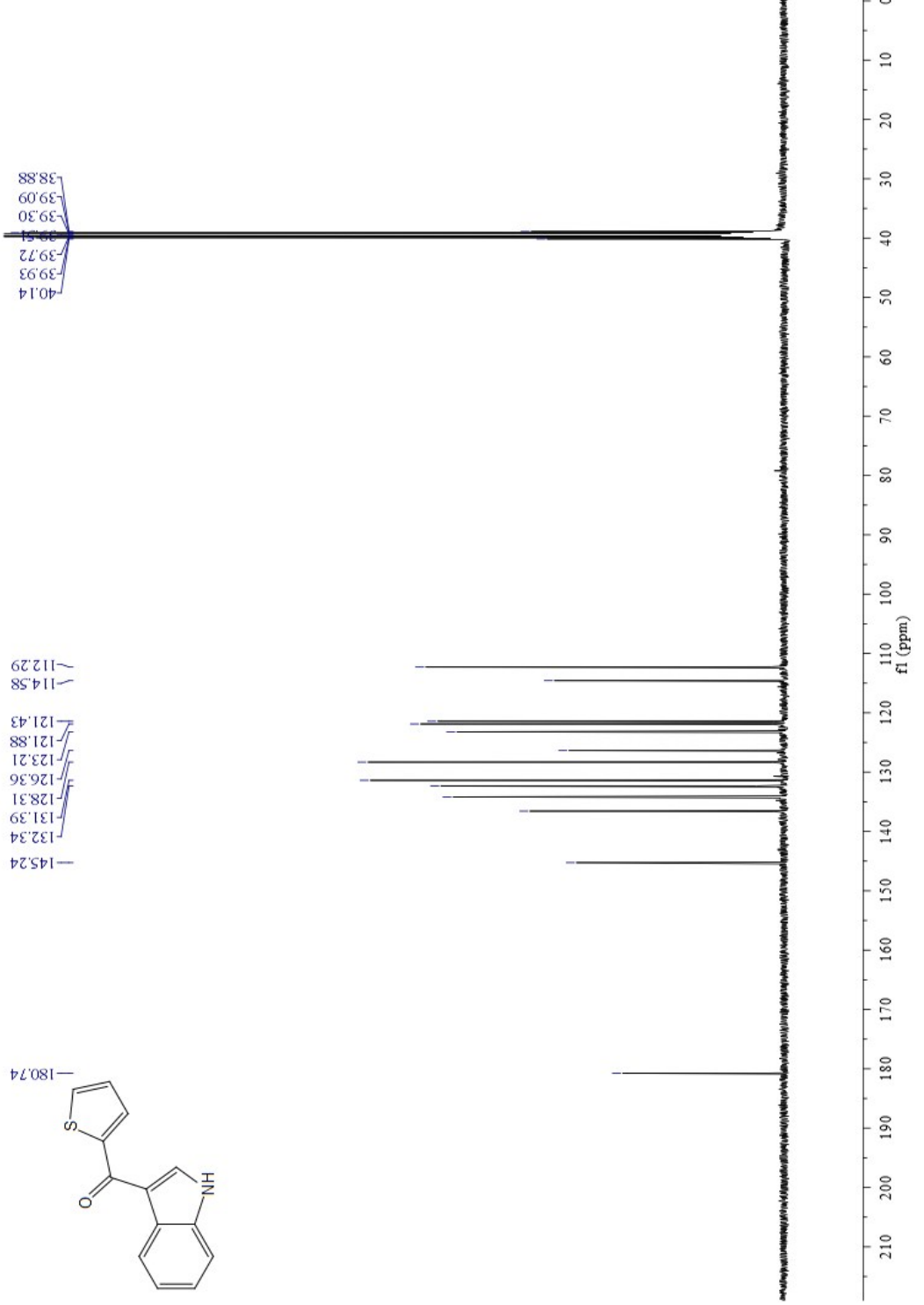
^{13}C NMR of biphenyl-4-yl(1*H*-indol-3-yl)methanone (**3aj**)



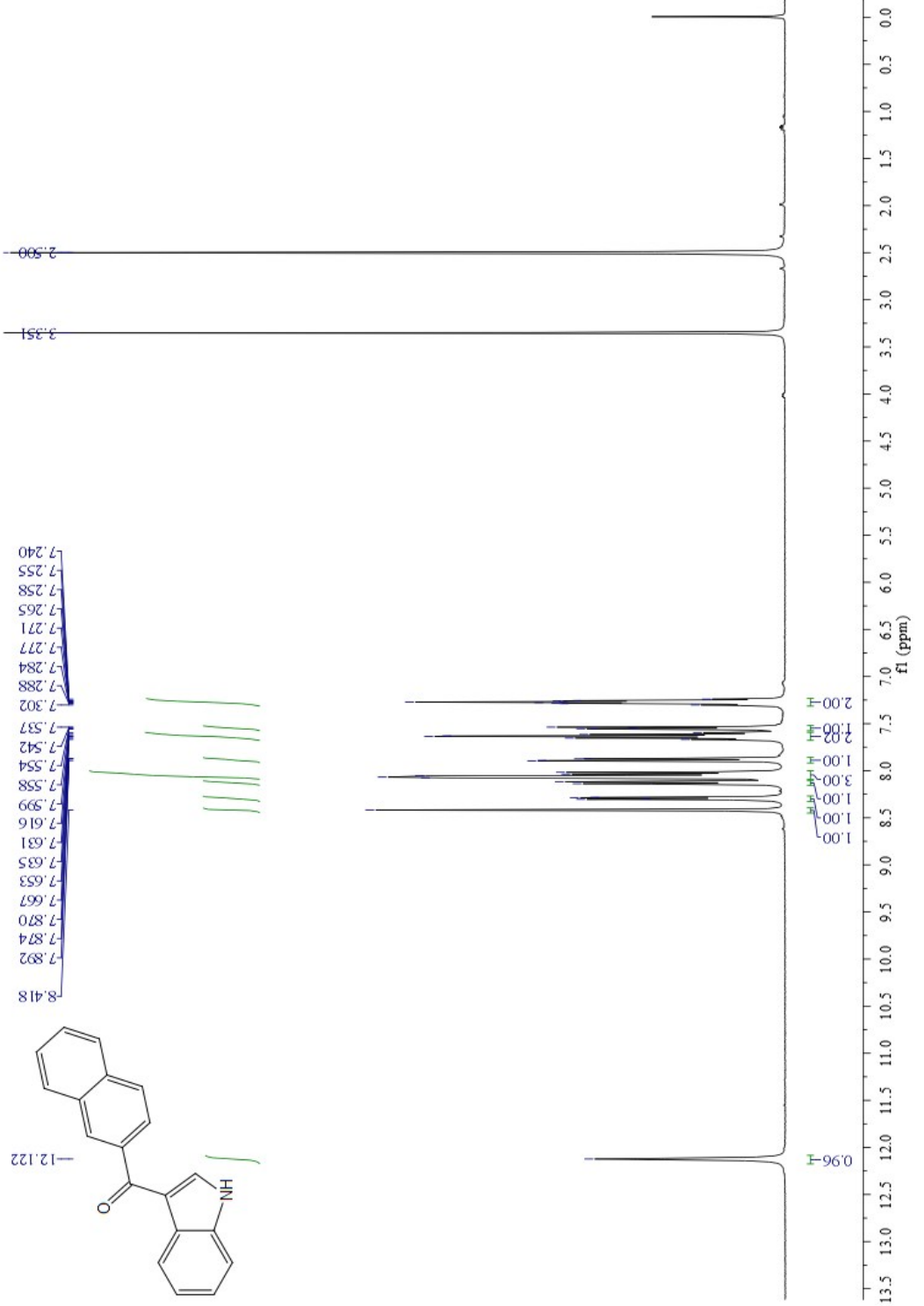
^{1}H NMR of (1*H*-indol-3-yl)(thiophen-2-yl)methanone (**3ak**)



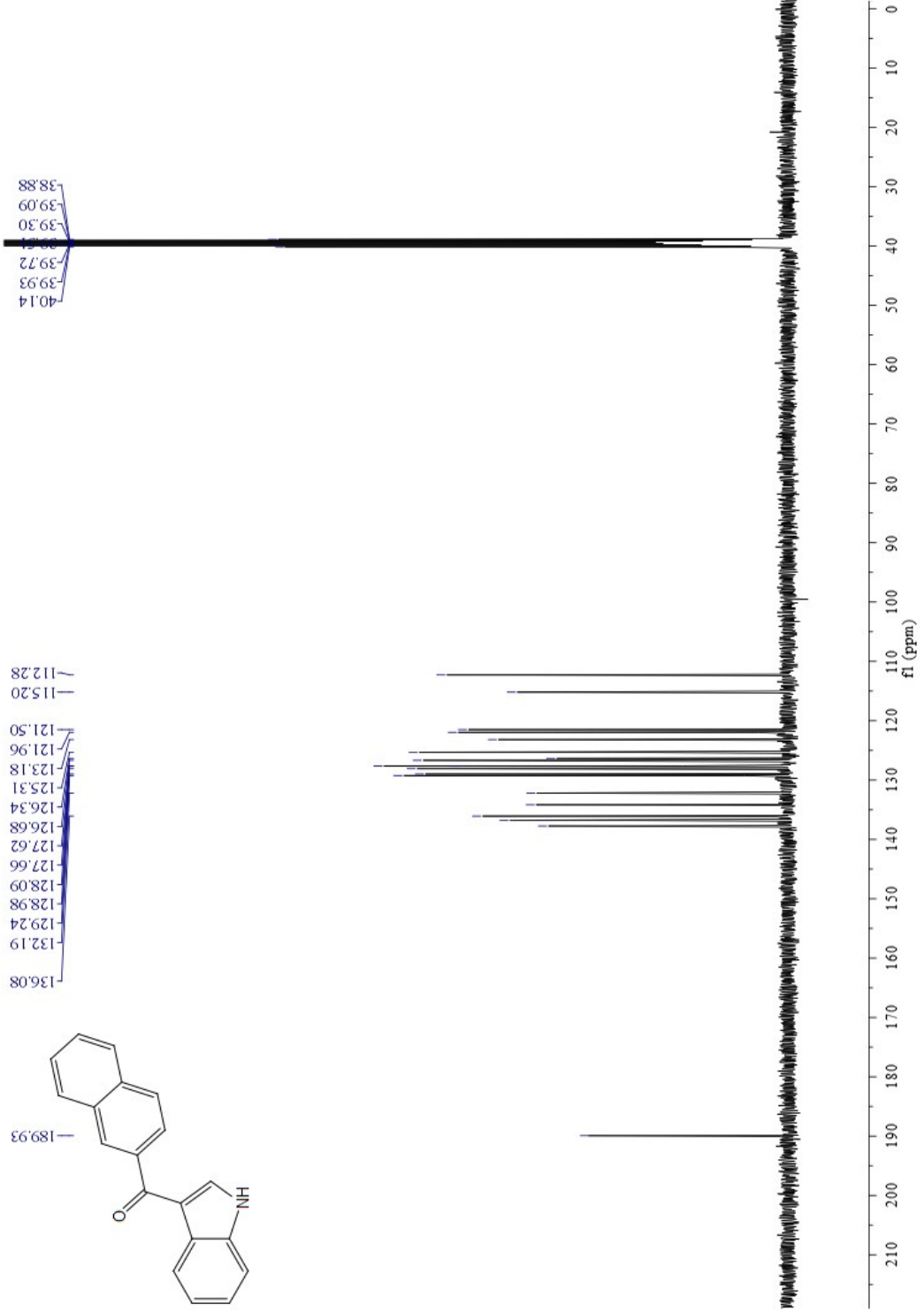
^{13}C NMR of (1*H*-indol-3-yl)(thiophen-2-yl)methanone (**3ak**)



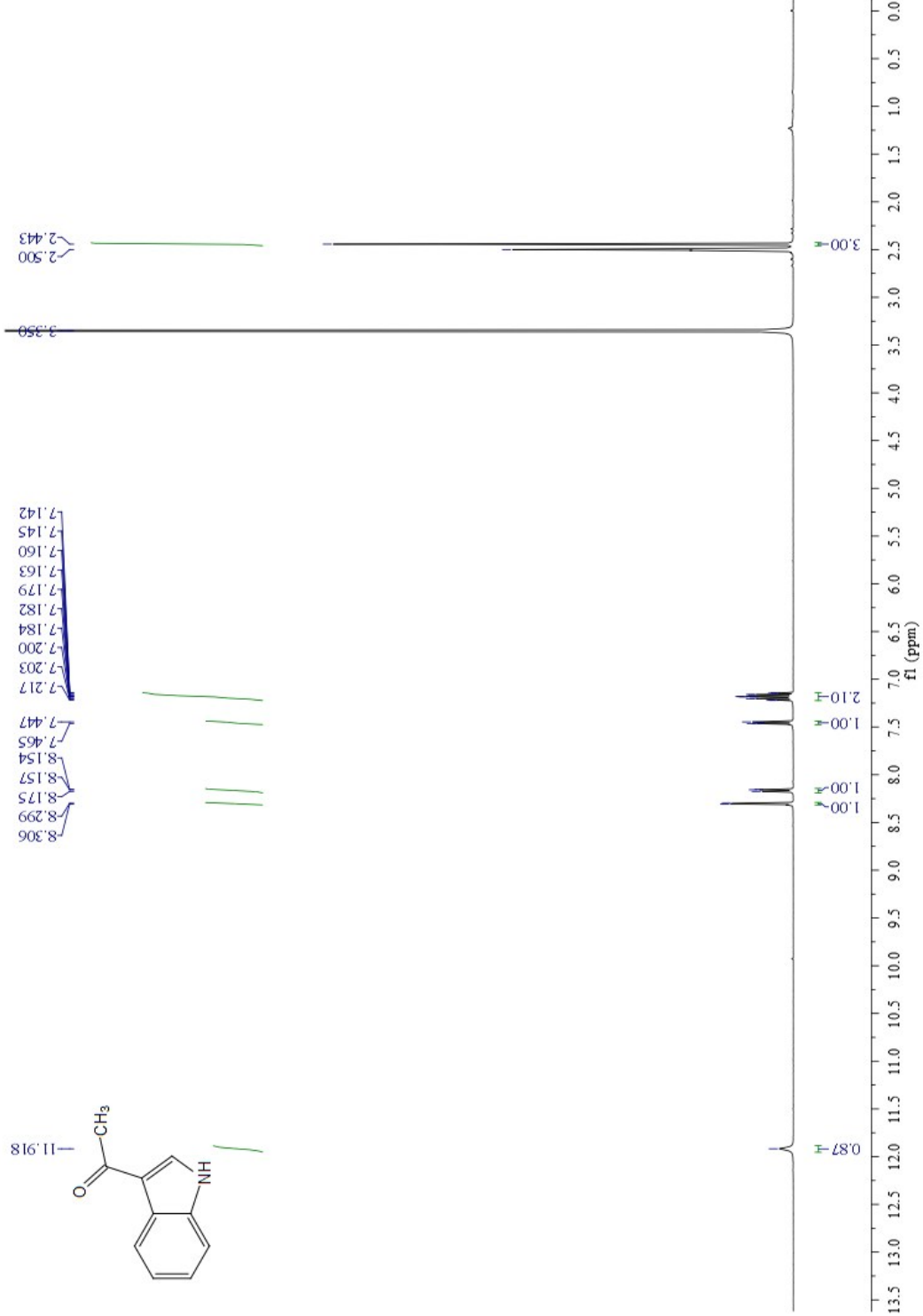
^{1}H NMR of (1*H*-indol-3-yl)(naphthalen-2-yl)methanone (**3al**)



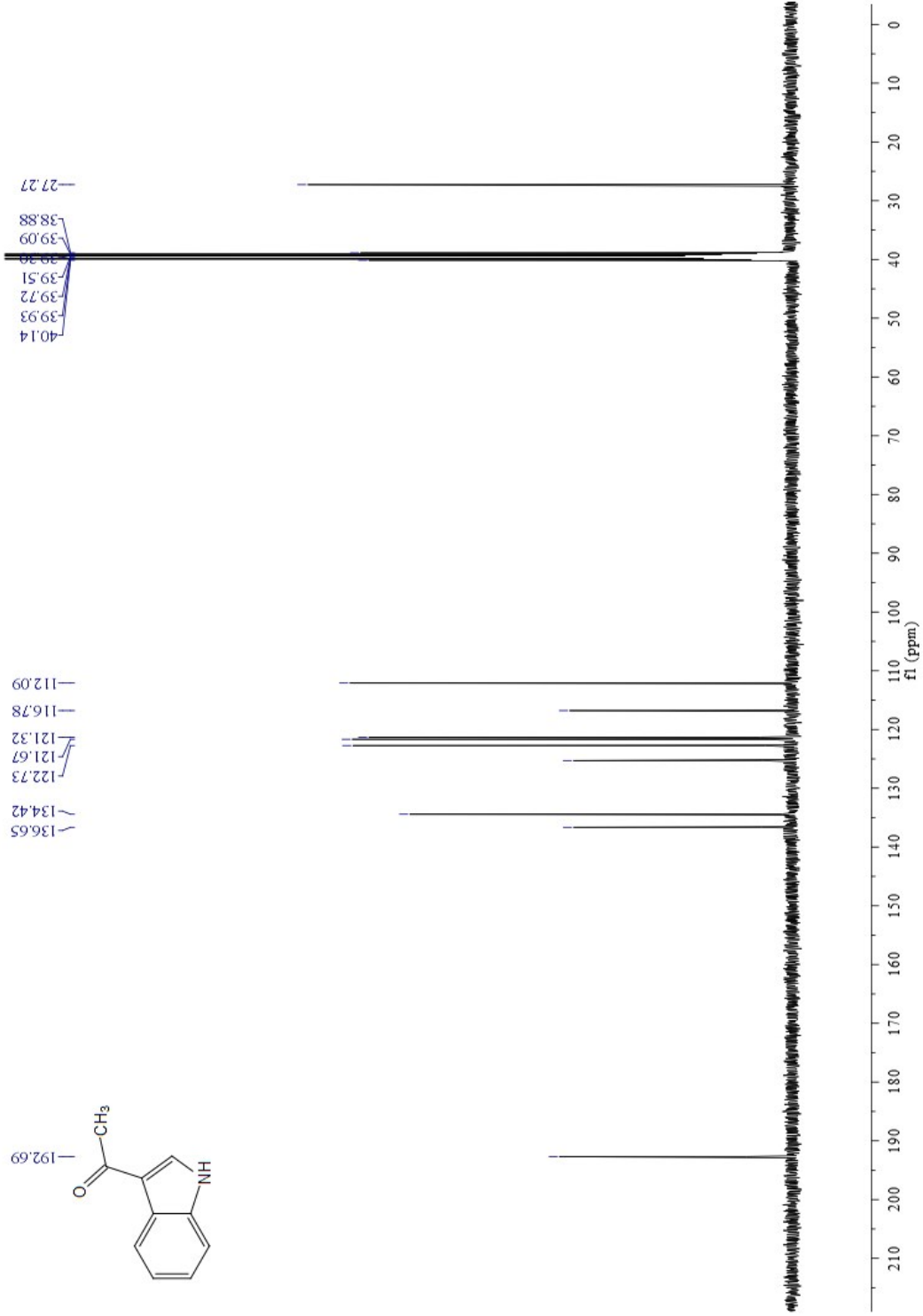
^{13}C NMR of (1*H*-indol-3-yl)(naphthalen-2-yl)methanone (**3al**)



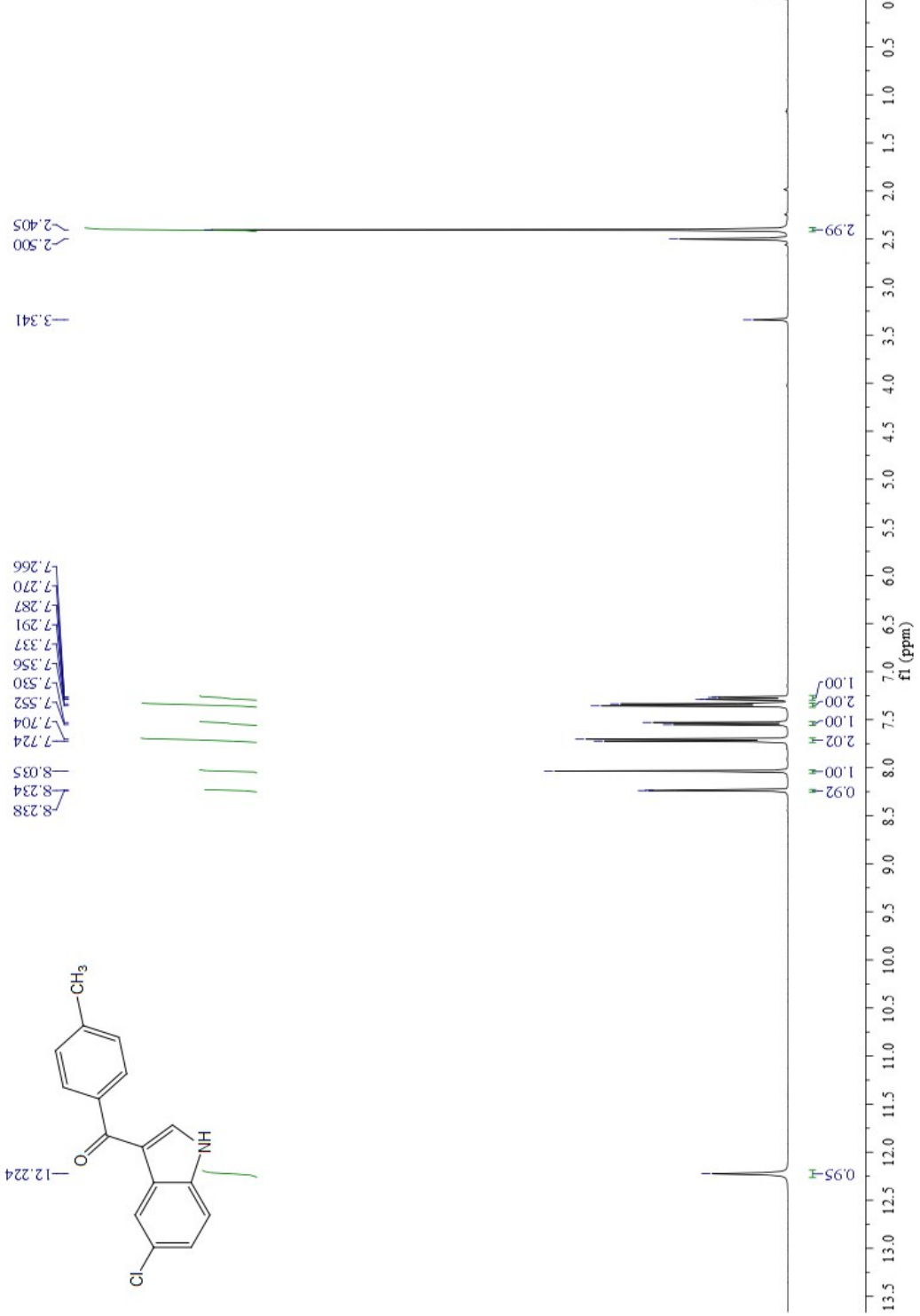
^{1}H NMR of 1-(1*H*-indol-3-yl)ethan-1-one (**3am**)



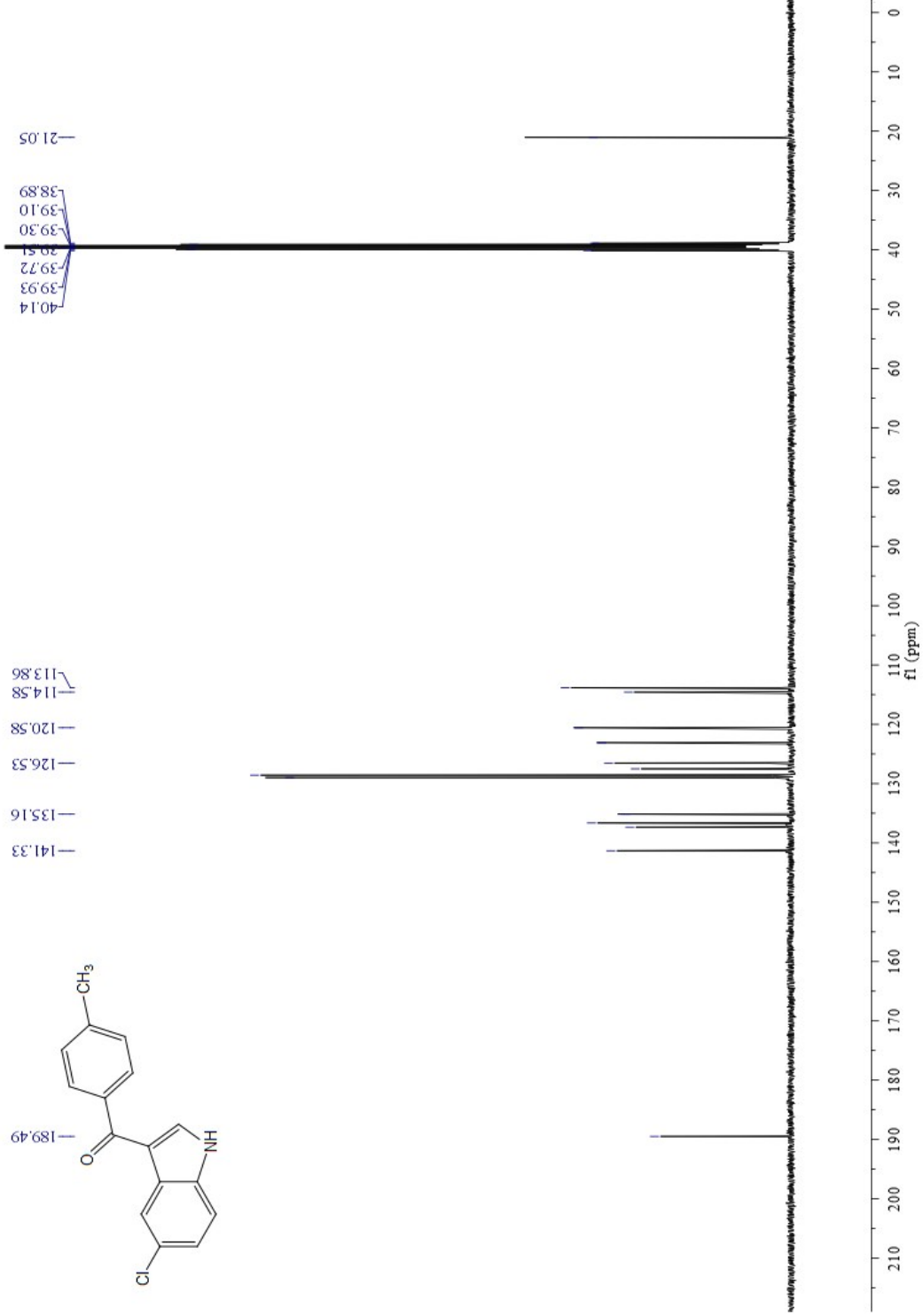
^{13}C NMR of 1-(1*H*-indol-3-yl)ethan-1-one (**3am**)



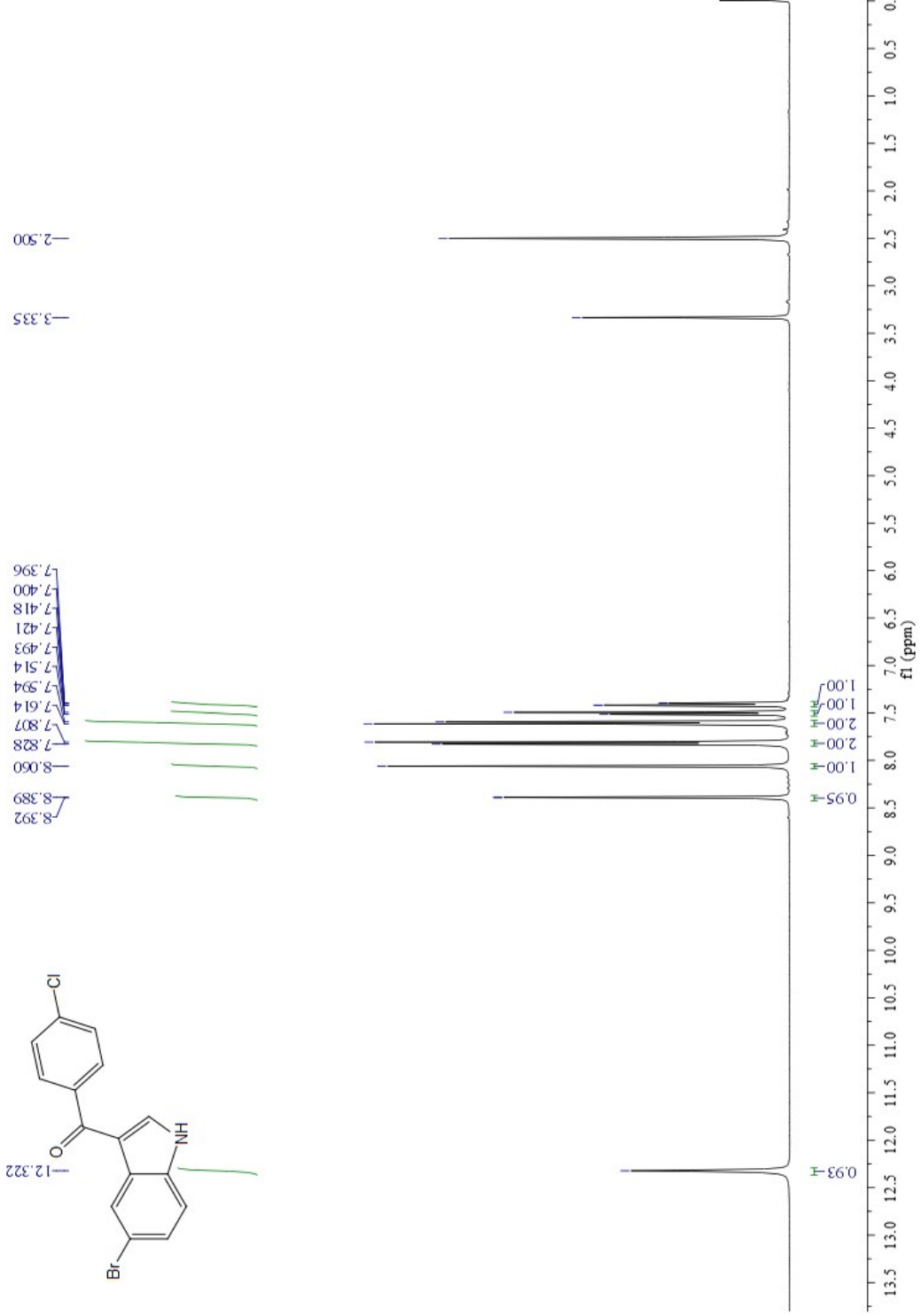
^{1}H NMR of (5-chloro-1*H*-indol-3-yl)(*p*-tolyl)methanone (**3gb**)



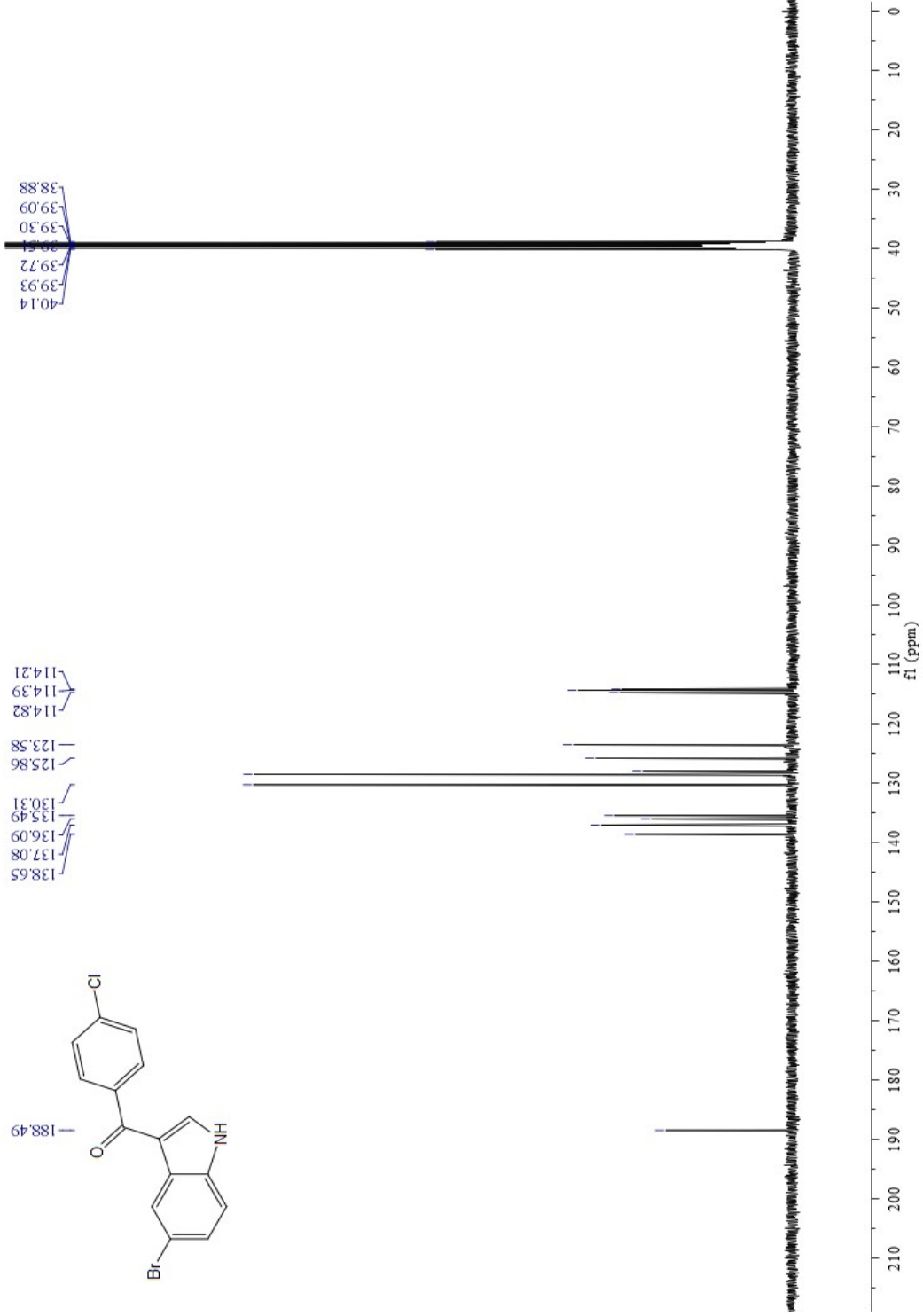
^{13}C NMR of (5-chloro-1*H*-indol-3-yl)(*p*-tolyl)methanone (**3gb**)



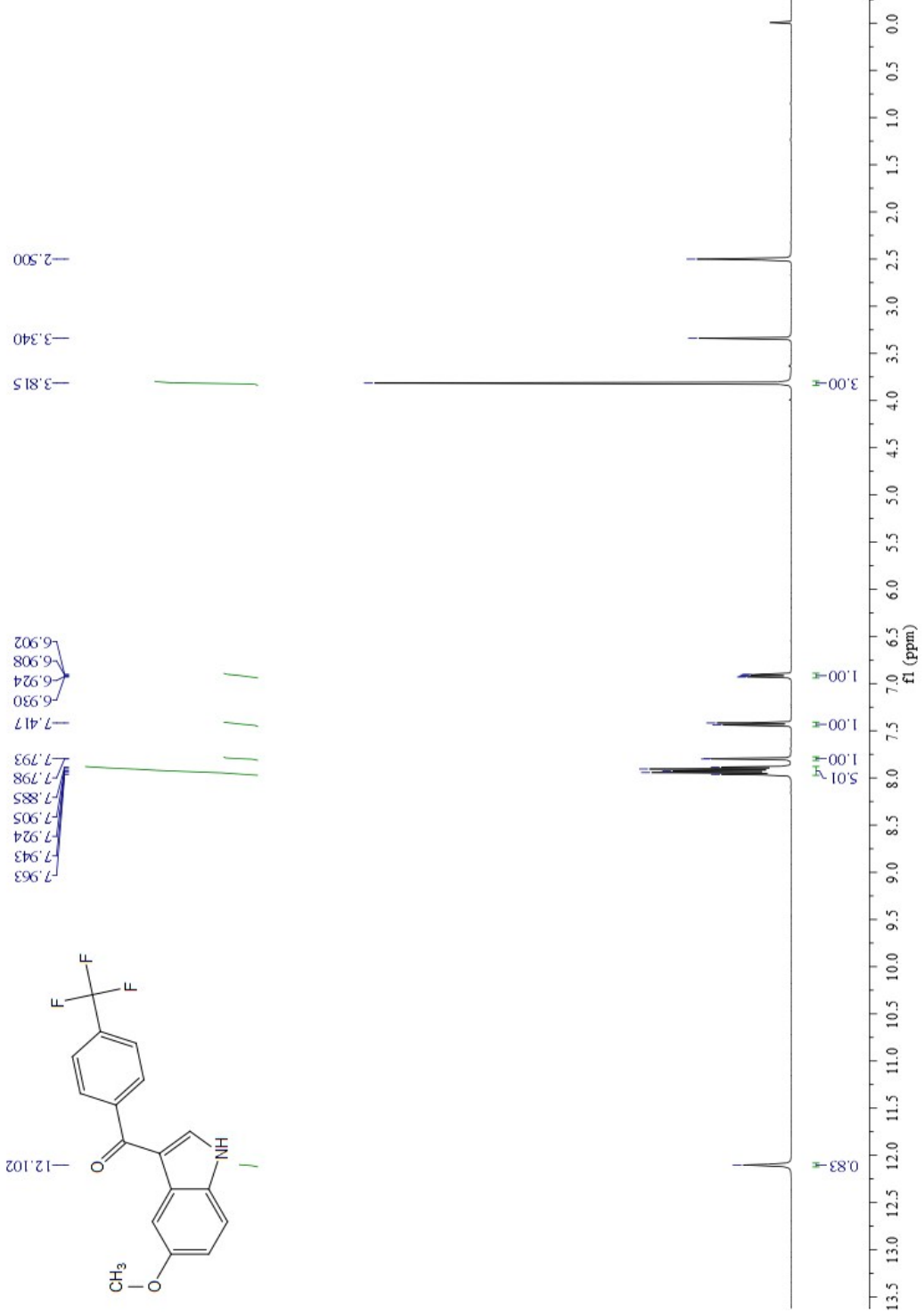
^{1}H NMR of (5-bromo-1*H*-indol-3-yl)(4-chlorophenyl)methanone (**3hd**)



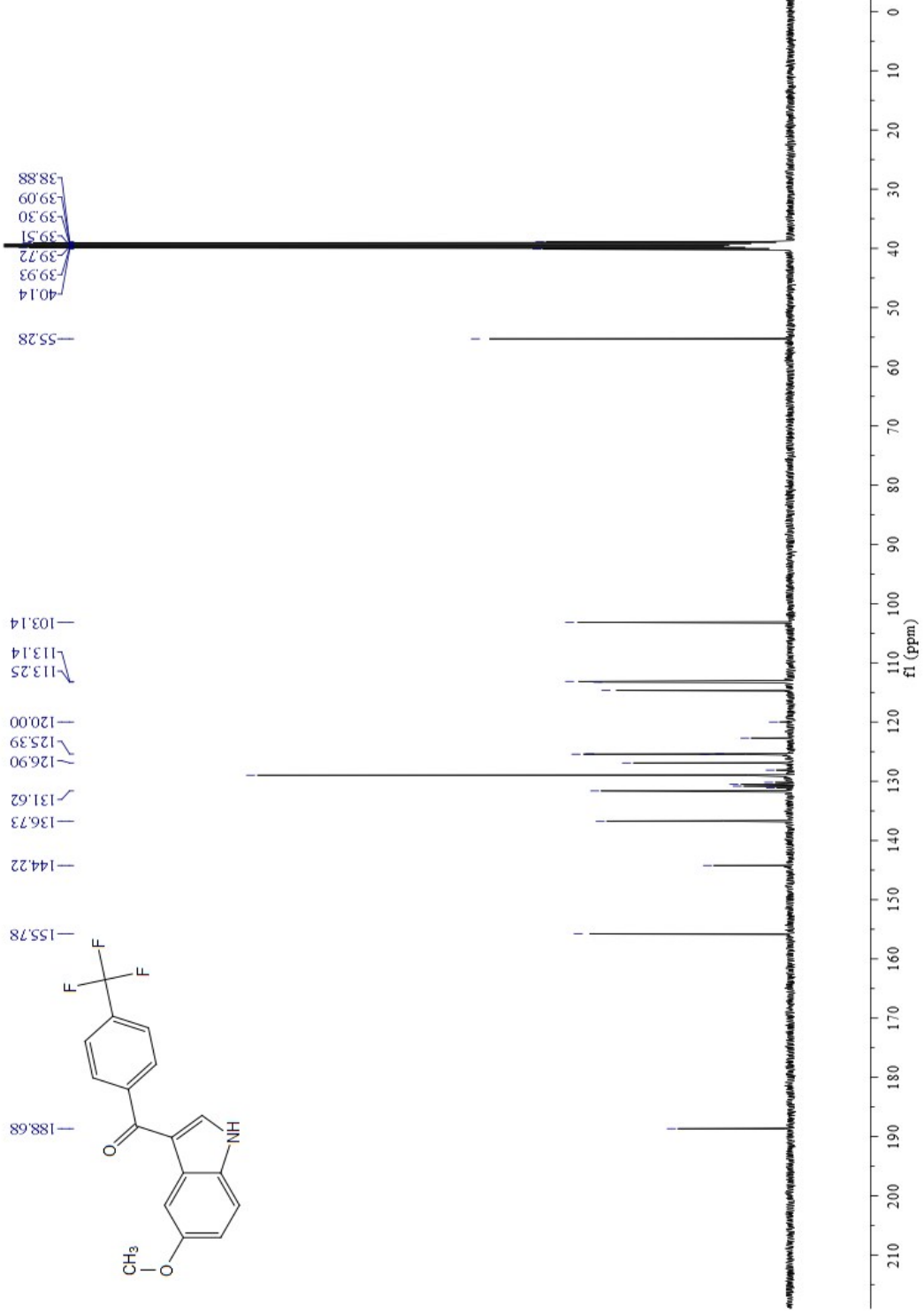
^{13}C NMR of (5-bromo-1*H*-indol-3-yl)(4-chlorophenyl)methanone (**3hd**)



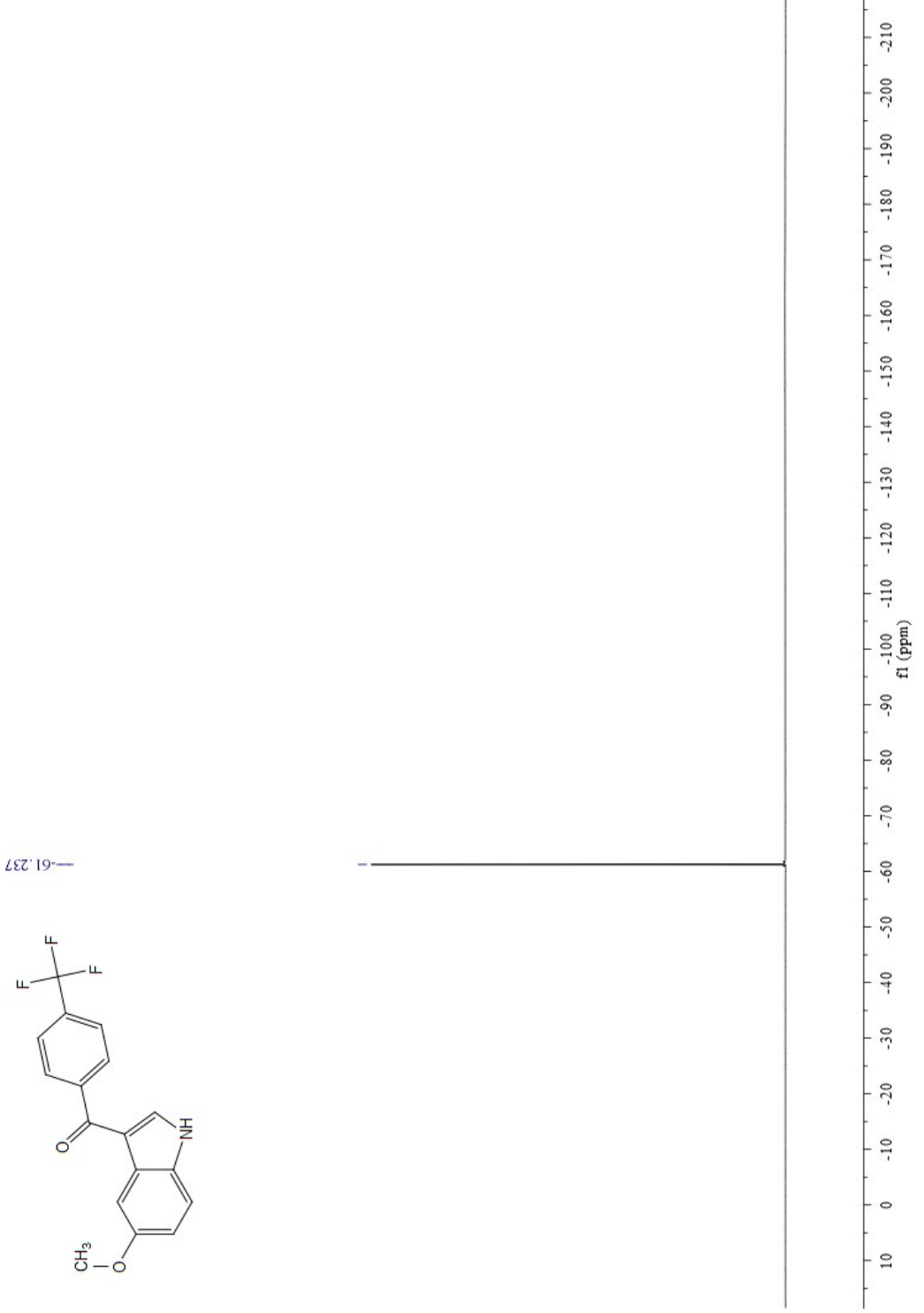
^{1}H NMR of (5-methoxy-1*H*-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3de**)



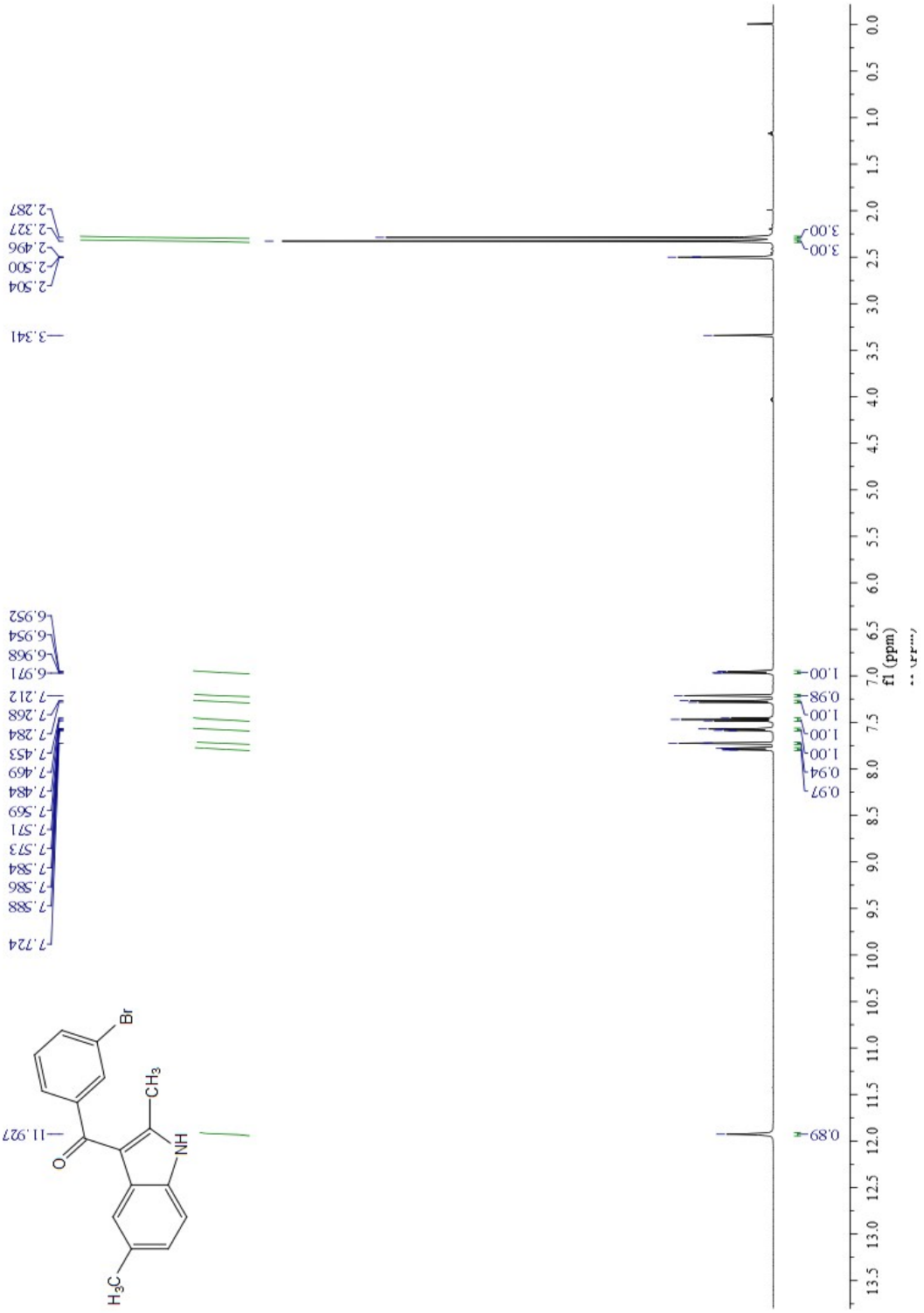
^{13}C NMR of (5-methoxy-1*H*-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3de**)



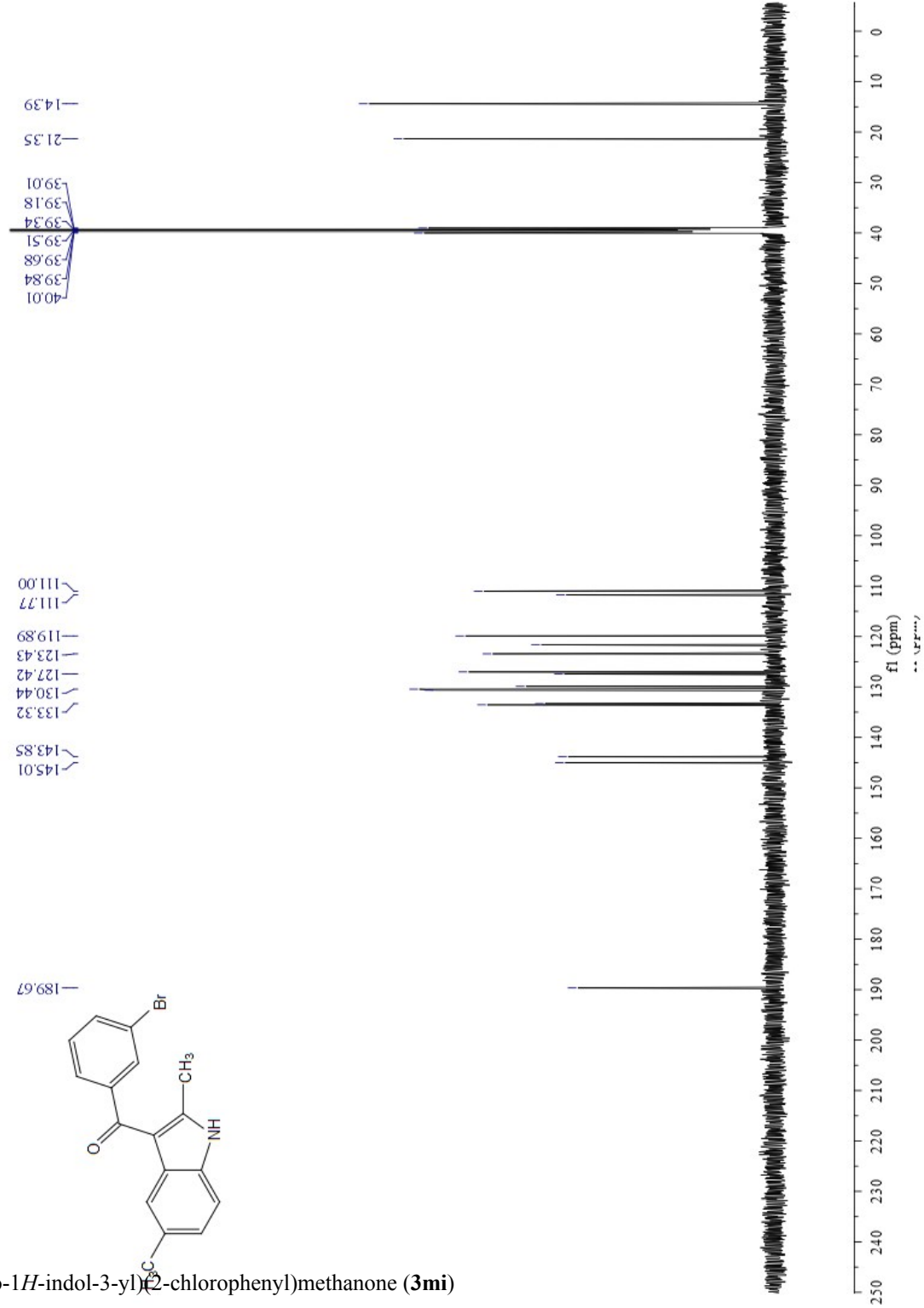
^{19}F NMR of (5-methoxy-1*H*-indol-3-yl)(4-(trifluoromethyl)phenyl)methanone (**3de**)



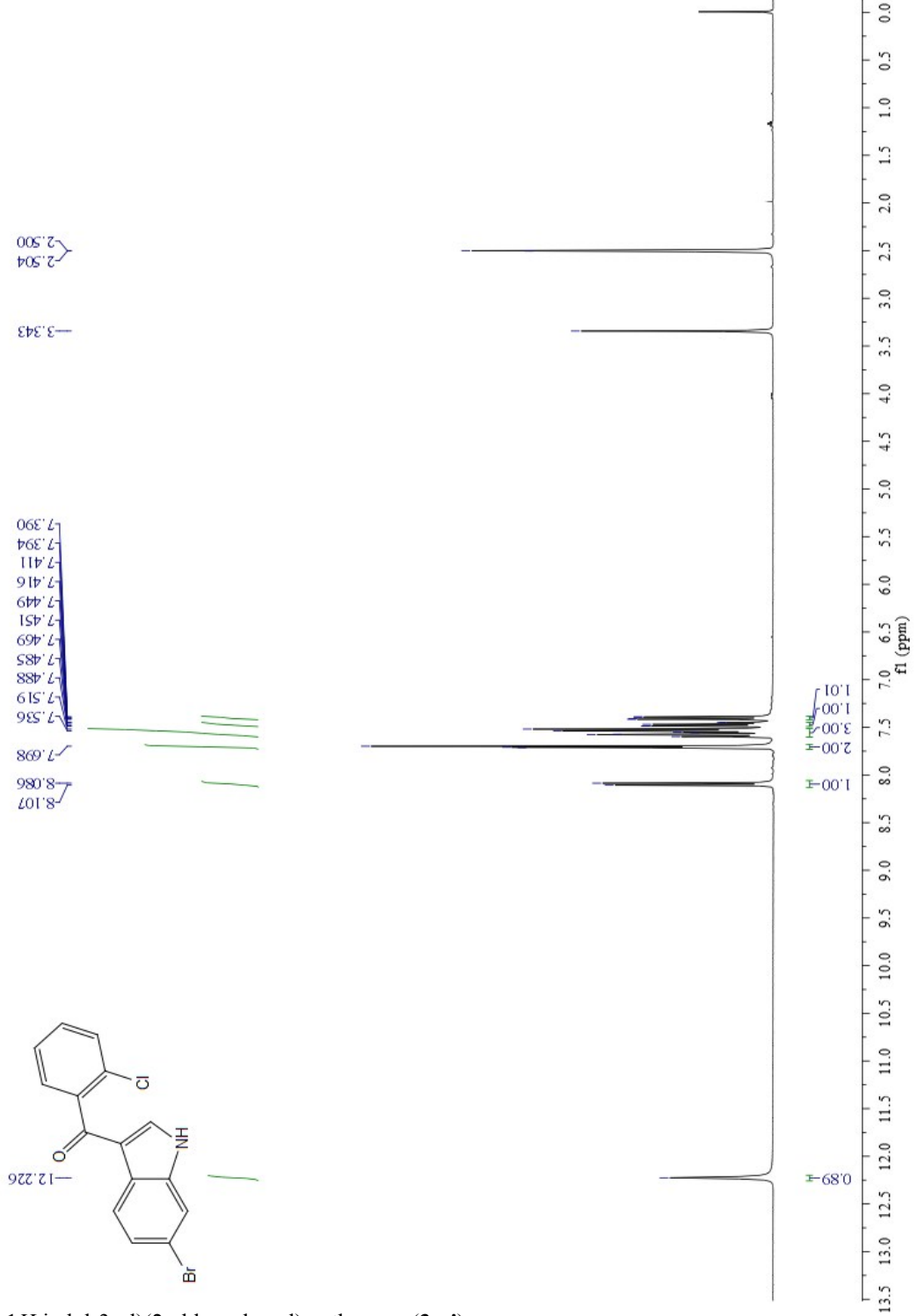
^{1}H NMR of (3-bromophenyl)(2,5-dimethyl-1*H*-indol-3-yl)methanone (**3rg**)



^{13}C NMR of (3-bromophenyl)(2,5-dimethyl-1*H*-indol-3-yl)methanone (**3rg**)

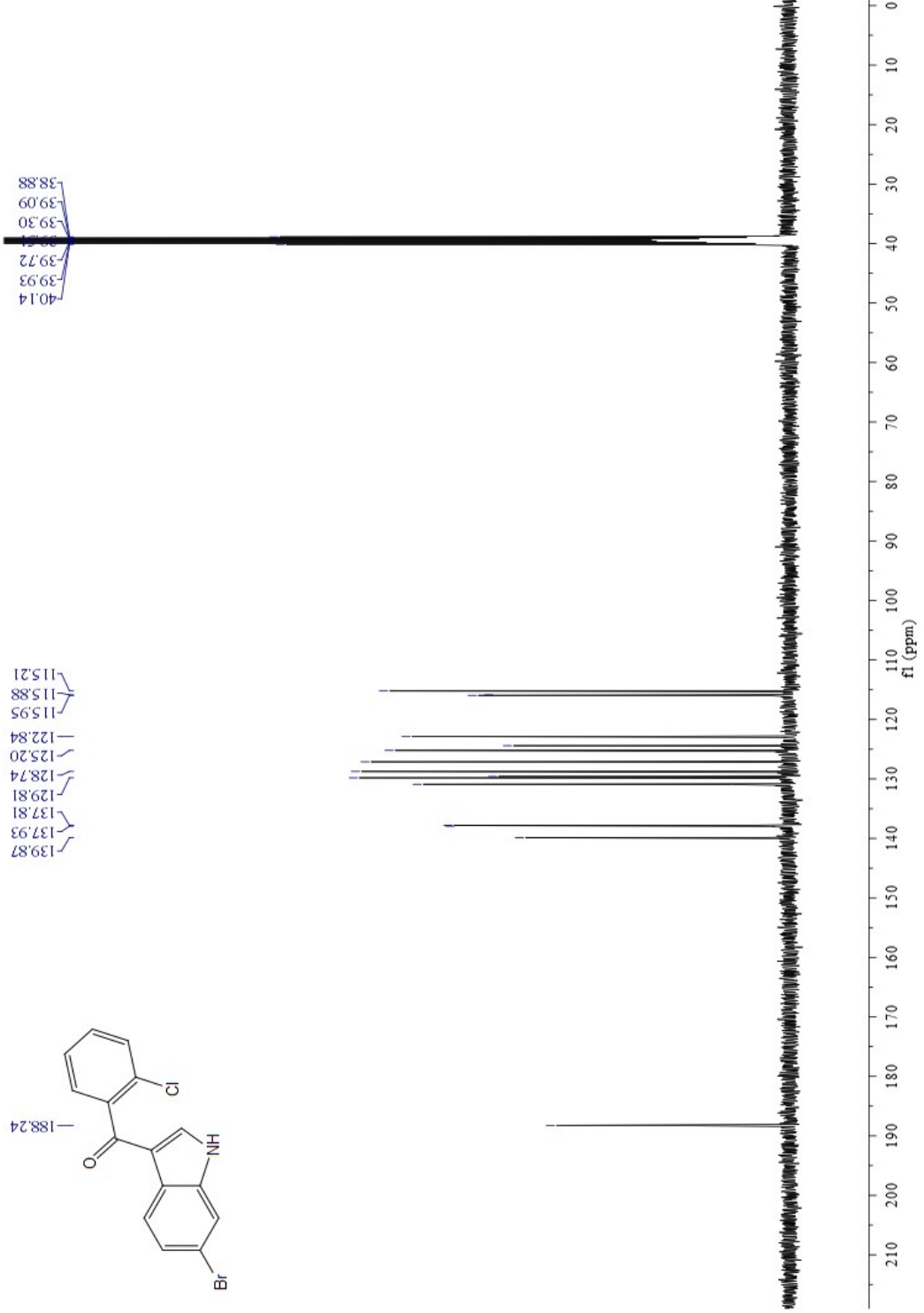


^{1}H NMR of (6-bromo-1*H*-indol-3-yl)(2-chlorophenyl)methanone (**3mi**)

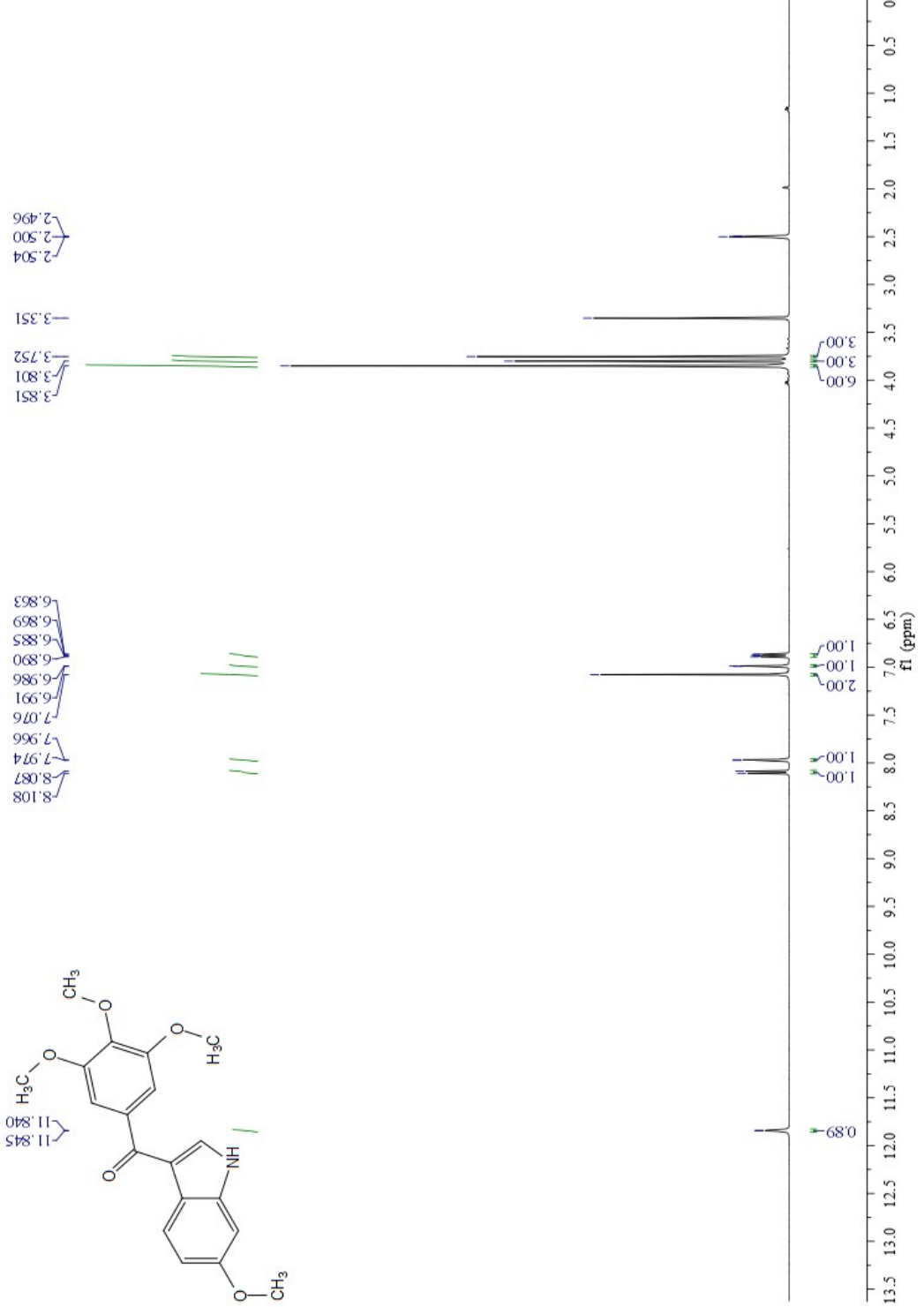


^{13}C NMR of (6-bromo-1*H*-indol-3-yl)(2-chlorophenyl)methanone (**3mi**)

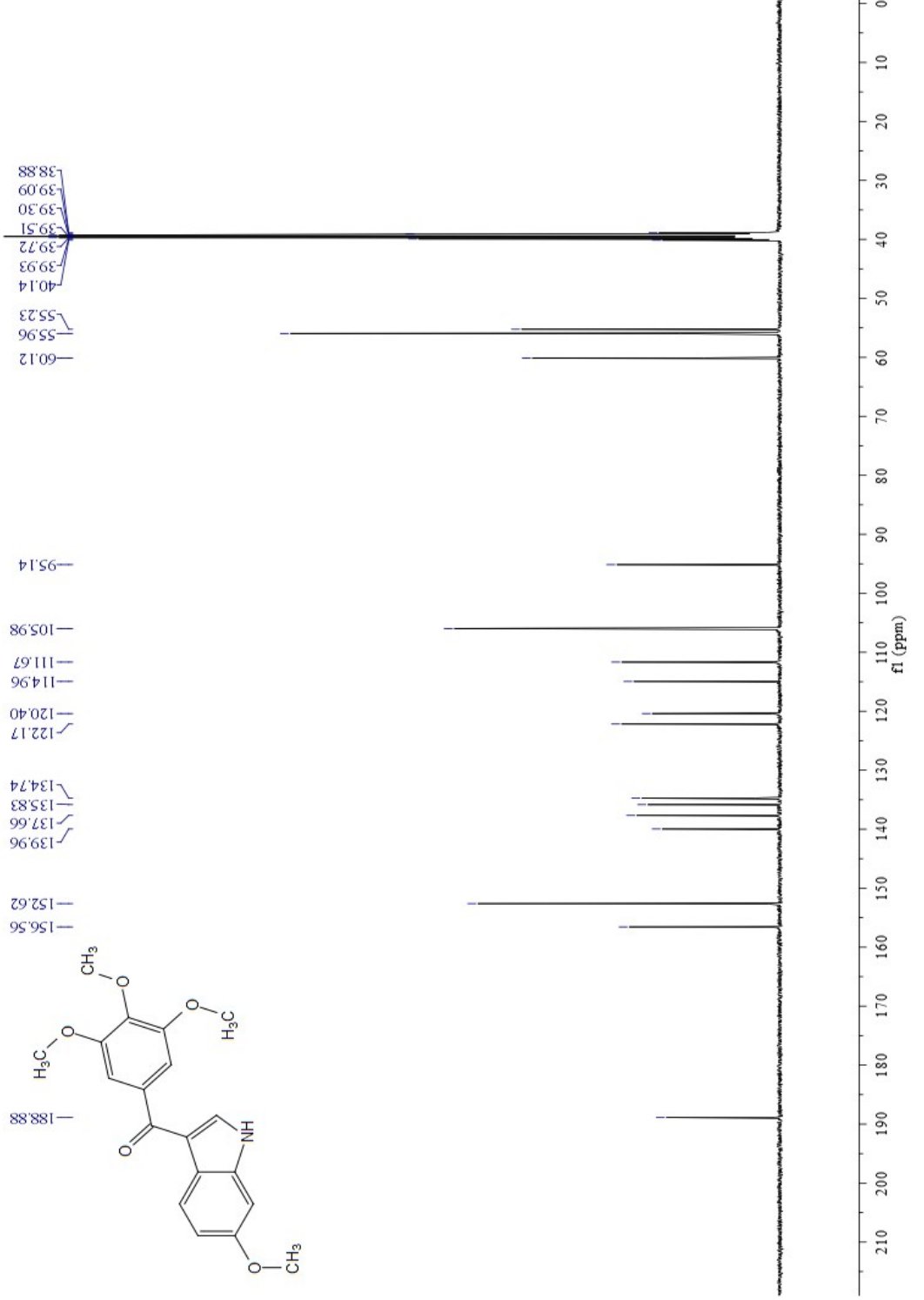
c



^{1}H NMR of (6-methoxy-1*H*-indol-3-yl)(3,4,5-trimethoxyphenyl)methanone (**3jn**, SCB01A)



^{13}C NMR of (6-methoxy-1*H*-indol-3-yl)(3,4,5-trimethoxyphenyl)methanone (**3jn**, SCB01A)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39.51
39.72
39.93
40.14
55.23
55.96
60.12
95.14
105.98
111.67
114.96
120.40
122.17
134.74
135.83
137.66
139.96
152.62
156.56
188.88
f1 (ppm)