Supporting Information

Ruthenium-catalyzed site-selective C-H arylation of 2-pyridones and 1-isoquinolinones

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Experimental

General Information

All purchased chemicals were used without further purification. All reactions were performed under open air. Analytical thin layer chromatography was performed using TLC pre-coated silica gel 60 F254 MERCK (20x20 cm). TLC plates were visualized by exposing UV light or by iodine vapors. Organic solutions were concentrated by rotatory evaporation on BUCHI-Switzerland; R-120 rotatory evaporator and vacuum pump V-710. Flash column chromatography was performed on Merck flash silica gel 100-200 mesh size. Melting points of solid compounds were determined on BUCHI-B-545-Switzerland melting point apparatus. ^{1}H and ^{13}C NMR spectra were recorded with BRUKER 500 and 400 MHz NMR instruments. Proton and carbon magnetic resonance spectra (^{1}H NMR and ^{13}C NMR) were recorded using tetramethylsilane (TMS) in the solvent of $CDCl_3$ as the internal standard (^{1}H NMR: TMS at 0.00 ppm, $CDCl_3$ at 7.24 ppm; ^{13}C NMR: $CDCl_3$ at 77.0 ppm) or were recorded using tetramethylsilane (TMS) in the solvent of DMSO-d_6 as the internal standard (^{1}H NMR: TMS at 0.00 ppm, DMSO-d_6 at 2.50 ppm; ^{13}C NMR: DMSO-d_6 at 40.0 ppm) or were recorded using tetramethylsilane (TMS) in the solvent of MeOD as the internal standard (^{1}H NMR: TMS at 0.00 ppm, MeOD at 3.31, 4.78 ppm; ^{13}C NMR: MeOD at 49.15 ppm). All the NMR spectra were processed in MestReNova. HRMS spectra were recorded with LCMS-QTOF Module No. G6540 A (UHD) instrument.

General procedure for selective C6-arylation of 2-pyridones and C3-arylation of 1-isoquinolones with boronic acids:

An oven-dried sealed tube equipped with a magnetic stirring bar was charged with 1-(2-pyridyl)-2-pyridone (50 mg, 0.29 mmol) in 1.5 mL of dry dioxane. The reaction mixture was bubbled for 10 min. with nitrogen followed by the addition of $[RuCl_2(p\text{-cym})]_2$ (8.9 mg, 0.0145 mmol), Cu_2O (41.5 mg, 0.29 mmol), AgOTf (74.5 mg, 0.29 mmol) and phenylboronic acid (106 mg, 0.87 mmol). The tube was fitted with teflon screw cap under a nitrogen flow. The reaction mixture was stirred at 100 ^{o}C for 24 h. The progress of the reaction was monitored by TLC and after completion, the mixture was allowed to cool down to room temperature. The crude reaction mixture was diluted with 15 mL of water and extracted with ethyl acetate (3x10 mL). The combined organic layers were dried over Na_2SO_4 and concentrated under vacuum. The crude product was purified by flash column chromatography to afford the desired product **2a**. By following the above general procedure, C6-arylated 2-pyridones (**2a-n**) and C3-arylated 1-isoquinolinones (**4a-j**) were synthesized.

6-Phenyl-2*H*-[1,2'-bipyridin]-2-one (2a):[1] Purification: $CHCl_3$/MeOH (98.5: 1.5), white solid (85% yield, 61 mg), mp. 137-139 ^{o}C; ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.29 (dd, J = 4.8, 1.1 Hz, 1H), 7.77 (td, J = 7.7, 1.9 Hz, 1H), 7.56 (dd, J = 9.3, 6.8 Hz, 1H), 7.41 (d, J = 7.9 Hz, 1H), 7.16 – 7.09 (m, 6H), 6.50 (dd, J = 9.2, 1.0 Hz, 1H), 6.27 (dd, J = 6.8, 1.0 Hz, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) δ 162.0, 151.6, 148.8, 148.6, 140.4, 137.7, 134.8, 128.5, 128.2, 127.7, 124.9, 123.4, 119.0, 107.0; HRMS (ESI): Calcd for $C_{16}H_{13}N_2O$ $[M+H]^+$: 249.1023, found: 249.1013.

6-(4-Methoxyphenyl)-2*H*-[1,2'-bipyridin]-2-one (2b):[1] Purification: $CHCl_3$/MeOH (98: 2), white solid (84% yield, 67 mg), mp. 200-202 °C; ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.37 (dd, J = 4.8, 1.1 Hz, 1H), 7.82 (td, J = 7.7, 1.9 Hz, 1H), 7.58 (dd, J = 9.2, 6.9 Hz, 1H), 7.42 (d, J = 7.9 Hz, 1H), 7.30 (ddd, J = 7.5, 4.9, 1.0 Hz, 1H), 7.07 (d, J = 8.8 Hz, 2H), 6.74 (d, J = 8.8 Hz, 2H), 6.50 (dd, J = 9.2, 1.1 Hz, 1H), 6.27 (dd, J = 6.9, 1.1 Hz, 1H), 3.67 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6) δ 162.7, 159.5, 152.4, 149.3, 149.2, 141.0, 138.4, 130.5, 127.7, 125.4, 124.0, 119.1, 113.7, 107.4, 55.5; HRMS (ESI): Calcd for $C_{17}H_{15}N_2O_2$ $[M+H]^+$: 279.1128, found: 279.1136.

6-(4-Fluorophenyl)-2*H*-[1,2'-bipyridin]-2-one (2c):[1] Purification: $CHCl_3$/MeOH (98: 2), white solid (81% yield, 62 mg), mp. 162-163 °C; ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.40 (dd, J = 4.9, 1.1 Hz, 1H), 7.88 (td, J = 7.7, 1.9 Hz, 1H), 7.65 (dd, J = 9.3, 6.8 Hz, 1H), 7.52 (d, J = 7.9 Hz, 1H), 7.35 (dd, J = 6.5, 4.9 Hz, 1H), 7.28 – 7.24 (m, 2H), 7.11 – 7.06 (m, 2H), 6.60 (dd, J = 9.3, 1.1 Hz, 1H), 6.37 (dd, J = 6.8, 1.1 Hz, 1H); ^{13}C NMR (125 MHz, DMSO-d_6) δ 162.1, 151.5, 148.7, 147.8, 140.4 (d, J = 4.6 Hz), 137.9, 131.3 (d, J = 3.2 Hz), 130.9 (d, J = 8.5 Hz), 125.0, 123.5, 119.3, 114.9, 114.7, 107.2; HRMS (ESI): Calcd for $C_{16}H_{12}FN_2O$ $[M+H]^+$: 267.0928, found: 267.0934.

6-(3-(Trifluoromethyl)phenyl)-2*H*-[1,2'-bipyridin]-2-one (2d): Purification: $CHCl_3$/MeOH (98: 2), light brown liquid (80% yield, 73 mg); ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.36 (dd, J = 4.9, 1.0 Hz, 1H), 7.89 (td, J = 7.9, 1.9 Hz, 1H), 7.68 (dd, J = 9.3, 6.8 Hz, 1H), 7.64 – 7.56 (m, 3H), 7.53 – 7.49 (m, 2H), 7.33 (dd, J = 7.0, 5.4 Hz, 1H), 6.64 (d, J = 9.3 Hz, 1H), 6.47 (d, J = 6.8 Hz, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) δ 161.9, 151.3, 148.7, 147.0, 140.4, 137.9, 135.8, 132.6, 129.1, 128.7, 128.3, 125.3 (q, J = 3.9 Hz), 125.1, 124.9 (q, J = 3.6 Hz), 123.6, 120.0, 107.5; HRMS (ESI): Calcd for $C_{17}H_{12}F_3N_2O$ $[M+H]^+$: 317.0896, found: 317.0903.

6-(3-Nitrophenyl)-2*H*-[1,2'-bipyridin]-2-one (2e): Purification: $CHCl_3$/MeOH (97: 3), yellow liquid (69% yield, 58 mg); ^{1}H NMR (400 MHz, MeOD) δ 8.31 (dd, J = 4.9, 1.1 Hz, 1H), 8.03 (ddd, J = 8.2, 2.2, 1.0 Hz, 1H), 8.00 (t, J = 1.8 Hz, 1H), 7.79 (td, J = 7.8, 1.7 Hz, 1H), 7.66 (dd, J = 9.3, 6.9 Hz, 2H), 7.56 – 7.53 (m, 1H), 7.41 (dd, J = 15.1, 7.5 Hz, 2H), 6.67 (d, J = 8.2 Hz, 1H), 6.49 (d, J = 5.8 Hz, 1H); ^{13}C NMR (125 MHz, MeOD) δ 163.7, 151.0, 148.8, 147.6, 146.7, 141.2, 138.7, 136.1, 134.8, 129.2, 124.9, 124.1, 123.7, 123.1, 120.0, 109.1; HRMS (ESI): Calcd for $C_{16}H_{12}N_3O_3$ $[M+H]^+$: 294.0873, found: 294.0879.

6-(4-Cyclopentylphenyl)-2*H*-[1,2'-bipyridin]-2-one (2f): Purification: $CHCl_3$/MeOH (98: 2), light brown liquid (78% yield, 71 mg); ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.36 (d, J = 3.7 Hz, 1H), 7.82 (td, J = 7.8, 1.7 Hz, 1H), 7.59 (dd, J = 9.2, 6.9 Hz, 1H), 7.42 (d, J = 7.9 Hz, 1H), 7.29 (dd, J = 6.6, 5.0 Hz, 1H), 7.06 (br, 4H), 6.51 (d, J = 9.2 Hz, 1H), 6.29 (d, J = 6.8 Hz, 1H), 2.91 – 2.81 (m, 1H), 1.96 – 1.86 (m, 2H), 1.74 – 1.65 (m, 2H), 1.63 – 1.55 (m, 2H), 1.45 – 1.34 (m, 2H); ^{13}C NMR (125 MHz, DMSO-d_6) δ 162.7, 152.3, 149.4, 149.2, 146.7, 141.0, 138.4, 132.8, 129.0, 126.9, 125.4, 124.0, 119.3, 107.5, 45.2, 34.3, 25.4; HRMS (ESI): Calcd for $C_{21}H_{21}N_2O$ $[M+H]^+$: 317.1649, found: 317.1652.

6-(2,5-Dimethoxyphenyl)-2*H*-[1,2'-bipyridin]-2-one (2g): Purification: $CHCl_3$/MeOH (98: 2), light brown liquid (70% yield, 62 mg); ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.25 (d, J = 3.5 Hz, 1H), 7.79 (t, J = 7.0 Hz, 1H), 7.57 (dd, J = 9.2, 6.9 Hz, 1H), 7.38 (d, J = 8.0 Hz, 1H), 7.23 (dd, J = 6.6, 5.1 Hz, 1H), 6.76 (d, J = 6.9 Hz, 2H), 6.65 (d, J = 9.5 Hz, 1H), 6.52 (d, J = 8.5 Hz, 1H), 6.24 (d, J = 5.9 Hz, 1H), 3.63 (s, 3H), 3.49 (s, 3H); ^{13}C NMR (125 MHz, DMSO-d_6) δ 162.5, 152.6, 152.0, 148.5, 146.6, 141.1, 141.0,

137.4, 125.0, 124.6, 123.8, 119.6, 116.9, 115.7, 112.0, 107.8, 55.9, 55.7; HRMS (ESI): Calcd for $C_{18}H_{17}N_2O_3$ $[M+H]^+$: 309.1234, found: 309.1241.

6-(Benzo[d][1, 3]dioxol-5-yl)-2*H*-[1,2'-bipyridin]-2-one (2h): Purification: $CHCl_3$/MeOH (98: 2), light brown liquid (81% yield, 68 mg); ^1H NMR (400 MHz, DMSO-d_6) δ 8.39 (dd, J = 4.8, 1.0 Hz, 1H), 7.84 (td, J = 7.7, 1.8 Hz, 1H), 7.57 (dd, J = 9.2, 6.9 Hz, 1H), 7.44 (d, J = 7.9 Hz, 1H), 7.31 (dd, J = 7.0, 5.3 Hz, 1H), 6.72 (dd, J = 9.7, 4.8 Hz, 2H), 6.65 (dd, J = 8.0, 1.7 Hz, 1H), 6.50 (d, J = 9.2 Hz, 1H), 6.28 (d, J = 6.8 Hz, 1H), 5.95 (s, 2H); ^{13}C NMR (100 MHz, DMSO-d_6) δ 162.1, 151.8, 148.7, 148.5, 147.1, 146.6, 140.4, 137.9, 128.6, 124.9, 123.5, 123.0, 118.9, 109.0, 107.7, 107.0, 101.2; HRMS (ESI): Calcd for $C_{17}H_{13}N_2O_3$ $[M+H]^+$: 293.0921, found: 293.0932.

6-(Thiophen-3-yl)-2*H*-[1,2'-bipyridin]-2-one (2i): Purification: $CHCl_3$/MeOH (98: 2), white semi solid (68% yield, 50 mg); ^1H NMR (400 MHz, MeOD) δ 8.47 (dd, J = 4.9, 1.2 Hz, 1H), 7.88 (td, J = 7.8, 1.8 Hz, 1H), 7.68 (dd, J = 9.2, 7.0 Hz, 1H), 7.42 (dd, J = 6.7, 5.0 Hz, 1H), 7.37 (d, J = 8.0 Hz, 1H), 7.28 (dd, J = 3.0, 1.3 Hz, 1H), 7.22 (dd, J = 5.0, 3.0 Hz, 1H), 6.74 (dd, J = 5.1, 1.3 Hz, 1H), 6.65 (d, J = 9.2 Hz, 1H), 6.57 (d, J = 7.0 Hz, 1H); ^{13}C NMR (100 MHz, MeOD) δ 167.9, 155.5, 152.5, 148.5, 145.3, 142.7, 138.5, 131.2, 130.2, 129.4, 128.3, 128.1, 122.4, 112.4; HRMS (ESI): Calcd for $C_{14}H_{11}N_2OS$ $[M+H]^+$: 255.0587, found: 255.0593.

3-Phenyl-6-(*p*-tolyl)-2*H*-[1,2'-bipyridin]-2-one (2j): Purification: Hexane/EtOAc (60: 40), white semi solid (77% yield, 52 mg), ^1H NMR (400 MHz, MeOD) δ 8.31 (dd, J = 4.9, 1.0 Hz, 1H), 7.71 (dd, J = 7.5, 2.1 Hz, 2H), 7.60 (d, J = 7.1 Hz, 2H), 7.33 – 7.27 (m, 3H), 7.26 – 7.21 (m, 2H), 6.99 (d, J = 8.2 Hz, 2H), 6.91 (d, J = 7.9 Hz, 2H), 6.44 (d, J = 7.3 Hz, 1H), 2.13 (s, 3H); ^{13}C NMR (100 MHz, MeOD) δ 164.1, 153.5, 150.1, 149.9, 140.6, 140.2, 140.1, 137.8, 133.2, 131.6, 130.1, 129.8, 129.7, 129.2, 128.9, 126.4, 125.2, 110.0, 21.1; HRMS (ESI): Calcd for $C_{23}H_{19}N_2O$ $[M+H]^+$: 339.1492, found: 339.1490.

6-(4-Bromophenyl)-4-methyl-2H-[1,2'-bipyridin]-2-one (2k): Purification: Hexane/EtOAc (60: 40), colourless liquid (72% yield, 65 mg); ^1H NMR (400 MHz, MeOD) δ 8.38 (d, J = 4.7 Hz, 1H), 7.84 (t, J = 7.7 Hz, 2H), 7.37 (d, J = 8.0 Hz, 1H), 7.35 (d, J = 8.3 Hz, 2H), 7.10 (d, J = 8.4 Hz, 2H), 6.50 (s, 1H), 6.37 (s, 1H), 2.33 (s, 3H); ^{13}C NMR (125 MHz, MeOD) δ 163.9, 153.8, 151.2, 148.6, 147.0, 138.6, 133.7, 130.9, 130.6, 124.9, 124.0, 122.7, 117.3, 111.3, 20.1; HRMS (ESI): Calcd for $C_{17}H_{14}BrN_2O$ $[M+H]^+$: 341.0284, found: 341.0284.

5-Chloro-6-phenyl-2*H*-[1,2'-bipyridin]-2-one (2l): Purification: Hexane/Acetone (60: 40), white solid (65% yield, 44 mg), mp. 169-172 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 8.39 (dd, J = 4.8, 1.0 Hz, 1H), 7.63 (td, J = 7.7, 1.8 Hz, 1H), 7.53 (d, J = 9.8 Hz, 1H), 7.21 (br, 4H), 7.14 (d, J = 3.2 Hz, 1H), 7.13 – 7.11 (m, 2H), 6.71 (d, J = 9.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.8, 151.7, 149.2, 145.2, 141.8, 137.8, 132.3, 128.9, 127.9, 124.3, 123.4, 121.5, 112.3; HRMS (ESI): Calcd for $C_{16}H_{12}ClN_2O$ $[M+H]^+$: 283.0633, found: 283.0630.

5-Chloro-6-(4-methoxyphenyl)-2*H*-[1,2'-bipyridin]-2-one (2m): Purification: Hexane/Acetone (60: 40), white solid (61% yield, 46 mg), mp. 151-153 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 8.43 (dd, J = 4.8, 1.1 Hz, 1H), 7.65 (td, J = 7.7, 1.9 Hz, 1H), 7.52 (d, J = 9.8 Hz, 1H), 7.16 (dd, J = 7.1, 5.3 Hz, 1H), 7.12 (d, J = 7.9 Hz, 2H), 7.05 (br, 1H), 6.73 (d, J = 9.0 Hz, 2H), 6.69 (d, J = 9.8 Hz, 1H), 3.76 (s, 3H); ^{13}C NMR

(125 MHz, $CDCl_3$) δ 162.0, 159.6, 151.9, 149.3, 145.1, 141.8, 137.9, 124.5, 124.2, 123.4, 121.3, 113.3, 112.6, 55.1; HRMS (ESI): Calcd for $C_{17}H_{14}ClN_2O_2$ $[M+H]^+$: 313.0739, found: 313.0737.

5-Bromo-6-(4-chlorophenyl)-2H-[1,2'-bipyridin]-2-one (2n): Purification: Hexane/Acetone (70: 30), light brown solid (59% yield, 42 mg), mp. 183-185 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 (d, *J* = 3.9 Hz, 1H), 7.67 – 7.62 (m, 1H), 7.61 (d, *J* = 9.9 Hz, 1H), 7.18 (d, *J* = 9.0 Hz, 2H), 7.15 (d, *J* = 2.6 Hz, 1H), 7.12 (d, *J* = 7.8 Hz, 2H), 7.08 (br, 1H), 6.63 (d, *J* = 9.8 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 161.9, 151.6, 149.4, 145.5, 144.0, 138.1, 135.0, 132.4, 128.3, 124.2, 123.7, 122.1, 100.3; HRMS (ESI): Calcd for $C_{16}H_{11}BrClN_2O$ $[M+H]^+$: 360.9738, found: 360.9733.

3-(4-Fluorophenyl)-2-(pyridin-2-yl)isoquinolin-1(2H)-one (4a): Purification: Hexane/EtOAc (80: 20), white solid (82% yield, 58 mg), mp. 198-200 °C; ^{1}H NMR (400 MHz, MeOD) δ 8.29 (dd, *J* = 4.9, 1.1 Hz, 1H), 8.25 (d, *J* = 8.1 Hz, 1H), 7.74 (ddd, *J* = 14.7, 7.4, 1.6 Hz, 1H), 7.69 (dd, *J* = 7.0, 1.2 Hz, 1H), 7.62 (d, *J* = 7.7 Hz, 1H), 7.49 (ddd, *J* = 8.2, 7.1, 1.3 Hz, 1H), 7.34 (d, *J* = 8.0 Hz, 1H), 7.24 (ddd, *J* = 7.5, 5.0, 1.0 Hz, 1H), 7.17 (dd, *J* = 8.8, 5.3 Hz, 2H), 6.85 – 6.80 (m, 2H), 6.68 (s, 1H); ^{13}C NMR (100 MHz, MeOD) δ 163.5, 161.2, 151.9, 148.5, 141.7, 138.6, 137.1, 133.3, 131.6 (d, *J* = 3.5 Hz), 131.3 (d, *J* = 8.5 Hz), 127.2 (d, *J* = 4.5 Hz), 126.4, 125.4, 124.6, 123.7, 114.6, 114.3, 108.4; HRMS (ESI): Calcd for $C_{20}H_{14}FN_2O$ $[M+H]^+$: 317.1085, found: 317.1088.

3-(4-Bromophenyl)-6-chloro-2-(pyridin-2-yl)isoquinolin-1(2H)-one (4b): Purification: Hexane/EtOAc (80: 20), white solid (84% yield, 67 mg), mp. 204-205 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (dd, *J* = 4.9, 1.1 Hz, 1H), 8.39 (d, *J* = 2.2 Hz, 1H), 7.71 (td, *J* = 7.7, 1.9 Hz, 1H), 7.62 (dd, *J* = 8.4, 2.2 Hz, 1H), 7.49 (d, *J* = 8.5 Hz, 1H), 7.30 (dt, *J* = 4.6, 2.1 Hz, 3H), 7.19 (dd, *J* = 7.5, 4.9 Hz, 1H), 7.07 (d, *J* = 8.5 Hz, 2H), 6.54 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.0, 151.8, 149.2, 142.0, 137.8, 135.0, 134.6, 133.5, 133.2, 131.2, 130.4, 127.8, 127.7, 126.6, 124.7, 123.4, 122.6, 107.5; HRMS (ESI): Calcd for $C_{20}H_{13}BrClN_2O$ $[M+H]^+$: 410.9961, found: 410.9954.

6-Chloro-3-(3-nitrophenyl)-2-(pyridin-2-yl)isoquinolin-1(2H)-one (4c): Purification: Hexane/EtOAc (70: 30), yellow semi solid (75% yield, 55 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 2.2 Hz, 1H), 8.36 (dd, *J* = 4.9, 1.1 Hz, 1H), 8.10 (t, *J* = 1.8 Hz, 1H), 8.06 (dd, *J* = 7.1, 1.1 Hz, 1H), 7.76 (td, *J* = 7.8, 1.9 Hz, 1H), 7.68 (dd, *J* = 8.4, 2.2 Hz, 1H), 7.55 (dd, *J* = 8.1, 3.9 Hz, 2H), 7.45 (d, *J* = 7.9 Hz, 1H), 7.37 (t, *J* = 7.9 Hz, 1H), 7.19 (dd, *J* = 7.0, 4.4 Hz, 1H), 6.64 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.6, 155.2, 153.1, 151.5, 144.4, 141.8, 141.2, 138.5, 138.4, 137.7, 137.6, 132.8, 131.8, 131.6, 130.6, 128.7, 127.6, 127.3, 126.8, 112.2; HRMS (ESI): Calcd for $C_{20}H_{13}ClN_3O_3$ $[M+H]^+$: 378.0640, found: 378.0640.

6-Bromo-3-(3,4-dichlorophenyl)-2-(pyridin-2-yl)isoquinolin-1(2*H*)-one (4d): Purification: Hexane/EtOAc (80: 20), white solid (78% yield, 57 mg), mp. 220-223 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.57 (d, *J* = 2.1 Hz, 1H), 8.44 (d, *J* = 3.8 Hz, 1H), 7.78 (dd, *J* = 16.1, 8.1 Hz, 2H), 7.45 (d, *J* = 8.4 Hz, 1H), 7.38 – 7.34 (m, 2H), 7.26 – 7.20 (m, 2H), 7.00 (dd, *J* = 8.3, 2.1 Hz, 1H), 6.56 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.7, 151.6, 149.3, 140.9, 138.0, 136.4, 135.6, 135.1, 132.6, 132.4, 130.9, 130.74 129.9, 128.1, 128.0, 126.9, 124.7, 123.5, 121.4, 108.0; HRMS (ESI): Calcd for $C_{20}H_{12}BrCl_2N_2O$ $[M+H]^+$: 444.9505, found: 444.9501.

6-Bromo-3-(naphthalen-2-yl)-2-(pyridin-2-yl)isoquinolin-1(2H)-one (4e): Purification: Hexane/EtOAc (80: 20), pale yellow gel (80% yield, 56 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.61 (d, *J* = 2.1 Hz, 1H), 8.37 (dd, *J* = 5.1, 1.4 Hz, 1H), 7.82 (d, *J* = 1.1 Hz, 1H), 7.78 (dd, *J* = 8.4, 2.1 Hz, 1H), 7.77 – 7.71 (m, 2H), 7.64 (td, *J* = 7.7, 1.9 Hz, 1H), 7.57 (d, *J* = 8.6 Hz, 1H), 7.48 – 7.44 (m, 3H), 7.34 (d, *J* = 7.9 Hz, 1H), 7.20 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.10 (dd, *J* = 7.9, 5.4 Hz, 1H), 6.67 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.9, 155.9, 152.9, 147.2, 141.6, 140.0, 139.5, 137.0, 136.5, 136.4, 134.7, 132.3, 131.9, 131.7, 131.4, 131.3, 130.6, 130.4, 129.8, 128.6, 127.0, 124.6, 111.7; HRMS (ESI): Calcd for $C_{24}H_{16}BrN_2O$ $[M+H]^+$: 427.0441, found: 427.0444.

6-Bromo-2-(pyridin-2-yl)-3-(thiophen-3-yl)isoquinolin-1(2*H*)-one (4f): Purification: Hexane/EtOAc (80: 20), white solid (70% yield, 44 mg), mp. 174-176 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.55 (d, *J* = 2.0 Hz, 1H), 8.51 (d, *J* = 3.3 Hz, 1H), 7.77 – 7.70 (m, 2H), 7.42 (d, *J* = 8.4 Hz, 1H), 7.27 (dd, *J* = 7.3, 3.1 Hz, 2H), 7.14 (d, *J* = 1.8 Hz, 1H), 7.07 (dd, *J* = 5.0, 3.0 Hz, 1H), 6.73 (d, *J* = 3.8 Hz, 1H), 6.63 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.9, 152.2, 149.3, 138.5, 138.0, 136.1, 136.0, 135.6, 130.8, 127.8, 127.7, 126.8, 125.5, 125.4, 124.5, 123.6, 120.7, 107.1; HRMS (ESI): Calcd for $C_{18}H_{12}BrN_2OS$ $[M+H]^+$: 382.9848, found: 382.9850.

6-Phenyl-2-(pyridin-2-yl)-3-(*p*-tolyl)isoquinolin-1(2*H*)-one (4g): Purification: Hexane/EtOAc (60: 40), white solid (78% yield, 50 mg), mp. 201-203 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.70 (d, *J* = 1.9 Hz, 1H), 8.45 (dd, *J* = 4.9, 1.1 Hz, 1H), 7.96 (dd, *J* = 8.2, 2.0 Hz, 1H), 7.73 (d, *J* = 7.3 Hz, 2H), 7.69 (dd, *J* = 7.8, 1.9 Hz, 1H), 7.64 (d, *J* = 8.2 Hz, 1H), 7.49 (t, *J* = 7.6 Hz, 2H), 7.39 (t, *J* = 7.4 Hz, 1H), 7.31 (d, *J* = 7.9 Hz, 1H), 7.18 (dd, *J* = 7.5, 4.9 Hz, 1H), 7.12 (d, *J* = 8.1 Hz, 2H), 6.98 (d, *J* = 7.9 Hz, 2H), 6.63 (s, 1H), 2.27 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.3, 152.6, 149.1, 142.9, 140.1, 139.7, 137.9, 137.6, 136.0, 133.2, 131.8, 128.9, 128.8, 128.6, 127.6, 127.2, 126.7, 126.2, 125.7, 124.9, 123.0, 107.6, 21.1; HRMS (ESI): Calcd for $C_{27}H_{21}N_2O$ $[M+H]^+$: 389.1649, found: 389.1649.

6,7-Dimethoxy-3-phenyl-2-(pyridin-2-yl)isoquinolin-1(2*H*)-one (4h): Purification: $CHCl_3$/MeOH (98: 2), colourless liquid (74% yield, 46 mg); ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.33 (d, *J* = 4.6 Hz, 1H), 7.82 (t, *J* = 6.9 Hz, 1H), 7.61 (s, 1H), 7.50 (d, *J* = 7.9 Hz, 1H), 7.29 (s, 1H), 7.27 (dd, *J* = 7.0, 5.4 Hz, 1H), 7.19 (br, 5H), 6.66 (s, 1H), 3.93 (s, 3H), 3.89 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ 161.2, 153.7, 152.2, 149.1, 148.5, 141.2, 137.6, 135.8, 132.1, 128.7, 127.8, 127.7, 125.4, 123.1, 118.1, 107.3, 107.2, 106.7, 55.8, 55.6; HRMS (ESI): Calcd for $C_{22}H_{19}N_2O_3$ $[M+H]^+$: 359.1390, found: 359.1393.

7-(4-Methoxyphenyl)-6-(pyridin-2-yl)-[1,3]dioxolo[4,5-g]isoquinolin-5(6*H*)-one (4i): Purification: $CHCl_3$/MeOH (95: 5), brown gel (72% yield, 50 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 5.6 Hz, 1H), 7.75 (s, 1H), 7.65 (t, *J* = 7.7 Hz, 1H), 7.22 (d, *J* = 7.9 Hz, 1H), 7.14 (dd, *J* = 7.4, 4.9 Hz, 1H), 7.08 (d, *J* = 8.8 Hz, 2H), 6.87 (s, 1H), 6.65 (d, *J* = 8.8 Hz, 2H), 6.43 (s, 1H), 6.07 (s, 2H), 3.71 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.4, 159.1, 152.6, 152.4, 149.0, 147.8, 141.4, 137.6, 134.4, 130.3, 128.3, 124.8, 122.9, 120.6, 113.3, 107.7, 106.0, 103.9, 101.7, 55.1; HRMS (ESI): Calcd for $C_{22}H_{17}N_2O_4$ $[M+H]^+$: 373.1183, found: 373.1181.

7-(3,4-Dimethoxyphenyl)-6-(pyridin-2-yl)-[1,3]dioxolo[4,5-g]isoquinolin-5(6*H*)-one (4j): Purification: $CHCl_3$/MeOH (95: 5), white solid (73% yield, 55 mg), mp. 197-198 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.3 Hz, 1H), 7.78 (s, 1H), 7.66 (t, *J* = 6.8 Hz, 1H), 7.22 (d, *J* = 7.9 Hz, 1H), 7.18 (dd, *J* = 7.5,

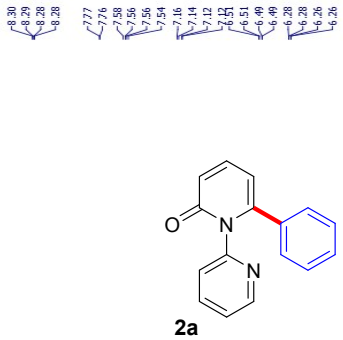
4.9 Hz, 1H), 6.90 (s, 1H), 6.83 (dd, *J* = 8.3, 2.0 Hz, 1H), 6.68 (d, *J* = 8.3 Hz, 1H), 6.63 (d, *J* = 2.0 Hz, 1H), 6.48 (s, 1H), 6.09 (s, 2H), 3.81 (s, 3H), 3.66 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.4, 152.9, 152.4, 149.0, 148.7, 148.1, 147.9, 141.4, 137.7, 134.3, 128.5, 124.8, 123.0, 121.7, 120.7, 112.4, 110.5, 107.6, 106.1, 103.9, 101.8, 55.7; HRMS (ESI): Calcd for $C_{23}H_{19}N_2O_5$ $[M+H]^+$: 403.1289, found: 403.1292.

References

1. P. Peng, J. Wang, H. Jiang and H. Liu, *Org. Lett*., 2016, **18**, 5376.

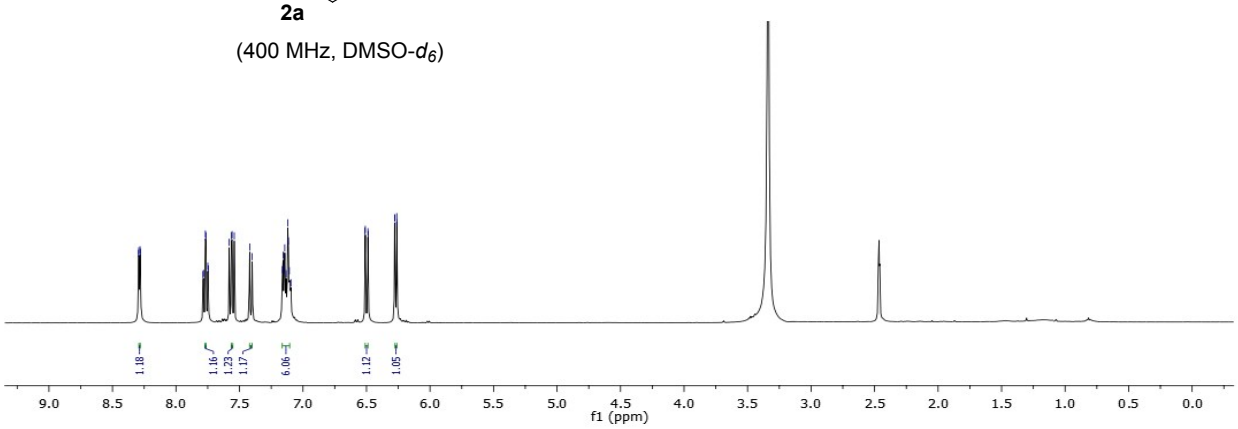
^{1}H NMR and ^{13}C NMR spectra of products

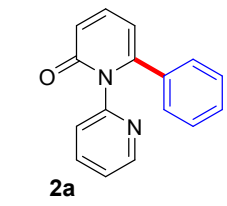
6-Phenyl-2*H*-[1,2'-bipyridin]-2-one:



2a

(400 MHz, DMSO-d_6)

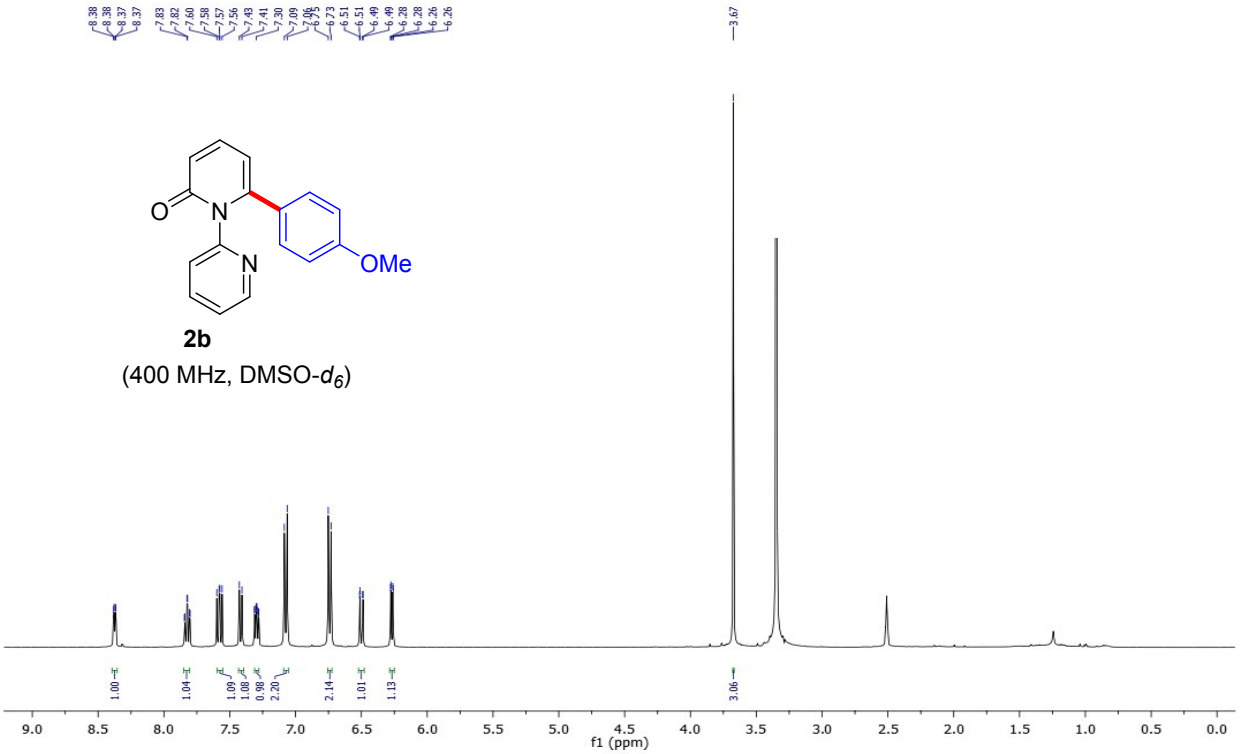




2a

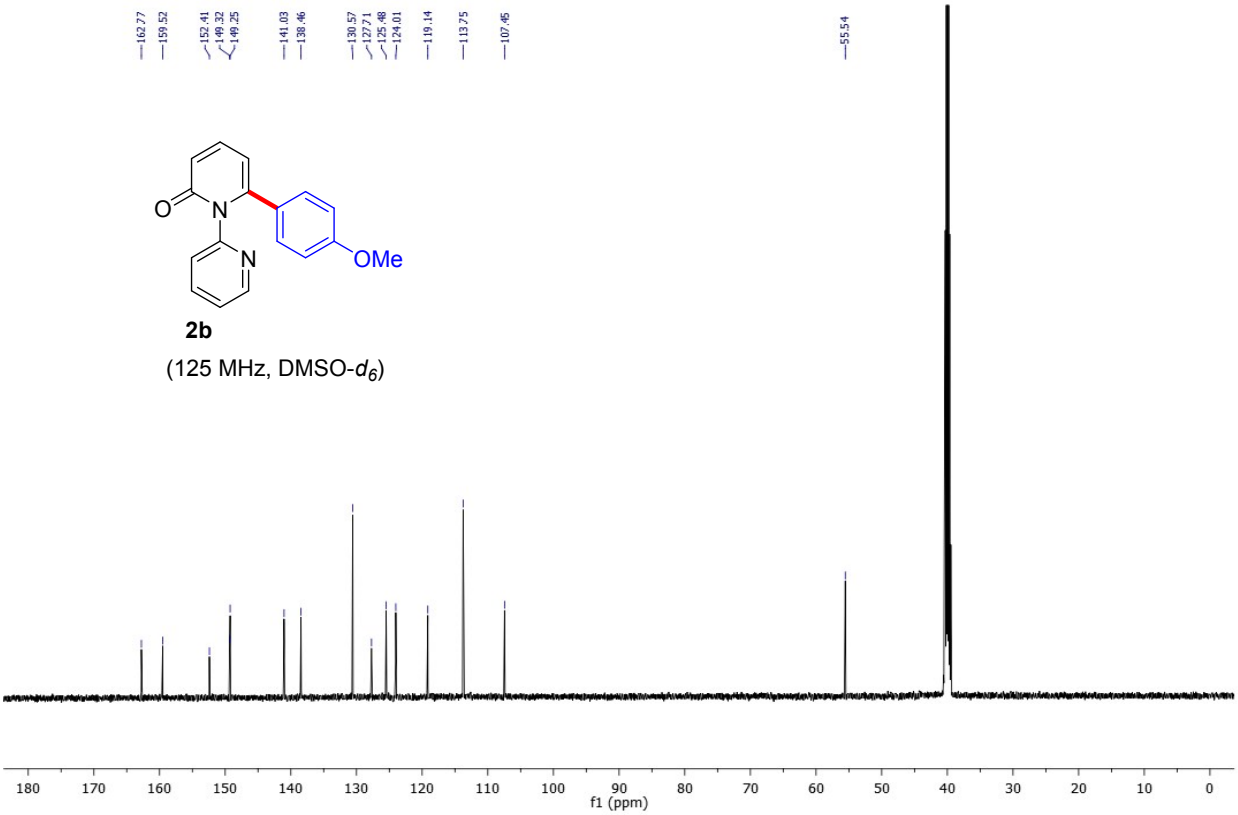
(100 MHz, DMSO-d_6)

6-(4-Methoxyphenyl)-2*H*-[1, 2'-bipyridin]-2-one:



2b

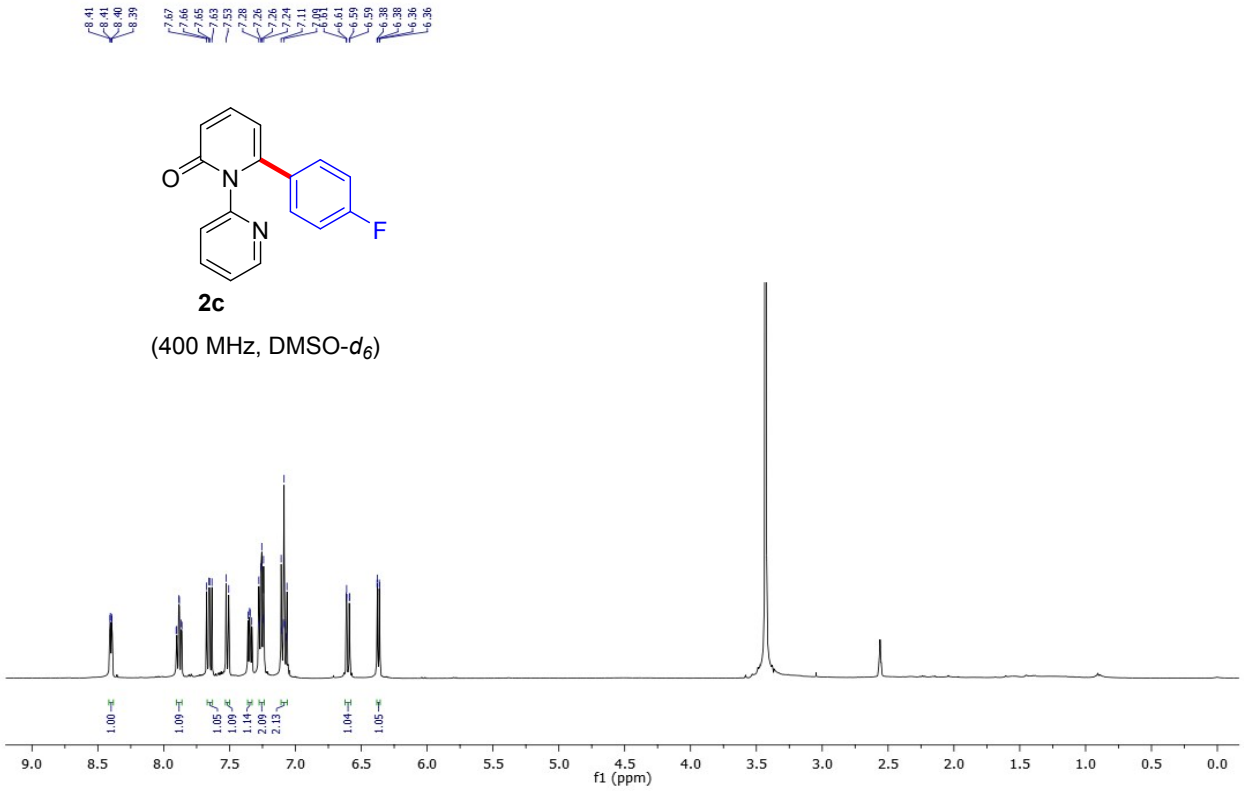
(400 MHz, DMSO-d_6)



2b

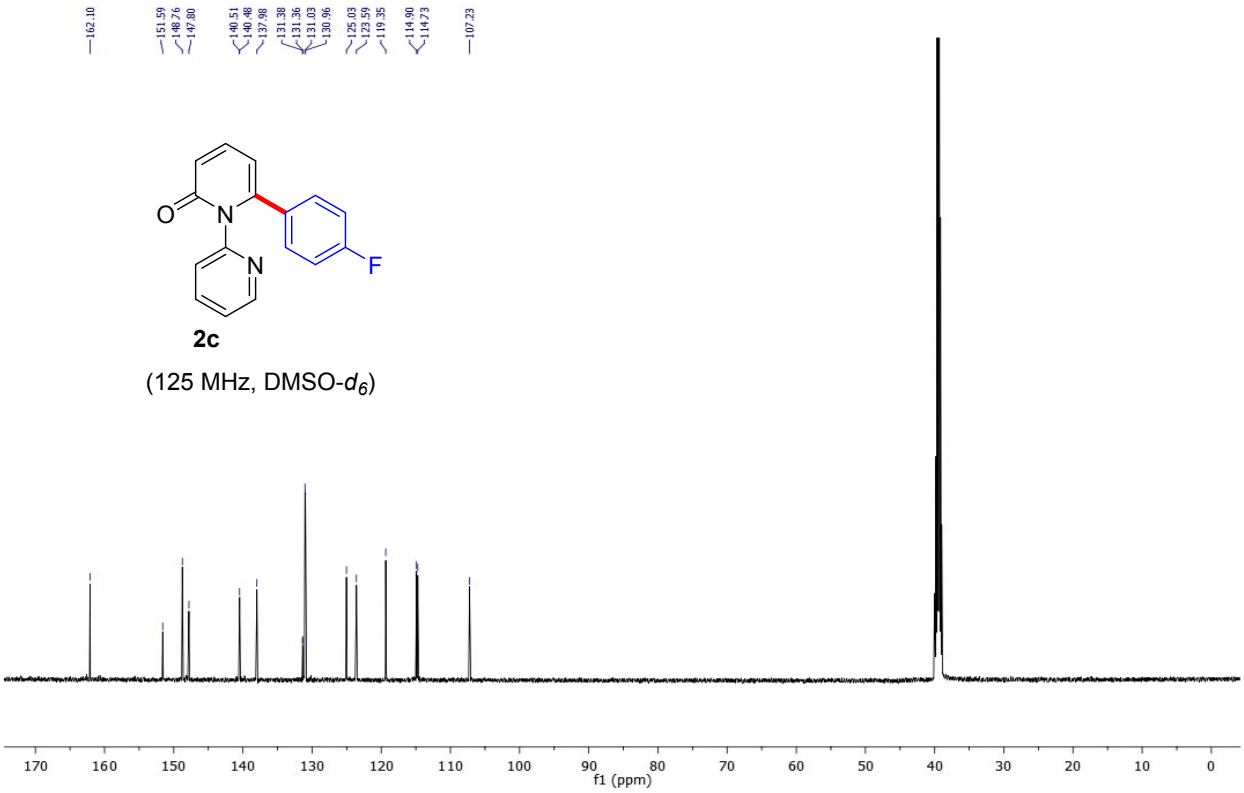
(125 MHz, DMSO-d_6)

6-(4-Fluorophenyl)-2*H*-[1, 2'-bipyridin]-2-one:



2c

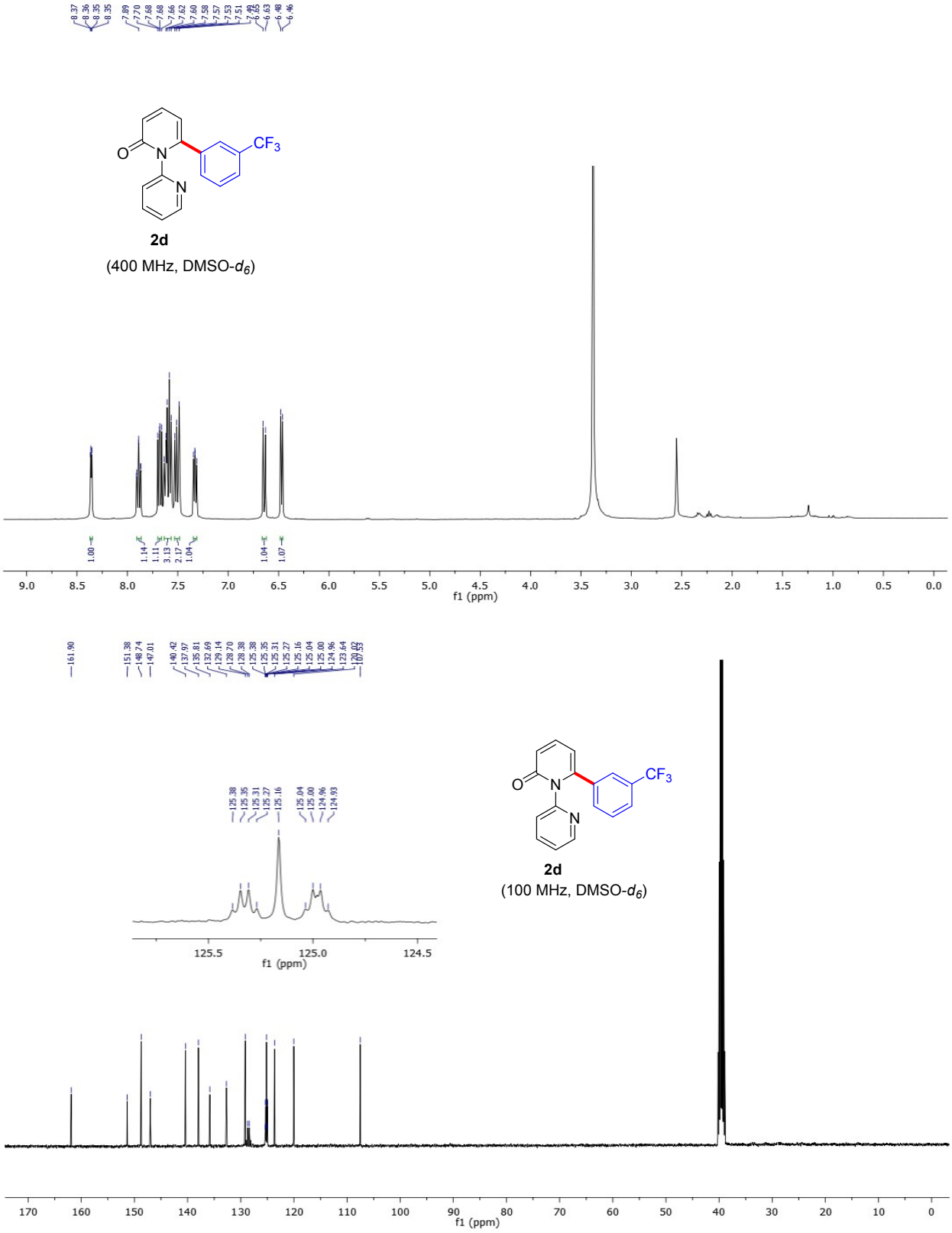
(400 MHz, DMSO-d_6)



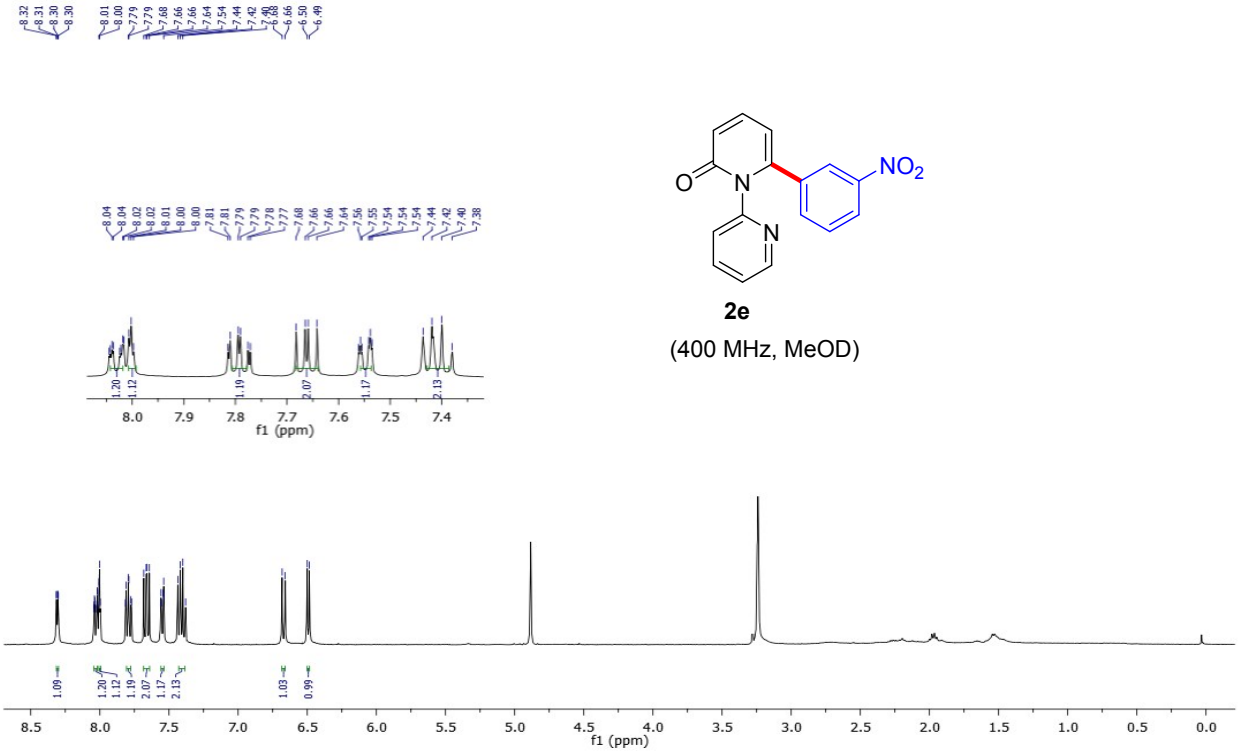
2c

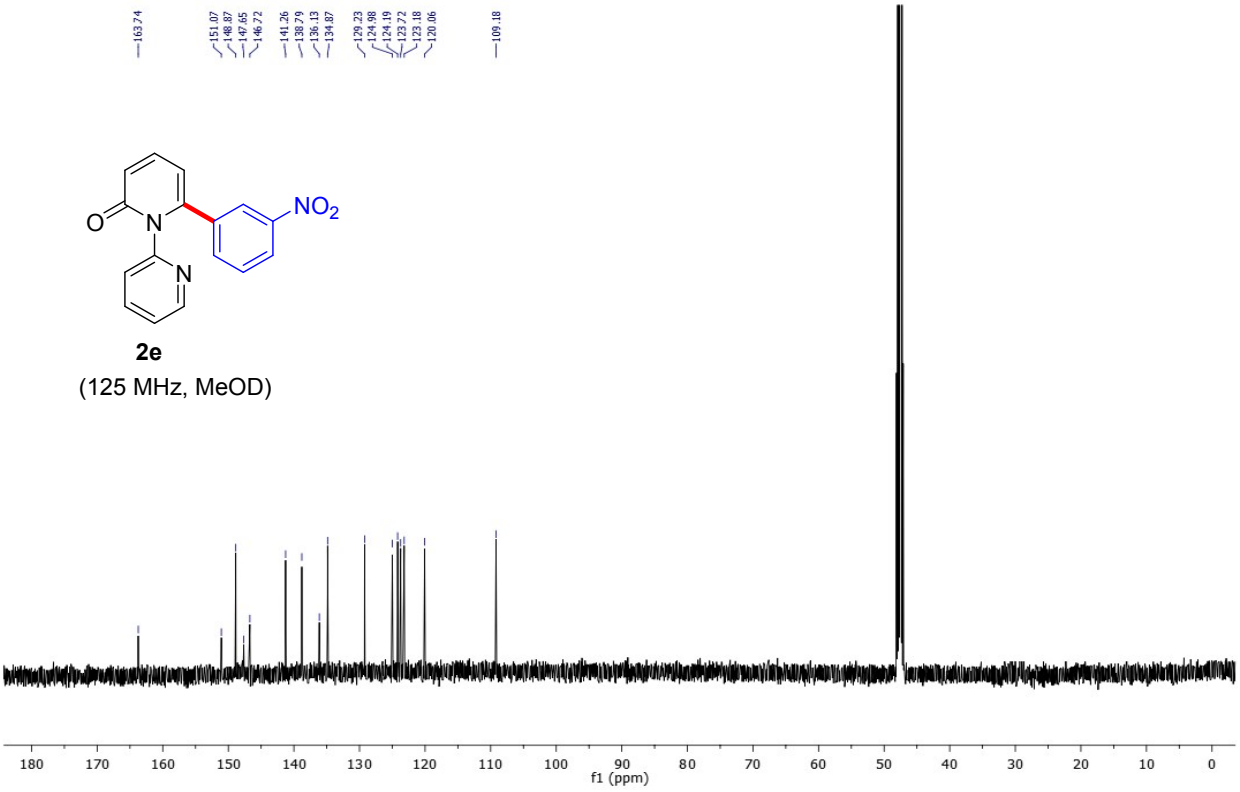
(125 MHz, DMSO-d_6)

6-(3-(Trifluoromethyl)phenyl)-2*H*-[1, 2'-bipyridin]-2-one:

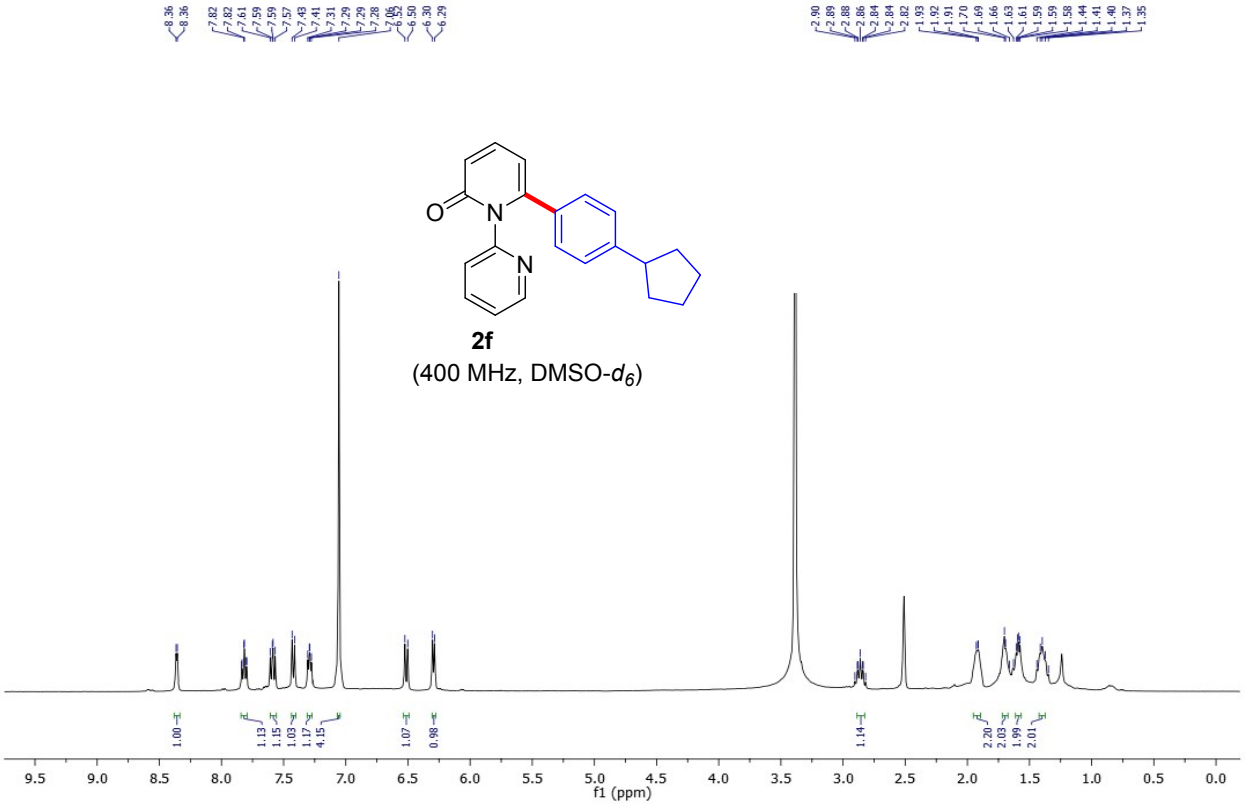


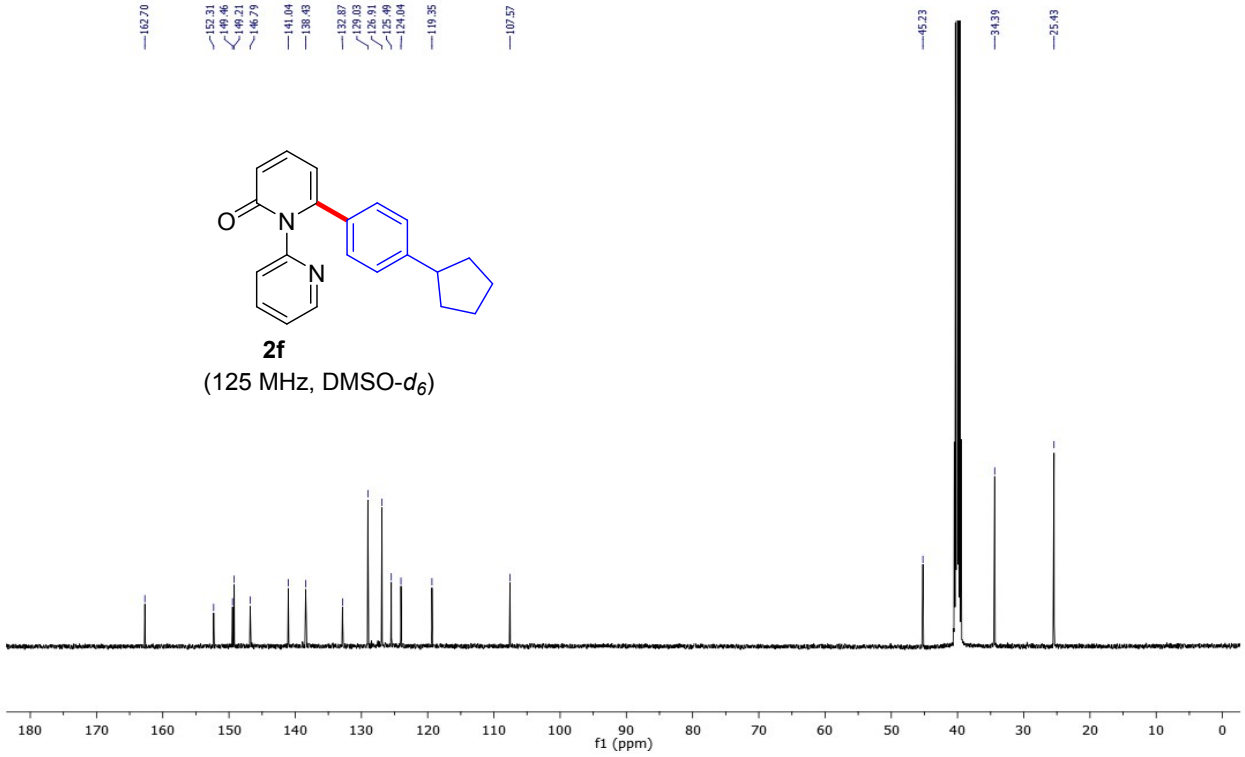
6-(3-Nitrophenyl)-2*H*-[1, 2'-bipyridin]-2-one:



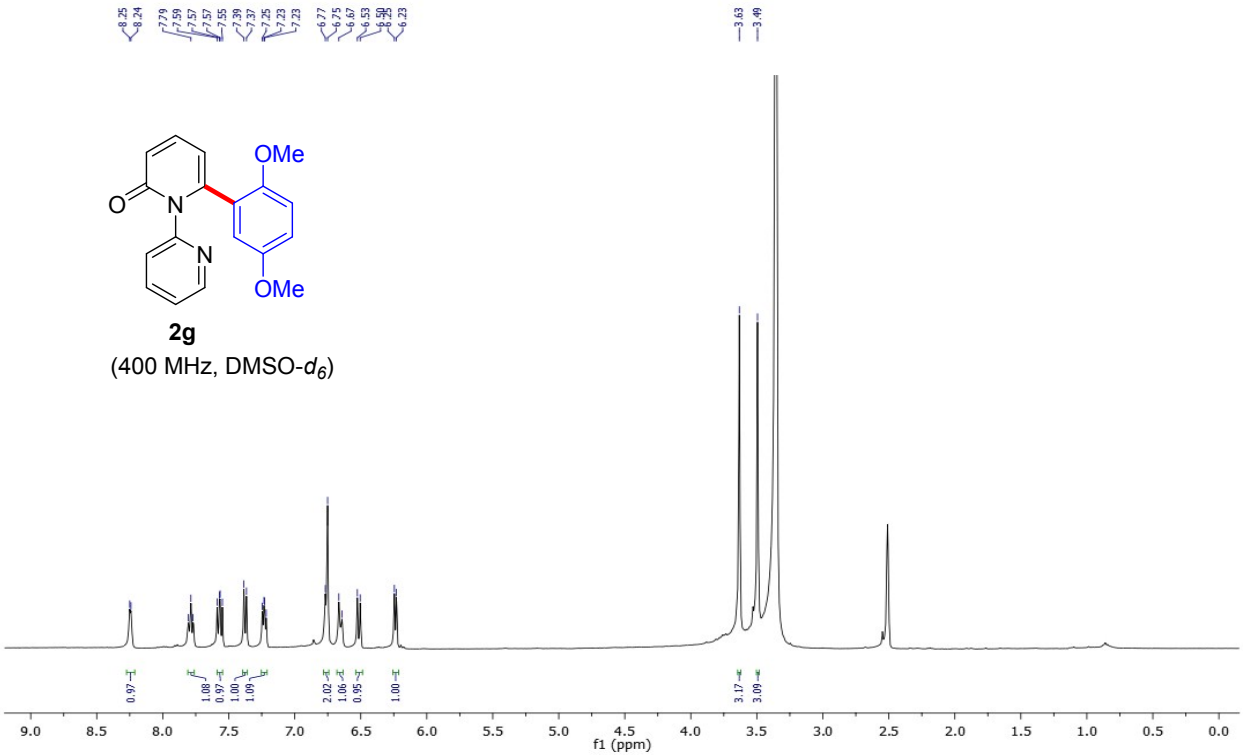


6-(4-Cyclopentylphenyl)-2*H*-[1, 2'-bipyridin]-2-one:



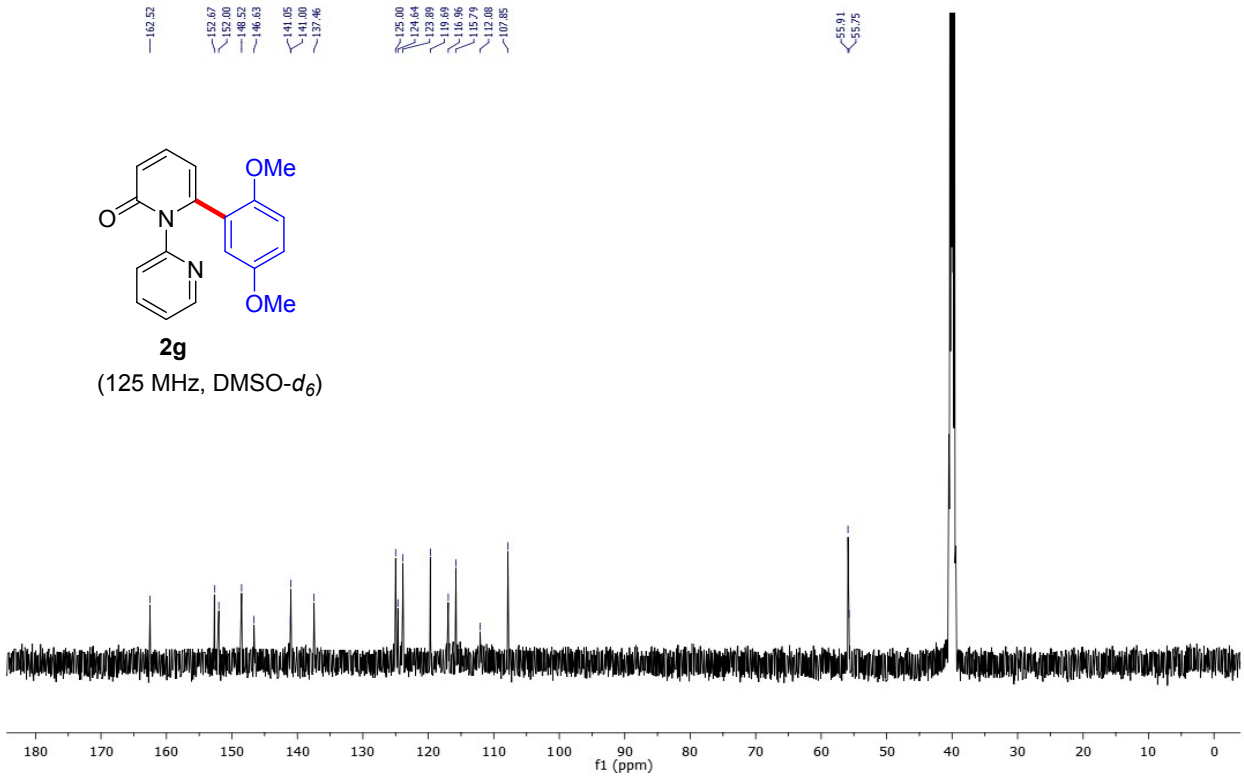


6-(2, 5-Dimethoxyphenyl)-2*H*-[1, 2'-bipyridin]-2-one:



2g

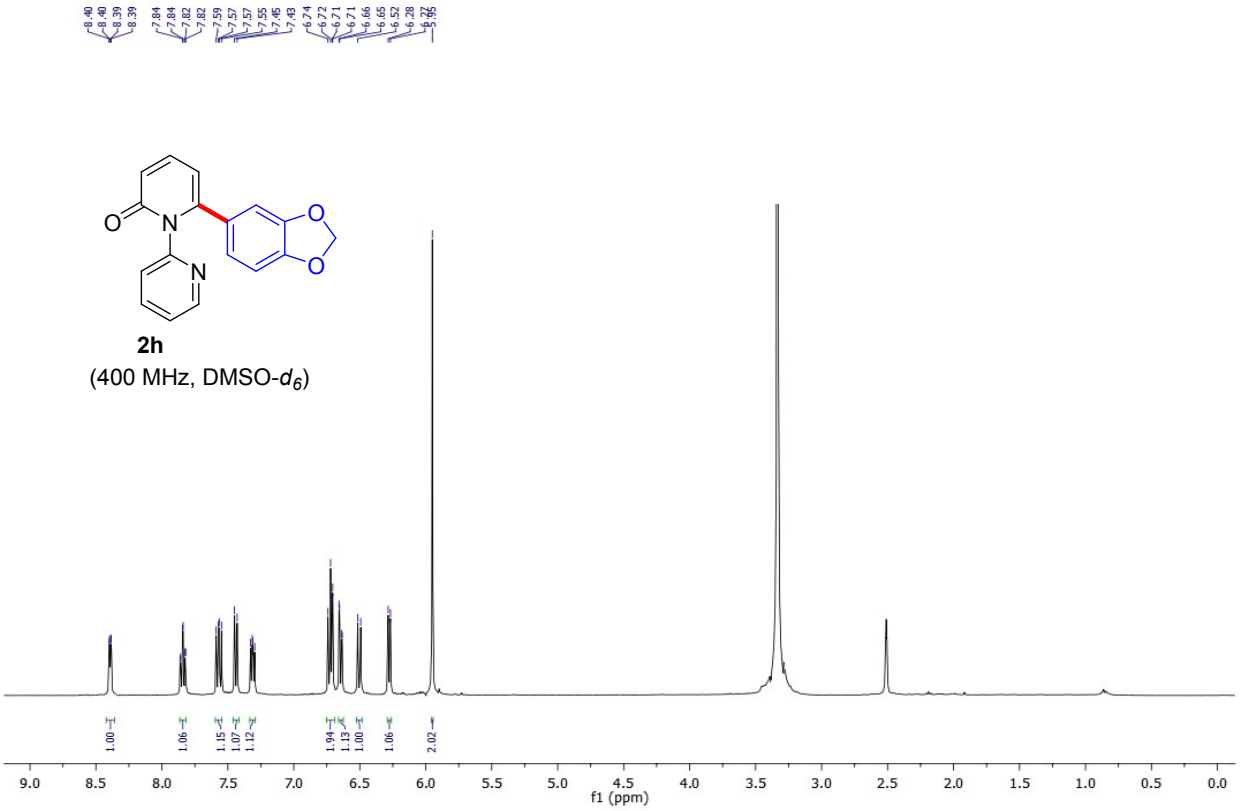
(400 MHz, DMSO-d_6)



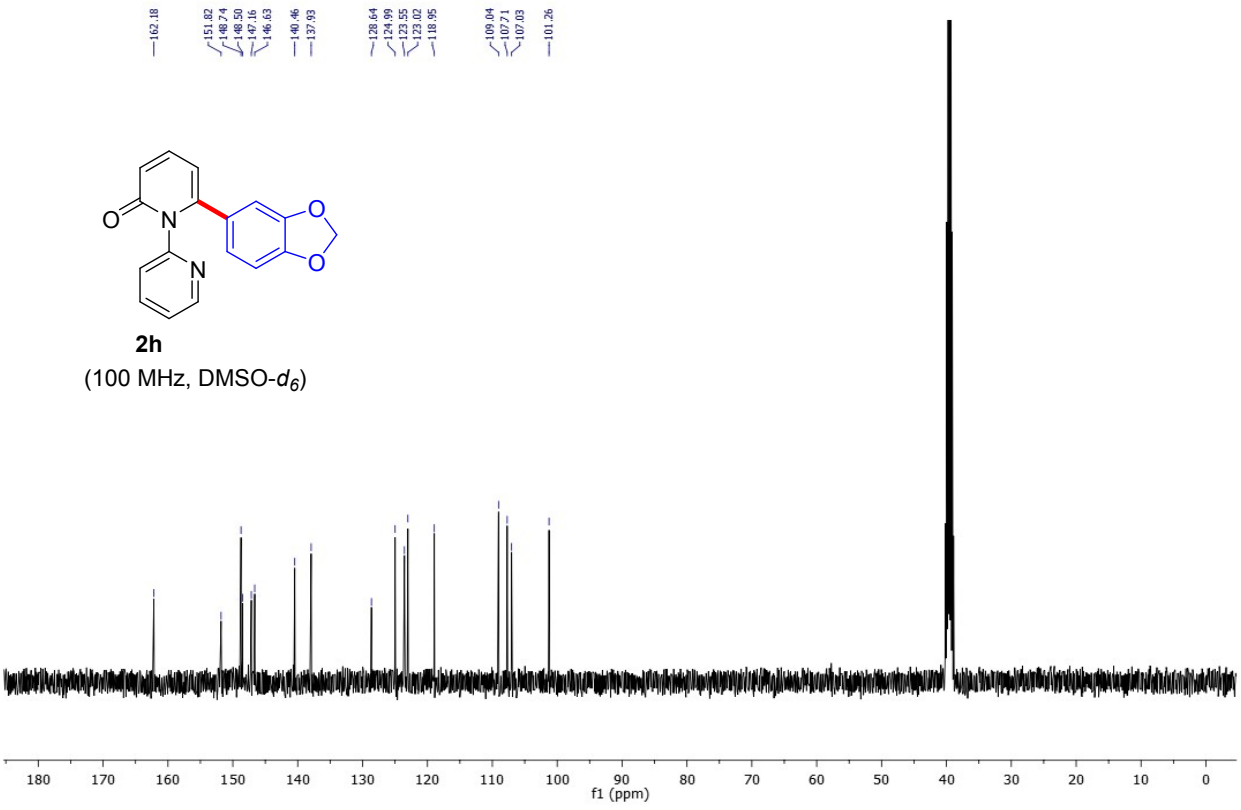
2g

(125 MHz, DMSO-d_6)

6-(Benzo[d][1, 3]dioxol-5-yl)-2*H*-[1, 2'-bipyridin]-2-one:

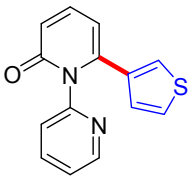


2h
(400 MHz, DMSO-d_6)

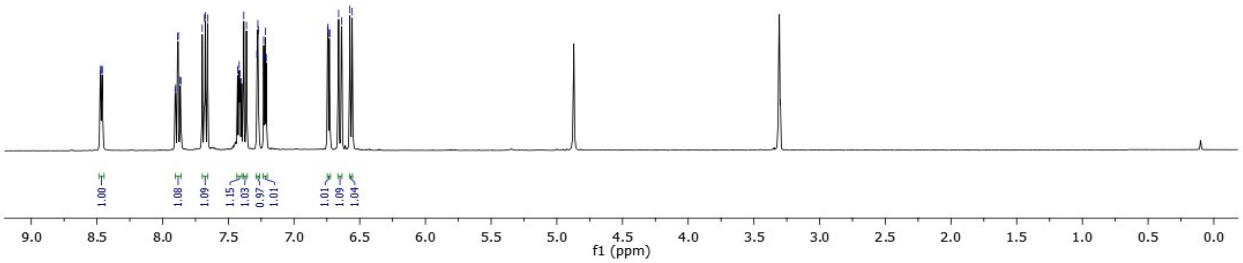


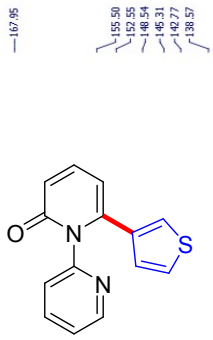
2h
(100 MHz, DMSO-d_6)

6-(Thiophen-3-yl)-2*H*-[1, 2'-bipyridin]-2-one:



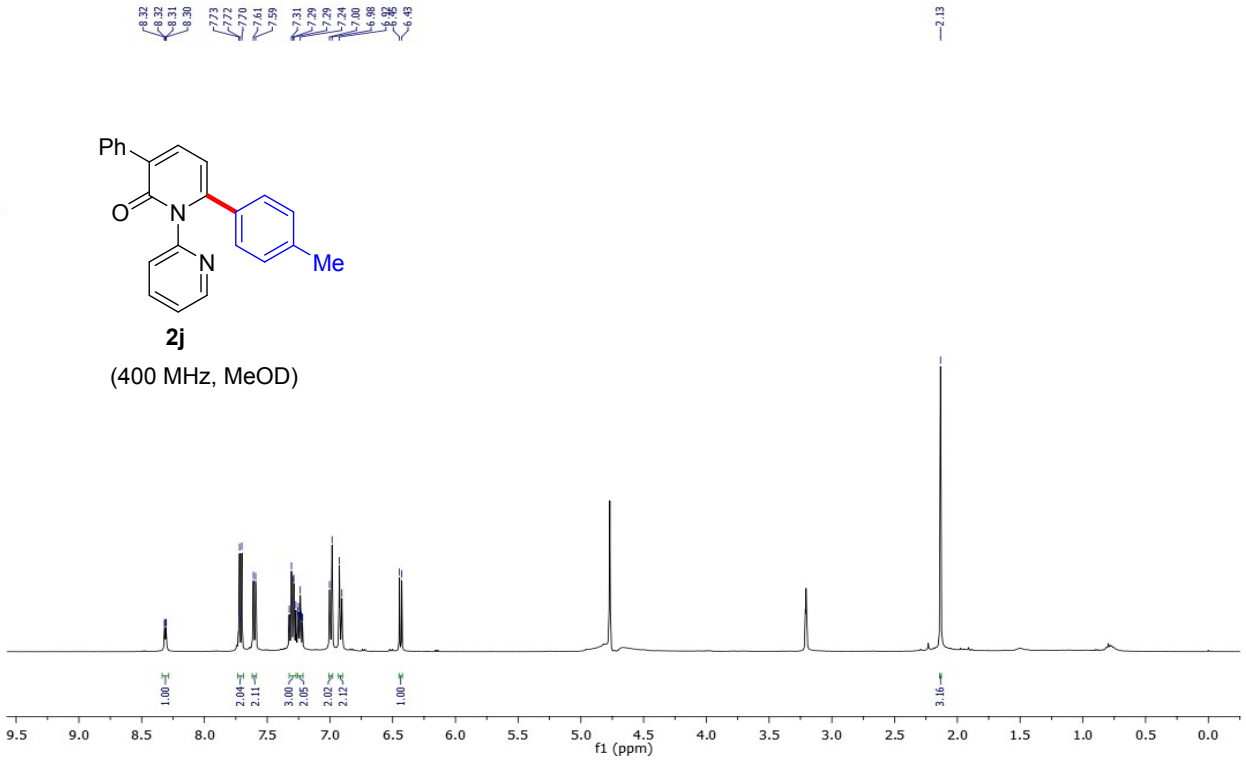
2i
(400 MHz, MeOD)

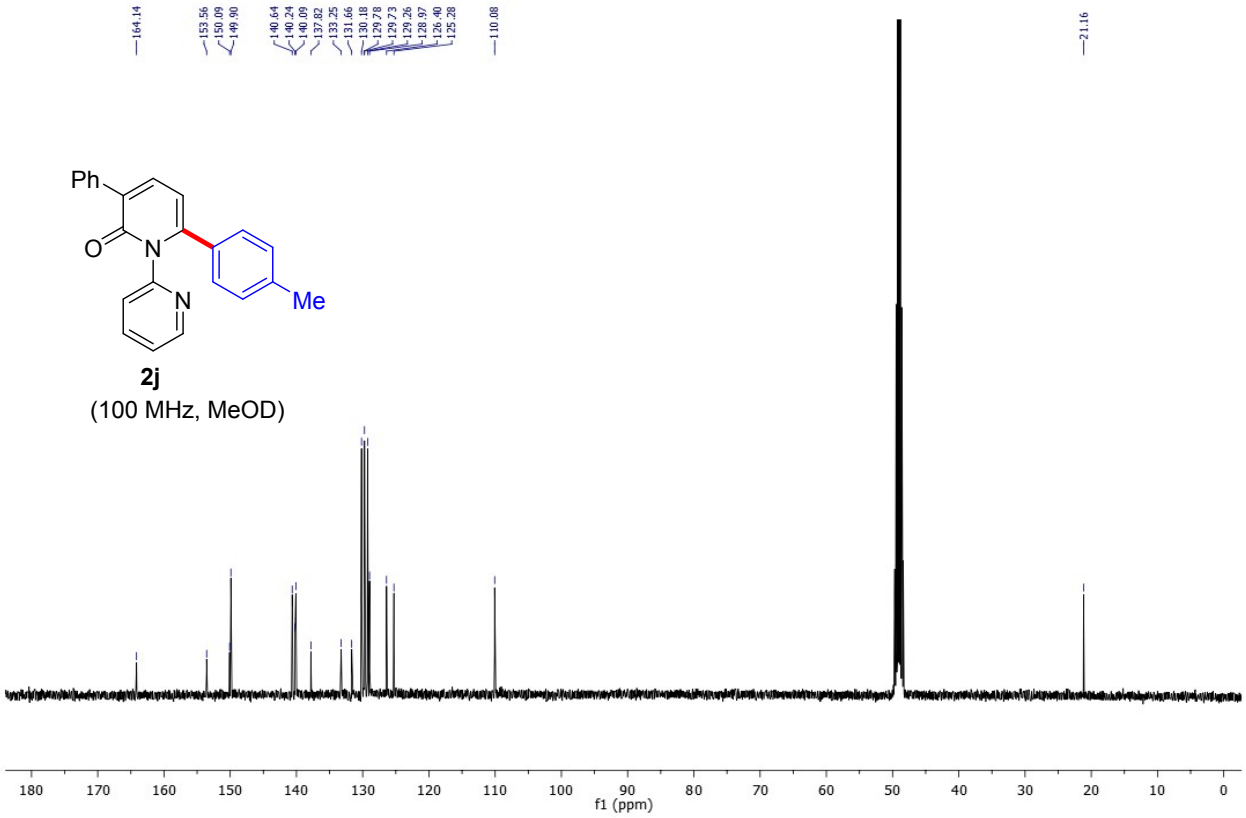




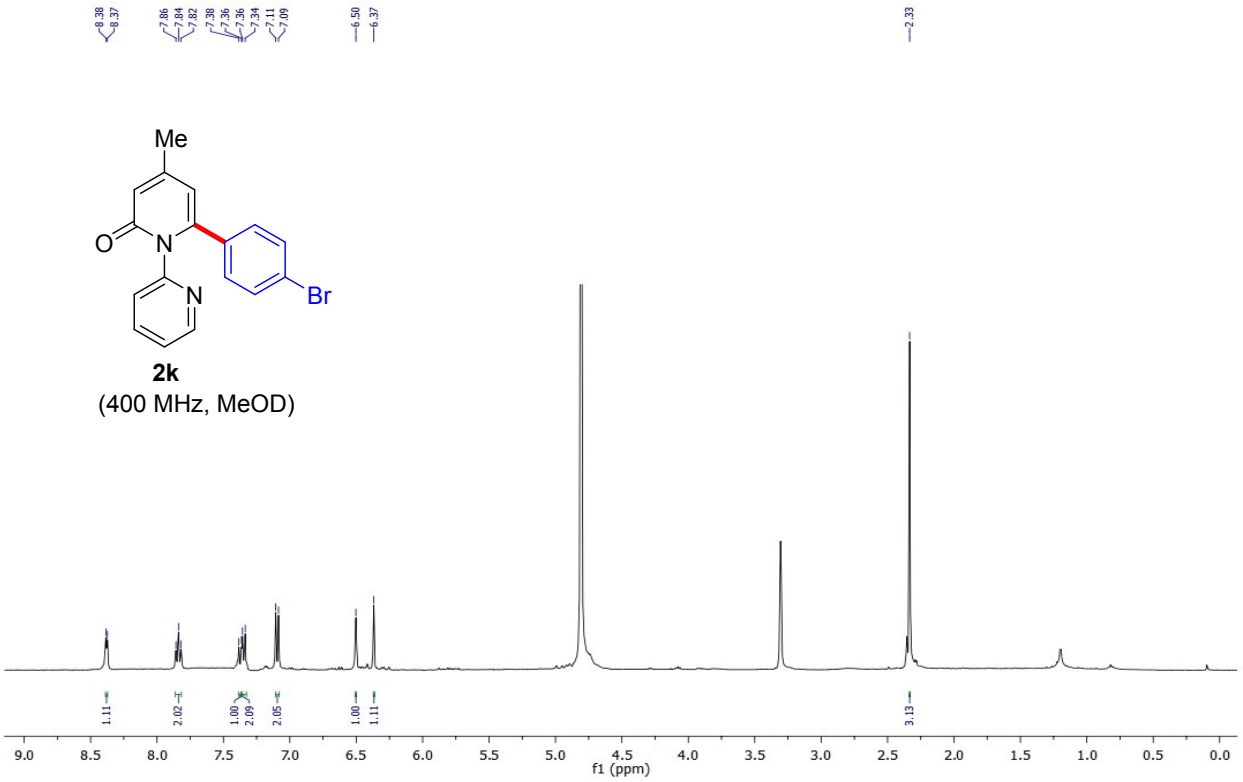
2i
(100 MHz, MeOD)

3-Phenyl-6-(*p*-tolyl)-2*H*-[1, 2'-bipyridin]-2-one:

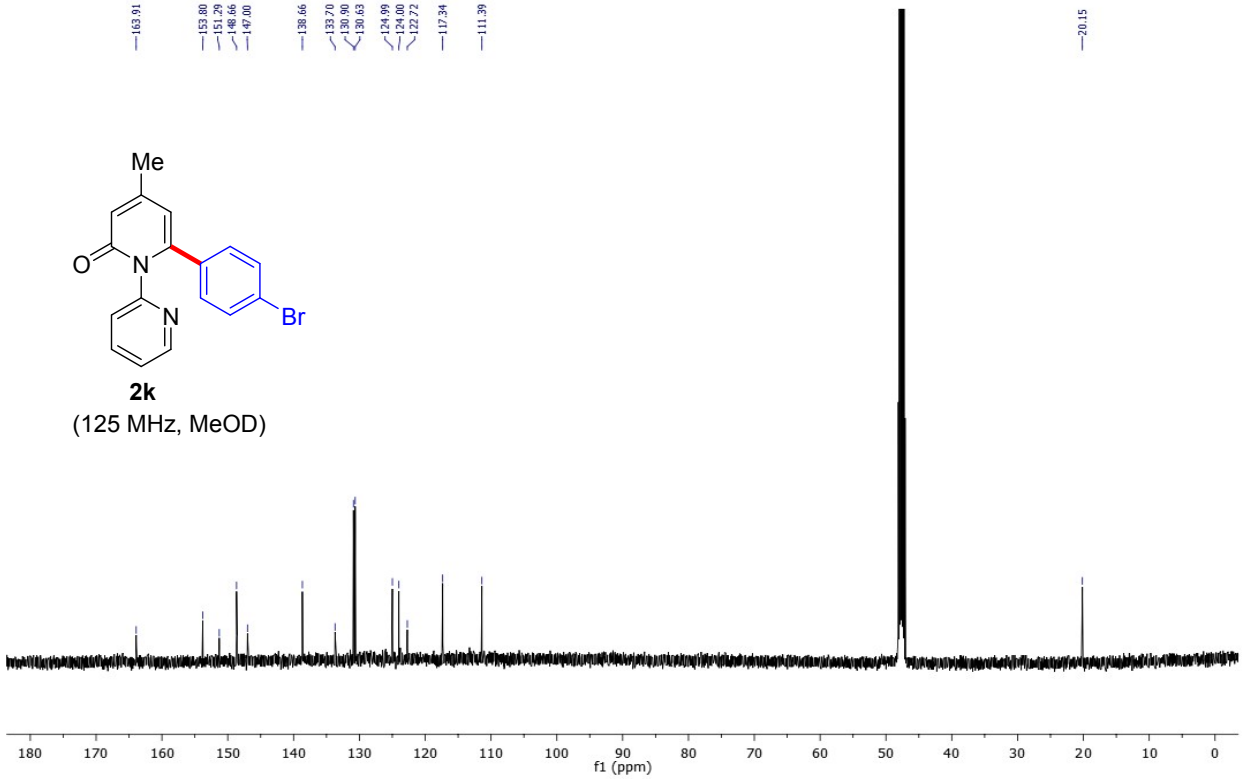




6-(4-Bromophenyl)-4-methyl-2H-[1,2'-bipyridin]-2-one:

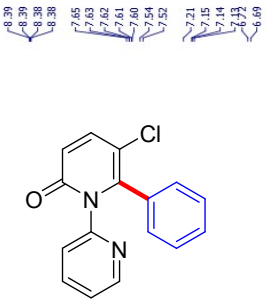


2k
(400 MHz, MeOD)



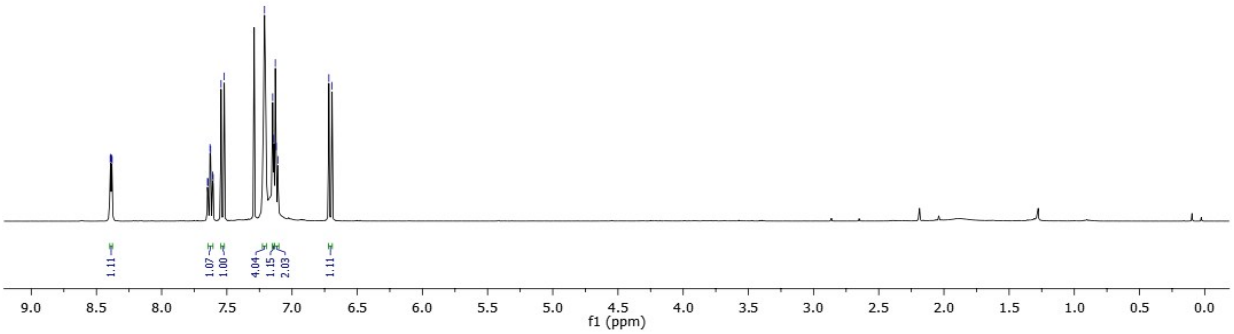
2k
(125 MHz, MeOD)

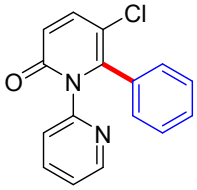
5-Chloro-6-phenyl-2*H*-[1, 2'-bipyridin]-2-one:



2l

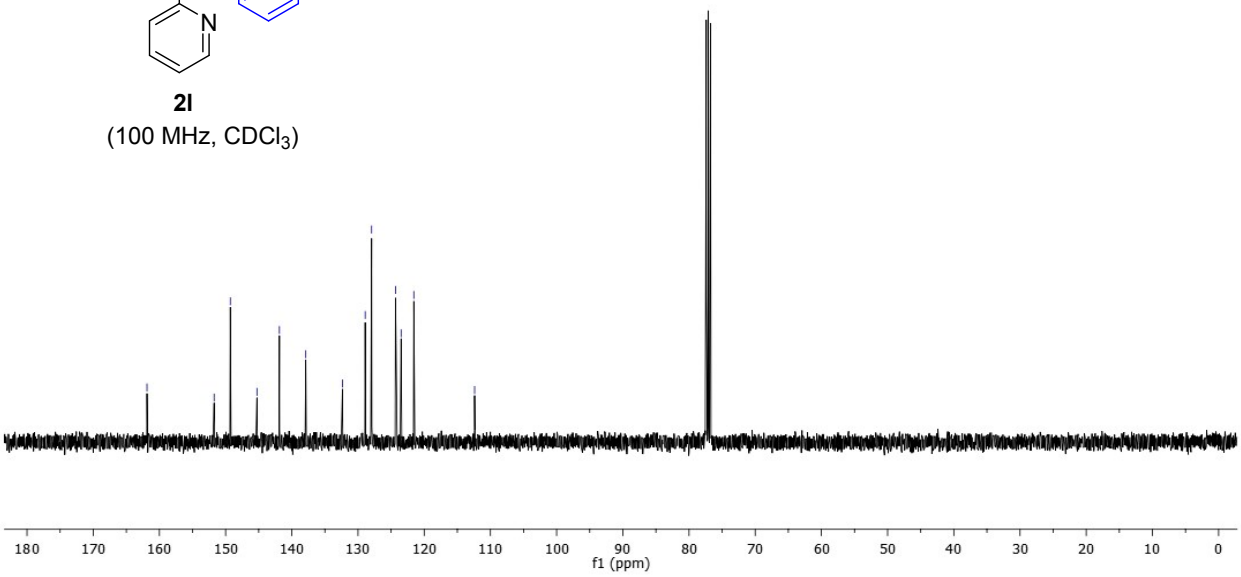
(400 MHz, $CDCl_3$)



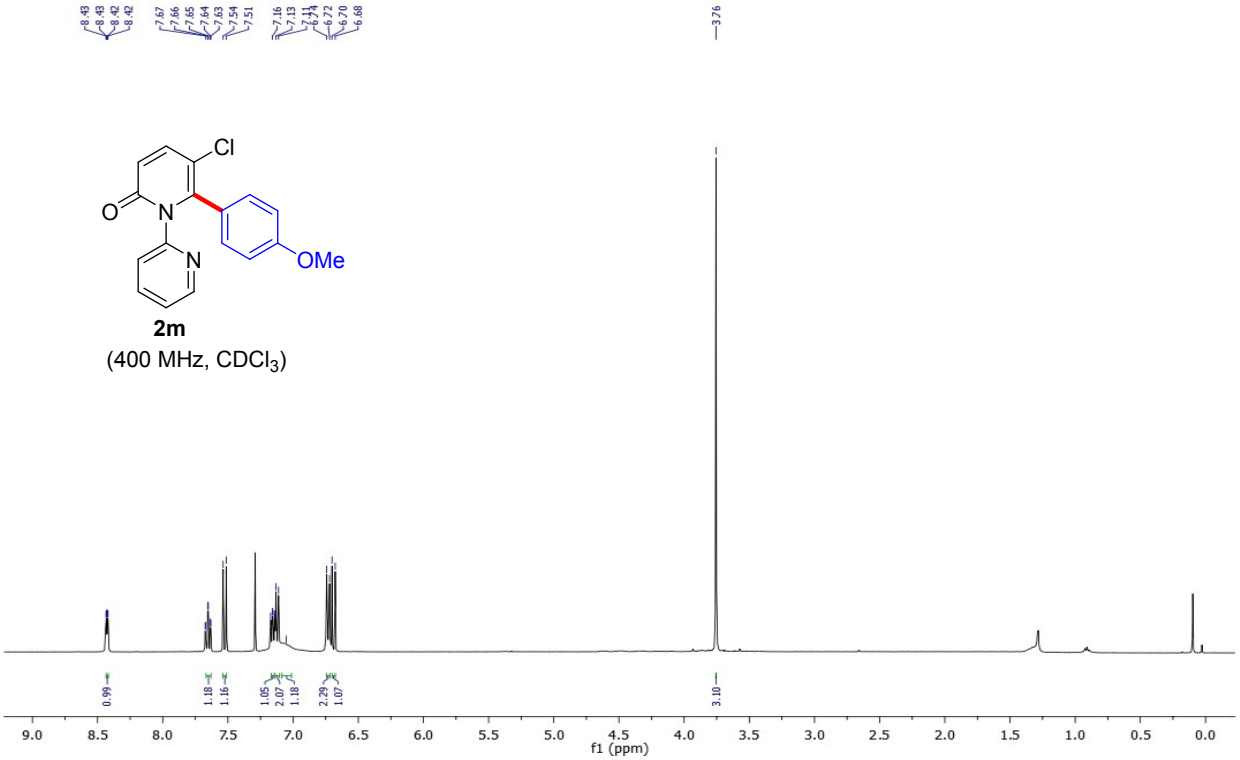


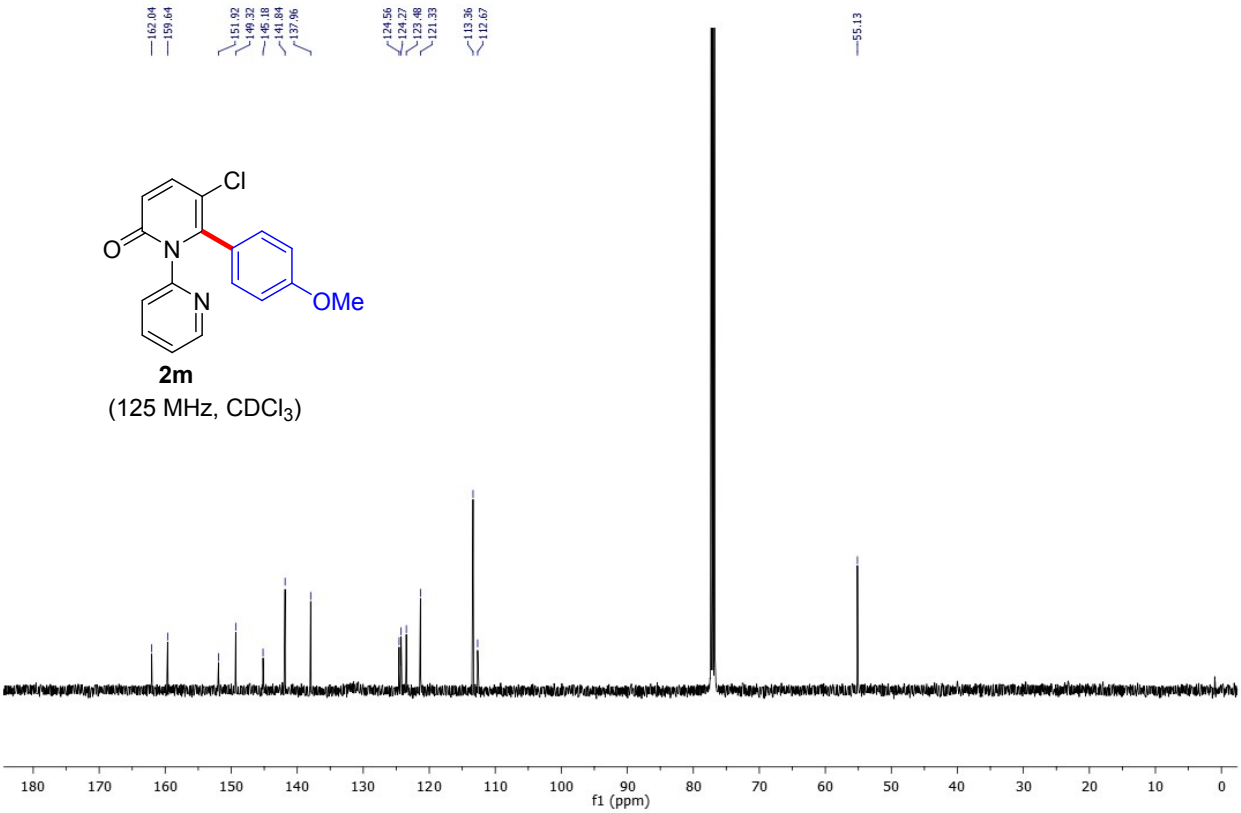
2l

(100 MHz, $CDCl_3$)

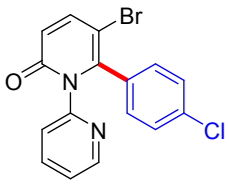


5-Chloro-6-(4-methoxyphenyl)-2*H*-[1, 2'-bipyridin]-2-one:



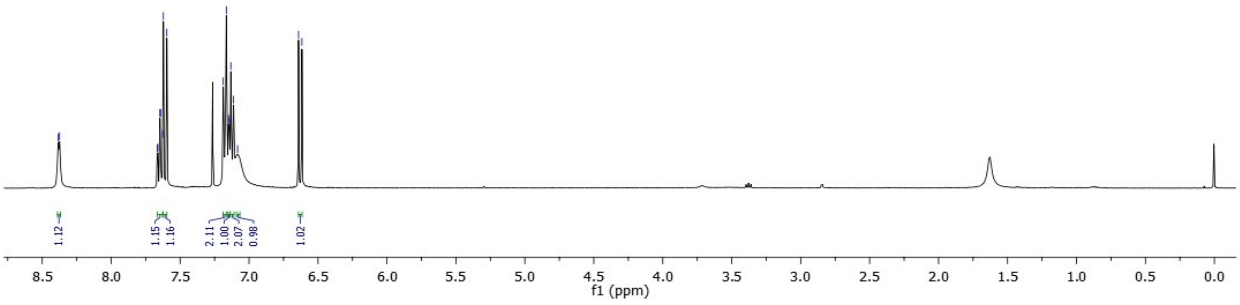


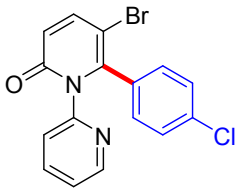
5-Bromo-6-(4-chlorophenyl)-2H-[1,2'-bipyridin]-2-one:



2n

(400 MHz, $CDCl_3$)

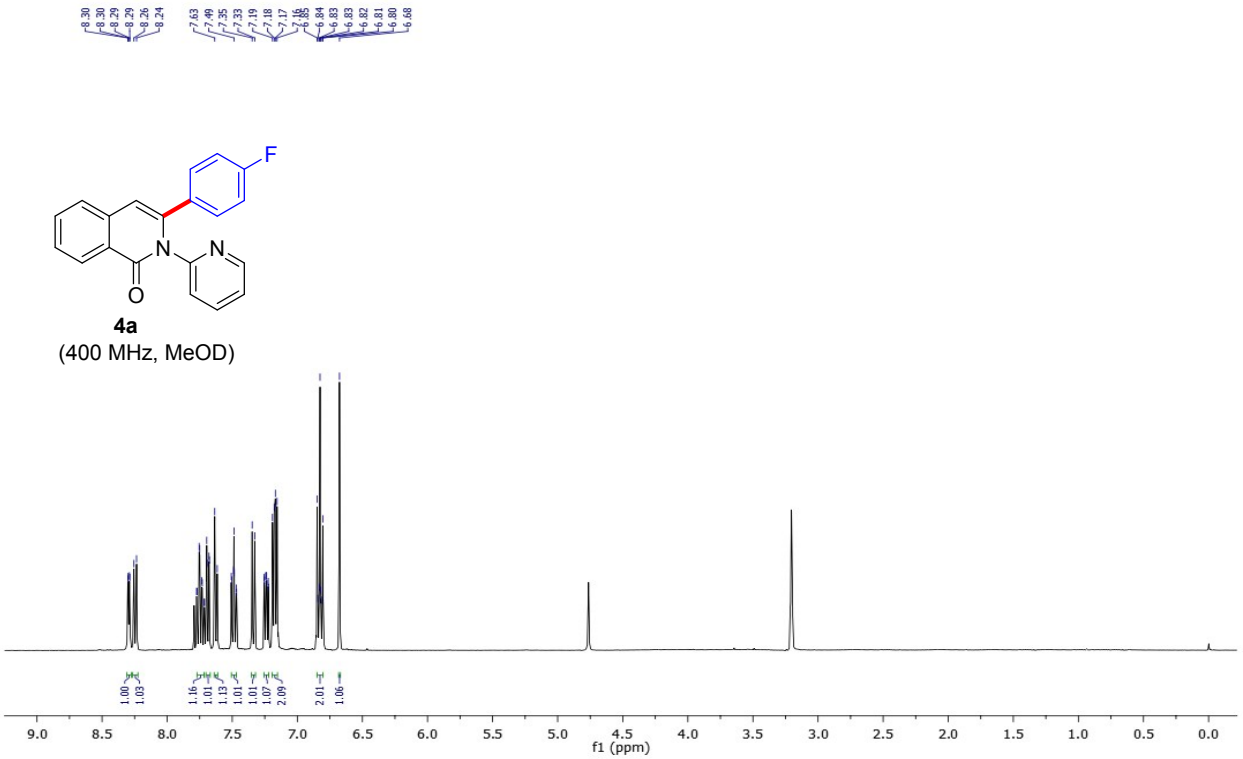


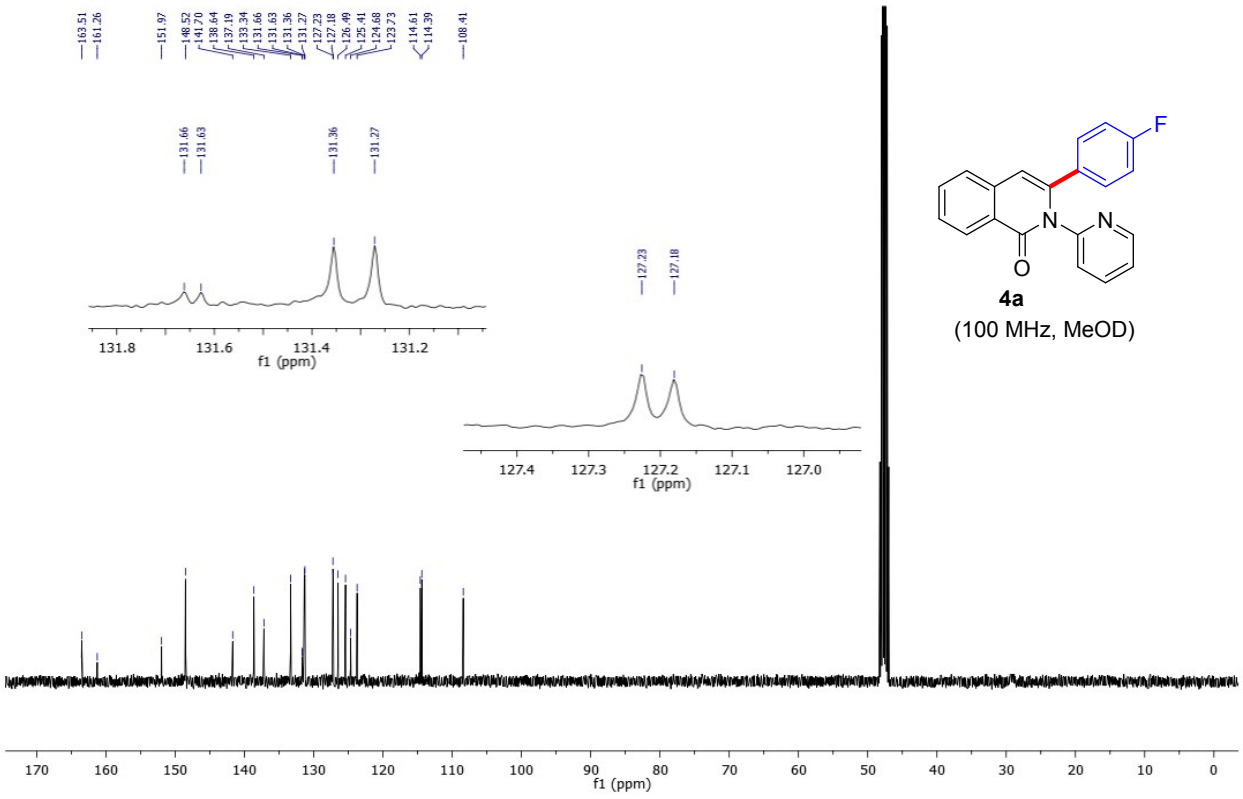


2n

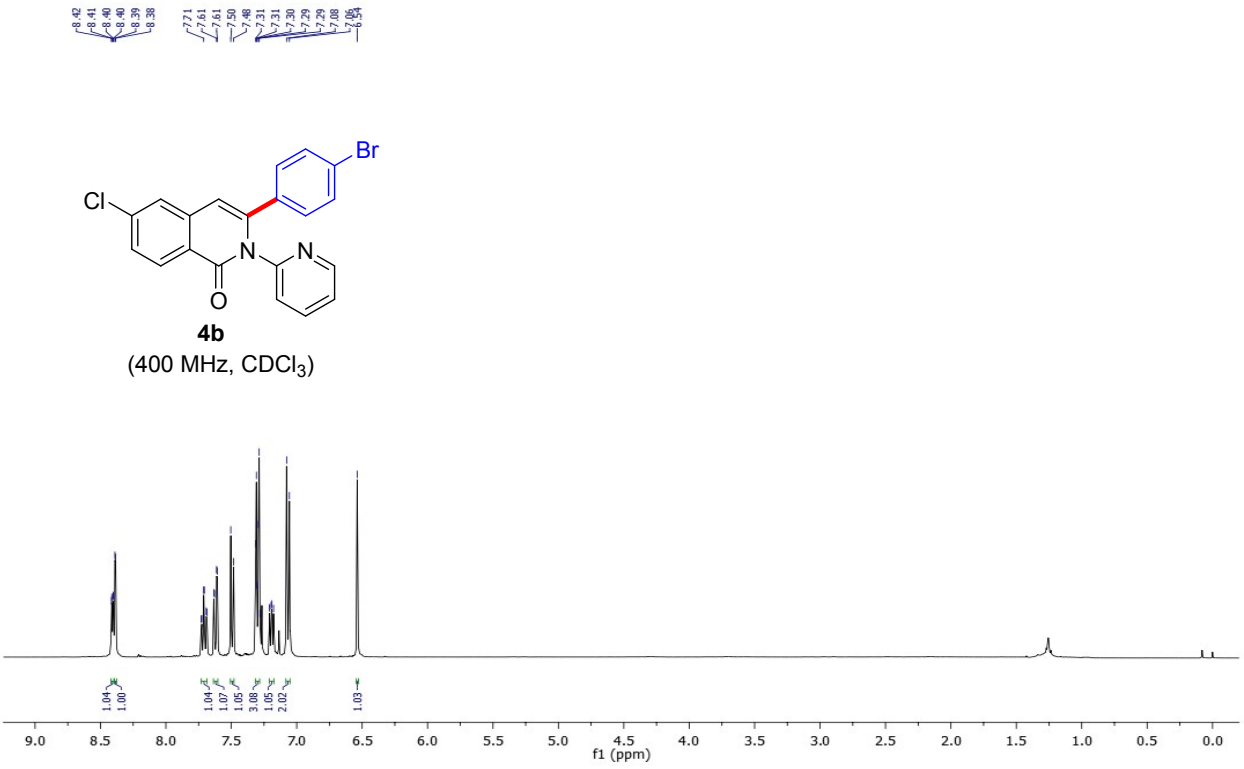
(125 MHz, $CDCl_3$)

3-(4-Fluorophenyl)-2-(pyridin-2-yl)isoquinolin-1(2H)-one:



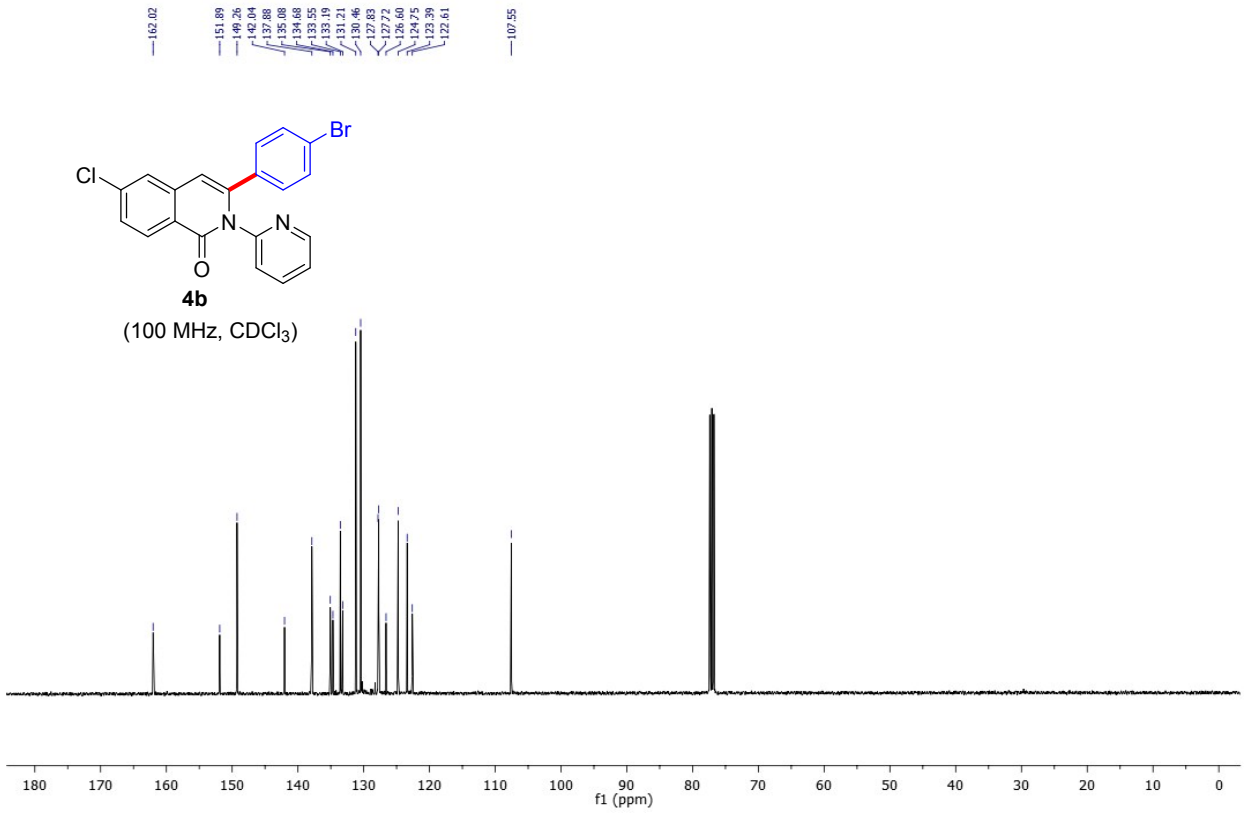


3-(4-Bromophenyl)-6-chloro-2-(pyridin-2-yl)isoquinolin-1(2H)-one:



4b

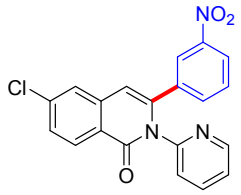
(400 MHz, $CDCl_3$)



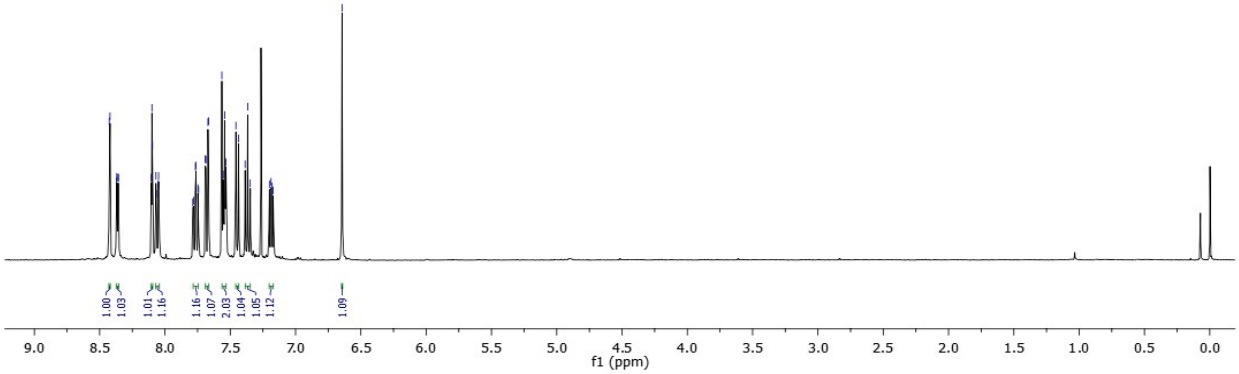
4b

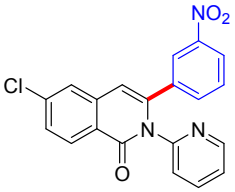
(100 MHz, $CDCl_3$)

6-Chloro-3-(3-nitrophenyl)-2-(pyridin-2-yl)isoquinolin-1(2H)-one:



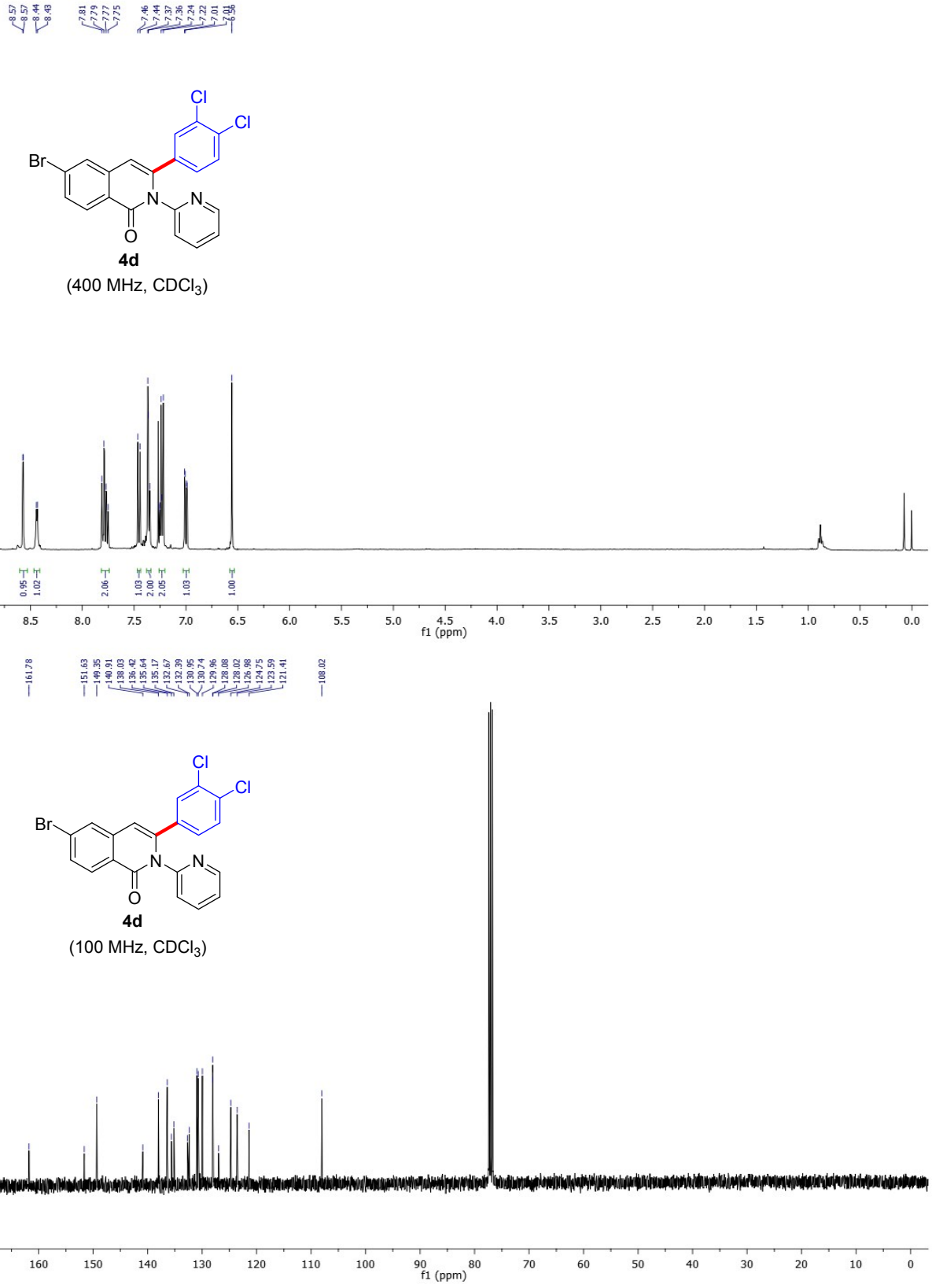
4c
(400 MHz, $CDCl_3$)



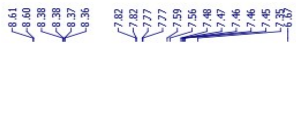


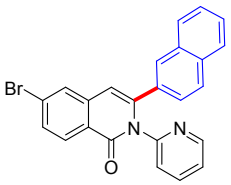
4c
(100 MHz, $CDCl_3$)

6-Bromo-3-(3, 4-dichlorophenyl)-2-(pyridin-2-yl)isoquinolin-1(2*H*)-one:

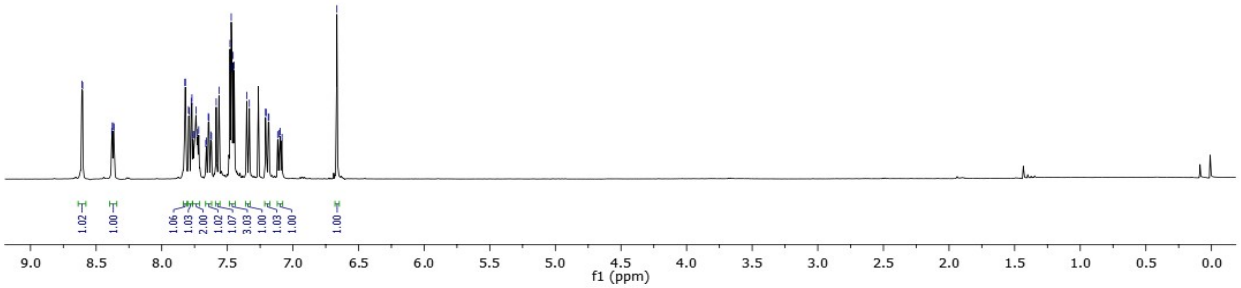


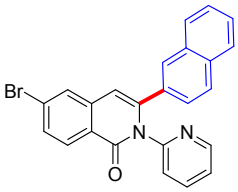
6-Bromo-3-(naphthalen-2-yl)-2-(pyridin-2-yl)isoquinolin-1(2H)-one:





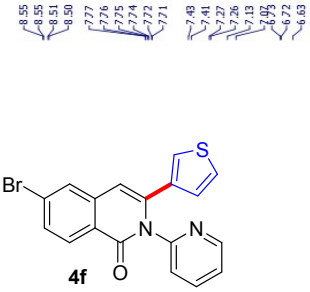
4e
(400 MHz, $CDCl_3$)



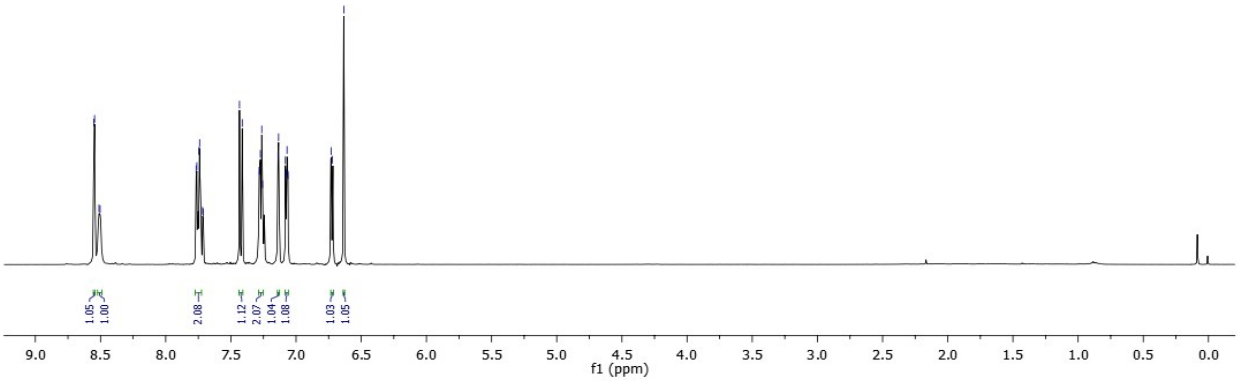


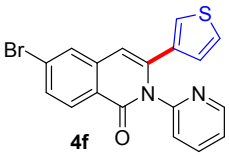
4e
(100 MHz, $CDCl_3$)

6-Bromo-2-(pyridin-2-yl)-3-(thiophen-3-yl)isoquinolin-1(2*H*)-one:

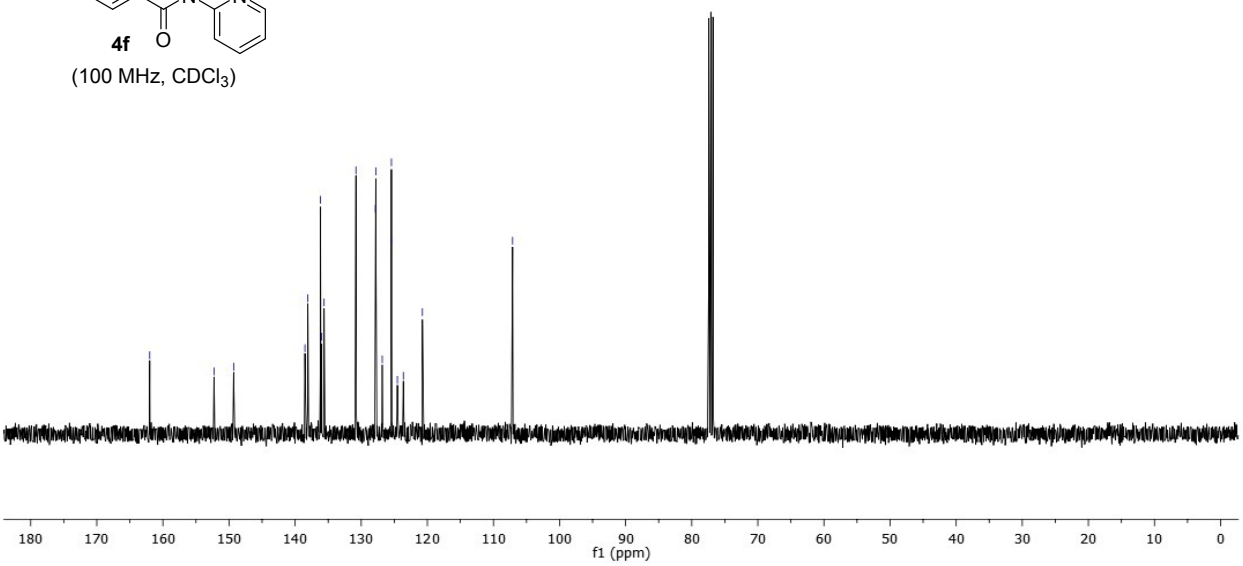


(400 MHz, $CDCl_3$)

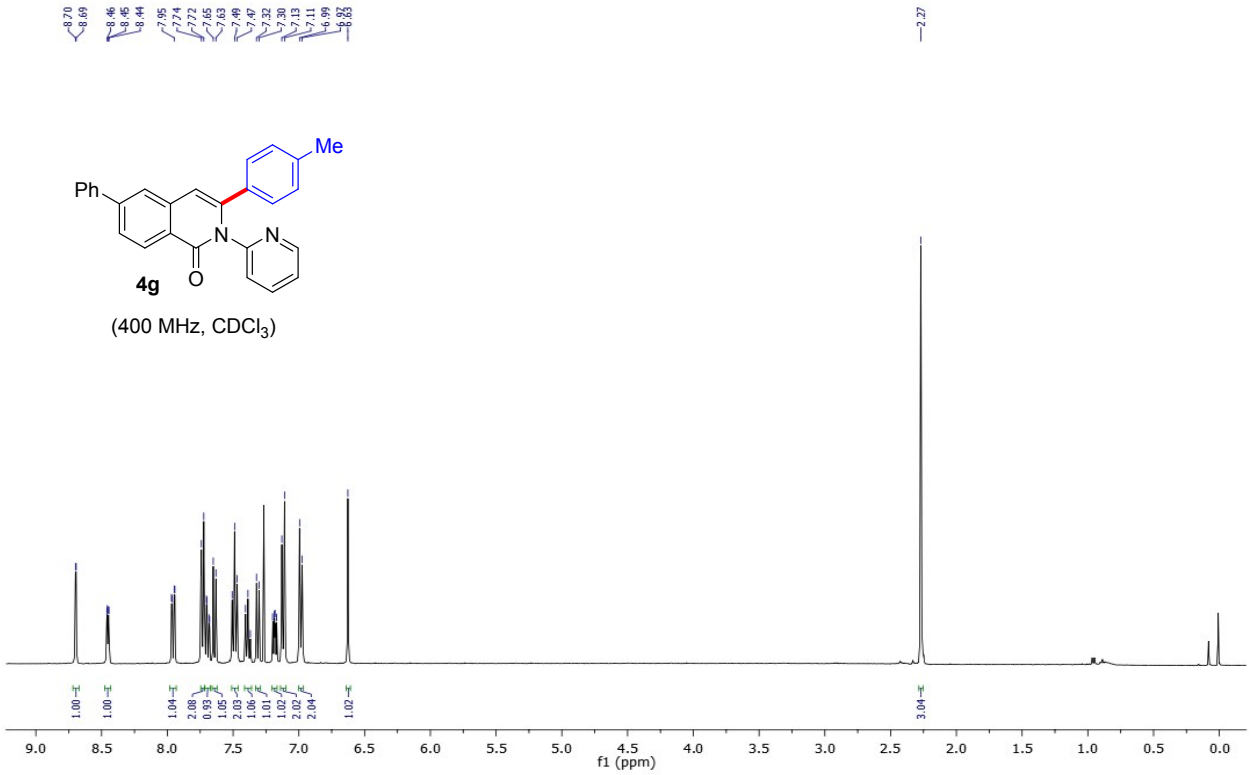


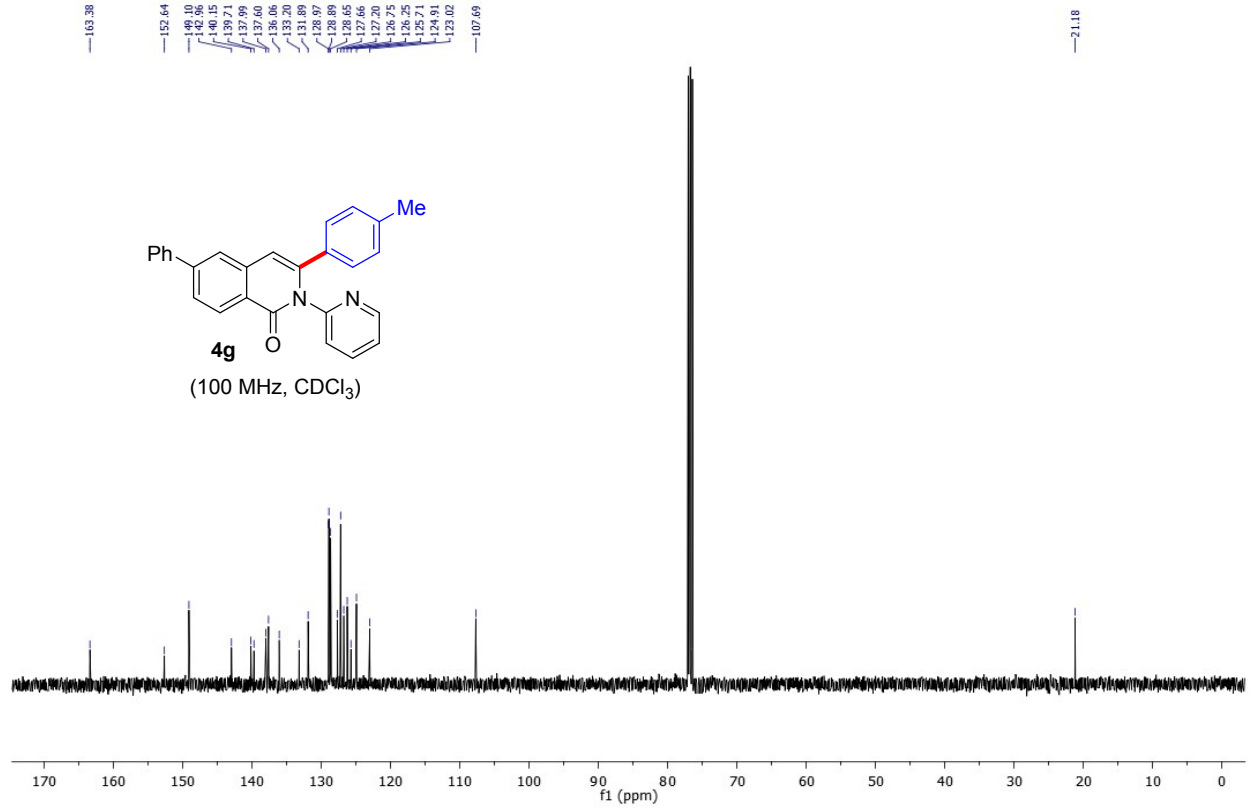


(100 MHz, $CDCl_3$)

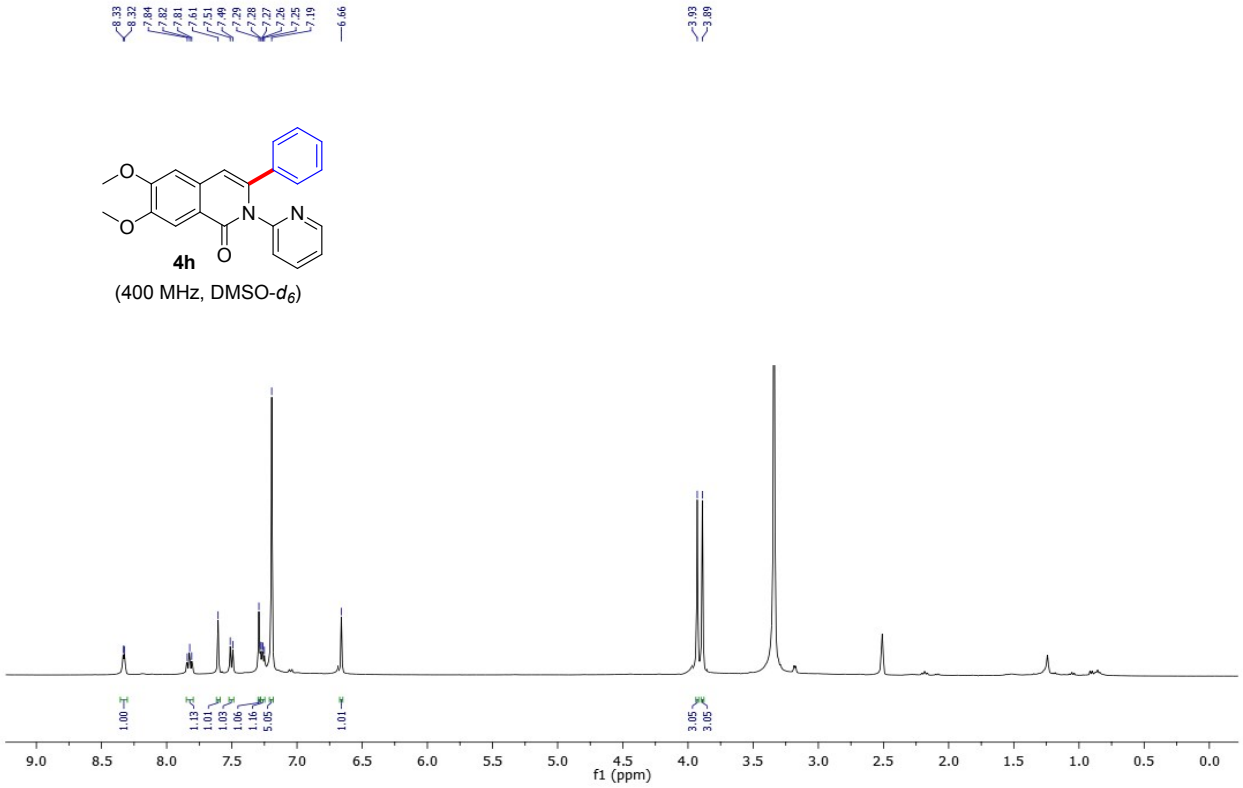


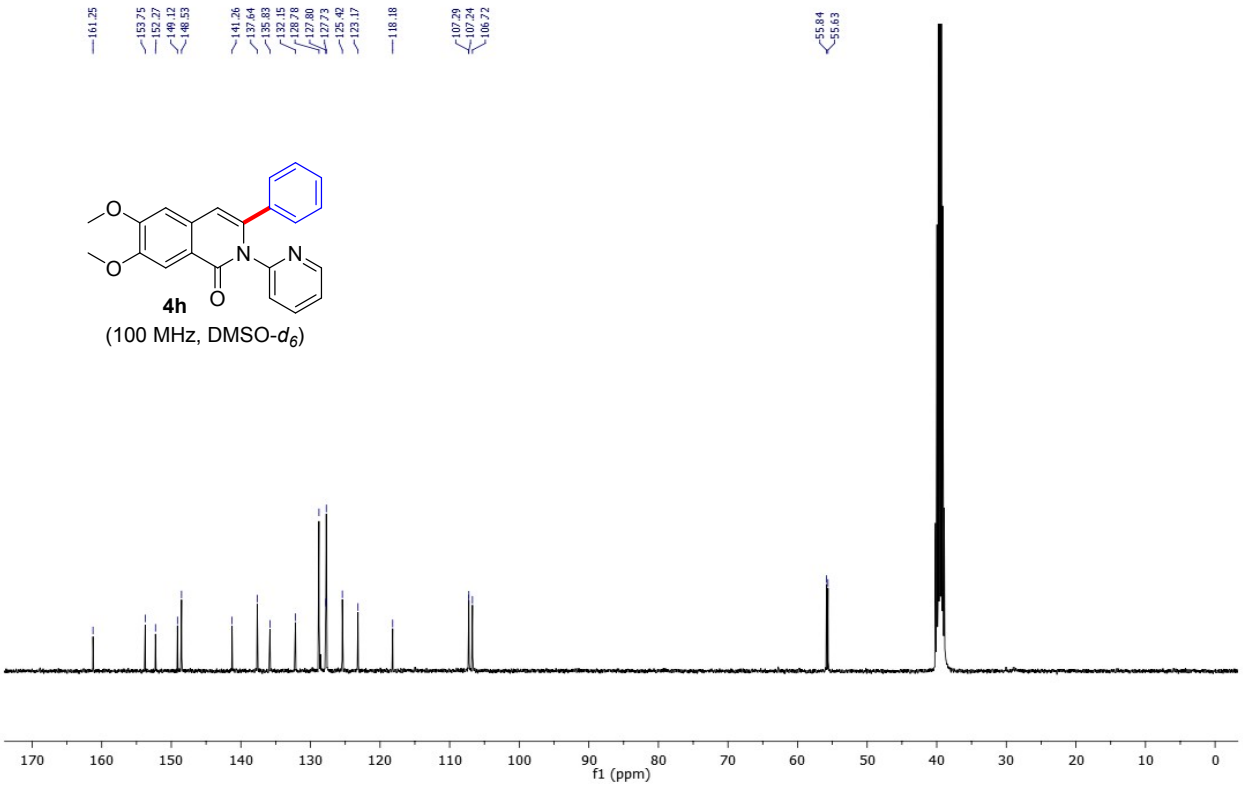
6-Phenyl-2-(pyridin-2-yl)-3-(*p*-tolyl)isoquinolin-1(2*H*)-one:



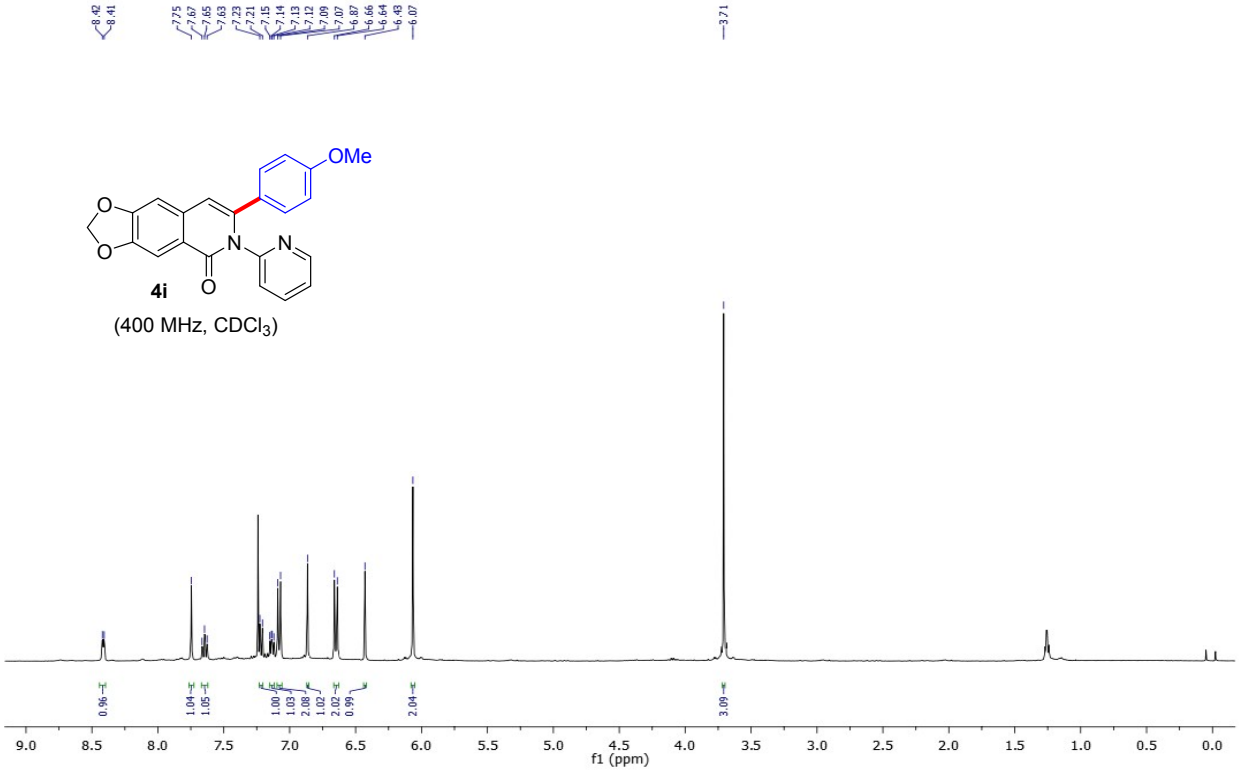


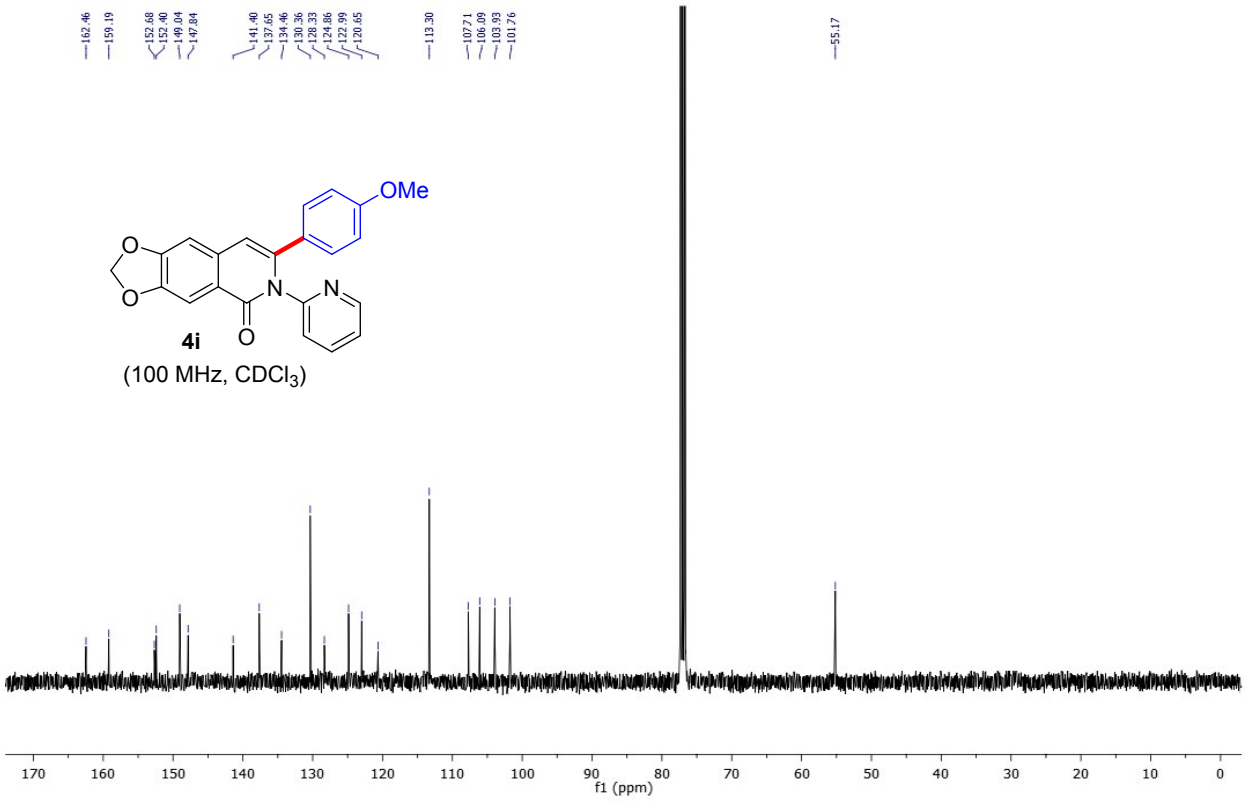
6, 7-Dimethoxy-3-phenyl-2-(pyridin-2-yl)isoquinolin-1(2*H*)-one:





7-(4-Methoxyphenyl)-6-(pyridin-2-yl)-[1, 3]dioxolo[4, 5-g]isoquinolin-5(6*H*)-one:





7-(3, 4-Dimethoxyphenyl)-6-(pyridin-2-yl)-[1, 3]dioxolo[4, 5-g]isoquinolin-5(6*H*)-one: