

Supporting Information

Direct C4–H Amination of Pyridines and Quinolines under Benign Conditions

Tong Han, Fenlian Xu, Xinqiao Nie and Dong Wang*

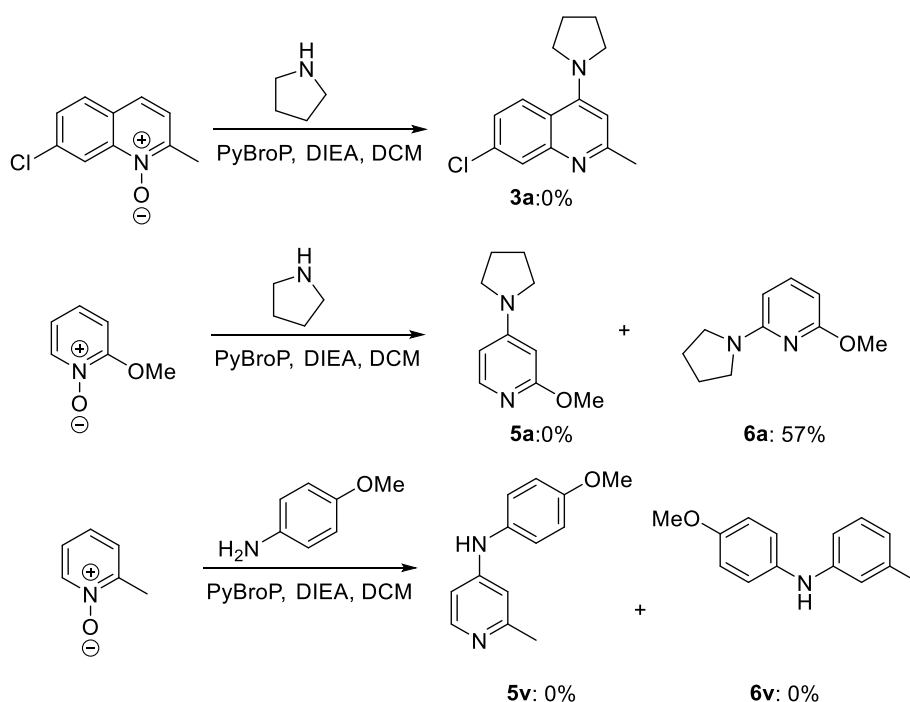
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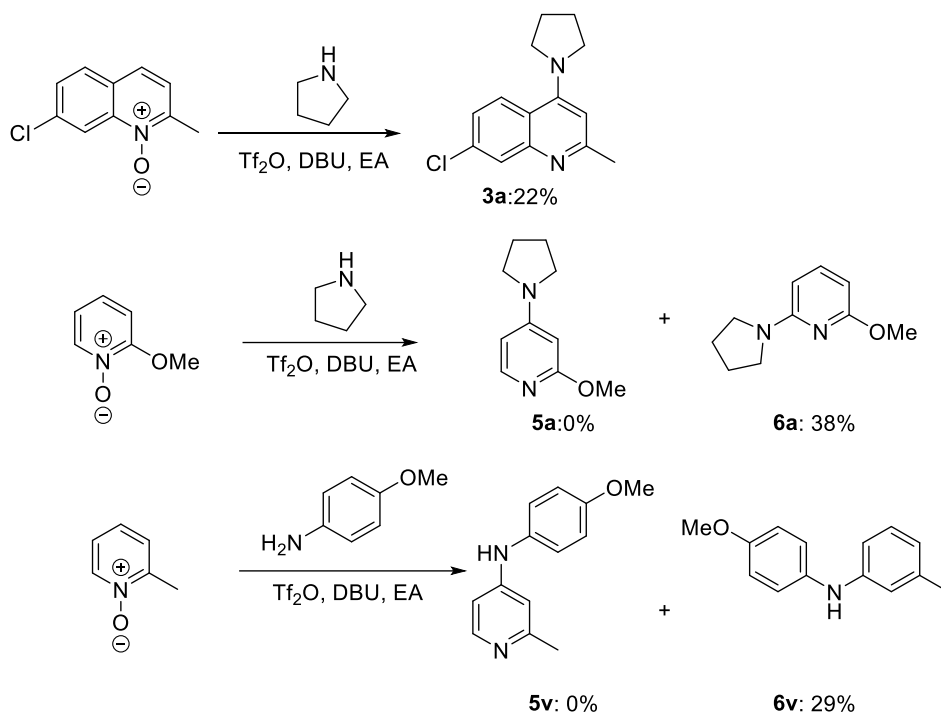
1. General Experimental

The preparation experiments were performed under air or an argon atmosphere in oven dried glassware. Anhydrous solvents were purchased from commercial sources. All reagents were purchased at the highest commercial quality and used without further purification. Reactions were monitored by thin layer chromatography (TLC) using ultra violet light (UV) as the visualizing agent. Nuclear magnetic resonance spectra (NMR) were recorded on Bruker AV-400, or QUANTUM 400 or Bruker Avance NEO 600 instruments and were calibrated using residual undeuterated solvent as an internal reference (^1H NMR: CHCl_3 7.26 ppm, ^{13}C NMR: CHCl_3 77.16 ppm). High resolution mass spectra (HRMS) were recorded on a ThermoFisher Scientific Ultimate 3000/Q-Exactive spectrometer (quadrupole mass analyzer) using electron spray ionization source (ESI). Melting points were recorded on a Buchi Melting Point M-560. The following abbreviations were used to indicate multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, quin = quintet, sex = sextet, sep = septet, dd = doublet of doublets, dt = doublet of triplets, ddd = doublet of doublet of doublets, ddt = doublet of doublet of triplets, m = multiplet).

2. Initial attempts



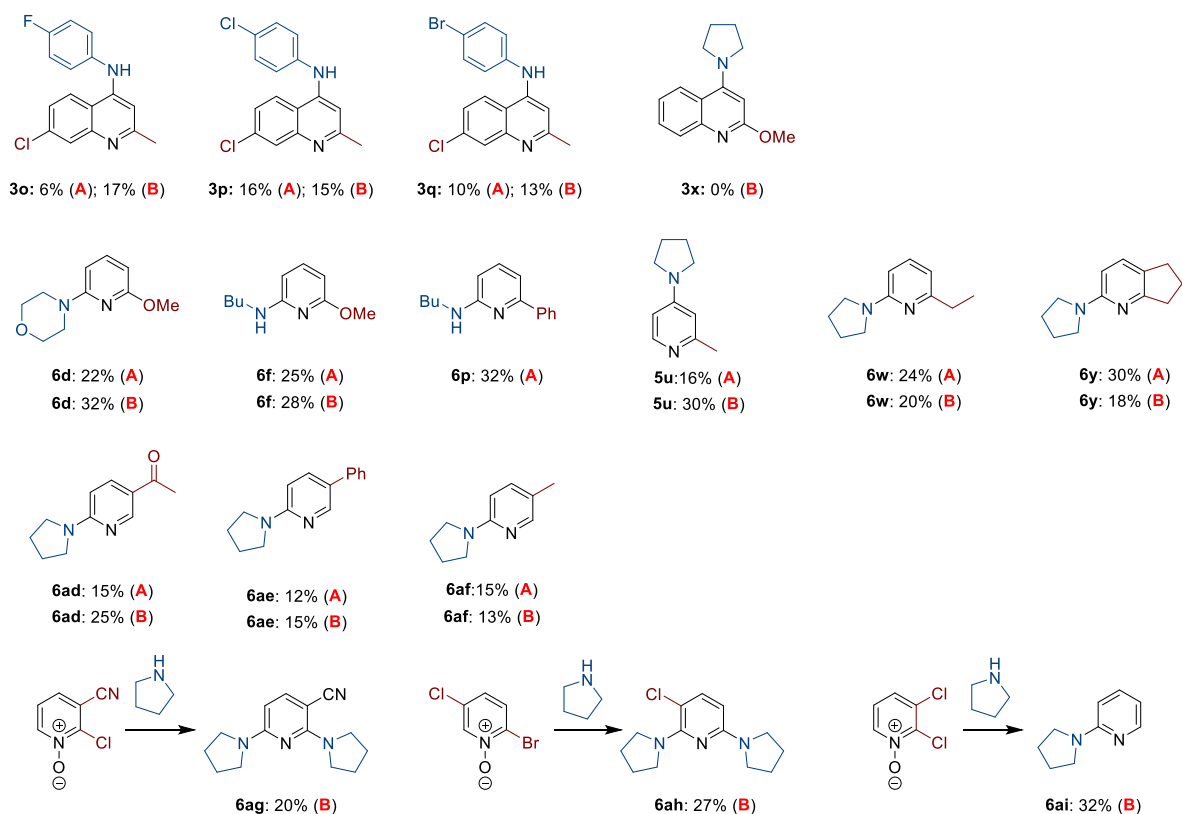
We employed 7-chloro-2-methylquinoline and 2-substituted pyridine *N*-oxides as substrates to react with amines. Referring to the reported C2–H amination of quinoline *N*-oxides¹, we found that this protocol failed to achieve amination at the 4-position of quinolines/pyridines.



Meanwhile, referring to the literature reported by our group², we found that amination at the 4-position of pyridines could not be achieved either. These results indicate that C4–H amination is much more challenging than C2–H amination.

3. Challenges and limitations

The results reveal that electron-withdrawing substituents at the *para*-position of aniline substrates markedly inhibit the reaction process, thus resulting in low yields of the target products. 2-Methoxy quinoline *N*-oxide is not compatible with the developed method. In terms of pyridine-based substrates, bulky amine derivatives as well as pyridines bearing large steric substituents at the C2 and C3 positions greatly reduce the reaction conversion efficiency and distinctly decrease the isolated yields of products.



4. General Procedure

General Procedure 1: Amination of Quinoline/Pyridine *N*-oxide. To a solution of a quinoline/pyridine *N*-oxide derivative (1.0 equiv) in dry EA (0.75 M) is added amine (3.0 equiv) and DIEA (2.0 equiv). The resulting solution is cooled to 0 °C, followed by the dropwise addition of Tf₂O (3.0 equiv). The reaction mixture is then warmed to room temperature and stirred until the reaction is complete as indicated by TLC. Finally, it is quenched with saturated ammonium chloride solution and extracted with EA three times. The combined organic phases are dried over Na₂SO₄, and concentrated in vacuo to give the crude product. Purification by flash column chromatography furnishes the desired pure product.

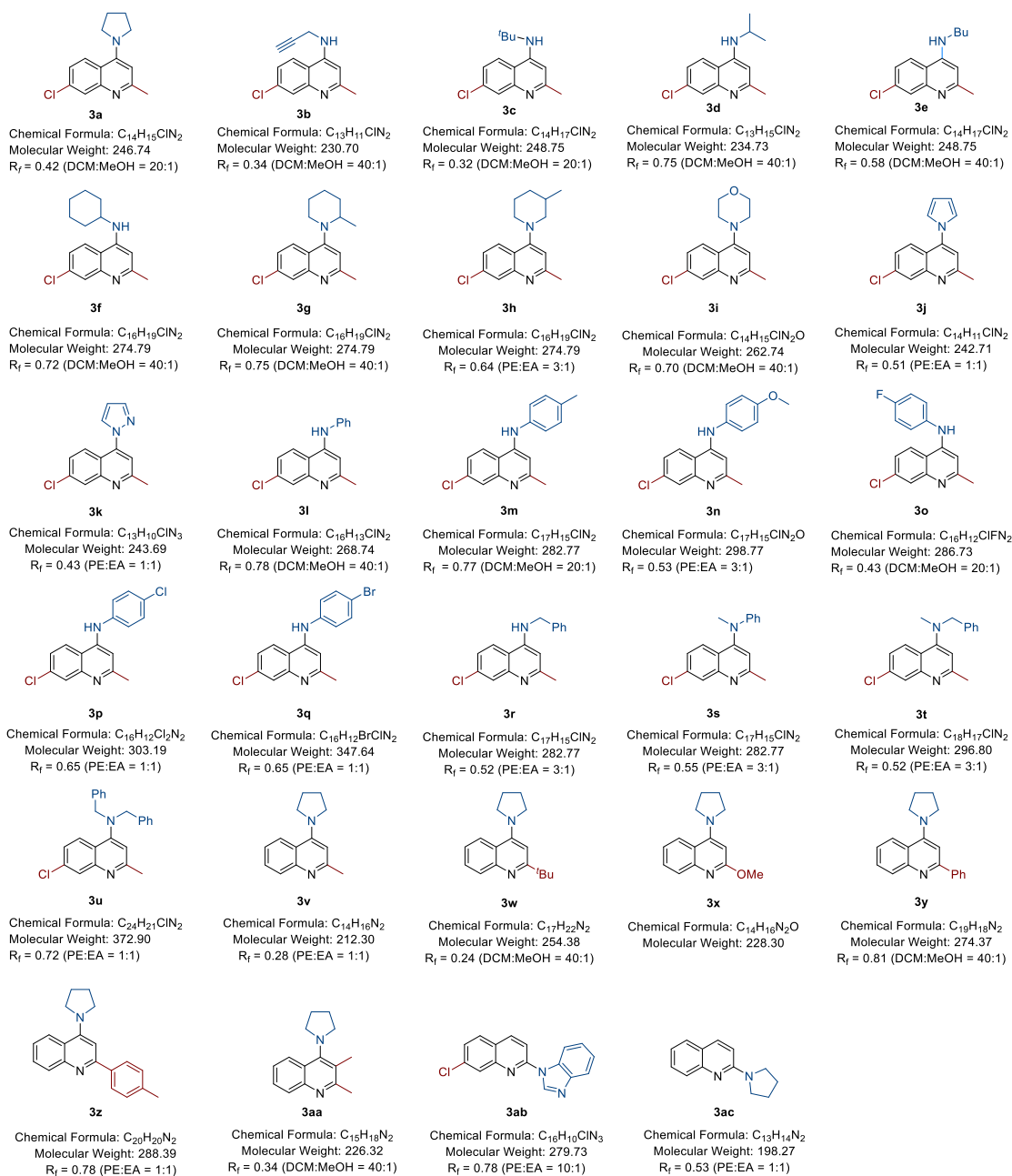
General Procedure 2: Amination of Quinoline/Pyridine *N*-oxide. To a solution of a quinoline/pyridine *N*-oxide derivative (1.0 equiv.) in dry DCE (0.75 M) is added amine (3.0 equiv) and DIEA (2.0 equiv). The resulting solution is cooled to 0 °C, followed by the dropwise addition of Tf₂O (3.0 equiv). The reaction mixture is then warmed to room temperature and stirred until the reaction is complete as indicated by TLC. Finally, it is quenched with saturated ammonium chloride solution and

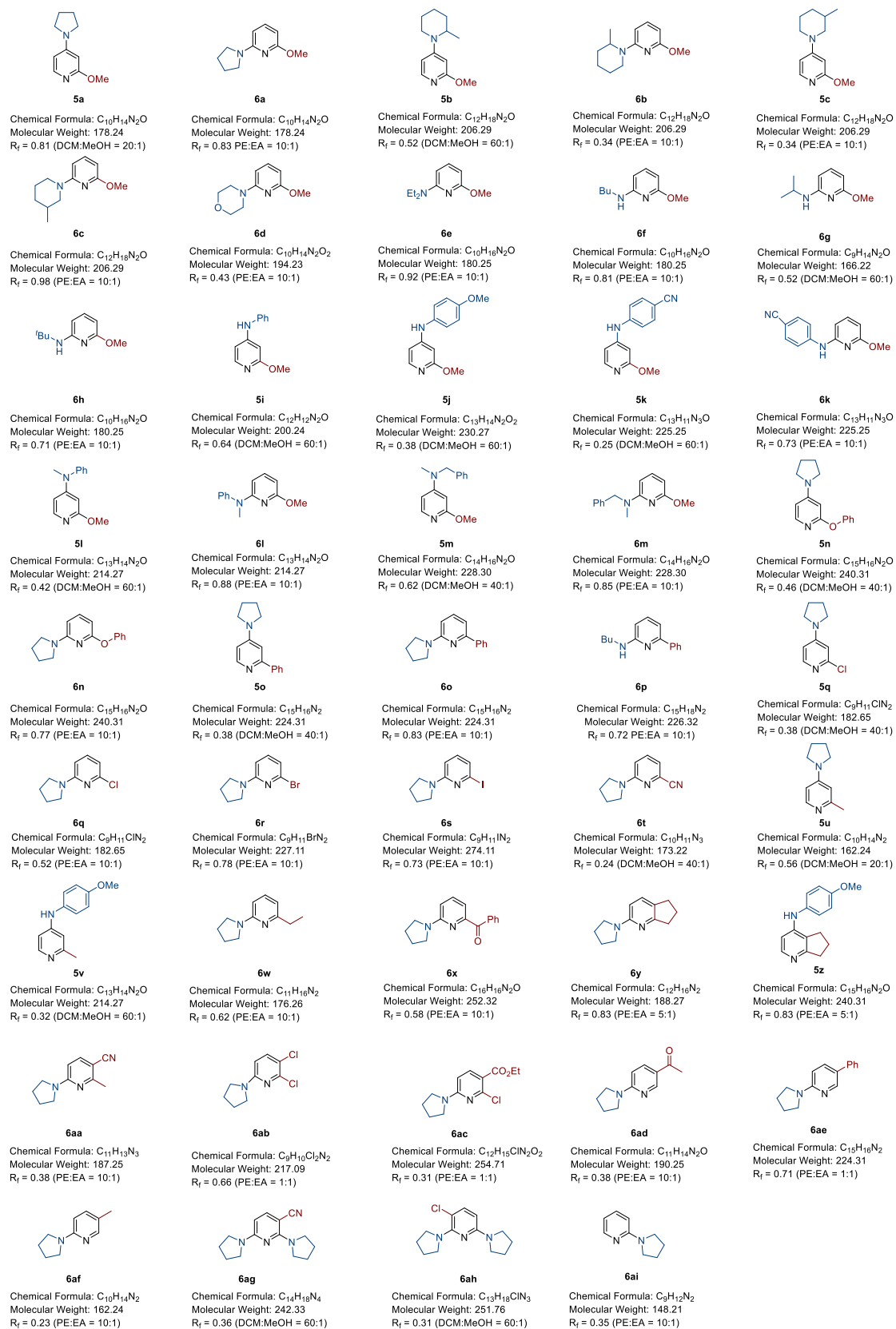
extracted with EA three times. The combined organic phases are dried over Na₂SO₄, and concentrated in vacuo to give the crude product. Purification by flash column chromatography furnishes the desired pure product.

5. Preparation of Azine *N*-oxides

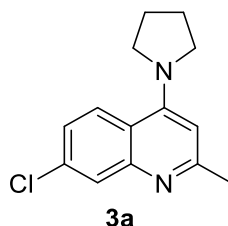
All of *N*-oxides were prepared following the reported procedure.³

6. List of compounds





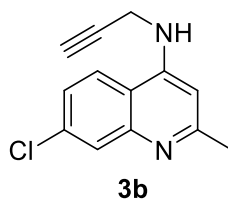
7. Preparation Procedure



7-chloro-2-methyl-4-(pyrrolidin-1-yl)quinoline (3a). Following **GP1**, using pyrrolidine (111 mg, 1.56 mmol), the title compound was obtained (94 mg, 70% yield) as a yellow solid. TLC: $R_f = 0.42$ (DCM:MeOH = 20:1). Melting point: 81.4-82.0 °C. $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.08 (d, $J = 9.0$ Hz, 1H), 7.88 (d, $J = 1.8$ Hz, 1H), 7.21 (dd, $J = 9.6, 2.4$ Hz, 1H), 6.34 (s, 1H), 3.67-3.64 (m, 4H), 2.58 (s, 3H), 2.05-2.03 (m, 4H). $^{13}\text{C NMR}$ (150 MHz, CDCl_3) δ 159.7, 152.8, 150.9, 134.4, 127.8, 126.4, 123.1, 118.3, 103.3, 52.2, 26.1, 25.6. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{16}\text{ClN}_2$ 247.0997 (^{35}Cl), 249.0967 (^{37}Cl); Found 247.0997, 249.0697.

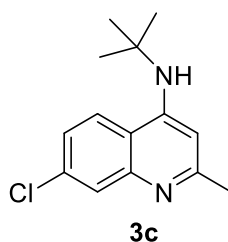
Gram scale synthesis:

To a 15 mL pressure tube equipped with a magnetic stir bar were added 2-methyl-7-chloroquinoline *N*-oxide (1.0 g, 5.16 mmol) and anhydrous ethyl acetate (7 mL), followed by pyrrolidine (1.1 g, 15.5 mmol) and *N,N*-diisopropylethylamine (DIEA) (1.33 g, 10.3 mmol). The resulting solution was cooled to 0 °C, and trifluoromethanesulfonic anhydride (Tf_2O) (4.37 g, 15.5 mmol) was added dropwise slowly. The reaction mixture was then warmed to room temperature and stirred until completion as monitored by TLC. The reaction was quenched with saturated ammonium chloride solution (30 mL), and the organic phase was separated. The aqueous phase was extracted once with ethyl acetate (30 mL*5). The combined organic phases were dried over sodium sulfate and concentrated under reduced pressure to afford the crude product. Purification by flash column chromatography (PE:EA = 10:1-1:1 ~ DCM:MeOH = 60:1-20:1) gave the desired pure product (789 mg, 62% yield).

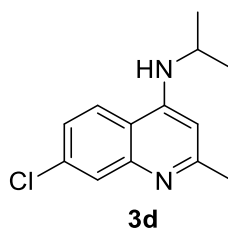


7-chloro-2-methyl-N-(prop-2-yn-1-yl)quinolin-4-amine (3b). Following **GP1**, using prop-2-yn-

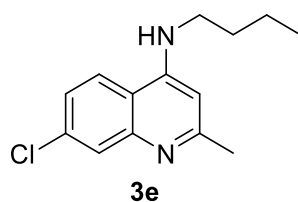
1-amine (86 mg, 1.56 mmol), the title compound was obtained (61 mg, 52% yield) as a yellow solid. TLC: R_f = 0.34 (DCM:MeOH = 40:1). Melting point: 169.5-170.0 °C. ^1H NMR (600 MHz, CD_3OD) δ 8.06 (d, J = 9.0 Hz, 1H), 7.76 (d, J = 1.8 Hz, 1H), 7.46 (dd, J = 9.6, 2.4 Hz, 1H), 6.65 (s, 1H), 4.24 (d, J = 2.4 Hz, 3H), 2.73 (t, J = 2.4 Hz, 1H), 2.62 (s, J = 2.4 Hz, 3H). ^{13}C NMR (150 MHz, CD_3OD) δ 159.5, 154.1, 145.2, 138.4, 127.2, 127.0, 124.7, 123.8, 116.9, 100.9, 73.6, 33.1, 22.9. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{13}\text{H}_{12}\text{ClN}_2$ 231.0684 (^{35}Cl), 233.0654 (^{37}Cl); Found 231.0681, 233.0653.



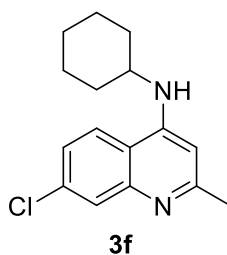
N-(tert-butyl)-7-chloro-2-methylquinolin-4-amine (3c). Following **GP1**, using 2-methylpropan-2-amine (92 mg, 1.56 mmol), the title compound was obtained (55 mg, 43% yield) as a brown oil. TLC: R_f = 0.32 (DCM:MeOH = 20:1). ^1H NMR (600 MHz, CDCl_3) δ 7.87 (d, J = 2.4 Hz, 1H), 7.64-7.66 (m, 1H), 7.29-7.29 (m, 1H), 6.50 (s, 1H), 2.60 (s, 3H), 1.56 (s, 10H). ^{13}C NMR (100 MHz, CDCl_3) δ 154.7, 152.6, 137.7, 126.0, 124.1, 115.2, 106.8, 100.8, 86.7, 54.1, 29.1, 22.2. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{18}\text{ClN}_2$ 249.1153 (^{35}Cl), 251.1124 (^{37}Cl); Found 249.1151, 251.1122.



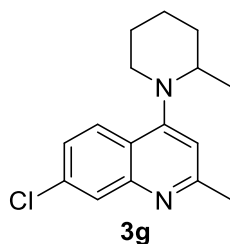
7-chloro-N-isopropyl-2-methylquinolin-4-amine (3d). Following **GP2**, using propan-2-amine (92 mg, 1.56 mmol), the title compound was obtained (83 mg, 58% yield) as a brown solid. TLC: R_f = 0.75 (DCM:MeOH = 40:1). Melting point: 130.4-131.3 °C. ^1H NMR (600 MHz, CDCl_3) δ 7.87 (d, J = 1.8 Hz, 1H), 7.59 (d, J = 9.0 Hz, 1H), 7.28 (dd, J = 9.0, 2.4 Hz, 1H), 6.31 (s, 1H), 4.81 (s, 1H), 3.87-3.82 (m, 1H), 2.59 (s, 3H), 1.34 (d, J = 9.0, 2.4 Hz, 6H). ^{13}C NMR (150 MHz, CDCl_3) δ 159.6, 149.8, 135.7, 126.4, 124.8, 121.7, 115.6, 99.3, 87.1, 44.6, 24.8, 22.5. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{13}\text{H}_{16}\text{ClN}_2$ 235.0997 (^{35}Cl), 237.0967 (^{37}Cl); Found 235.0995, 237.0963.



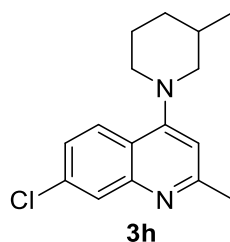
N-butyl-7-chloro-2-methylquinolin-4-amine (3e). Following **GP2**, using butan-1-amine (114 mg, 1.56 mmol), the title compound was obtained (63 mg, 48% yield) as a yellow solid. TLC: $R_f = 0.58$ (DCM:MeOH = 40:1). Melting point: 141.9-143.0 °C. ^1H NMR (600 MHz, CDCl_3) δ 7.86 (d, $J = 1.8$ Hz, 1H), 7.59 (d, $J = 9.0$ Hz, 1H), 7.26 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.27 (s, 1H), 3.29-3.25 (m, 2H), 2.58 (s, 3H), 1.75-1.70 (m, 2H), 1.51-1.47 (m, 2H), 1.00 (t, $J = 7.2$ Hz, 3H) ^{13}C NMR (150 MHz, CDCl_3) δ 160.7, 150.0, 148.7, 135.0, 127.9, 124.6, 120.9, 115.8, 99.3, 43.1, 31.1, 25.7, 20.4, 14.0. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{18}\text{ClN}_2$ 249.1153 (^{35}Cl), 251.1124 (^{37}Cl); Found 249.1151, 251.1122.



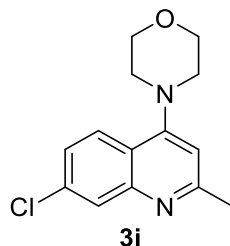
7-chloro-N-cyclohexyl-2-methylquinolin-4-amine (3f). Following **GP2**, using cyclohexanamine (155 mg, 1.56 mmol), the title compound was obtained (83 mg, 58% yield) as a yellow solid. TLC: $R_f = 0.72$ (DCM:MeOH = 40:1). Melting point: 133.9-134.1 °C. ^1H NMR (600 MHz, CDCl_3) δ 7.86 (d, $J = 1.8$ Hz, 1H), 7.59 (d, $J = 9.0$ Hz, 1H), 7.28 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.32 (s, 1H), 2.59 (s, 3H), 2.15-2.13 (m, 2H), 1.86-1.82 (m, 2H), 1.74-1.70 (m, 1H), 1.48-1.44 (m, 2H), 1.34-1.25 (m, 4H). ^{13}C NMR (150 MHz, CDCl_3) δ 160.6, 148.8, 135.1, 128.0, 124.5, 120.8, 115.9, 115.0, 99.5, 51.4, 32.9, 25.8, 25.7, 25.0. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{20}\text{ClN}_2$ 275.1310 (^{35}Cl), 277.1280 (^{37}Cl); Found 275.1306.



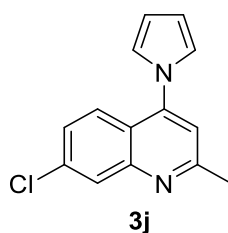
7-chloro-2-methyl-4-(2-methylpiperidin-1-yl) quinoline (3g). Following **GP2**, using 2-methylpiperidine (155 mg, 1.56 mmol), the title compound was obtained (64 mg, 45% yield) as a brown oil. TLC: $R_f = 0.75$ (DCM:MeOH = 40:1). $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.96 (d, $J = 9.0$ Hz, 2H), 7.34 (dd, $J = 9.0, 1.8$ Hz, 1H), 6.75 (s, 1H), 3.73-3.70 (m, 1H), 3.32-3.28 (m, 1H), 2.89-2.86 (m, 1H), 2.66 (s, 3H), 2.03-1.98 (m, 1H), 1.82-1.73 (m, 3H), 1.64-1.56 (m, 2H), 0.98 (d, $J = 6.6$ Hz, 3H). $^{13}\text{C NMR}$ (150 MHz, CDCl_3) δ 160.4, 157.8, 149.9, 141.0, 135.0, 127.8, 125.5, 125.4, 121.9, 112.6, 54.5, 32.5, 26.4, 25.6, 21.1, 15.8. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{20}\text{ClN}_2$ 275.1310 (^{35}Cl), 277.1280 (^{37}Cl); Found 275.1309, 277.1280.



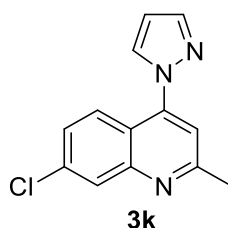
7-chloro-2-methyl-4-(3-methylpiperidin-1-yl)quinoline (3h). Following **GP2**, using 3-methylpiperidine (155 mg, 1.56 mmol), the title compound was obtained (80 mg, 56% yield) as a brown oil. TLC: $R_f = 0.64$ (PE:EA = 3:1). $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.00 (s, 1H), 7.85 (d, $J = 9.0$ Hz, 1H), 7.35 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.68 (s, 1H), 3.53-3.45 (m, 2H), 2.80-2.76 (m, 1H), 2.66 (s, 3H), 2.48 (t, $J = 9.0$ Hz, 1H), 2.00-1.92 (m, 2H), 1.87-1.83 (m, 2H), 1.17-1.13 (m, 1H), 0.98 (d, $J = 6.0$ Hz, 3H). $^{13}\text{C NMR}$ (150 MHz, CDCl_3) δ 160.3, 158.3, 135.3, 127.4, 125.4, 125.3, 120.4, 109.4, 67.2, 60.5, 53.3, 33.1, 31.5, 25.7, 25.2, 19.4. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{20}\text{ClN}_2$ 275.1310 (^{35}Cl), 277.1280 (^{37}Cl); Found 275.1309, 277.1279.



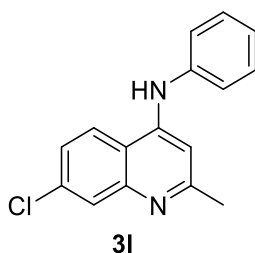
4-(7-chloro-2-methylquinolin-4-yl)morpholine (3i). Following **GP2**, using morpholine (136 mg, 1.56 mmol), the title compound was obtained (51 mg, 38% yield) as a yellow oil. TLC: $R_f = 0.70$ (DCM:MeOH = 40:1). ^1H NMR (400 MHz, CDCl_3) δ 7.95 (d, $J = 2.0$ Hz, 1H), 7.63 (d, $J = 8.8$ Hz, 1H), 7.54 (s, 1H), 7.40 (dd, $J = 8.4, 2.4$ Hz, 1H), 3.93-3.91 (m, 4H), 3.02-3.00 (m, 4H), 2.72 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 158.2, 145.9, 144.6, 133.4, 128.0, 127.5, 127.0, 126.2, 122.6, 67.3, 52.4, 22.1. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{16}\text{ClN}_2\text{O}$ 263.0946 (^{35}Cl), 265.0916 (^{37}Cl); Found 263.0946, 265.0916.



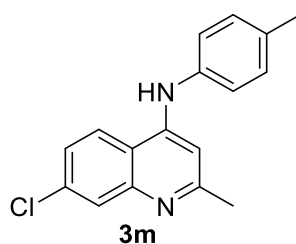
7-chloro-2-methyl-4-(1H-pyrrol-1-yl)quinolin (3j). Following **GP2**, using 1H-pyrrole (105 mg, 1.56 mmol), the title compound was obtained (60 mg, 48% yield) as a black solid. TLC: $R_f = 0.51$ (PE:EA = 1:1). Melting point: 53.1-54.3 °C. ^1H NMR (400 MHz, CDCl_3) δ 8.03 (d, $J = 8.4$ Hz, 1H), 8.00-7.99 (m, 1H), 7.70 (d, $J = 8.8$ Hz, 1H), 7.43 (dd, $J = 8.8, 2.4$ Hz, 1H), 7.30-7.27 (m, 2H), 7.22-7.21 (m, 1H), 6.50-6.49 (m, 1H), 2.73 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 160.4, 148.2, 136.3, 135.5, 128.9, 128.4, 127.6, 126.9, 122.5, 122.4, 112.8, 25.3. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{12}\text{ClN}_2$ 243.0684 (^{35}Cl), 245.0654 (^{37}Cl); Found 243.0683, 245.0652.



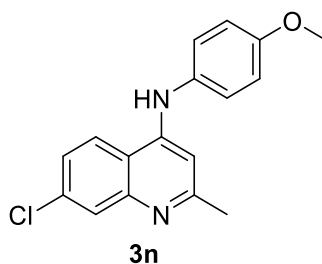
7-chloro-2-methyl-4-(1H-pyrazol-1-yl)quinoline (3k). Following **GP1**, using 1H-pyrazole (106 mg, 1.56 mmol), the title compound was obtained (60 mg, 48% yield) as a yellowish-brown solid. TLC: $R_f = 0.43$ (PE:EA = 1:1). Melting point: 114.1-115.2 °C. ^1H NMR (600 MHz, CDCl_3) δ 8.46 (d, $J = 2.4$ Hz, 1H), 8.07 (s, 1H), 7.99 (d, $J = 1.8$ Hz, 1H), 7.80 (d, $J = 1.8$ Hz, 1H), 7.71 (d, $J = 9.0$ Hz, 1H), 7.46 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.51-6.50 (m, 1H), 2.74 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 150.9, 145.7, 141.8, 140.2, 135.3, 130.3, 128.0, 127.7, 127.6, 126.0, 125.9, 107.2, 20.8. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{13}\text{H}_{11}\text{ClN}_3$ 244.0636 (^{35}Cl), 246.0607 (^{37}Cl); Found 244.0636 246.0606.



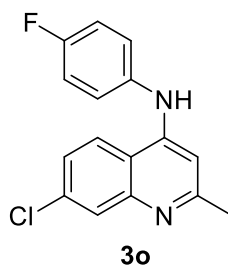
7-chloro-2-methyl-N-phenylquinolin-4-amine (3l). Following **GP2**, using aniline (145 mg, 1.56 mmol), the title compound was obtained (80 mg, 58% yield) as a yellowish-brown solid. TLC: $R_f = 0.78$ (DCM:MeOH = 40:1). Melting point: 172.8-173.2 °C. ^1H NMR (600 MHz, CDCl_3) δ 7.99 (d, $J = 9.0$ Hz, 1H), 7.84 (d, $J = 1.8$ Hz, 1H), 7.42-7.39 (m, 2H), 7.31-7.29 (m, 3H), 7.23-7.20 (m, 1H), 6.77 (s, 1H), 2.50 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 159.6, 149.6, 147.3, 139.1, 136.4, 129.9, 125.9, 125.7, 125.5, 123.5, 122.4, 116.5, 102.2, 24.4. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{14}\text{ClN}_2$ 269.0840 (^{35}Cl), 271.0811 (^{37}Cl); Found 269.0836, 271.0807.



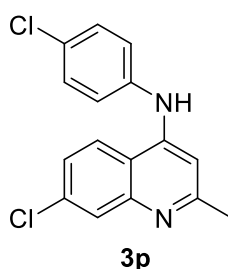
7-chloro-2-methyl-N-(p-tolyl)quinolin-4-amine (3m). Following **GP1**, using p-toluidine (167 mg, 1.56 mmol), the title compound was obtained (101 mg, 69% yield) as a pale yellow solid. TLC: $R_f = 0.77$ (DCM:MeOH = 20:1). Melting point: 192.9-193.0 °C. ^1H NMR (600 MHz, CDCl_3) δ 7.94 (d, $J = 2.4$ Hz, 1H), 7.79 (d, $J = 9.04$ Hz, 1H), 7.38 (dd, $J = 9.0, 2.4$ Hz, 1H), 7.25-7.24 (m, 2H, AA' of AA'BB'), 7.19-7.17 (m, 2H, BB' of AA'BB'), 6.75 (s, 1H), 6.51 (br s, 1H), 2.53 (s, 3H), 2.40 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 161.0, 149.6, 148.3, 136.9, 135.4, 135.1, 130.5, 128.4, 125.3, 123.7, 121.0, 116.6, 102.3, 25.7, 21.1. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{17}\text{H}_{16}\text{ClN}_2$ 283.0997 (^{35}Cl), 285.0967 (^{37}Cl); Found 283.0997, 285.0967.



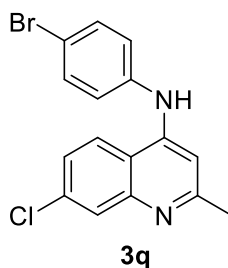
7-chloro-N-(4-methoxyphenyl)-2-methylquinolin-4-amine (3n). Following **GP1**, using 4-methoxyaniline (192 mg, 1.56 mmol), the title compound was obtained (83 mg, 54% yield) as a yellow solid. TLC: $R_f = 0.53$ (PE:EA = 3:1). Melting point: 170.1-170.7 °C. ^1H NMR (600 MHz, CDCl_3) δ 8.07 (d, $J = 9.0$ Hz, 1H), 7.78 (d, $J = 1.8$ Hz, 1H), 7.31-7.28 (m, 3H), 7.00-6.99 (m, 2H, BB' of AA'BB'), 6.48 (s, 1H), 3.86 (s, 3H), 2.52 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 158.5, 157.5, 152.3, 137.6, 130.5, 126.5, 126.1, 123.3, 115.3, 100.9, 55.7, 32.1, 29.8, 22.9, 14.3. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{17}\text{H}_{16}\text{ClN}_2\text{O}$ 299.0946 (^{35}Cl), 301.0916 (^{37}Cl); Found 299.0944, 301.0915.



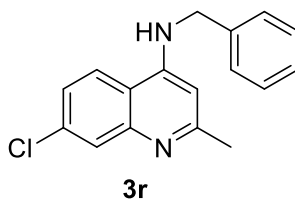
7-chloro-N-(4-fluorophenyl)-2-methylquinolin-4-amine (3o). Following **GP2**, using 4-fluoroaniline (173 mg, 1.56 mmol), the title compound was obtained (48 mg, 17% yield) as a brown solid. TLC: $R_f = 0.43$ (DCM:MeOH = 20:1). Melting point: 185.4-185.6 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.93 (d, $J = 2.0$ Hz, 1H), 7.80 (d, $J = 8.8$, 1H), 7.35 (dd, $J = 8.8, 2.4$ Hz, 1H), 7.27-7.23 (m, 2H, AA' of AA'BB'), 7.14-7.10 (m, 2H, BB' of AA'BB'), 6.69 (s, 1H), 6.64 (s, 1H), 2.52 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 161.0, 160.3 (d, $J = 244.9$ Hz), 149.5, 148.5, 135.5 (d, $J = 3.0$ Hz), 135.46, 128.3, 125.8 (d, $J = 8.2$ Hz), 125.4, 121.1, 116.7 (d, $J = 22.7$ Hz), 116.5, 102.3, 25.7. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{13}\text{ClFN}_2$ 287.0746 (^{35}Cl), 289.0716 (^{37}Cl); Found 287.0743, 289.0716.



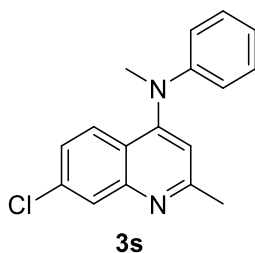
7-chloro-N-(4-chlorophenyl)-2-methylquinolin-4-amine (3p). Following **GP1**, using 4-chloroaniline (199 mg, 1.56 mmol), the title compound was obtained (25 mg, 16% yield) as a yellow solid. TLC: $R_f = 0.65$ (PE:EA = 1:1). Melting point: 193.6-193.9 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.95 (d, $J = 1.2$ Hz, 1H), 7.80 (d, $J = 6.0$ Hz, 1H), 7.39-7.36 (m, 3H, AA' of AA'BB'), 7.22-7.21 (m, 2H, BB' of AA'BB'), 6.79 (s, 1H), 2.55 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 161.0, 149.6, 147.5, 138.5, 135.6, 130.03, 130.00, 128.4, 125.6, 124.2, 121.2, 116.8, 103.1, 25.7. HRMS (+ESI-TOF) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{13}\text{Cl}_2\text{N}_2$ 303.0450 ($^{35}\text{Cl}^{35}\text{Cl}$), 305.0421 ($^{35}\text{Cl}^{37}\text{Cl}$) or 307.0391 ($^{37}\text{Cl}^{37}\text{Cl}$); found 303.0448, 305.0421 or 307.0391.



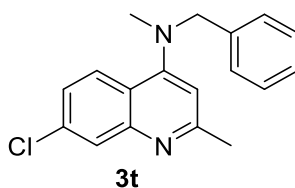
***N*-(4-bromophenyl)-7-chloro-2-methylquinolin-4-amine (3q).** Following **GP2**, using 4-bromoaniline (268 mg, 1.56 mmol), the title compound was obtained (23 mg, 13% yield) as a yellow solid. TLC: $R_f = 0.65$ (PE:EA = 1:1). Melting point: 195.97-196.67 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.96 (d, $J = 1.6$ Hz, 1H), 7.79 (d, $J = 6.0$ Hz, 1H), 7.54-7.53 (m, 2H, AA' of AA'BB'), 7.39 (dd, $J = 6.0, 2.4$ Hz, 1H), 7.17-7.15 (m, 2H, BB' of AA'BB'), 6.83 (s, 1H), 2.56 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 161.0, 149.7, 147.3, 139.0, 135.6, 133.0, 128.5, 125.7, 124.3, 121.1, 117.5, 116.9, 103.3, 25.8. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{16}\text{H}_{13}\text{BrClN}_2$ 346.9945 ($^{35}\text{Cl}^{79}\text{Br}$), 348.9925 ($^{37}\text{Cl}^{79}\text{Br}$) or ($^{35}\text{Cl}^{81}\text{Br}$) or 350.9895 ($^{37}\text{Cl}^{81}\text{Br}$); found 346.9943, 348.9923 or 350.9893.



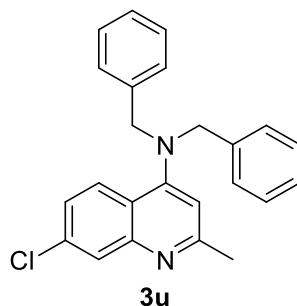
***N*-benzyl-7-chloro-2-methylquinolin-4-amine (3r).** Following **GP2**, using phenylmethanamine (167 mg, 1.56 mmol), the title compound was obtained (64 mg, 43% yield) as a yellow solid. TLC: $R_f = 0.52$ (PE:EA = 3:1). Melting point: 162.5-163.0 °C. ^1H NMR (600 MHz, CDCl_3) δ 7.91 (d, $J = 1.8$ Hz, 1H), 7.63 (d, $J = 8.4$ Hz, 1H), 7.37-7.40 (m, 4H), 7.33-7.36 (m, 1H), 7.29 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.36 (s, 1H), 5.31 (s, 1H), 4.50 (d, $J = 4.8$ Hz, 2H), 2.57 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 161.0, 149.6, 149.0, 137.5, 135.1, 129.1, 128.2, 128.1, 127.8, 124.8, 120.9, 115.9, 99.9, 47.7, 25.8. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{17}\text{H}_{16}\text{ClN}_2$ 283.0997 (^{35}Cl), 285.0967 (^{37}Cl); Found 283.0996, 285.0966.



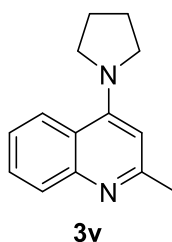
7-chloro-N,2-dimethyl-N-phenylquinolin-4-amine (3s). Following **GP2**, using N-methylaniline (167 mg, 1.56 mmol), the title compound was obtained (84 mg, 58% yield) as a brown solid. TLC: $R_f = 0.55$ (PE:EA = 3:1). Melting point: 149.1-149.3 °C. $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.97 (d, $J = 1.8$ Hz, 1H), 7.54 (d, $J = 9.0$ Hz, 1H), 7.25-7.22 (m, 2H), 7.16 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.99 (s, 1H), 6.98-6.96 (m, 1H), 6.87-6.86 (m, 2H), 3.44 (s, 3H), 2.70 (s, 3H). $^{13}\text{C NMR}$ (150 MHz, CDCl_3) δ 161.2, 153.8, 150.4, 149.8, 135.1, 129.5, 128.2, 126.1, 125.7, 122.1, 121.2, 119.8, 114.7, 42.1, 25.7. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{17}\text{H}_{16}\text{ClN}_2$ 283.0997 (^{35}Cl), 285.0967 (^{37}Cl); Found 283.0995, 285.0965.



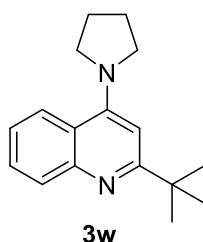
N-benzyl-7-chloro-N,2-dimethylquinolin-4-amine (3t). Following **GP1**, using N-methyl-1-phenylmethanamine (189 mg, 1.56 mmol), the title compound was obtained (92 mg, 59% yield) as a brown solid. TLC: $R_f = 0.52$ (PE:EA = 3:1). Melting point: 149.4-149.7 °C. $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.97 (d, $J = 2.4$ Hz, 1H), 7.94 (d, $J = 9.0$ Hz, 1H), 7.41-7.36 (m, 4H), 7.34-7.31 (m, 1H), 7.29 (dd, $J = 9.0, 2.4$ Hz, 1H), 6.71 (s, 1H), 4.47 (s, 2H), 2.88 (s, 3H), 2.65 (s, 3H). $^{13}\text{C NMR}$ (150 MHz, CDCl_3) δ 160.5, 157.3, 150.2, 137.4, 135.0, 128.9, 128.2, 127.7, 127.6, 125.2, 125.1, 120.2, 109.3, 60.5, 40.3, 25.7. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{18}\text{H}_{18}\text{ClN}_2$ 297.1153 (^{35}Cl), 299.1124 (^{37}Cl); Found 297.1152, 299.1124.



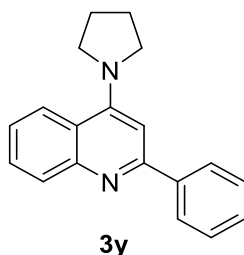
***N,N*-dibenzyl-7-chloro-2-methylquinolin-4-amine (3u)**. Following **GP2**, using dibenzylamine (308 mg, 1.56 mmol), the title compound was obtained (82 mg, 43% yield) as a brown oil. TLC: $R_f = 0.72$ (PE:EA = 1:1). ^1H NMR (600 MHz, CDCl_3) δ 8.14 (d, $J = 9.0$ Hz, 1H), 7.99 (d, $J = 1.8$ Hz, 1H), 7.37 (dd, $J = 9.0, 1.8$ Hz, 1H), 7.32-7.27 (m, 5H), 7.25-7.21 (m, 5H), 6.60 (s, 1H), 4.43 (s, 4H), 2.55 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 160.4, 155.7, 150.3, 137.0, 135.1, 128.7, 128.4, 128.1, 127.6, 125.6, 125.1, 120.9, 112.4, 56.5, 25.7. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{24}\text{H}_{22}\text{ClN}_2$ 373.1466 (^{35}Cl), 375.1437 (^{37}Cl); Found 373.1466, 375.1433.



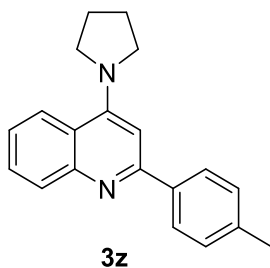
2-methyl-4-(pyrrolidin-1-yl)quinoline (3v). Following **GP2**, using pyrrolidine (134 mg, 1.89 mmol), the title compound was obtained (110 mg, 83% yield) as a brown solid. TLC: $R_f = 0.28$ (PE:EA = 1:1). Melting point: 165.5-165.8 °C. ^1H NMR (600 MHz, CDCl_3) δ 8.29 (d, $J = 9.6$ Hz, 1H), 8.00 (d, $J = 8.4$ Hz, 1H), 7.70-7.67 (m, 1H), 7.47-7.44 (m, 1H), 6.34 (s, 1H), 3.92-3.90 (m, 4H), 2.64 (s, 3H), 2.17-2.15 (m, 4H). ^{13}C NMR (150 MHz, CDCl_3) δ 155.7, 152.4, 140.3, 132.9, 126.0, 125.2, 120.9, 117.3, 102.0, 53.6, 25.8, 20.3. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{17}\text{N}_2$ 213.1386; Found 213.1385.



2-(*tert*-butyl)-4-(pyrrolidin-1-yl)quinoline (3w). Following **GP1**, using pyrrolidine (107 mg, 1.50 mmol), the title compound was obtained (45 mg, 35% yield) as a yellow oil. TLC: $R_f = 0.24$ (DCM:MeOH = 40:1). ^1H NMR (600 MHz, CDCl_3) δ 8.41 (d, $J = 9.0$ Hz, 1H), 8.29 (d, $J = 9.0$ Hz, 1H), 7.72 (t, $J = 7.8$ Hz, 1H), 7.47 (t, $J = 7.8$ Hz, 1H), 6.44 (s, 1H), 3.96 (s, 4H), 2.20-2.18 (m, 4H), 1.51 (s, 9H). ^{13}C NMR (150 MHz, CDCl_3) δ 163.0, 156.2, 140.7, 133.2, 125.7, 125.4, 121.9, 121.5, 119.7, 117.0, 98.2, 36.7, 29.2. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{17}\text{H}_{23}\text{N}_2$ 255.1856, 257.1923; Found 255.1853, 257.1917.

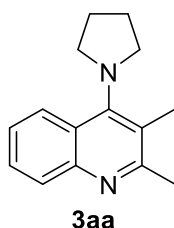


2-phenyl-4-(pyrrolidin-1-yl)quinoline (3y). Following **GP2**, using pyrrolidine (134 mg, 1.56 mmol), the title compound was obtained (75 mg, 60% yield) as a yellow oil. The spectroscopic data are consistent with previously reported.⁴ TLC: $R_f = 0.81$ (DCM:MeOH = 40:1). ^1H NMR (600 MHz, CDCl_3) δ 8.23 (d, $J = 7.4, 1.2$ Hz, 1H), 8.08-8.05 (m, 3H), 7.62-7.59 (m, 1H), 7.50-7.47 (m, 2H), 7.44-7.41 (m, 1H), 7.34-7.32 (m, 1H), 6.90 (s, 1H), 3.77-3.75 (m, 4H), 2.09-2.05 (m, 4H).

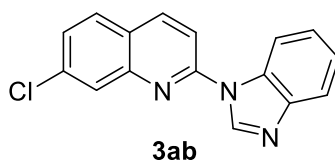


4-(pyrrolidin-1-yl)-2-(*p*-tolyl)quinoline (3z). Following **GP2**, using pyrrolidine (92 mg, 1.29 mmol), the title compound was obtained (85 mg, 68% yield) as a yellow oil. TLC: $R_f = 0.78$ (PE:EA

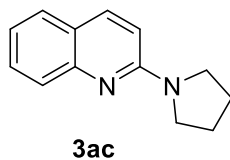
= 1:1). Melting point: 119.8-119.9 °C. ¹H NMR (400 MHz, CDCl₃) δ 8.22-8.20 (m, 1H), 8.15-8.12 (m, 1H), 7.80-7.78 (m, 2H, AA' of AA'BB'), 7.60-7.56 (m, 1H), 7.38-7.34 (m, 1H), 7.22-7.20 (m, 2H, BB' of AA'BB'), 6.64 (s, 1H), 3.86-3.83 (m, 4H), 2.30 (s, 3H), 2.12-2.09 (m, 4H). ¹³C NMR (100 MHz, CDCl₃) δ 154.8, 153.0, 143.4, 141.5, 131.63, 131.55, 129.9, 127.7, 125.7, 124.6, 123.8, 118.2, 100.2, 53.3, 25.8, 21.5. HRMS (+ESI-TOF) m/z: [M+H]⁺ calcd for C₂₀H₂₁N₂ 289.1699; Found 289.1699.



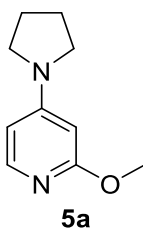
2,3-dimethyl-4-(pyrrolidin-1-yl)quinoline (3aa). Following **GP1**, using pyrrolidine (123 mg, 1.73 mmol), the title compound was obtained (75 mg, 57% yield) as a brown oil. TLC: R_f = 0.34 (DCM:MeOH = 40:1). ¹H NMR (600 MHz, CDCl₃) δ 8.0 (d, *J* = 9.6 Hz, 1H), 7.94 (d, *J* = 9.6 Hz, 1H), 7.59-7.56 (m, 1H), 7.43-7.40 (m, 1H), 3.46-3.42 (m, 4H), 2.68 (s, 3H), 2.33 (s, 3H), 2.15-2.13 (m, 4H). ¹³C NMR (150 MHz, CDCl₃) δ 171.7, 159.9, 151.7, 147.1, 128.6, 128.4, 126.4, 125.0, 124.0, 52.1, 26.7, 24.3, 15.2. HRMS (+ESI-TOF) m/z: [M+H]⁺ calcd for C₁₅H₁₉N₂ 227.1543; Found 227.1541.



4-(1H-benzo[d]imidazol-1-yl)-7-chloroquinoline (3ab). Following **GP2**, using 1H-benzo[d]imidazole (185 mg, 1.56 mmol), the title compound was obtained (129 mg, 85% yield) as a brown oil. TLC: R_f = 0.78 (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 8.20 (s, 2H), 7.87-7.85 (m, 2H), 7.82-7.80 (m, 2H), 7.49-7.47 (m, 4H). ¹³C NMR (150 MHz, CDCl₃) δ 143.8, 141.0, 131.1, 128.9, 128.6, 127.7, 127.5, 127.0, 126.4, 124.2, 124.1, 121.8, 121.0, 117.8, 114.5, 112.9. HRMS (+ESI-TOF) m/z: [M+H]⁺ calcd for C₁₆H₁₁ClN₃ 280.0636 (³⁵Cl), 282.0607 (³⁷Cl); Found 280.0633, 282.0603.



2-(pyrrolidin-1-yl)quinoline (3ac). Following **GP1**, using pyrrolidine (111 mg, 1.56 mmol), the title compound was obtained (45 mg, 30% yield) as a yellow oil. The spectroscopic data are consistent with previously reported.⁵ TLC: $R_f = 0.53$ (PE:EA = 1:1). ¹H NMR (600 MHz, CDCl₃) δ 7.84 (d, $J = 9.0$ Hz, 1H), 7.73 (d, $J = 8.4$ Hz, 1H), 7.58-7.57 (m, 1H), 7.53-7.50 (m, 1H), 7.18-7.15 (m, 1H), 6.73-6.71 (m, 1H), 3.64-3.62 (m, 4H), 2.05-2.03 (m, 4H).

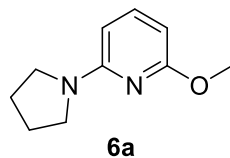


2-methoxy-4-(pyrrolidin-1-yl)pyridine (5a). Following **GP1**, using pyrrolidine (171 mg, 2.40 mmol), the title compound was obtained (73 mg, 51% yield) as a yellow oil. The spectroscopic data are consistent with previously reported.⁶ TLC: $R_f = 0.81$ (DCM:MeOH = 20:1). ¹H NMR (600 MHz, CDCl₃) δ 7.83 (d, $J = 6.0$ Hz, 1H), 6.13 (dd, $J = 6.0, 2.4$ Hz, 1H), 5.76 (d, $J = 1.8$ Hz, 1H), 3.89 (s, 3H), 3.29-3.27 (m, 4H), 2.01-1.99 (m, 4H).

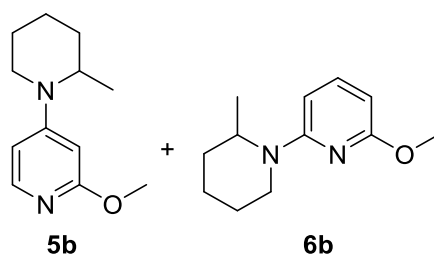
Gram scale synthesis:

To a 15 mL pressure tube equipped with a magnetic stir bar were added 2-methoxypyridine *N*-oxide (1.0 g, 7.99 mmol) and anhydrous ethyl acetate (11 mL), followed by pyrrolidine (1.7 g, 23.97 mmol) and *N,N*-diisopropylethylamine (DIEA) (2.07 g, 15.98 mmol). The resulting solution was cooled to 0 °C, and trifluoromethanesulfonic anhydride (Tf₂O) (6.76 g, 23.97 mmol) was added dropwise slowly. The reaction mixture was then warmed to room temperature and stirred until completion as monitored by TLC. The reaction was quenched with saturated ammonium chloride solution (30 mL), and the organic phase was separated. The aqueous phase was extracted once with ethyl acetate (30 mL*5). The combined organic phases were dried over sodium sulfate and concentrated under reduced

pressure to afford the crude product. Purification by flash column chromatography (PE:EA = 10:1-1:1~DCM:MeOH = 60:1-20:1) gave the desired pure product (754 mg, 53% yield).

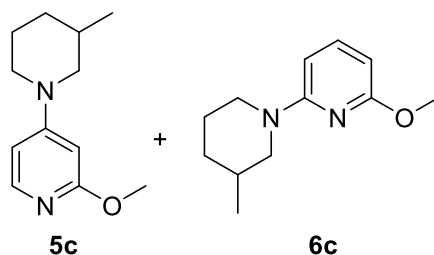


2-methoxy-6-(pyrrolidin-1-yl)pyridine (6a). Following **GP2**, using pyrrolidine (170 mg, 2.39 mmol), the title compound was obtained (102 mg, 72% yield) as a yellow oil. The spectroscopic data are consistent with previously reported.⁷ TLC: $R_f = 0.83$ (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 7.35 (t, $J = 8.0$ Hz, 1H), 5.95 (d, $J = 8.0$ Hz, 1H), 5.88 (d, $J = 8.0$ Hz, 1H), 3.87 (s, 3H), 3.46-3.42 (m, 4H), 1.99-1.96 (m, 4H).



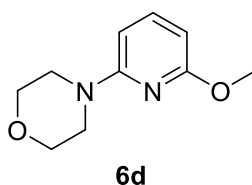
2-methoxy-4-(2-methylpiperidin-1-yl)pyridine (5b). Following **GP1**, using 2-methylpiperidine (238 mg, 2.40 mmol), the title compound (**5b**) was obtained (74 mg, 45% yield) as a brown oil. Additionally, **6b** was isolated (53 mg, 32% yield) as a brown oil. TLC(**5b**): $R_f = 0.52$ (DCM:MeOH = 60:1). ¹H NMR (400 MHz, CDCl₃) δ 7.83 (d, $J = 6.6$ Hz, 1H), 6.36 (dd, $J = 4.0, 1.6$ Hz, 1H), 5.99 (d, $J = 1.6$ Hz, 1H), 4.15-4.13 (m, 1H), 3.87 (s, 3H), 3.54-3.51 (m, 1H), 2.92-2.87 (m, 1H), 1.78-1.73 (m, 2H), 1.65-1.59 (m, 3H), 1.55-1.50 (m, 1H), 1.10 (d, $J = 4.8$ Hz, 3H). ¹³C NMR (100 MHz, CDCl₃) δ 166.1, 157.3, 146.94, 104.1, 92.5, 53.3, 48.5, 40.9, 30.5, 25.5, 18.6, 13.5. HRMS (+ESI-TOF) m/z : $[M+H]^+$ Calcd for C₁₂H₁₉N₂O 207.1492; found 207.1492.

2-methoxy-6-(2-methylpiperidin-1-yl)pyridine (6b). The spectroscopic data are consistent with previously reported.⁸ TLC: $R_f = 0.34$ (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 7.36 (t, $J = 8.0$ Hz, 1H), 6.12 (d, $J = 8.0$ Hz, 1H), 5.98 (d, $J = 7.6$ Hz, 1H), 4.66-4.61 (m, 1H), 3.86 (s, 3H), 2.91-2.86 (m, 1H), 1.79-1.51 (m, 7H), 1.12 (d, $J = 4.8$ Hz, 3H).

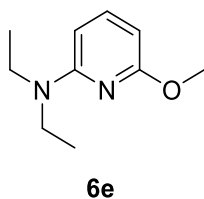


2-methoxy-4-(3-methylpiperidin-1-yl)pyridine (5c). Following **GP1**, using 3-methylpiperidine (238 mg, 2.40 mmol), the title compound was obtained (58 mg, 35% yield) as a colorless oil. Additionally, **6c** was isolated (54 mg, 38% yield) as a brown oil. The spectroscopic data are consistent with previously reported.⁹ TLC(**5c**): $R_f = 0.34$ (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 7.84 (d, $J = 6.4$ Hz, 1H), 6.37 (dd, $J = 6.4, 2.4$ Hz, 1H), 6.02 (d, $J = 2.4$ Hz, 1H), 3.88 (s, 3H), 3.75-3.64 (m, 2H), 2.79-2.72 (m, 1H), 2.48-2.42 (m, 1H), 1.84-1.78 (m, 1H), 1.71-1.52 (m, 3H), 1.16-1.06 (m, 1H), 0.92 (d, $J = 6.8$ Hz, 3H).

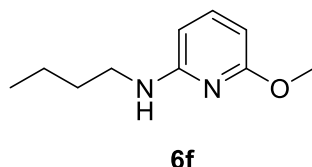
2-methoxy-6-(3-methylpiperidin-1-yl)pyridine (6c). TLC: $R_f = 0.98$ (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 7.33 (t, $J = 7.8$ Hz, 1H), 6.14 (d, $J = 8.4$ Hz, 1H), 5.96 (d, $J = 7.8$ Hz, 1H), 3.83 (s, 3H), 1.62-1.54 (m, 8H), 0.91 (s, 3H), 0.90 (s, 3H). ¹³C NMR (100 MHz, CDCl₃) δ 140.1, 98.3, 97.0, 53.3, 53.1, 45.9, 33.6, 30.74, 25.1, 19.6. HRMS (+ESI-TOF) m/z : [M+H]⁺ Calcd for C₁₂H₁₉N₂O 207.1492; found 207.1492.



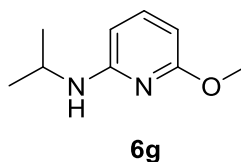
4-(6-methoxypyridin-2-yl)morpholine (6d). Following **GP2**, using morpholine (209 mg, 2.40 mmol), the title compound was obtained (50 mg, 32% yield) as a yellow solid. The spectroscopic data are consistent with previously reported.¹⁰ TLC: $R_f = 0.43$ (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 7.42 (t, $J = 8.4$ Hz, 1H), 6.14-6.11 (m, 2H), 3.86 (s, 3H), 3.82-3.81 (m, 4H), 3.49-3.47 (m, 4H).



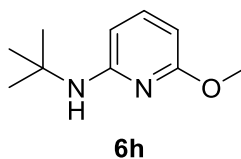
***N,N*-diethyl-6-methoxypyridin-2-amine (6e)**. Following **GP2**, using diethylamine (176 mg, 2.40 mmol), the title compound was obtained (59 mg, 41% yield) as a colorless oil. The spectroscopic data are consistent with previously reported.¹¹ TLC: $R_f = 0.92$ (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 7.33 (t, $J = 7.8$ Hz, 1H), 5.99 (d, $J = 7.8$ Hz, 1H), 5.94 (d, $J = 7.8$ Hz, 1H), 3.86 (s, 3H), 3.49 (q, $J = 7.2$ Hz, 4H), 1.18 (t, $J = 7.2$ Hz, 6H).



***N*-butyl-6-methoxypyridin-2-amine (6f)**. Following **GP2**, using butan-1-amine (176 mg, 2.40 mmol), the title compound was obtained (40 mg, 28% yield) as a light yellow oil. The spectroscopic data are consistent with previously reported.¹² TLC: $R_f = 0.81$ (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 7.34 (t, $J = 7.8$ Hz, 1H), 6.01 (d, $J = 7.8$ Hz, 1H), 5.92 (d, $J = 7.8$ Hz, 1H), 3.84 (s, 3H), 3.33 (t, $J = 9.0$ Hz, 2H), 1.62-1.58 (m, 2H), 1.44-1.41 (m, 2H), 0.95 (t, $J = 7.2$ Hz, 3H).

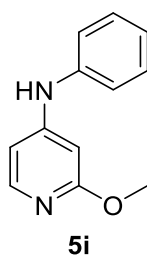


***N*-isopropyl-6-methoxypyridin-2-amine (6g)**. Following **GP1**, using propan-2-amine (142 mg, 2.40 mmol), the title compound was obtained (56 mg, 42% yield) as a yellow oil. TLC: $R_f = 0.52$ (DCM:MeOH = 60:1). ¹H NMR (400 MHz, CDCl₃) δ 7.33 (t, $J = 7.6$ Hz, 1H), 5.99 (d, $J = 7.6$ Hz, 1H), 5.90 (d, $J = 8.0$ Hz, 1H), 4.22 (s, 1H), 3.90-3.86 (m, 1H), 3.84 (s, 3H), 1.23 (d, $J = 6.4$ Hz, 6H). ¹³C NMR (100 MHz, CDCl₃) δ 163.8, 157.3, 140.1, 97.9, 97.0, 53.2, 43.3, 23.2. HRMS (+ESI-TOF) m/z : [M+H]⁺ Calcd for C₉H₁₅N₂O 167.1179; found 167.1179.

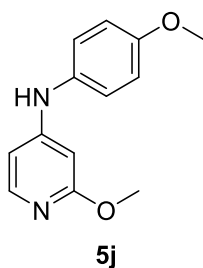


***N*-(*tert*-butyl)-6-methoxypyridin-2-amine (6h)**. Following **GP2**, using 2-methylpropan-2-amine (176 mg, 2.40 mmol), the title compound was obtained (84 mg, 58% yield) as a brown oil. TLC: $R_f =$

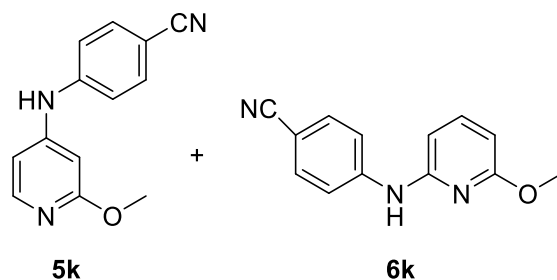
0.71 (PE:EA = 10:1). ^1H NMR (400 MHz, CDCl_3) δ 7.26 (t, $J = 8.0$ Hz, 1H), 5.97 (d, $J = 8.0$ Hz, 1H), 5.93 (d, $J = 8.0$ Hz, 1H), 4.30 (s, 1H), 3.85 (s, 3H), 1.44 (s, 9H). ^{13}C NMR (100 MHz, CDCl_3) δ 163.4, 157.4, 139.5, 100.3, 96.7, 53.4, 51.0, 29.7. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{10}\text{H}_{17}\text{N}_2\text{O}$ 181.1335; found 181.1337.



2-methoxy-N-phenylpyridin-4-amine (5i). Following **GP2**, using aniline (225 mg, 2.40 mmol), the title compound was obtained (61 mg, 38% yield) as a brown oil. TLC: $R_f = 0.64$ (DCM:MeOH = 60:1). ^1H NMR (400 MHz, CDCl_3) δ 8.95 (s, 1H), 7.62 (s, 1H), 7.35-7.30 (m, 2H), 7.26-7.21 (m, 2H), 6.66-6.50 (m, 2H), 3.87 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 140.9, 134.2, 129.6, 127.5, 123.8, 121.1, 118.9, 112.9, 110.3, 53.9. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{12}\text{H}_{13}\text{N}_2\text{O}$ 201.1022; found 201.1023.

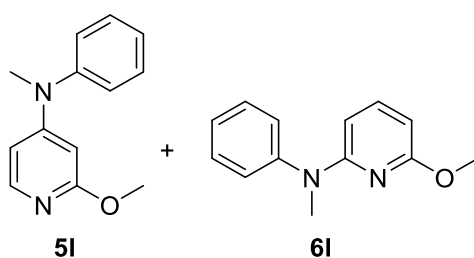


2-methoxy-N-(4-methoxyphenyl)pyridin-4-amine (5j). Following **GP1**, using 4-methoxyaniline (296 mg, 2.40 mmol), the title compound was obtained (70 mg, 38% yield) as a white solid. TLC: $R_f = 0.38$ (DCM:MeOH = 60:1). Melting point: 123.4-123.8 $^\circ\text{C}$. ^1H NMR (600 MHz, CDCl_3) δ 7.83 (d, $J = 6.0$ Hz, 1H), 7.11-7.08 (m, 2H, AA' of AA'BB'), 6.89-6.86 (m, 2H, BB' of AA'BB'), 6.31 (dd, $J = 6.0, 2.4$ Hz, 1H), 6.08 (d, $J = 1.8$ Hz, 1H), 3.86 (s, 3H), 3.79 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 165.9, 157.1, 154.4, 147.4, 132.6, 125.3, 114.9, 105.1, 92.7, 55.7, 53.4. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}_2$ 231.1128; found 231.1129.



4-((2-methoxypyridin-4-yl)amino)benzonitrile (5k). Following **GP2**, using p-toluidine (284 mg, 2.40 mmol), the title compound was obtained (94 mg, 52% yield) as a white solid. Additionally, **6k** was isolated (41 mg, 23% yield) as a yellow oil. TLC(**5k**): $R_f = 0.25$ (DCM:MeOH = 60:1). Melting point: 135.2-135.7 °C. ^1H NMR (400 MHz, CDCl_3) δ 8.18 (d, $J = 5.4$ Hz, 1H), 7.77-7.75 (m, 2H, AA' of AA'BB'), 7.53-7.50 (m, 2H, BB' of AA'BB'), 6.81 (dd, $J = 5.6, 2.0$ Hz, 1H), 6.64 (d, $J = 2.0$ Hz, 1H), 3.94 (s, 3H), 2.88 (d, $J = 4.8$ Hz, 1H). ^{13}C NMR (100 MHz, CDCl_3) δ 165.6, 148.9, 148.7, 142.1, 134.0, 129.53, 113.8, 113.6, 112.0, 108.1, 54.2. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{13}\text{H}_{12}\text{N}_3\text{O}$ 225.1022; found 225.1016.

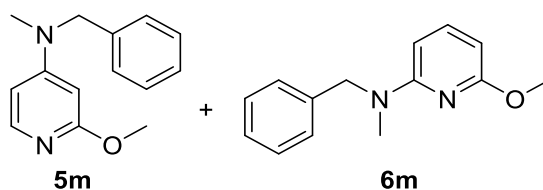
4-((6-methoxypyridin-2-yl)amino)benzonitrile (6k). TLC: $R_f = 0.73$ (PE:EA = 10:1). ^1H NMR (600 MHz, CDCl_3) δ 7.73-7.71 (m, 2H, AA' of AA'BB'), 7.68-7.65 (m, 2H, BB' of AA'BB'), 7.62 (t, $J = 7.8$ Hz, 1H), 6.83 (d, $J = 7.8$ Hz, 2H), 6.76 (d, $J = 8.4$ Hz, 1H), 3.88 (s, 3H). ^{13}C NMR (150 MHz, CDCl_3) δ 163.8, 149.2, 142.3, 141.1, 133.5, 130.0, 117.8, 113.6, 113.3, 111.5, 54.1. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{13}\text{H}_{12}\text{N}_3\text{O}$ 225.1022.



2-methoxy-N-methyl-N-phenylpyridin-4-amine (5l). Following **GP2**, using N-methylaniline (258 mg, 2.40 mmol), the title compound was obtained (96 mg, 56% yield) as a brown oil. Additionally, **6l** was isolated (38 mg, 22% yield) as a colorless oil. TLC(**5l**): $R_f = 0.42$ (DCM:MeOH = 60:1). ^1H NMR (600 MHz, CDCl_3) δ 7.79 (d, $J = 6.0$ Hz, 1H), 7.42-7.38 (m, 2H), 7.26-7.23 (m, 1H), 7.21-7.19 (m, 2H), 6.23 (dd, $J = 6.6, 2.4$ Hz, 1H), 5.98 (d, $J = 1.8$ Hz, 1H), 3.88 (s, 3H), 3.29 (s, 3H). ^{13}C NMR

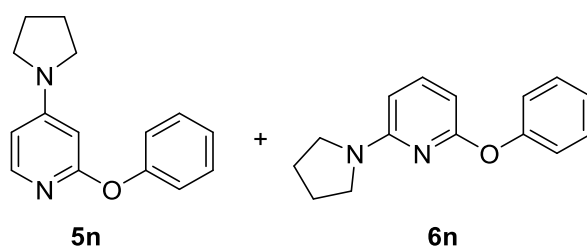
(150 MHz, CDCl₃) δ 165.7, 156.5, 146.7, 146.6, 130.0, 126.9, 126.3, 104.6, 92.7, 53.4, 39.7. HRMS (+ESI-TOF) m/z: [M+H]⁺ Calcd for C₁₃H₁₅N₂O 215.1179; found 215.1179.

6-methoxy-N-methyl-N-phenylpyridin-2-amine (6l). The spectroscopic data are consistent with previously reported.¹³ TLC: R_f = 0.88 (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 7.65 (d, *J* = 7.2 Hz, 1H), 7.48 (t, *J* = 7.8 Hz, 2H), 7.38 (t, *J* = 7.8 Hz, 1H), 7.19-7.18 (m, 2H), 6.27-6.26 (m, 1H), 6.07 (s, 1H), 3.96 (s, 3H), 3.47 (s, 3H).



N-benzyl-2-methoxy-N-methylpyridin-4-amine (5m). Following GP2, using N-methyl-1-phenylmethanamine (290 mg, 2.40 mmol), the title compound was obtained (100 mg, 55% yield) as a brown oil. Additionally, **6m** was isolated (58 mg, 32% yield) as a yellow solid. TLC(**5m**): R_f = 0.62 (DCM:MeOH = 40:1). ¹H NMR (600 MHz, CDCl₃) δ 7.84 (d, *J* = 6.0 Hz, 1H), 7.32 (t, *J* = 7.8 Hz, 2H), 7.26-7.24 (m, 1H), 7.16 (d, *J* = 7.2 Hz, 2H), 6.29 (dd, *J* = 6.6, 2.4 Hz, 1H), 5.95 (d, *J* = 1.8 Hz, 1H), 4.55 (s, 2H), 3.88 (s, 3H), 3.04 (s, 3H). ¹³C NMR (150 MHz, CDCl₃) δ 165.9, 156.7, 147.0, 137.6, 128.9, 127.4, 126.6, 103.0, 91.0, 55.4, 53.3, 38.1. HRMS (+ESI-TOF) m/z: [M+H]⁺ Calcd for C₁₄H₁₇N₂O 229.1335; found 229.1335.

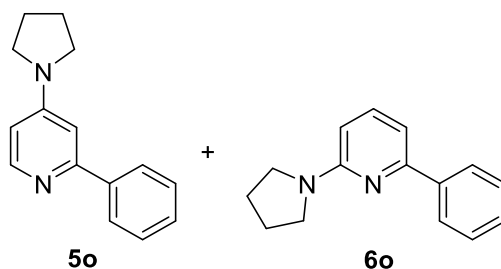
N-benzyl-6-methoxy-N-methylpyridin-2-amine (6m). The spectroscopic data are consistent with previously reported.¹⁴ TLC: R_f = 0.85 (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 7.68 (d, *J* = 7.8 Hz, 1H), 7.33-7.32 (m, 2H), 7.29-7.27 (m, 1H), 7.14-7.13 (m, 2H), 6.48 (dd, *J* = 4.8, 1.6 Hz, 1H), 6.07 (d, *J* = 1.6 Hz, 1H), 4.71 (s, 2H), 3.94 (s, 3H), 3.25 (s, 3H).



2-phenoxy-4-(pyrrolidin-1-yl)pyridine (5n). Following GP1, using pyrrolidine (114 mg, 1.60 mmol), the title compound was obtained (34 mg, 26% yield) as a brown oil. Additionally, **6n** was

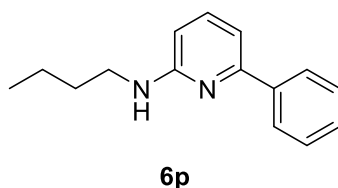
isolated (45 mg, 40% yield) as a colorless oil. TLC(**5n**): $R_f = 0.46$ (DCM:MeOH = 40:1). ^1H NMR (600 MHz, CDCl_3) δ 7.86 (d, $J = 6.0$ Hz, 1H), 7.37-7.34 (m, 2H), 7.15-7.10 (m, 3H), 6.19 (dd, $J = 6.0, 2.4$ Hz, 1H), 5.93 (d, $J = 2.4$ Hz, 1H), 3.30-3.28 (m, 4H), 2.02-2.00 (m, 4H). ^{13}C NMR (150 MHz, CDCl_3) δ 142.7, 140.0, 130.94, 130.0, 127.6, 125.5, 121.4, 105.9, 90.6, 49.5, 48.9. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{15}\text{H}_{17}\text{N}_2\text{O}$ 241.1335; found 241.1336.

2-phenoxy-6-(pyrrolidin-1-yl)pyridine (6n). TLC: $R_f = 0.77$ (PE:EA = 10:1). ^1H NMR (400 MHz, CDCl_3) δ 7.40-7.33 (m, 3H), 7.18-7.13 (m, 3H), 6.02 (d, $J = 8.0$ Hz, 1H), 5.91 (d, $J = 7.6$ Hz, 1H), 3.41-3.37 (m, 4H), 1.98-1.92 (s, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 163.2, 156.7, 154.8, 140.0, 129.4, 124.1, 121.3, 100.4, 95.73, 46.7, 25.5. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{15}\text{H}_{17}\text{N}_2\text{O}$ 241.1335; found 241.1335.

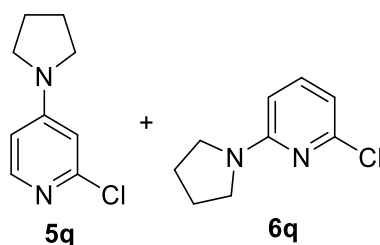


2-phenyl-4-(pyrrolidin-1-yl)pyridine (5o). Following **GP2**, using pyrrolidine (124 mg, 1.75 mmol), the title compound was obtained (48 mg, 38% yield) as a yellow solid. Additionally, **6o** was isolated (31 mg, 23% yield) as a yellow oil. The spectroscopic data are consistent with previously reported.¹⁵ TLC: $R_f = 0.38$ (DCM:MeOH = 40:1). ^1H NMR (400 MHz, $\text{DMSO}-d_6$) δ 8.20 (d, $J = 7.2$ Hz, 1H), 7.91-7.88 (m, 2H), 7.64-7.61 (m, 3H), 7.06 (d, $J = 2.8$ Hz, 1H), 6.84 (dd, $J = 7.2, 2.8$ Hz, 1H), 3.58 (s, 4H), 2.04-2.03 (m, 4H).

2-phenyl-6-(pyrrolidin-1-yl)pyridine (6o). The spectroscopic data are consistent with previously reported.¹⁶ TLC: $R_f = 0.83$ (PE:EA = 10:1). ^1H NMR (400 MHz, CDCl_3) δ 8.06 (d, $J = 7.6$ Hz, 2H), 7.51 (t, $J = 8.0$ Hz, 1H), 7.44 (t, $J = 7.6$ Hz, 2H), 7.38-7.35 (m, 1H), 7.02 (d, $J = 7.2$ Hz, 1H), 6.32 (d, $J = 8.4$ Hz, 1H), 3.58-3.55 (m, 4H), 2.04-2.01 (m, 4H).

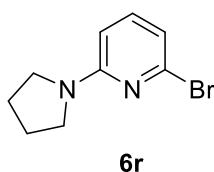


N-butyl-6-phenylpyridin-2-amine (6p). Following **GP1**, using pyrrolidine (165 mg, 2.32 mmol), the title compound was obtained (42 mg, 32% yield) as a yellow solid. The spectroscopic data are consistent with previously reported.¹⁷ TLC: $R_f = 0.72$ (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 8.03-8.00 (m, 2H), 7.83 (t, $J = 8.0$ Hz, 1H), 7.73 (d, $J = 7.6$ Hz, 1H), 7.52-7.46 (m, 3H), 7.38 (d, $J = 7.6$ Hz, 1H), 4.18 (t, $J = 7.6$ Hz, 2H), 1.57-1.50 (m, 2H), 1.40-1.34 (m, 2H), 0.90 (t, $J = 7.6$ Hz, 3H).



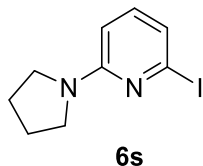
2-chloro-4-(pyrrolidin-1-yl)pyridine (5q). Following **GP2**, using pyrrolidine (165 mg, 2.32 mmol), the title compound was obtained (35 mg, 25% yield) as a yellow solid. Additionally, **6q** was isolated (39 mg, 28% yield) as a yellow solid. The spectroscopic data are consistent with previously reported.¹⁸ TLC(**5q**): $R_f = 0.38$ (DCM:MeOH = 40:1). ¹H NMR (600 MHz, CDCl₃) δ 7.96 (d, $J = 6.0$ Hz, 1H), 6.38 (s, 1H), 6.32 (d, $J = 7.8$ Hz, 1H), 3.33-3.31 (m, 4H), 2.05-2.03 (m, 4H).

2-chloro-6-(pyrrolidin-1-yl)pyridine (6q). The spectroscopic data are consistent with previously reported.¹⁹ TLC: $R_f = 0.52$ (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 7.33-7.27 (m, 1H), 6.47 (d, $J = 7.2$ Hz, 1H), 6.18 (d, $J = 8.4$ Hz, 1H), 3.42 (t, $J = 6.4$ Hz, 4H), 1.99-1.96 (m, 4H).

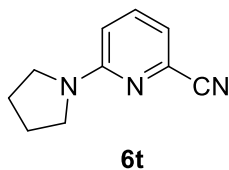


2-bromo-6-(pyrrolidin-1-yl)pyridine (6r). Following **GP1**, using pyrrolidine (122 mg, 1.72 mmol), the title compound was obtained (90 mg, 70% yield) as a white solid. The spectroscopic data are consistent with previously reported.²⁰ TLC: $R_f = 0.78$ (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃)

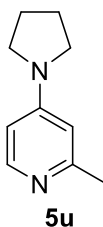
δ 7.22 (t, J = 8.8 Hz, 1H), 6.64 (d, J = 7.2 Hz, 1H), 6.23 (d, J = 8.0 Hz, 1H), 3.45-3.41 (m, 4H), 2.00-1.97 (m, 4H).



2-iodo-6-(pyrrolidin-1-yl)pyridine (6s). Following **GP2**, using pyrrolidine (97 mg, 1.36 mmol), the title compound was obtained (53 mg, 43% yield) as a black oil. TLC: R_f = 0.73 (PE:EA = 10:1). ^1H NMR (400 MHz, CDCl_3) δ 6.98 (t, J = 8.0 Hz, 1H), 6.89 (d, J = 7.6 Hz, 1H), 6.24 (d, J = 8.4 Hz, 1H), 3.42-3.39 (m, 4H), 1.99-1.96 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 157.3, 138.1, 121.4, 117.0, 105.1, 46.9, 25.6. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_9\text{H}_{12}\text{IN}$ 274.1551; found 274.1552.

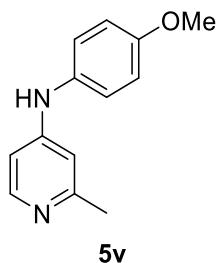


6-(pyrrolidin-1-yl)picolinonitrile (6t). Following **GP2**, using pyrrolidine (178 mg, 2.50 mmol), the title compound was obtained (101 mg, 75% yield) as a white solid. The spectroscopic data are consistent with previously reported.²¹ TLC: R_f = 0.24 (DCM:MeOH = 40:1). ^1H NMR (600 MHz, CDCl_3) δ 7.45-7.42 (m, 1H), 6.87 (d, J = 7.2 Hz, 1H), 6.51 (d, J = 9.0 Hz, 1H), 3.44-3.42 (m, 4H), 2.02-1.99 (m, 4H).

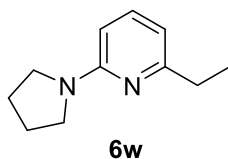


2-methyl-4-(pyrrolidin-1-yl)pyridine (5u). Following **GP2**, using pyrrolidine (196 mg, 2.75 mmol), the title compound was obtained (45 mg, 30% yield) as a white solid. The spectroscopic data are consistent with previously reported.²² TLC: R_f = 0.56 (DCM:MeOH = 20:1). ^1H NMR (600 MHz,

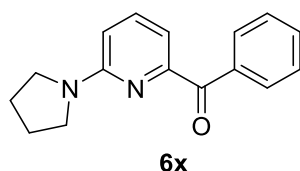
CDCl₃) δ 7.94 (d, J = 7.2 Hz, 1H), 6.53 (dd, J = 7.2, 2.4 Hz, 1H), 6.39 (d, J = 2.4 Hz, 1H), 3.51-3.47 (m, 4H), 2.55 (s, 3H), 2.14-2.12 (m, 4H).



***N*-(4-methoxyphenyl)-2-methylpyridin-4-amine (5v)**. Following **GP1**, using pyrrolidine (196 mg, 2.75 mmol), the title compound was obtained (124 mg, 63% yield) as a yellow solid. The spectroscopic data are consistent with previously reported.²³ TLC: R_f = 0.32 (DCM:MeOH = 60:1). ¹H NMR (400 MHz, CDCl₃) δ 7.99 (d, J = 6.8 Hz, 1H), 7.25 (d, J = 8.8 Hz, 2H), 7.06-7.04 (m, 2H, AA' of AA'BB'), 6.86-6.85 (m, 1H, BB' of AA'BB'), 6.79 (s, 1H), 4.93 (s, 3H), 3.85 (s, 3H), 2.49 (s, 1H).

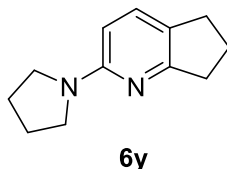


2-ethyl-6-(pyrrolidin-1-yl)pyridine (6w). Following **GP1**, using pyrrolidine (153 mg, 2.16 mmol), the title compound was obtained (42 mg, 24% yield) as a yellow solid. TLC: R_f = 0.62 (PE:EA = 10:1). Melting point: 72.4-72.5 °C. ¹H NMR (600 MHz, CDCl₃) δ 8.00 (d, J = 7.2 Hz, 1H), 6.52 (dd, J = 7.2, 4.2 Hz, 1H), 6.37 (d, J = 2.4 Hz, 1H), 3.51-3.49 (m, 4H), 2.83 (q, J = 7.8 Hz, 2H), 2.15-2.12 (m, 4H), 1.33 (t, J = 7.8 Hz, 3H). ¹³C NMR (100 MHz, CDCl₃) δ 156.1, 139.4, 106.1, 105.3, 48.7, 48.5, 27.0, 25.3, 13.0. HRMS (+ESI-TOF) m/z : [M+H]⁺ Calcd for C₁₁H₁₇N₂ 177.1386; found 177.1386.



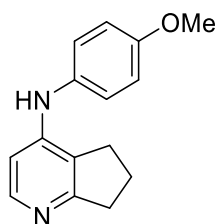
phenyl(6-(pyrrolidin-1-yl)pyridin-2-yl)methanone (6x). Following **GP2**, using pyrrolidine (107 mg, 1.51 mmol), the title compound was obtained (57 mg, 45% yield) as a yellow oil. TLC: R_f = 0.58 (PE:EA = 10:1). ¹H NMR (400 MHz, CDCl₃) δ 7.87 (d, J = 6.0 Hz, 2H), 7.24-7.19 (m, 2H), 7.11 (t, J

= 7.6 Hz, 2H), 6.91 (d, $J = 7.2$ Hz, 1H), 6.17 (d, $J = 8.4$ Hz, 1H), 3.31-3.09 (m, 4H), 1.67-1.63 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 194.4, 156.2, 153.5, 137.5, 137.1, 132.4, 131.3, 127.7, 112.1, 109.3, 46.8, 25.6. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{16}\text{H}_{17}\text{N}_2\text{O}$ 253.1335; found 253.1335.



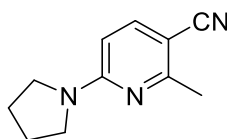
6y

2-(pyrrolidin-1-yl)-6,7-dihydro-5H-cyclopenta[b]pyridine (6y). Following **GP1**, using pyrrolidine (158 mg, 2.22 mmol), the title compound was obtained (42 mg, 30% yield) as a brown solid. TLC: $R_f = 0.83$ (PE:EA = 5:1). Melting point: 83.2-83.4 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.29-7.26 (m, 1H), 6.12 (d, $J = 8.4$ Hz, 1H), 3.46-3.42 (m, 4H), 2.88 (t, $J = 7.6$ Hz, 2H), 2.79 (t, $J = 7.6$ Hz, 2H), 2.08-2.03 (m, 2H), 2.00-1.96 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 133.6, 103.9, 47.2, 34.9, 30.1, 25.7, 23.5. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{12}\text{H}_{17}\text{N}_2$ 189.1386; found 189.1386.



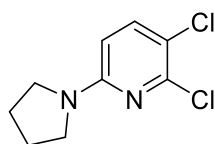
5z

N-(4-methoxyphenyl)-6,7-dihydro-5H-cyclopenta[b]pyridin-4-amine (5z). Following **GP1**, using pyrrolidine (158 mg, 2.22 mmol), the title compound was obtained (94 mg, 53% yield) as a yellow solid. The spectroscopic data are consistent with previously reported.²⁴ TLC: $R_f = 0.83$ (PE:EA = 5:1). ^1H NMR (400 MHz, CDCl_3) δ 8.92 (d, $J = 7.2$ Hz, 1H), 8.27-8.25 (m, 2H, AA' of AA'BB'), 8.06-8.04 (m, 2H, BB' of AA'BB'), 7.71 (d, $J = 6.8$ Hz, 1H), 5.94 (s, 3H), 4.12 (t, $J = 7.6$ Hz, 2H), 3.95 (t, $J = 7.6$ Hz, 2H), 3.35-3.27 (m, 2H).



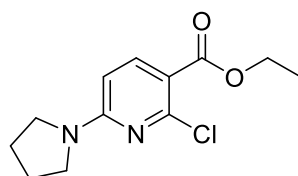
6aa

2-methyl-6-(pyrrolidin-1-yl)nicotinonitrile (6aa). Following **GP1**, using pyrrolidine (159 mg, 2.24 mmol), the title compound was obtained (75 mg, 53% yield) as a yellow solid. TLC: R_f = 0.38 (PE:EA = 10:1). Melting point: 90.6-91.1 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.49 (d, J = 8.4 Hz, 1H), 6.16 (d, J = 8.4 Hz, 1H), 3.48 (s, 4H), 2.55 (s, 3H), 2.02-1.99 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 162.2, 157.4, 140.0, 119.84, 103.7, 94.0, 46.9, 25.5, 23.9. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ Calcd for $\text{C}_{11}\text{H}_{14}\text{N}_3$ 188.1182; found 188.1182.



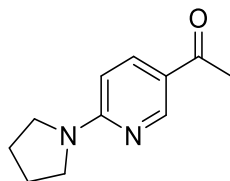
6ab

2,3-dichloro-6-(pyrrolidin-1-yl)pyridine (6ab). Following **GP1**, using pyrrolidine (218 mg, 3.06 mmol), the title compound was obtained (48 mg, 36% yield) as a brown solid. TLC: R_f = 0.66 (PE:EA = 1:1). Melting point: 78.0-78.2 °C. ^1H NMR (400 MHz, CDCl_3) δ 7.40 (d, J = 8.8 Hz, 1H), 6.19 (d, J = 8.4 Hz, 1H), 3.43-3.39 (m, 4H), 2.01-1.98 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 155.3, 142.8, 139.2, 115.1, 105.9, 47.1, 25.6. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_9\text{H}_{11}\text{Cl}_2\text{N}_2$ 217.0294 ($^{35}\text{Cl}^{35}\text{Cl}$), 219.0264 ($^{35}\text{Cl}^{37}\text{Cl}$) or 221.0235 ($^{37}\text{Cl}^{37}\text{Cl}$); found 217.0294, 219.0264 or 221.0233.



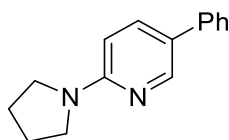
6ac

ethyl 2-chloro-6-(pyrrolidin-1-yl)nicotinate (6ac). Following **GP1**, using pyrrolidine (107 mg, 1.50 mmol), the title compound was obtained (67 mg, 53% yield) as a yellow oil. TLC: R_f = 0.31 (PE:EA = 1:1). ^1H NMR (400 MHz, CDCl_3) δ 8.17 (d, J = 2.8 Hz, 1H), 7.76 (d, J = 3.2 Hz, 1H), 4.34 (q, J = 7.2 Hz, 2H), 3.41-3.38 (m, 4H), 1.96-1.92 (m, 4H), 1.37 (t, J = 7.2 Hz, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 165.6, 154.7, 143.2, 136.7, 132.5, 110.38, 61.7, 50.1, 25.7, 14.4. HRMS (+ESI-TOF) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{12}\text{H}_{16}\text{ClN}_2\text{O}_2$ 255.0895 (^{35}Cl), 257.0865 (^{37}Cl); found 255.0893, 257.0864.



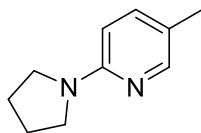
6ad

1-(6-(pyrrolidin-1-yl)pyridin-3-yl)ethan-1-one (6ad). Following **GP2**, using pyrrolidine (155 mg, 2.19 mmol), the title compound was obtained (35 mg, 25% yield) as a light yellow solid. The spectroscopic data are consistent with previously reported.²⁵ TLC: $R_f = 0.38$ (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 8.22 (dd, $J = 3.2, 1.8$ Hz, 1H), 7.76 (dd, $J = 5.2, 1.6$ Hz, 1H), 6.59-6.57 (m, 1H), 3.28-3.26 (m, 4H), 2.52 (s, 3H), 1.91-1.89 (m, 4H).



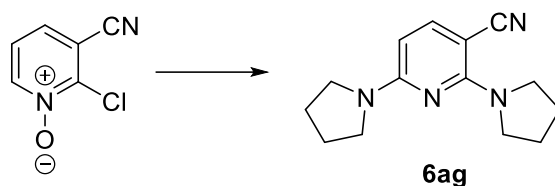
6ae

5-phenyl-2-(pyrrolidin-1-yl)pyridine (6ae). Following **GP2**, using pyrrolidine (125 mg, 1.75 mmol), the title compound was obtained (20 mg, 15% yield) as a yellow oil. TLC: $R_f = 0.71$ (PE:EA = 1:1). ¹H NMR (600 MHz, CDCl₃) δ 8.45 (d, $J = 1.6$ Hz, 1H), 7.69 (dd, $J = 8.8, 2.4$ Hz, 1H), 7.51 (d, $J = 7.6$ Hz, 2H), 7.41 (t, $J = 7.6$ Hz, 2H), 7.30-7.28 (m, 1H), 6.47 (d, $J = 8.8$ Hz, 1H), 3.52-3.49 (m, 4H), 2.04-2.02 (m, 4H). ¹³C NMR (100 MHz, CDCl₃) δ 156.7, 146.6, 139.0, 135.8, 129.0, 126.5, 126.1, 124.3, 106.5, 46.9, 25.7. HRMS (+ESI-TOF) m/z : $[M+H]^+$ Calcd for C₁₅H₁₇N₂ 225.1386; found 225.1383.

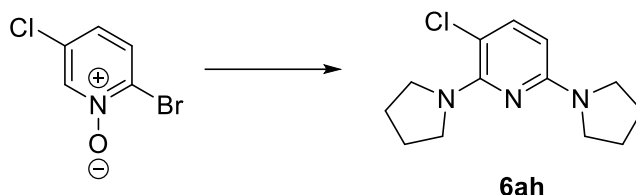


6af

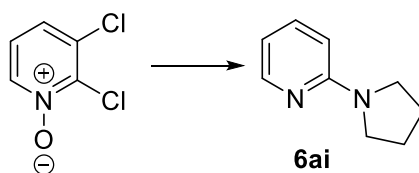
5-methyl-2-(pyrrolidin-1-yl)pyridine (6af). Following **GP1**, using pyrrolidine (196 mg, 2.75 mmol), the title compound was obtained (22 mg, 15% yield) as a light-yellow oil. The spectroscopic data are consistent with previously reported.²⁶ TLC: $R_f = 0.23$ (PE:EA = 10:1). ¹H NMR (600 MHz, CDCl₃) δ 7.98 (s, 1H), 7.27 – 7.25 (m, 1H), 6.29 (d, $J = 8.4$ Hz, 1H), 3.43-3.41 (m, 4H), 2.17 (s, 3H), 2.00-1.98 (m, 4H).



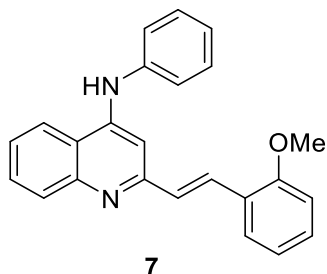
2,6-di(pyrrolidin-1-yl)nicotinonitrile (6ag). Following **GP2**, using pyrrolidine (138 mg, 1.94 mmol), the title compound was obtained (27 mg, 20% yield) as a yellow oil. TLC: $R_f = 0.36$ (DCM:MeOH = 60:1). $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.80 (d, $J = 6.0$ Hz, 1H), 5.90 (d, $J = 6.0$ Hz, 1H), 3.68-3.65 (m, 4H), 3.60-3.56 (m, 4H), 2.00-1.98 (m, 4H), 1.97-1.93 (m, 4H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 162.5, 157.8, 150.3, 120.81, 98.7, 74.4, 50.5, 50.0, 25.9, 25.8. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{14}\text{H}_{19}\text{N}_4$ 243.1604; Found 243.1604.



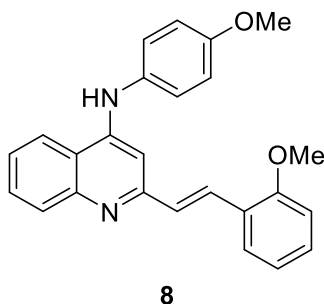
3-chloro-2,6-di(pyrrolidin-1-yl)pyridine (6ah). Following **GP2**, using pyrrolidine (102 mg, 1.44 mmol), the title compound was obtained (34 mg, 27% yield) as a yellow oil. TLC: $R_f = 0.31$ (DCM:MeOH = 60:1). $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 7.79 (d, $J = 6.0$ Hz, 1H), 5.89 (d, $J = 6.0$ Hz, 1H), 3.67-3.66 (m, 4H), 3.58 – 3.56 (m, 4H), 1.99-1.97 (m, 4H), 1.95-1.93 (m, 4H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 154.8, 140.8, 136.9, 116.4, 114.7, 50.1, 25.8. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{13}\text{H}_{19}\text{ClN}_3$ 252.1262 (^{35}Cl), 254.1233 (^{37}Cl); Found 252.1257, 254.1226.



2-(pyrrolidin-1-yl)pyridine (6ai). Following **GP2**, using pyrrolidine (130 mg, 1.84 mmol), the title compound was obtained (43 mg, 32% yield) as a yellow oil. The spectroscopic data are consistent with previously reported.²⁶ TLC: $R_f = 0.35$ (PE:EA = 10:1). $^1\text{H NMR}$ (600 MHz, CDCl_3) δ 8.04 (d, $J = 8.4$ Hz, 1H), 7.88-7.87 (m, 2H), 6.71 (d, $J = 7.8$ Hz, 1H), 3.20-3.18 (m, 4H), 1.80-1.78 (m, 4H).

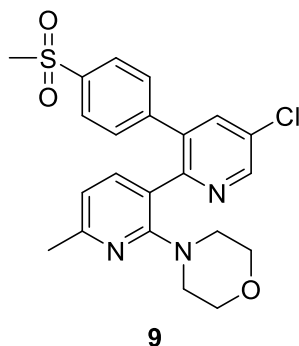


(E)-2-(2-methoxystyryl)-N-phenylquinolin-4-amine (7). Following **GP2**, using aniline (100.74 mg, 1.08 mmol), the title compound was obtained (79 mg, 62% yield) as a yellow oil. TLC: R_f = 0.28 (DCM:MeOH = 60:1). ^1H NMR (400 MHz, CDCl_3) δ 8.21 (d, J = 8.4 Hz, 1H), 7.87 (d, J = 8.4 Hz, 1H), 7.73 (m, 1H), 7.52 (d, J = 6.4 Hz, 1H), 7.47 (t, J = 8.0 Hz, 1H), 7.40-7.39 (m, 4H), 7.34 (t, J = 7.6 Hz, 1H), 7.27-7.25 (m, 2H), 7.22 (d, J = 3.6 Hz, 1H), 7.01 (s, 1H), 6.89 (t, J = 7.6 Hz, 1H), 6.83 (d, J = 8.4 Hz, 1H), 3.81 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 158.1, 153.2, 152.0, 141.8, 138.3, 134.2, 132.2, 131.3, 129.9, 128.8, 126.3, 126.1, 124.0, 123.8, 123.1, 122.5, 122.0, 120.98, 117.6, 111.2, 97.52 55.6. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{24}\text{H}_{21}\text{N}_2\text{O}$ 352.1570; Found 352.1570.



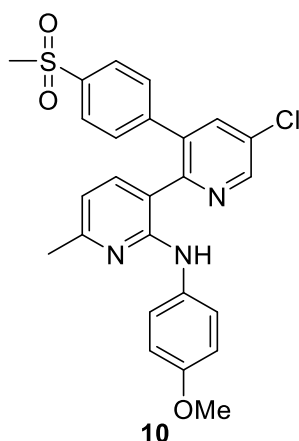
(E)-N-(4-methoxyphenyl)-2-(2-methoxystyryl)quinolin-4-amine (8). Following **GP2**, using 4-methoxyaniline (133 mg, 1.08 mmol), the title compound was obtained (73 mg, 53% yield) as a yellow oil. TLC: R_f = 0.38 (PE:EA = 1:1). ^1H NMR (400 MHz, CDCl_3) δ 8.13 (d, J = 8.4 Hz, 1H), 7.83 (d, J = 8.8 Hz, 1H), 7.69-7.60 (m, 3H), 7.42 (t, J = 7.6 Hz, 1H), 7.10 (t, J = 8.0 Hz, 1H), 6.96 (d, J = 7.6 Hz, 1H), 6.81-6.76 (m, 4H), 6.50-6.48 (m, 3H), 3.71 (s, 3H), 3.42 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 196.5, 184.5, 183.5, 182.5, 171.7, 157.0, 148.1, 135.8, 133.8, 132.5, 132.4, 129.8, 129.4, 129.2, 127.3,

125.6, 121.1, 119.4, 113.4, 110.1, 55.6, 54.7. HRMS (+ESI-TOF) m/z : $[M+H]^+$ calcd for $C_{25}H_{23}N_2O_2$ 383.1754; Found 383.1754.



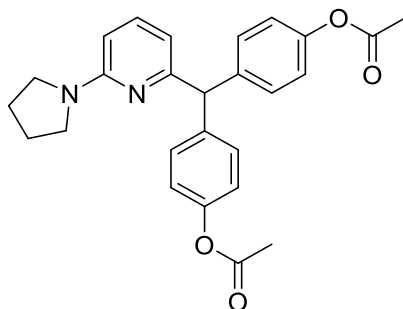
4-(5-chloro-6'-methyl-3-(4-(methylsulfonyl)phenyl)-[2,3'-bipyridin]-2'-yl)morpholine (9).

Following **GP2**, using morpholine (70 mg, 0.80 mmol), the title compound was obtained (38 mg, 32% yield) as a brown oil. TLC: R_f = 0.28 (PE:EA = 1:1). 1H NMR (400 MHz, $CDCl_3$) δ 8.68-8.67 (m, 1H), 7.78 (d, J = 8.0 Hz, 2H), 7.73-7.72 (m, 1H), 7.58 (d, J = 8.4 Hz, 1H), 7.23 (d, J = 8.0 Hz, 2H), 6.83 (d, J = 7.6 Hz, 1H), 3.31-3.29 (m, 4H), 2.99 (s, 3H), 2.82-2.51 (m, 4H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ 157.4, 156.5, 154.4, 147.9, 143.0, 141.3, 139.9, 137.4, 135.2, 129.9, 129.4, 126.3, 121.6, 116.3, 65.4, 48.8, 43.3, 24.0. HRMS (+ESI-TOF) m/z : $[M+K]^+$ calcd for $C_{22}H_{23}ClN_3O_3S$ 444.1143 (^{35}Cl), 446.1114 (^{37}Cl); Found 444.1140, 446.1103.



5-chloro-N-(4-methoxyphenyl)-6'-methyl-3-(4-(methylsulfonyl)phenyl)-[2,3'-bipyridin]-2'-amine (10). Following **GP2**, using 4-methoxyaniline (100 mg, 0.80 mmol), the title compound was obtained (17 mg, 35% yield) as a brown oil. TLC: R_f = 0.34 (DCM:MeOH = 40:1). 1H NMR (400 MHz, $CDCl_3$) δ 8.47 (s, 1H), 7.84 (d, J = 8.4 Hz, 2H), 7.75 (d, J = 2.4 Hz, 1H), 7.47-7.43 (m, 1H),

7.26-7.13 (m, 3H), 6.94 (d, $J = 9.2$ Hz, 2H), 6.67 (d, $J = 8.8$ Hz, 2H), 3.74 (s, 3H), 3.02 (s, 3H), 2.59 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 159.5, 158.9, 151.1, 149.8, 148.0, 142.3, 141.6, 140.5, 137.2, 136.6, 131.8, 131.0, 130.0, 129.4, 128.2, 123.0, 114.0, 55.9, 55.6, 44.7, 24.0. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{25}\text{H}_{23}\text{ClN}_3\text{O}_3\text{S}$ 480.1143 (^{35}Cl), 482.1114 (^{37}Cl); Found 480.1143, 482.1114.



11

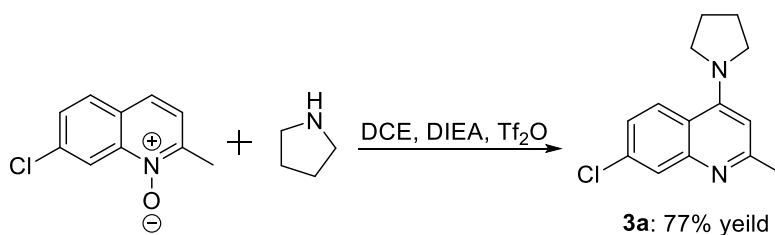
((6-(pyrrolidin-1-yl)pyridin-2-yl)methylene)bis(4,1-phenylene) diacetate (11). Following **GP2**, using pyrrolidine (49 mg, 0.79 mmol), the title compound was obtained (38 mg, 43% yield) as a yellow oil. TLC: $R_f = 0.83$ (PE:EA = 1:1). ^1H NMR (400 MHz, CDCl_3) δ 7.35-7.33 (m, 1H), 7.32-7.30 (m, 4H), 6.99-6.97 (m, 3H), 6.37 (d, $J = 7.2$ Hz, 1H), 6.18 (d, $J = 8.4$ Hz, 1H), 5.36 (s, 1H), 3.41-3.37 (m, 4H), 2.27 (s, 6H), 1.97-1.93 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 169.7, 160.3, 157.1, 149.1, 141.3, 137.4, 130.6, 130.5, 130.4, 121.0, 120.9, 111.1, 104.2, 58.2, 58.0, 46.7, 25.6, 21.3. HRMS (+ESI-TOF) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{26}\text{H}_{27}\text{N}_2\text{O}_4$ 431.1965; Found 431.1965.

8. Green Chemistry Metrics Analysis

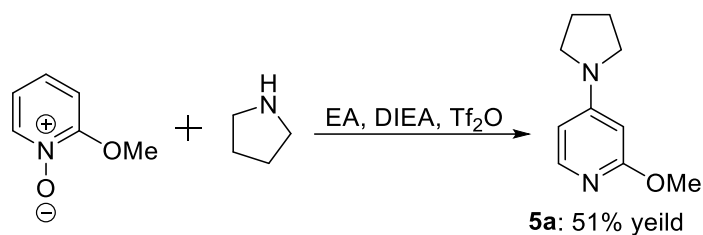
The following formula were used for calculating Atom Economy (AE).

$$\text{AE} = \frac{\text{Molecular weight of product}}{\text{Total molecular weight of reactants}} \times 100$$

Process A-our developed method

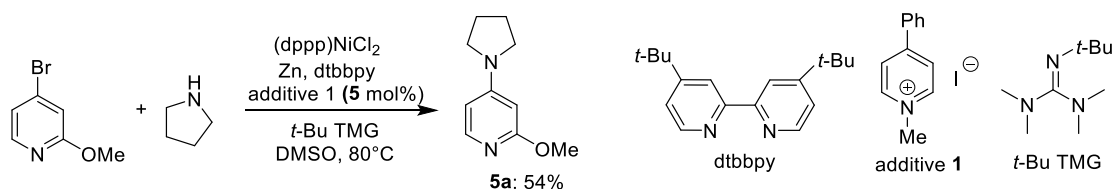


$$AE = \frac{246.74}{193.63 + 71.12} \times 100 = 93\%$$



$$AE = \frac{178.24}{125.13 + 71.12} \times 100 = 91\%$$

Process B-previous method^[7]



$$AE = \frac{178.24}{188.02 + 71.12} \times 100 = 68\%$$

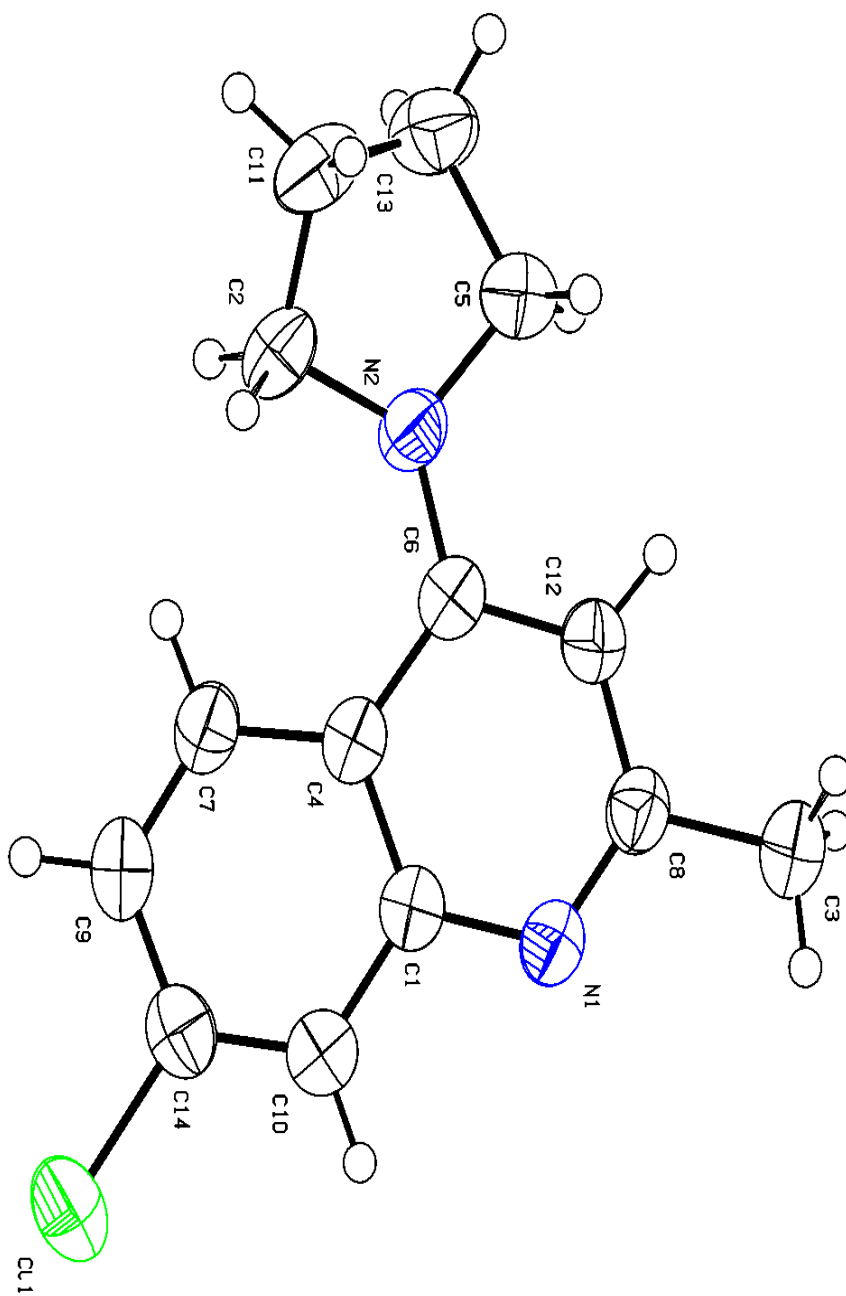
9. X-ray crystallographic analysis

The single crystal of compound **3a** (CCDC 2535858) was obtained by vapor diffusion from tetrahydrofuran and cyclohexane. The atoms are depicted with 50% probability ellipsoids. The crystallographic data are summarized in the following table.

-17 Y

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Z -126 230802wk | 159_0m P 1 21/c 1 R = 0.04 RES = 0-119 X



NOMOVE FORCED

Prob = 50
Temp = 296

Table S1. Crystal data and structure refinement for **3a**.

Crystal data	
Chemical formula	C ₁₄ H ₁₅ ClN ₂
M _r	246.73
Crystal system, space group	monoclinic, P2 ₁ /c
Temperature (K)	296.15
<i>a</i> , <i>b</i> , <i>c</i> (Å)	9.6537(11), 15.3596(18), 8.5643(9)
α, β, γ (°)	90, 96.813(2), 90
<i>V</i> (Å ³)	1260.9(2)
<i>Z</i>	4
Radiation type	MoKα (λ = 0.71073)
μ (mm ⁻¹)	0.282
Crystal size (mm)	0.2 × 0.15 × 0.1
Data collection	
Diffractometer	Bruker D8VENTUR
2θ range for data collection/°	5.304 to 55.206
Index ranges	-12 ≤ <i>h</i> ≤ 6, -19 ≤ <i>k</i> ≤ 18, -10 ≤ <i>l</i> ≤ 11

Reflections collected	7495
Independent reflections	2789 [$R_{\text{int}} = 0.0213$, $R_{\text{sigma}} = 0.0260$]
Refinement	
<i>Data</i>	2789
Restraints	0
Parameters	155

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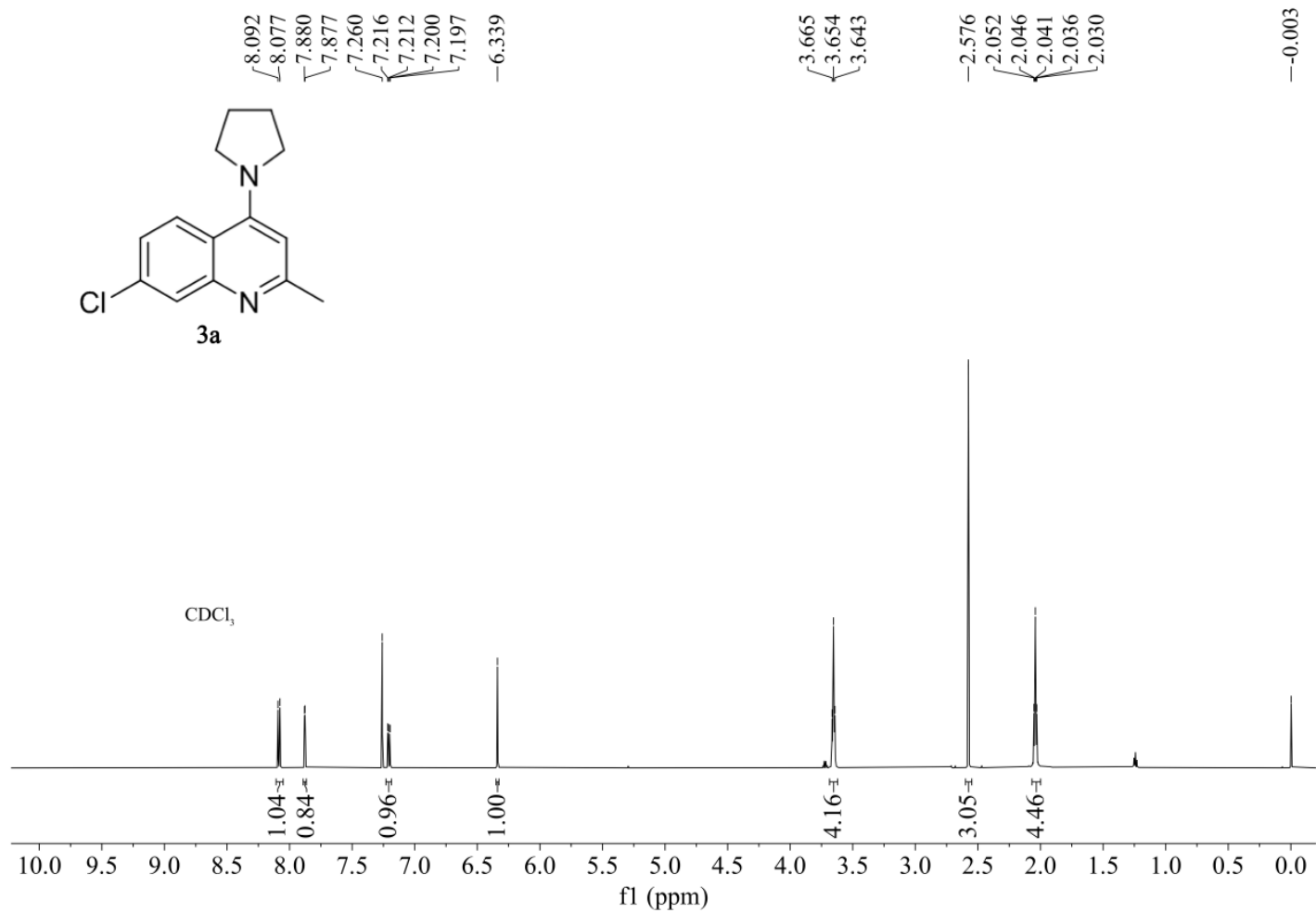
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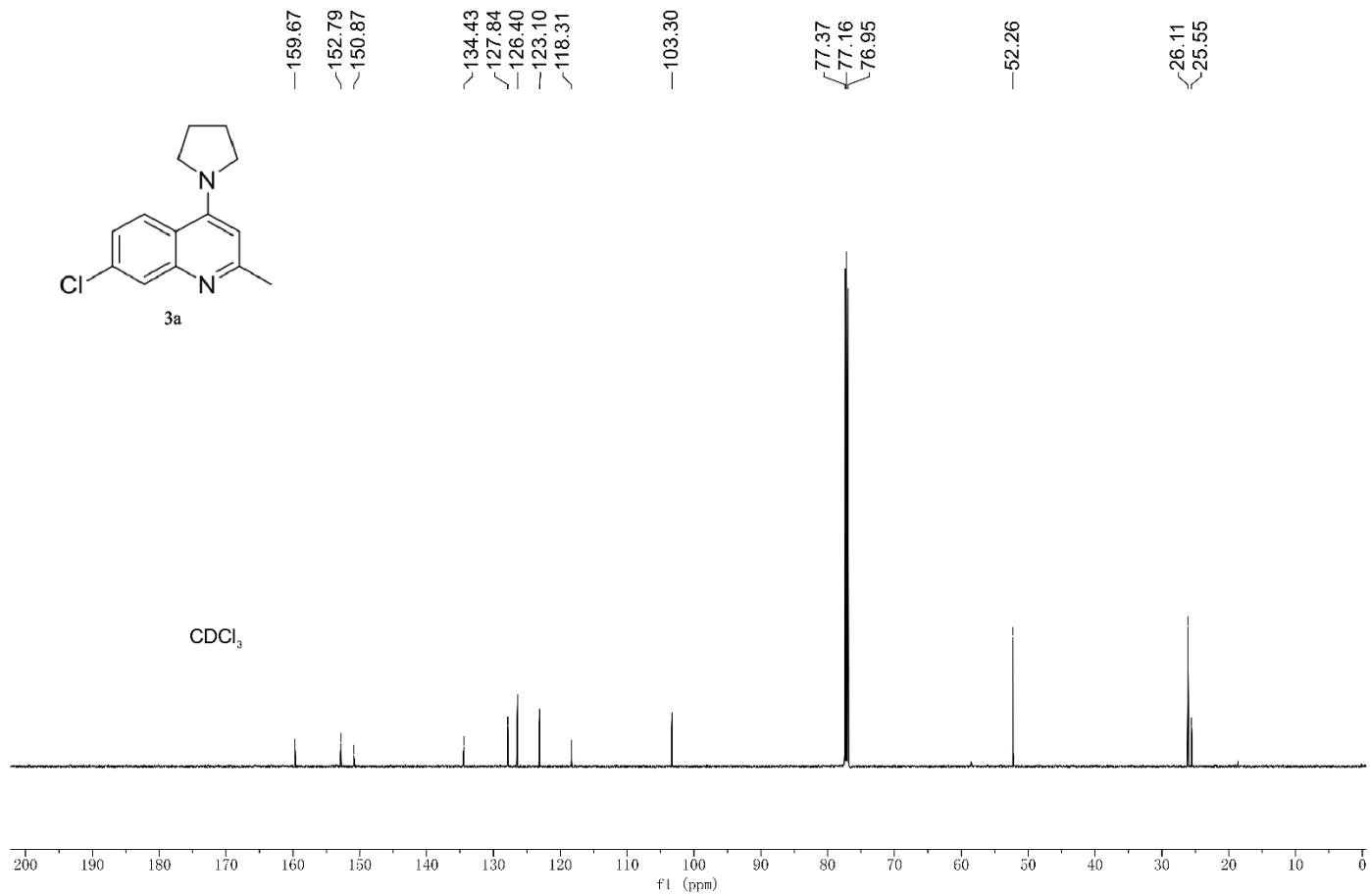
11. NMR Spectra

Spectra data are shown from the next page.

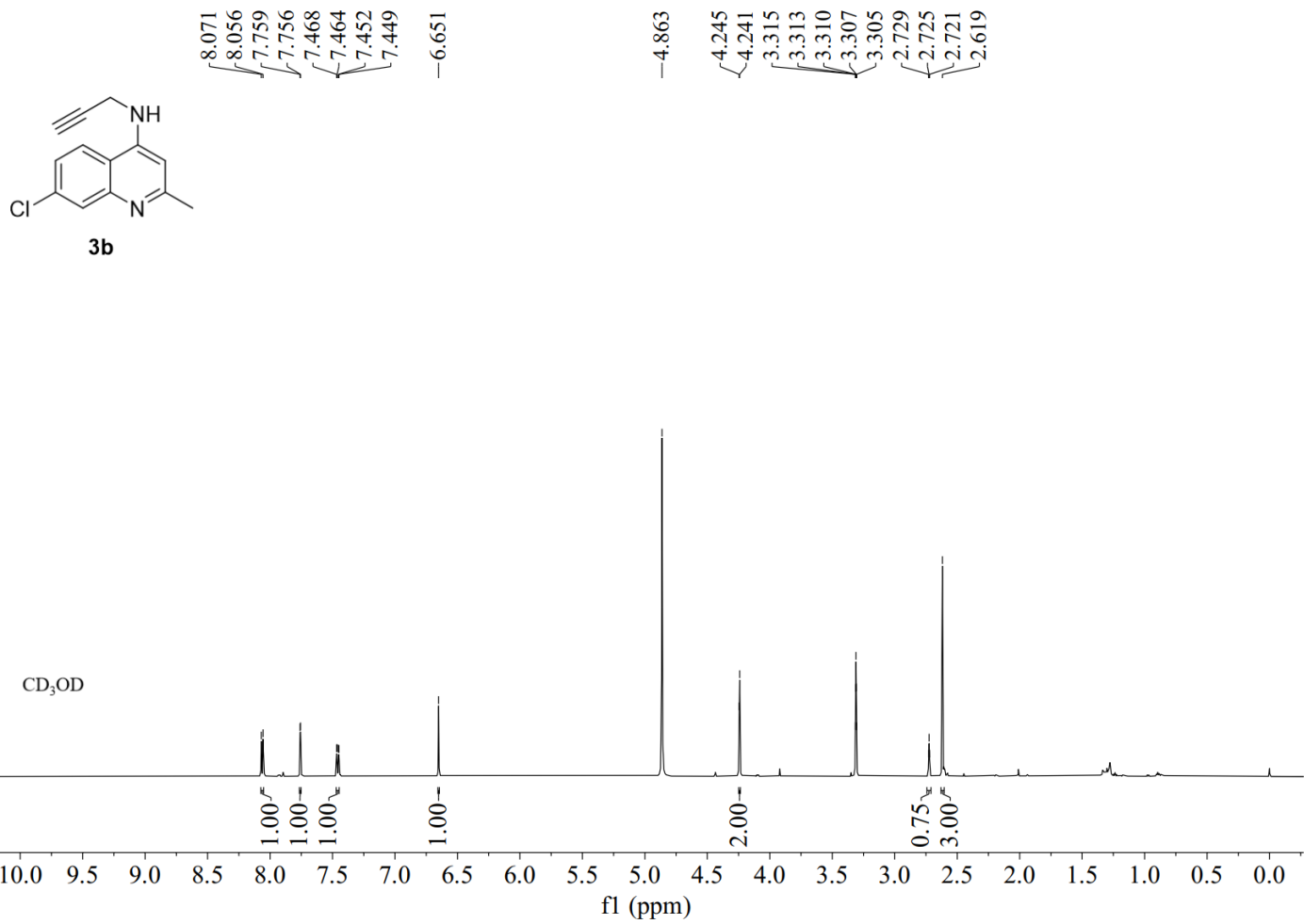
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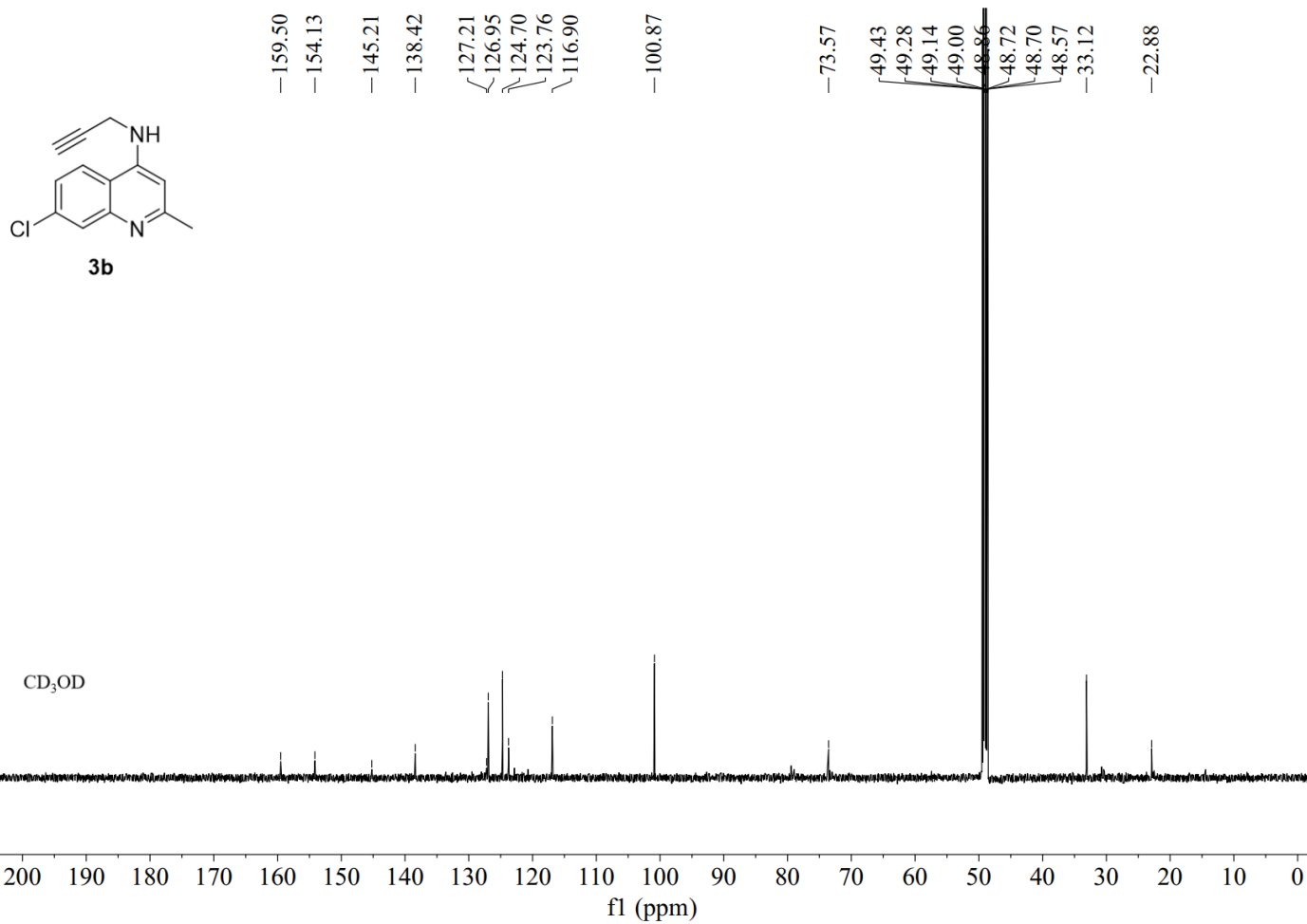
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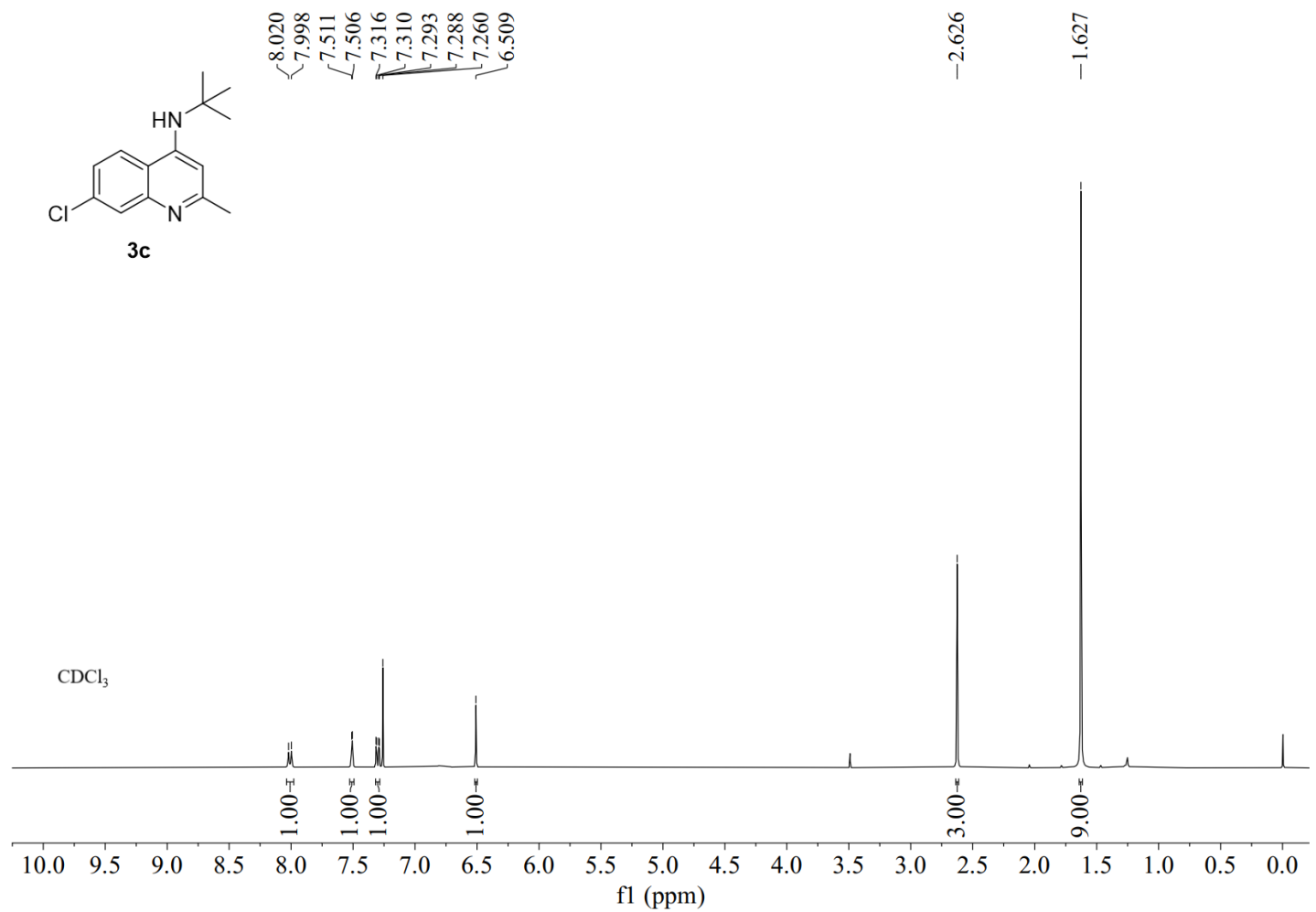
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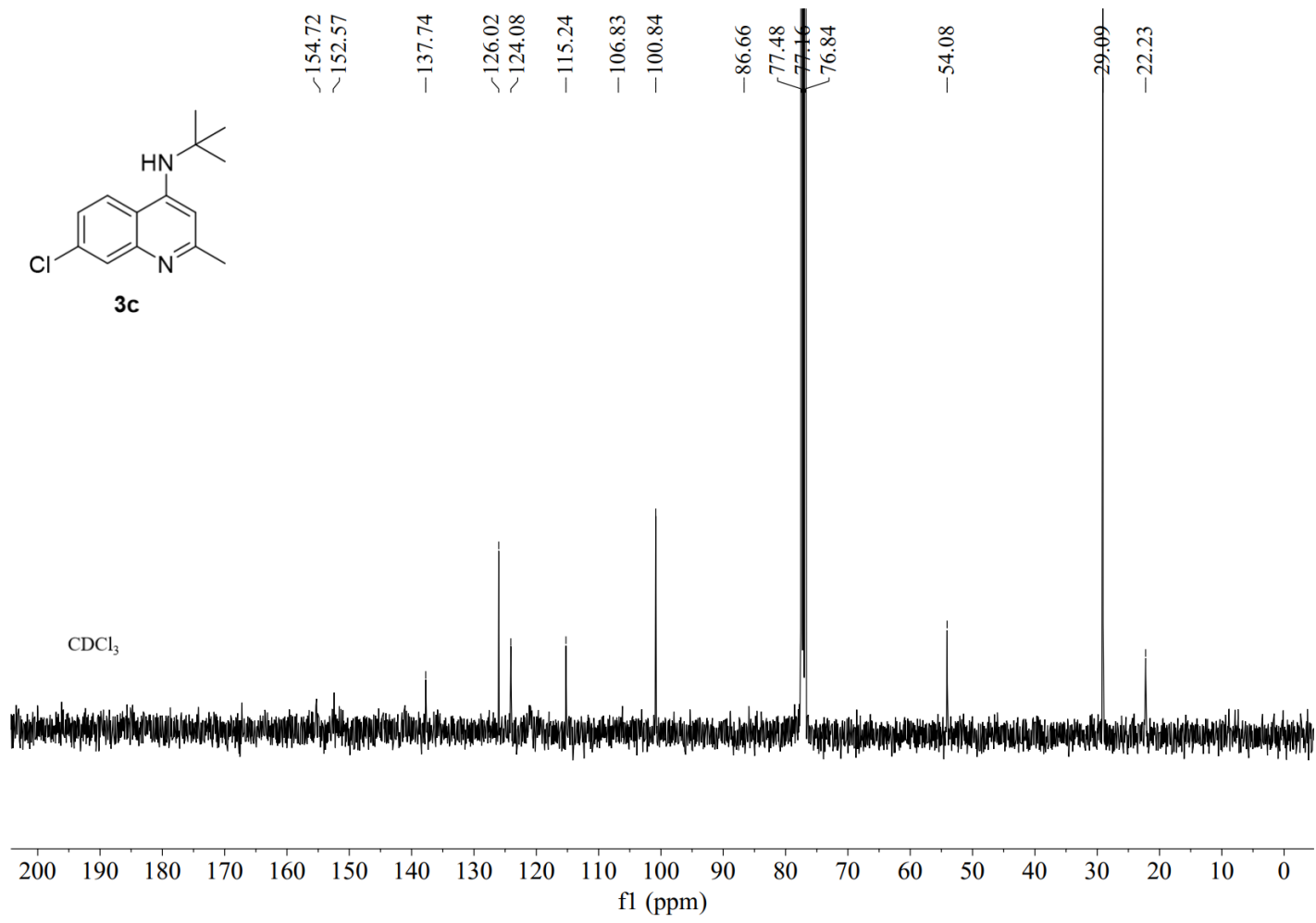
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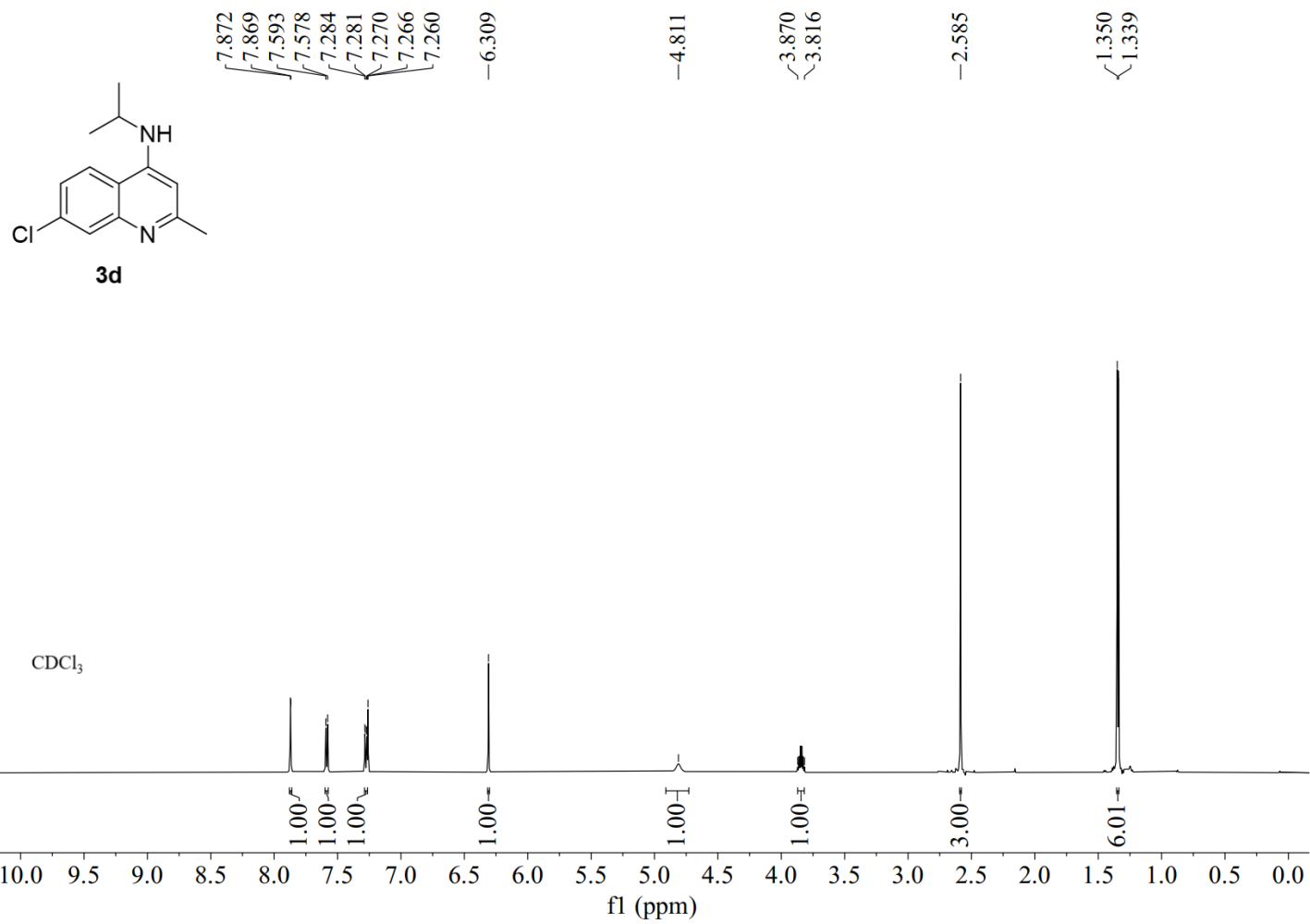
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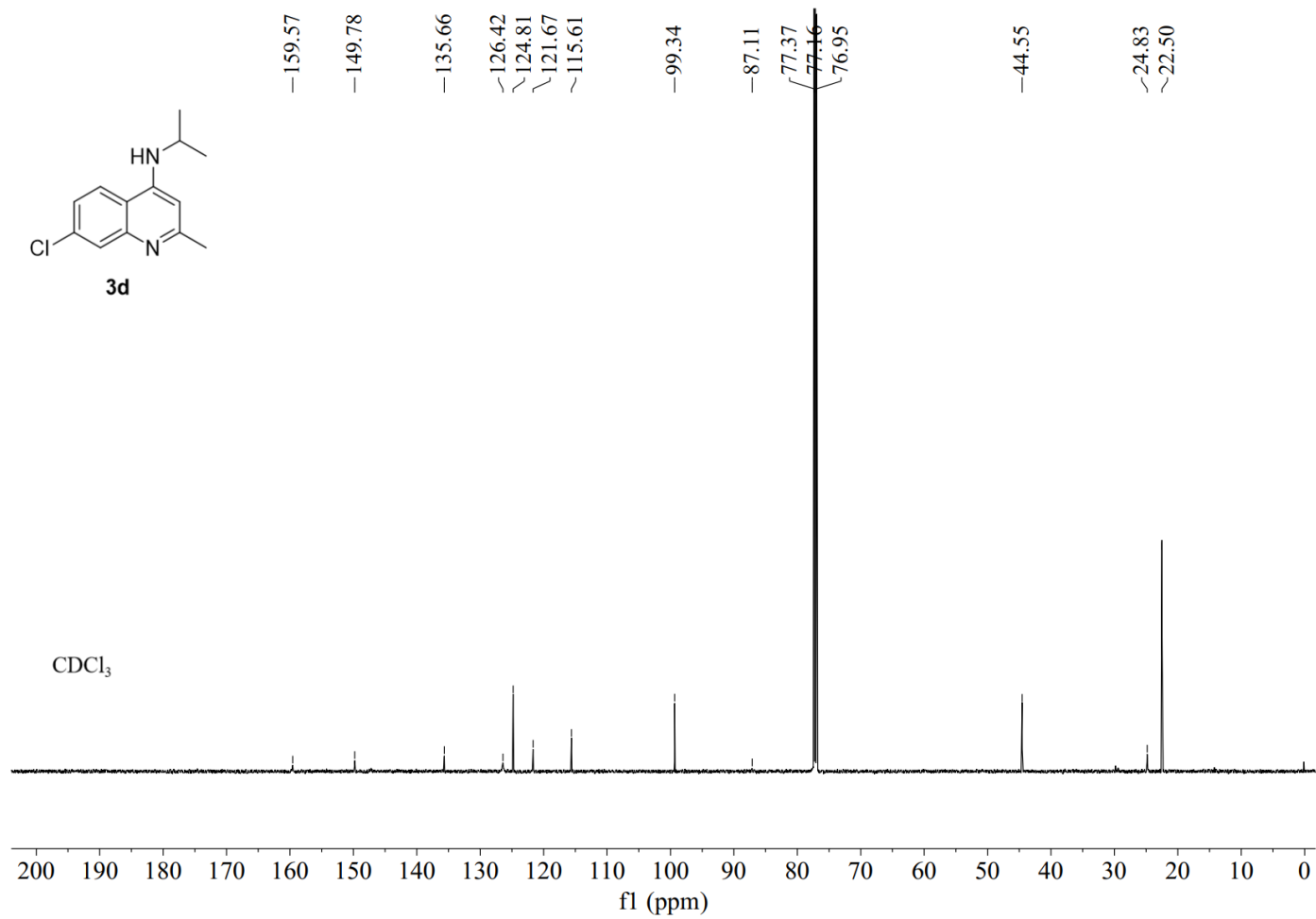
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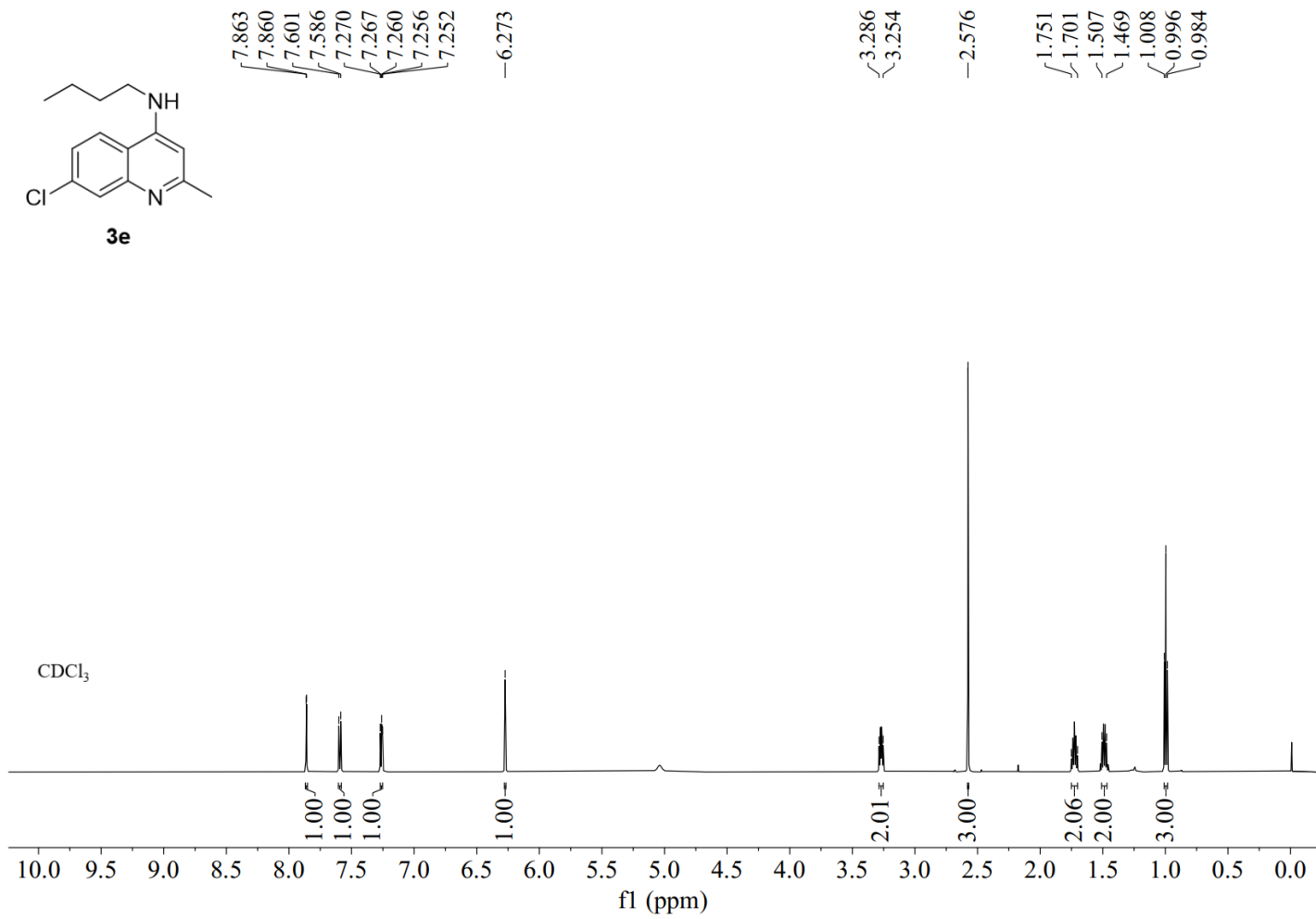
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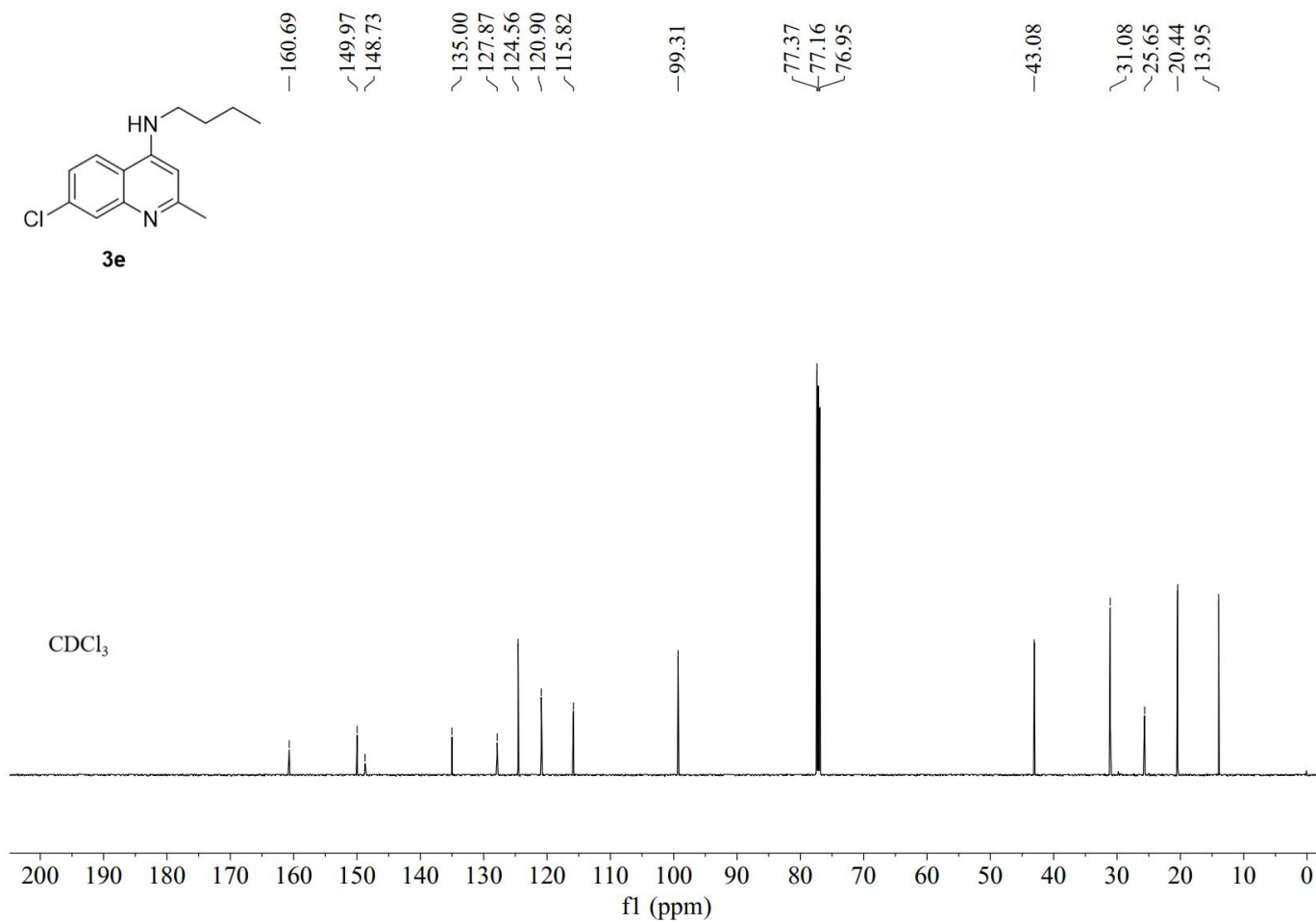
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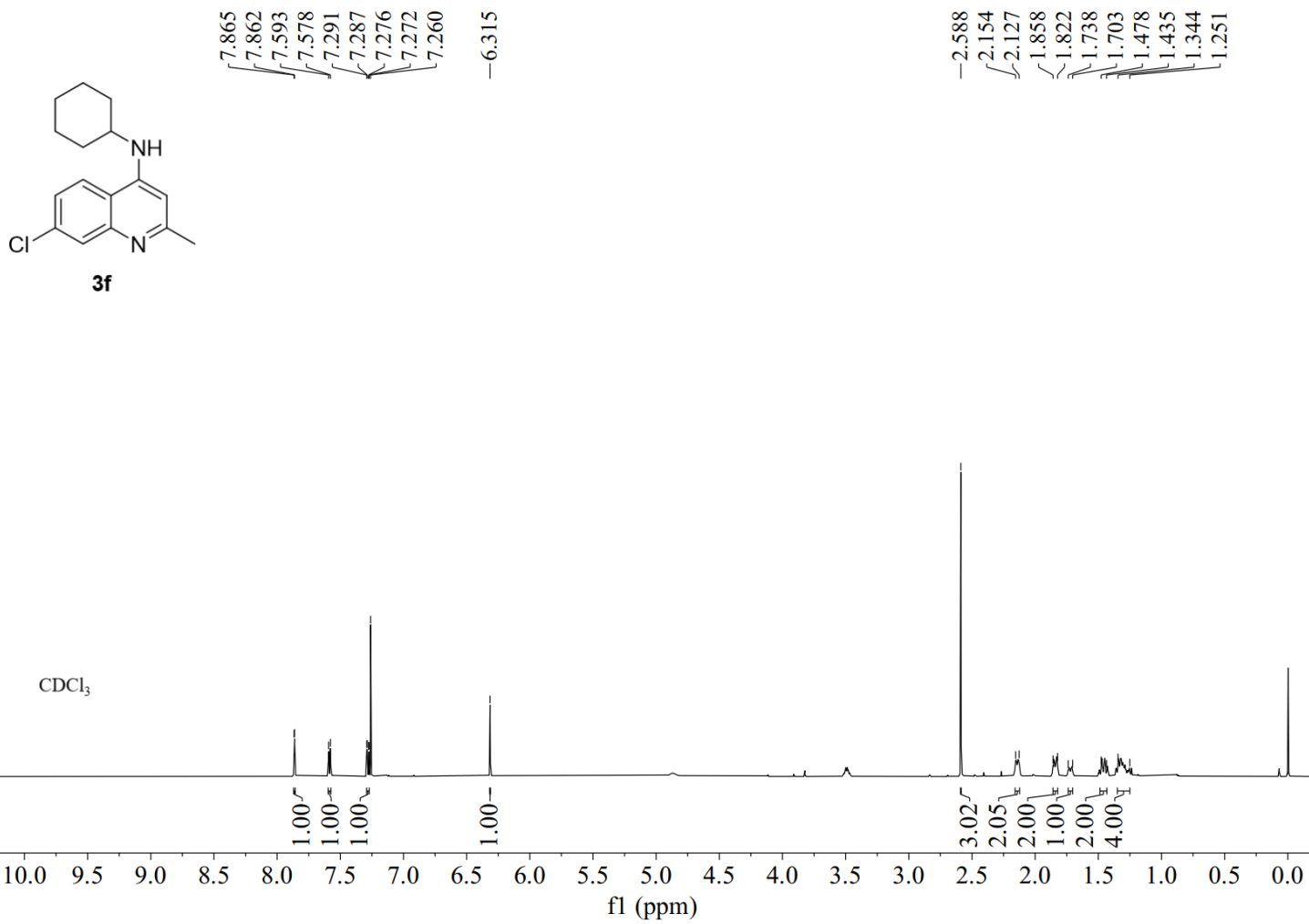
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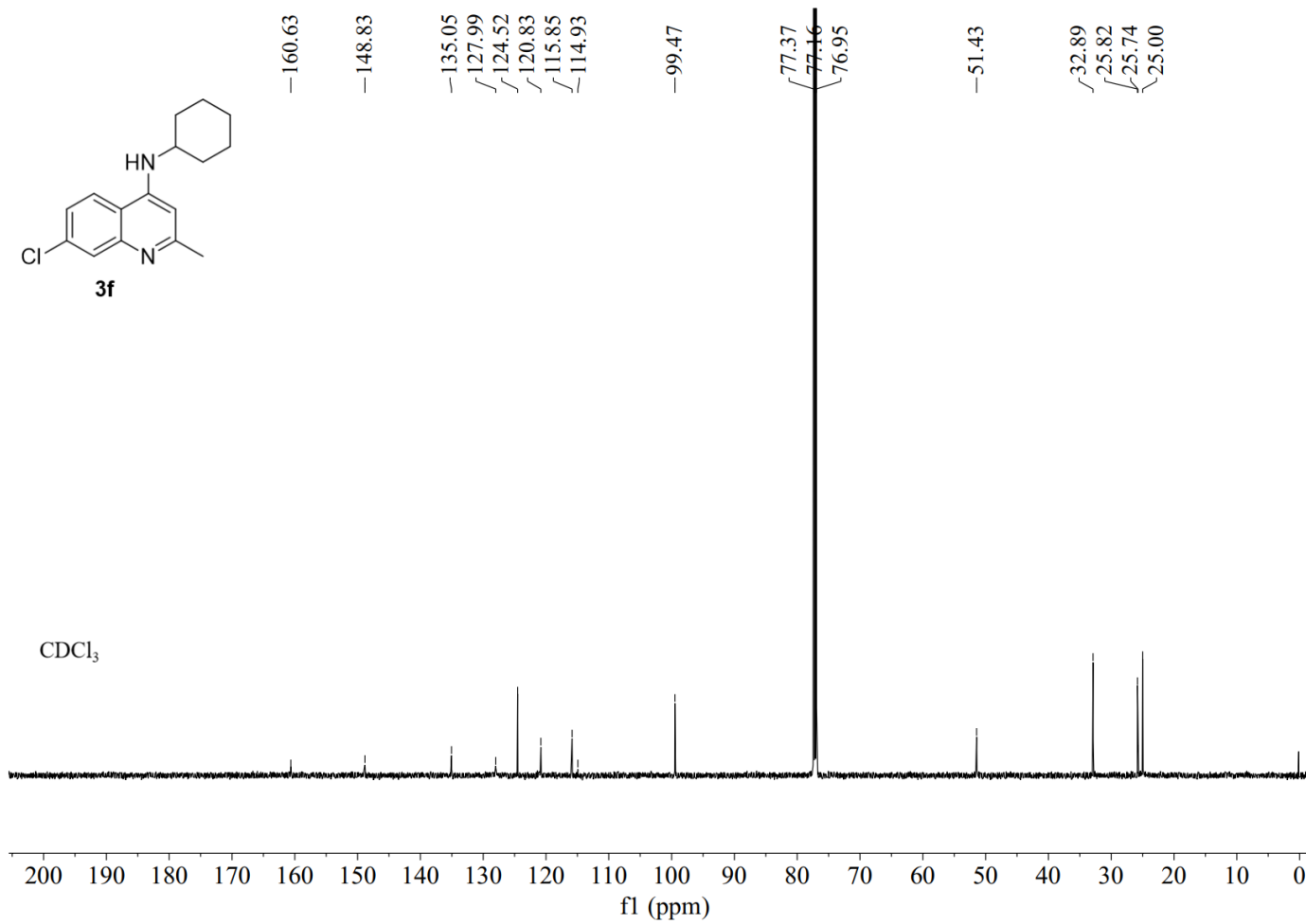
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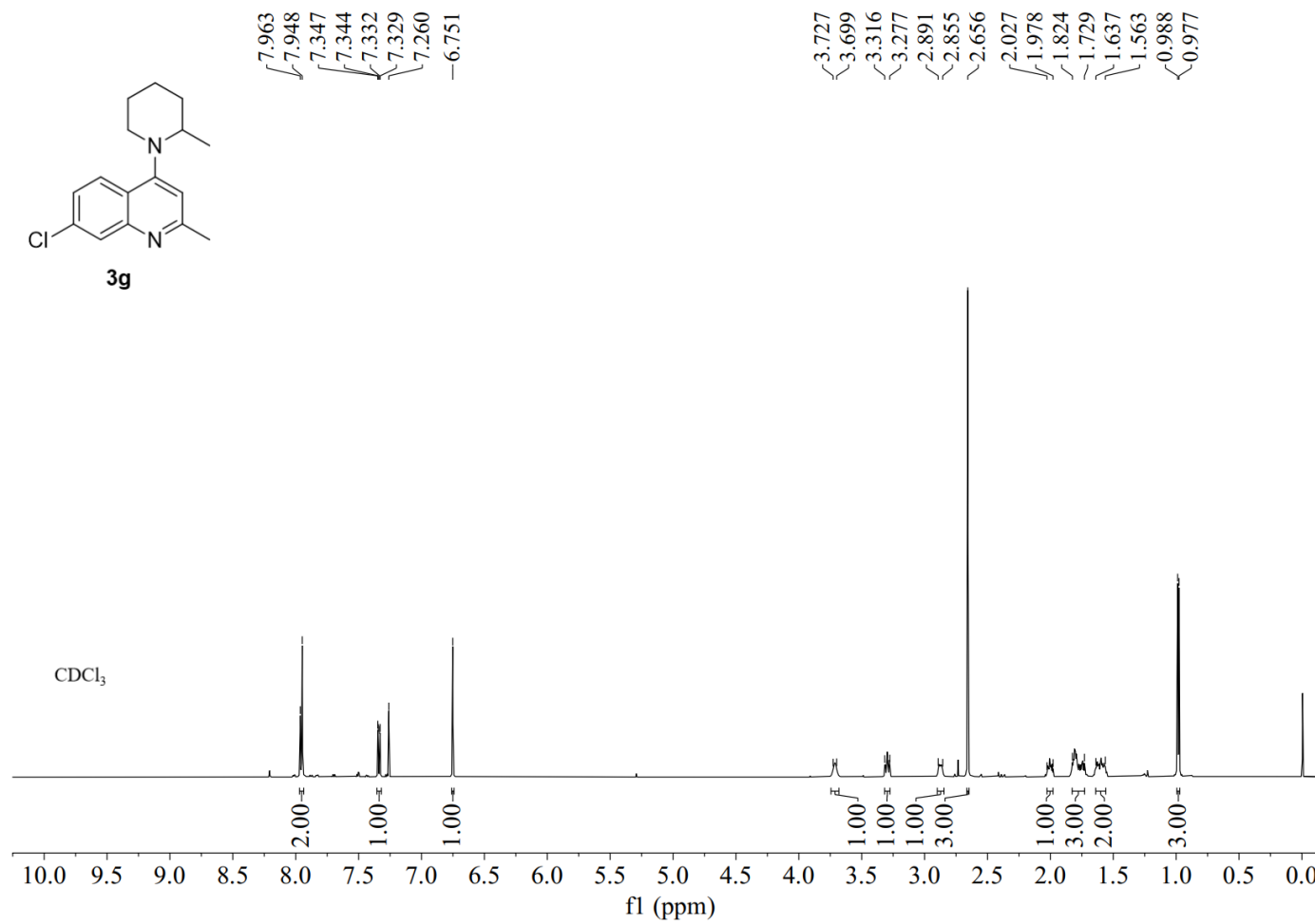
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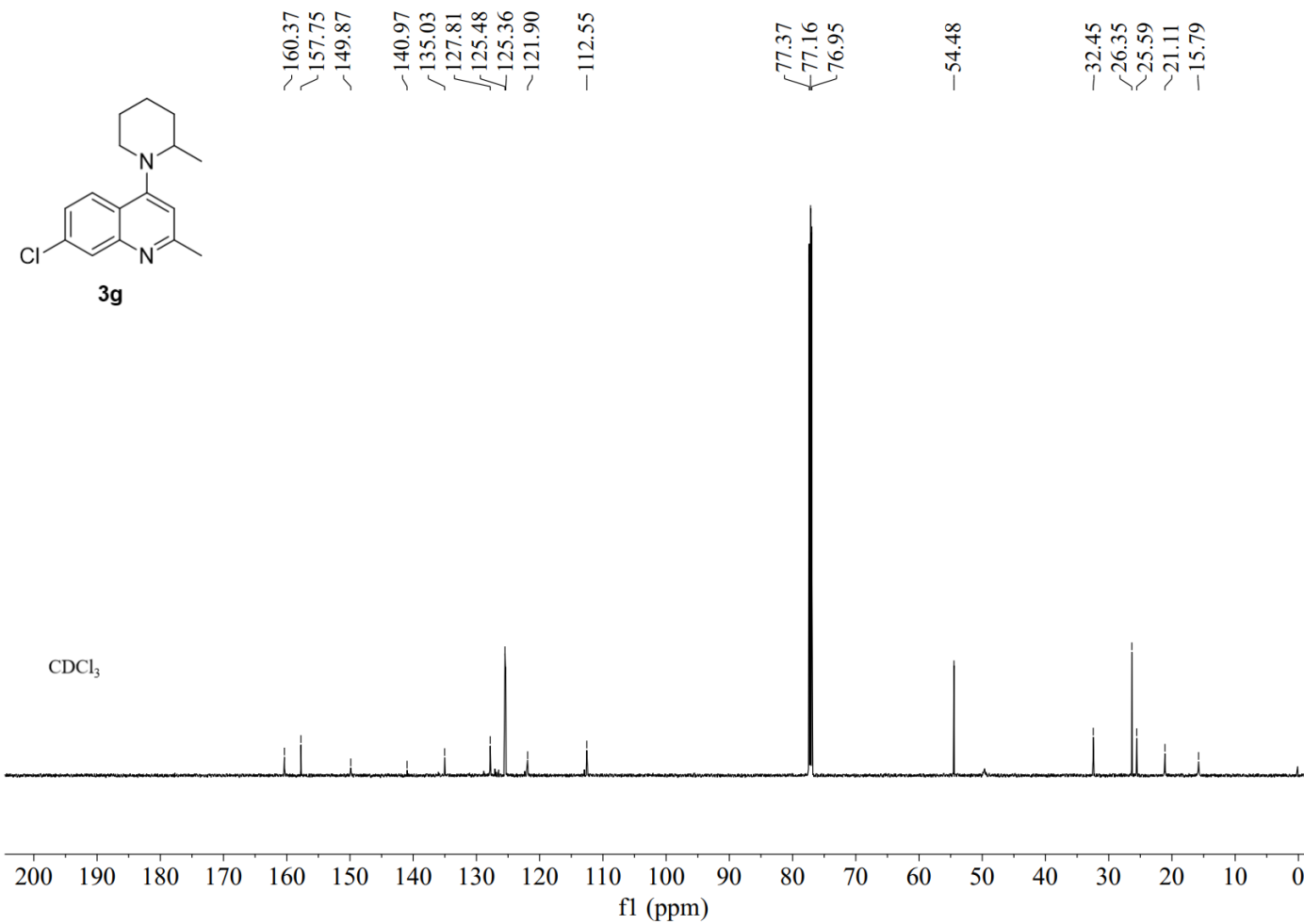
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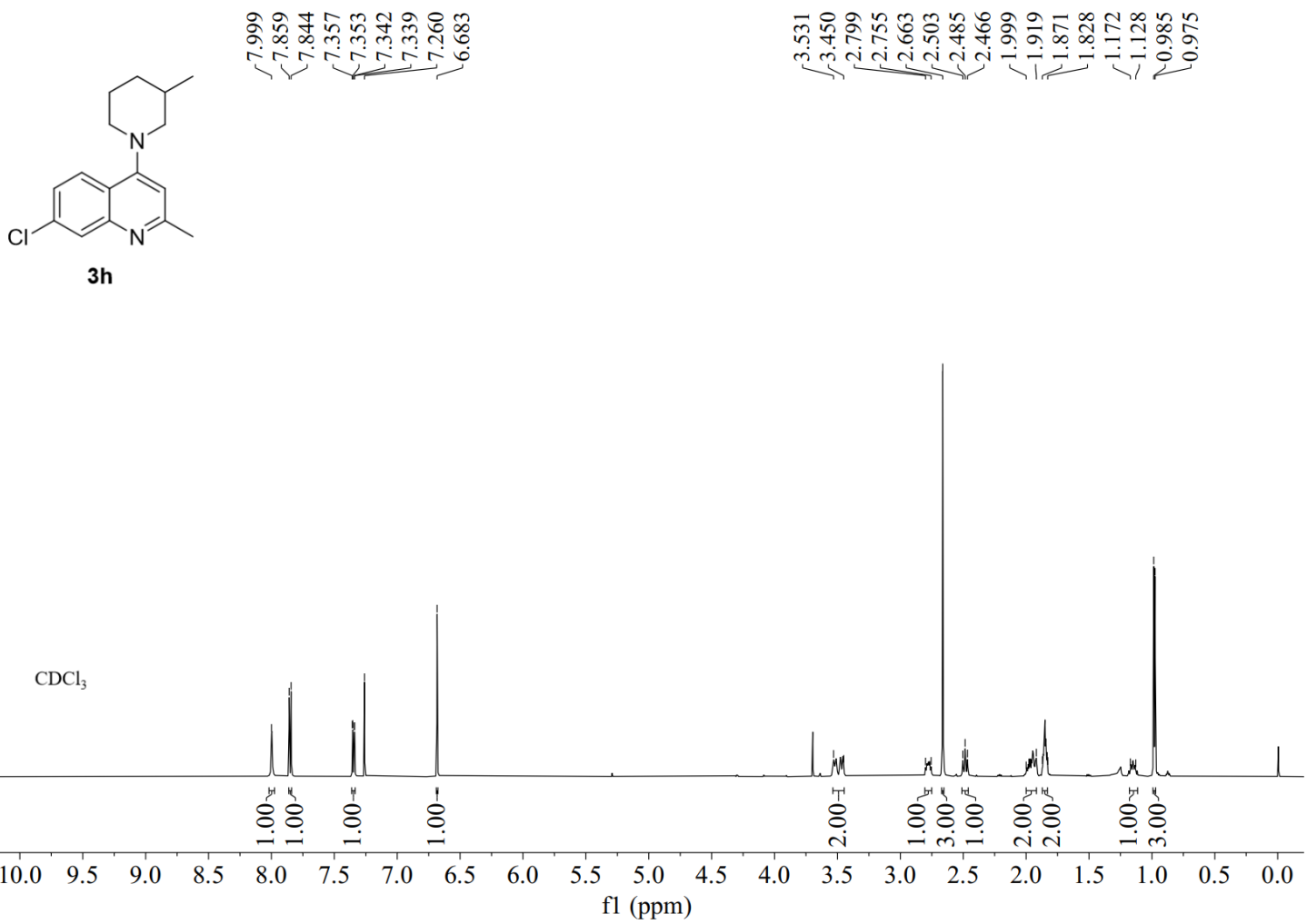
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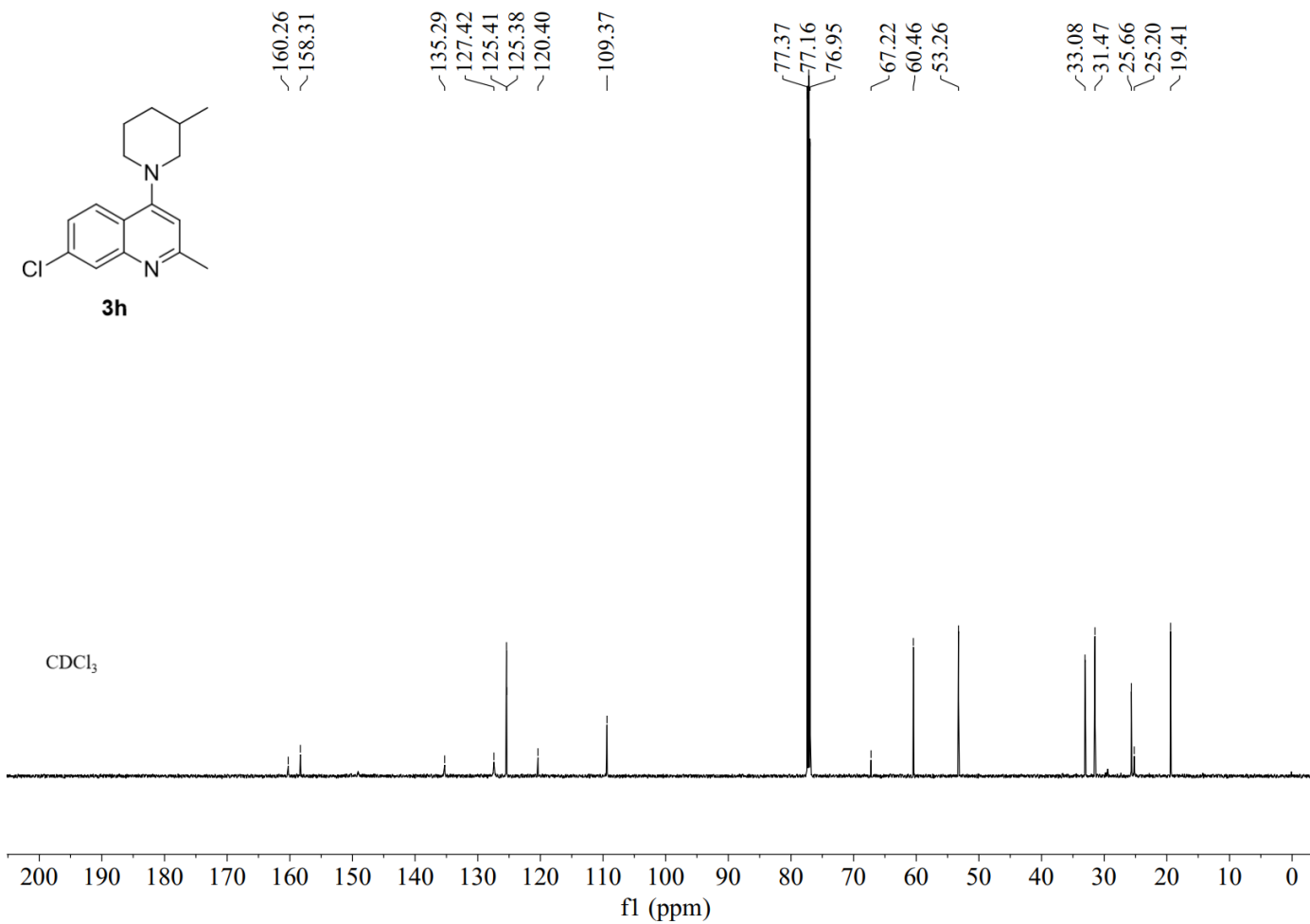
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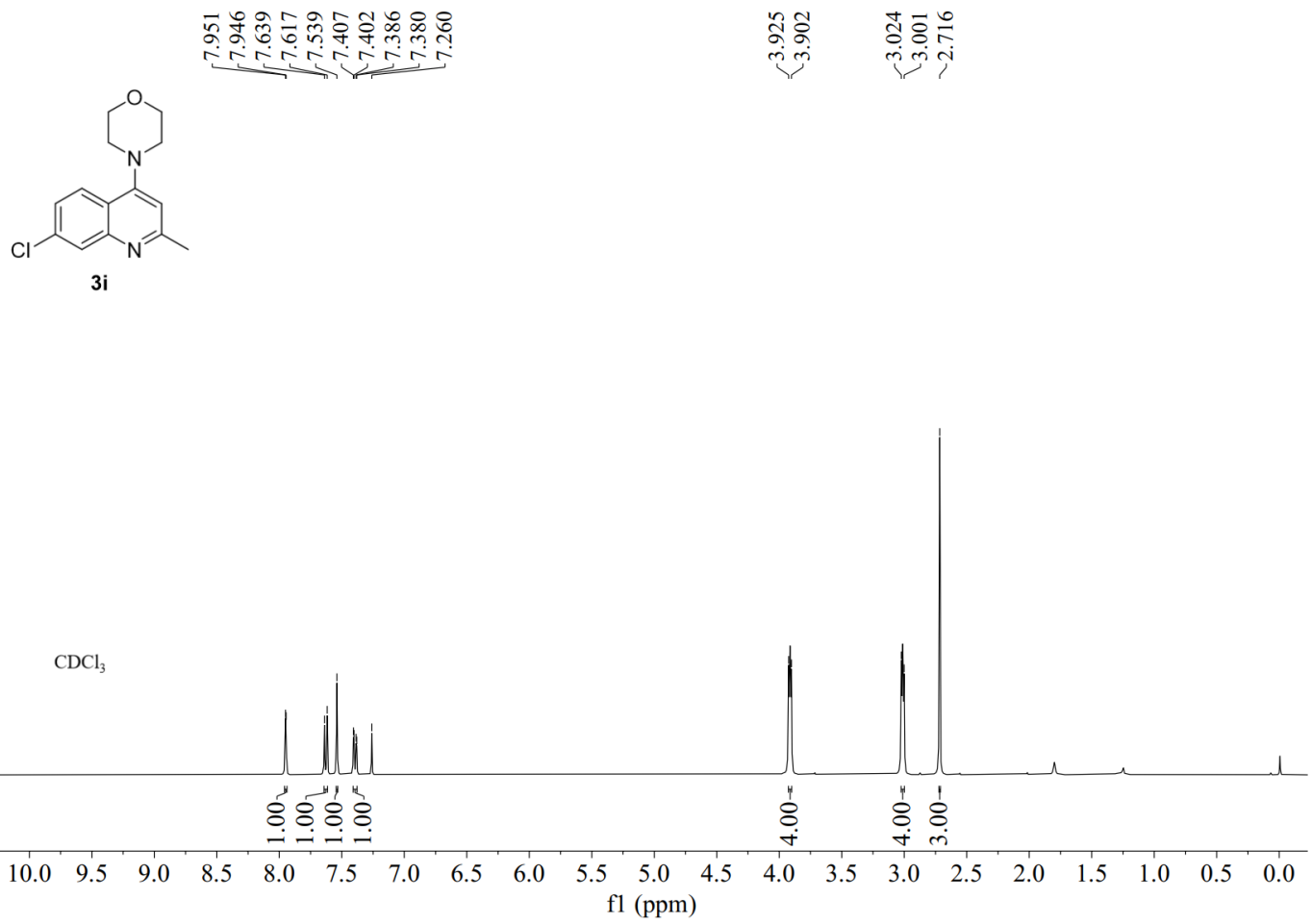
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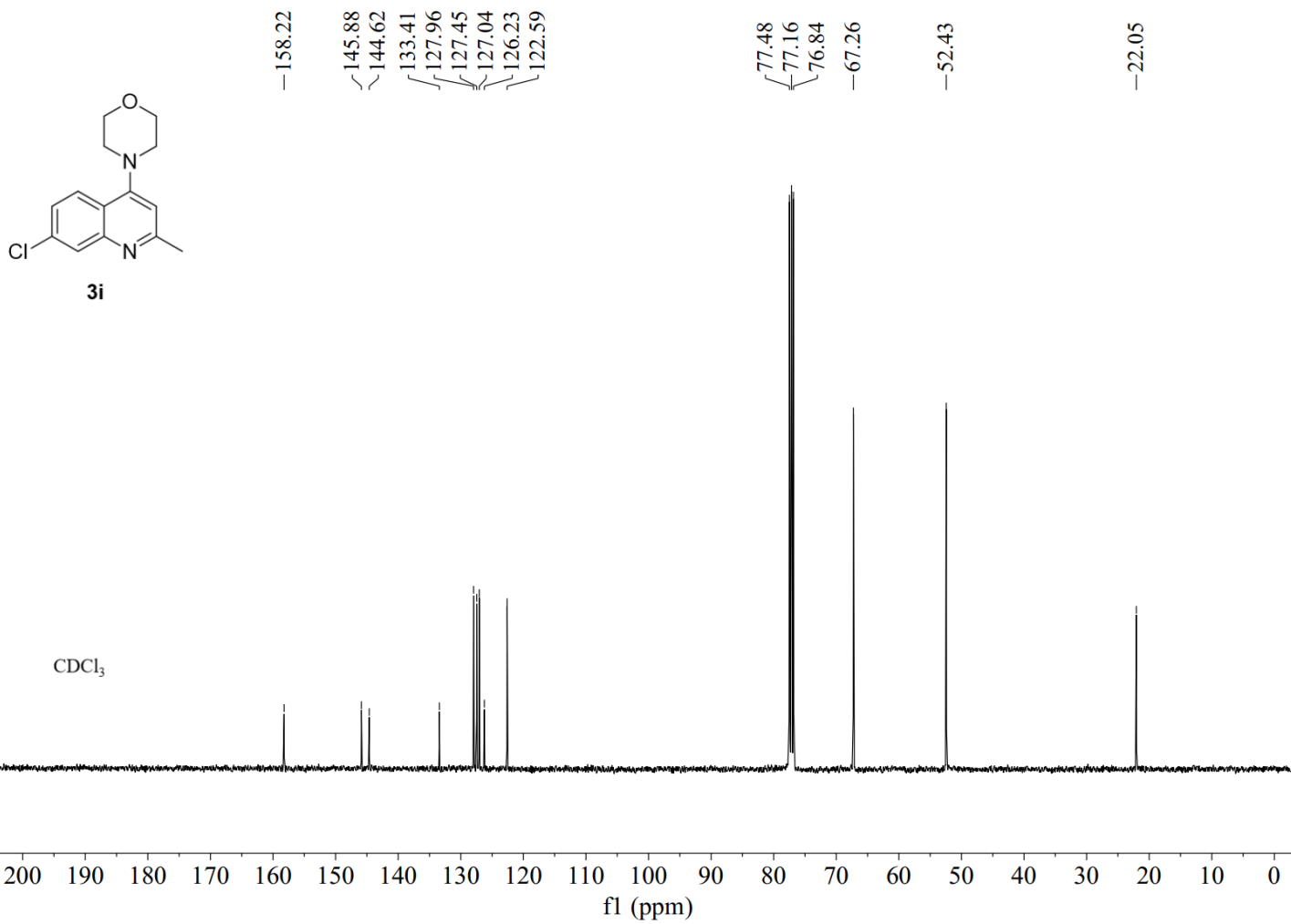
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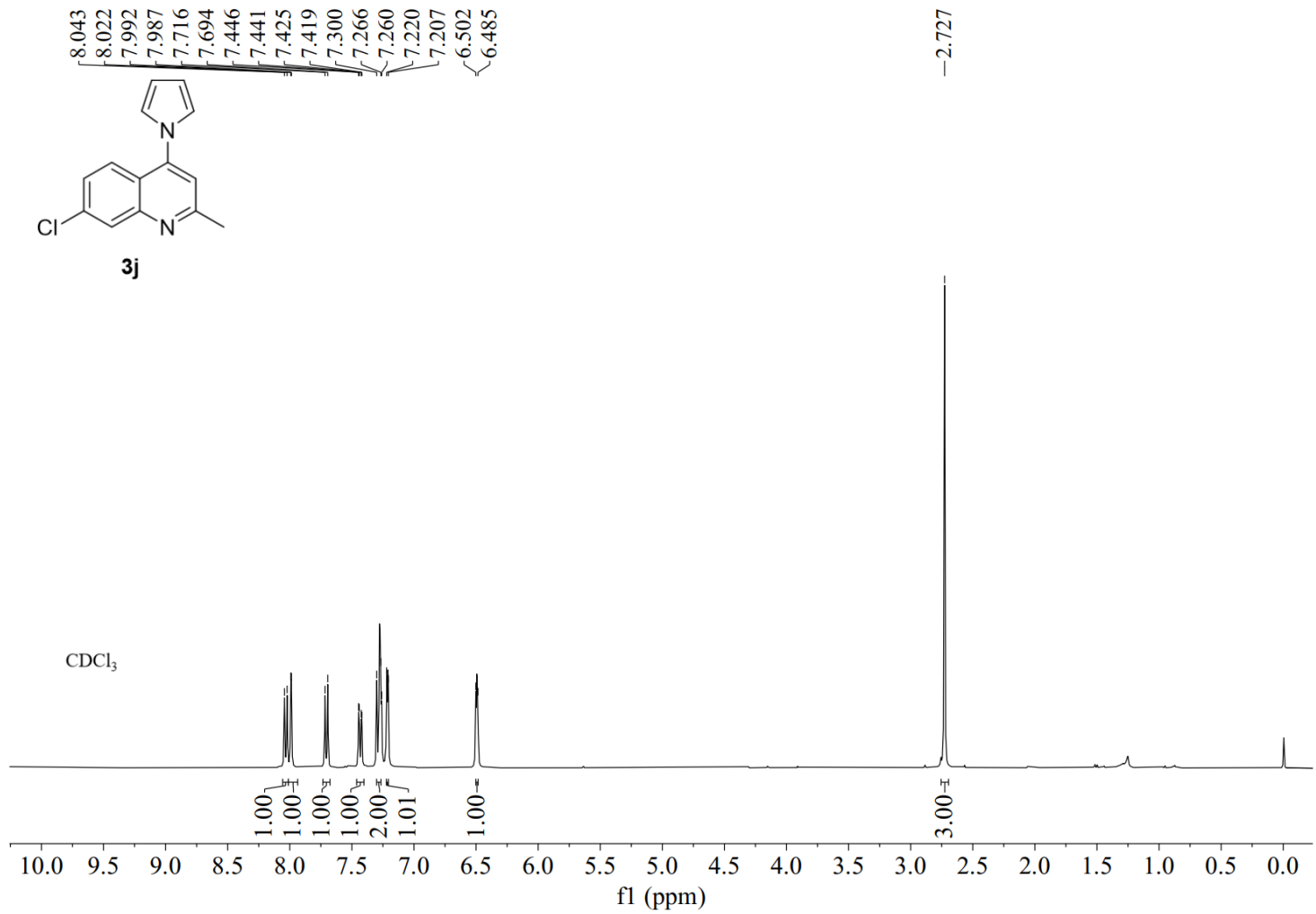
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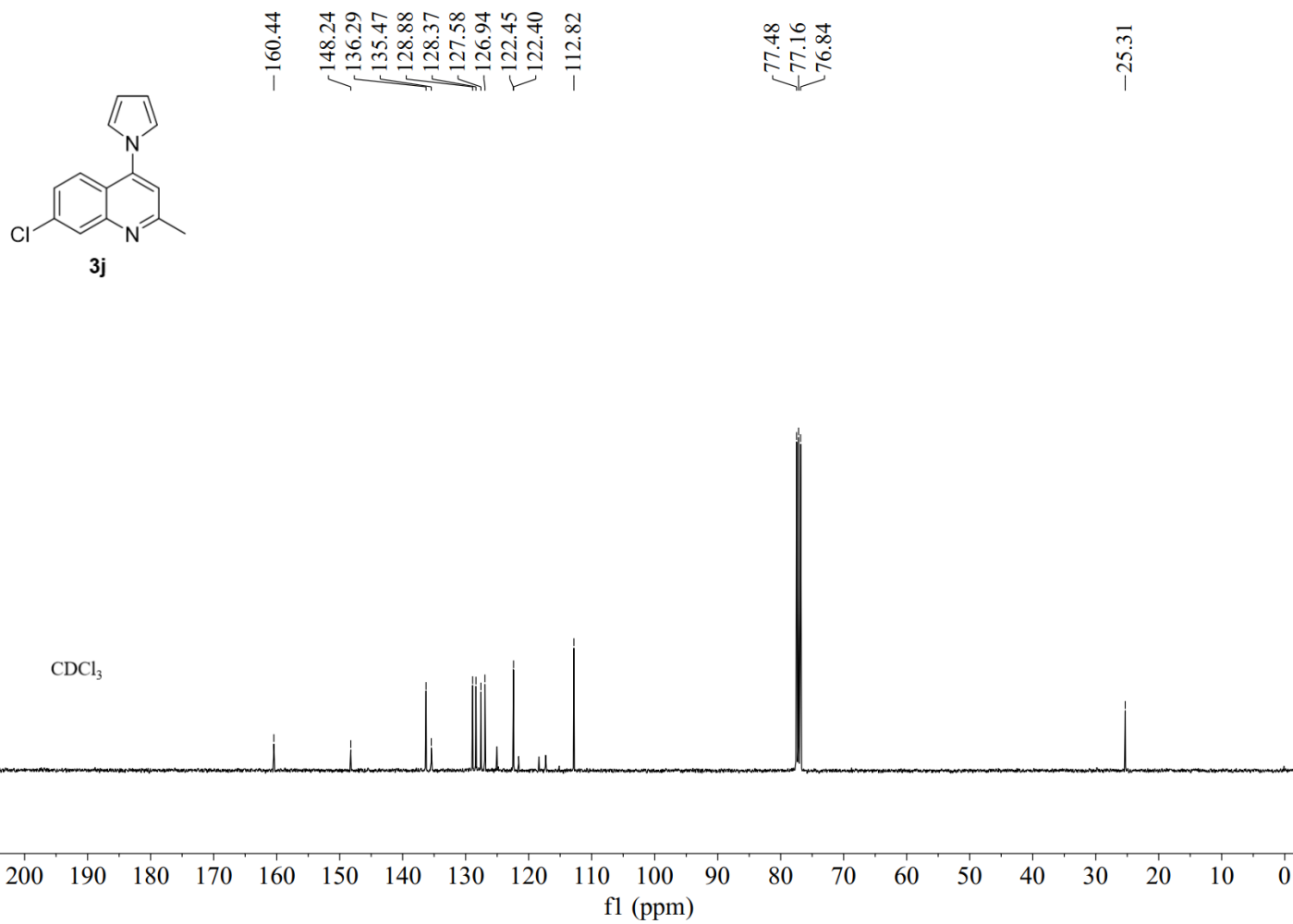
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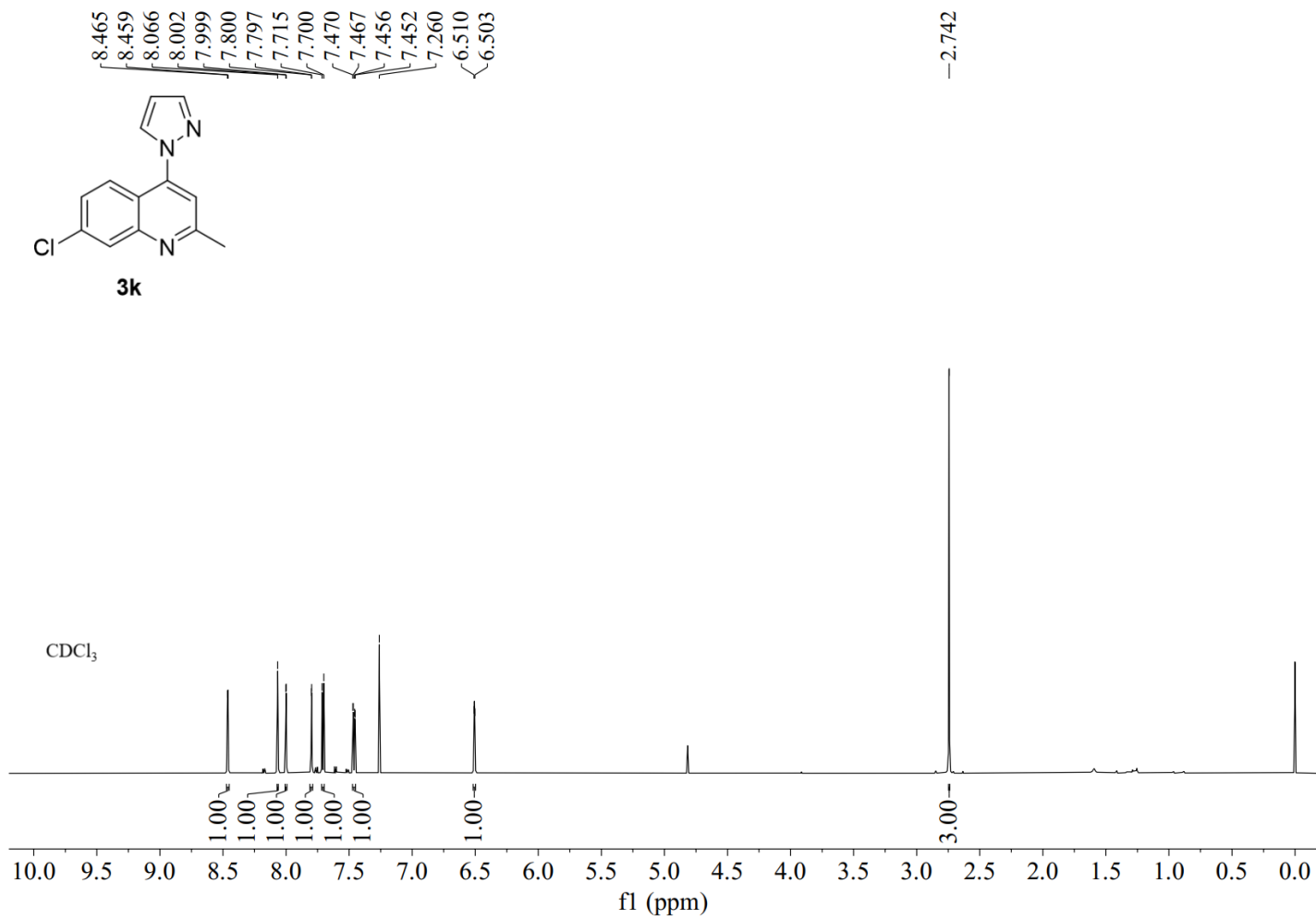
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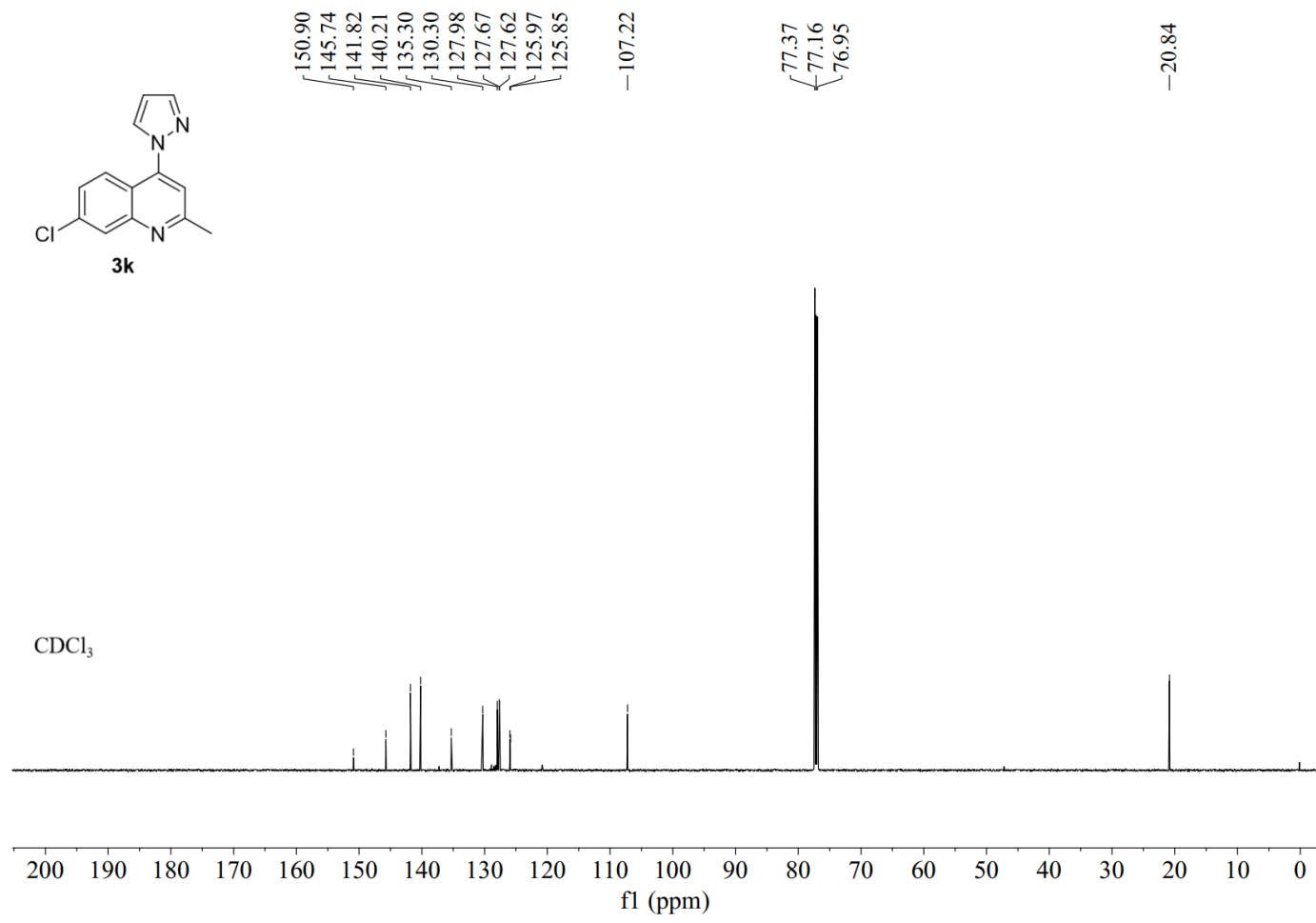
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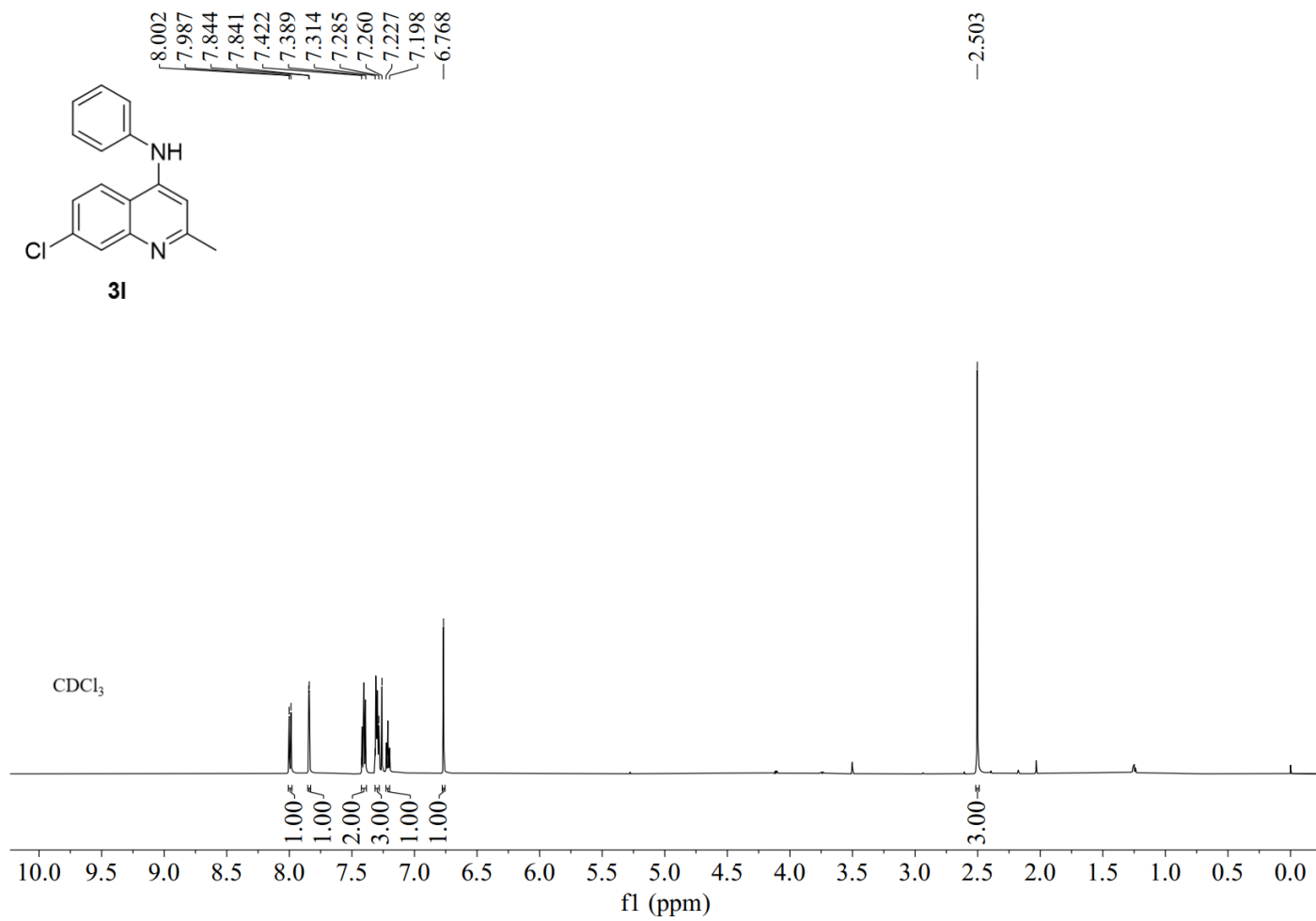
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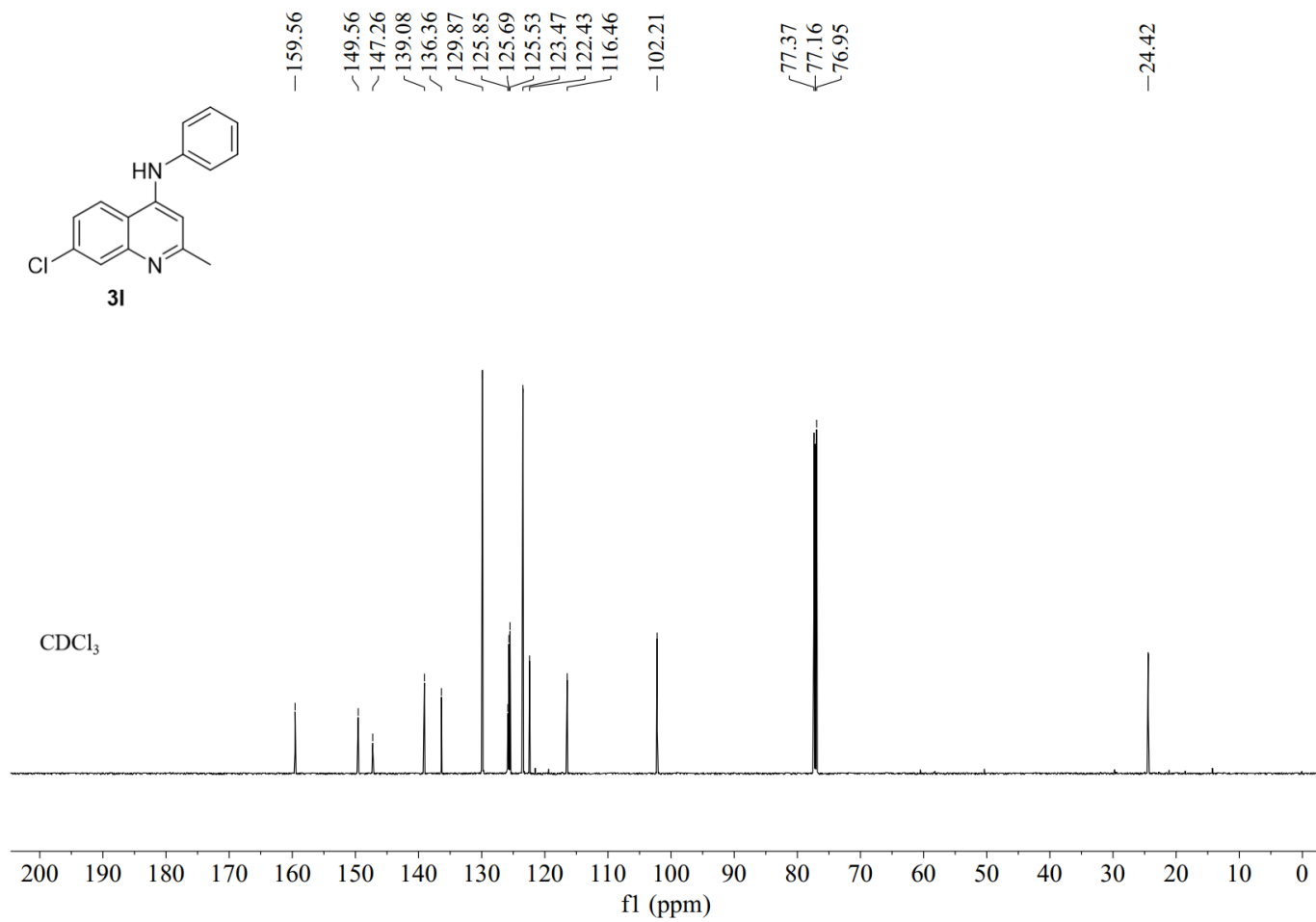
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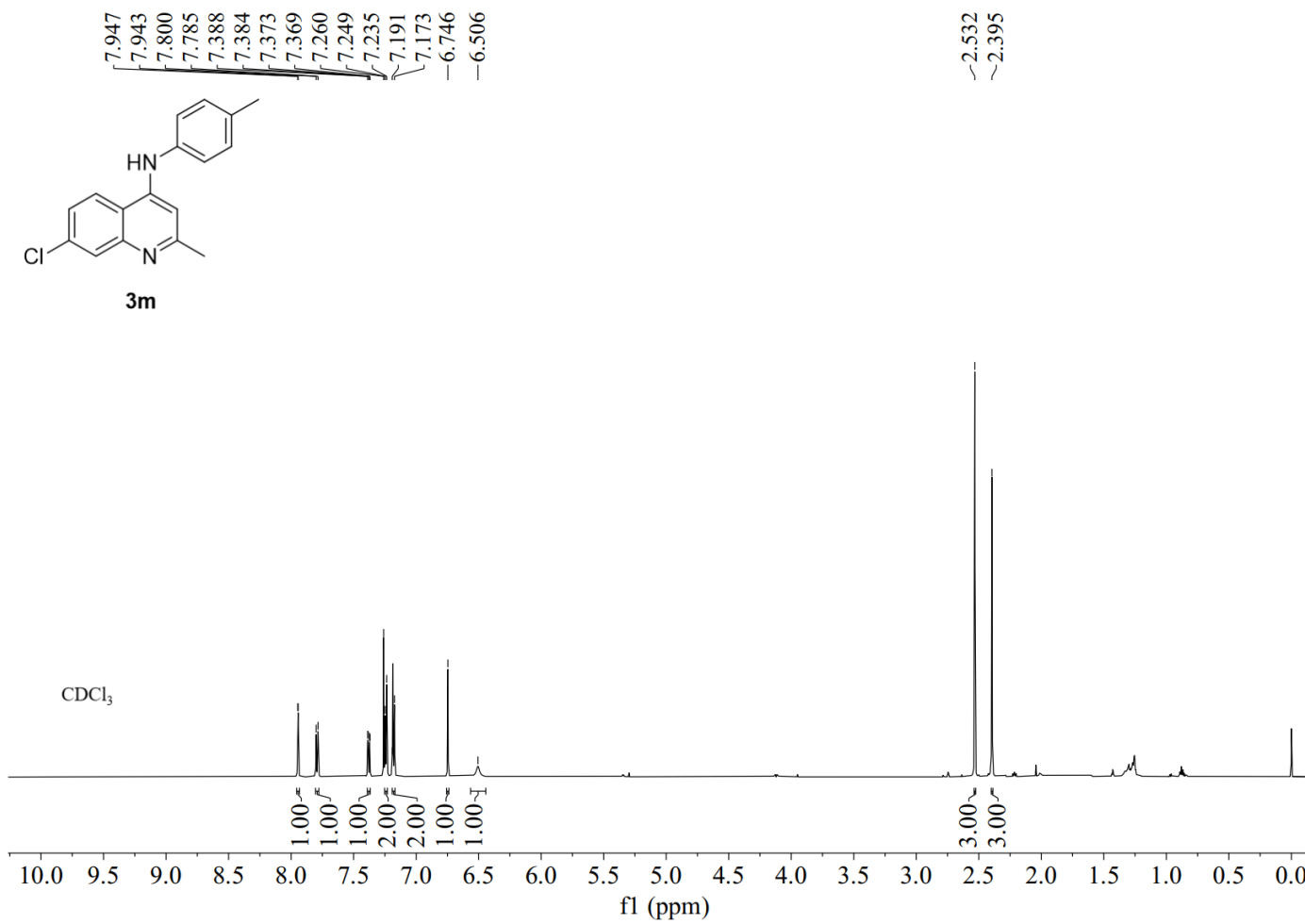
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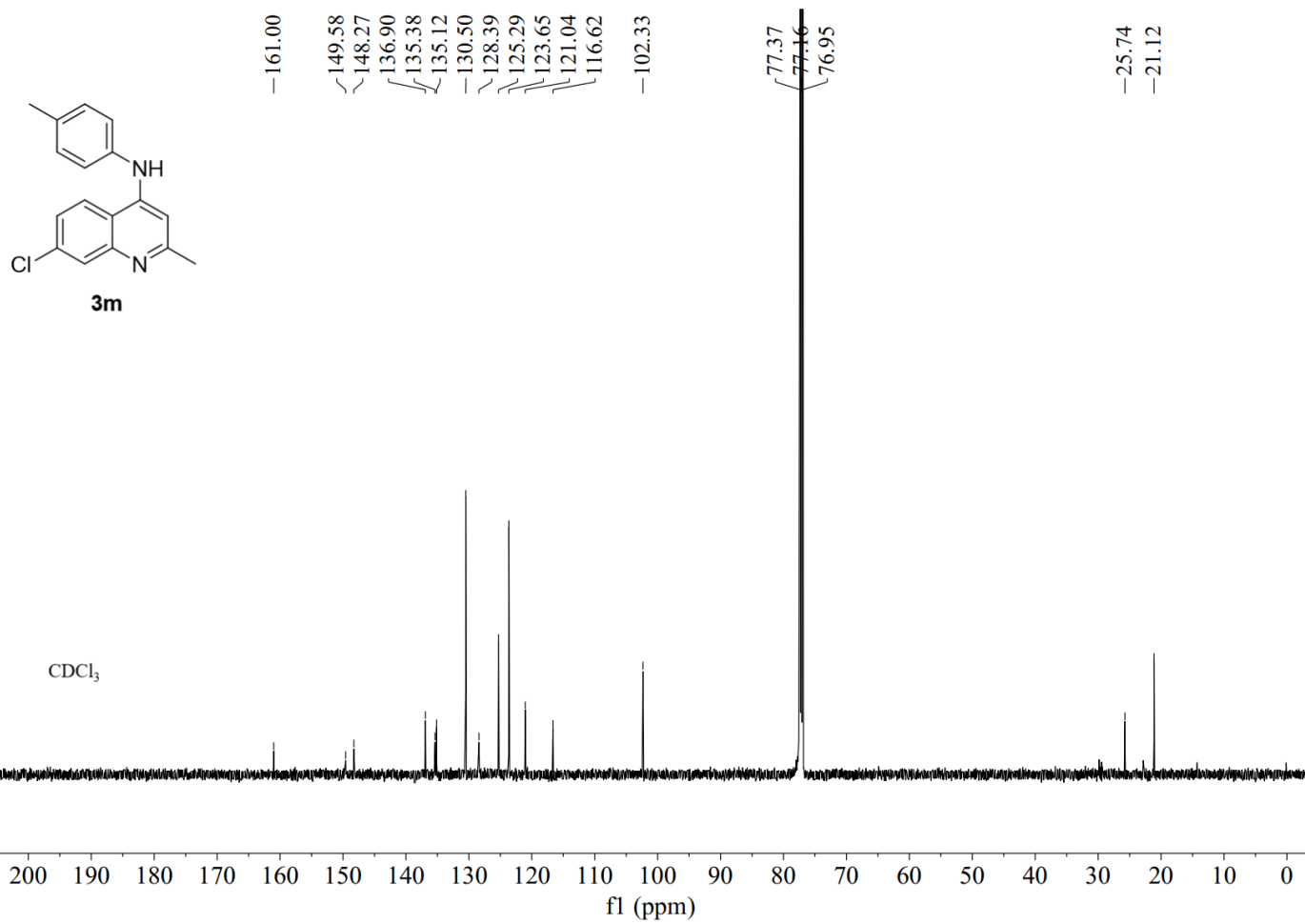
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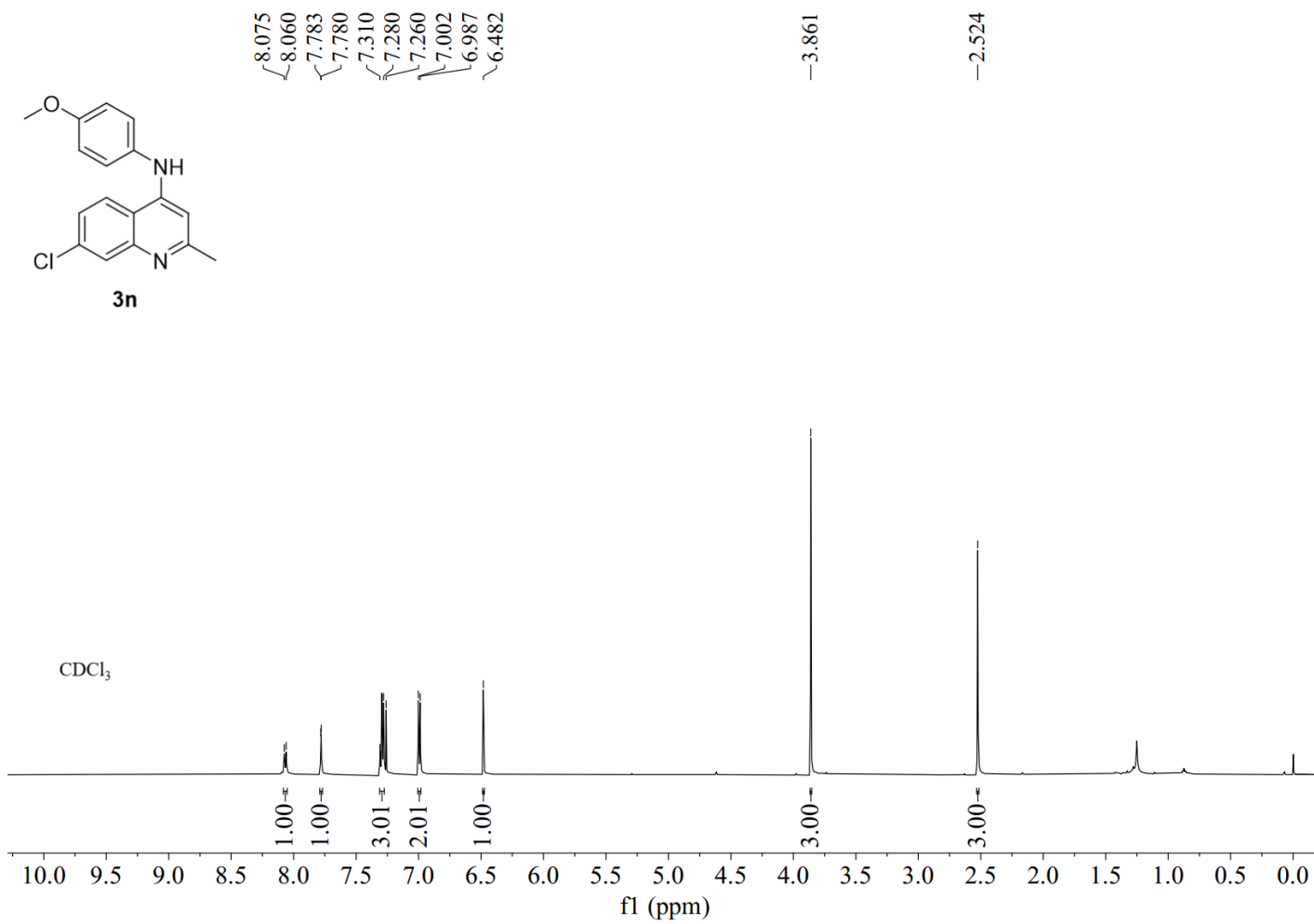
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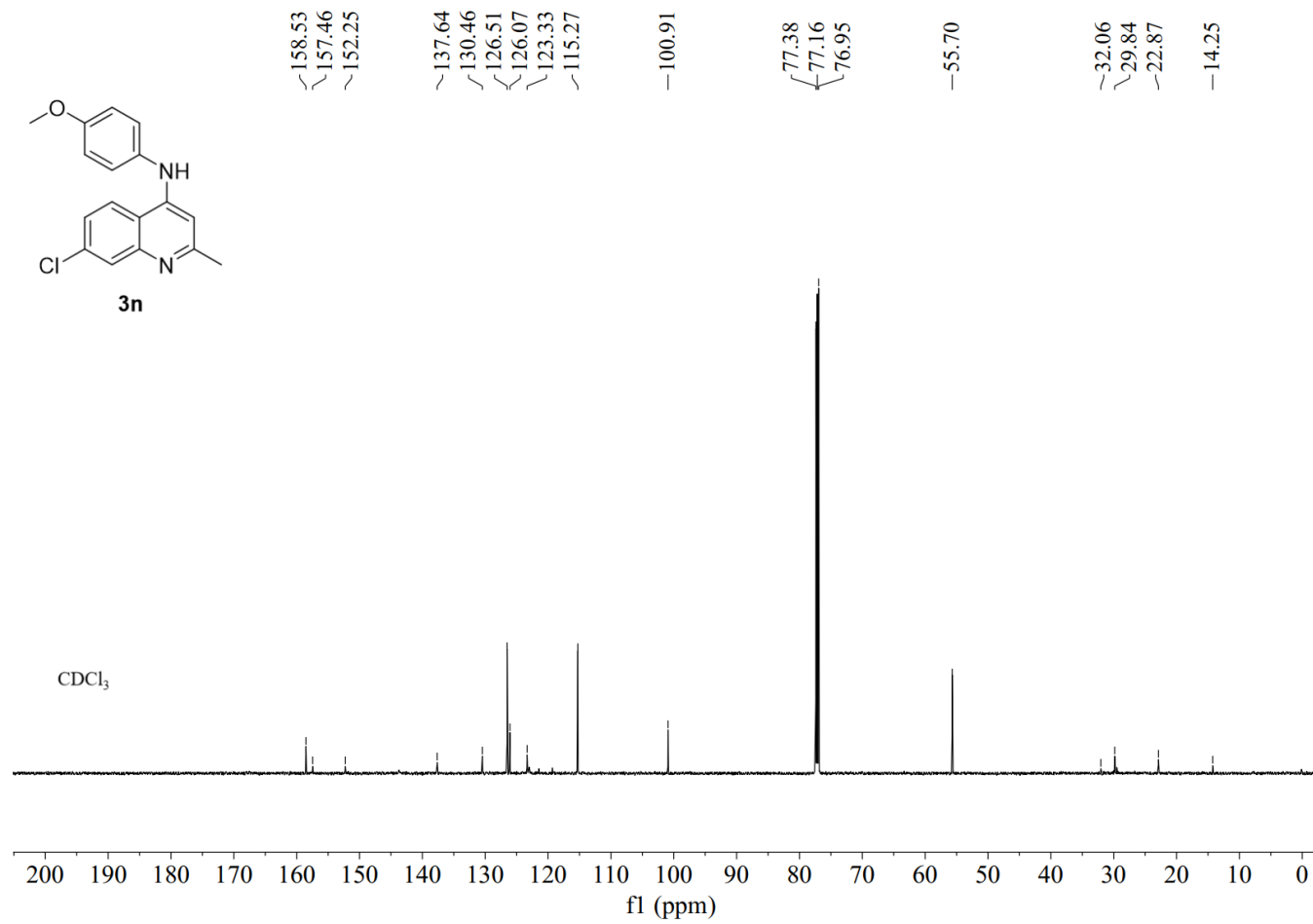
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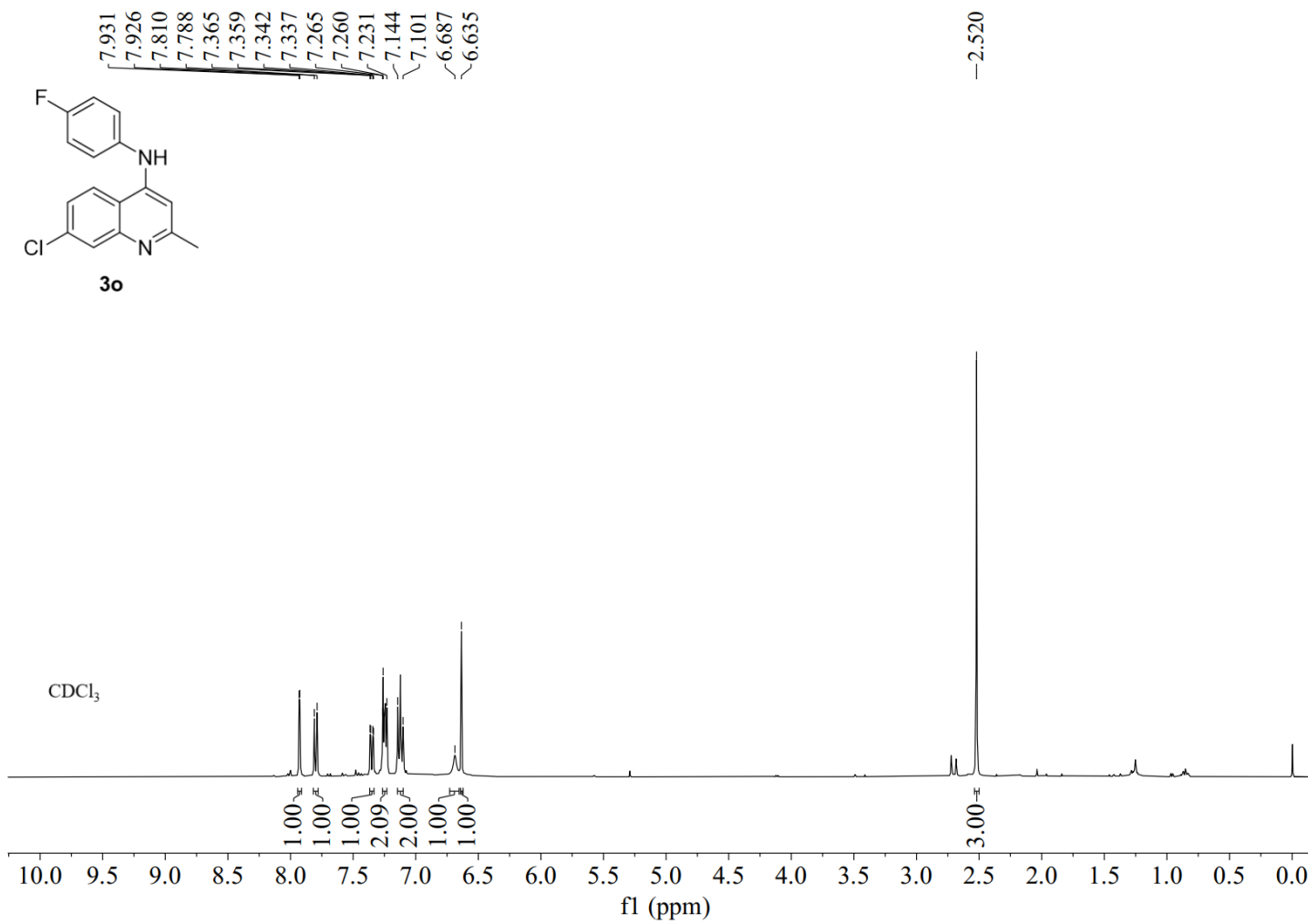
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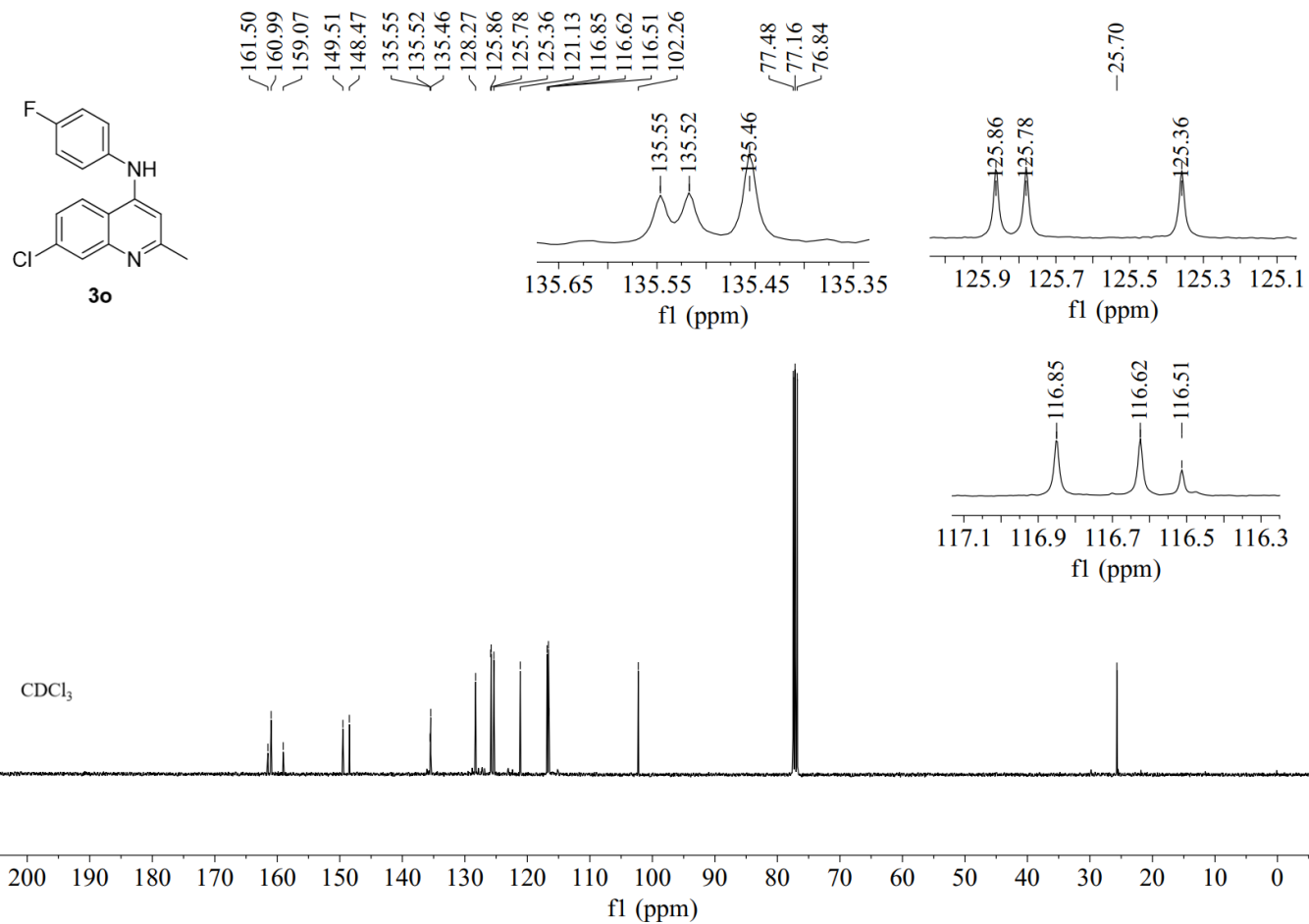
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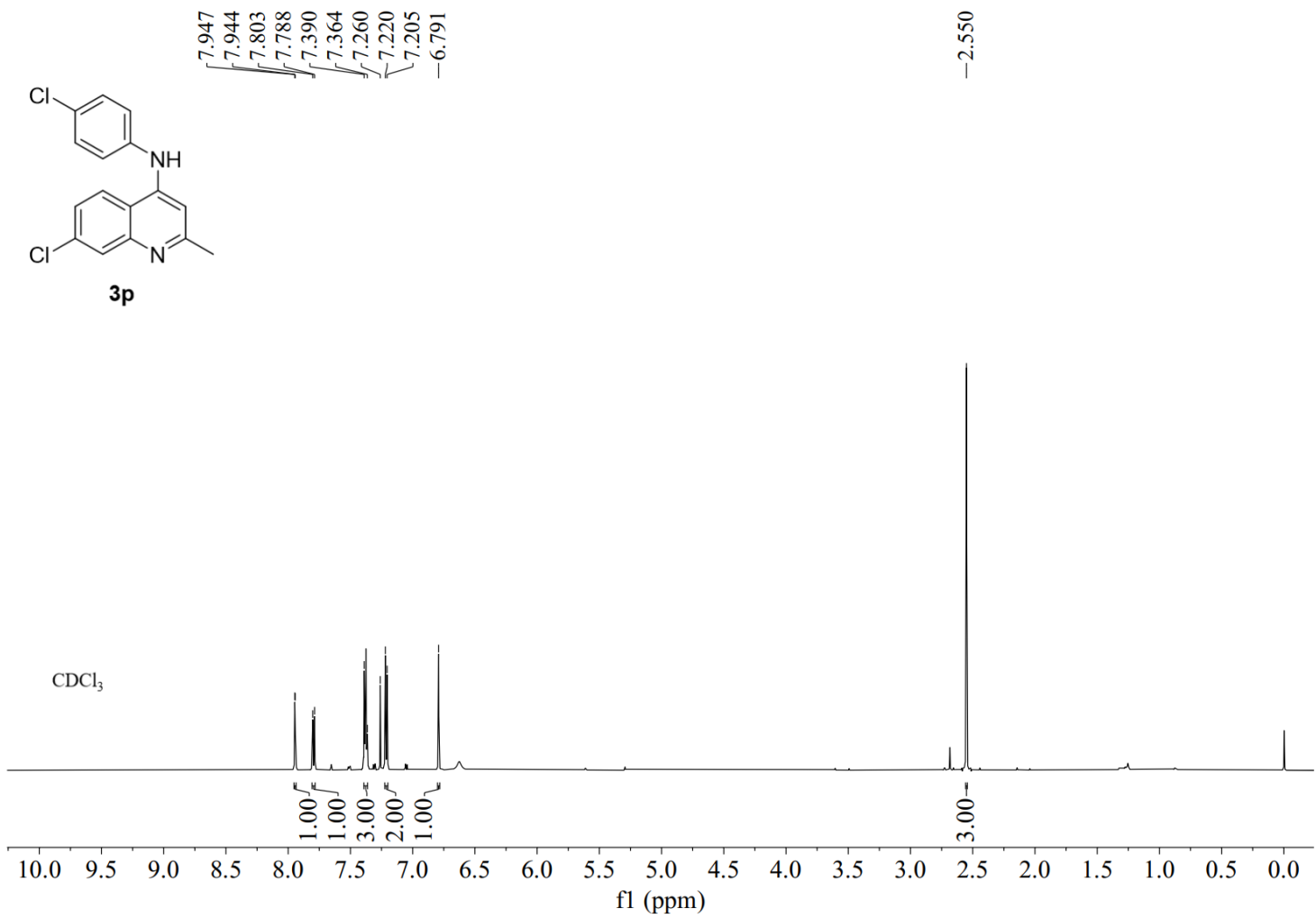
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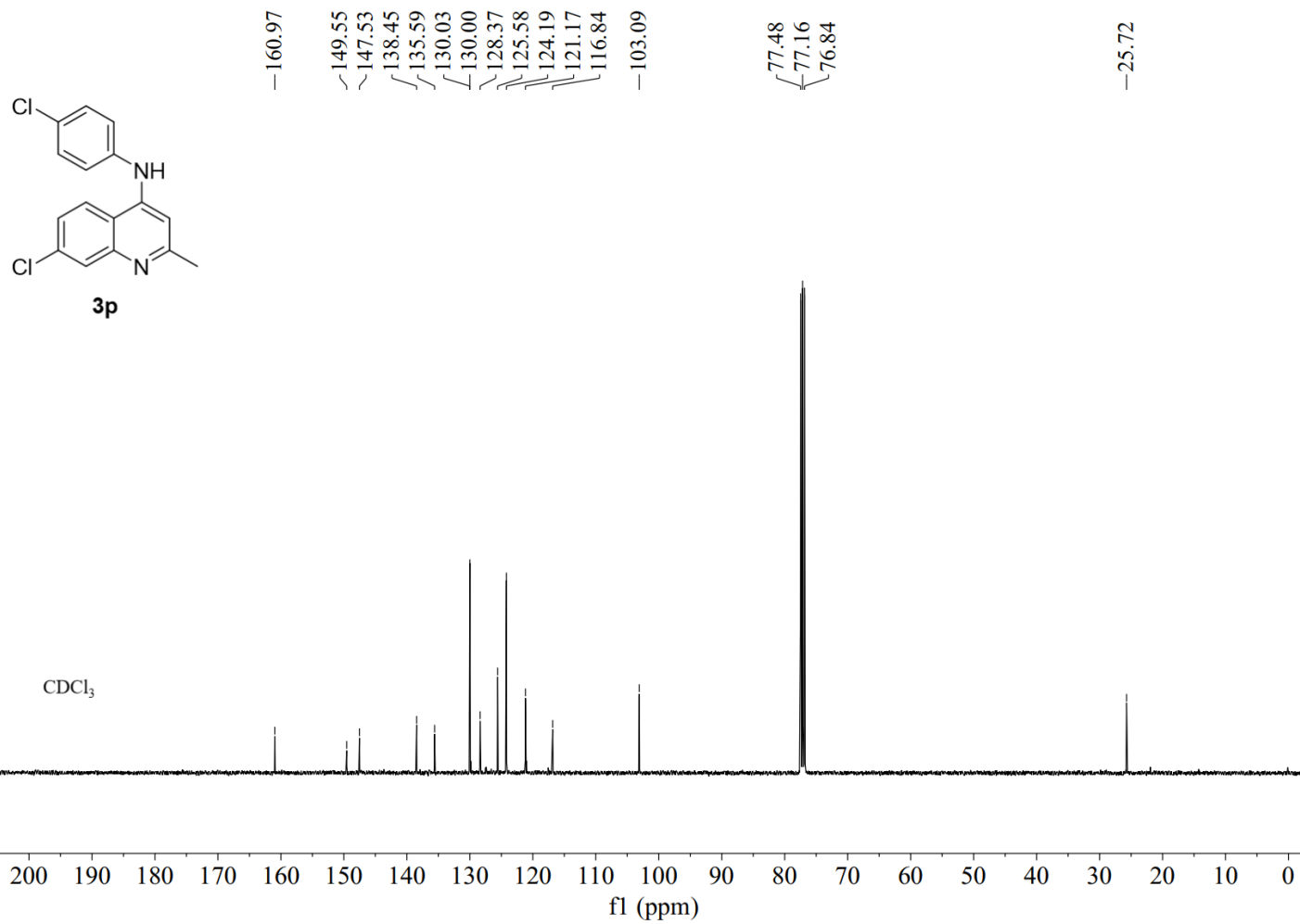
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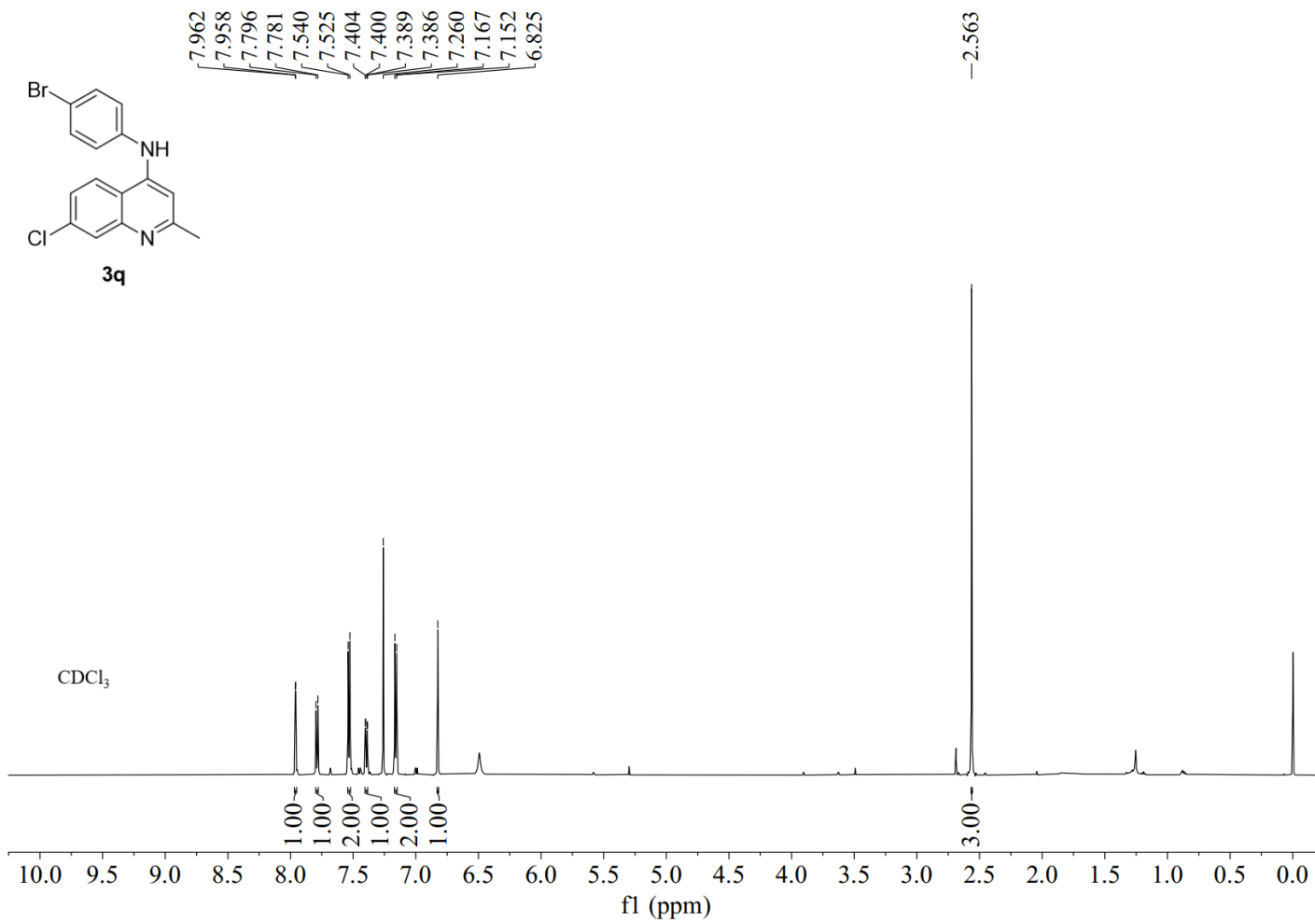
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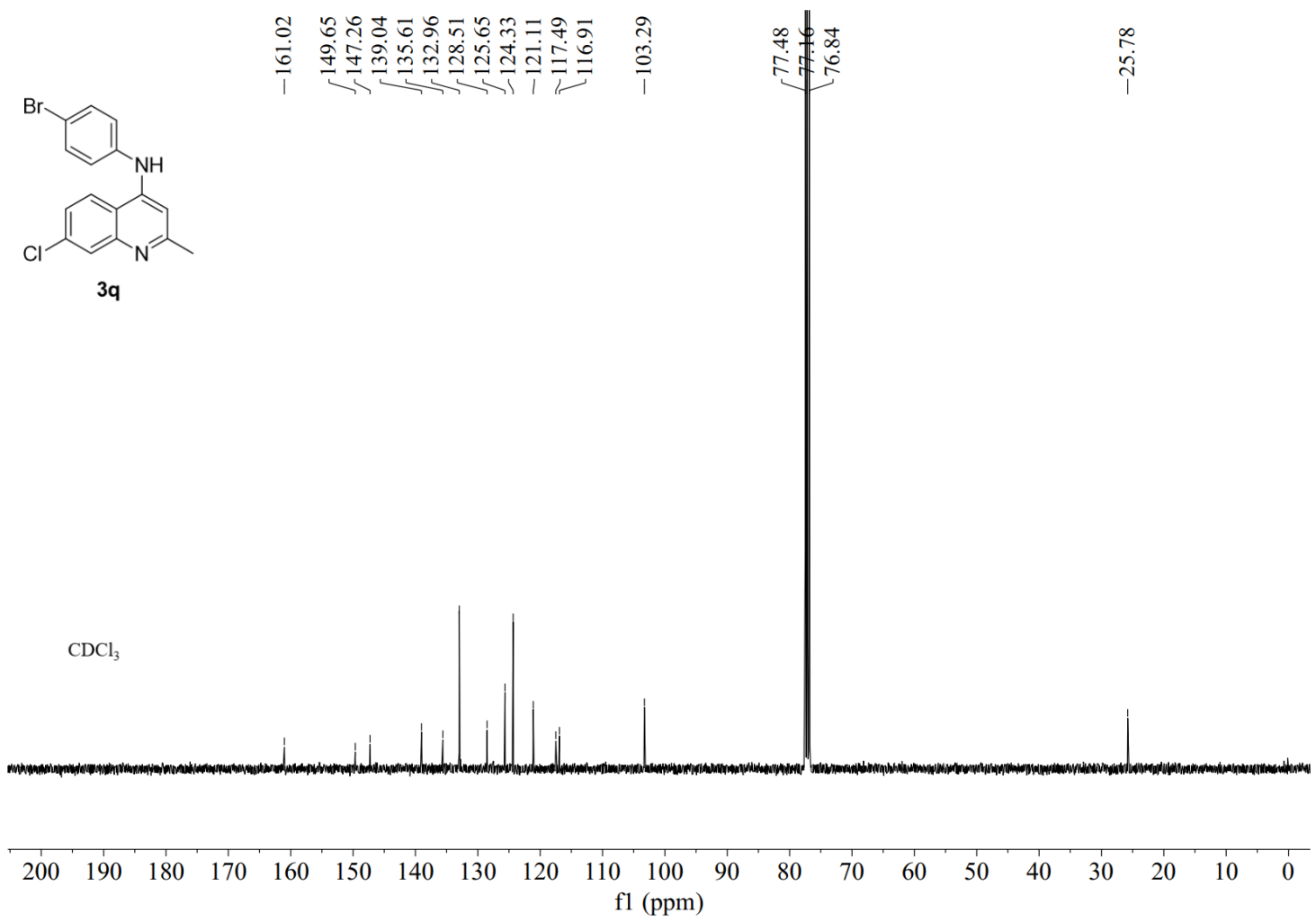
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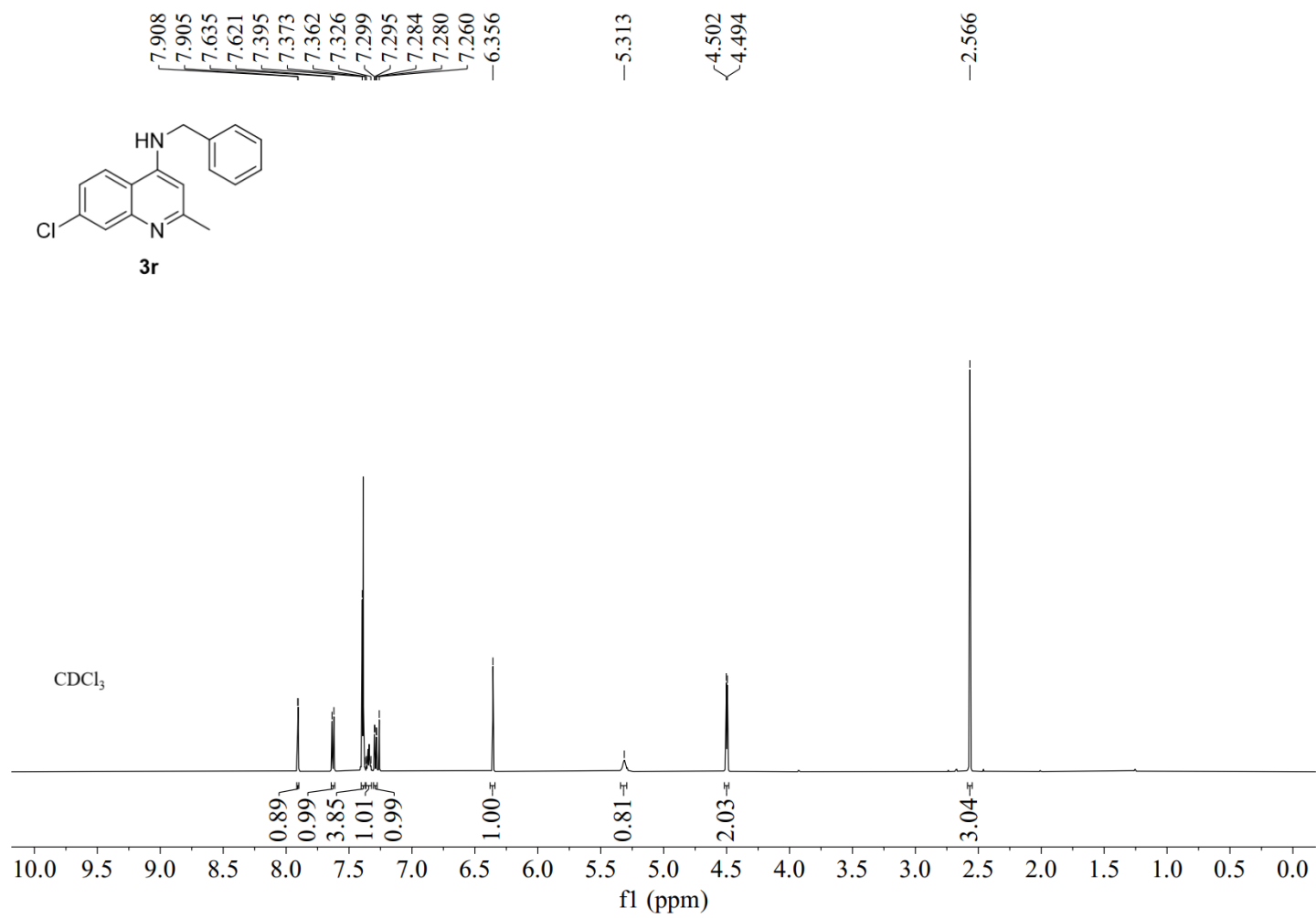
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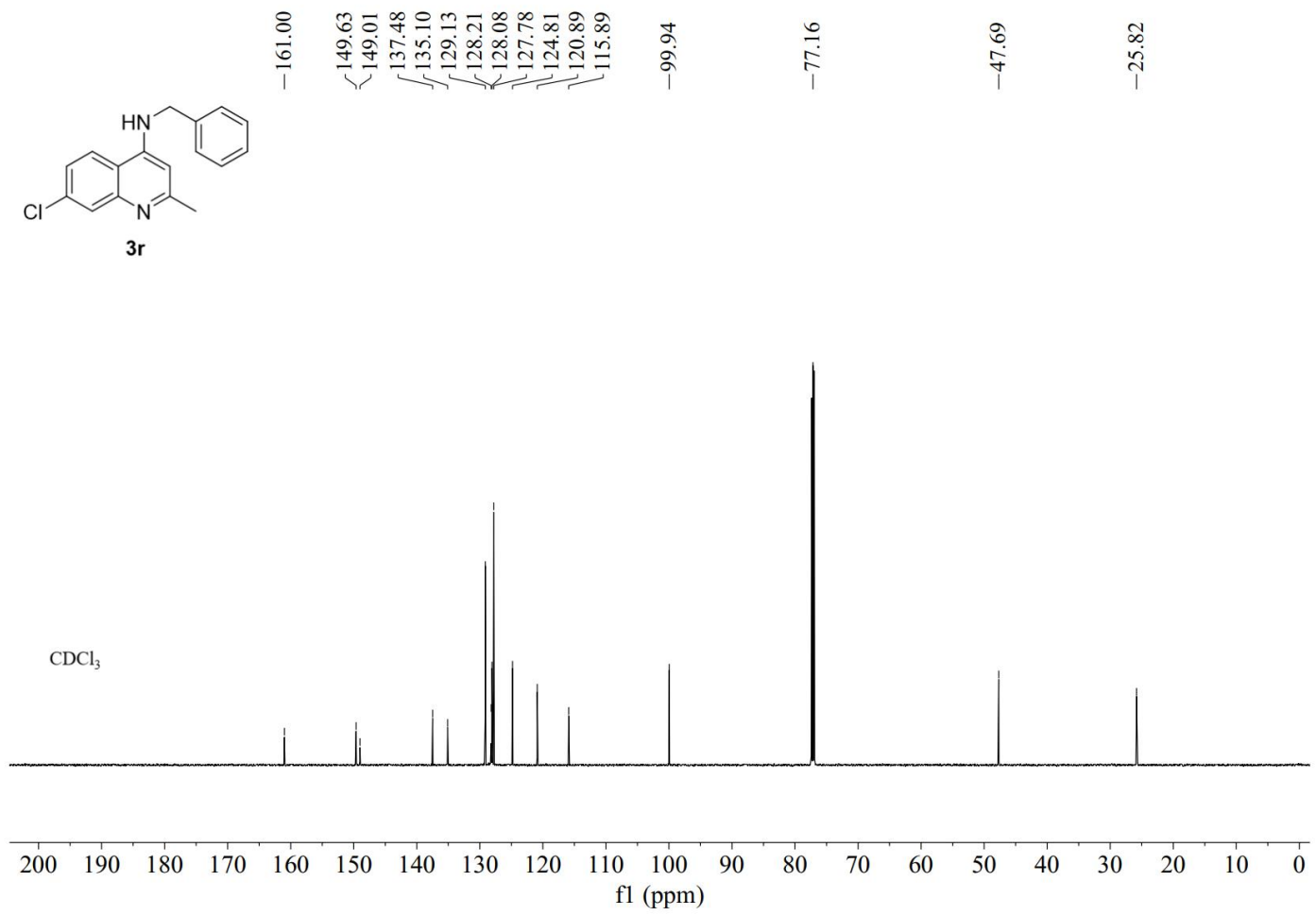
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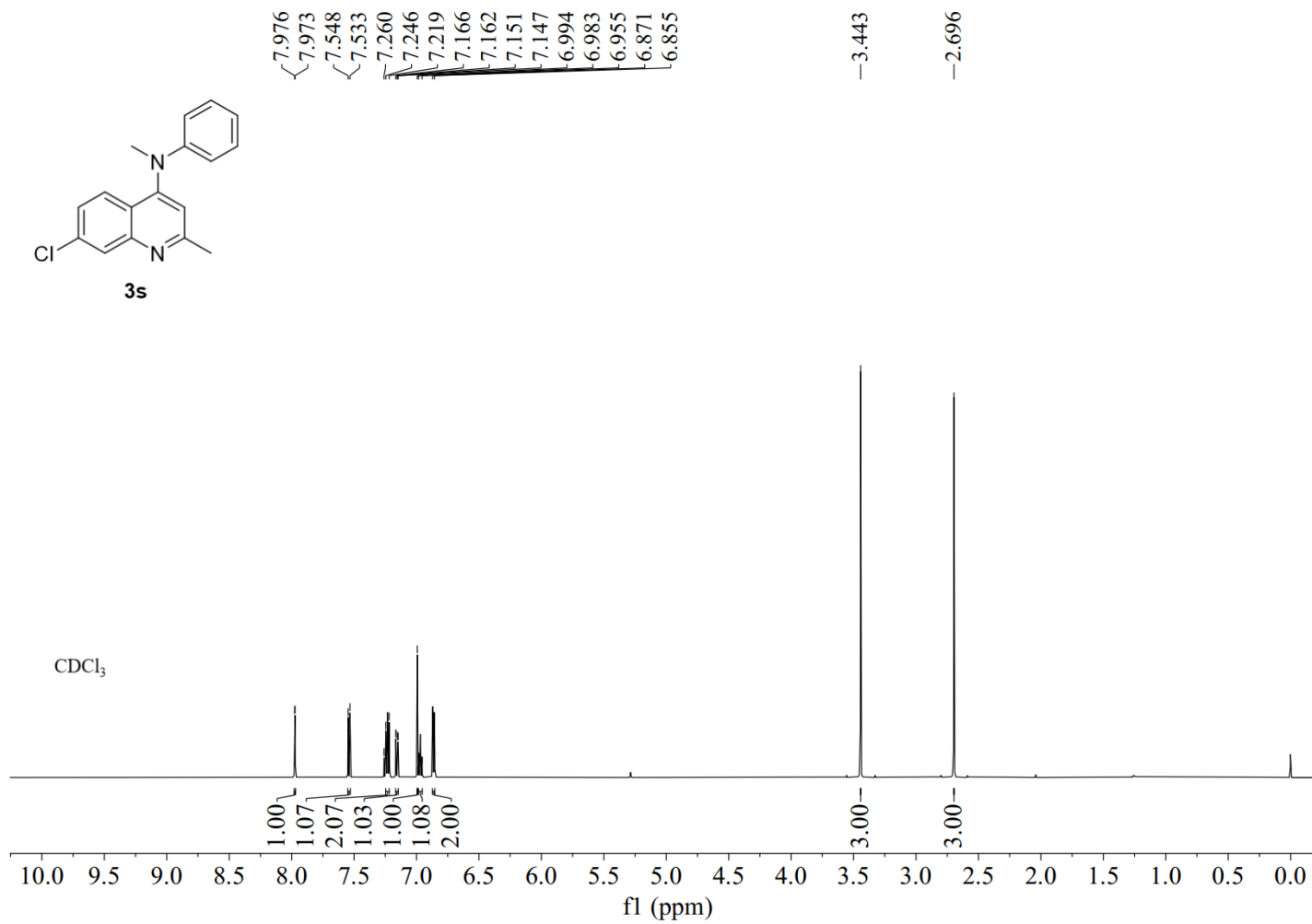
¹H NMR (600 MHz, CDCl₃):



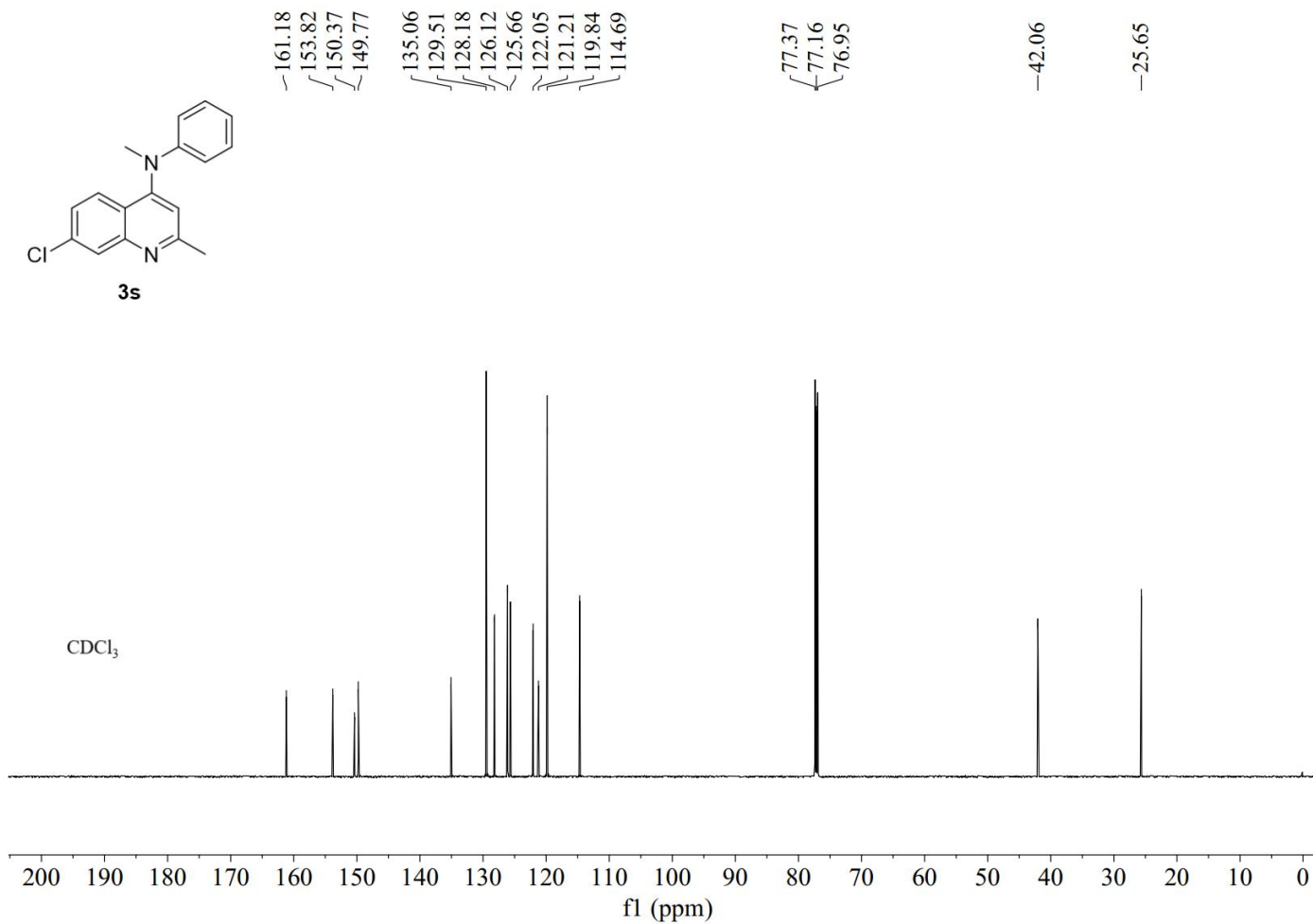
¹³C NMR (150 MHz, CDCl₃):



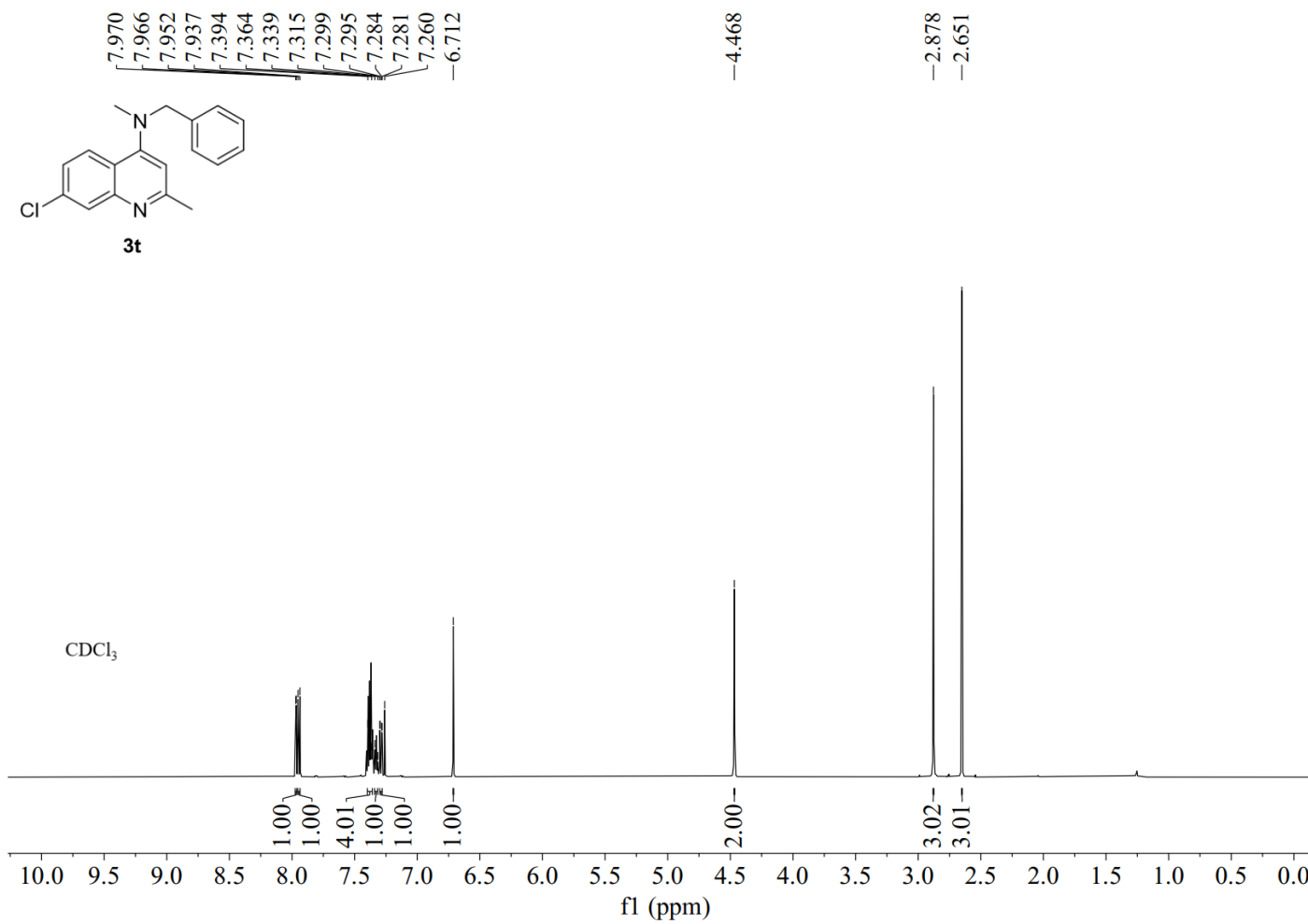
¹H NMR (600 MHz, CDCl₃):



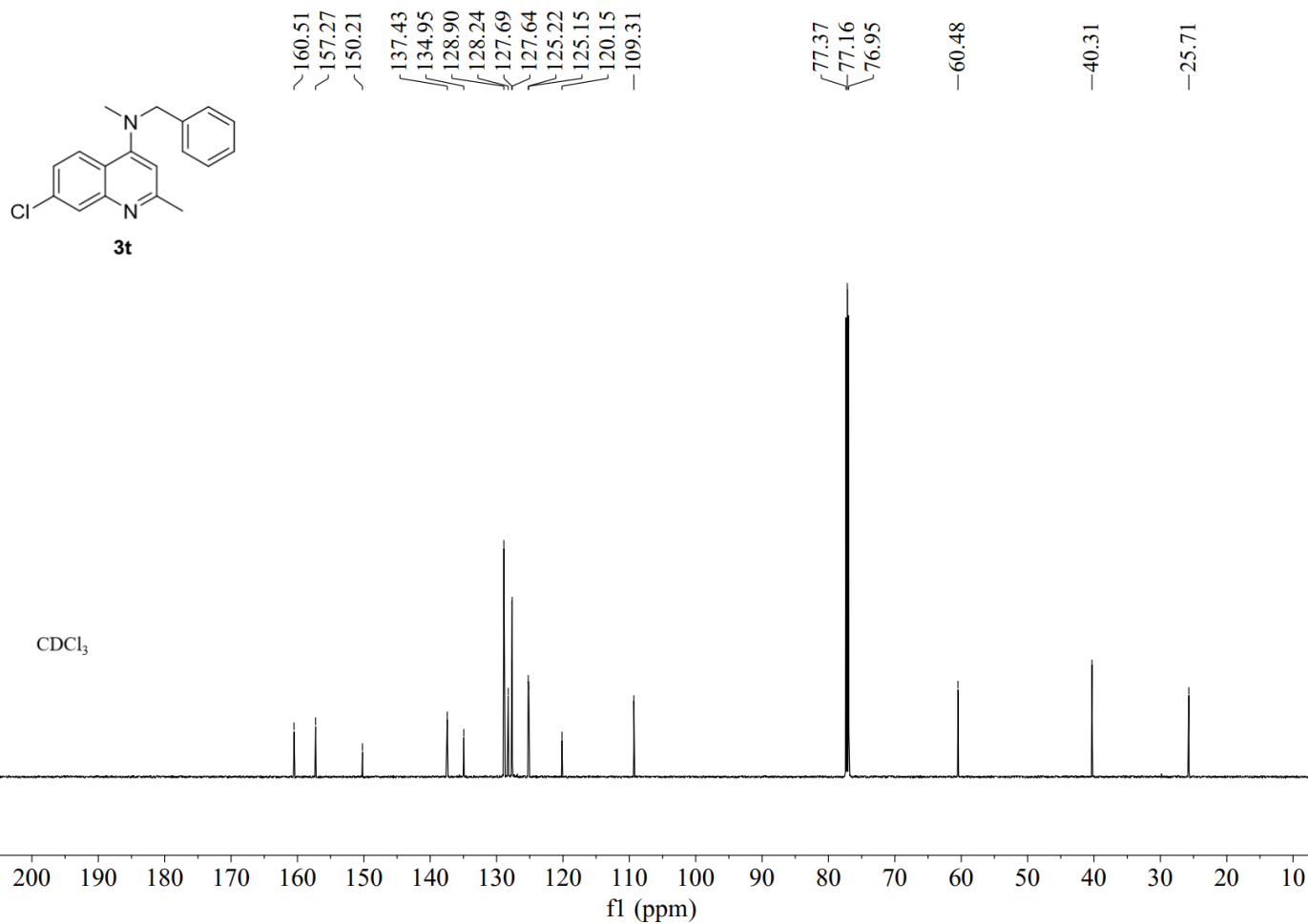
^{13}C NMR (150 MHz, CDCl_3):



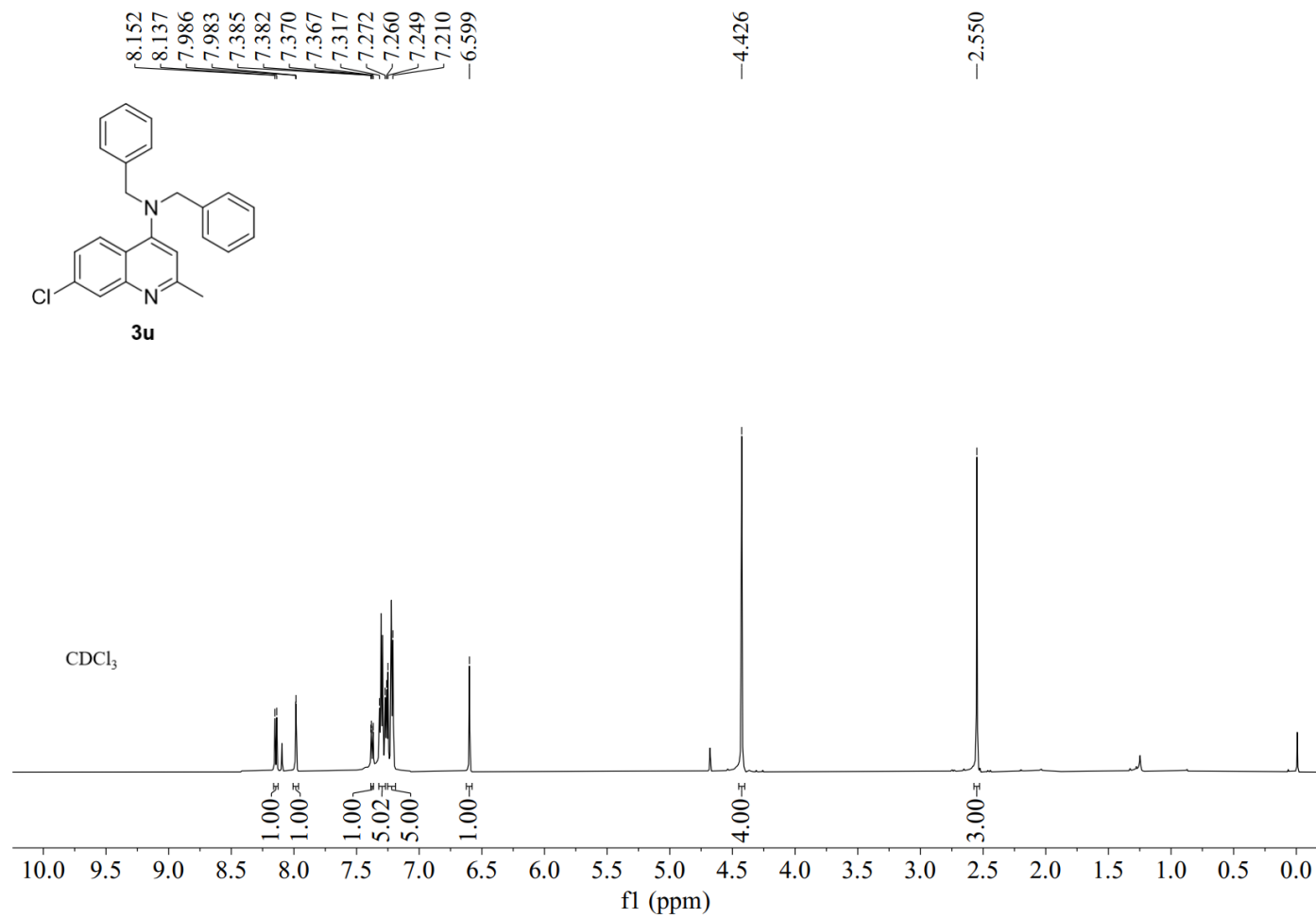
¹H NMR (600 MHz, CDCl₃):



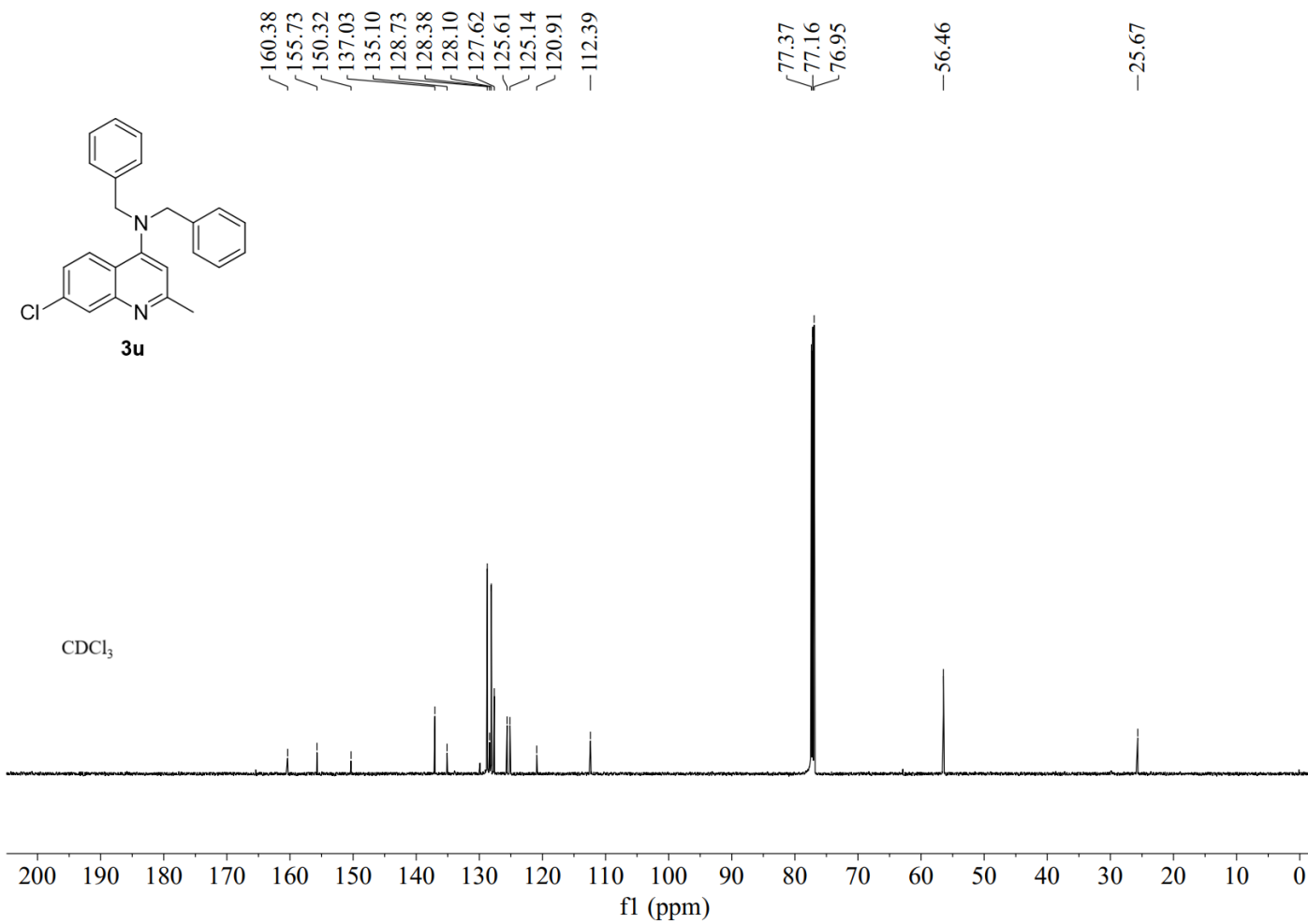
¹³C NMR (150 MHz, CDCl₃):



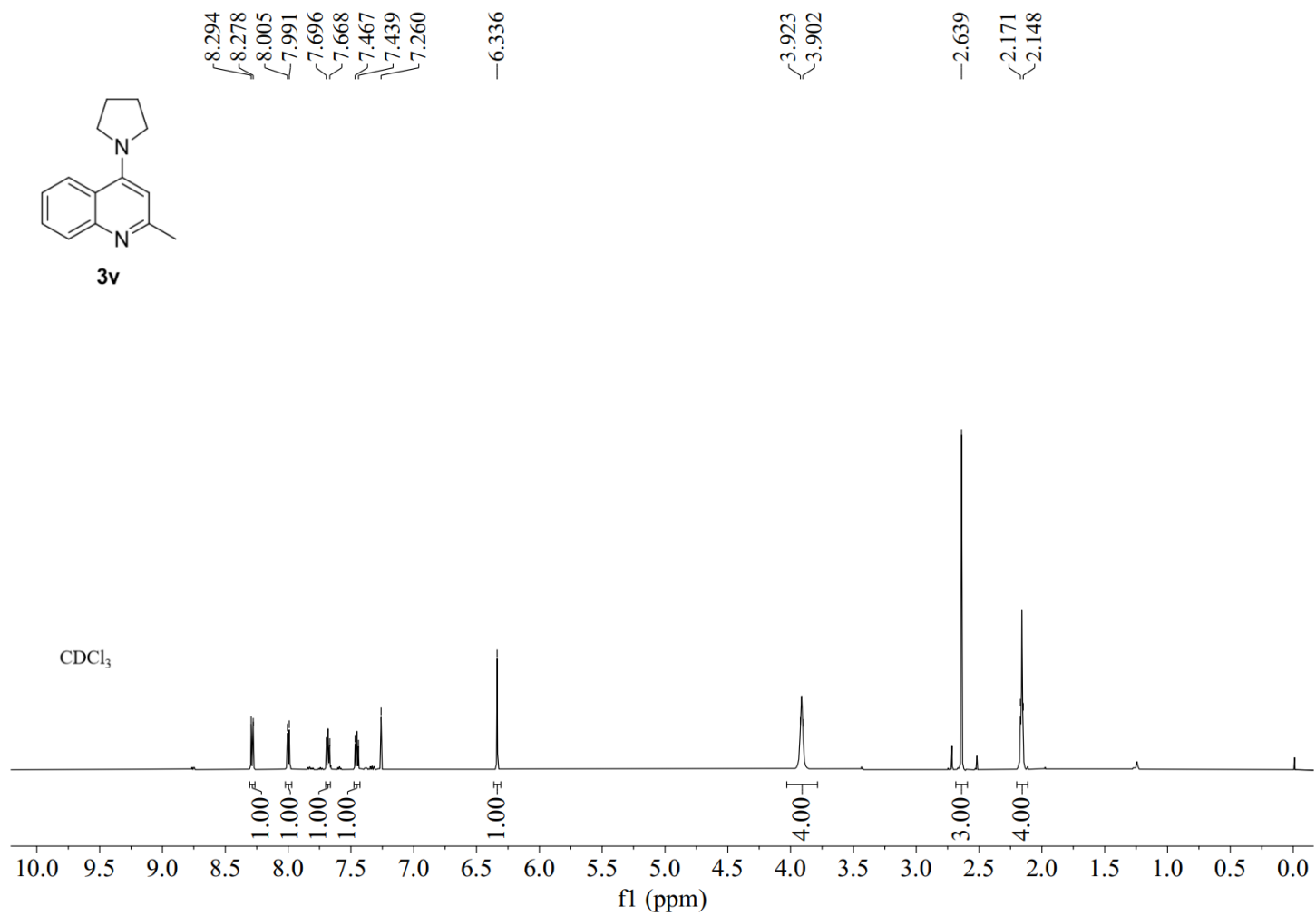
¹H NMR (600 MHz, CDCl₃):



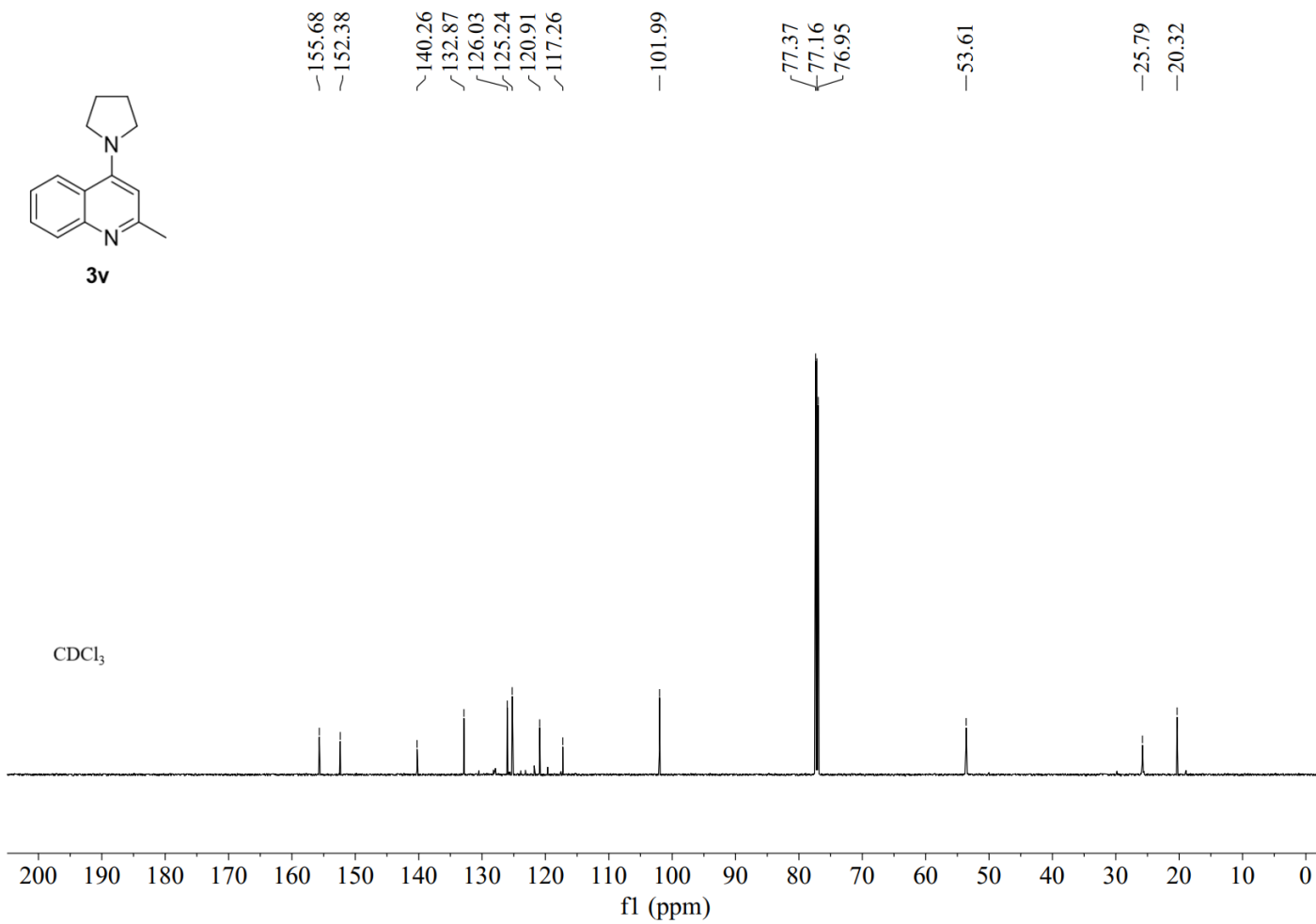
^{13}C NMR (150 MHz, CDCl_3):



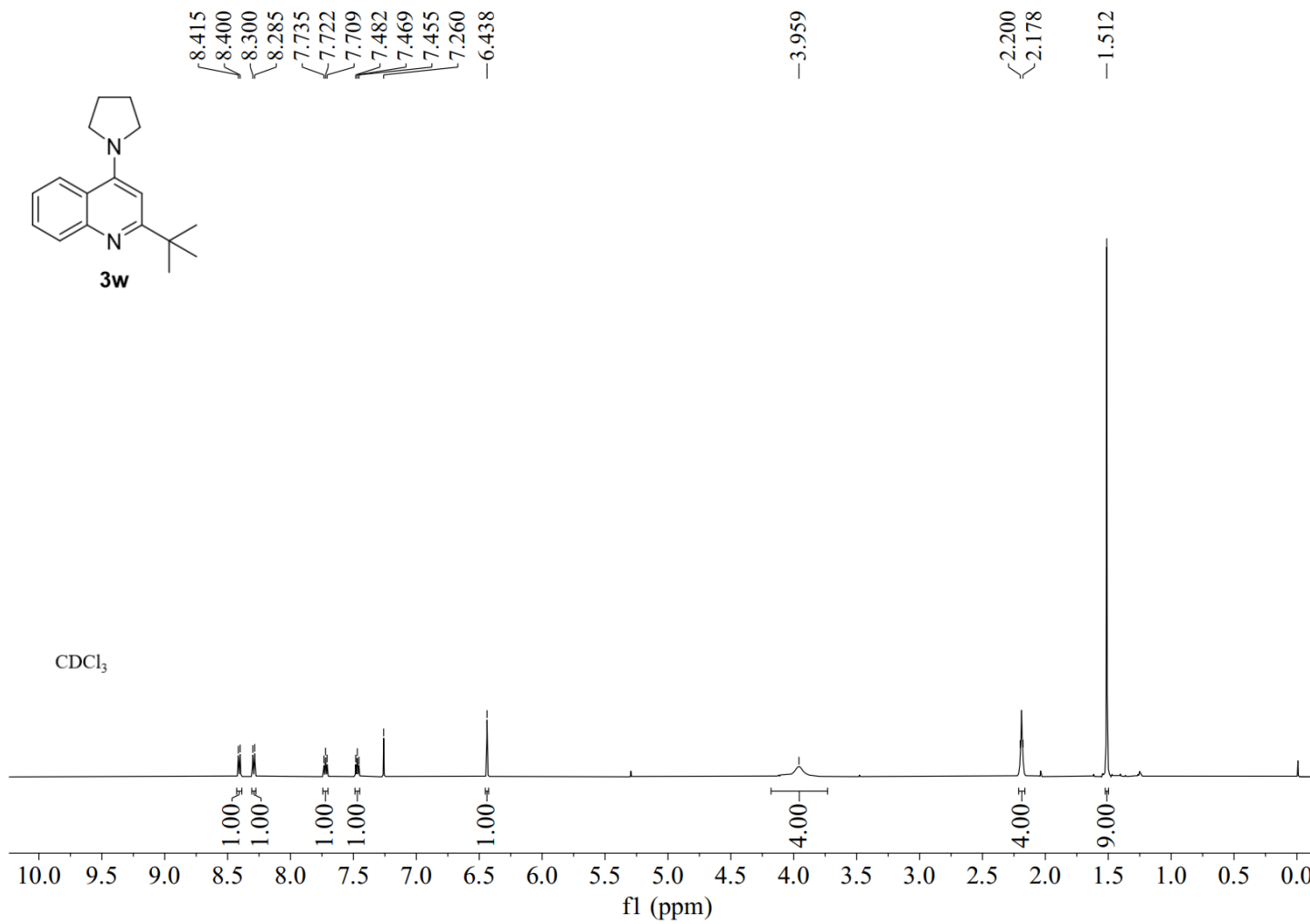
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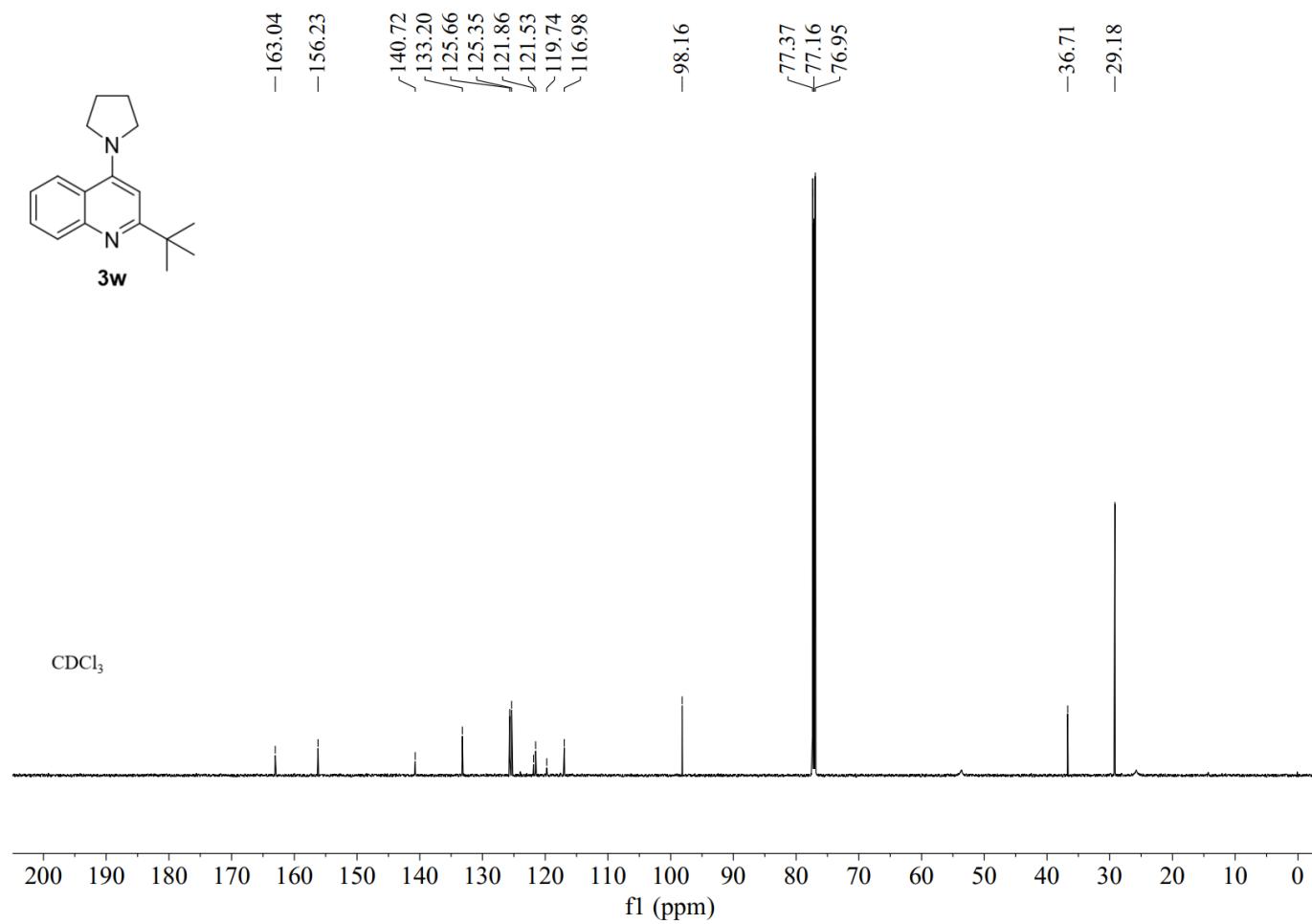
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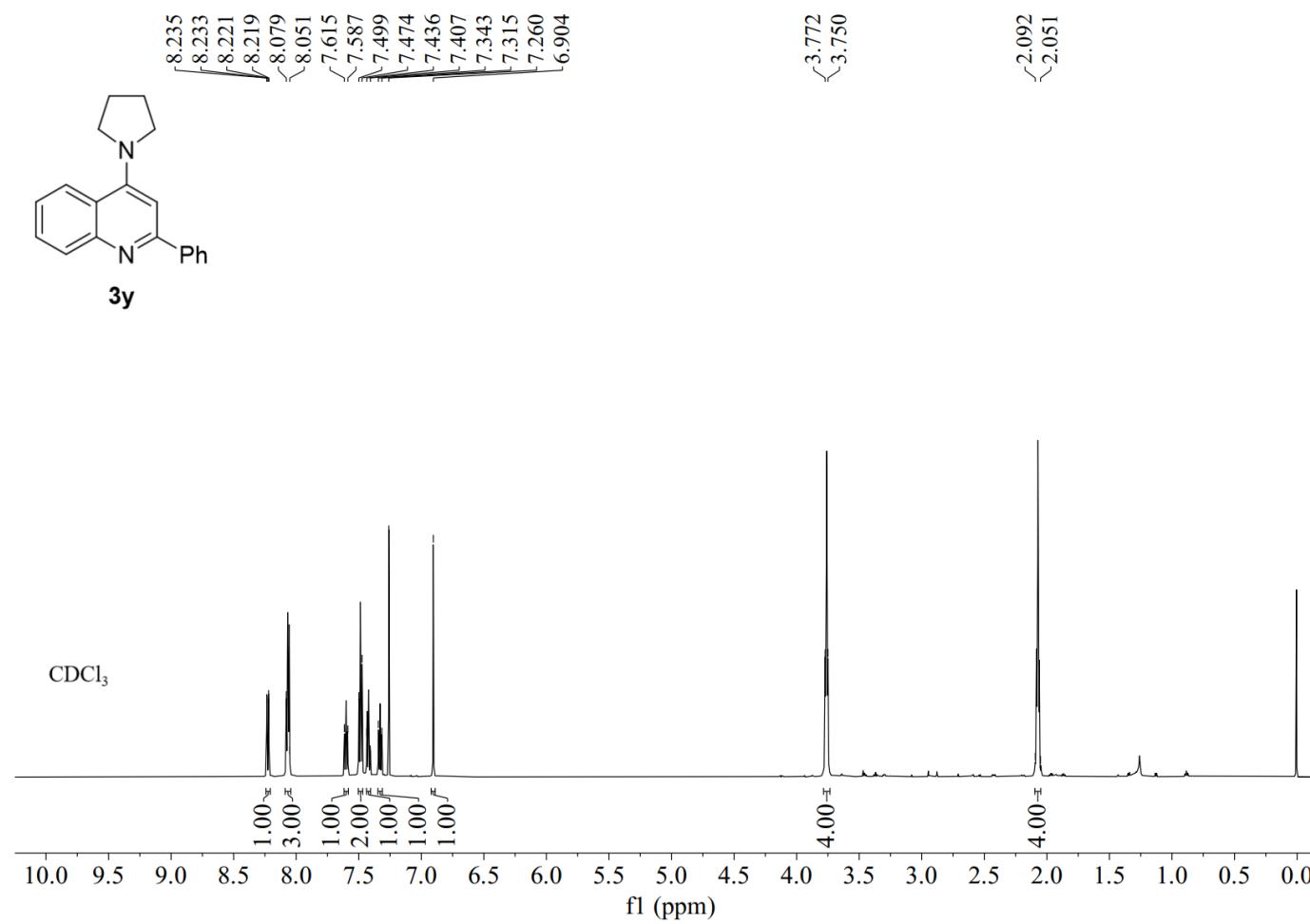
¹H NMR (600 MHz, CDCl₃):



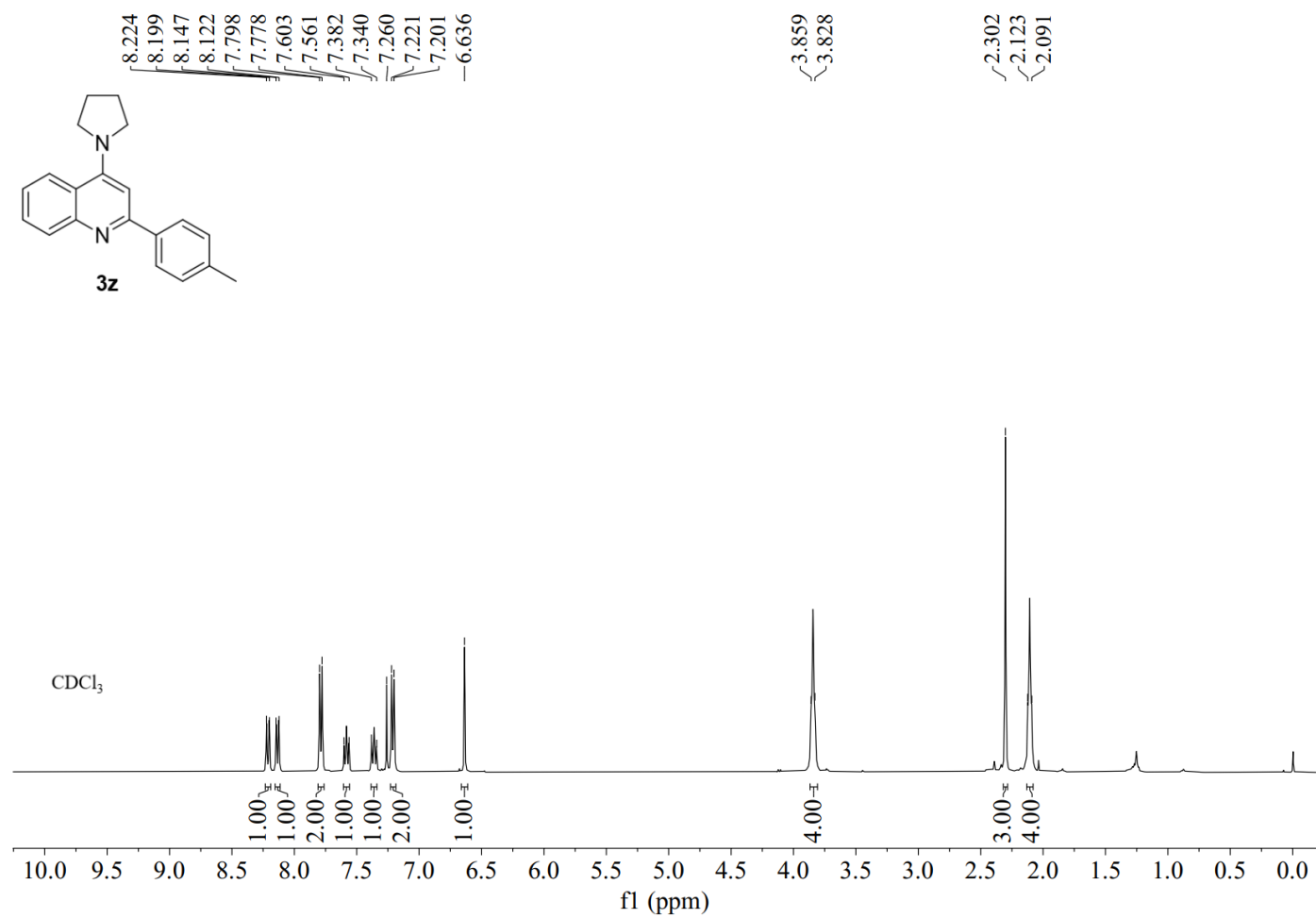
^{13}C NMR (150 MHz, CDCl_3):



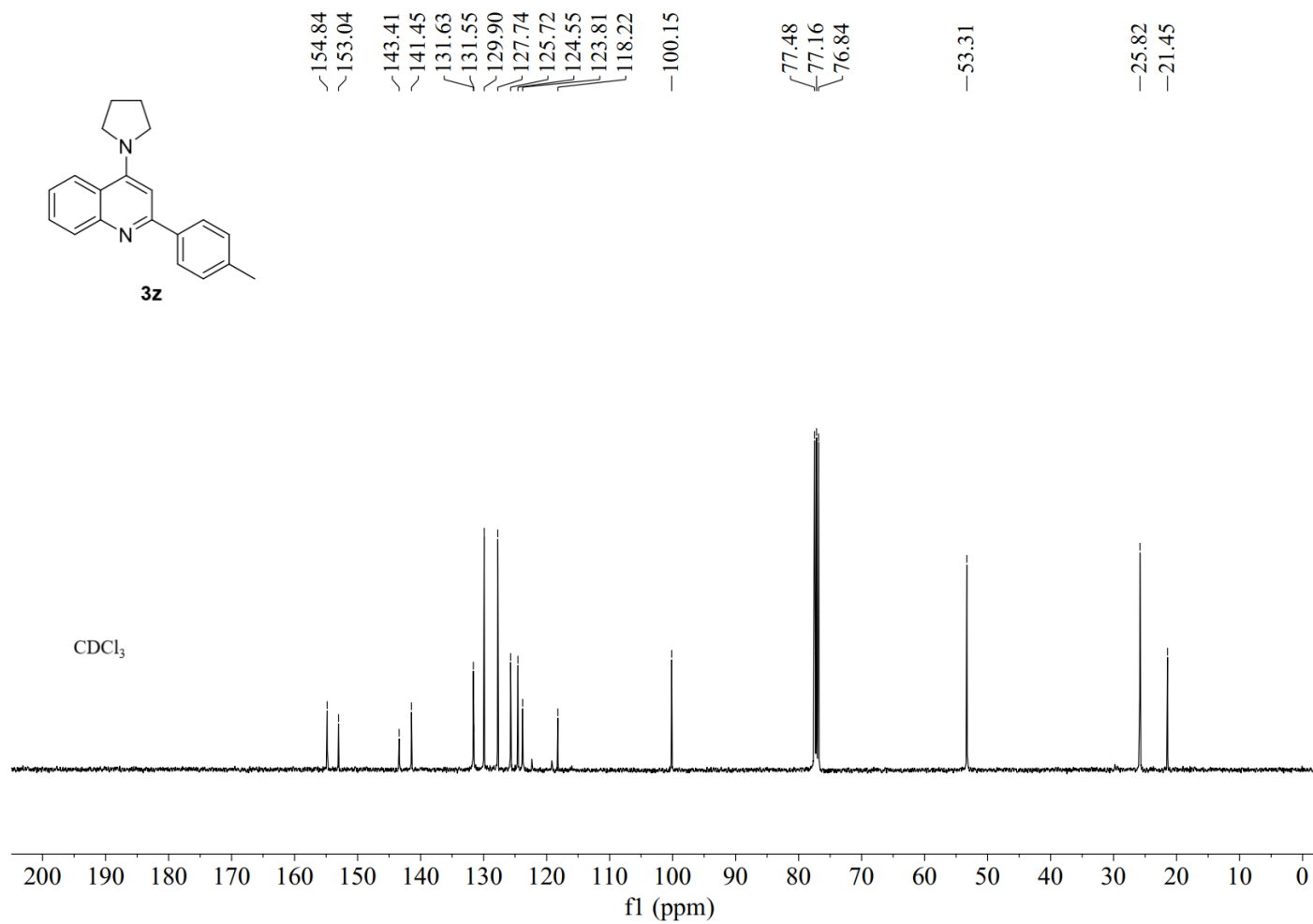
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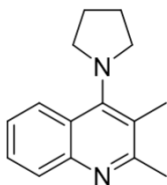
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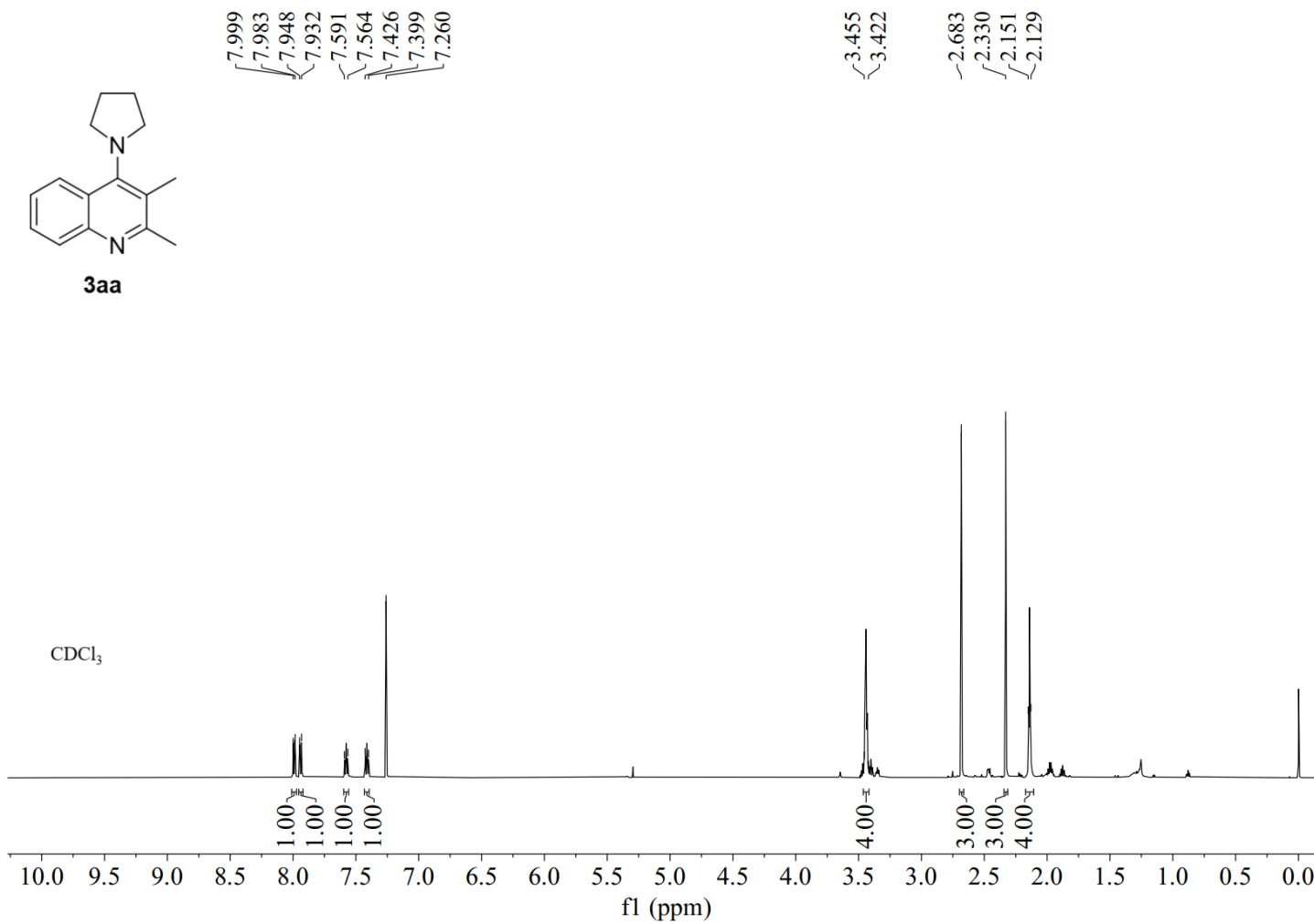
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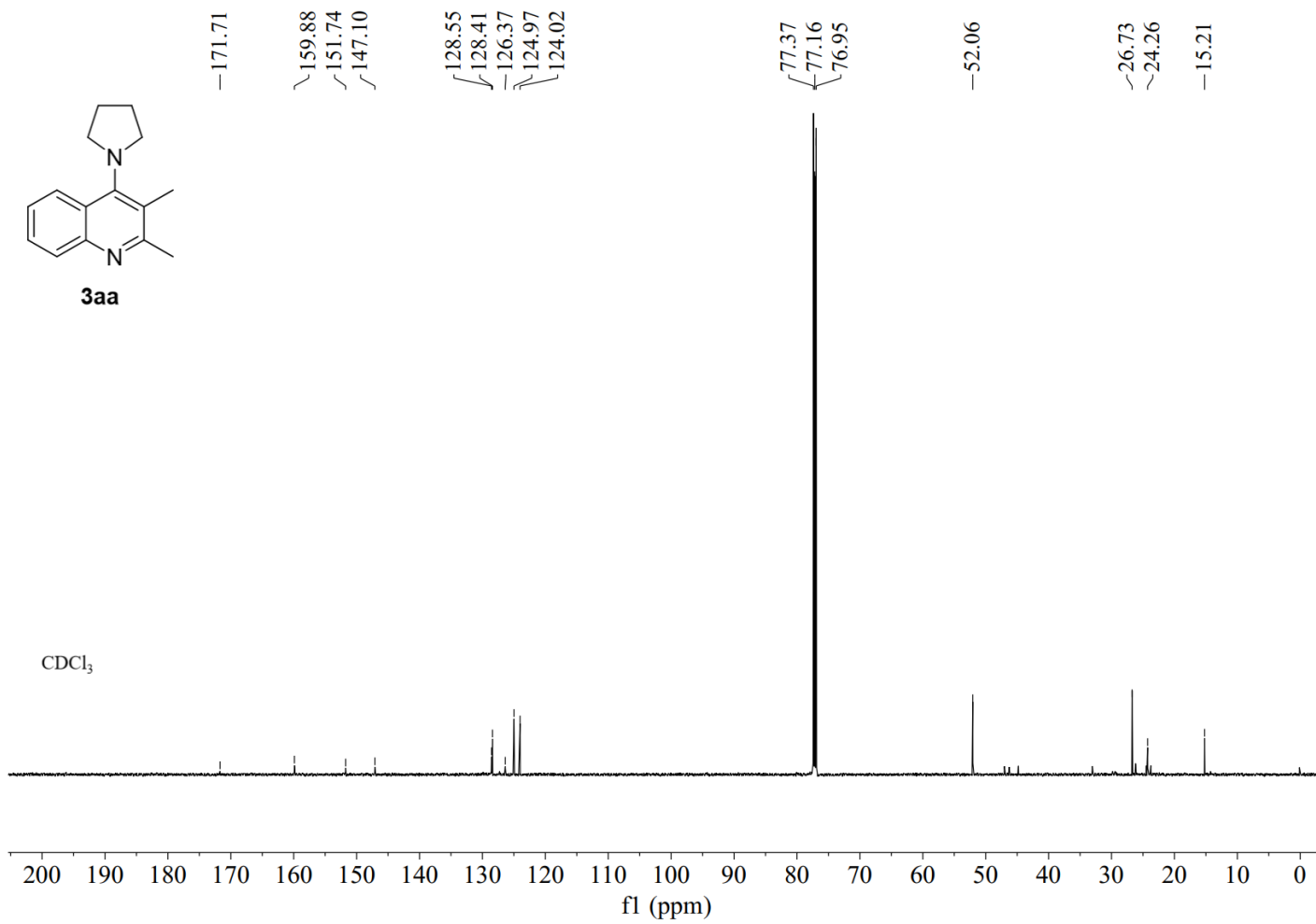
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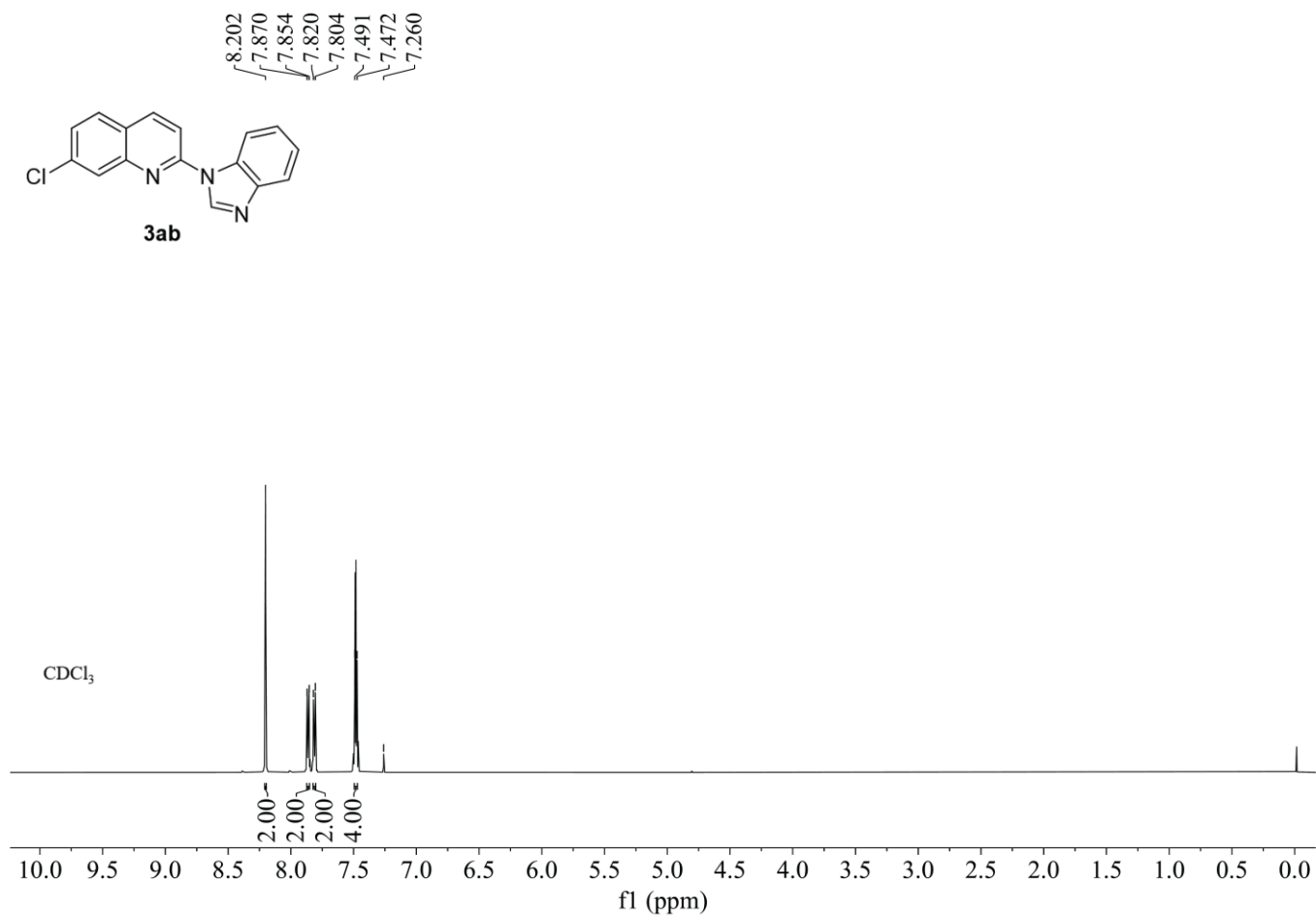
3aa



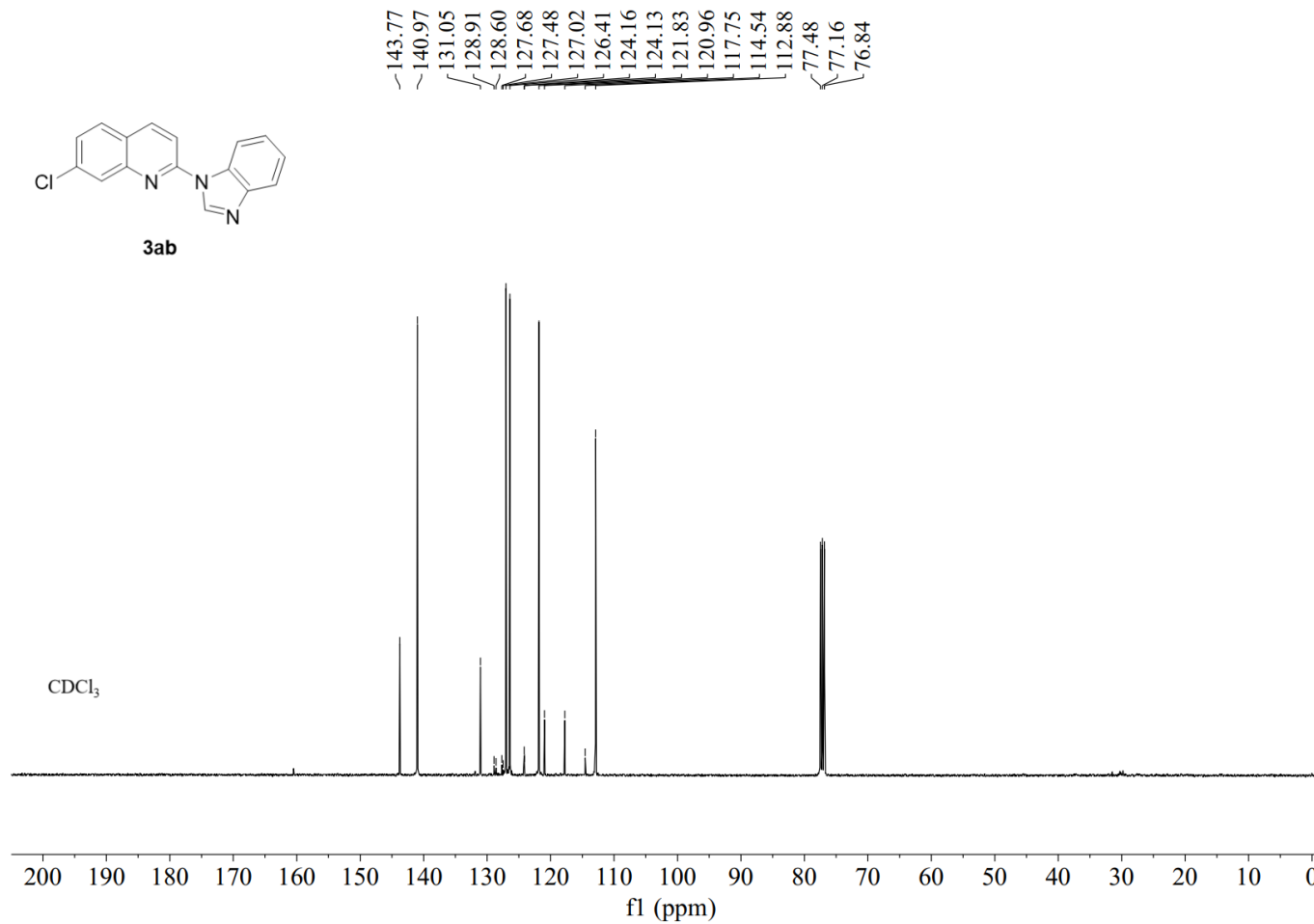
¹³C NMR (150 MHz, CDCl₃):



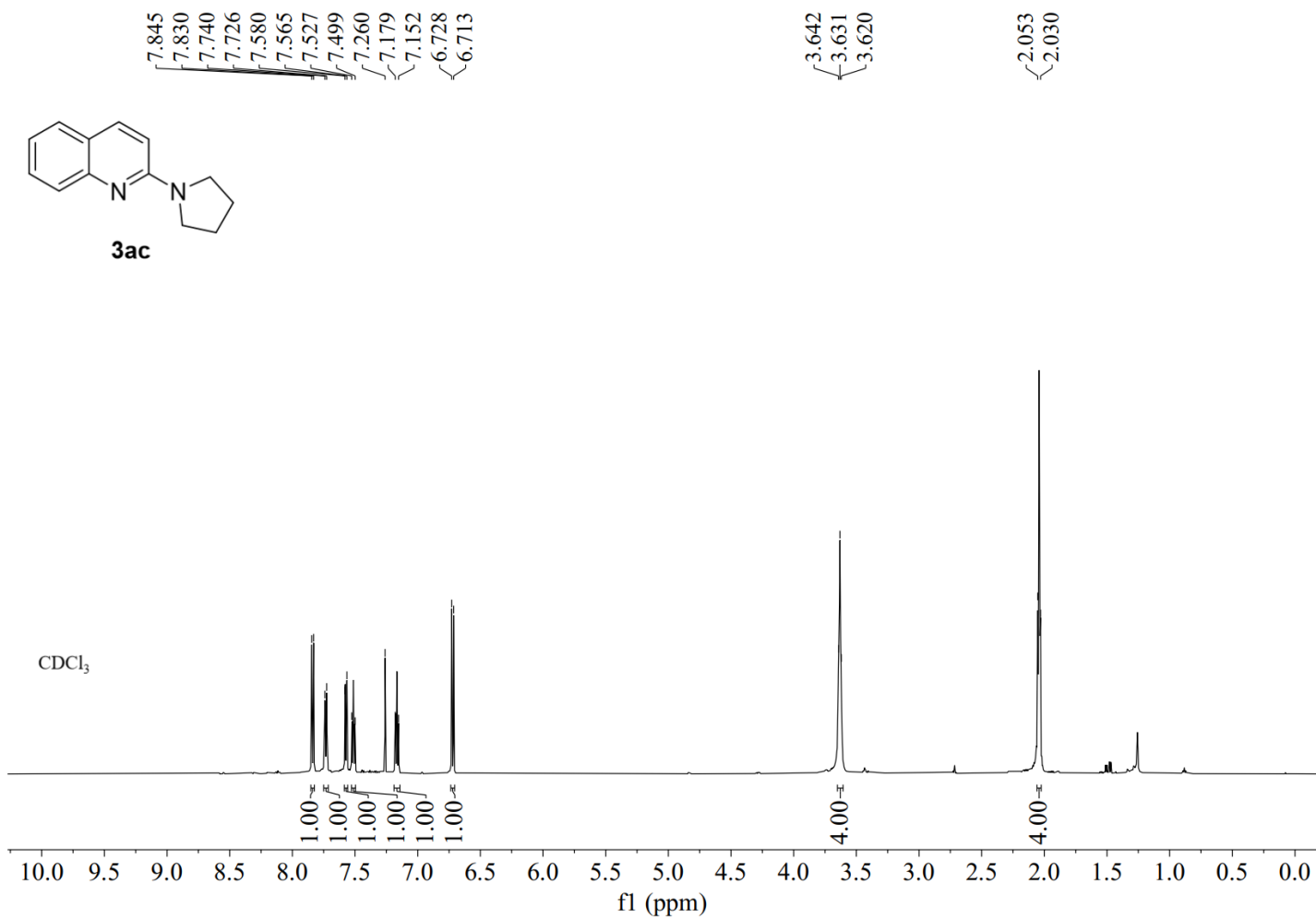
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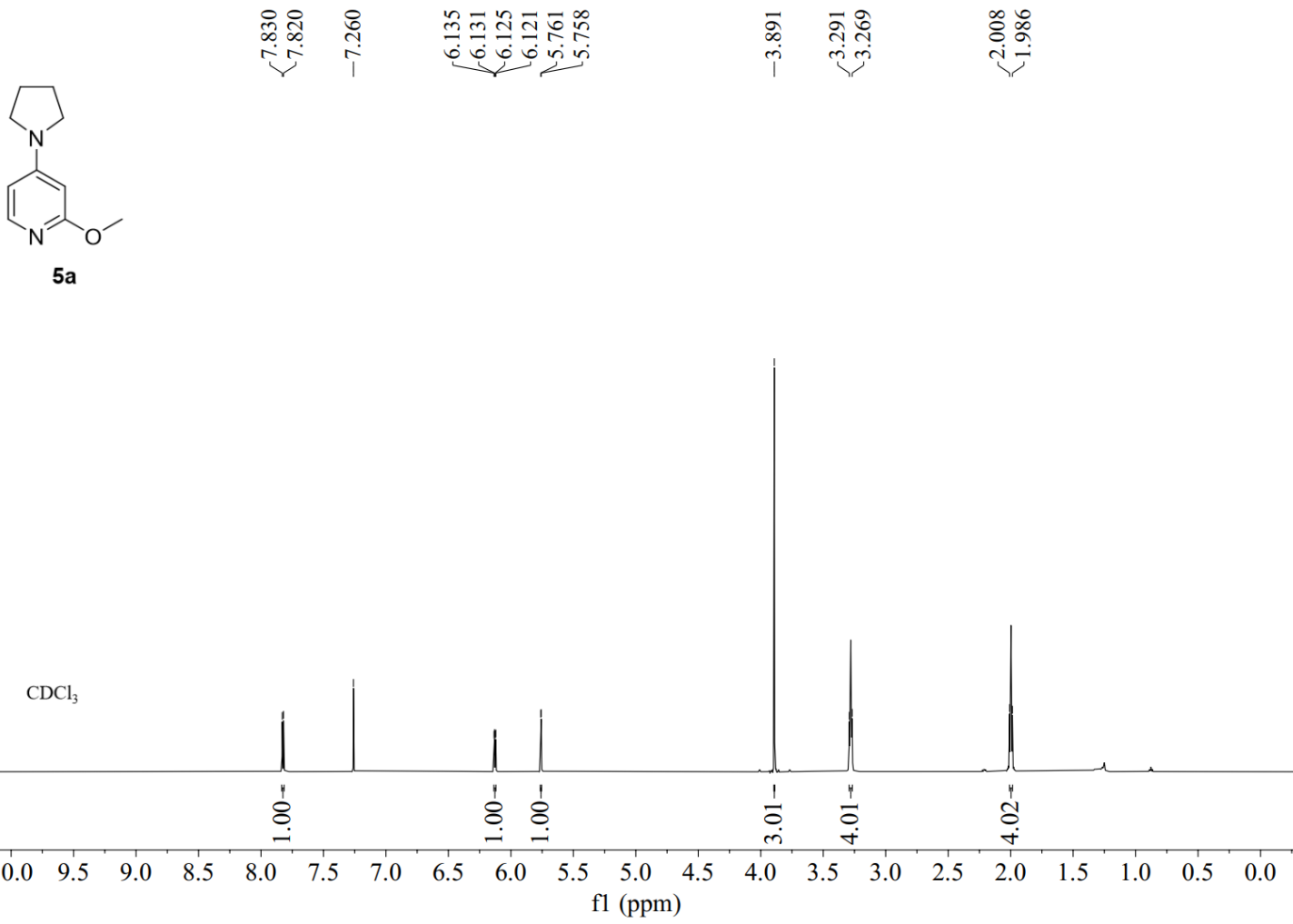
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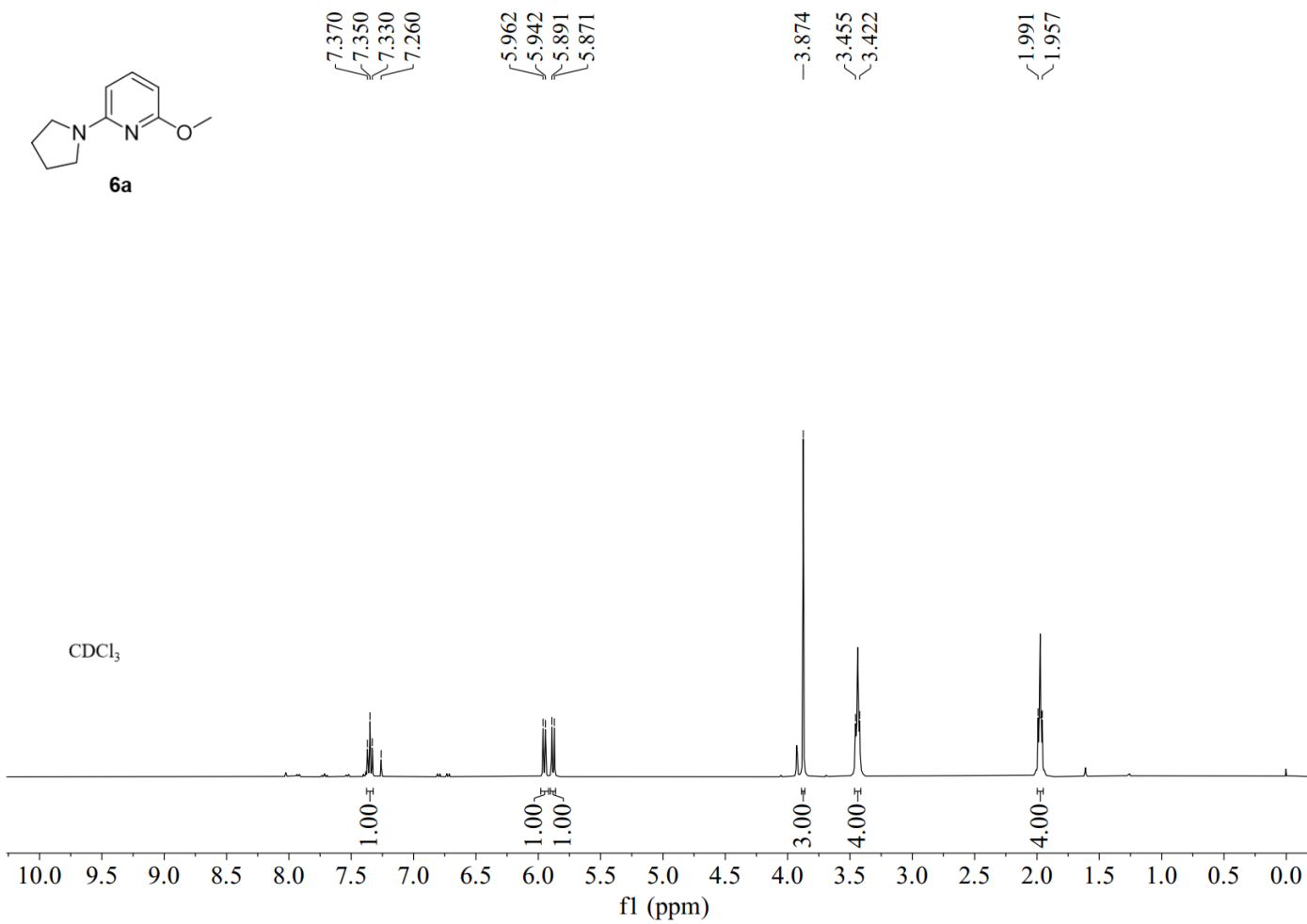
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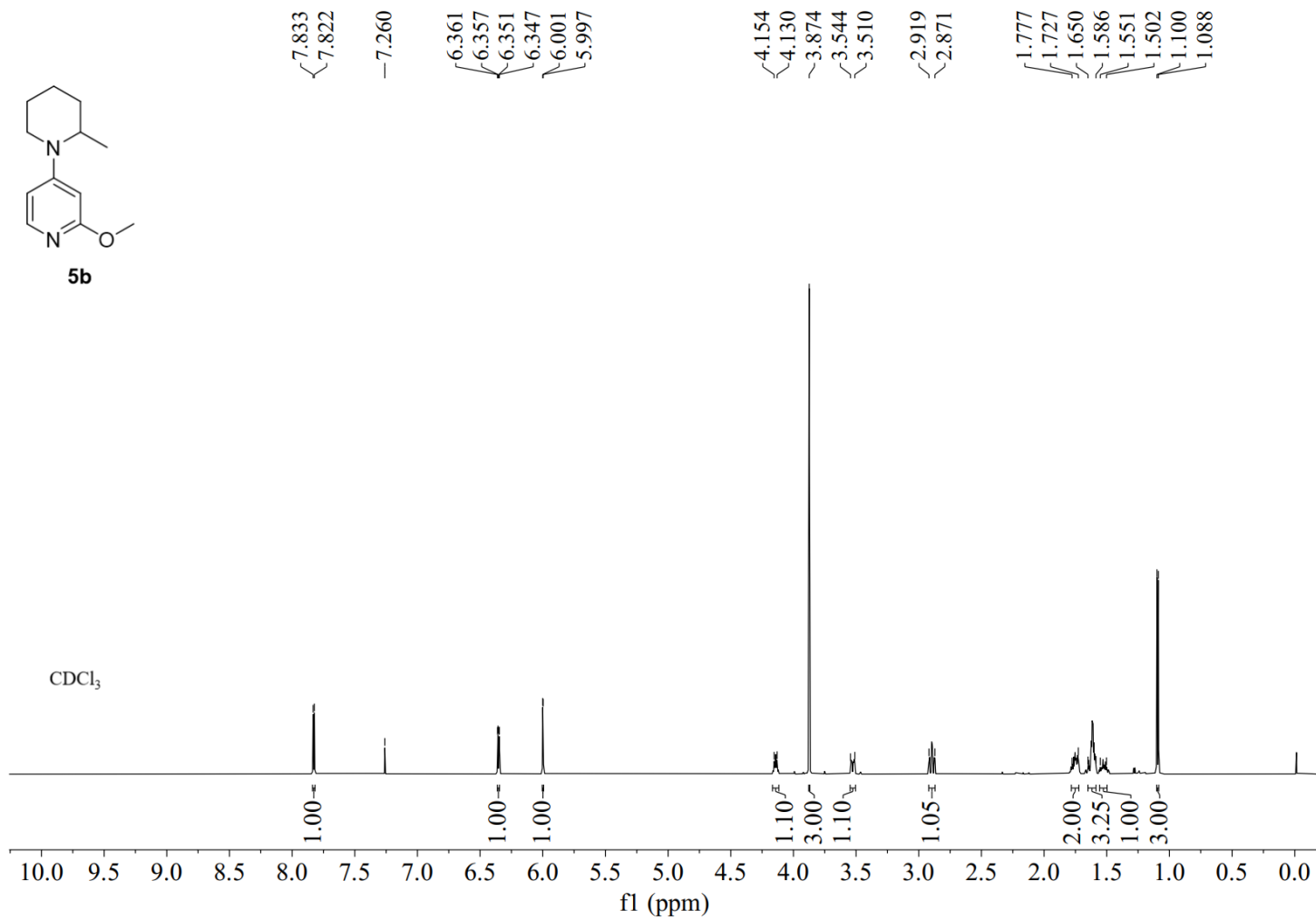
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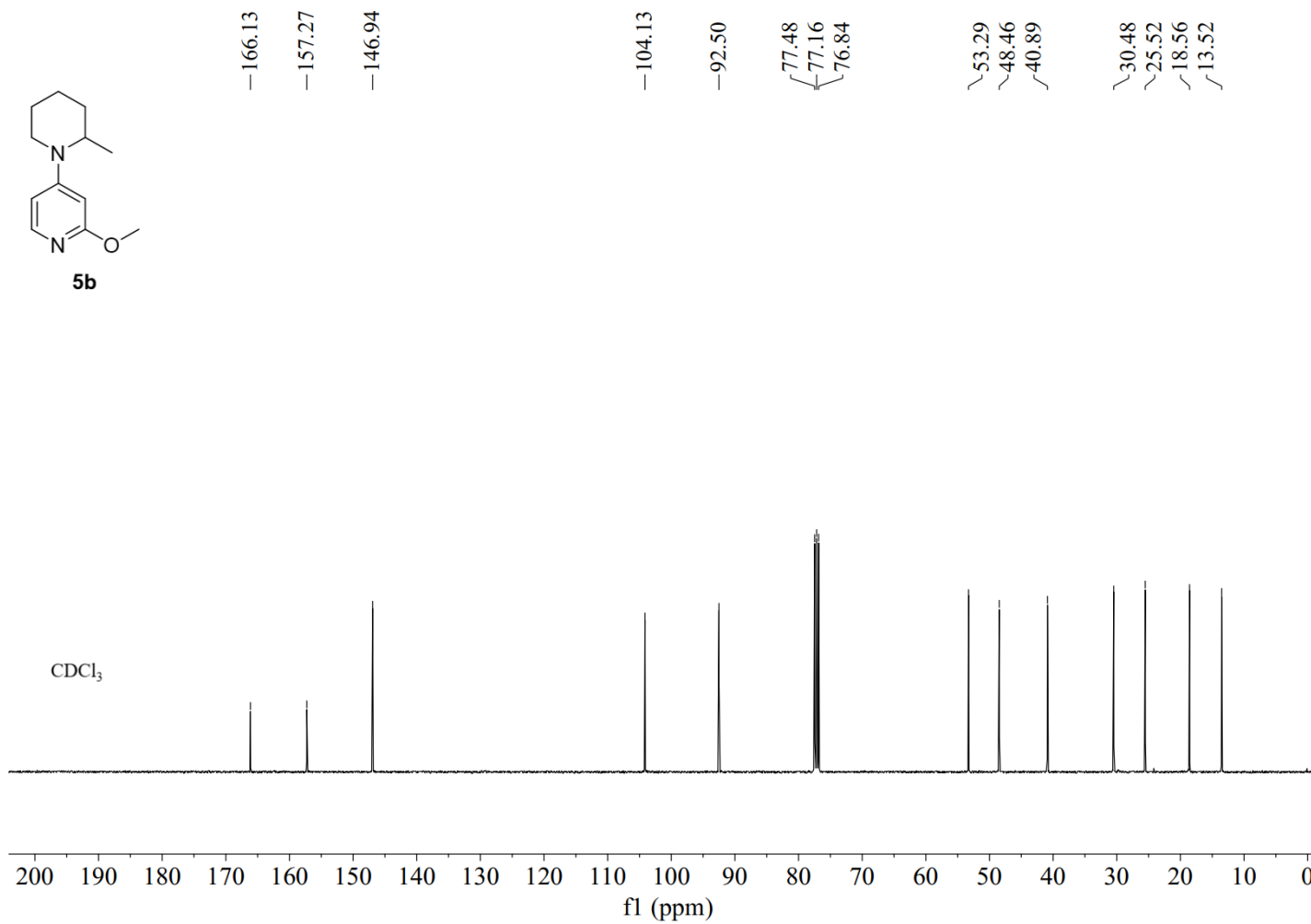
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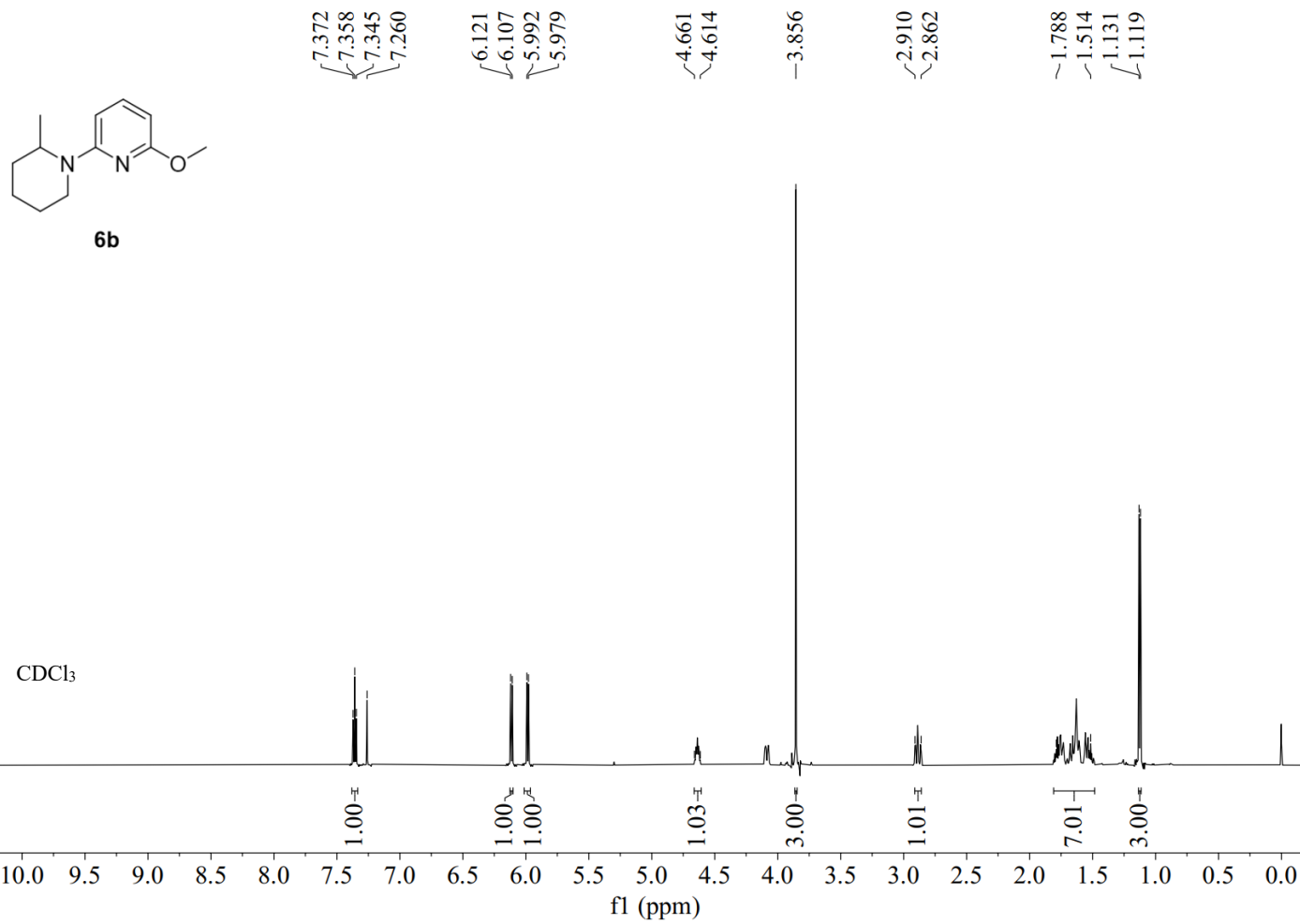
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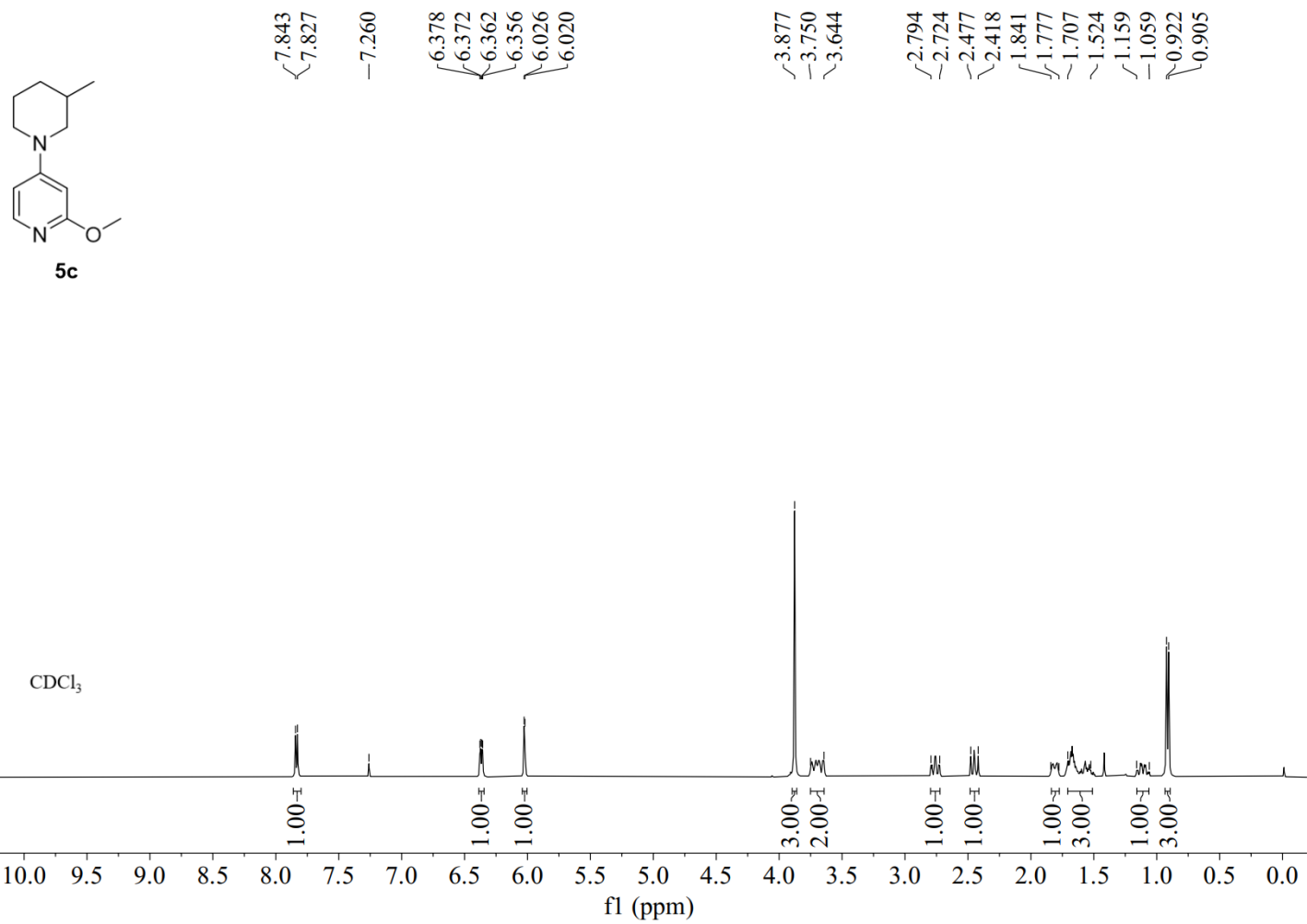
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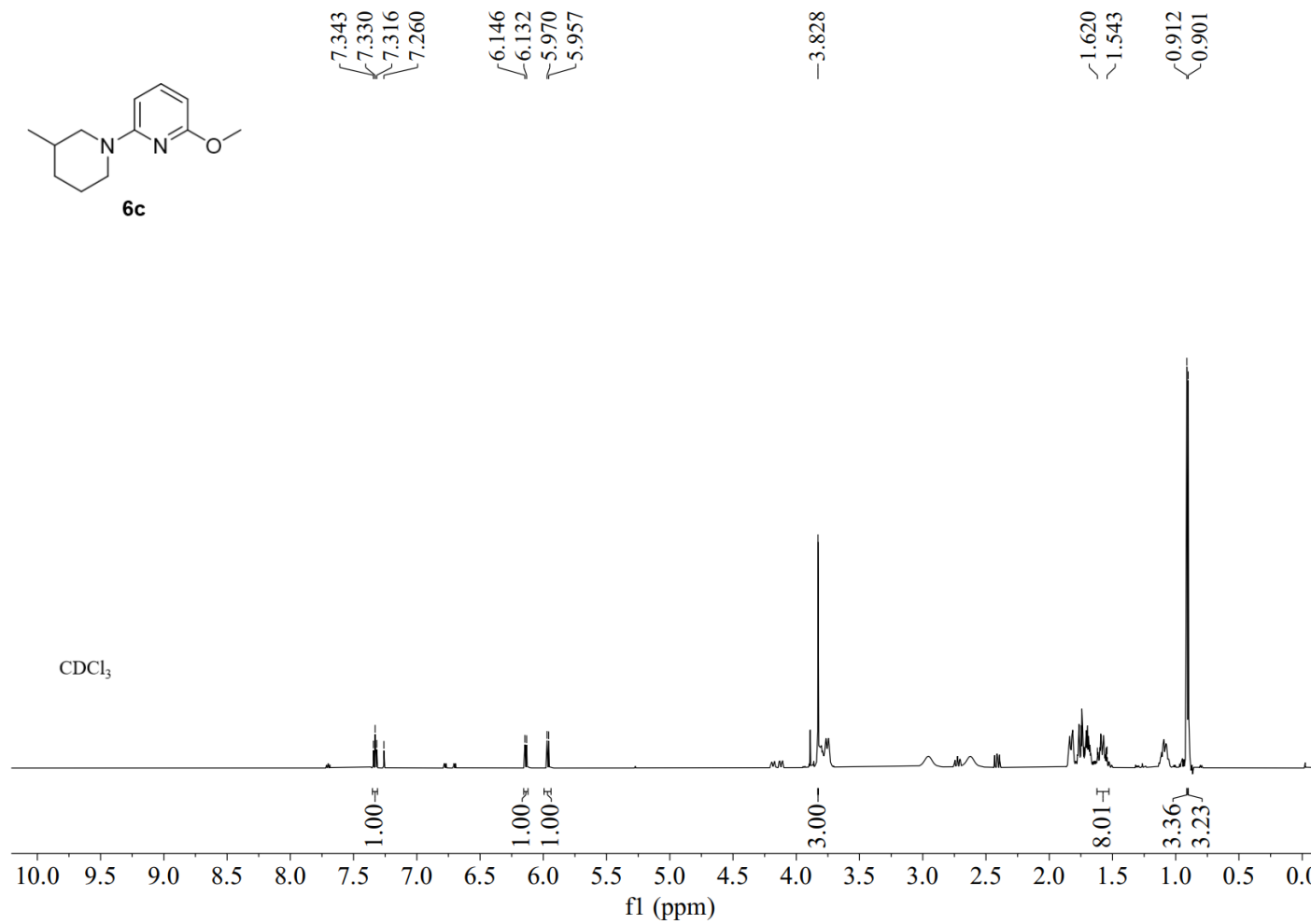
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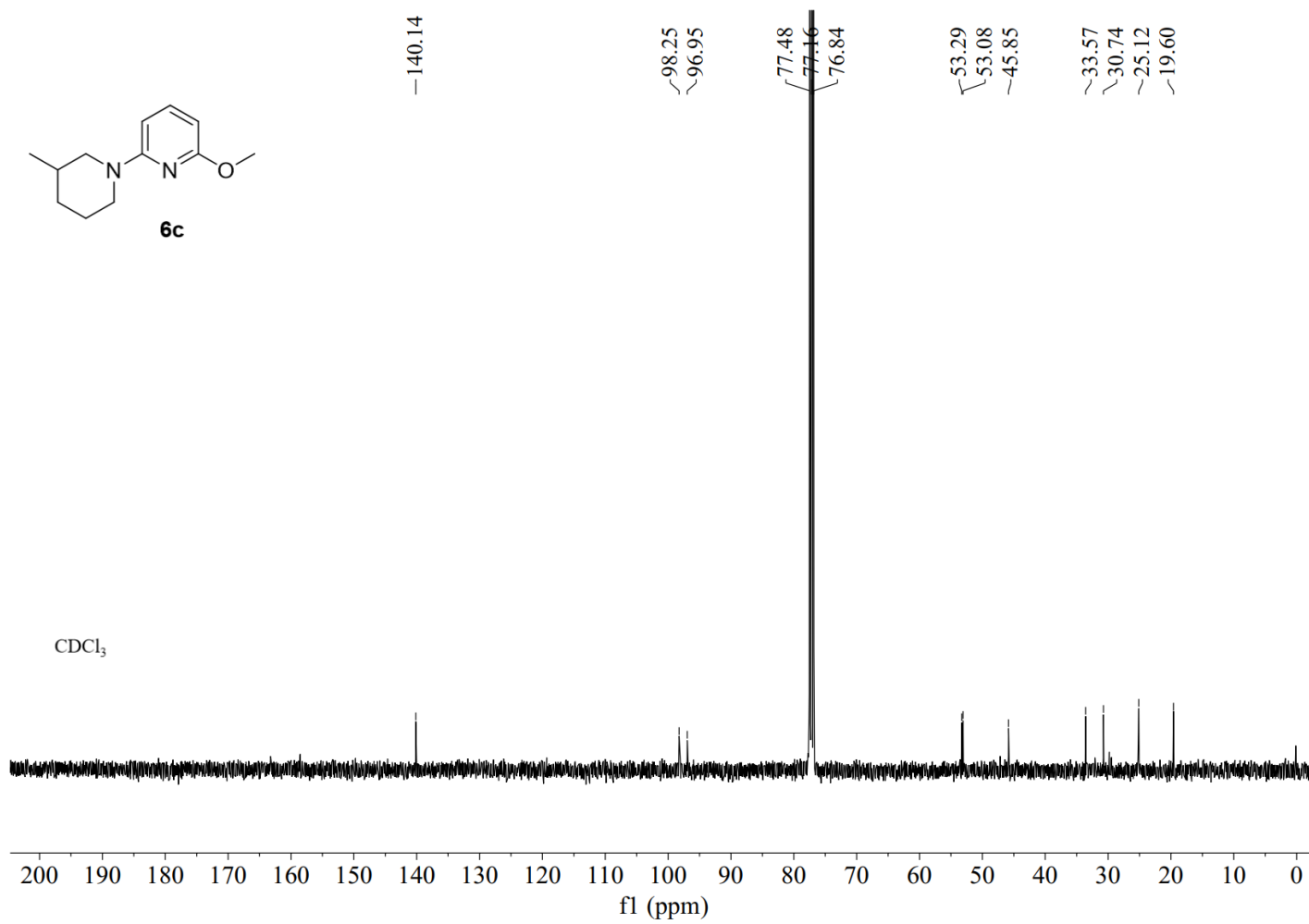
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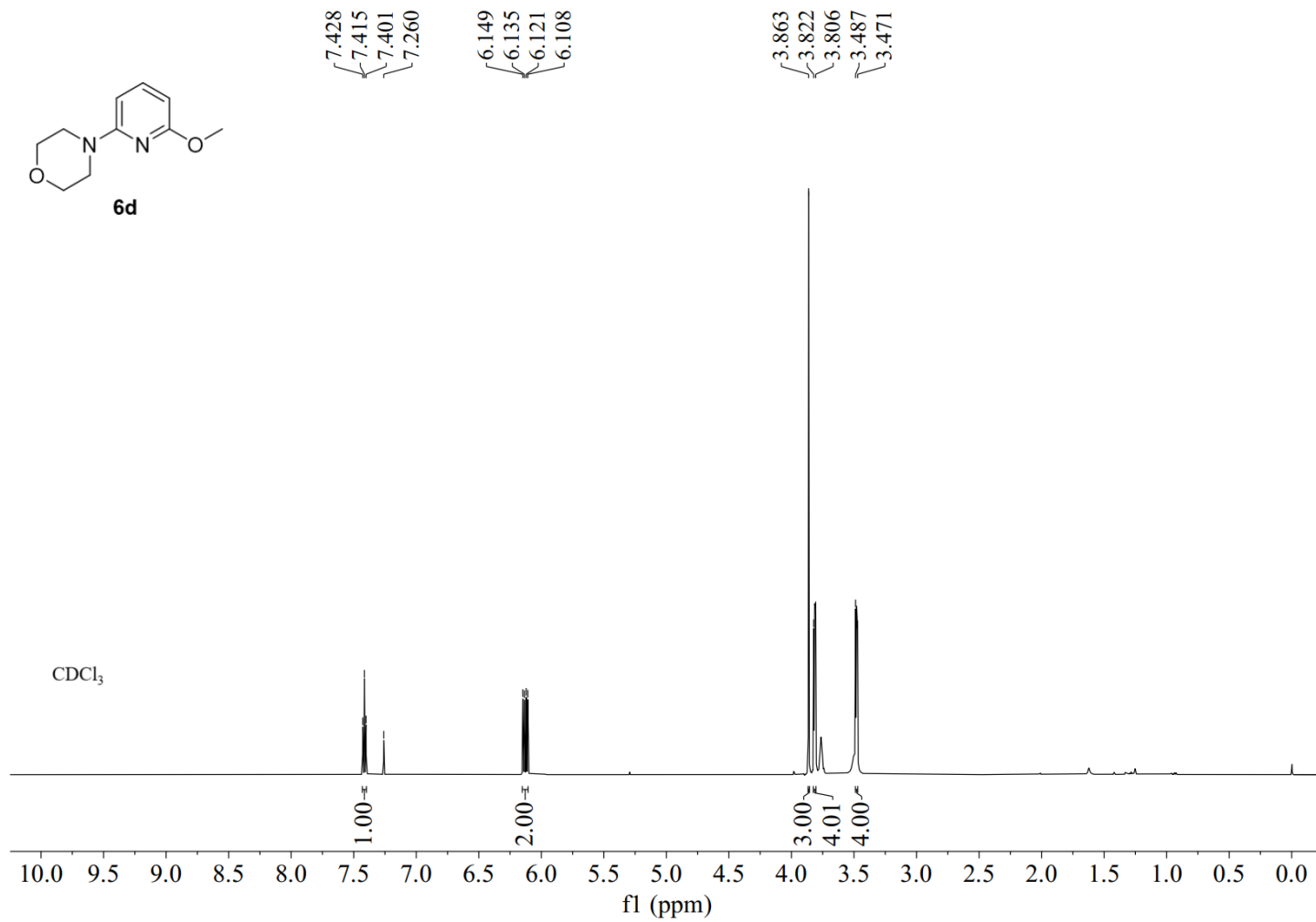
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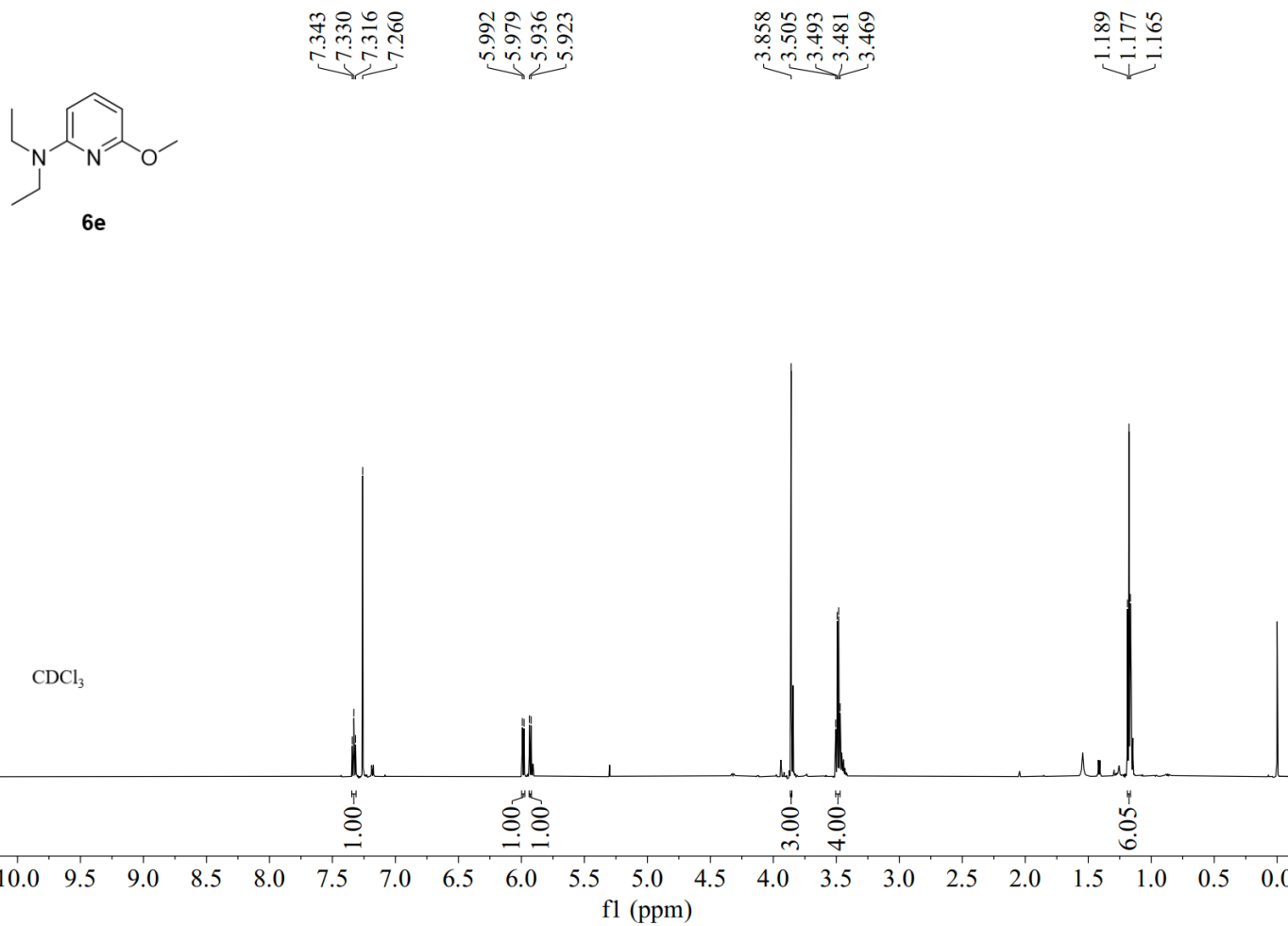
^{13}C NMR (100 MHz, CDCl_3):



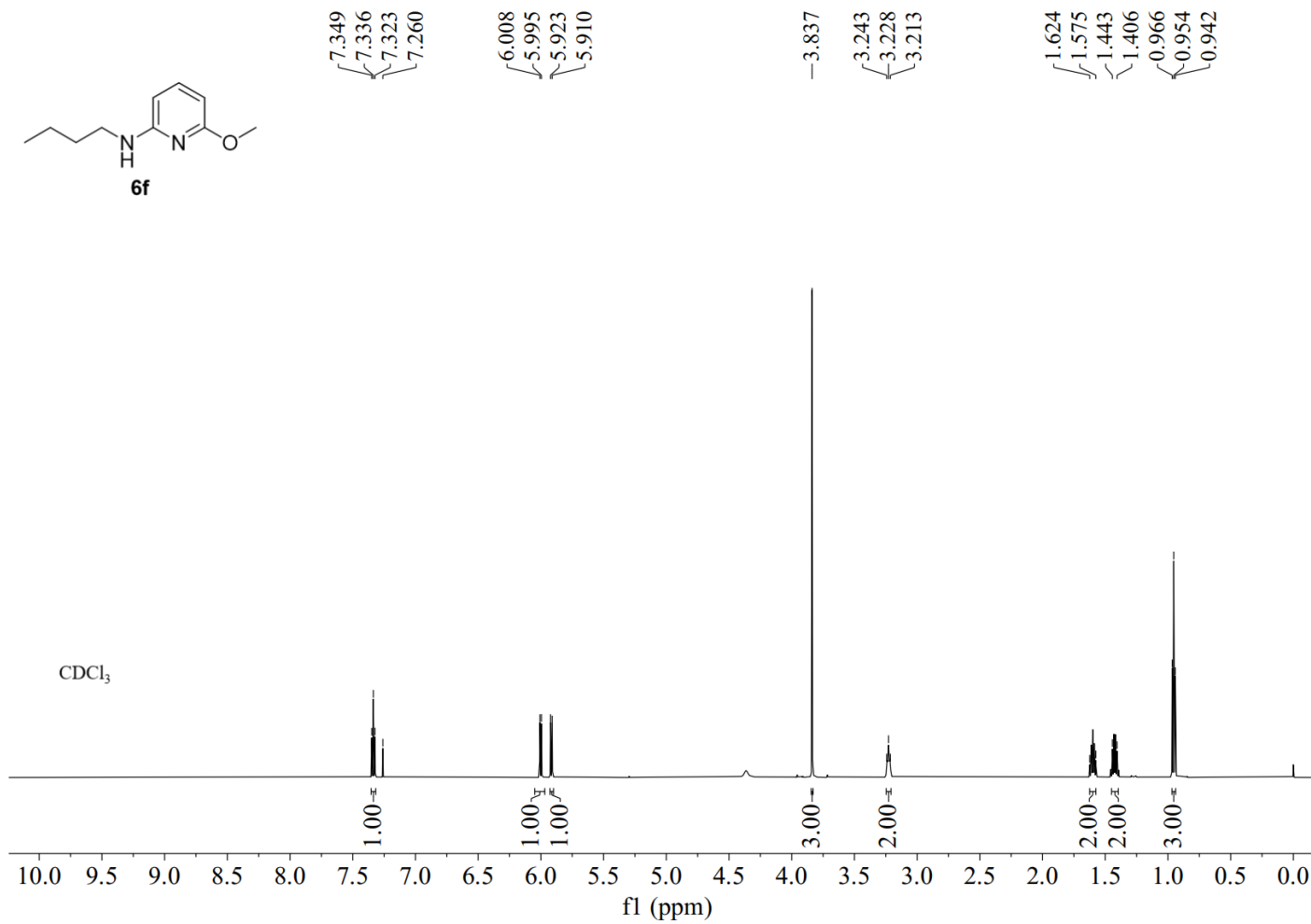
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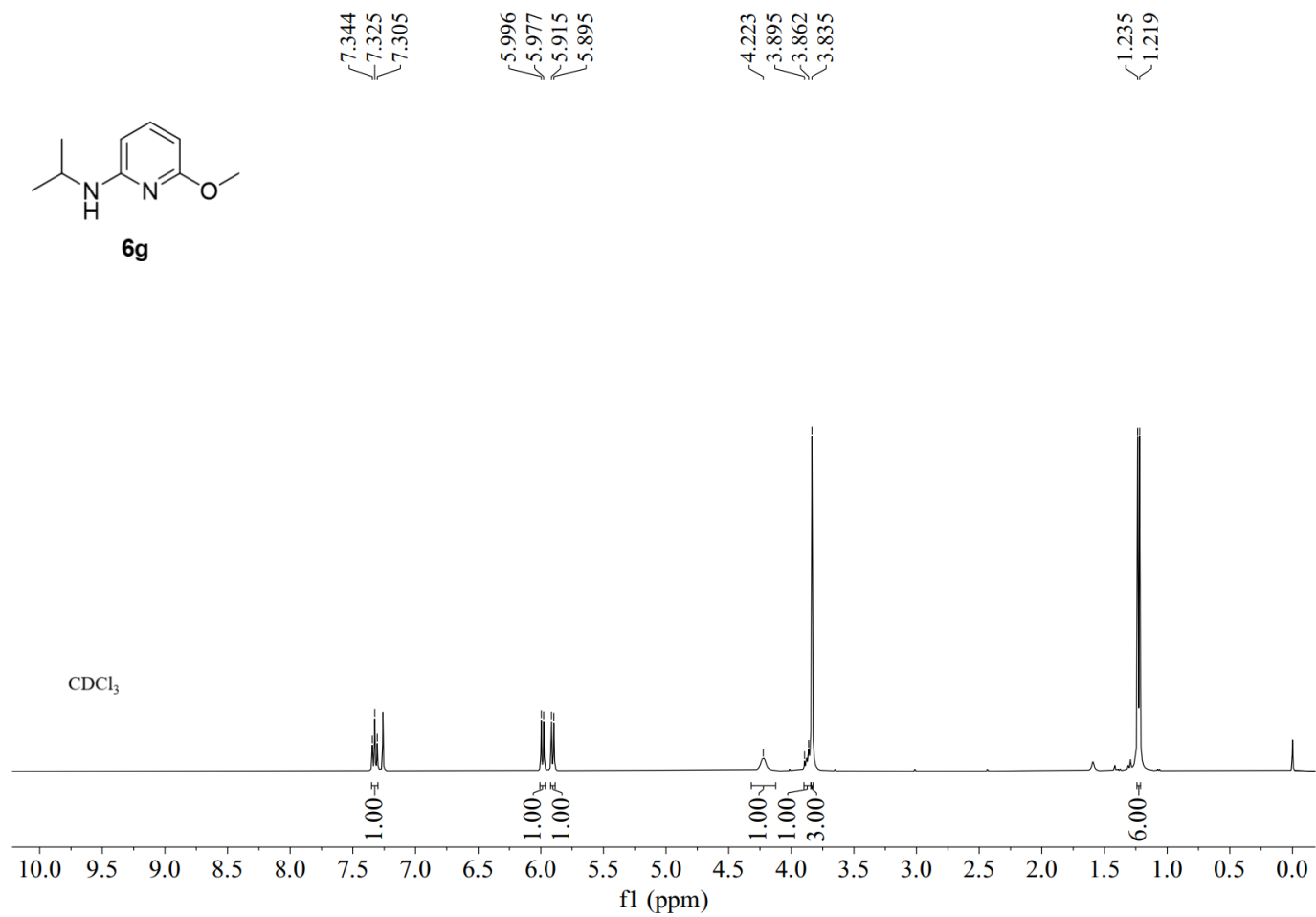
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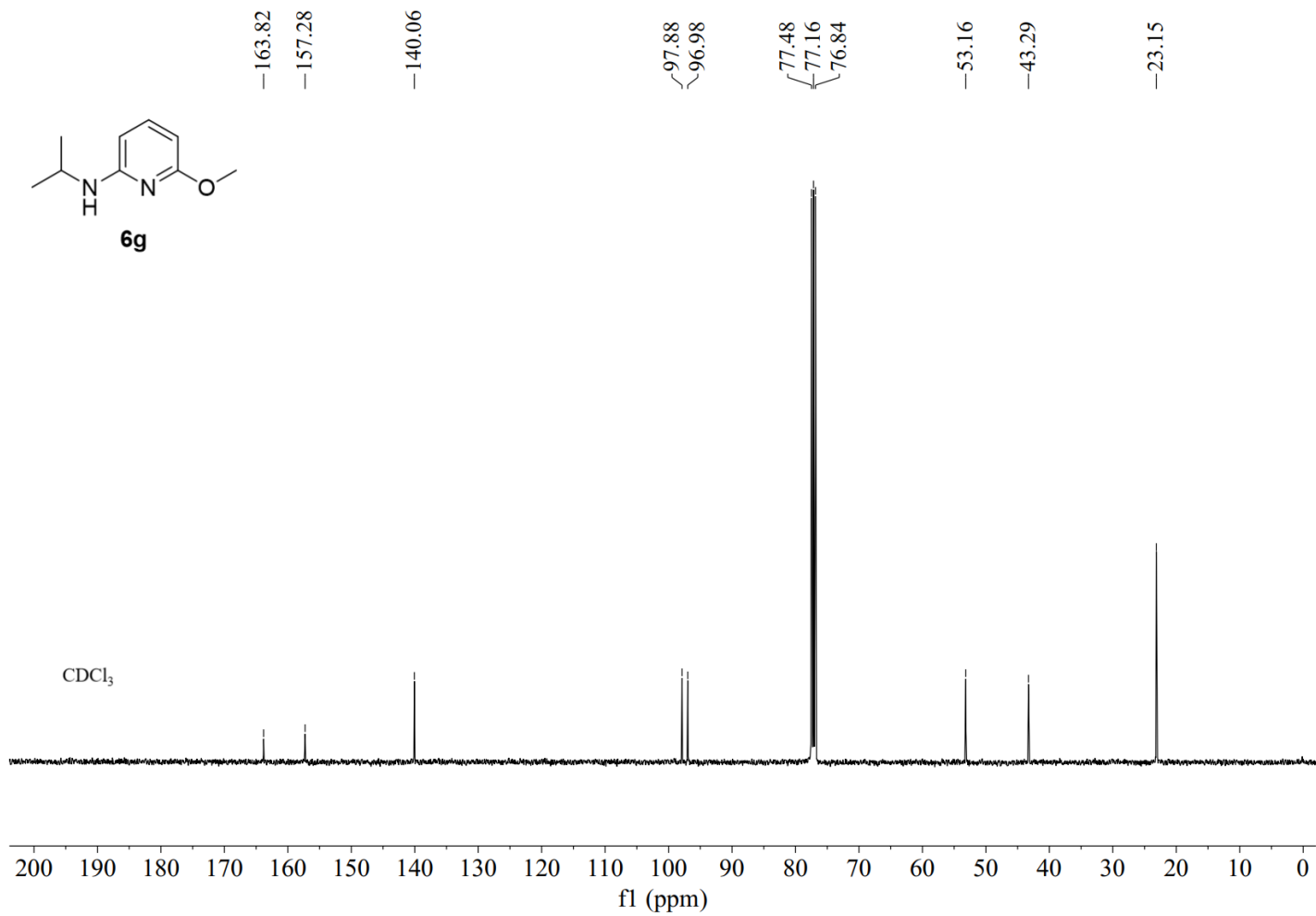
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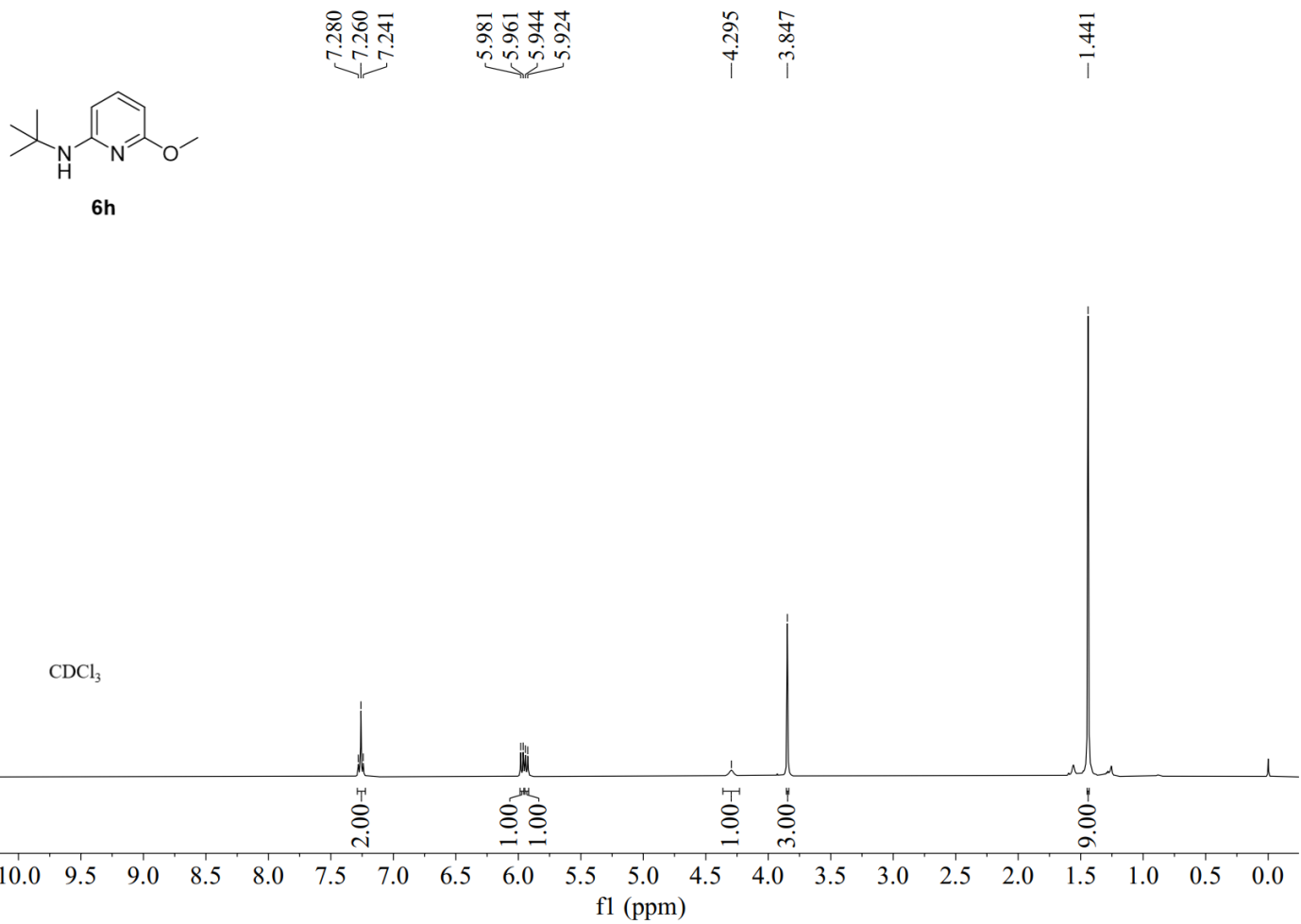
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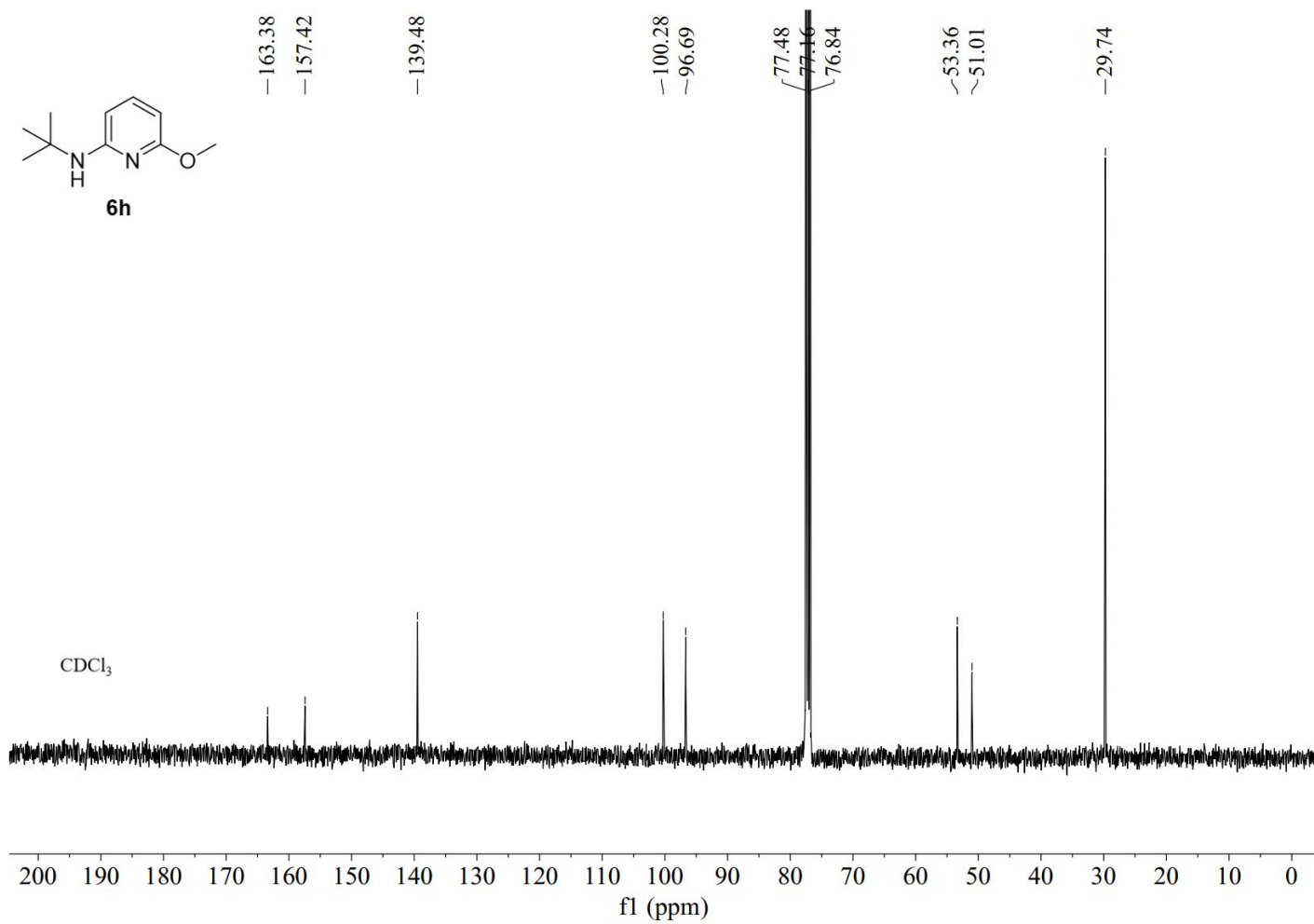
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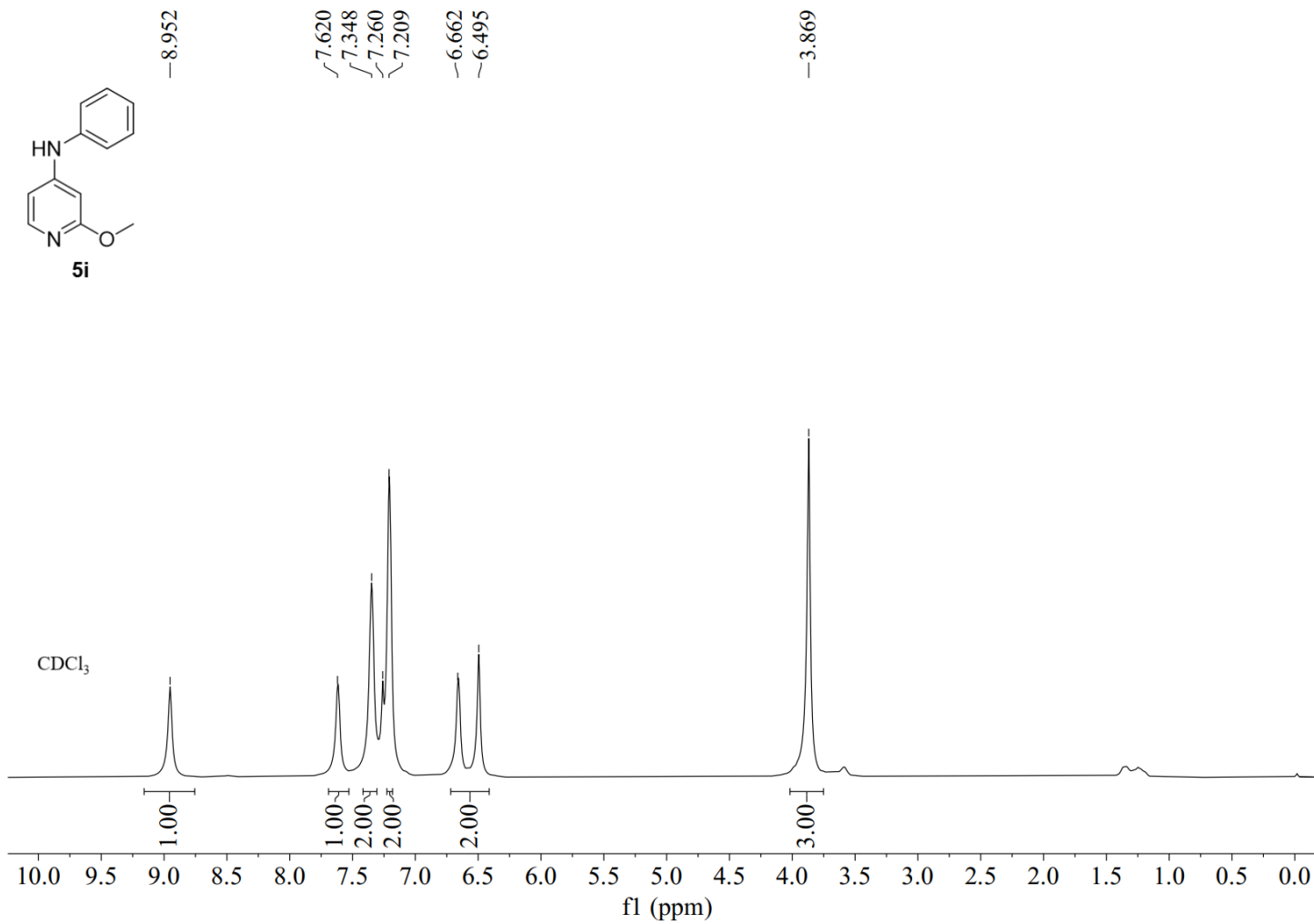
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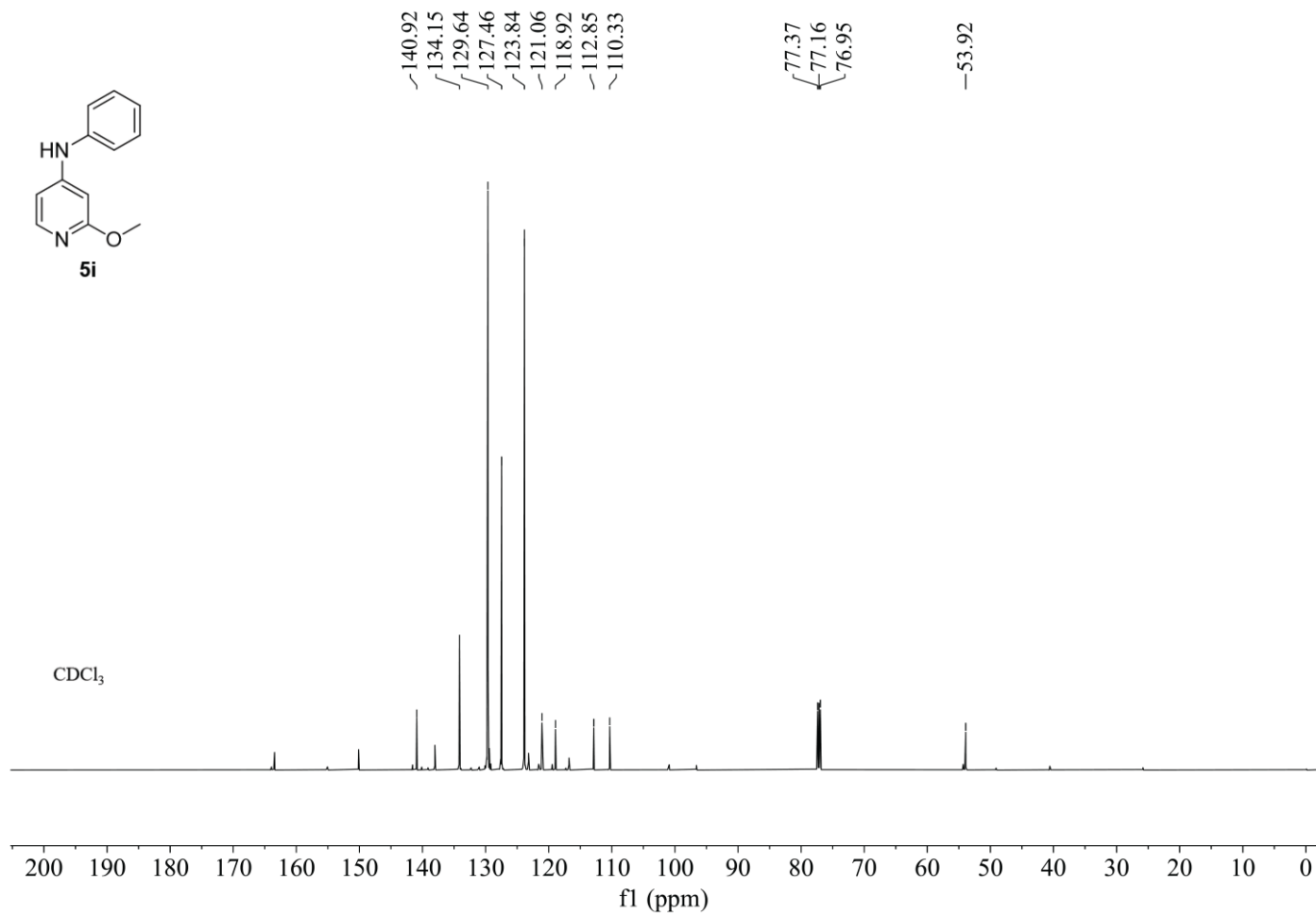
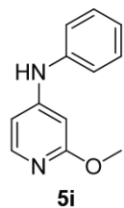
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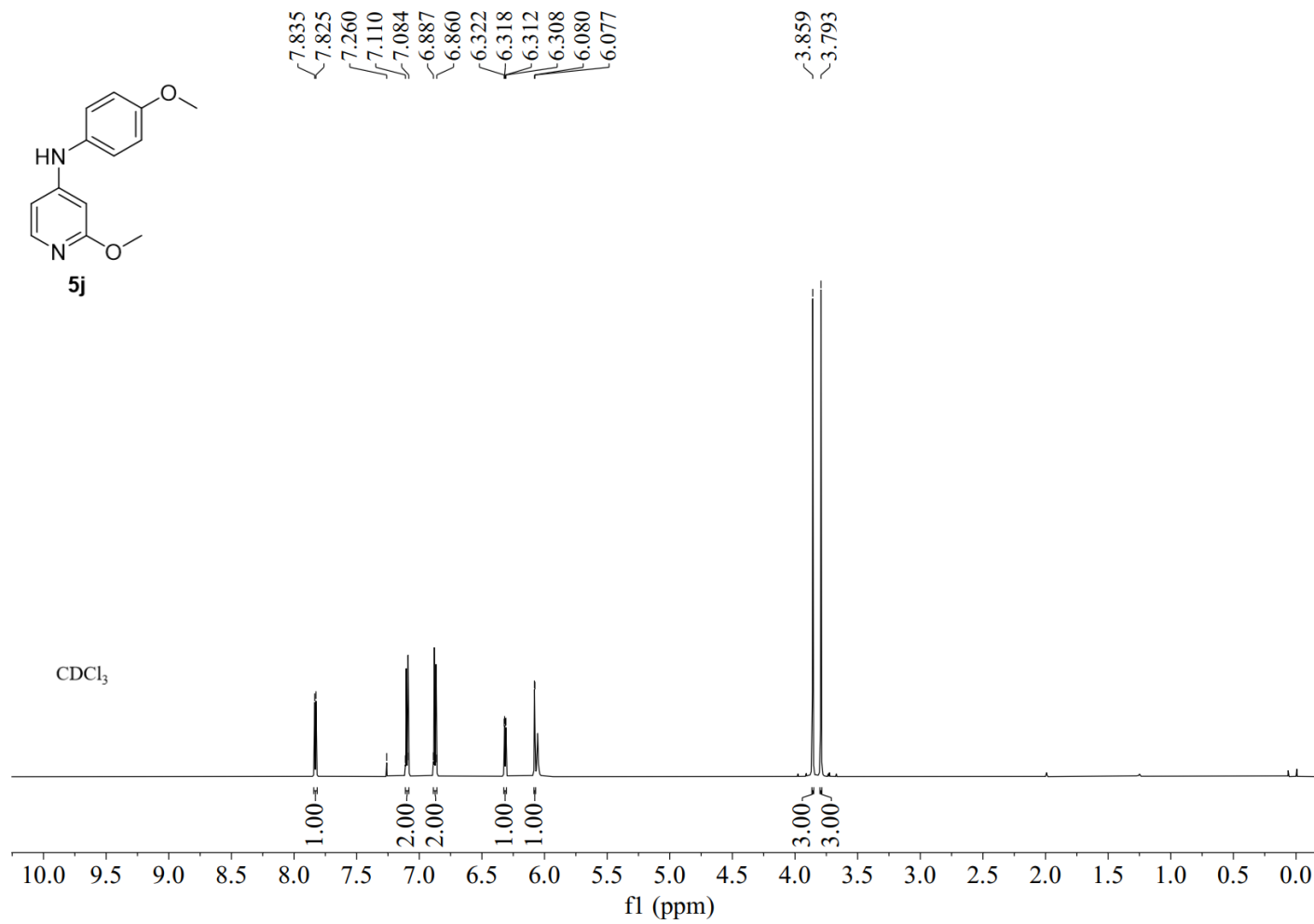
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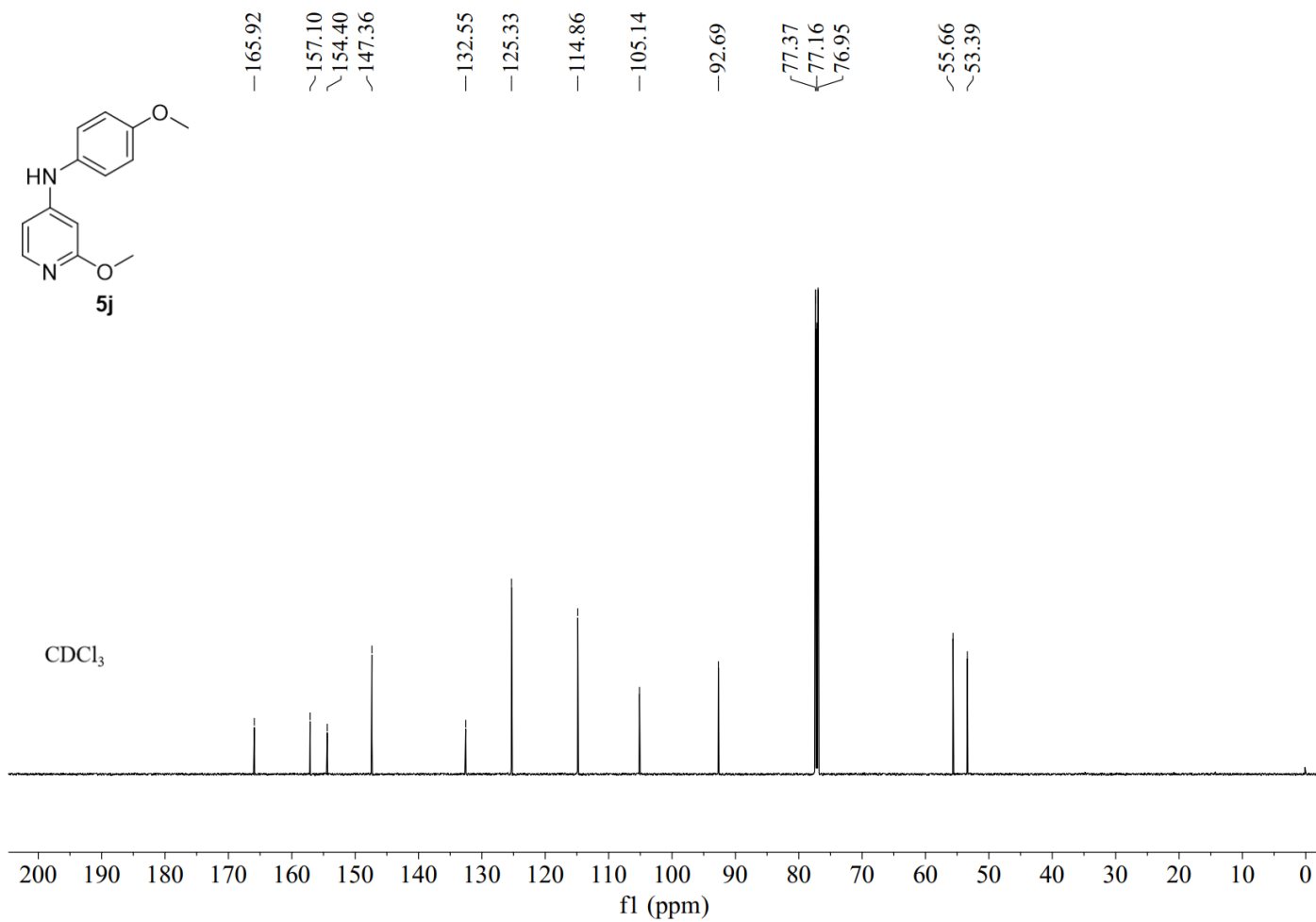
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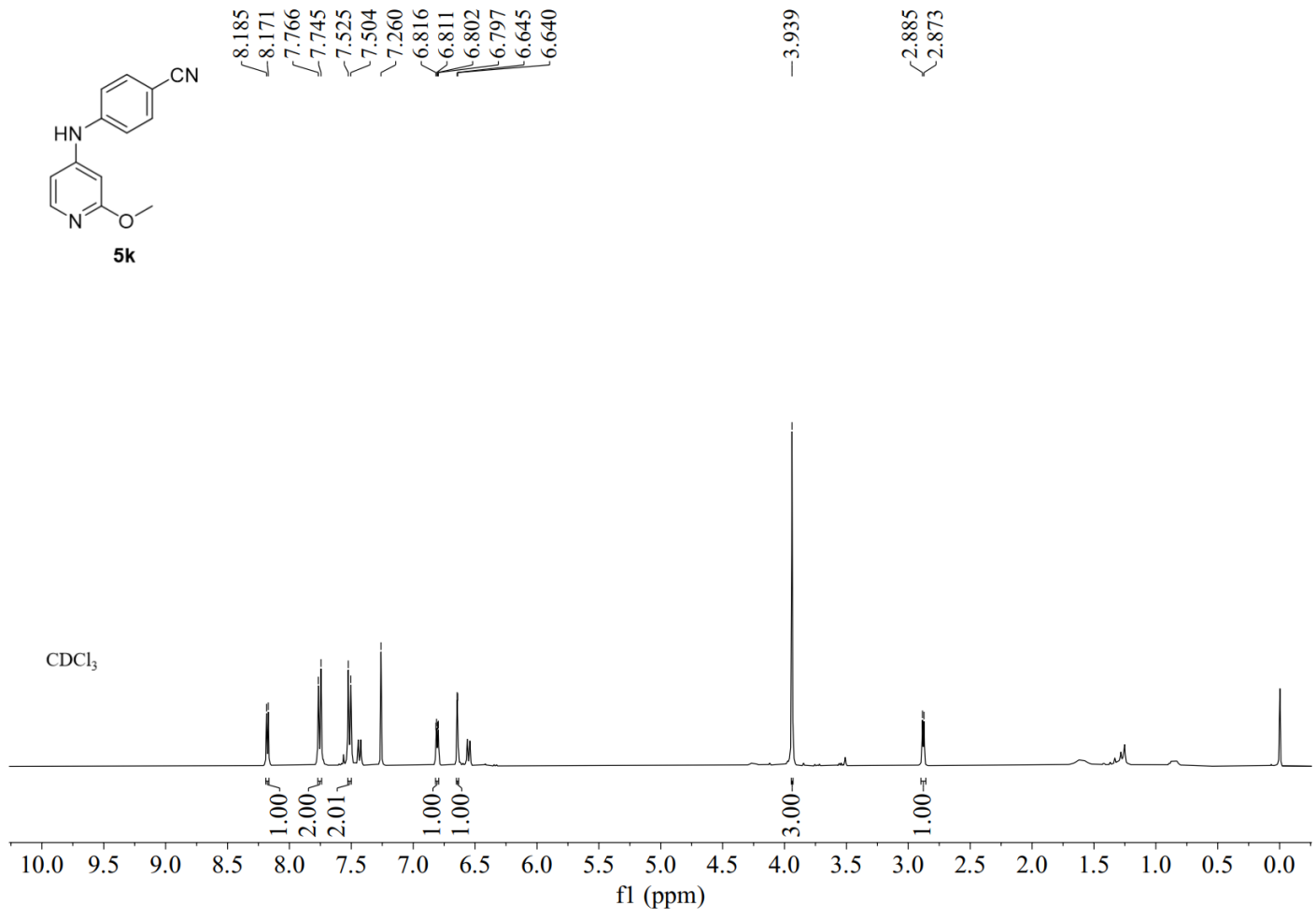
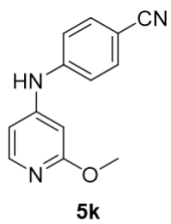
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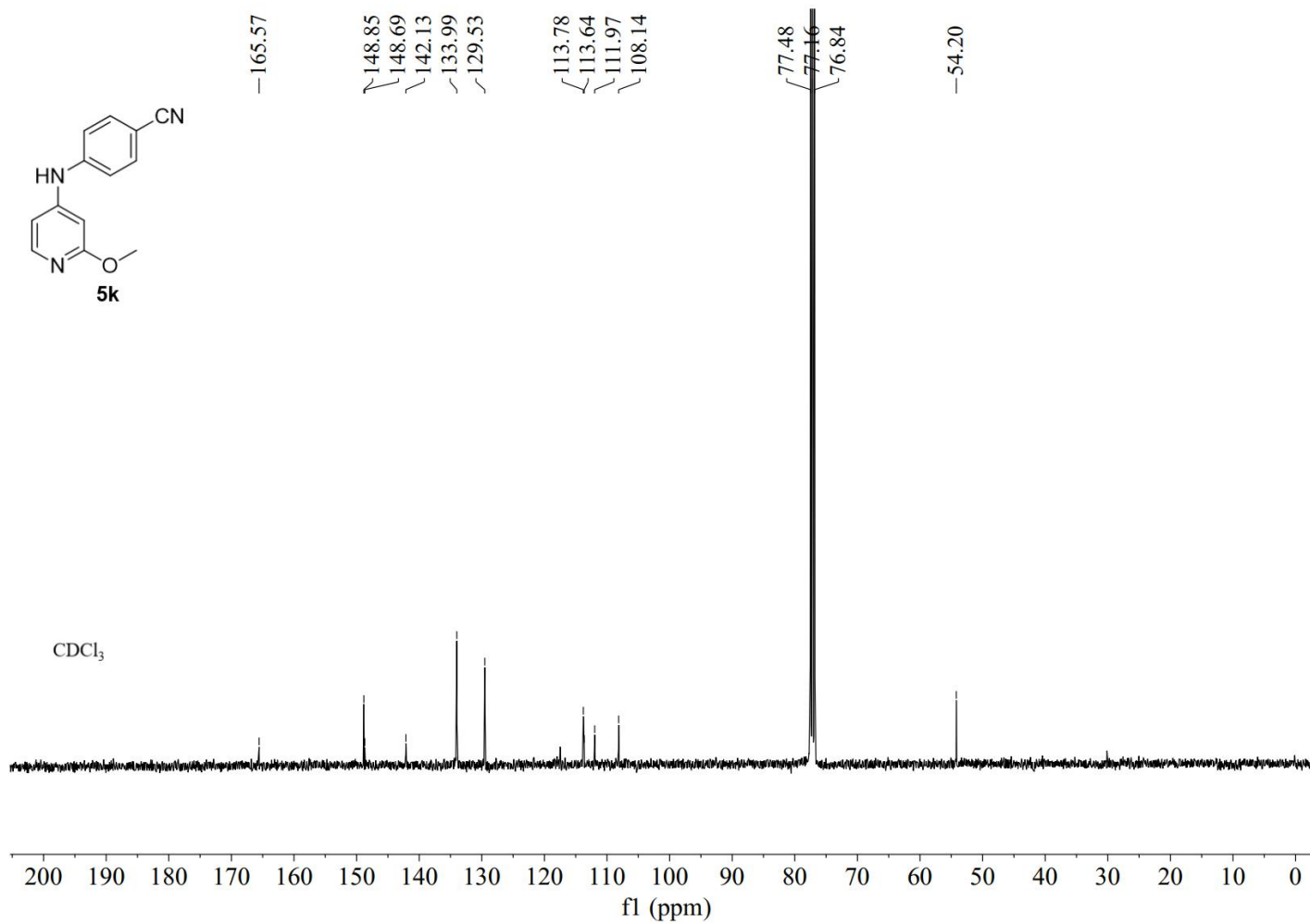
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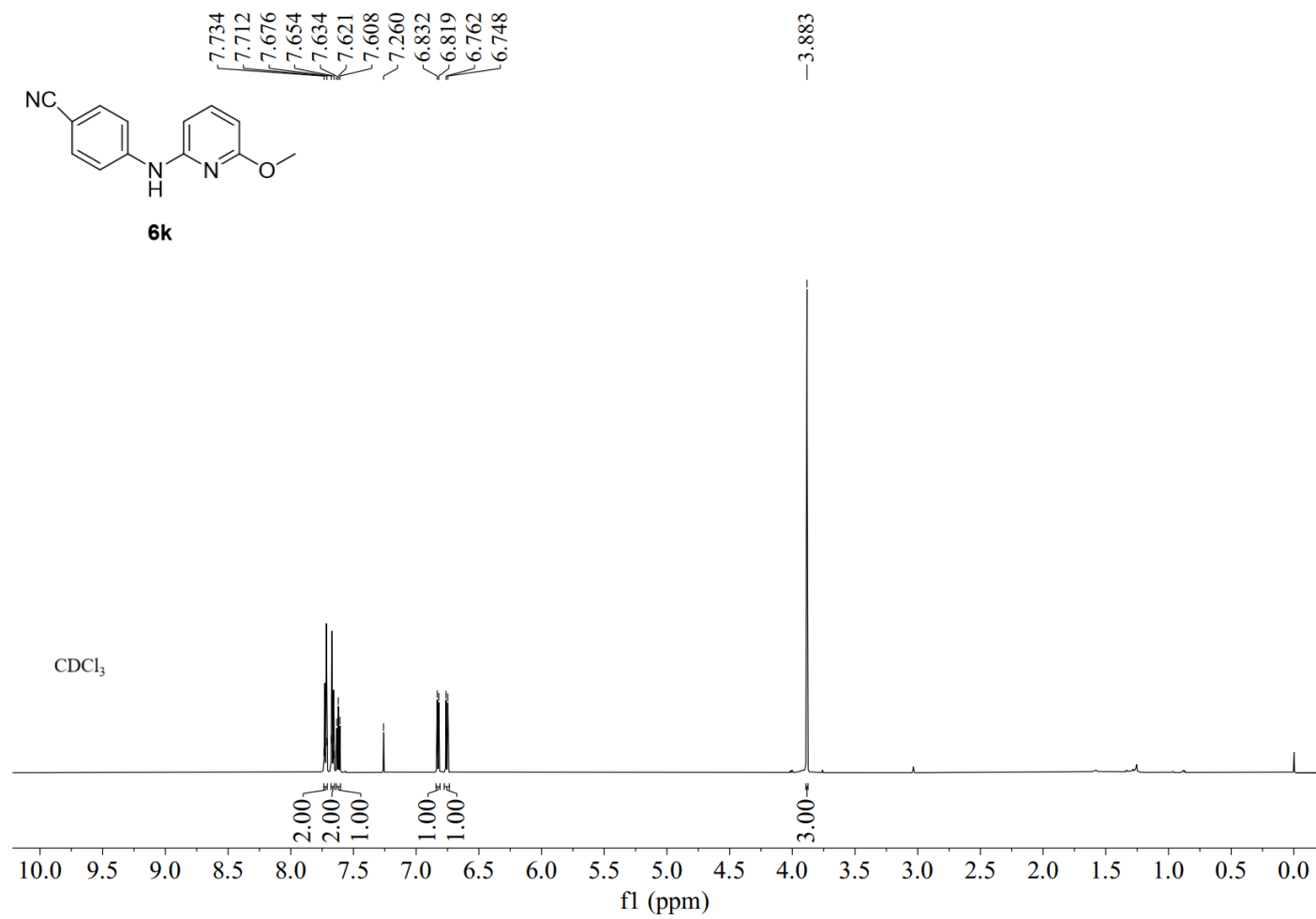
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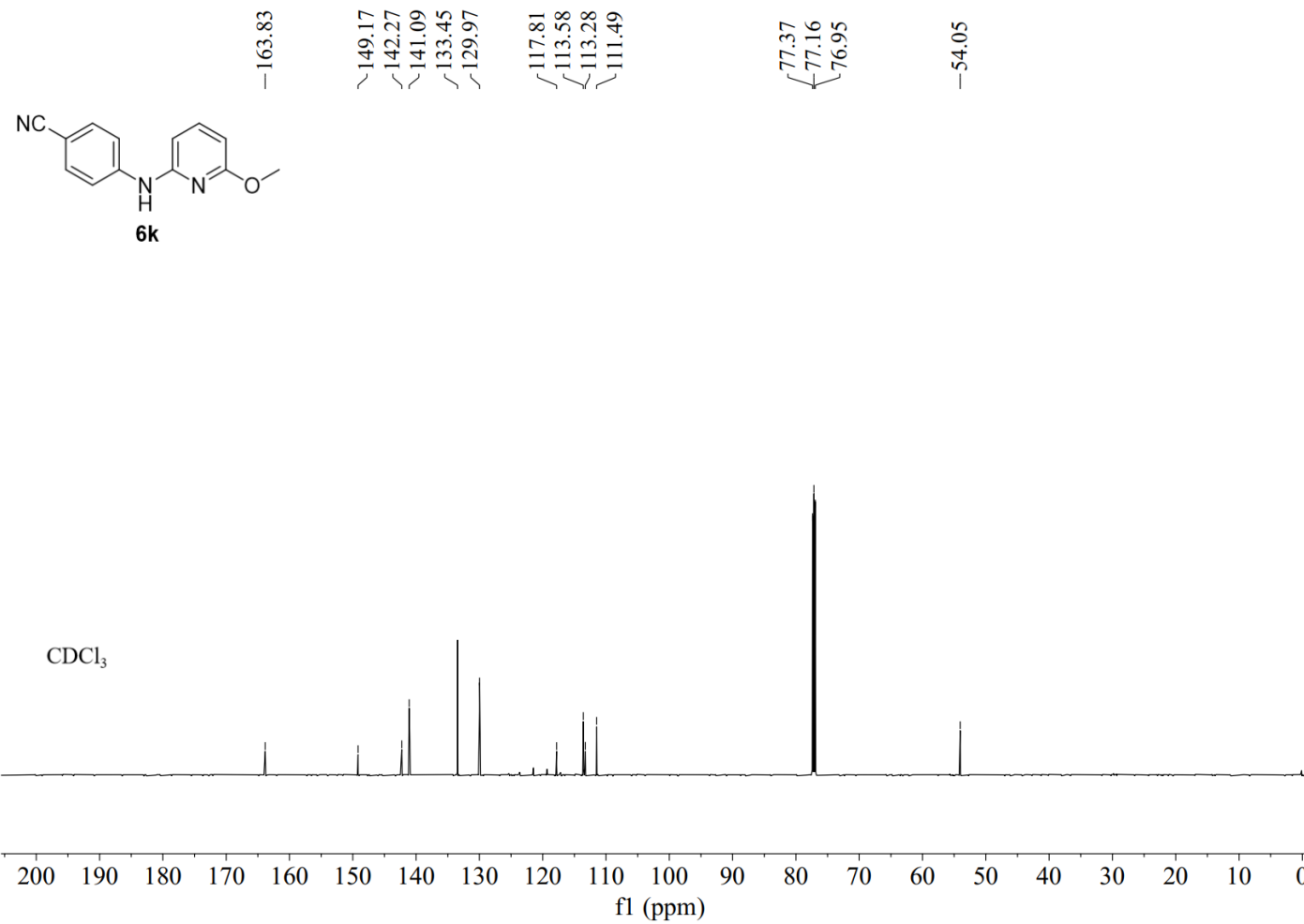
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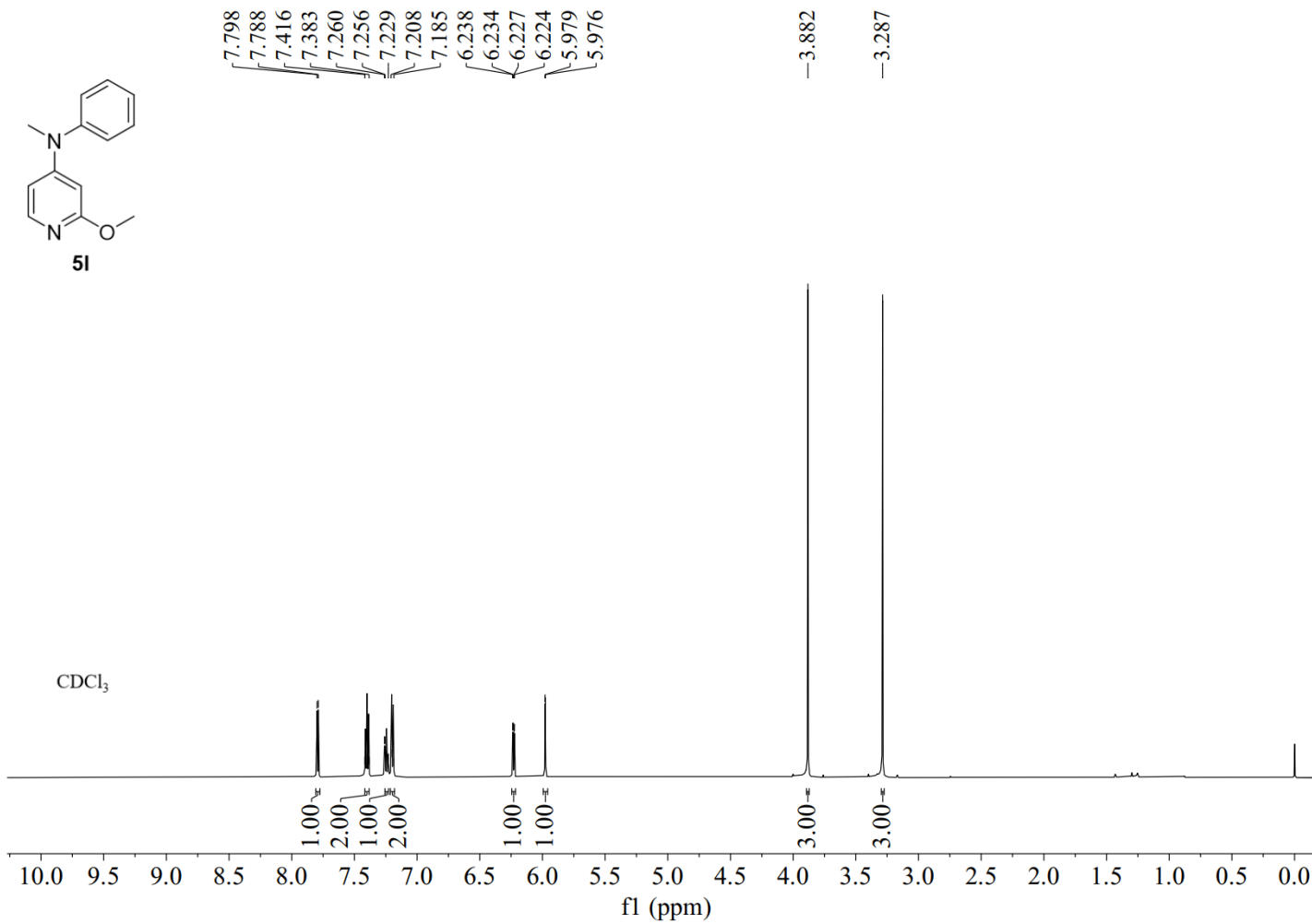
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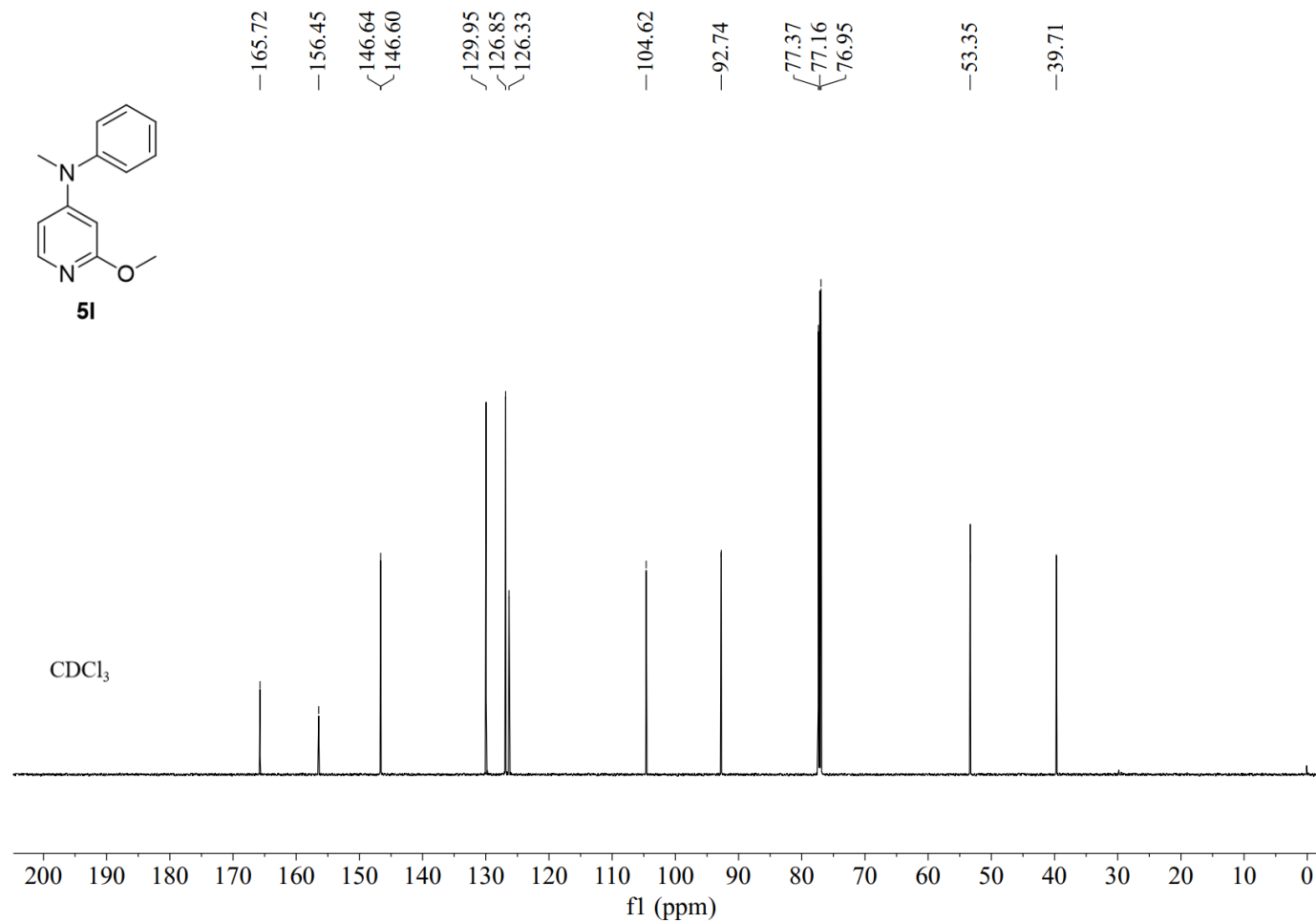
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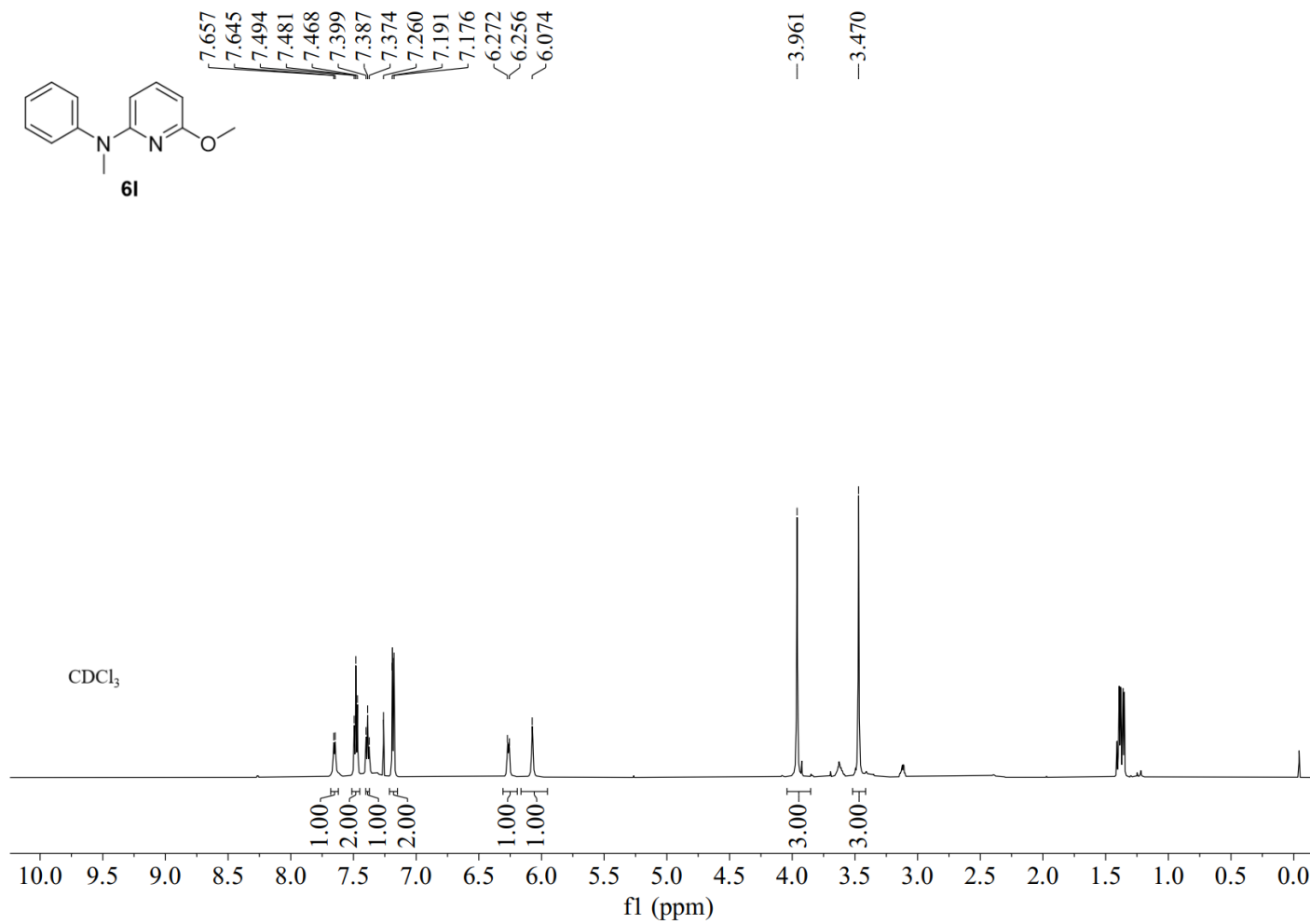
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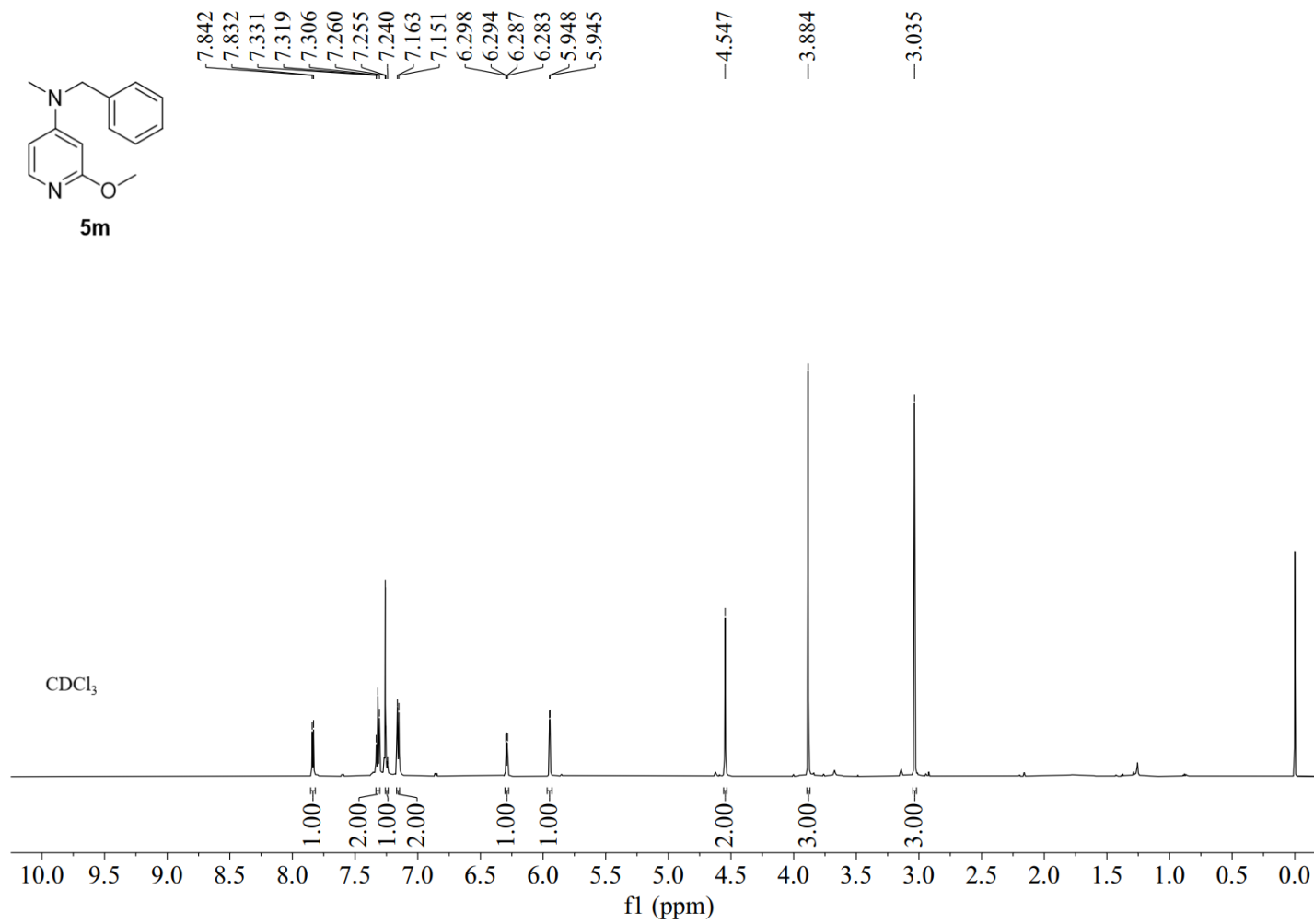
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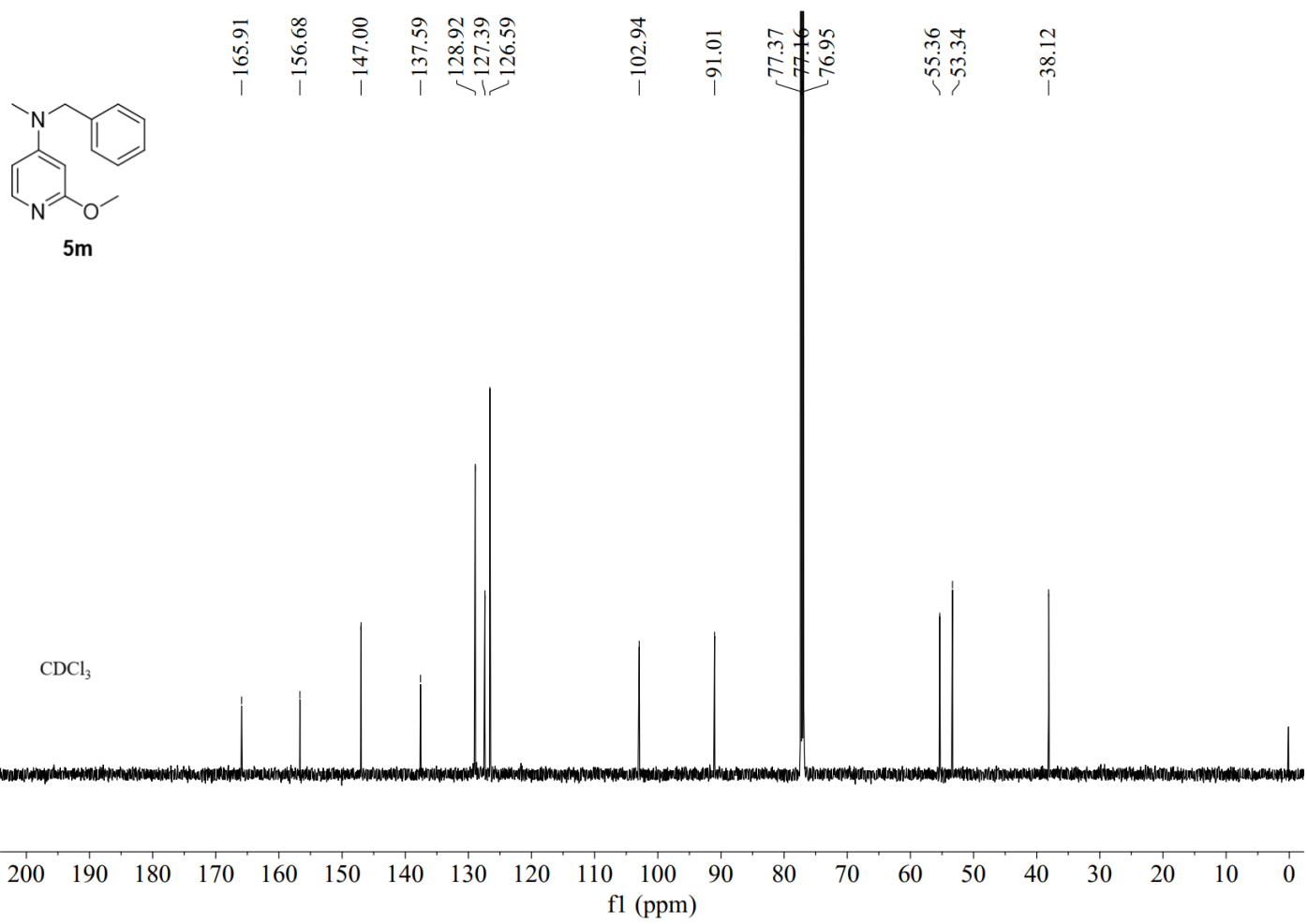
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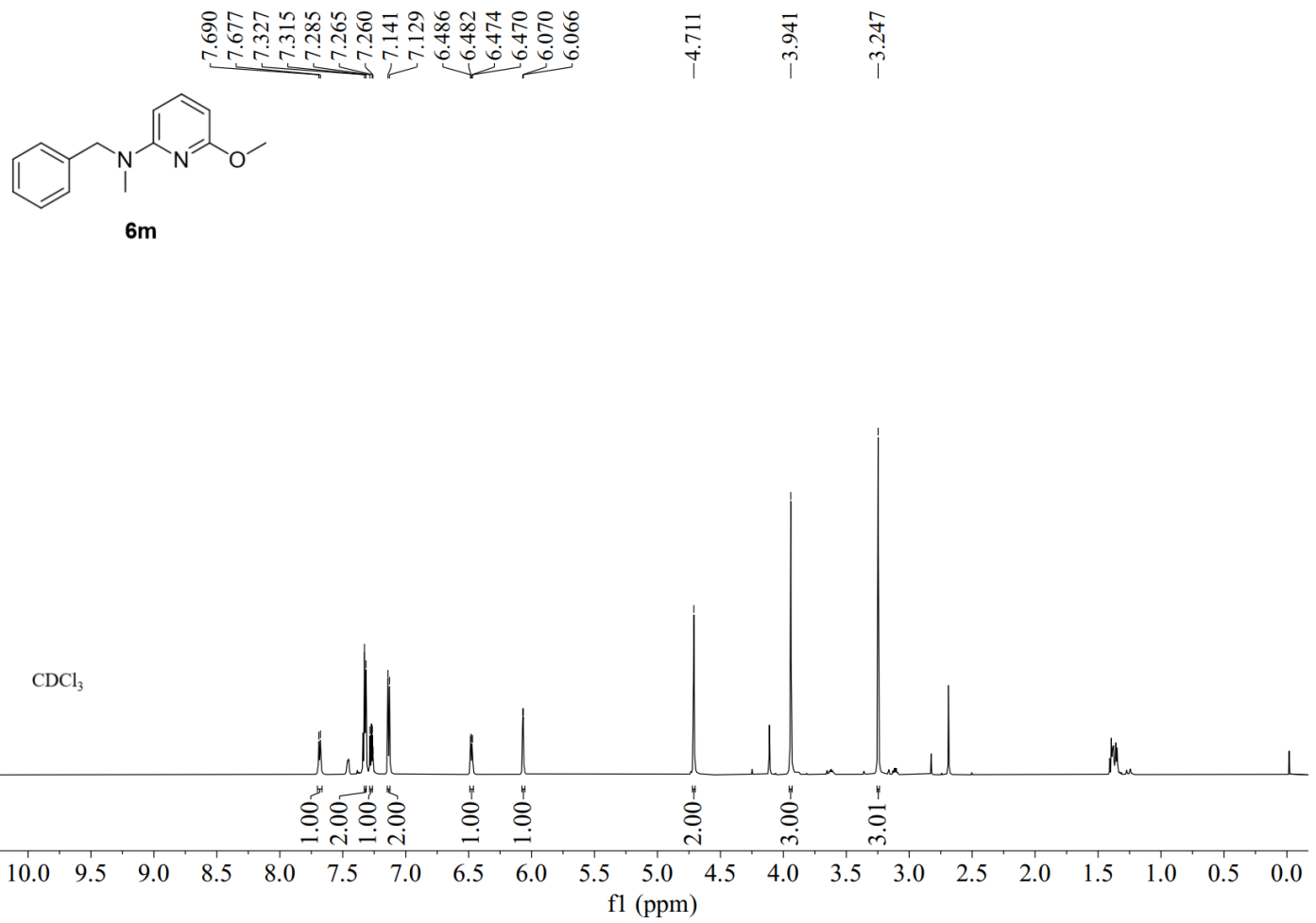
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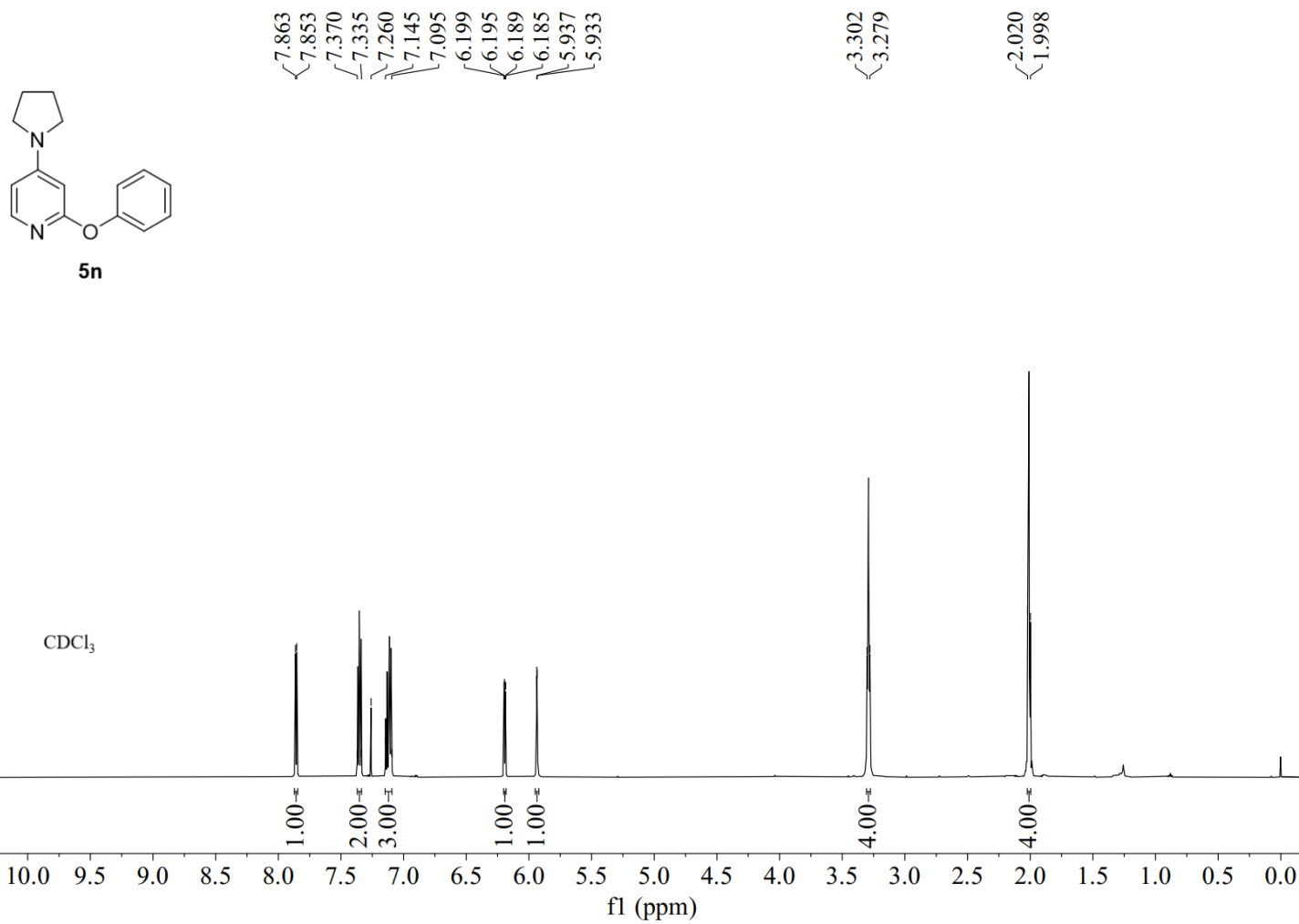
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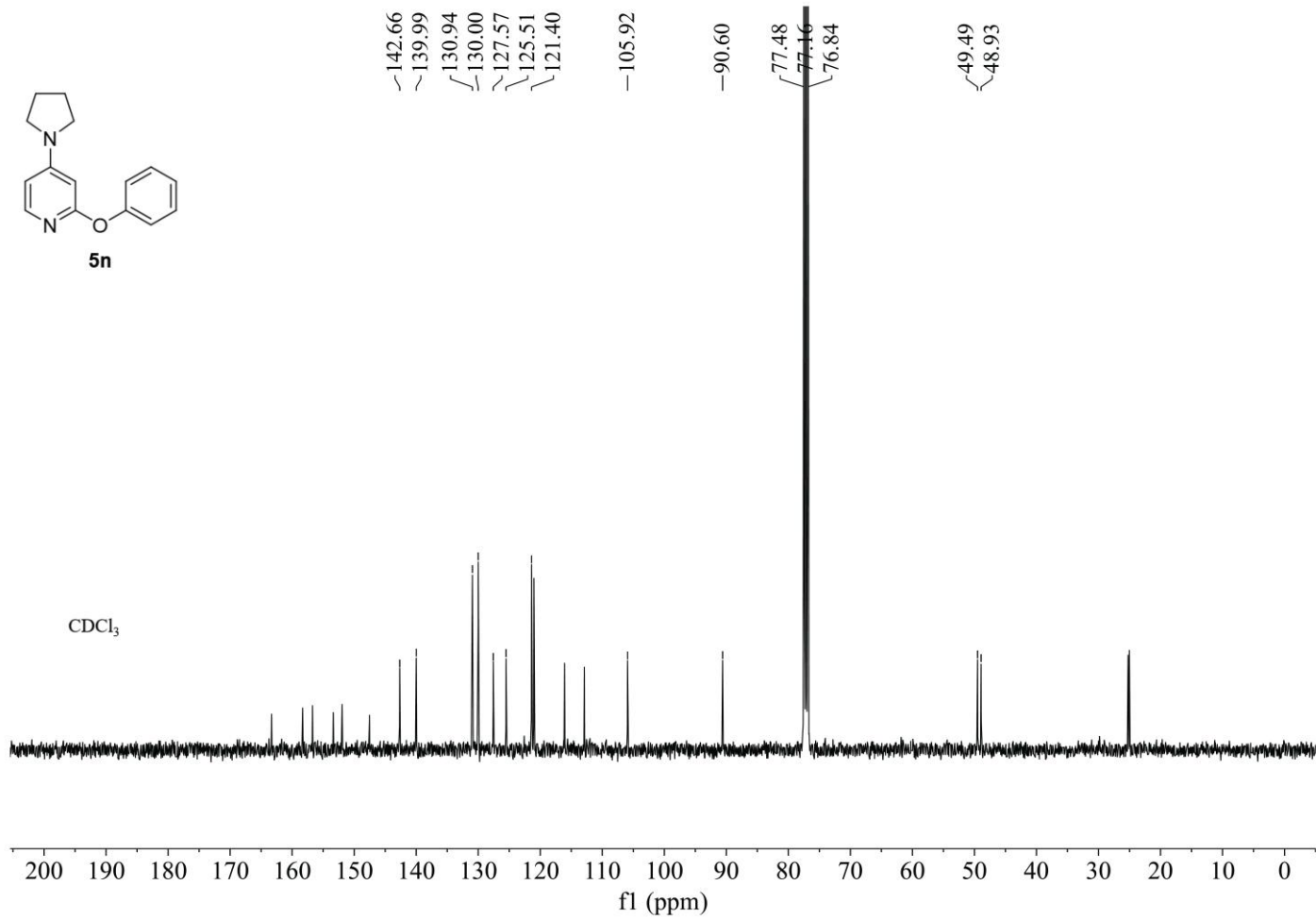
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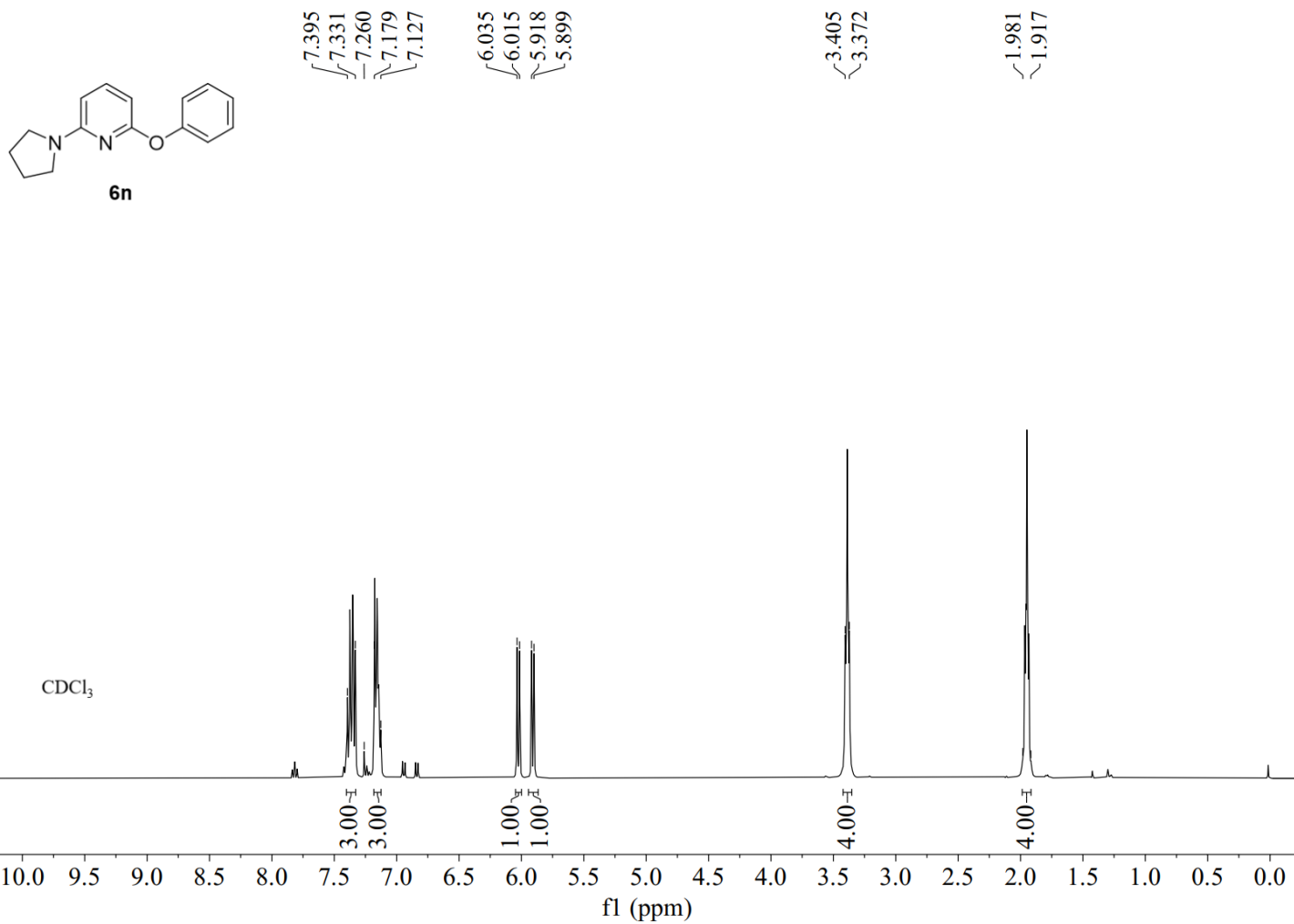
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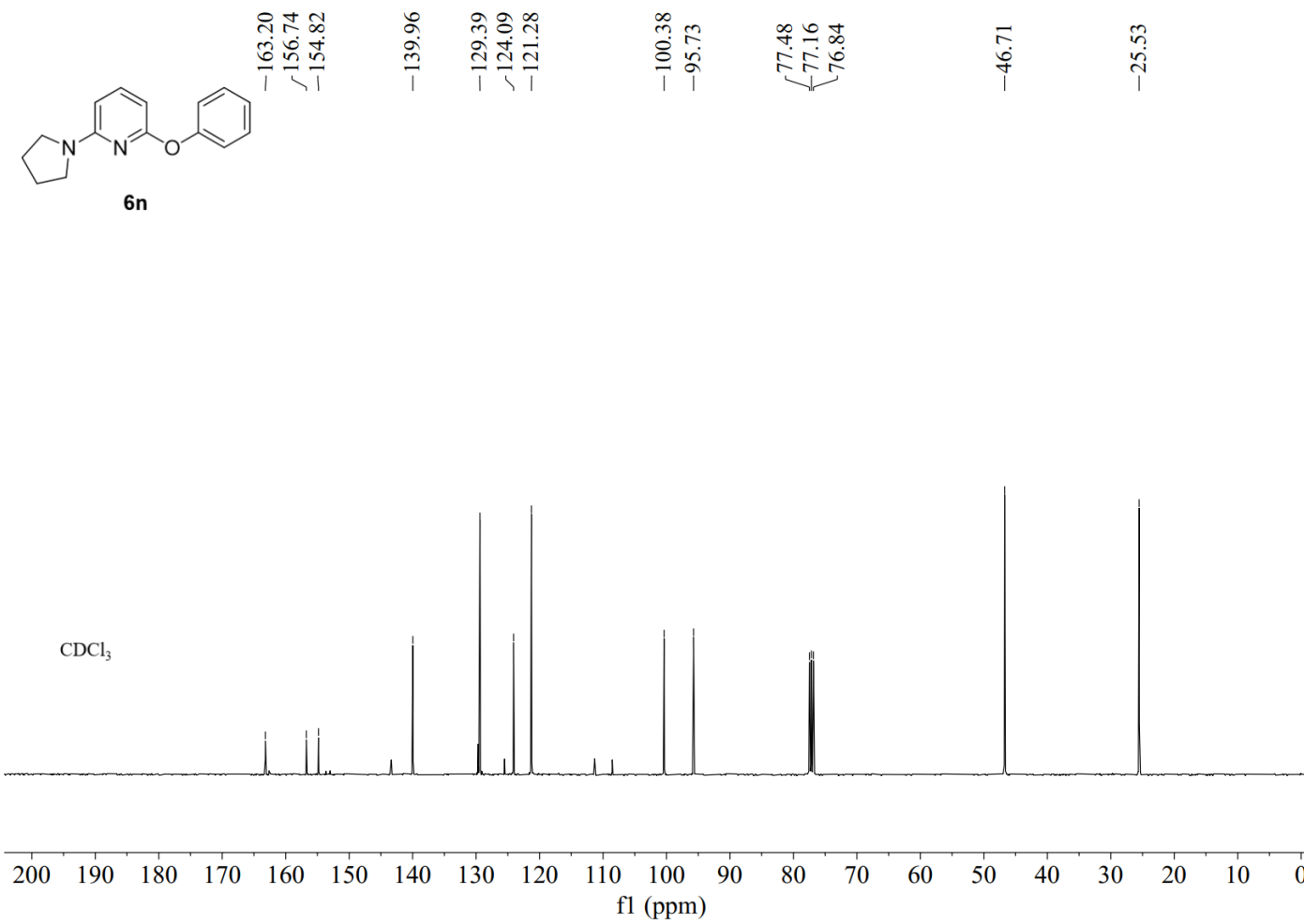
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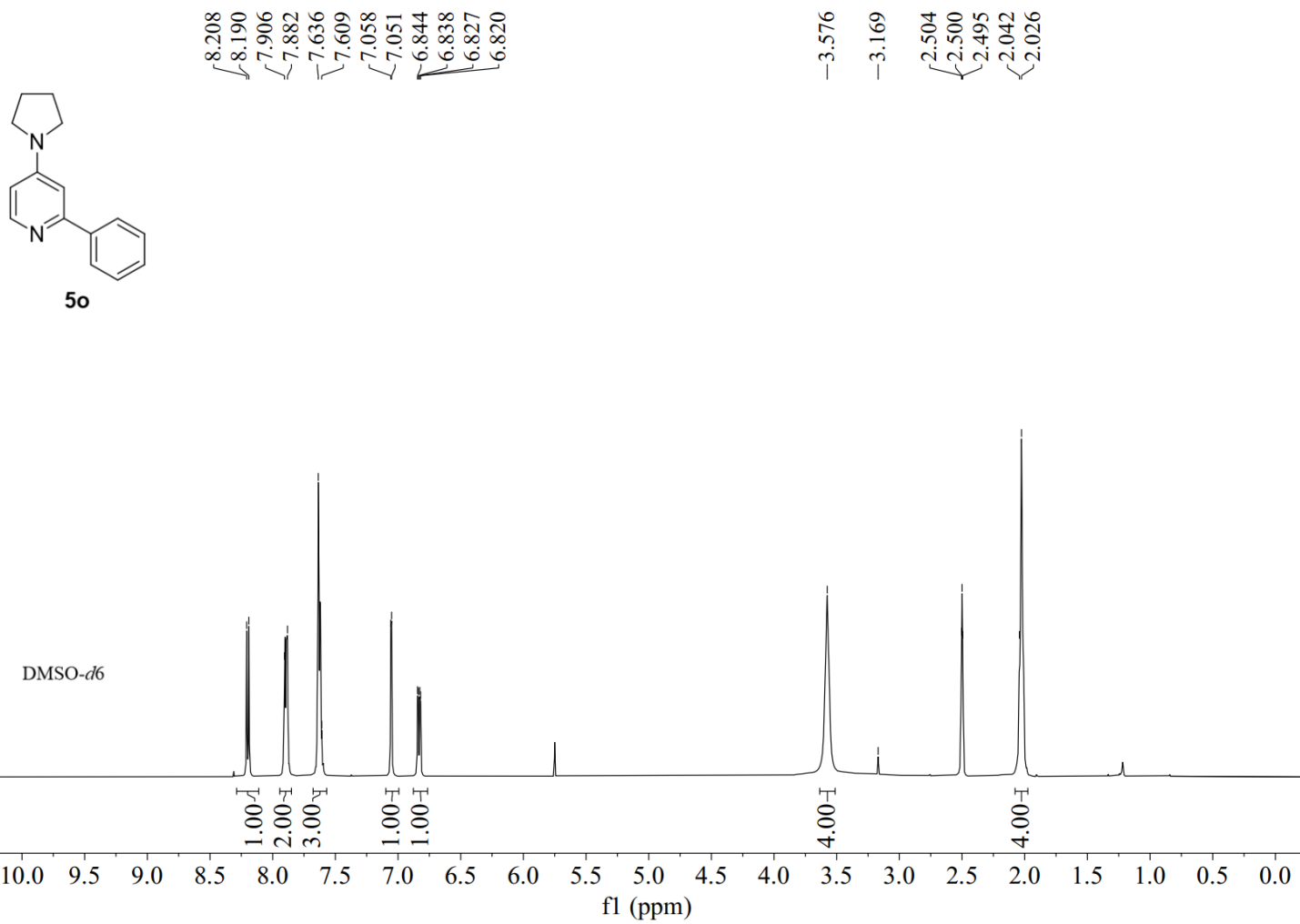
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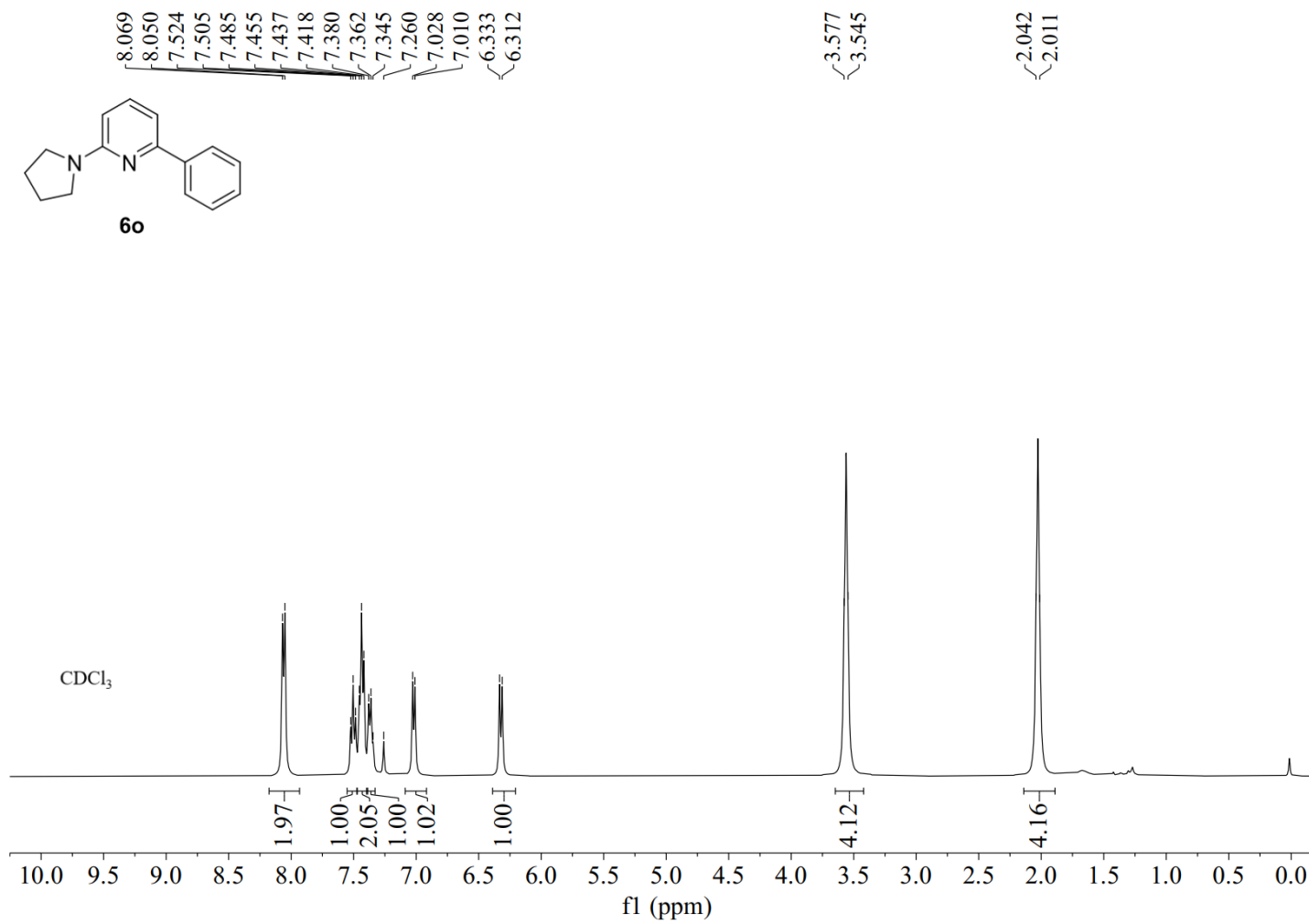
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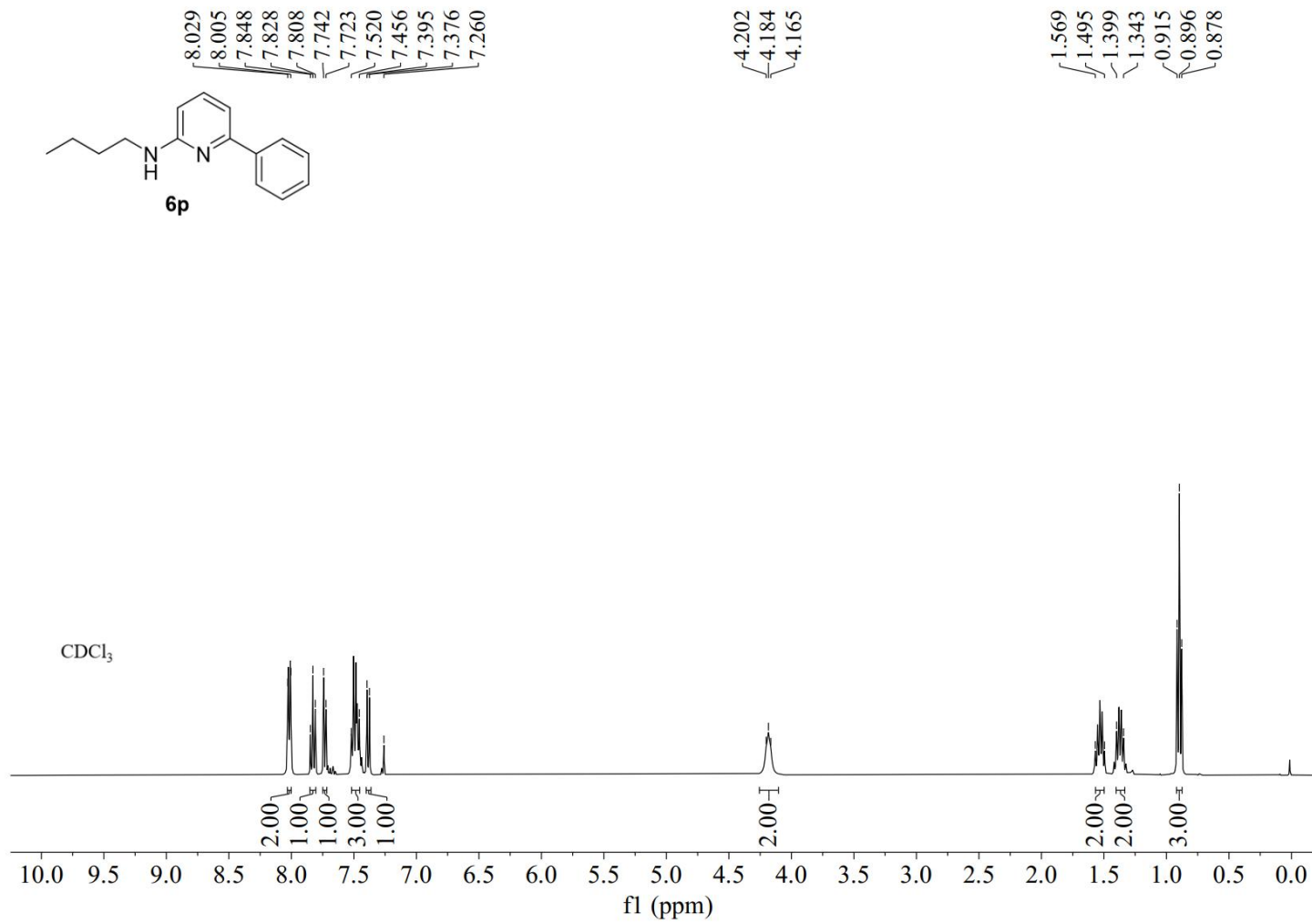
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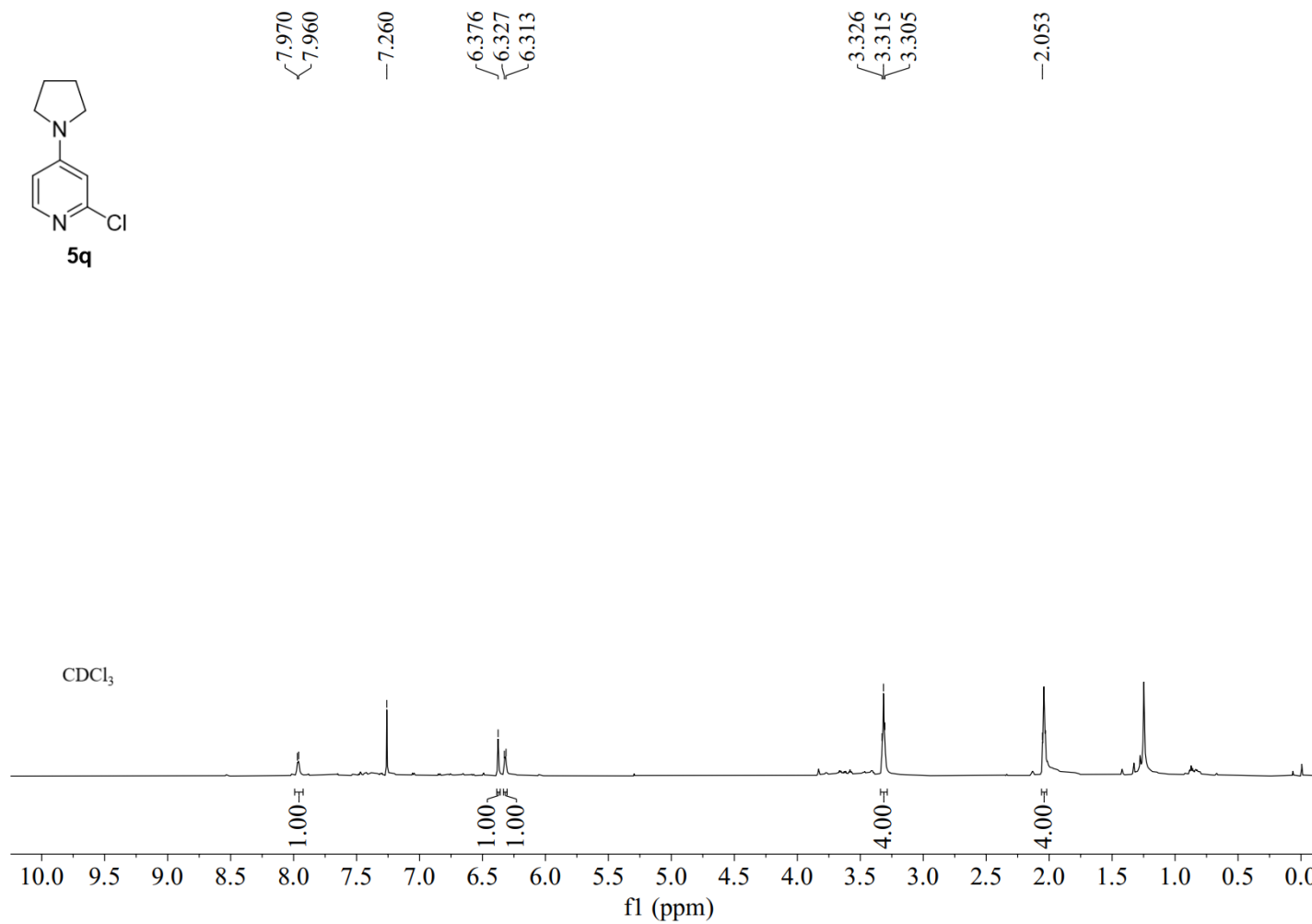
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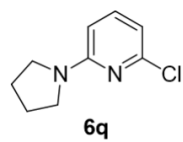
¹H NMR (400 MHz, CDCl₃):



¹H NMR (600 MHz, CDCl₃):



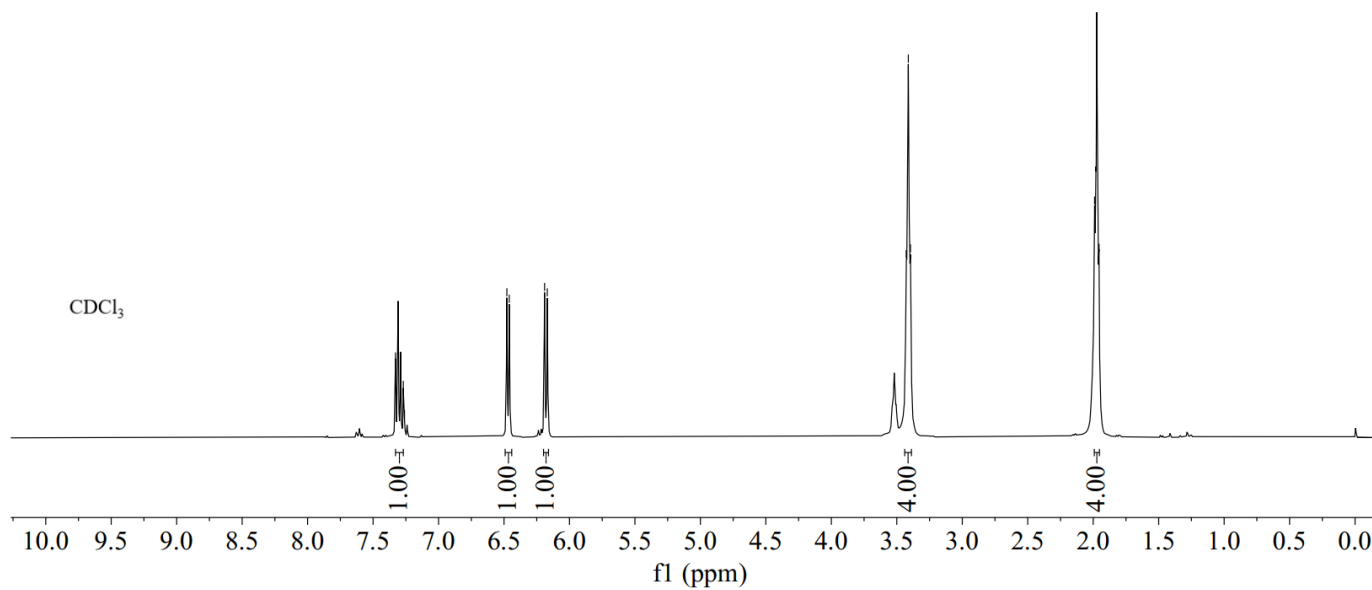
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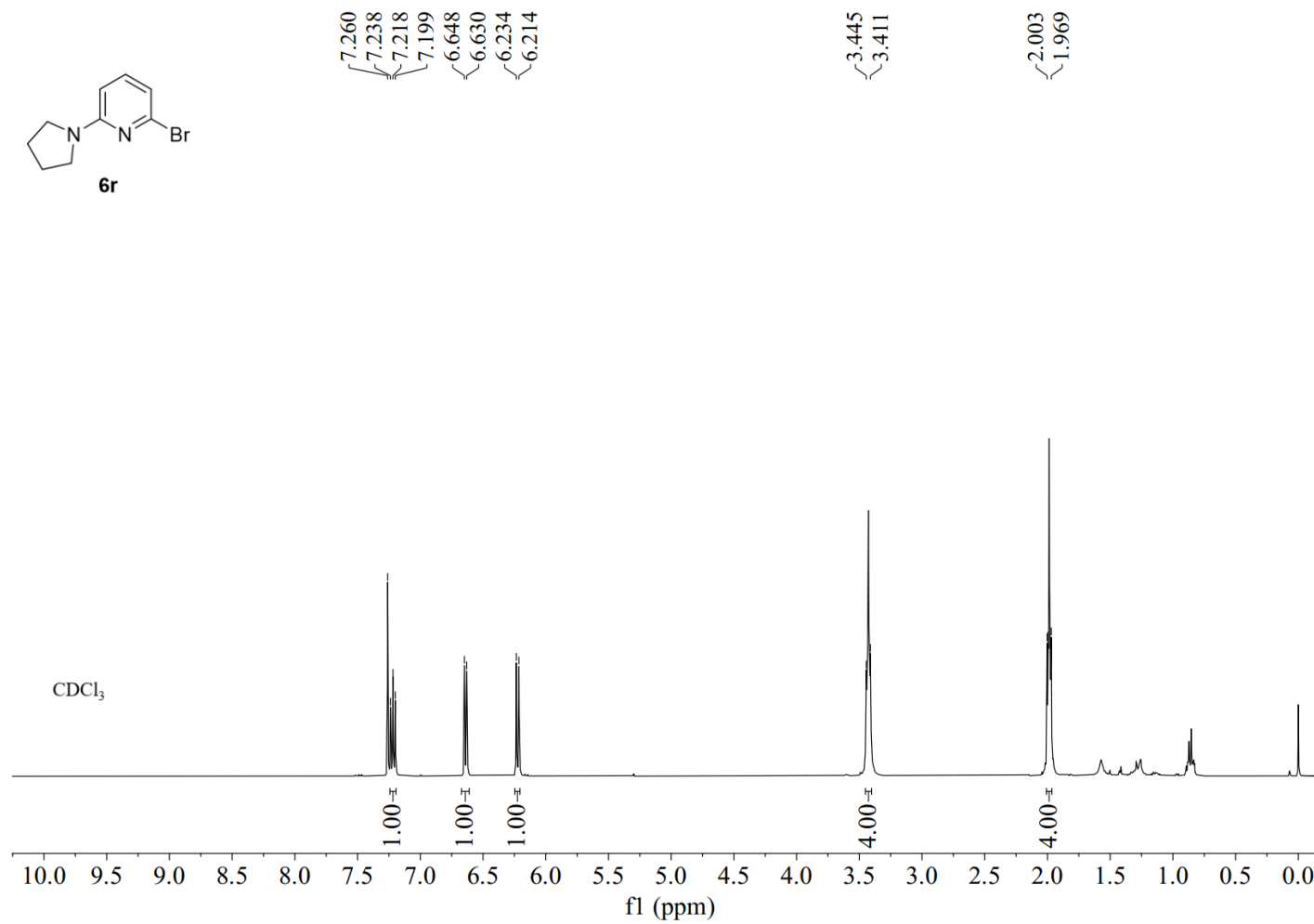
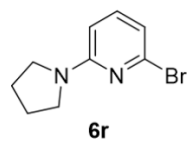
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7.269
7.260
6.478
6.460
6.190
6.169

3.428
3.412
3.396

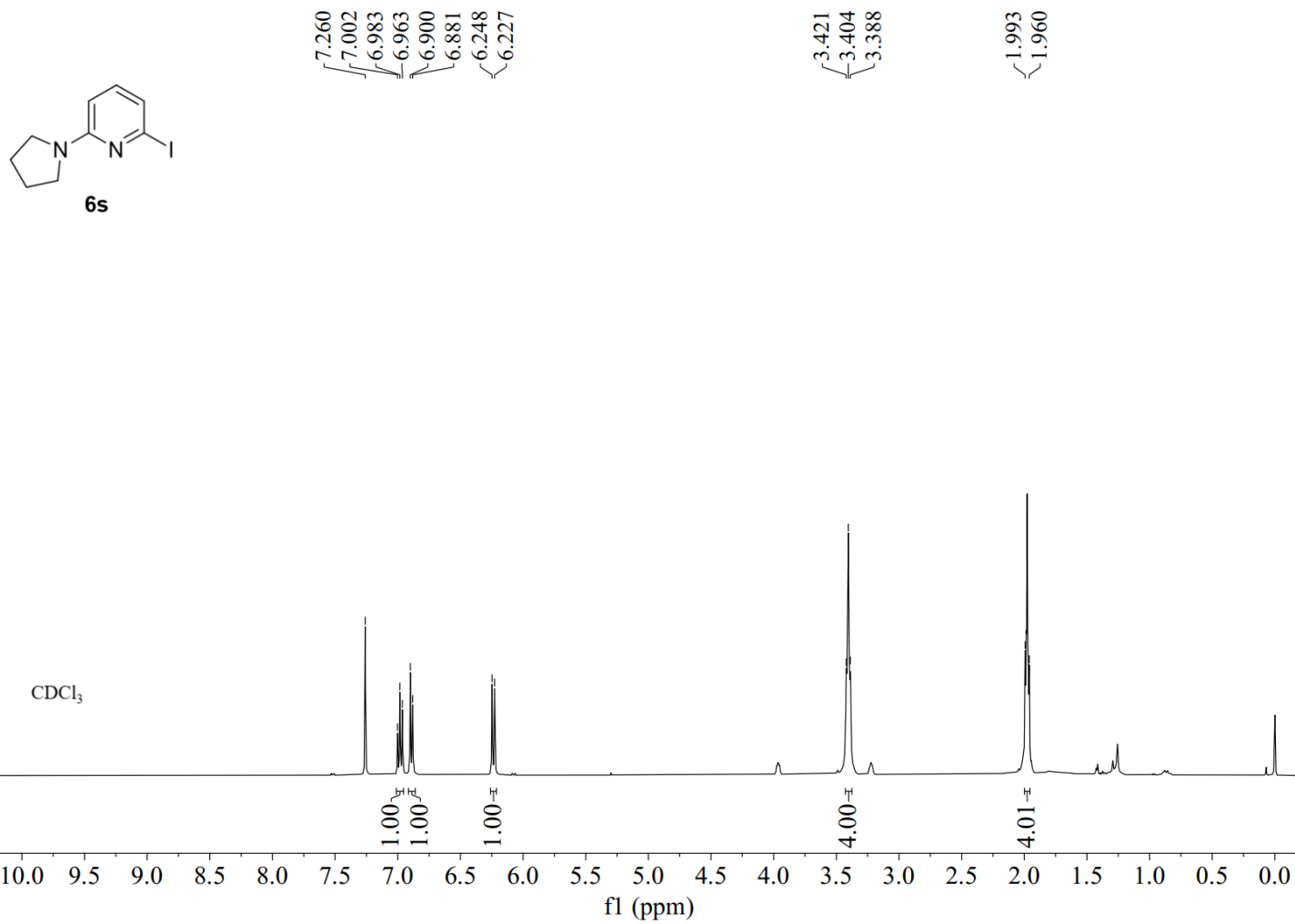
1.990
1.955



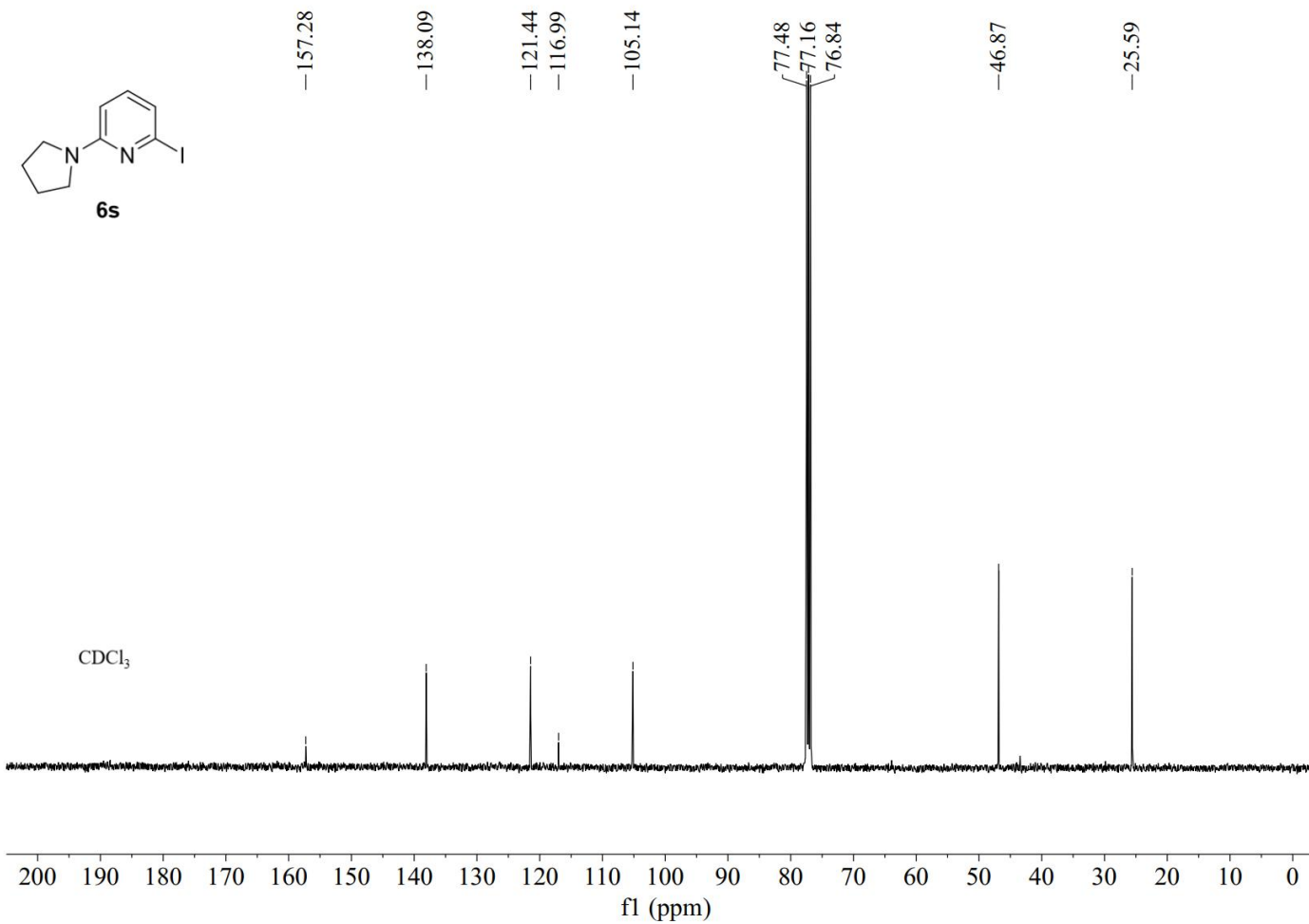
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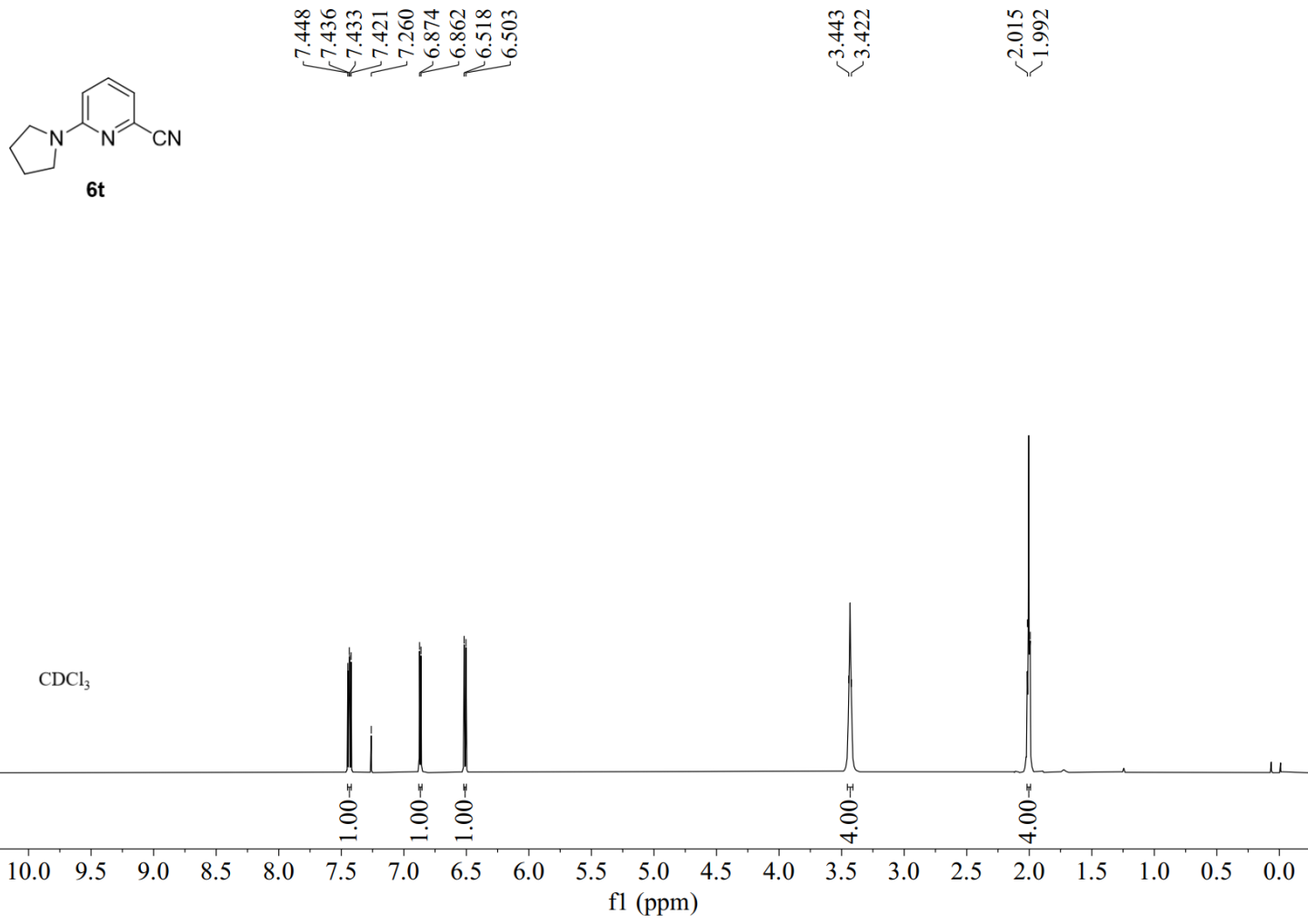
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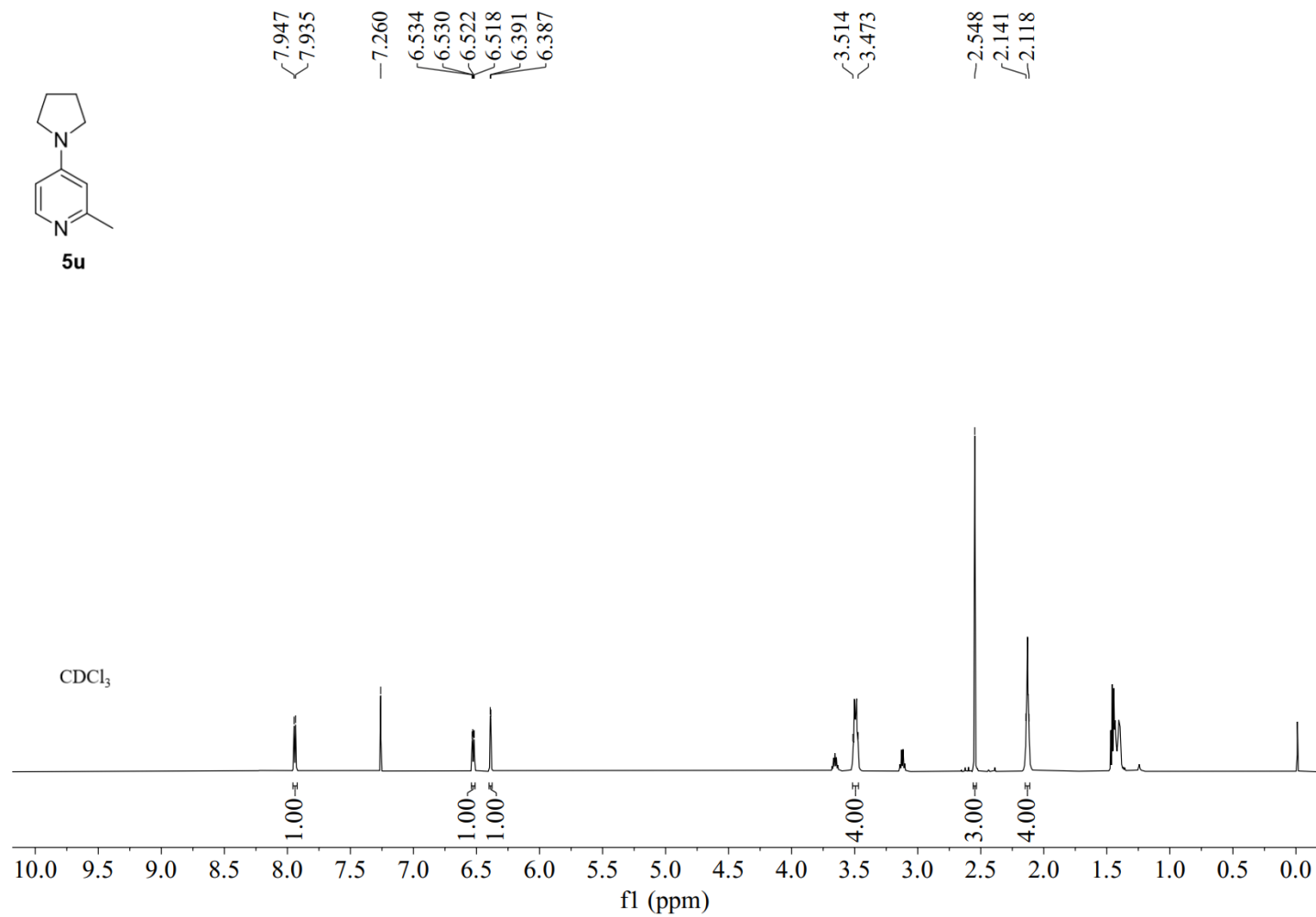
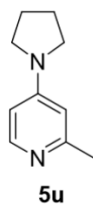
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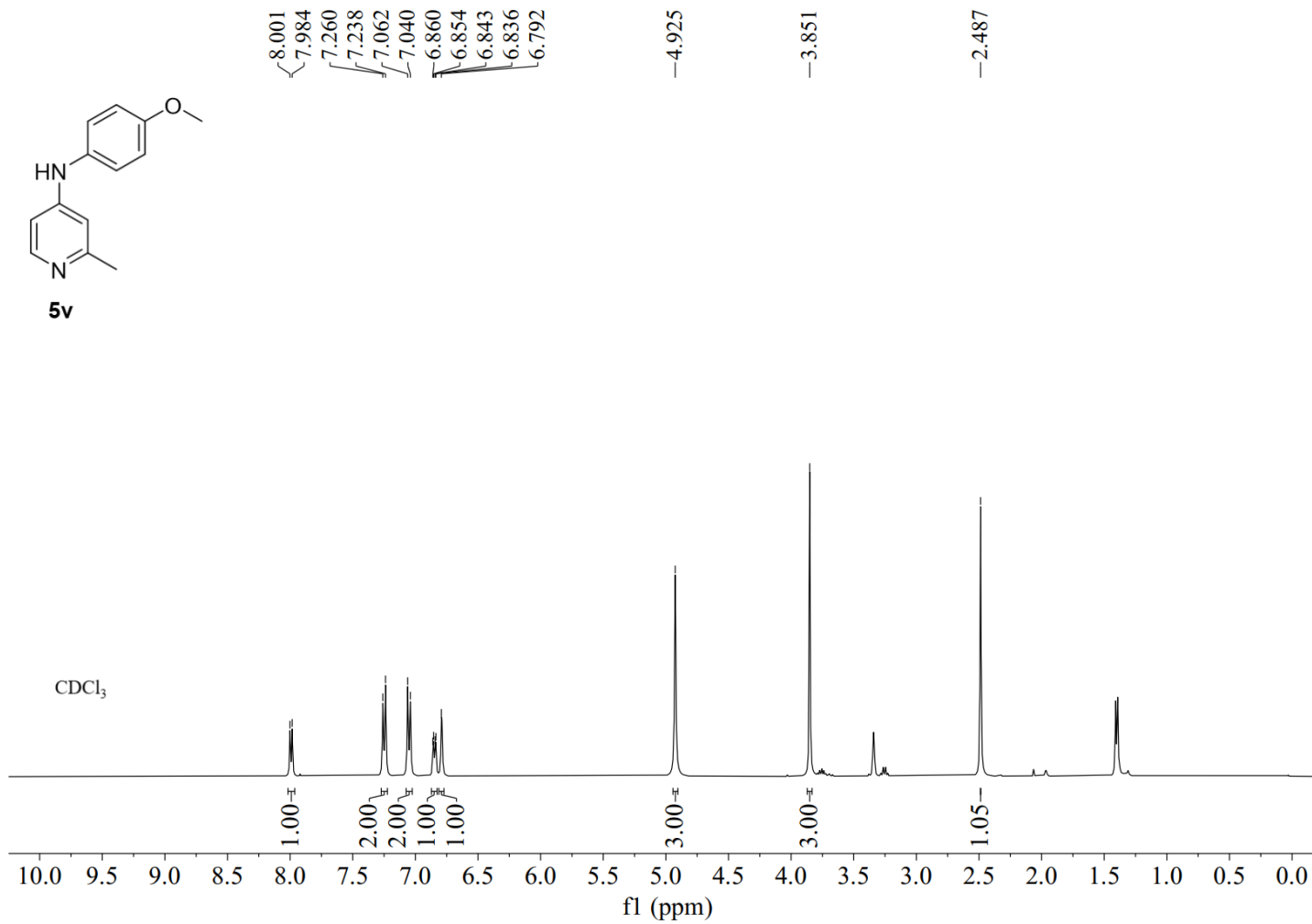
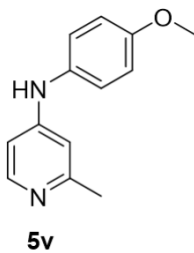
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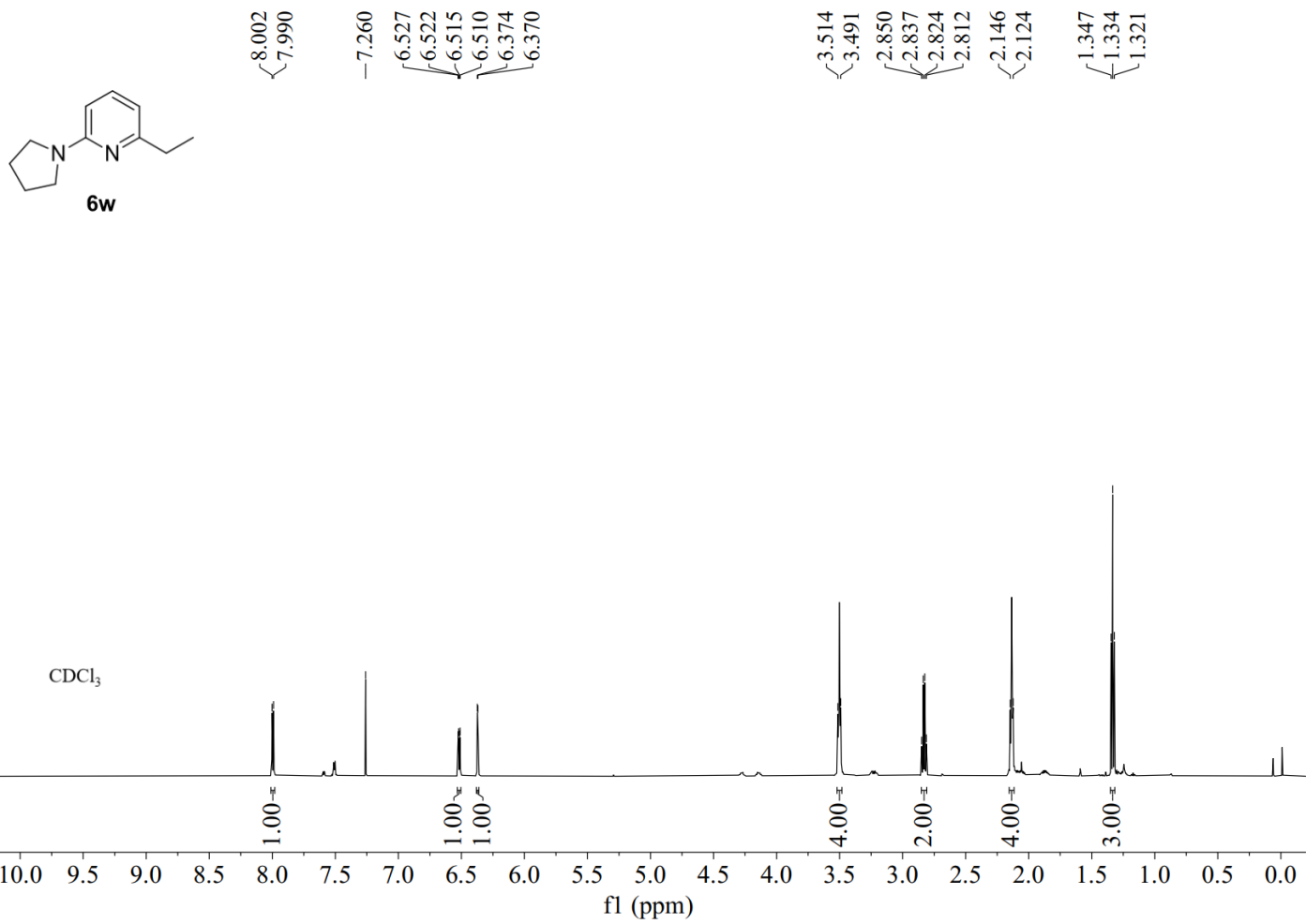
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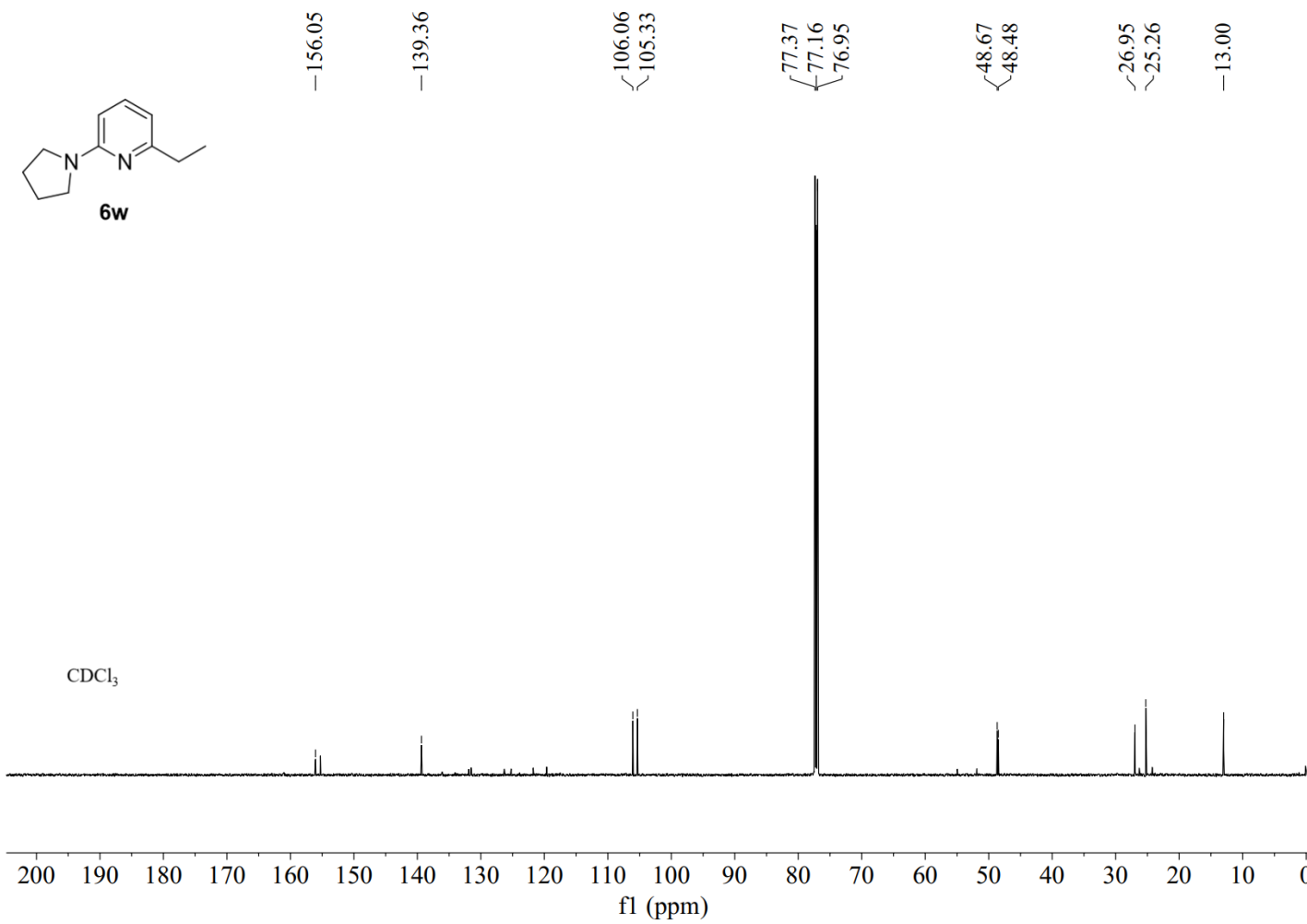
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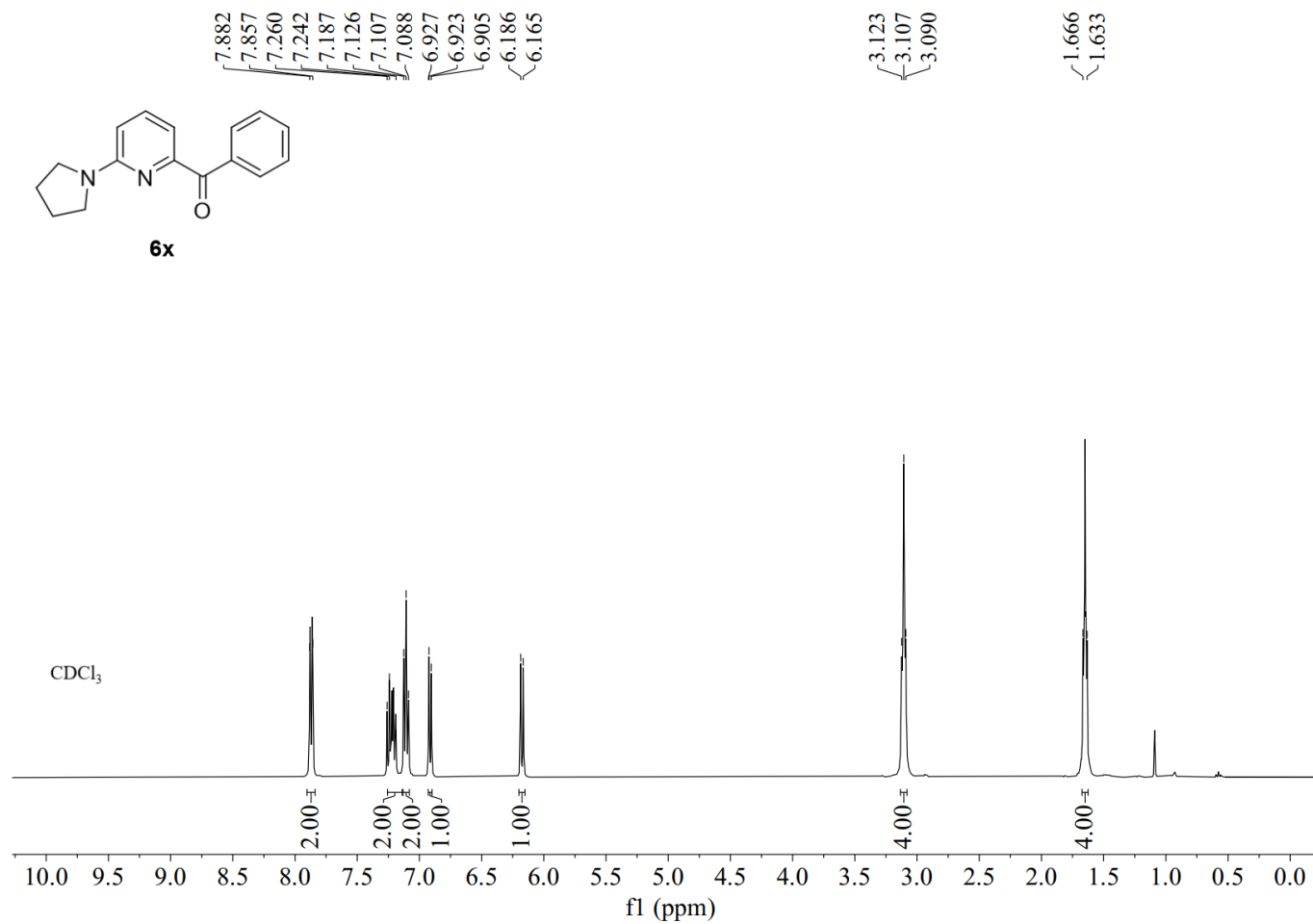
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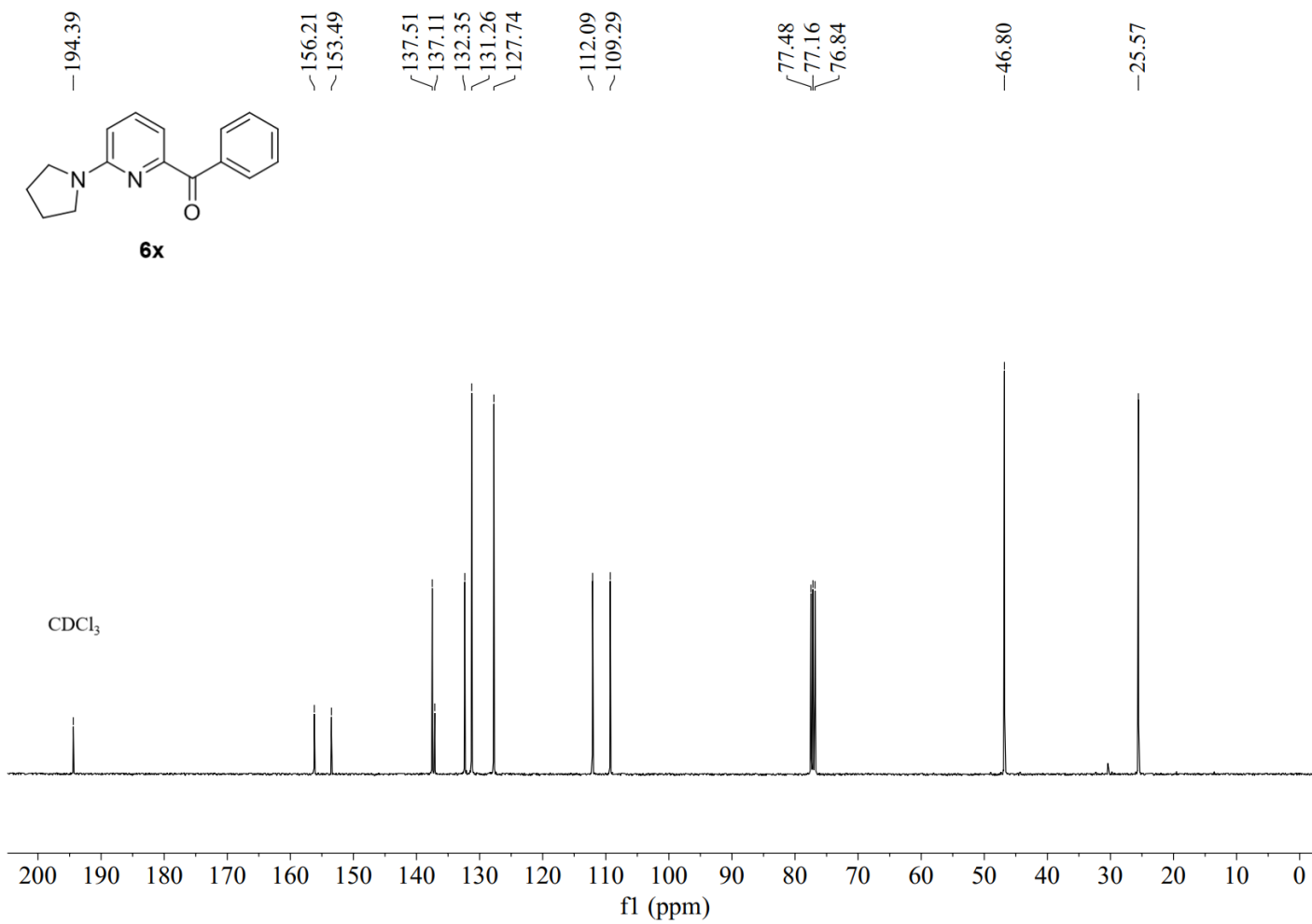
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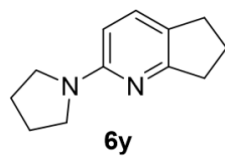
¹H NMR (400 MHz, CDCl₃):



¹³C NMR (100 MHz, CDCl₃):



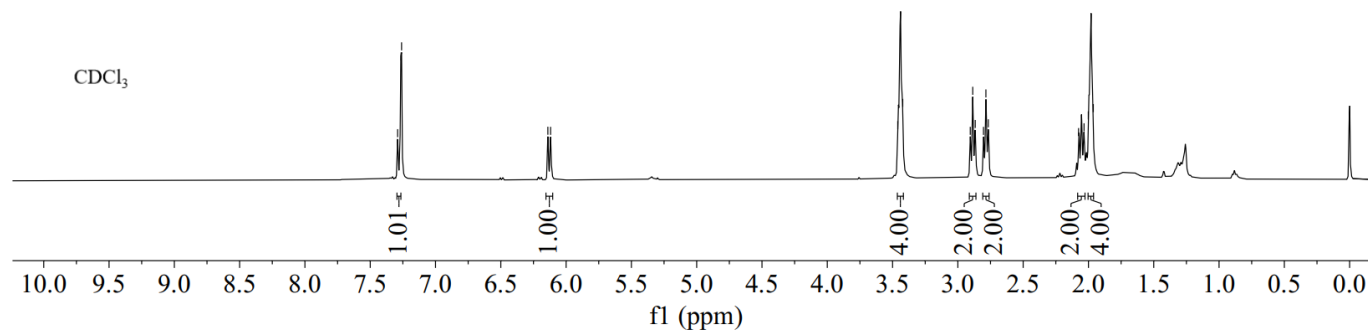
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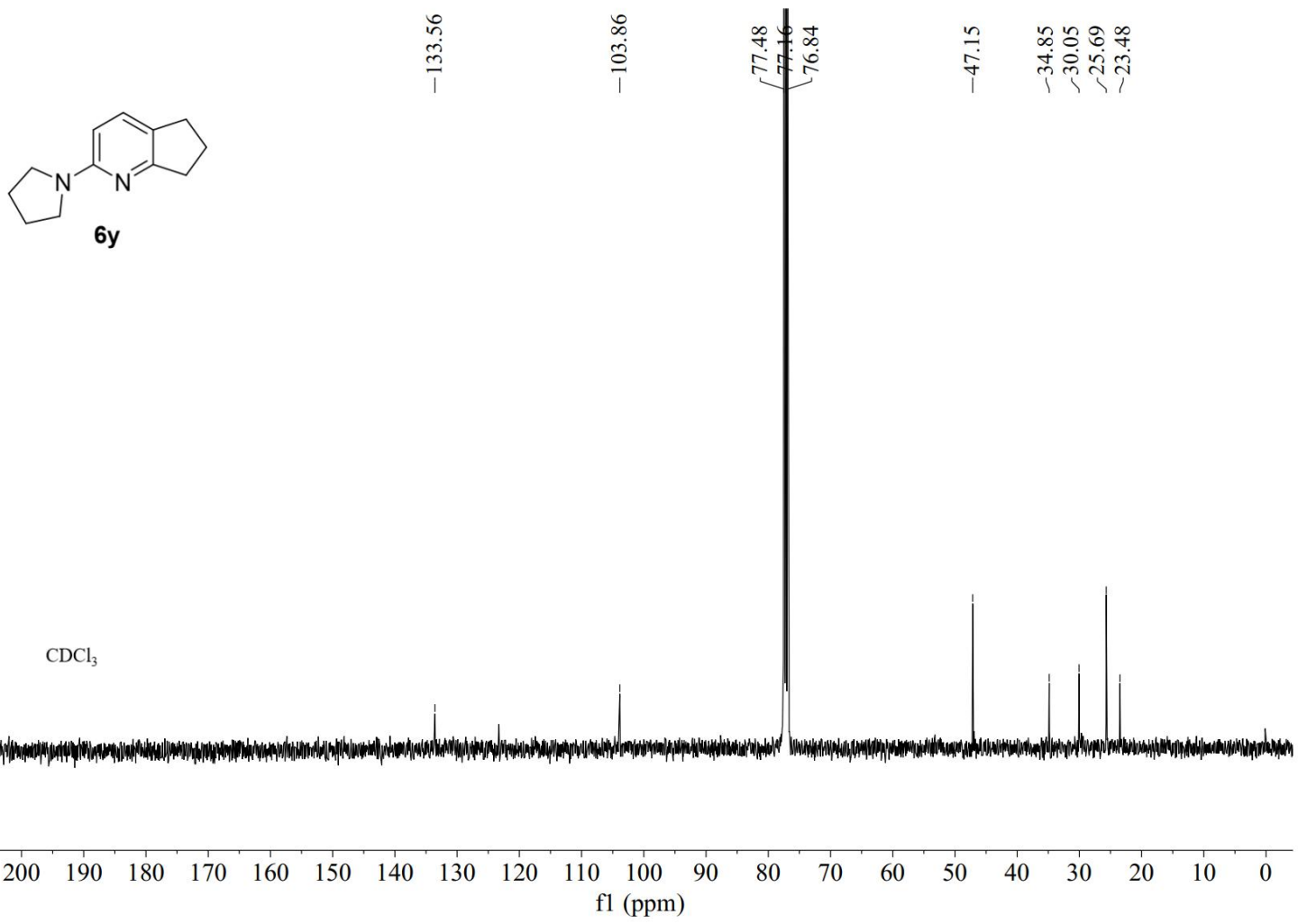
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6.119

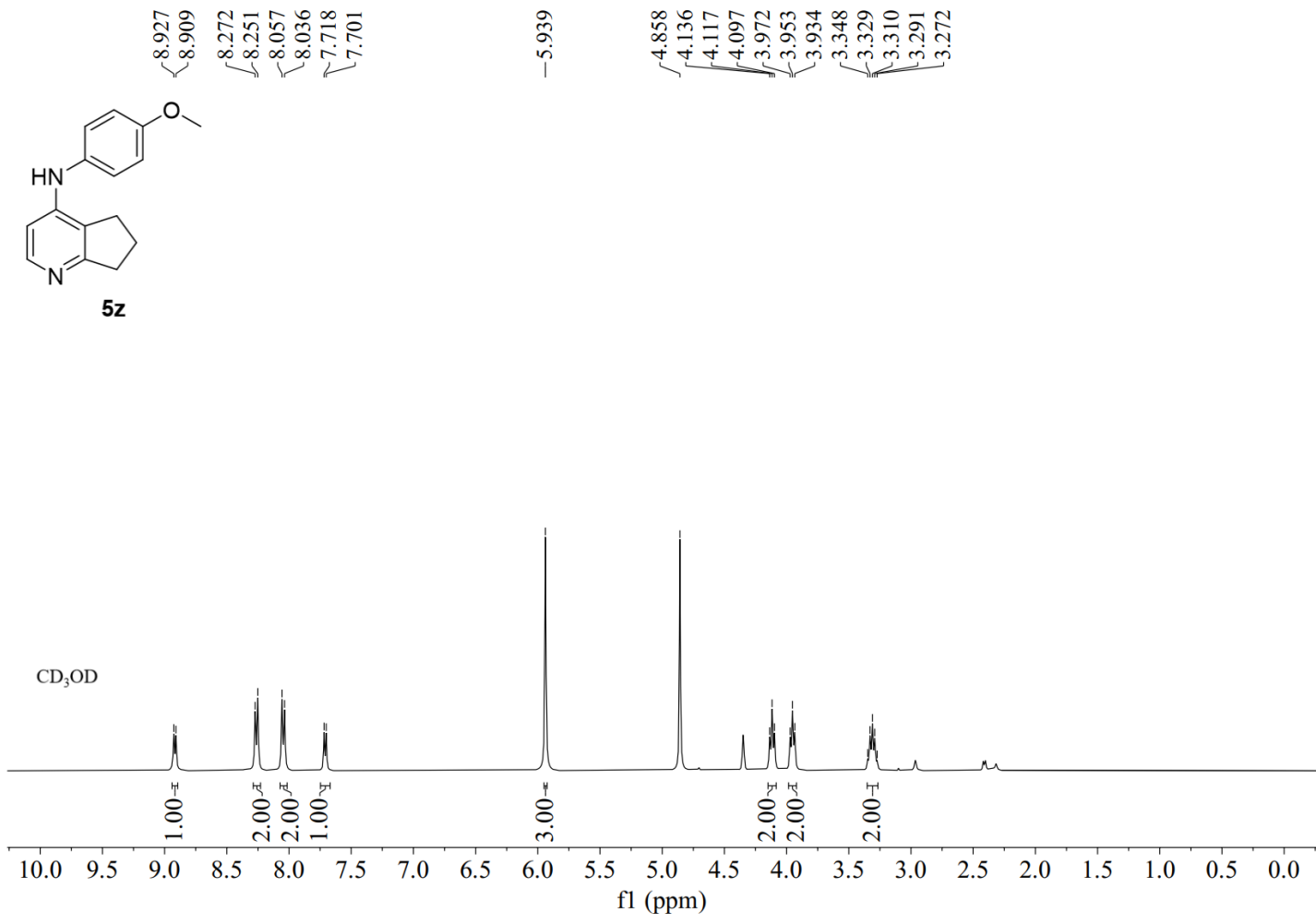
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1.963



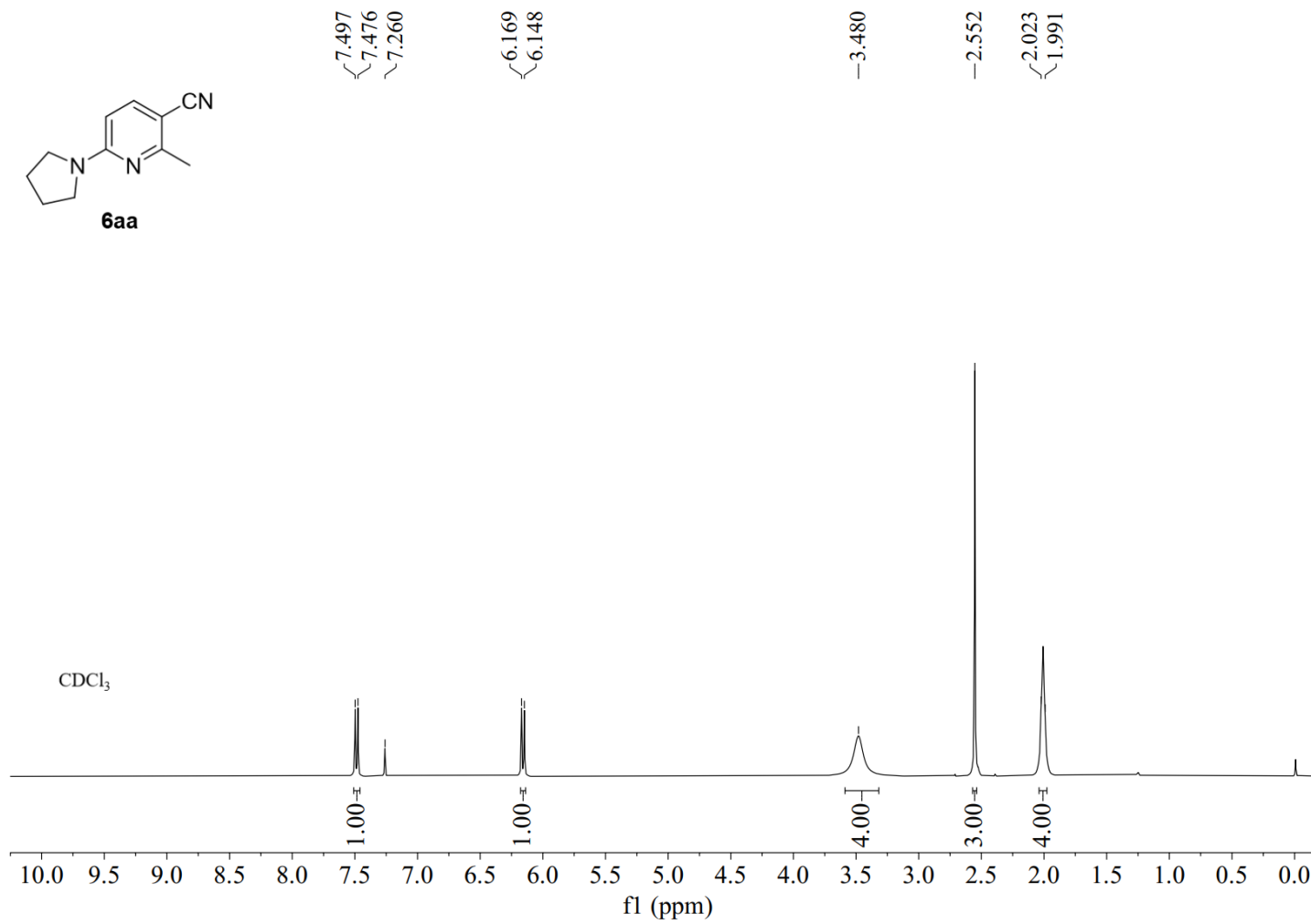
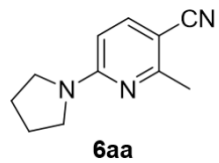
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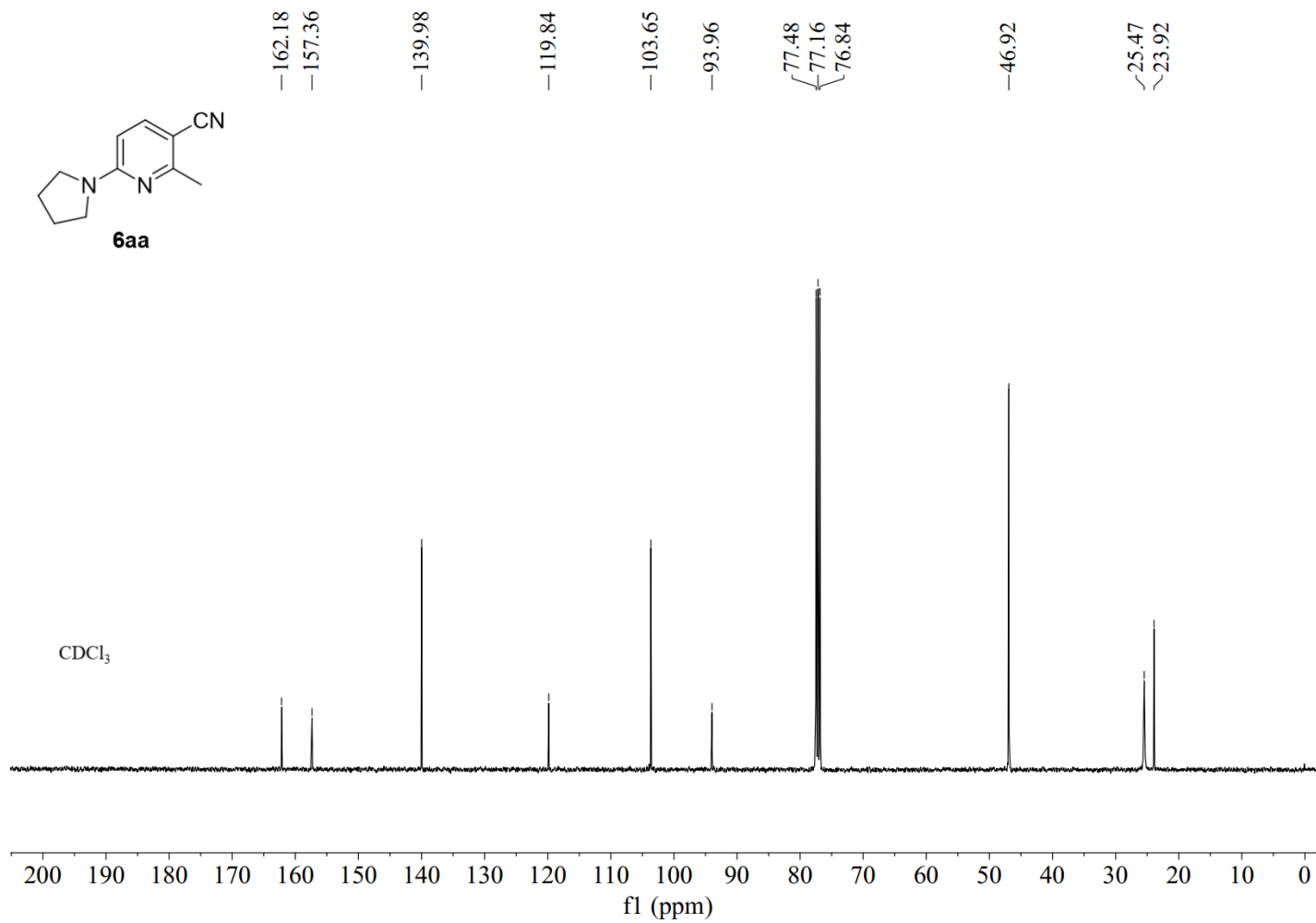
¹H NMR (400 MHz, CDCl₃):



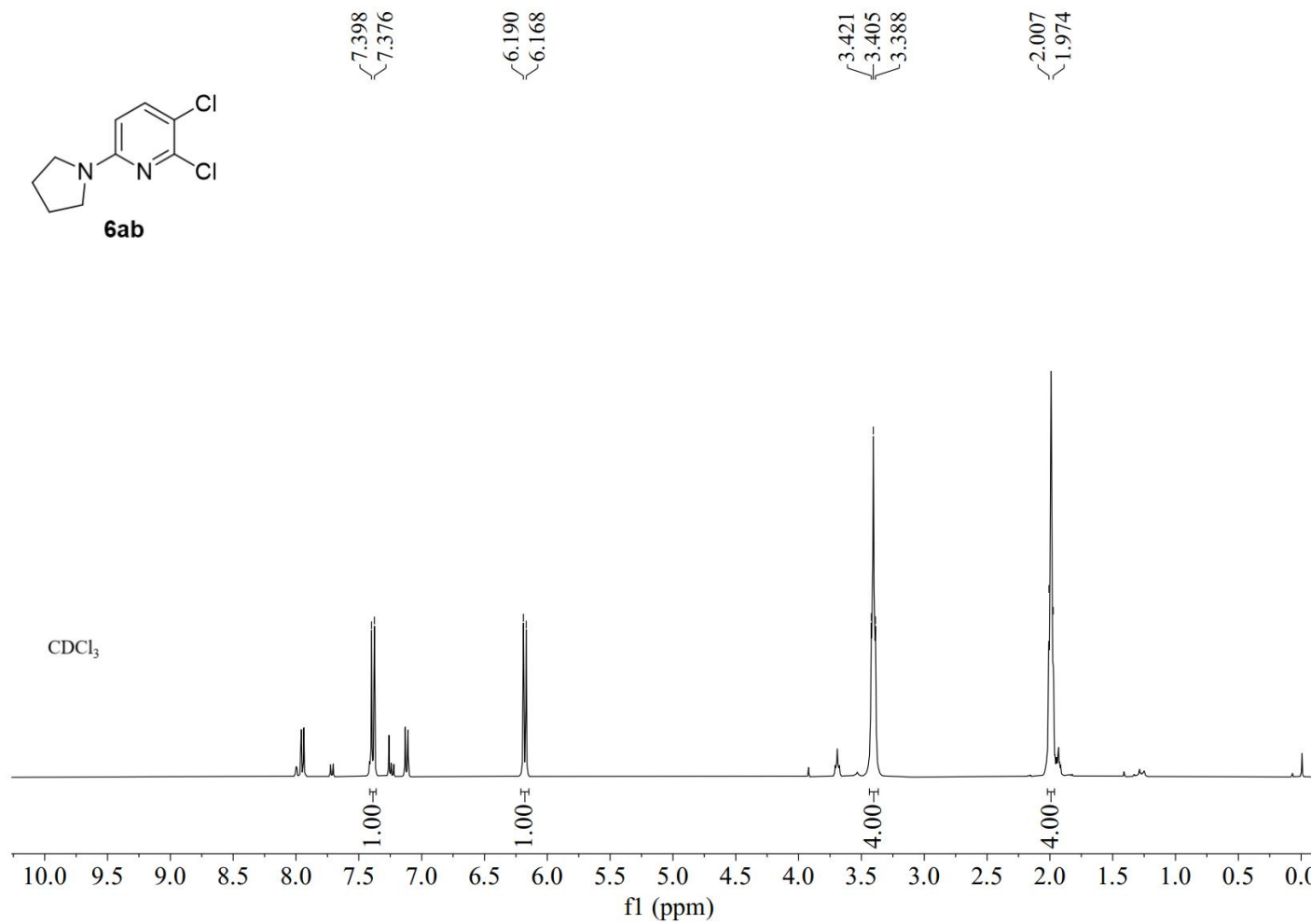
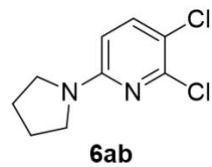
¹H NMR (400 MHz, CDCl₃):



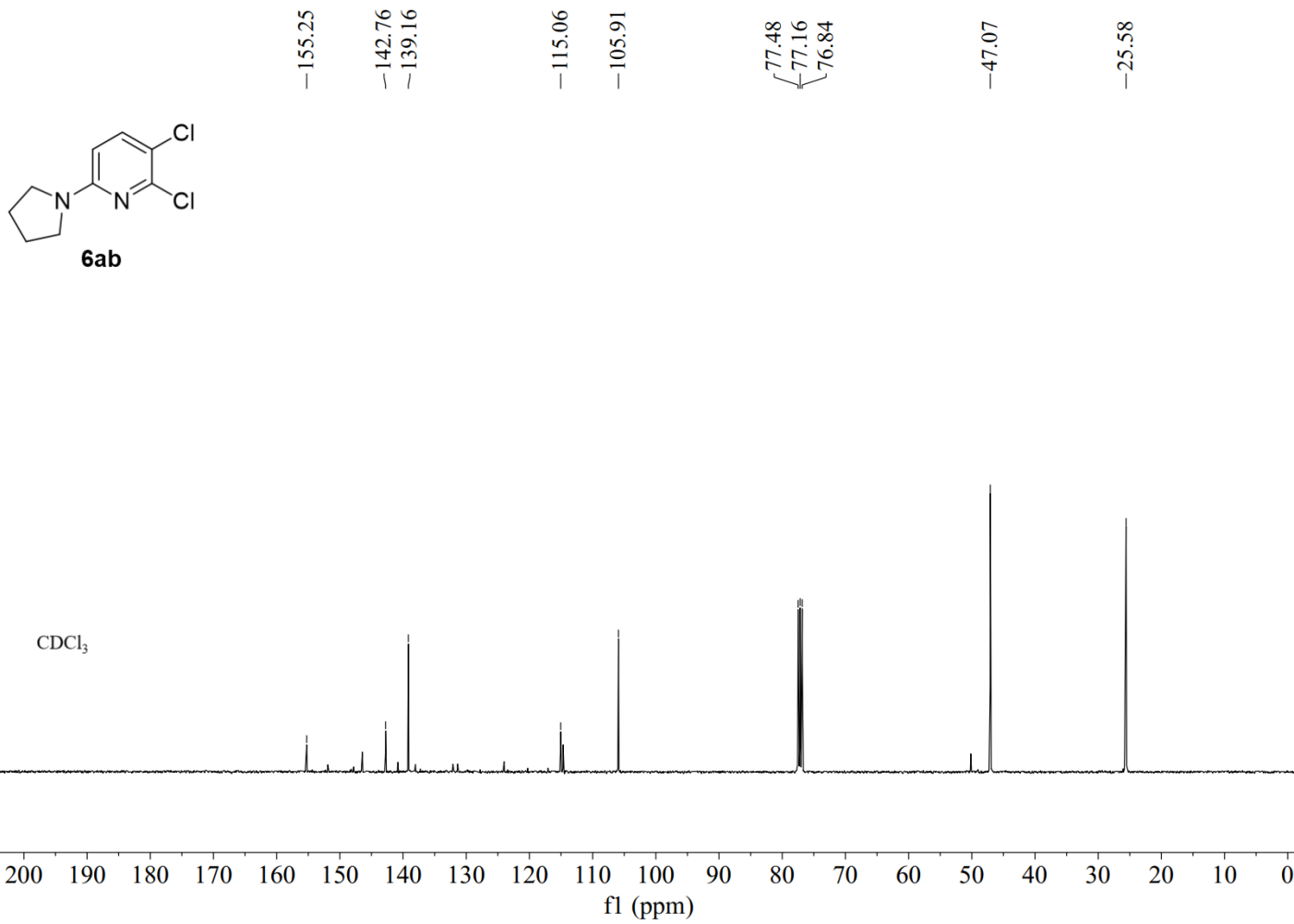
^{13}C NMR (100 MHz, CDCl_3):



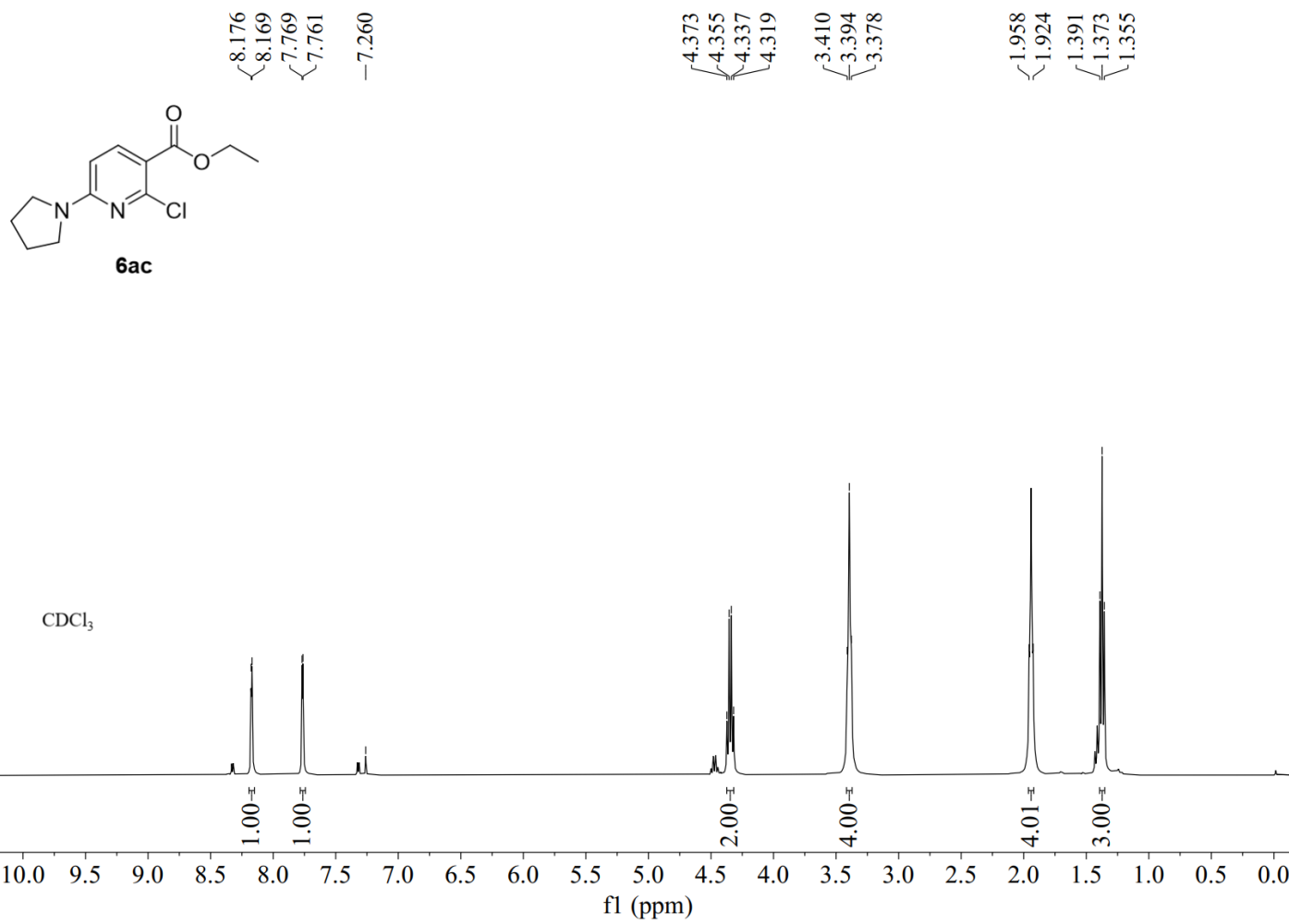
¹H NMR (400 MHz, CDCl₃):



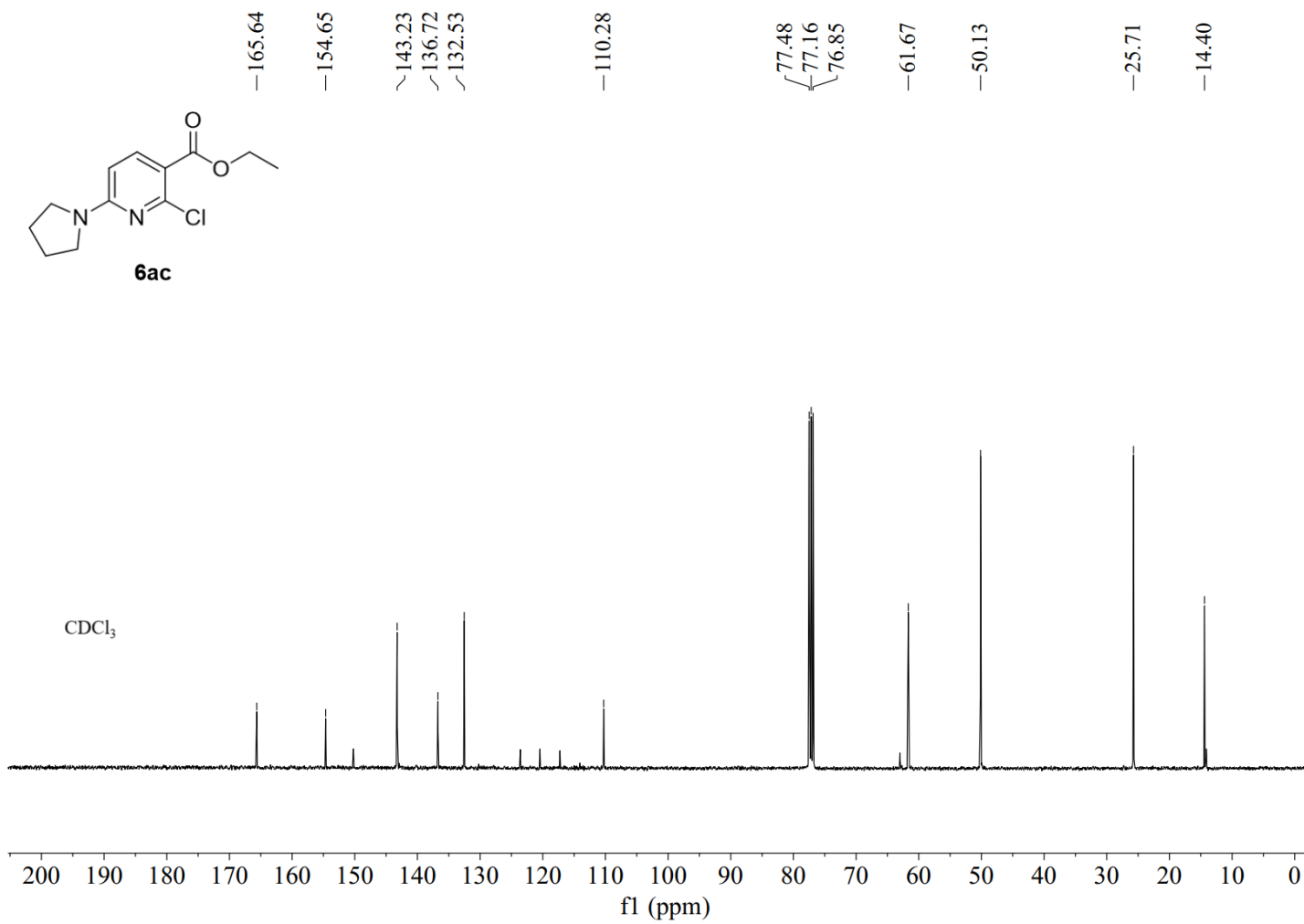
¹³C NMR (100 MHz, CDCl₃):



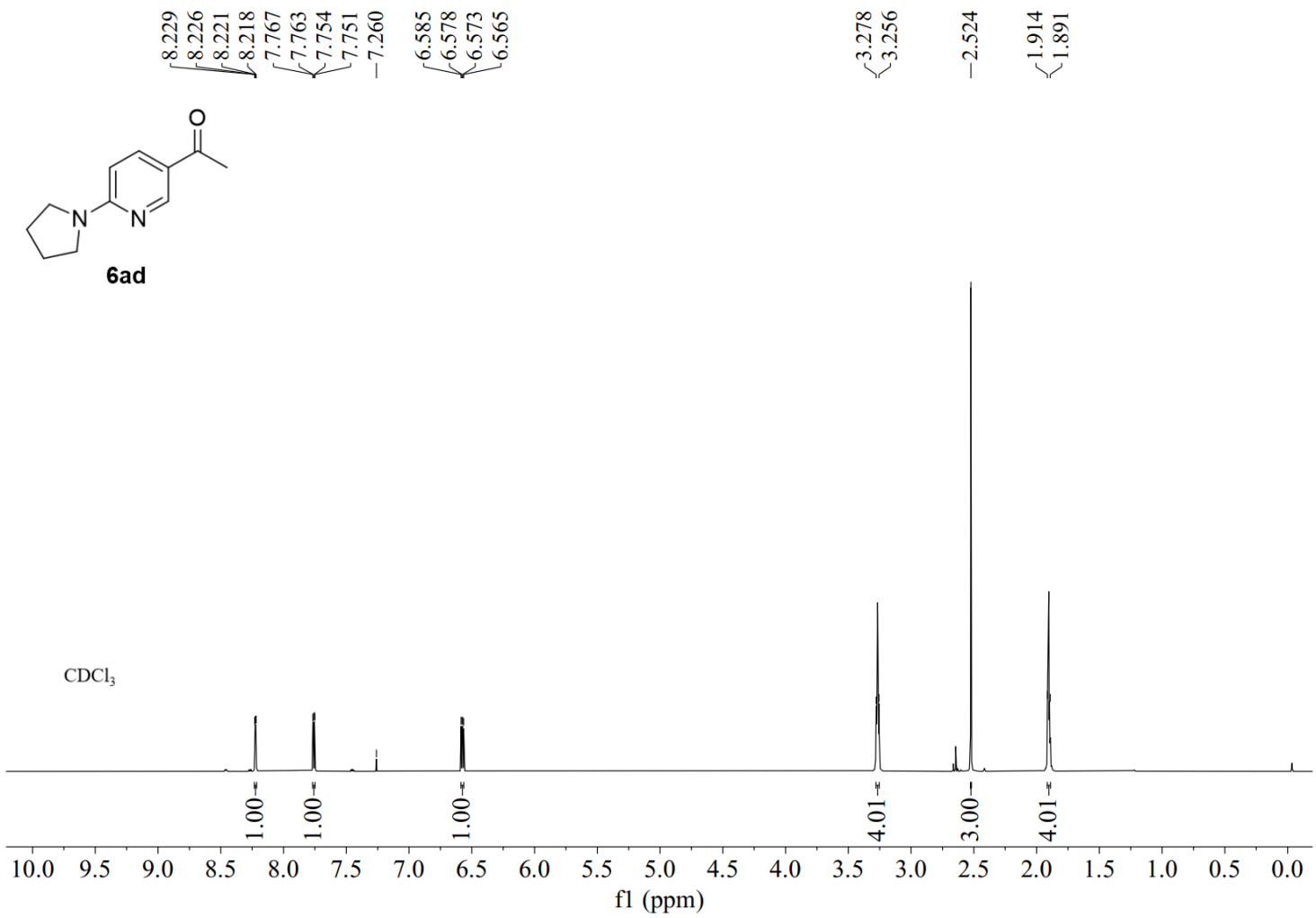
¹H NMR (400 MHz, CDCl₃):



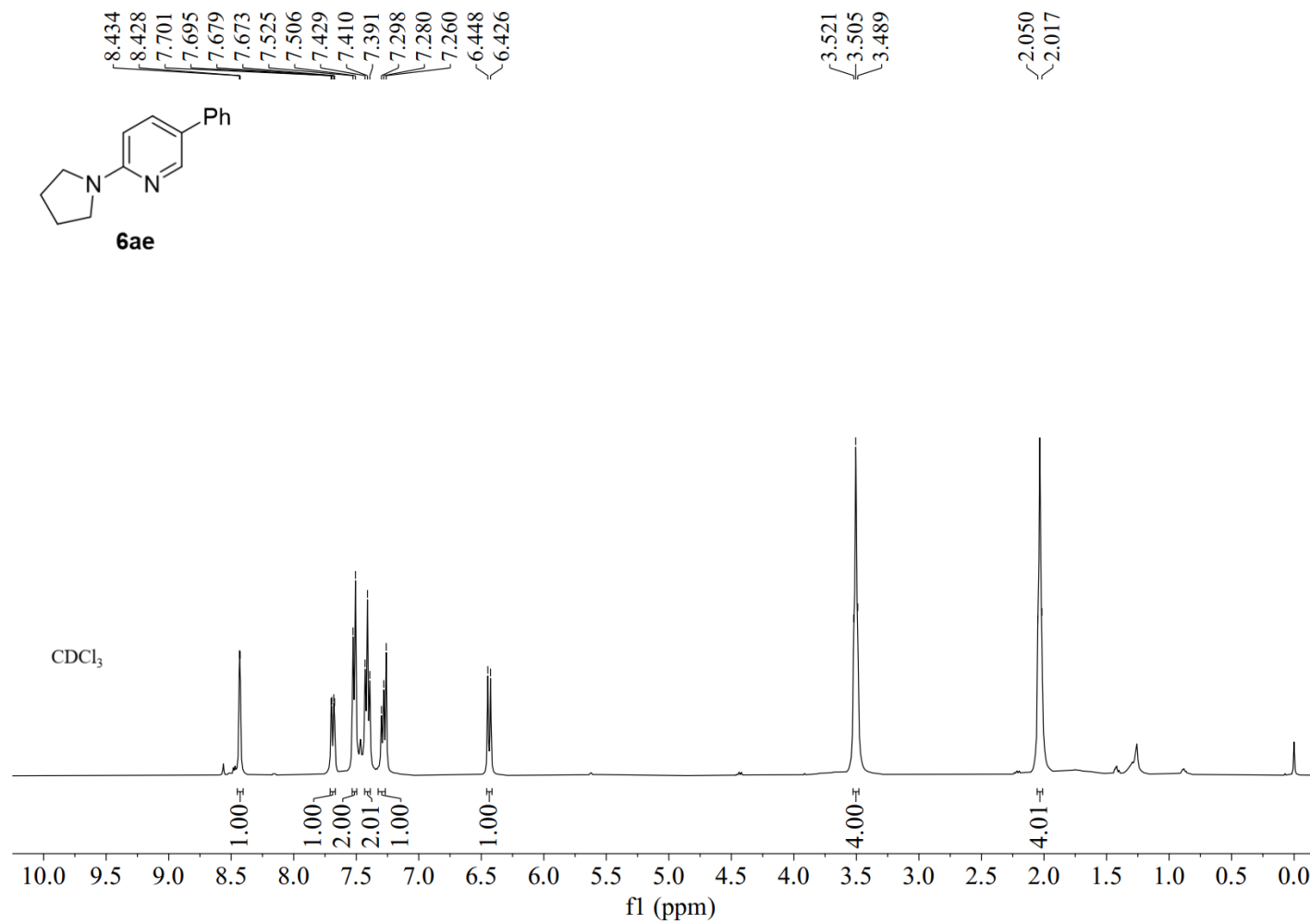
¹³C NMR (100 MHz, CDCl₃):



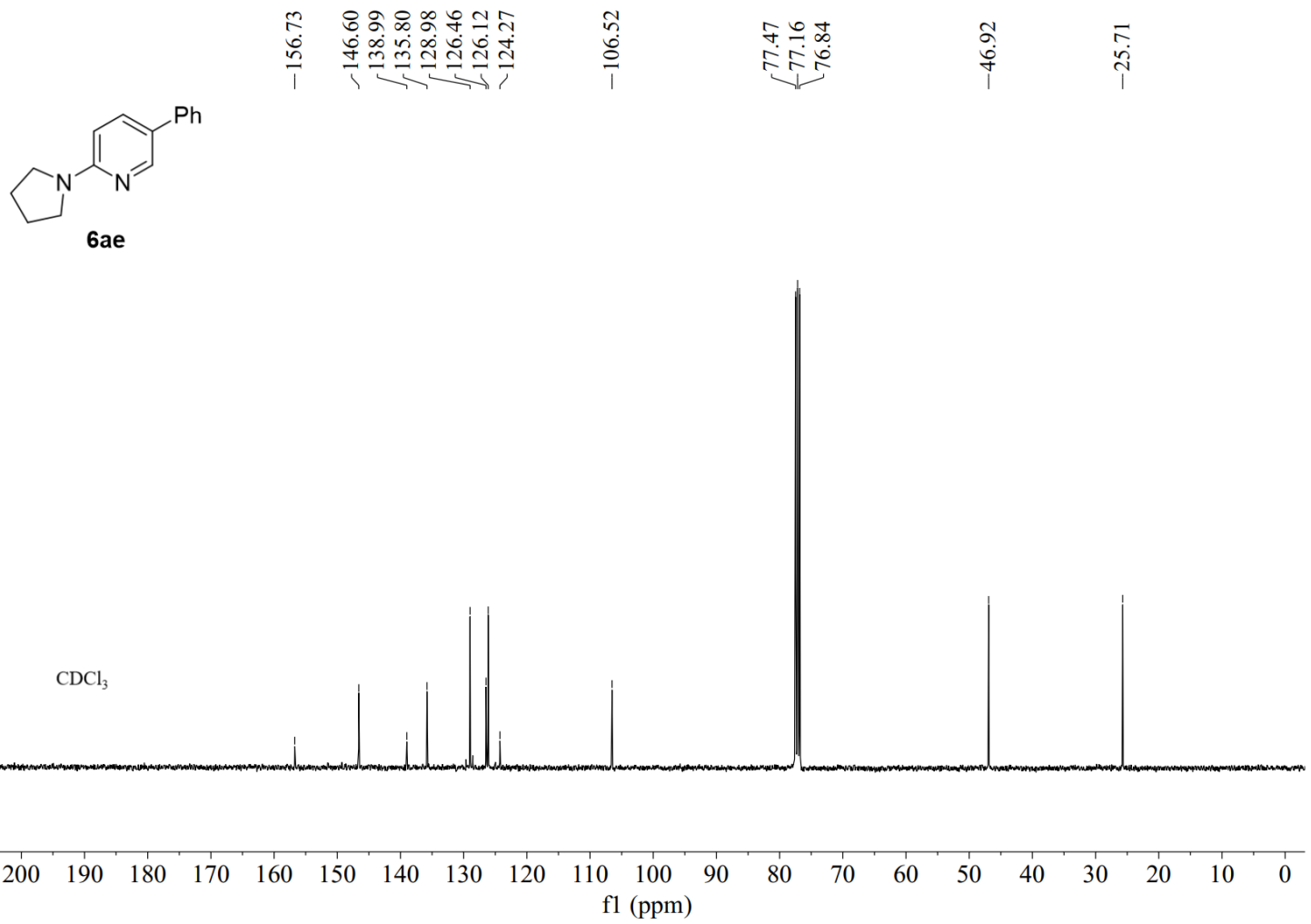
¹H NMR (600 MHz, CDCl₃):



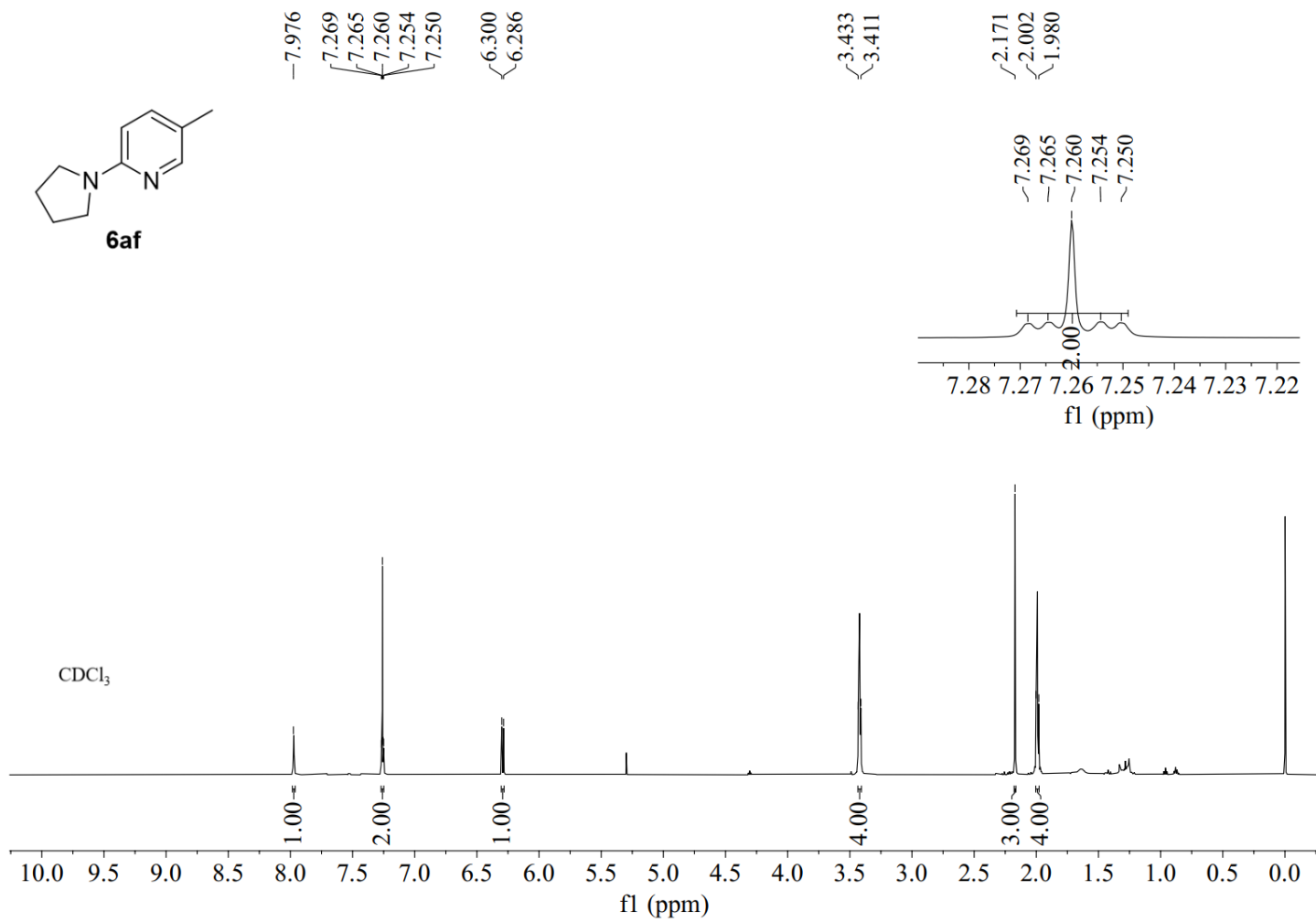
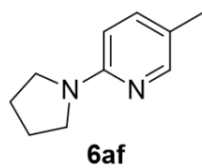
¹H NMR (600 MHz, CDCl₃):



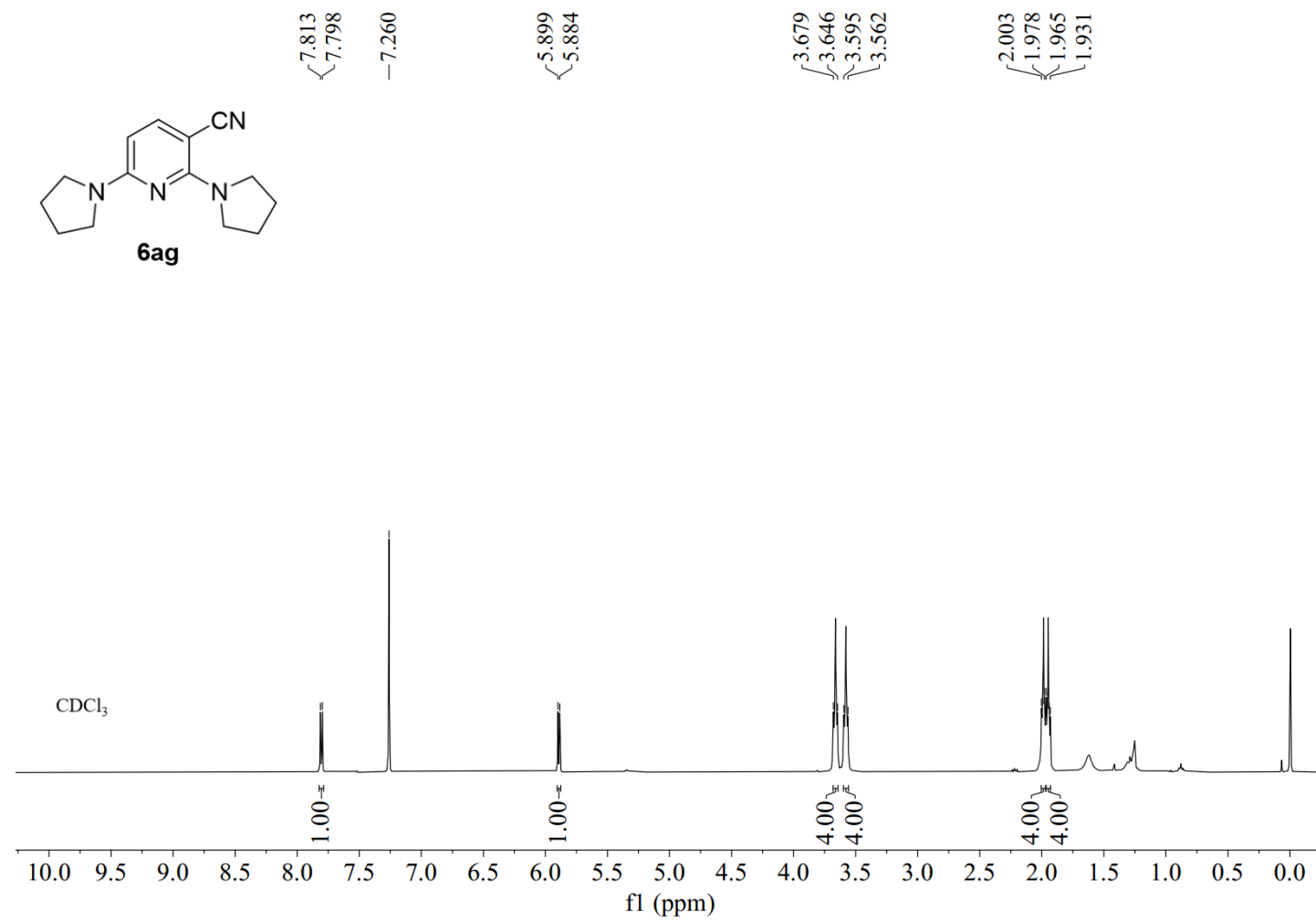
¹³C NMR (100 MHz, CDCl₃):



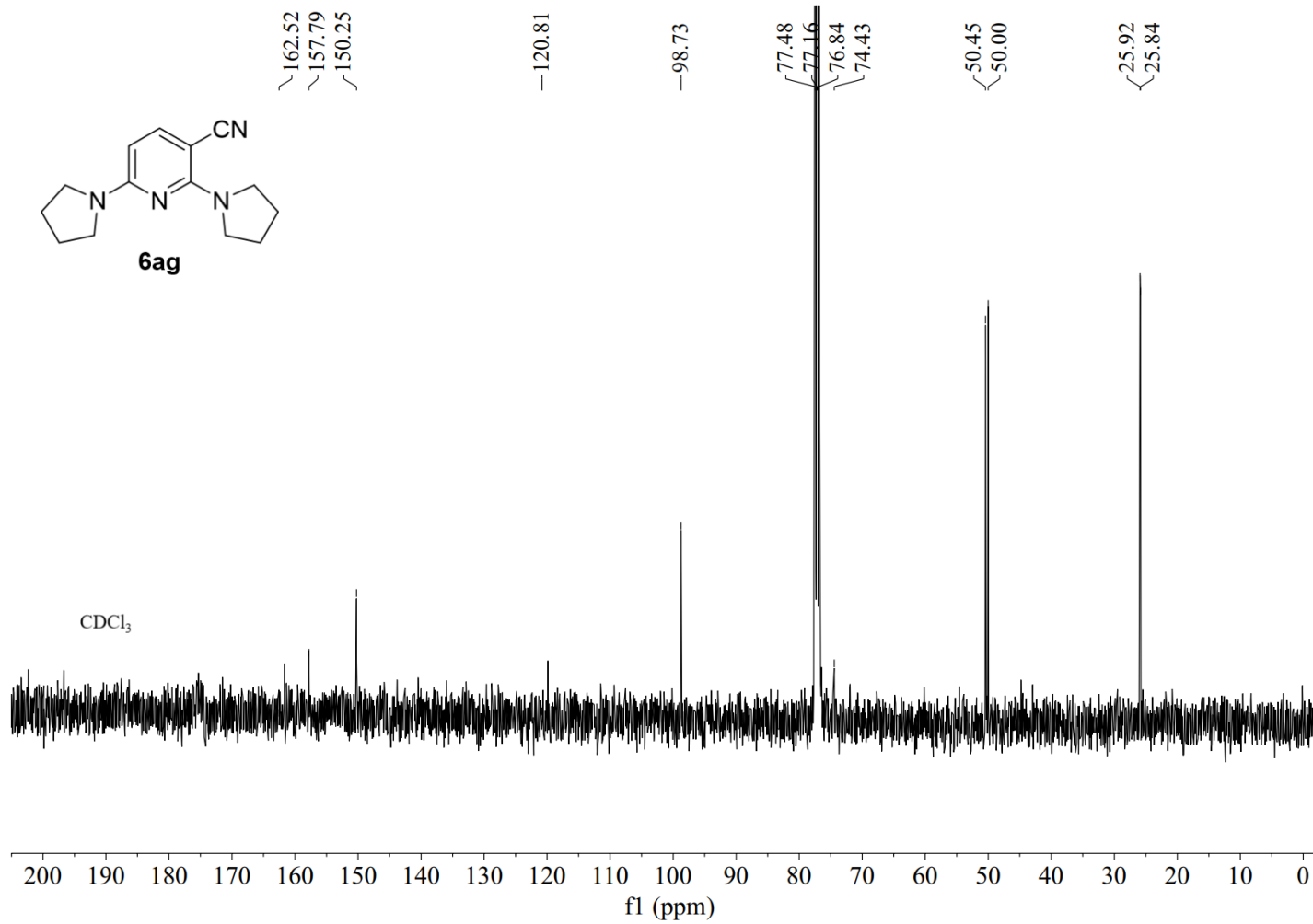
¹H NMR (600 MHz, CDCl₃):



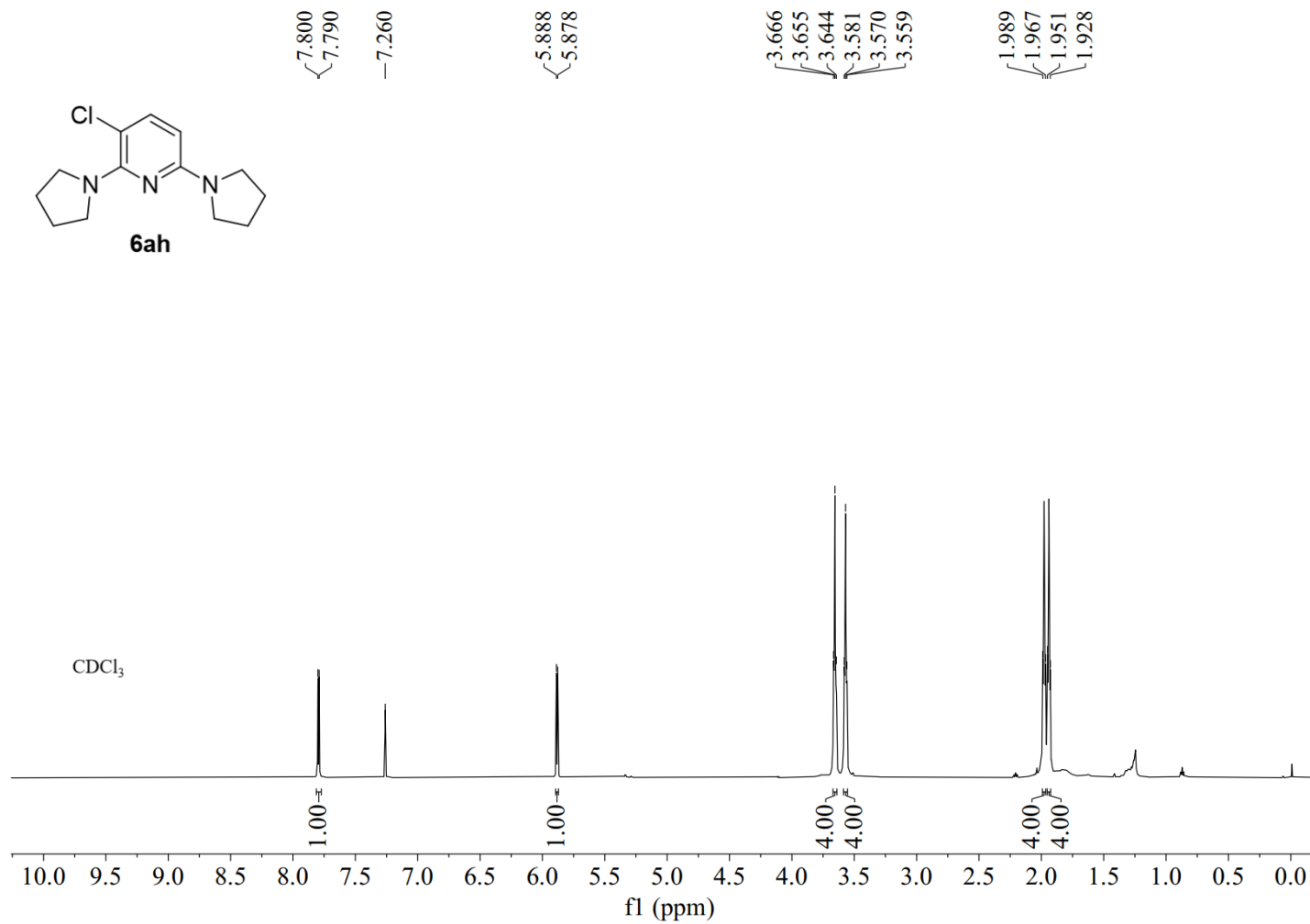
¹H NMR (400 MHz, CDCl₃):



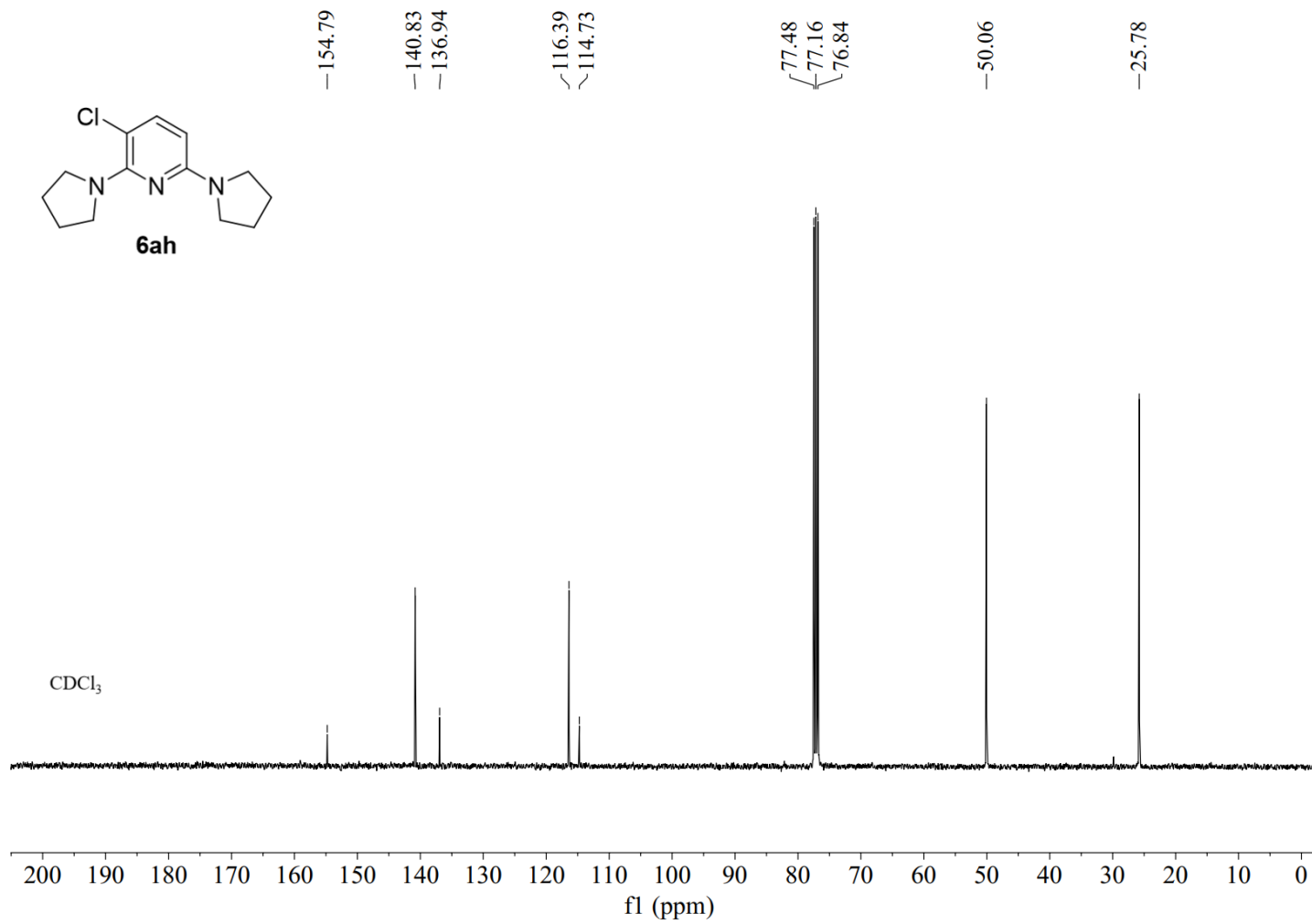
^{13}C NMR (100 MHz, CDCl_3):



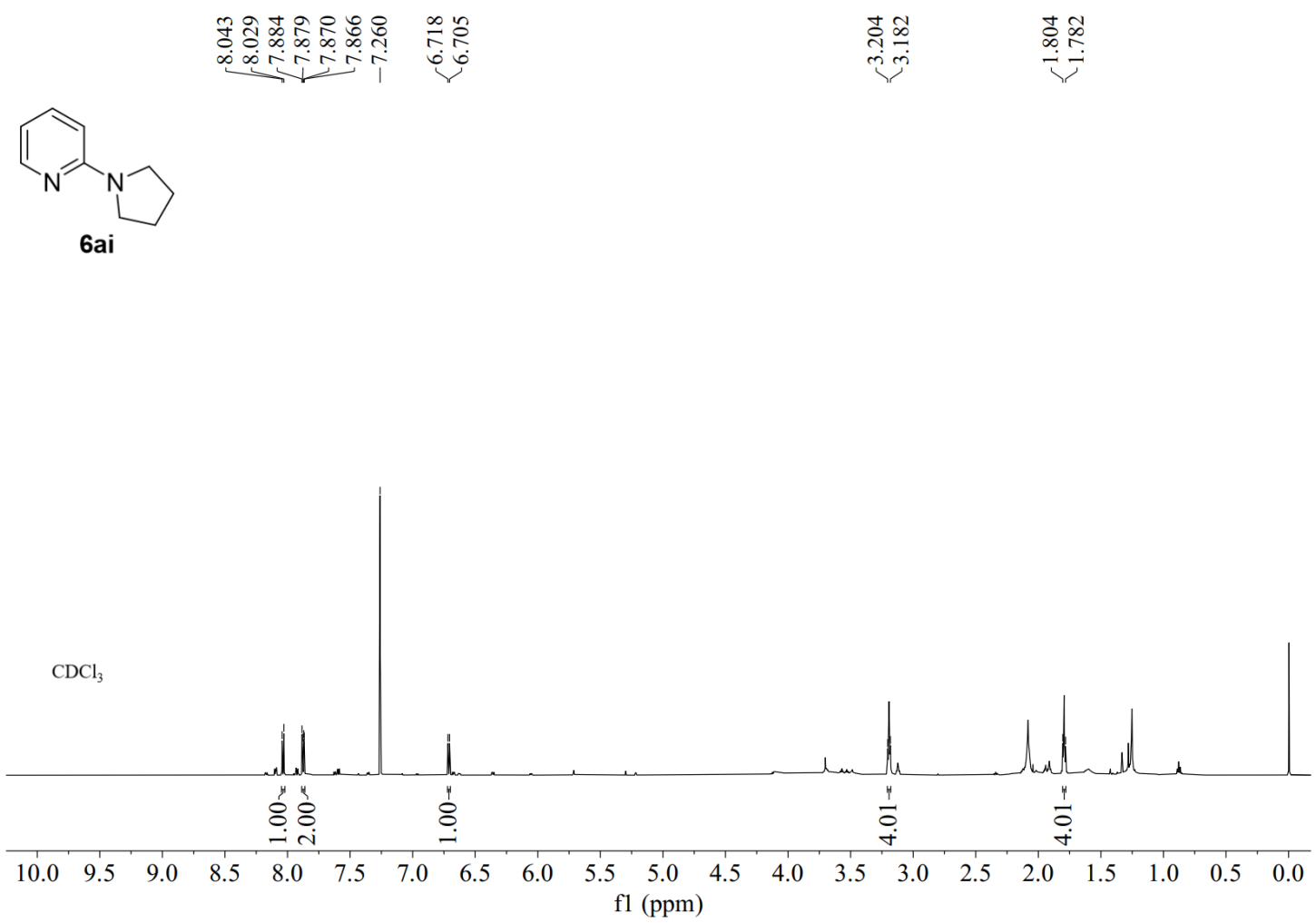
¹H NMR (600 MHz, CDCl₃):



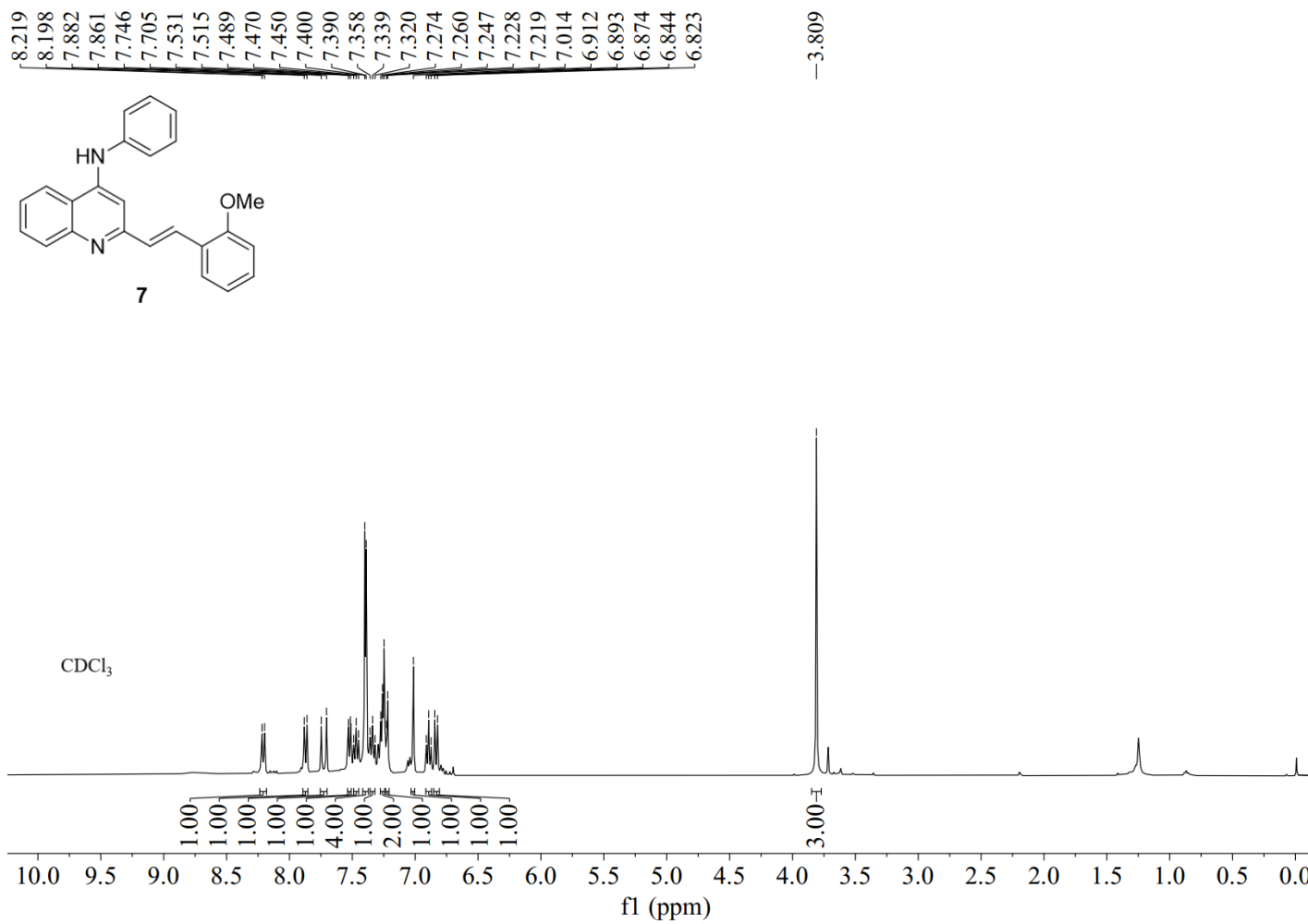
¹³C NMR (100 MHz, CDCl₃):



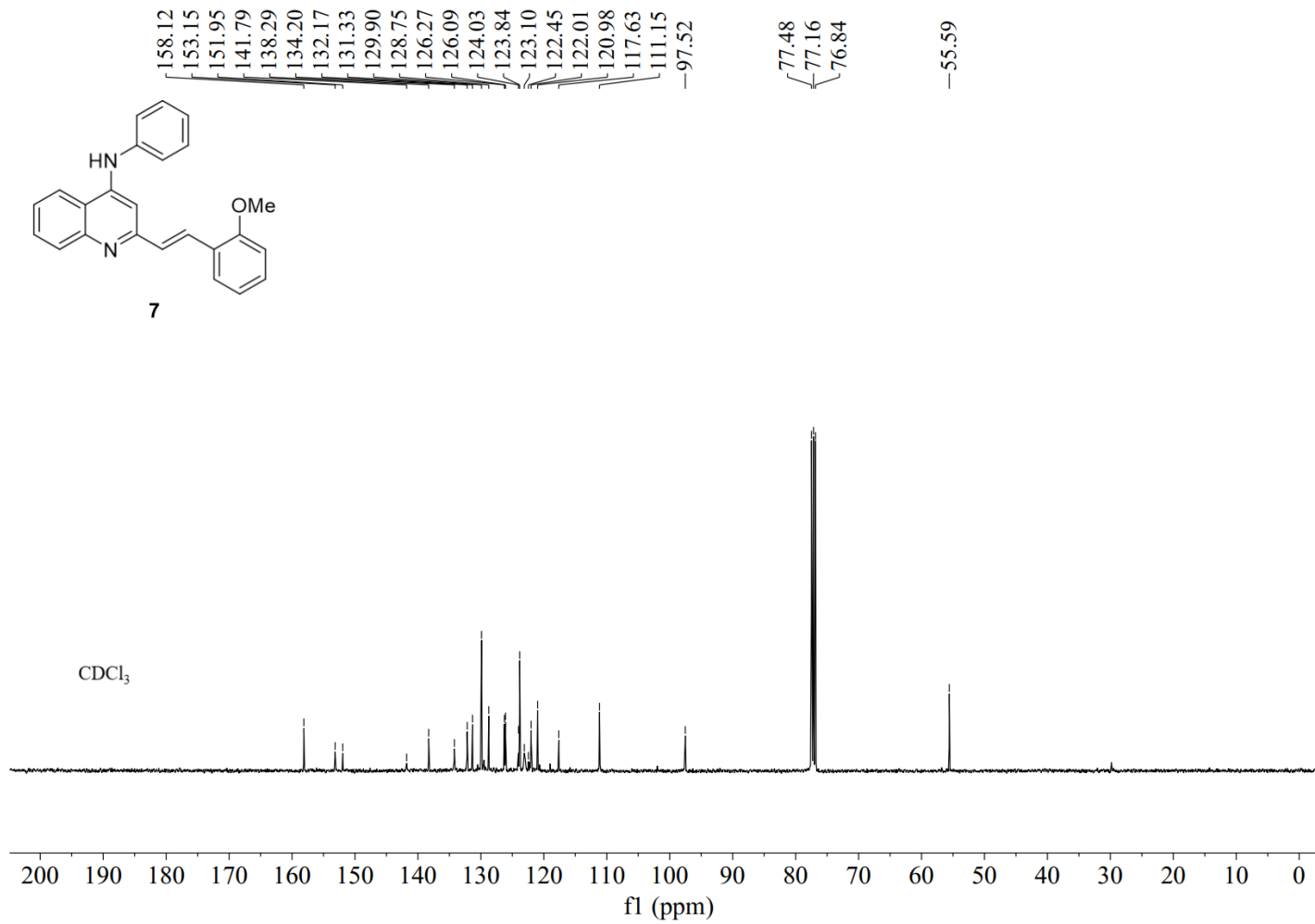
¹H NMR (400 MHz, CDCl₃):



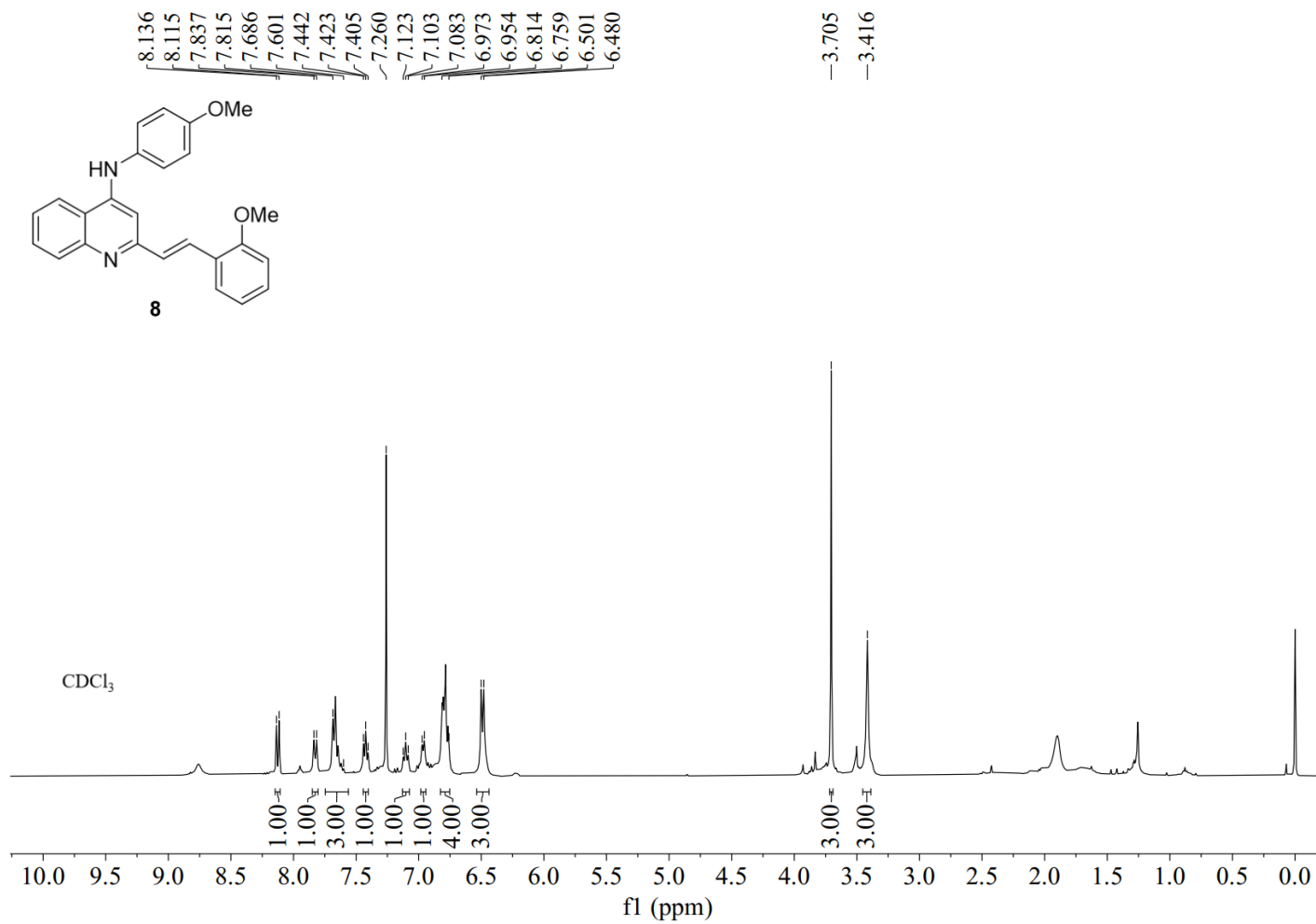
¹H NMR (400 MHz, CDCl₃):



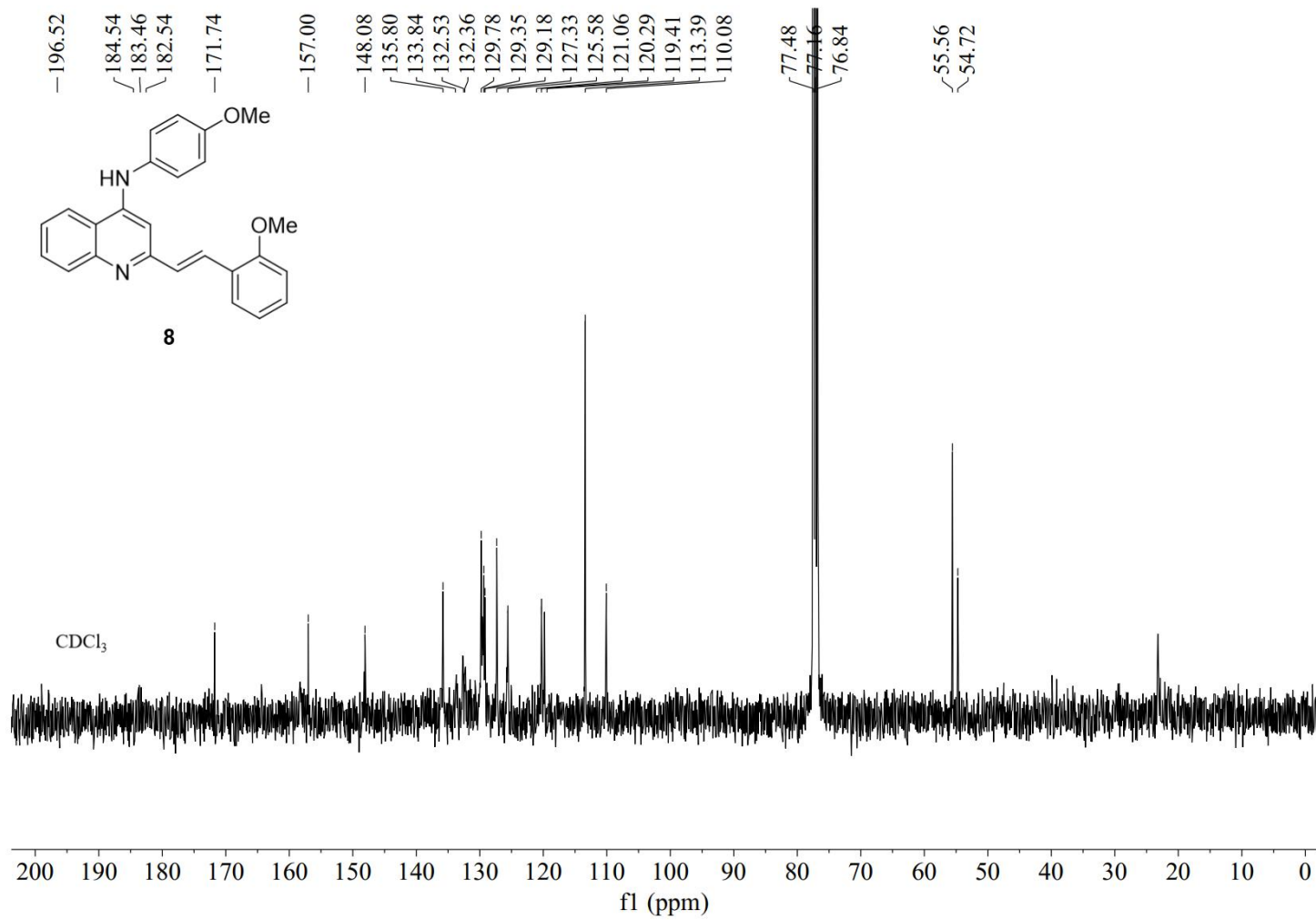
¹³C NMR (100 MHz, CDCl₃):



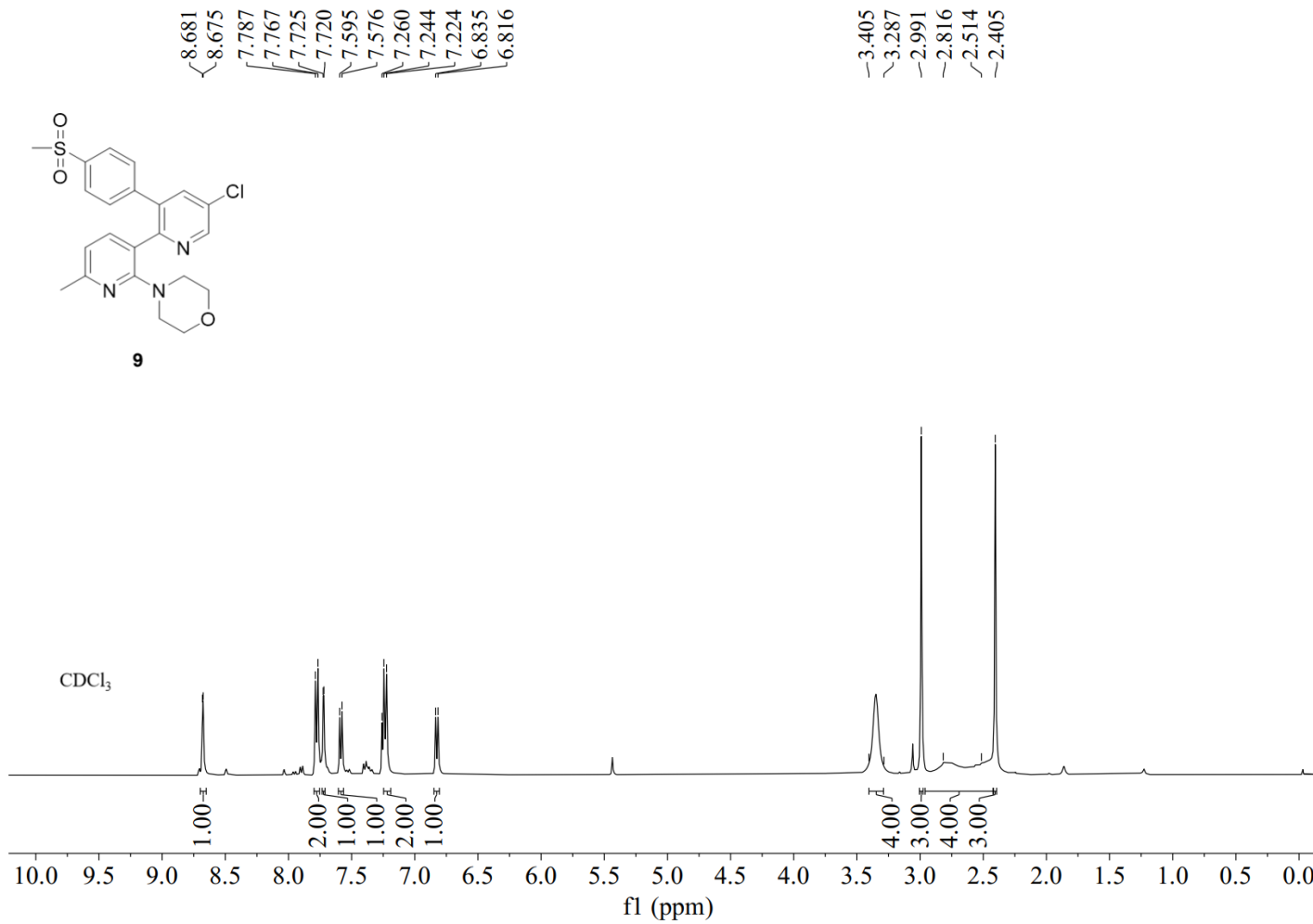
¹H NMR (400 MHz, CDCl₃):



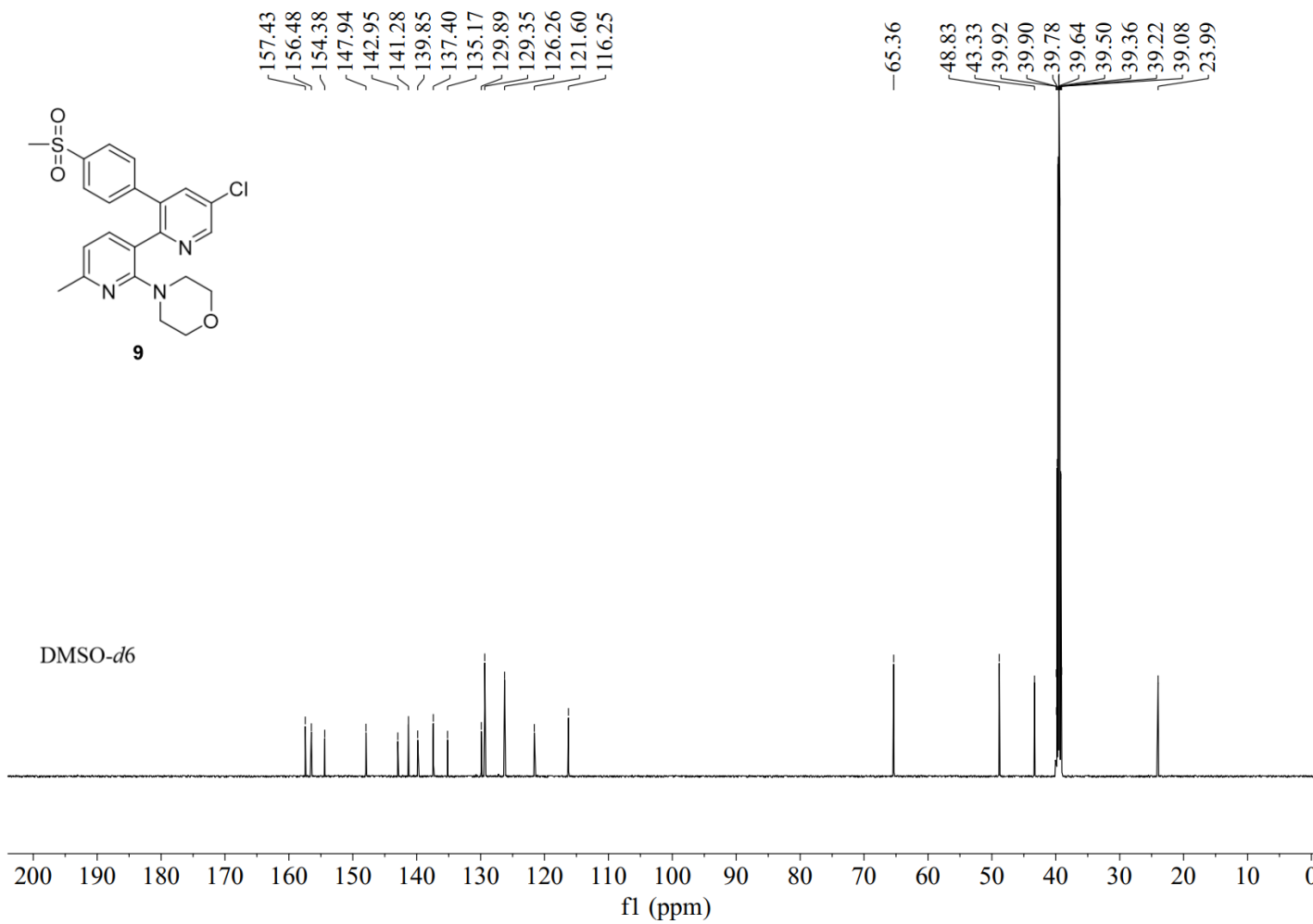
¹³C NMR (100 MHz, CDCl₃):



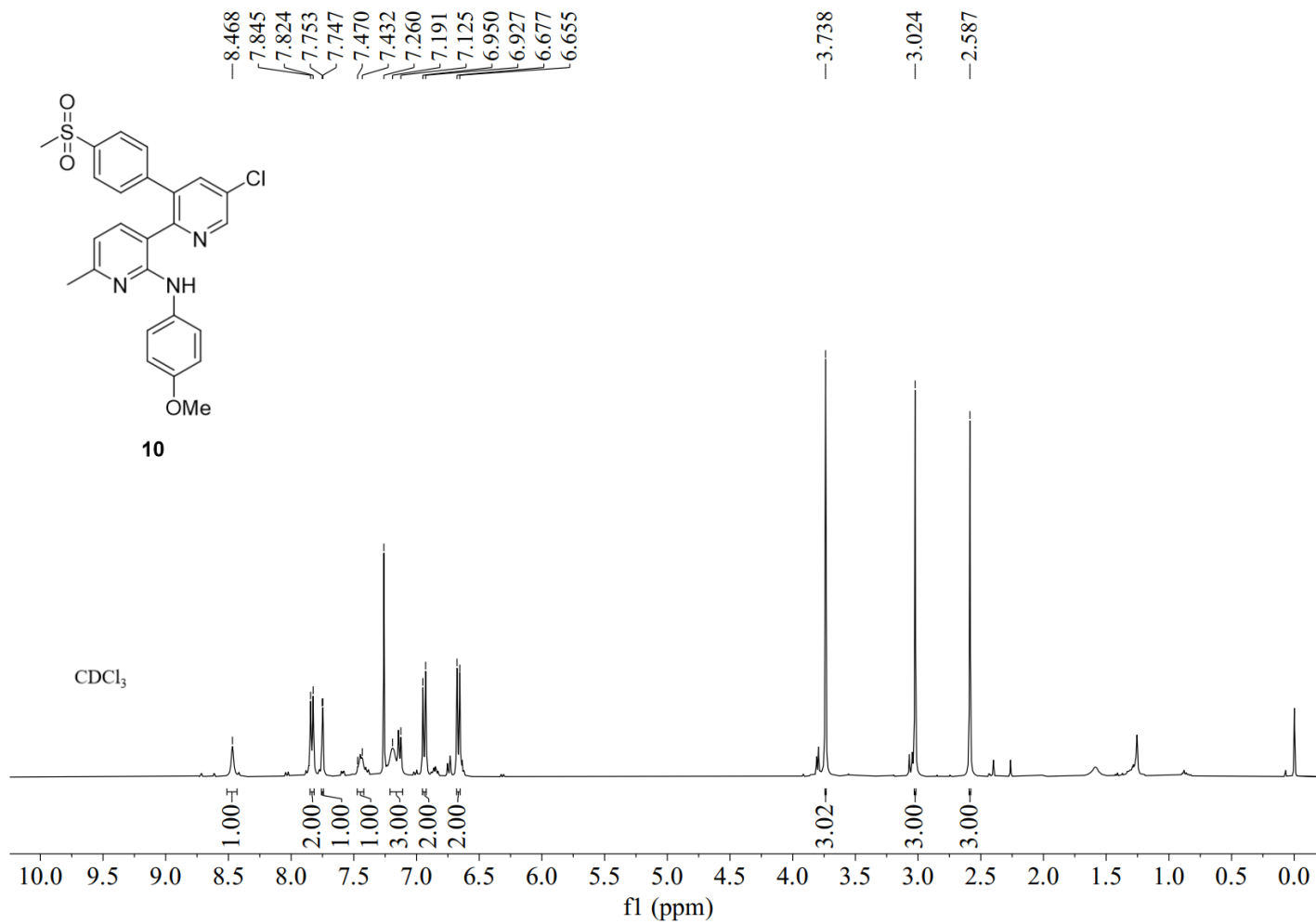
¹H NMR (400 MHz, CDCl₃):



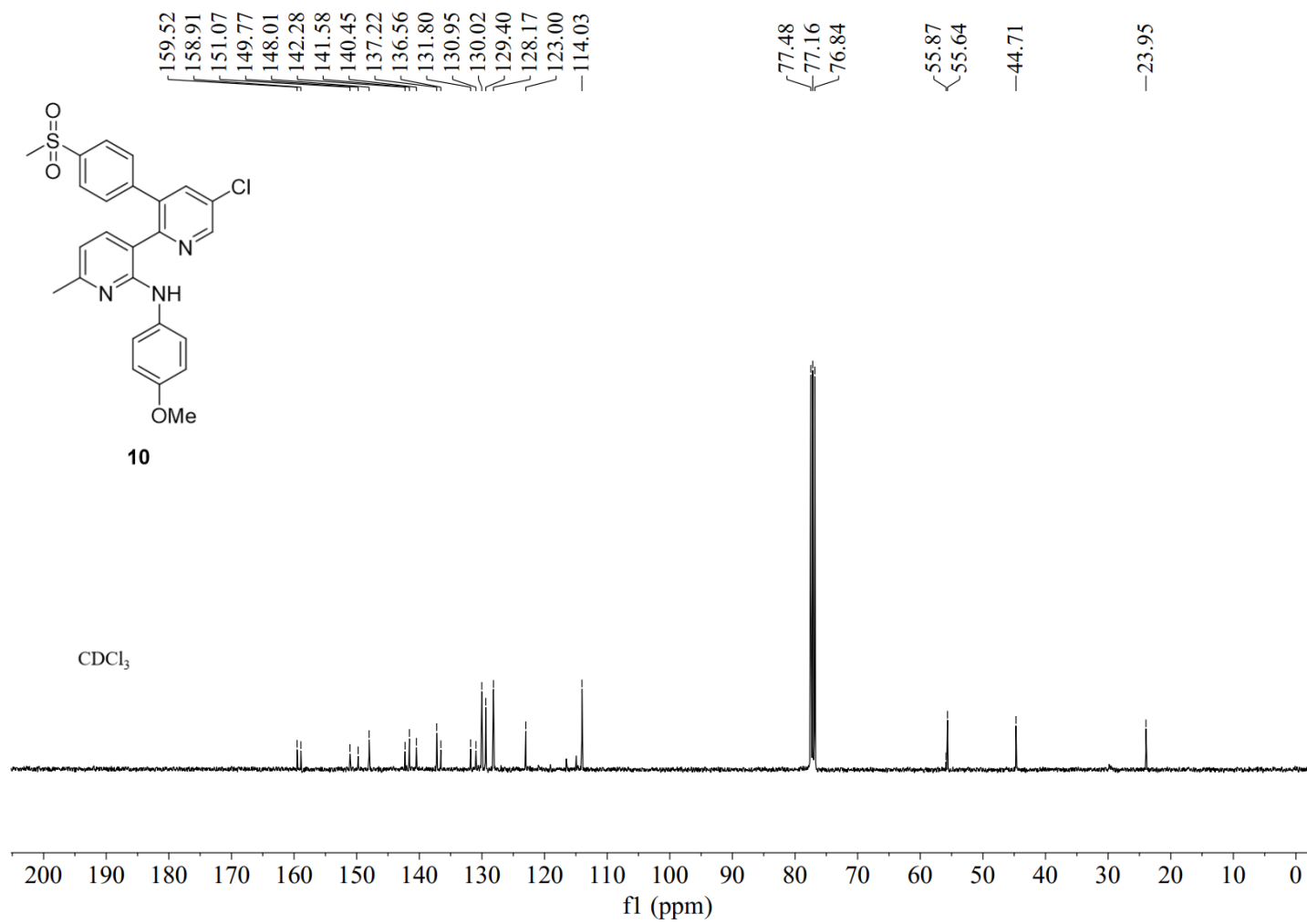
¹³C NMR (100 MHz, DMSO-d6):



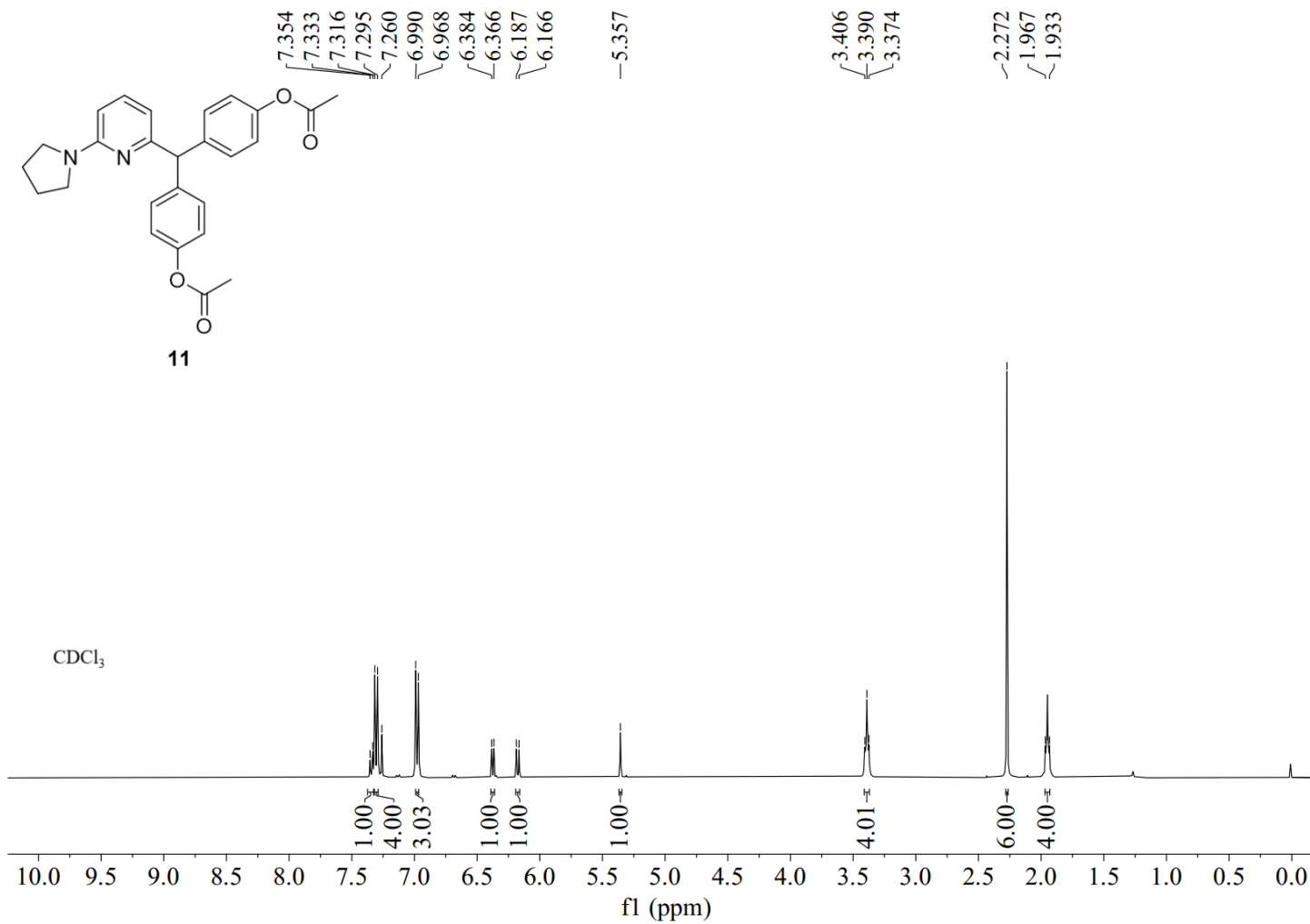
¹H NMR (400 MHz, CDCl₃):



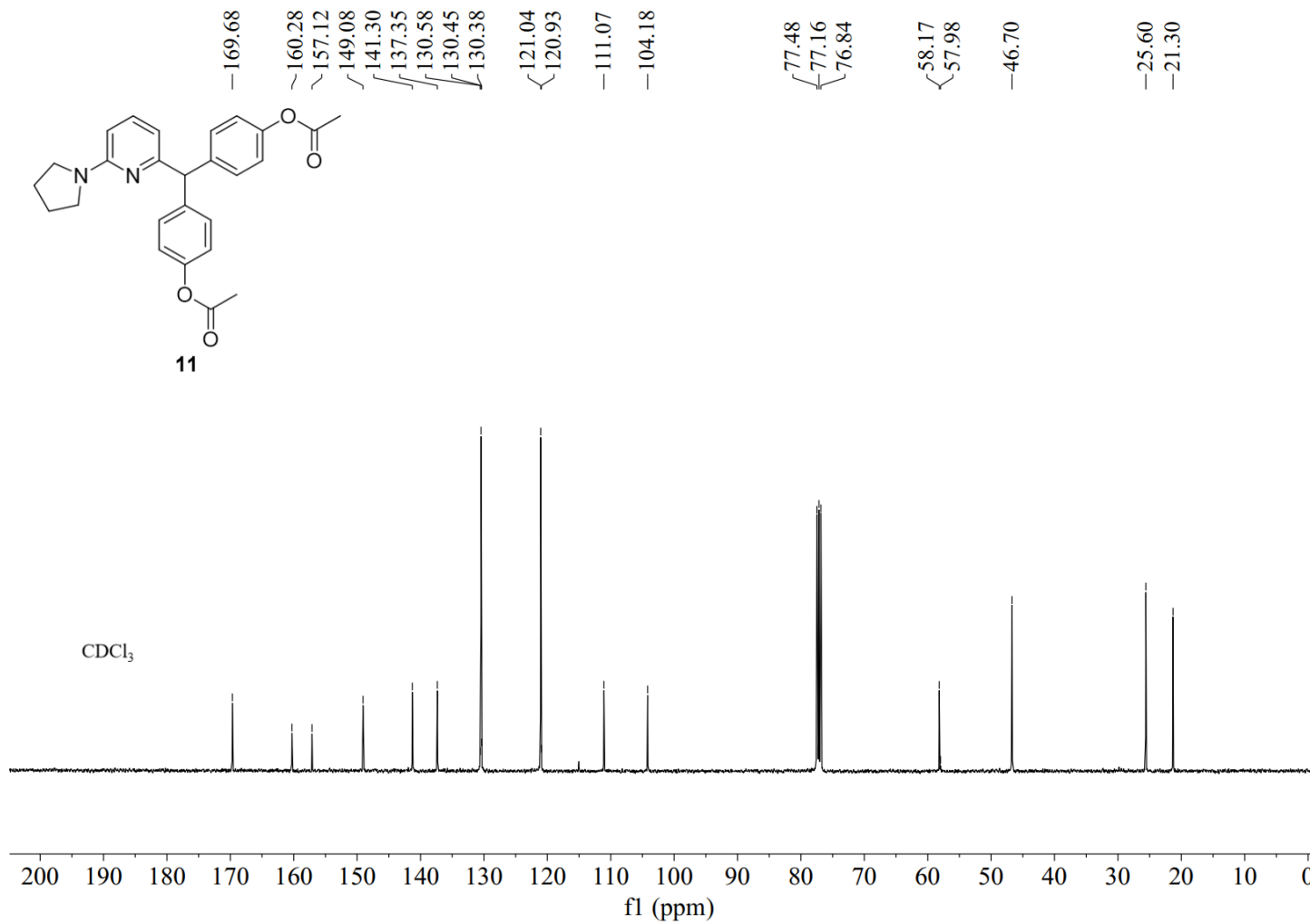
¹³C NMR (400 MHz, CDCl₃):



¹H NMR (400 MHz, CDCl₃):



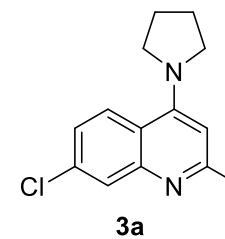
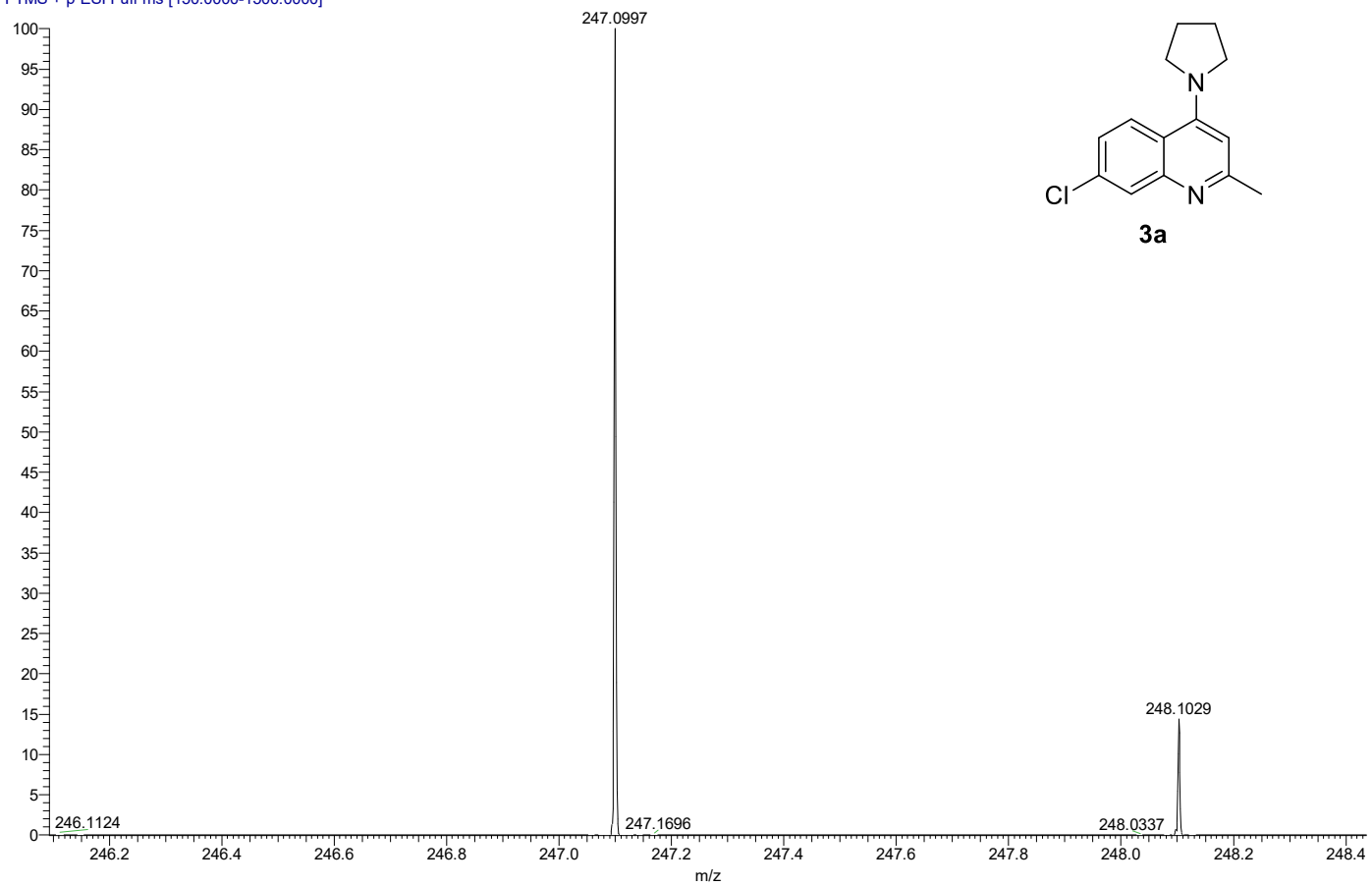
¹³C NMR (400 MHz, CDCl₃):



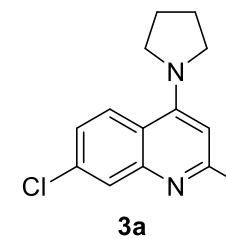
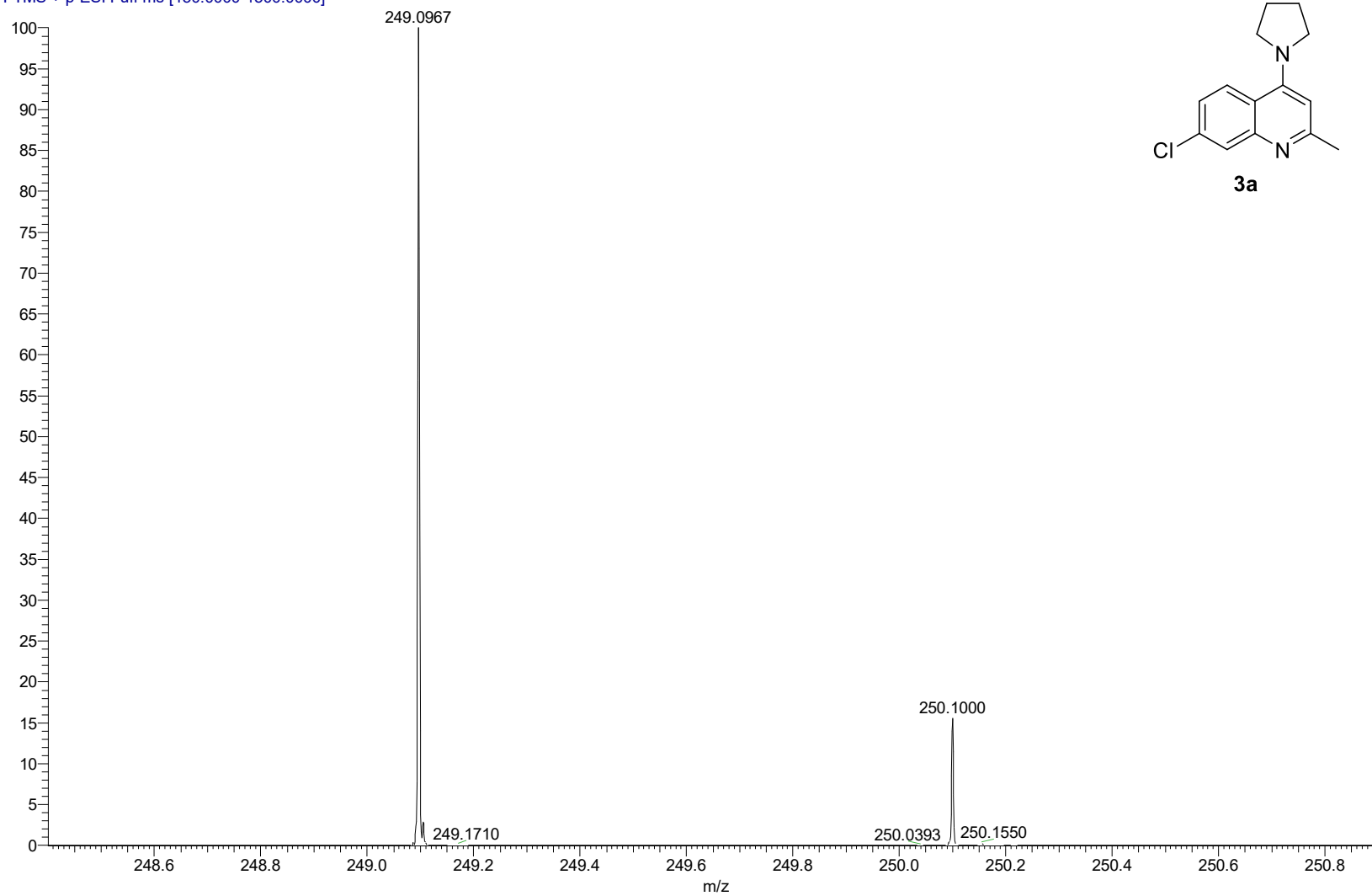
12. HRMS Spectra

Spectra data are shown from the next page.

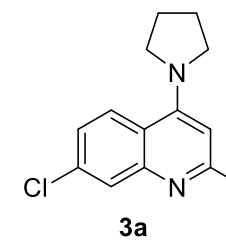
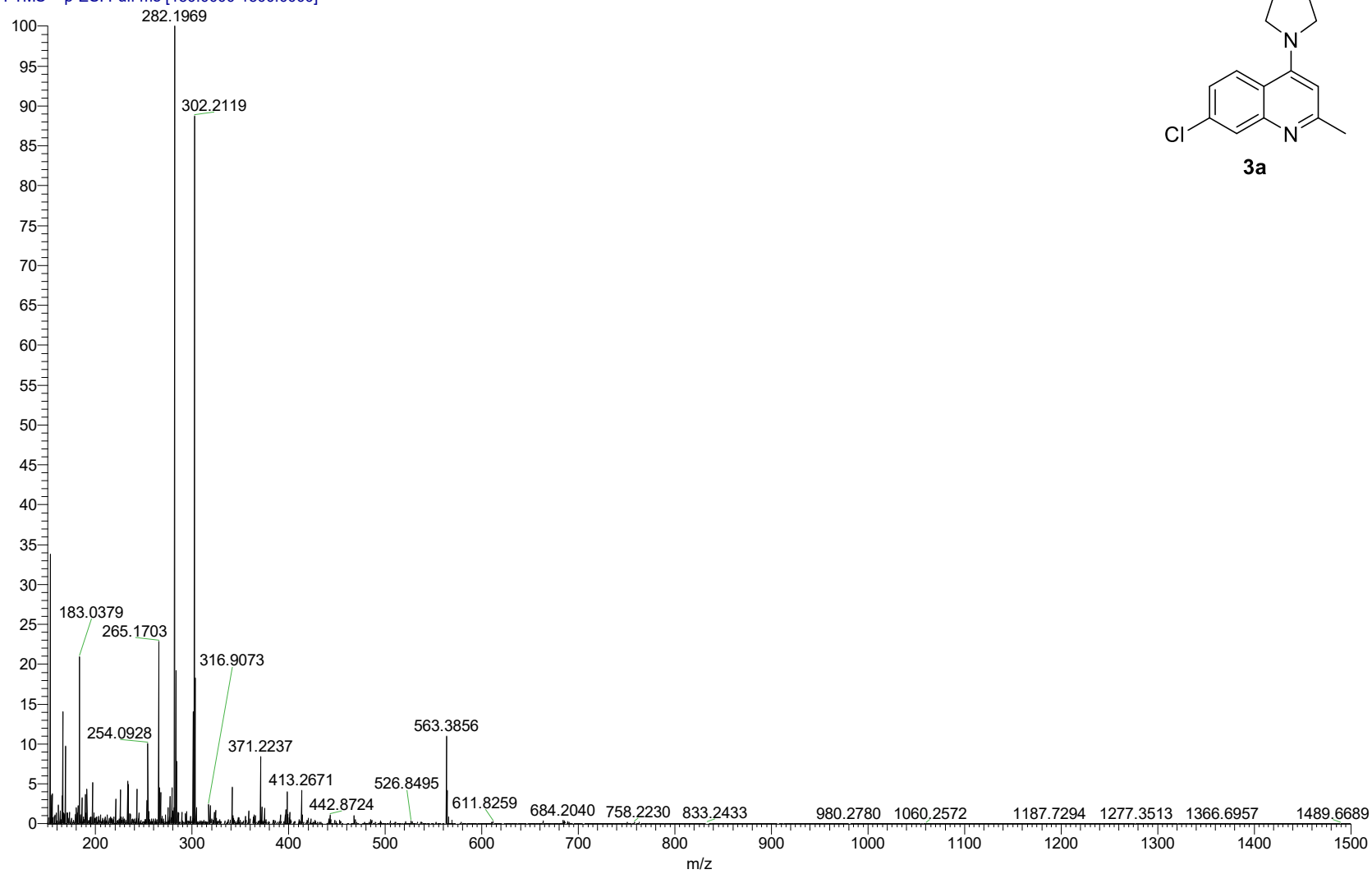
wangdong-15 #59 RT: 0.26 AV: 1 NL: 3.30E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



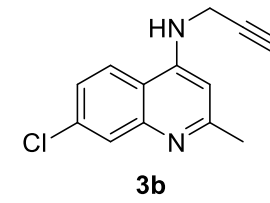
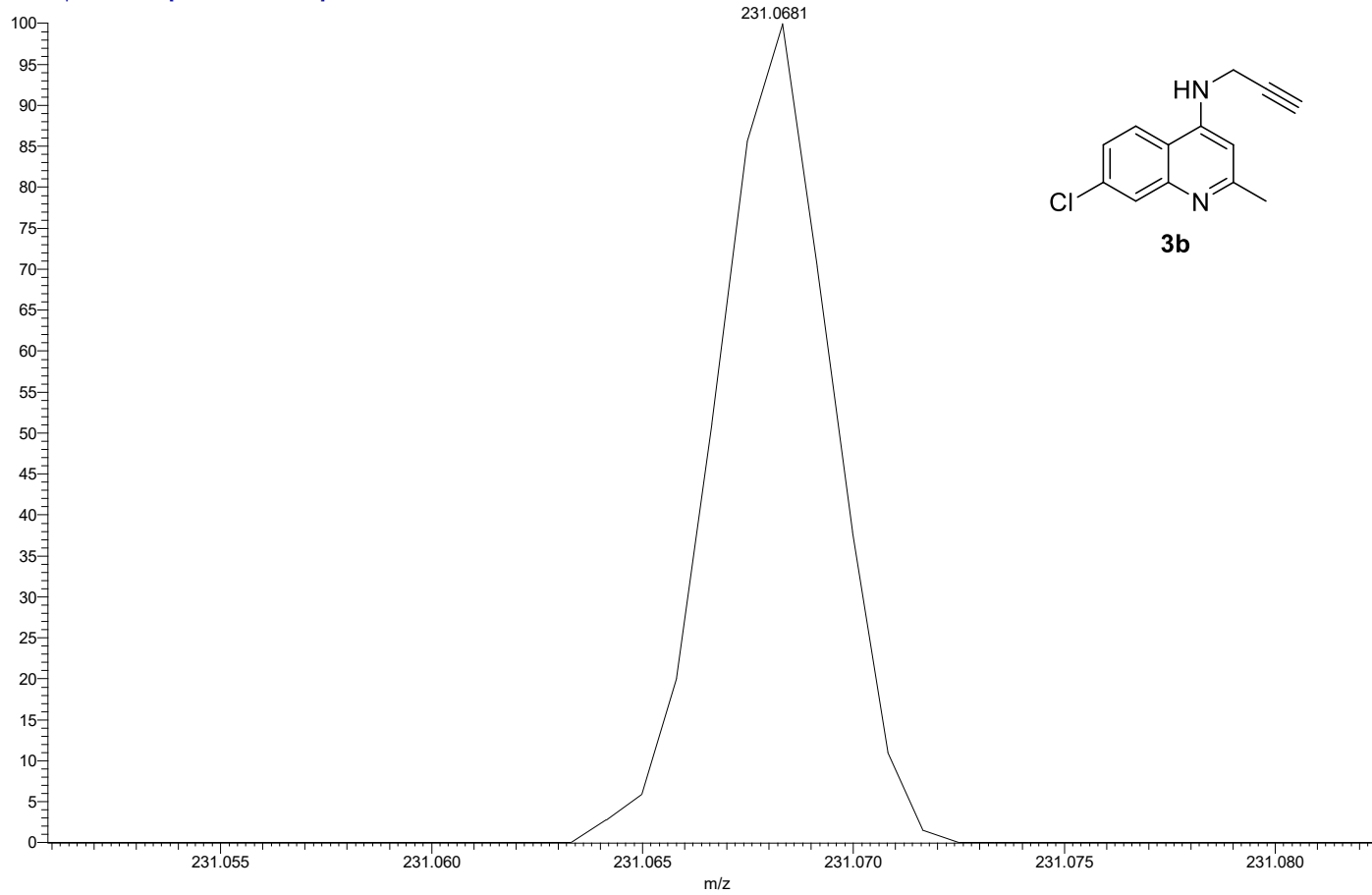
wangdong-15 #170-171 RT: 0.76-0.76 AV: 2 NL: 1.65E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



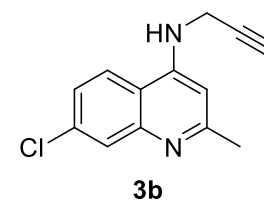
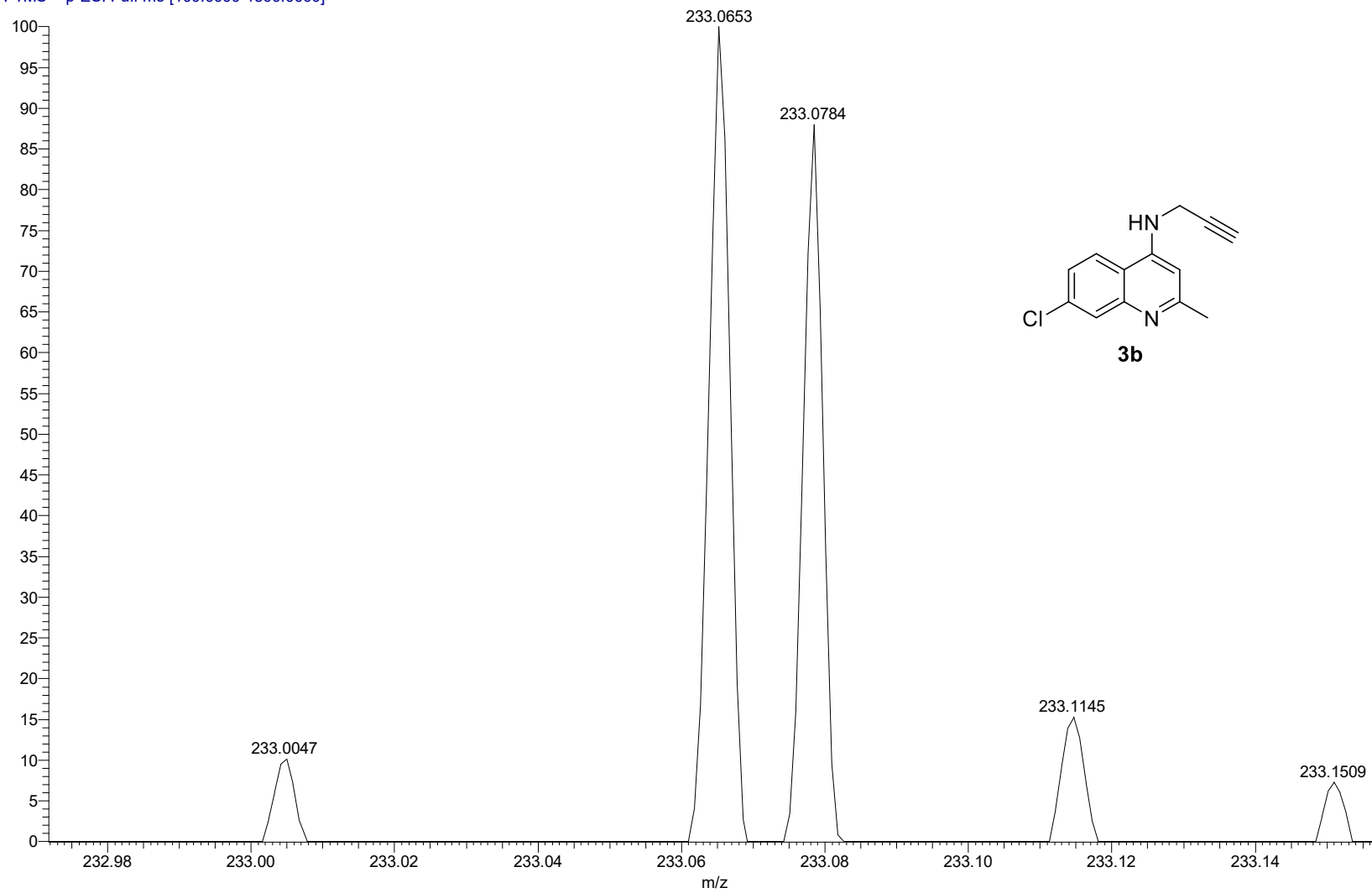
wangdong-15 #1 RT: 0.01 AV: 1 NL: 2.13E7
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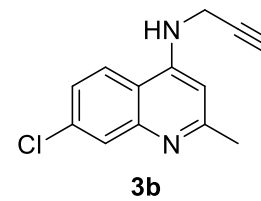
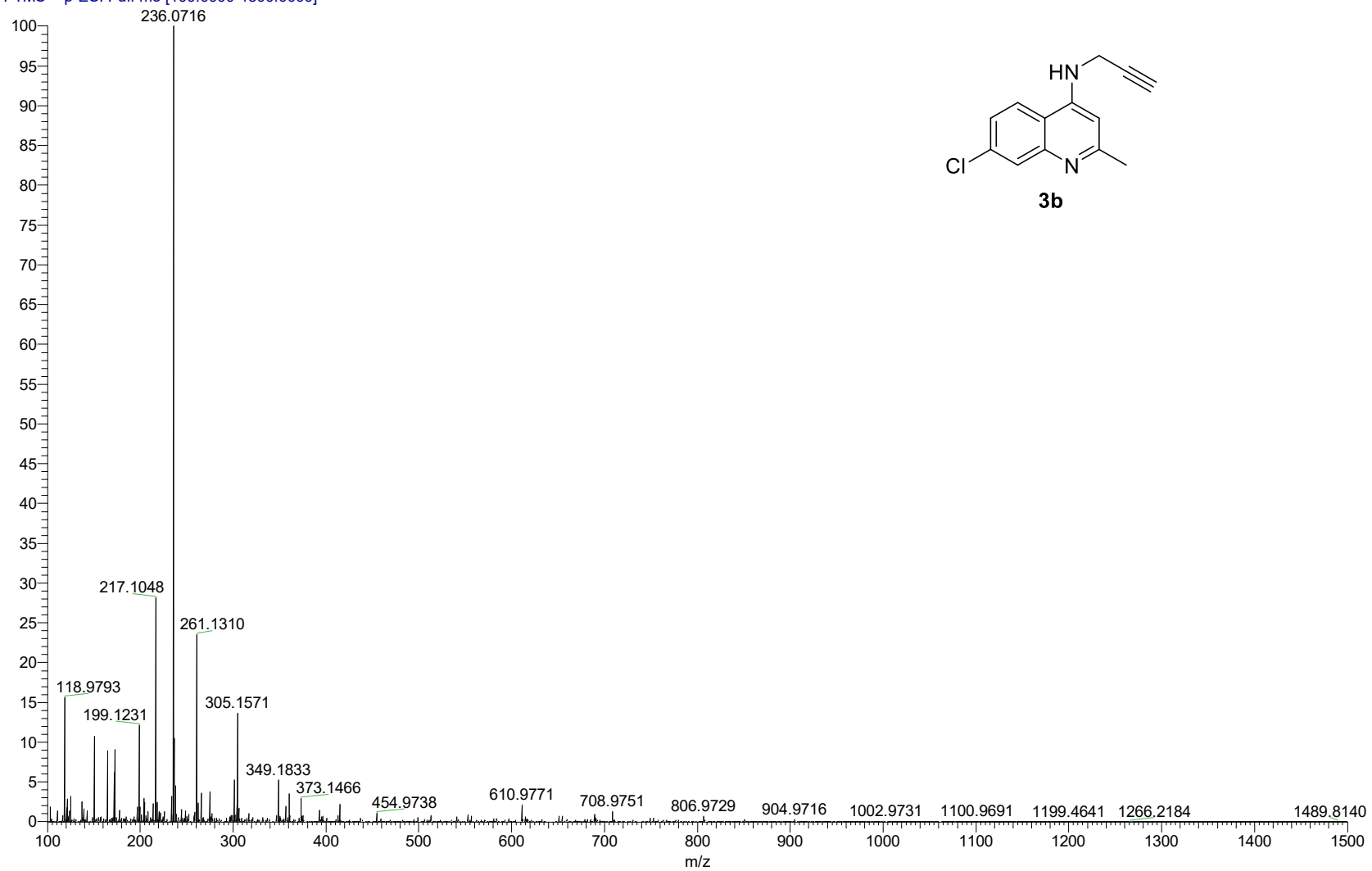
030-52 #56 RT: 0.31 AV: 1 NL: 5.13E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



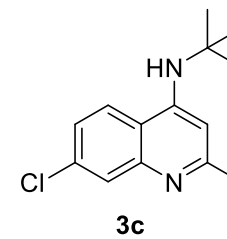
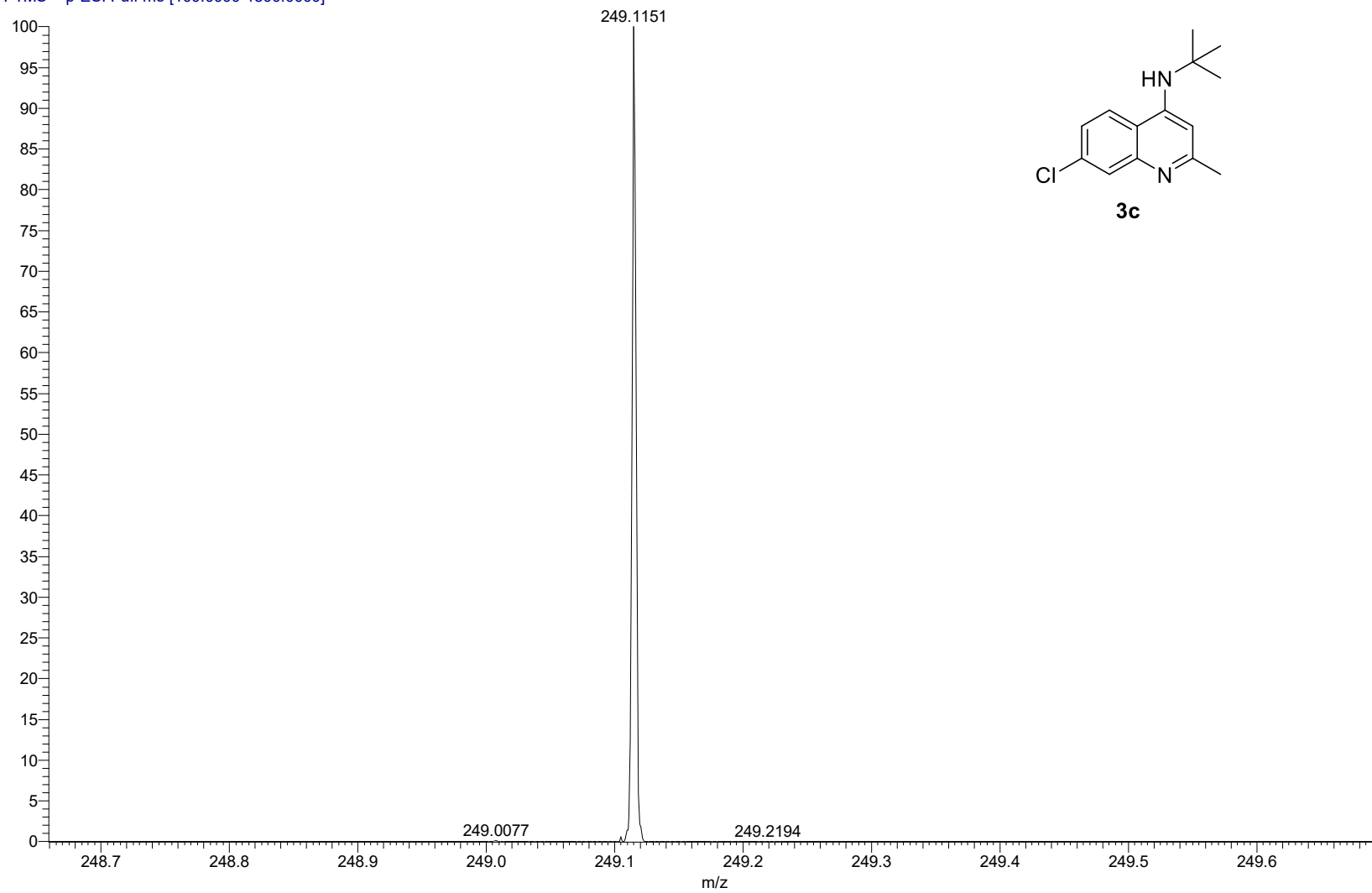
030-52 #64 RT: 0.35 AV: 1 NL: 4.82E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



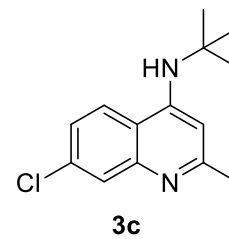
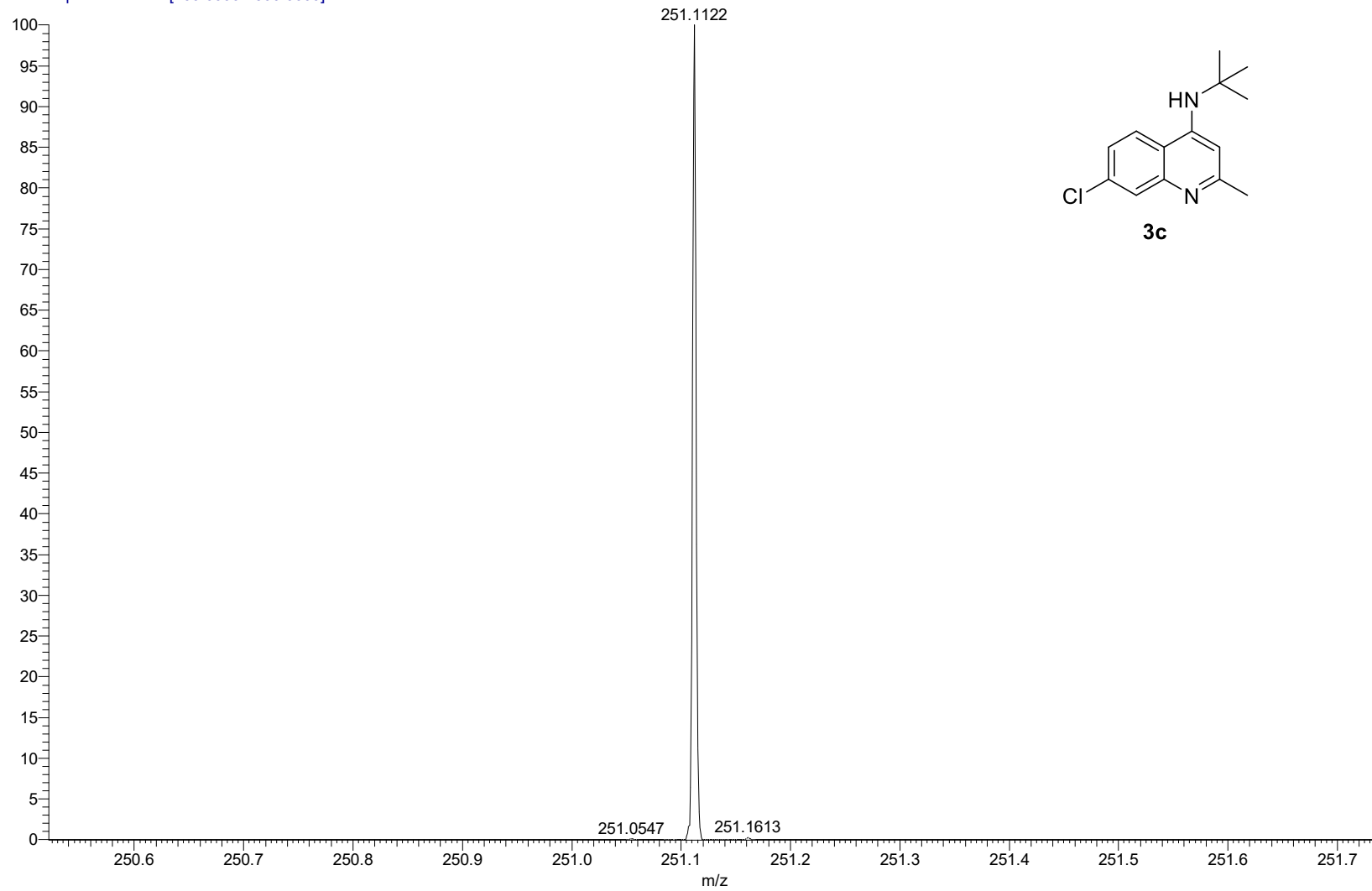
030-52 #1 RT: 0.00 AV: 1 NL: 4.91E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



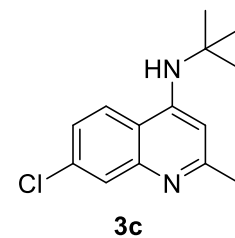
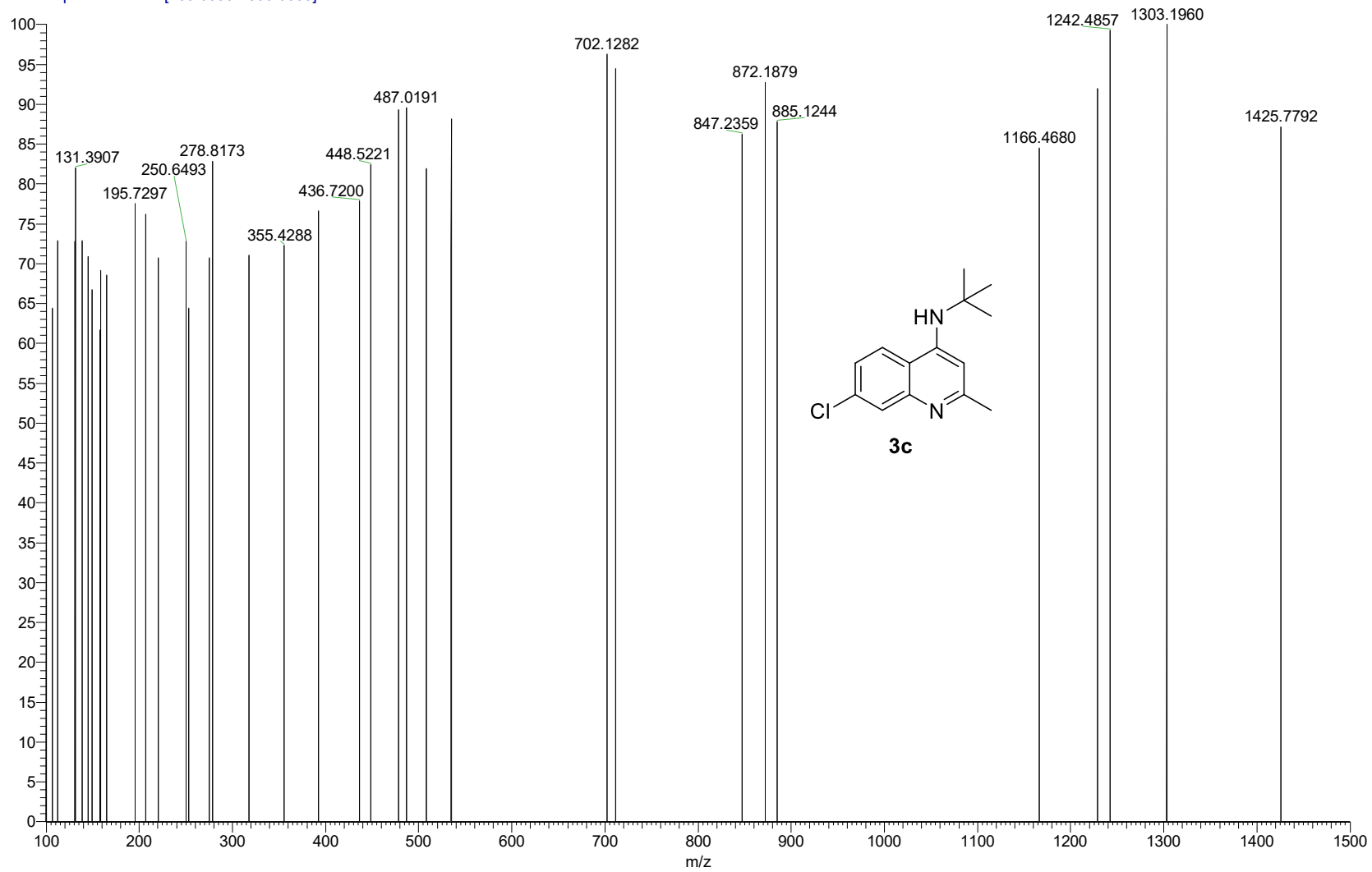
030-54 #64 RT: 0.36 AV: 1 NL: 5.14E9
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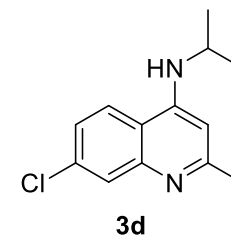
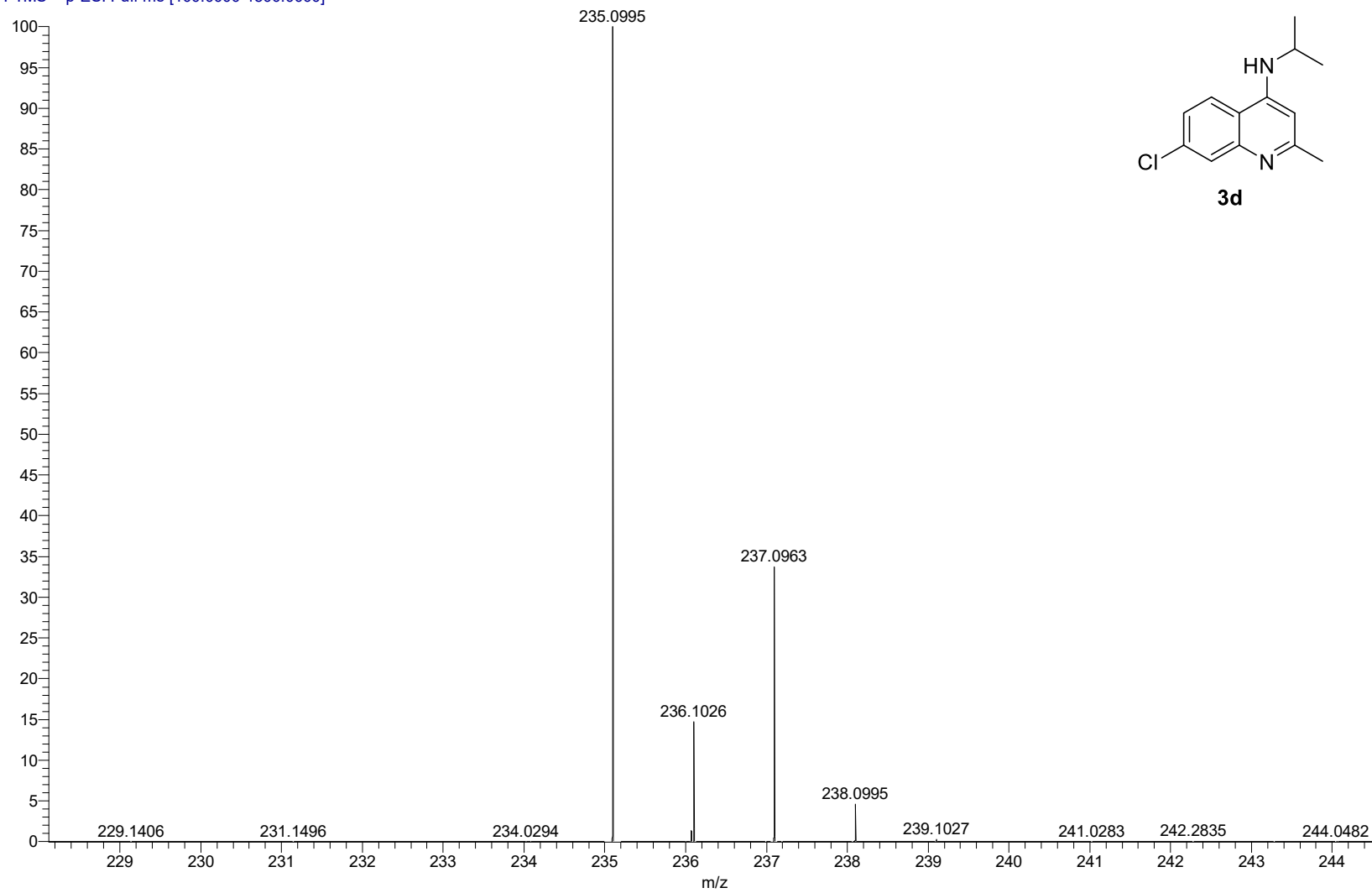
030-54 #56 RT: 0.32 AV: 1 NL: 3.12E7
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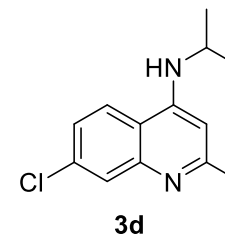
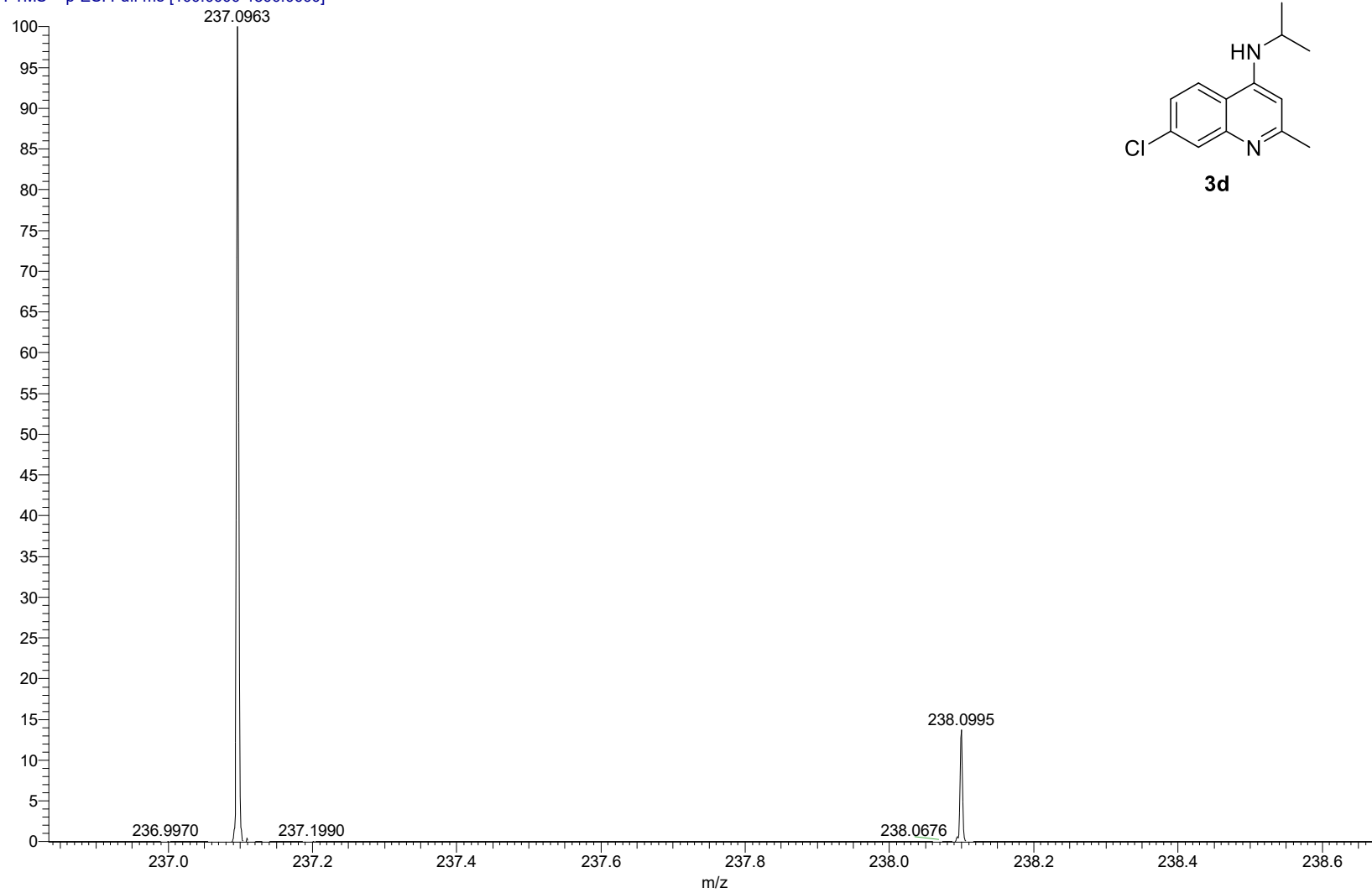
030-54 #1 RT: 0.00 AV: 1 NL: 3.59E2
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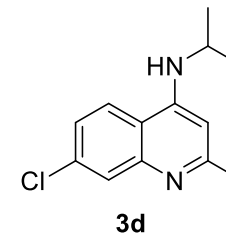
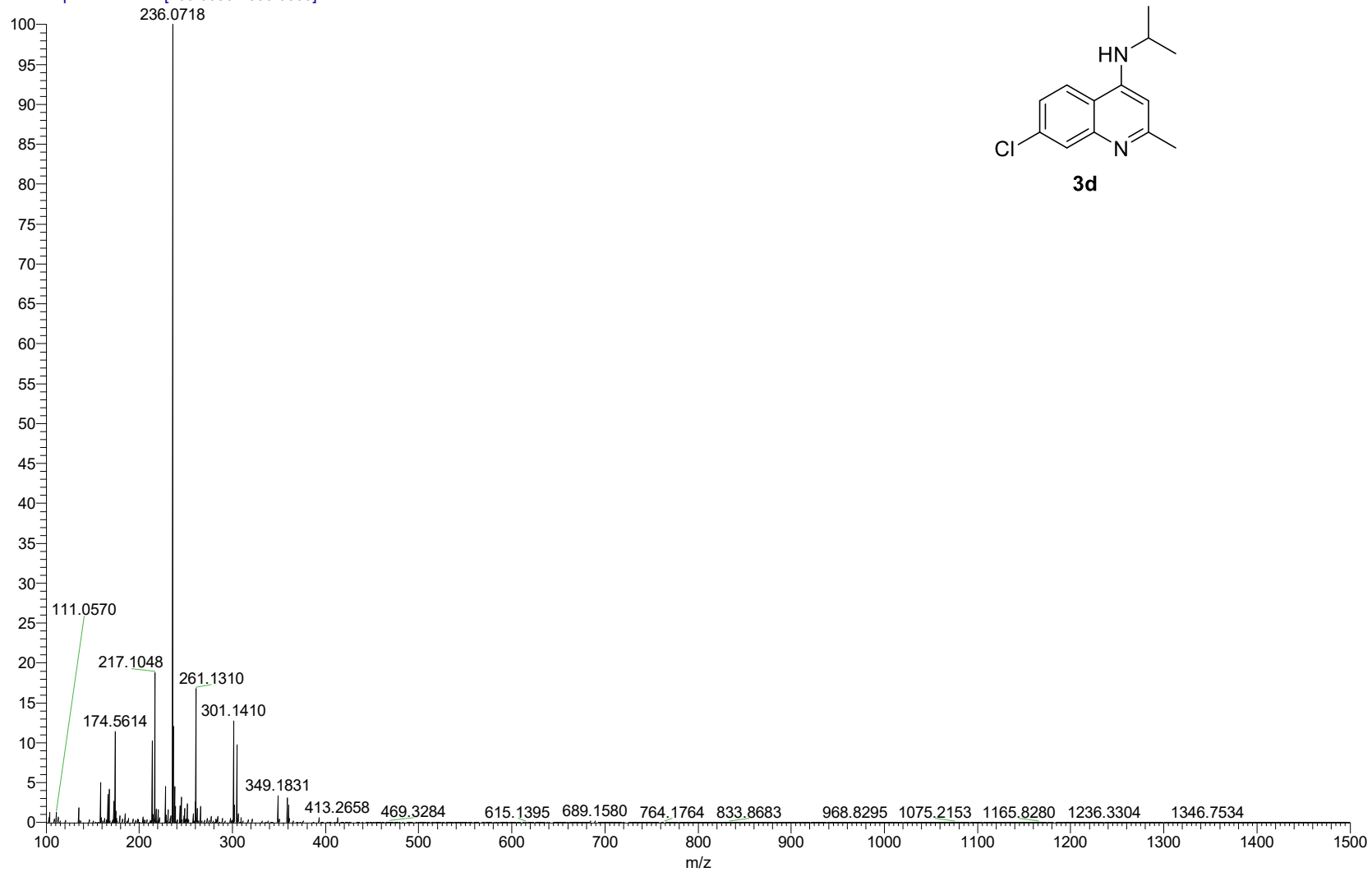
030--37 #45 RT: 0.24 AV: 1 NL: 2.37E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



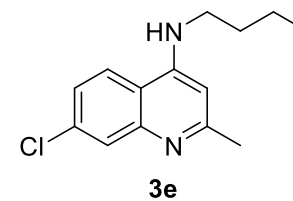
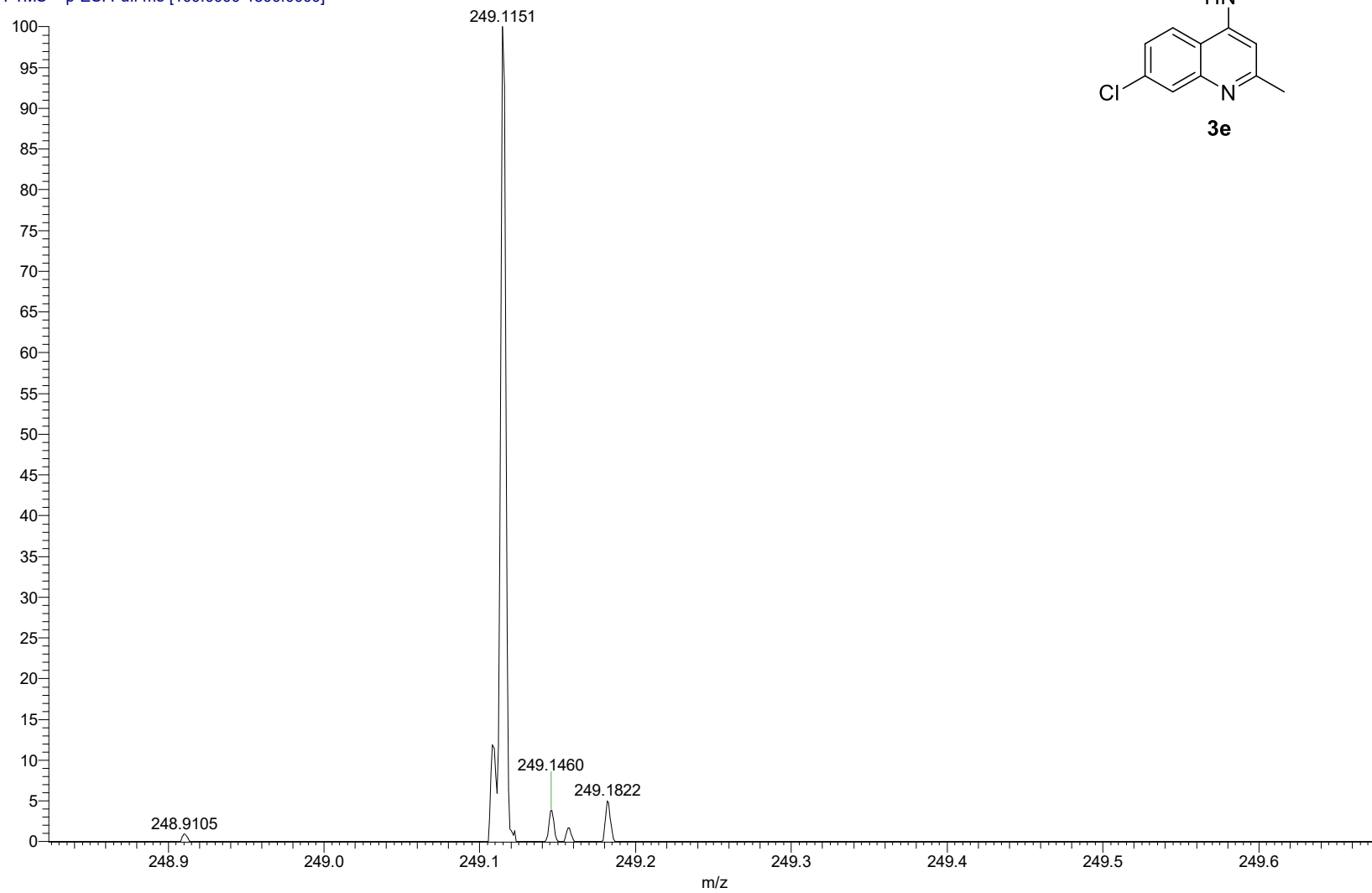
030--37 #45 RT: 0.24 AV: 1 NL: 8.00E8
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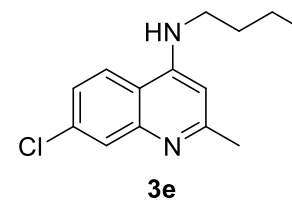
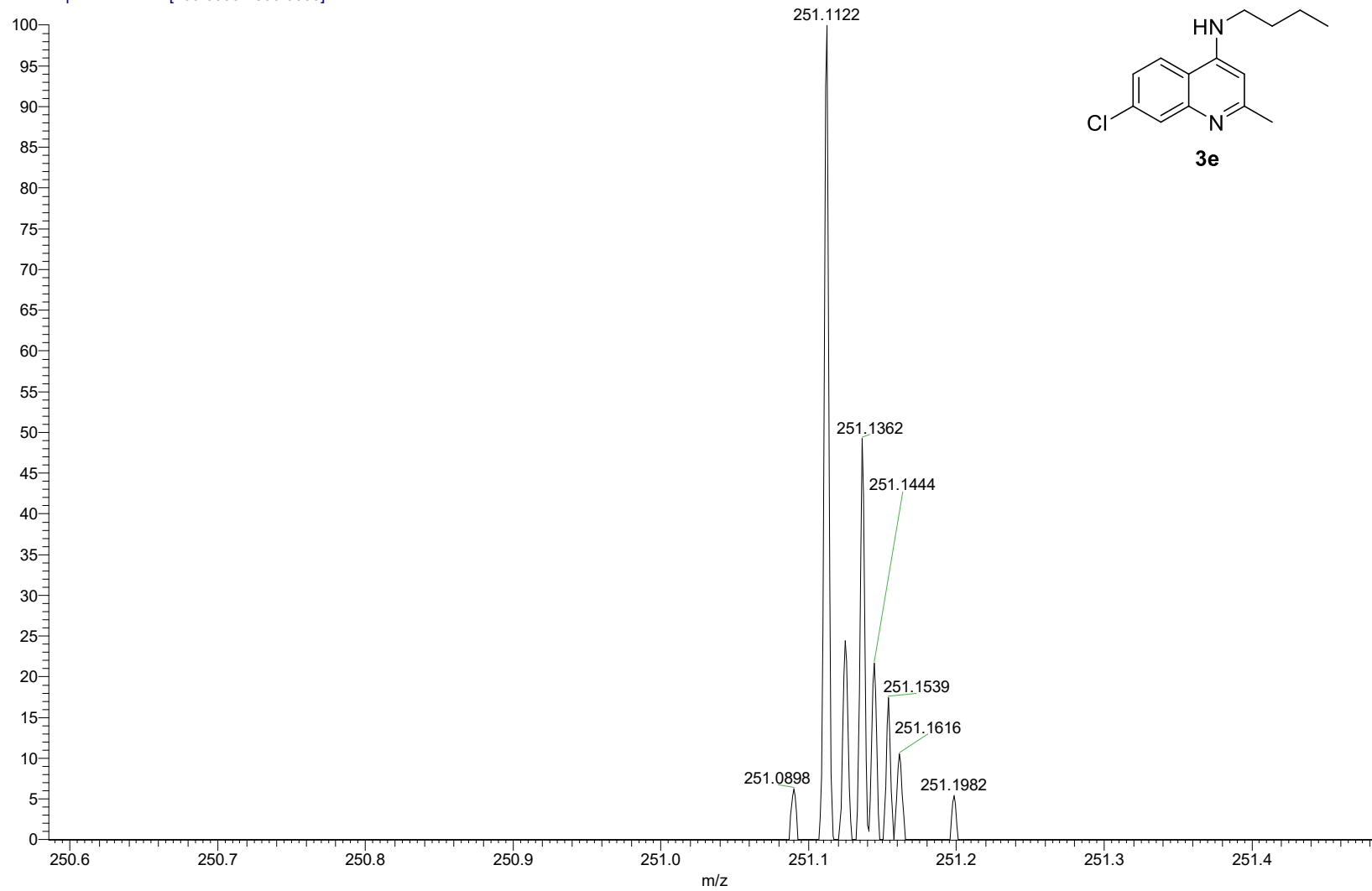
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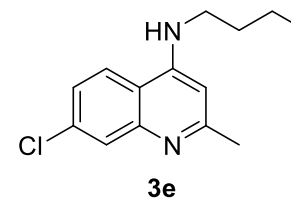
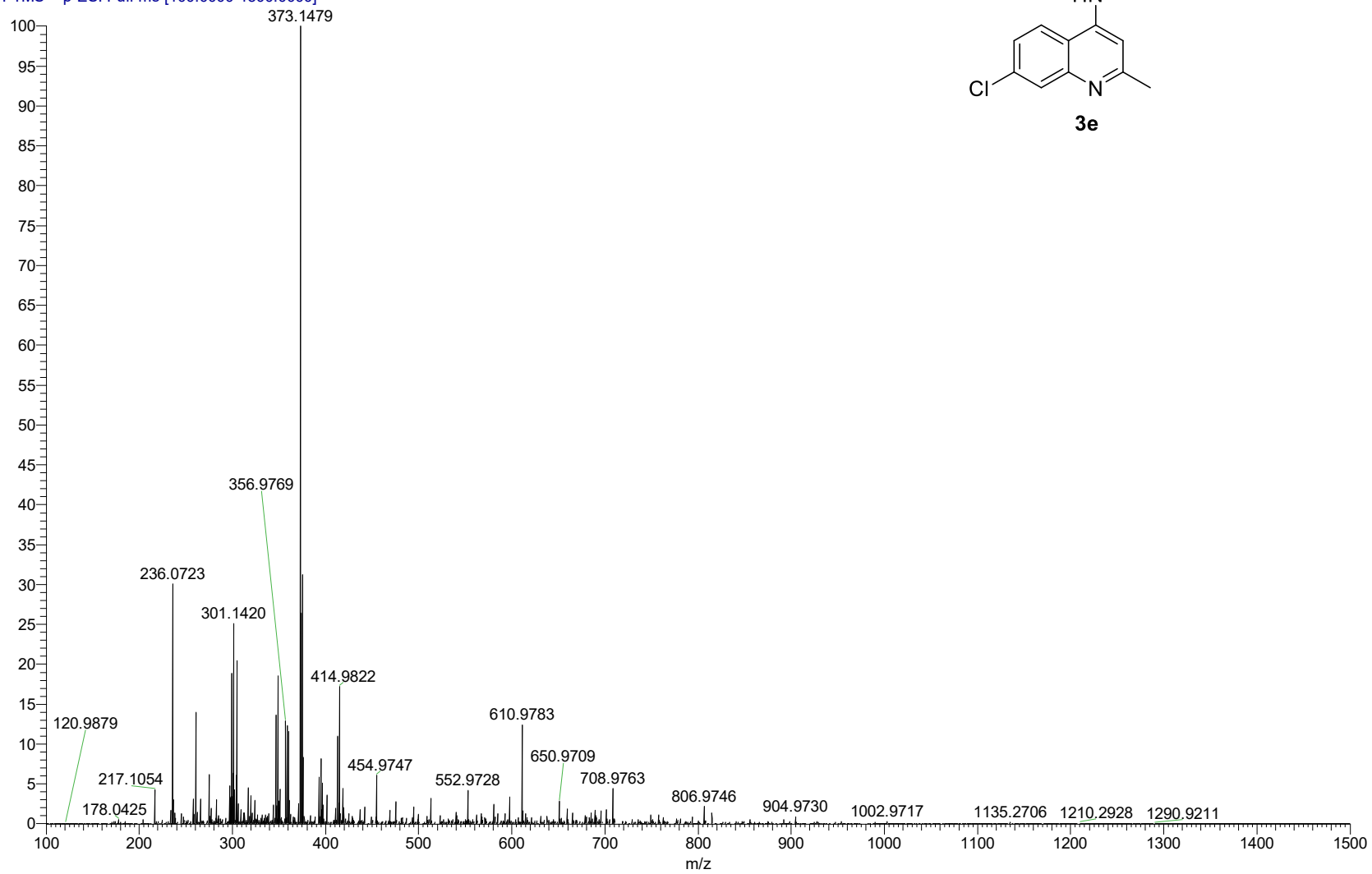
030-38 #96 RT: 0.50 AV: 1 NL: 2.35E6
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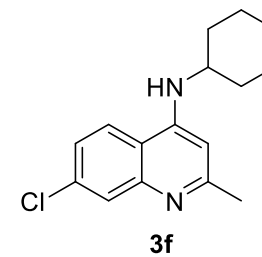
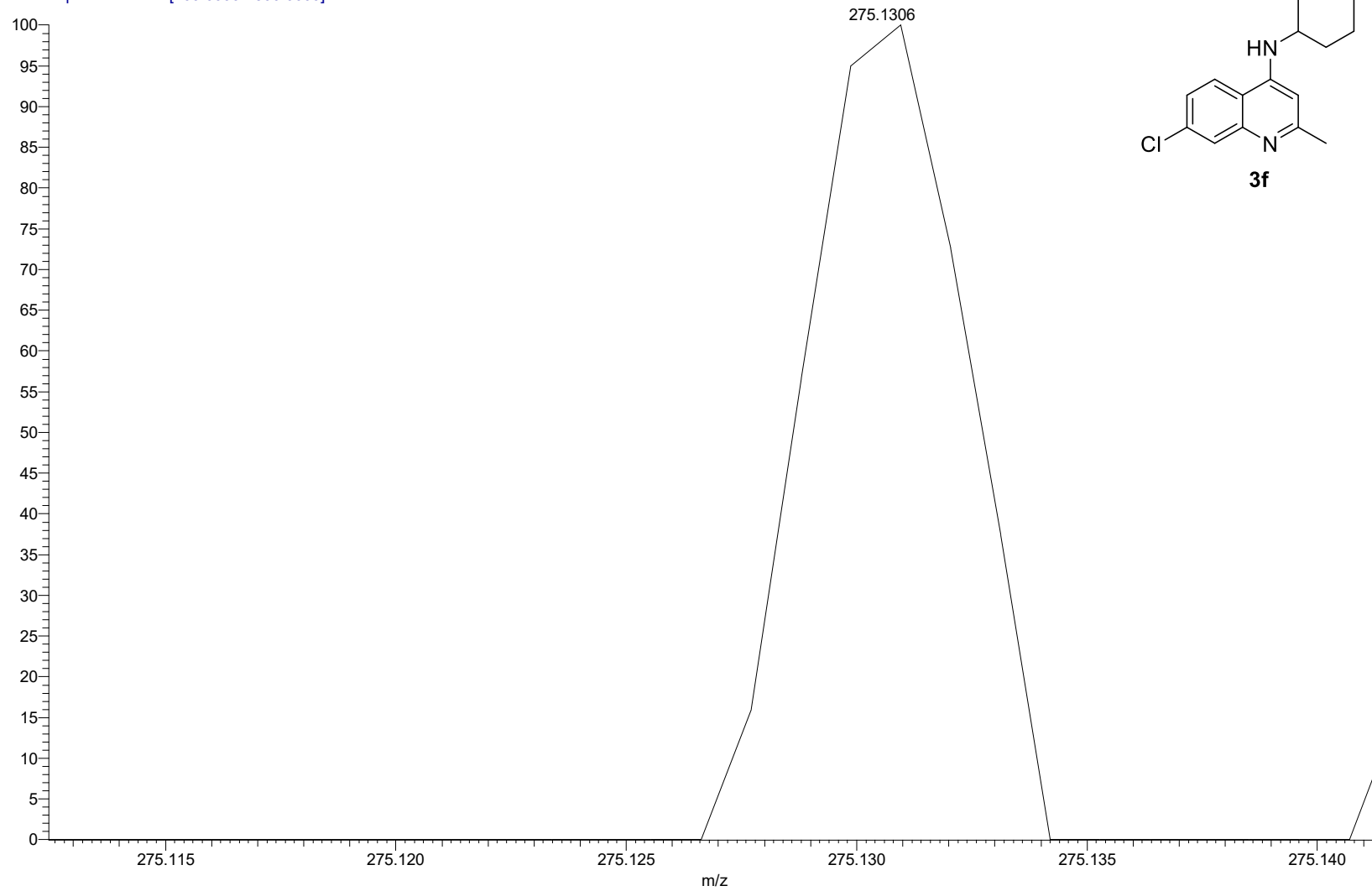
030-38 #100 RT: 0.52 AV: 1 NL: 5.16E5
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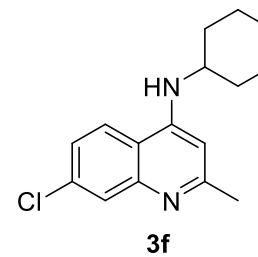
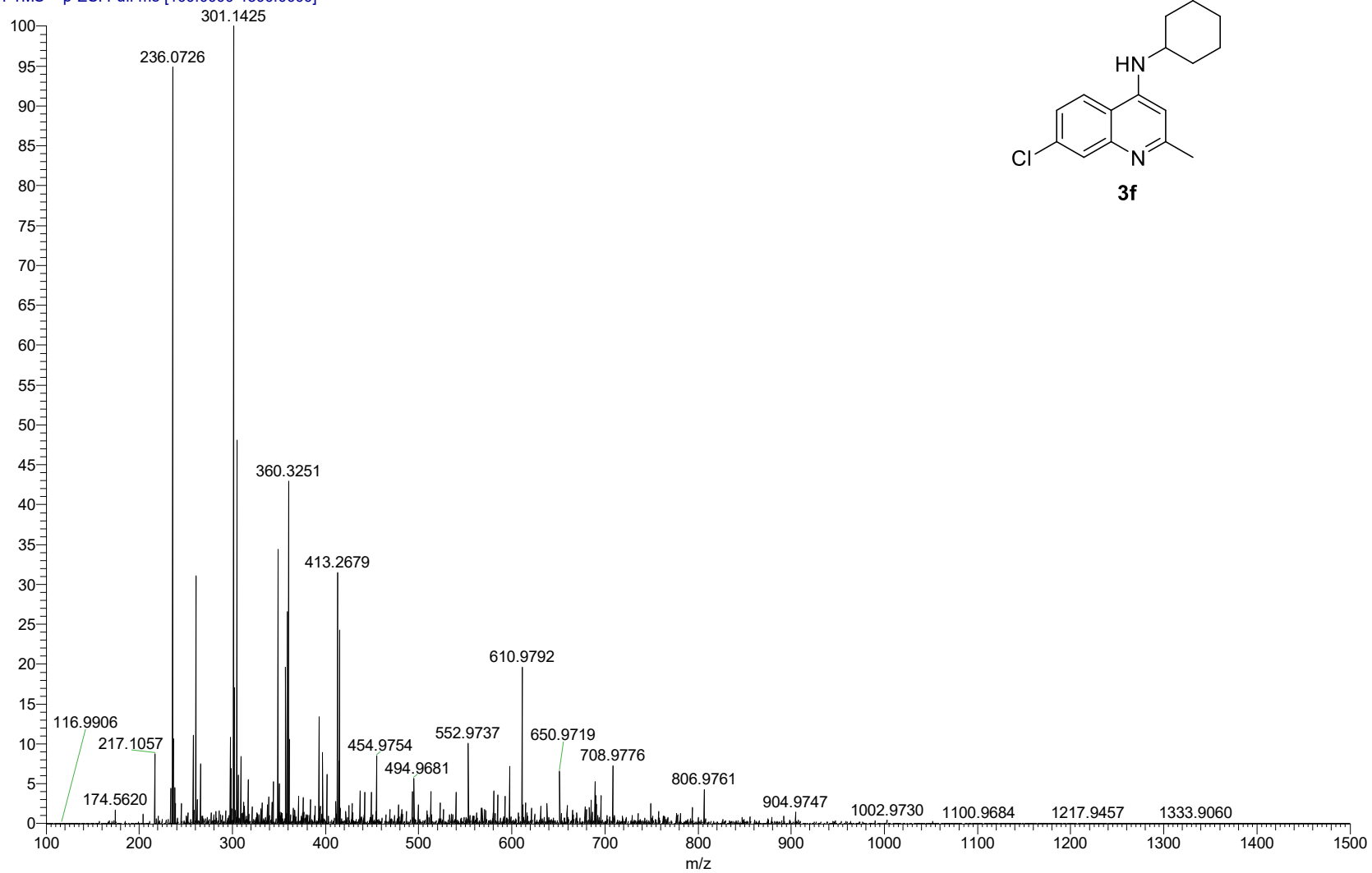
030-38 #1 RT: 0.00 AV: 1 NL: 1.02E7
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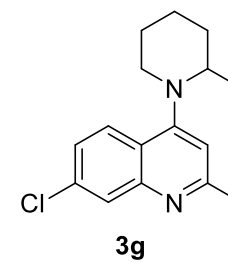
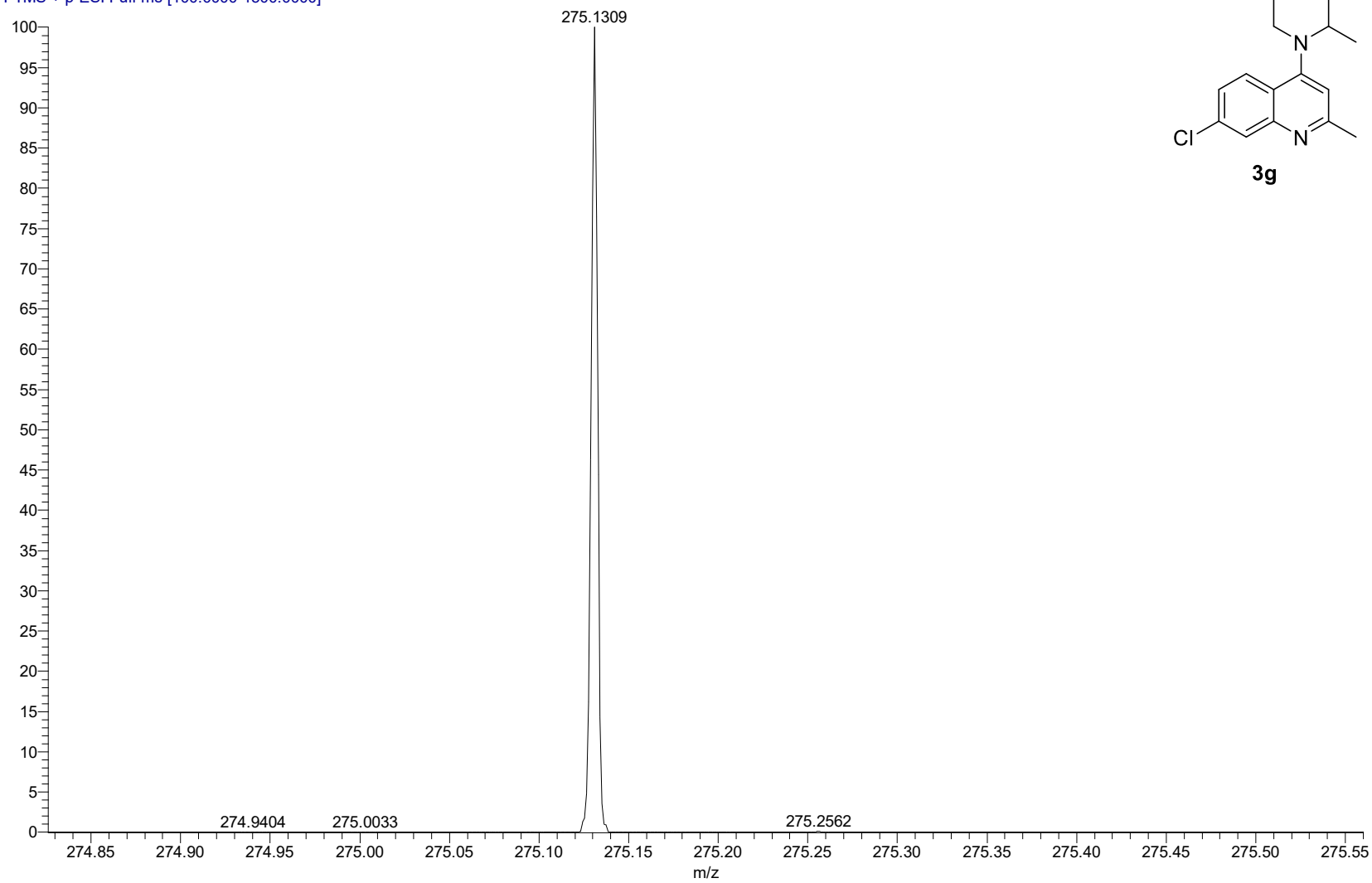
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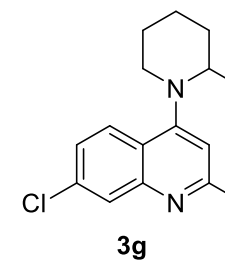
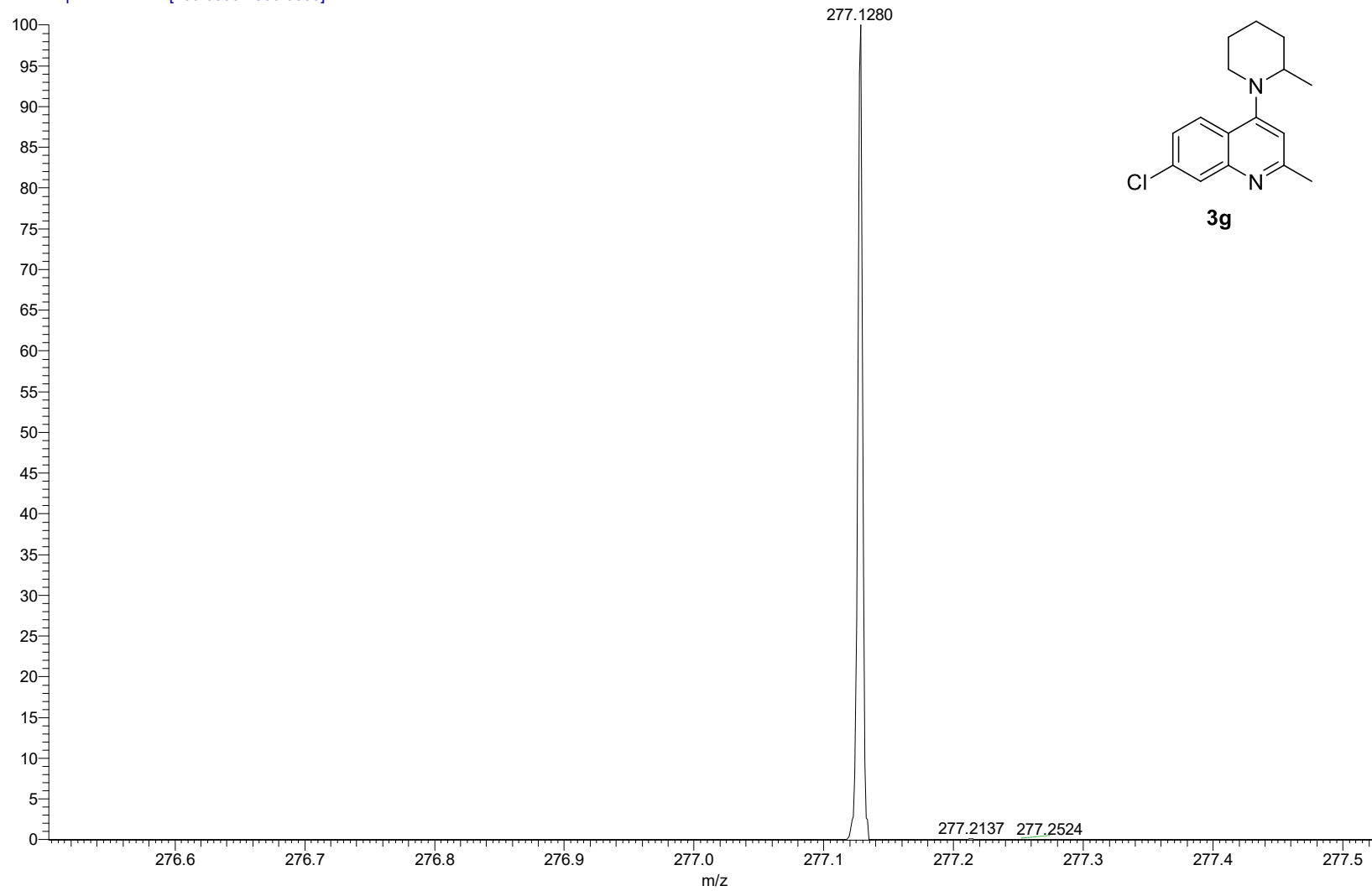
030-35 #1 RT: 0.00 AV: 1 NL: 5.61E6
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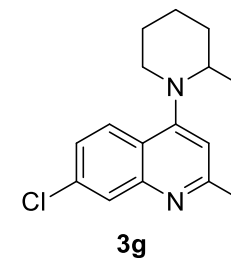
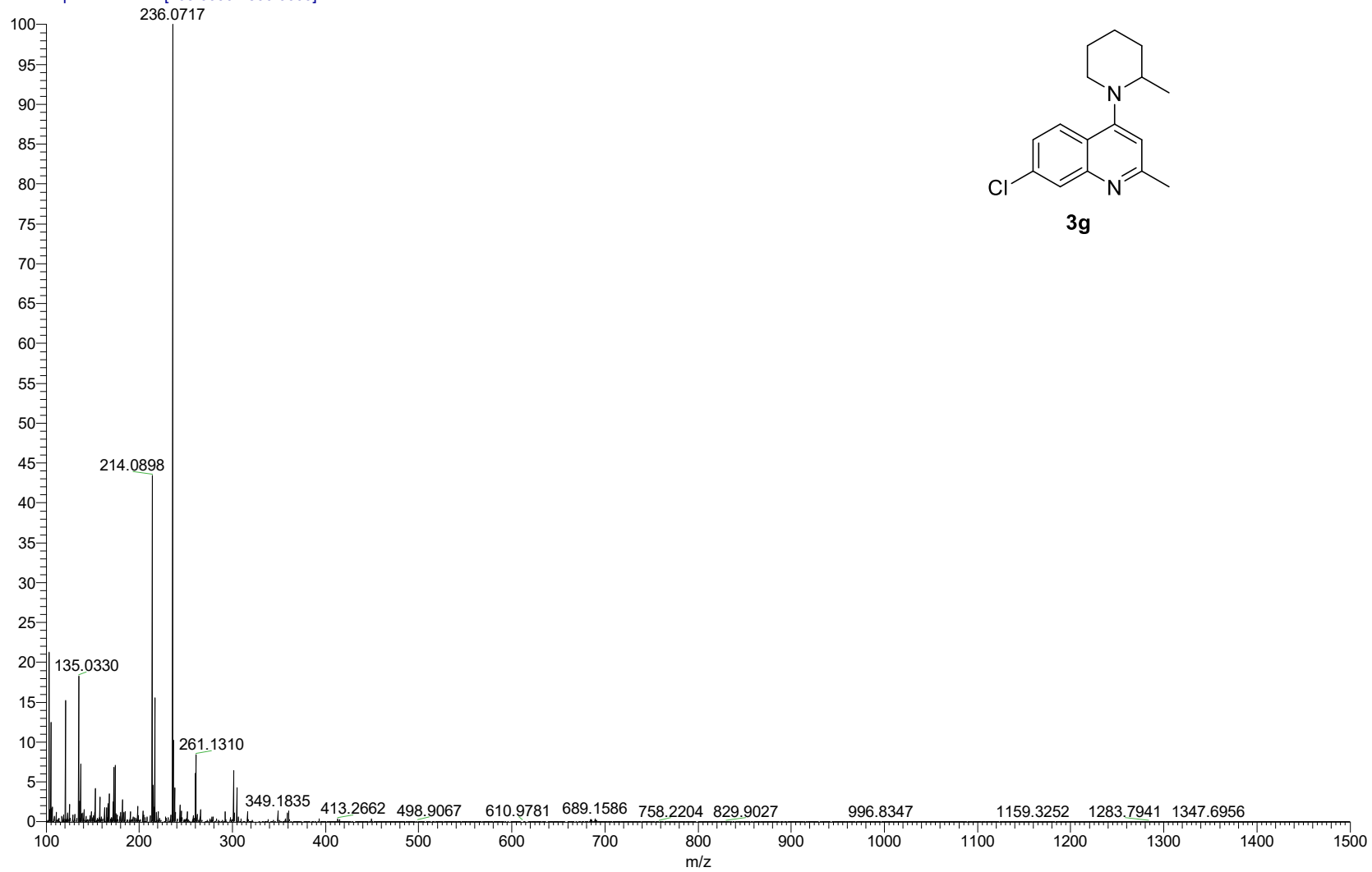
030-36 #74 RT: 0.40 AV: 1 NL: 8.65E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



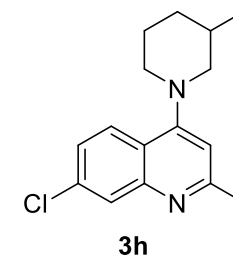
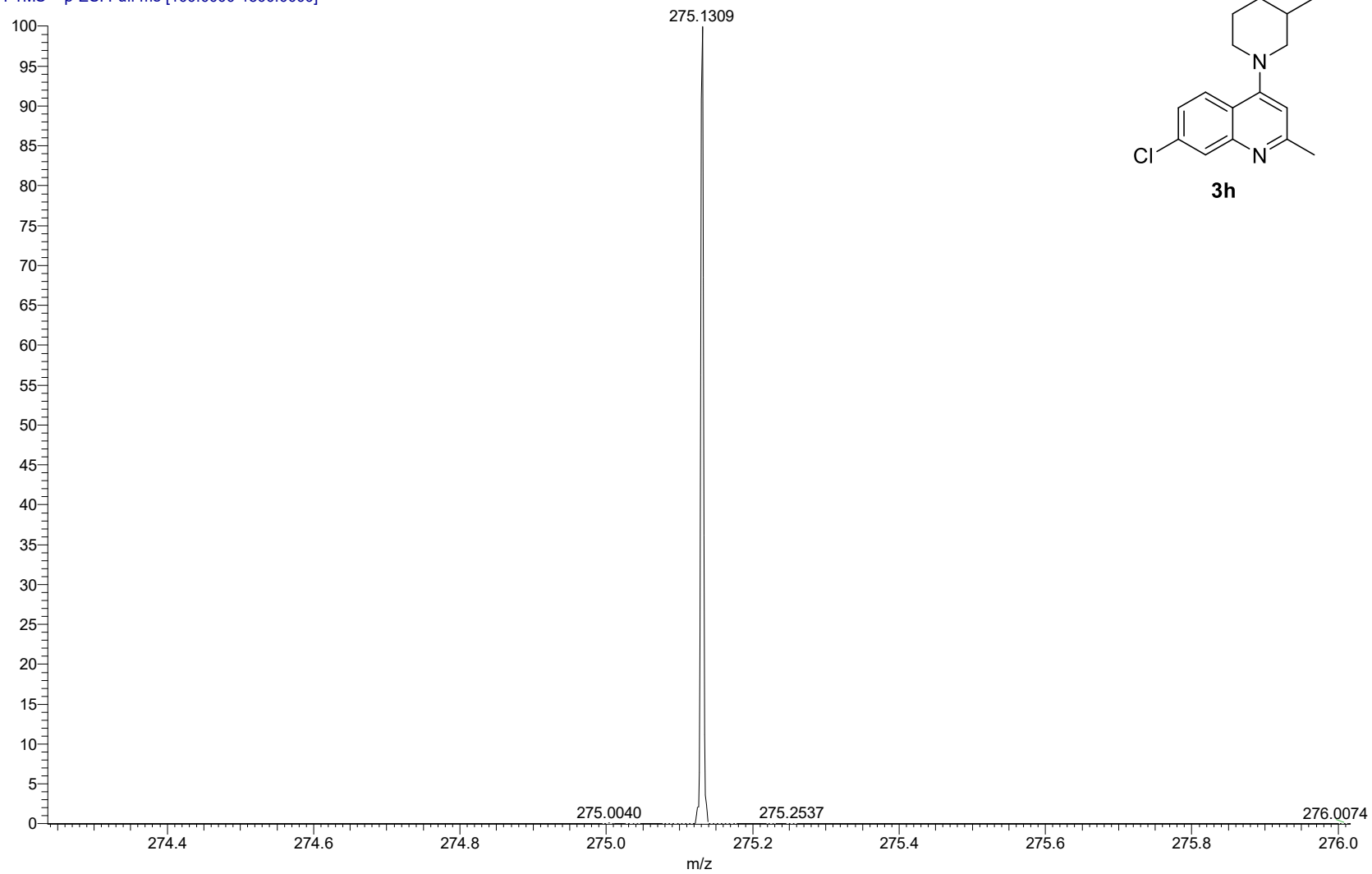
030-36 #74 RT: 0.40 AV: 1 NL: 2.69E7
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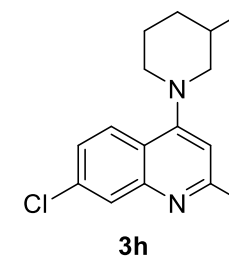
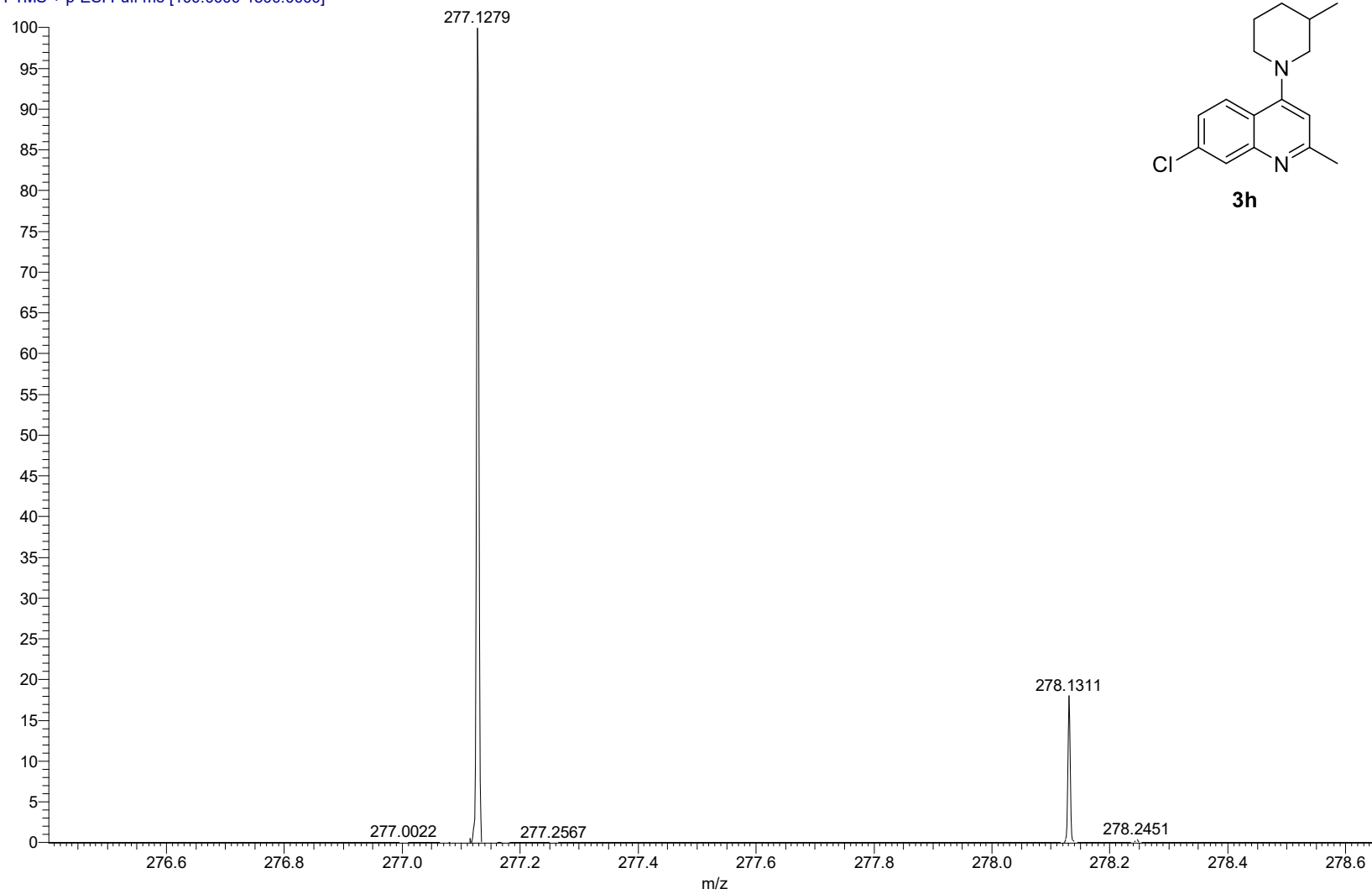
030-36 #1 RT: 0.00 AV: 1 NL: 5.85E6
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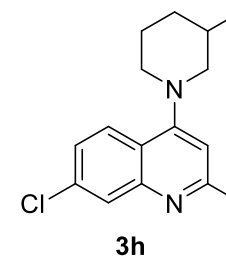
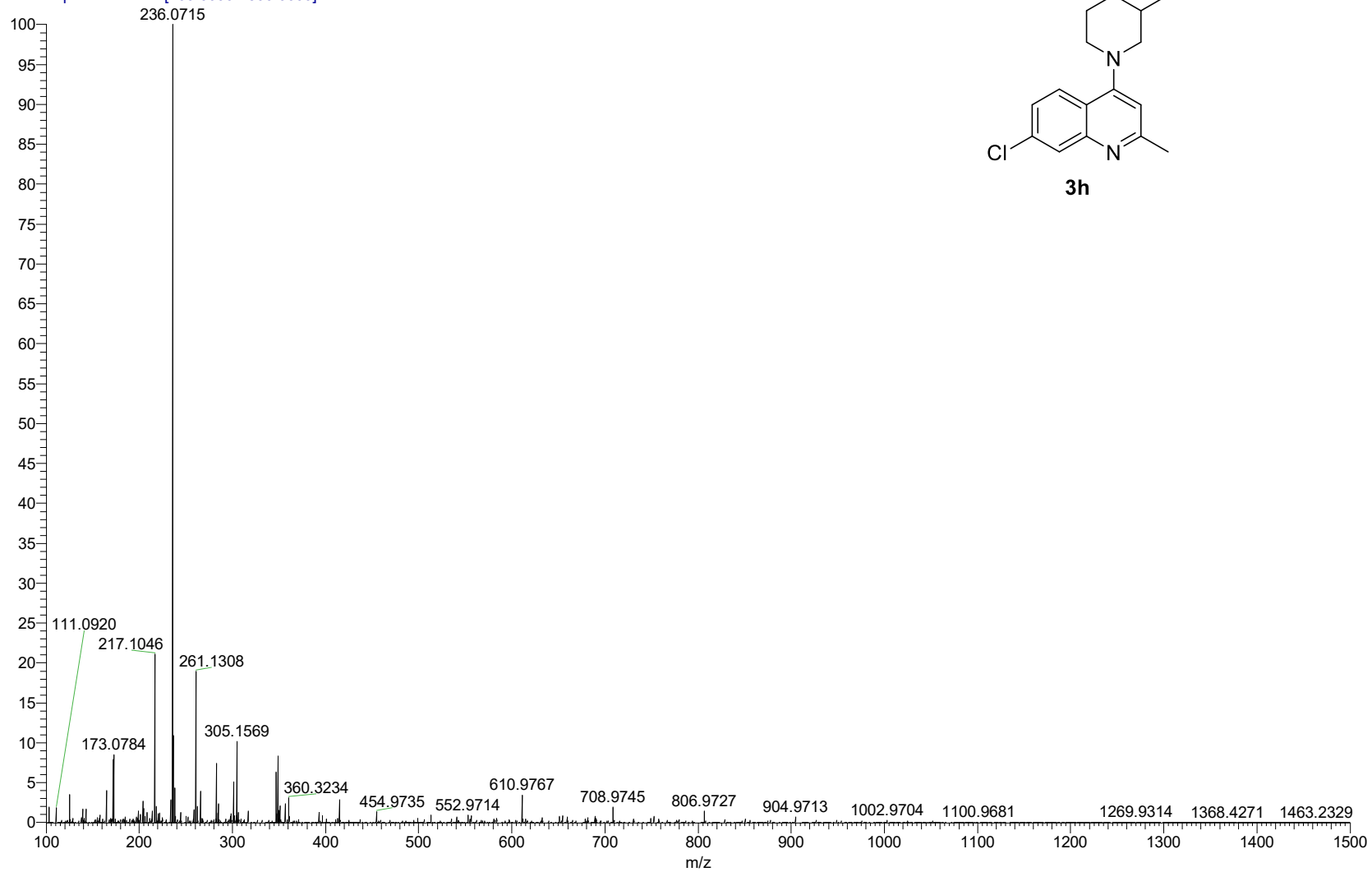
030-42 #96 RT: 0.51 AV: 1 NL: 2.03E9
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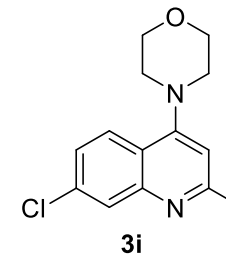
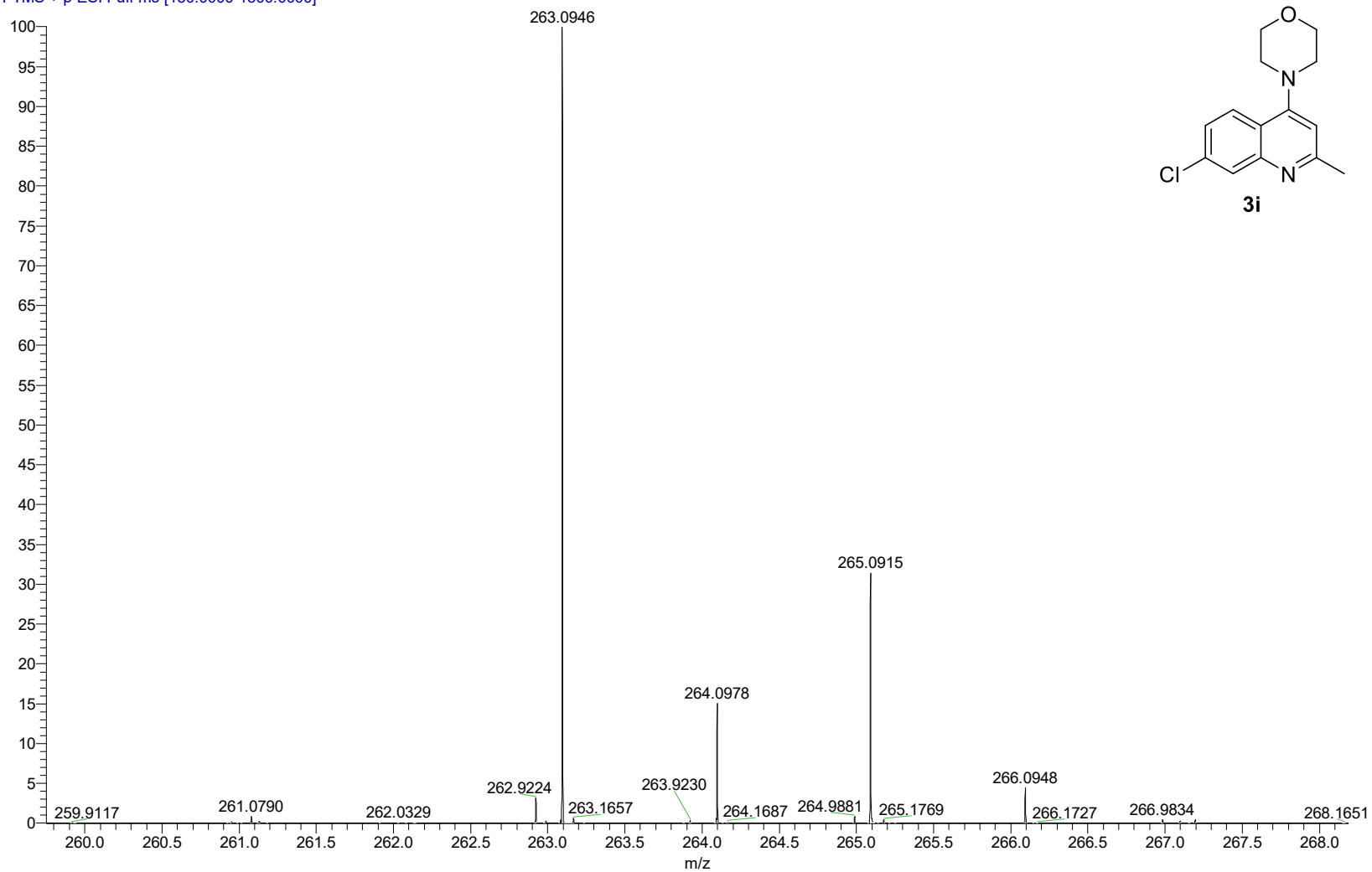
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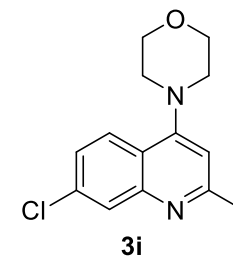
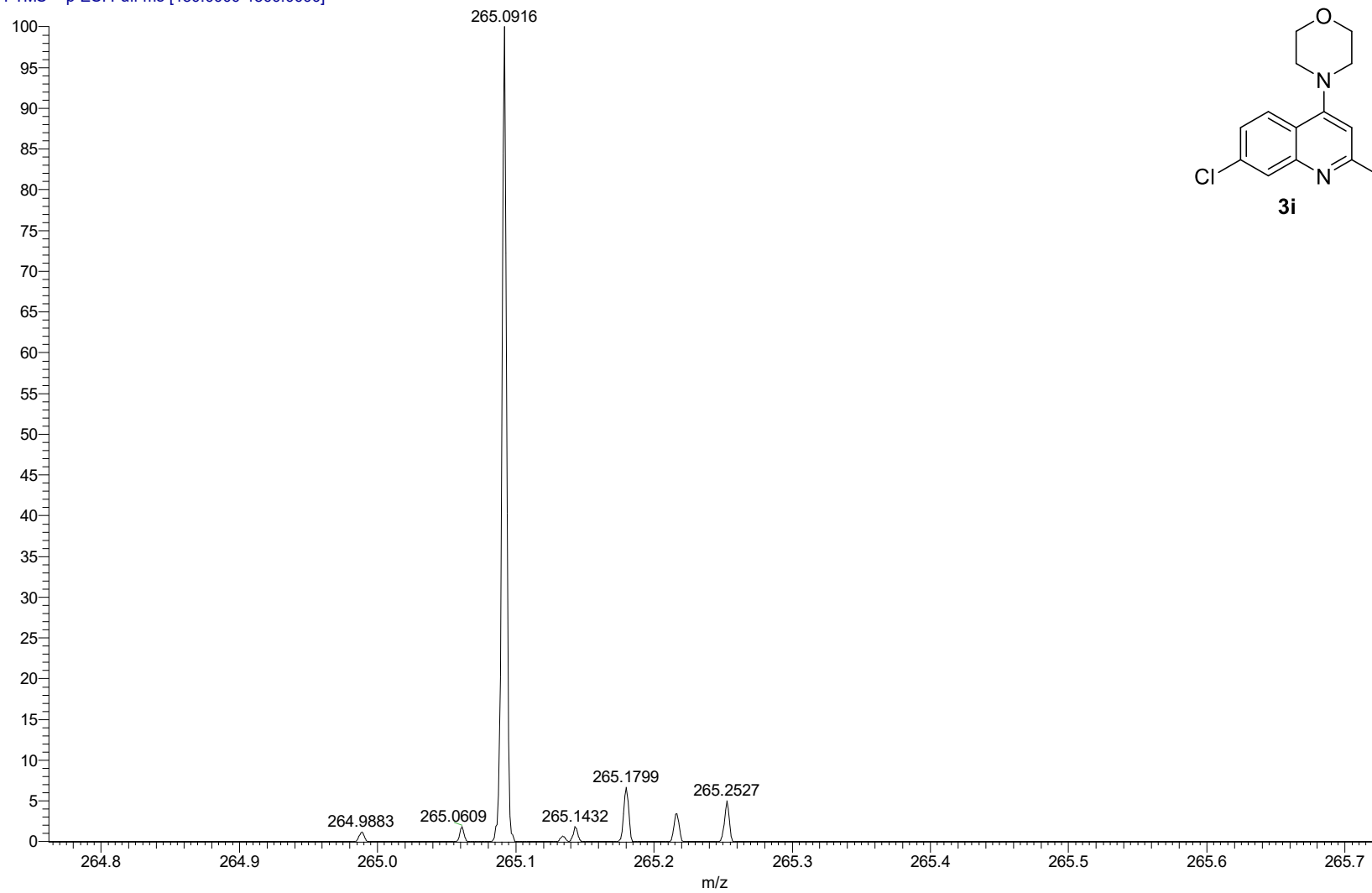
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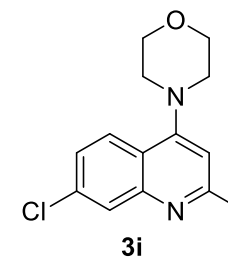
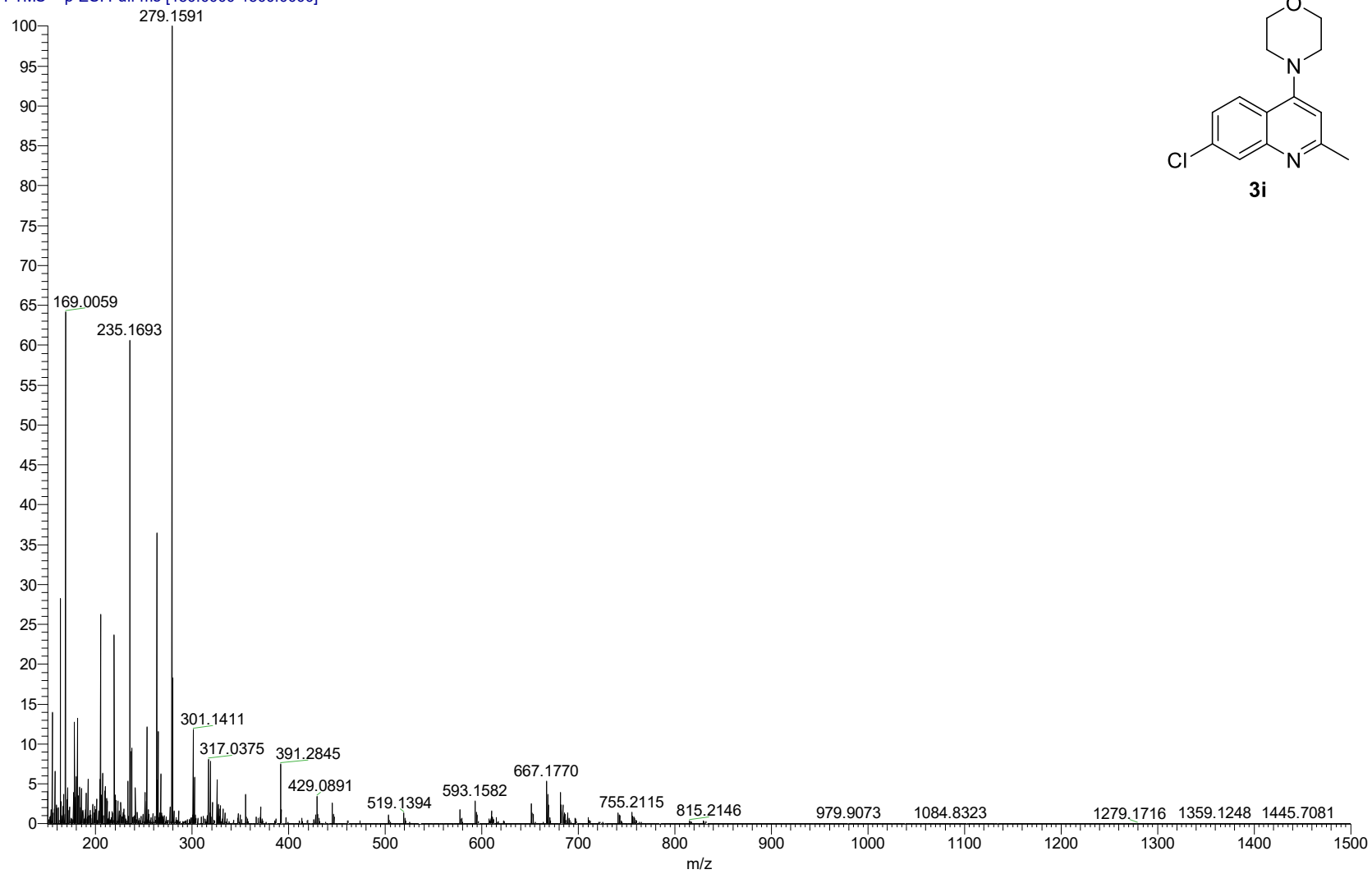
wd-1 #97 RT: 0.44 AV: 1 NL: 3.07E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



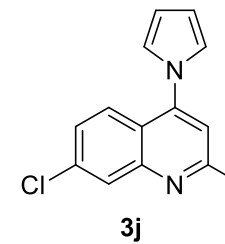
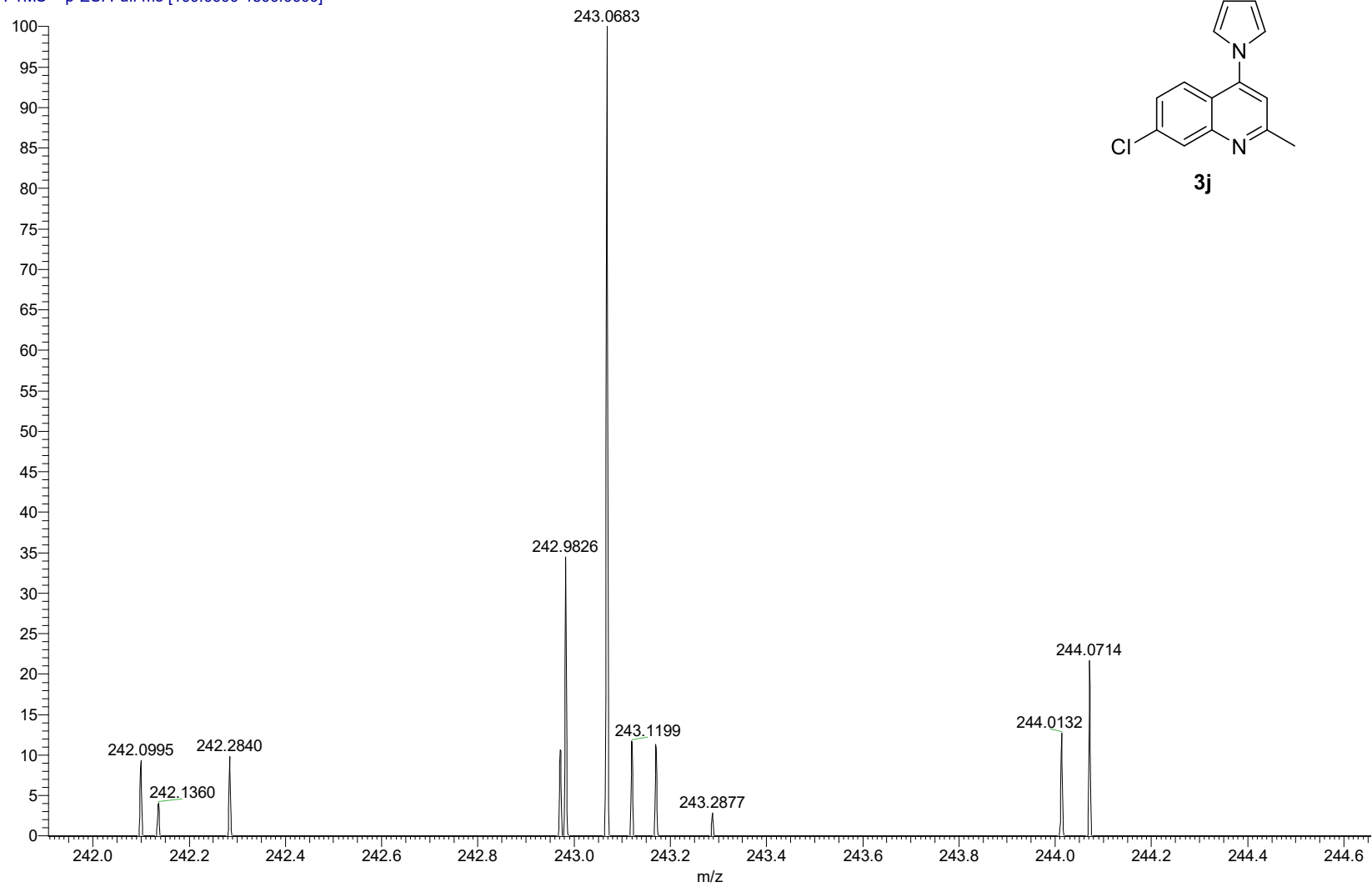
wd-1 #104 RT: 0.47 AV: 1 NL: 1.58E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



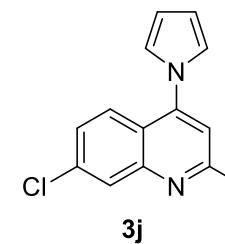
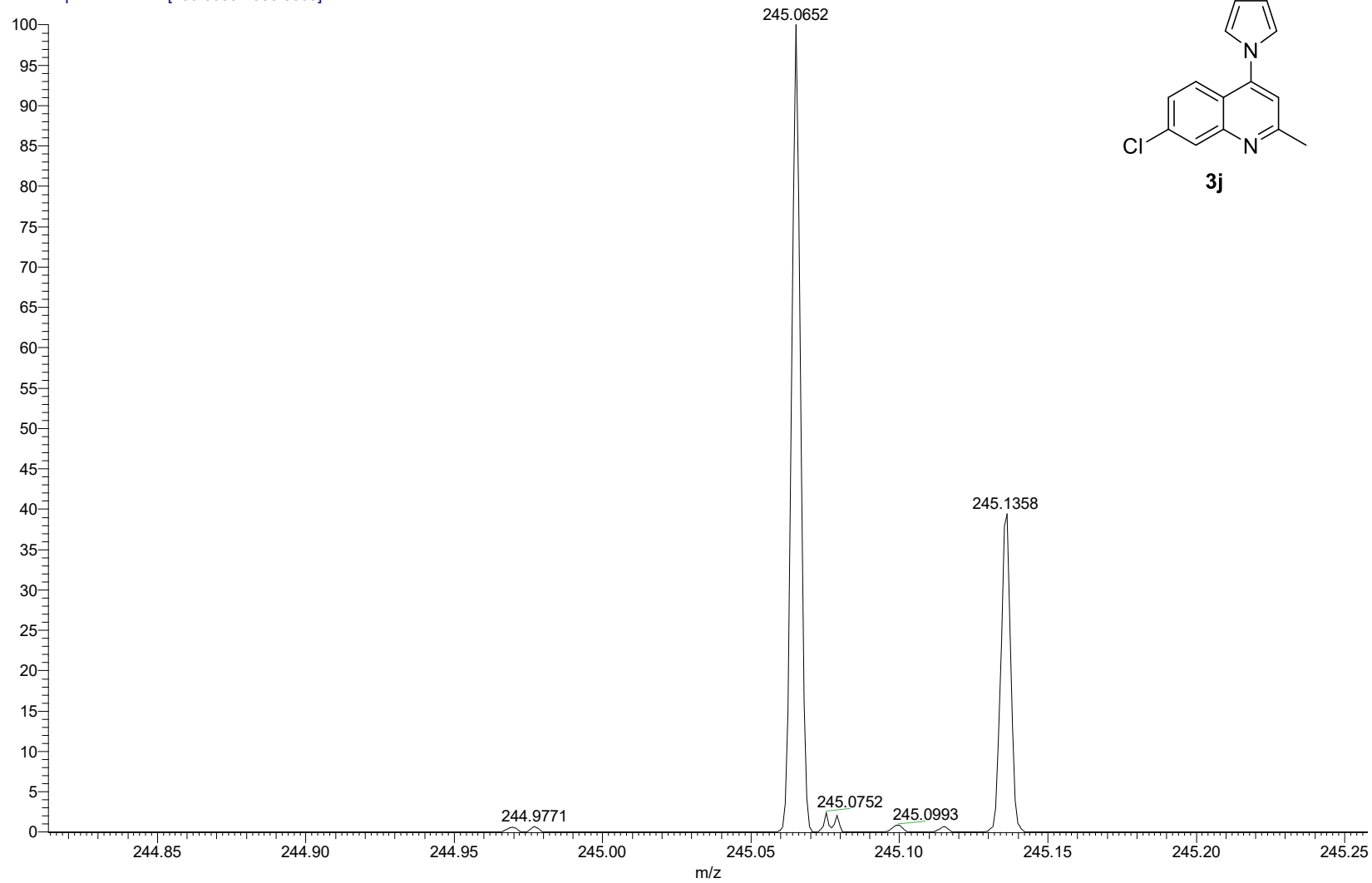
wd-1 #104 RT: 0.47 AV: 1 NL: 1.37E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



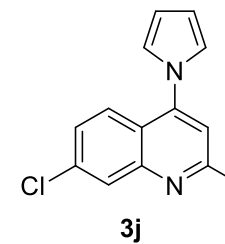
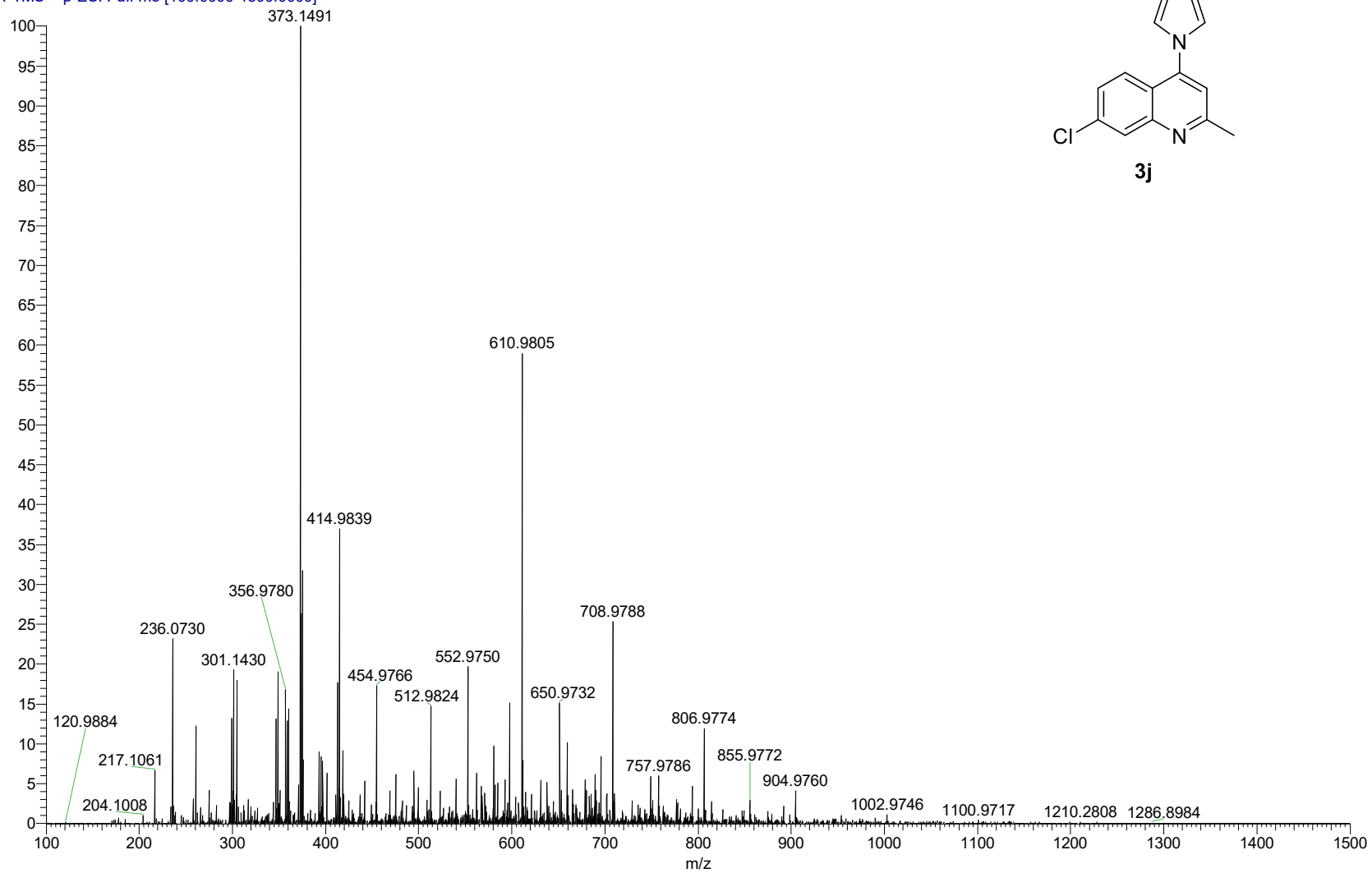
030-46 #115 RT: 0.60 AV: 1 NL: 1.28E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



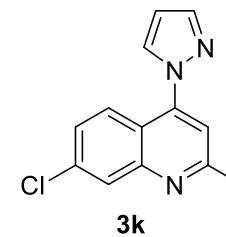
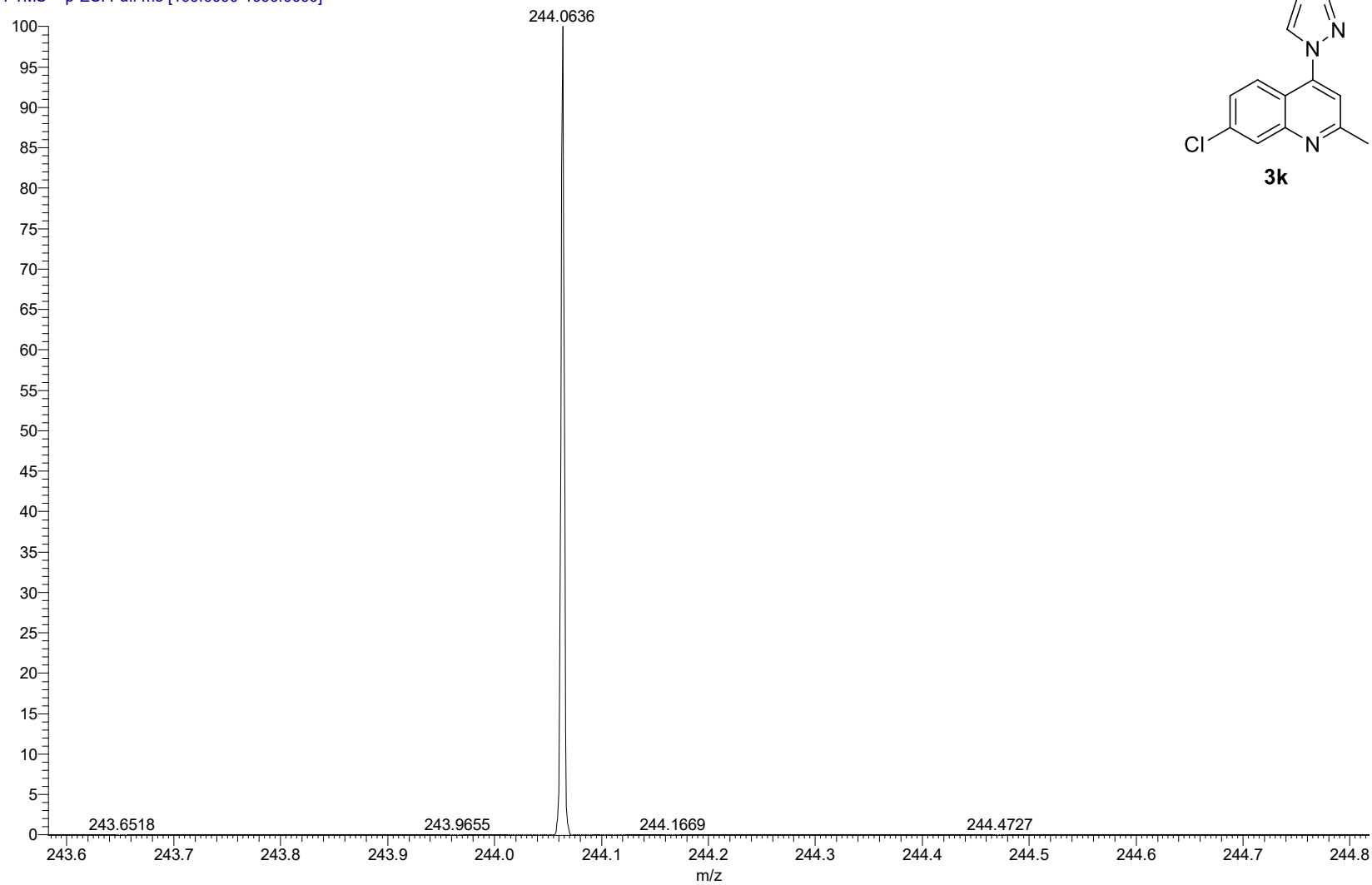
030-46 #70 RT: 0.37 AV: 1 NL: 7.41E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



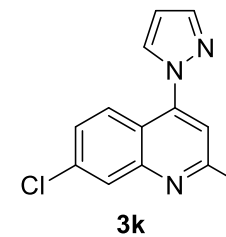
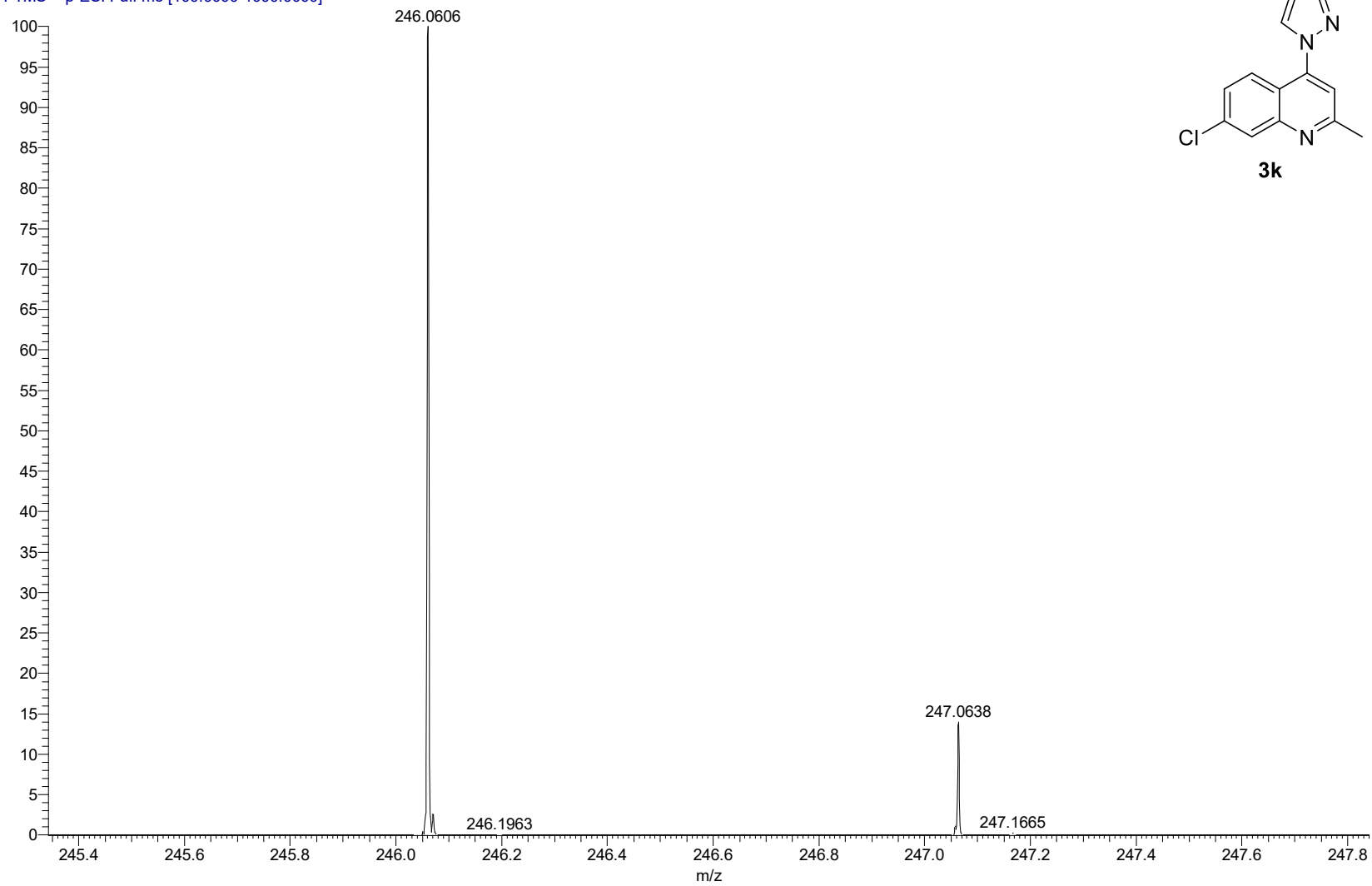
030-46 #1 RT: 0.00 AV: 1 NL: 3.70E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



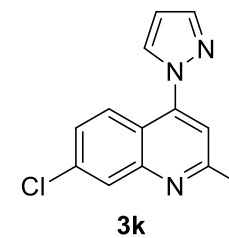
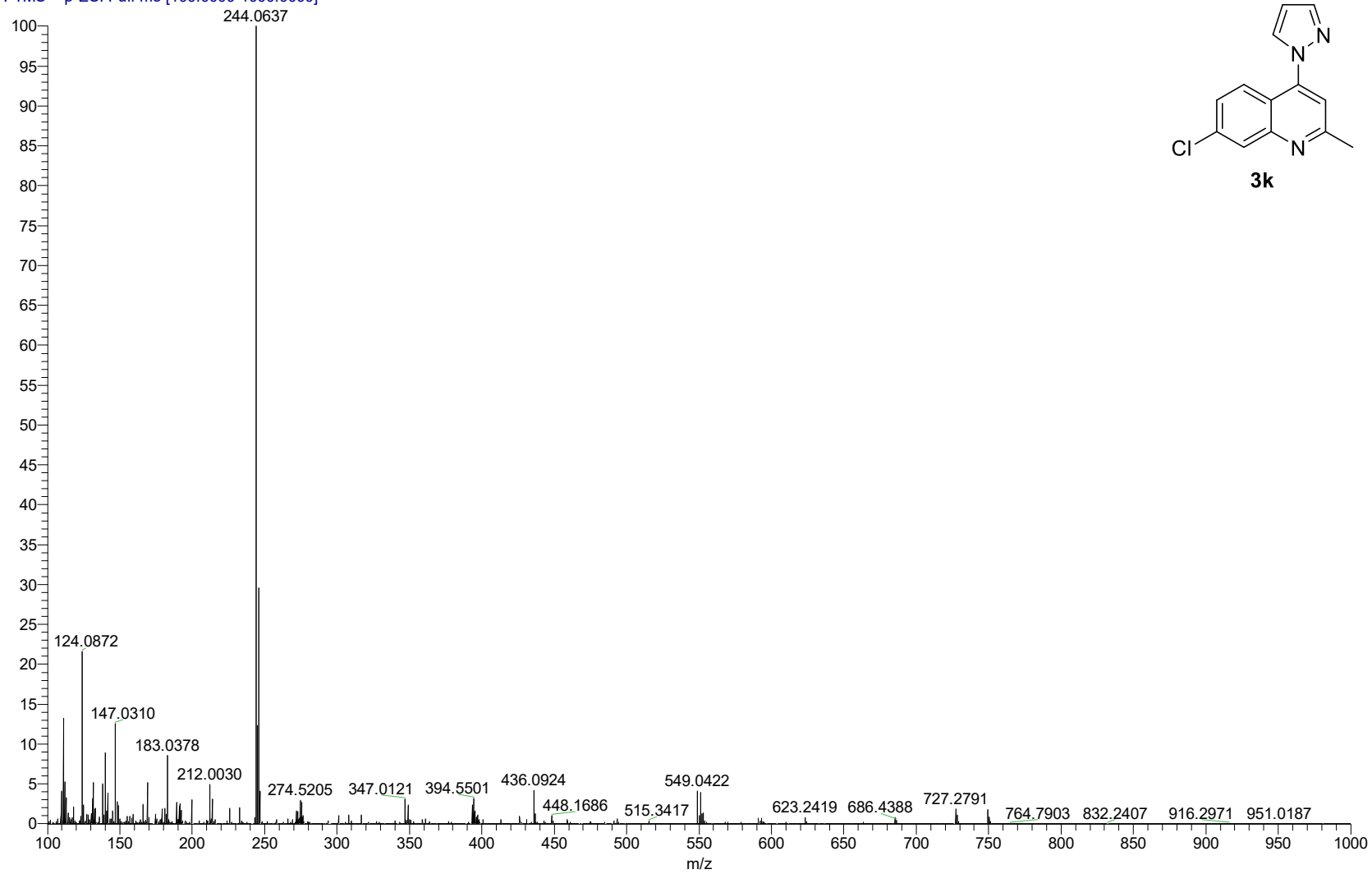
WD-1 #33 RT: 0.15 AV: 1 NL: 2.75E9
T: FTMS + p ESI Full ms [100.0000-1000.0000]



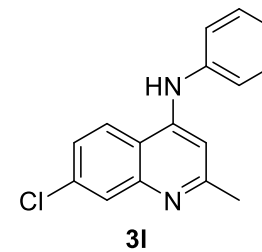
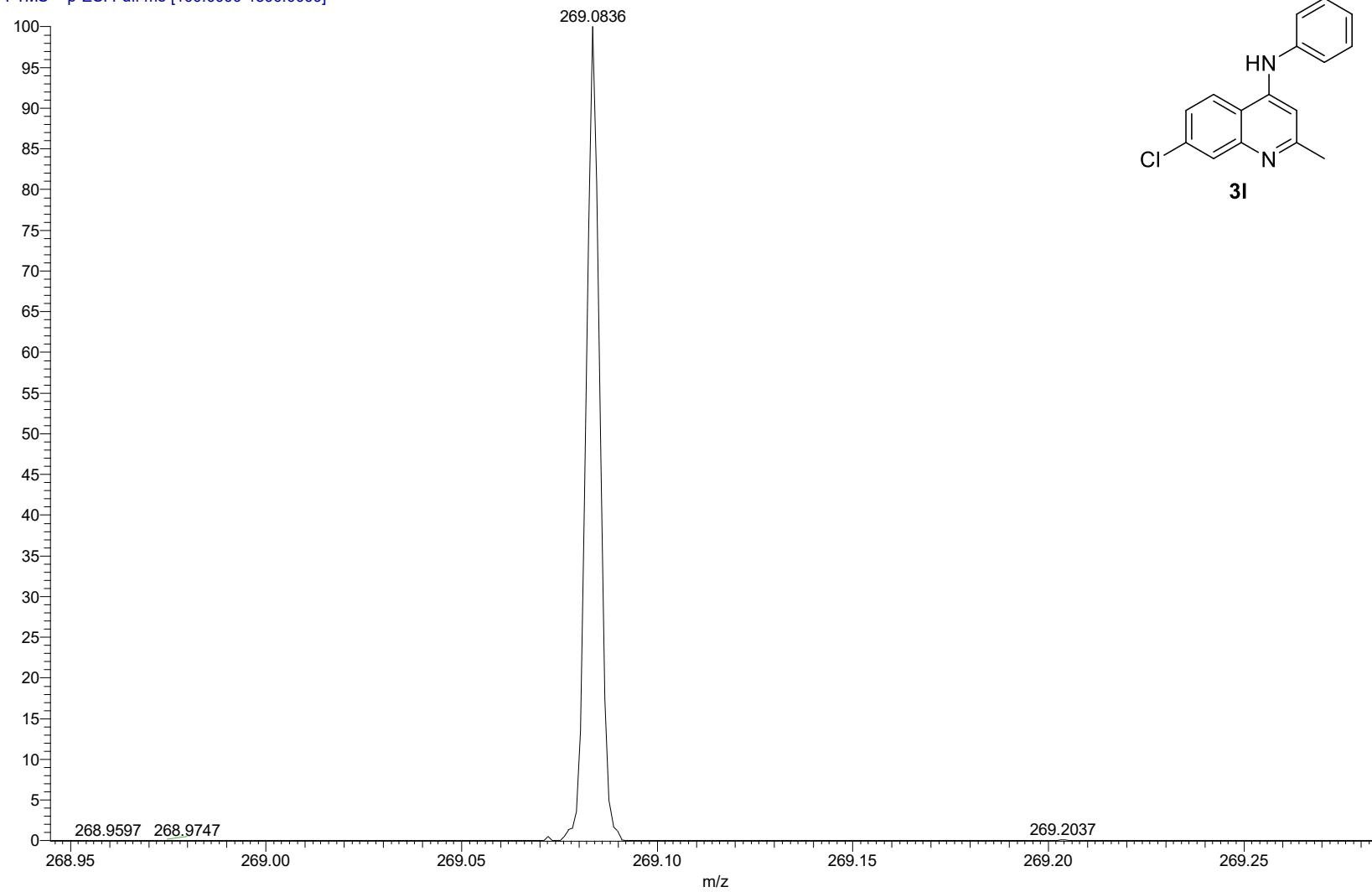
WD-1 #199 RT: 0.89 AV: 1 NL: 2.68E7
T: FTMS + p ESI Full ms [100.0000-1000.0000]



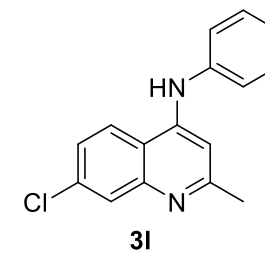
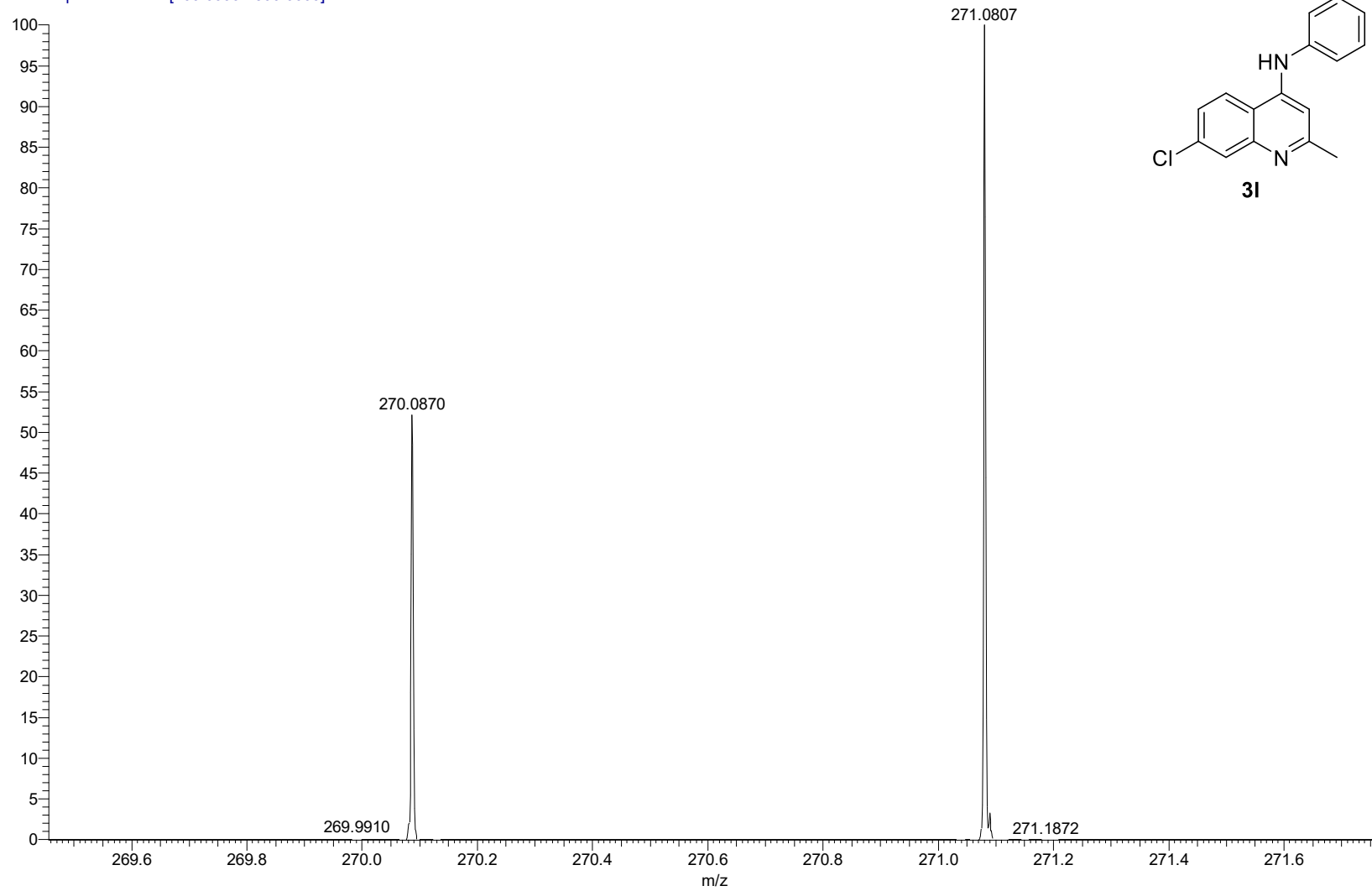
WD-1 #199 RT: 0.89 AV: 1 NL: 9.04E7
T: FTMS + p ESI Full ms [100.0000-1000.0000]



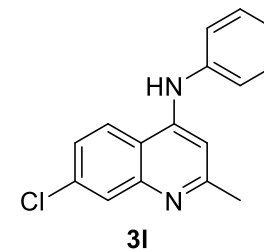
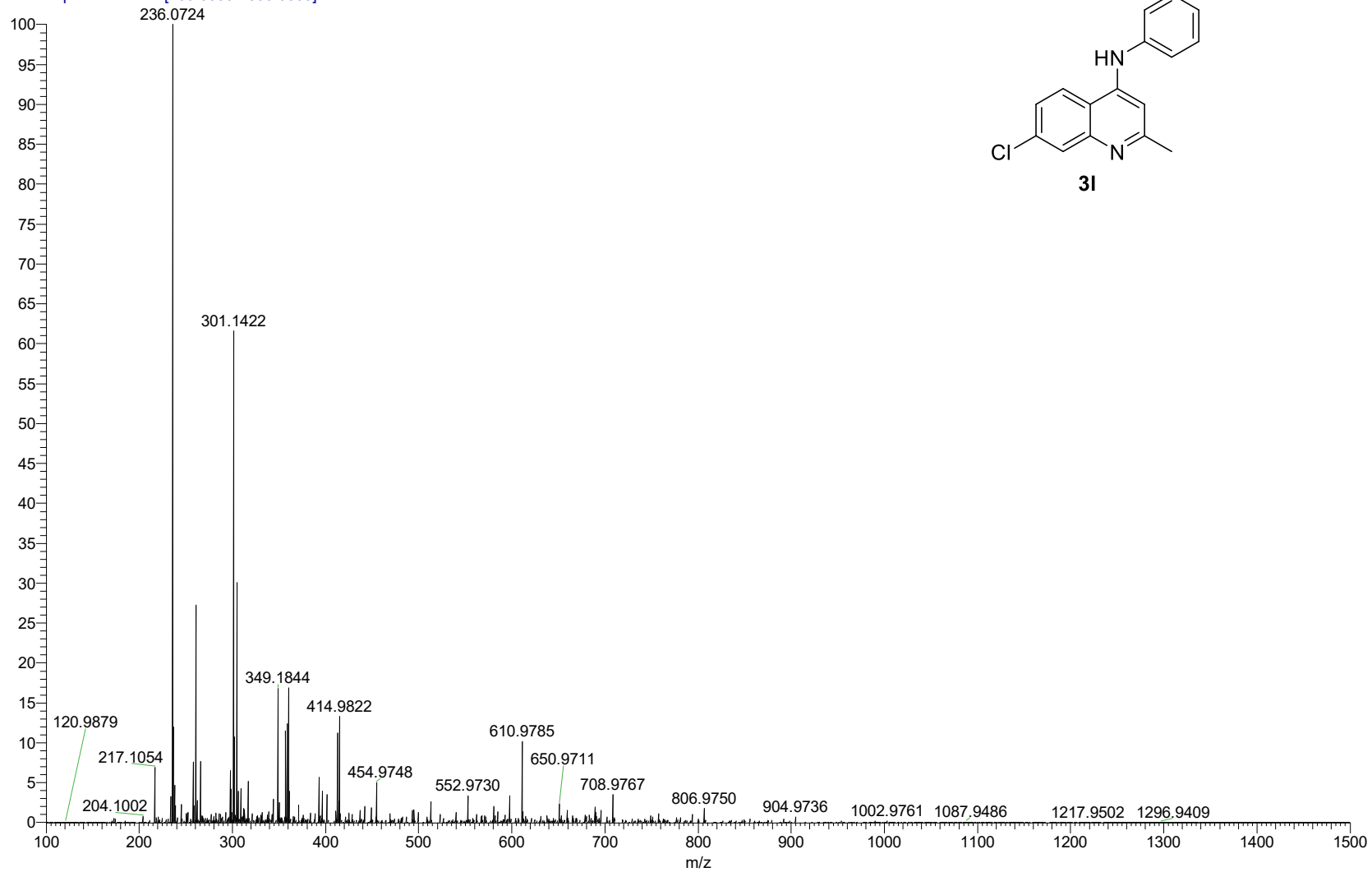
030-32 #59 RT: 0.31 AV: 1 NL: 1.89E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



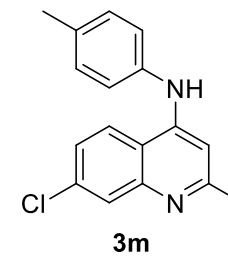
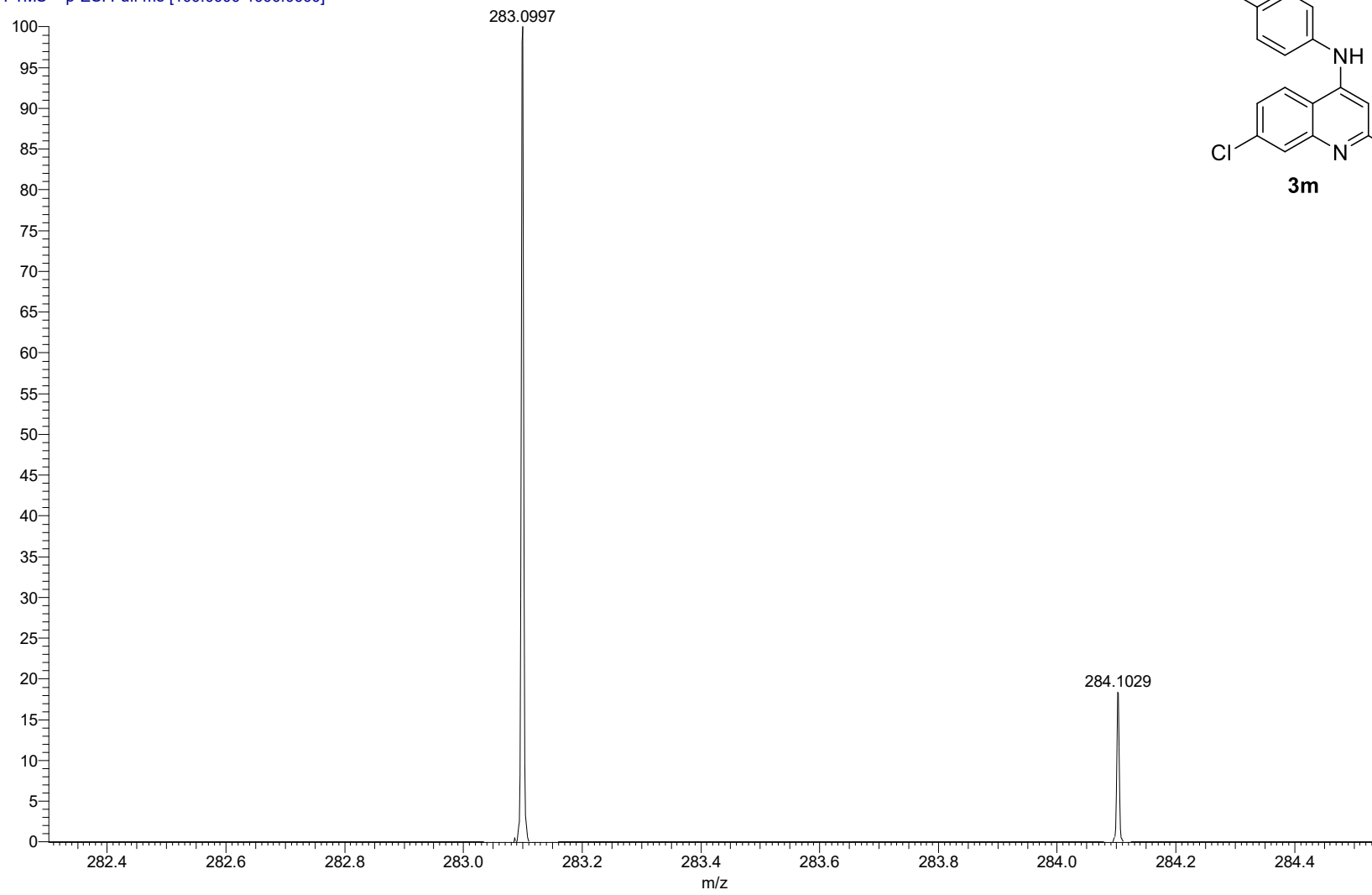
030-32 #95 RT: 0.49 AV: 1 NL: 7.92E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



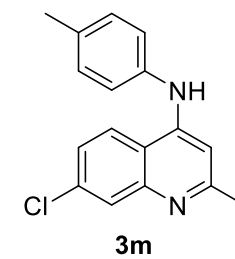
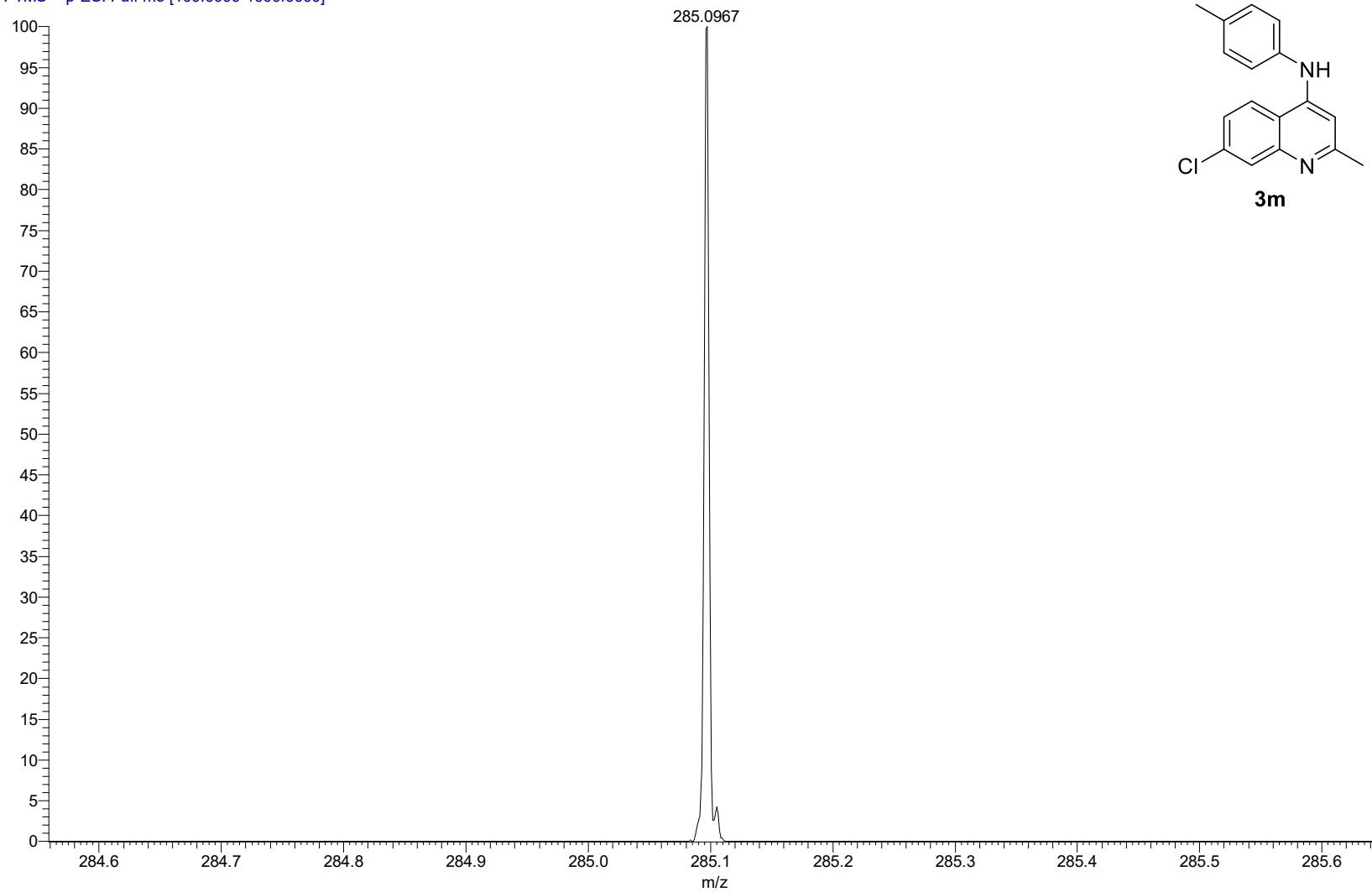
030-32 #1 RT: 0.00 AV: 1 NL: 1.26E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



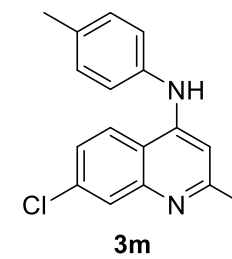
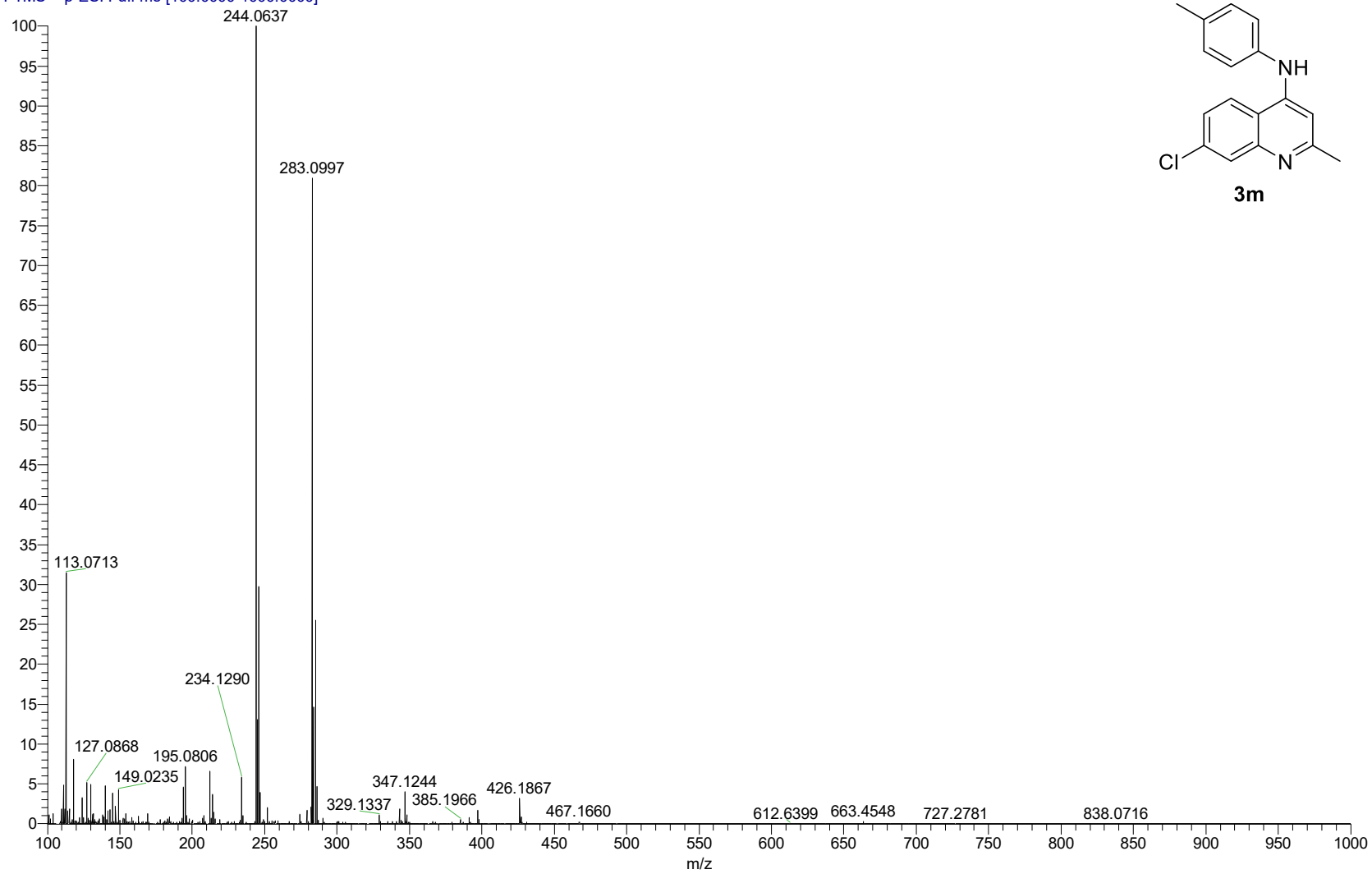
WD-2 #56 RT: 0.25 AV: 1 NL: 1.66E9
T: FTMS + p ESI Full ms [100.0000-1000.0000]



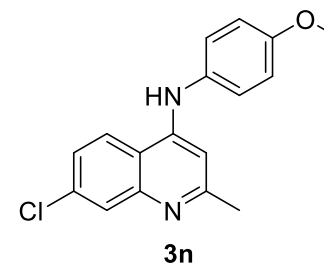
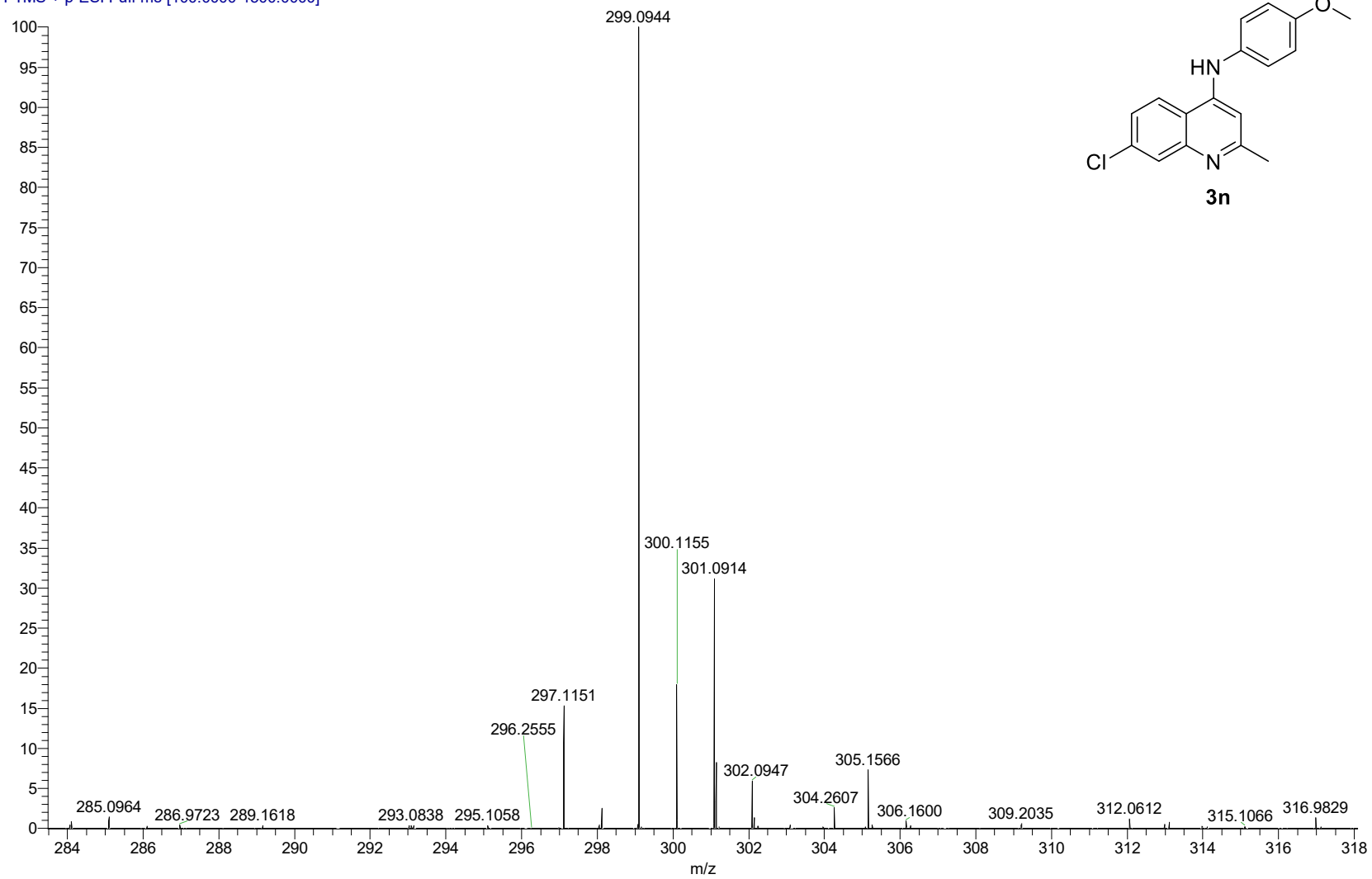
WD-2 #161 RT: 0.72 AV: 1 NL: 3.23E7
T: FTMS + p ESI Full ms [100.0000-1000.0000]



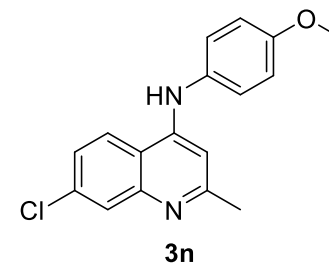
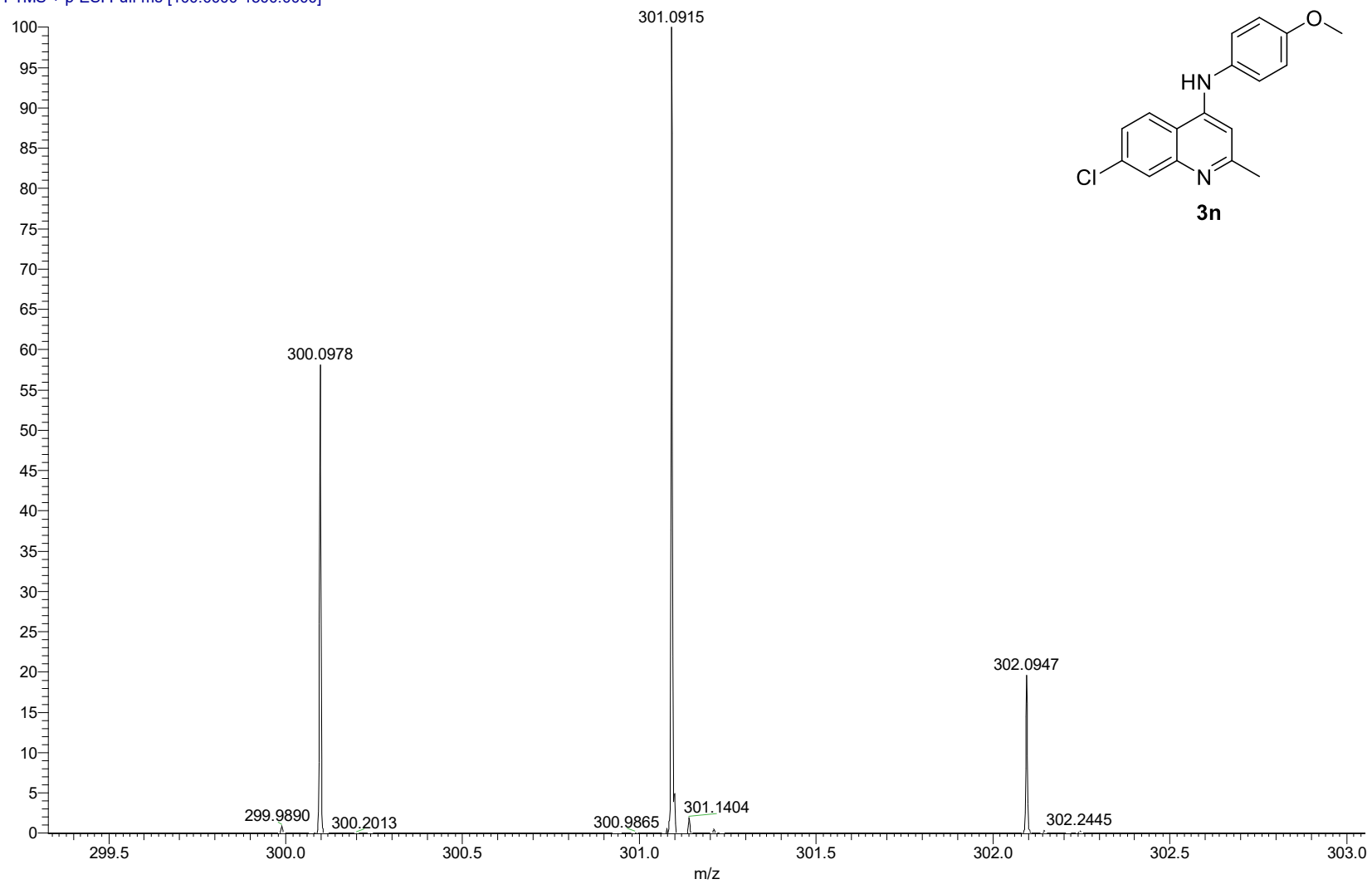
WD-2 #161 RT: 0.72 AV: 1 NL: 1.27E8
T: FTMS + p ESI Full ms [100.0000-1000.0000]



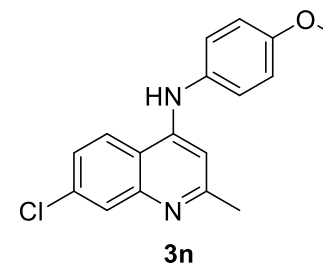
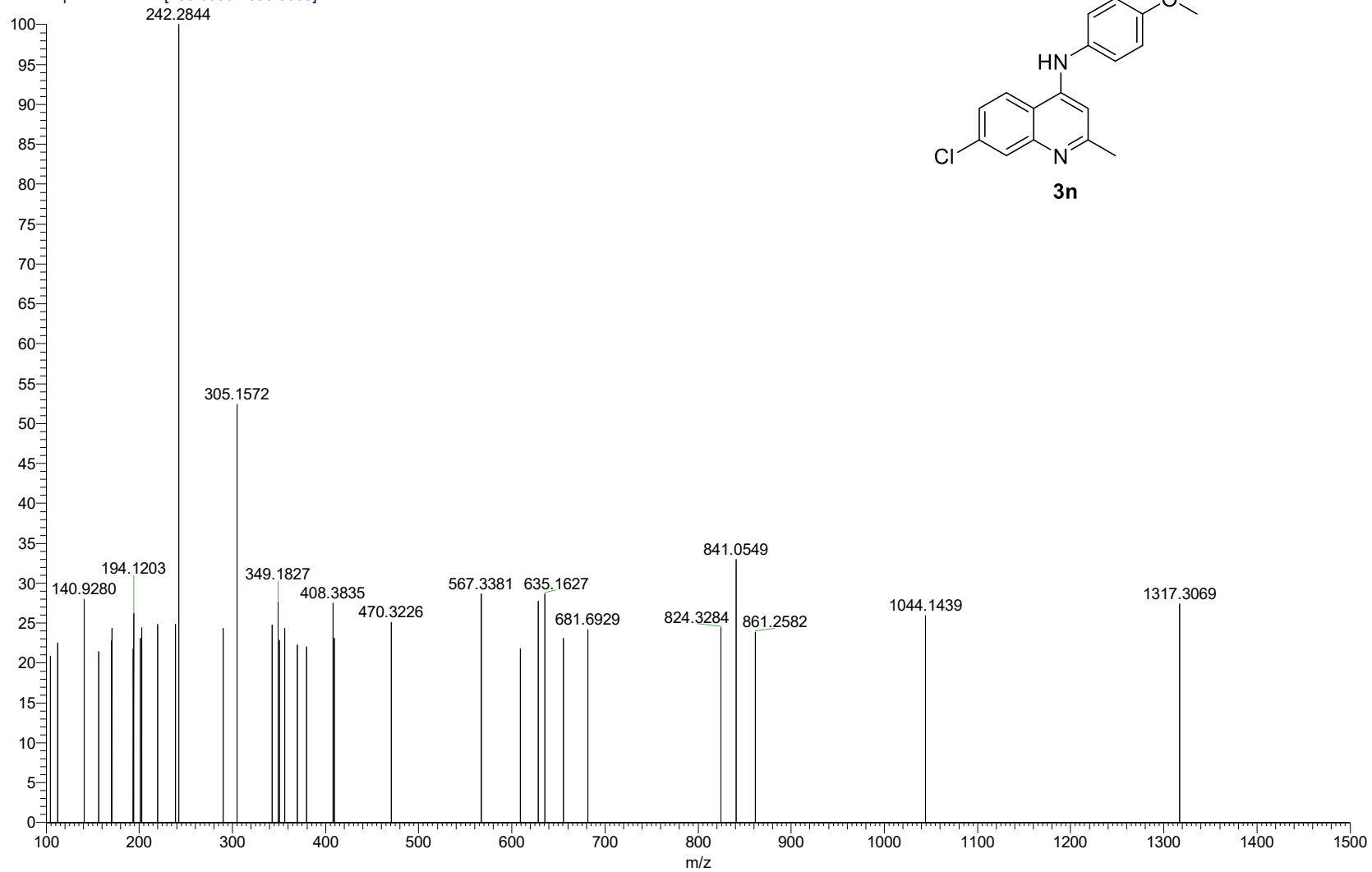
030-39 #56 RT: 0.31 AV: 1 NL: 2.06E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



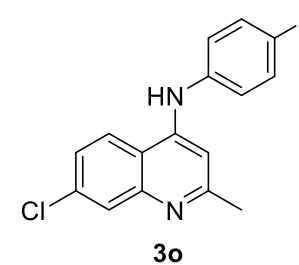
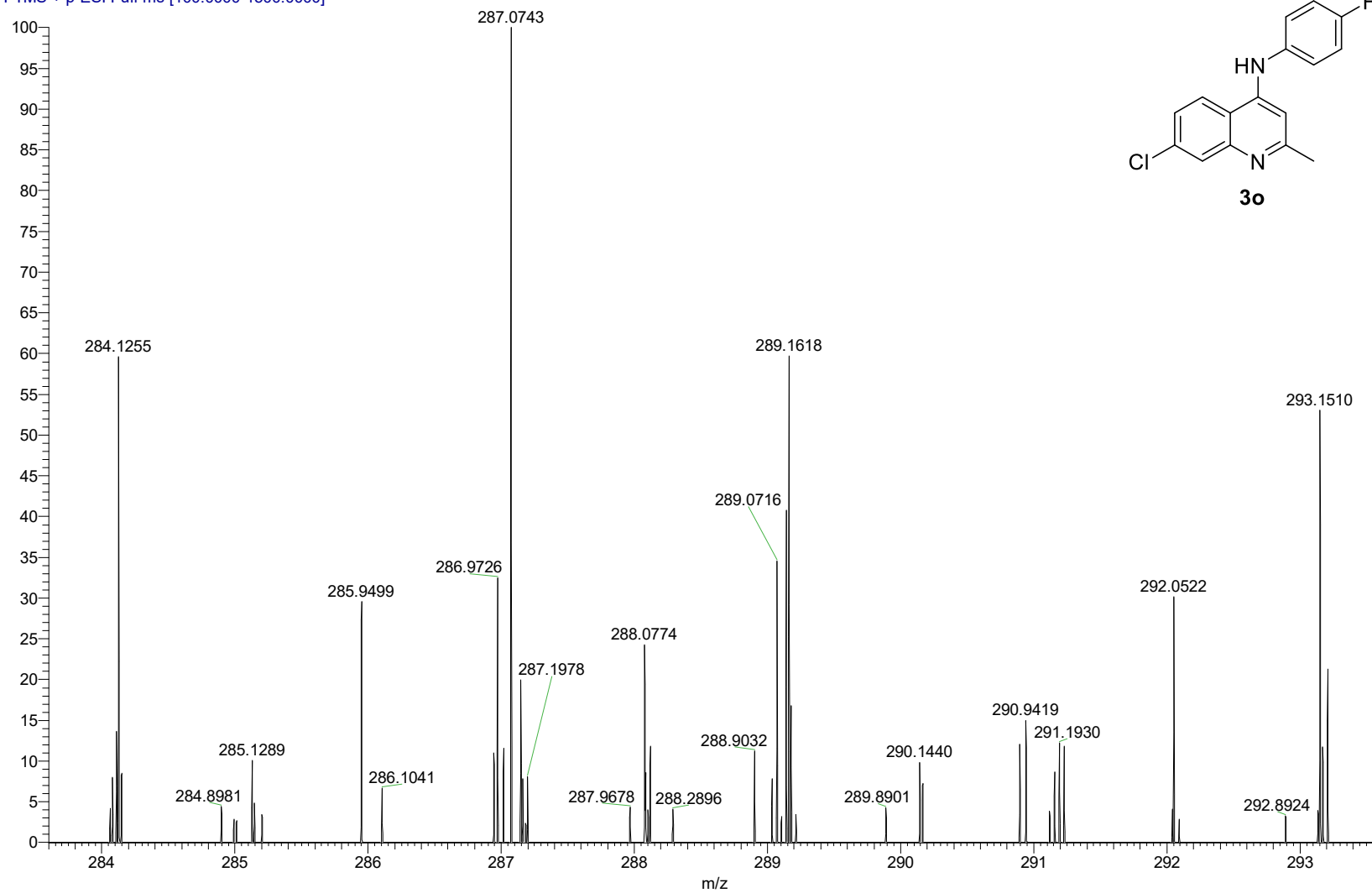
030-39 #107 RT: 0.58 AV: 1 NL: 3.79E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



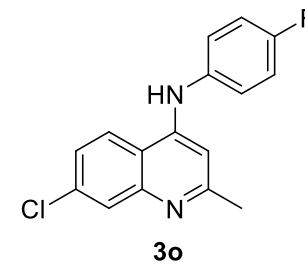
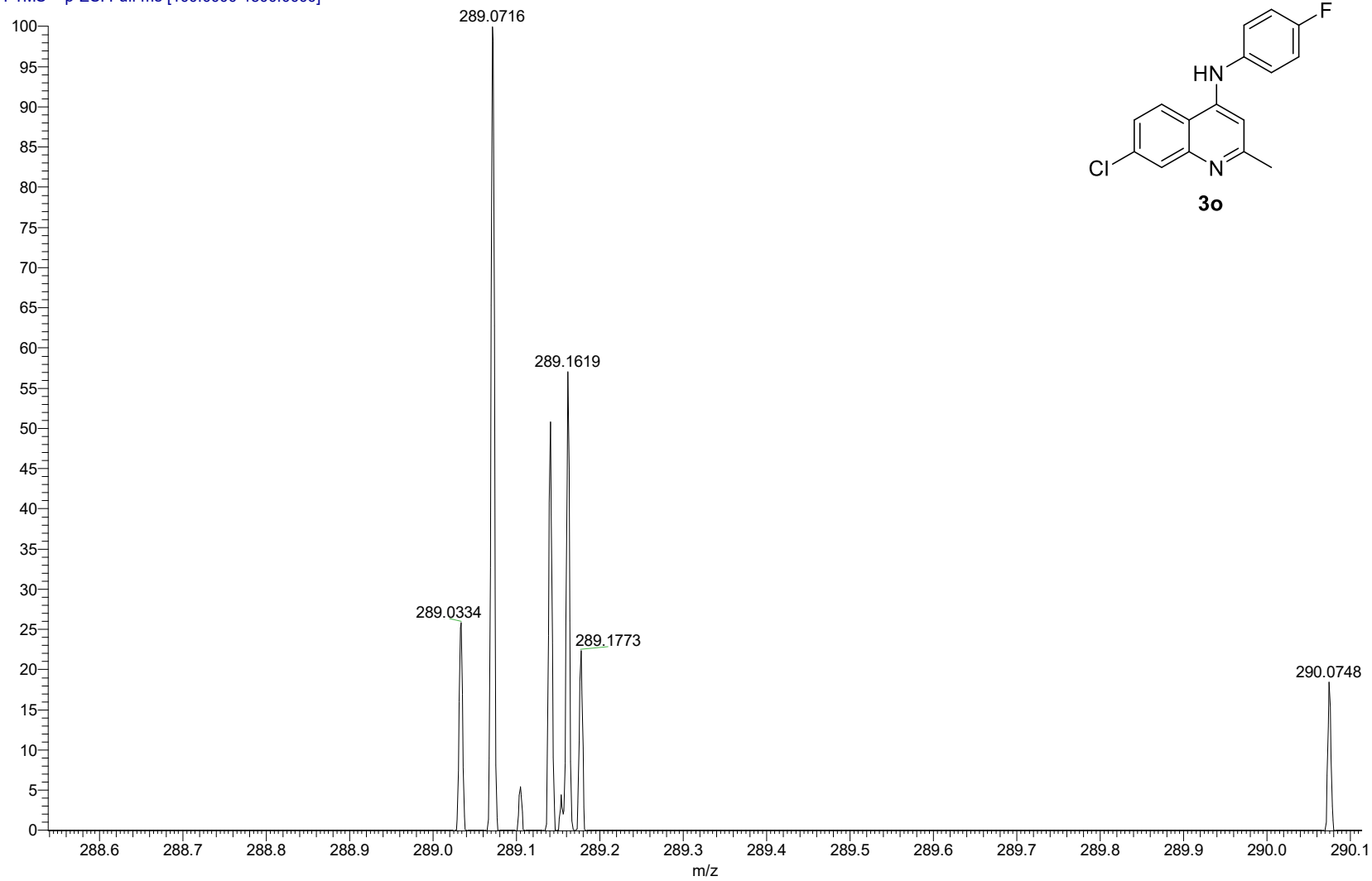
030-39 #1 RT: 0.00 AV: 1 NL: 1.15E3
T: FTMS + p ESI Full ms [100.0000-1500.0000]



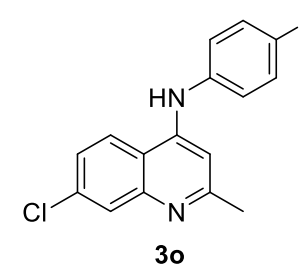
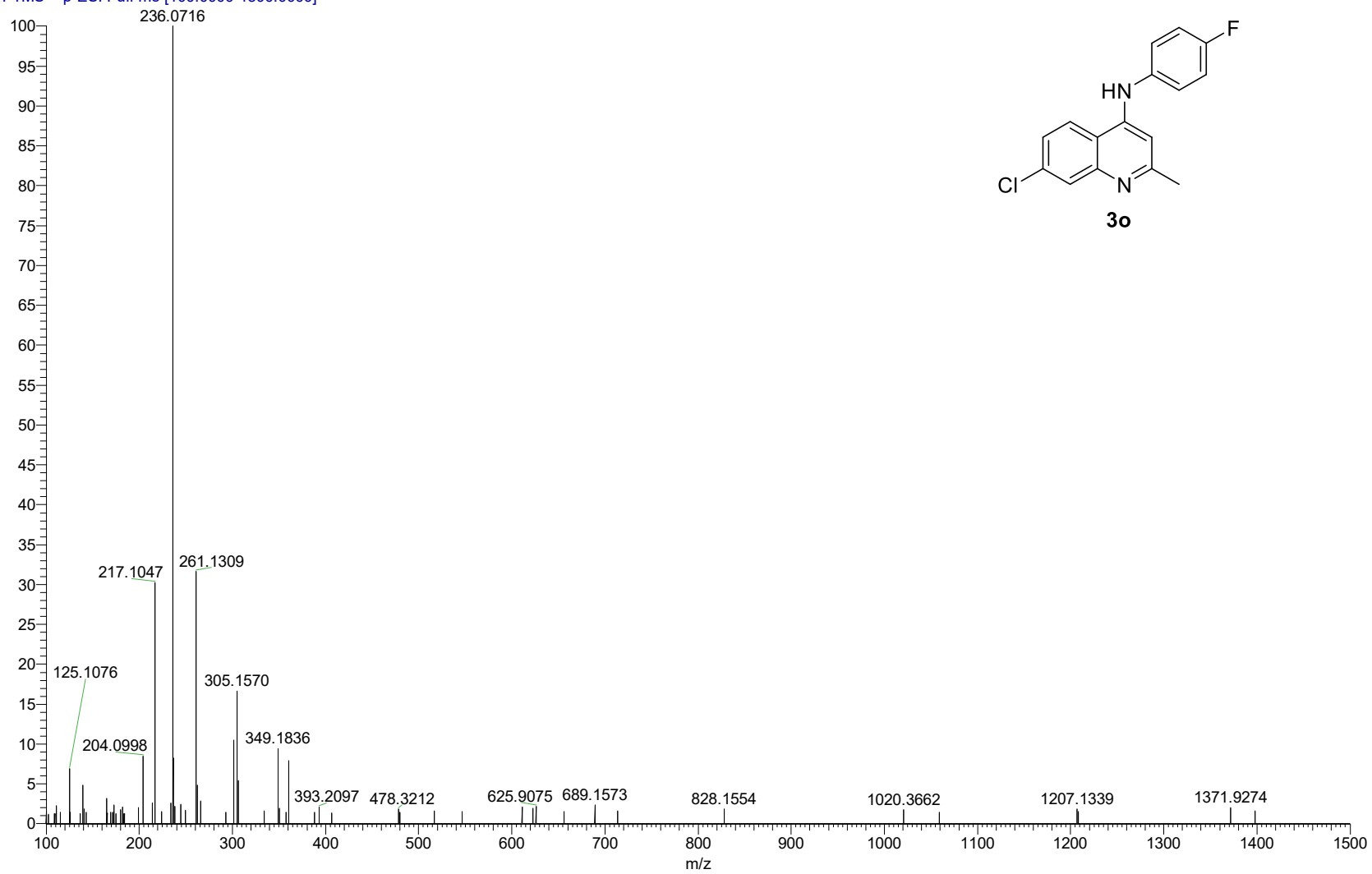
030-34 #78 RT: 0.43 AV: 1 NL: 1.01E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



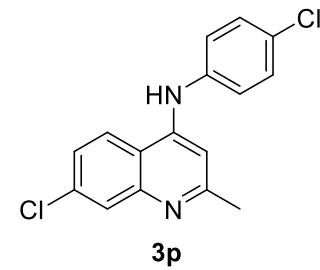
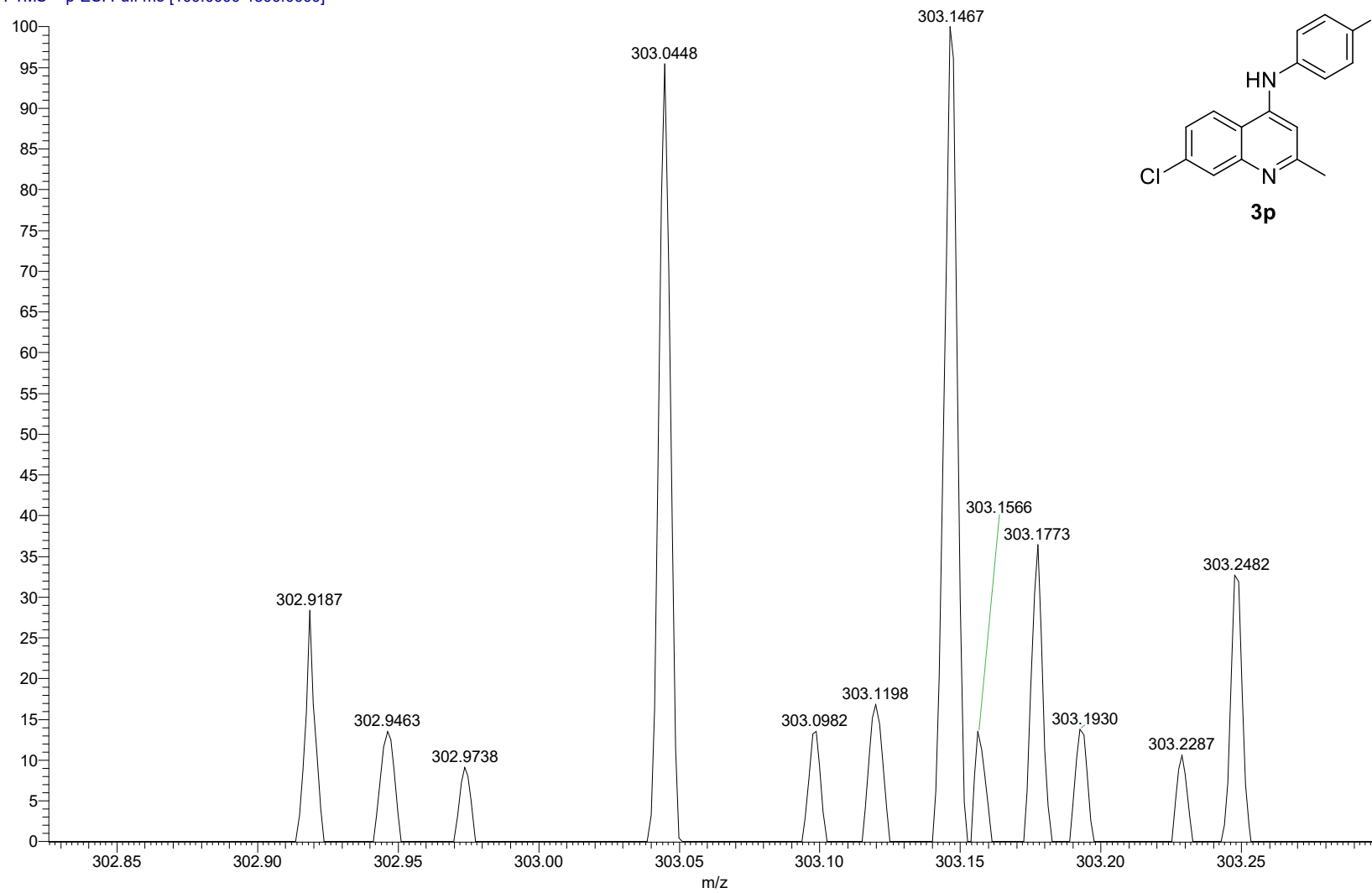
030-34 #62 RT: 0.35 AV: 1 NL: 9.36E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



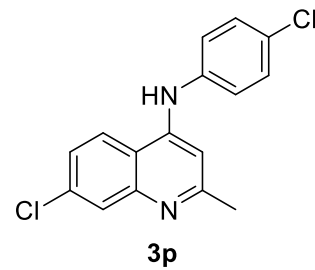
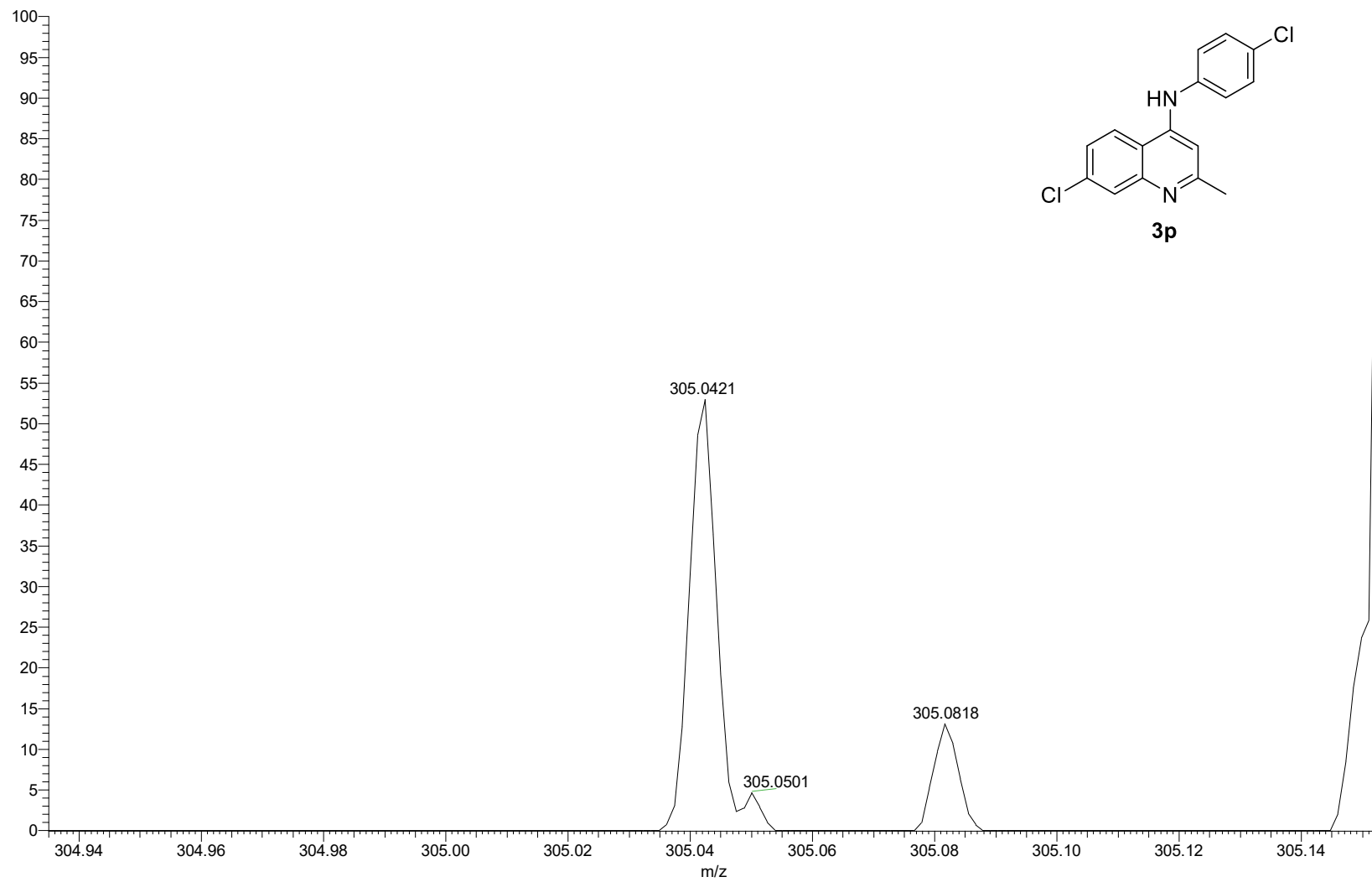
030-34 #1 RT: 0.00 AV: 1 NL: 1.98E4
T: FTMS + p ESI Full ms [100.0000-1500.0000]



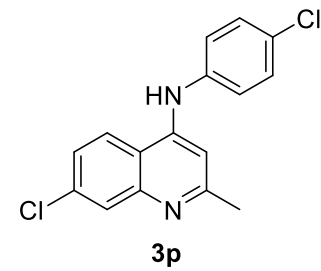
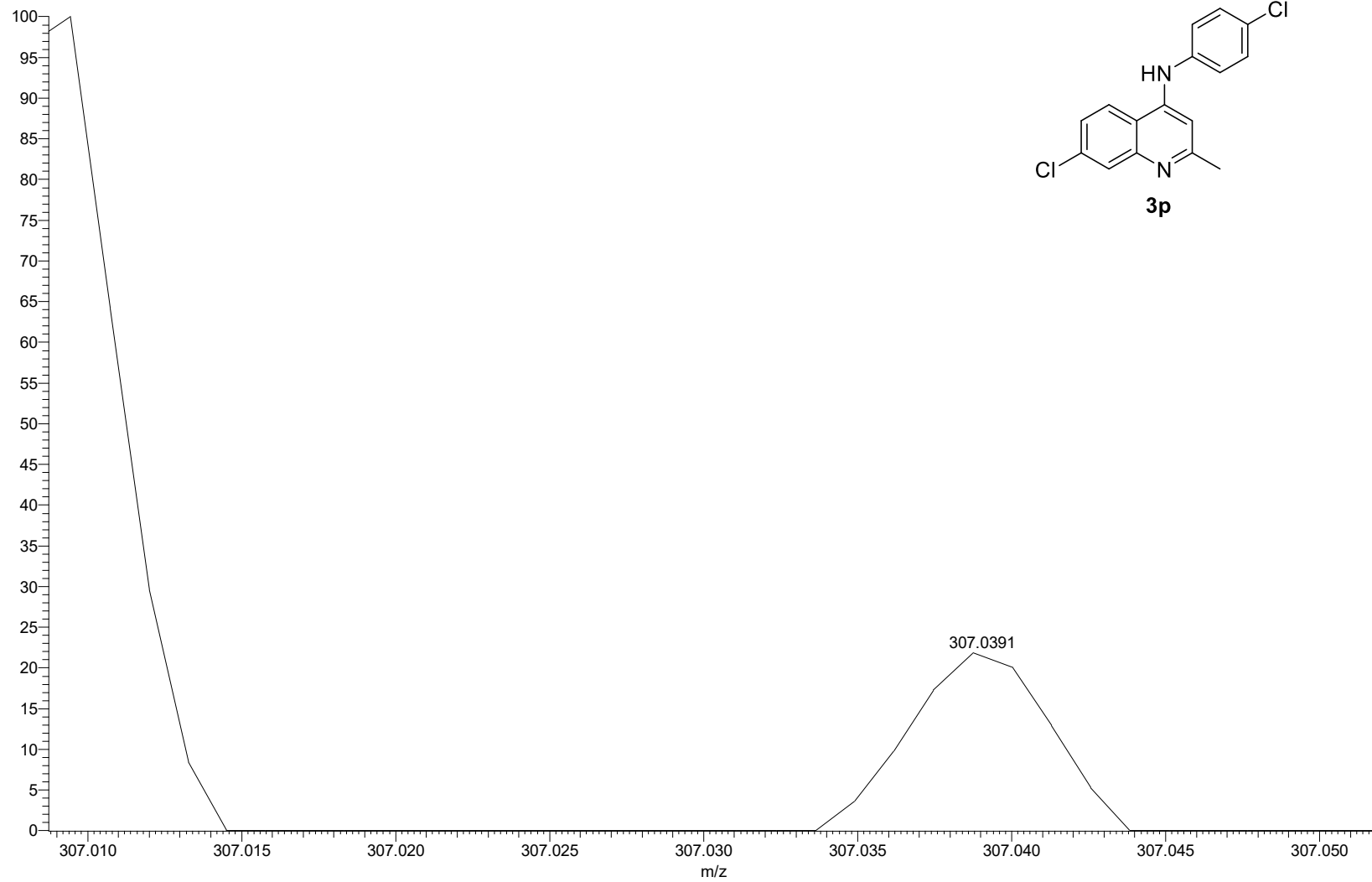
030-45 #107 RT: 0.56 AV: 1 NL: 2.98E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



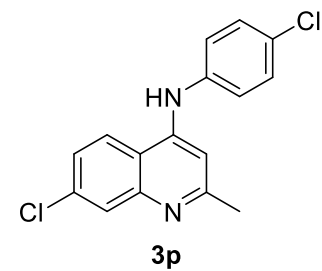
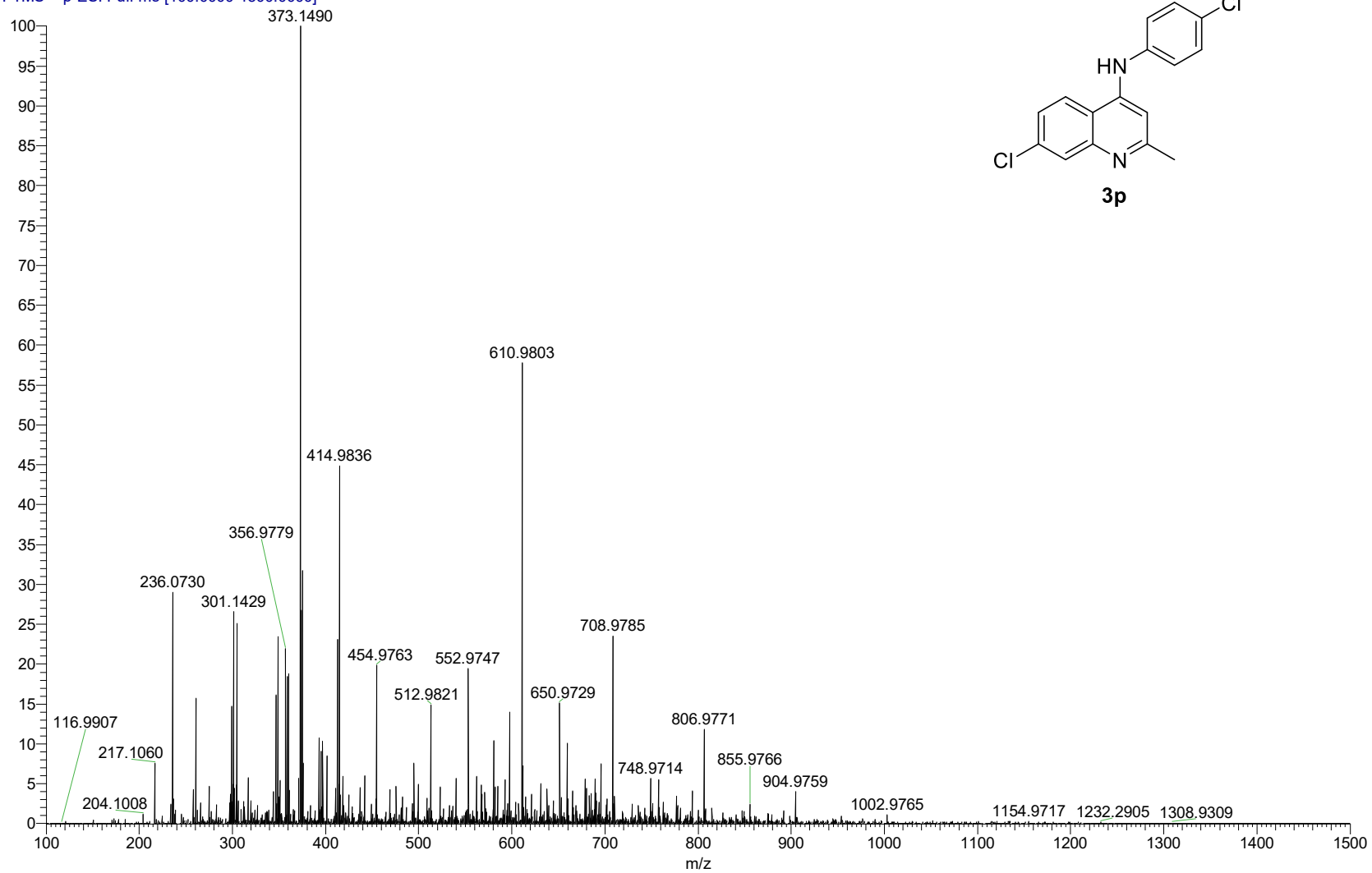
030-45 #81 RT: 0.42 AV: 1 NL: 1.04E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



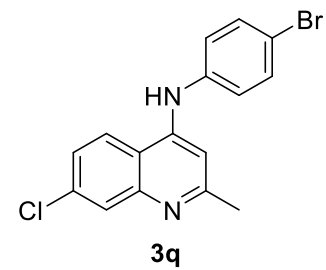
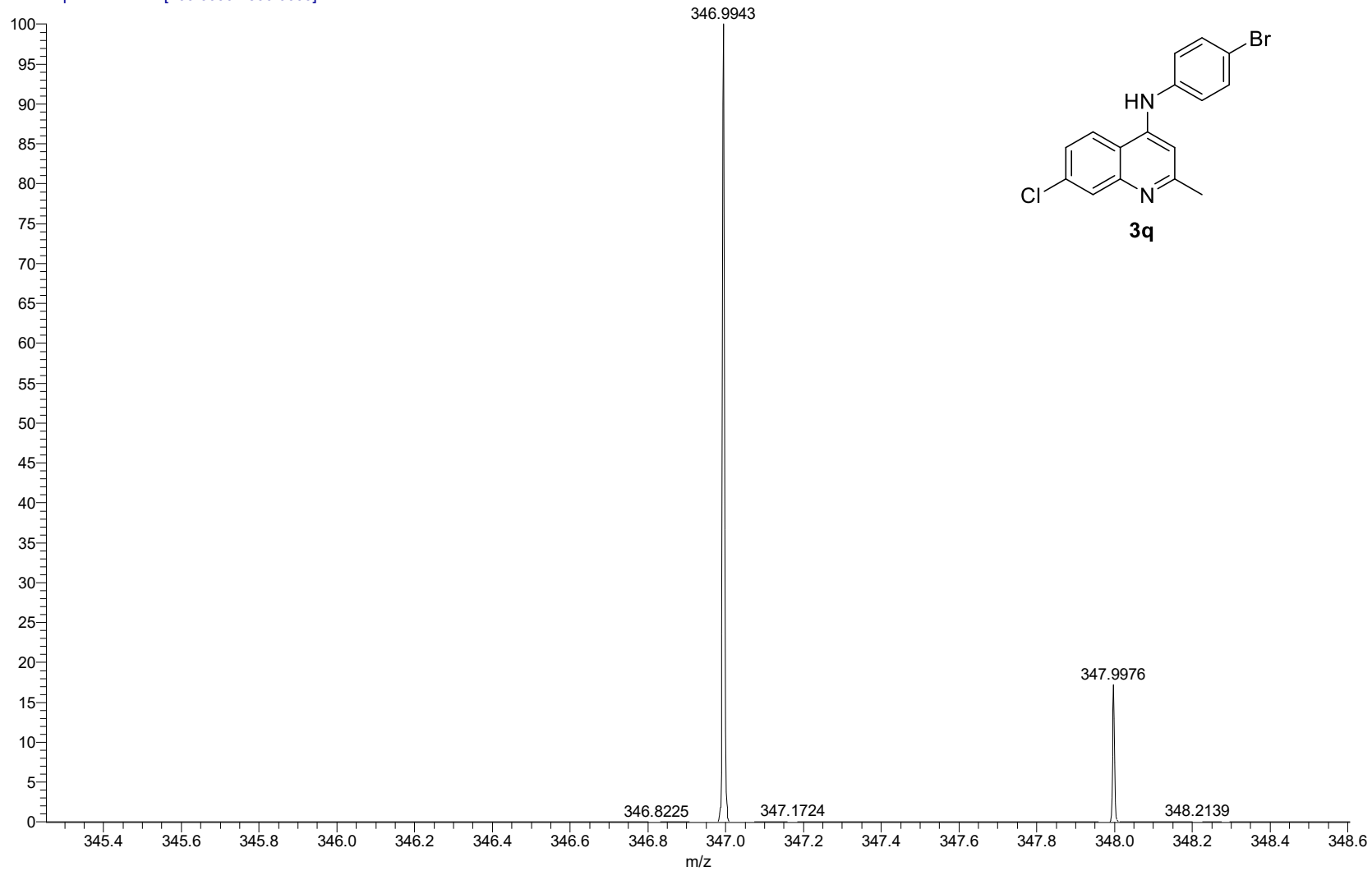
030-45 #95 RT: 0.50 AV: 1 NL: 2.16E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



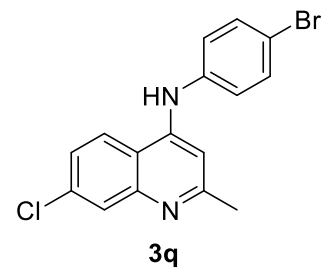
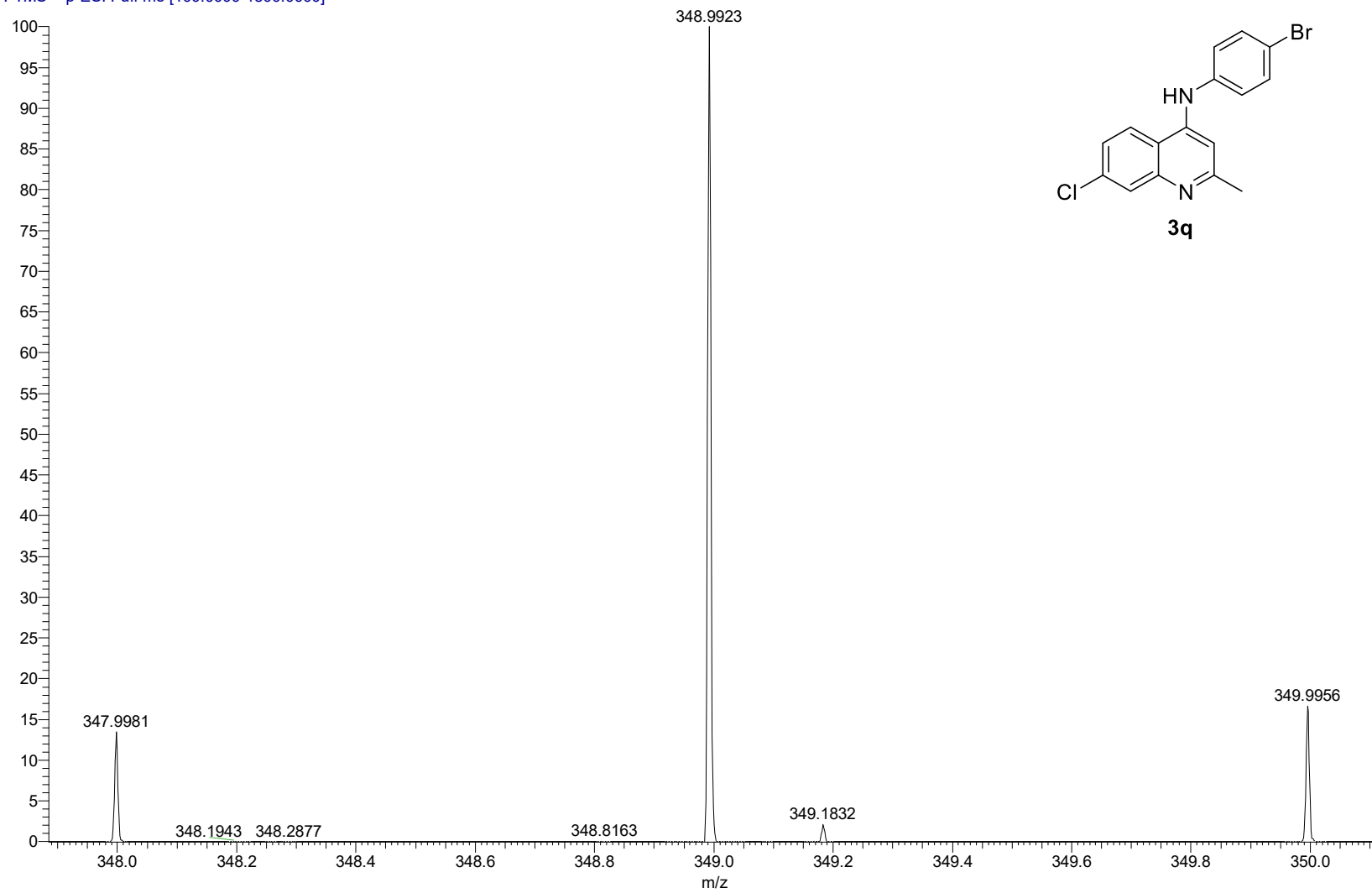
030-45 #1 RT: 0.00 AV: 1 NL: 3.59E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



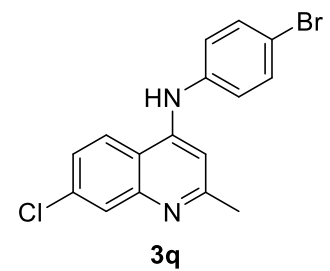
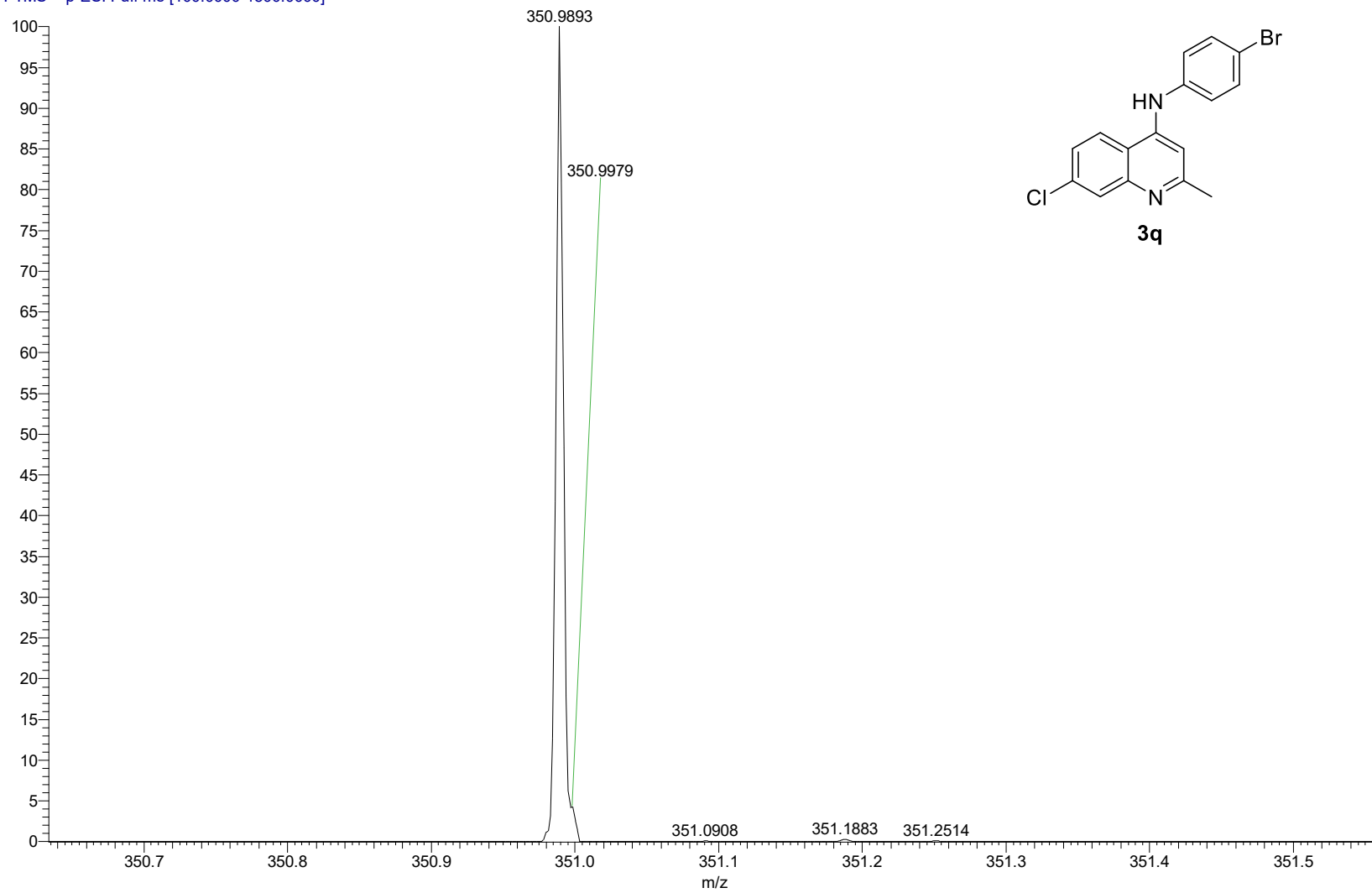
030-44 #63 RT: 0.34 AV: 1 NL: 3.40E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



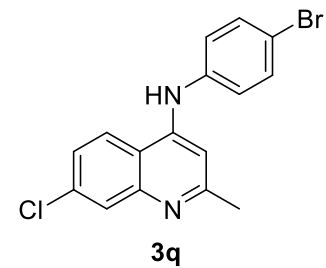
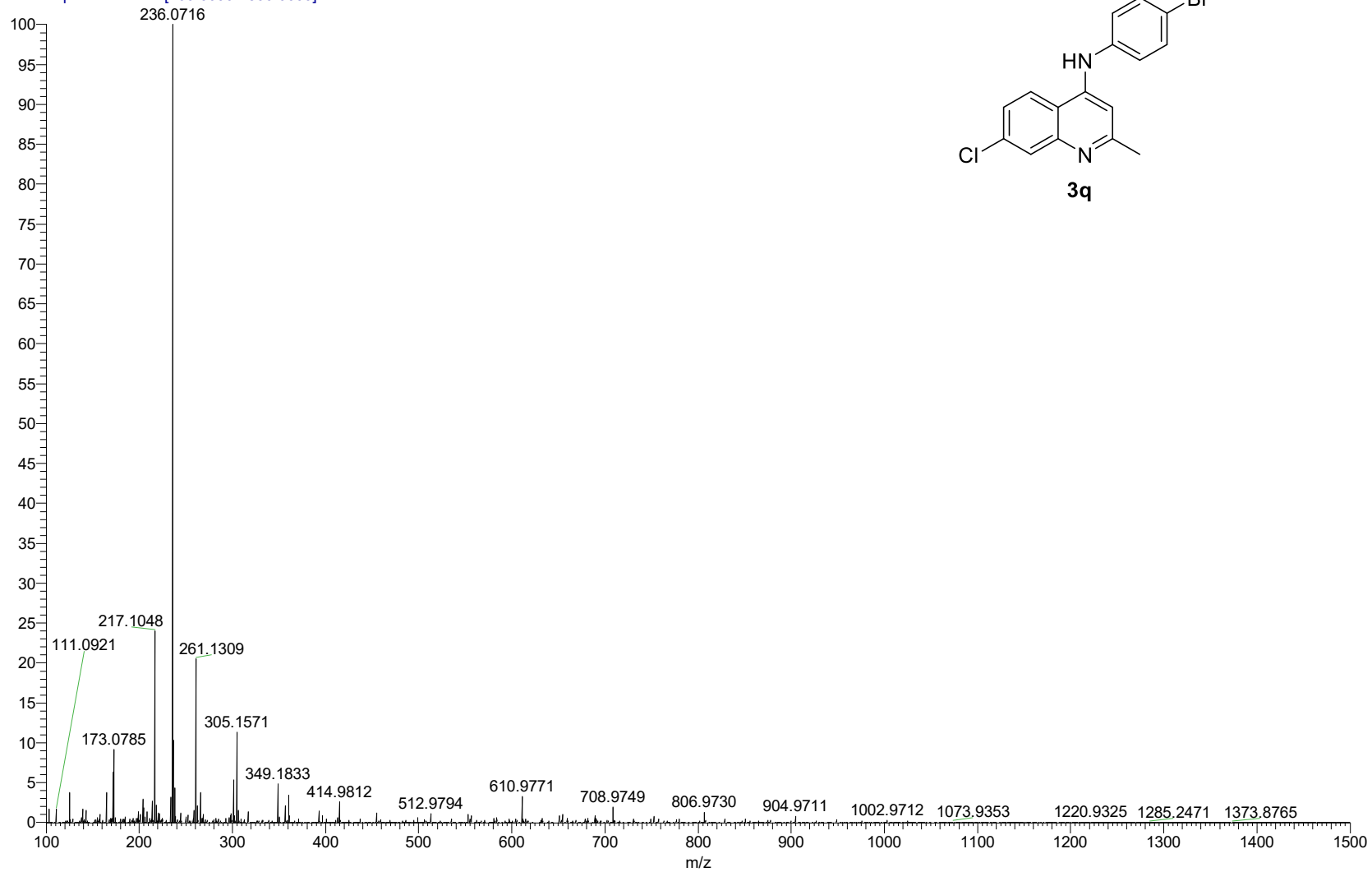
030-44 #161 RT: 0.85 AV: 1 NL: 3.11E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



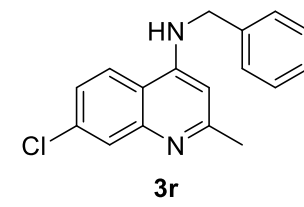
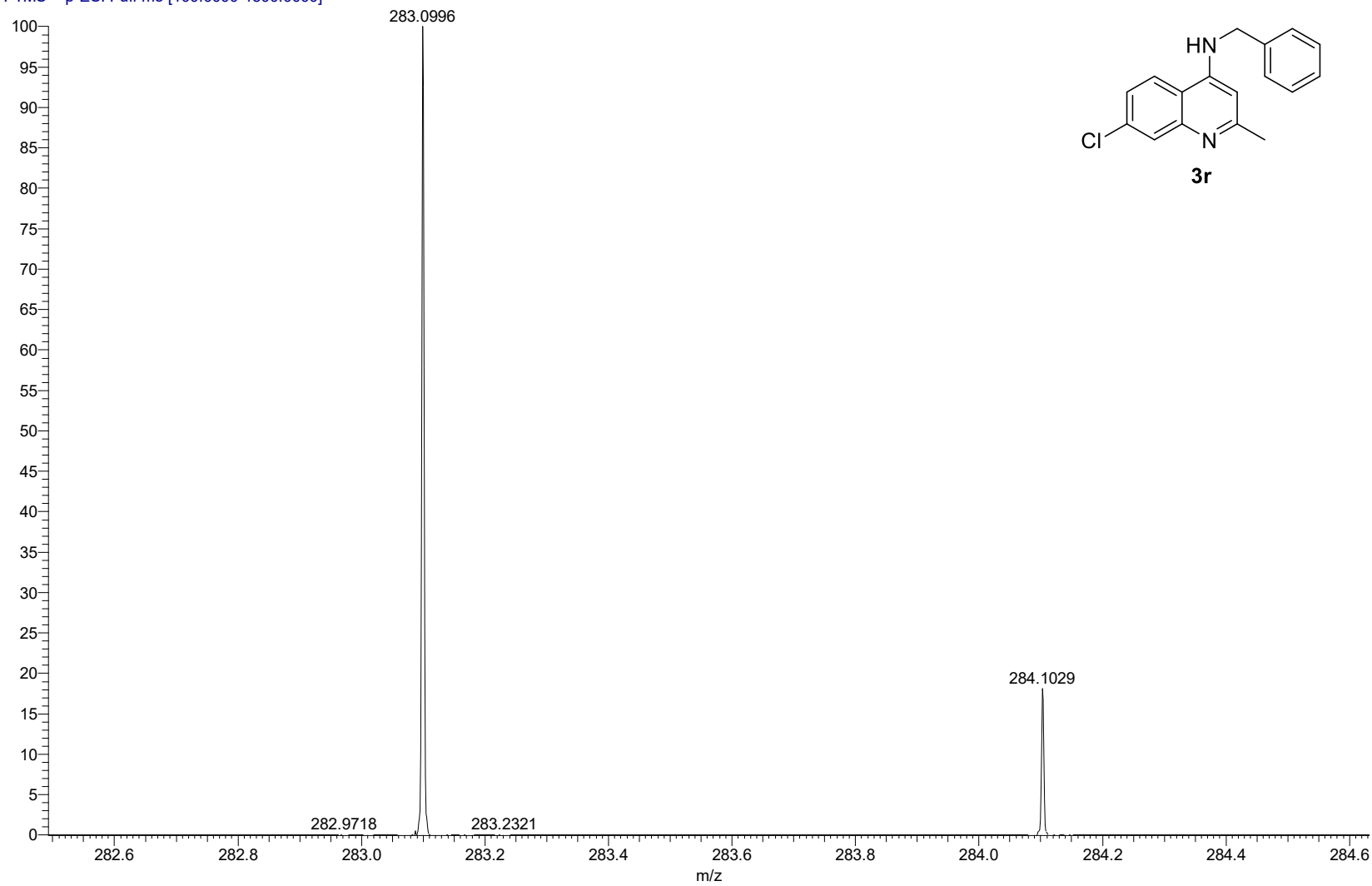
030-44 #153 RT: 0.81 AV: 1 NL: 9.95E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



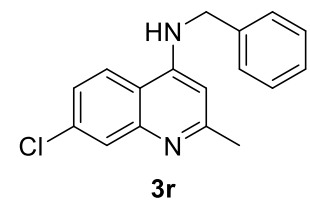
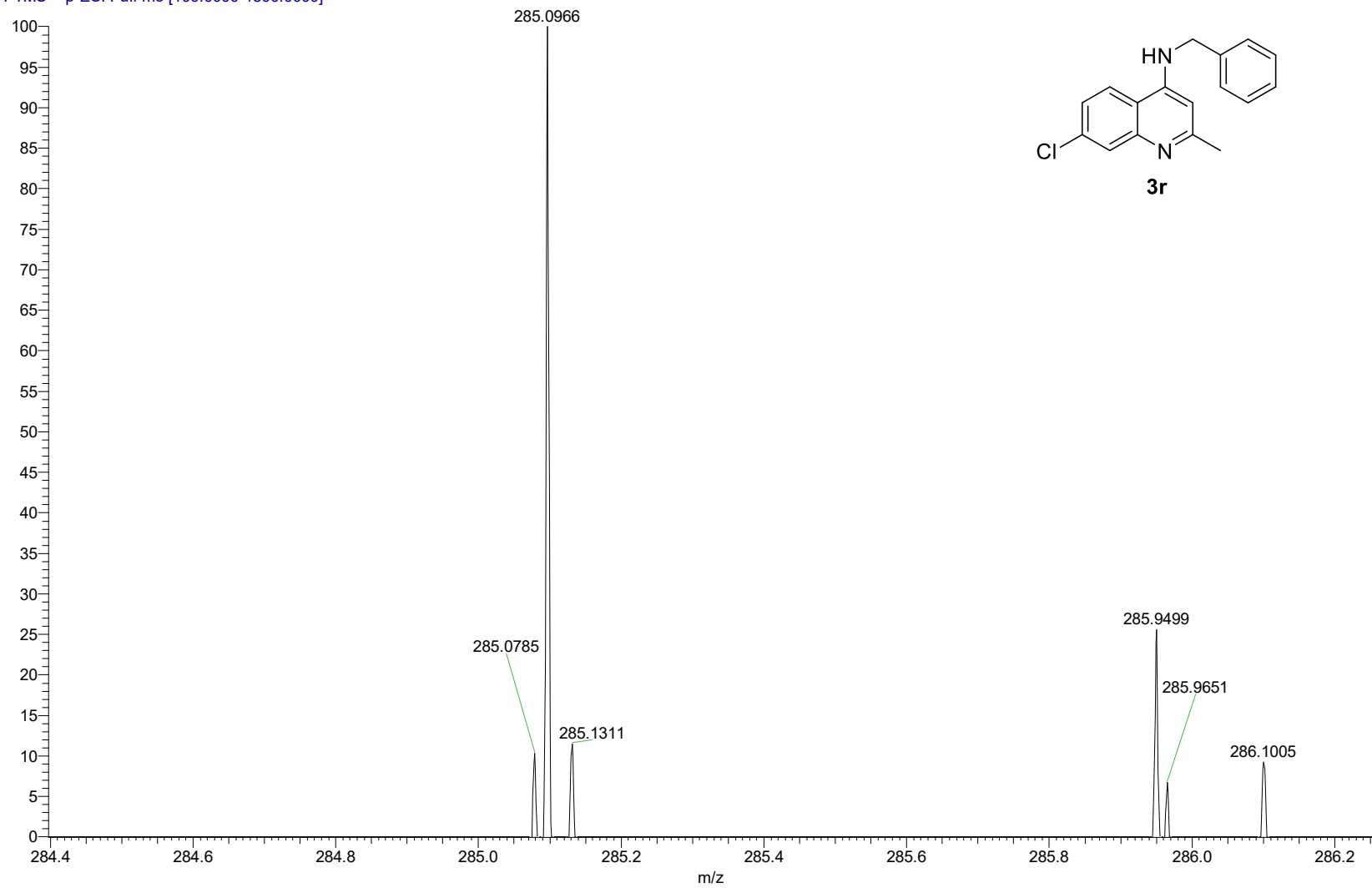
030-44 #1 RT: 0.00 AV: 1 NL: 4.97E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



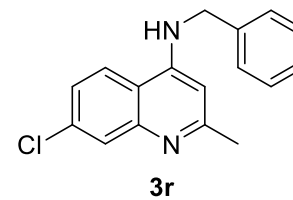
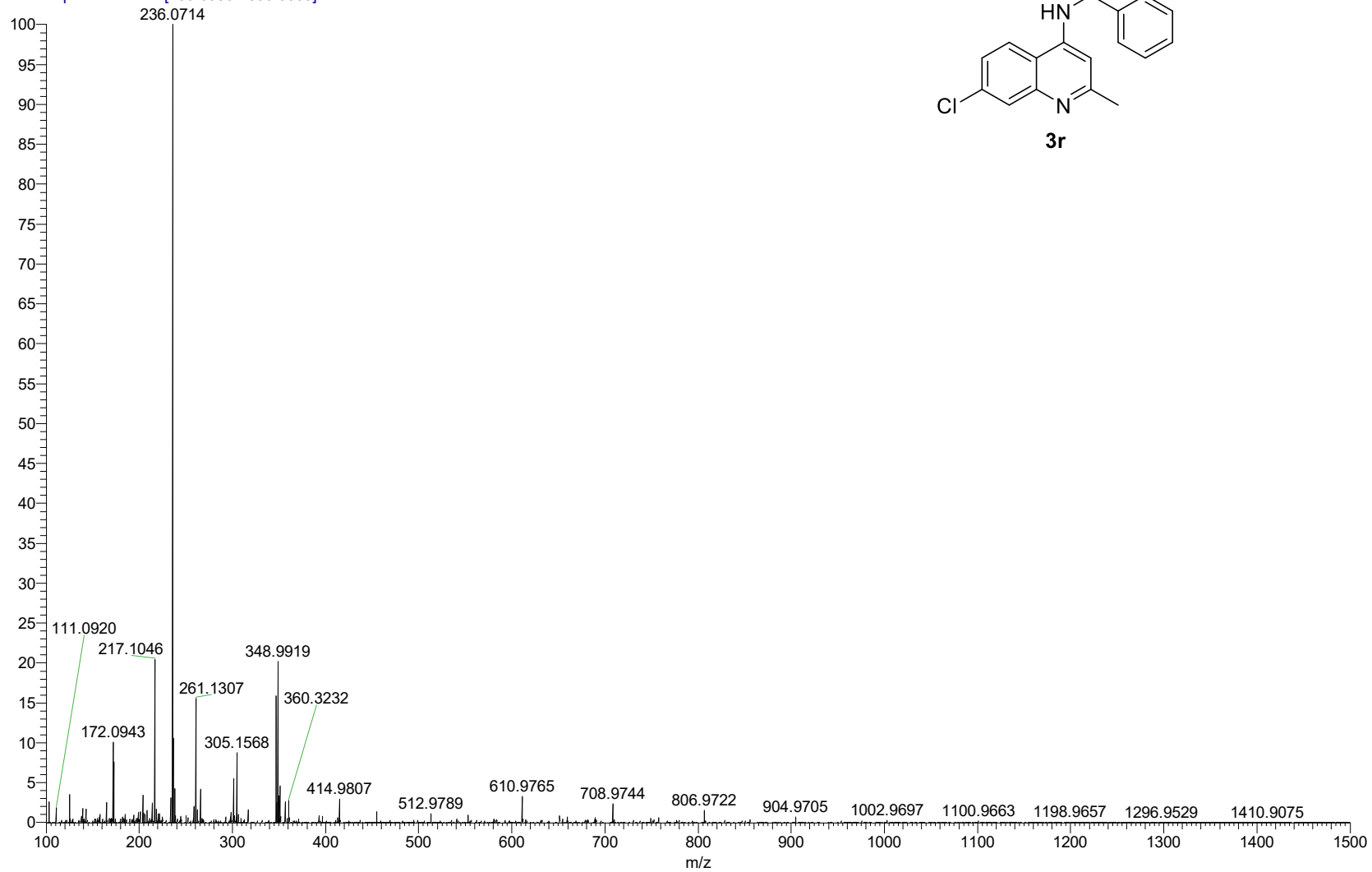
030-43 #105 RT: 0.55 AV: 1 NL: 7.16E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



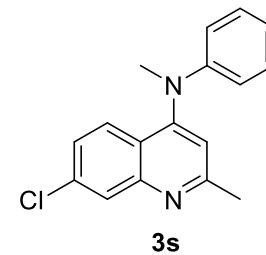
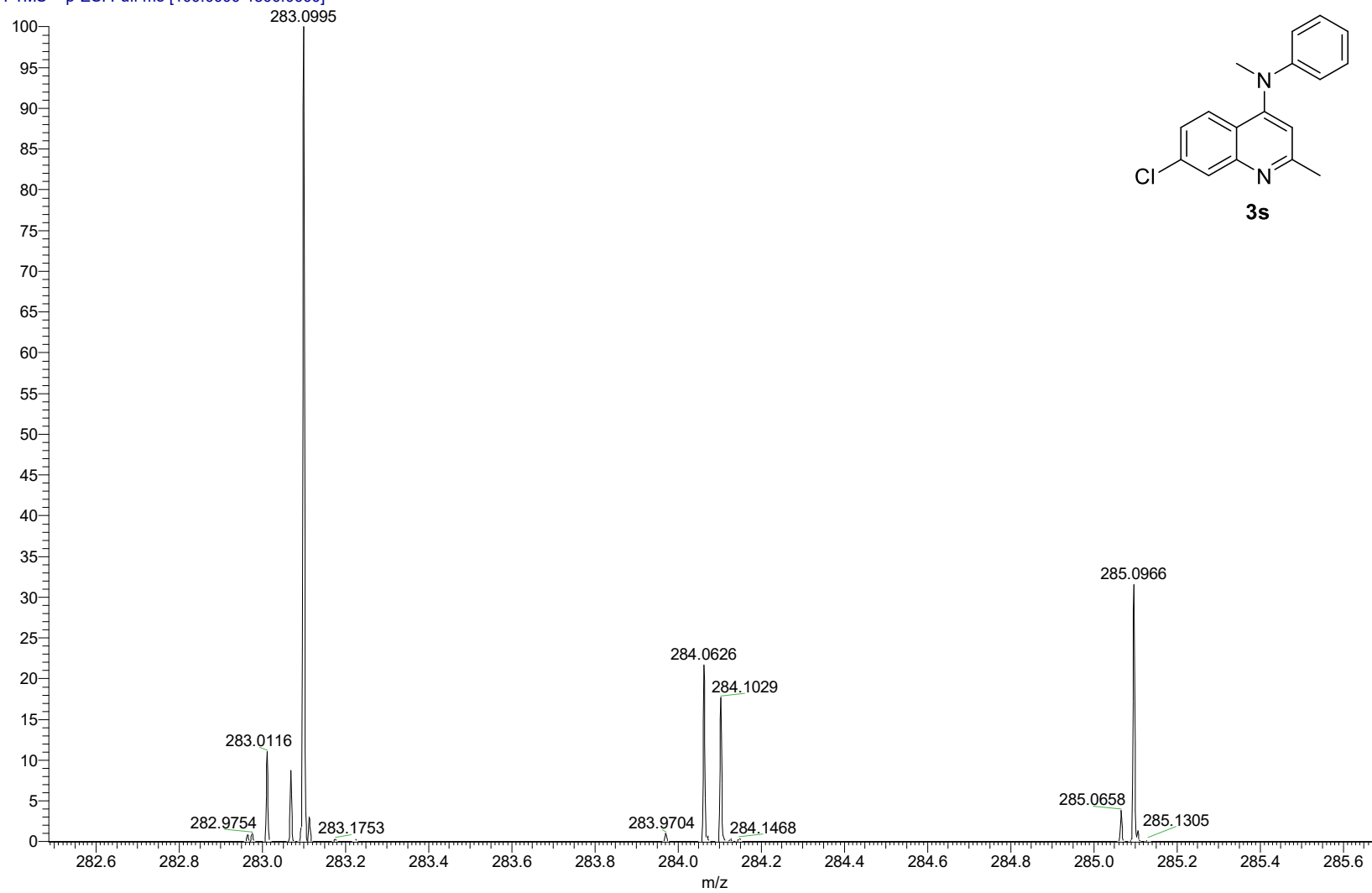
030-43 #43 RT: 0.23 AV: 1 NL: 3.73E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



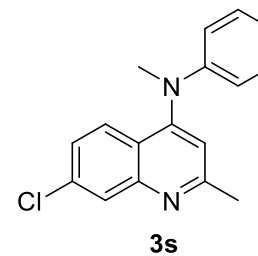
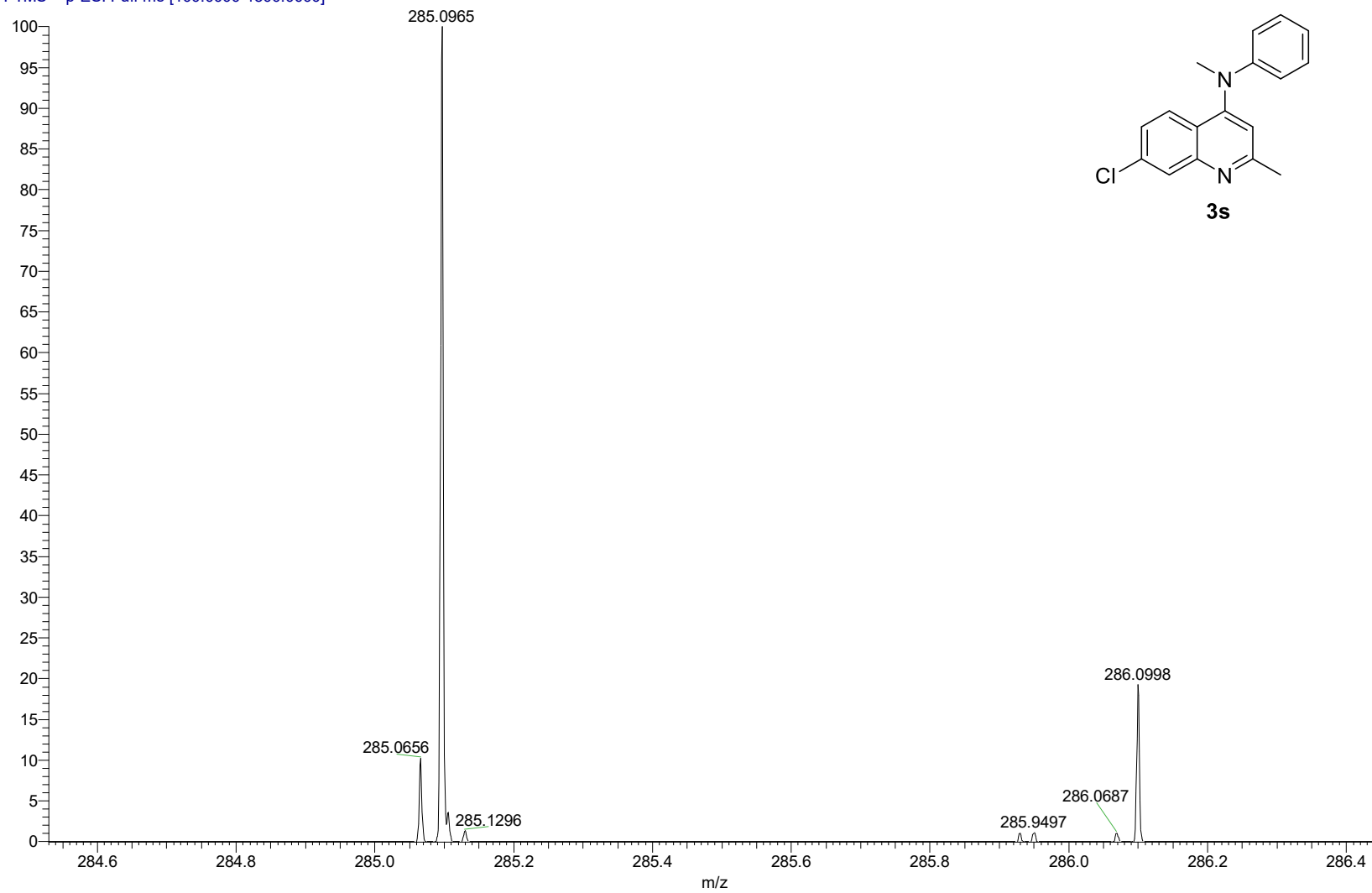
030-43 #1 RT: 0.00 AV: 1 NL: 8.75E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



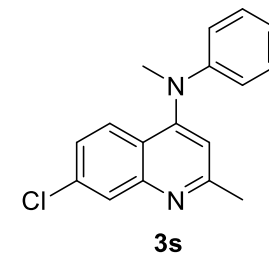
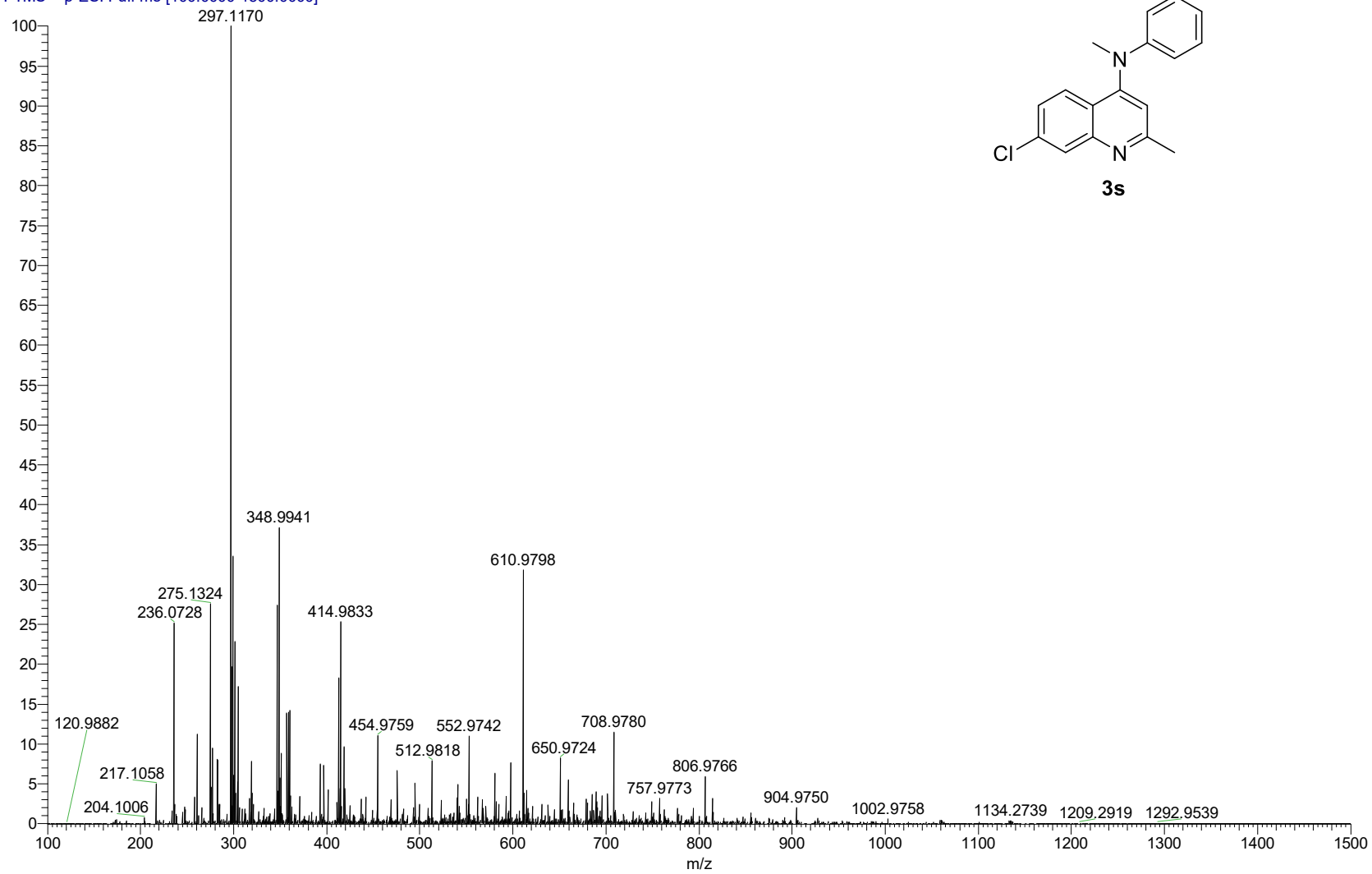
030-40 #142 RT: 0.74 AV: 1 NL: 1.16E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



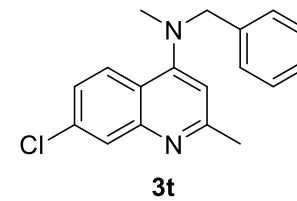
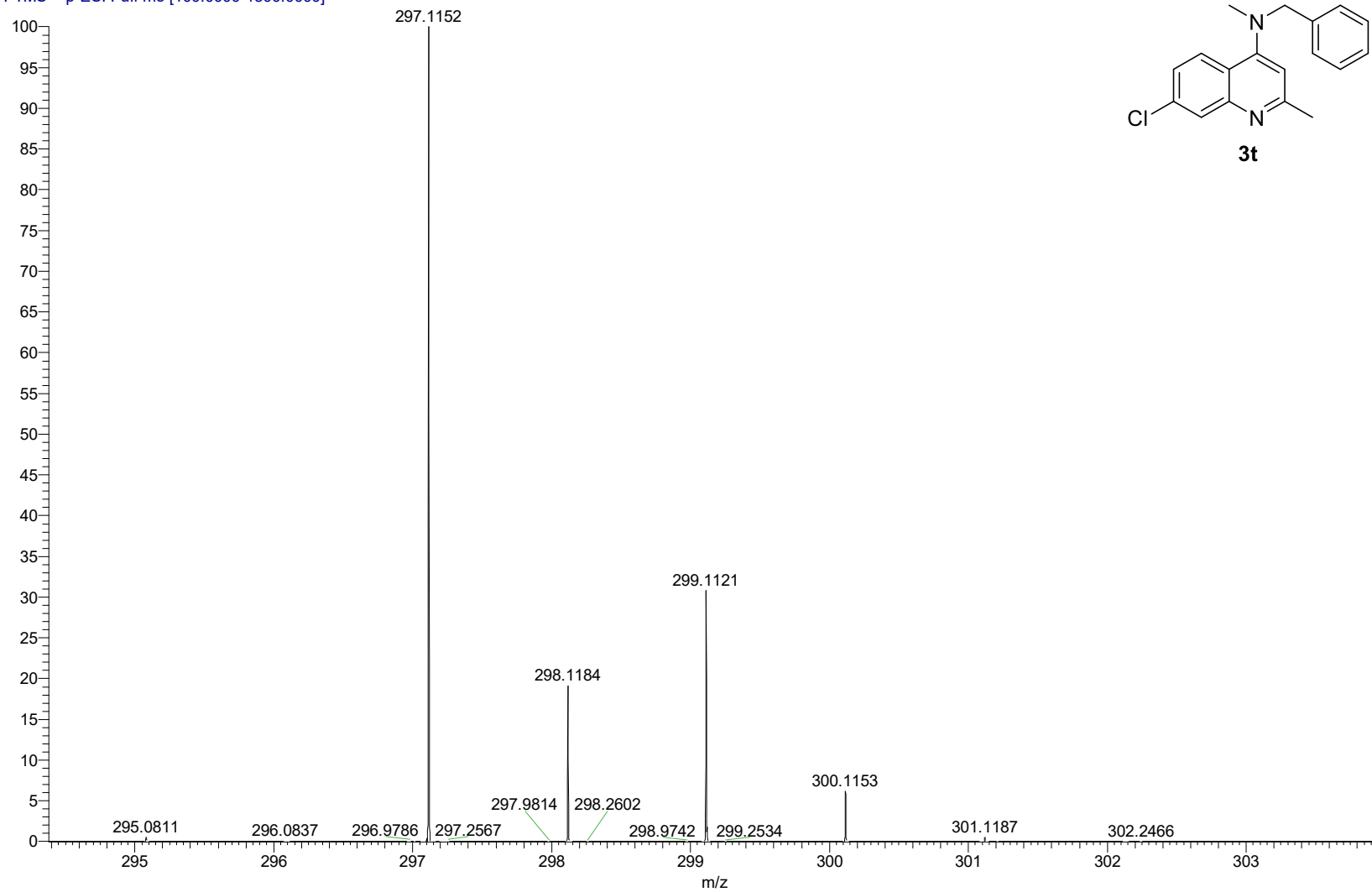
030-40 #162 RT: 0.85 AV: 1 NL: 3.78E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



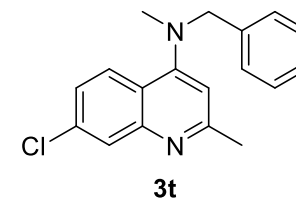
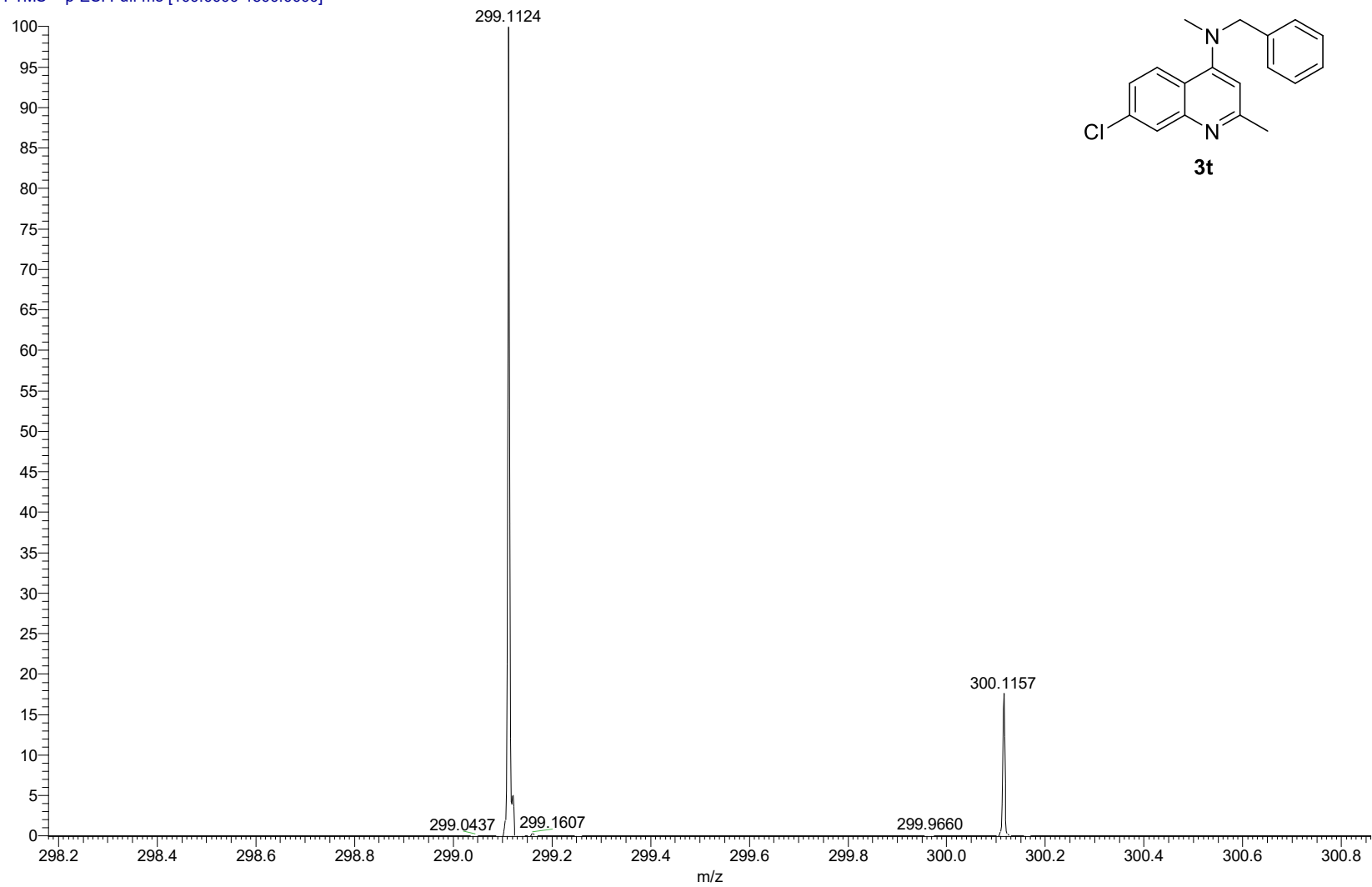
030-40 #1 RT: 0.00 AV: 1 NL: 5.52E6
T: FTMS + p ESI Full ms [100.0000-1500.0000]



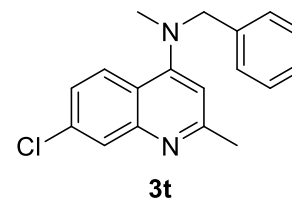
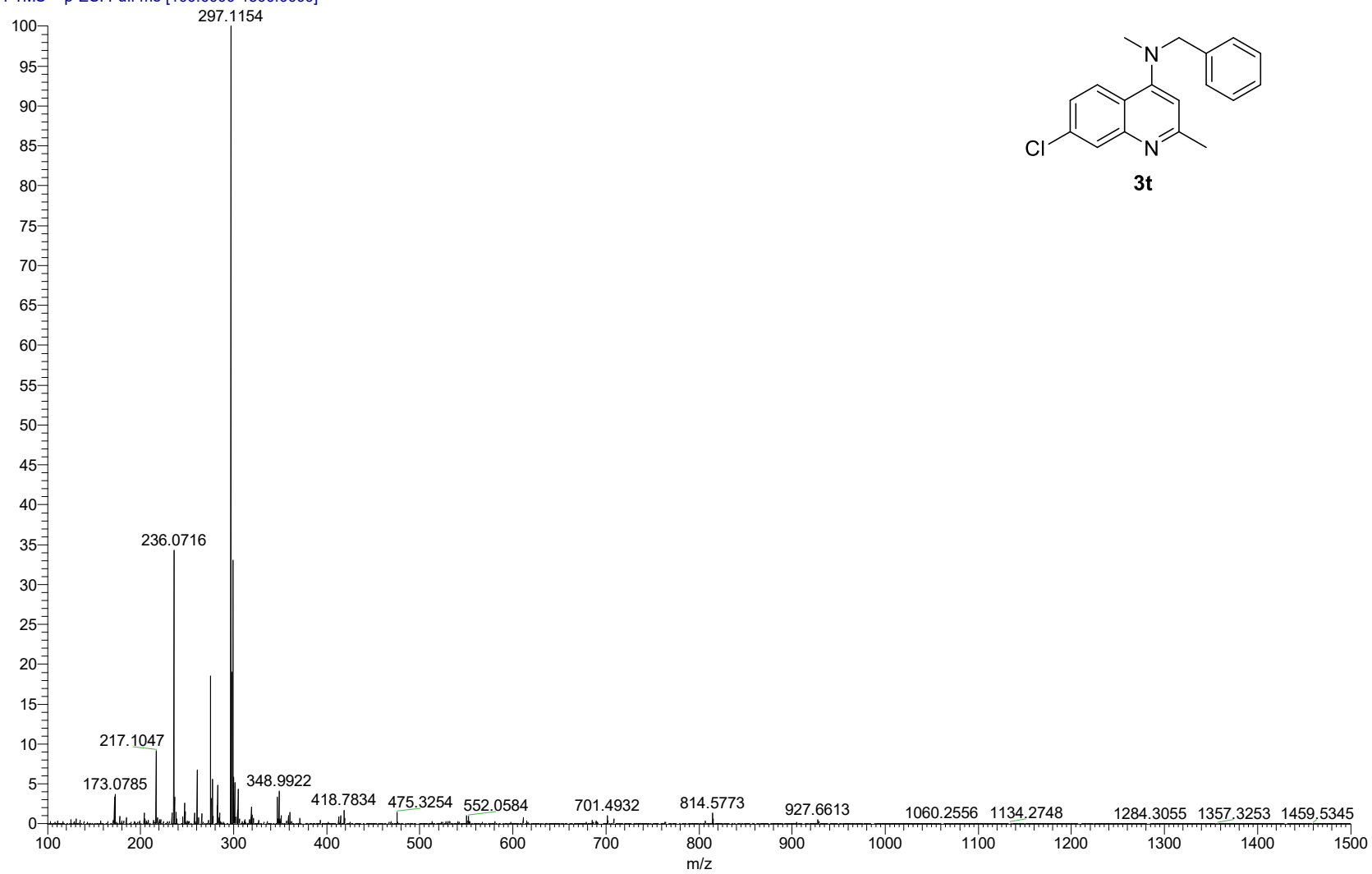
030-41 #64 RT: 0.35 AV: 1 NL: 1.09E10
T: FTMS + p ESI Full ms [100.0000-1500.0000]



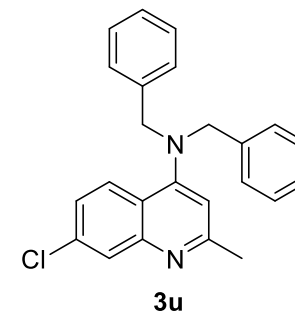
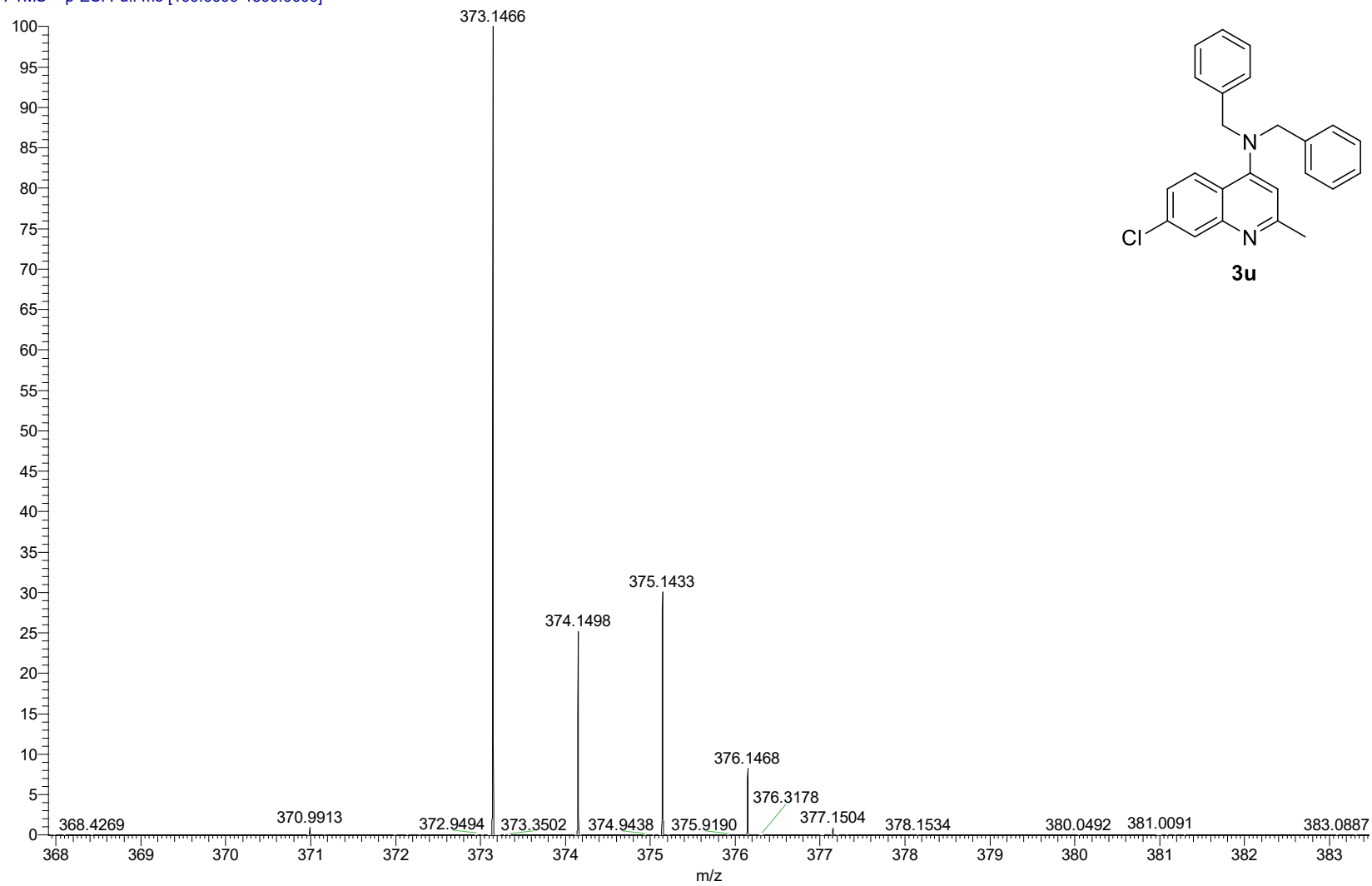
030-41 #53 RT: 0.29 AV: 1 NL: 1.58E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



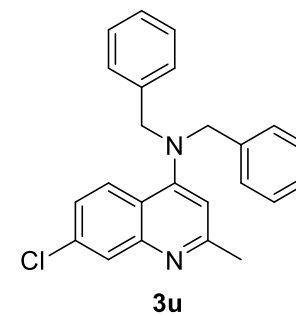
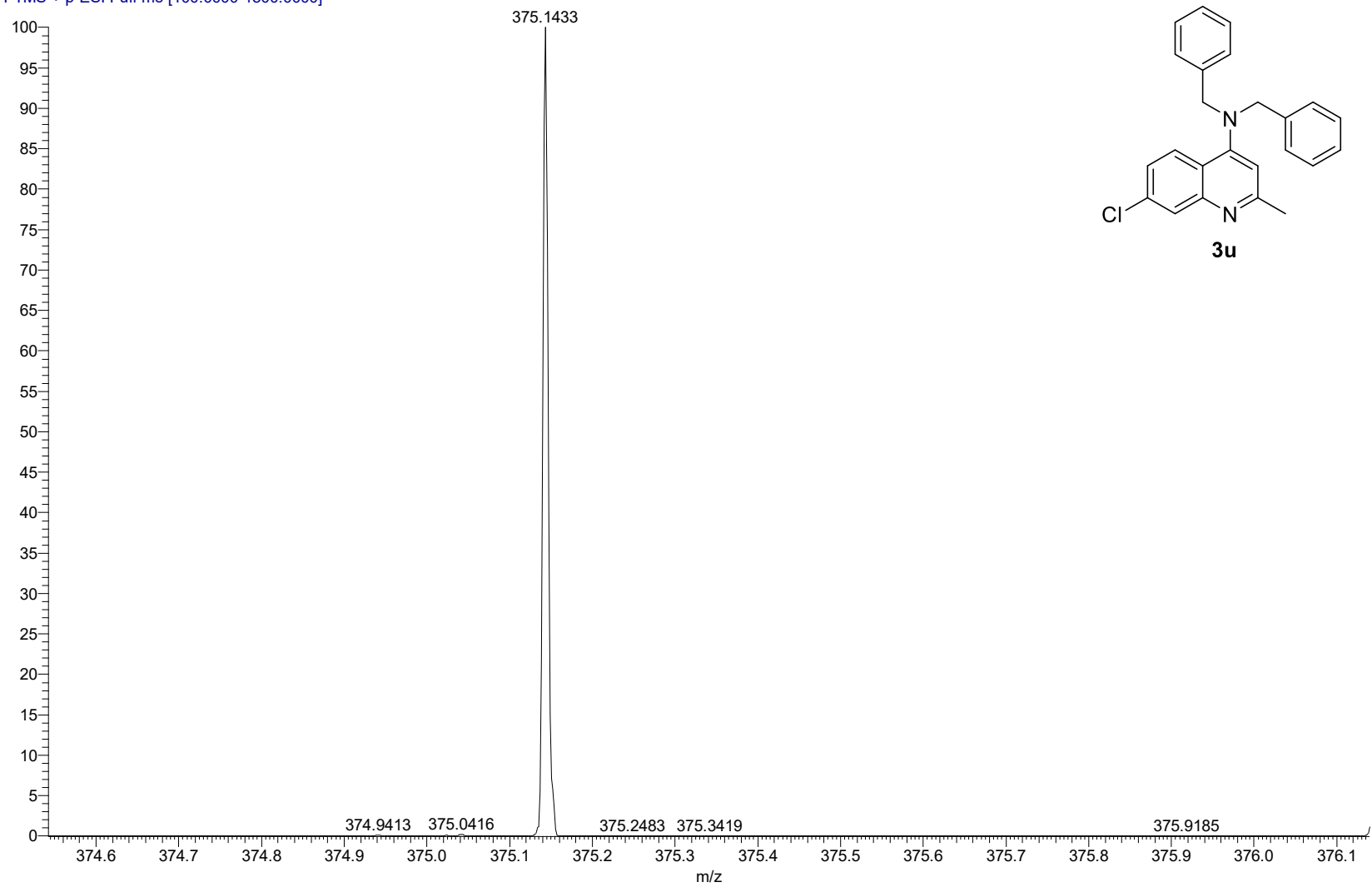
030-41 #53 RT: 0.29 AV: 1 NL: 4.77E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



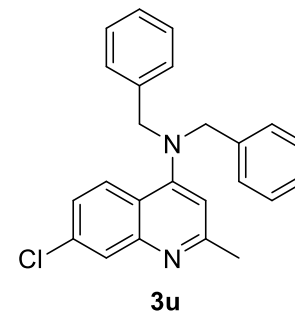
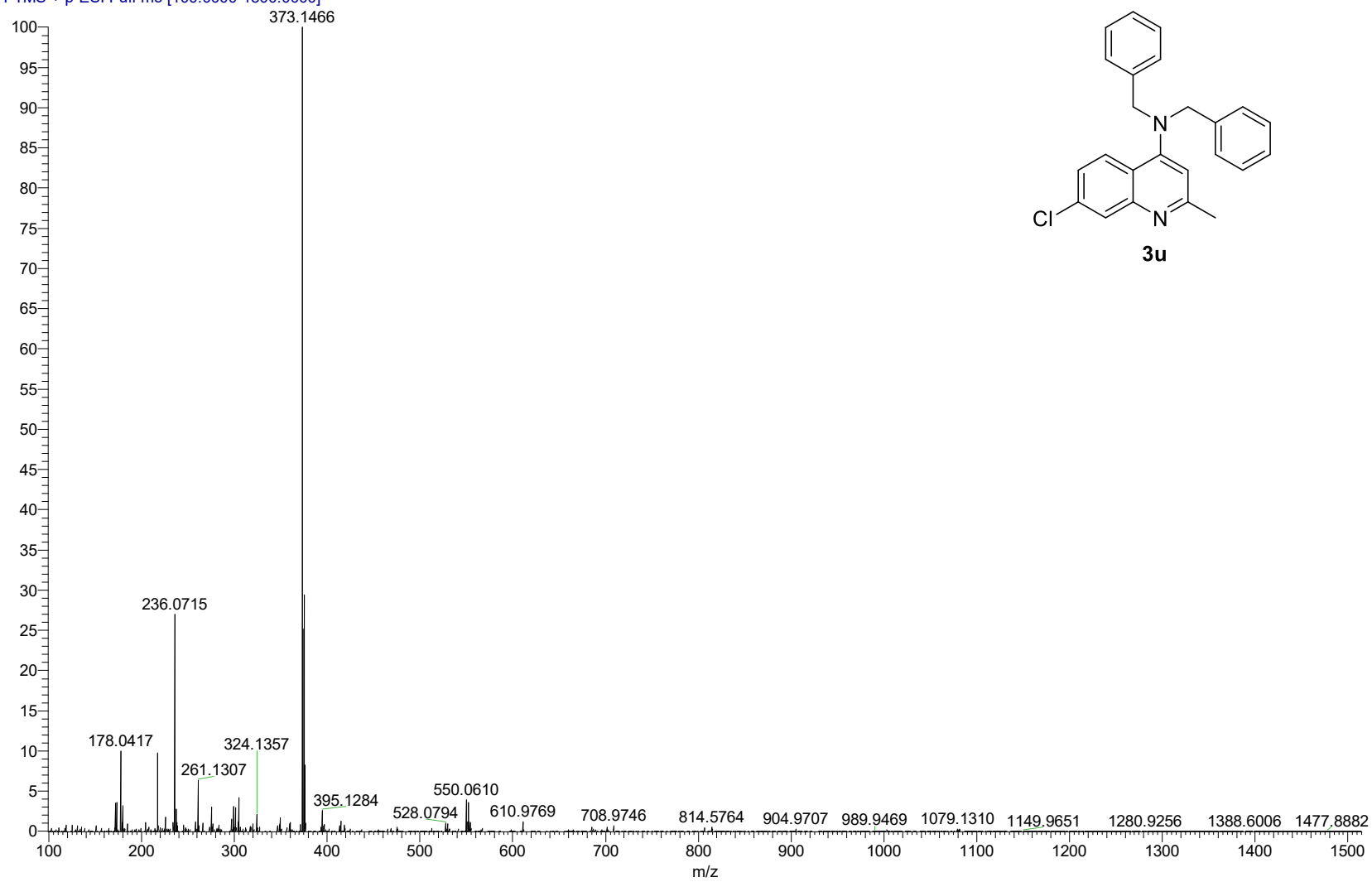
030-50 #48 RT: 0.26 AV: 1 NL: 3.67E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



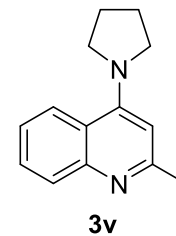
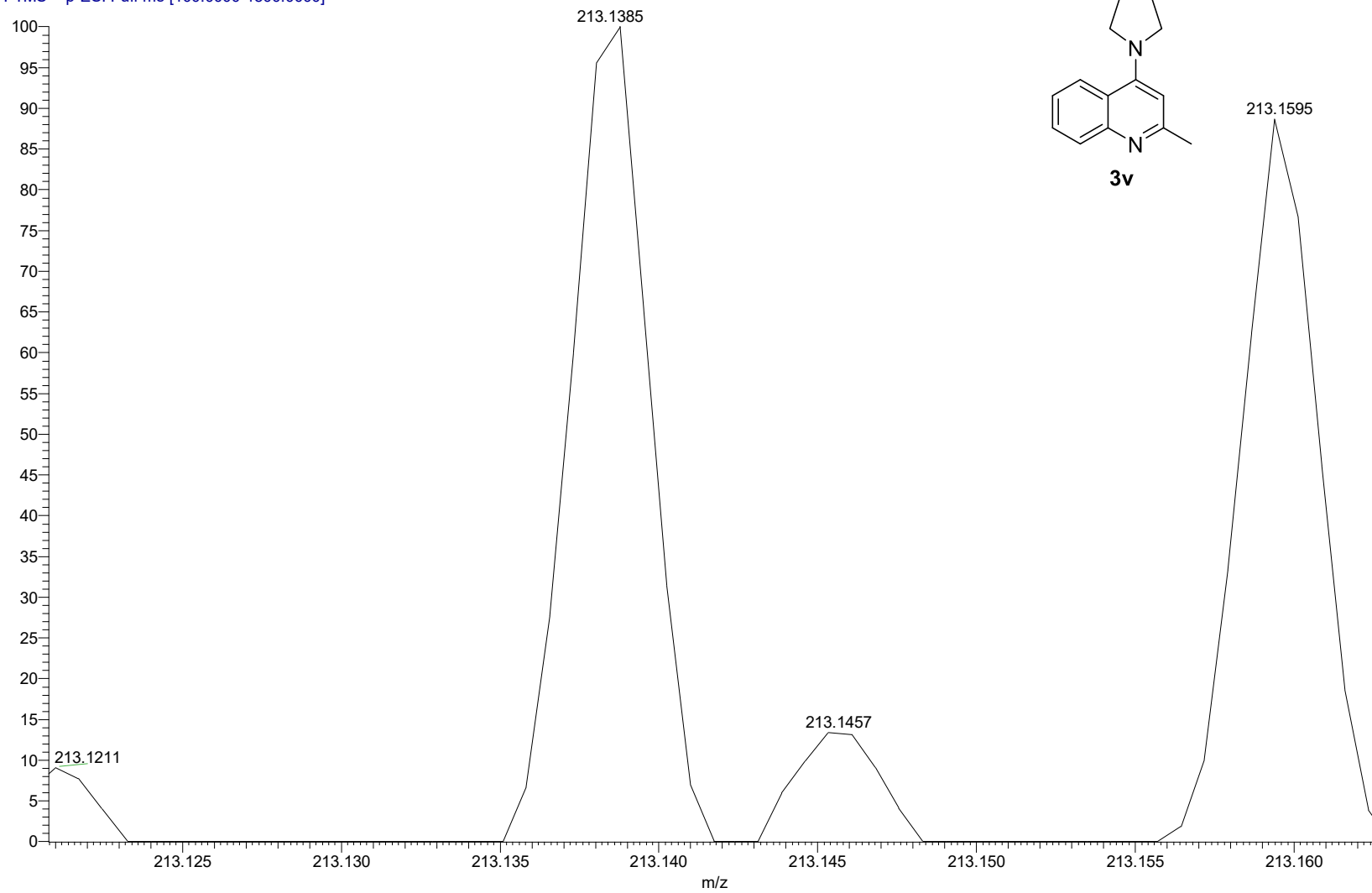
030-50 #154-156 RT: 0.81-0.82 AV: 3 NL: 1.12E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



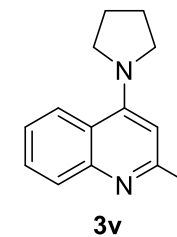
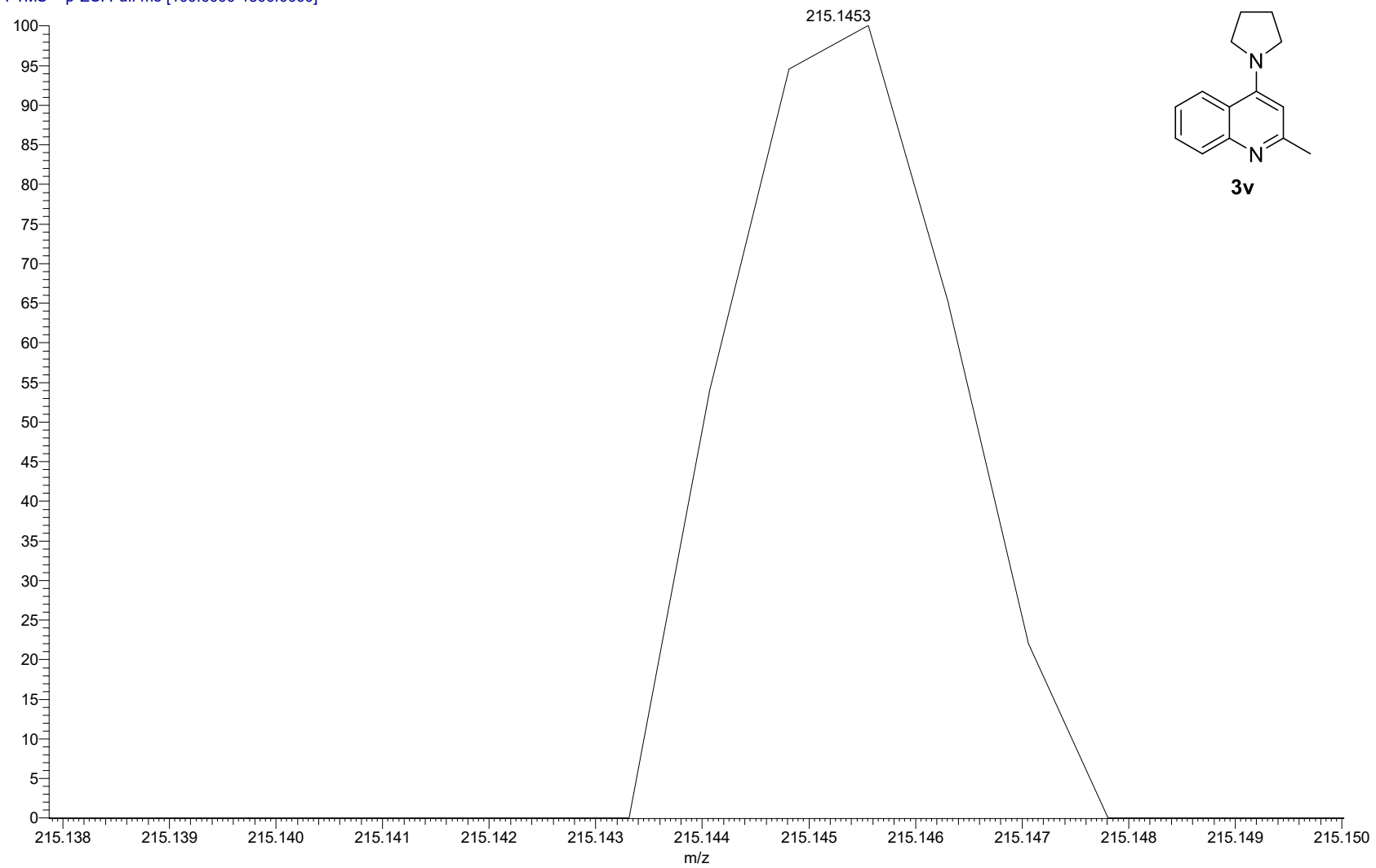
030-50 #155-157 RT: 0.82-0.83 AV: 3 NL: 3.64E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



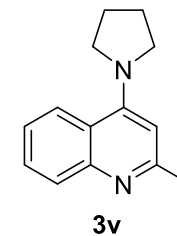
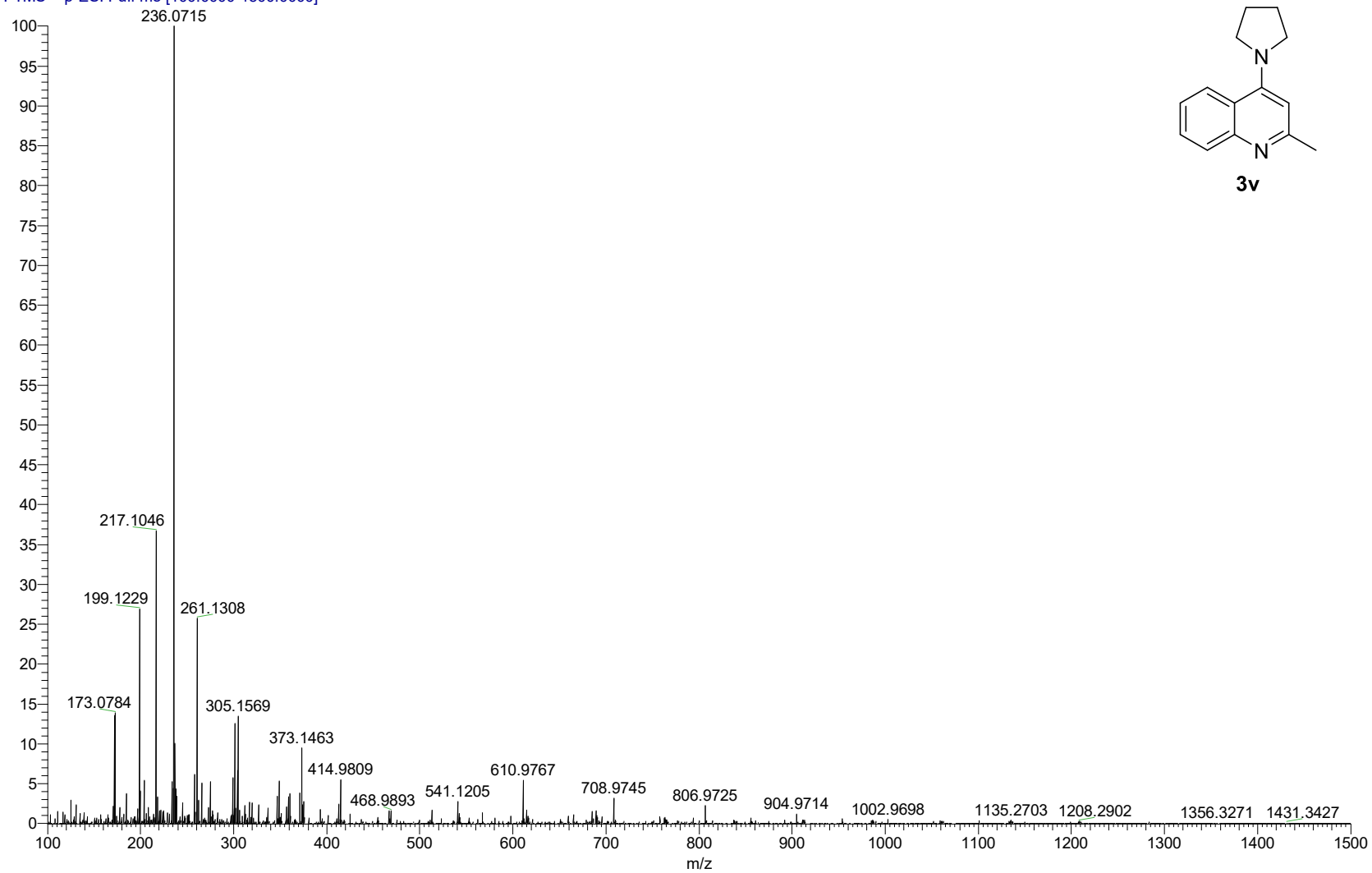
030-57 #77 RT: 0.43 AV: 1 NL: 6.62E5
T: FTMS + p ESI Full ms [100.0000-1500.0000]



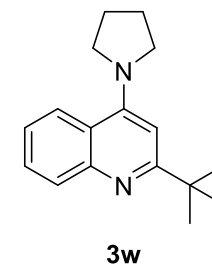
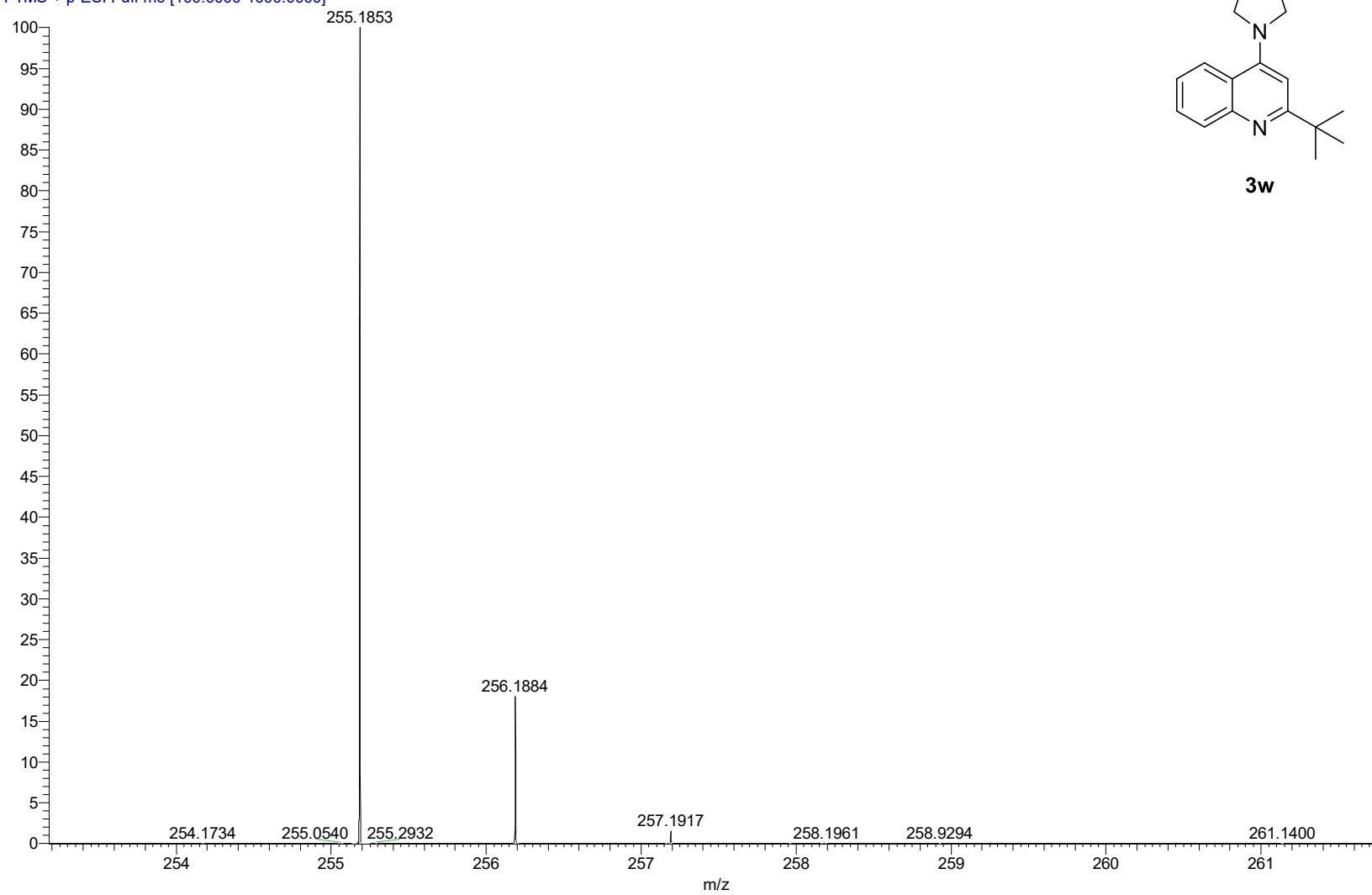
030-57 #123 RT: 0.68 AV: 1 NL: 2.54E4
T: FTMS + p ESI Full ms [100.0000-1500.0000]



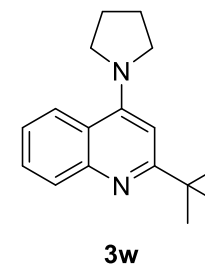
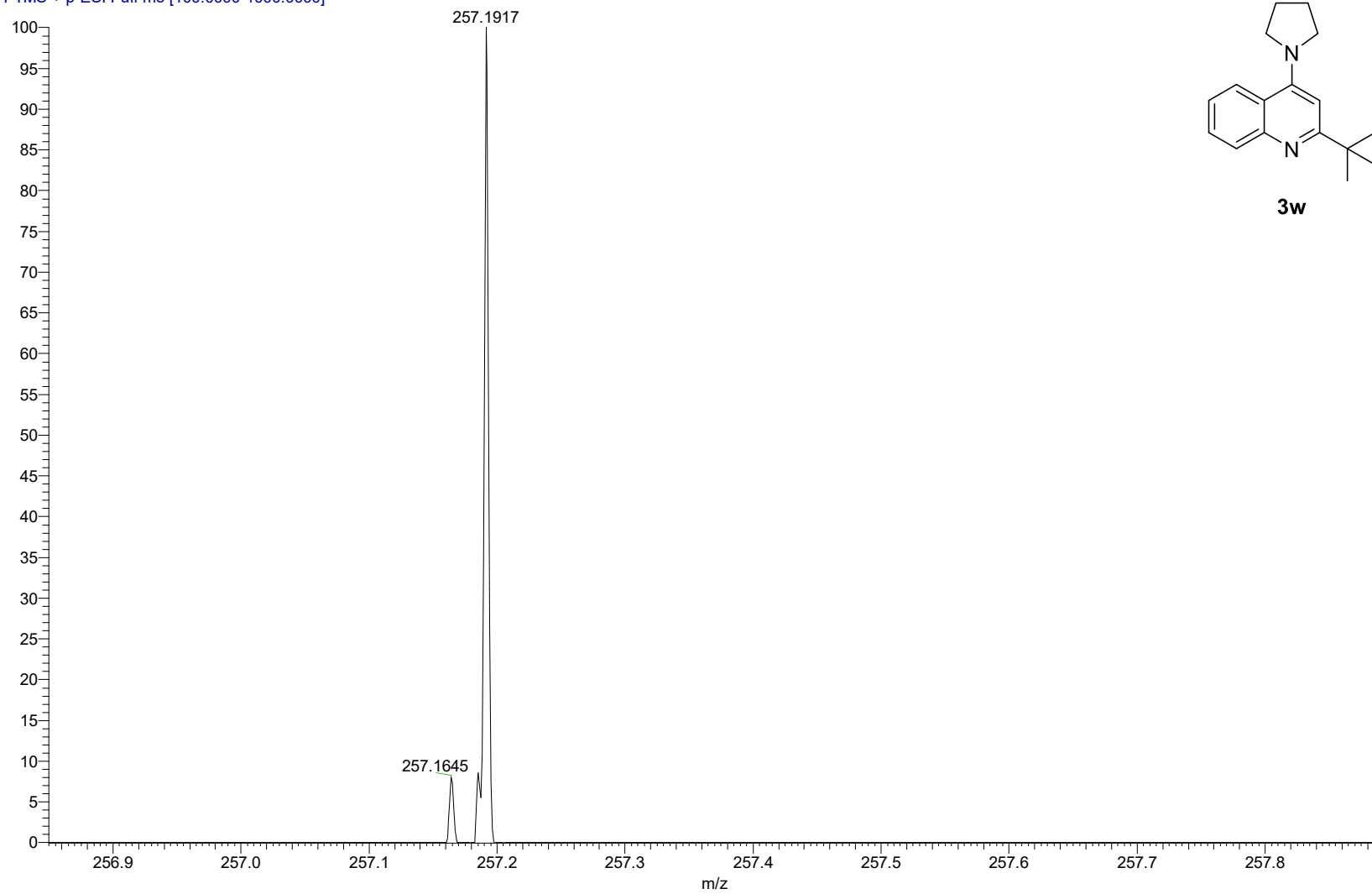
030-57 #123 RT: 0.68 AV: 1 NL: 9.34E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



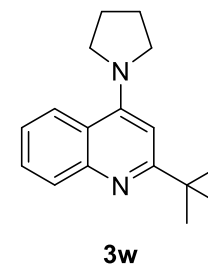
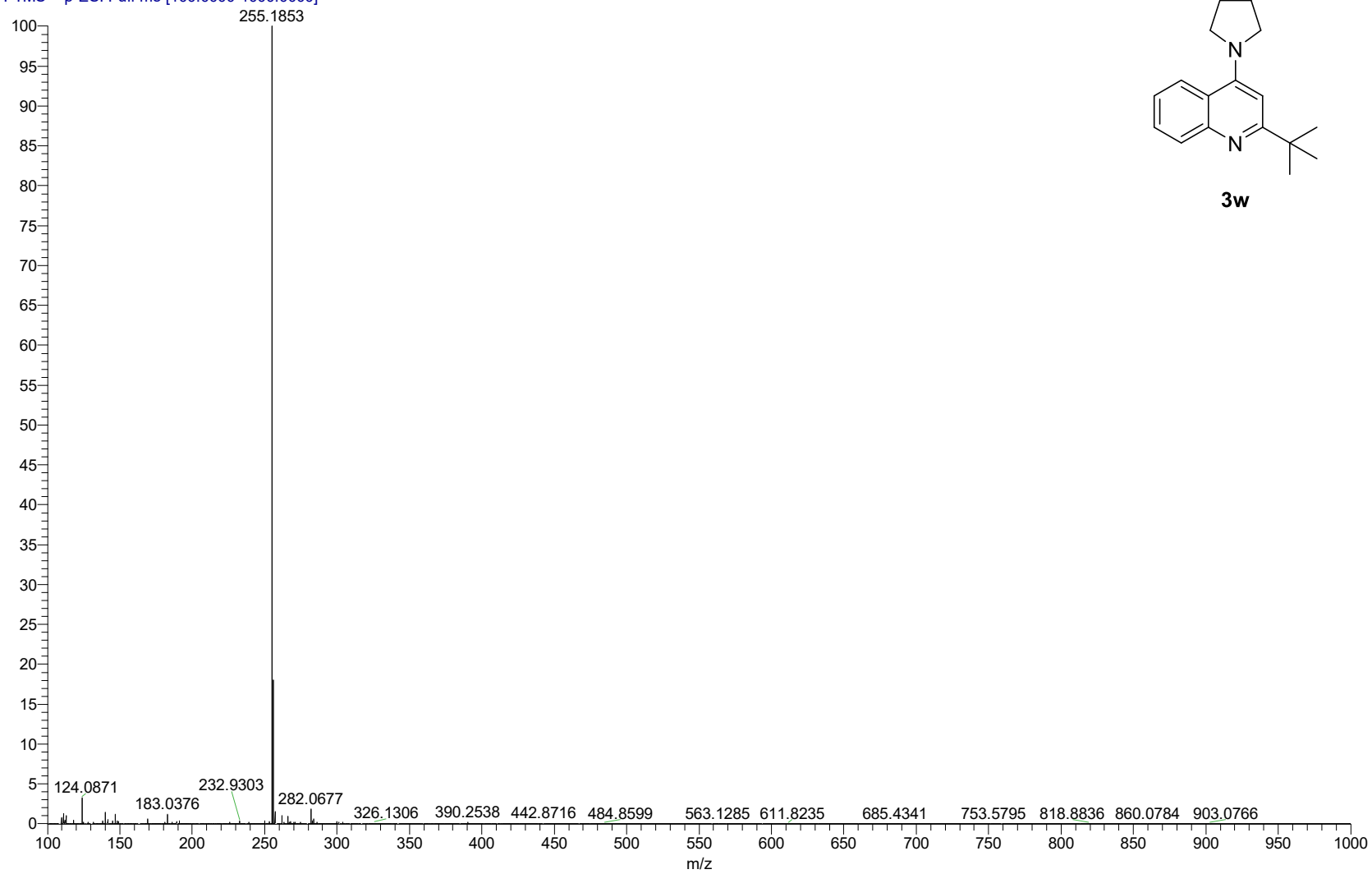
WD-22 #219 RT: 0.98 AV: 1 NL: 6.43E8
T: FTMS + p ESI Full ms [100.0000-1000.0000]



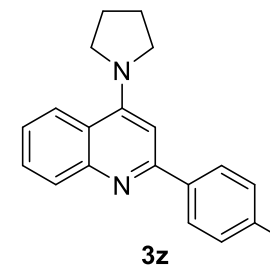
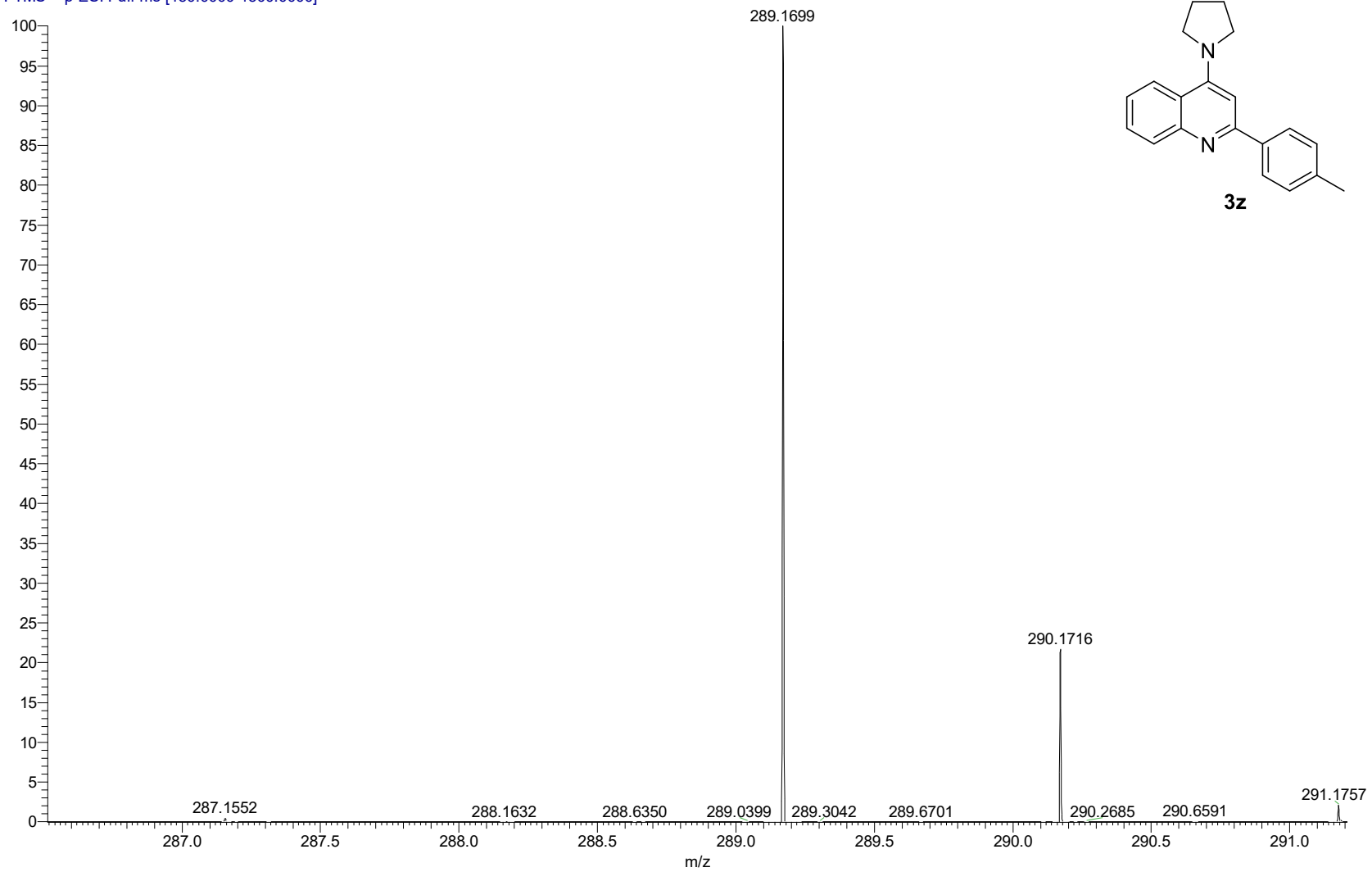
WD-22 #219 RT: 0.98 AV: 1 NL: 9.83E6
T: FTMS + p ESI Full ms [100.0000-1000.0000]



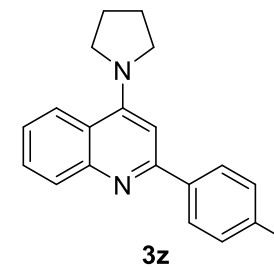
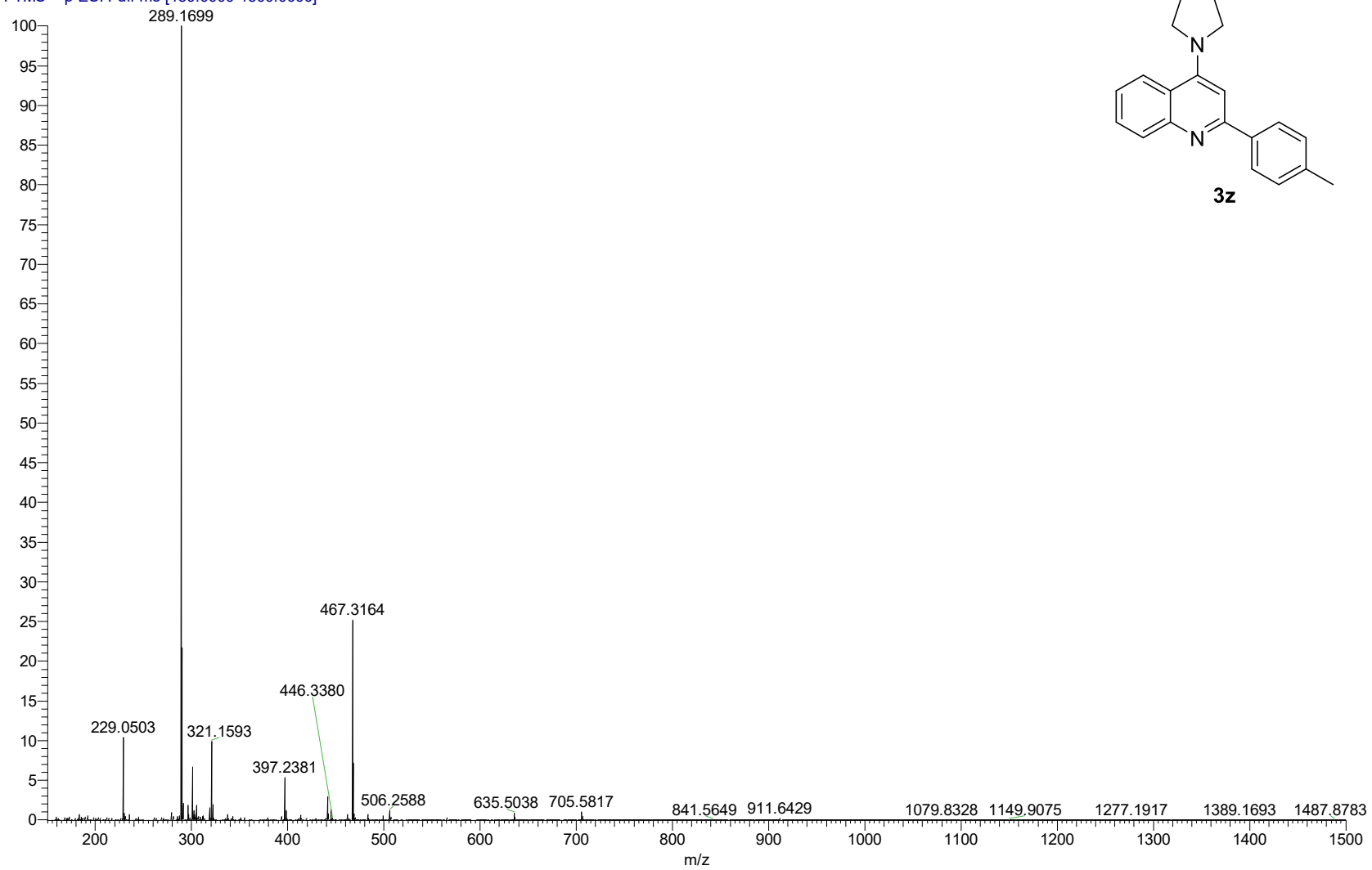
WD-22 #219 RT: 0.98 AV: 1 NL: 6.43E8
T: FTMS + p ESI Full ms [100.0000-1000.0000]



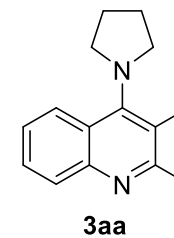
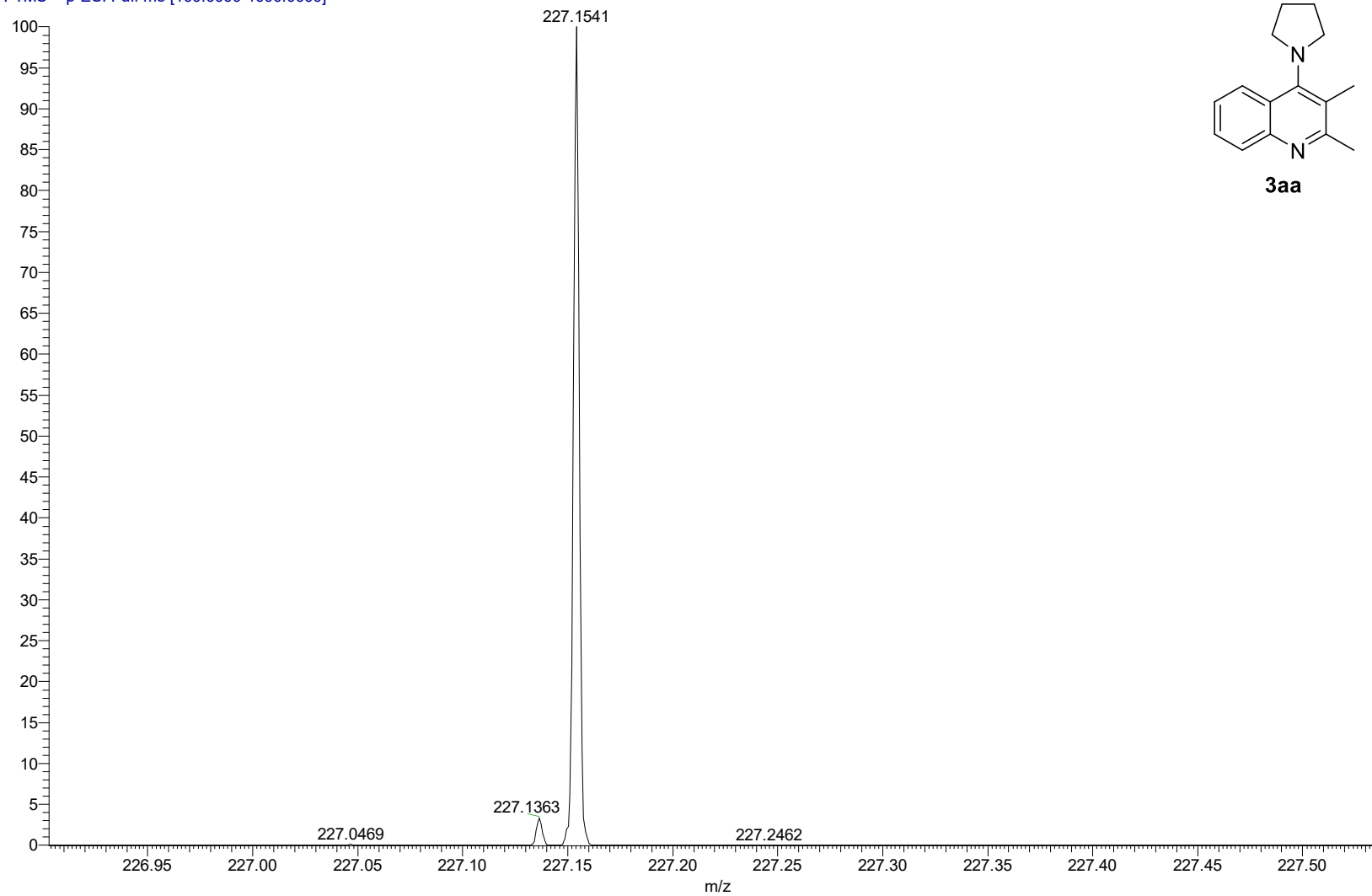
wd-2 #154 RT: 0.69 AV: 1 NL: 5.45E8
T: FTMS + p ESI Full ms [150.0000-1500.0000]



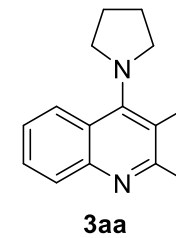
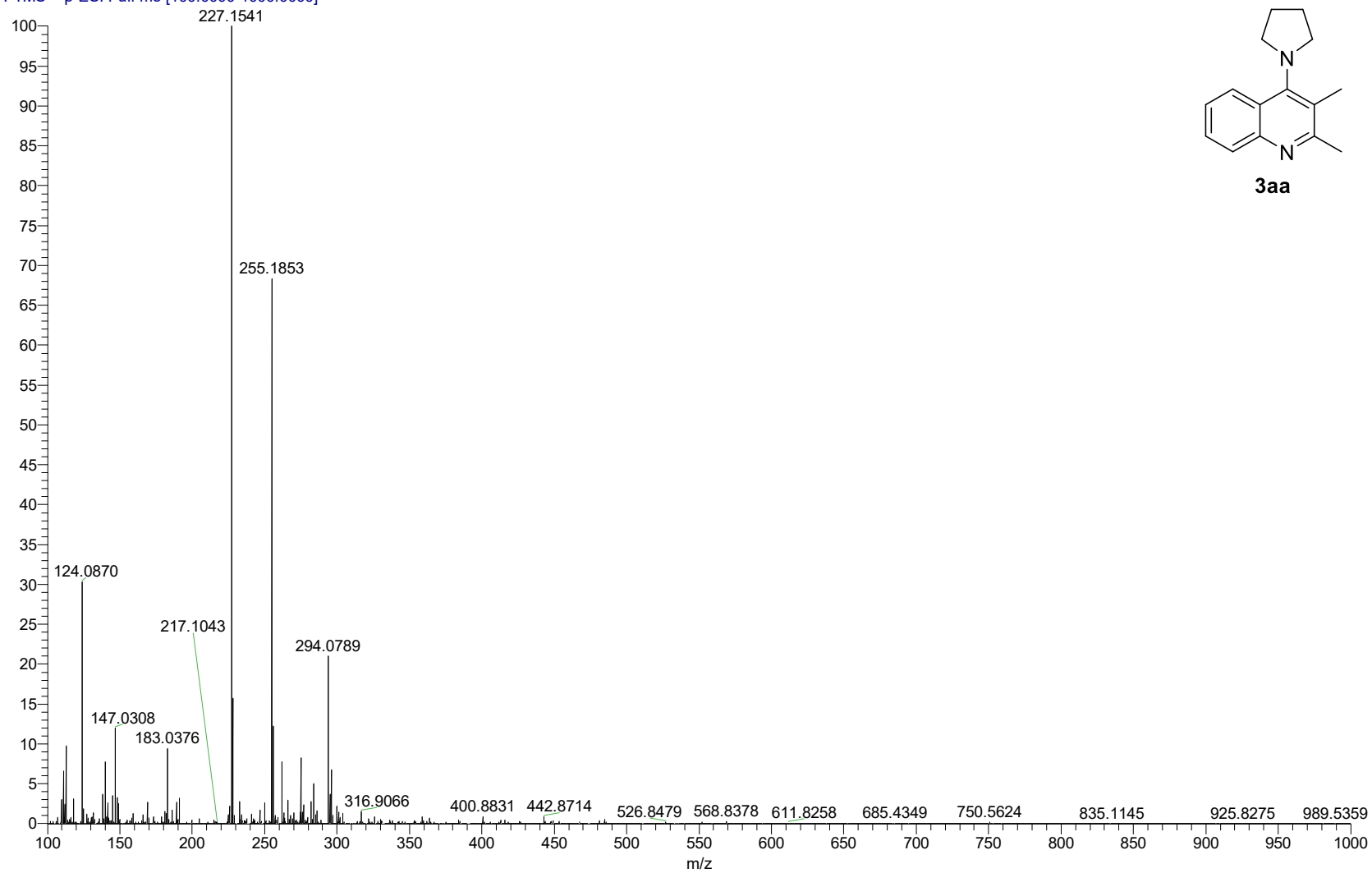
wd-2 #154 RT: 0.69 AV: 1 NL: 5.45E8
T: FTMS + p ESI Full ms [150.0000-1500.0000]



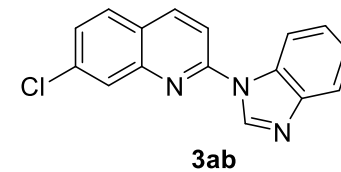
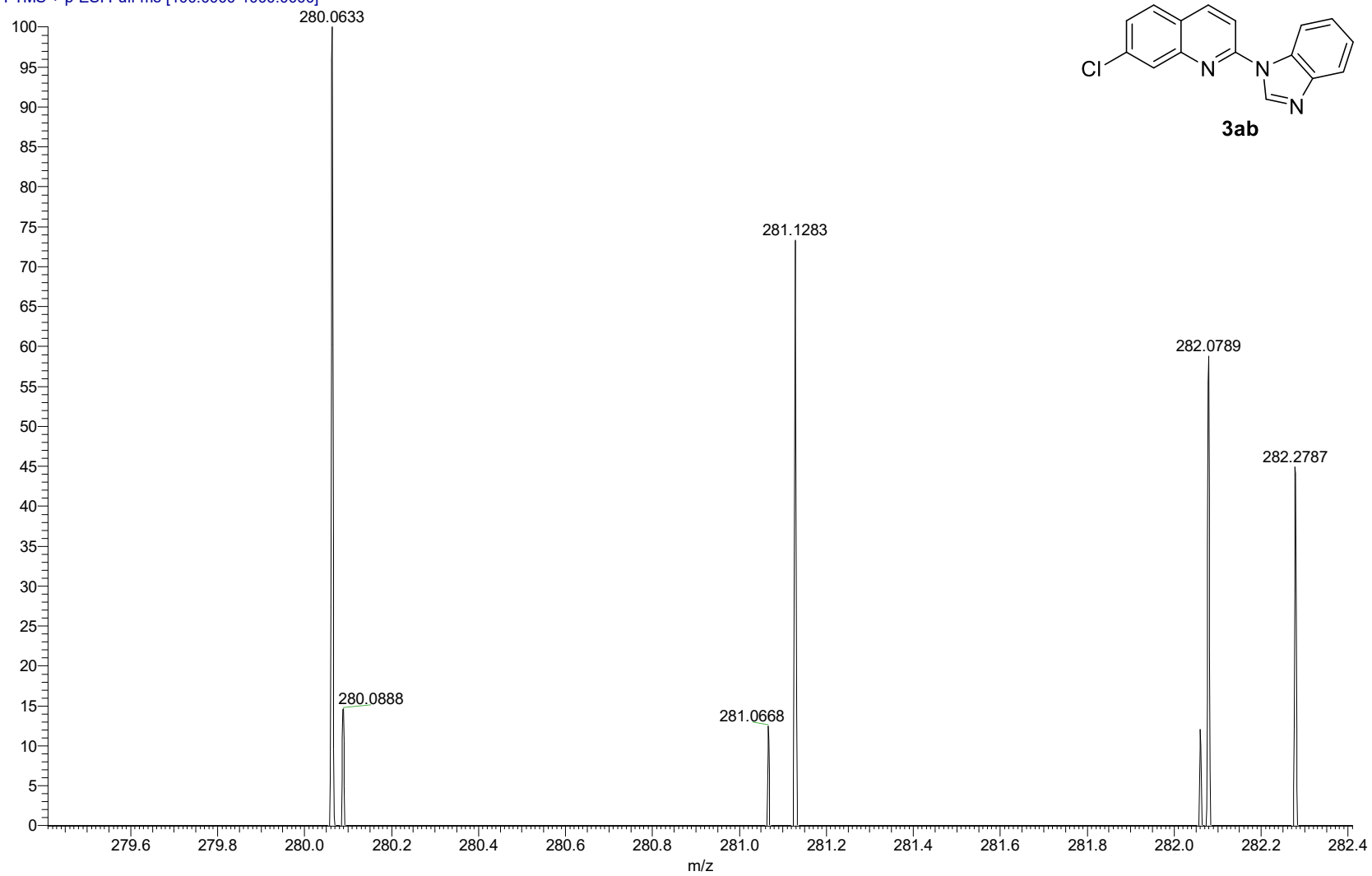
WD-24 #215 RT: 0.96 AV: 1 NL: 8.78E7
T: FTMS + p ESI Full ms [100.0000-1000.0000]



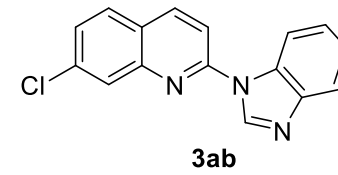
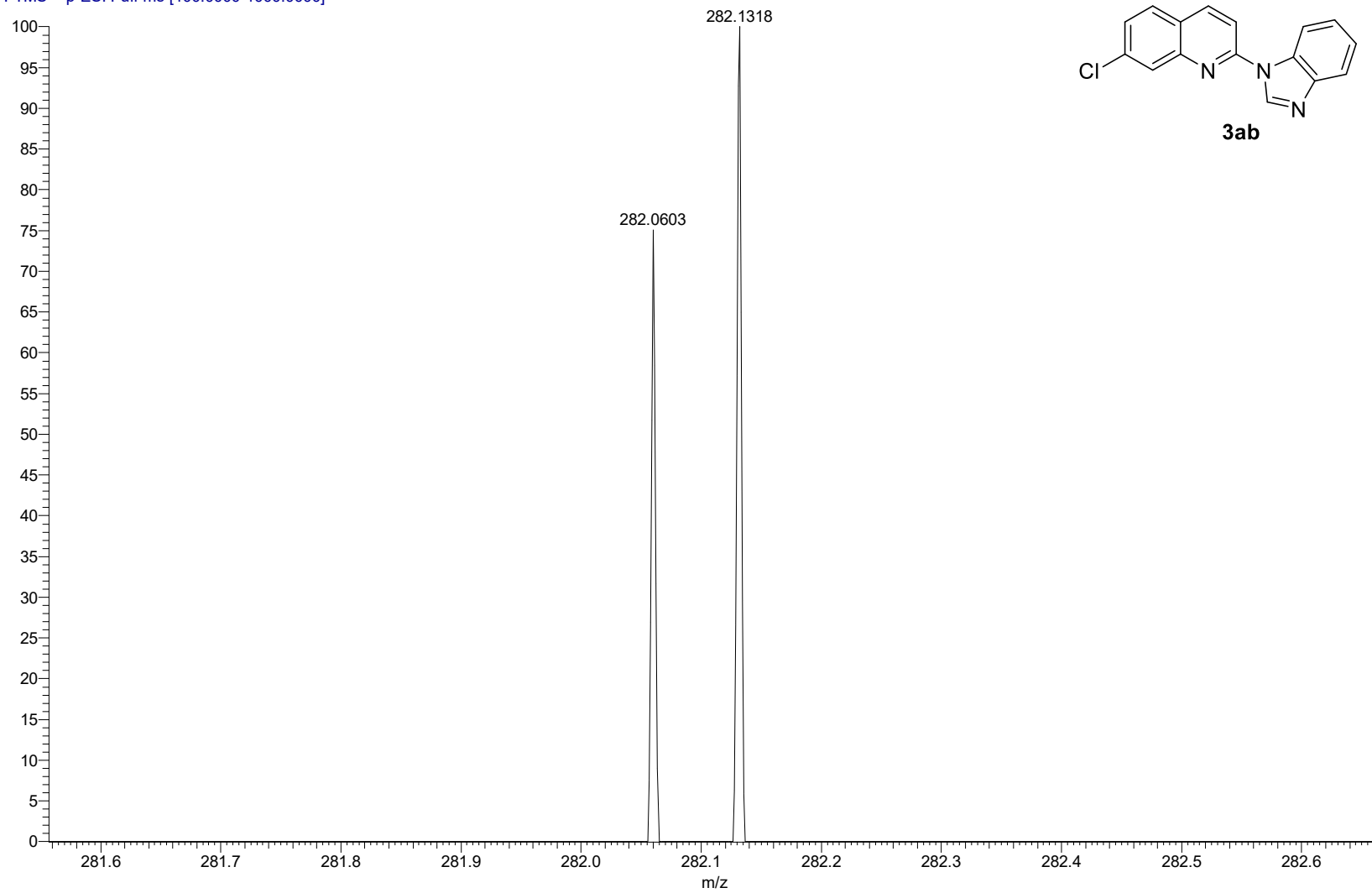
WD-24 #215 RT: 0.96 AV: 1 NL: 8.78E7
T: FTMS + p ESI Full ms [100.0000-1000.0000]



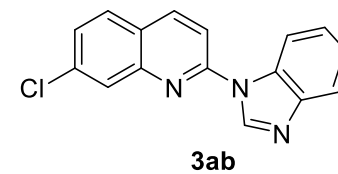
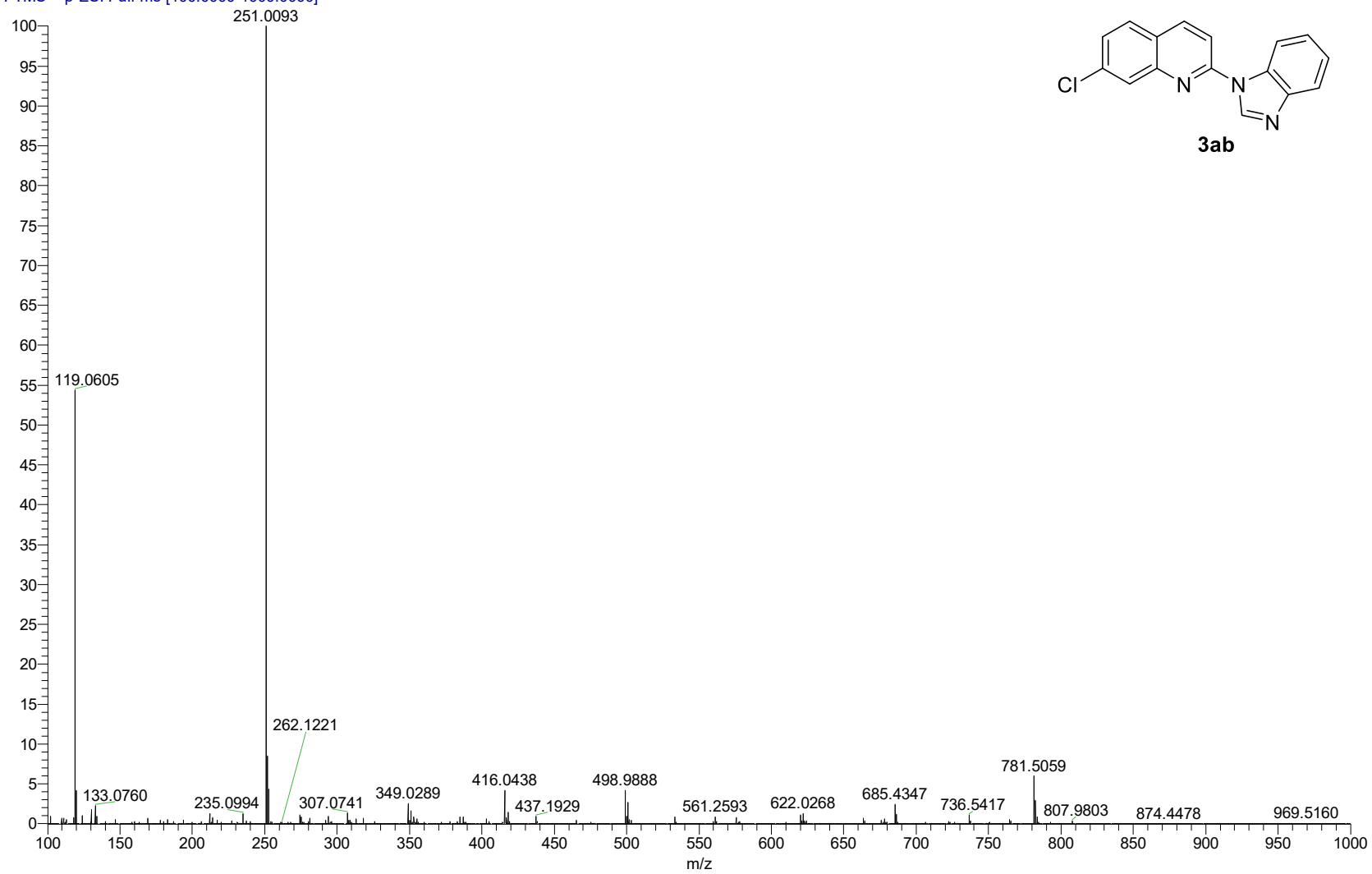
WD-41 #20 RT: 0.09 AV: 1 NL: 4.99E6
T: FTMS + p ESI Full ms [100.0000-1000.0000]



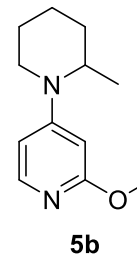
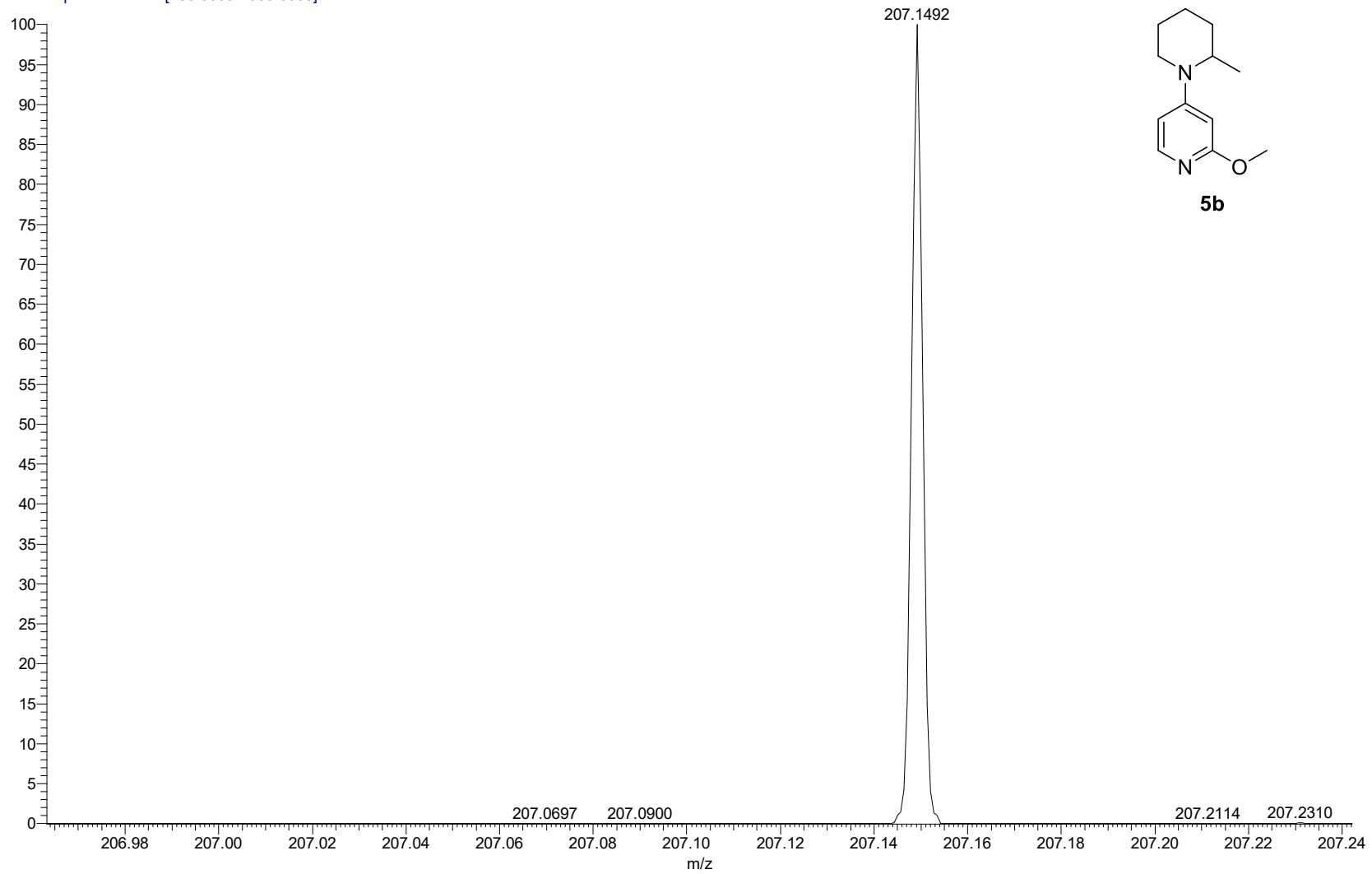
WD-41 #28 RT: 0.13 AV: 1 NL: 1.28E6
T: FTMS + p ESI Full ms [100.0000-1000.0000]



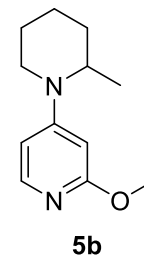
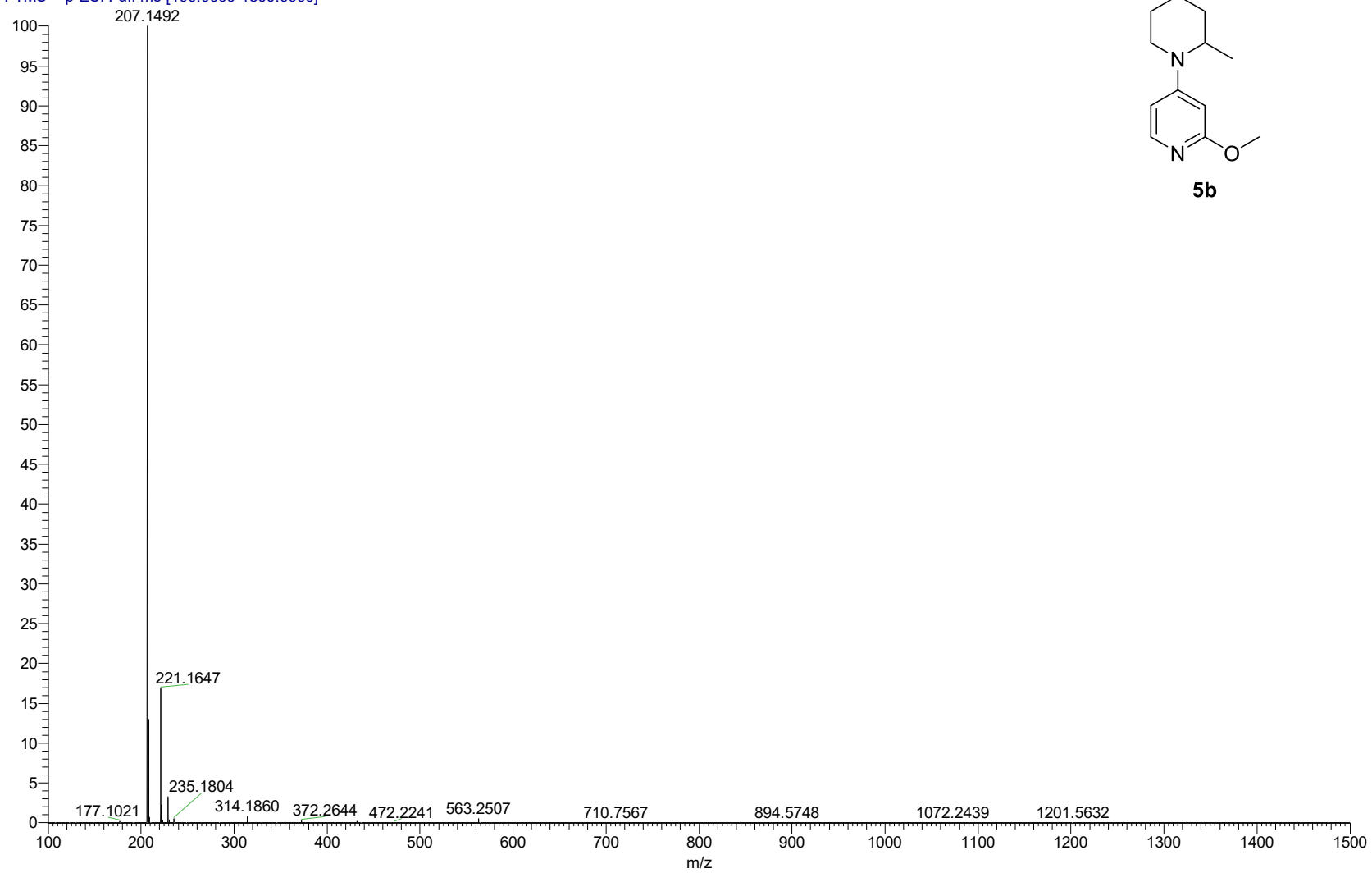
WD-41 #28 RT: 0.13 AV: 1 NL: 1.01E9
T: FTMS + p ESI Full ms [100.0000-1000.0000]



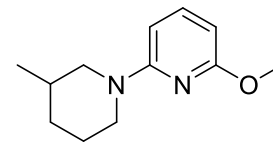
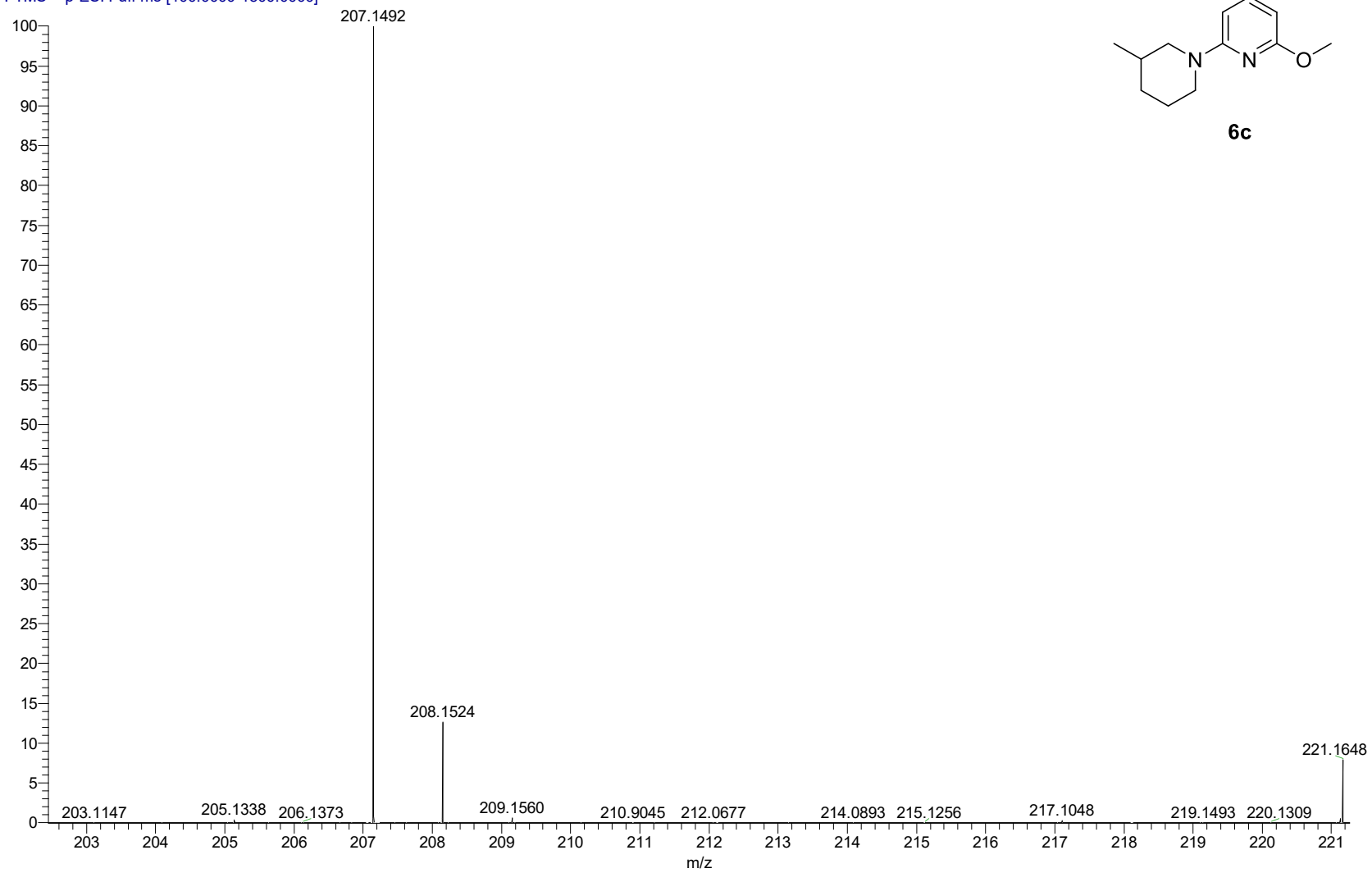
H-154 #80 RT: 0.43 AV: 1 NL: 1.70E10
T: FTMS + p ESI Full ms [100.0000-1500.0000]



H-154 #80 RT: 0.43 AV: 1 NL: 1.70E10
T: FTMS + p ESI Full ms [100.0000-1500.0000]

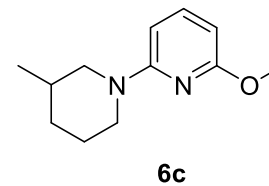
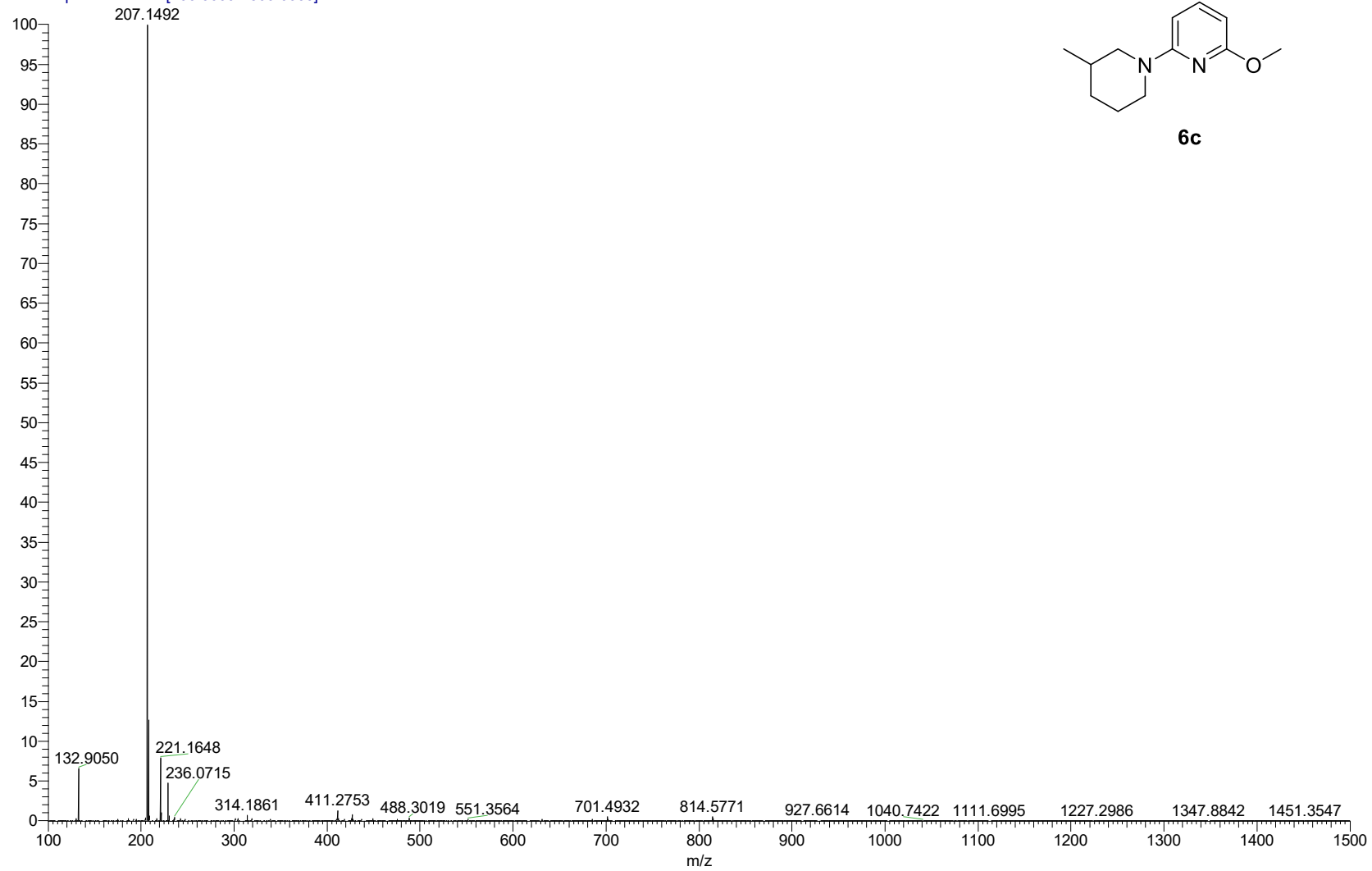


H-155 #40 RT: 0.21 AV: 1 NL: 1.74E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]

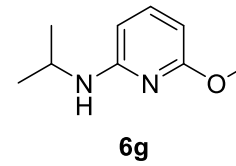
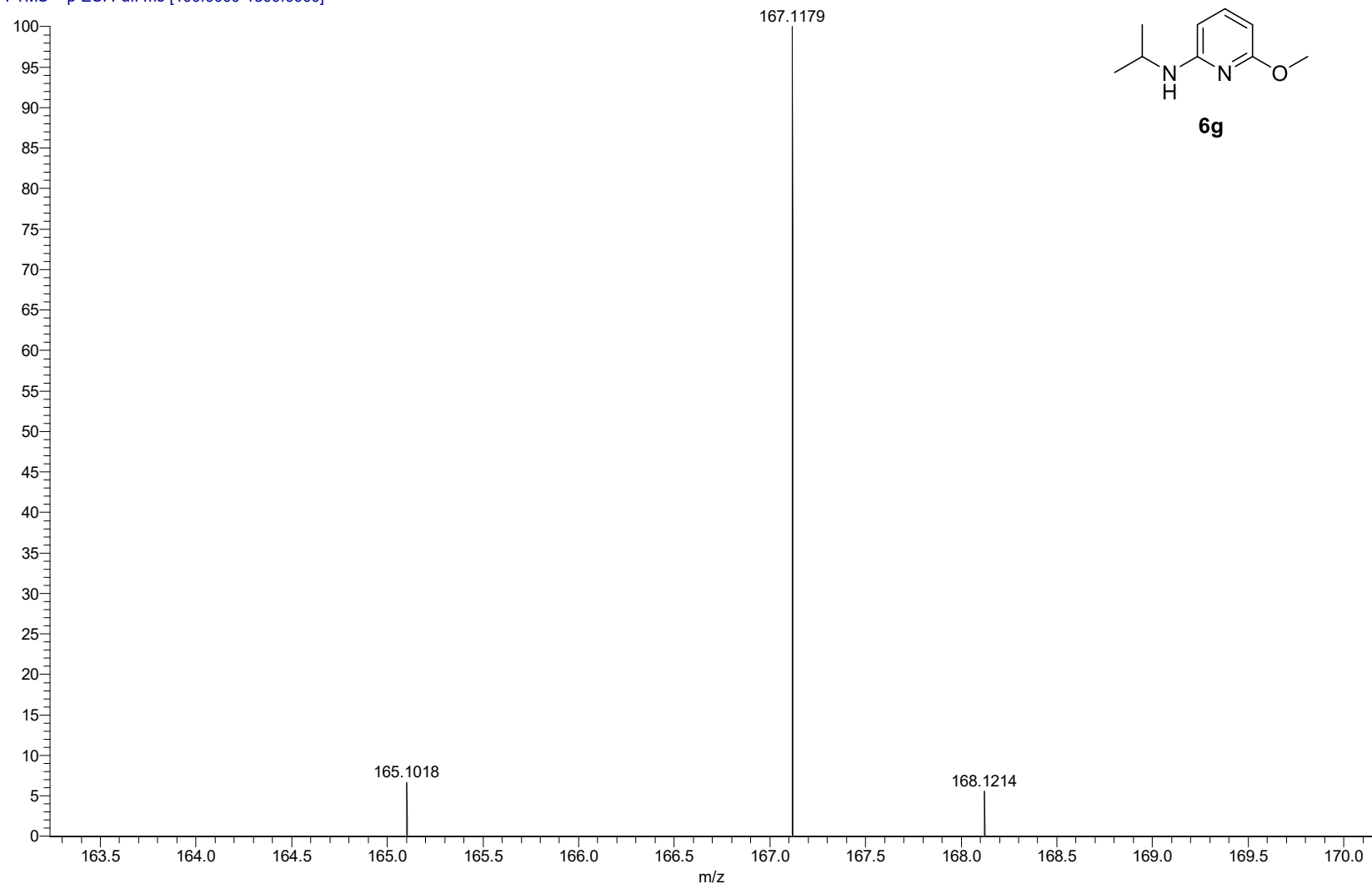


6c

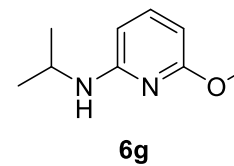
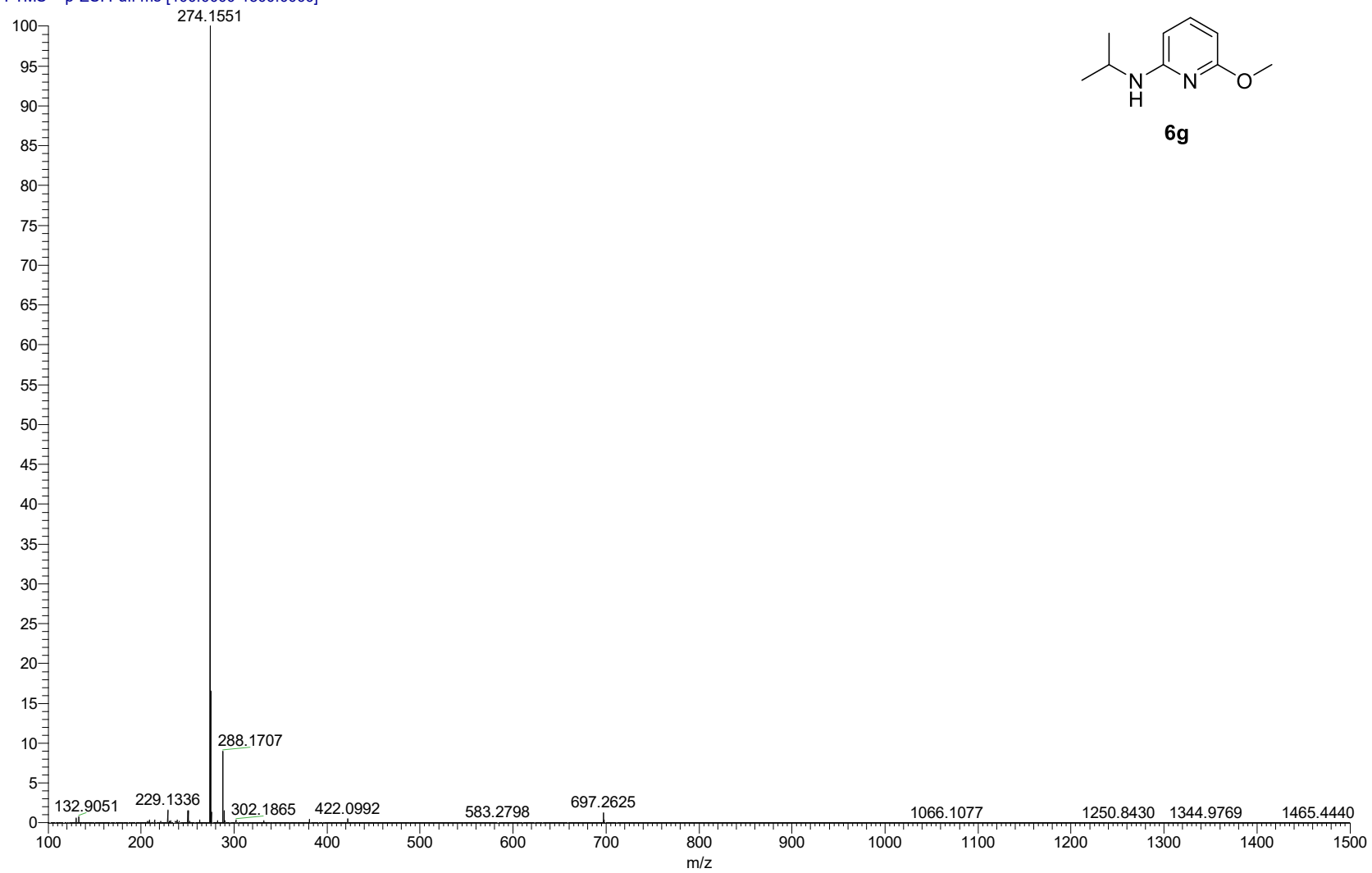
H-155 #40 RT: 0.21 AV: 1 NL: 1.74E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



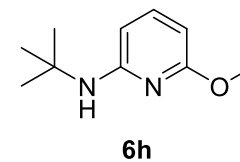
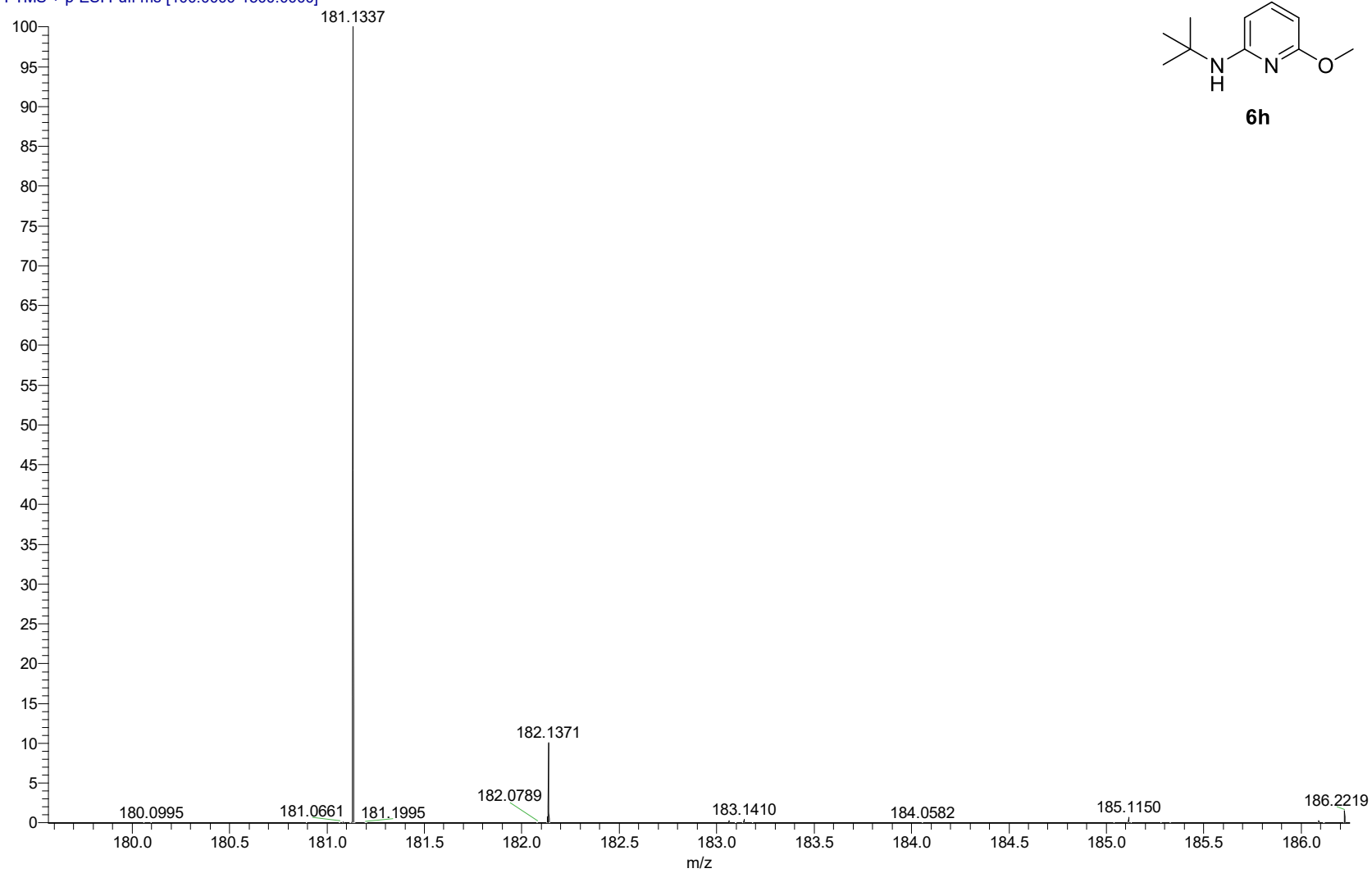
H-157 #102 RT: 0.52 AV: 1 NL: 1.25E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



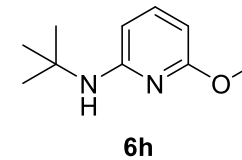
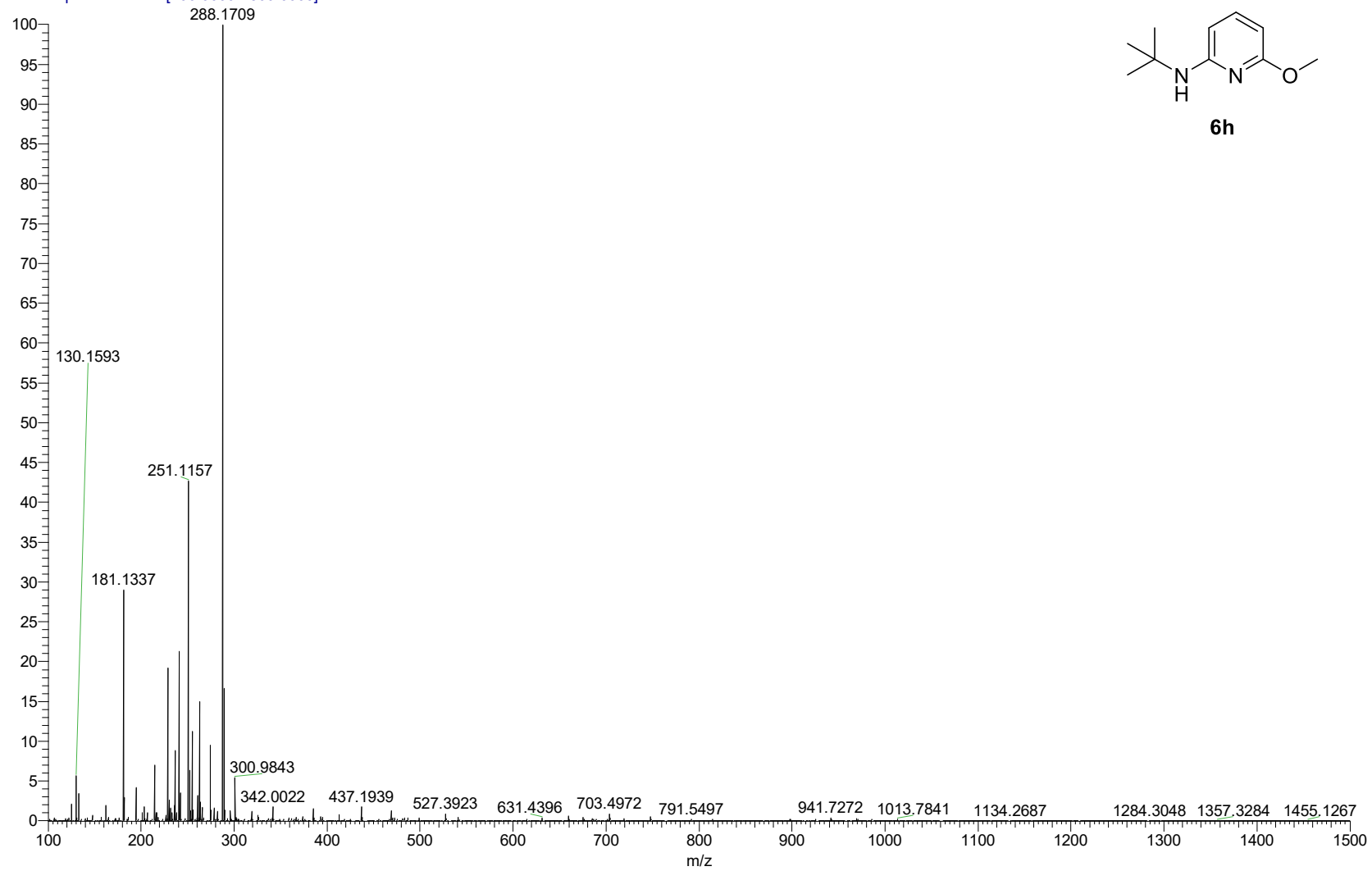
H-157 #102 RT: 0.52 AV: 1 NL: 1.04E10
T: FTMS + p ESI Full ms [100.0000-1500.0000]



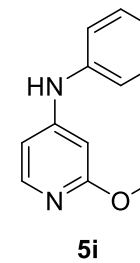
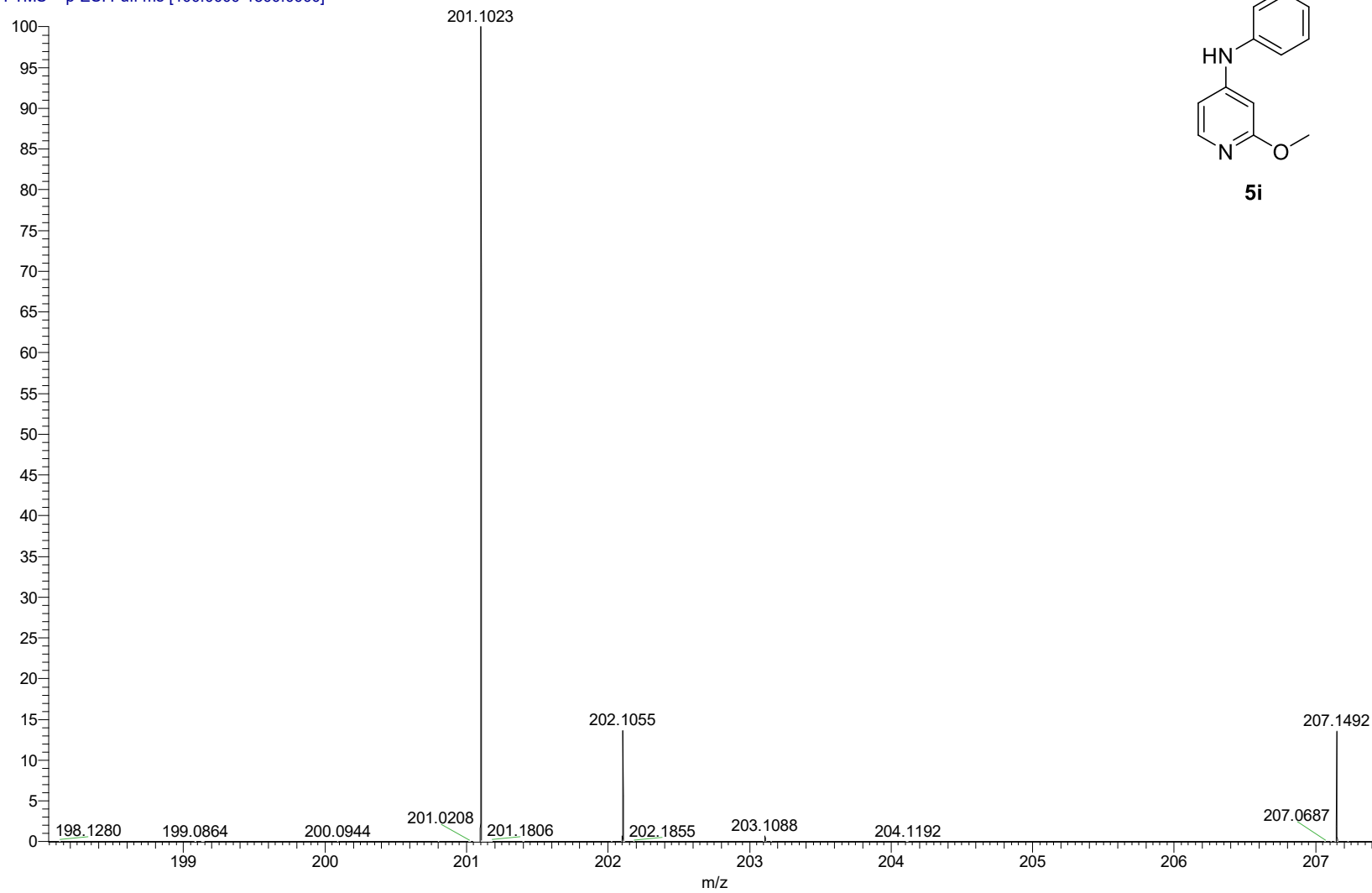
H-162 #47 RT: 0.24 AV: 1 NL: 2.87E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



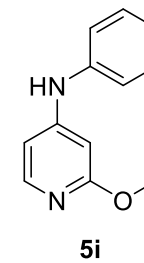
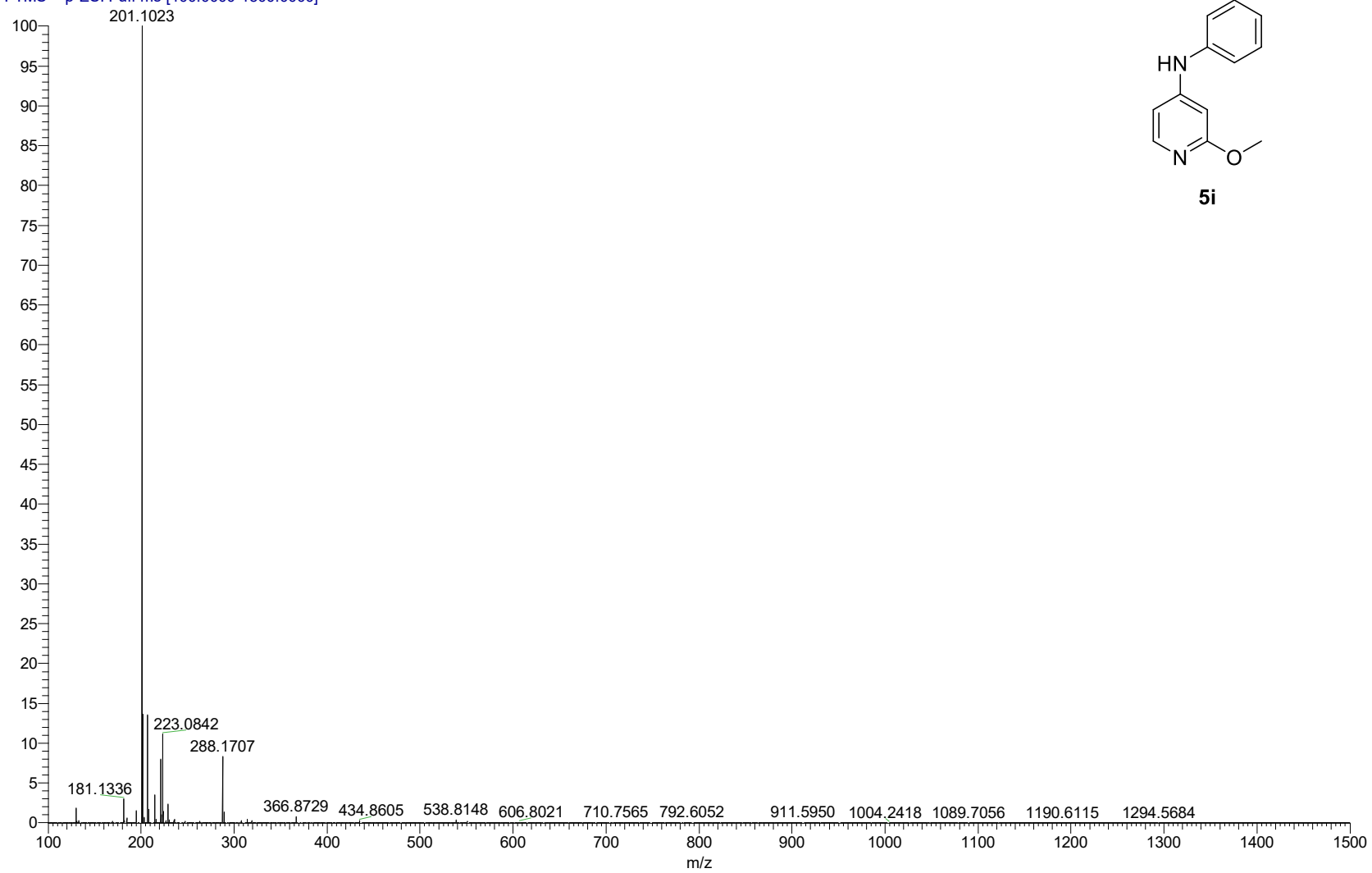
H-162 #47 RT: 0.24 AV: 1 NL: 9.89E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



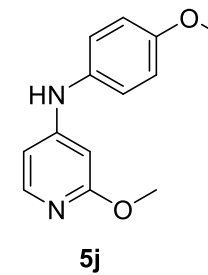
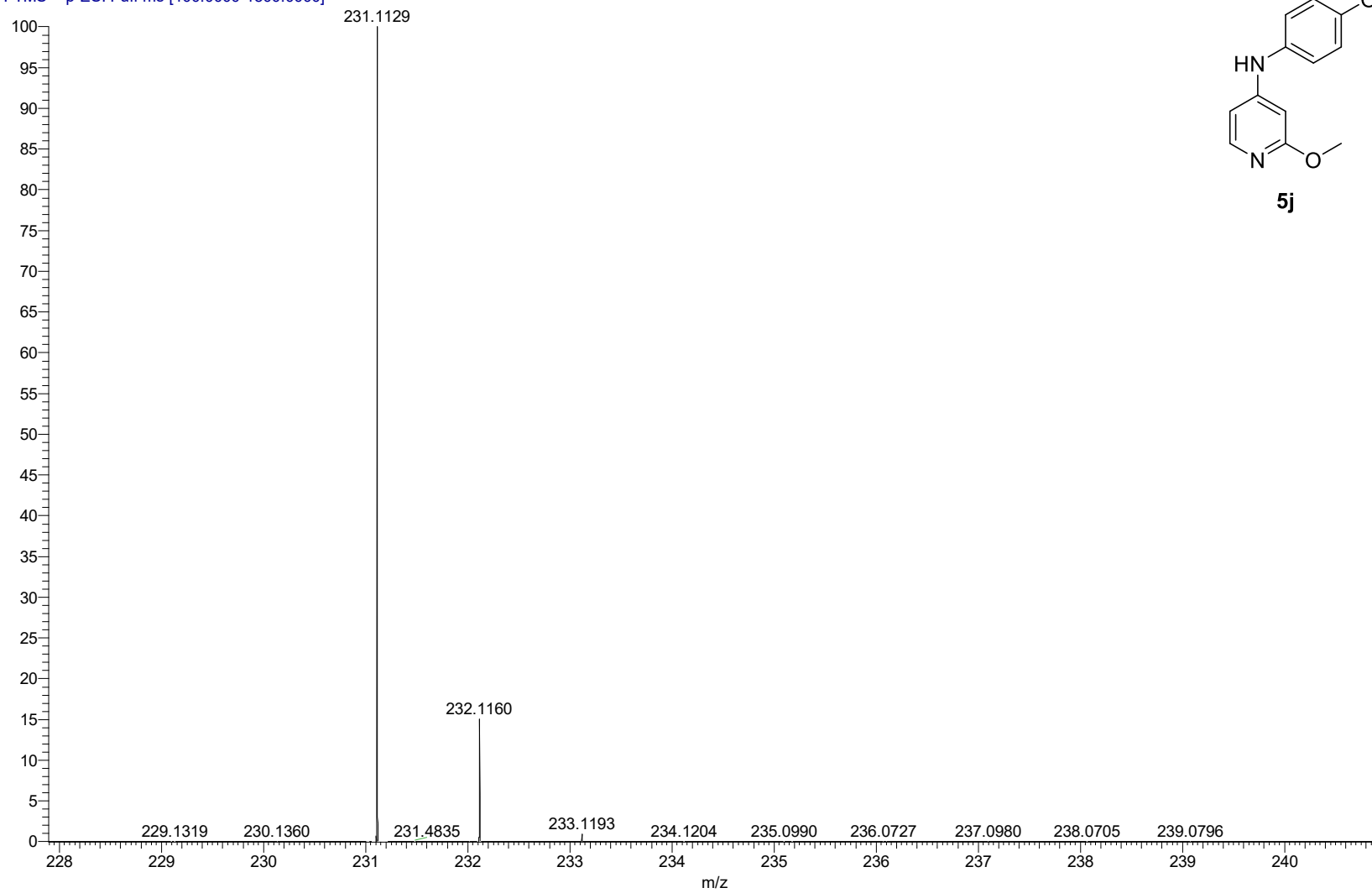
H-161 #45 RT: 0.23 AV: 1 NL: 4.61E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



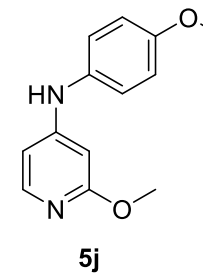
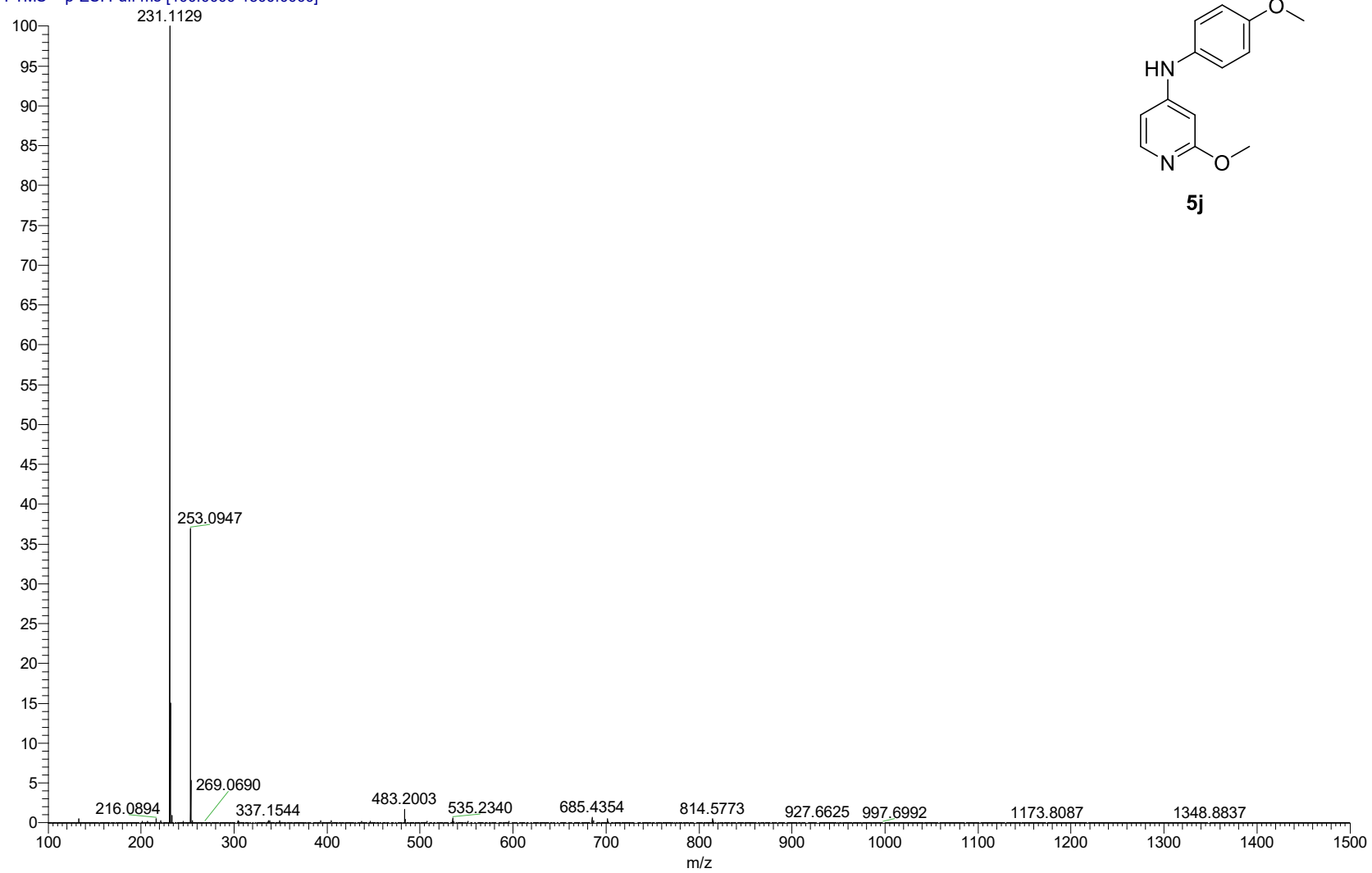
H-161 #45 RT: 0.23 AV: 1 NL: 4.61E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



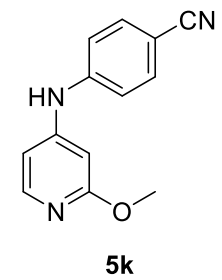
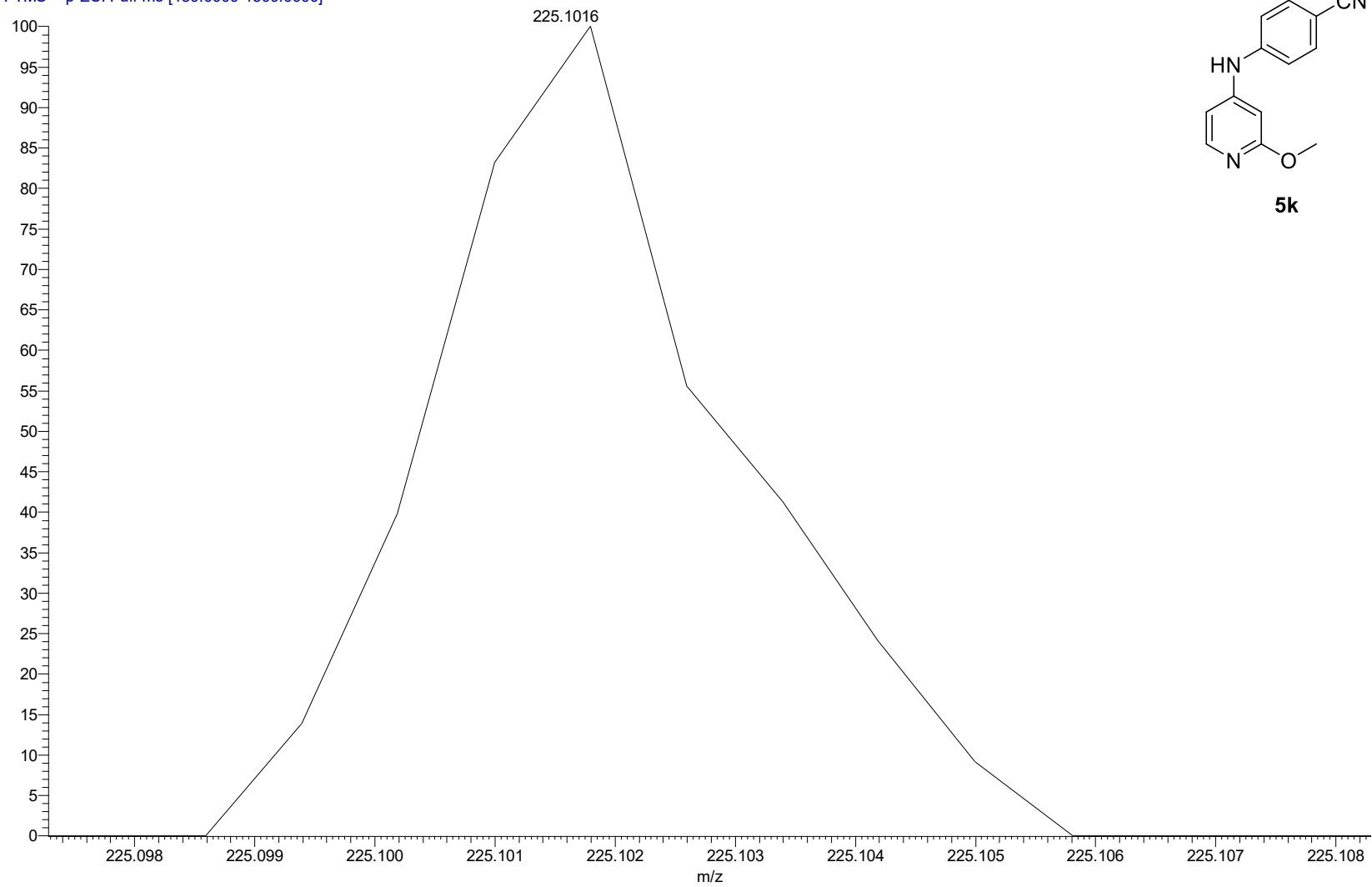
H-181 #50 RT: 0.26 AV: 1 NL: 9.18E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



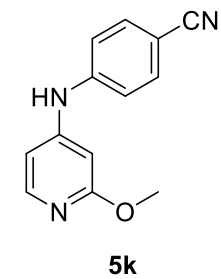
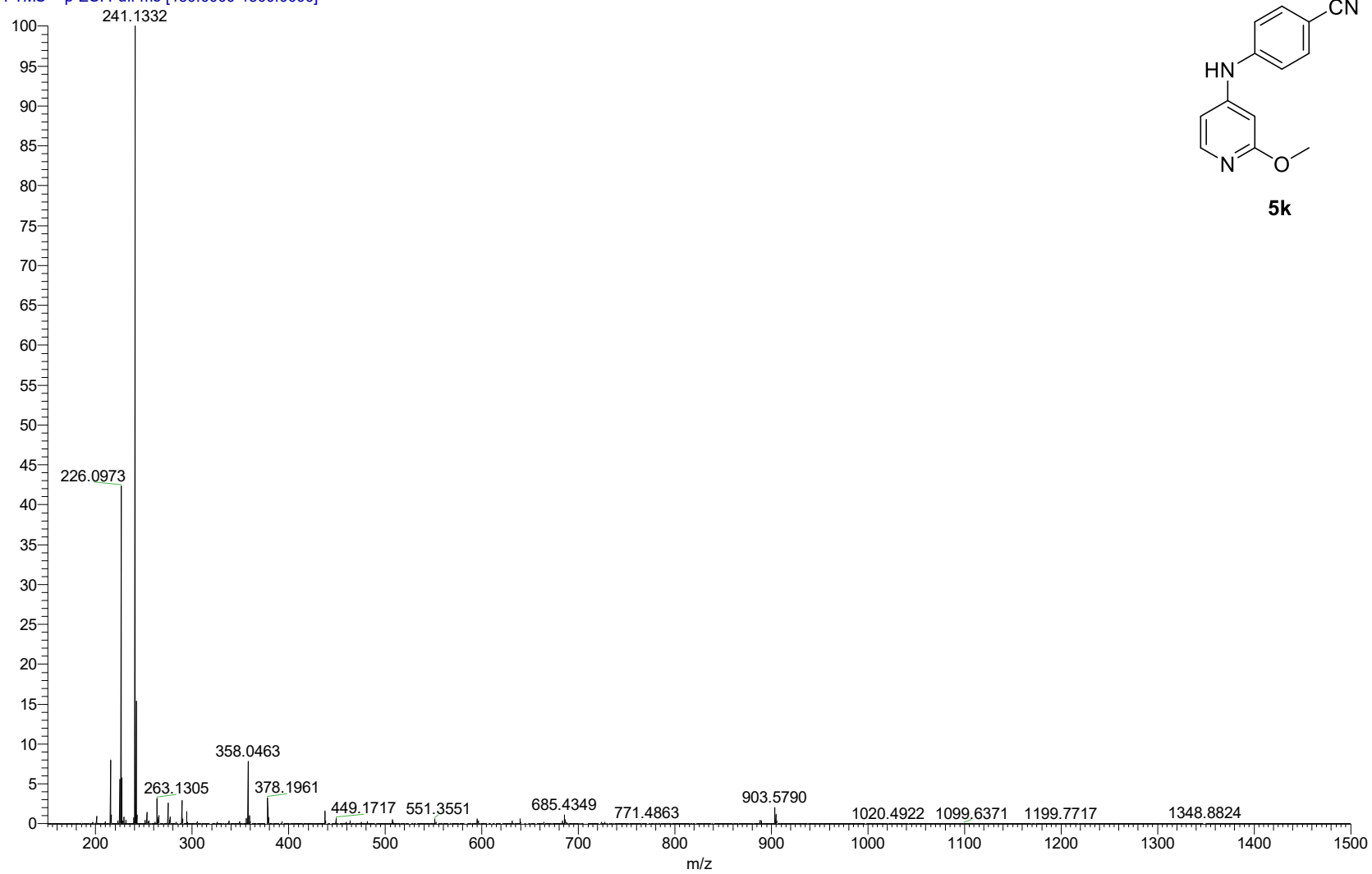
H-181 #50 RT: 0.26 AV: 1 NL: 9.18E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



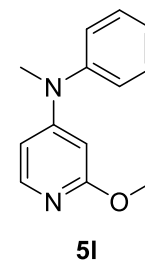
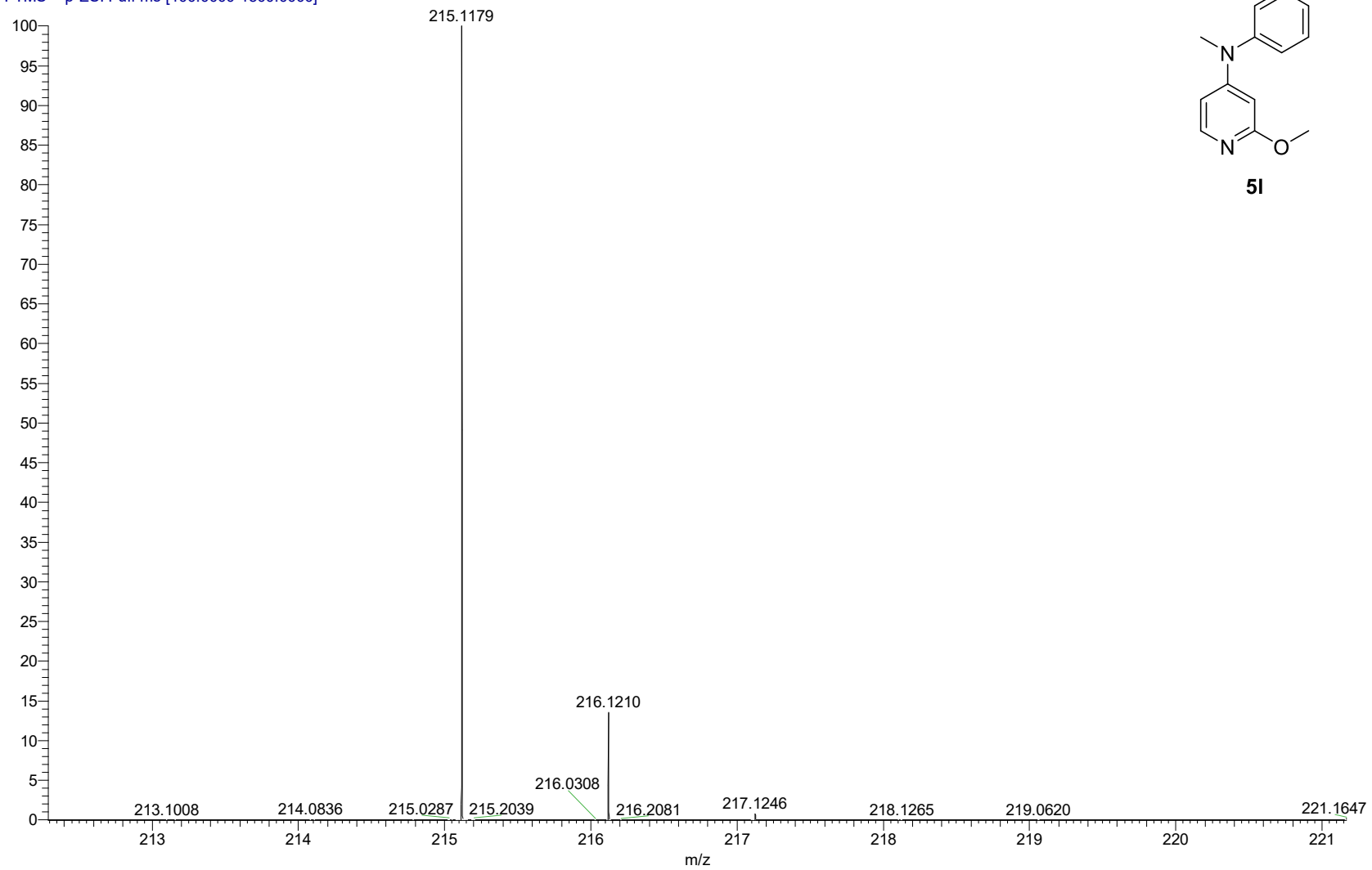
wd-5 #22 RT: 0.10 AV: 1 NL: 3.02E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



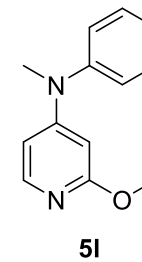
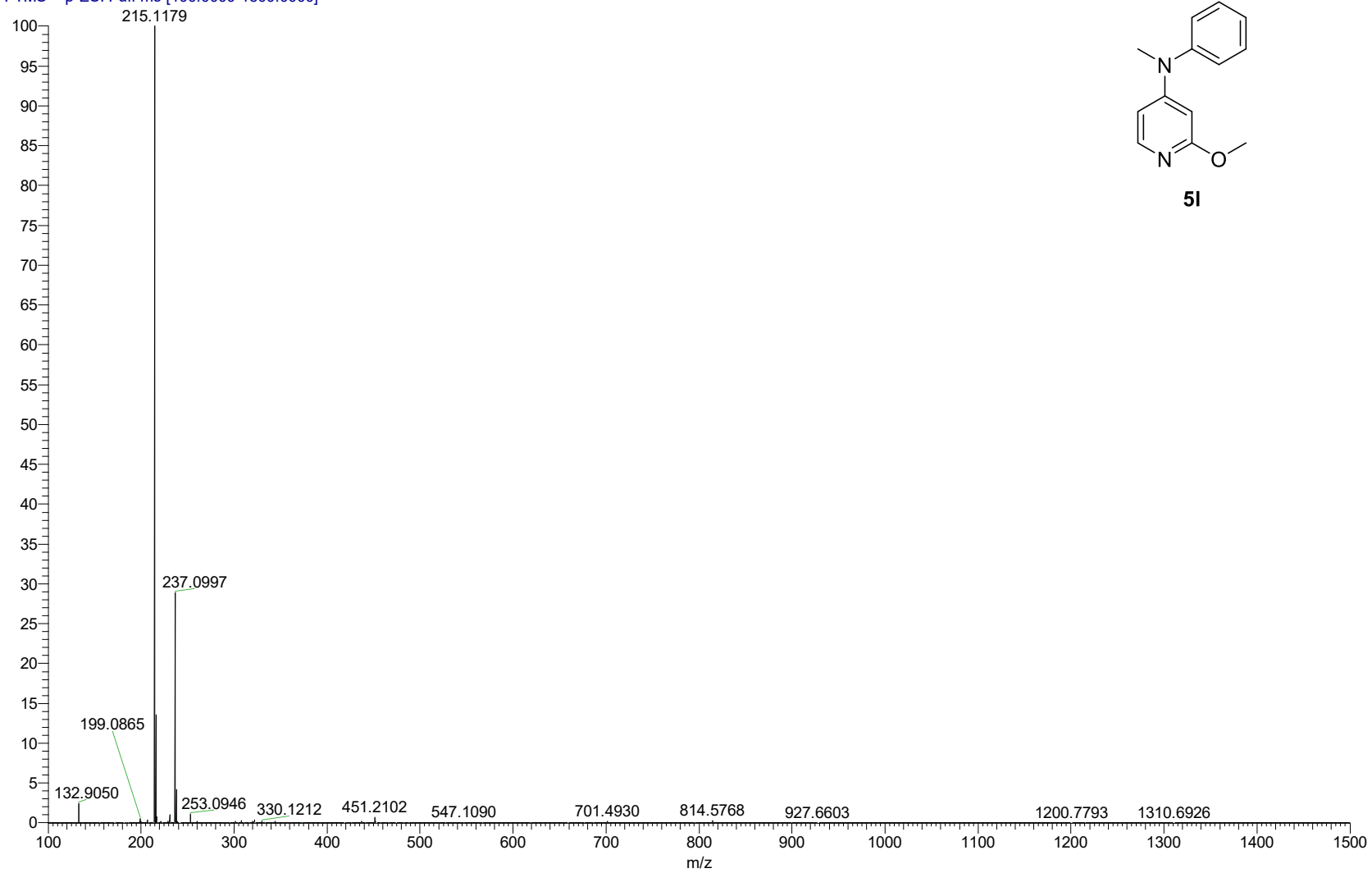
wd-5 #22 RT: 0.10 AV: 1 NL: 7.05E9
T: FTMS + p ESI Full ms [150.0000-1500.0000]



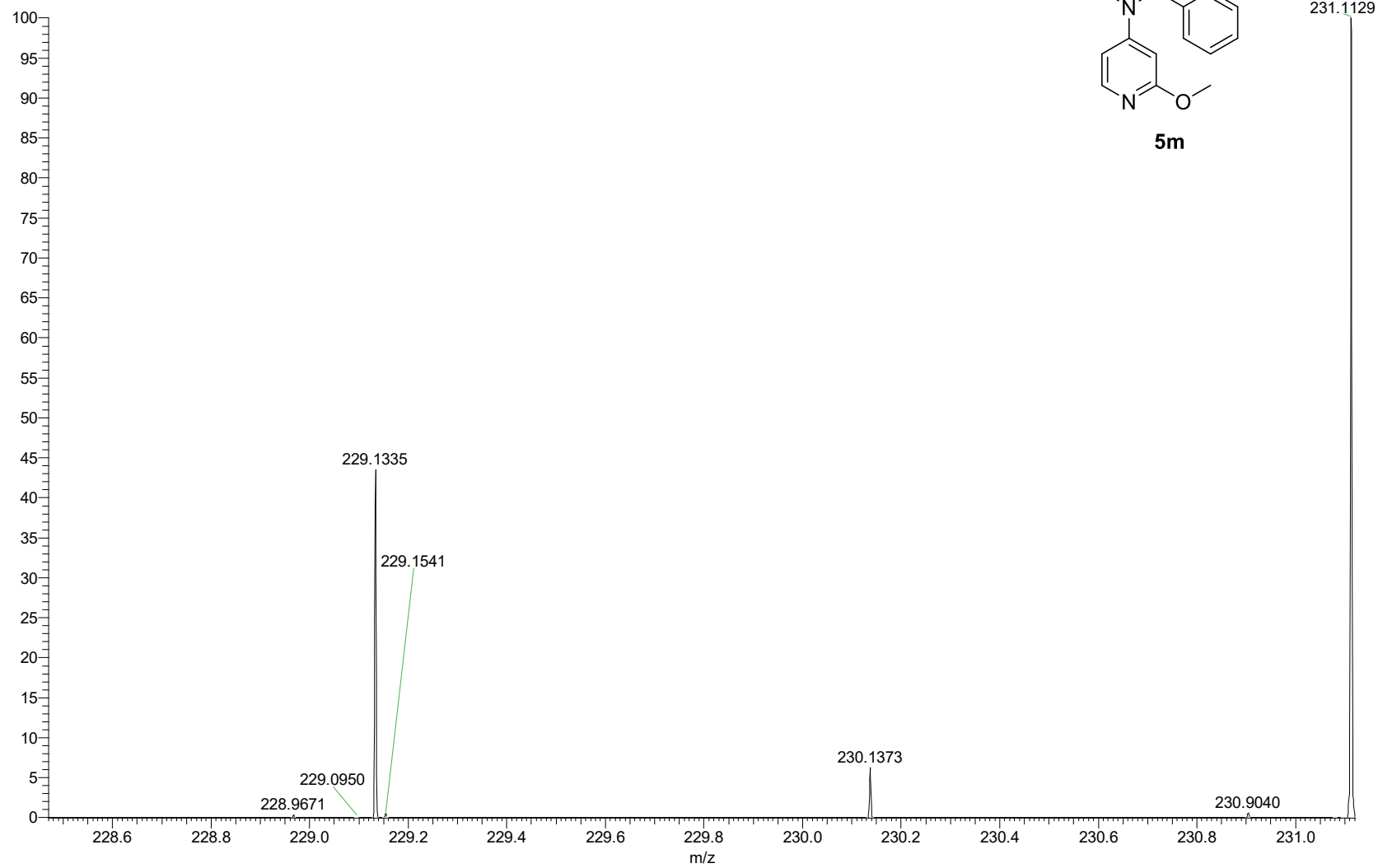
H-160 #41 RT: 0.21 AV: 1 NL: 5.05E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



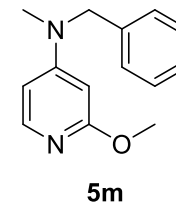
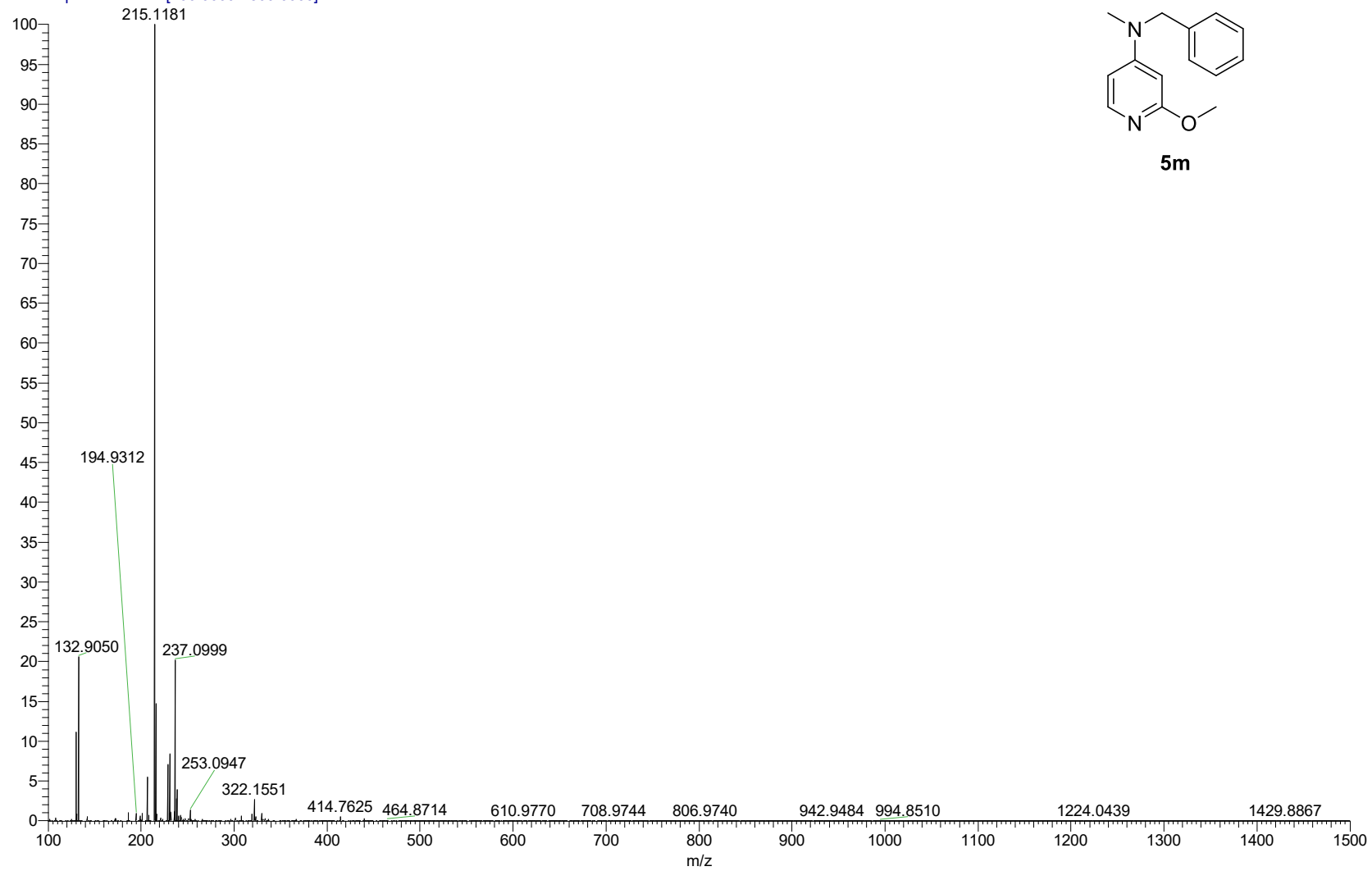
H-160 #41 RT: 0.21 AV: 1 NL: 5.05E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



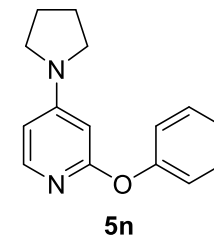
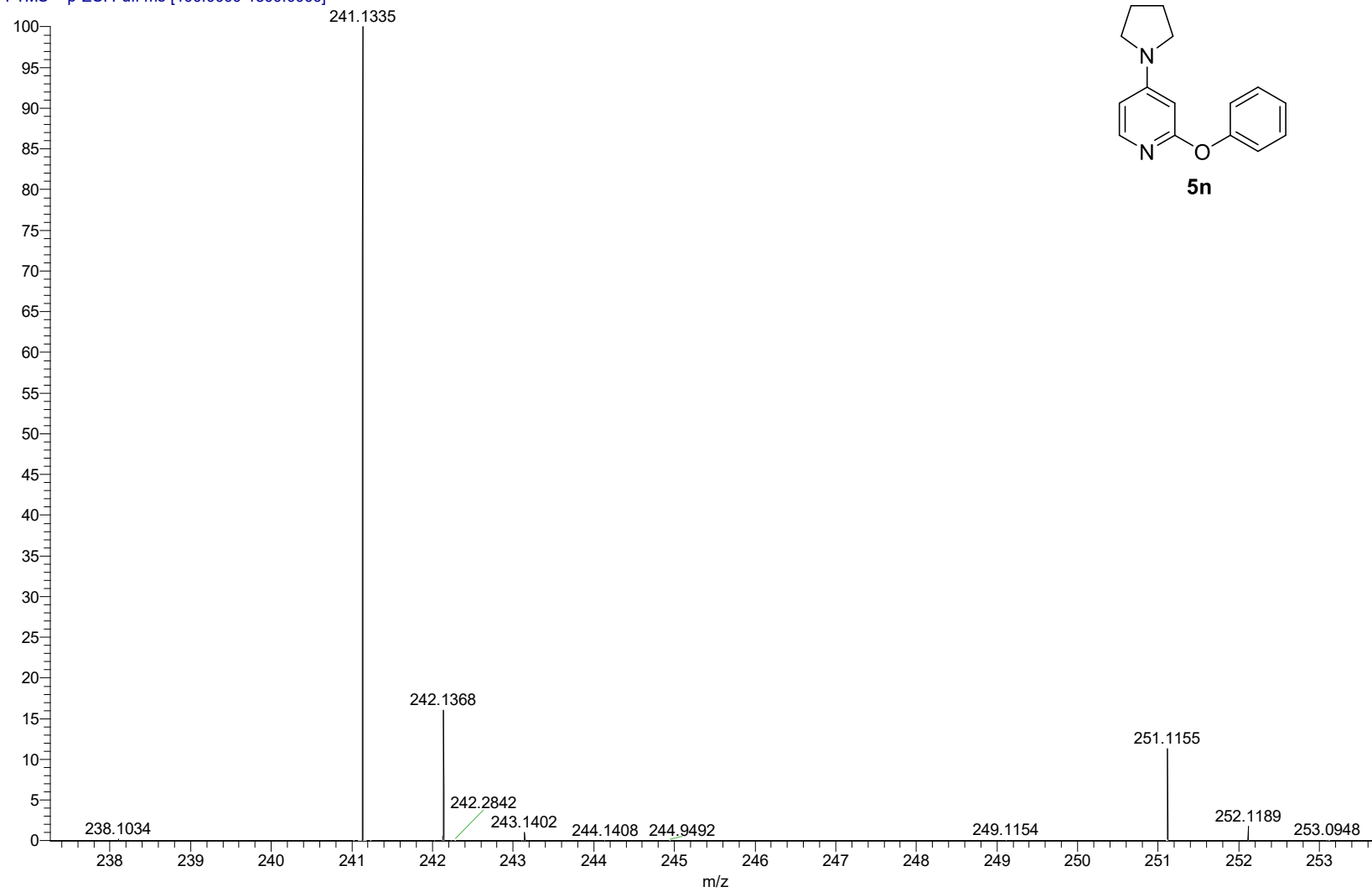
H-165 #34 RT: 0.17 AV: 1 NL: 1.05E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



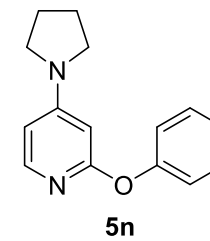
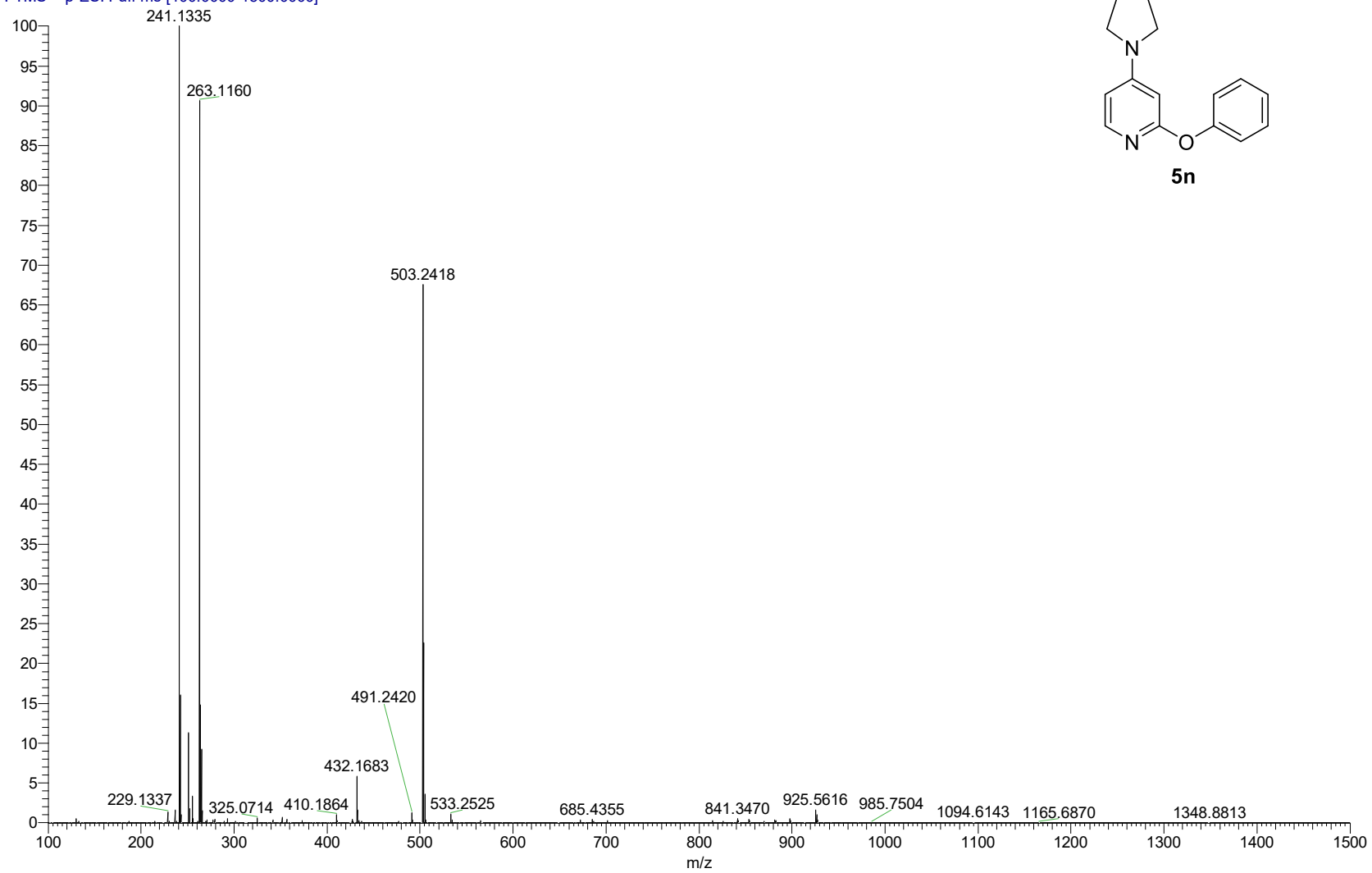
H-165 #35 RT: 0.18 AV: 1 NL: 1.34E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



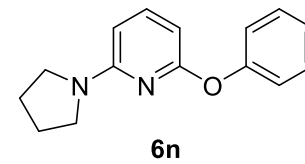
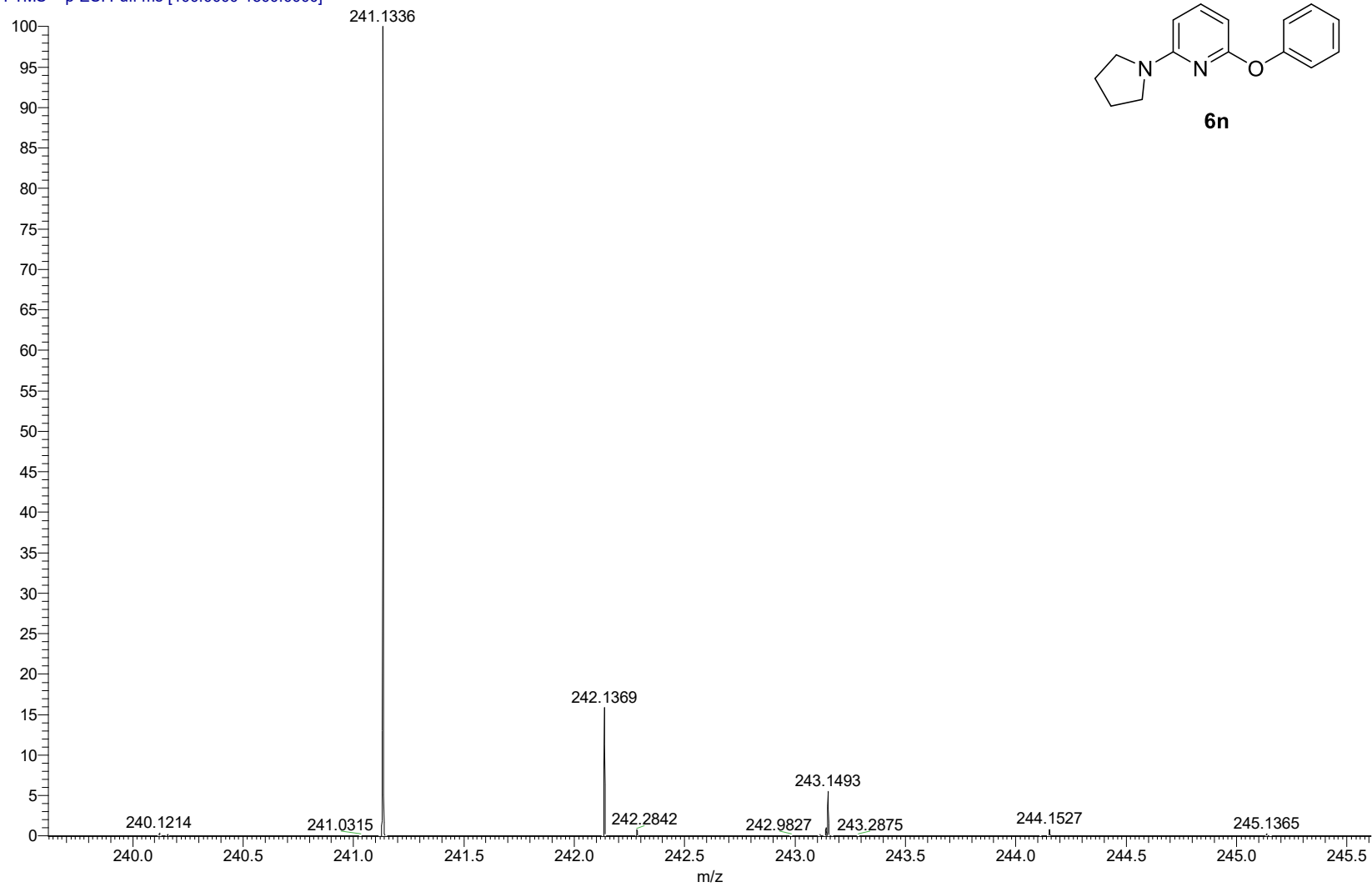
H-144-2 #59 RT: 0.30 AV: 1 NL: 3.30E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



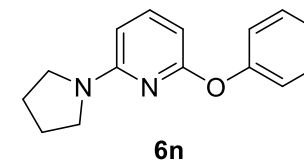
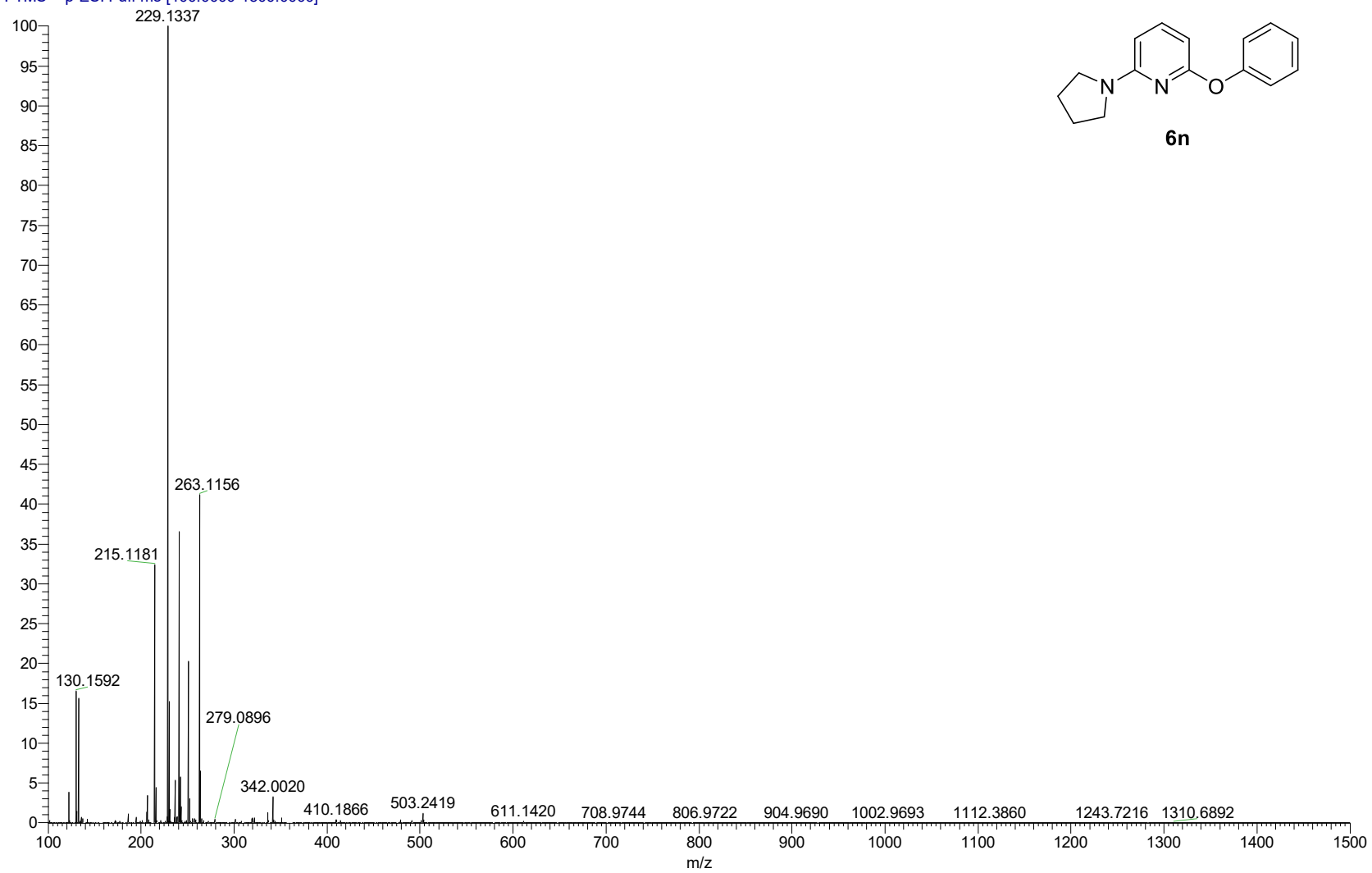
H-144-2 #59 RT: 0.30 AV: 1 NL: 3.30E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



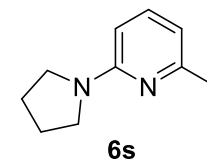
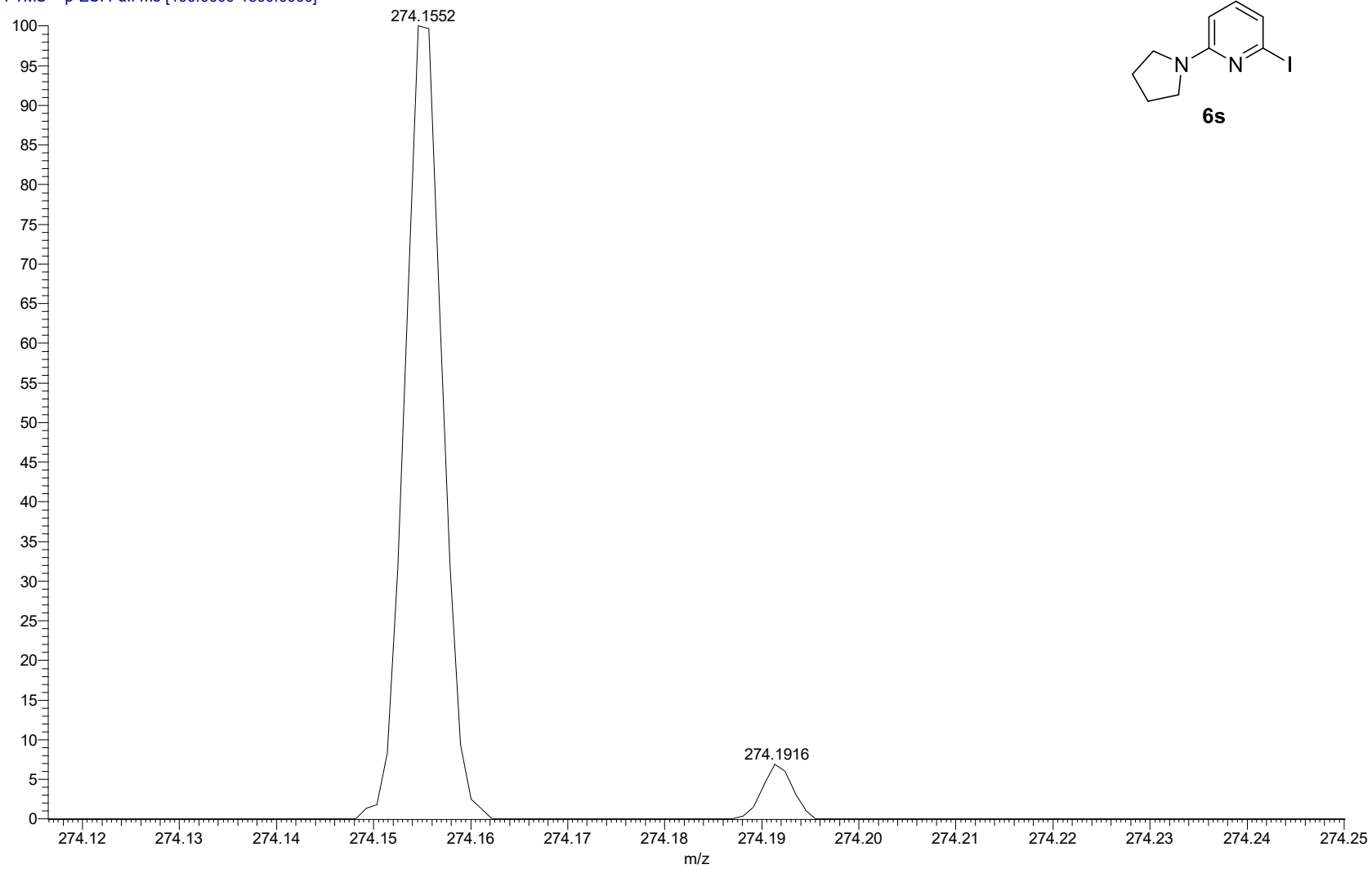
H-144-1 #208 RT: 1.07 AV: 1 NL: 4.70E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



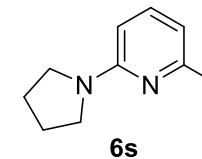
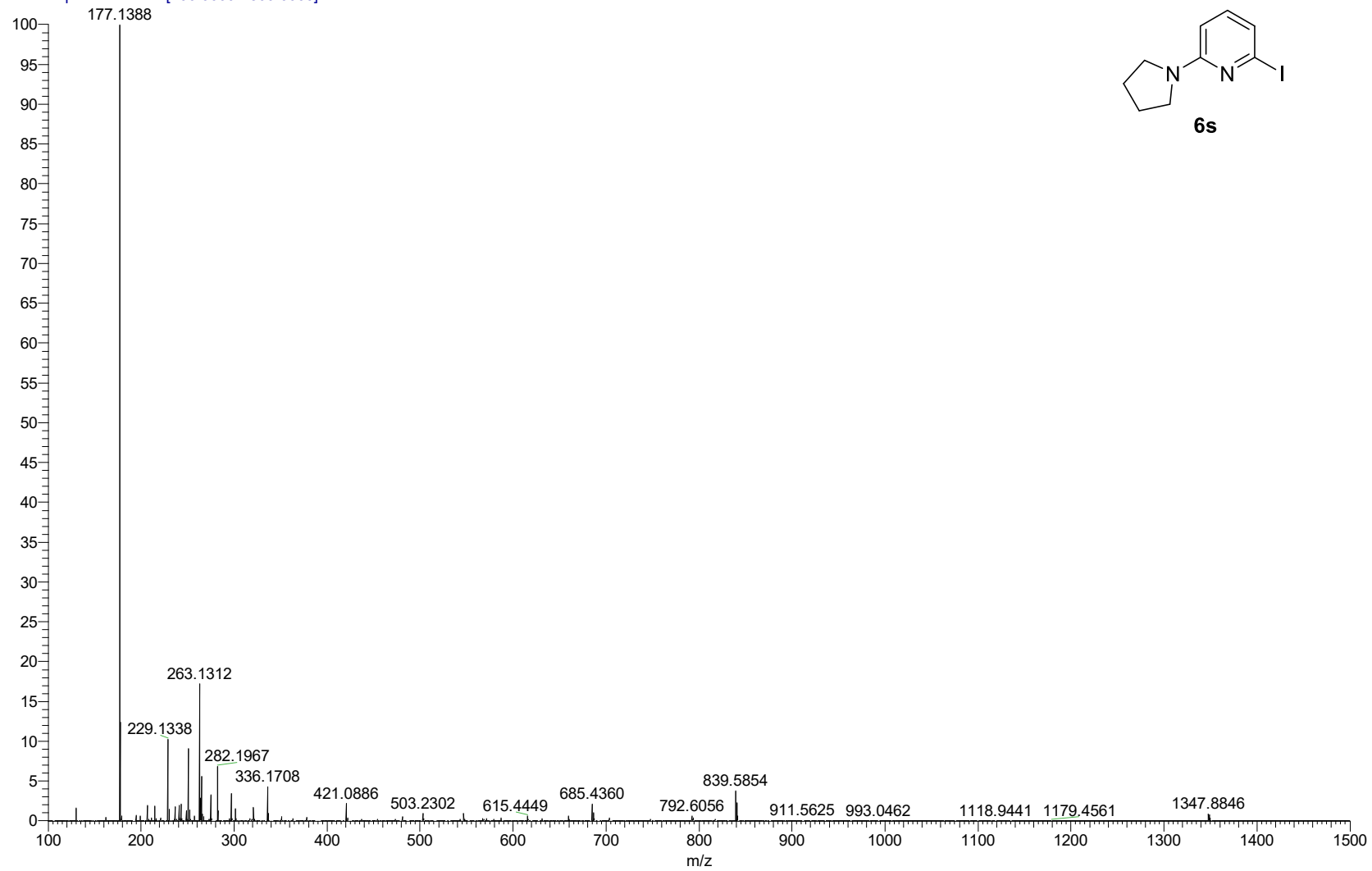
H-144-1 #208 RT: 1.07 AV: 1 NL: 1.29E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



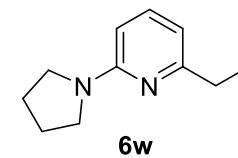
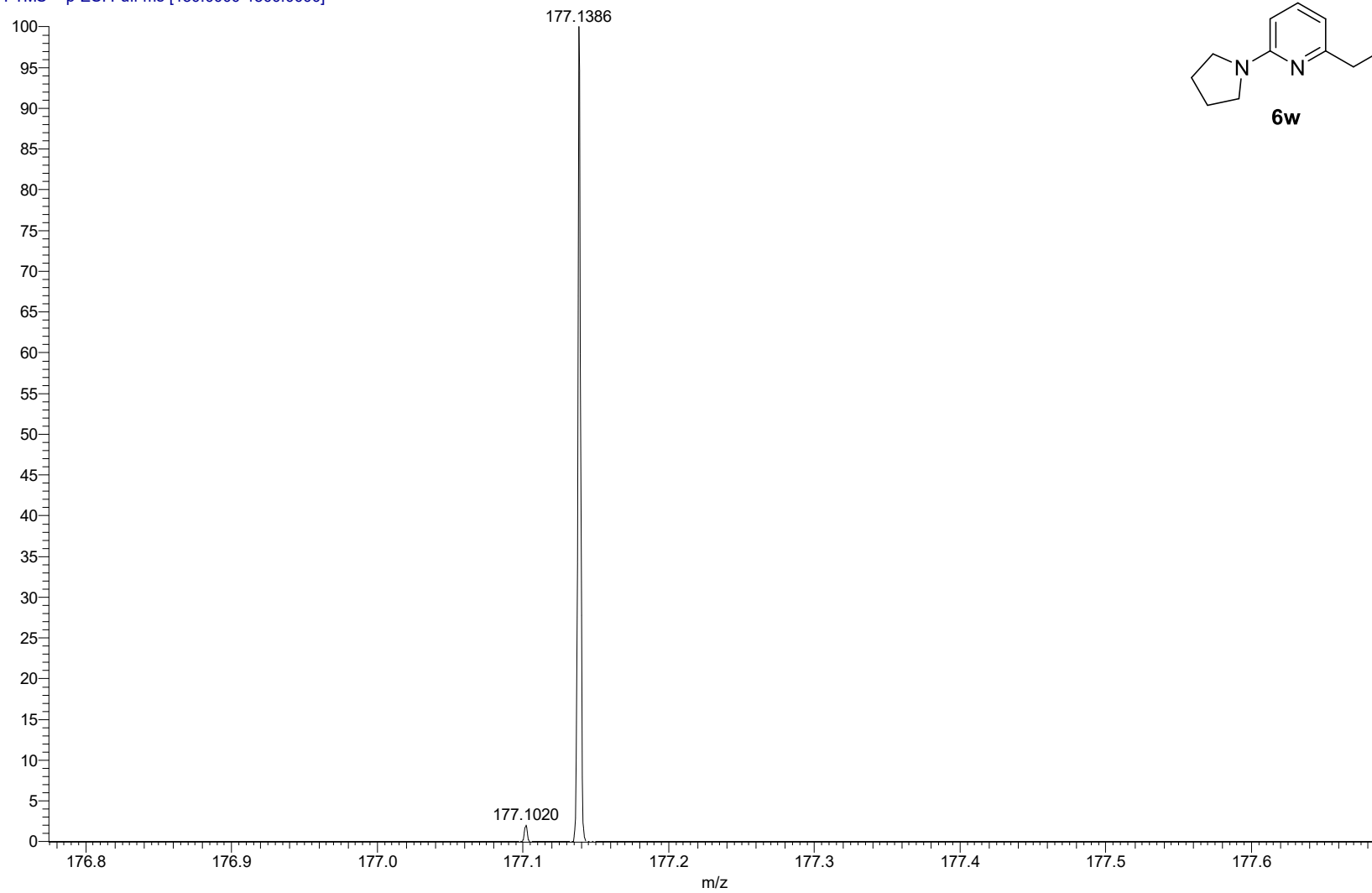
H-172 #49 RT: 0.25 AV: 1 NL: 2.93E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



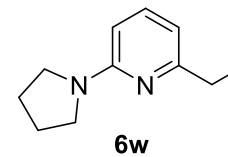
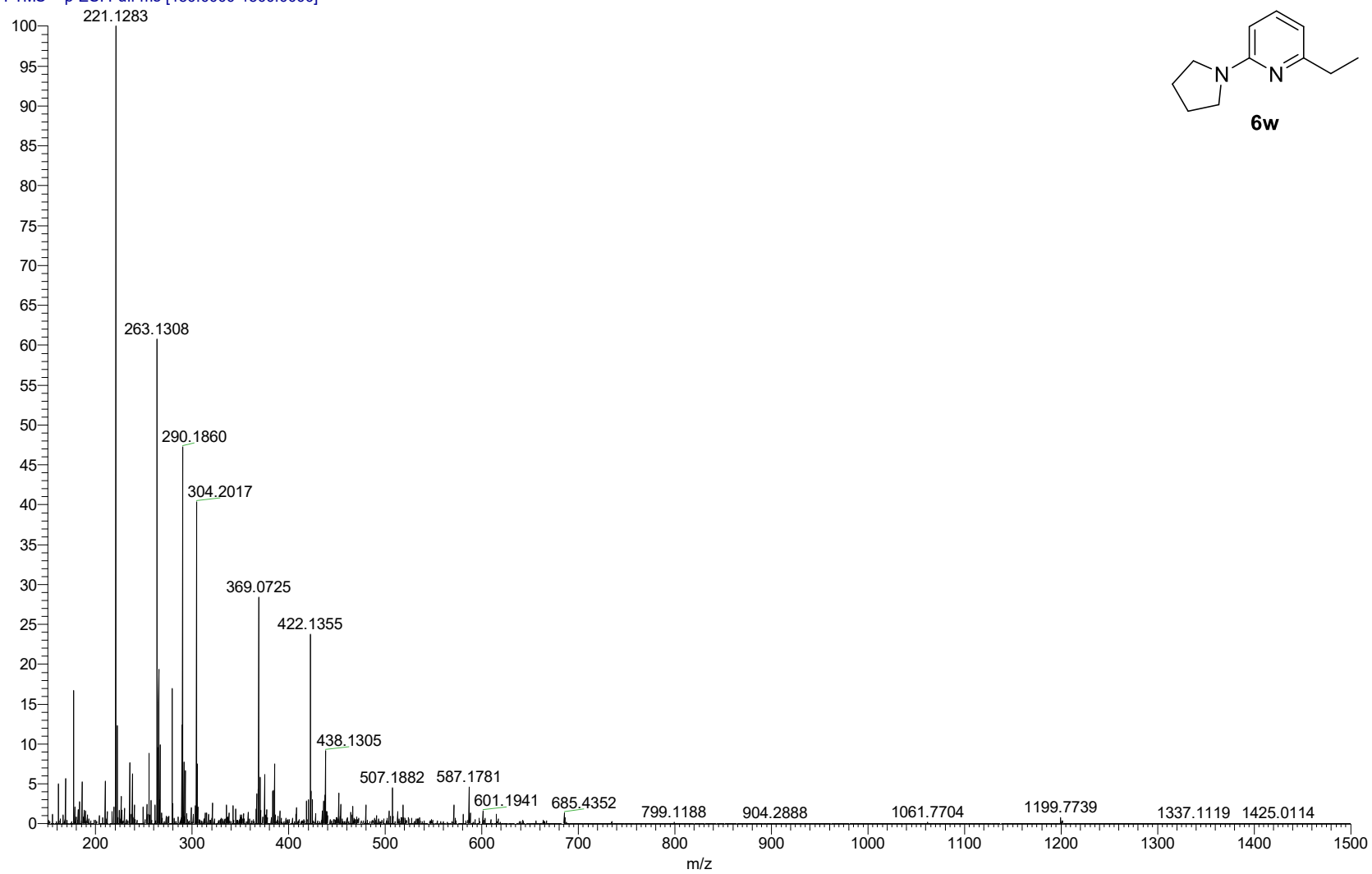
H-172 #49 RT: 0.25 AV: 1 NL: 7.09E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



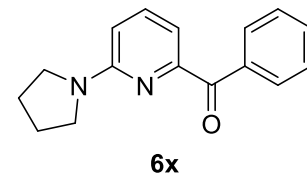
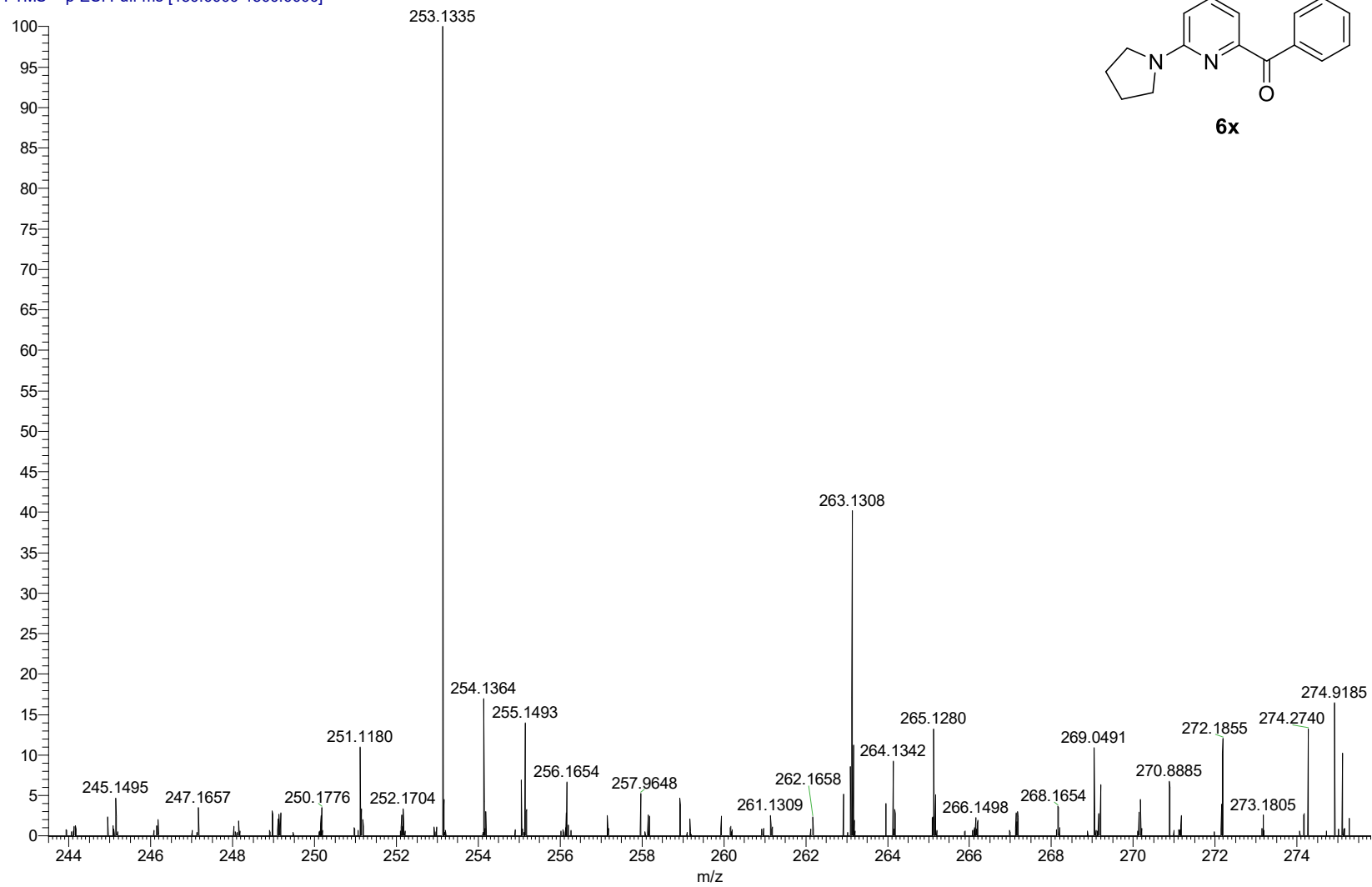
wd-7 #45 RT: 0.20 AV: 1 NL: 1.80E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



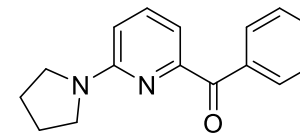
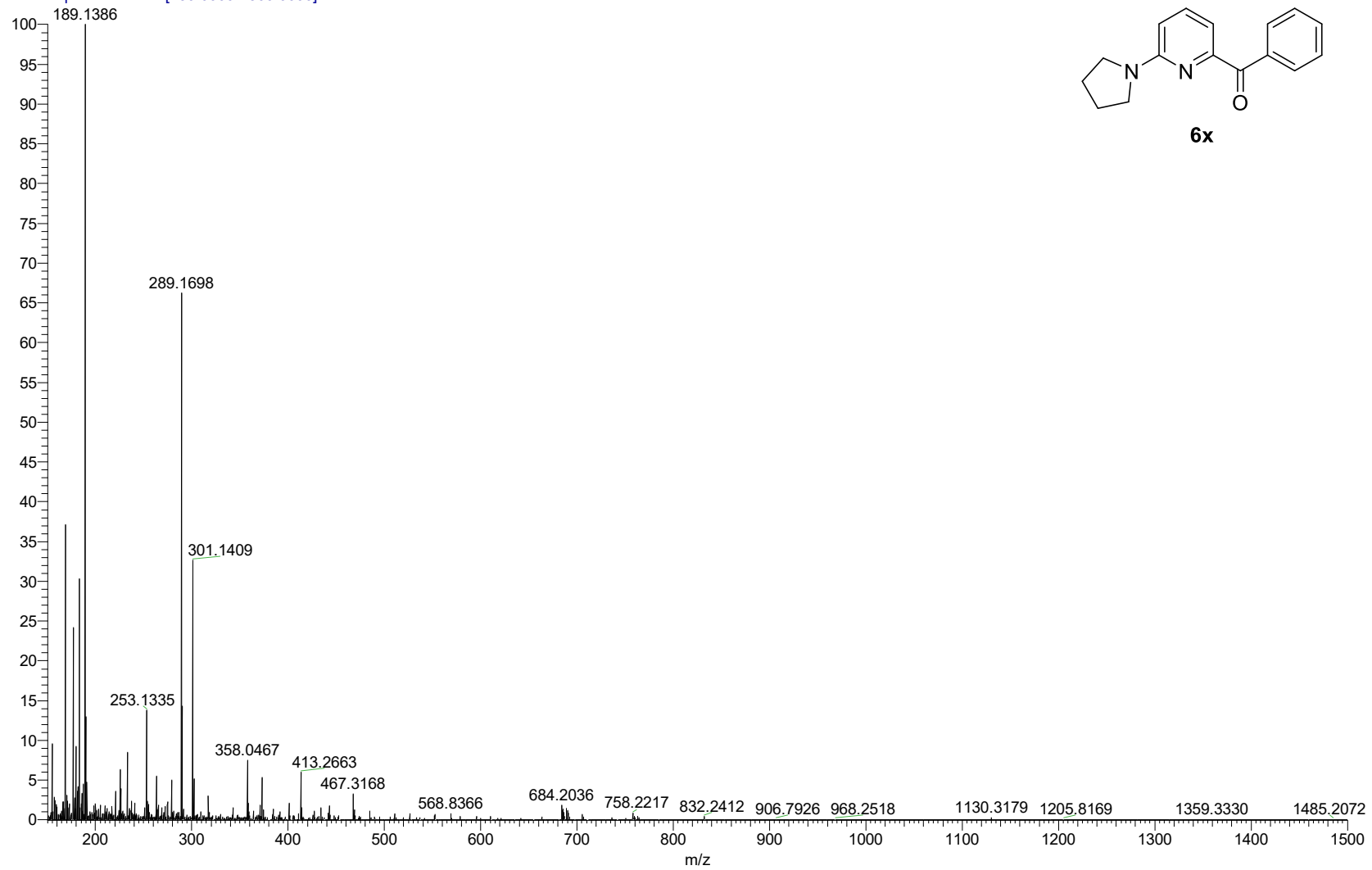
wd-7 #45 RT: 0.20 AV: 1 NL: 1.07E8
T: FTMS + p ESI Full ms [150.0000-1500.0000]



wd-9 #168 RT: 0.76 AV: 1 NL: 1.60E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]

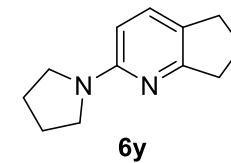
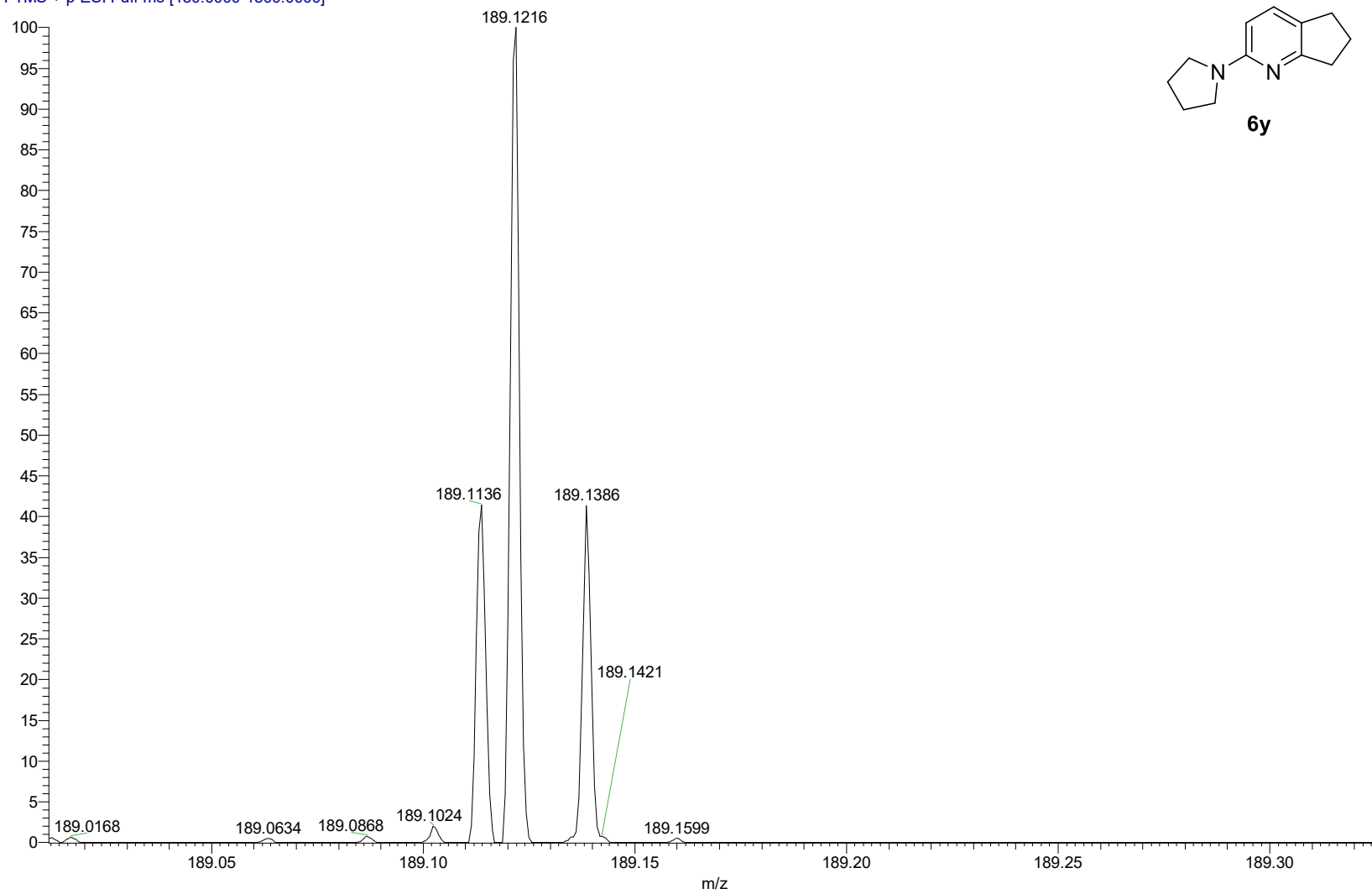


wd-9 #168 RT: 0.76 AV: 1 NL: 1.16E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]

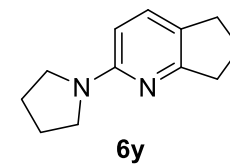
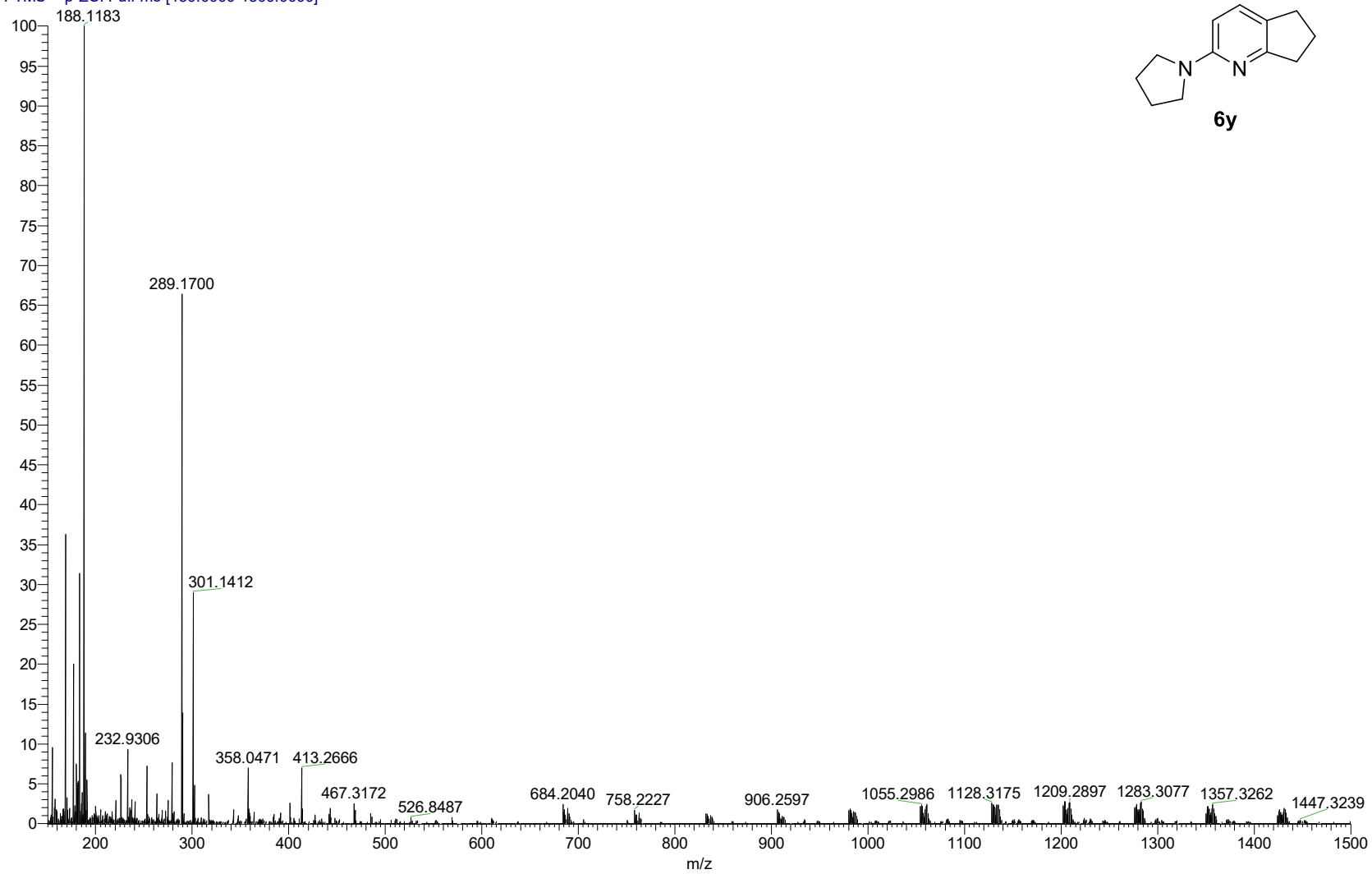


6x

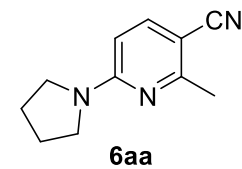
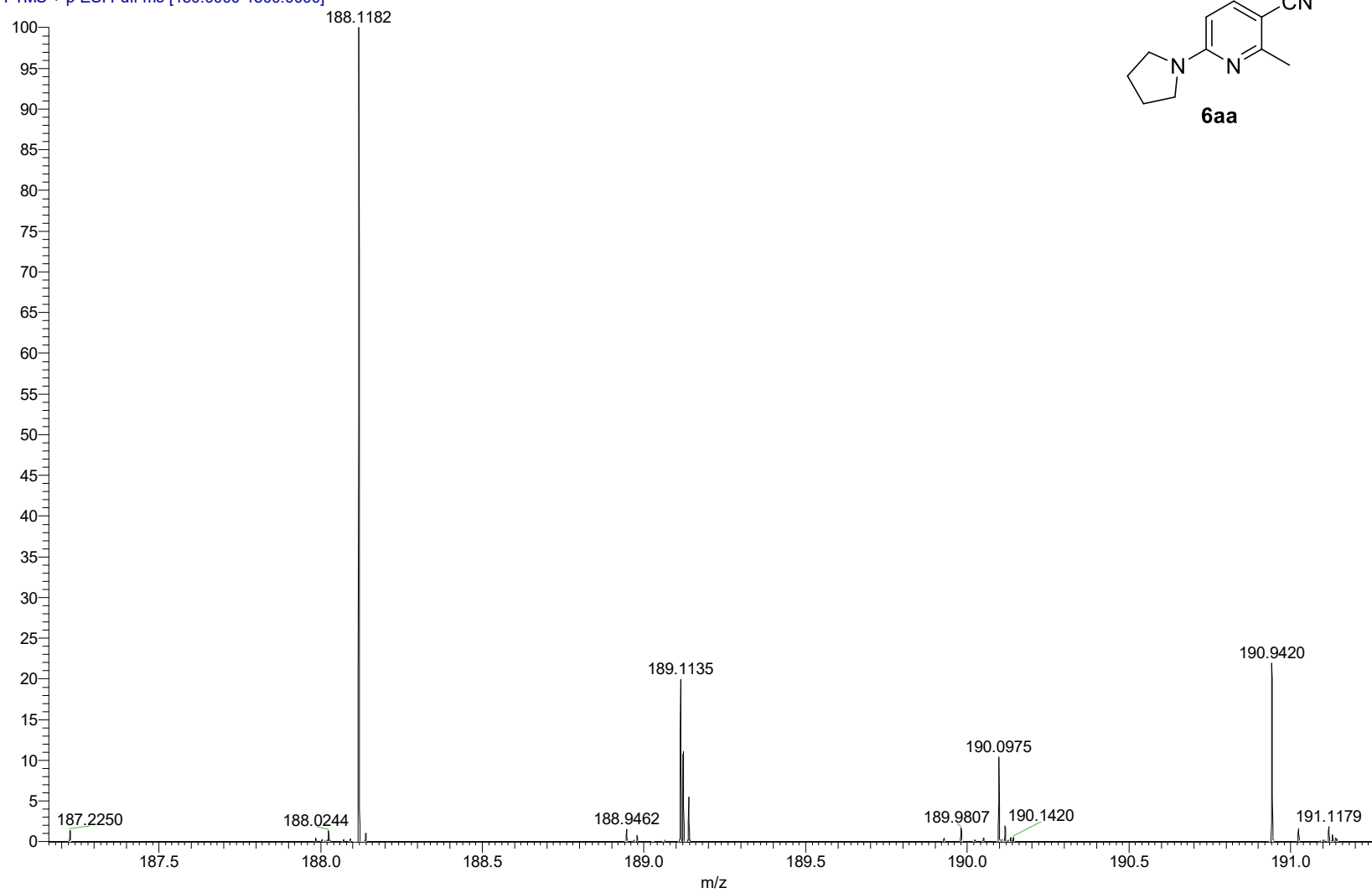
wd-10 #205 RT: 0.92 AV: 1 NL: 1.31E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



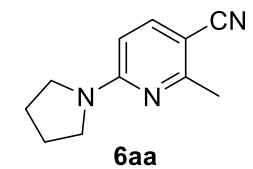
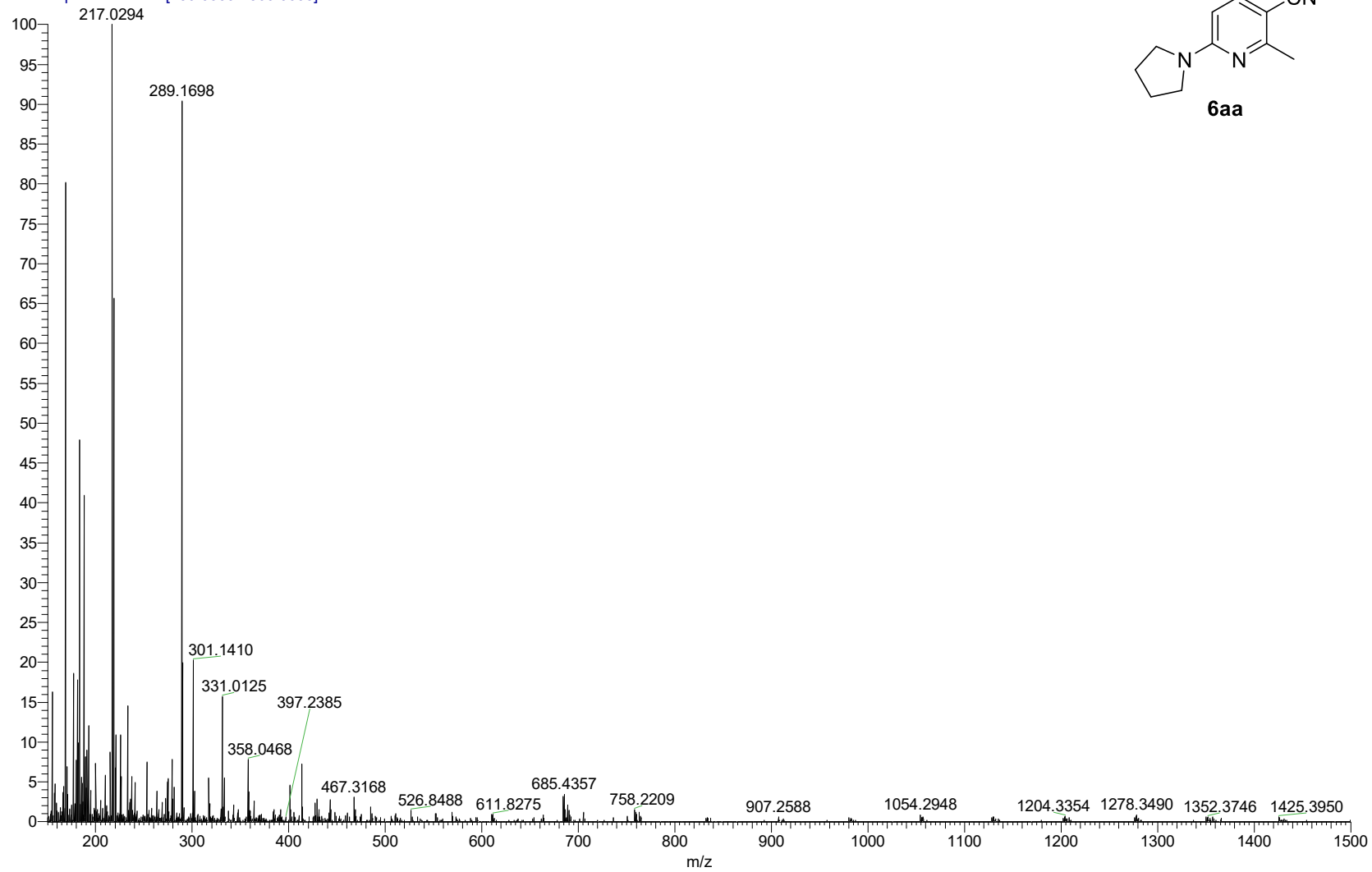
wd-10 #205 RT: 0.92 AV: 1 NL: 1.15E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



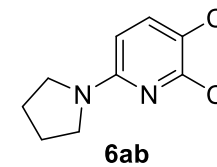
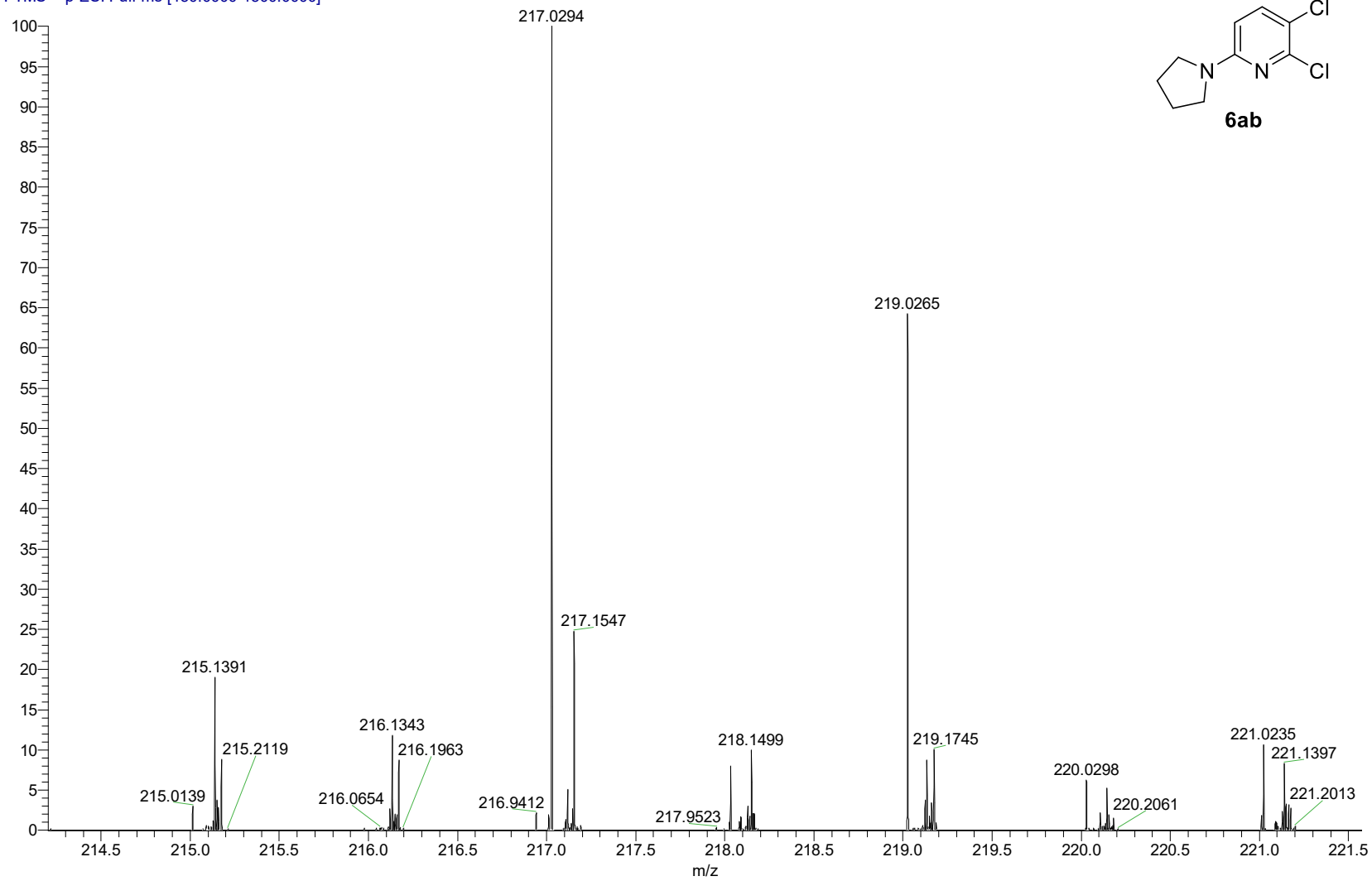
wd-11 #97 RT: 0.44 AV: 1 NL: 3.41E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



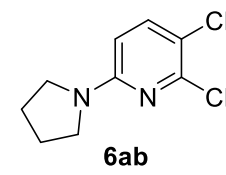
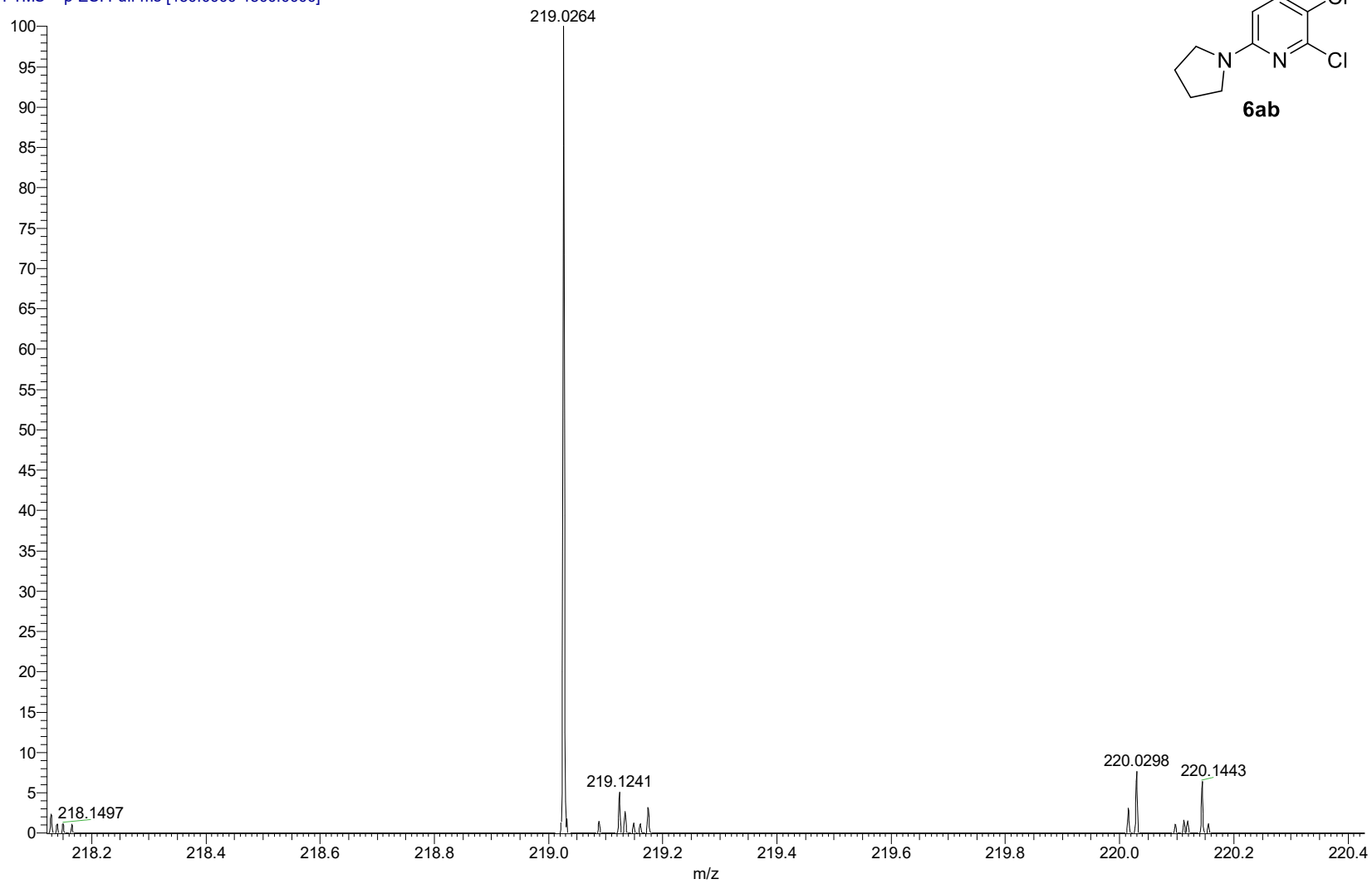
wd-11 #97 RT: 0.44 AV: 1 NL: 8.33E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



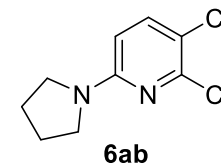
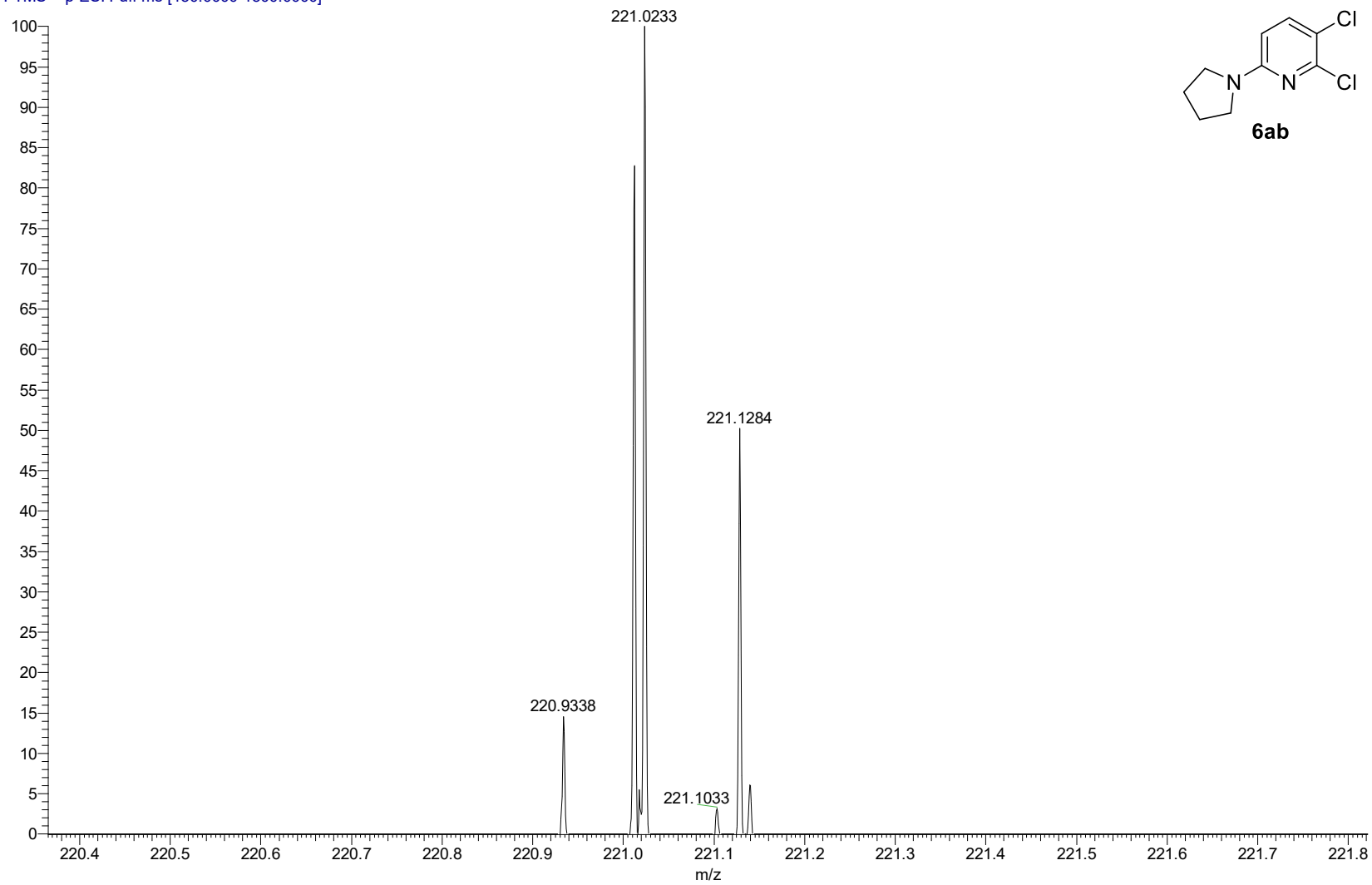
wd-12 #100 RT: 0.45 AV: 1 NL: 4.39E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



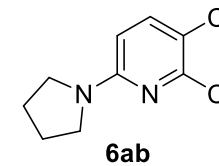
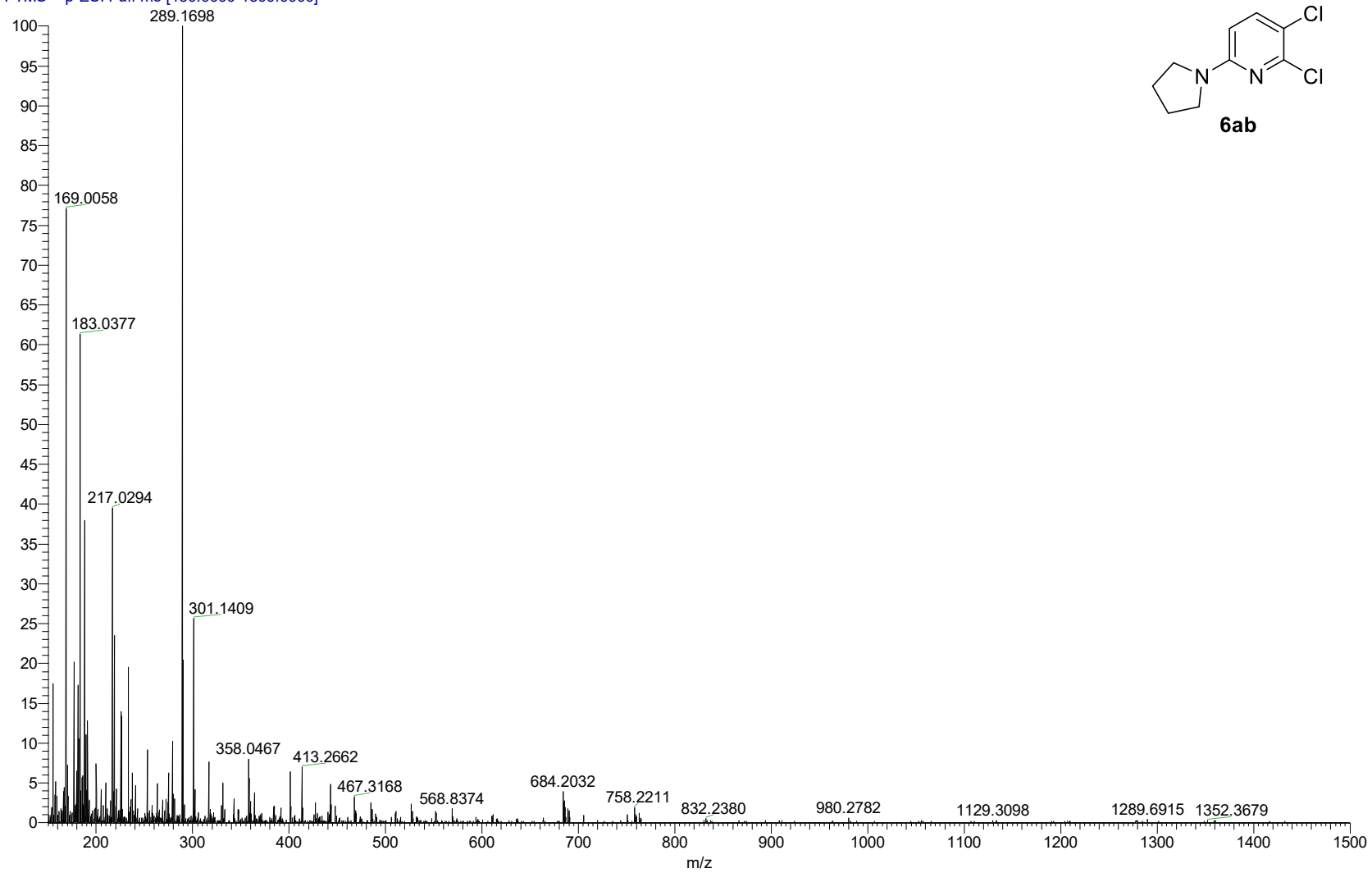
wd-12 #111 RT: 0.50 AV: 1 NL: 6.63E5
T: FTMS + p ESI Full ms [150.0000-1500.0000]



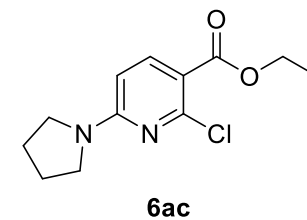
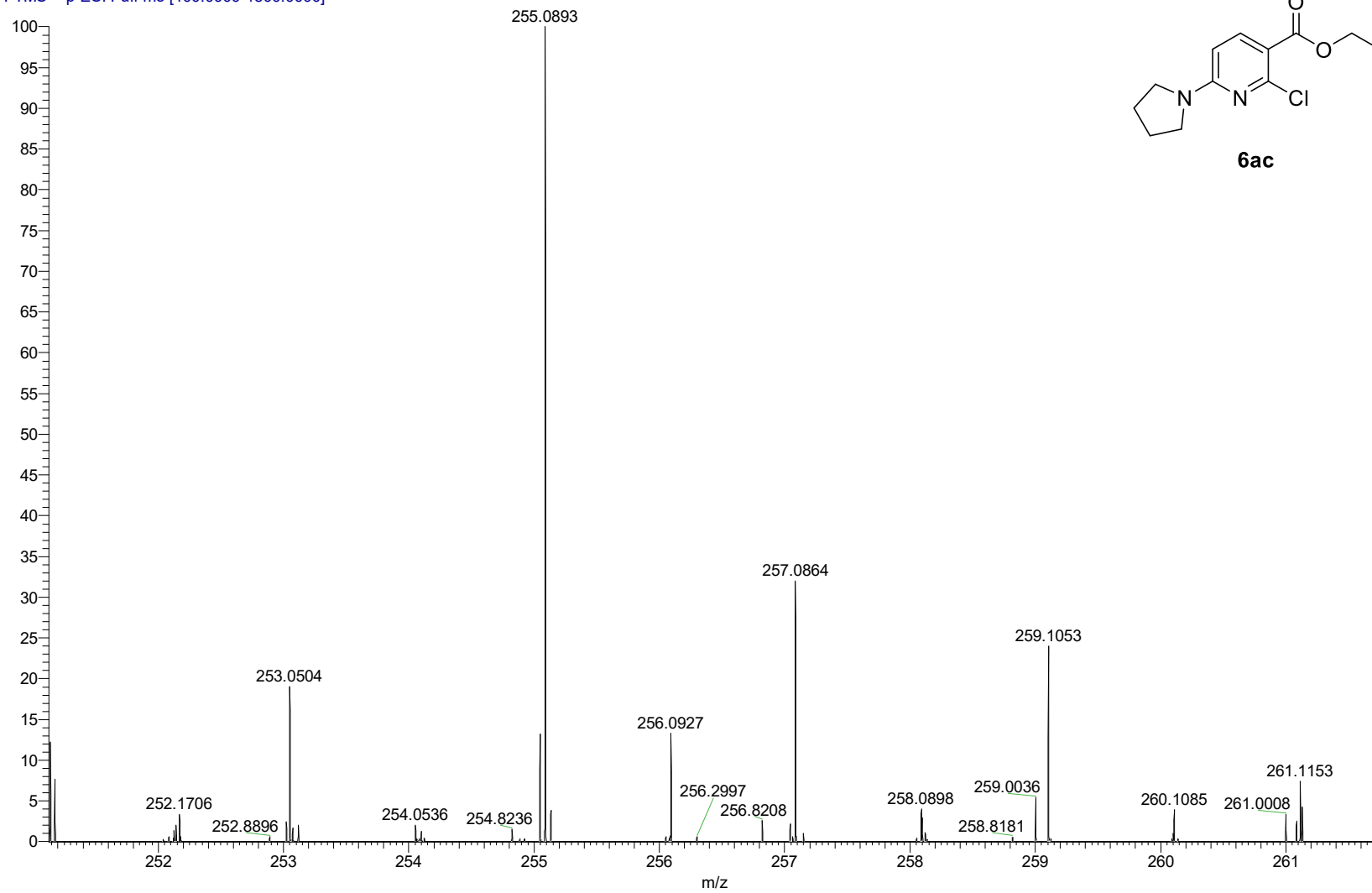
wd-11 #188 RT: 0.85 AV: 1 NL: 2.52E5
T: FTMS + p ESI Full ms [150.0000-1500.0000]



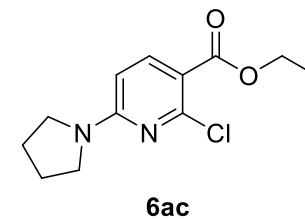
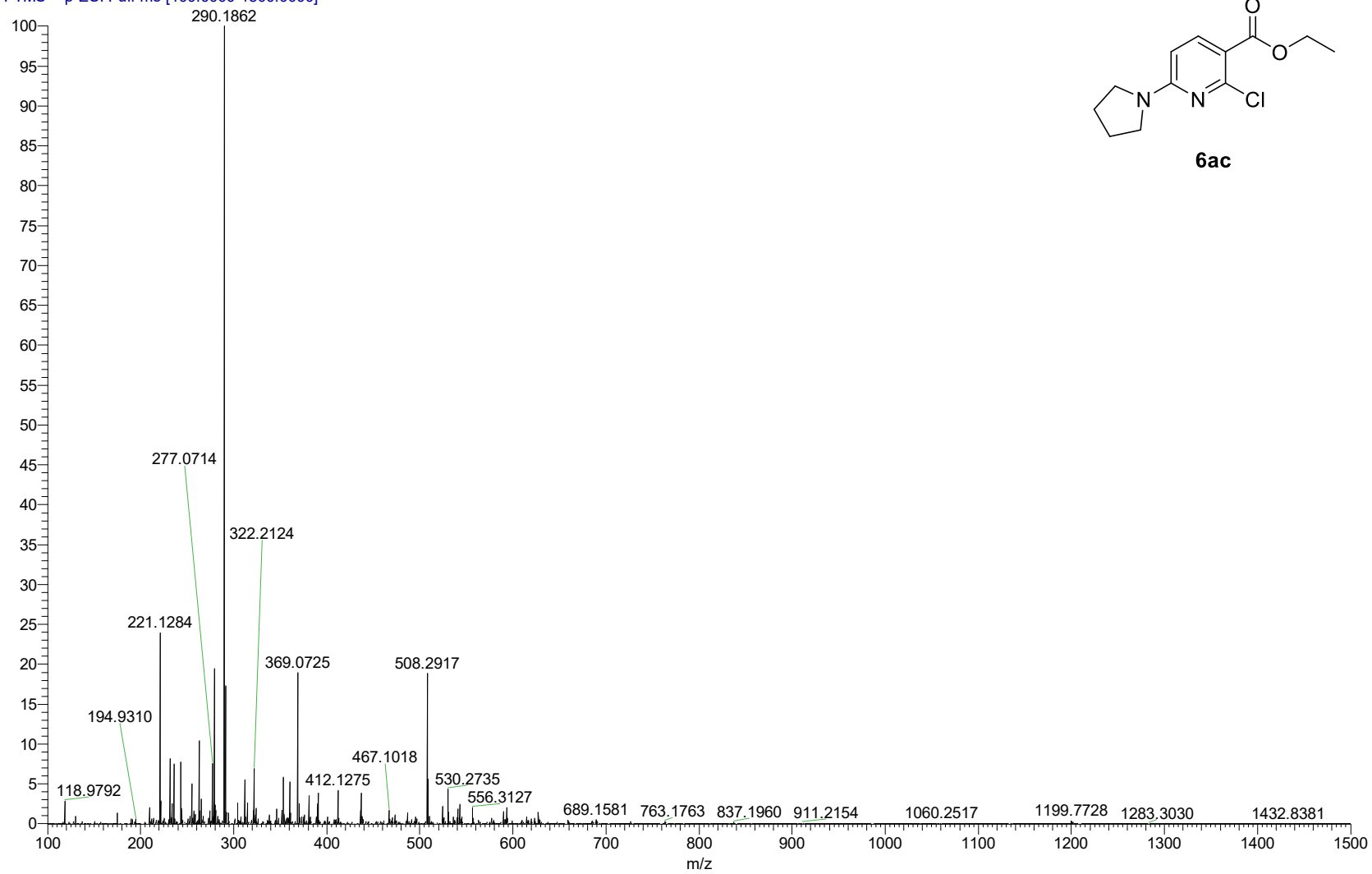
wd-11 #188 RT: 0.85 AV: 1 NL: 5.92E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



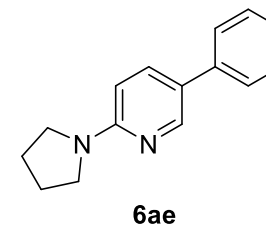
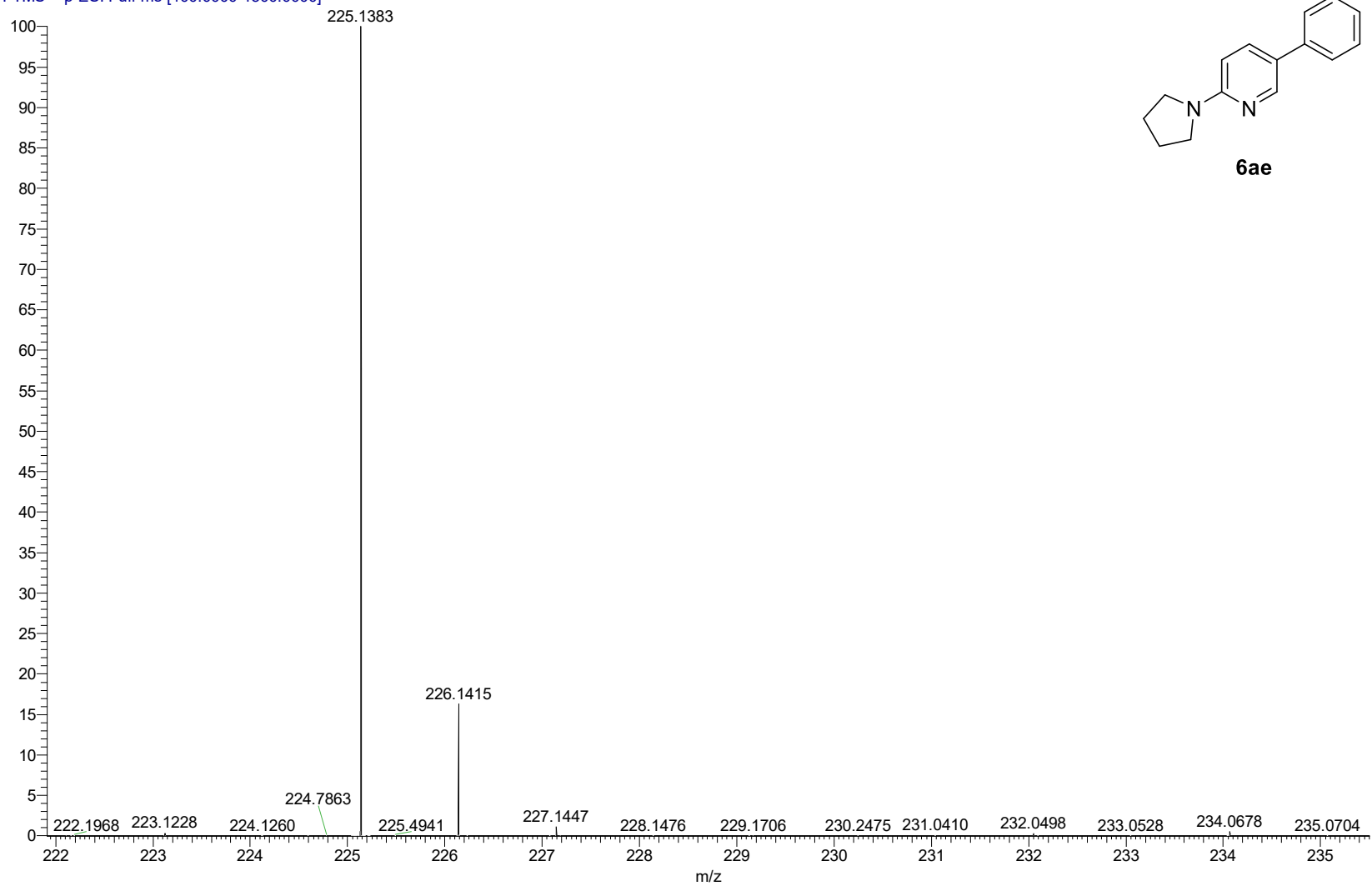
WD-10 #47 RT: 0.46 AV: 1 NL: 4.29E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



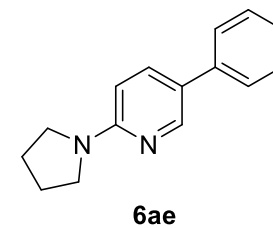
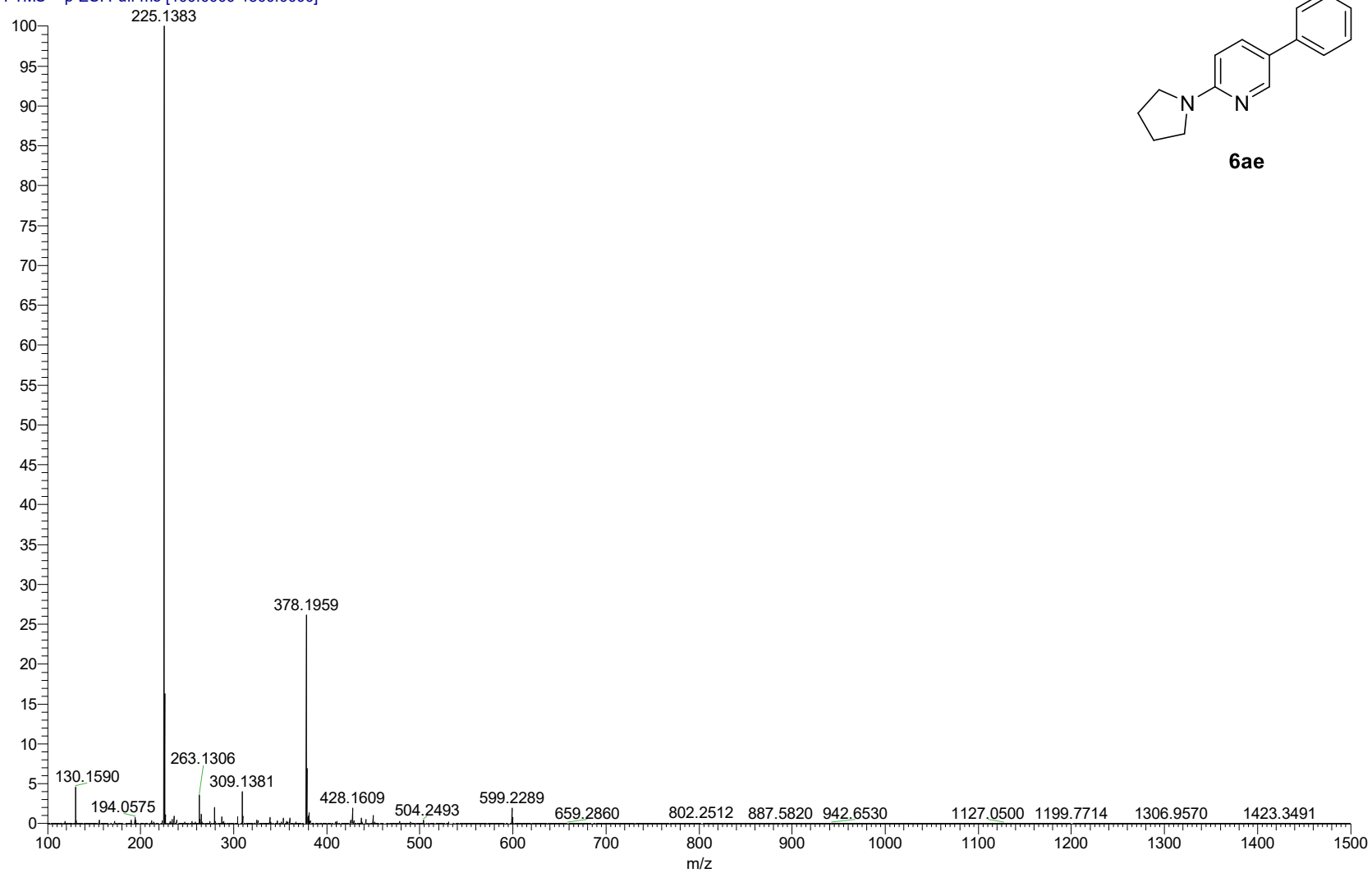
WD-10 #47 RT: 0.46 AV: 1 NL: 8.55E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



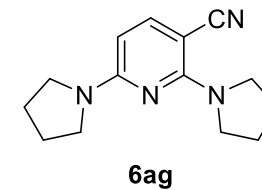
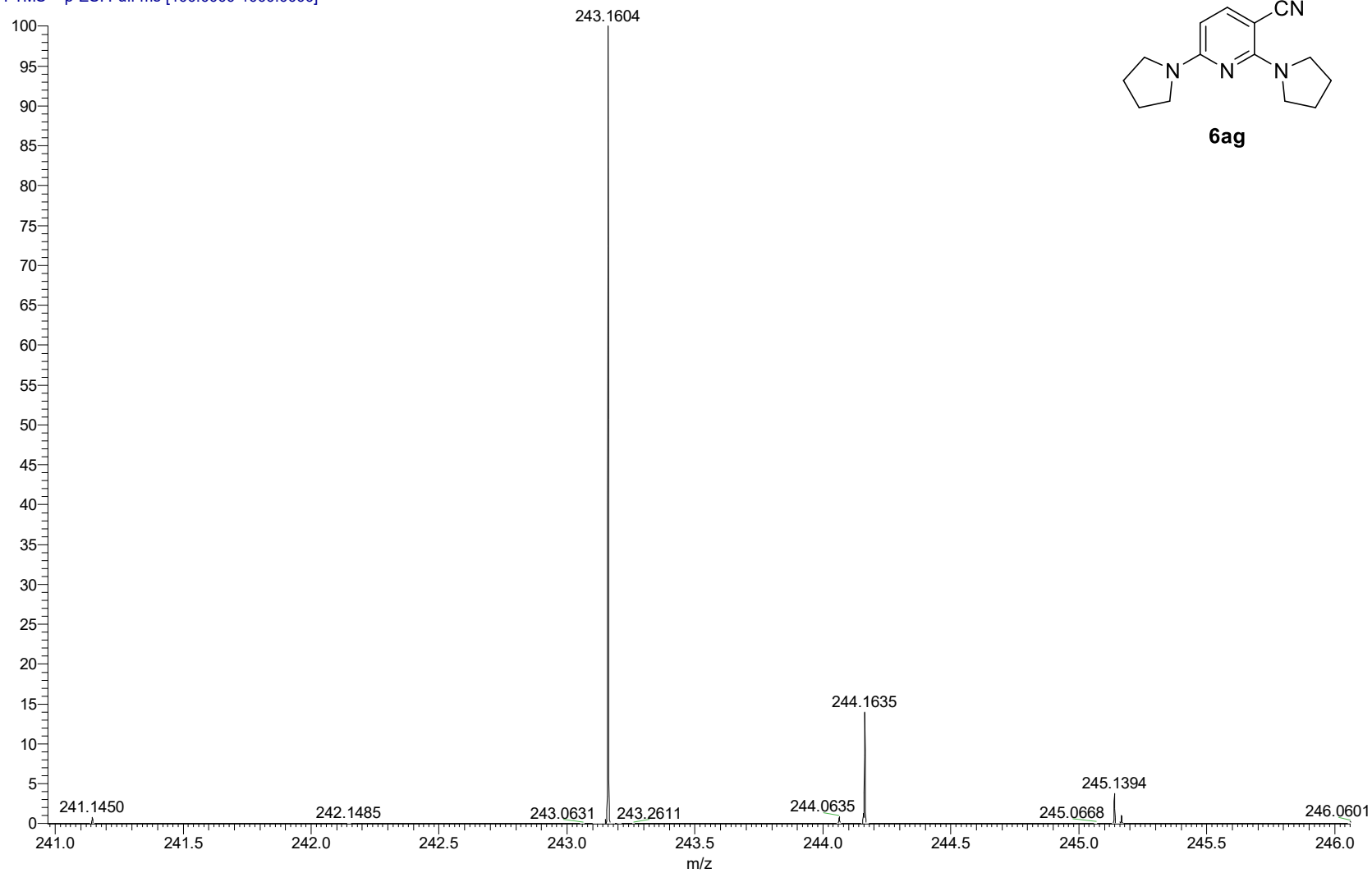
WD-11 #47 RT: 0.46 AV: 1 NL: 6.35E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



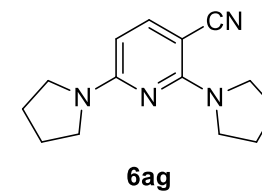
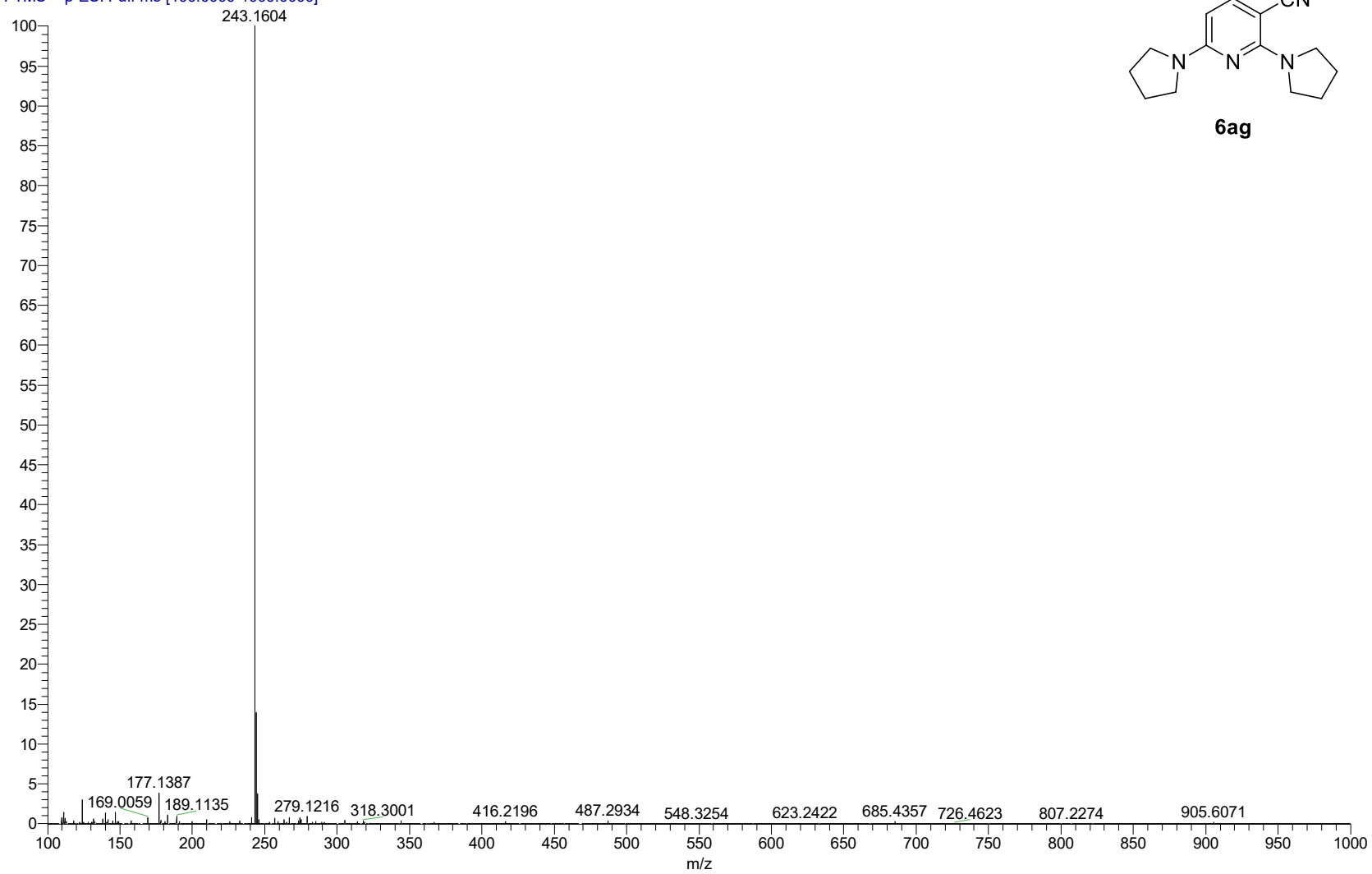
WD-11 #47 RT: 0.46 AV: 1 NL: 6.35E9
T: FTMS + p ESI Full ms [100.0000-1500.0000]



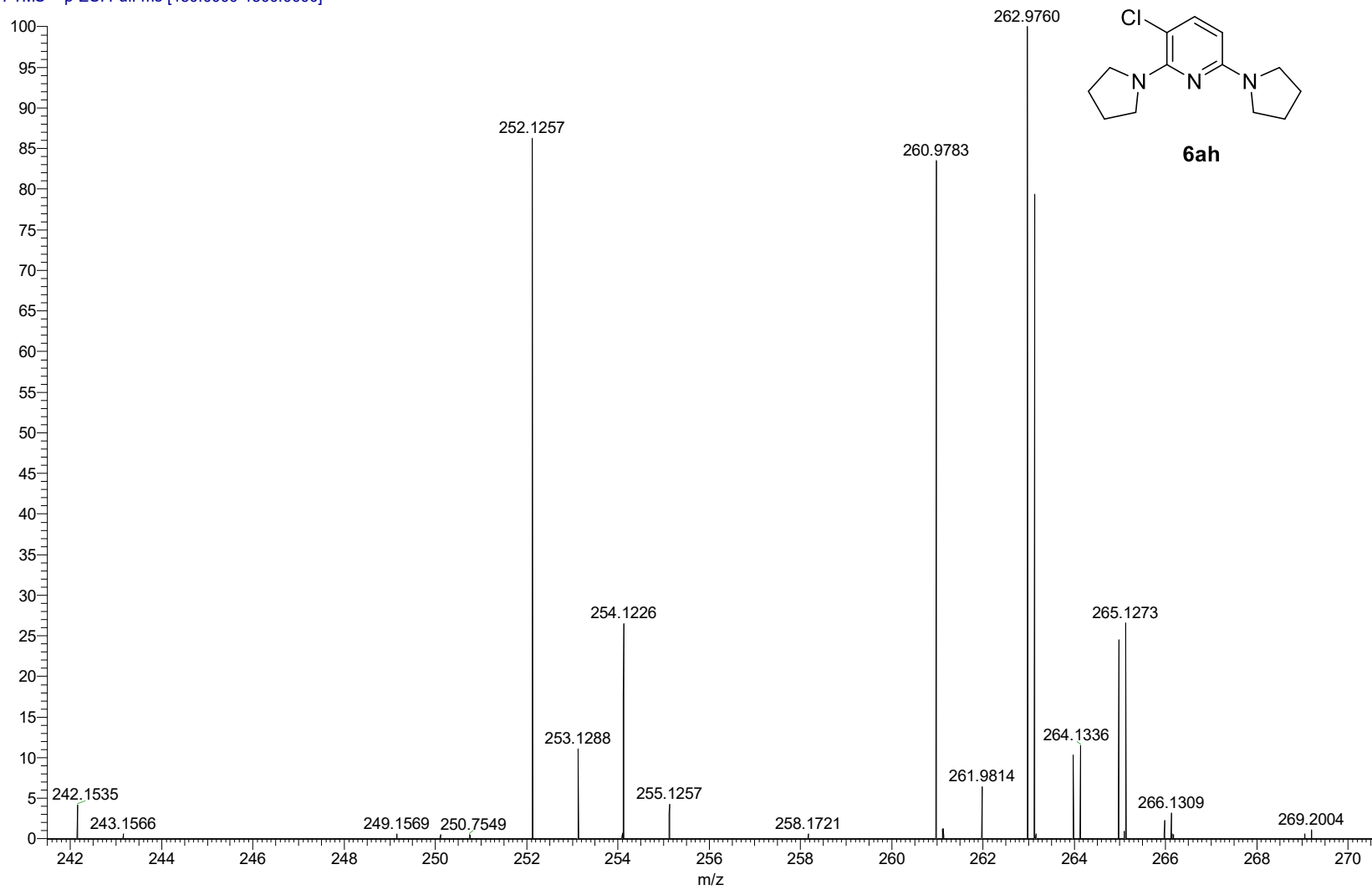
WD-8 #57 RT: 0.25 AV: 1 NL: 6.34E8
T: FTMS + p ESI Full ms [100.0000-1000.0000]



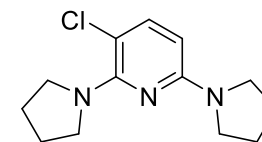
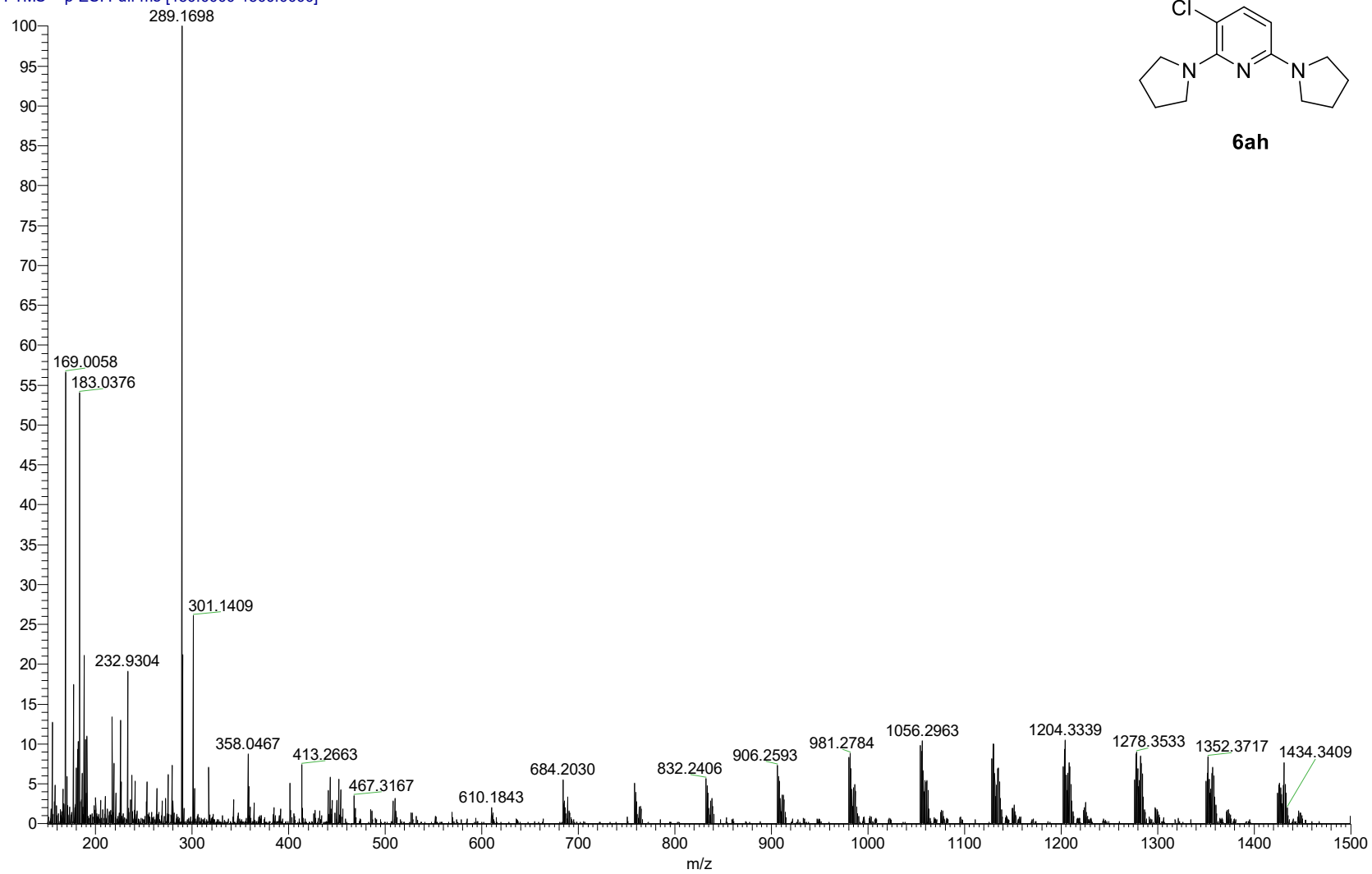
WD-8 #57 RT: 0.25 AV: 1 NL: 6.34E8
T: FTMS + p ESI Full ms [100.0000-1000.0000]



wd-12 #31 RT: 0.14 AV: 1 NL: 3.12E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]

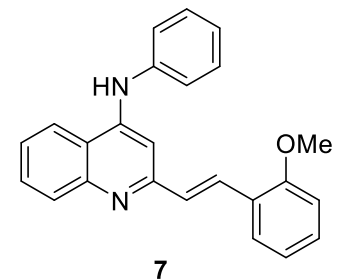
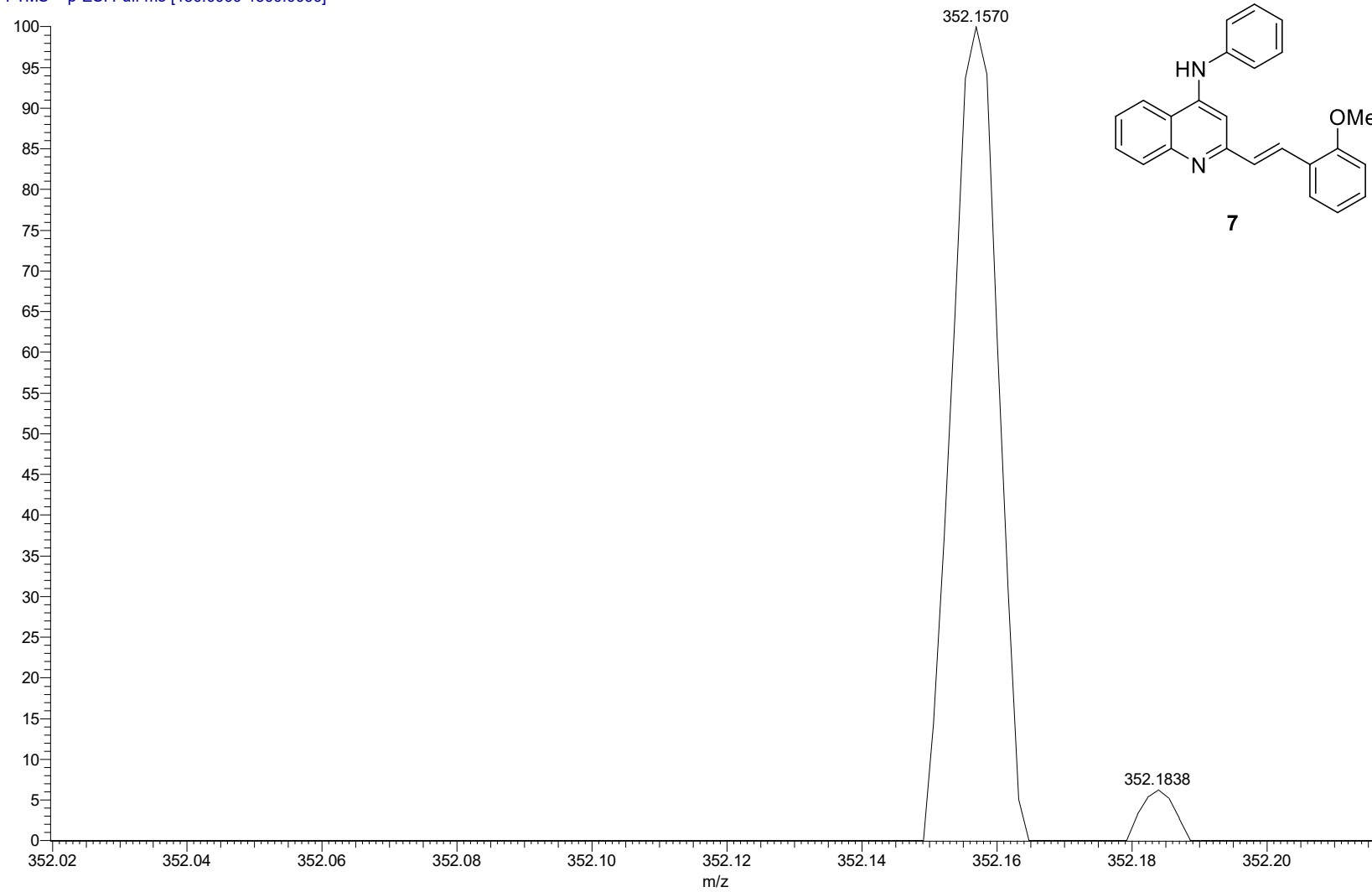


wd-12 #129 RT: 0.58 AV: 1 NL: 6.50E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]

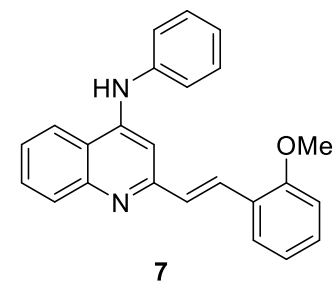
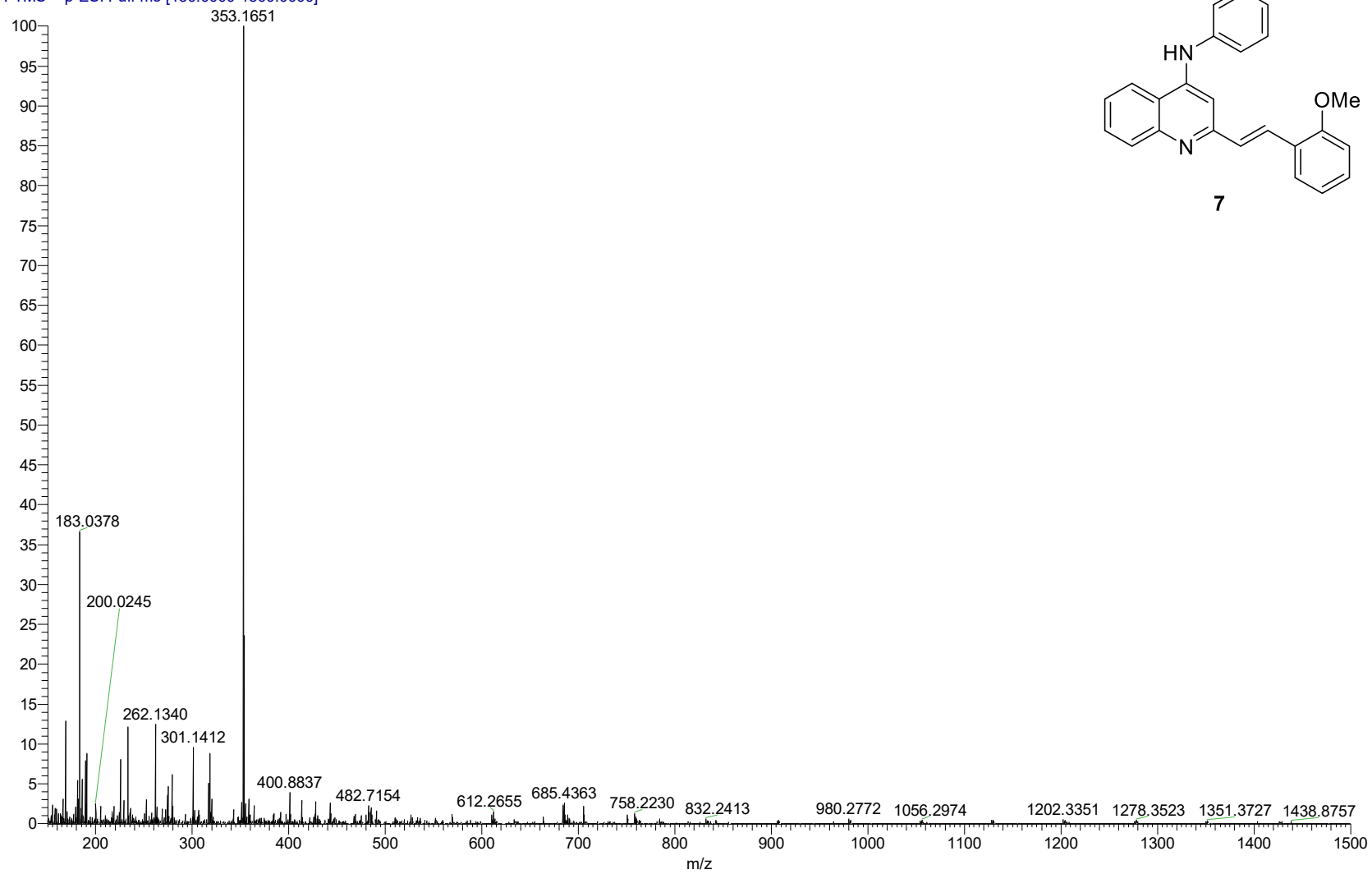


6ah

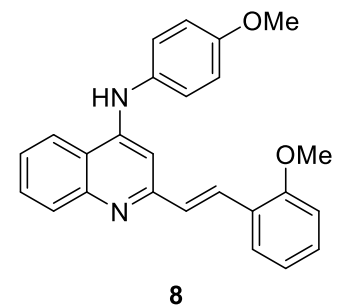
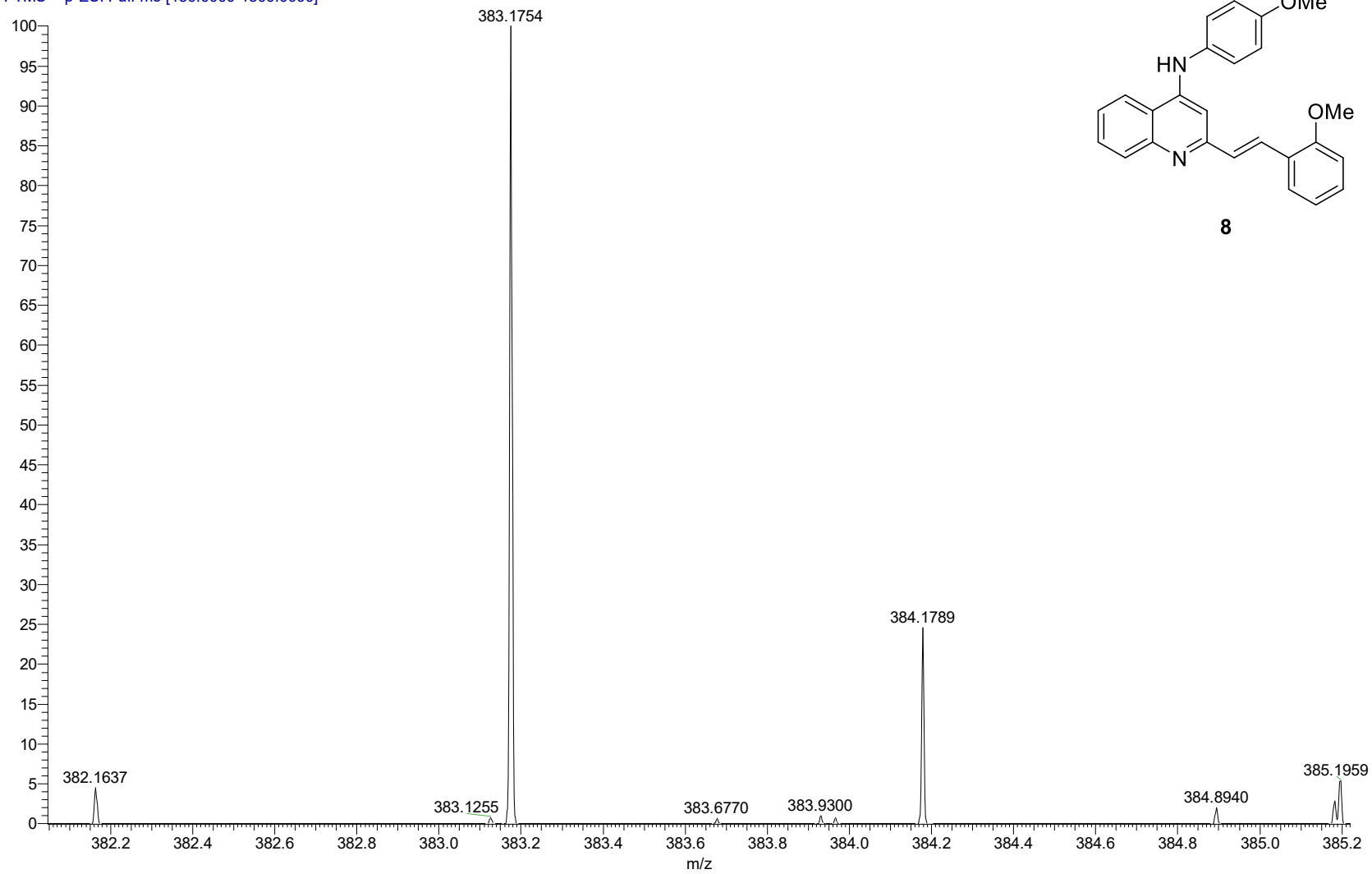
wd-9 #86 RT: 0.39 AV: 1 NL: 9.96E4
T: FTMS + p ESI Full ms [150.0000-1500.0000]



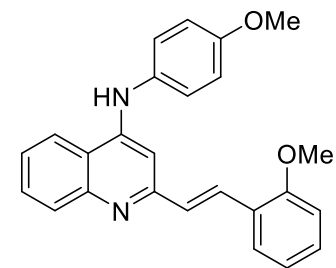
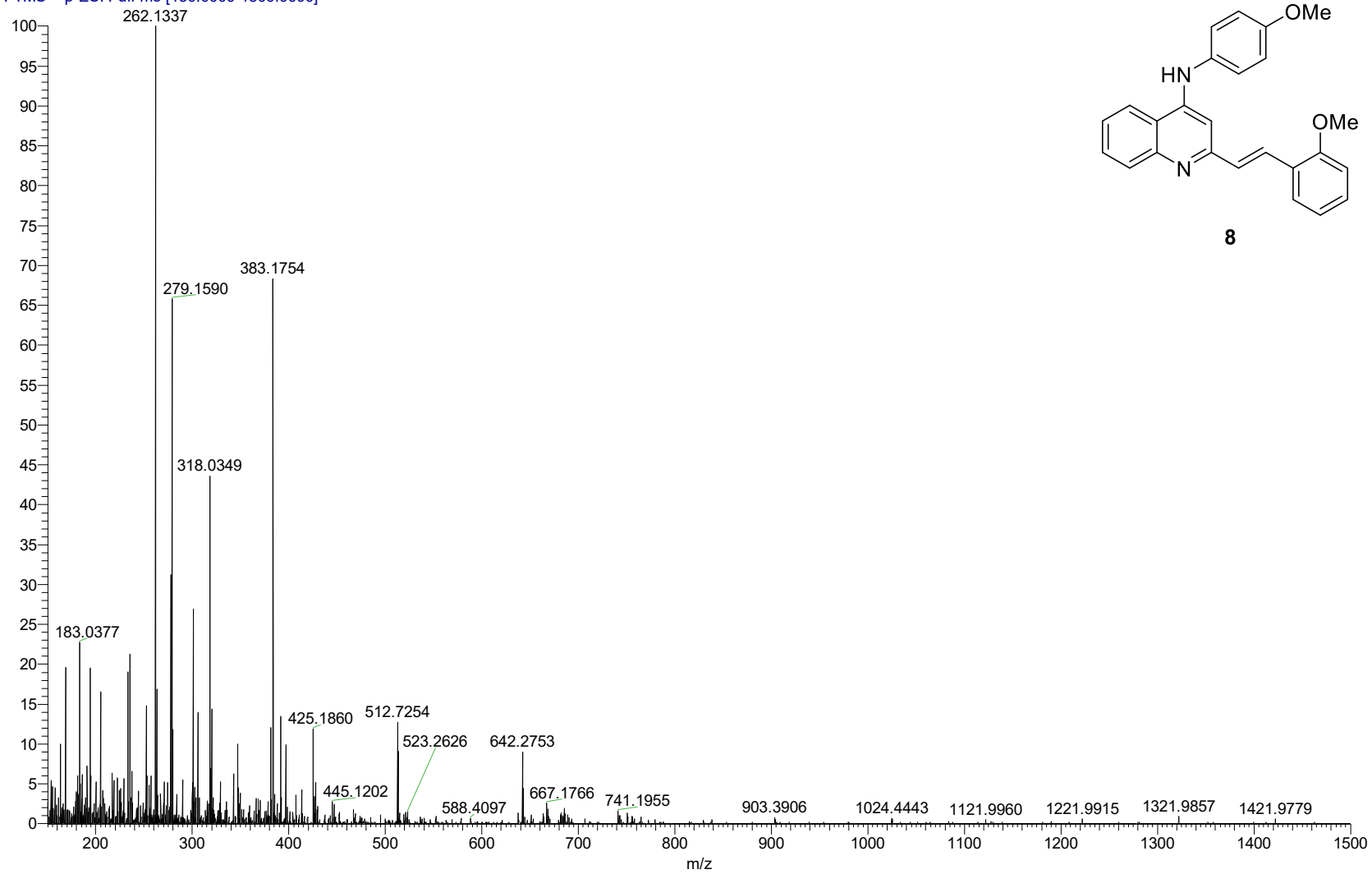
wd-9 #86 RT: 0.39 AV: 1 NL: 1.21E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



wd-10 #72 RT: 0.33 AV: 1 NL: 2.56E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]

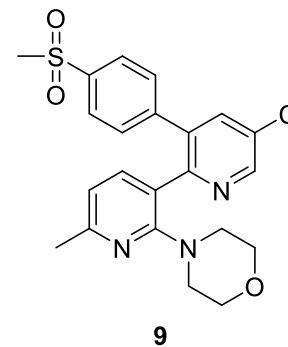
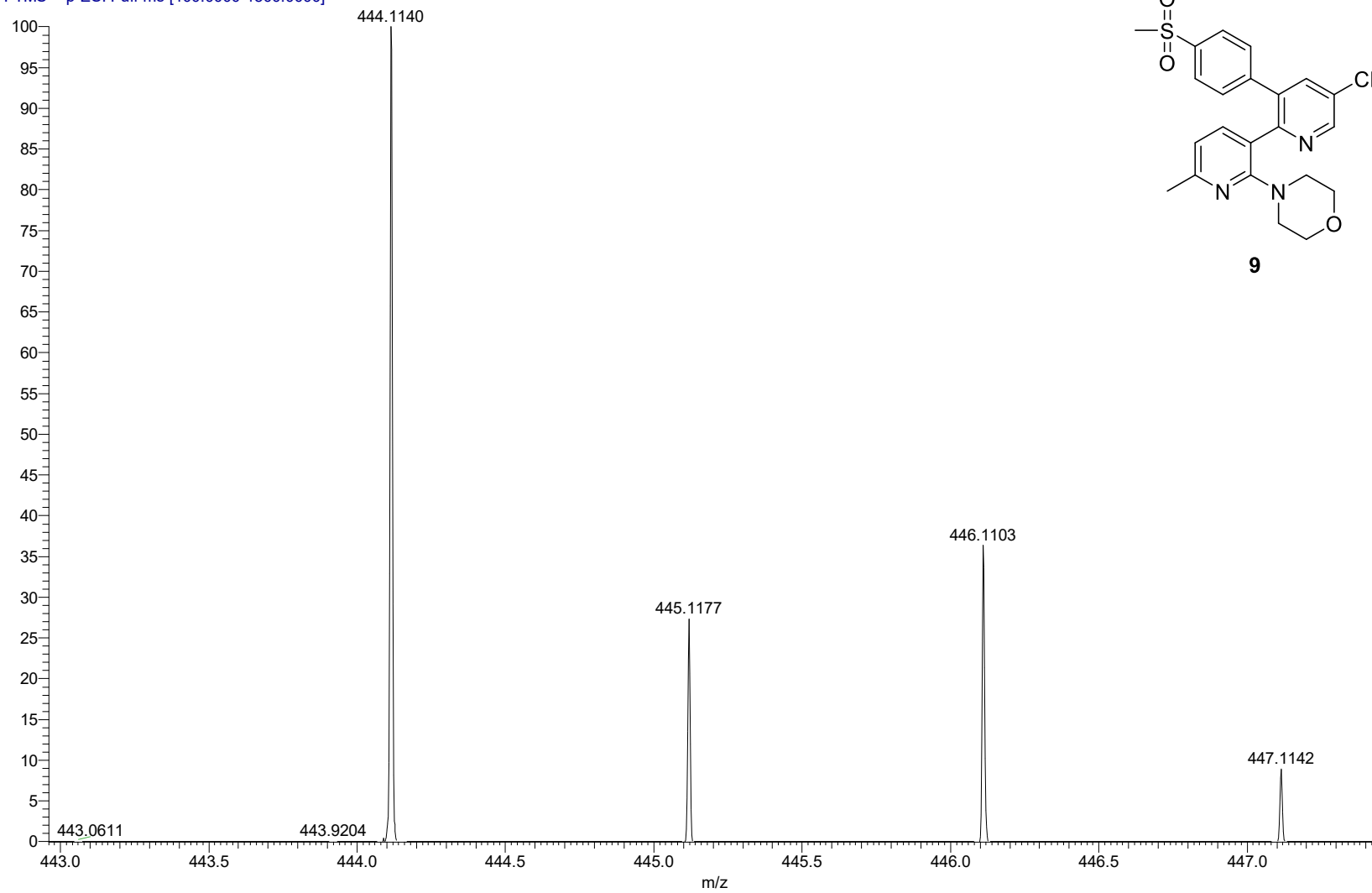


wd-10 #72 RT: 0.33 AV: 1 NL: 3.75E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]

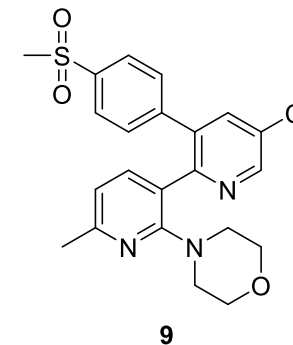
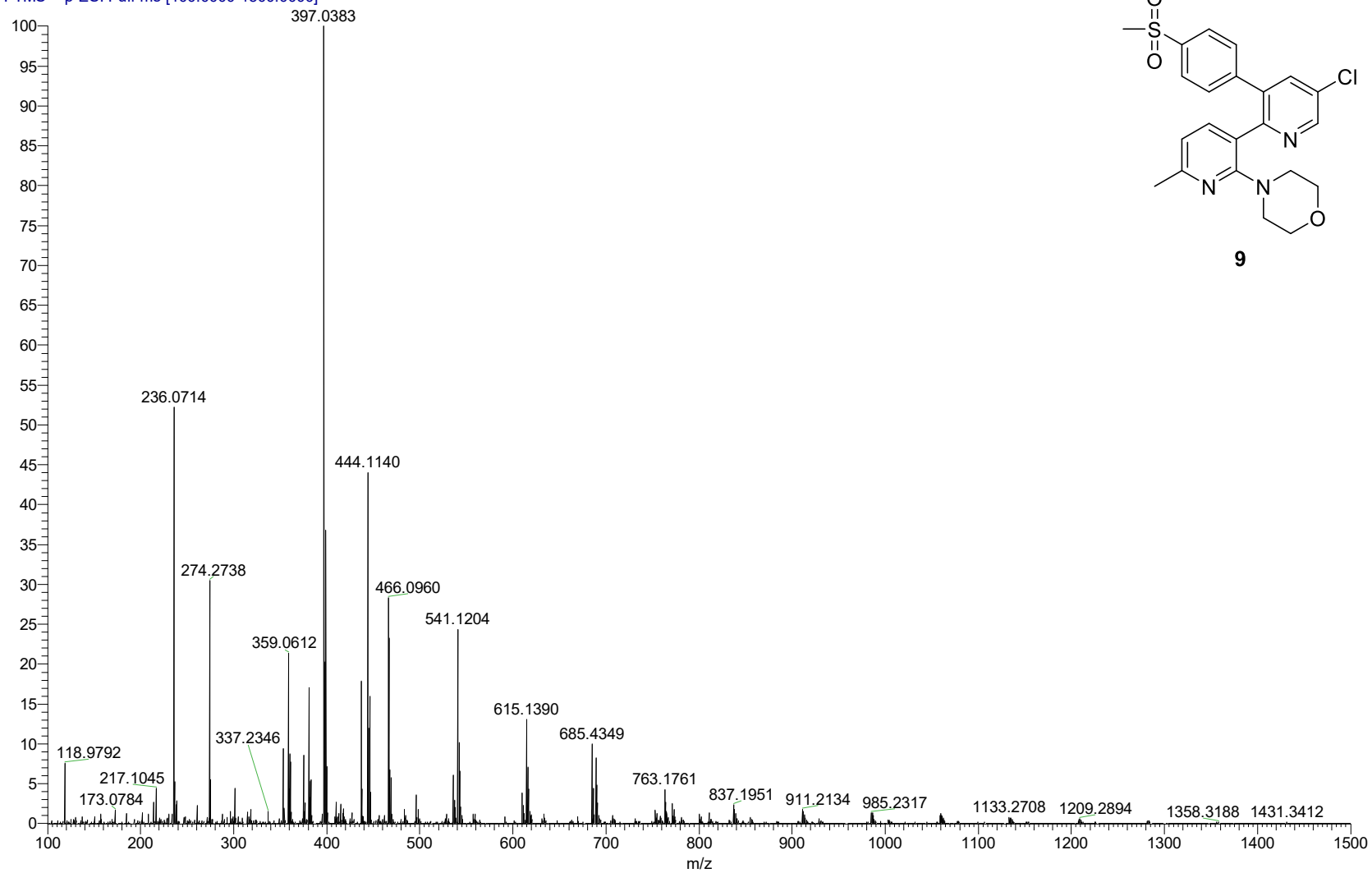


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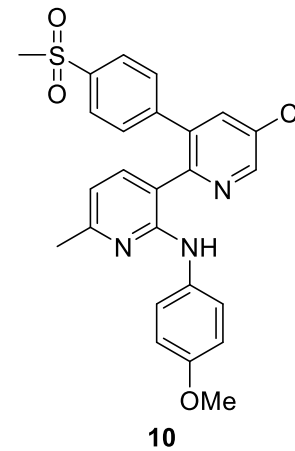
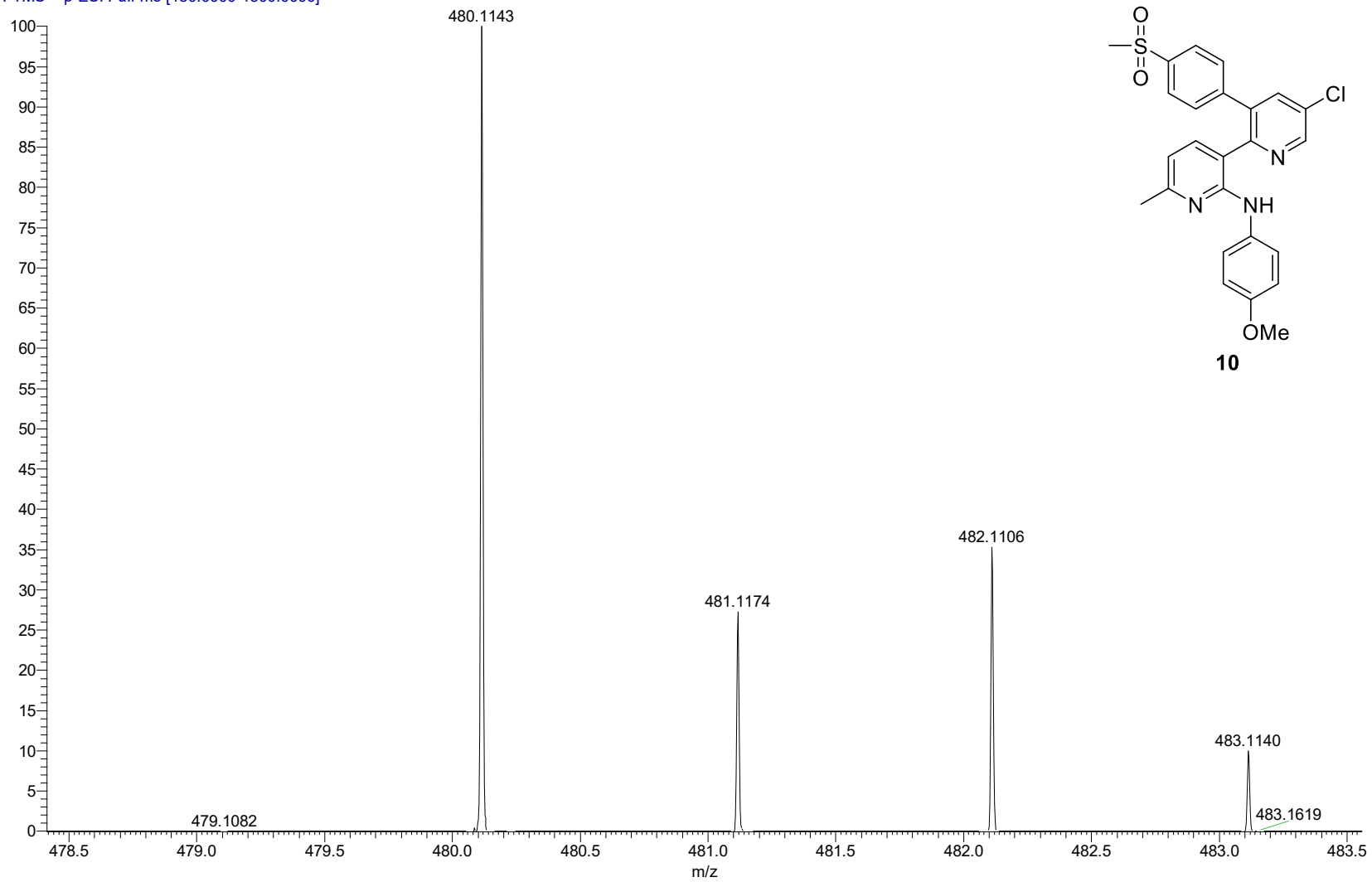
WD-9 #49 RT: 0.49 AV: 1 NL: 5.37E7
T: FTMS + p ESI Full ms [100.0000-1500.0000]



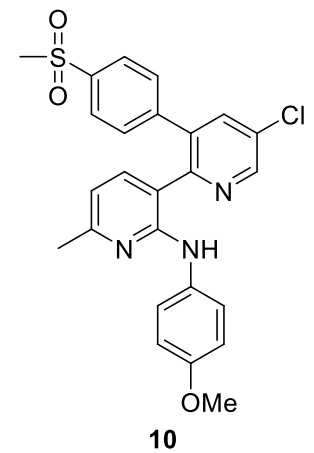
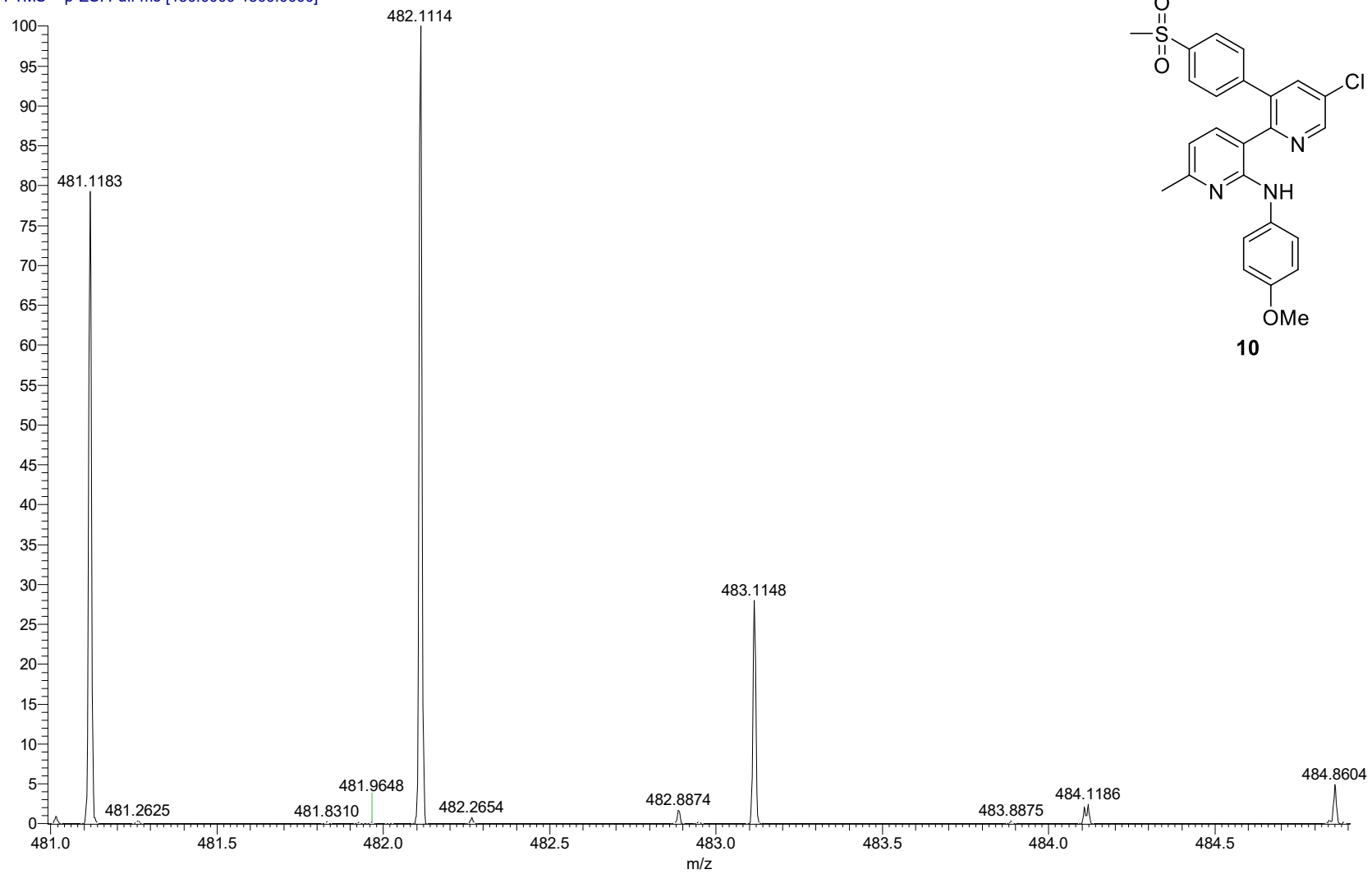
WD-9 #49 RT: 0.49 AV: 1 NL: 1.22E8
T: FTMS + p ESI Full ms [100.0000-1500.0000]



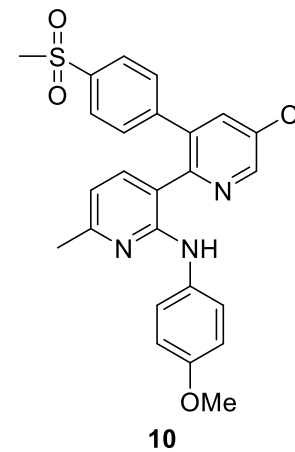
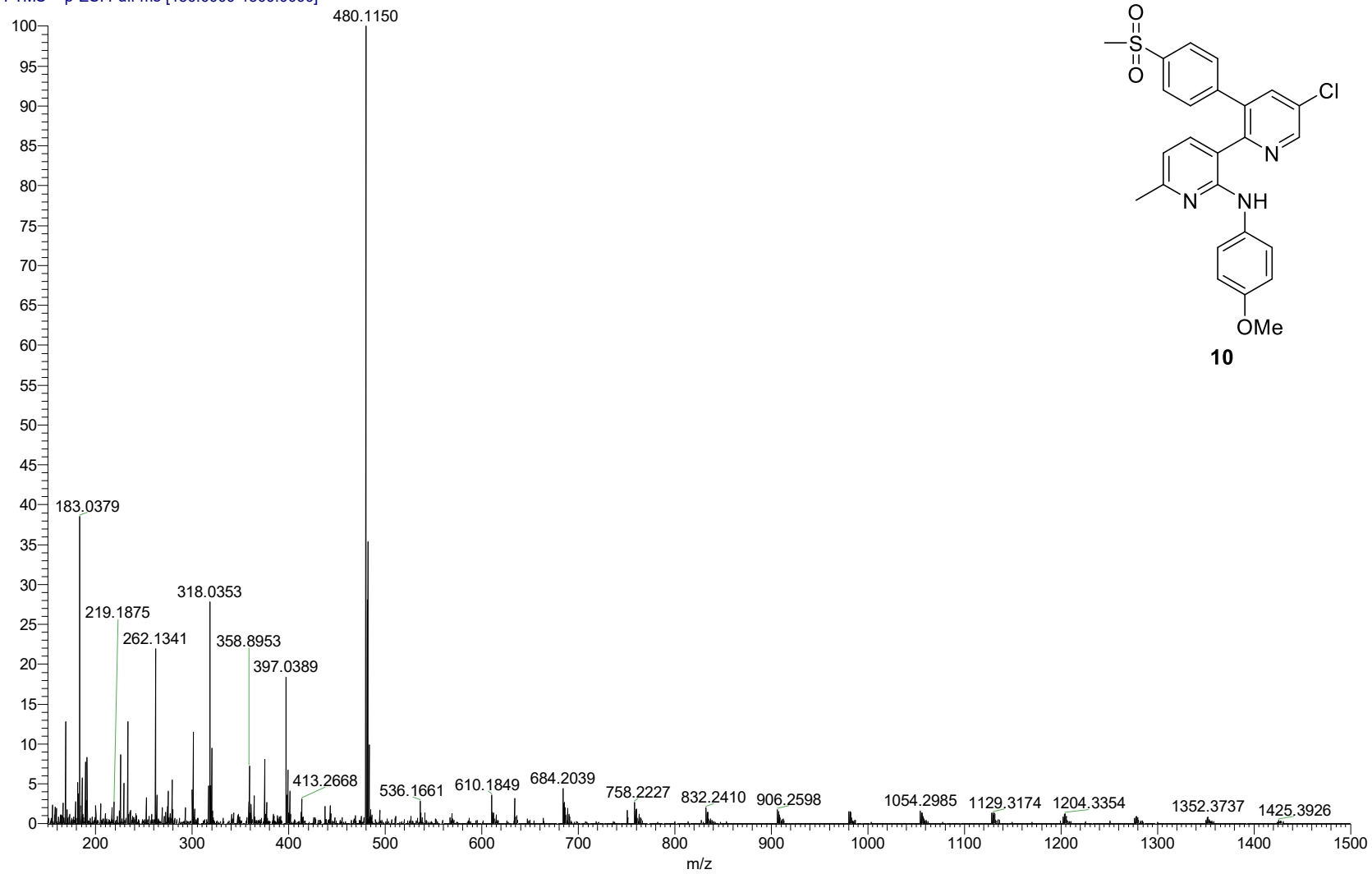
wd-7 #21 RT: 0.10 AV: 1 NL: 3.31E9
T: FTMS + p ESI Full ms [150.0000-1500.0000]



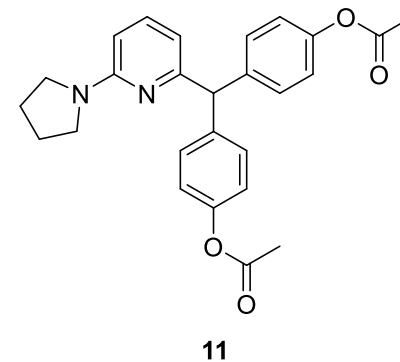
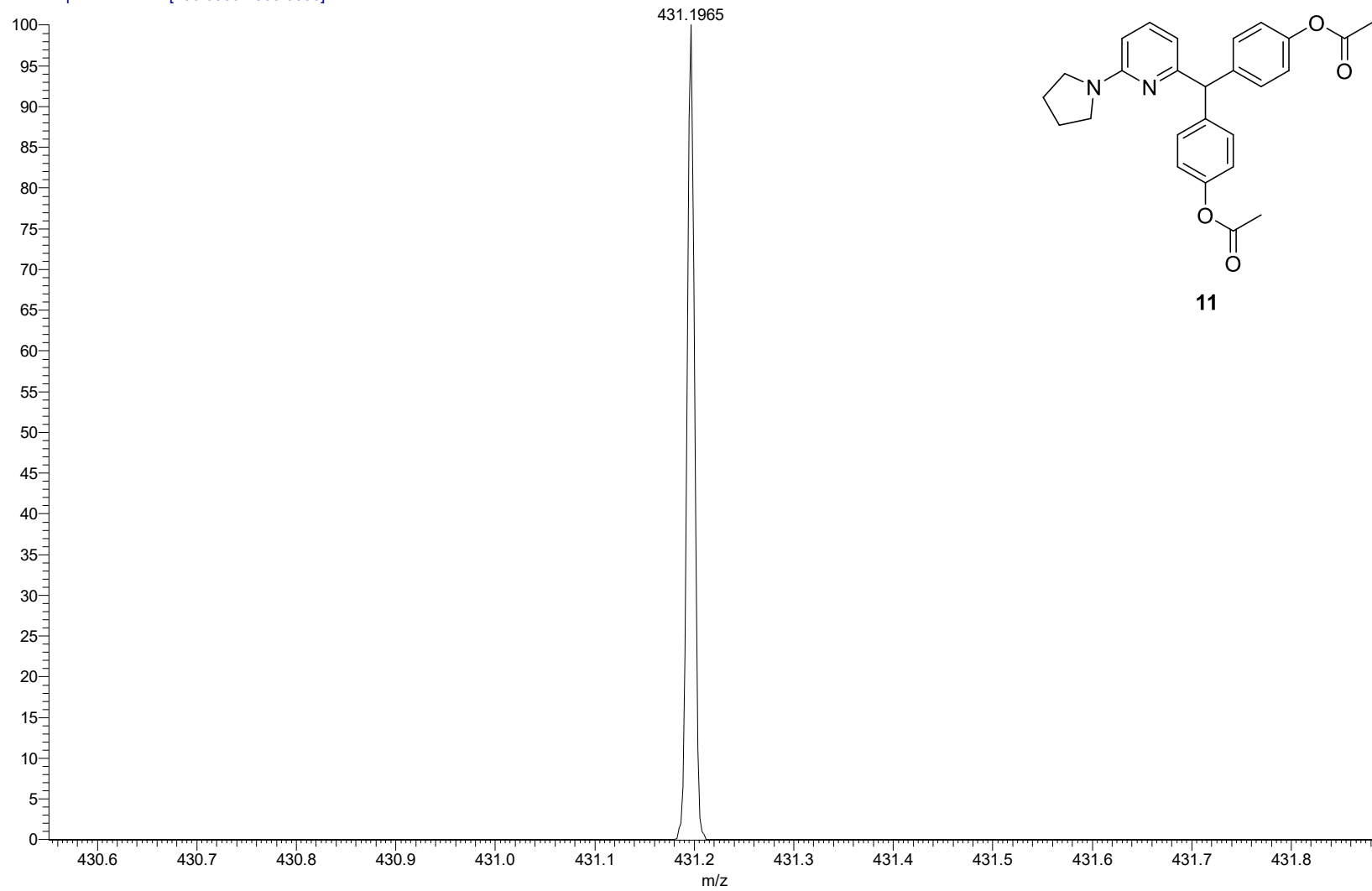
wd-7 #110 RT: 0.50 AV: 1 NL: 3.99E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]



wd-7 #110 RT: 0.50 AV: 1 NL: 1.13E7
T: FTMS + p ESI Full ms [150.0000-1500.0000]



wd-12 #59 RT: 0.27 AV: 1 NL: 6.52E5
T: FTMS + p ESI Full ms [150.0000-1500.0000]



wd-12 #59 RT: 0.27 AV: 1 NL: 3.31E6
T: FTMS + p ESI Full ms [150.0000-1500.0000]

