Supporting information

for

Catalyst-free Synthesis of Substituted Pyridin-2-yl, Quinolin-2-yl, and Isoquinolin-1-yl Carbamates from the Corresponding Hetaryl Ureas and Alcohols

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Content

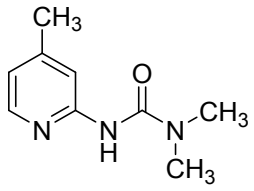
1. General remarks

Starting *N*-oxides were synthesiszed according to literature procedures: pyridine-*N*-oxides, quinoline-*N*-oxide and benzo[h]quinoline-*N*-oxide,[1] isoquinoline-*N*-oxide,[2] 4-nitroquinoline-*N*-oxide,[3] 4-methoxyquinoline-*N*-oxide.[4] All other reagents and solvents were purchased and were used as is. Reactions were monitored by analytical thin layer chromatography (TLC) Macherey–Nagel, TLC plates Silufol UV–254 using UV light for detection. Column chromatography was carried out with silica gel grade 60 (0.040–0.063 mm) 230–400 mesh with a hexane ethyl acetate mixture as eluent. NMR spectra were recorded on Bruker Avance DPX 400 (400 MHz and 101 MHz for ^{1}H and $^{13}C\{^{1}H\}$ respectively) or on Bruker Avance III 500 MHz (500 MHz for ^{1}H, 126 MHz for ^{13}C) in DMSO–d_6 or in $CDCl_3$. Chemical shifts are reported as parts per million (δ, ppm); the solvent peaks were used as internal standards: 2.50 ppm for residual ^{1}H, 39.50 ppm for ^{13}C in DMSO–d_6; 7.26 ppm for residual ^{1}H, 77.16 ppm for ^{13}C in $CDCl_3$. Multiplicities are abbreviated as follows: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad; coupling constants, *J*, are reported in Hertz (Hz). Melting points were determined in open capillary tubes on Electrothermal IA 9300 series Digital Melting Point Apparatus. High–resolution mass spectra (HRMS) were measured on Bruker Maxis HRMS–ESI–qTOF (ESI Ionization).

2. Preparation and characterization of ureas 1

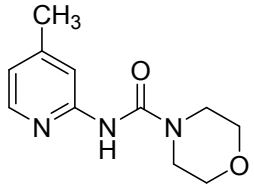
General procedure 1 (*GP1*).[1] A mixture of substituted azine *N*–oxide (1.00 mmol) and dialkyl cyanamide (1.50 mmol) was stirred at r.t. for 2 min and methanesulfonic acid (96.0 mg, 1.00 mmol) was then added dropwise within 3 min. The reaction mixture was then stirred at 60 °C for 2 h, cooled down, diluted with saturated aq. Na_2CO_3 (5.0 mL) and aq. NaCl (20 mL), and extracted with EtOAc (4 × 15 mL). Combined organic fractions were dried over anhydrous Na_2SO_4, filtered, and concentrated on a rotary evaporator. The crude product was subjected to column chromatography on silica gel (EtOAc/hexane, gradient from 50% to pure EtOAc) to give target urea **1** in good to excellent yields.

General procedure 2 (*GP2*).[5] A mixture of substituted azine–*N*–oxide (1 mmol), diamethyl cyanamide (2.0 mmol) and acetonitrile (2 mL, 20.0 mmol) was stirred at room temperature for 2 min, and then MsOH (144 mg, 1.5 mmol) was added dropwise within 3 min. The reaction mixture was stirred at 60 °C for 3 h, cooled, diluted with saturated aq. Na_2CO_3 (2 mL) and aq. NaCl (5 mL), and extracted with EtOAc (4 × 10 mL). Combined organic fractions were dried with anhydrous Na_2SO_4, filtered, and concentrated on a rotary evaporator. The crude product was purified by column chromatography on silica gel (EtOAc/hexane (2:1) for 1,2,4–oxadiazole and acetone/DCM (1:19) for 1,3,4–oxadiazole) to give target urea **1**.



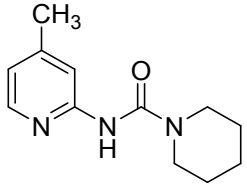
1,1–Dimethyl–3–(4–methylpyridin–2–yl)urea 1a[1]

GP1. Beige powder; 81% yield (145 mg); mp 103–104 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.06 (d, J = 5.2 Hz, 1H), 7.93 (s, 1H), 7.11 (s, 1H), 6.79 (d, J = 5.2 Hz, 1H), 3.07 (s, 6H), 2.35 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.94, 152.82, 149.47, 147.03, 119.57, 113.51, 36.38, 21.37. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_9H_{13}N_3O$ 180.1131; found 180.1145.



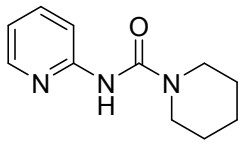
***N*–(4–Methylpyridin–2–yl)morpholine–4–carboxamide 1b**

GP1. Beige powder; 79% yield (175 mg); mp 56–58 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.03 (d, J = 5.2 Hz, 1H), 7.89 (s, 1H), 6.79 (dd, J = 5.2, 1.5 Hz, 1H), 3.72 (d, J = 5.2 Hz, 4H), 3.53 (d, J = 5.2 Hz, 4H), 2.35 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.32, 152.60, 150.09, 146.35, 119.76, 114.07, 66.48, 44.27, 21.45. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{15}N_3O_2$ 222.1237; found 222.1248.



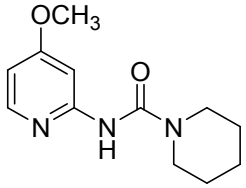
***N*–(4–Methylpyridin–2–yl)piperidine–1–carboxamide 1c**

GP1. Beige powder; 71% yield (156 mg); mp 108–109 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.06 (d, J = 5.2 Hz, 1H), 7.90 (s, 1H), 7.15 (s, 1H), 6.77 (d, J = 5.2 Hz, 1H), 3.54 – 3.46 (m, 4H), 2.35 (s, 3H), 1.71 – 1.60 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.00, 153.01, 149.40, 147.05, 119.45, 113.66, 45.20, 25.70, 24.38, 21.37. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{12}H_{17}N_3O$ 242.1264; found 242.1280.



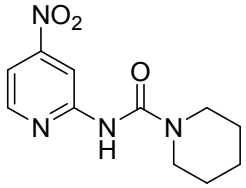
***N*–(Pyridin–2–yl)piperidine–1–carboxamide 1d**[1]

GP1. Brown powder; 44% yield (90 mg); mp 87–88 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.23 – 8.16 (m, 1H), 8.03 (d, J = 8.4 Hz, 1H), 7.64 (s, 1H), 7.28 (s, 1H), 6.93 (d, J = 2.4 Hz, 1H), 3.57 – 3.41 (m, 4H), 1.71 – 1.57 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.92, 153.02, 147.44, 138.01, 118.14, 113.26, 45.20, 25.71, 24.37.



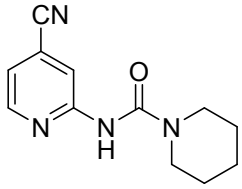
***N*–(4–Methoxypyridin–2–yl)piperidine–1–carboxamide 1e**

GP1. White powder; 58% yield (136 mg); mp 74–75 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.99 (d, J = 6.0 Hz, 1H), 7.72 (d, J = 2.4 Hz, 1H), 7.25 (s, 1H), 6.51 (dd, J = 6.0, 2.4 Hz, 1H), 3.88 (s, 3H), 3.55 – 3.44 (m, 4H), 1.74 – 1.58 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 167.56, 154.72, 153.92, 147.37, 106.92, 97.16, 55.32, 45.23, 25.71, 24.36. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{12}H_{17}N_3O_2$ 258.1213; found 258.1214.



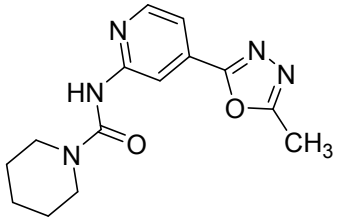
***N*–(4–Nitropyridin–2–yl)piperidine–1–carboxamide 1f**

GP1. Orange powder; 66% yield (165 mg); mp 119–121 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.83 (d, J = 2.0 Hz, 1H), 8.42 (d, J = 5.6 Hz, 1H), 7.78 – 7.51 (m, 2H), 3.58 – 3.48 (m, 4H), 1.75 – 1.60 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 155.42, 155.22, 153.07, 149.13, 110.65, 106.65, 45.31, 25.69, 24.24. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{15}H_{17}N_3O$ 273.0958; found 273.0963.



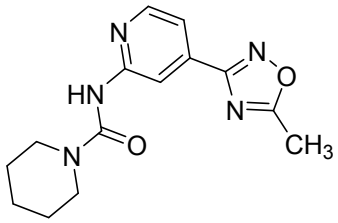
***N*–(4–Cyanopyridin–2–yl)piperidine–1–carboxamide 1g**

GP1. Beige powder; 75% yield (173 mg); mp 114–115 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 – 8.37 (m, 1H), 8.34 (dd, J = 5.2, 0.8 Hz, 1H), 7.34 (s, 1H), 7.14 (dd, J = 5.2, 1.2 Hz, 1H), 3.57 – 3.47 (m, 4H), 1.74 – 1.62 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.79, 153.17, 148.63, 121.97, 121.95, 119.27, 119.25, 116.77, 115.38, 45.28, 25.67, 24.24. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{12}H_{14}N_4O$ 253.1060; found 253.1072.



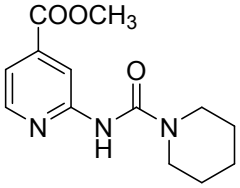
***N*–(4–(5–Methyl–1,3,4–oxadiazol–2–yl)pyridin–2–yl)piperidine–1–carboxamide 1h**[5]

GP2. Beige powder; 57% yield (164 mg); m.p. 162–164 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.68 (s, 1H), 8.33 (dd, J = 5.2, 0.9 Hz, 1H), 7.93 – 7.77 (br s, 1H), 7.68 (dd, J = 5.2, 1.5 Hz, 1H), 3.54 – 3.57 (m, 4H), 2.65 (s, 3H), 1.74 – 1.64 (m, 6H). ^{13}C NMR (101 MHz, DMSO–d_6): δ 165.46, 163.12, 155.05, 154.48, 148.31, 132.85, 114.14, 110.26, 45.32, 25.95, 24.44, 11.17. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{14}H_{17}N_5O_2$ 288.1455; found 288.1457.



***N*–(4–(5–Methyl–1,2,4–oxadiazol–3–yl)pyridin–2–yl)piperidine–1–carboxamide 1i**[5]

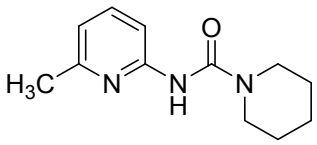
GP2. Beige powder; 52% yield (149 mg); m.p. 127–129 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.75 (m, 1H), 8.30 (d, J = 5.2 Hz, 1H), 7.79 – 7.60 (br s, 1H), 7.58 (dd, J = 5.2, 1.0 Hz, 1H), 3.60 – 3.44 (m, 4H), 2.67 (s, 3H), 1.72 – 1.60 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 177.09, 167.18, 153.90, 153.54, 147.83, 147.79, 136.50, 136.47, 115.61, 111.56, 45.28, 25.72, 24.36, 12.35. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{14}H_{17}N_5O_2$ 288.1455; found 288.1469.



Methyl 2–(piperidine–1–carboxamido)isonicotinate 1j

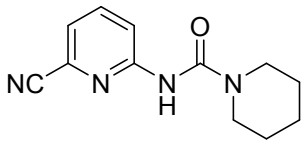
GP1. White powder; 68% yield (179 mg); mp 102–104 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.58 (s, 1H), 8.32 (d, J = 5.2 Hz, 1H), 7.52 – 7.47 (m, 1H), 7.39 (s, 1H), 3.93 (s, 3H), 3.55 – 3.46 (m, 4H), 1.71 – 1.59 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 165.73, 153.92, 153.64, 148.10,

139.43, 117.52, 113.00, 52.53, 45.24, 25.70, 24.33. HRMS (ESI), m/z: $[M+H]^+$ calcd. For $C_{13}H_{17}N_3O_3$ 264.1343; found 264.1356.



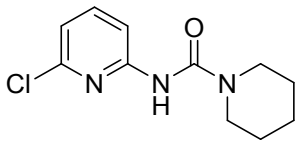
***N*–(6–Methylpyridin–2–yl)piperidine–1–carboxamide 1k**

GP1. Beige powder; 49% yield (107 mg); mp 67–68 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.85 (d, J = 8.4 Hz, 1H), 7.54 (t, J = 8.0 Hz, 1H), 7.09 (s, 1H), 6.80 (d, J = 7.6 Hz, 1H), 3.55 – 3.46 (m, 4H), 2.44 (s, 3H), 1.71 – 1.58 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 156.26, 153.94, 152.32, 138.32, 117.53, 109.96, 45.18, 25.72, 24.38, 23.97. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{12}H_{17}N_3O$ 220.1444; found 220.1468.



***N*–(6–Cyanopyridin–2–yl)piperidine–1–carboxamide 1l**

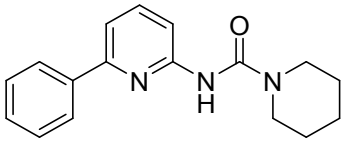
GP1. Beige powder; 64% yield (147 mg); mp 105–106 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.31 (d, J = 8.8 Hz, 1H), 7.74 (t, J = 8.0 Hz, 1H), 7.54 – 7.30 (m, 2H), 3.54 – 3.47 (m, 4H), 1.73 – 1.60 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.13, 153.23, 138.75, 130.94, 122.79, 117.37, 117.03, 45.29, 25.68, 24.24. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{12}H_{14}N_4O$ 253.1060; found 253.1051.



***N*–(6–Chloropyridin–2–yl)piperidine–1–carboxamide 1m**

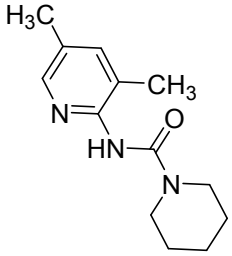
GP1. Beige powder; 52% yield (125 mg); mp 108–109 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (d, J = 8.4 Hz, 1H), 7.70 – 7.34 (m, 2H), 6.96 (d, J = 7.6 Hz, 1H), 3.56 – 3.44 (m, 4H), 1.71 – 1.58 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.26, 153.00, 140.84, 117.76, 111.38, 45.29,

25.69, 24.29. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{11}H_{14}ClN_3O$ 262.0718.1060; found 262.0719.



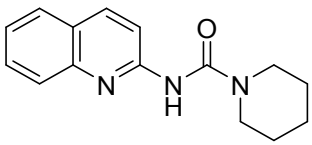
***N*–(6–Phenylpyridin–2–yl)piperidine–1–carboxamide 1n**

GP2. White powder; 46% yield (129 mg); mp 111–112 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.15 – 7.91 (m, 3H), 7.74 (t, J = 8.0 Hz, 1H), 7.62 – 7.28 (m, 5H), 3.63 – 3.42 (m, 4H), 1.76 – 1.53 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 155.27, 153.99, 152.81, 139.00, 128.97, 128.72, 126.80, 114.95, 111.76, 45.23, 25.74, 24.38. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{15}H_{17}N_3O$ 282.1601; found 282.1619.



***N*–(3,5–Dimethylpyridin–2–yl)piperidine–1–carboxamide 1o**

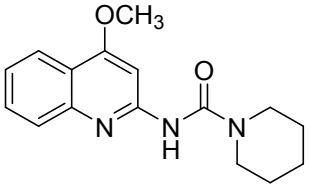
GP2. White powder; 22% yield (51 mg); mp 104–105 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.96 (s, 1H), 7.32 (s, 1H), 7.20 (s, 1H), 3.47 (s, 4H), 2.25 (s, 3H), 2.23 (s, 4H), 1.67 – 1.53 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 155.35, 149.51, 145.16, 140.26, 129.80, 127.60, 45.32, 25.77, 24.47, 18.02, 17.59. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{13}H_{19}N_3O$ 234.1601; found 234.1613.



***N*–(Quinolin–2–yl)piperidine–1–carboxamide 1p**

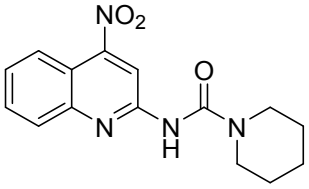
GP2. Pale yellow powder; 63% yield (161 mg); mp 85–87 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.29 (d, J = 9.2 Hz, 1H), 8.11 (d, J = 9.2 Hz, 1H), 7.77 (t, J = 7.6 Hz, 2H), 7.69 – 7.48 (m, 2H),

7.41 (t, J = 7.6 Hz, 1H), 3.65 – 3.48 (m, 4H), 1.75 – 1.57 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.00, 152.73, 146.70, 138.01, 129.70, 127.57, 126.77, 125.72, 124.37, 114.33, 45.33, 25.77, 24.39. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{15}H_{17}N_3O$ 256.1444; found 256.1433.



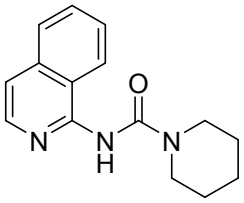
***N*–(4–Methoxyquinolin–2–yl)piperidine–1–carboxamide 1q**

GP2. Whire powder; 69% yield (197 mg); mp 88–89 °C.^{1}H NMR (400 MHz, DMSO–d_6): δ 9.36 (br s, 1H), 7.98 (d, J = 8.0, 1.6 Hz, 1H), 7.81 – 7.49 (m, 3H), 7.40 – 7.31 (m, 1H), 4.00 (s, 3H), 3.55 – 3.44 (m, 4H), 1.62 – 1.47 (m, 6H). 13C NMR (101 MHz, DMSO): δ 162.45, 155.44, 155.02, 147.59, 130.39, 126.66, 123.65, 121.89, 118.69, 94.18, 56.21, 45.30, 26.02, 24.53. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{16}H_{19}N_3O_2$ 286.1550; found 286.1551.



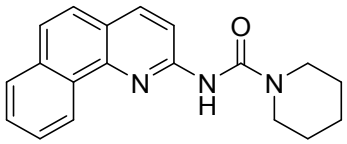
***N*–(4–Nitroquinolin–2–yl)piperidine–1–carboxamide 1r**

GP2. Beige powder; 61% yield (183 mg); mp 145–146 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.92 – 8.83 (m, 1H), 8.20 (t, J = 7.2 Hz, 1H), 7.84 (t, J = 8.0 Hz, 1H), 7.78 – 7.65 (m, 2H), 7.61 – 7.51 (m, 1H), 3.62 – 3.50 (m, 4H), 1.75 – 1.61 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.05, 153.30, 152.22, 148.28, 131.13, 127.53, 126.95, 122.75, 116.34, 109.21, 45.38, 25.72, 24.25. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{15}H_{16}N_4O_3$ 301.1295; found 301.1301.



***N*–(Isoquinolin–1–yl)piperidine–1–carboxamide 1s**

GP2. Brown powder; 70% yield (179 mg); mp 97–98 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 14.45 (br s, 1H), 8.68 (d, J = 8.0 Hz, 1H), 7.68 (t, J = 7.6 Hz, 1H), 7.59 – 7.48 (m, 2H), 7.17 (d, J = 6.8 Hz, 1H), 6.67 (d, J = 6.8 Hz, 1H), 4.71 – 3.53 (m, 4H), 1.76 – 1.57 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 164.60, 156.90, 136.66, 132.12, 126.96, 126.70, 126.42, 126.31, 126.09, 118.61, 108.19, 50.21, 24.94, 24.59, 23.05. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{15}H_{17}N_3O$ 256.1444; found 256.1459.

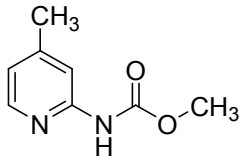


***N*–(Benzo[h]quinolin–2–yl)piperidine–1–carboxamide 1t**

GP2. Pale yellow powder; 45% yield (137 mg); mp 167–168 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.24 – 9.11 (m, 1H), 8.37 (d, J = 8.8 Hz, 1H), 8.16 (d, J = 8.8 Hz, 1H), 7.94 – 7.87 (m, 1H), 7.75 – 7.60 (m, 5H), 3.61 – 3.48 (m, 4H), 1.78 – 1.57 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 54.04, 151.91, 144.87, 137.99, 133.96, 130.55, 127.86, 127.84, 126.42, 125.22, 125.19, 124.06, 123.50, 123.03, 113.54, 45.26, 25.75, 24.38. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{19}H_{19}N_3O$ 306.1601; found 306.1613.

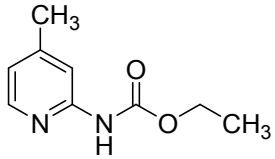
3. Synthesis of carbamates 2 and 3

General procedure 3 (*GP3*). A solution of urea **1** (0.2 mmol) in alcohol (4 mL) was placed into a sealed tube and irradiated with microwave in Biotage Initiator+ at 120 °C for 1 h (for compounds **1a–j,o**) or 3 h (for compounds **1k–n** and **1r–t**) at 1 bar and 80 W. Then the reaction mixture was concentrated at reduced pressure to drynes and the crude product was purified by column chromatography using an *n*–hexane and ethyl acetate mixture as an eluent.



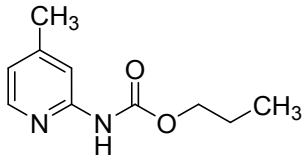
Methyl (4–methylpyridin–2–yl)carbamate 2a[6]

White powder; 91% yield (30 mg); mp 141–143 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.89 (s, 1H), 8.20 (d, J = 5.2 Hz, 1H), 7.89 (s, 1H), 6.83 (dd, J = 5.2, 1.6 Hz, 1H), 3.84 (s, 3H), 2.38 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.18, 152.33, 149.95, 147.20, 147.18, 119.79, 119.76, 112.90, 52.23, 21.45. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_8H_{10}N_2O_2$ 167.0815; found 167.0821.



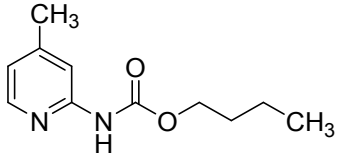
Ethyl (4–methylpyridin–2–yl)carbamate 2b[7]

White powder; 94% yield (34 mg); mp 128–130 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.69 (s, 1H), 8.18 (dd, J = 5.2, 0.8 Hz, 1H), 7.87 (d, J = 1.6 Hz, 1H), 6.83 (ddd, J = 5.2, 1.6, 0.8 Hz, 1H), 4.28 (q, J = 7.2 Hz, 2H), 2.38 (s, 3H), 1.37 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.78, 152.48, 149.88, 147.19, 119.65, 112.94, 61.15, 21.44, 14.58. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_9H_{12}N_2O_2$ 181.0972; found 181.0991.



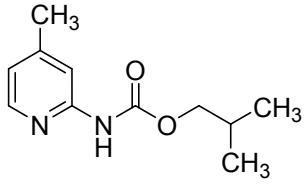
Propyl (4–methylpyridin–2–yl)carbamate 2c

White powder; 90% yield (35 mg); mp 113–114 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 10.14 (s, 1H), 8.22 (d, J = 5.2 Hz, 1H), 7.92 (s, 1H), 6.82 (d, J = 5.2 Hz, 1H), 4.18 (t, J = 6.8 Hz, 2H), 2.37 (s, 3H), 1.76 (hept., J = 7.2 Hz, 2H), 1.00 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.92, 152.55, 150.10, 146.89, 119.58, 113.06, 66.82, 22.32, 21.48, 10.36. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{10}H_{14}N_2O_2$ 195.1128; found: 195.1130.



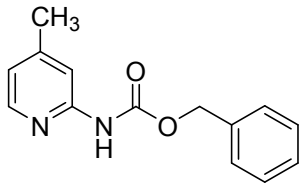
Butyl (4–methylpyridin–2–yl)carbamate 2d

White powder; 93% yield (39 mg); mp 87–88 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.10 (s, 1H), 8.21 (d, J = 5.2 Hz, 1H), 7.92 (s, 1H), 6.82 (d, J = 5.2 Hz, 1H), 4.22 (t, J = 6.8 Hz, 2H), 2.38 (s, 3H), 1.78 – 1.65 (m, 2H), 1.45 (p, J = 6.8 Hz, 2H), 0.98 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.82, 152.36, 149.92, 147.14, 119.68, 112.95, 65.10, 31.00, 21.45, 19.09, 13.72. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{16}N_2O_2$ 209.1285; found 209.1295.



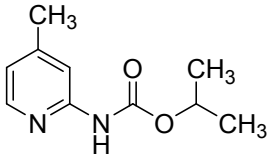
Isobutyl (4–methylpyridin–2–yl)carbamate 2e

White powder; 83% yield (35 mg); mp 113–114 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.59 (s, 1H), 8.17 (s, 1H), 7.87 (s, 1H), 6.83 (d, J = 5.2 Hz, 1H), 4.00 (d, J = 6.8 Hz, 2H), 2.38 (s, 3H), 2.12 – 1.97 (m, 1H), 1.00 (d, J = 6.8 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.75, 152.20, 149.86, 147.19, 119.80, 112.97, 71.39, 28.01, 21.44, 19.07. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{16}N_2O_2$ 209.1285; found 209.1301.



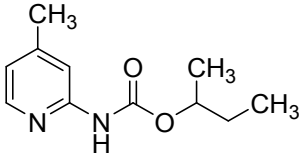
Benzyl (4–methylpyridin–2–yl)carbamate 2f

White powder; 88% yield (43 mg); mp 145–146 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.98 (s, 1H), 8.22 – 8.08 (m, 1H), 7.95 (s, 1H), 6.86 (d, J = 4.8 Hz, 1H), 4.84 – 4.74 (m, 1H), 2.41 (s, 3H), 2.02 – 1.92 (m, 2H), 1.84 – 1.74 (m, 2H), 1.63 – 1.27 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 152.92, 151.74, 151.25, 145.57, 119.71, 113.30, 74.25, 31.88, 25.34, 23.81, 21.67. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{14}H_{14}N_2O_2$ 243.1128; found: 243.1127.



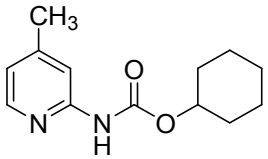
Isopropyl (4–methylpyridin–2–yl)carbamate 2g

White powder; 87% yield (34 mg); mp 136–137 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.54 (s, 1H), 8.17 (d, J = 5.2 Hz, 1H), 7.87 (s, 1H), 6.82 (dd, J = 5.2, 1.6 Hz, 1H), 5.06 (hept, J = 6.4 Hz, 1H), 2.38 (s, 3H), 1.35 (d, J = 6.4 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.41, 152.62, 149.81, 147.18, 119.51, 112.95, 68.70, 22.14, 22.12, 21.43. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{10}H_{14}N_2O_2$ 195.1128; found 195.1130.



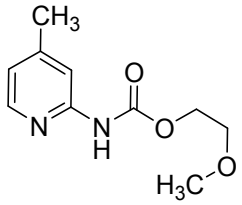
***sec*–Butyl (4–methylpyridin–2–yl)carbamate 2h**

White powder; 92% yield (38 mg); mp 93–94 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.45 (s, 1H), 8.19 (d, J = 5.2 Hz, 1H), 7.93 (s, 1H), 6.83 (dd, J = 5.2, 1.5 Hz, 1H), 4.89 (hept, J = 6.4 Hz, 1H), 2.39 (s, 3H), 1.77 – 1.58 (m, 2H), 1.32 (d, J = 6.4 Hz, 3H), 0.97 (t, J = 7.6 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.45, 152.29, 150.34, 146.56, 119.59, 113.08, 73.51, 29.05, 21.51, 19.73, 9.72. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{16}N_2O_2$ 209.1285; found: 209.1284.



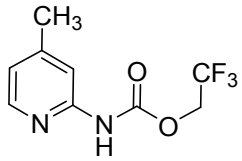
Cyclohexyl (4–methylpyridin–2–yl)carbamate 2i

White powder; 74% yield (35 mg); mp 171–173 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.98 (s, 1H), 8.22 – 8.08 (m, 1H), 7.95 (s, 1H), 6.86 (d, J = 4.8 Hz, 1H), 4.84 – 4.74 (m, 1H), 2.41 (s, 3H), 2.02 – 1.92 (m, 2H), 1.84 – 1.74 (m, 2H), 1.63 – 1.27 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 152.92, 151.74, 151.25, 145.57, 119.71, 113.30, 74.25, 31.88, 25.34, 23.81, 21.67. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{13}H_{18}N_2O_2$ 235.1441; found: 235.1438.



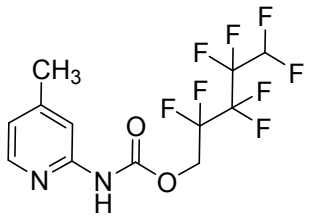
2–Methoxyethyl (4–methylpyridin–2–yl)carbamate 2j

Pale yellow powder; 63% yield (26 mg); mp 128–129 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.94 (s, 1H), 8.27 (d, J = 5.2 Hz, 1H), 7.90 (s, 1H), 6.83 (d, J = 4.8 Hz, 1H), 4.40 – 4.34 (m, 2H), 3.71 – 3.66 (m, 2H), 3.45 (s, 3H), 2.38 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.51, 152.16, 150.21, 147.04, 119.79, 112.96, 70.69, 64.14, 58.95, 21.50. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{10}H_{14}N_2O_3$ 211.1077; found: 211.1079.



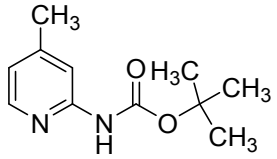
2,2,2–Trifluoroethyl (4–methylpyridin–2–yl)carbamate 2k

White powder; 53% yield (25 mg); mp 186–187 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 10.52 (br s, 1H), 8.24 (d, J = 5.2 Hz, 1H), 7.88 (s, 1H), 6.91 (dd, J = 5.2, 1.5 Hz, 1H), 4.63 (q, J = 8.4 Hz, 2H), 2.41 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 151.71, 151.60, 150.85, 146.70, 127.21 (q, J = 277 Hz), 120.45, 113.39, 61.50, 61.14, 60.77, 60.41, 21.53. ^{19}F NMR (376 MHz, $CDCl_3$): δ –73.90. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_9H_9F_3N_2O_2$ 235.0689; found 235.0688.



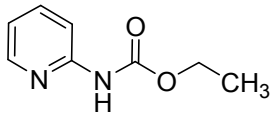
2,2,3,3,4,4,5,5–Octafluoropentyl (4–methylpyridin–2–yl)carbamate 2l

White powder; 64% yield (42 mg); mp 110–111 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.25 (d, J = 5.2 Hz, 1H), 7.90 (s, 1H), 6.91 (d, J = 5.2 Hz, 1H), 6.08 (tt, J = 51.8, 5.2 Hz, 1H), 4.77 (t, J = 14.0 Hz, 2H), 2.41 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 151.81, 151.59, 150.79, 146.79, 120.45, 114.70 (t, J = 31.7 Hz), 113.43, 110.11 (t, J = 31.1 Hz), 107.58 (t, J = 30.4 Hz), 105.05 (t, J = 32.9 Hz), 59.96 (t, J = 25.6 Hz), 21.49. ^{19}F NMR (376 MHz, $CDCl_3$): δ –119.84 (m), –125.31 (m), –129.88 (m), –137.17 (m). HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{12}H_{10}F_8N_2O_2$ 367.0687; found: 367.0689.



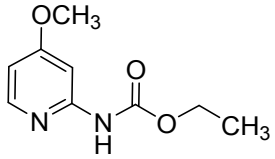
***tert*–Butyl (4–methylpyridin–2–yl)carbamate 2m**[8]

White powder; 44% yield (18 mg); mp 114–116 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.95 (s, 1H), 8.17 (d, J = 5.2 Hz, 1H), 7.87 (s, 1H), 6.81 (dd, J = 5.2, 1.5 Hz, 1H), 2.37 (s, 3H), 1.56 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 152.75, 152.32, 150.19, 146.69, 119.43, 112.99, 80.88, 28.35, 21.48. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{16}N_2O_2$ 209.1285; found 209.1280.



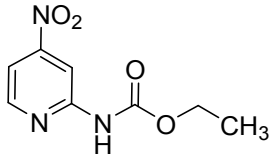
Ethyl pyridin–2–ylcarbamate 2n[9]

White powder; 90% yield (30 mg); mp 101–103 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.15 (s, 1H), 8.33 (ddd, J = 5.2, 2.0, 0.8 Hz, 1H), 8.08 (d, J = 8.4 Hz, 1H), 7.78 – 7.71 (m, 1H), 7.02 (ddd, J = 7.2, 5.2, 0.8 Hz, 1H), 4.29 (q, J = 7.2 Hz, 2H)), 1.37 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.40, 151.99, 146.84, 138.95, 118.51, 112.69, 61.46, 14.53. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_8H_{10}N_2O_2$ 167.0815; found 167.0813.



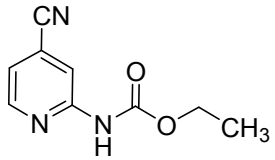
Ethyl (4–methoxypyridin–2–yl)carbamate 2o

White powder; 89% yield (35 mg); mp 116–118 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.38 (br s, 1H), 8.14 – 8.01 (m, 1H), 7.78 – 7.68 (m, 1H), 6.65 – 6.56 (m, 1H), 4.29 (q, J = 7.2 Hz, 2H), 3.97 – 3.89 (m, 3H), 1.37 (td, J = 7.6, 0.8 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 168.09, 153.80, 153.55, 147.19, 106.88, 96.84, 61.42, 55.45, 14.53. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_9H_{12}N_2O_3$ 197.0921; found 197.0939.



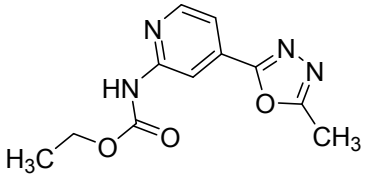
Ethyl (4–nitropyridin–2–yl)carbamate 2p

Pale orange powder; 66% yield (28 mg); mp 118–120 °C. ^{1}H NMR (400 MHz, DMSO–d_6): δ 10.83 (s, 1H), 8.62 (d, J = 5.4 Hz, 1H), 8.55 (d, J = 2.0 Hz, 1H), 7.76 (dd, J = 5.6, 2.1 Hz, 1H), 4.21 (q, J = 7.2 Hz, 2H), 1.27 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, DMSO–d_6): δ 155.48, 154.83, 154.12, 151.05, 111.42, 105.13, 61.50, 14.82. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_8H_9N_3O_4$ 212.0666 found: 212.0671.



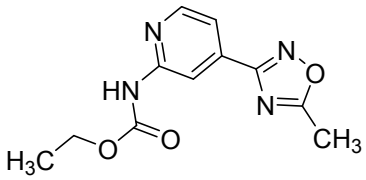
Ethyl (4–cyanopyridin–2–yl)carbamate 2q

White powder; 64% yield (24 mg); mp 196–197 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.04 (s, 1H), 8.48 (d, J = 5.2 Hz, 1H), 8.36 (s, 1H), 7.22 (d, J = 5.2 Hz, 1H), 4.33 (q, J = 7.2 Hz, 2H), 1.39 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.04, 152.91, 148.81, 122.63, 119.89, 116.53, 114.64, 62.06, 14.49. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_9H_9N_3O_2$ 192.0768; found 192.0769.



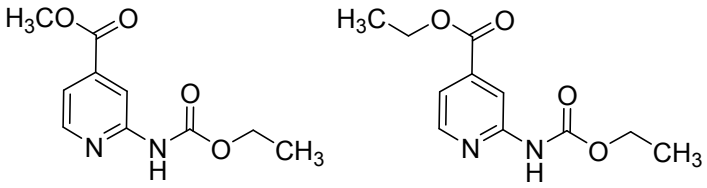
Ethyl (4–(5–methyl–1,3,4–oxadiazol–2–yl)pyridin–2–yl)carbamate 2r

White powder; 65% yield (32 mg); mp 216–217 °C. ^{1}H NMR (400 MHz, DMSO–d_6): δ 10.23 (s, 1H), 8.48 (d, J = 5.2 Hz, 1H), 8.40 (s, 1H), 7.55 (dd, J = 5.2, 1.6 Hz, 1H), 4.21 (q, J = 7.2 Hz, 2H), 2.63 (s, 3H), 1.29 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, DMSO–d_6): δ 165.44, 163.13, 154.14, 153.84, 149.94, 132.80, 115.20, 108.70, 61.22, 14.89, 11.17. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{12}N_4O_3$ 249.0982; found 249.0989.



Ethyl (4–(5–methyl–1,2,4–oxadiazol–3–yl)pyridin–2–yl)carbamate 2s

White powder; 59% yield (29 mg); mp 205–207 °C. ^{1}H NMR (400 MHz, DMSO–d_6): δ 10.24 (s, 1H), 8.52 – 8.41 (m, 2H), 7.57 (dd, J = 5.2, 1.5 Hz, 1H), 4.20 (q, J = 7.2 Hz, 2H), 2.70 (s, 3H), 1.28 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, DMSO–d_6): δ 178.73, 166.98, 154.11, 153.82, 149.74, 135.86, 116.00, 109.84, 61.15, 14.90, 12.54. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{12}N_4O_3$ 249.0982; found 249.0985.



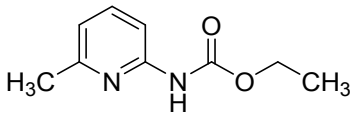
Methyl 2–((ethoxycarbonyl)amino)isonicotinate 2t (69%) and ethyl 2–((ethoxycarbonyl)amino)isonicotinate 2t' (9%)

The title compounds were obtained and characterized as a mixture.

2t. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.62 (s, 1H), 8.62 (s, 1H), 8.48 (d, J = 5.2 Hz, 1H), 7.58 (dd, J = 5.2, 1.6 Hz, 1H), 4.32 (q, J = 7.2 Hz, 2H), 3.97 (s, 3H), 1.39 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101

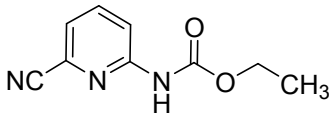
MHz, $CDCl_3$): δ 165.44, 153.40, 153.16, 148.04, 140.0, 117.89, 112.31, 61.64, 52.73, 14.53. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{10}H_{12}N_2O_4$ 225.0870; found 225.0874.

2t'. ^1H NMR (400 MHz, $CDCl_3$): δ 9.62 (s, 1H), 8.62 (s, 1H), 8.48 (d, J = 5.2 Hz, 1H), 7.58 (dd, J = 5.2, 1.6 Hz, 1H), 4.43 (q, J = 7.2 Hz, 2H), 4.32 (q, J = 7.2 Hz, 2H), 1.43 (t, J = 7.2 Hz, 3H), 1.39 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 164.94, 153.10, 147.90, 140.51, 61.88, 61.64, 14.53, 14.21. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{11}H_{14}N_2O_4$ 239.1026; found 239.1023.



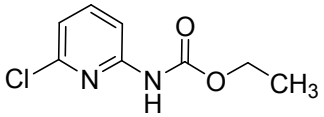
Ethyl (6–methylpyridin–2–yl)carbamate 2u[10]

White powder; 73% yield (26 mg); mp 58–59 °C. ^1H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, J = 8.3 Hz, 1H), 7.66 (s, 1H), 7.58 (t, J = 8.0 Hz, 1H), 6.85 (d, J = 7.6 Hz, 1H), 4.24 (q, J = 7.2 Hz, 2H), 2.46 (s, 3H), 1.32 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 156.86, 153.33, 151.00, 138.53, 118.19, 109.11, 61.27, 23.93, 14.46. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_9H_{12}N_2O_2$ 203.0791; found 203.0801.



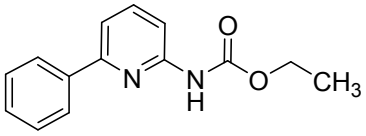
Ethyl (6–cyanopyridin–2–yl)carbamate 2v

Pale yellow powder; 78% yield (30 mg); mp 126–127 °C. ^1H NMR (400 MHz, $CDCl_3$): δ 8.28 (d, J = 8.8 Hz, 1H), 7.82 (t, J = 8.0 Hz, 1H), 7.63 (br s, 1H), 7.40 (d, J = 7.6 Hz, 1H), 4.29 (q, J = 7.2 Hz, 2H), 1.36 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 152.88, 152.67, 139.19, 131.50, 123.46, 116.81, 116.18, 62.03, 14.38. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_9H_9N_3O_2$ 214.0587; found 214.0589.



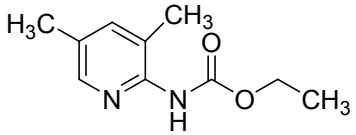
Ethyl (6–chloropyridin–2–yl)carbamate 2w

White powder; 71% yield (28 mg); mp 68–69 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.91 (d, J = 8.2 Hz, 1H), 7.65 (t, J = 7.8 Hz, 1H), 7.34 (br s, 1H), 7.03 (d, J = 7.6 Hz, 1H), 4.27 (q, J = 7.2 Hz, 2H), 1.34 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 152.84, 151.43, 148.92, 140.86, 118.69, 110.31, 61.81, 14.43. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_8H_9ClN_2O_2$ 201.0425; found: 201.0439.



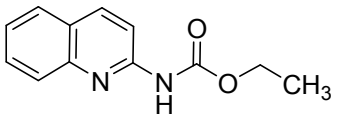
Ethyl (6–phenylpyridin–2–yl)carbamate 2x

White powder; 62% yield (30 mg); mp 73–74 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 – 7.91 (m, 3H), 7.77 (t, J = 7.8 Hz, 1H), 7.66 (br s, 1H), 7.52 – 7.38 (m, 4H), 4.27 (q, J = 7.2 Hz, 2H), 1.34 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 155.66, 153.29, 151.32, 139.16, 138.59, 129.10, 128.71, 126.79, 115.43, 110.59, 61.43, 14.49. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{14}H_{14}N_2O_2$ 243.1128; found 243.1115.



Ethyl (3,5-dimethylpyridin-2-yl)carbamate 2y

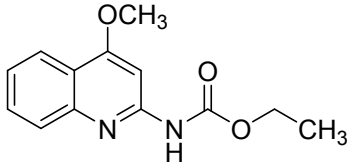
White powder; 36% yield (14 mg); mp 73–74 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.09 (s, 1H), 7.37 (d, J = 2.0 Hz, 1H), 7.07 (s, 1H), 4.23 (q, J = 7.2 Hz, 2H), 2.29 (d, J = 6.4 Hz, 6H), 1.32 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.05, 147.01, 145.92, 140.50, 130.79, 126.88, 61.43, 17.77, 17.66, 14.54. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{10}H_{14}N_2O_2$ 195.1128; found 195.1127.



Ethyl quinolin–2–ylcarbamate 3a[11]

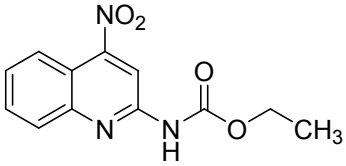
Pale yellow powder; 54% yield (23 mg); mp 98–99 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.27 (d, J = 9.2 Hz, 1H), 8.19 (d, J = 9.2 Hz, 1H), 7.96 (br s, 1H), 7.85 (d, J = 8.4 Hz, 1H), 7.79 (d, J = 8.0

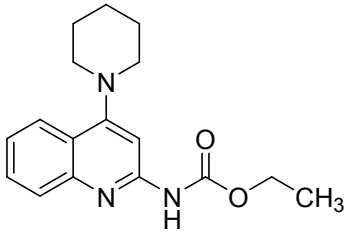
Hz, 1H), 7.72 – 7.65 (m, 1H), 7.46 (t, J = 7.6 Hz, 1H), 4.30 (q, J = 7.2 Hz, 2H), 1.36 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.52, 151.19, 146.09, 138.94, 130.07, 127.54, 126.93, 125.72, 124.96, 112.97, 61.65, 14.40. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{12}H_{12}N_2O_2$ 217.0972; found 217.0988.



Ethyl (4–methoxyquinolin–2–yl)carbamate 3b

White powder; 72% yield (35 mg); mp 156–158 °C. ^{1}H NMR (400 MHz, $CDCl_3$):δ 8.11 (d, J = 8.0 Hz, 1H), 7.97 (s, 1H), 7.80 – 7.71 (m, 2H), 7.67 – 7.61 (m, 1H), 7.39 (t, J = 8.4 Hz, 1H), 4.28 (q, J = 7.2 Hz, 2H), 4.11 (s, 3H), 1.34 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 163.98, 153.92, 152.84, 147.29, 130.03, 126.91, 123.83, 121.80, 119.32, 91.89, 61.35, 55.88, 14.35. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{13}H_{14}N_2O_3$ 247.1077; found 247.1078.





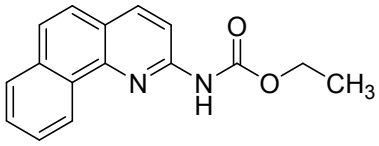
Ethyl (4–nitroquinolin–2–yl)carbamate 3c (57%) and ethyl (4–(piperidin–1–yl)quinolin–2–yl)carbamate 3c' (25%)

The title compounds were obtained and characterized as a mixture.

3c. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.83 (s, 1H), 8.25 (d, J = 8.5 Hz, 2H + br s, 1H), 7.95 (d, J = 8.5 Hz, 1H), 7.79 (ddd, J = 8.4, 6.9, 1.4 Hz, 1H), 7.63 (ddd, J = 8.4, 6.8, 1.2 Hz, 1H), 4.32 (q, J = 7.2 Hz, 2H), 1.35 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 154.54, 153.15, 150.66, 148.39, 131.38, 128.01, 127.52, 122.72, 116.52, 107.75, 62.22, 14.37. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{12}H_{11}N_3O_4$ 262.0822; found 262.0829.

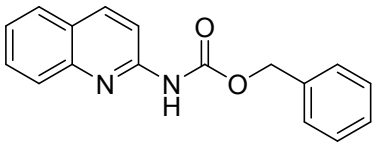
3c'. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.30 – 8.12 (br s, 1H), 7.95 (m, 1H), 7.77 (m, 2H), 7.63 (m, 1H), 7.39 – 7.34 (m, 1H), 4.25 (q, J = 7.2 Hz, 2H), 3.26 (t, J = 5.2 Hz, 4H), 1.87 (m, 4H), 1.73 (m, 2H), 1.30 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 160.31, 132.48, 129.51,

129.34, 124.62, 123.96, 123.40, 123.16, 121.45, 104.21, 61.39, 53.66, 26.09, 24.52, 14.45. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{17}H_{21}N_3O_2$ 300.1707; found 300.1711.



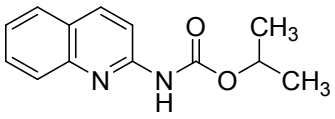
Ethyl benzo[*h*]quinolin–2–ylcarbamate 3e

Yellow powder; 68% yield (36 mg); mp 104–105 °C. ^{1}H NMR (400 MHz, Acetone–d_6): δ 9.25 (s, 1H), 9.18 – 9.10 (m, 1H), 8.37 – 8.32 (m, 2H), 8.01 – 7.94 (m, 1H), 7.82 – 7.77 (m, 2H), 7.73 – 7.66 (m, 2H), 4.29 (q, J = 7.2 Hz, 2H), 1.34 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, Acetone–d_6): δ 153.65, 151.12, 144.87, 138.14, 134.09, 130.65, 128.03, 127.78, 126.32, 125.40, 125.16, 124.21, 123.04, 112.35, 60.87, 13.96. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{16}H_{14}N_2O_2$ 267.1128; found 267.1127.



Benzyl quinolin–2–ylcarbamate 3f[12]

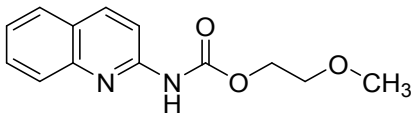
Yellow powder; 73% yield (41 mg); mp 103–104 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.26 (d, J = 8.8 Hz, 1H), 8.22 – 8.11 (m, 2H), 7.84 (d, J = 8.4 Hz, 1H), 7.78 (dd, J = 8.0, 1.6 Hz, 1H), 7.68 – 7.61 (m, 1H), 7.48 – 7.33 (m, 6H), 5.27 (s, 2H). ^{13}C NMR (101 MHz, Acetone–d_6): δ 153.67, 151.69, 146.94, 138.21, 136.68, 129.71, 128.42, 127.99, 127.92, 127.60, 127.38, 125.81, 124.68, 112.96, 66.42. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{17}H_{14}N_2O_2$ 279.1128; found 279.1127.



Isopropyl quinolin–2–ylcarbamate 3g[12]

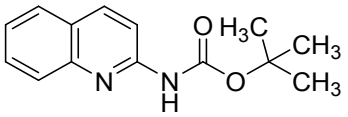
Pale yellow powder; 80% yield (37 mg); mp 100–101 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.46 (br s, 1H), 8.28 (d, J = 8.8 Hz, 1H), 8.18 (d, J = 8.8 Hz, 1H), 7.88 (dd, J = 8.4, 2.8 Hz, 1H), 7.78 (d, J = 8.0 Hz, 1H), 7.67 (t, J = 7.6 Hz, 1H), 7.45 (t, J = 7.6 Hz, 1H), 5.11 – 5.02 (m, 1H), 1.33 – 1.26 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.15, 151.26, 146.23, 138.81, 130.01, 127.52,

127.50, 127.01, 125.71, 124.88, 113.01, 69.35, 21.95. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{13}H_{14}N_2O_2$ 231.1128; found 231.1129.



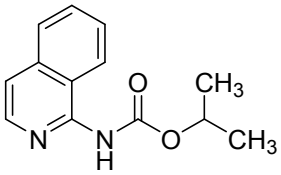
2–Methoxyethyl quinolin–2–ylcarbamate 3h

Pale yellow powder; 71% yield (35 mg); mp 60–62 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.25 (d, J = 8.8 Hz, 1H), 8.17 (d, J = 8.8 Hz, 1H), 7.87 (d, J = 8.4 Hz, 1H), 7.77 (d, J = 8.0 Hz, 1H), 7.71 – 7.62 (m, 1H), 7.44 (t, J = 7.2 Hz, 1H), 4.45 – 4.32 (m, 2H), 3.67 – 3.58 (m, 2H), 3.38 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 153.42, 151.03, 146.54, 138.64, 129.90, 127.48, 127.33, 125.85, 124.90, 112.97, 70.49, 64.50, 58.98. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{13}H_{14}N_2O_3$ 247.1077; found 247.1078.



***tert*–Butyl quinolin–2–ylcarbamate 3j**[13]

Yellow oil; 39% yield (19 mg). ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.22 (d, J = 8.8 Hz, 1H), 8.15 (d, J = 8.8 Hz, 1H), 7.79 – 7.71 (m, 2H), 7.69 – 7.63 (m, 1H), 7.46 – 7.41 (m, 1H), 1.56 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 152.53, 151.34, 146.78, 138.33, 129.81, 127.52, 127.49, 127.26, 125.78, 124.65, 112.94, 81.23, 28.25. HRMS (ESI), m/z: $[M+H]^+$ calcd. for $C_{14}H_{16}N_4O_3$ 245.1285; found 245.1279.



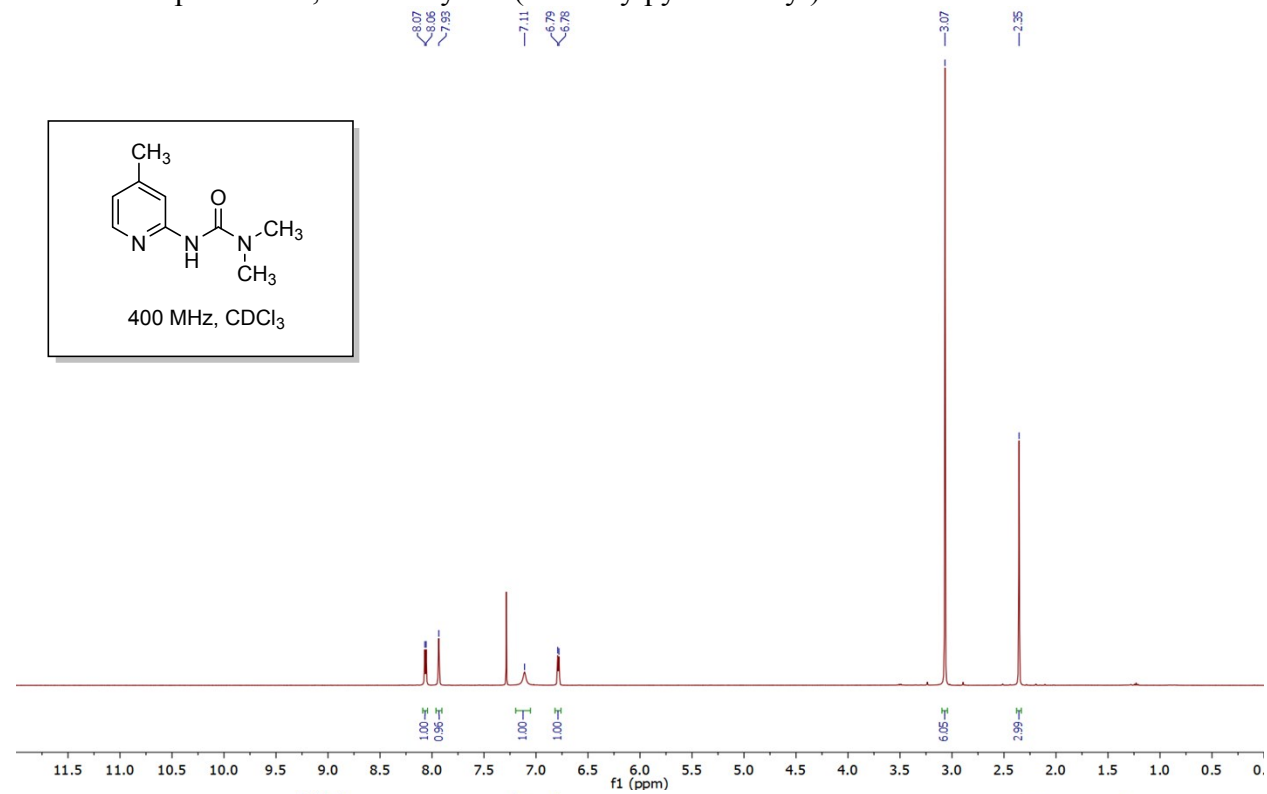
Isopropyl isoquinolin–1–ylcarbamate 3k

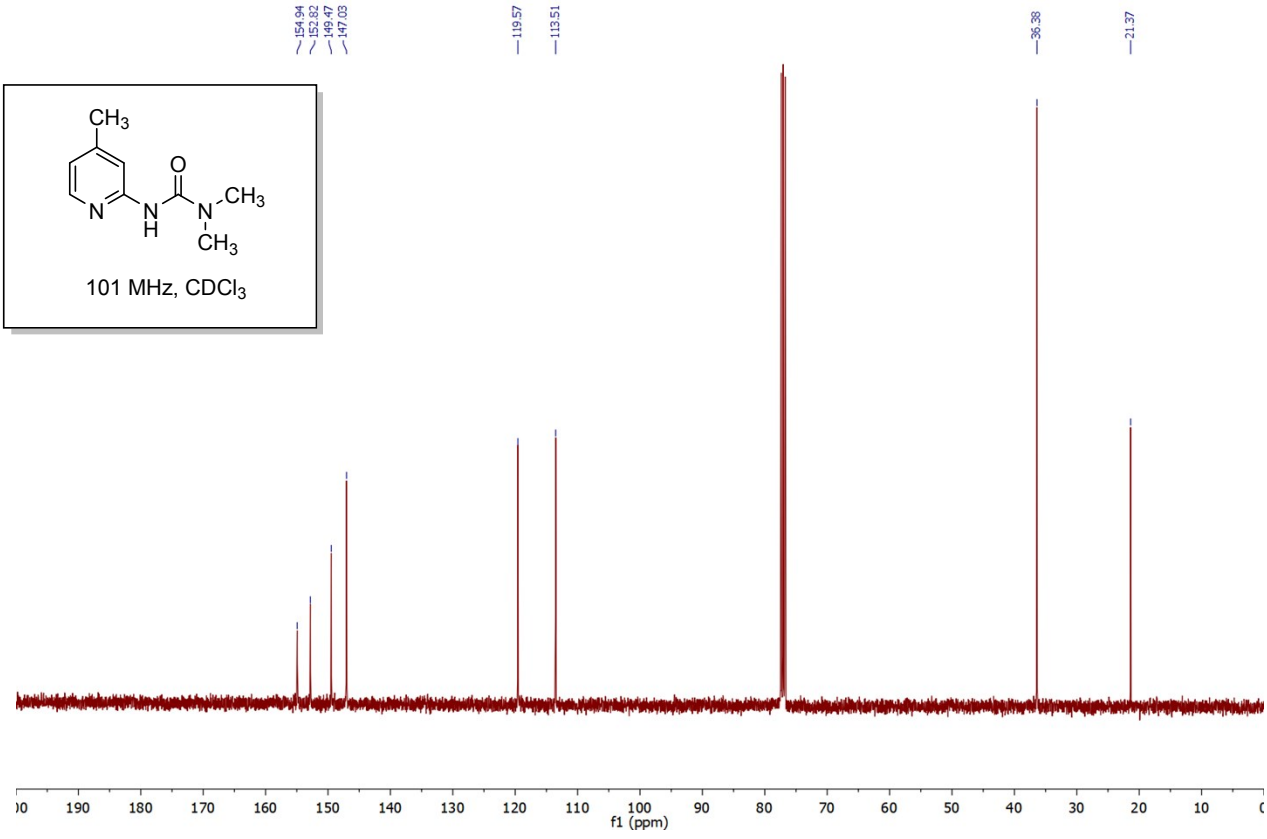
White powder; 27% yield (12 mg); mp 166–168 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.64 (d, J = 8.0 Hz, 1H), 7.79 – 7.57 (m, 4H), 7.15 (d, J = 6.4 Hz, 1H), 5.15 – 5.04 (m, 1H), 1.39 (d, J = 6.0 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$): δ 137.25, 132.45, 130.94, 127.64, 126.72, 126.54,

124.00, 114.10, 69.20, 22.09. HRMS (ESI), m/z: $[M+Na]^+$ calcd. for $C_{13}H_{14}N_2O_2$ 253.0947; found 253.0957.

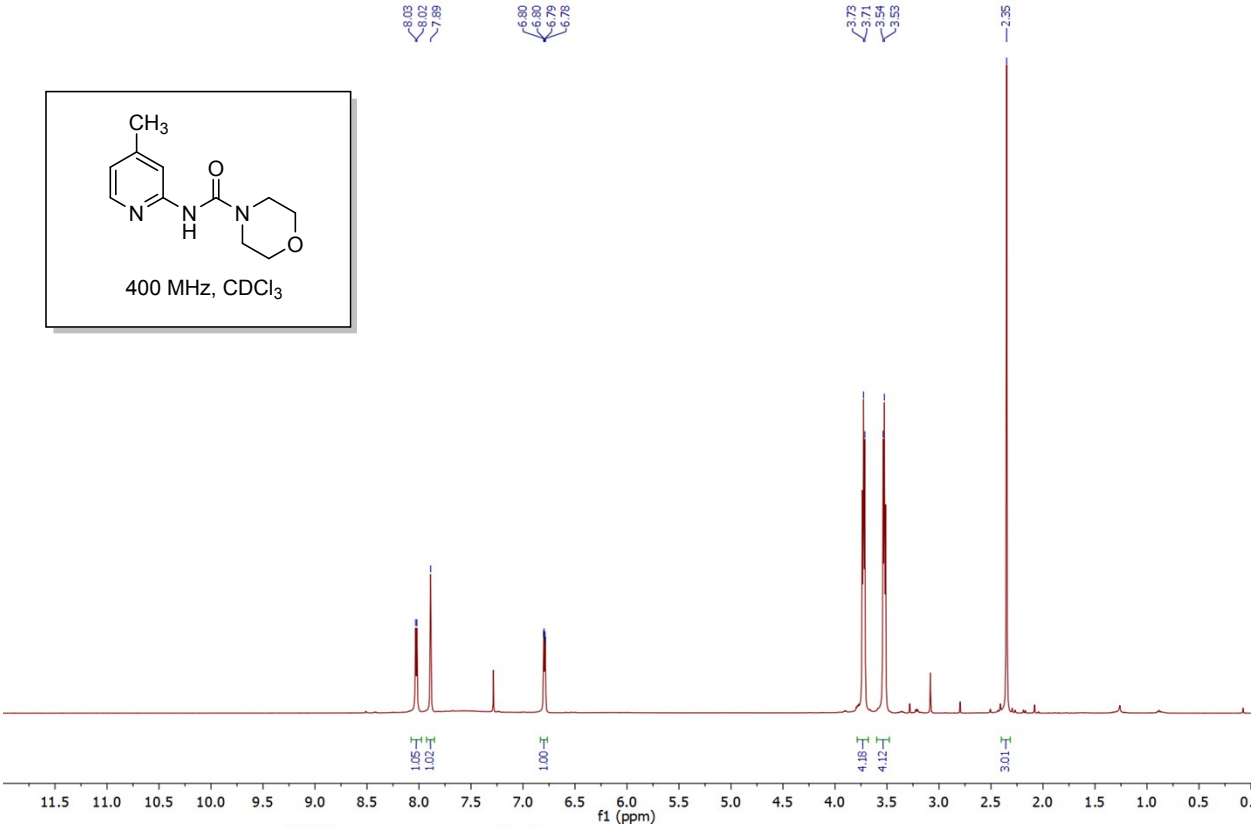
4. ^{1}H, ^{13}C, and ^{19}F NMR spectra of compounds 1, 2, and 3

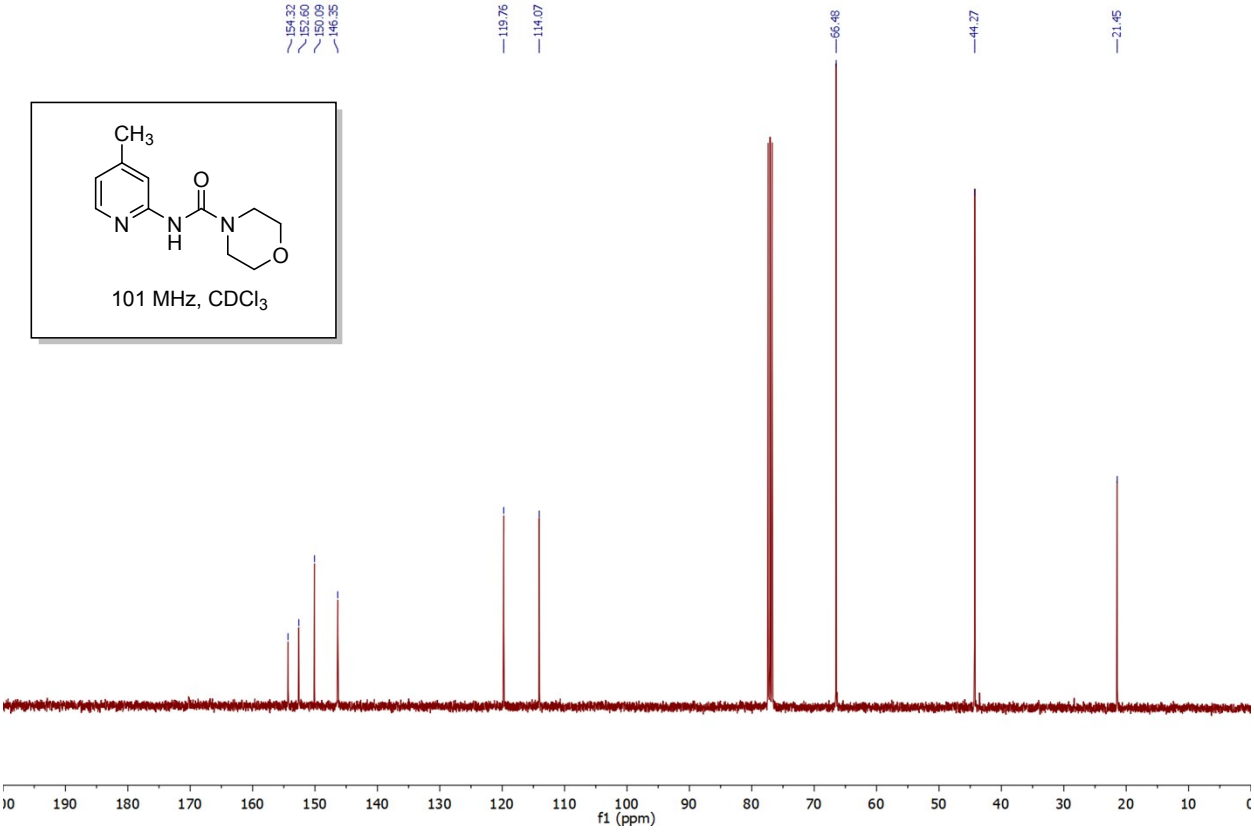
^{1}H and ^{13}C spectra of 1,1–dimethyl–3–(4–methylpyridin–2–yl)urea **1a**.



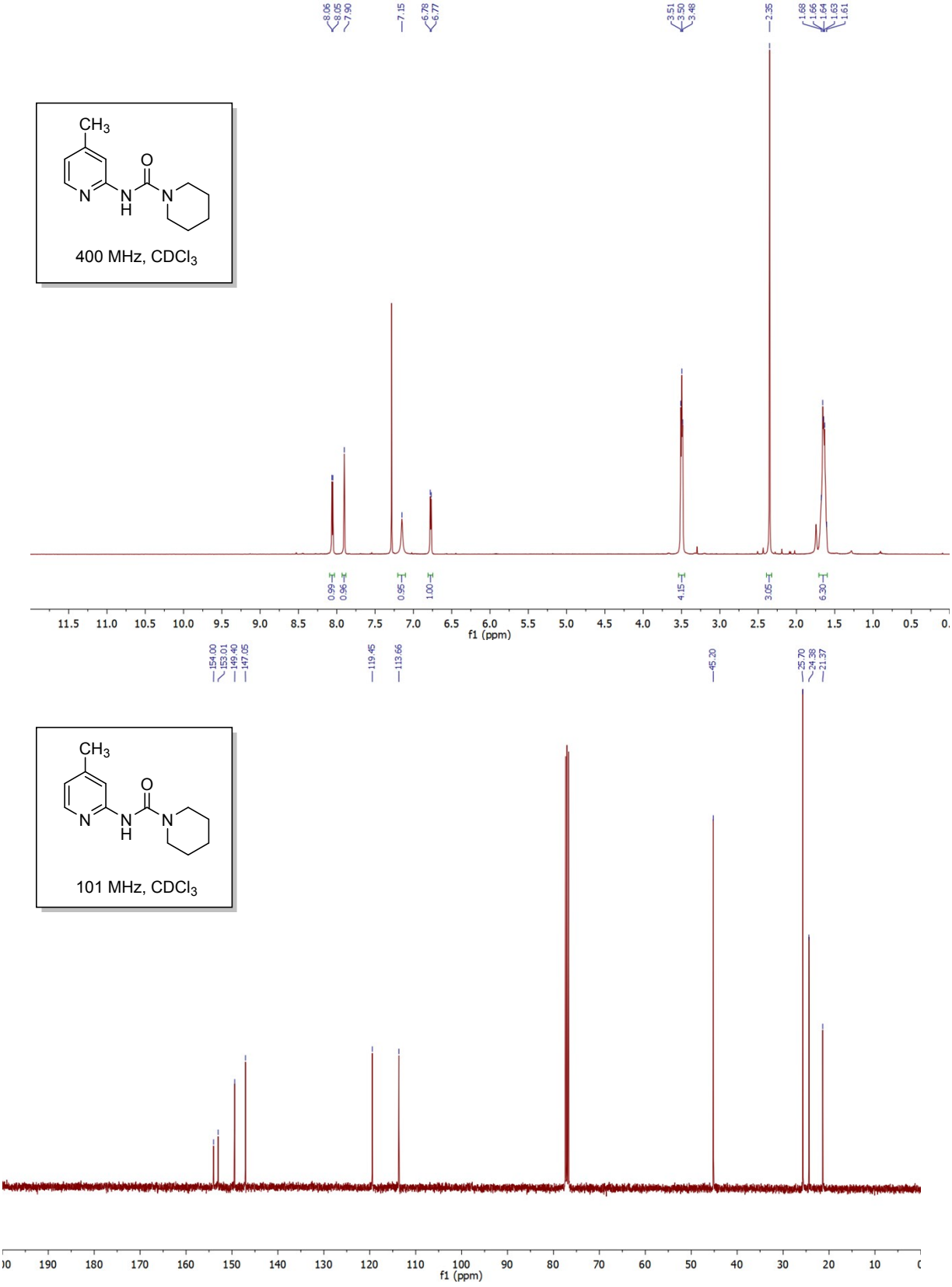


^{1}H and ^{13}C spectra of *N*–(4–methylpyridin–2–yl)morpholine–4–carboxamide **1b**.

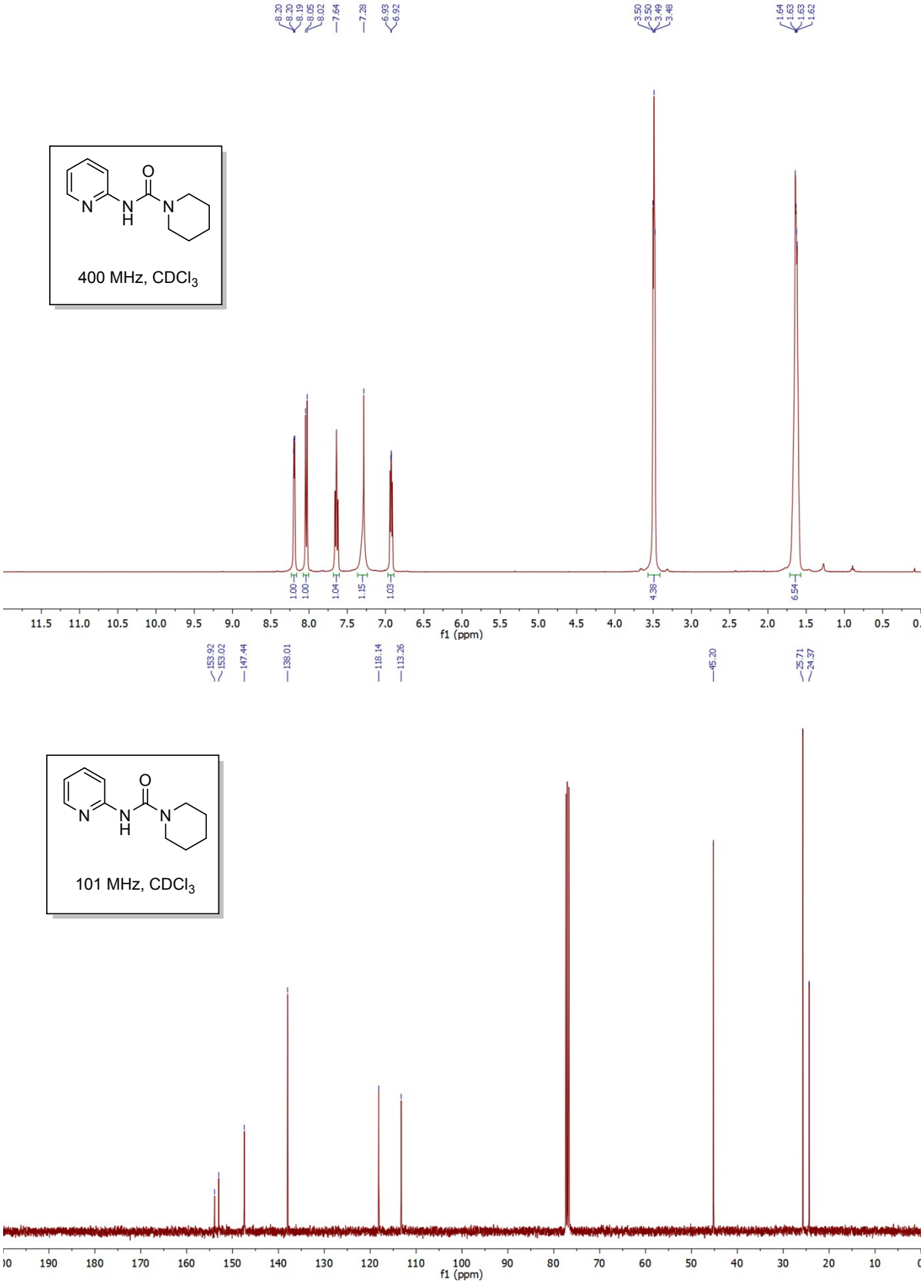




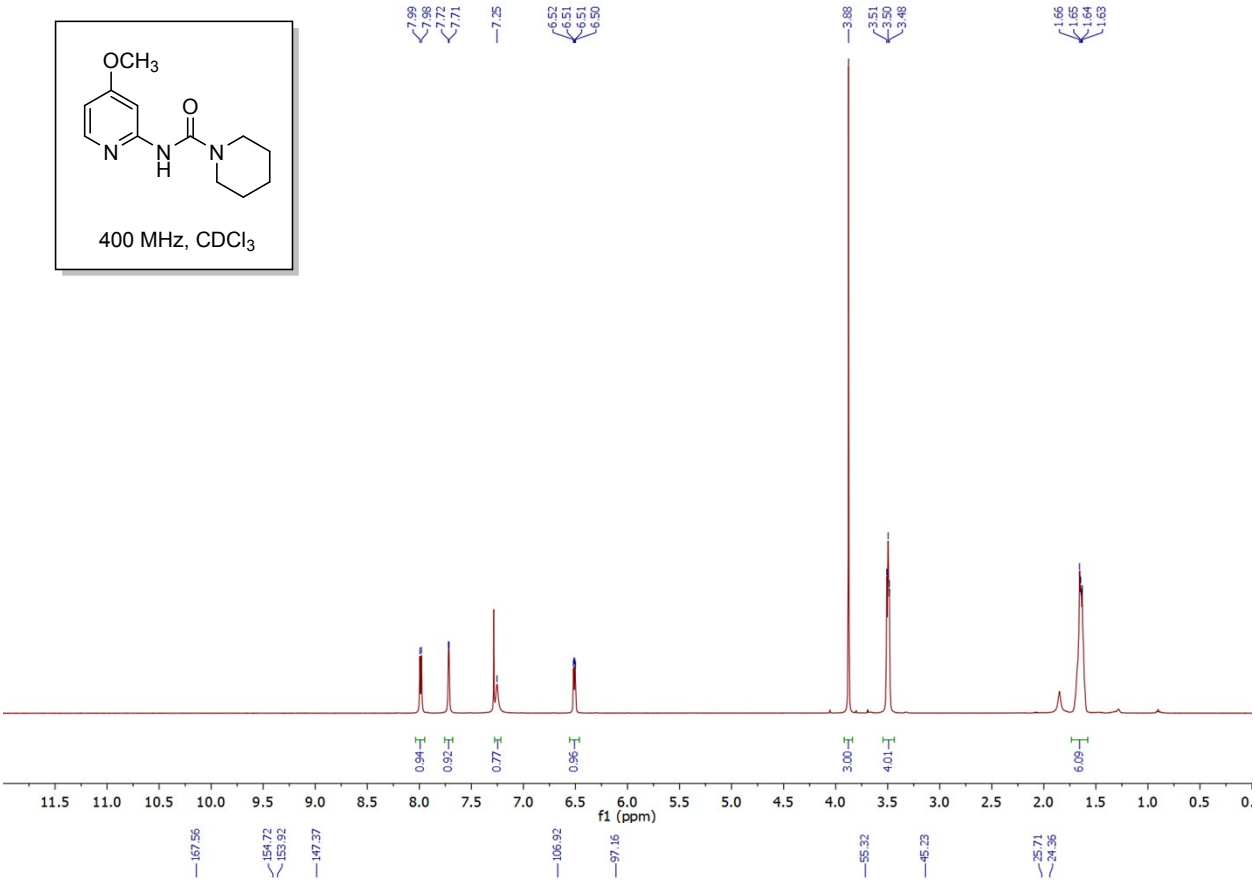
^{1}H and ^{13}C spectra of *N*–(4–methylpyridin–2–yl)piperidine–1–carboxamide **1c**.

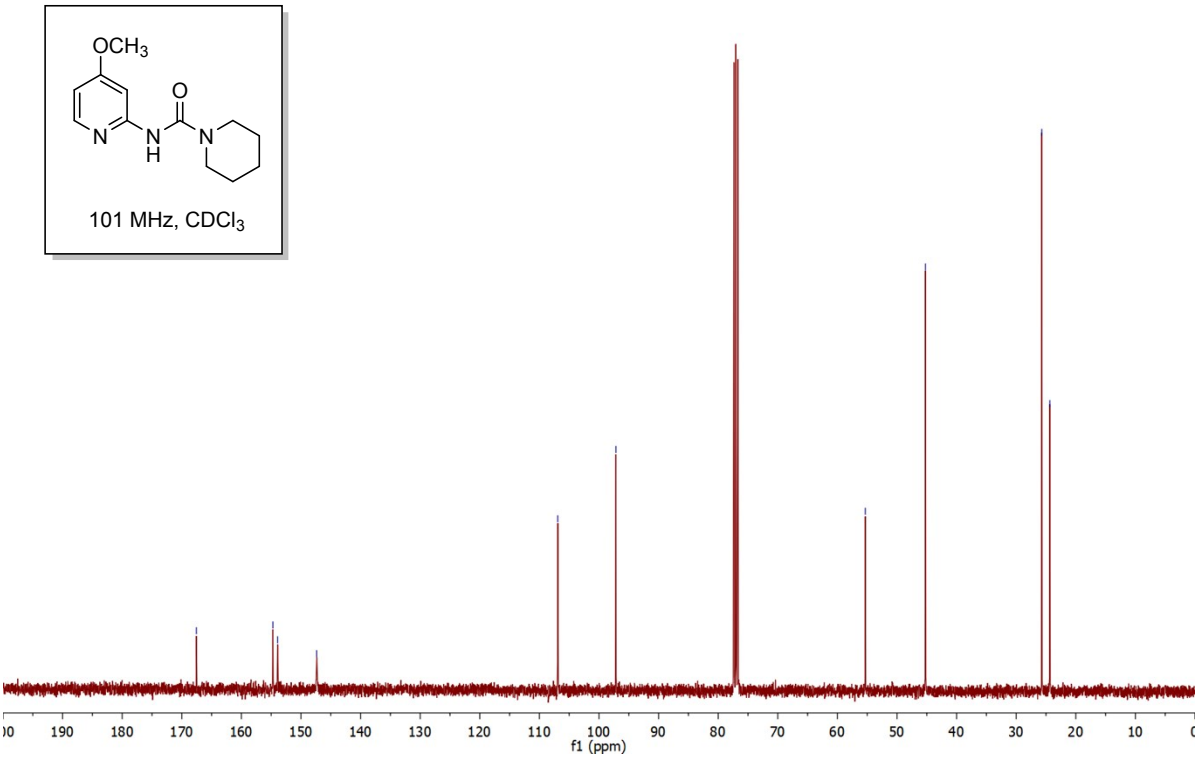


^{1}H and ^{13}C spectra of *N*–(pyridin–2–yl)piperidine–1–carboxamide **1d**.

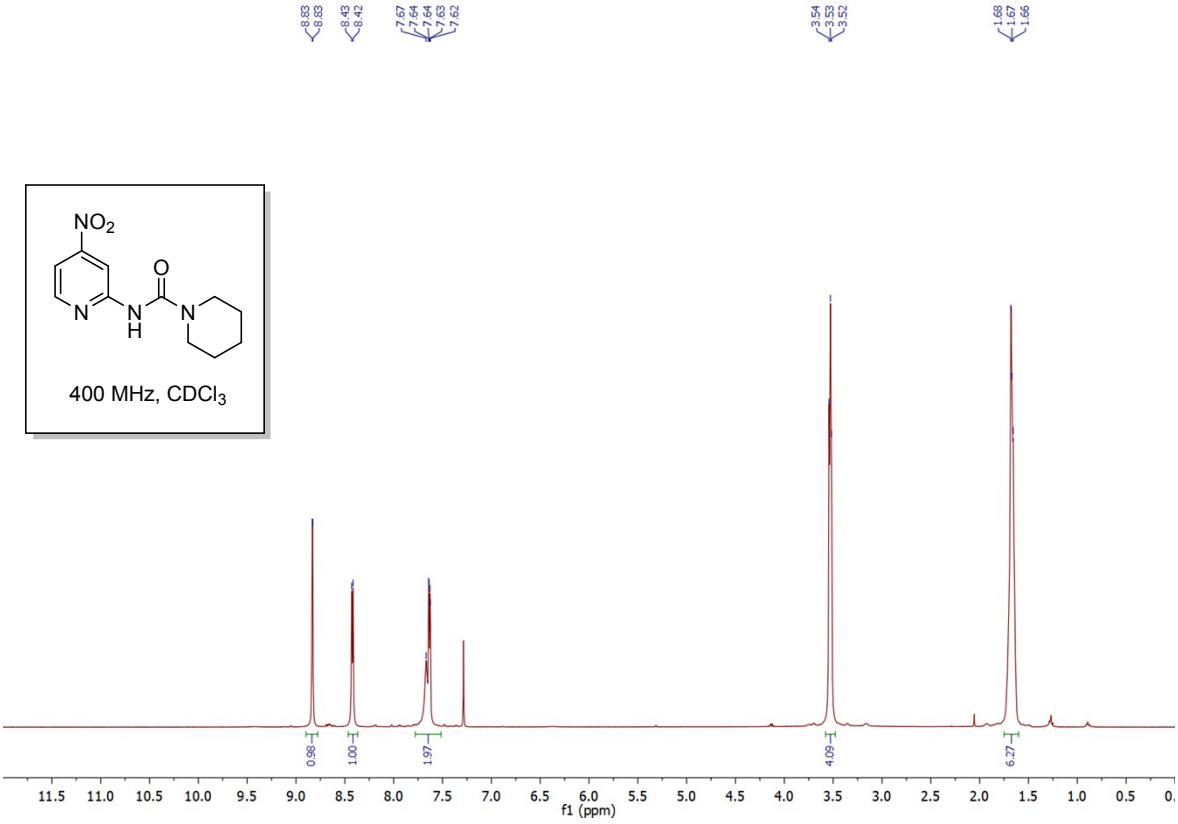


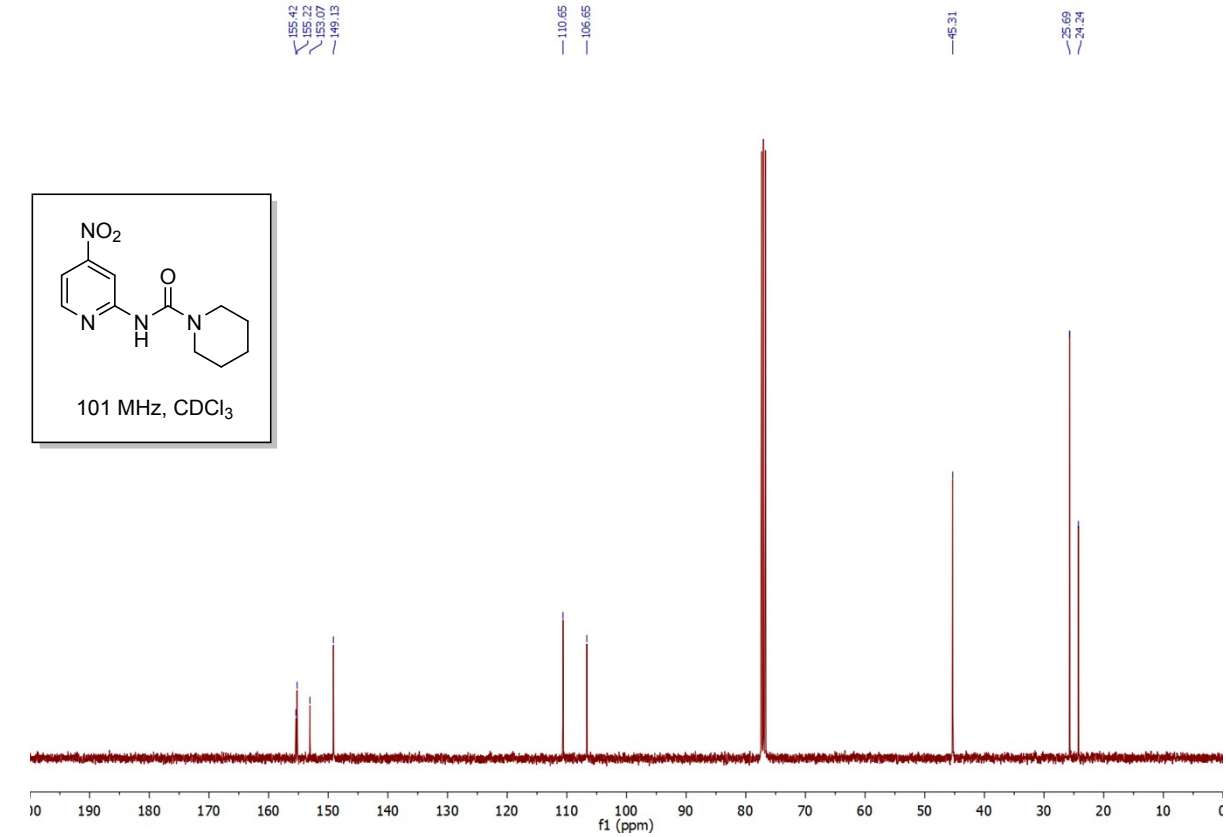
^{1}H and ^{13}C spectra of *N*–(4–methoxypyridin–2–yl)piperidine–1–carboxamide **1e**.



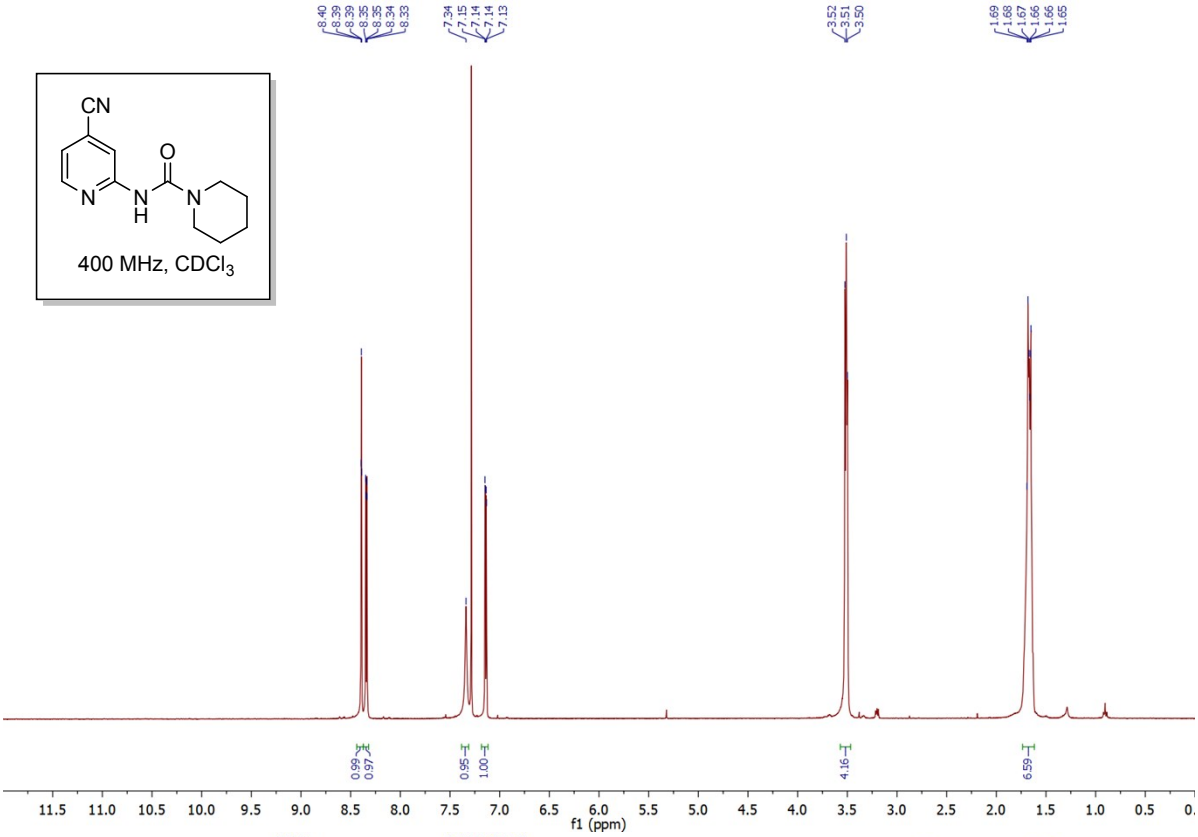


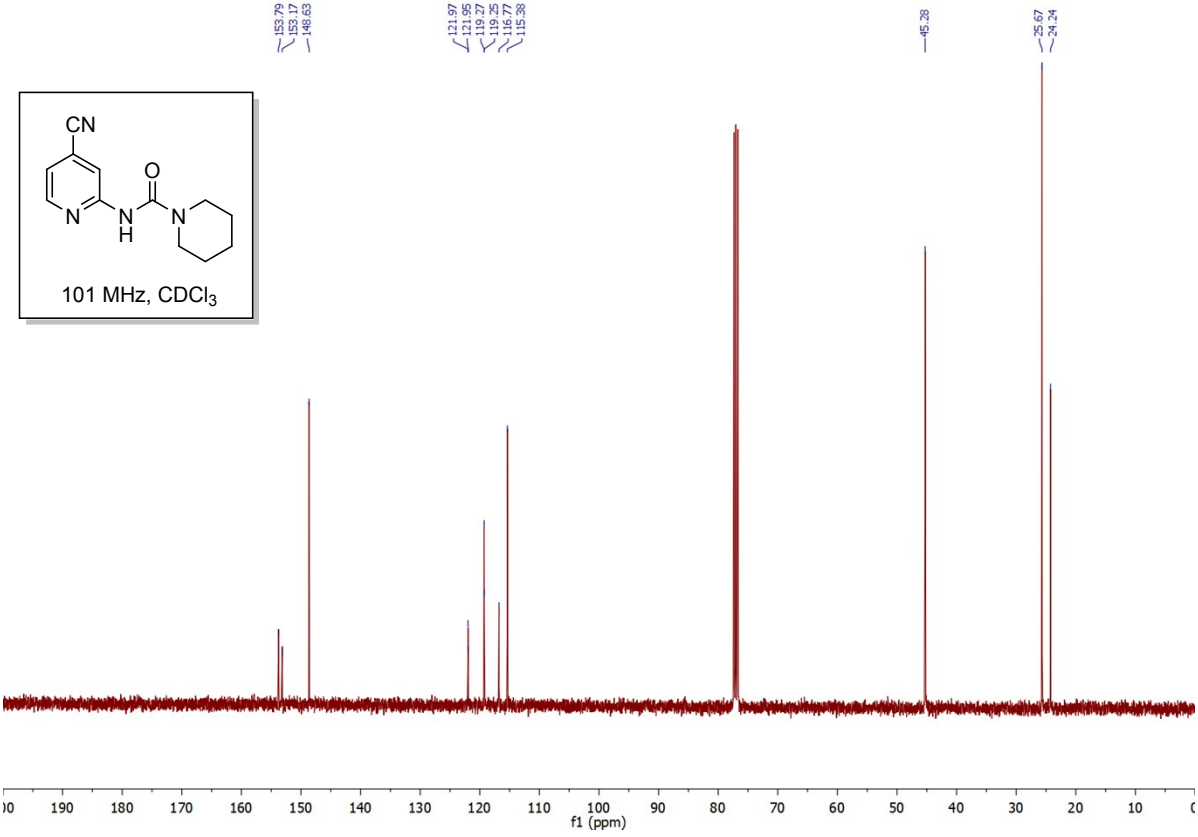
^{1}H and ^{13}C spectra of *N*–(4–nitropyridin–2–yl)piperidine–1–carboxamide **1f**.



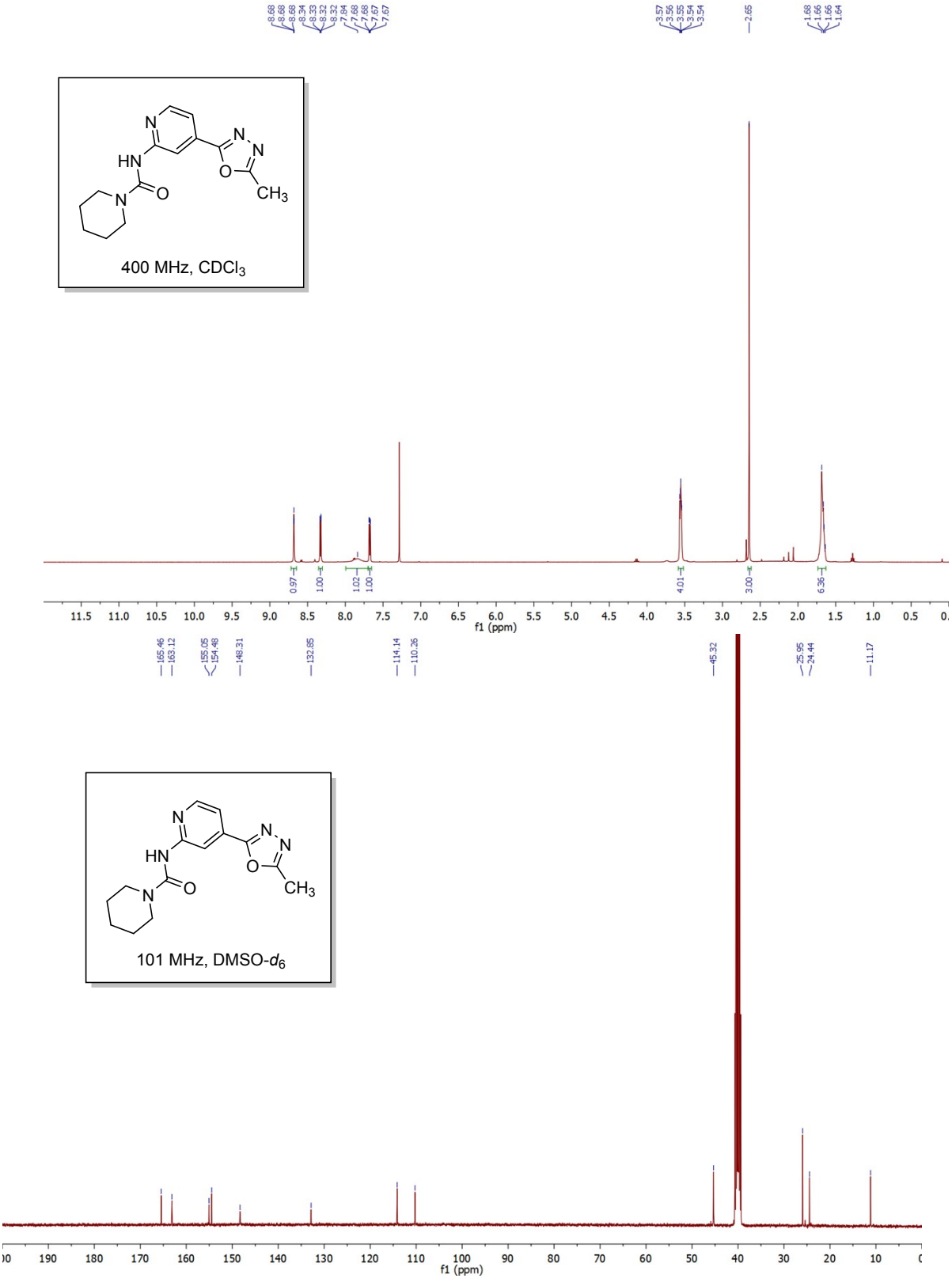


^{1}H and ^{13}C spectra of *N*–(4–cyanopyridin–2–yl)piperidine–1–carboxamide **1g**.

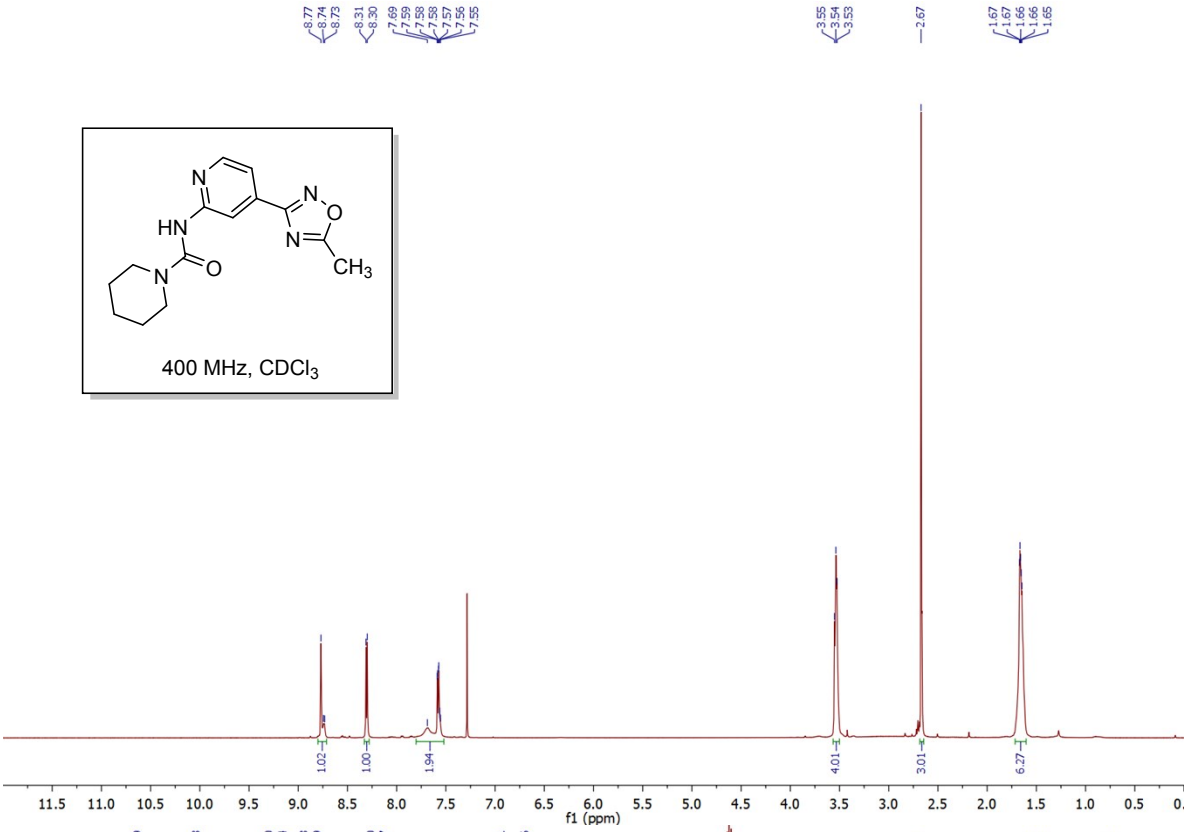


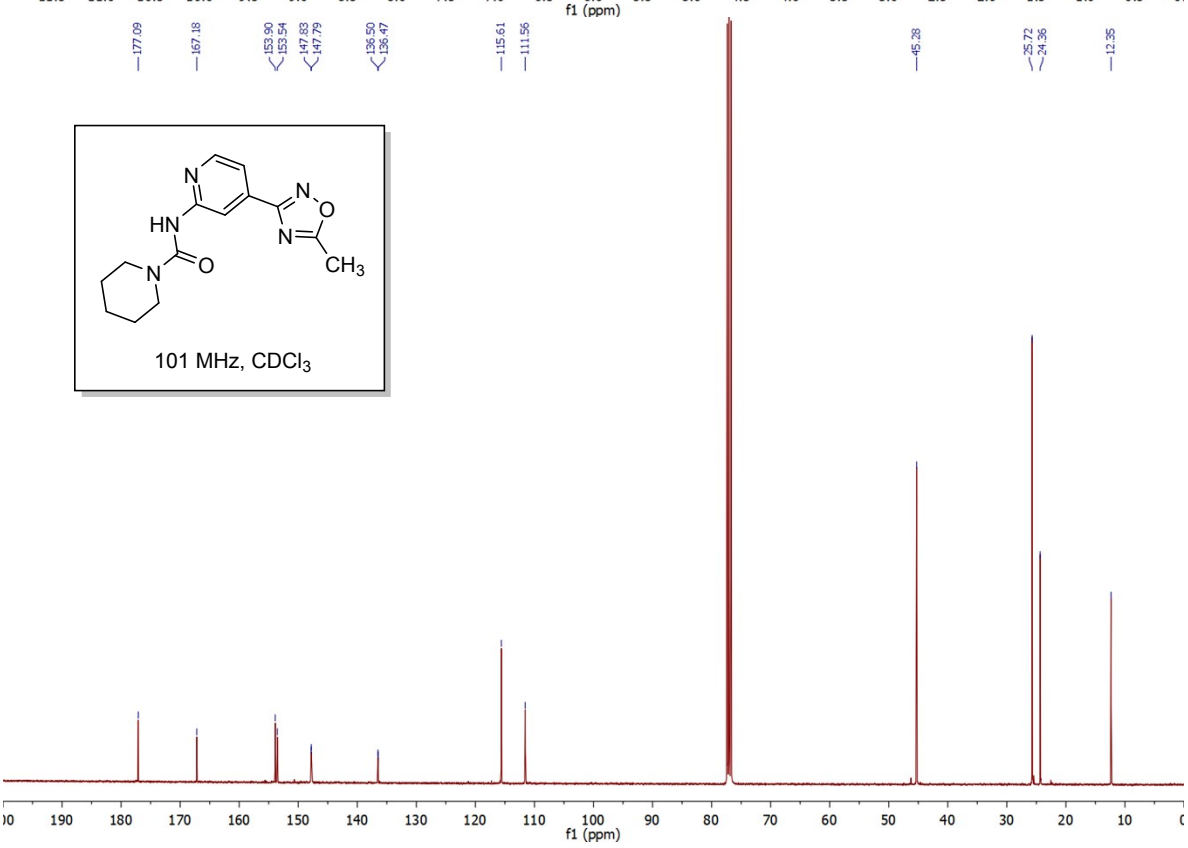


^{1}H and ^{13}C spectra of ***N***–(4–(5–methyl–1,3,4–oxadiazol–2–yl)pyridin–2–yl)piperidine–1–carboxamide **1h**.

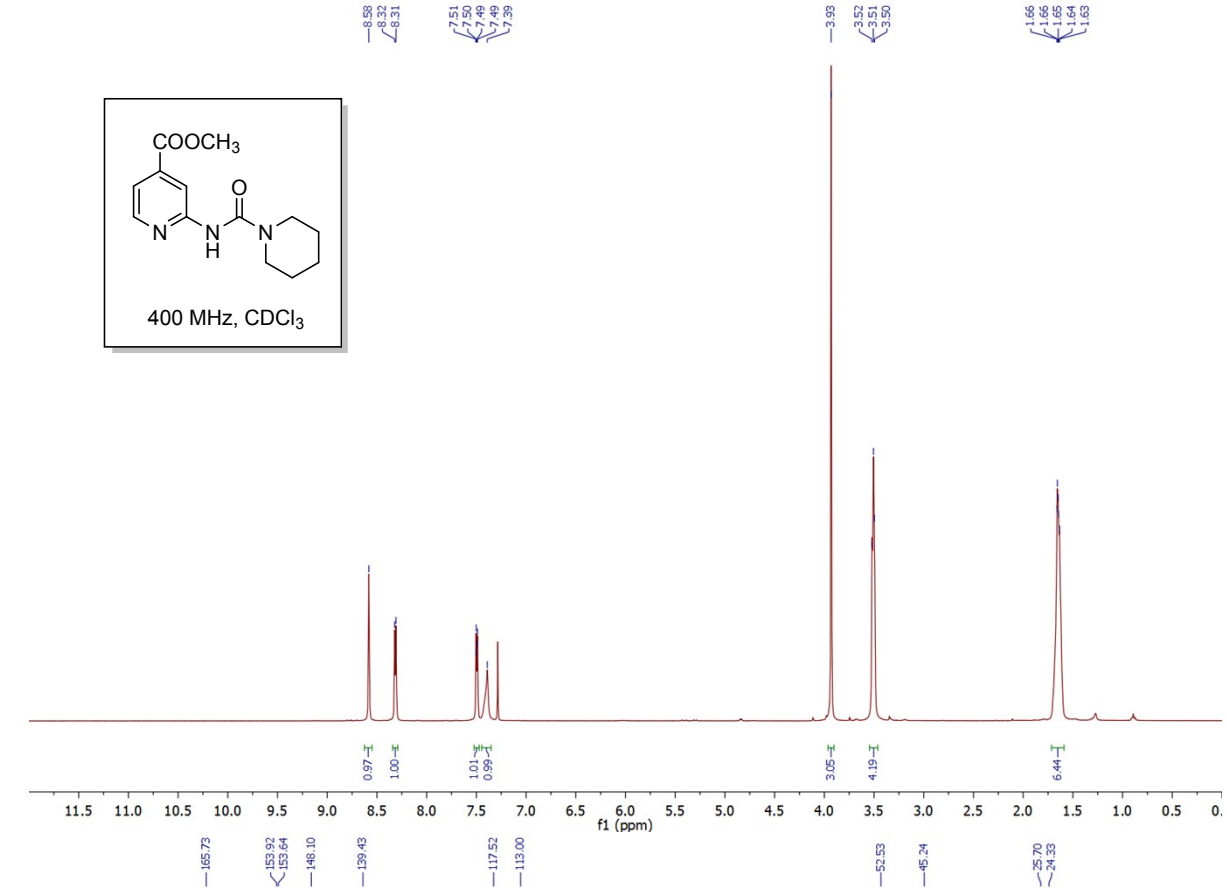


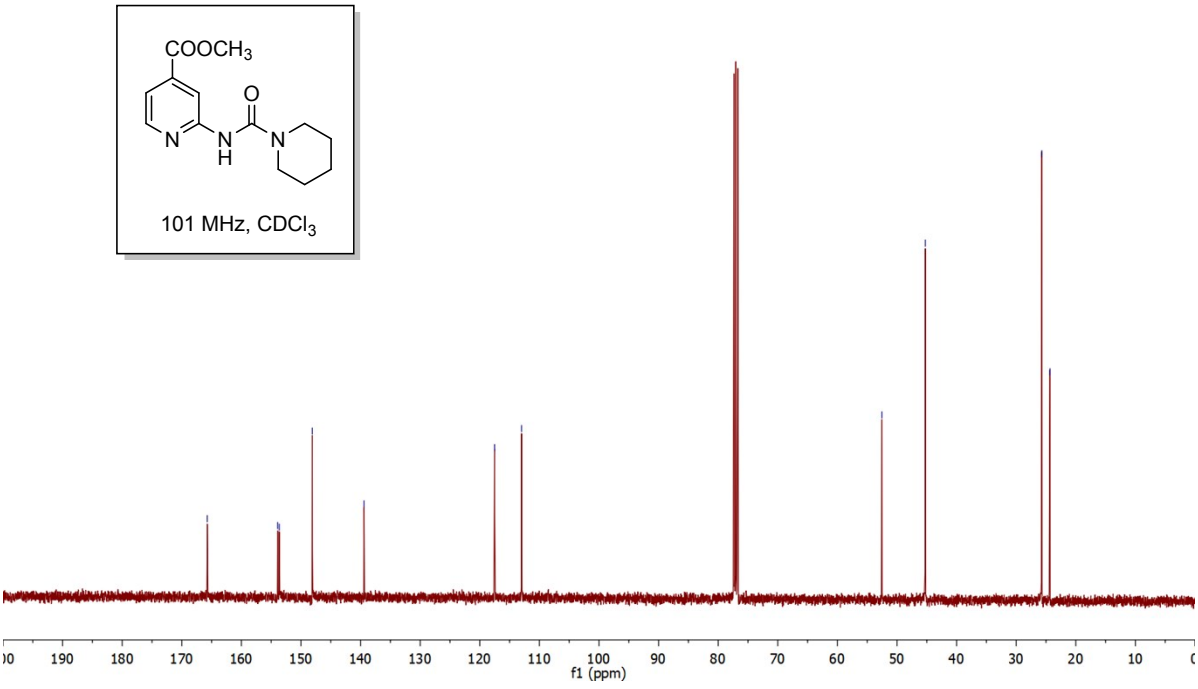
^{1}H and ^{13}C spectra of *N*–(4–(5–methyl–1,2,4–oxadiazol–3–yl)pyridin–2–yl)piperidine–1–carboxamide **1i**.



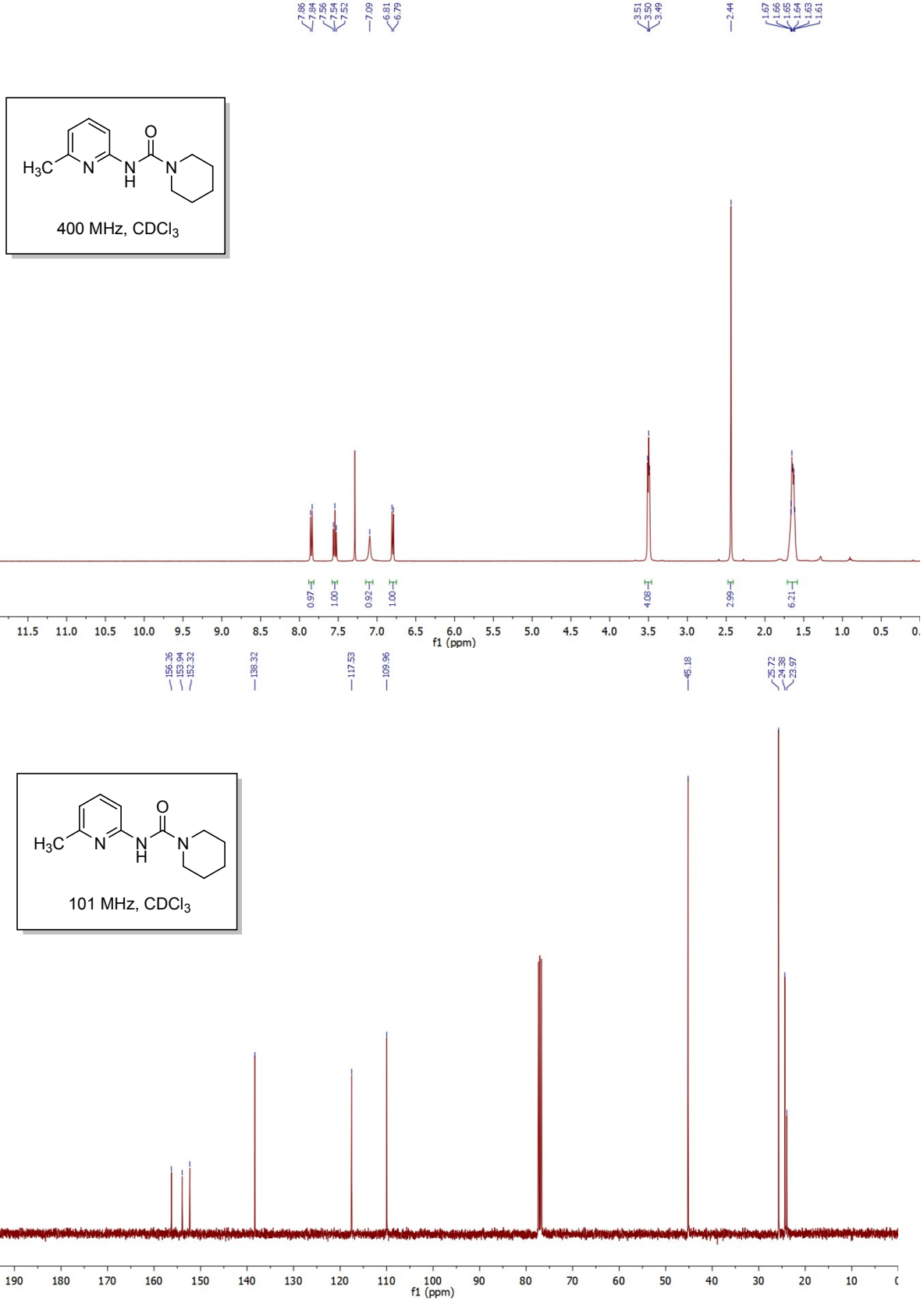


^{1}H and ^{13}C spectra of methyl 2–(piperidine–1–carboxamido)isonicotinate **1j**.

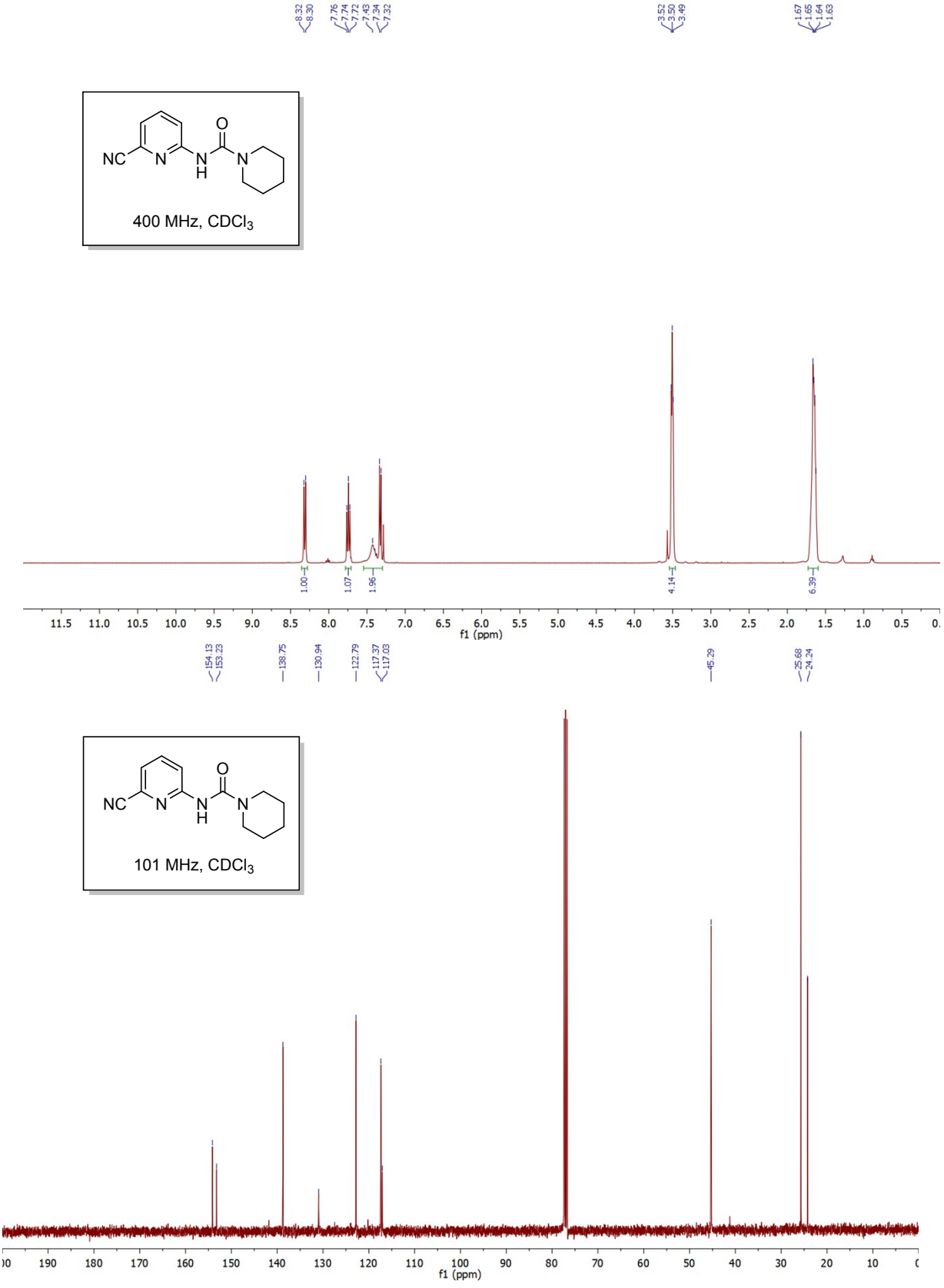




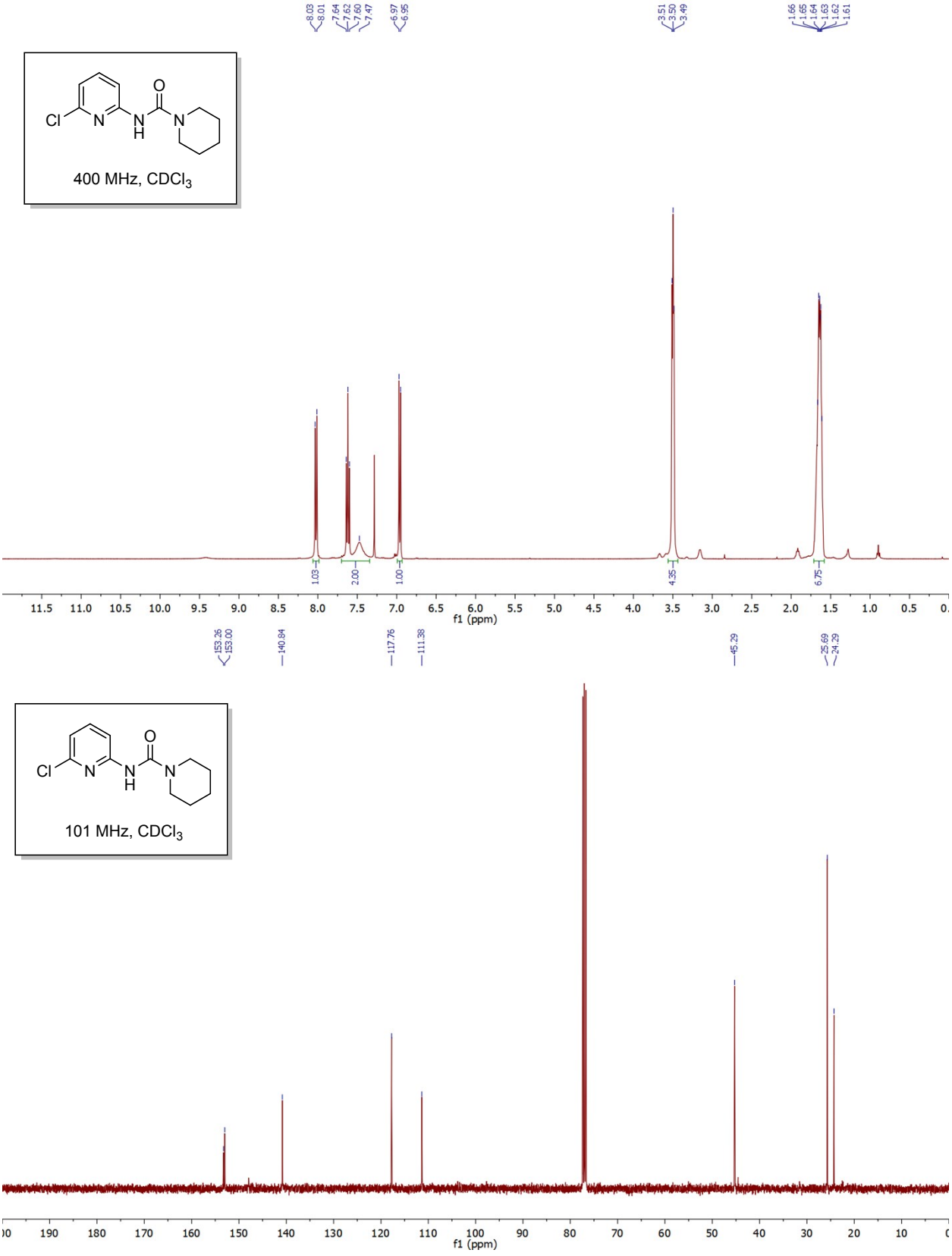
^{1}H and ^{13}C spectra of *N*–(6–methylpyridin–2–yl)piperidine–1–carboxamide **1k**.



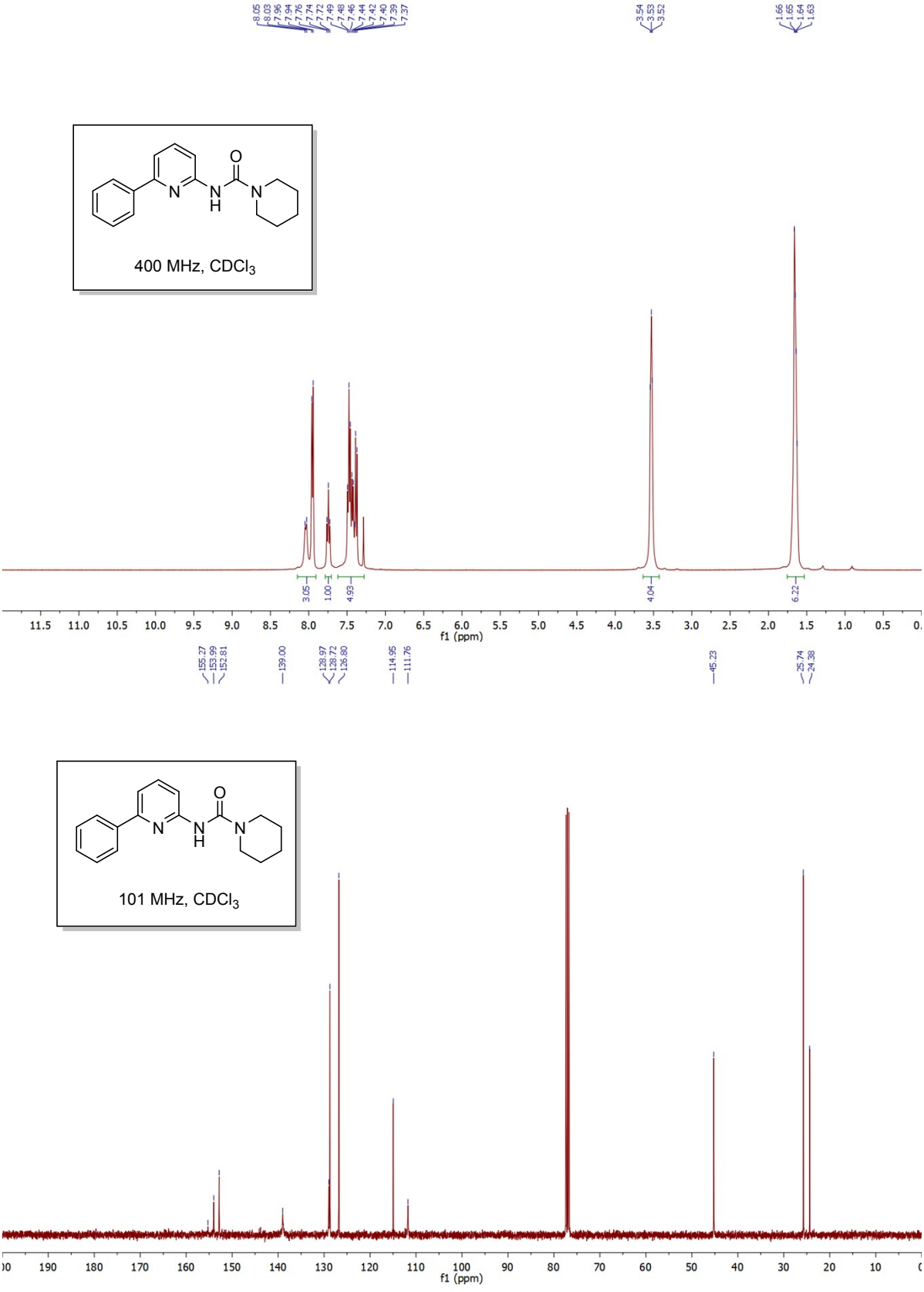
^{1}H and ^{13}C spectra of *N*–(6–cyanopyridin–2–yl)piperidine–1–carboxamide **1l**.



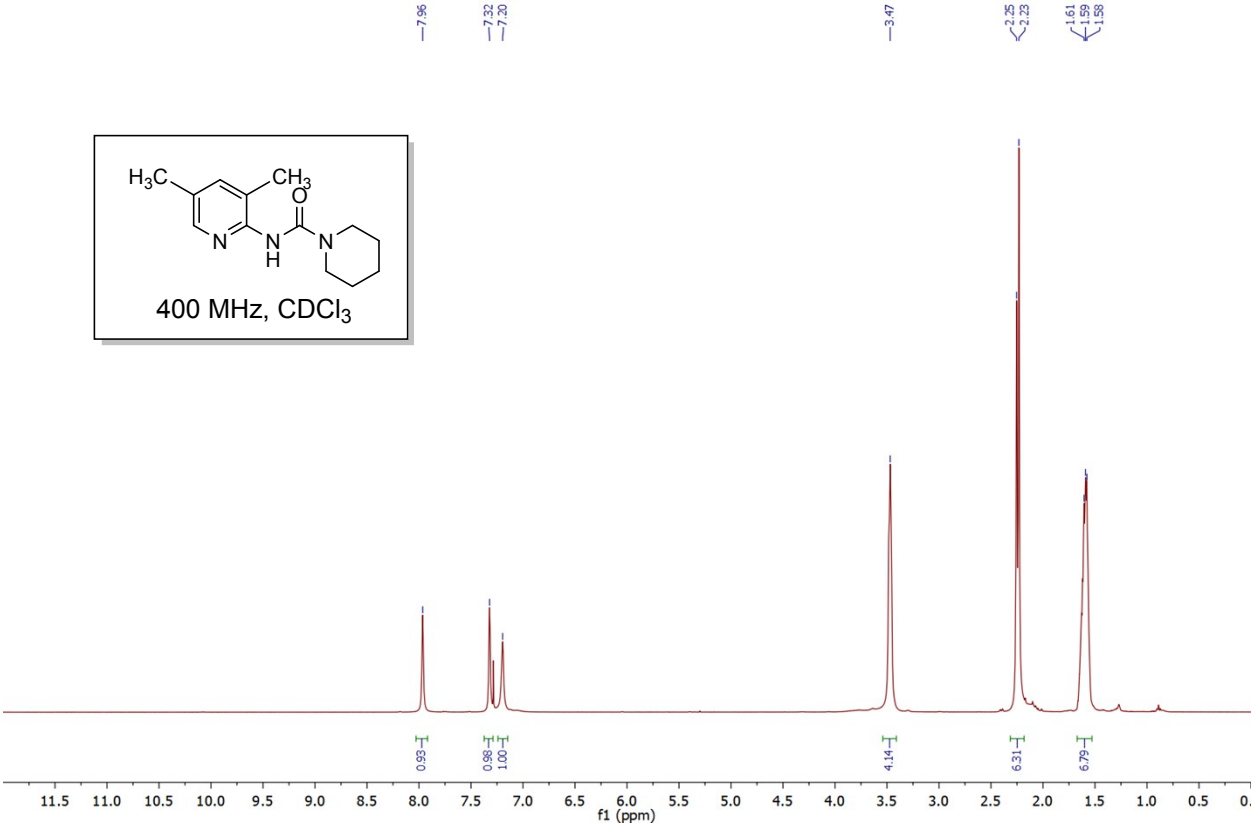
^{1}H and ^{13}C spectra of *N*–(6–chloropyridin–2–yl)piperidine–1–carboxamide **1m**.

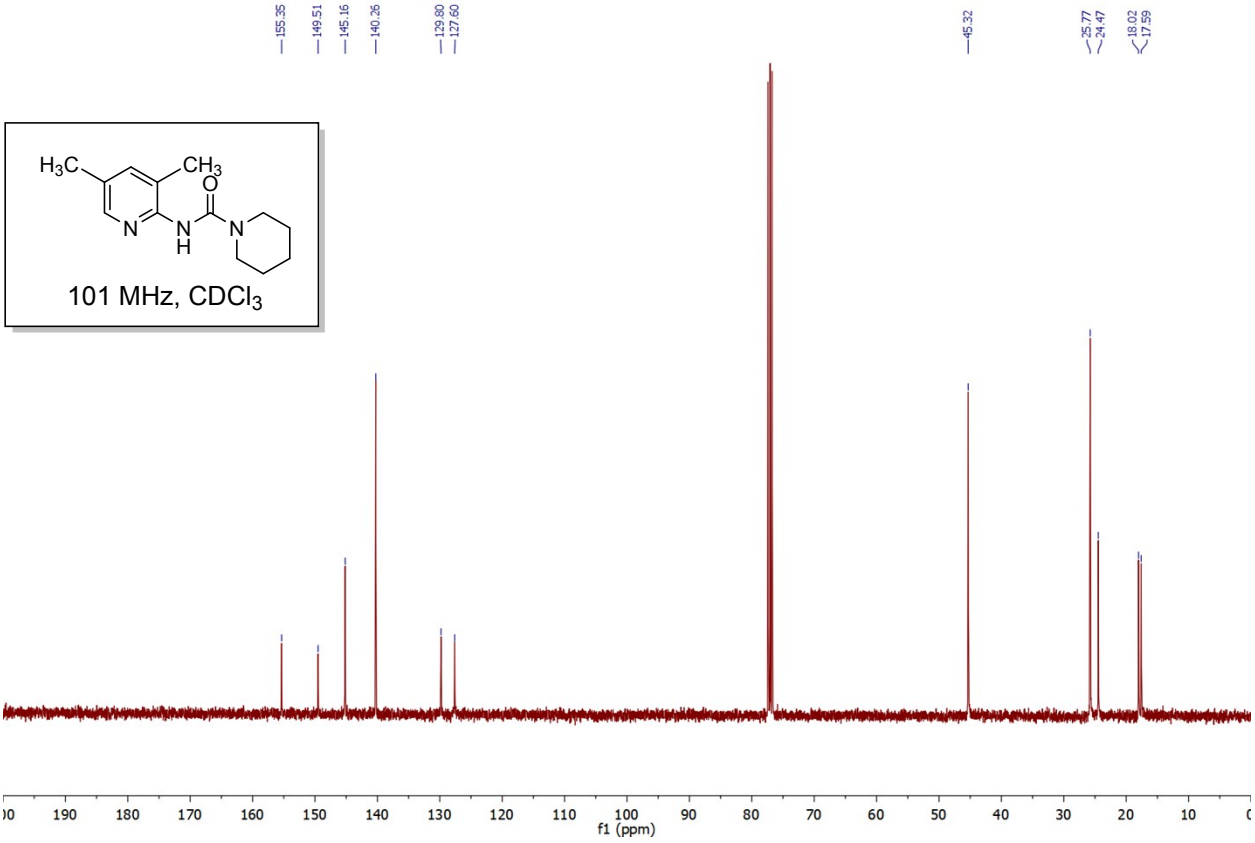


^{1}H and ^{13}C spectra of *N*–(6–phenylpyridin–2–yl)piperidine–1–carboxamide **1n**.

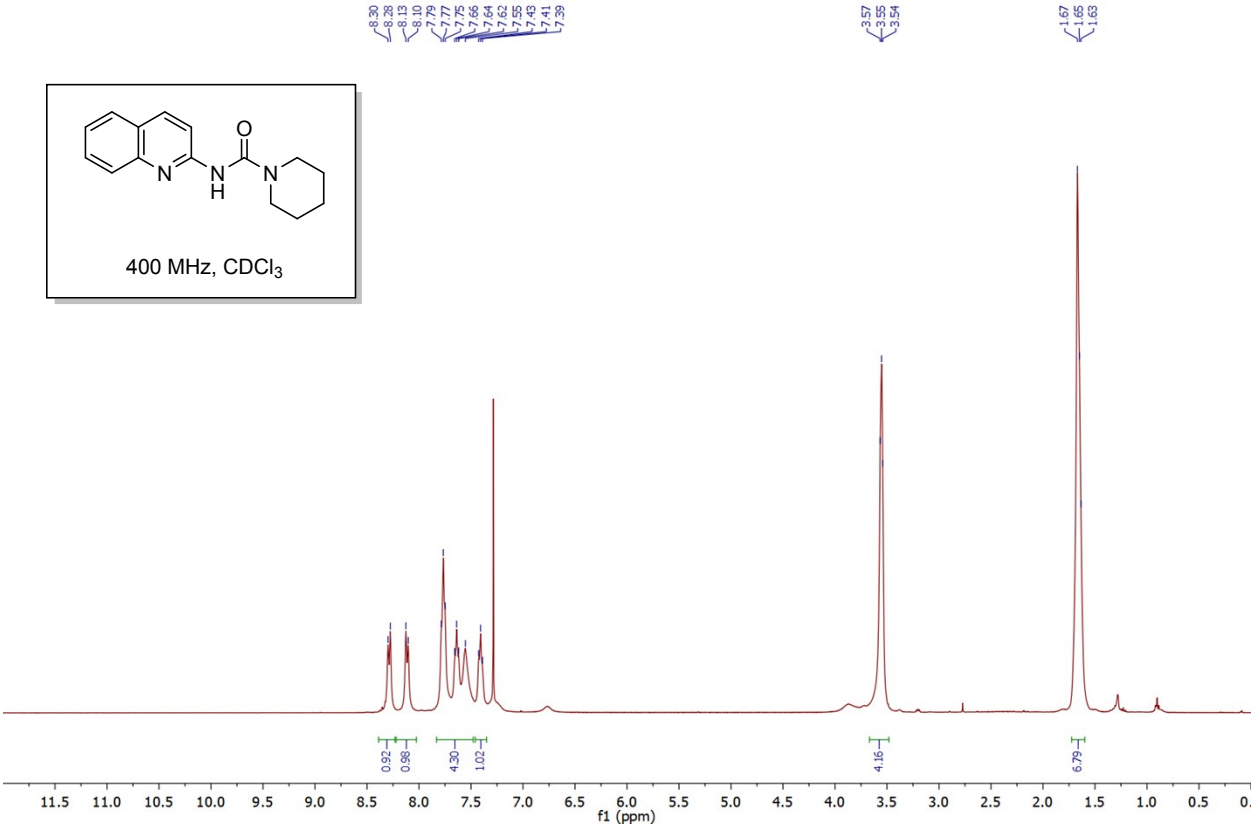


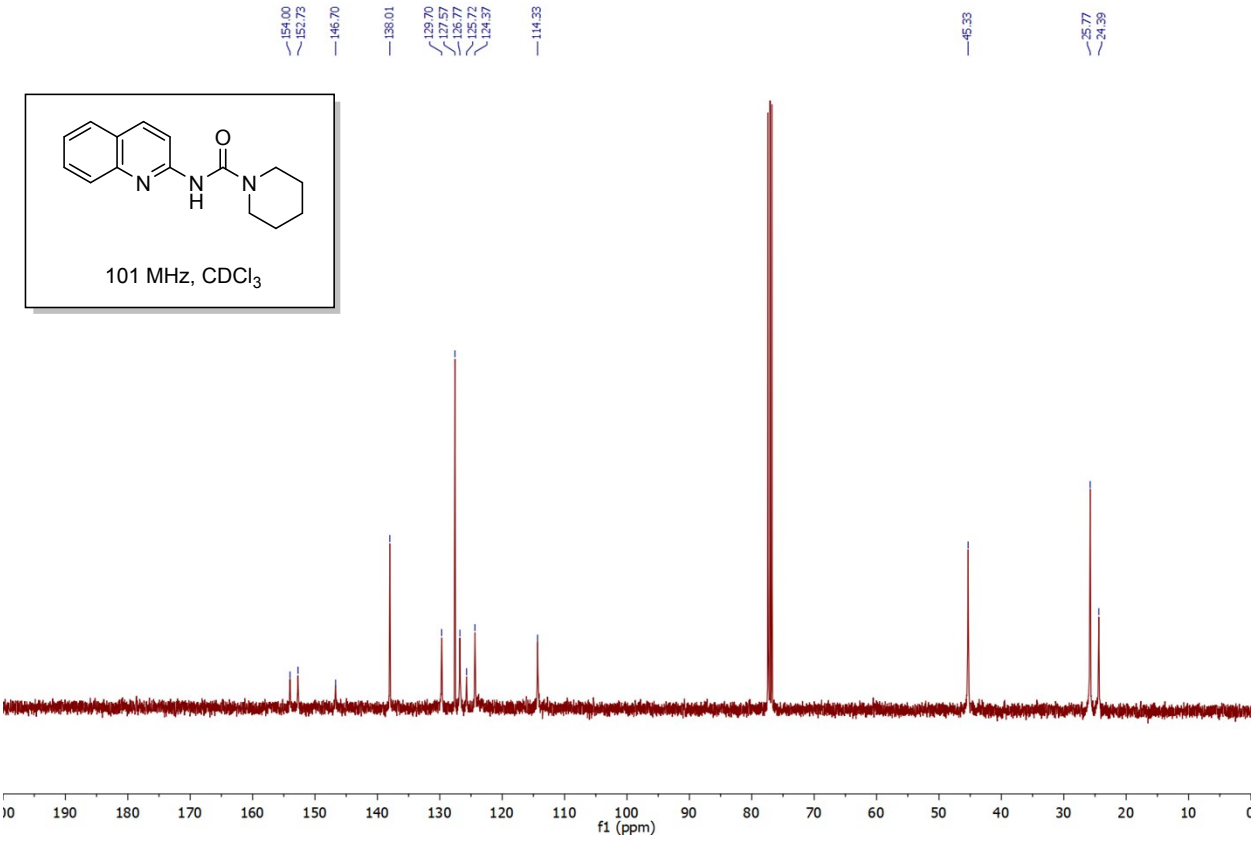
^{1}H and ^{13}C *N*–(3,5–dimethylpyridin–2–yl)piperidine–1–carboxamide **1o**.



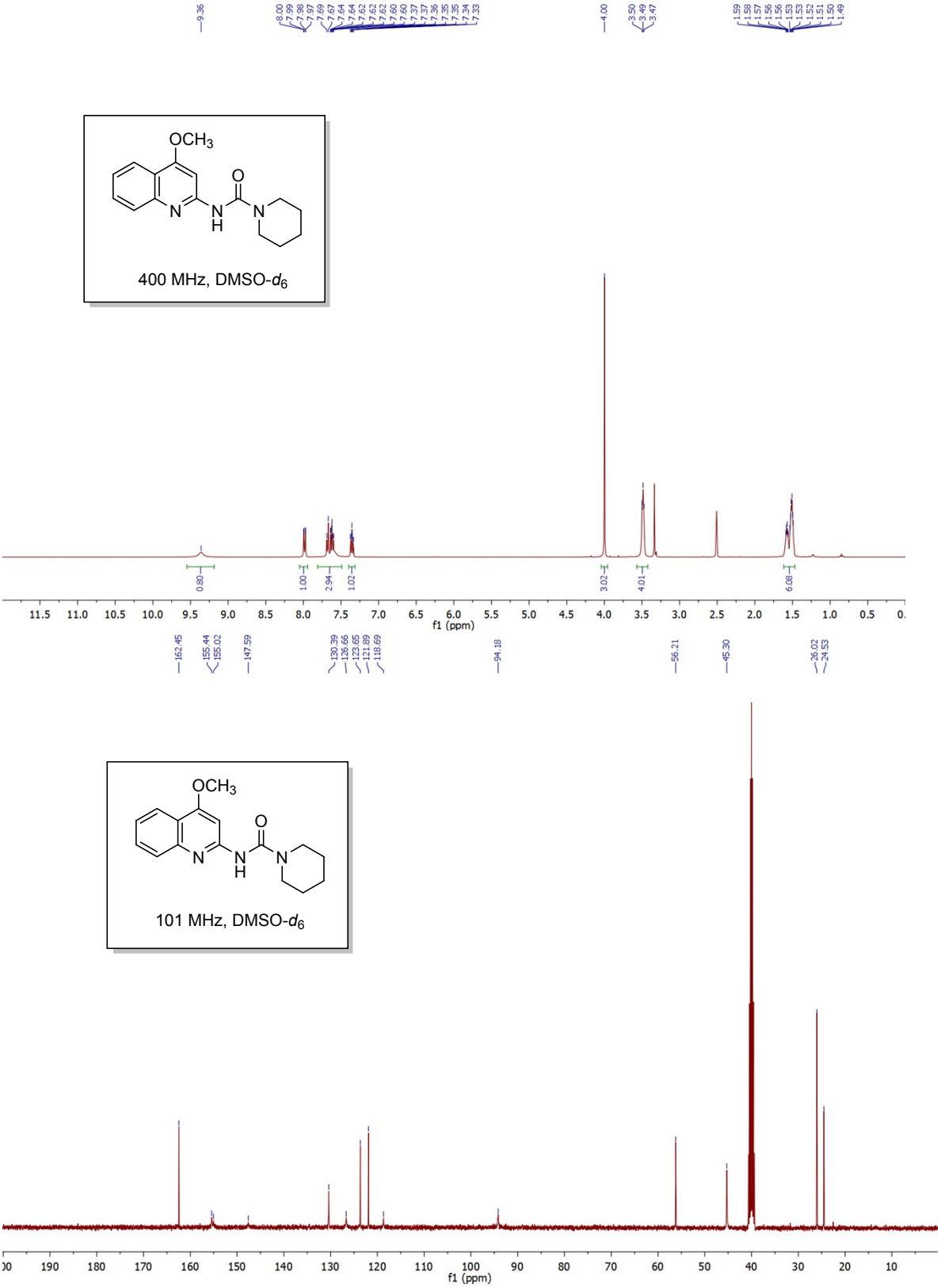

155.35
149.51
145.16
140.26
129.80
127.60
45.32
25.77
24.47
18.02
17.59
101 MHz, CDCl3
f1 (ppm)

^{1}H and ^{13}C spectra of *N*–(quinolin–2–yl)piperidine–1–carboxamide **1p**.

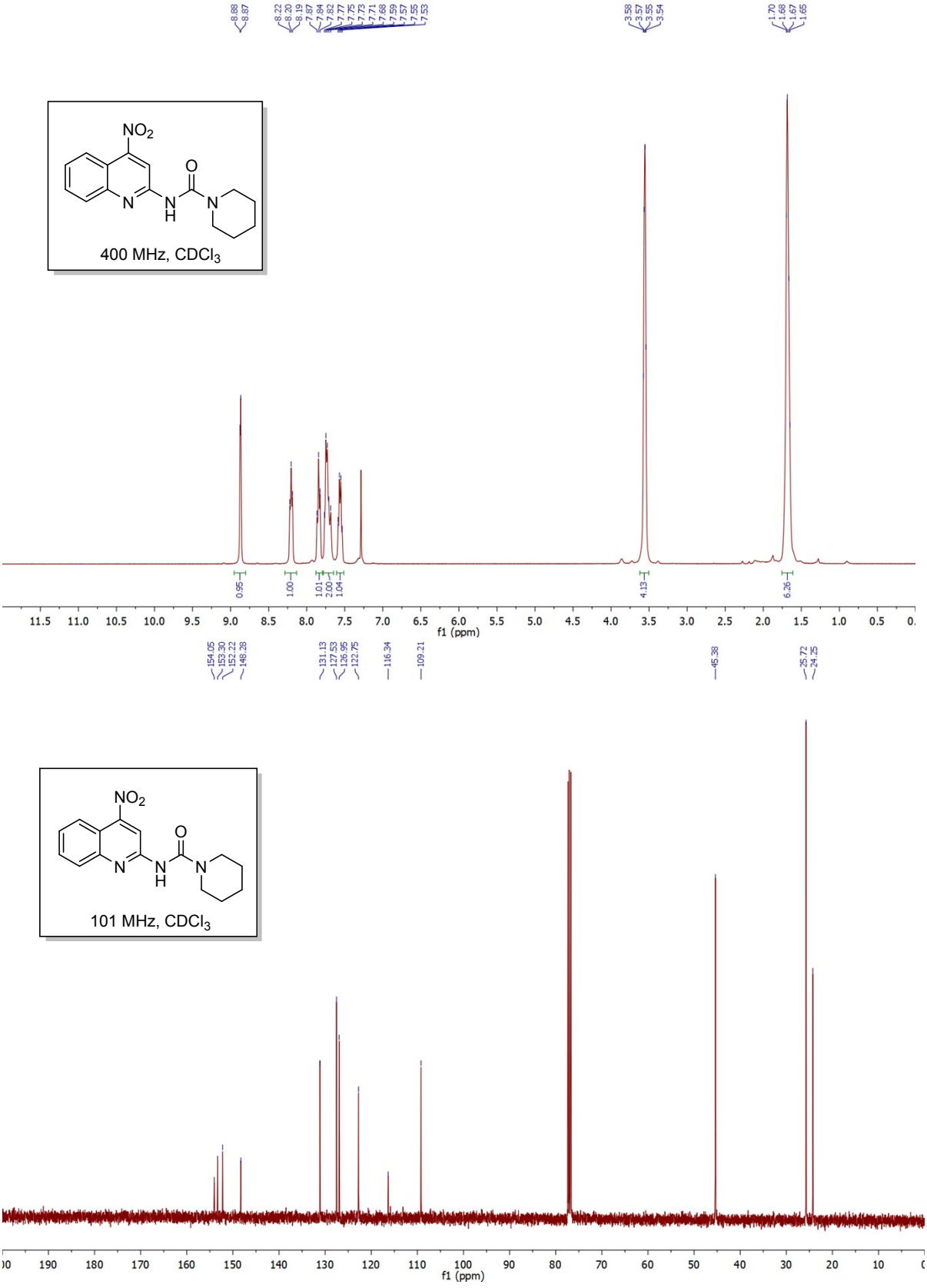



154.00
152.73
146.70
138.01
129.70
127.57
126.77
125.72
124.37
114.33
45.33
25.77
24.39
O
N
N
H
N
101 MHz, CDCl3
f1 (ppm)

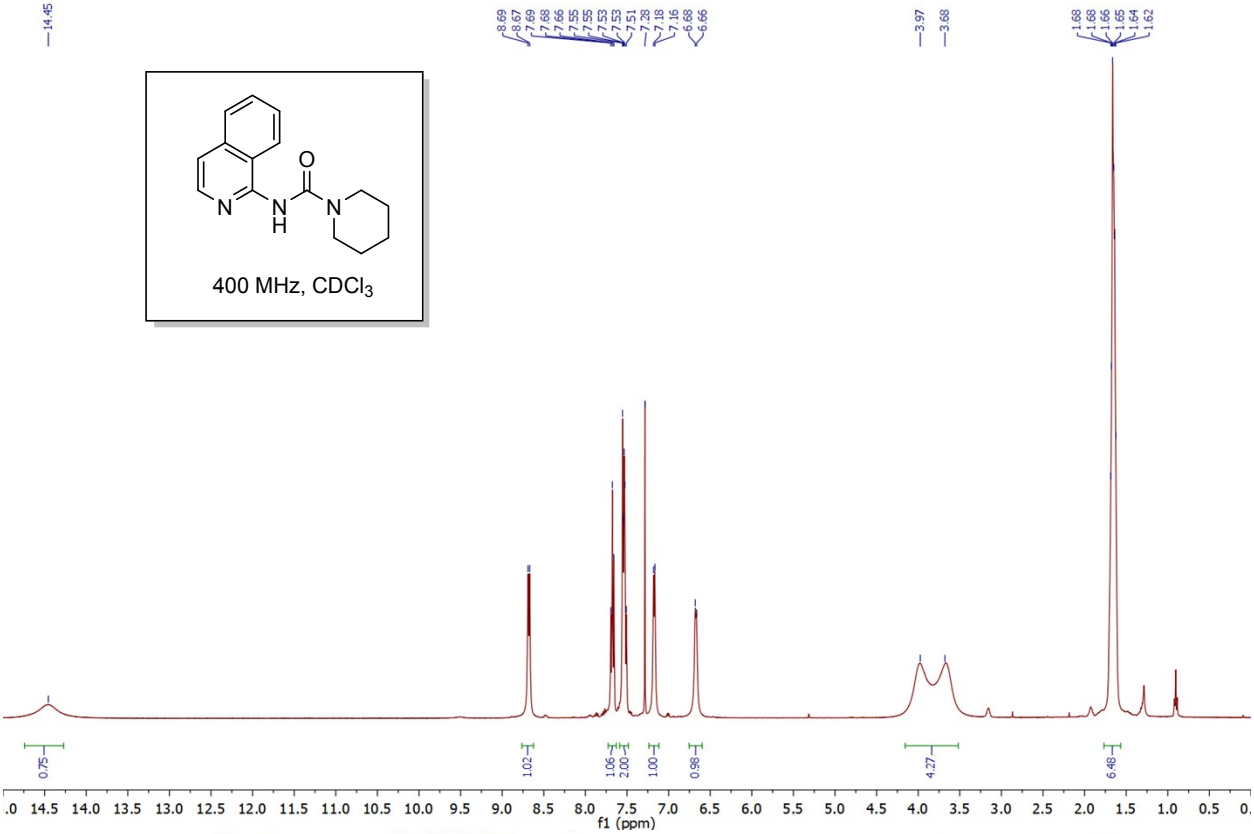
^{1}H and ^{13}C spectra of *N*–(4–methoxyquinolin–2–yl)piperidine–1–carboxamide **1q**.

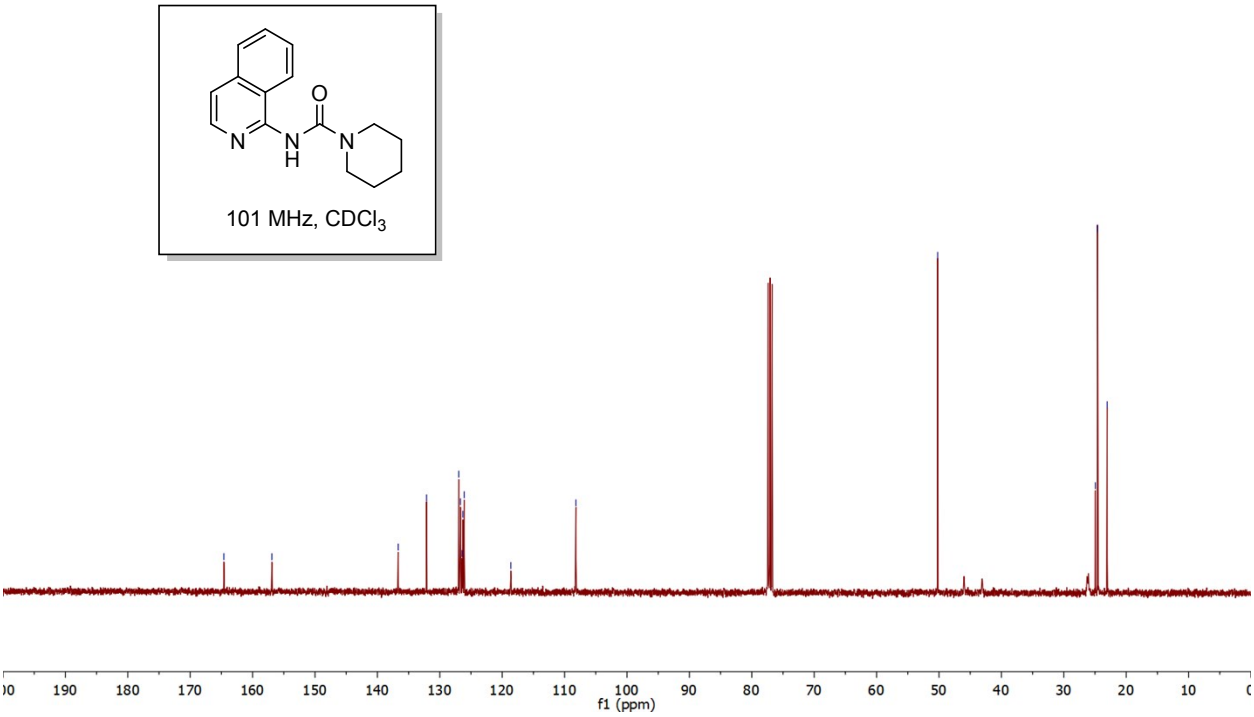


^{1}H and ^{13}C spectra of *N*–(4–nitroquinolin–2–yl)piperidine–1–carboxamide **1r**.

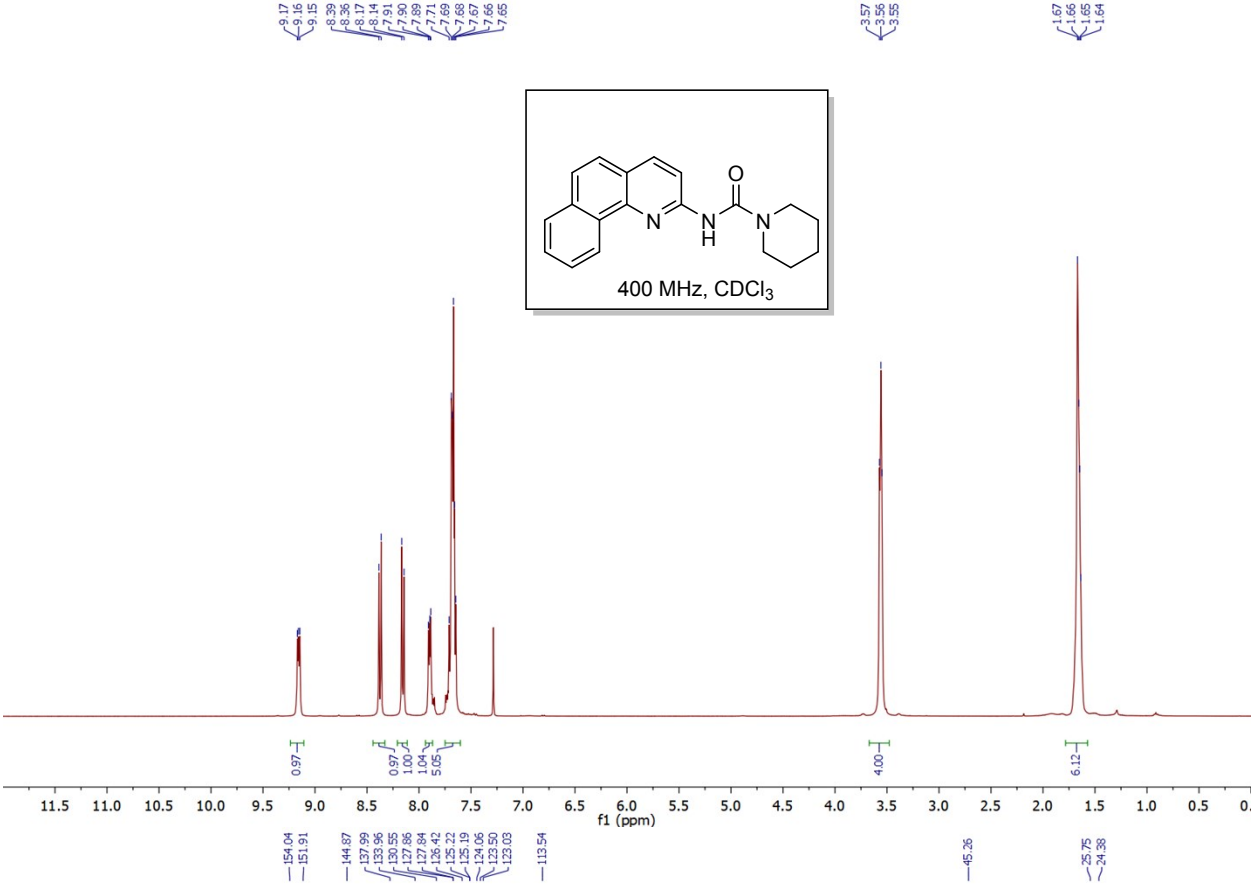


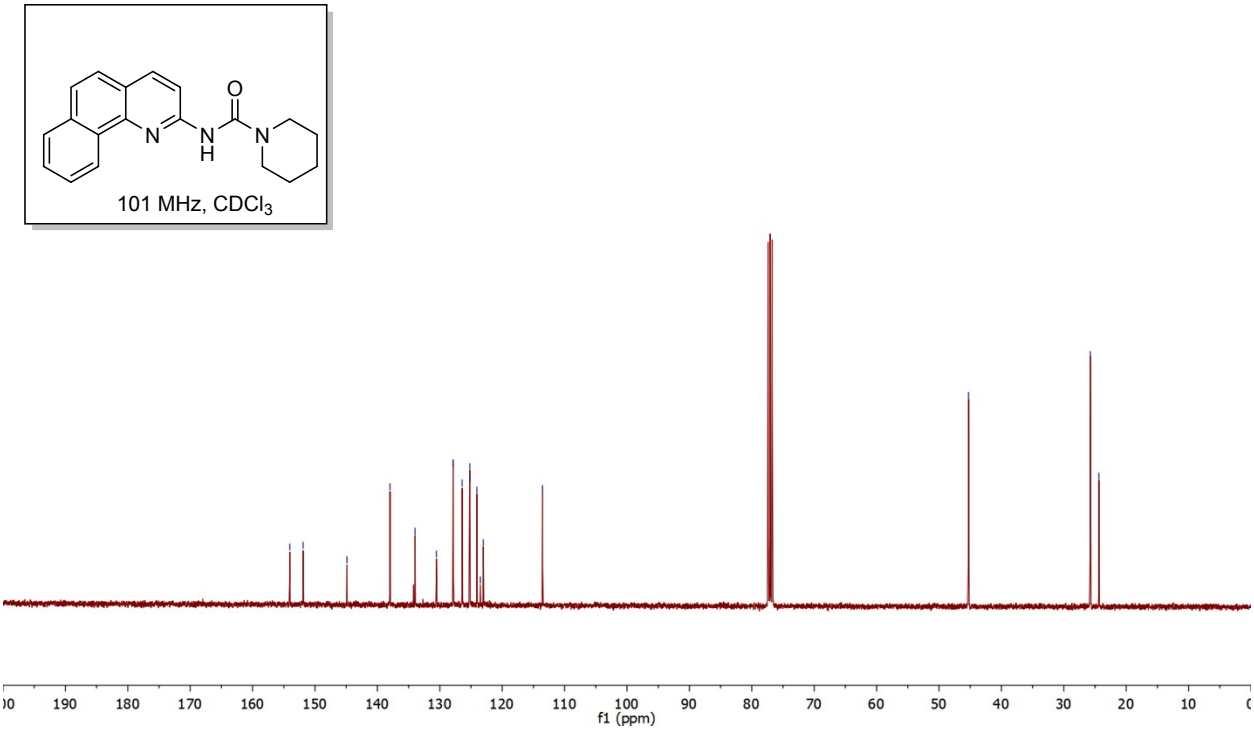
^{1}H and ^{13}C spectra of *N*–(isoquinolin–1–yl)piperidine–1–carboxamide **1s**.



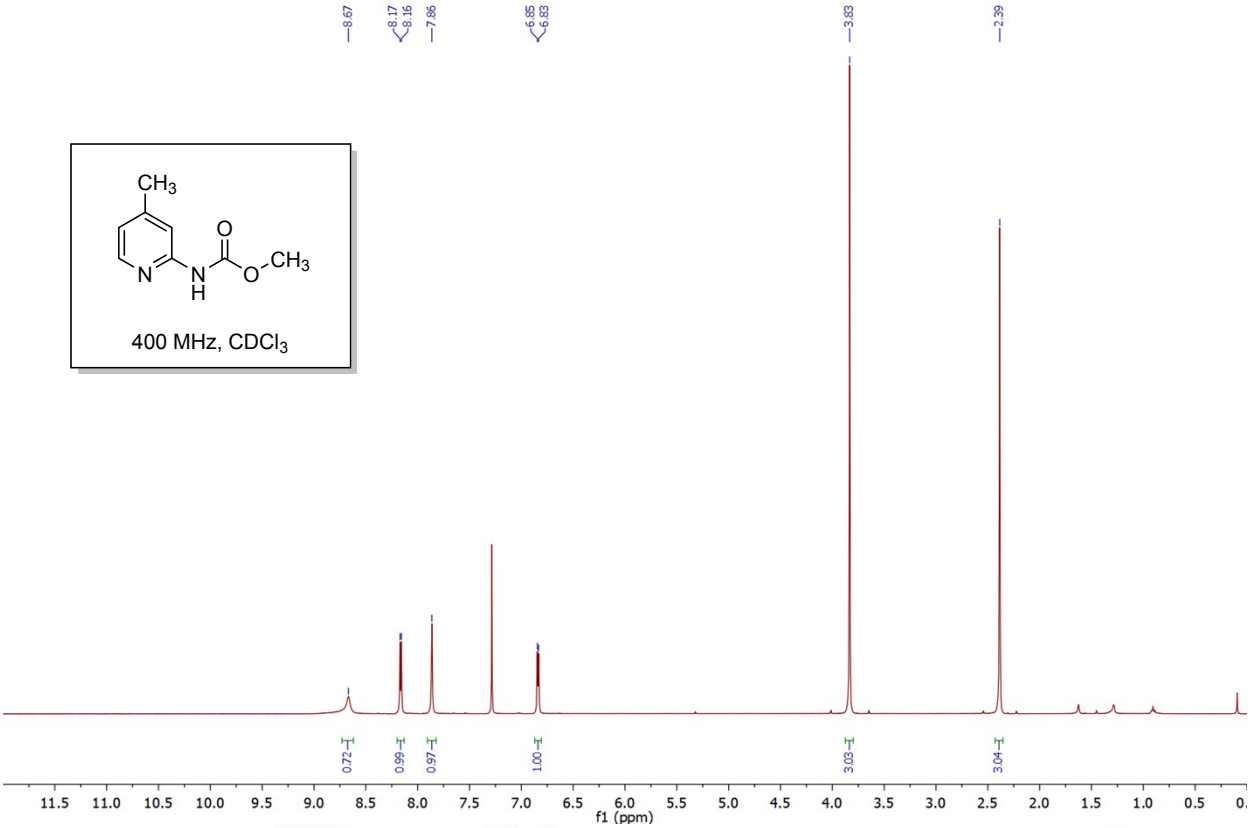


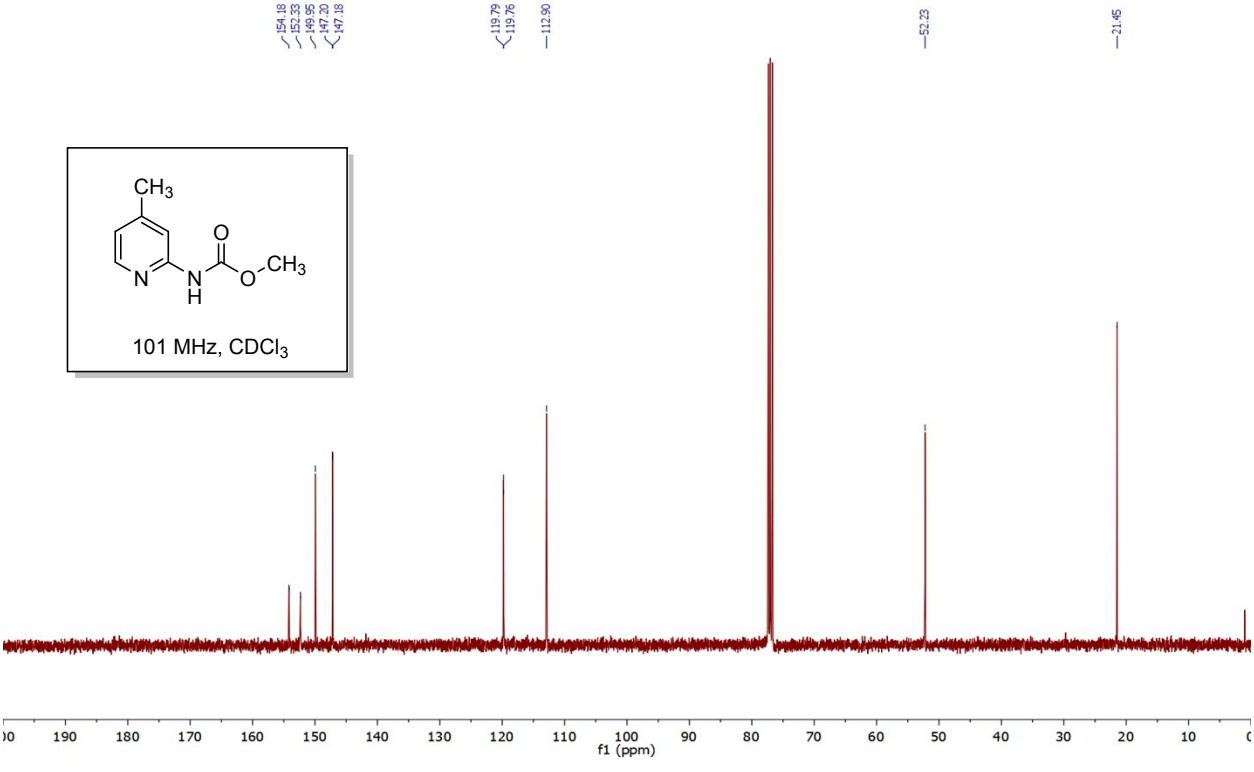
^{1}H and ^{13}C spectra of *N*–(benzo[h]quinolin–2–yl)piperidine–1–carboxamide **1t**.



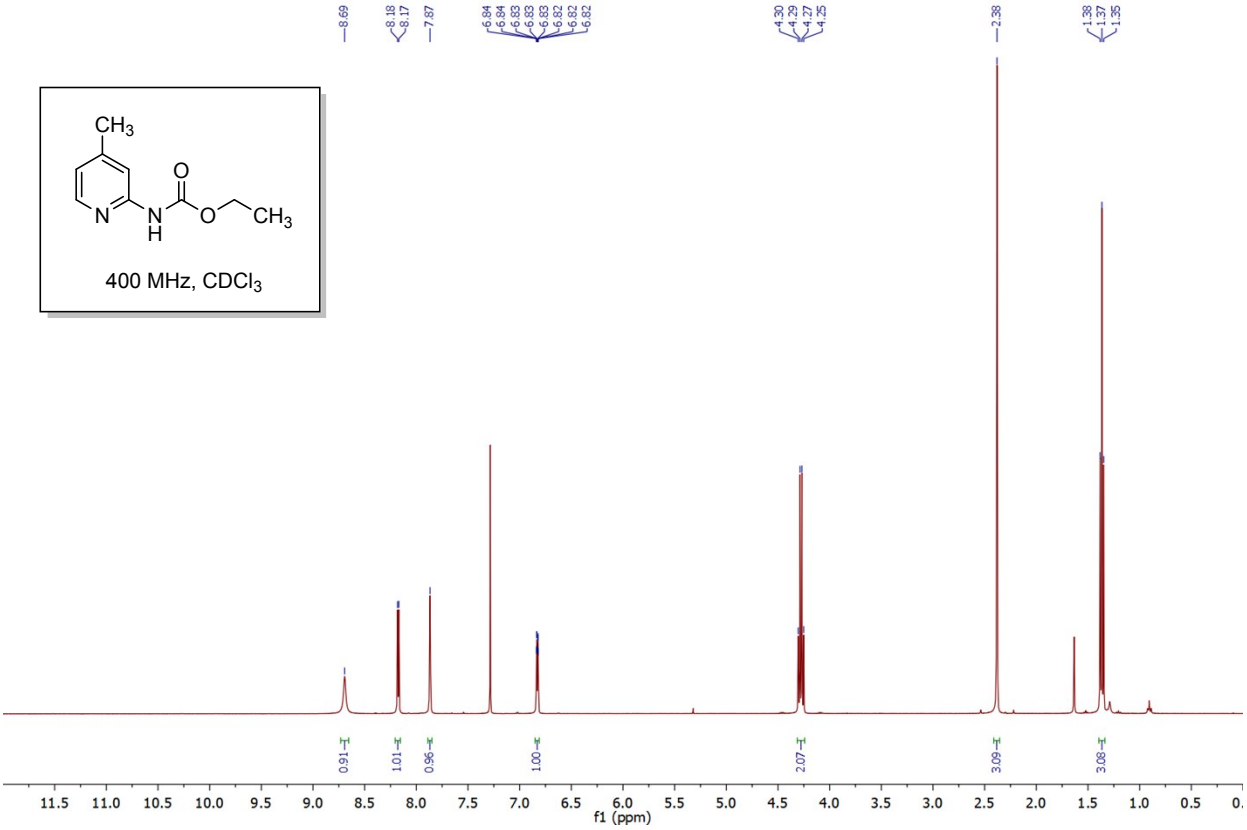


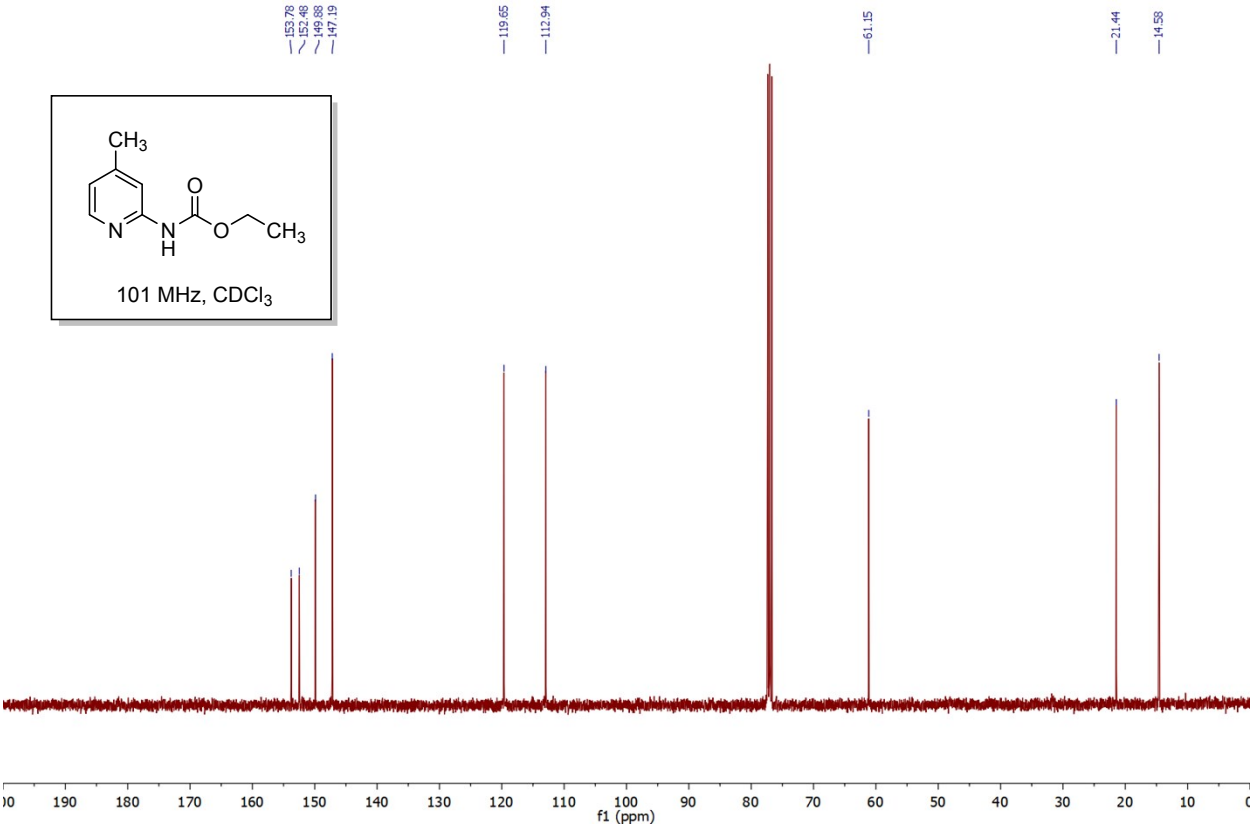
^{1}H and ^{13}C spectra of methyl (4–methylpyridin–2–yl)carbamate **2a**.



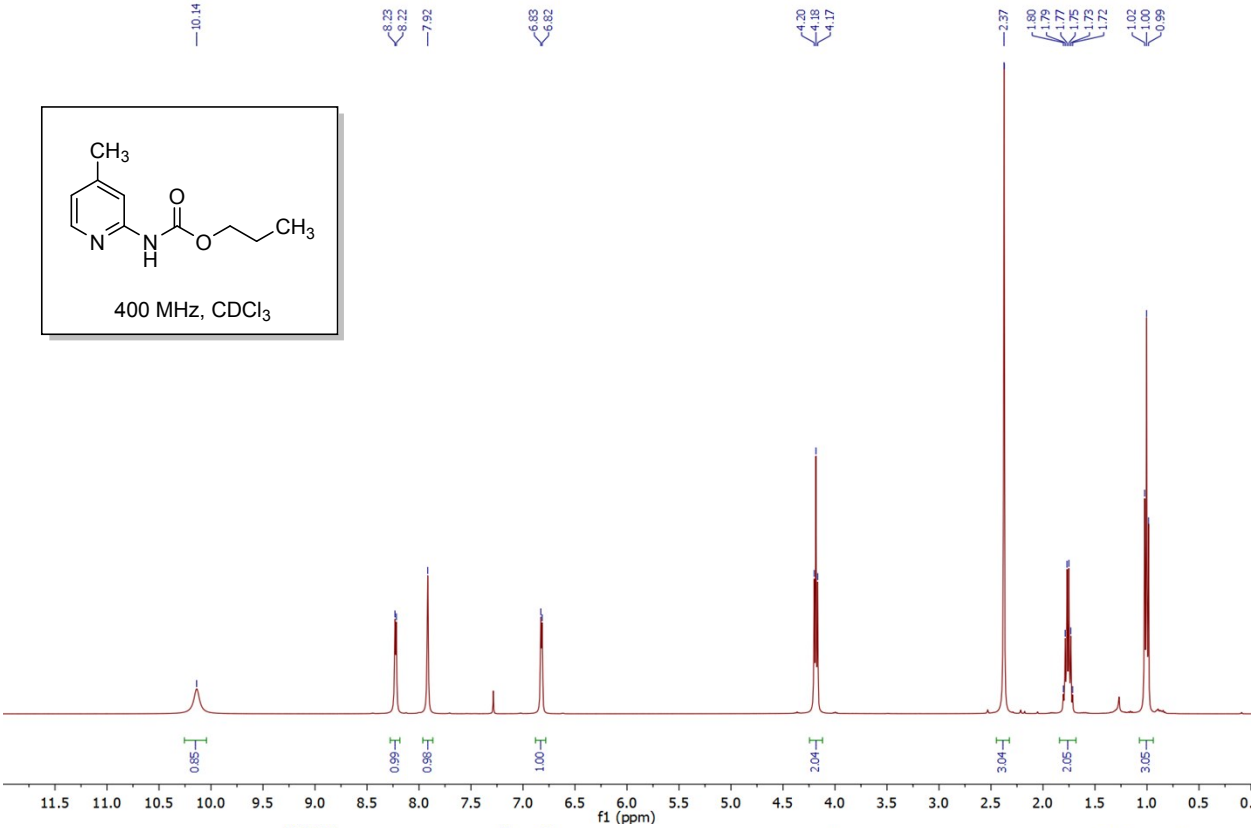


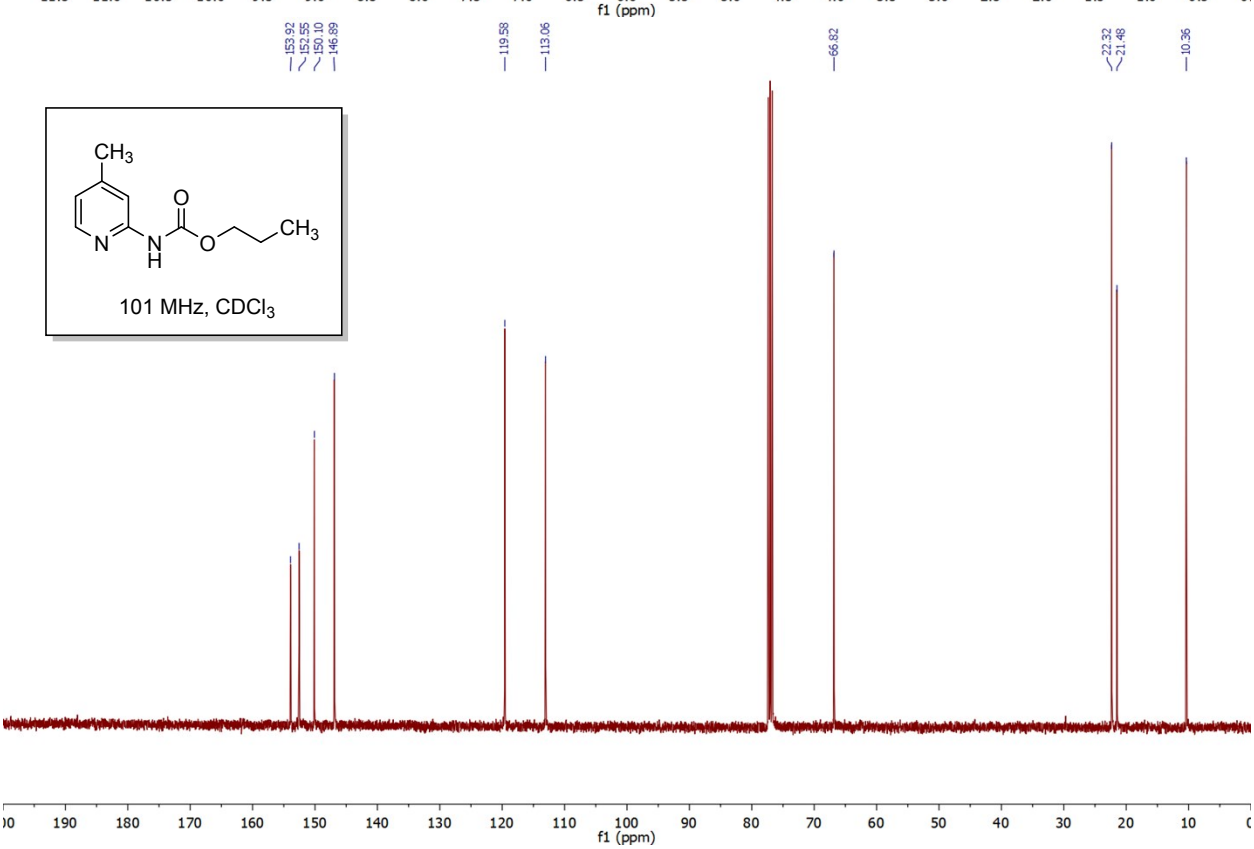
^{1}H and ^{13}C spectra of ethyl (4–methylpyridin–2–yl)carbamate **2b**.



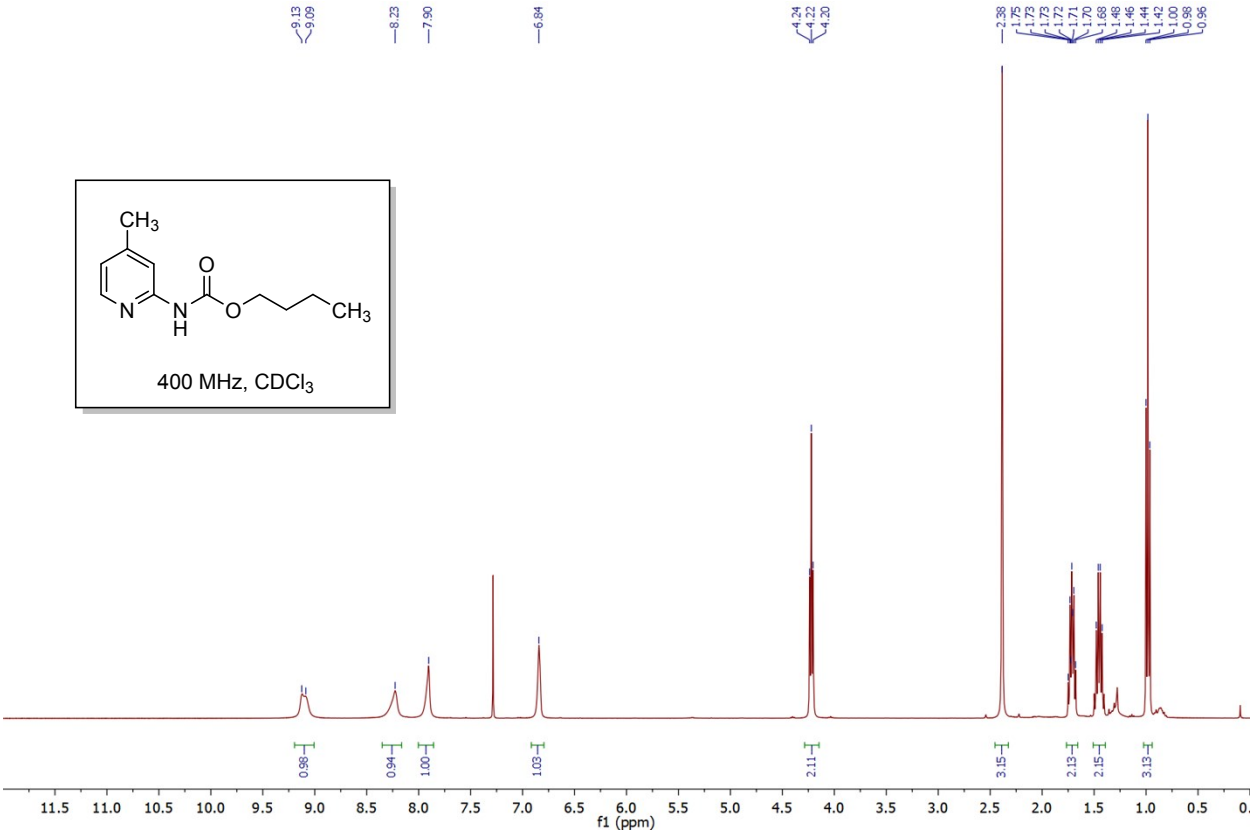

153.78
152.48
149.88
147.19
119.65
112.94
61.15
21.44
14.58
CH3
O
N
N
H
O
CH3
101 MHz, CDCl3
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

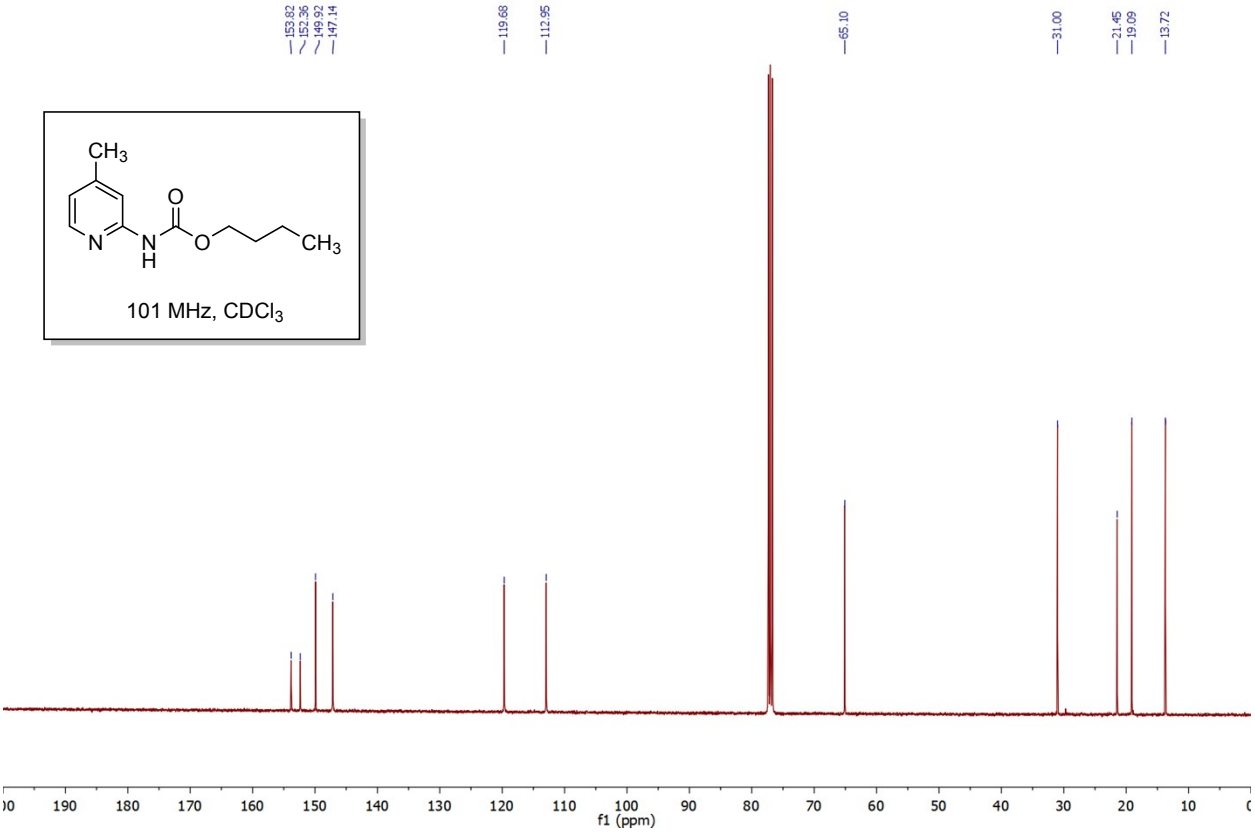
^{1}H and ^{13}C spectra of propyl (4–methylpyridin–2–yl)carbamate **2c**.



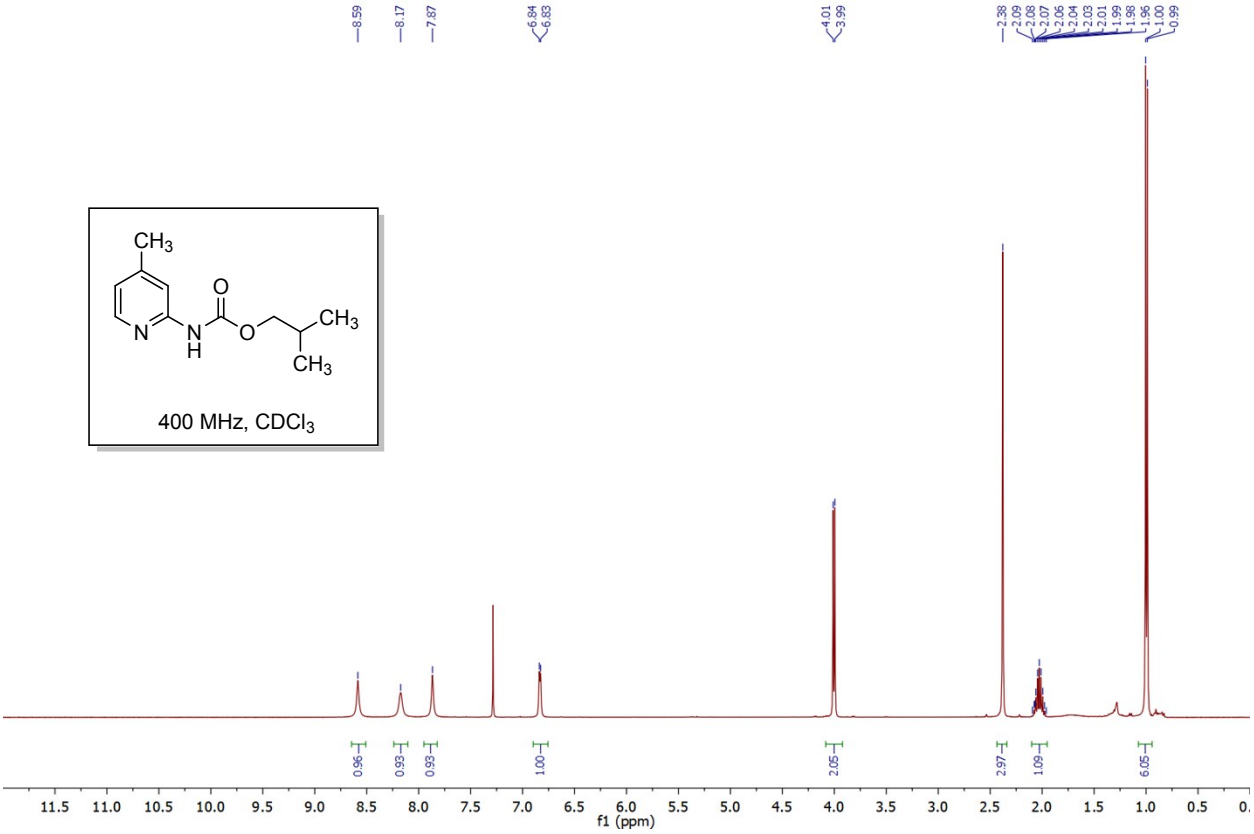


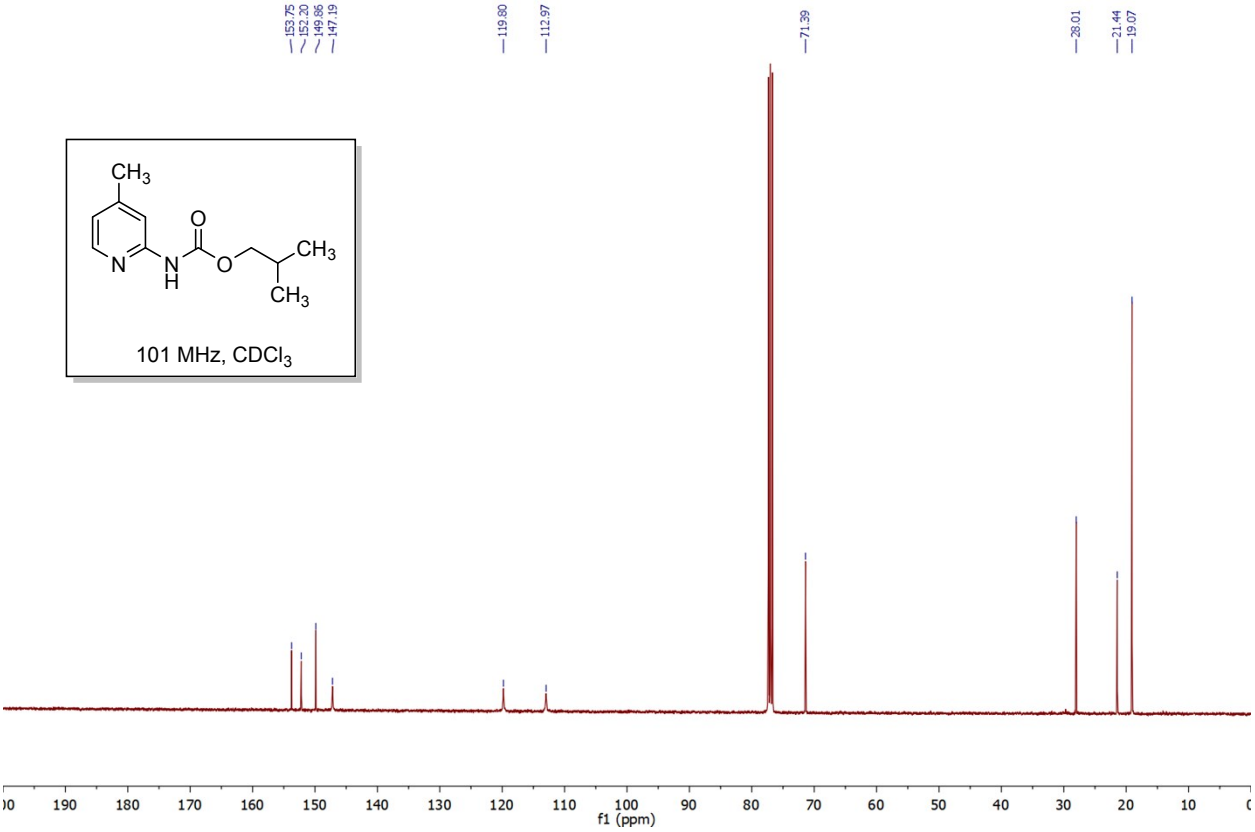
^{1}H and ^{13}C spectra of butyl (4–methylpyridin–2–yl)carbamate **2d**.



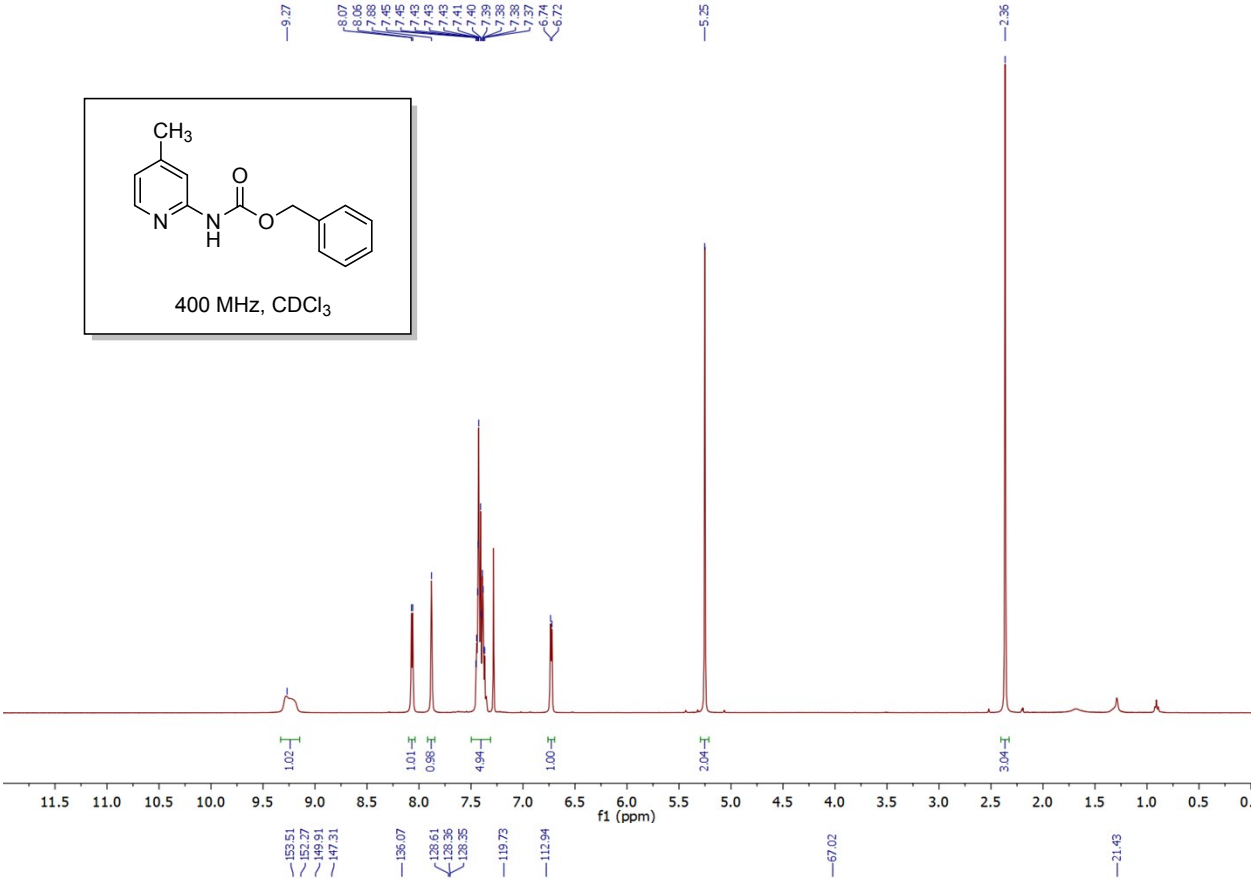

153.82
152.36
149.92
147.14
119.68
112.95
65.10
31.00
21.45
19.09
13.72
CH3
O
N
N
H
O
CH3
101 MHz, CDCl3
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

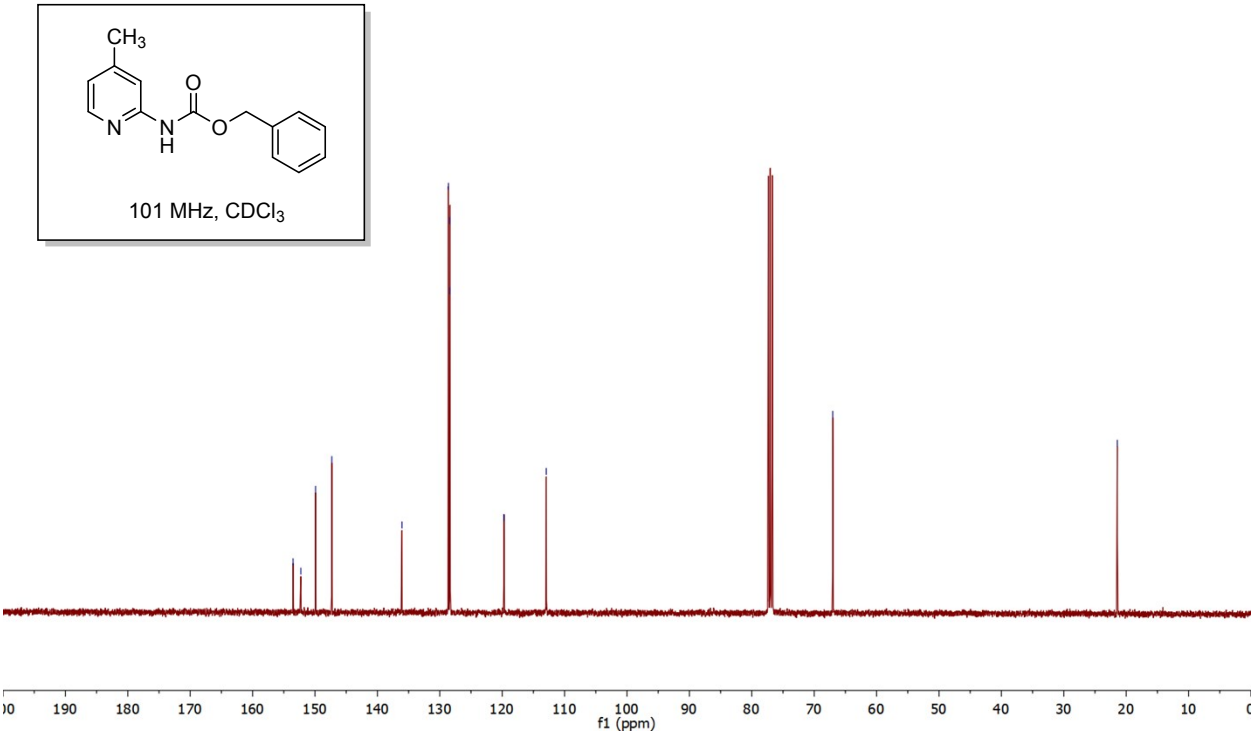
^{1}H and ^{13}C spectra of isobutyl (4–methylpyridin–2–yl)carbamate **2e**.



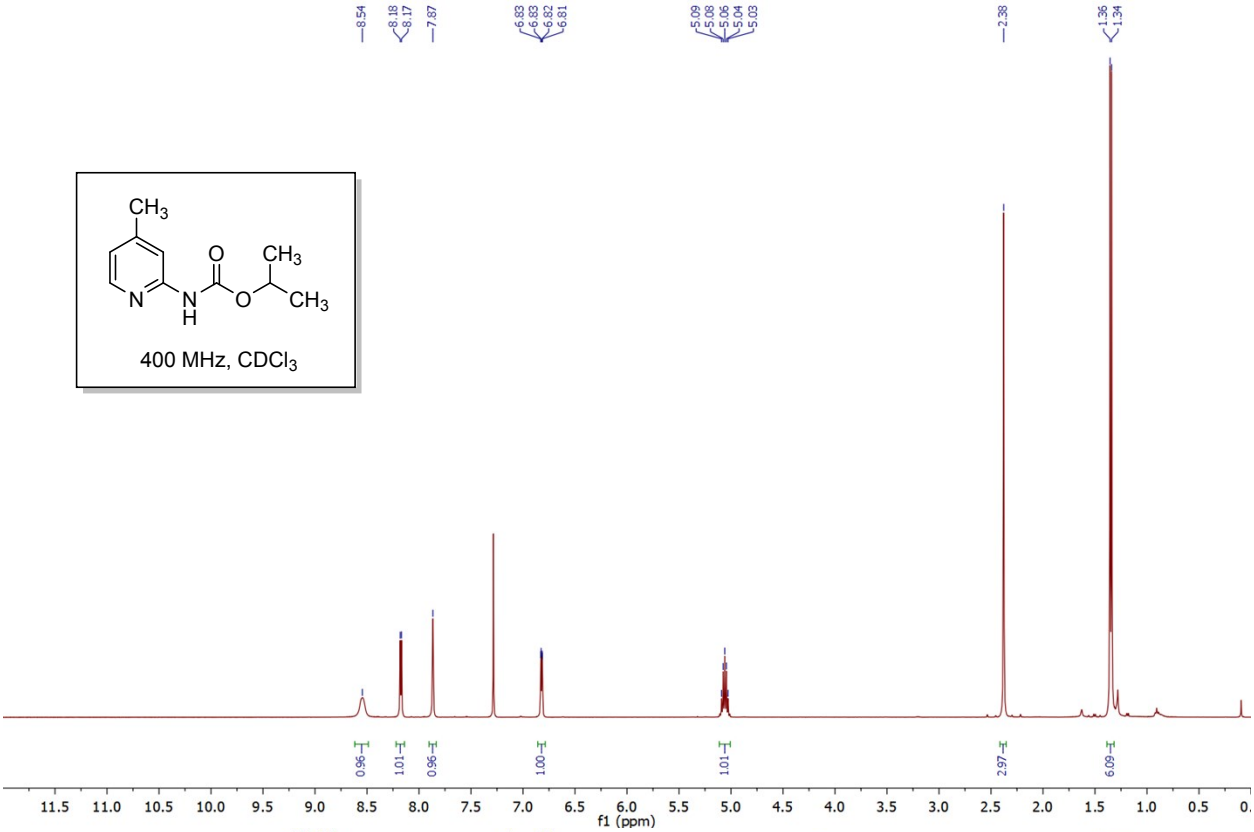

153.75
152.20
149.86
147.19
119.80
112.97
71.39
28.01
21.44
19.07
CH3
O
N
N
H
O
CH3
CH3
101 MHz, CDCl3
f1 (ppm)

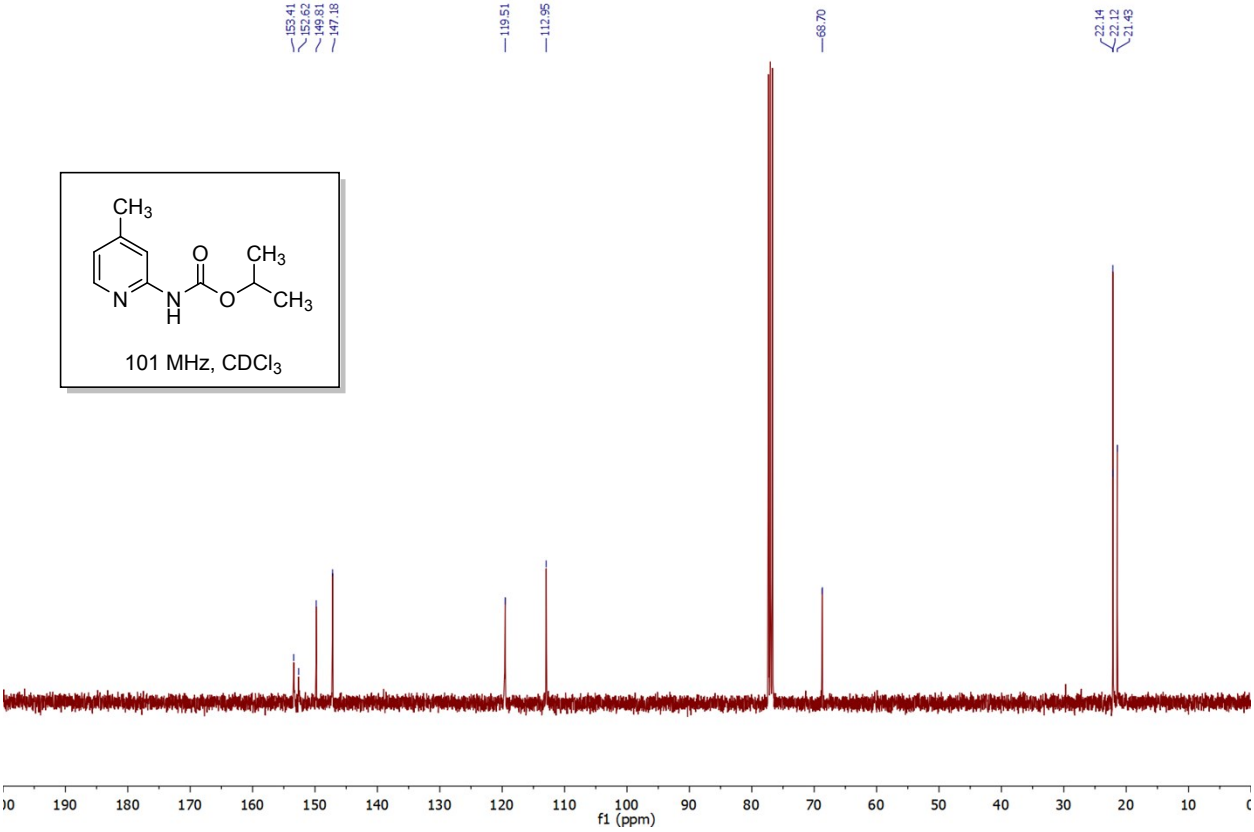
^{1}H and ^{13}C spectra of benzyl (4–methylpyridin–2–yl)carbamate **2f**.



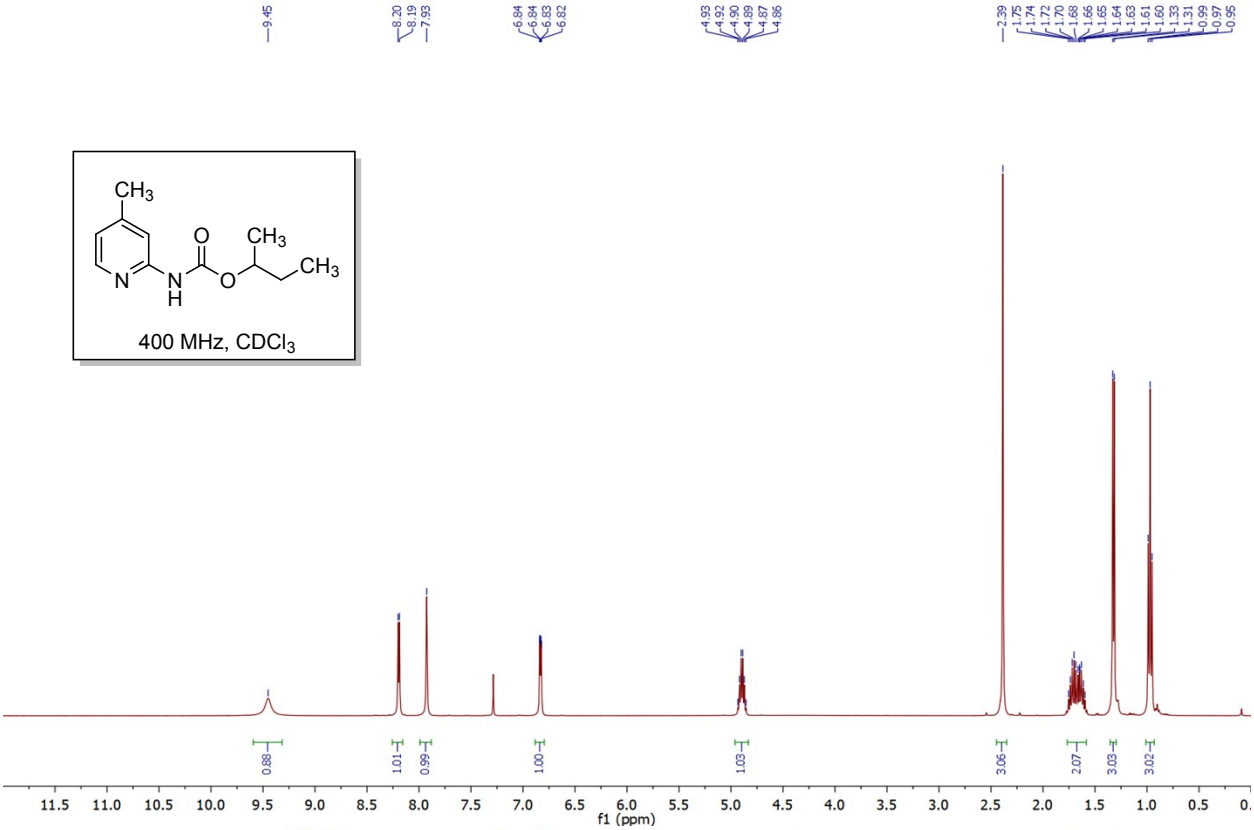


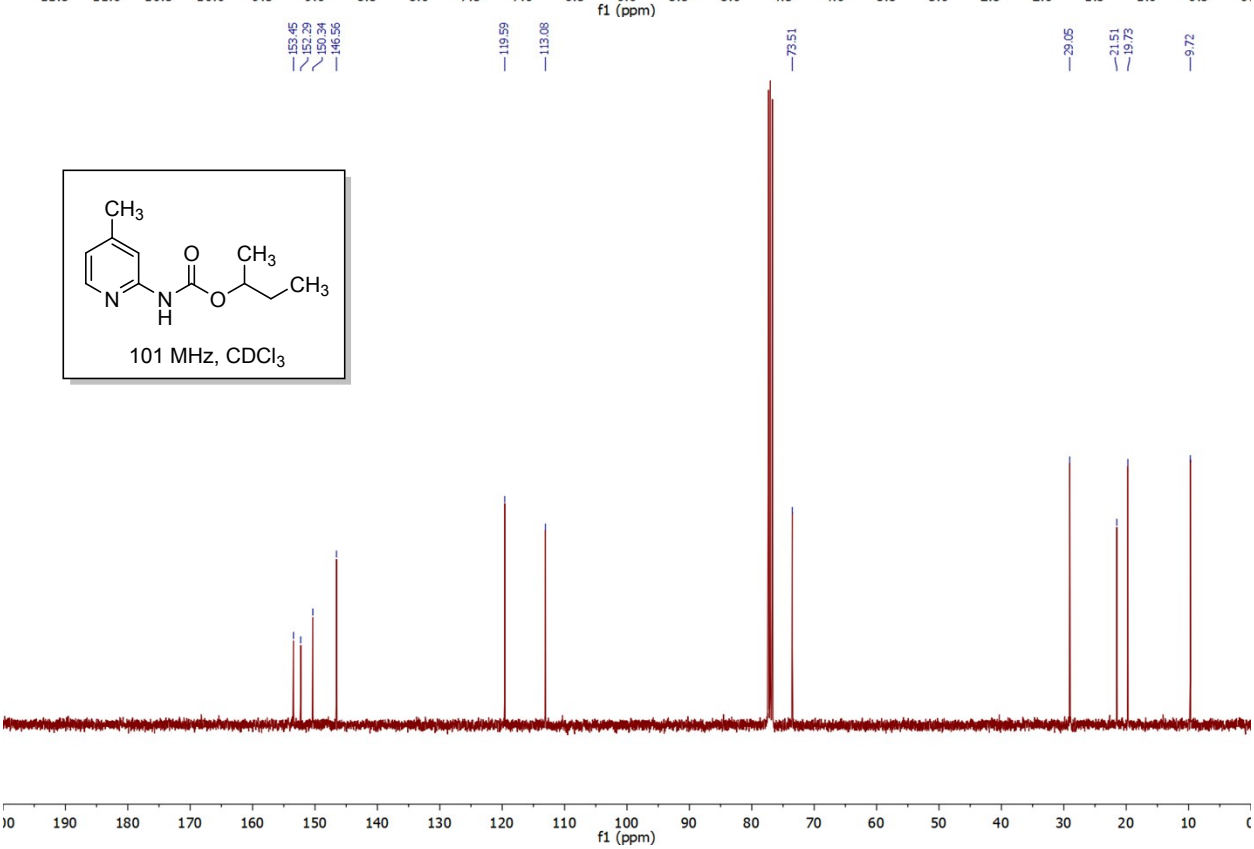
^{1}H and ^{13}C spectra of isopropyl (4–methylpyridin–2–yl)carbamate **2g**.



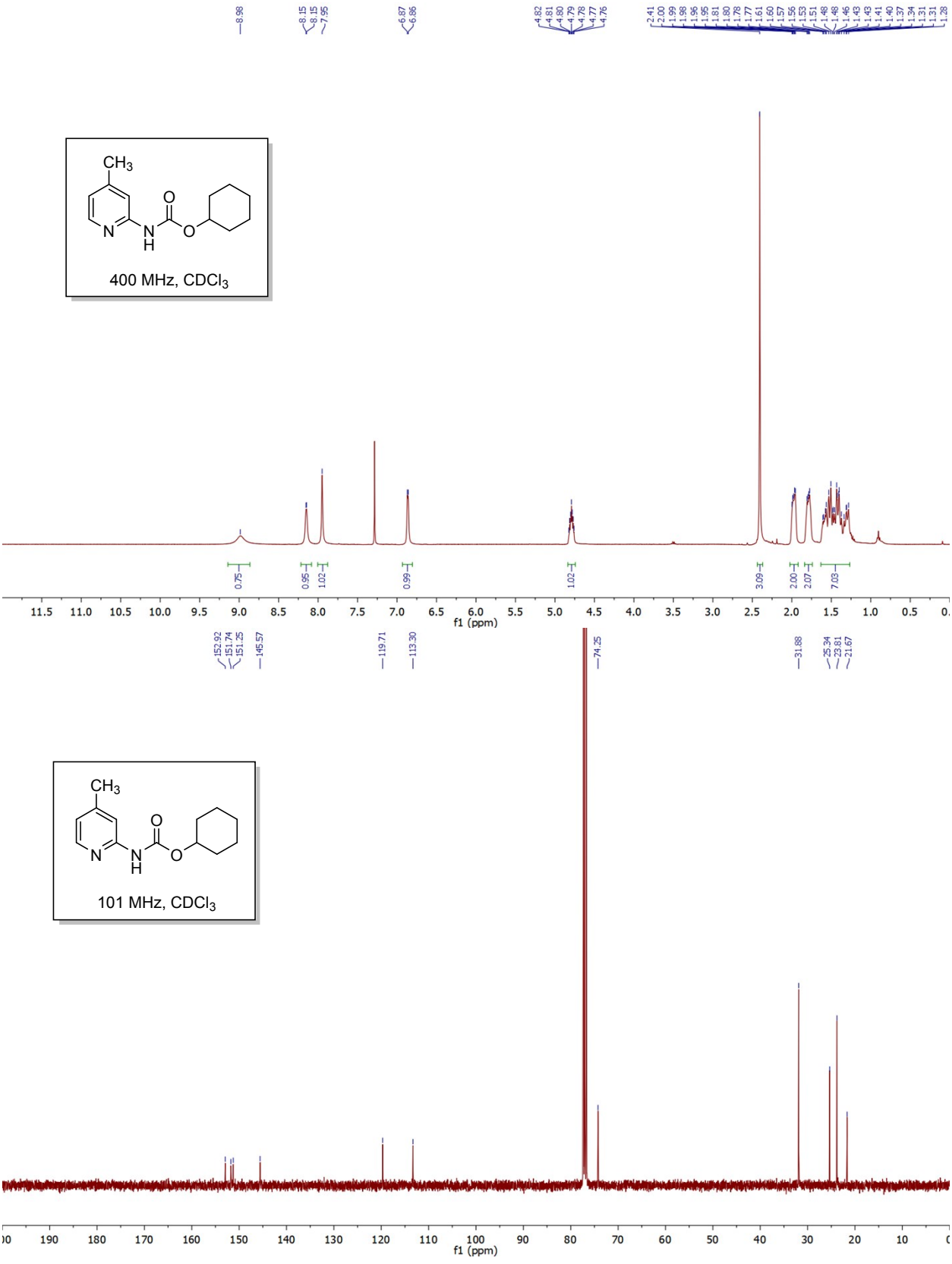


^{1}H and ^{13}C spectra of *sec*–butyl (4–methylpyridin–2–yl)carbamate **2h**.

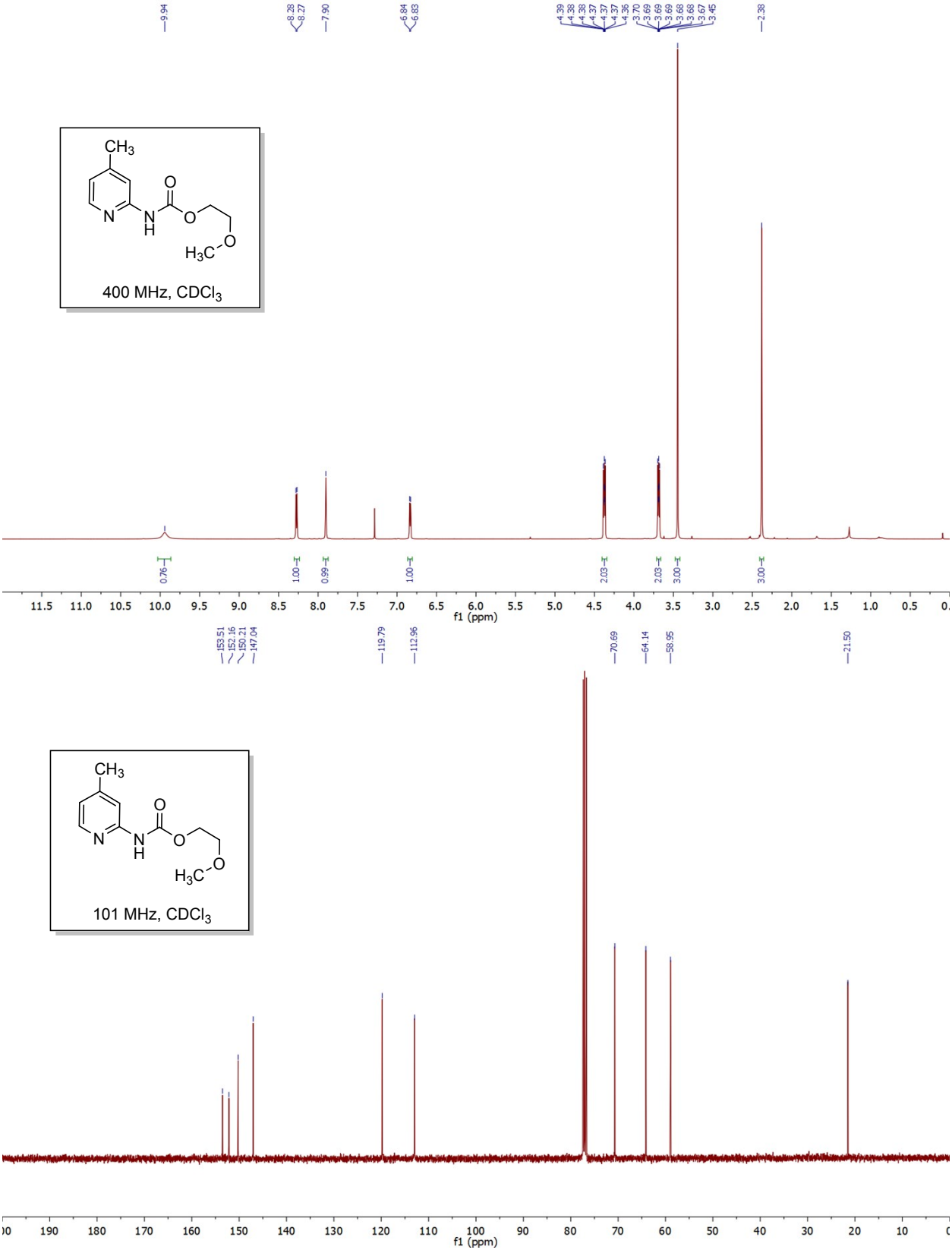




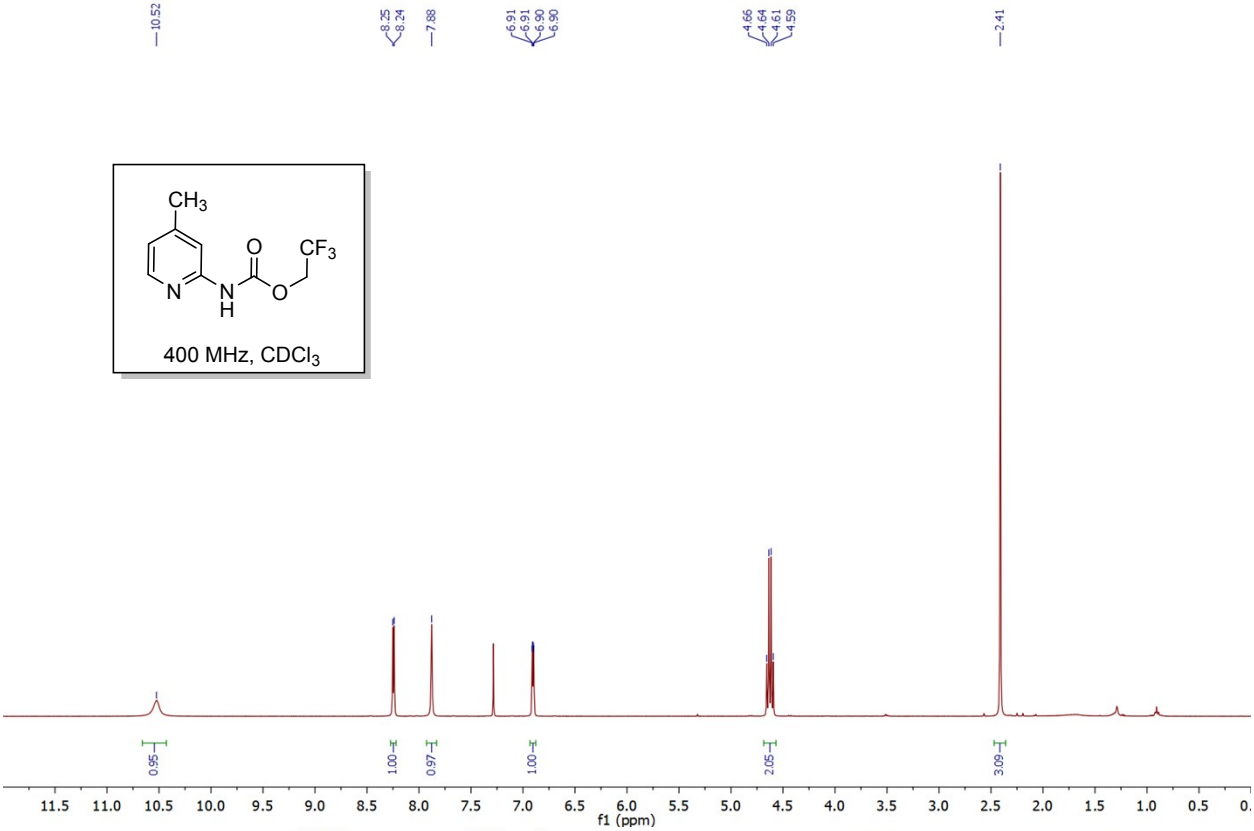
^{1}H and ^{13}C spectra of cyclohexyl (4–methylpyridin–2–yl)carbamate **2i**.

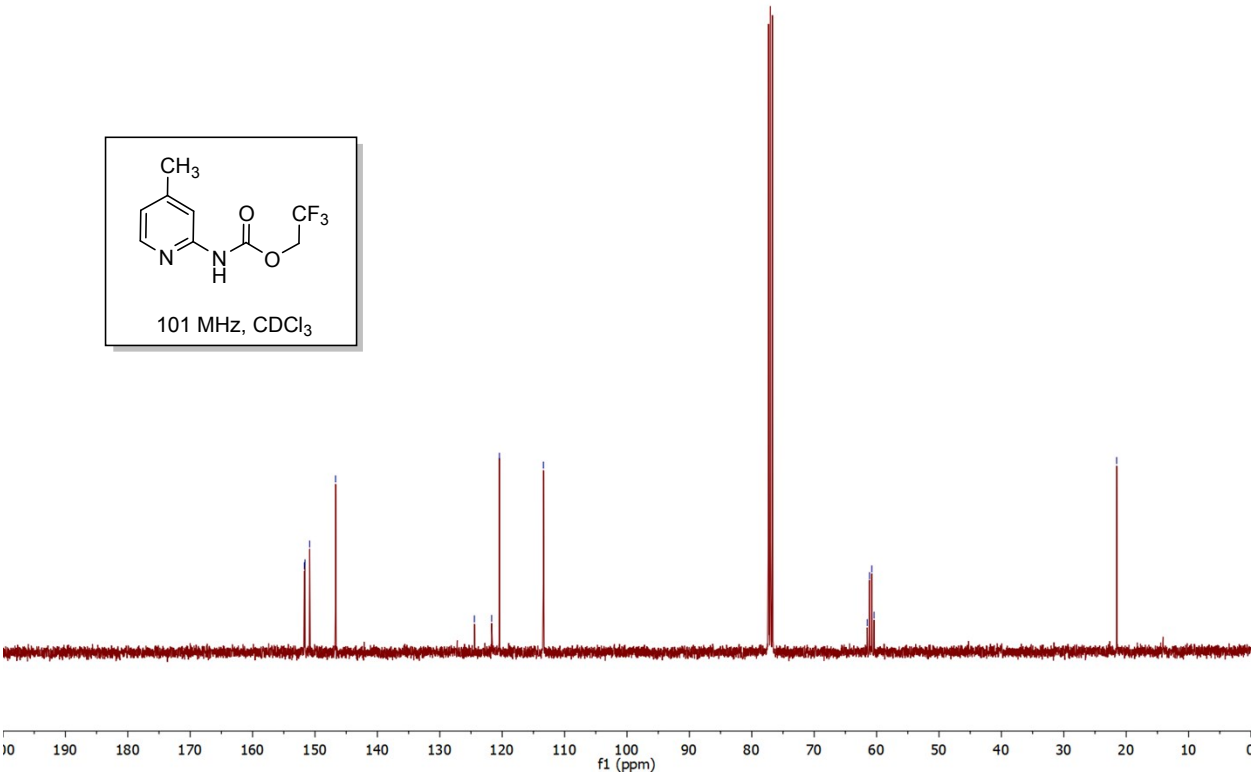


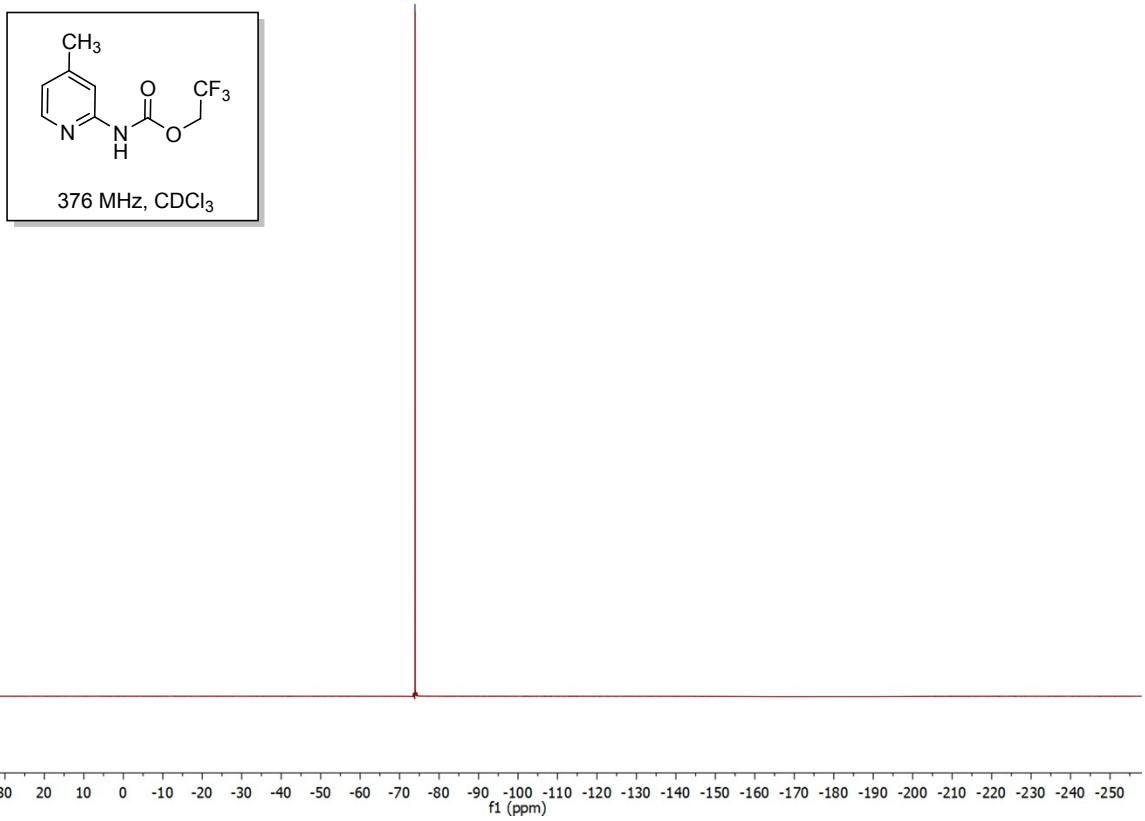
^{1}H and ^{13}C spectra of 2–methoxyethyl (4–methylpyridin–2–yl)carbamate **2j**.



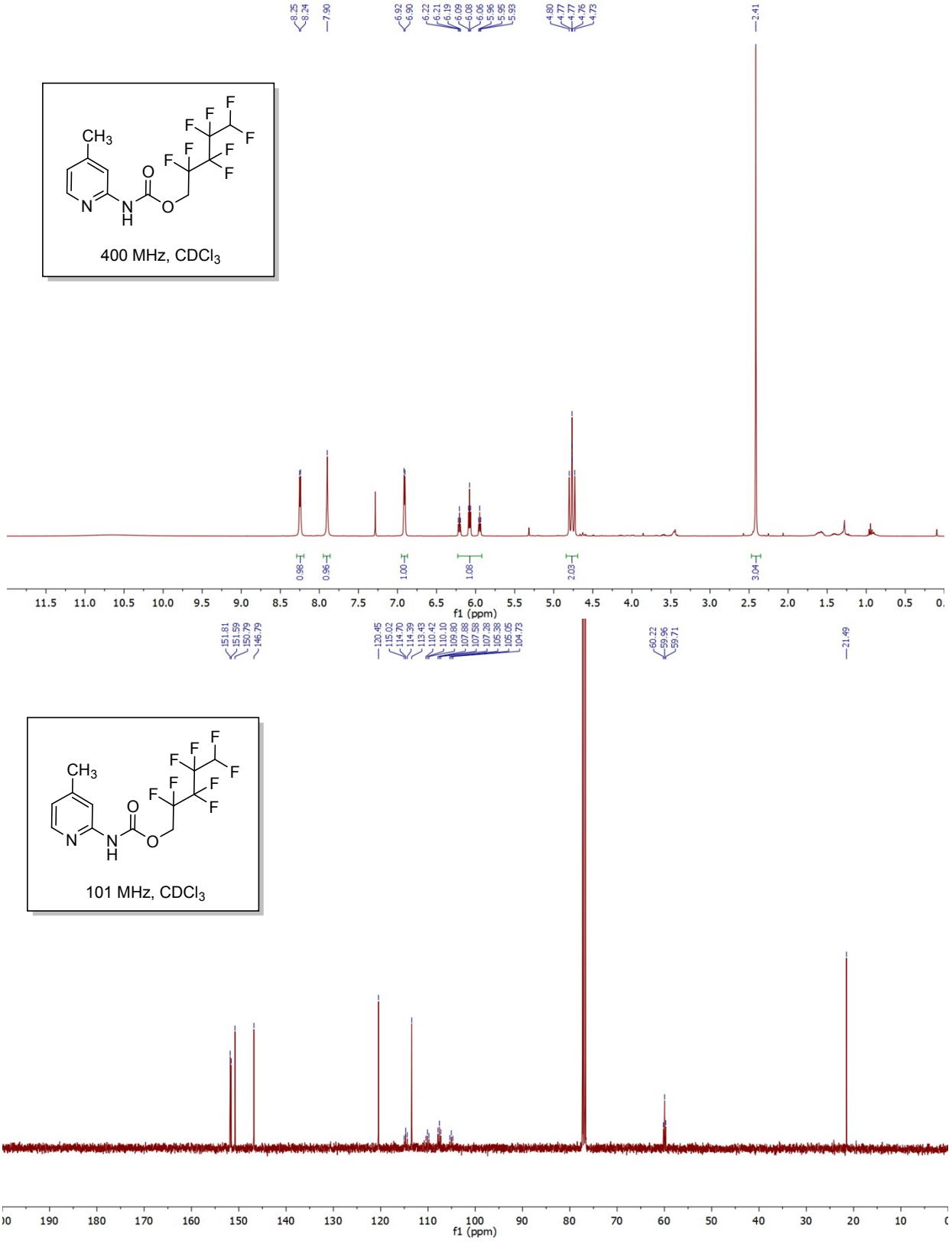
^{1}H, ^{13}C and ^{19}F spectra of 2,2,2–trifluoroethyl (4–methylpyridin–2–yl)carbamate **2k**.

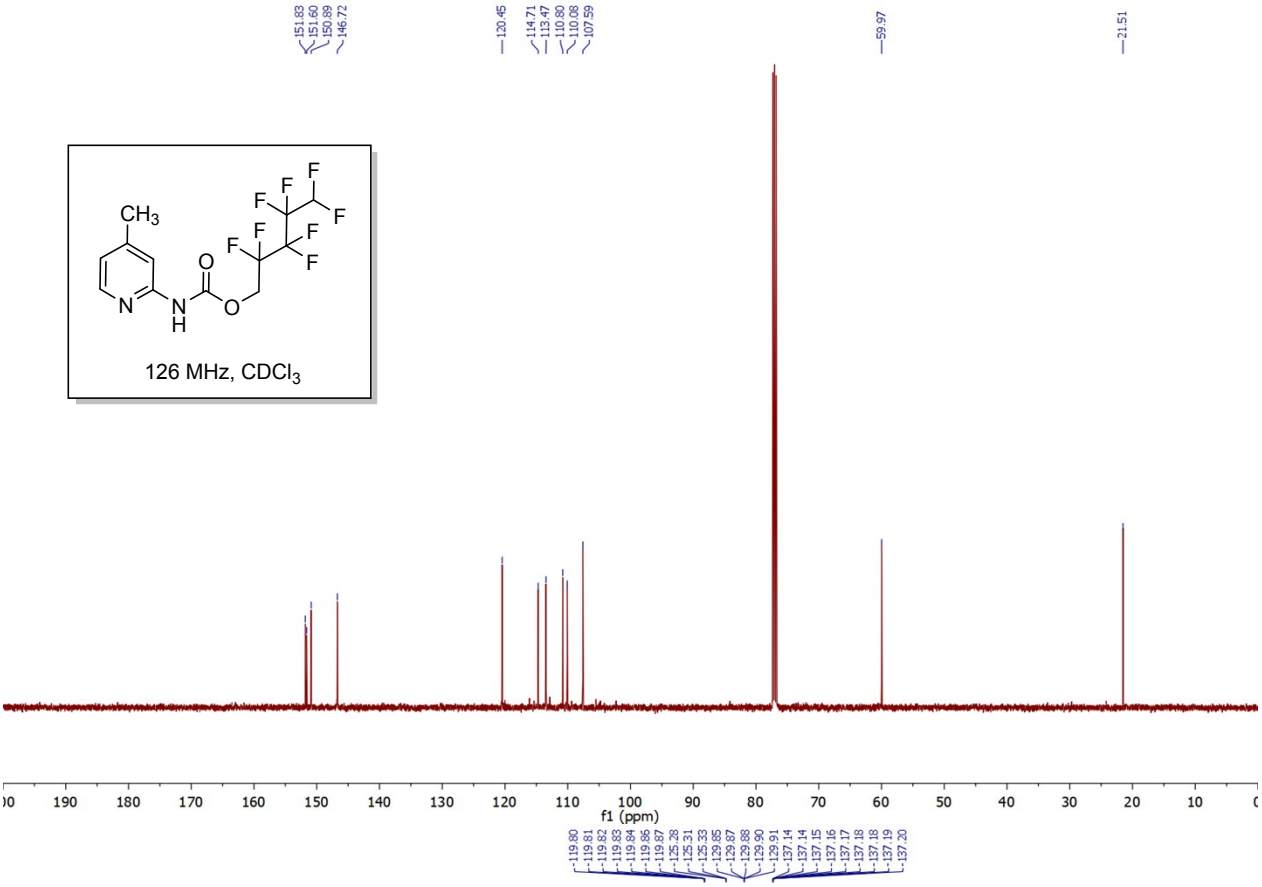


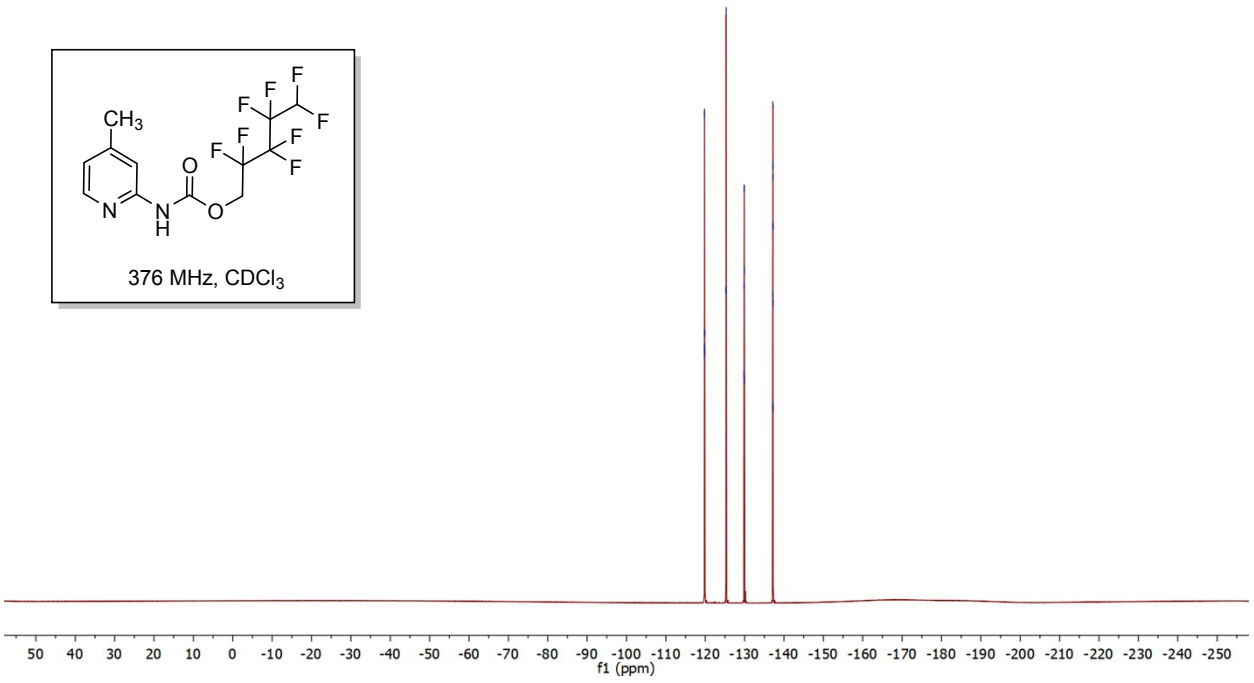



-73.90
CH3
O
CF3
N
N
H
O
376 MHz, CDCl3
50 40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220 -230 -240 -250
f1 (ppm)

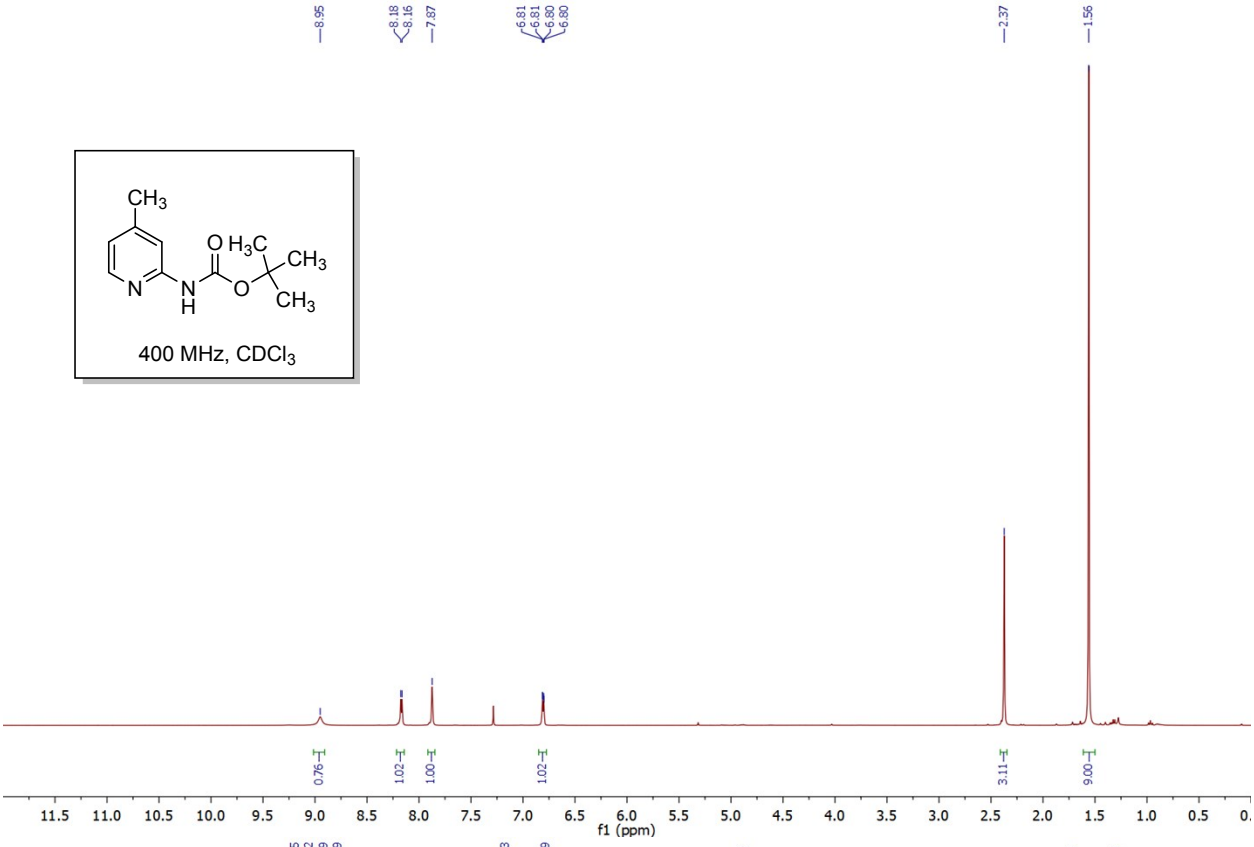
^{1}H, ^{13}C, ^{19}F spectra of 2,2,3,3,4,4,5,5–octafluoropentyl (4–methylpyridin–2–yl)carbamate **2l**.

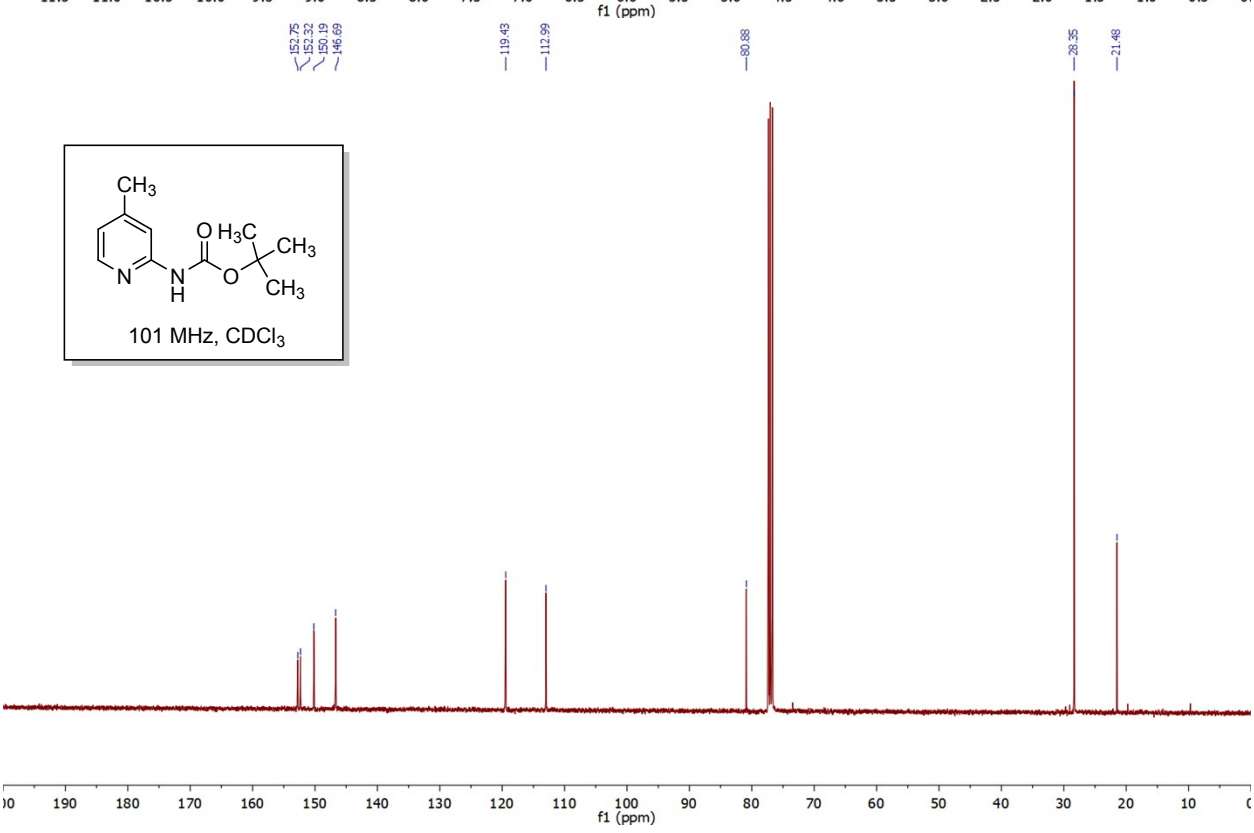



151.83
151.60
150.89
146.72
120.45
114.71
113.47
110.80
110.08
107.59
59.97
21.51
126 MHz, CDCl3
f1 (ppm)

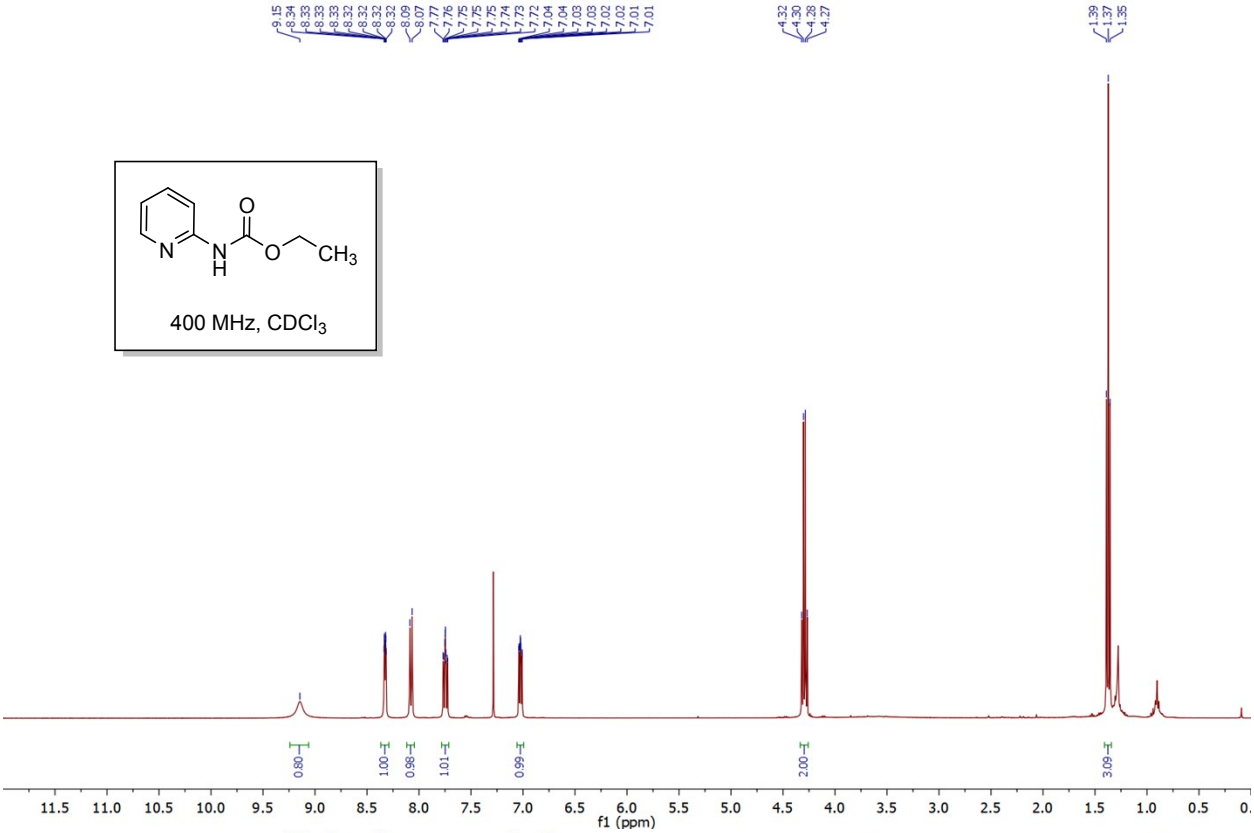

376 MHz, CDCl3
f1 (ppm)

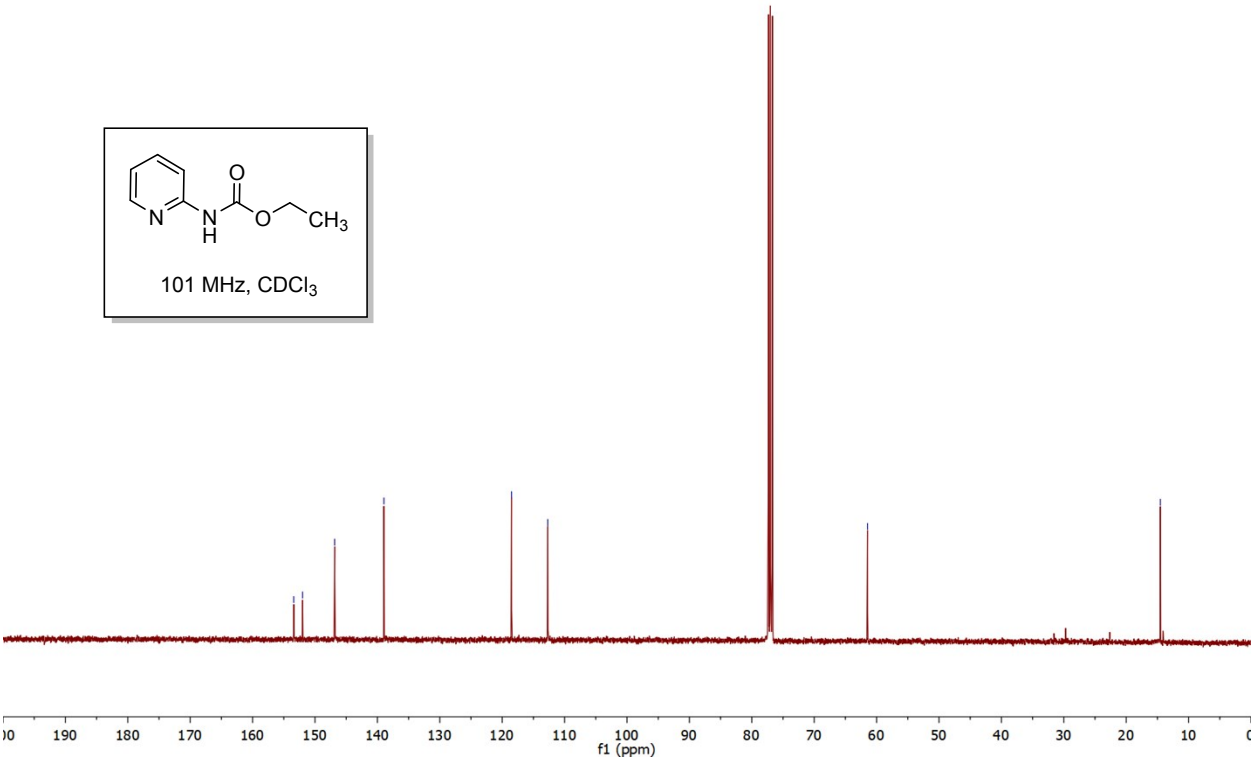
^{1}H and ^{13}C spectra of *tert*–butyl (4–methylpyridin–2–yl)carbamate **2m**.



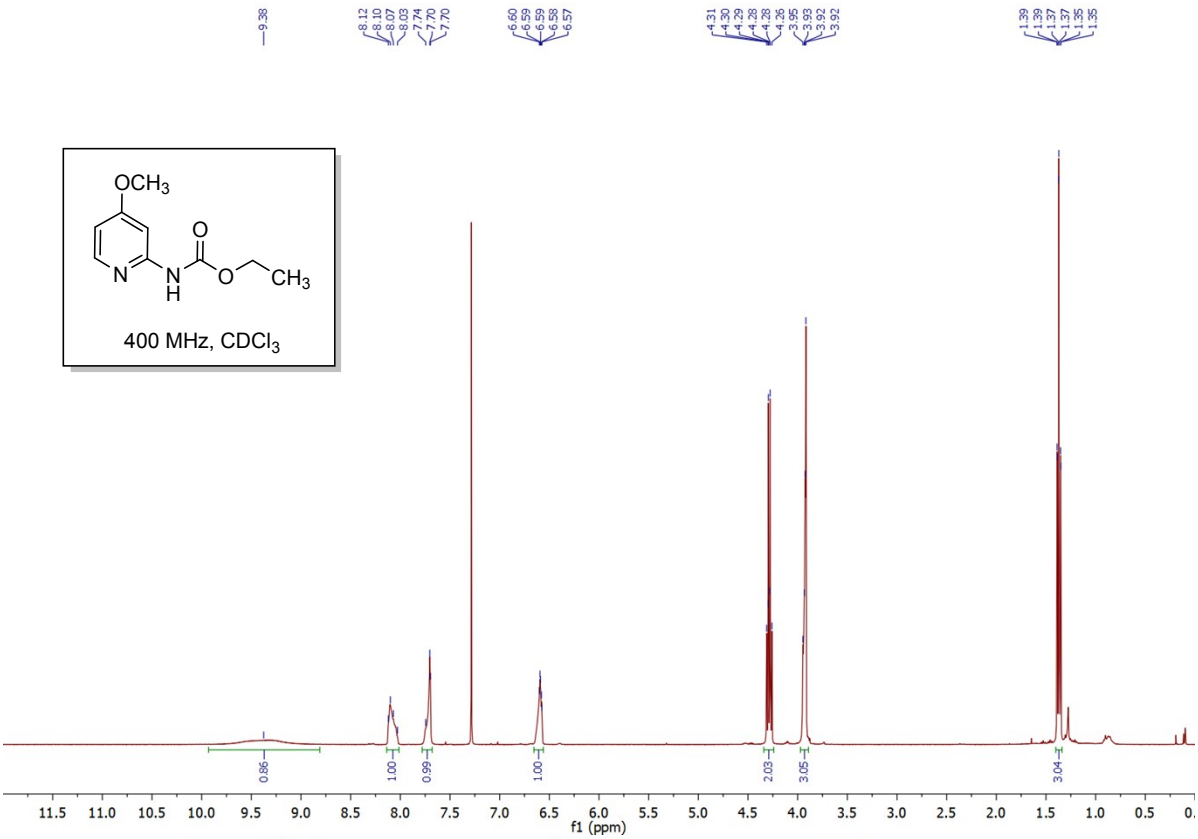


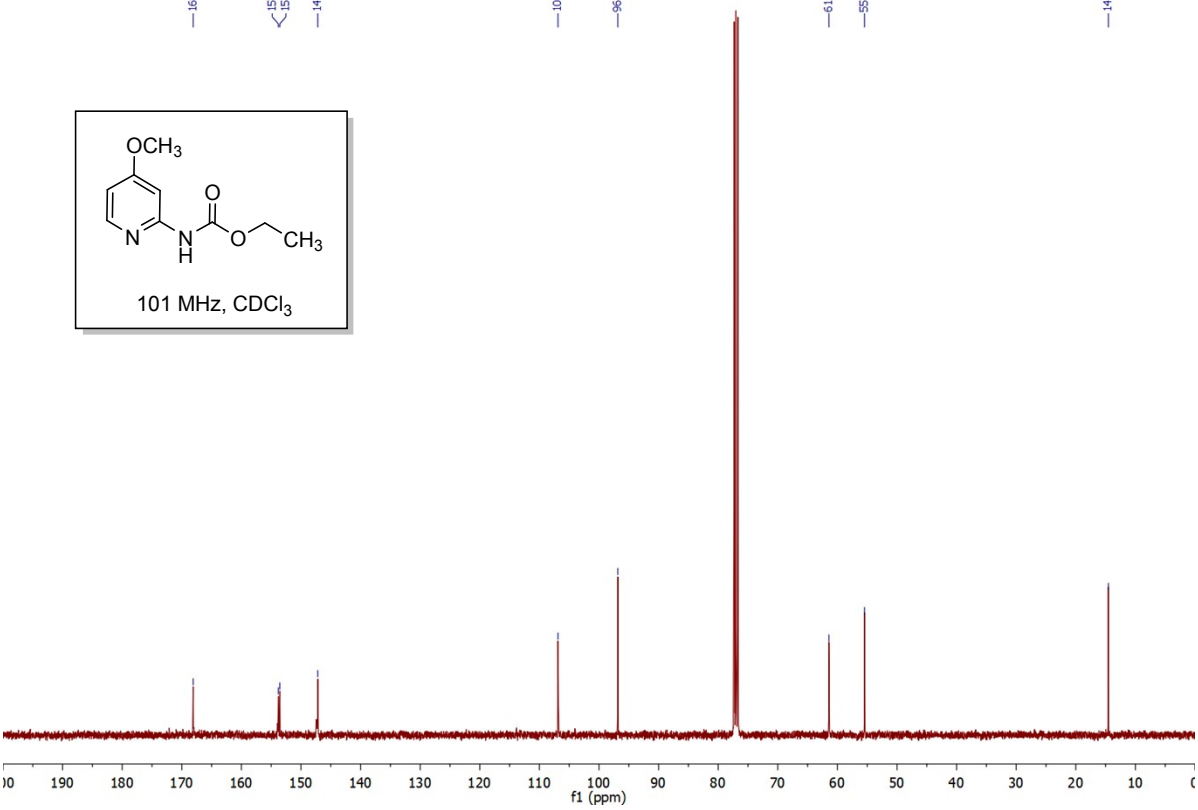
^{1}H and ^{13}C spectra of ethyl pyridin–2–ylcarbamate **2n**.



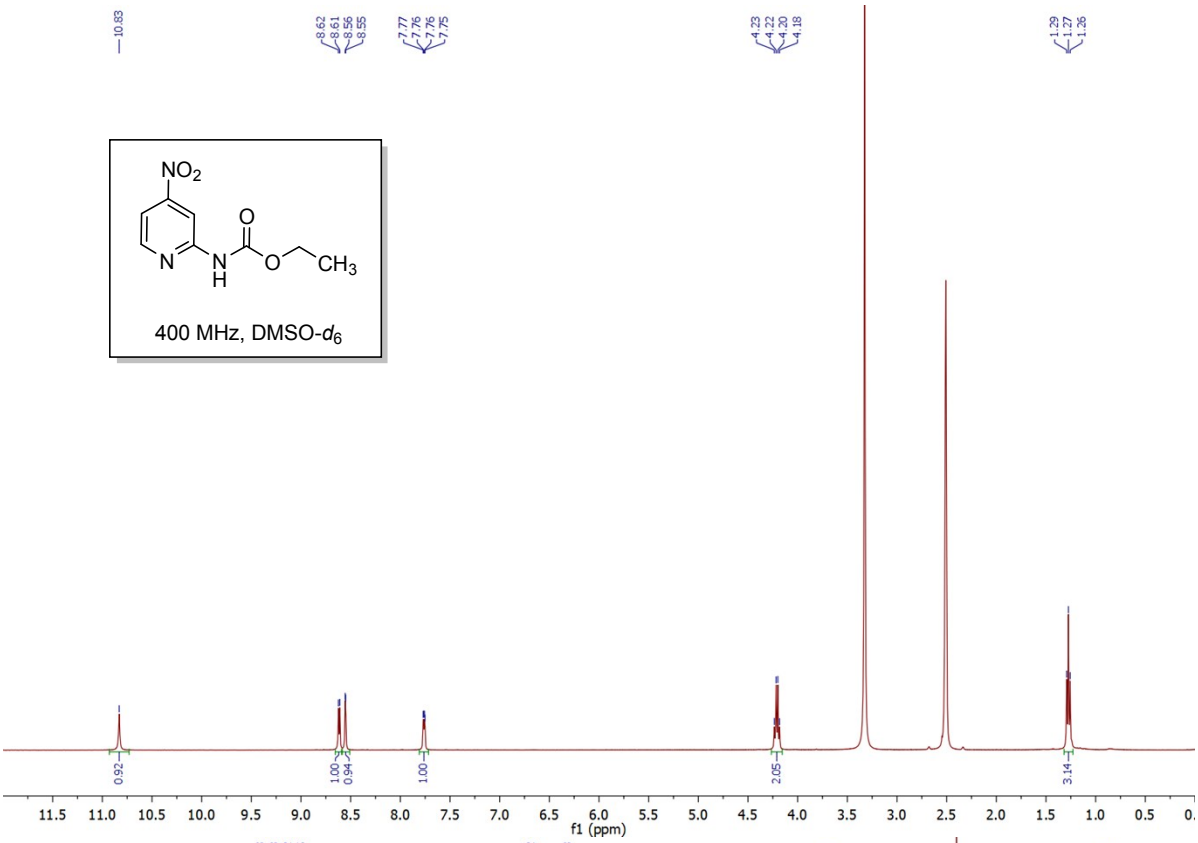


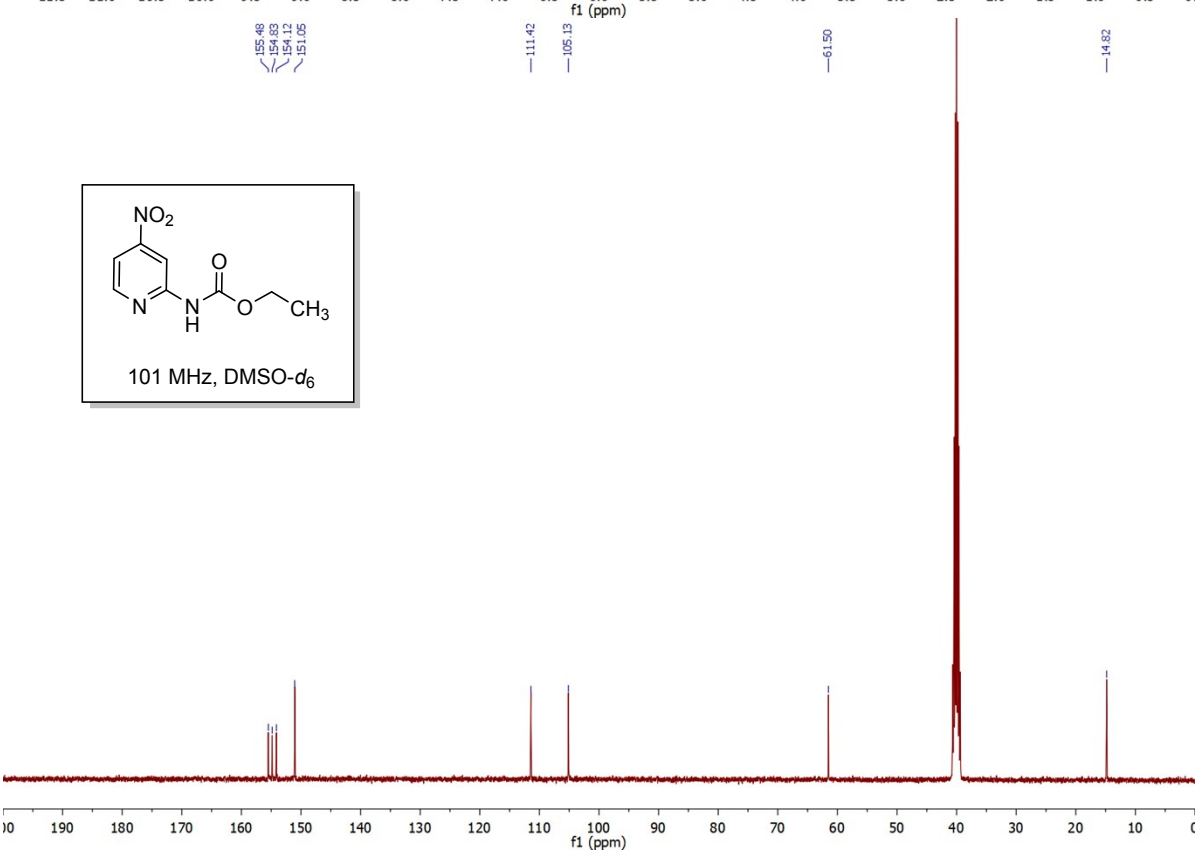
^{1}H and ^{13}C spectra of ethyl (4–methoxypyridin–2–yl)carbamate **2o**.



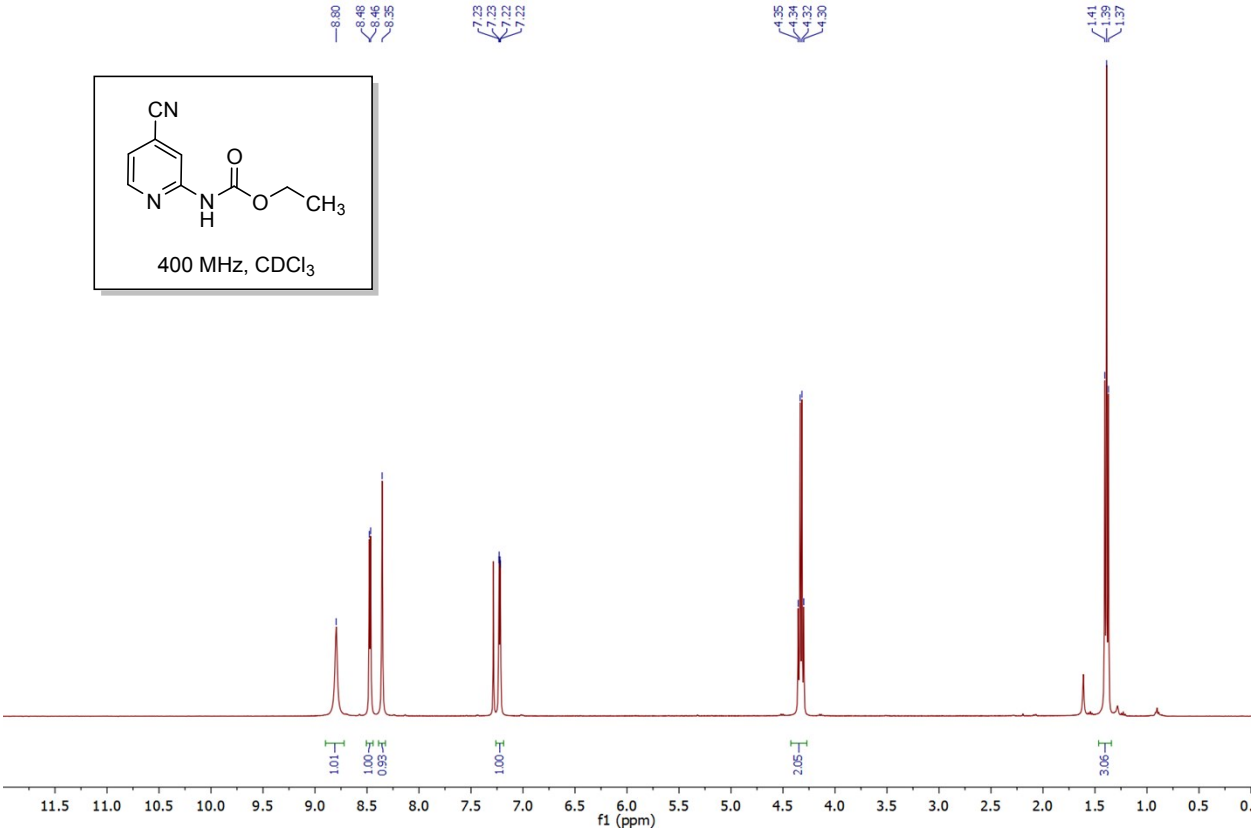


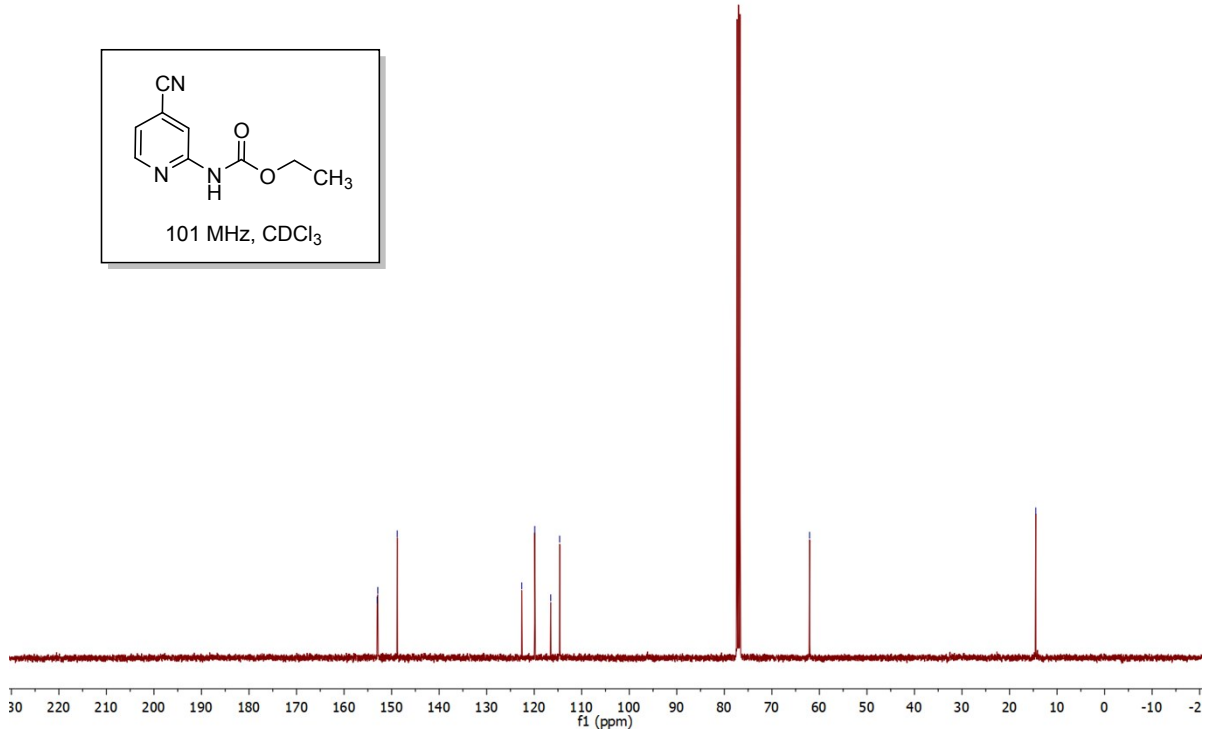
^{1}H and ^{13}C spectra of ethyl (4–nitropyridin–2–yl)carbamate **2p**.



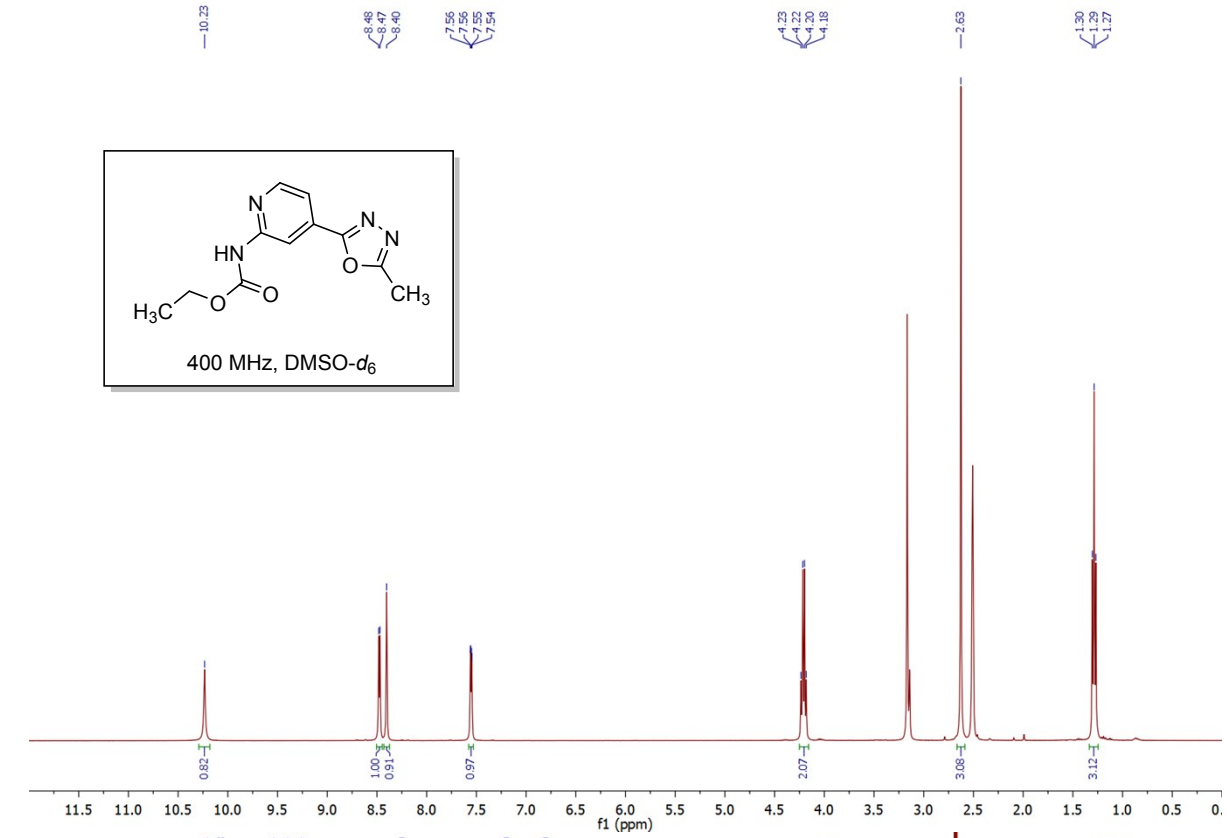


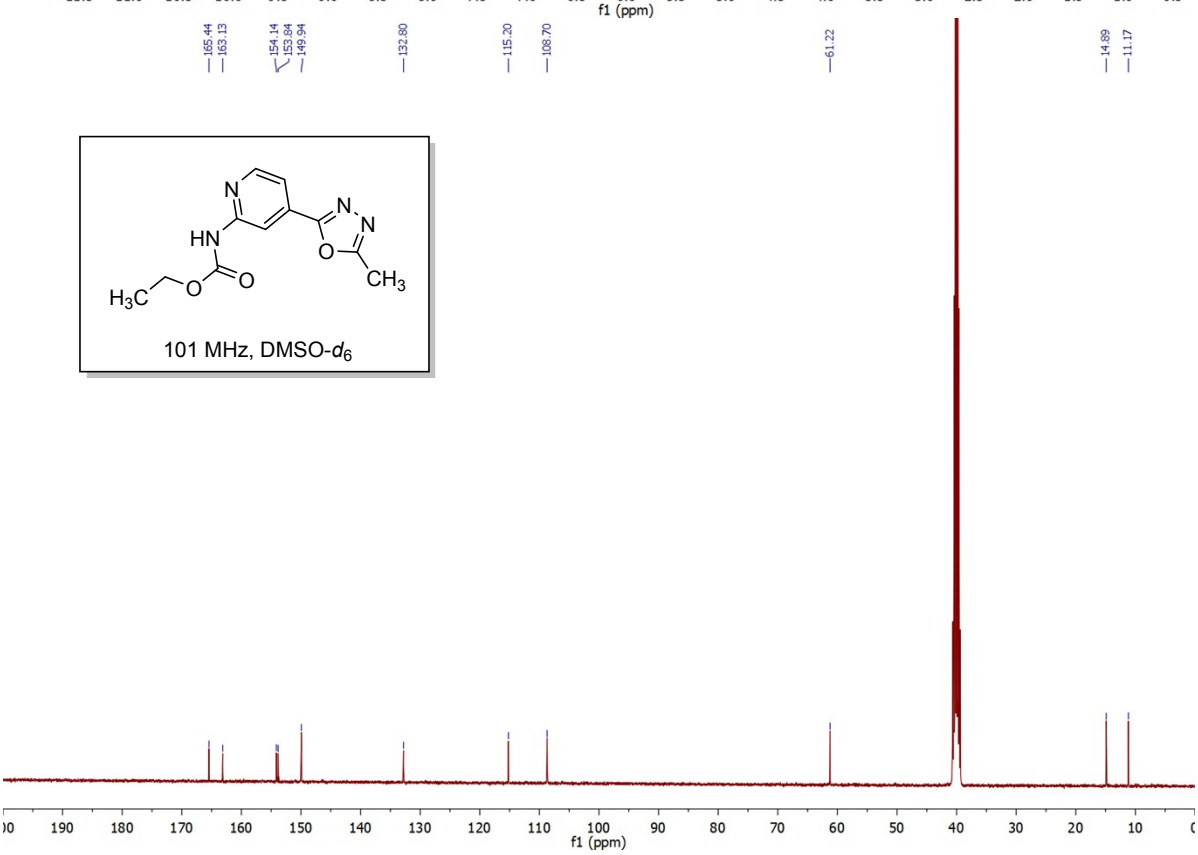
^{1}H and ^{13}C spectra ethyl (4–cyanopyridin–2–yl)carbamate **2q**.



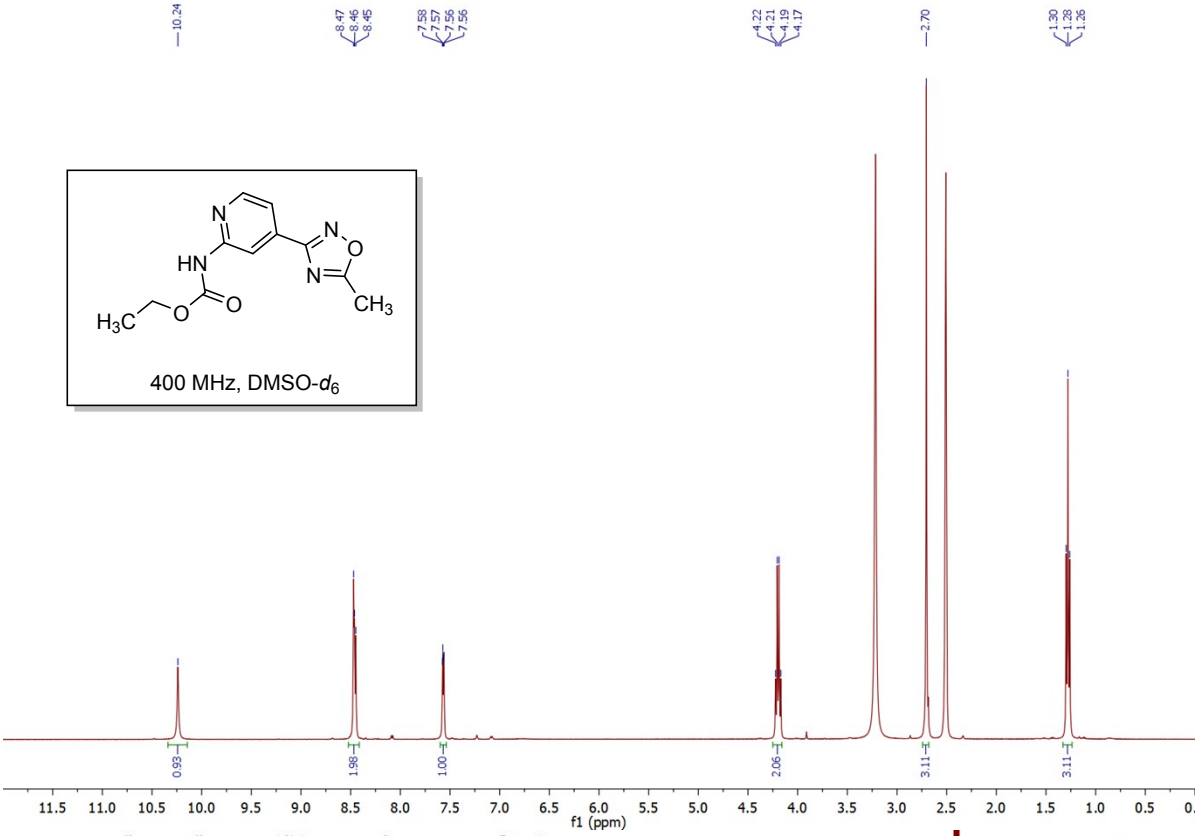


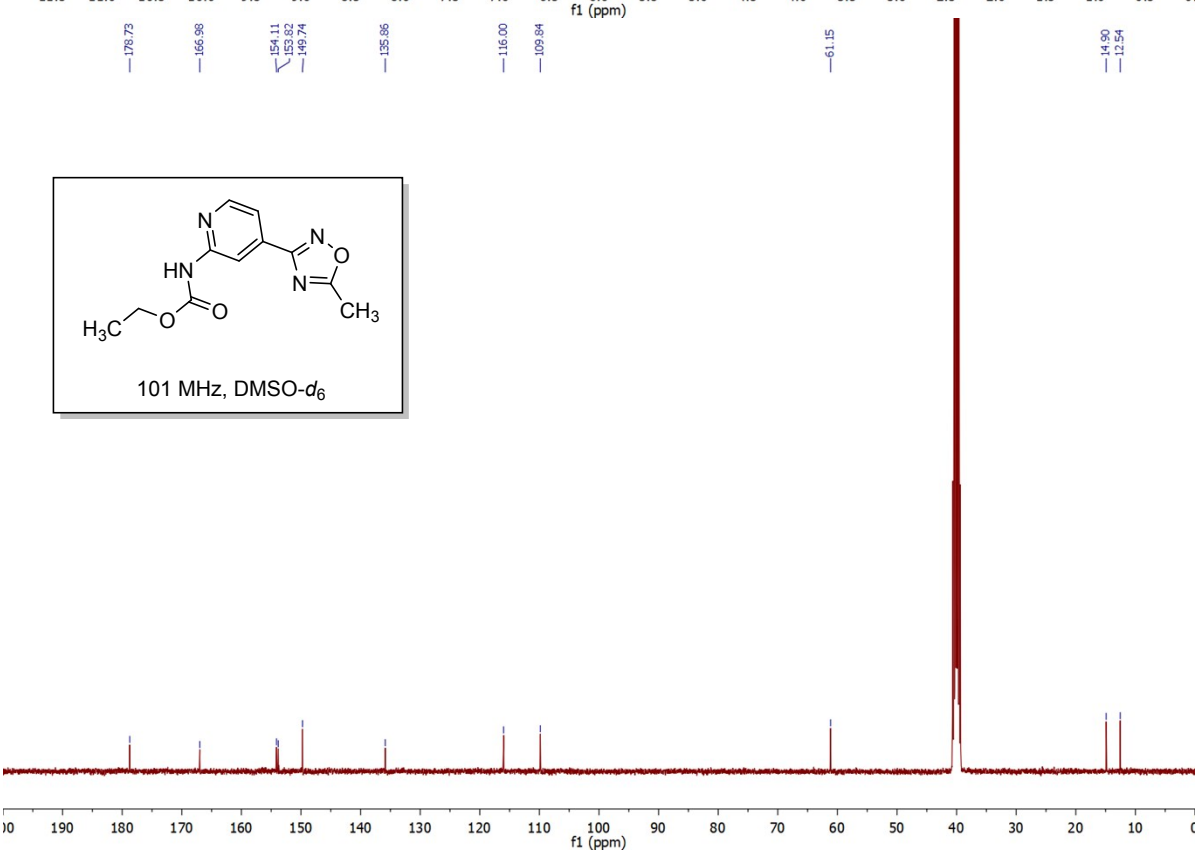
^{1}H and ^{13}C spectra of ethyl (4–(5–methyl–1,3,4–oxadiazol–2–yl)pyridin–2–yl)carbamate **2r**.



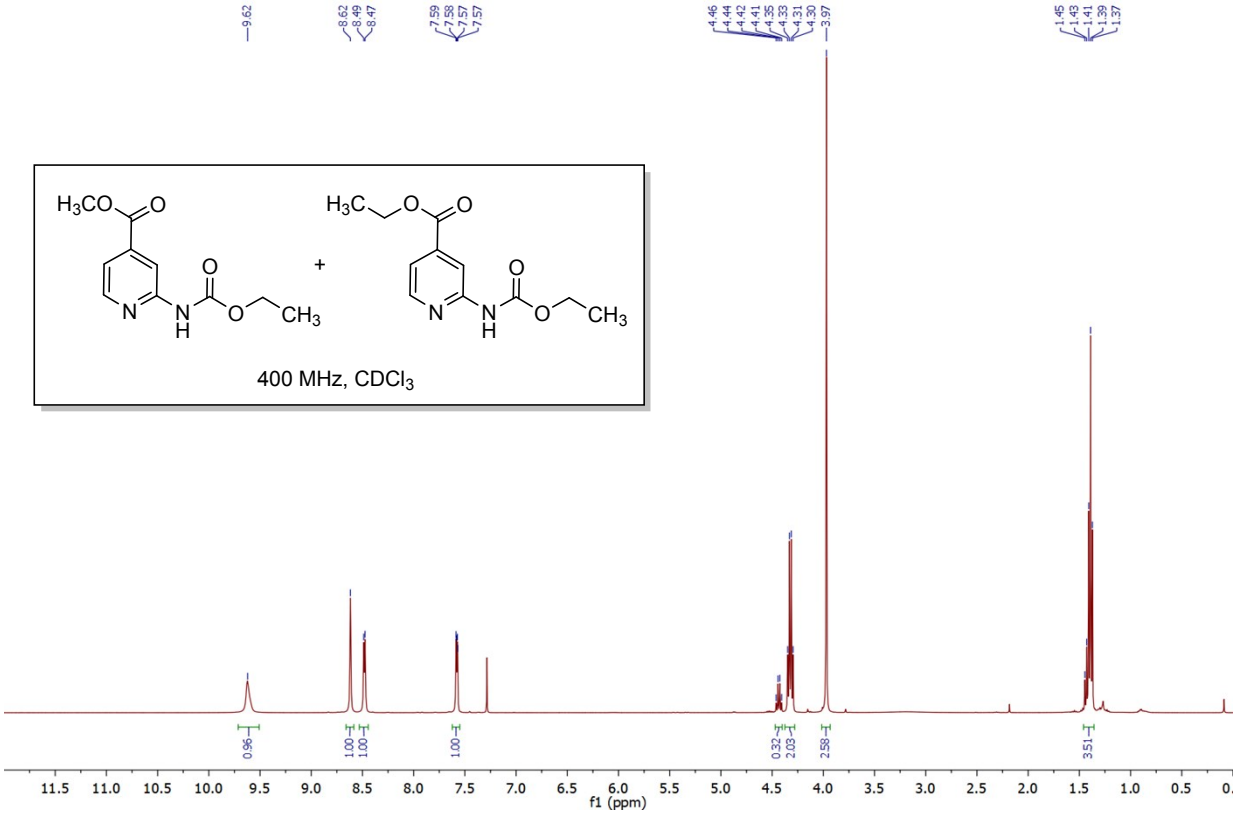


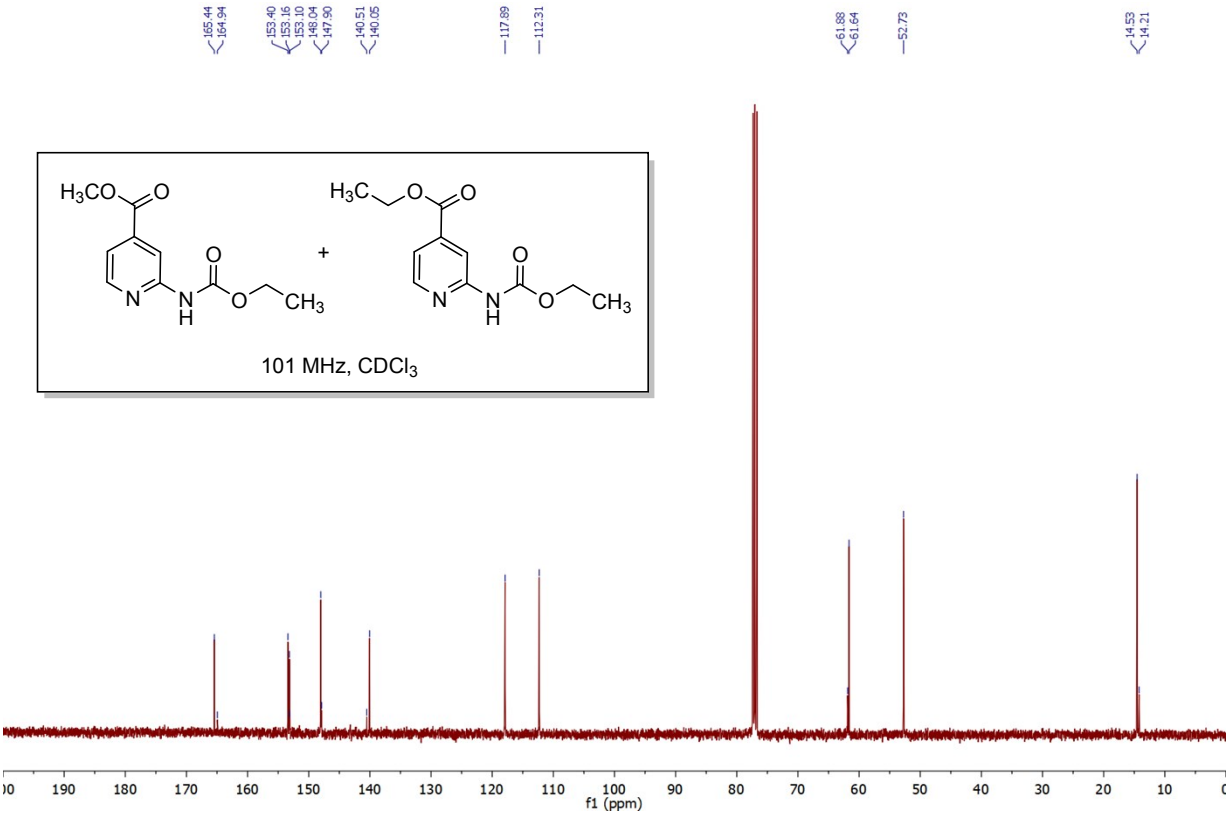
^{1}H and ^{13}C spectra of ethyl (4–(5–methyl–1,2,4–oxadiazol–3–yl)pyridin–2–yl)carbamate **2s**.



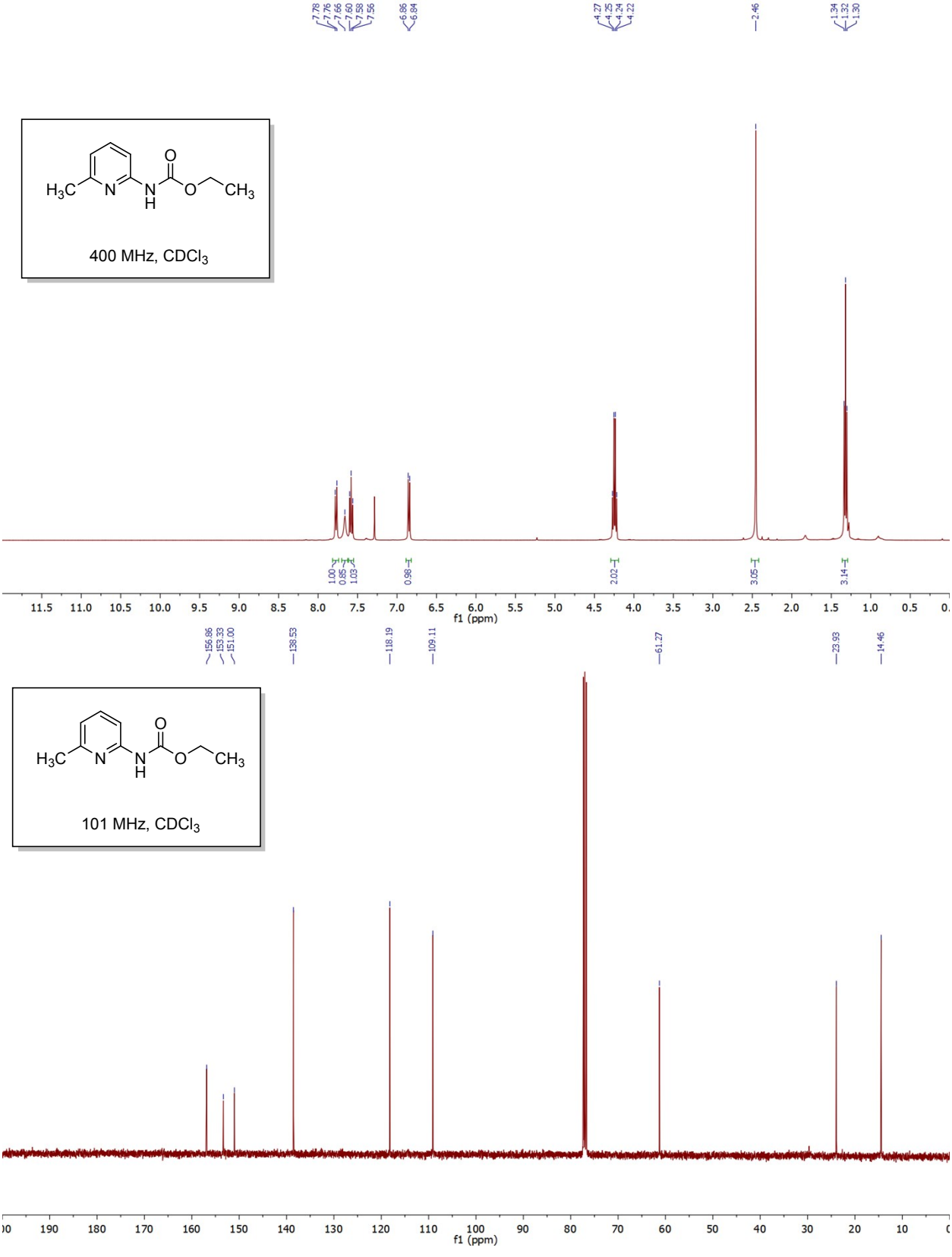


^{1}H and ^{13}C spectra of methyl 2–((ethoxycarbonyl)amino)isonicotinate **2t** and ethyl 2–((ethoxycarbonyl)amino)isonicotinate **2t'**.

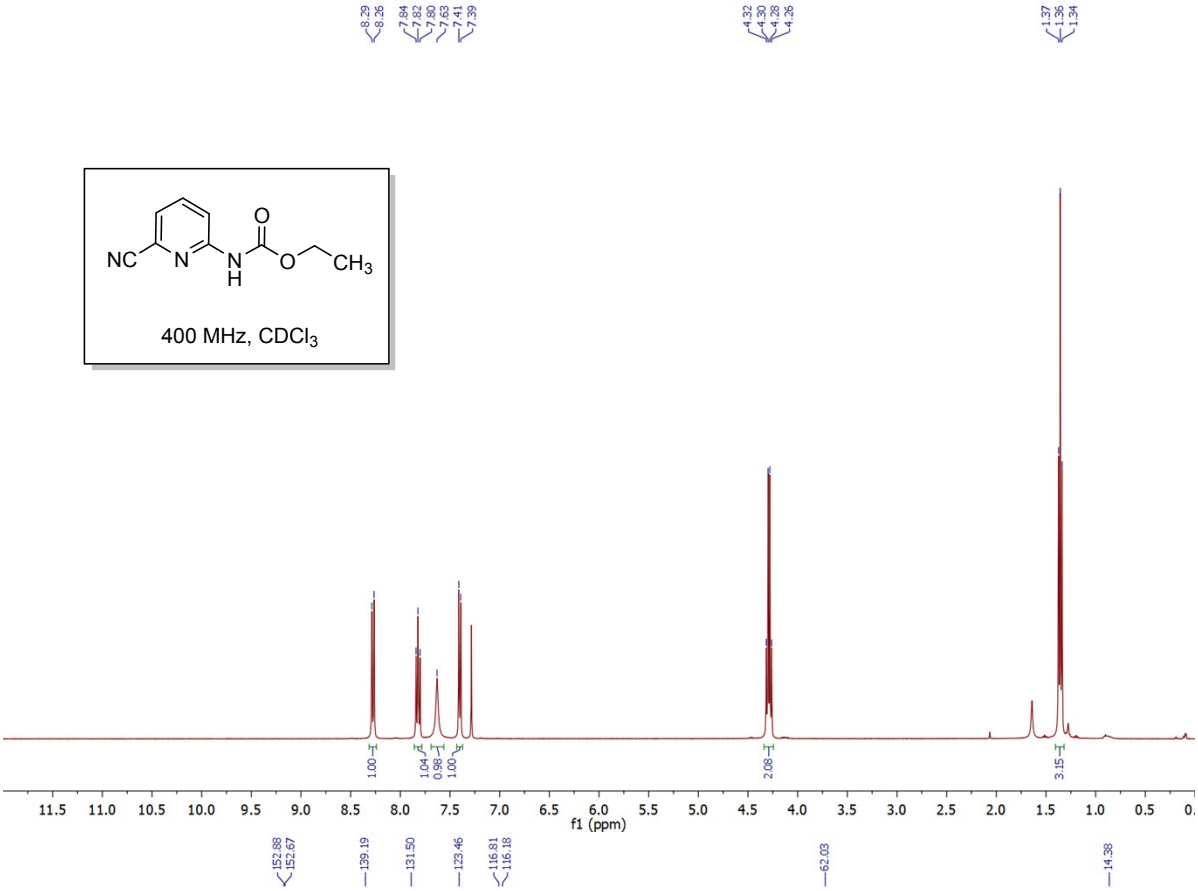


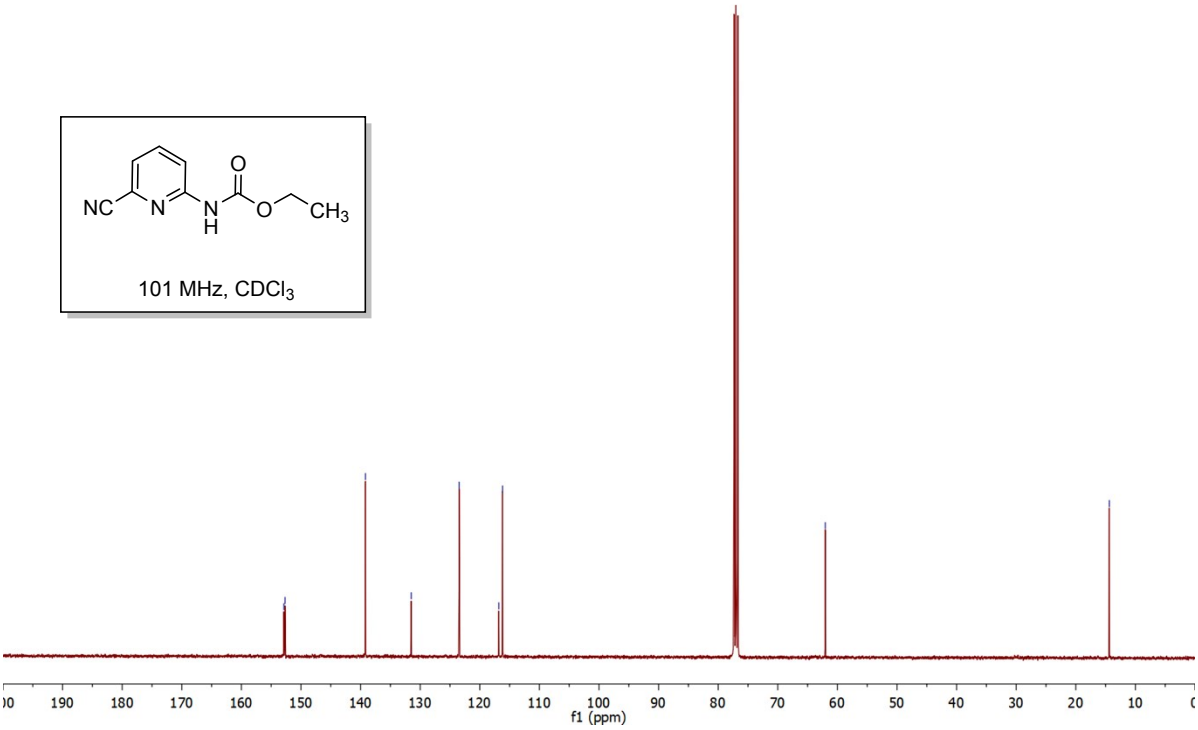

165.44
164.94
153.40
153.16
153.10
148.04
147.90
140.51
140.05
117.89
112.31
61.88
61.64
52.73
14.53
14.21
101 MHz, CDCl3
f1 (ppm)

^{1}H and ^{13}C spectra of ethyl (6–methylpyridin–2–yl)carbamate **2u**.

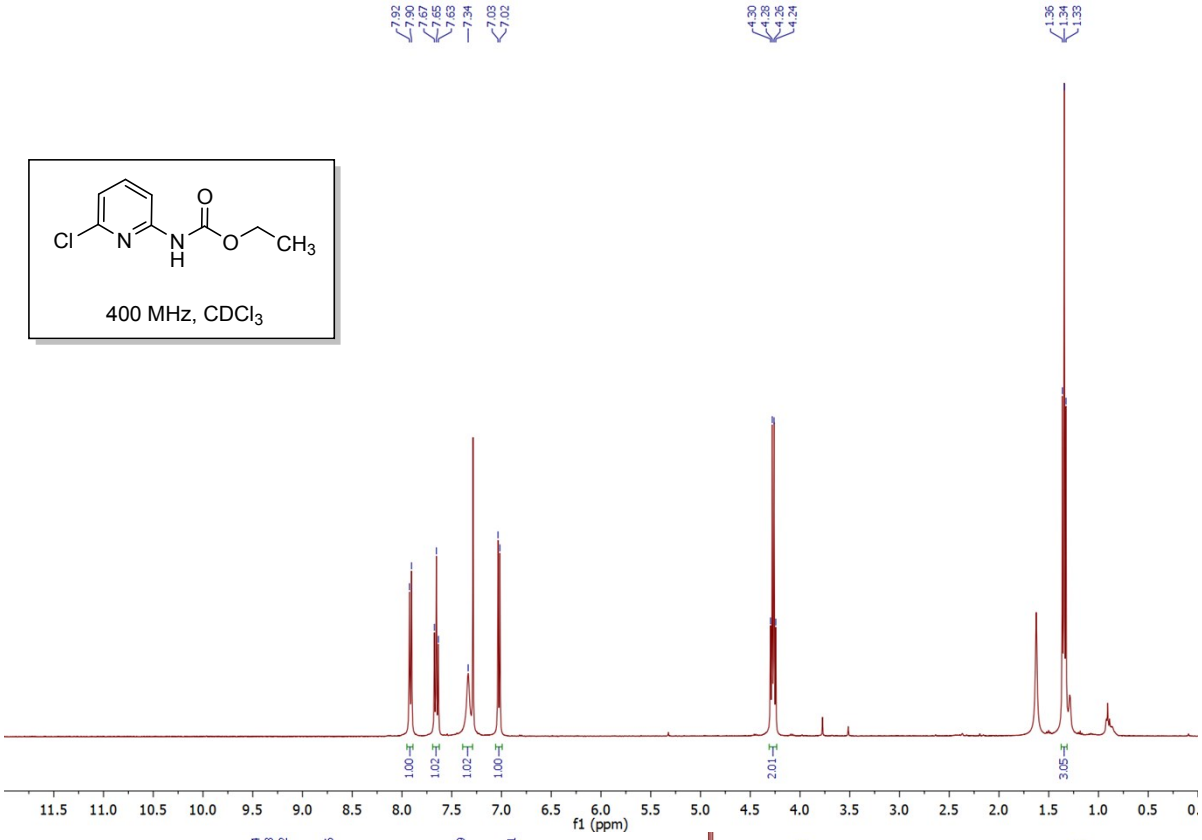


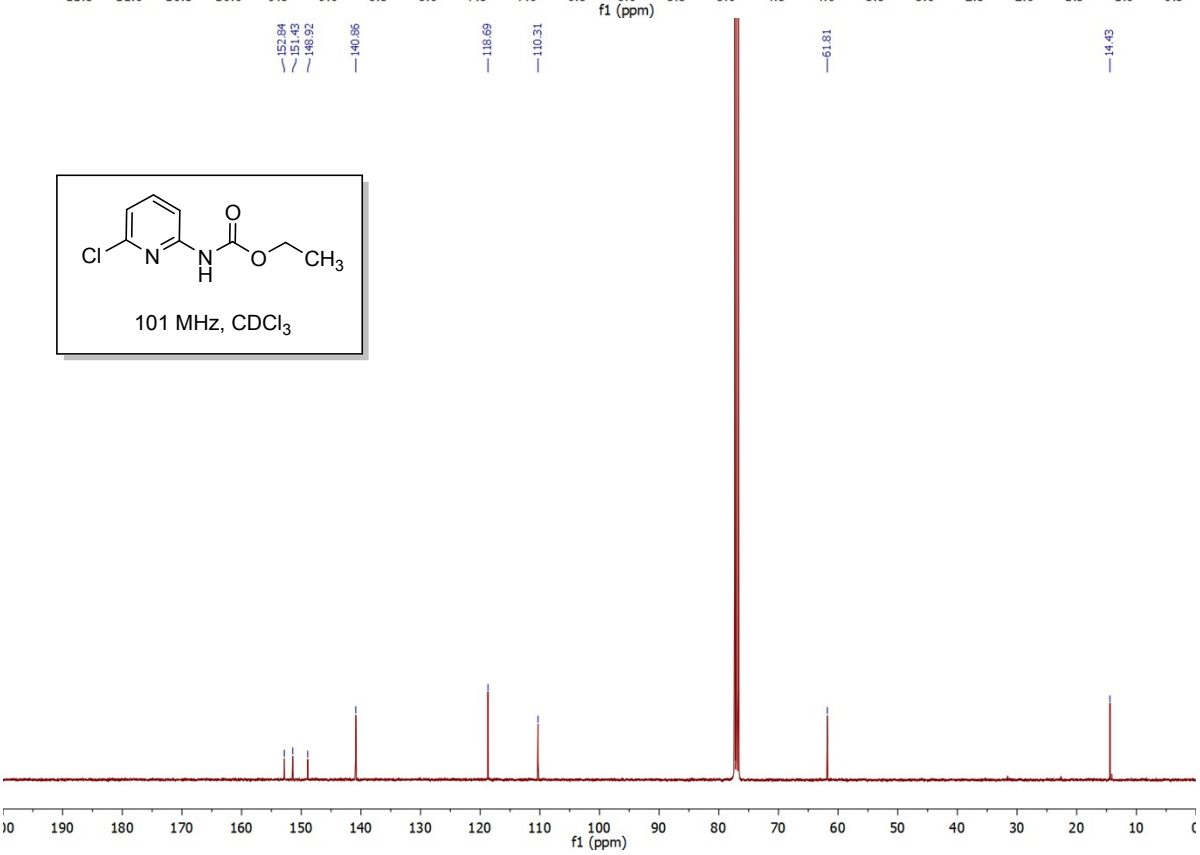
^{1}H and ^{13}C spectra of ethyl (6–cyanopyridin–2–yl)carbamate **2v**.



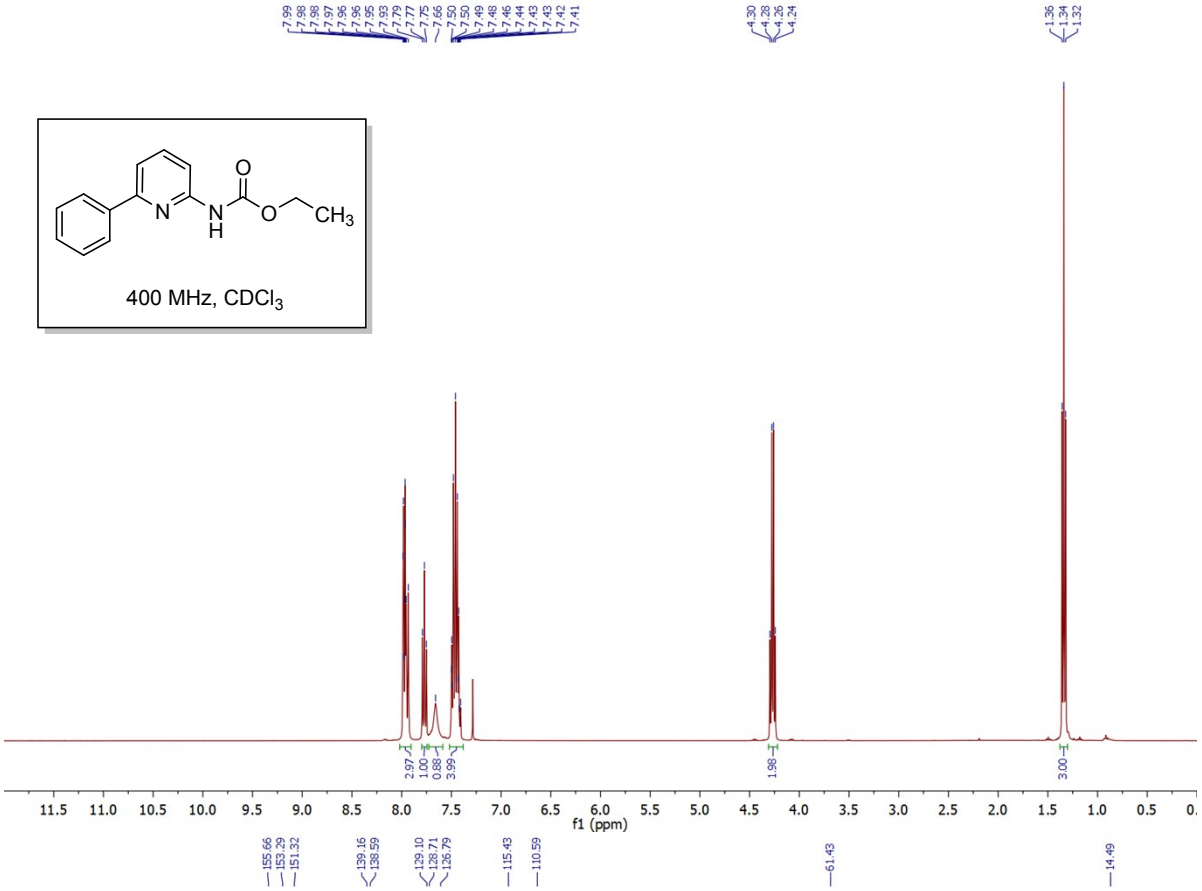


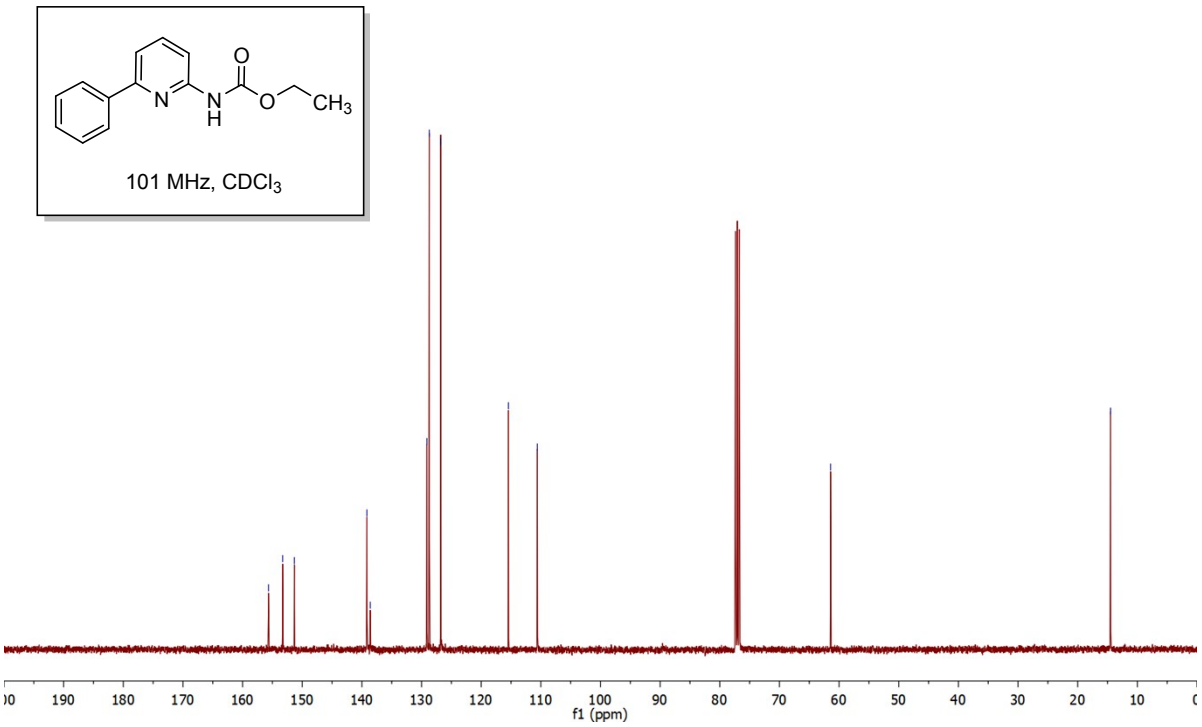
^{1}H and ^{13}C spectra ethyl (6–chloropyridin–2–yl)carbamate **2w**.



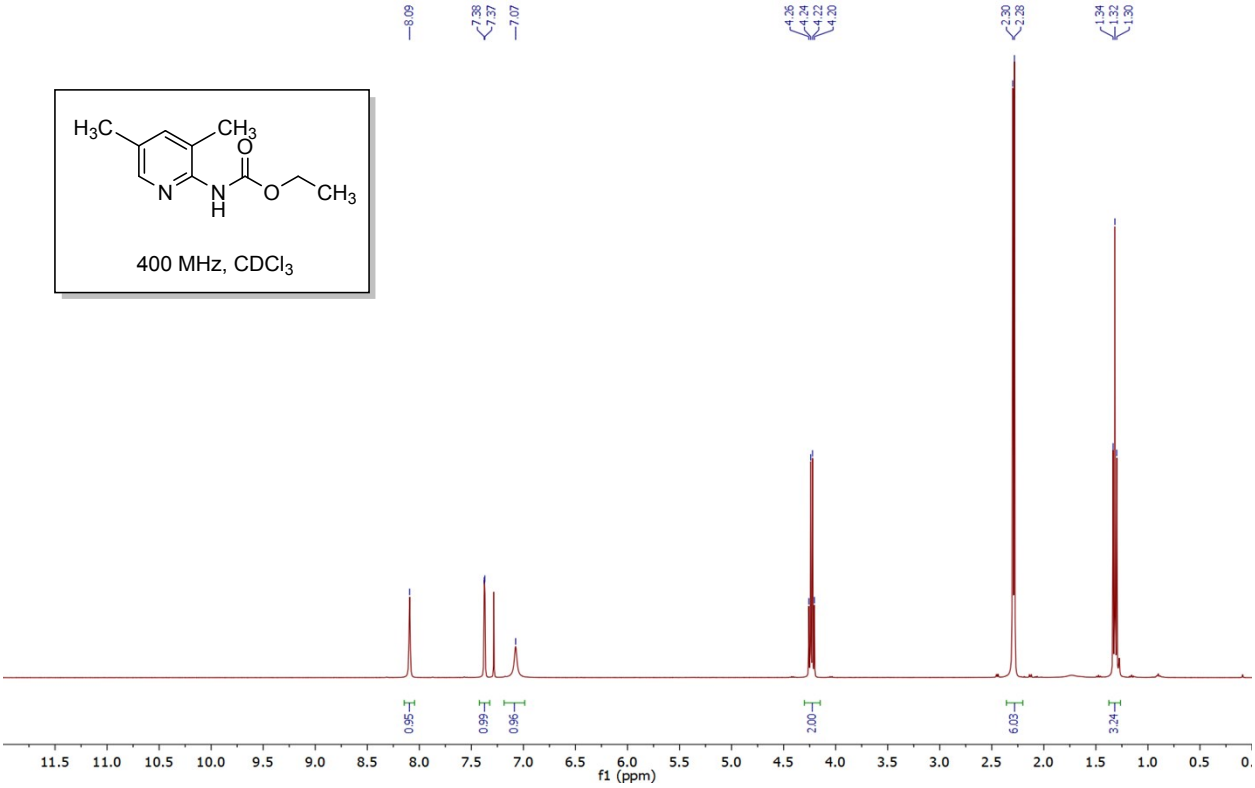


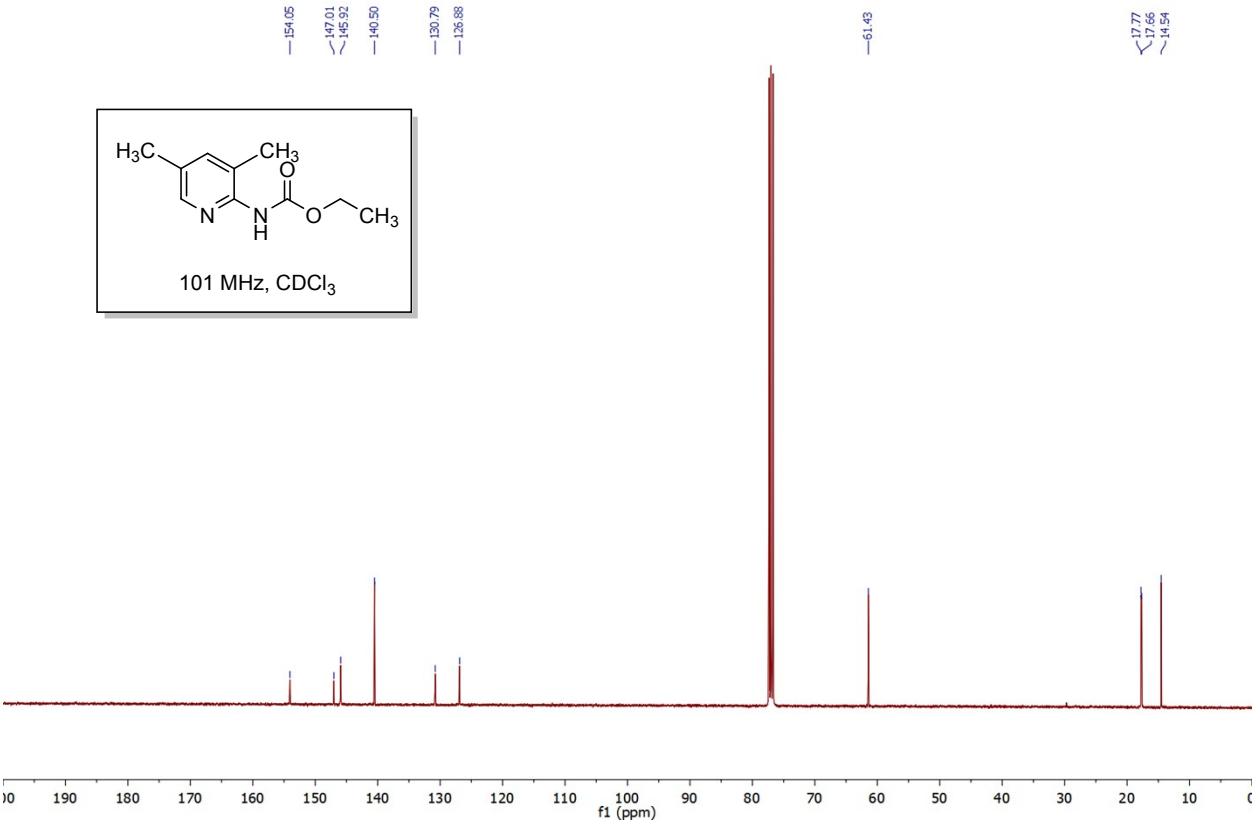
^{1}H and ^{13}C spectra of ethyl (6–phenylpyridin–2–yl)carbamate **2x**.



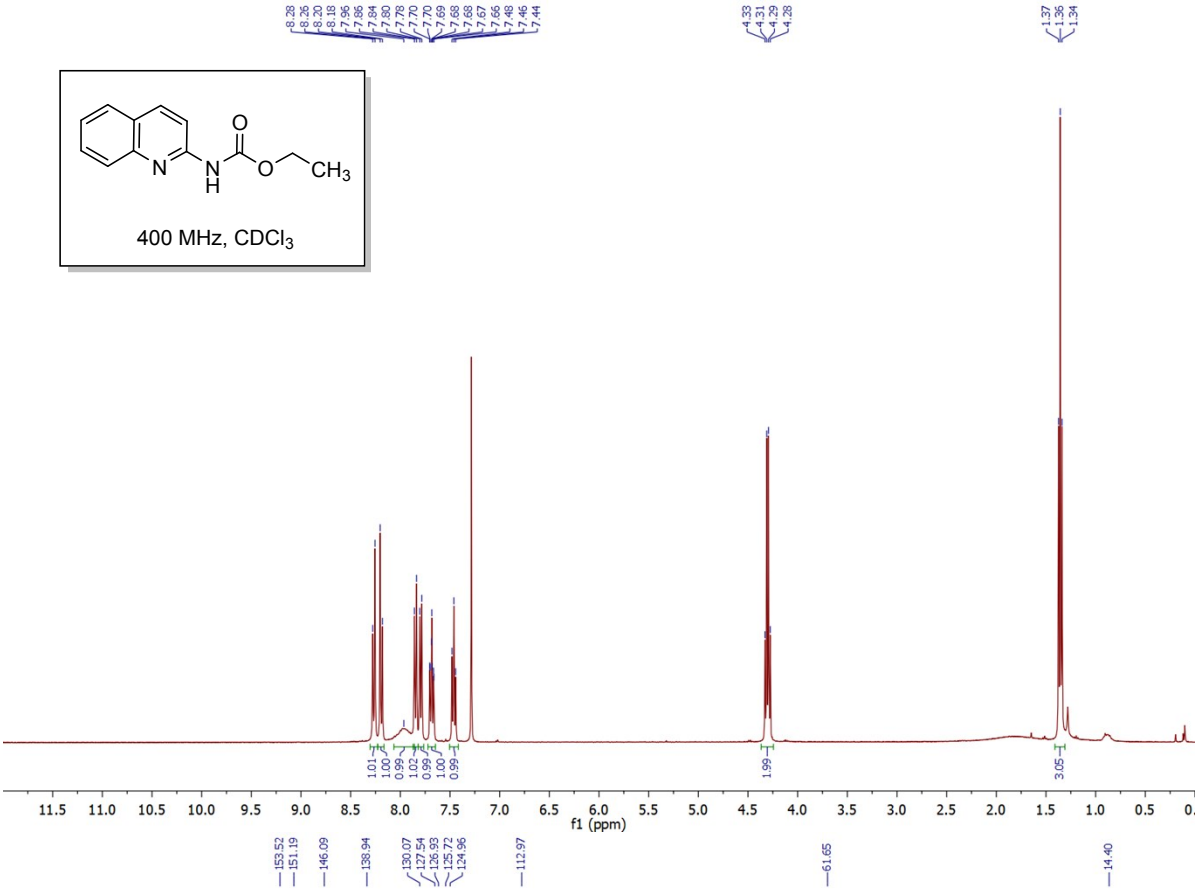


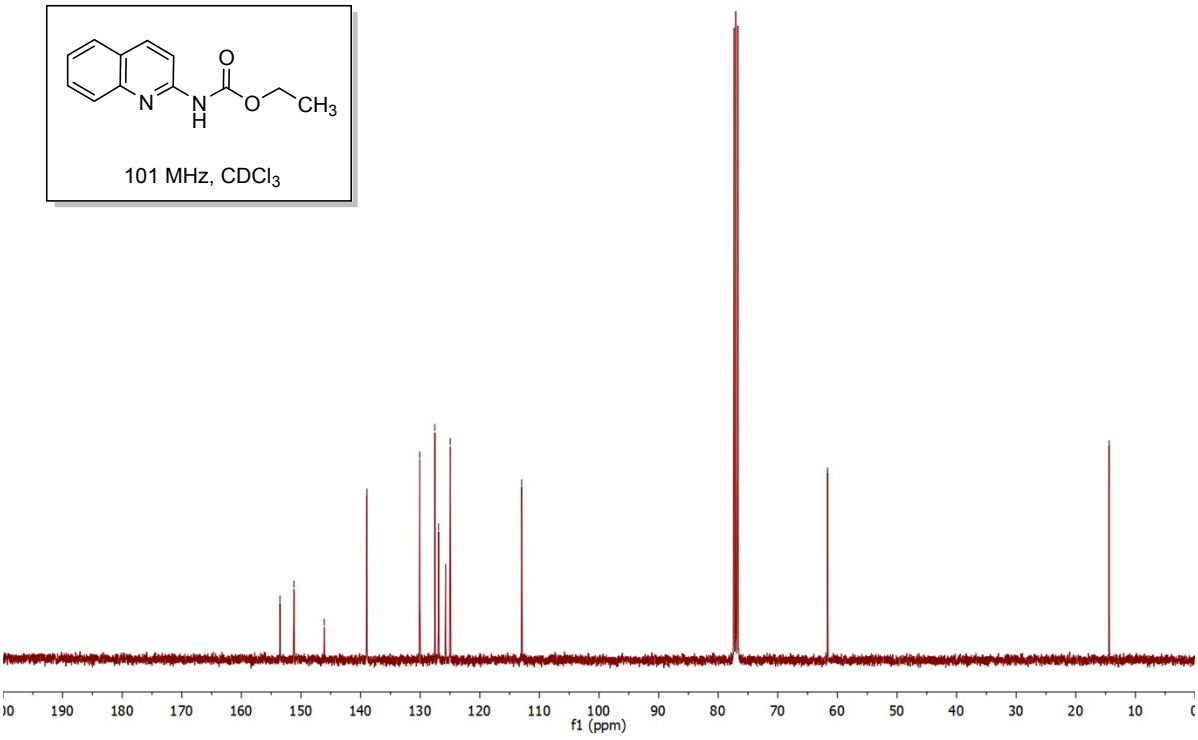
^{1}H and ^{13}C spectra of ethyl (3,5-dimethylpyridin–2–yl)carbamate **2y**.



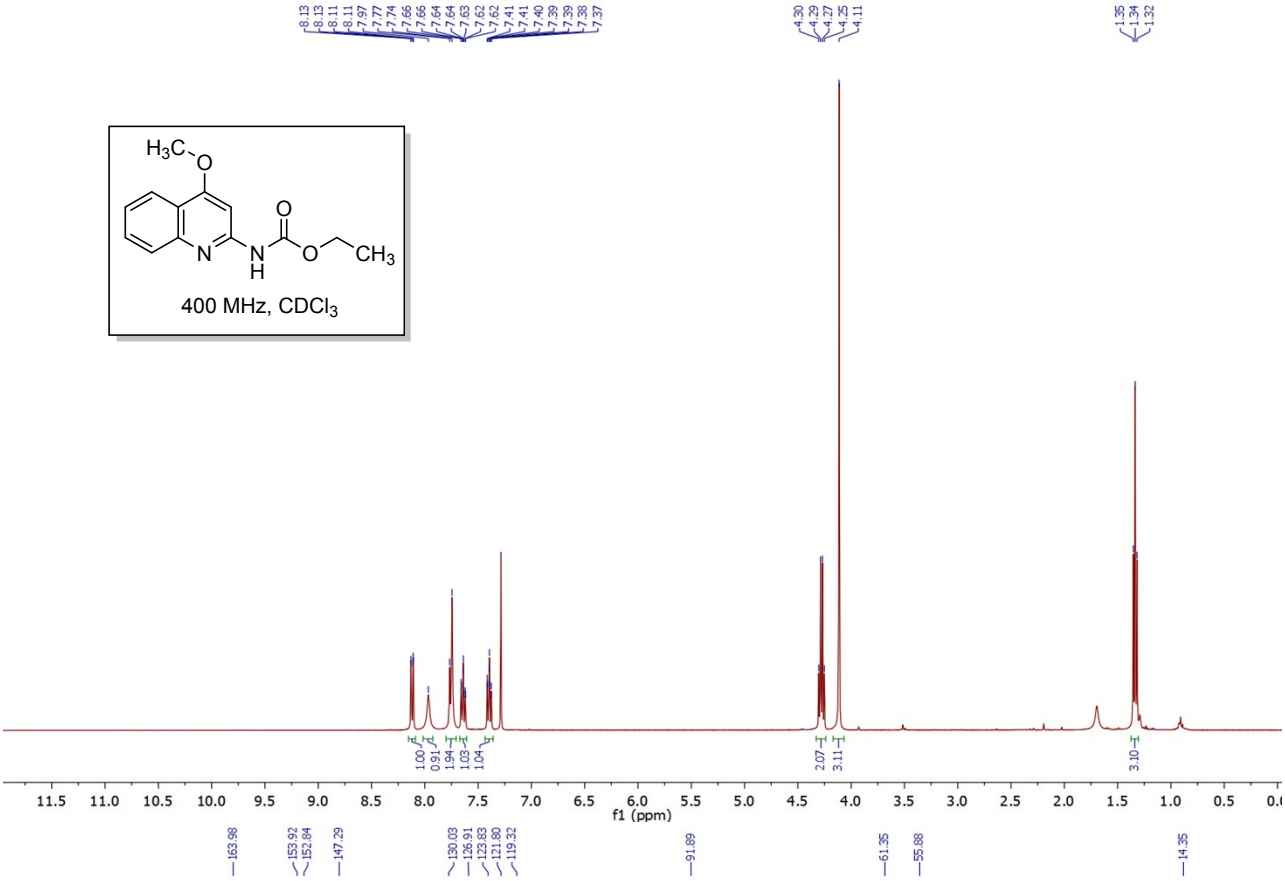


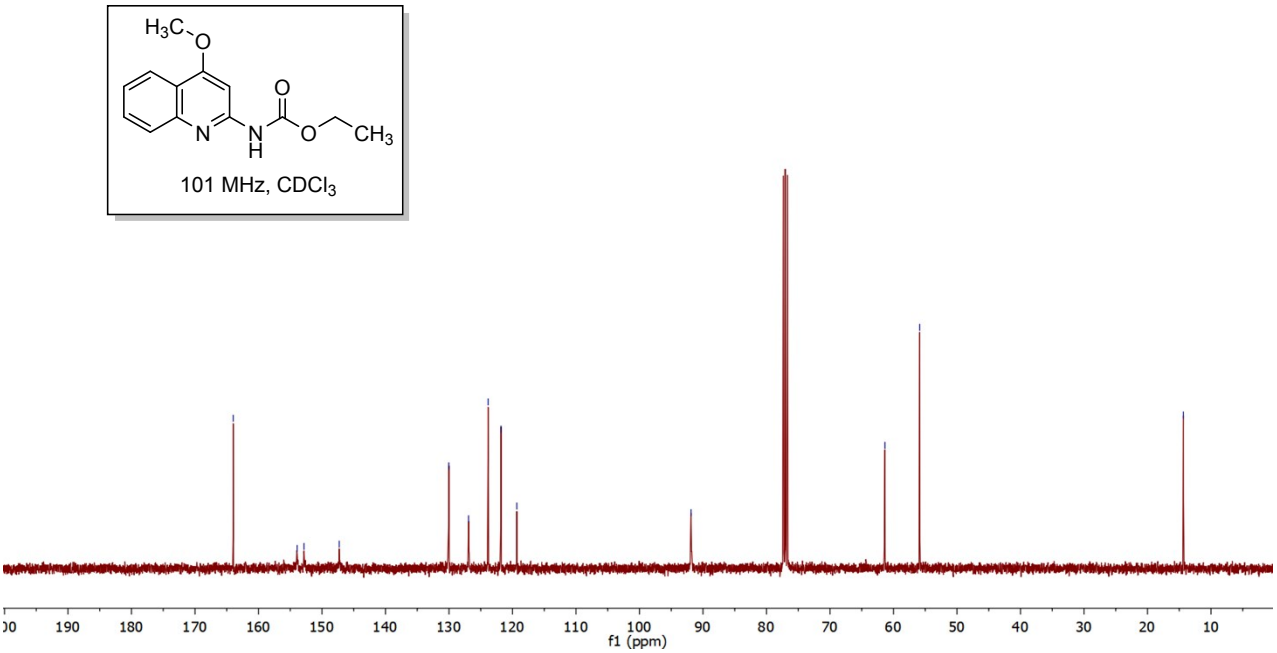
^{1}H and ^{13}C spectra of ethyl quinolin–2–ylcarbamate **3a**.



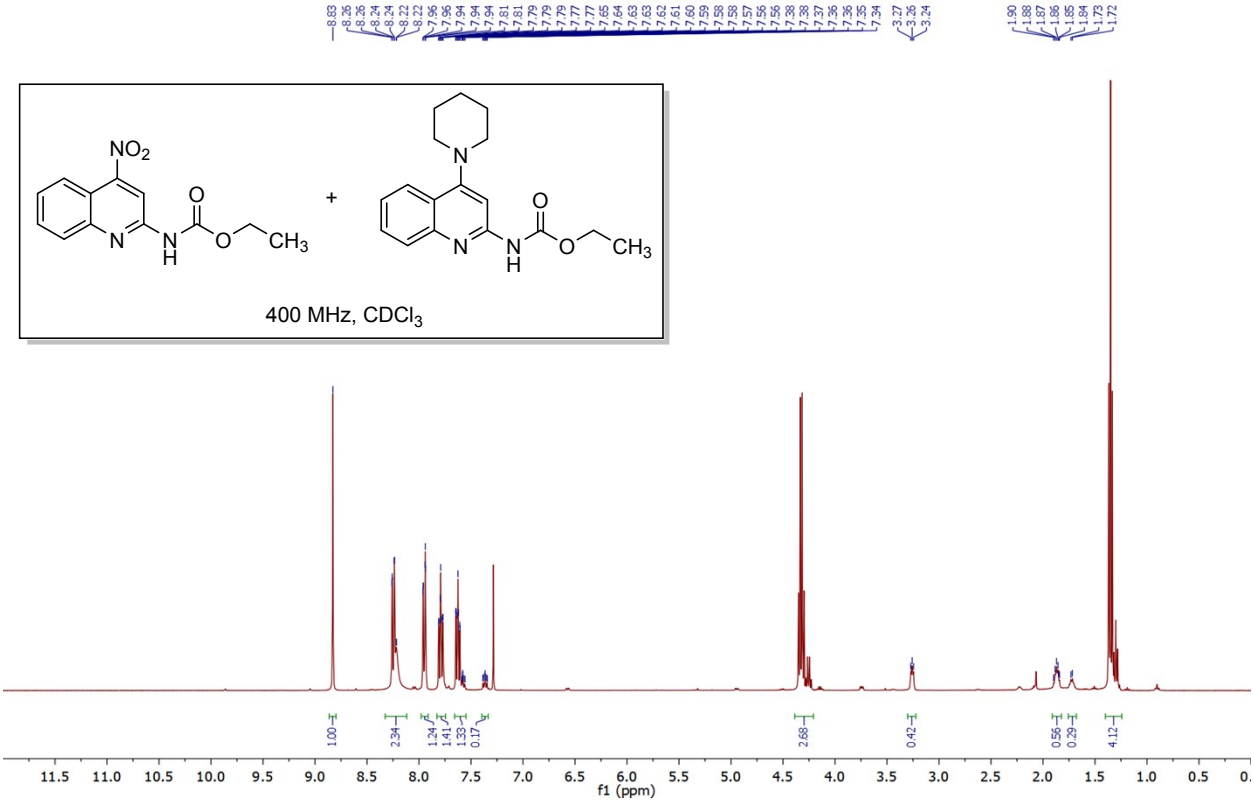


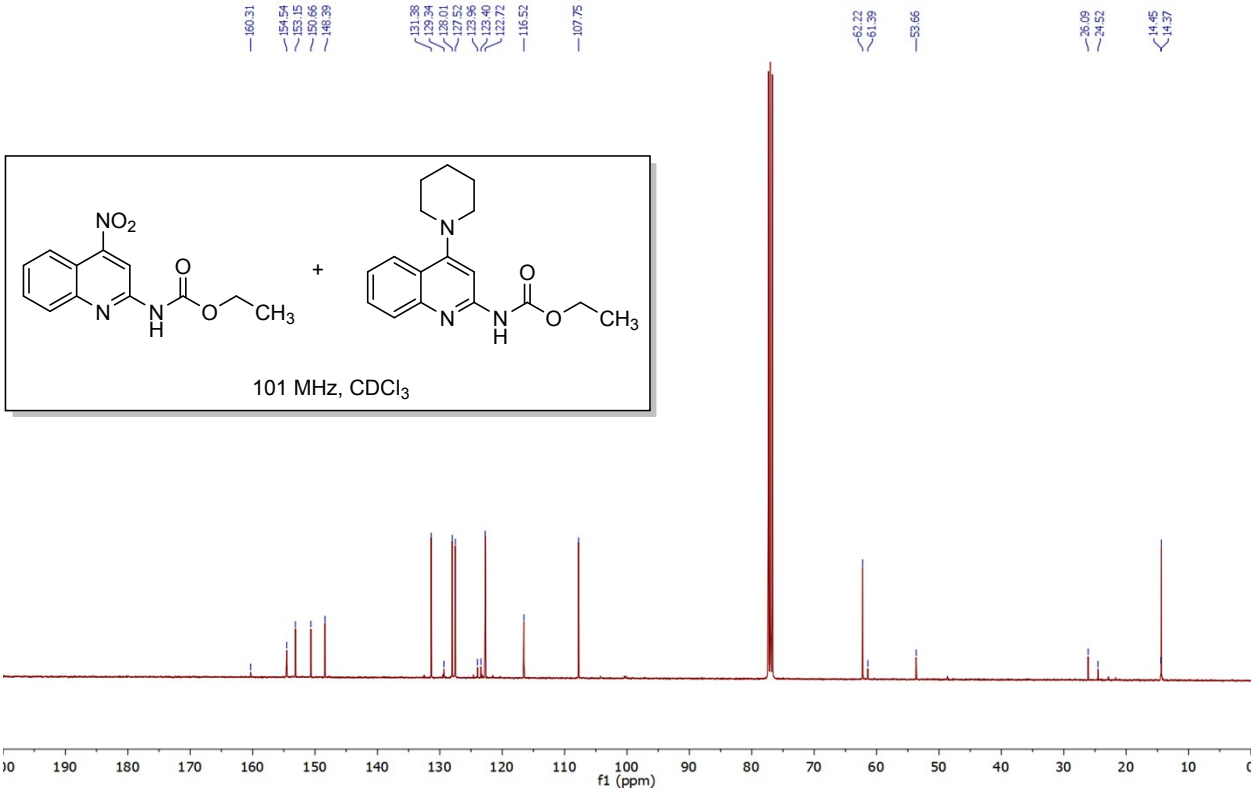
^{1}H and ^{13}C spectra of ethyl (4–methoxyquinolin–2–yl)carbamate **3b**.



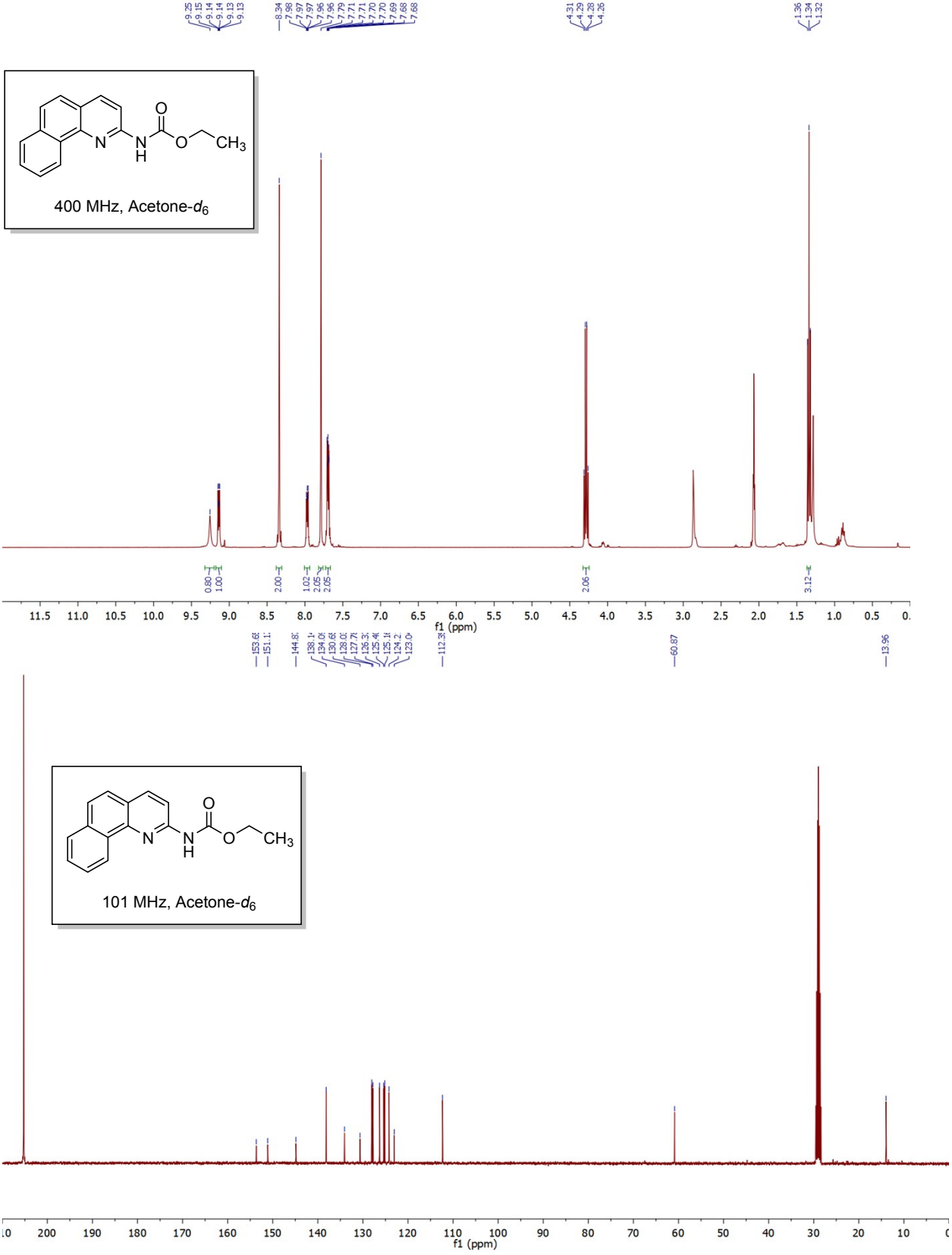


^{1}H and ^{13}C spectra of ethyl (4–nitroquinolin–2–yl)carbamate **3c** + ethyl (4–(piperidin–1–yl)quinolin–2–yl)carbamate **3c'**.

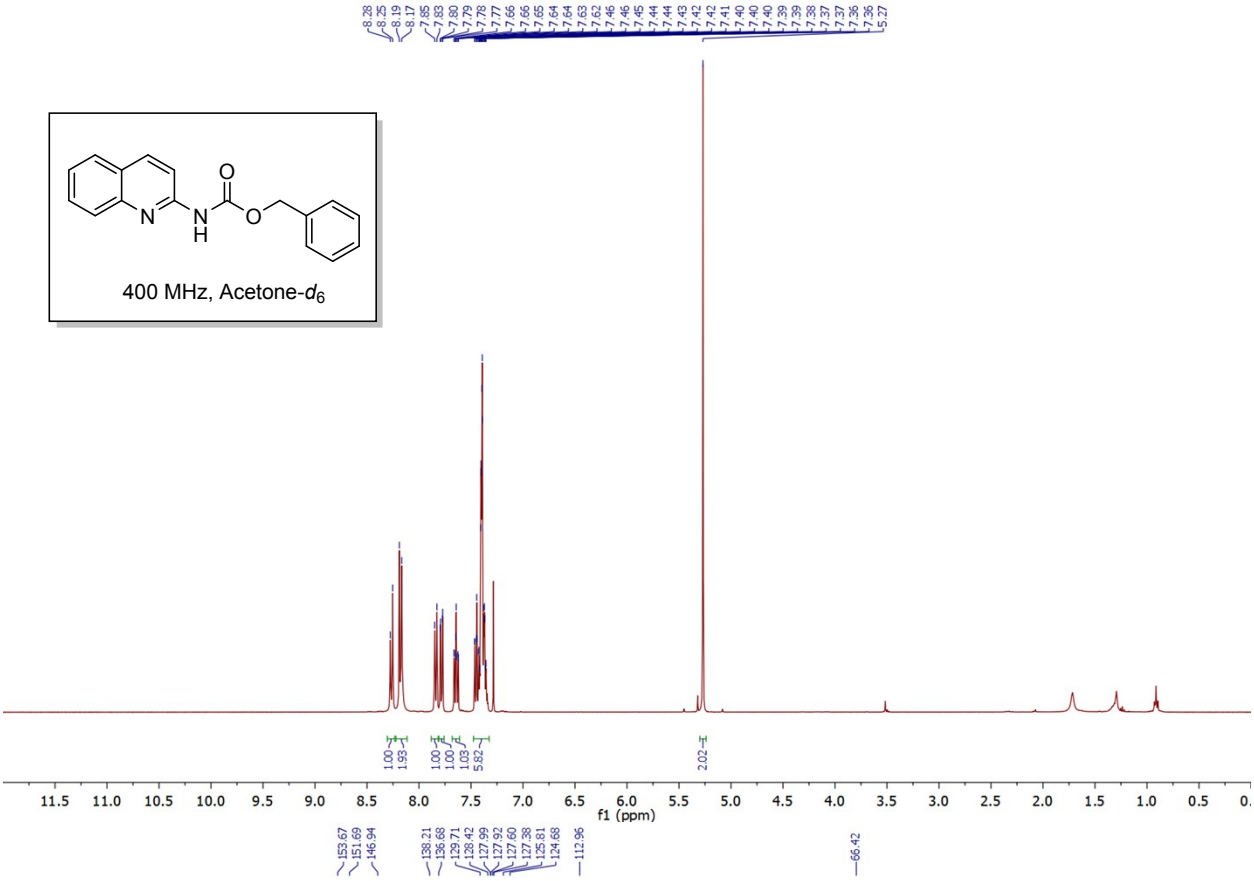


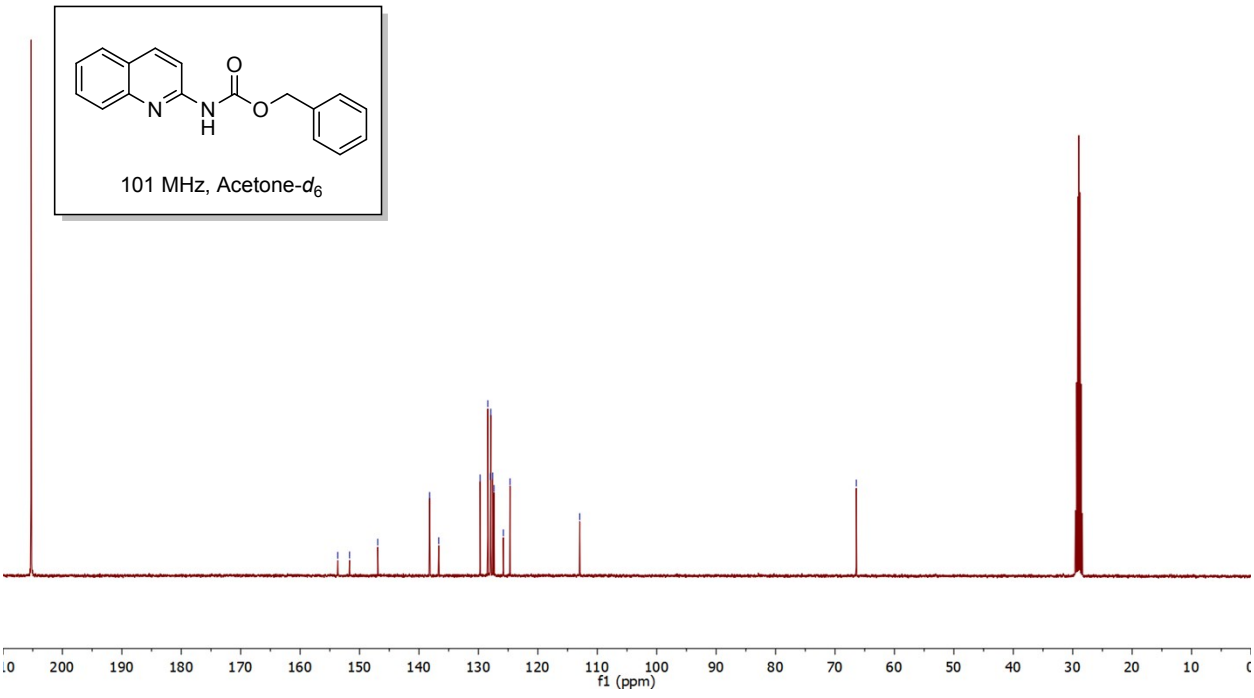

160.31
154.54
153.15
150.66
148.39
131.38
129.34
128.01
127.52
123.96
123.40
122.72
116.52
107.75
62.22
61.39
53.66
26.09
24.52
14.45
14.37
NO2
O
N
H
O
CH3
+
N
N
H
O
O
CH3
101 MHz, CDCl3
f1 (ppm)

^{1}H and ^{13}C spectra of ethyl benzo[*h*]quinolin–2–ylcarbamate **3e**.

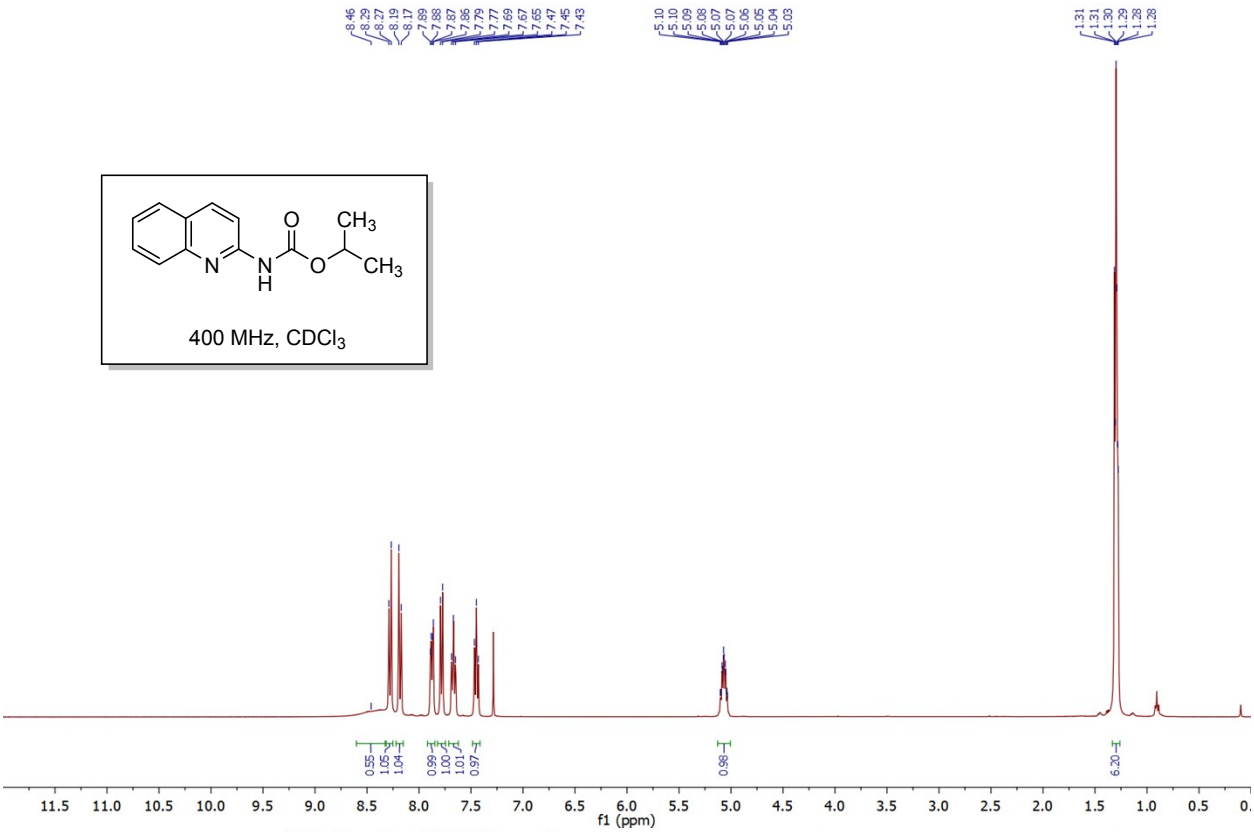


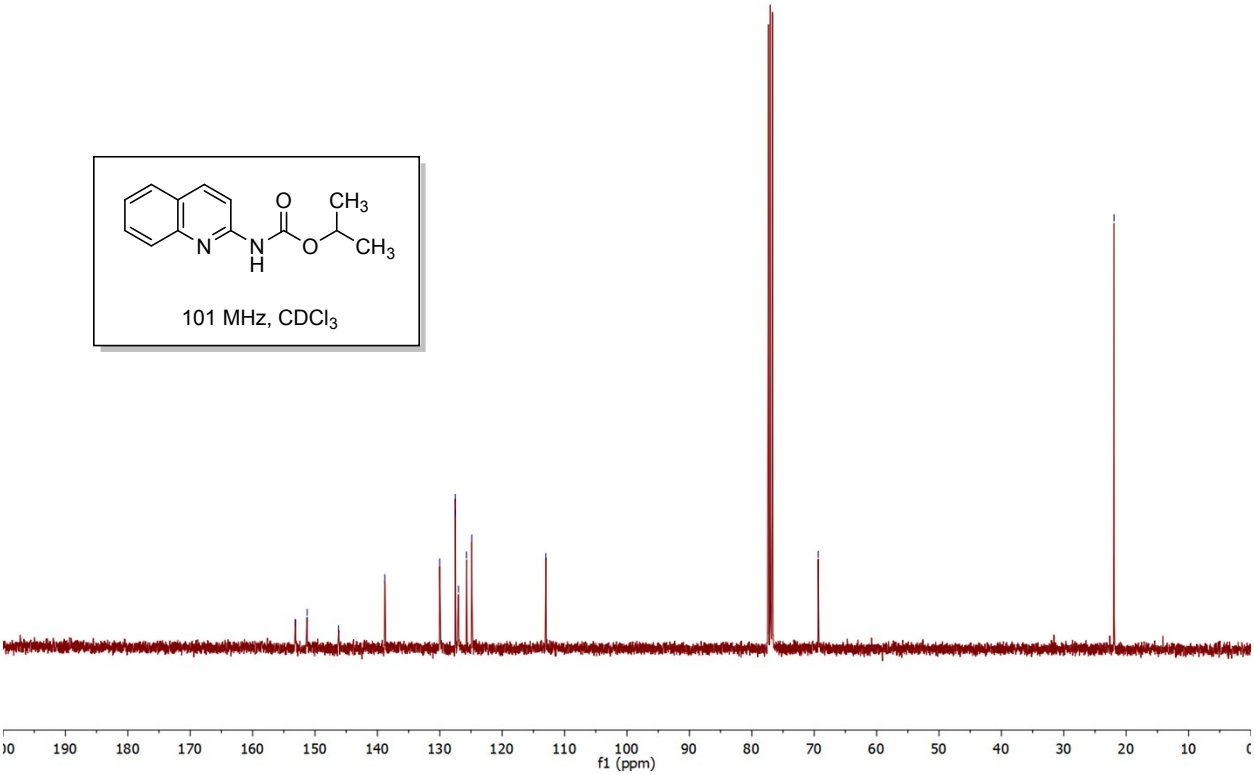
^{1}H and ^{13}C spectra of benzyl quinolin–2–ylcarbamate **3f**.



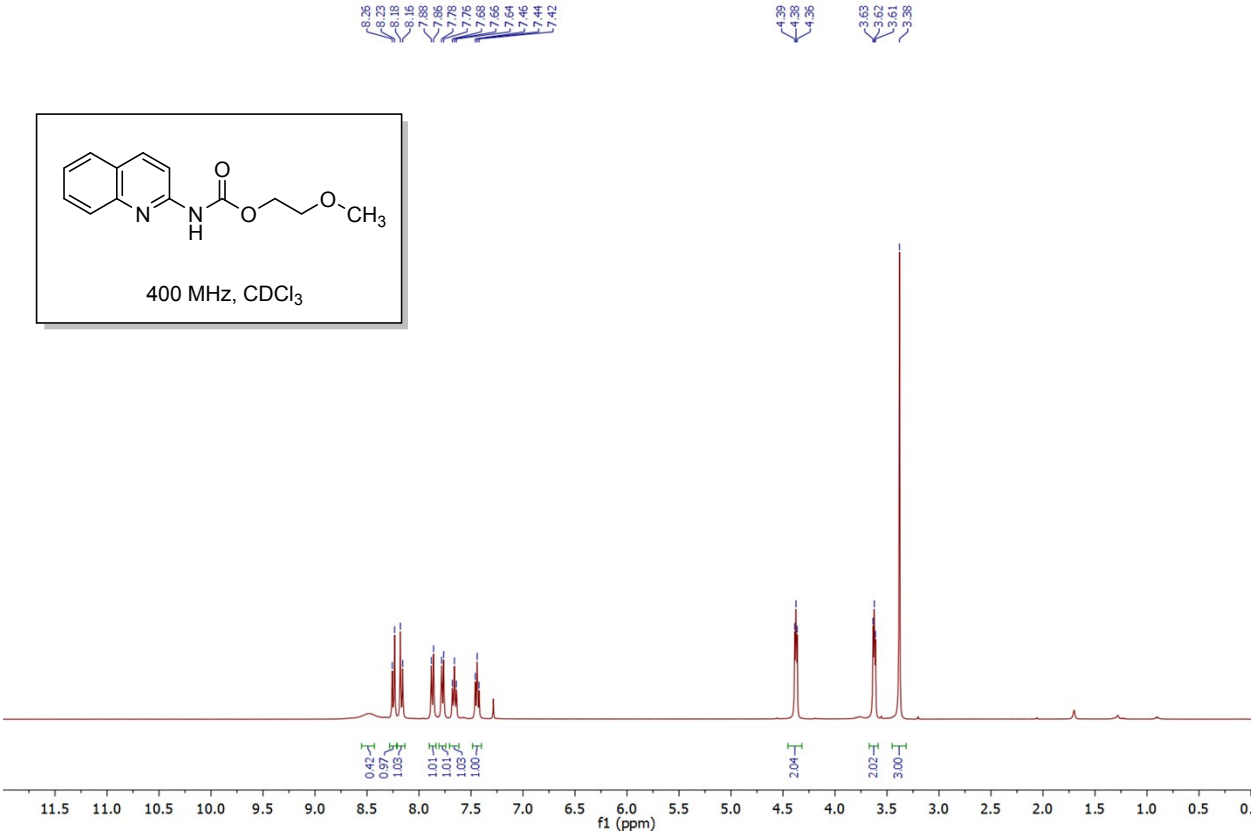


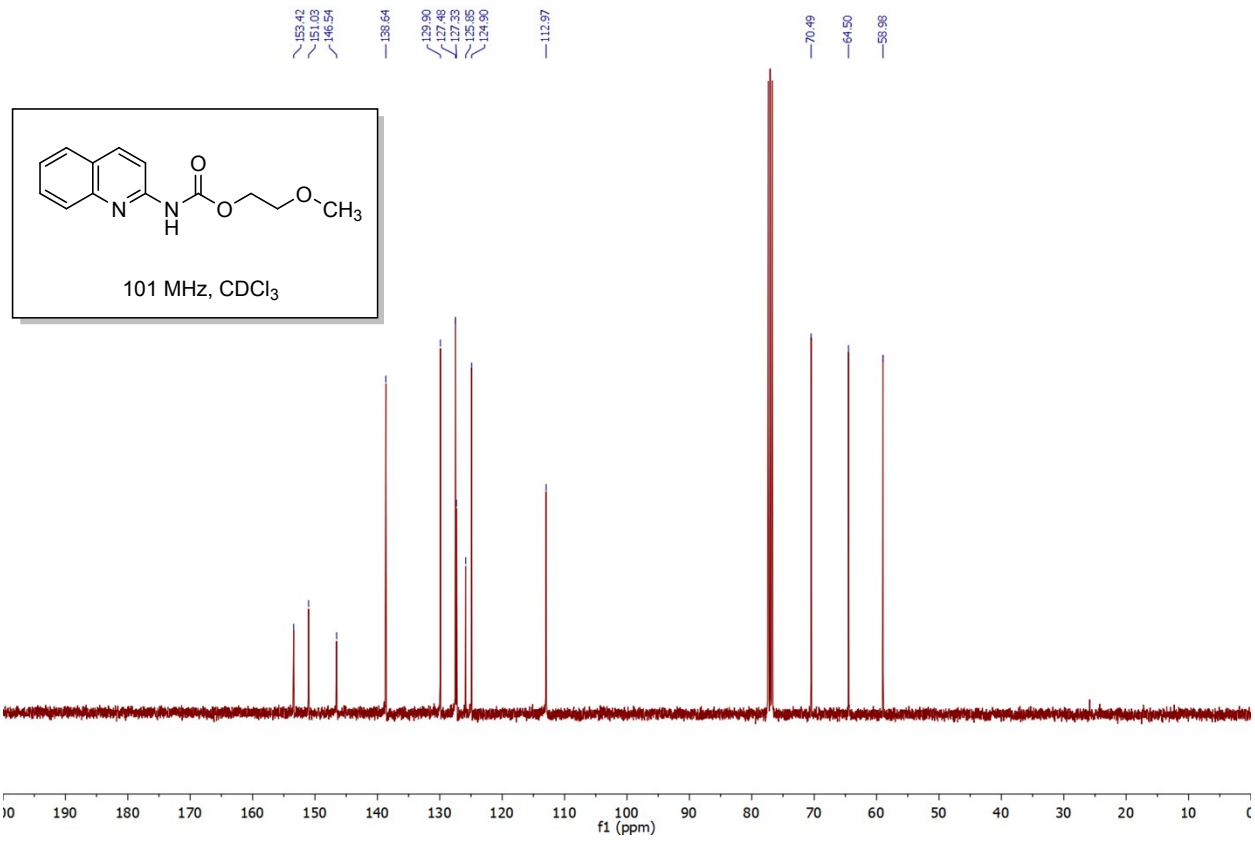
^{1}H and ^{13}C spectra of isopropyl quinolin–2–ylcarbamate **3g**.



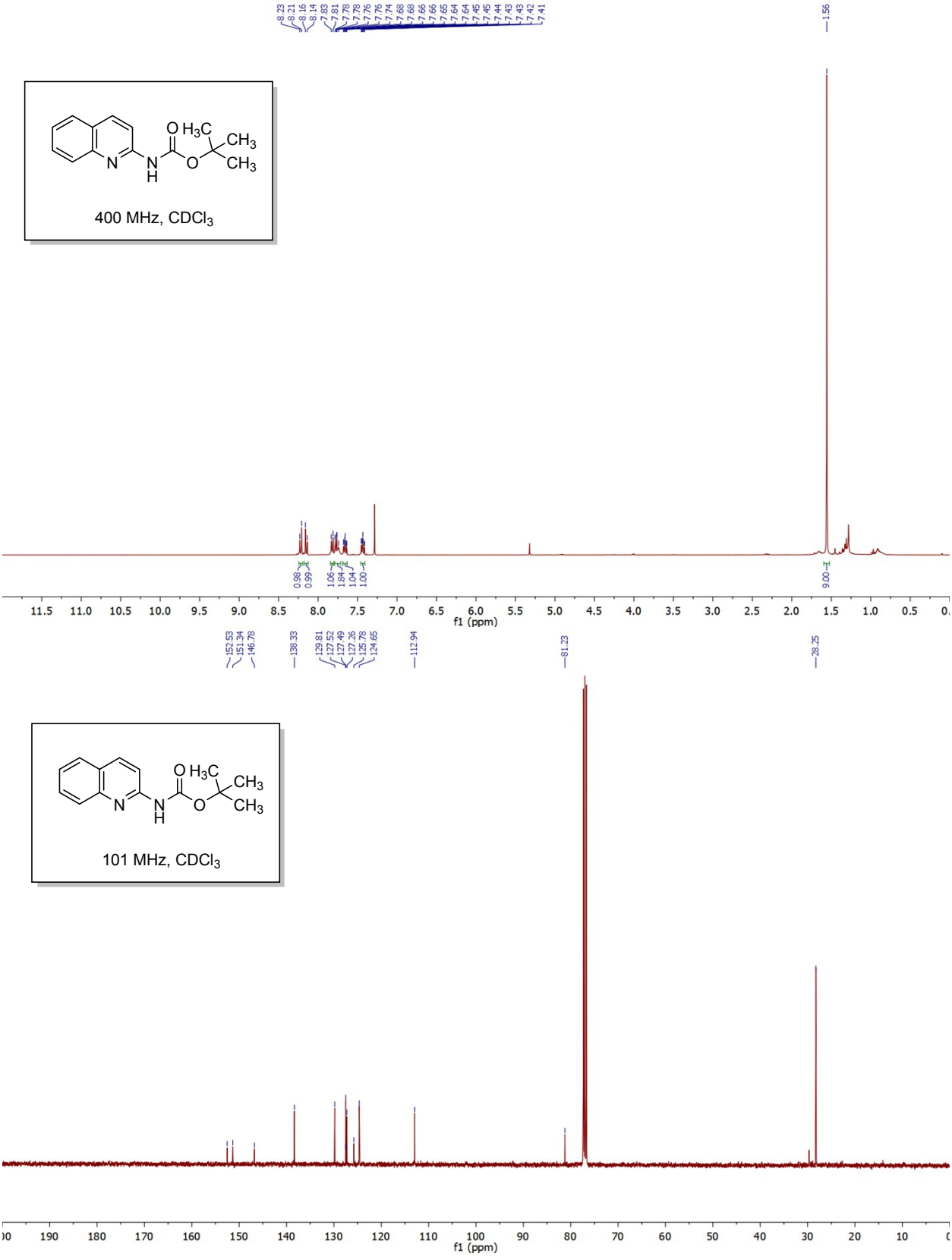


^{1}H and ^{13}C spectra of 2–methoxyethyl quinolin–2–ylcarbamate **3h**.

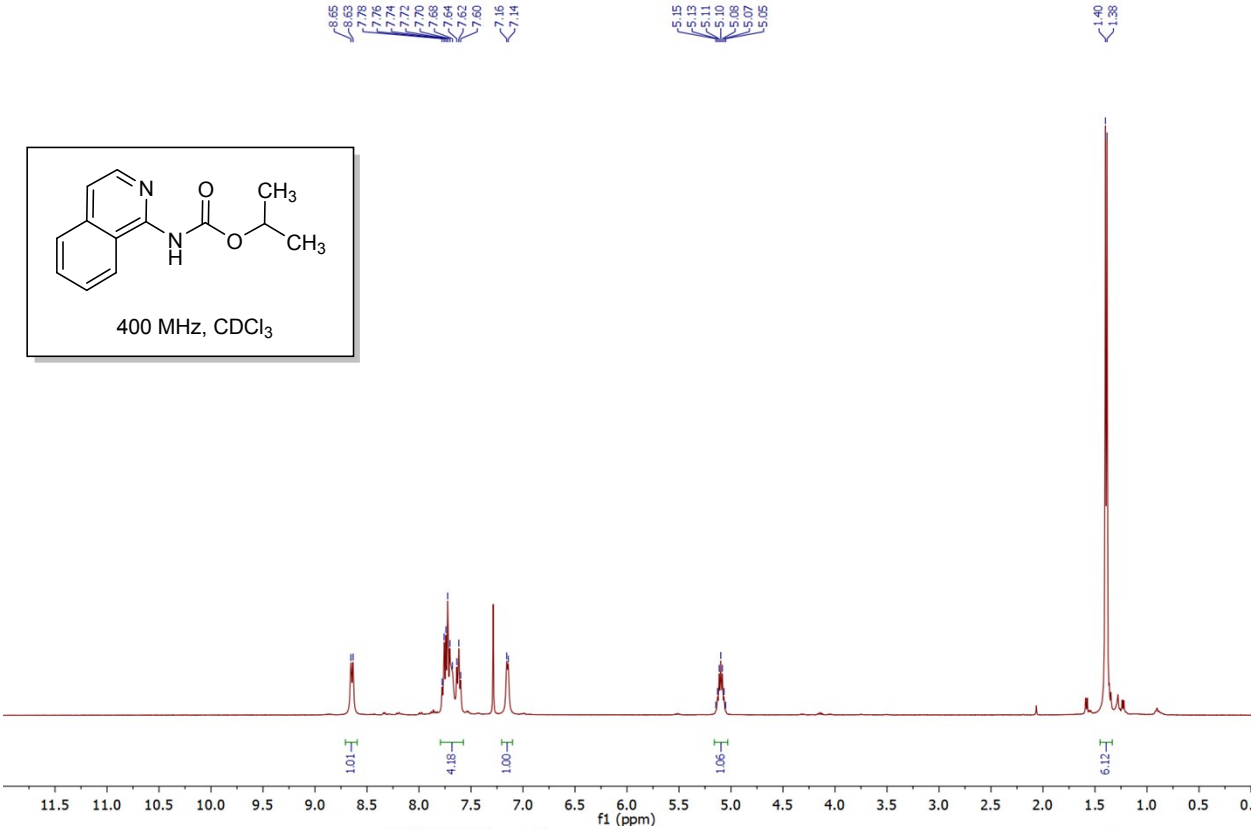


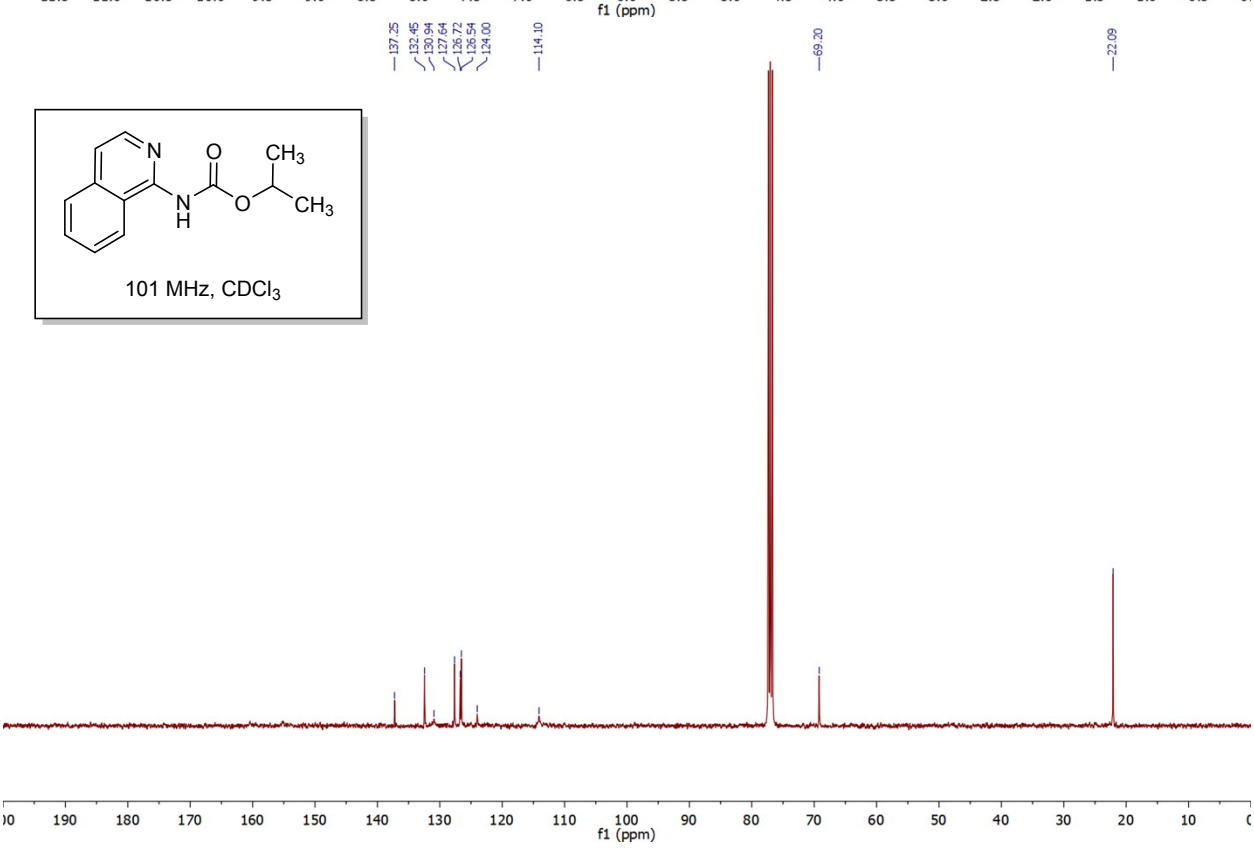

153.42
151.03
146.54
138.64
129.90
127.48
127.33
125.85
124.90
112.97
70.49
64.50
58.98
101 MHz, CDCl3
f1 (ppm)

^{1}H and ^{13}C spectra of *tert*–butyl quinolin–2–ylcarbamate **3j**.



^{1}H and ^{13}C spectra of isopropyl isoquinolin–1–ylcarbamate **3k**





5. X–ray diffraction data

Singe crystals for X-ray studying were obtained by slow evaporation of solutions of corresponding carbamates in MeOH (**2a**), $CDCl_3$ (**2i** and **2**k), and 1,2-DCE (**3b** and **3h**) at RT in air. X–ray diffraction data were collected at a Rigaku SuperNova (compounds **2a**, **2i**, **3b**) and at a Rigaku XtaLAB Synergy–S (compounds **2k and 3h**) diffractometers using Cu–Kα (λ = 0.154184 nm) radiation. The structures have been solved with the ShelXT[14] structure solution program using Intrinsic Phasing and refined with the ShelXL[15] refinement package incorporated in the OLEX2 program package[16] using Least Squares minimization. Empirical absorption correction was applied in CrysAlisPro[17] program complex using spherical harmonics, implemented in SCALE3 ABSPACK scaling algorithm. Supplementary crystallographic data for this paper have been deposited at Cambridge Crystallographic Data Centre and can be obtained free of charge *via* www.ccdc.cam.ac.uk/data_request/cif. CCDC numbers 2050683 (**2a**), 2050680 (**2i**), 2050682 (**2k**), 2050687 (**3b**), 2050685 (**3h**).

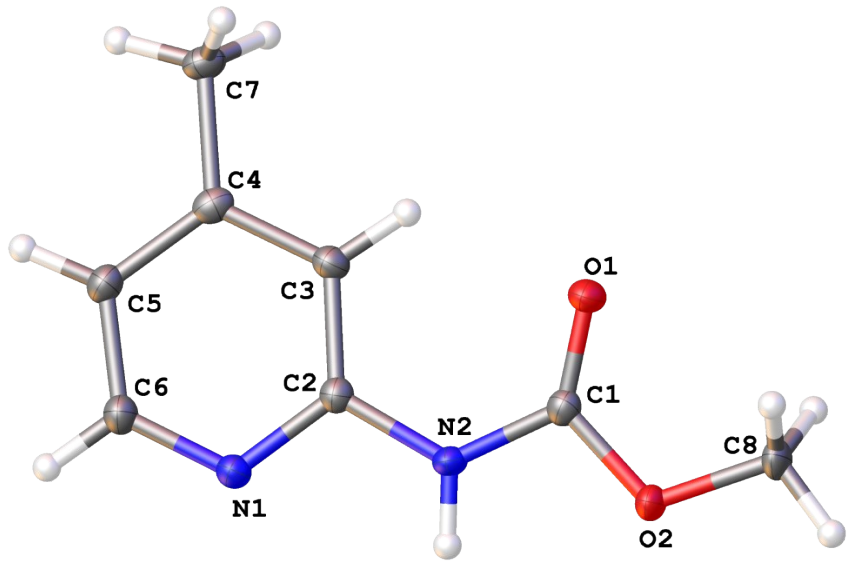


Figure S1. View of the molecular structure of **2a**. Thermal ellipsoids are drawn at the 50% probability level.

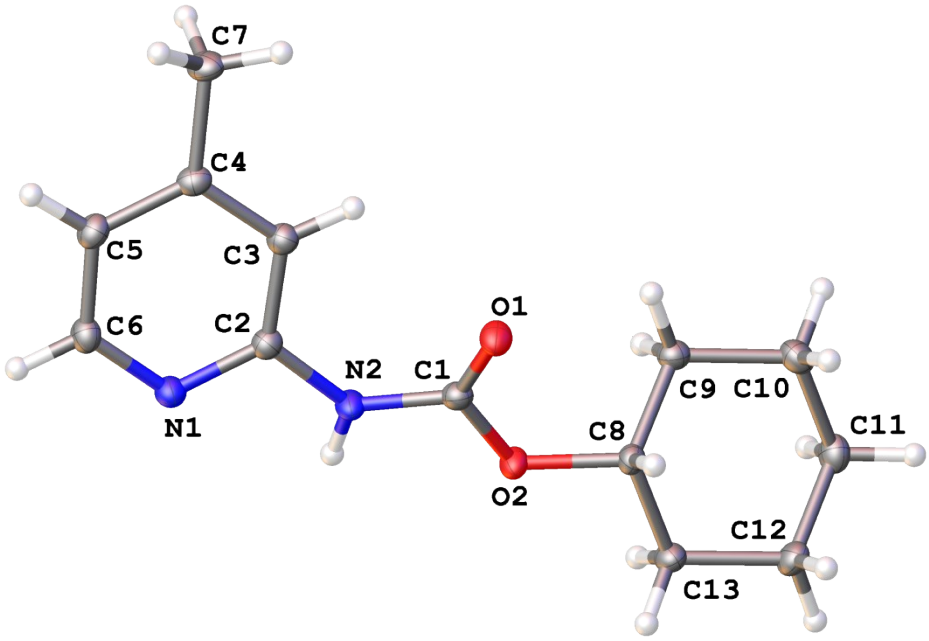


Figure S2. View of the molecular structure of **2i**. Thermal ellipsoids are drawn at the 50% probability level.

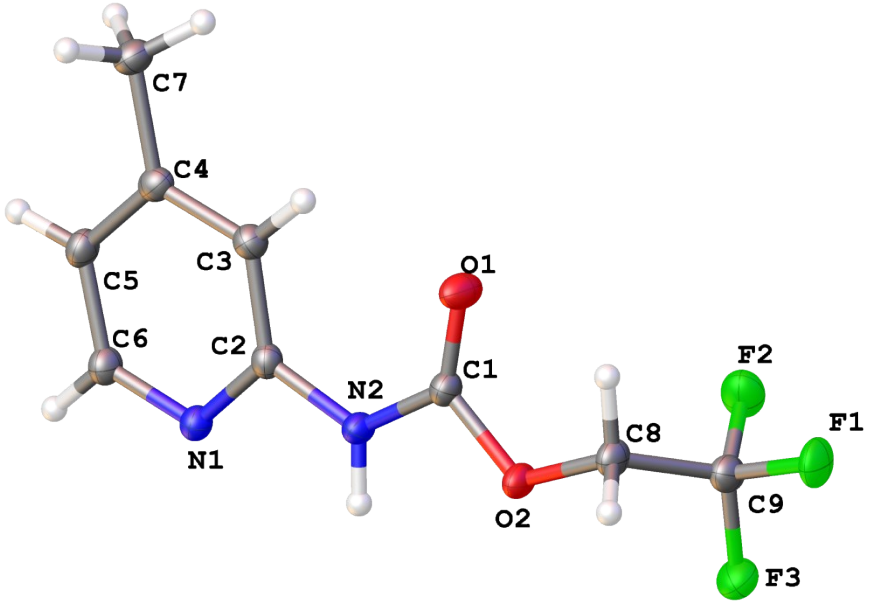


Figure S3. View of the molecular structure of **2k**. Thermal ellipsoids are drawn at the 50% probability level.

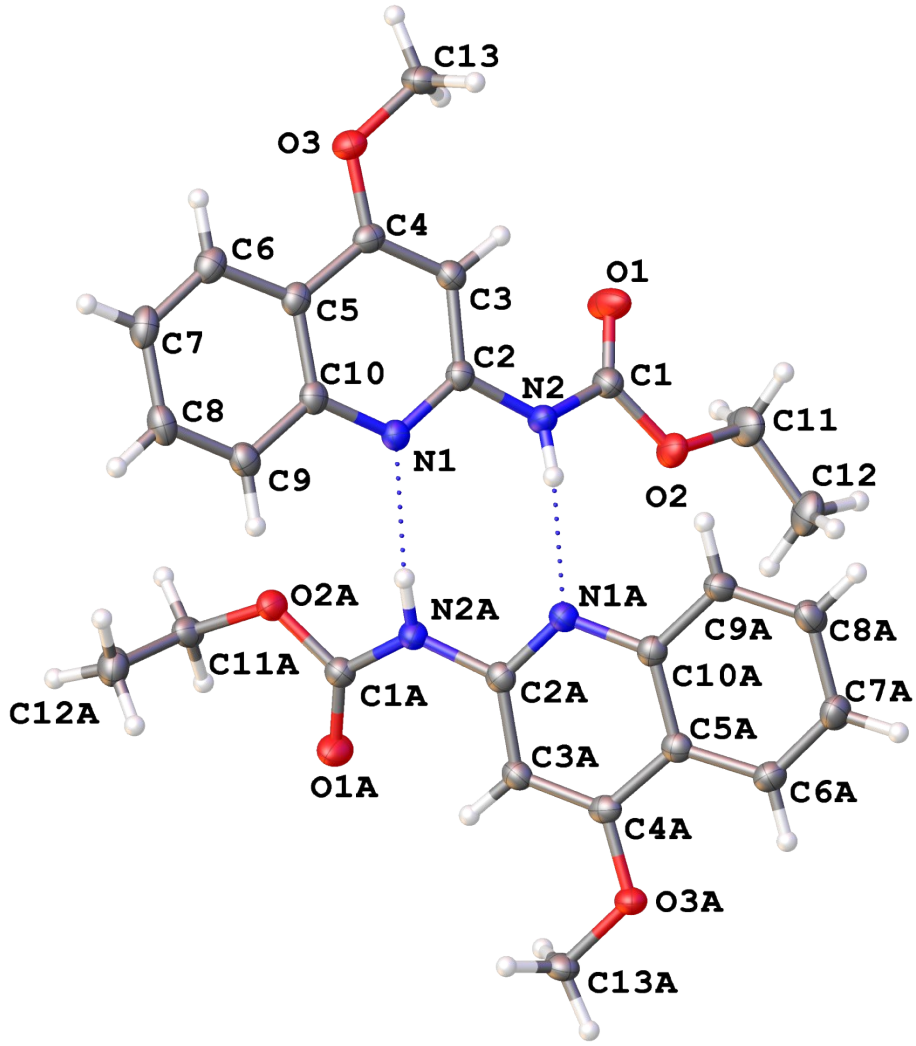


Figure S4. View of the molecular structure of **3b**. Thermal ellipsoids are drawn at the 50% probability level.

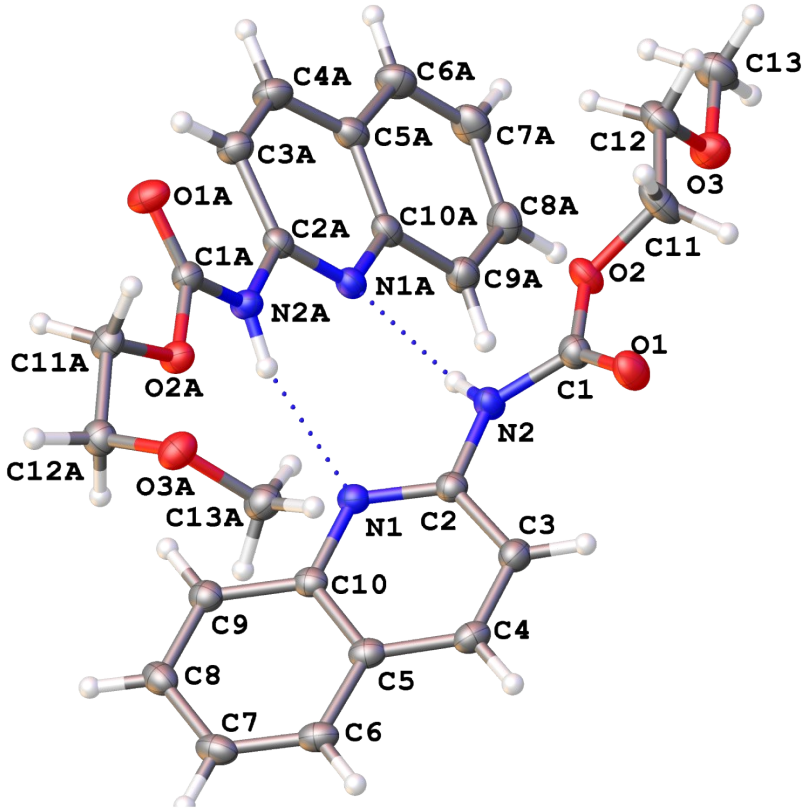


Figure S5. View of the molecular structure of **3h**. Thermal ellipsoids are drawn at the 50% probability level.

Table S1. Crystal data and structure refinement parameters for **2a**, **2i,** and **2k**.

Compound	**2a**	**2i**	**2k**
Identification code	KKG–167	BSC–296	BSC–297
CCDC number	2050683	2050680	2050682
Empirical formula	$C_8H_{10}N_2O_2$	$C_{13}H_{18}N_2O_2$	$C_9H_9F_3N_2O_2$
Formula weight	166.18	234.29	234.18
Temperature, K	100(2)	100(2)	100(2)
Crystal system	monoclinic	monoclinic	triclinic
Space group	$P2_1/c$	$P2_1/n$	P–1
a, Å	5.9064(3)	8.3092(2)	4.8119(2)
b, Å	18.7809(8)	12.0788(4)	10.5336(4)
c, Å	7.4306(4)	11.8379(3)	10.7314(4)
α, °	90	90	114.870(4)
β, °	97.589(5)	92.429(3)	94.157(4)
γ, °	90	90	90.003(3)
Volume, $Å^3$	817.04(7)	1187.05(6)	491.92(4)
Z	4	4	2
$\rho_{calc}g$, cm^3	1.351	1.311	1.581
μ, mm^{-1}	0.822	0.719	1.327
F(000)	352.0	504.0	240.0
Crystal size, mm^3	0.18 × 0.13 × 0.12	0.17 × 0.15 × 0.12	0.17 × 0.17 × 0.11
Radiation	CuKα (λ = 1.54184)	CuKα (λ = 1.54184)	CuKα (λ = 1.54184)
2Θ range for data collection, °	9.418 to 152.132	10.468 to 152.298	9.112 to 154.646
Index ranges	$-7 \le h \le 6$, $-23 \le k \le 22$, $-9 \le l \le 8$	$-8 \le h \le 10$, $-15 \le k \le 15$, $-14 \le l \le 14$	$-6 \le h \le 5$, $-12 \le k \le 13$, $-13 \le l \le 13$
Reflections collected	3366	10645	6782
Independent reflections	1661 [R_{int} = 0.0232, R_{sigma} = 0.0304]	2462 [R_{int} = 0.0425, R_{sigma} = 0.0317]	2033 [R_{int} = 0.0372, R_{sigma} = 0.0310]
Data/restraints/parameters	1661/0/111	2462/0/155	2033/0/146
Goodness–of–fit on F^2	1.093	1.048	1.096
Final R indexes [I>=2σ (I)]	R_1 = 0.0411, wR_2 = 0.1095	R_1 = 0.0382, wR_2 = 0.0975	R_1 = 0.0366, wR_2 = 0.1021
Final R indexes [all data]	R_1 = 0.0501, wR_2 = 0.1159	R_1 = 0.0465, wR_2 = 0.1032	R_1 = 0.0385, wR_2 = 0.1041
Largest diff. peak/hole/ $eÅ^{-3}$	0.23/–0.27	0.35/–0.20	0.25/–0.29

Table S2. Crystal data and structure refinement parameters for **3b** and **3h**.

Compound	**3b**	**3h**
Identification code	16831_UCM–32	16831_UCM–26
CCDC number	2050687	2050685
Empirical formula	$C_{13}H_{14}N_2O_3$	$C_{13}H_{14}N_2O_3$
Formula weight	246.26	246.26
Temperature, K	100(2)	100(2)
Crystal system	Triclinic	monoclinic
Space group	P–1	$P2_1/n$
a, Å	7.9429(2)	11.9095(2)
b, Å	12.4375(2)	7.96230(10)
c, Å	12.8747(3)	25.3411(4)
α, °	87.653(2)	90
β, °	74.488(2)	95.9570(10)
γ, °	87.068(2)	90
Volume, $Å^3$	1223.46(5)	2390.04(6)
Z	4	8
ρ_{calc}g, cm^3	1.337	1.369
μ, mm^{-1}	0.796	0.815
F(000)	520.0	1040.0
Crystal size, mm^3	0.15 × 0.14 × 0.11	0.19 × 0.12 × 0.1
Radiation	Cu Kα (λ = 1.54184)	Cu Kα (λ = 1.54184)
2Θ range for data collection, °	7.12 to 141.658	7.014 to 155.682
Index ranges	$-9 \le h \le 8$, $-15 \le k \le 15$, $-15 \le l \le 15$	$-15 \le h \le 14$, $-10 \le k \le 8$, $-32 \le l \le 31$
Reflections collected	24817	48959
Independent reflections	4672 [R_{int} = 0.0374, R_{sigma} = 0.0230]	4990 [R_{int} = 0.0473, R_{sigma} = 0.0228]
Data/restraints/parameters	4672/0/330	4990/0/327
Goodness–of–fit on F^2	1.085	1.068
Final R indexes [I>=2σ (I)]	R_1 = 0.0368, wR_2 = 0.0985	R_1 = 0.0383, wR_2 = 0.0968
Final R indexes [all data]	R_1 = 0.0404, wR_2 = 0.1021	R_1 = 0.0415, wR_2 = 0.0992
Largest diff. peak/hole/ $eÅ^{-3}$	0.24/–0.22	0.27/–0.33

6. DFT calculations

All computations were carried out at the DFT/HF hybrid level of theory using hybrid exchange functional B3LYP by using GAUSSIAN2003 program packages.[18] The geometries optimization were performed using the 6–311+G(2d,2p) basis set (standard 6–311G basis set added with polarization (d,p) and diffuse functions). Optimizations were performed on all degrees of freedom and solvent phase optimized structures were verified as true minima with no imaginary frequencies. The Hessian matrix was calculated analytically for the optimized structures in order to prove the location of correct minima and to estimate the thermodynamic parameters. Solvent–phase calculations used the Polarizable Continuum Model (PCM, solvent – ethanol).

Calculated energy for starting urea **1d**: E(B3LYP) = –667.937981796 h, G^{298} = –667.725729 h, μ=3.93 D.

Table S3. Cartesian coordinates for the optimized structure of urea **1d**, Å.

N	atom	x	y	z
1	N	2.787914	–1.196915	–0.532415
2	C	2.009452	–0.214563	–0.062091
3	C	2.527871	0.900541	0.609958
4	C	3.900672	0.983354	0.774111
5	C	4.720819	–0.030424	0.282563
6	C	4.110701	–1.099187	–0.356021
7	N	0.640989	–0.443122	–0.241921
8	C	–0.347700	0.534195	–0.352591
9	O	–0.066139	1.733816	–0.411153
10	N	–1.632298	0.076972	–0.379639
11	C	–2.061010	–1.307088	–0.153687
12	C	–3.212506	–1.367662	0.856268
13	C	–4.367847	–0.446720	0.457522
14	C	–3.858018	0.978651	0.229336
15	C	–2.708091	0.993042	–0.777340
16	H	4.328233	1.835809	1.290942
17	H	1.871107	1.668970	0.985229
18	H	4.703074	–1.918991	–0.752076
19	H	5.797308	0.003600	0.394675
20	H	0.461875	–1.357160	–0.644728

21	H	–1.229996	–1.895625	0.222440
22	H	–2.378998	–1.744262	–1.107396
23	H	–3.549858	–2.403275	0.933052
24	H	–2.832673	–1.077051	1.839585
25	H	–5.142937	–0.458962	1.225761
26	H	–4.828492	–0.818812	–0.463509
27	H	–4.658399	1.621690	–0.142368
28	H	–3.512157	1.405142	1.175123
29	H	–2.282821	1.985370	–0.877042
30	H	–3.078457	0.679655	–1.760805

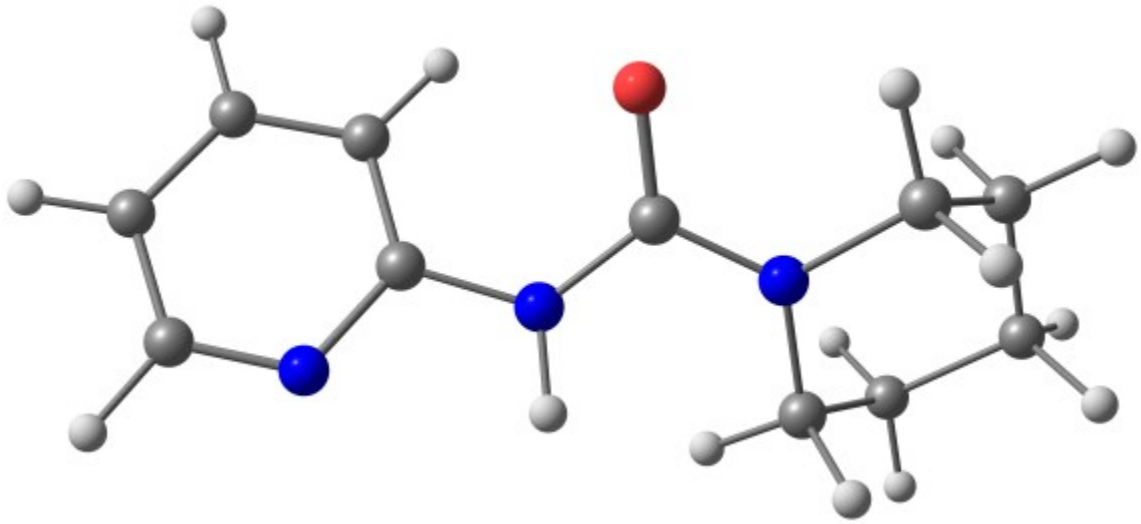


Figure S6. Optimized structure of urea **1d**.

Calculated energy for intermediate **I1** (Scheme 6): E(B3LYP) = –415.911526522 h, G^{298} = –415.852726 h, μ=5.24 D.

Table S4. Cartesian coordinates for the optimized structure of intermediate **I1**, Å.

N	atom	x	y	z
1	C	–2.238653	–0.893526	0.000349
2	C	–2.537870	0.465559	0.000256
3	C	–1.484504	1.371348	–0.000077
4	N	–0.197022	1.005570	–0.000379
5	C	0.069596	–0.300996	–0.000322
6	C	–0.910333	–1.292436	0.000073
7	H	–3.029584	–1.635391	0.000623
8	H	–3.561664	0.819212	0.000439
9	H	–1.674349	2.440612	–0.000138

10	H	–0.625593	–2.337214	0.000126
11	N	1.414851	–0.697345	–0.000731
12	C	2.458165	–0.091088	–0.000099
13	O	3.528498	0.375255	0.000705

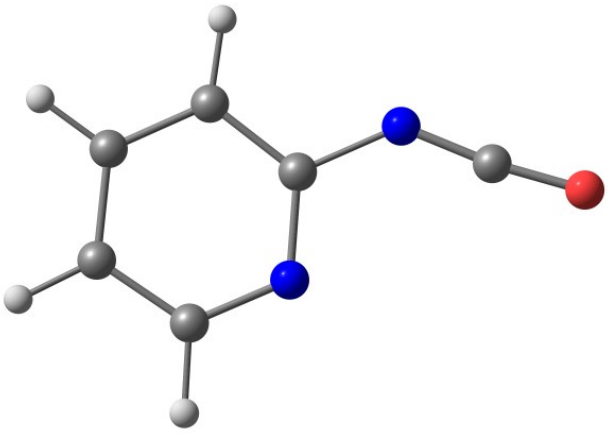


Figure S7. Optimized structure of intermediate **I1**.

Calculated energy for intermediate **I2** (Scheme 6): E(B3LYP) = –822.998020007 h, G^{298} = –822.709797 h, μ=6.43 D.

Table S5. Cartesian coordinates for the optimized structure of intermediate **I2**, Å.

N	atom	x	y	z
1	C	–1.738352	–0.920327	–0.812177
2	C	–1.817140	–0.468522	0.528639
3	N	–2.961345	–0.525434	1.213615
4	C	–4.043019	–1.052204	0.621639
5	C	–4.056793	–1.531602	–0.675168
6	C	–2.867212	–1.450546	–1.404060
7	N	–0.776363	0.103829	1.248320
8	C	0.592930	0.532758	1.136822
9	O	0.929258	1.360110	2.000362
10	N	1.575652	–0.242495	0.534346
11	C	2.962397	0.212130	0.635691
12	C	3.781747	–0.238228	–0.576268
13	C	3.678128	–1.753183	–0.785272
14	C	2.209389	–2.174222	–0.874394
15	C	1.425390	–1.685027	0.347840
16	O	0.136786	1.696862	–0.536959
17	C	–0.271756	3.073242	–0.310018

18	C	–0.786136	3.711065	–1.586487
19	H	–2.826259	–1.795308	–2.431678
20	H	–0.828070	–0.827986	–1.375313
21	H	–4.943273	–1.080405	1.228795
22	H	–4.962442	–1.941686	–1.103411
23	H	–1.056804	0.380427	2.189446
24	H	0.380904	–1.918393	0.226392
25	H	1.808356	–2.206786	1.238202
26	H	2.115536	–3.260292	–0.946458
27	H	1.761775	–1.748320	–1.778193
28	H	4.225438	–2.054660	–1.680311
29	H	4.147267	–2.265091	0.061349
30	H	4.821110	0.065250	–0.435757
31	H	3.415518	0.278905	–1.468977
32	H	2.968510	1.294063	0.736587
33	H	3.420483	–0.192823	1.549433
34	H	0.569409	3.619954	0.113498
35	H	–1.058127	3.004996	0.431597
36	H	–1.110460	4.735629	–1.390994
37	H	–0.005206	3.750216	–2.347128
38	H	–1.634338	3.154036	–1.981683
39	H	0.979268	1.669193	–0.997315

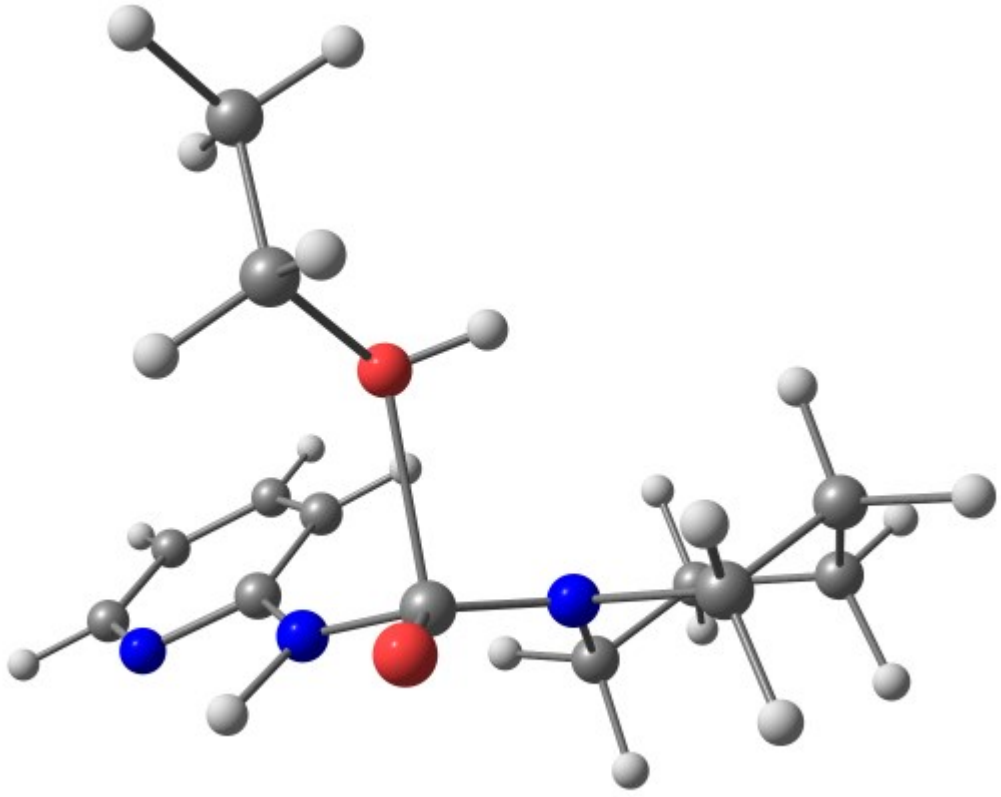


Figure S8. Optimized structure of intermediate **I2**.

Calculated energy for intermediate **I3** (Scheme 6): E(B3LYP) = –822.998020007 h, G^{298} = –822.709797 h, μ=6.43 D.

Table S6. Cartesian coordinates for the optimized structure of intermediate **I3**, Å.

N	atom	x	y	z
1	C	–2.228857	–0.782101	0.901647
2	C	–1.974992	0.014289	–0.232347
3	N	–2.930478	0.249840	–1.152139
4	C	–4.145093	–0.276684	–0.967776
5	C	–4.491526	–1.059064	0.123294
6	C	–3.497290	–1.309456	1.067630
7	N	–0.766814	0.612856	–0.524479
8	C	0.489287	0.686396	0.194897
9	O	0.278412	0.670682	1.590340
10	N	1.416507	–0.365562	–0.174570
11	C	2.722444	–0.274674	0.506764
12	C	3.740133	–1.197313	–0.162671
13	C	3.242174	–2.644327	–0.184896
14	C	1.840563	–2.711487	–0.796001
15	C	0.884805	–1.733080	–0.110826
16	O	1.131851	1.875240	–0.232030
17	C	0.590186	3.114312	0.246279
18	C	1.351176	4.243863	–0.419032
19	H	–3.707130	–1.922630	1.937795
20	H	–1.455220	–0.979128	1.625391
21	H	–4.875768	–0.054248	–1.740762
22	H	–5.492304	–1.458626	0.224728
23	H	–0.725399	1.021671	–1.455414
24	H	–0.079076	–1.761285	–0.610332
25	H	0.731092	–2.049297	0.931899
26	H	1.431244	–3.720822	–0.713830
27	H	1.890706	–2.468501	–1.861018
28	H	3.933727	–3.283083	–0.738191
29	H	3.207540	–3.029245	0.839650
30	H	4.690238	–1.124080	0.371321
31	H	3.916313	–0.851766	–1.185155
32	H	3.059903	0.756141	0.463057
33	H	2.625610	–0.550779	1.566486
34	H	0.701013	3.168839	1.331766
35	H	–0.475032	3.174357	0.004789

36	H	0.971872	5.202862	–0.064529
37	H	2.414072	4.188144	–0.183820
38	H	1.234523	4.208182	–1.502217
39	H	–0.452587	1.261941	1.848452

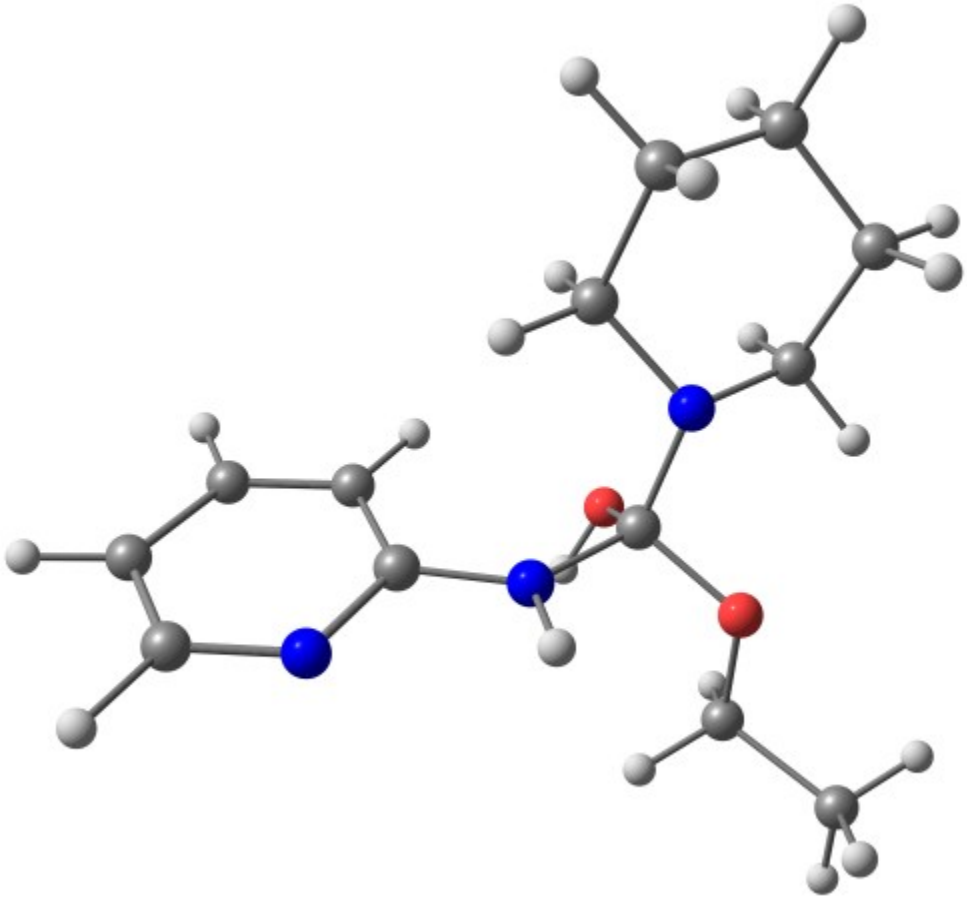


Figure S9. Optimized structure of intermediate **I3**.

Calculated energy for carbamate **2n** (Scheme 6): E(B3LYP) = –571.054236896 h, G^{298} = –570.917572 h, μ=0.59 D.

Table S7. Cartesian coordinates for the optimized structure of intermediate **2n**, Å.

N	atom	x	y	z
1	C	–3.953419	0.050140	0.001754
2	C	–3.136428	1.177112	–0.000264
3	C	–1.757252	1.032267	–0.001961
4	C	–1.236604	–0.267166	–0.001317
5	N	–2.011022	–1.358519	0.000115

6	C	–3.337346	–1.193181	0.001507
7	N	0.130262	–0.566907	–0.003574
8	C	1.193227	0.290940	–0.000224
9	O	2.339873	–0.419021	0.000456
10	C	3.570981	0.352168	0.001242
11	C	4.721672	–0.628475	0.000147
12	O	1.140523	1.506953	0.001510
13	H	–3.569144	2.171670	–0.000540
14	H	–1.101518	1.886840	–0.003870
15	H	–3.928731	–2.104228	0.003155
16	H	–5.033396	0.129484	0.003251
17	H	0.347317	–1.565119	–0.002356
18	H	3.580445	0.987710	0.886095
19	H	3.580370	0.989602	–0.882256
20	H	4.697539	–1.262017	–0.886255
21	H	4.697373	–1.264163	0.885016
22	H	5.662914	–0.078078	0.000936

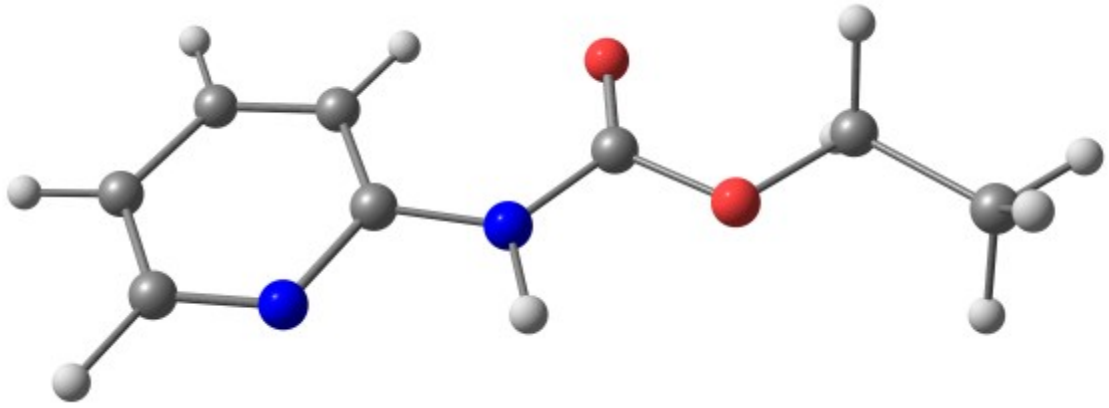


Figure S10. Optimized structure of carbamate **2n**.

7. The reaction mechanism experimental study

Urea 1c (10 mg, 1 eq) and phenyl isocyanate (0.02 mL, 4 eq) were mixed in toluene (1 mL) and stirred at 120 °C for 1 hour. A white precipitate formed. The reaction mixture was cooled to room temperature and the precipitate was filtered off. The filtrate was evaporated with a rotary evaporator, dissolved in $CDCl_3$, and analyzed by ^1H NMR spectroscopy and high-resolution mass spectrometry.

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