Supporting Information

Arenethiolate-catalyzed C_{aryl}–F bond activation: Synthesis of oxindoles

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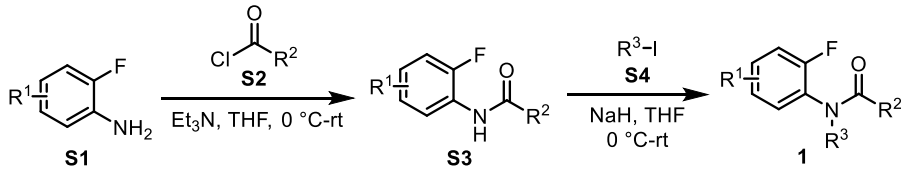
1. General information

All glassware was thoroughly oven-dried. Chemicals and solvents were either purchased from commercial suppliers or purified by standard techniques. Thin-layer chromatography plates were visualized by exposure to ultraviolet light and/or staining with phosphomolybdic acid followed by heating on a hot plate. Flash chromatography was carried out using silica gel (200−300 mesh). ^{1}H NMR and ^{13}C NMR spectra were recorded on a Bruker AM-400 (400 MHz). The spectra were recorded in deuterochloroform ($CDCl_3$) as solvent at room temperature, ^{1}H and ^{13}C NMR chemical shifts are reported in ppm relative to the residual solvent peak. The residual solvent signals were used as references and the chemical shifts were converted to the TMS scale ($CDCl_3$: δ_H = 7.26 ppm, δ_C = 77.0 ppm). Data for ^{1}H NMR are reported as follows: chemical shift (δ ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet, dd = doublet, br = broad), integration, coupling constant (Hz) and assignment. Data for ^{13}C NMR are reported as chemical shift. Mass spectra were measured on Shimadzu GCMS-QP2010 instrument (EI). Electrospray–ionisation HRMS data were acquired on a Q–TOF mass spectrometer (Waters SYNAPT G2-Si) LC-MS TOF. UV/vis absorption spectra were acquired on a UV-5 spectrophotometer

2. General procedure for the synthesis of substrates 1 and 3

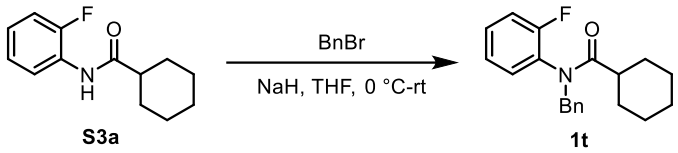
2.1. General procedure for the synthesis of substrates 1a-1s.



To a stirred, cooled (0–5 °C) solution of 2-fluoroaniline **S1** (0.96 mL, 10 mmol) and Et_3N (1.55 mL, 11 mmol) in THF (20 mL), a solution of acyl chloride **S2** (10 mmol) in THF (5 mL) was added dropwise within 10 min. Then the ice bath was removed and the mixture was stirred vigorously for 30 min at room temperature. Then the solid $Et_3N{\cdot}HCl$ was filtered off and washed with THF (3 x 5 mL) and the resulting organic layers were combined and THF was removed under reduced pressure to yield crude amides **S3**. Recrystallization from hexane/$CHCl_3$ and drying in vacuum afforded pure compounds **S3**.

To a stirred suspension of NaH (132.0 mg, 5.5 mmol) in THF (5 mL) at 0 °C, the respective amide **S3** (5 mmol) dissolved in THF (10 mL) was added dropwise within 10 min. The reaction mixture was stirred until the solution became clear (30 min, with hydrogen gas evolved), and the solution of the corresponding alkyl iodide **S4** (6.5 mmol) in THF (5 mL) was added dropwise within 10 min. The solution was warmed up to room temperature. The reaction mixture was monitored by TLC and quenched with water (30 mL). The resulting solution was extracted with ethyl acetate (3 x 20 mL). The combined organic layers were washed with brine (1 x 20 mL) and dried over Na_2SO_4. The ethyl acetate was removed under reduced pressure to give the crude product, which was purified by flash chromatography to afford the pure compound **1a-1s**.[1]

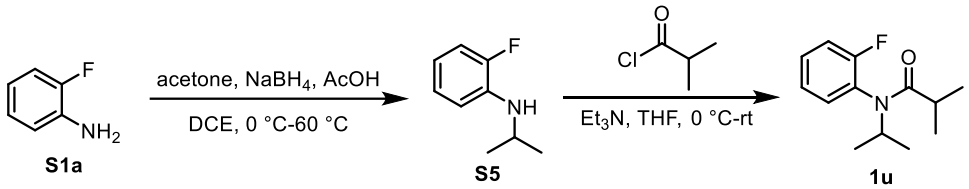
2.2. General procedure for the synthesis of substrates 1t.



S3a 1t

To a stirred suspension of NaH (132.0 mg, 5.5 mmol) in THF (5 mL) at 0 °C, the amide **S3a** (5 mmol) dissolved in THF (10 mL) was added dropwise within 10 min. The reaction mixture was stirred until the solution became clear (30 min, with hydrogen gas evolved), and the solution of BnBr (0.77 mL, 6.5 mmol) in THF (5 mL) was added dropwise within 10 min. The solution was warmed up to room temperature. The reaction mixture was monitored by TLC and quenched with water (30 mL). Then the resulting solution was extracted with ethyl acetate (3 x 20 mL). The combined organic layers were washed with brine (1 x 20 mL) and dried over Na_2SO_4. The ethyl acetate was removed under reduced pressure to give the crude product, which was purified by flash chromatography to afford the pure compound **1t**.

2.3. General procedure for the synthesis of substrates 1u.



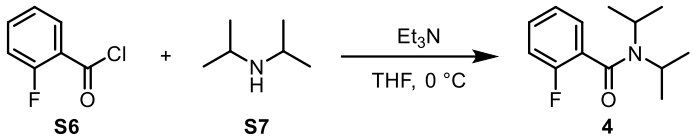
S1a S5 1u

Acetic acid (7.72 mL, 45 mmol) was added to the suspension of $NaBH_4$ (0.56 g, 15 mmol) in DCE or CH_2Cl_2 at 0 °C dropwise over 1 h and the resulting suspension was stirred at room temperature for 1-18 h. The mixture was added a solution of an aniline derivative **S1** (0.96 mL, 10 mmol), ketone (0.73 mL, 10 mmol), and acetic acid (1.7 mL, 10 mmol) in DCE. The solution was stirred at rt-60 °C for 3-16 h. The mixture was quenched by H_2O, and the organic layer was washed with H_2O (3 times) and all the volatiles were removed in vacuo. The residue was purified by flash chromatography to give the corresponding N-alkylaniline **S5**.[2]

To a stirred, cooled (0–5 °C) solution of N-alkylaniline **S6** (0.76 g, 5 mmol) and Et_3N (0.55 g, 0.77 mL, 5.5 mmol) in 10 mL of dry THF, a solution of an appropriate acyl chloride (5 mmol) in 5 mL of dry THF was added dropwise within 10 min. Then the ice bath was removed and the mixture was stirred vigorously for 30 min at room temperature. After solid $Et_3N{\cdot}HCl$ was filtered off and washed with THF (3 x 5 mL),

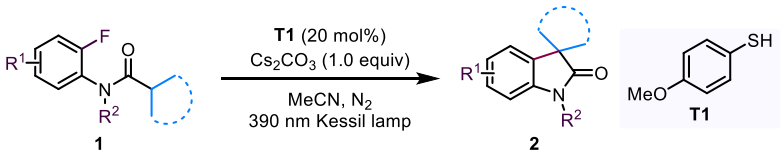
the resulting organic fractions were combined and THF was removed under reduced pressure to yield crude amides **1u**, which was purified by flash chromatography to afford the pure compound **1u**.[1]

2.4. General procedure for the synthesis of substrates 4.



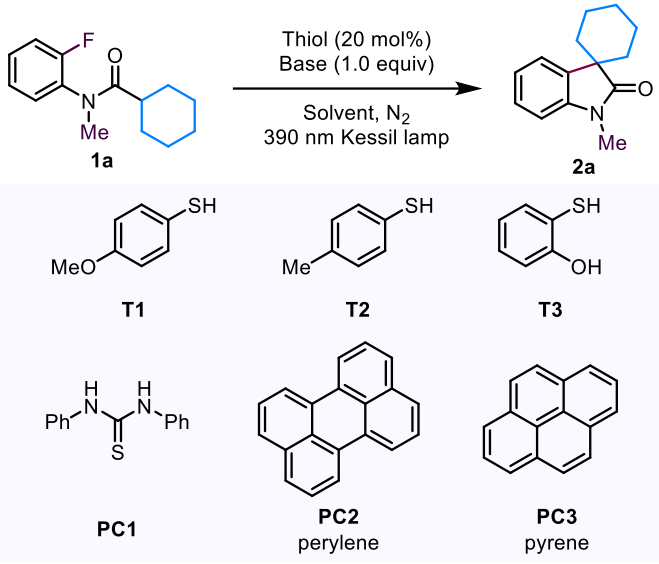
To a stirred, cooled (0–5 °C) solution of diisopropylamine **S7** (0.96 mL, 10 mmol) and Et_3N (1.55 mL, 11 mmol) in THF (20 mL), a solution of acyl chloride **S6** (10 mmol) in THF (5 mL) was added dropwise within 10 min. Then the ice bath was removed and the mixture was stirred vigorously for 30 min at room temperature. After solid $Et_3N{\cdot}HCl$ was filtered off and washed with THF (3 x 5 mL), the resulting organic layers were combined and THF was removed under reduced pressure to yield crude product, which was purified by flash chromatography to afford the pure product **4**.

3. General procedure for the arenethiolate-catalyzed C-F bond activation to access oxindoles.



All optimization reactions were set up in a glove box under N_2 atmosphere. Substrate **1** (0.2 mmol, 1.0 equiv), 4-methoxybenzenethiol (0.04 mmol, 0.2 equiv), Cs_2CO_3 (0.2 mmol, 1.0 equiv) were added to dry MeCN (2 mL) at room temperature under 390 nm Kessil lamp. The resulting mixture was stirred at rt for 24 h. Upon completion of the reaction, the solvent was removed under reduced pressure and the crude product was purified by column chromatography on silica gel to afford the desired product **2**. The light source is a 40 W Kessil LED photoreaction lighting and the intensity values are the average of PR160L-390 nm. The distance from the light source to the irradiation vessel is about 3 cm.

4. Condition optimization for the arenethiolate-catalyzed C-F bond activation to access oxindoles.[a]

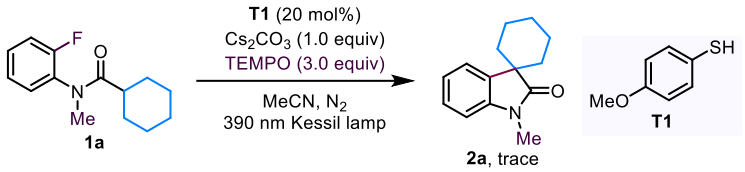


Entry	Photocatalyst	Base	Solvent	Yield (%)[b]
1	**T1**	K_2CO_3	DMSO	57
2[c]	**T1**	K_2CO_3	DMSO	24
3[d]	**T1**	K_2CO_3	DMSO	/
4	**T2**	K_2CO_3	DMSO	50
5	**T3**	K_2CO_3	DMSO	17
6	**T1**	$KHCO_3$	DMSO	56
7	**T1**	Cs_2CO_3	DMSO	71
8	**T1**	Cs_2CO_3	DMF	77
9	**T1**	Cs_2CO_3	MeCN	82 (77)[e]
10	**T1**	Cs_2CO_3	THF	/
11	**T1**	Cs_2CO_3	DCM	/
12	**T1**	Cs_2CO_3	DCE	/
13	**T1**	Cs_2CO_3	MeOH	13
14	**T1**	Cs_2CO_3	EtOH	34
15	$Ru(bpy)_3Cl_2$	Cs_2CO_3	MeCN	33
16	*fac*-$Ir(ppy)_3$	Cs_2CO_3	MeCN	62

17	**PC1**	Cs_2CO_3	MeCN	59
18	**PC2**	Cs_2CO_3	MeCN	30
19	**PC3**	Cs_2CO_3	MeCN	48

[a] Unless otherwise noted, reaction conditions are as follows: **1a** (0.2 mmol), thiol (0.04 mmol), base (0.2 mmol), solvent (2.0 mL), 390 nm Kessil lamp, 24 h, under a N_2 atmosphere; [b] Yields determined by ^1H NMR yield using trimethoxybenzene as an internal standard; [c] Under air; [d] In the dark; [e] isolated yield in parenthesis.

5. TEMPO trapping experiments



Substrate **1a** (0.2 mmol, 1.0 equiv), 4-methoxybenzenethiol (0.04 mmol, 0.2 equiv), Cs_2CO_3 (0.2 mmol, 1.0 equiv) and TEMPO (0.6 mmol, 3.0 equiv) were added to dry MeCN (2 mL) at room temperature under 390 nm Kessil lamp. The resulting mixture was stirred at rt for 24 h. Only trace amount of product **2a** was detected, indicating that the reaction is proceeded through a radical pathway.

6. UV-vis absorption spectra

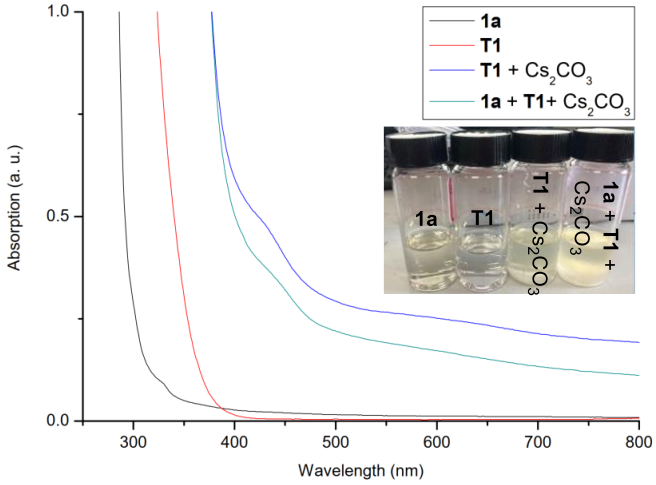


Figure S1. Absolute absorption spectra of 4-methoxybenzenethiol, substrate **1a**, Cs_2CO_3 and their mixtures. The UV/vis spectra of **1a** (0.1 M in MeCN), 4-methoxybenzenethiol (0.02 M in MeCN), Cs_2CO_3 (0.1 M in MeCN).

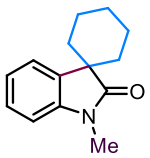
7. Reference

1. J.-Q. Chen, R. Chang, J.-B. Lin, Y.-C. Luo, P.-F. Xu, Photoredox-induced intramolecular 1,5-H transfer reaction of aryl iodides for the synthesis of spirocyclic γ-lactams. *Org. Lett.*, 2018, **20**, 2395-2398.

2. S. Okumura, T. Komine, E. Shigeki, K. Eemba, Y. Nakao, Site-selective linear alkylation of anilides by cooperative nickel/aluminum catalysis. *Angew. Chem. Int. Ed.*, 2018, **57**, 929-932.

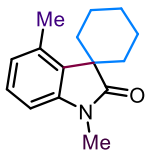
8. Characterization of all products

1'-Methylspiro[cyclohexane-1,3'-indolin]-2'-one (2a)



Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 33.1 mg, 77% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.45 (d, *J* = 7.4 Hz, 1H), 7.27 (td, *J* = 7.7, 1.2 Hz, 1H), 7.04 (td, *J* = 7.6, 1.1 Hz, 1H), 6.84 (d, *J* = 7.7 Hz, 1H), 3.20 (s, 3H), 2.01–1.89 (m, 2H), 1.89–1.80 (m, 2H), 1.80–1.67 (m, 3H), 1.67–1.60 (m, 1H), 1.60–1.52 (m, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 180.7, 142.8, 135.4, 127.4, 123.9, 121.9, 107.9, 47.5, 33.0, 26.2, 25.2, 21.2.

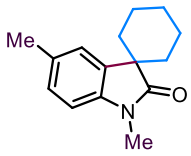
1',4'-Dimethylspiro[cyclohexane-1,3'-indolin]-2'-one (2b)



Purification by flash chromatography (*n*-hexane/ethyl acetate = 15/1); White solid; mp 52–54 °C; 18.8 mg, 41% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.14 (t, *J* = 7.8 Hz, 1H), 6.79 (d, *J* = 7.8 Hz, 1H), 6.64 (d, *J* = 7.7 Hz, 1H), 3.15 (s, 3H), 2.45 (s, 3H), 2.38–2.22 (m, 2H), 2.13 (td, *J* = 13.8, 4.4 Hz, 2H), 1.95–1.83 (m, 1H), 1.69–1.52 (m, 4H), 1.40–1.18 (m, 1H); **^{13}C NMR (100**

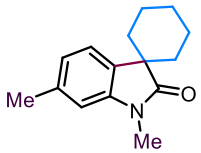
MHz, $CDCl_3$) δ (ppm) = 180.3, 143.2, 133.8, 131.9, 127.5, 125.5, 105.6, 47.4, 30.0, 25.8, 25.5, 20.5, 18.6; HRMS (ESI) for $C_{15}H_{20}NO$ $[M+H]^+$ calcd. 230.1539, found 230.1538

1',5'-Dimethylspiro[cyclohexane-1,3'-indolin]-2'-one (2c)



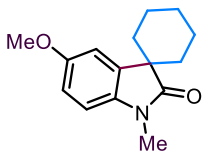
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 35.7 mg, 78% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.27 (s, 1H), 7.07 (d, *J* = 7.8 Hz, 1H), 6.73 (d, *J* = 7.9 Hz, 1H), 3.18 (s, 3H), 2.36 (s, 3H), 2.00–1.88 (m, 2H), 1.88–1.76 (m, 3H), 1.76–1.69 (m, 2H), 1.68–1.60 (m, 1H), 1.59–1.51 (m, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 180.7, 140.5, 135.5, 131.3, 127.6, 124.8, 107.6, 47.5, 33.1, 26.2, 25.2, 21.3, 21.3; HRMS (ESI) for $C_{15}H_{19}NO$ $[M+H]^+$ calcd. 230.1539, found 230.1537

1',6'-Dimethylspiro[cyclohexane-1,3'-indolin]-2'-one (2d)



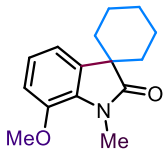
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 23.0 mg, 50% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.35 (d, *J* = 7.6 Hz, 1H), 6.86 (d, *J* = 7.6 Hz, 1H), 6.68 (s, 1H), 3.18 (s, 3H), 2.39 (s, 3H), 1.97–1.87 (m, 2H), 1.87–1.79 (m, 2H), 1.79–1.67 (m, 3H), 1.67–1.57 (m, 1H), 1.57–1.49 (m, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 181.0, 143.0, 137.5, 132.5, 123.7, 122.3, 108.9, 47.4, 33.1, 26.1, 25.2, 21.7, 21.3; HRMS (ESI) for $C_{15}H_{20}NO$ $[M+H]^+$ calcd. 230.1539, found 230.1538.

5'-Methoxy-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2e)



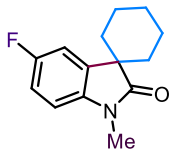
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 39.2 mg, 75% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.08 (d, *J* = 2.4 Hz, 1H), 6.79 (dd, *J* = 8.4, 2.4 Hz, 1H), 6.74 (d, *J* = 8.4 Hz, 1H), 3.81 (s, 3H), 3.18 (s, 3H), 2.00–1.89 (m, 2H), 1.89–1.80 (m, 2H), 1.80–1.67 (m, 3H), 1.67–1.59 (m, 1H), 1.59–1.50 (m, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 180.4, 155.5, 136.8, 136.5, 112.3, 110.8, 107.8, 55.9, 47.8, 33.0, 26.2, 25.1, 21.2.

7'-Methoxy-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2f)



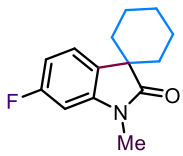
Purification by flash chromatography (*n*-hexane/ethyl acetate = 15/1); Yellow oil; 26.6 mg, 54% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.05 (dd, *J* = 7.4, 0.8 Hz, 1H), 6.98 (t, *J* = 7.9 Hz, 1H), 6.85 (dd, *J* = 8.2, 0.7 Hz, 1H), 3.85 (s, 3H), 3.47 (s, 3H), 2.09–1.90 (m, 2H), 1.86–1.76 (m, 2H), 1.76–1.62 (m, 4H), 1.61–1.50 (m, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.9, 145.2, 137.2, 130.7, 122.4, 116.6, 111.5, 56.0, 47.3, 33.3, 29.4, 25.2, 21.1; HRMS (ESI) for $C_{15}H_{20}NO_2$ $[M+H]^+$ calcd. 246.1489, found 246.1488.

5'-Fluoro-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2g)



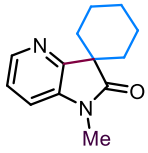
Purification by flash chromatography (*n*-hexane/ethyl acetate = 15/1); Colorless oil; 35.5 mg, 76% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.21 (dd, *J* = 8.5, 2.6 Hz, 1H), 6.97 (td, *J* = 8.8, 2.6 Hz, 1H), 6.75 (dd, *J* = 8.5, 4.3 Hz, 1H), 3.19 (s, 3H), 2.03–1.90 (m, 2H), 1.90–1.79 (m, 2H), 1.77–1.58 (m, 4H), 1.58–1.47 (m, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.4, 158.8 (*J* = 239.3 Hz), 138.8, 136.9 (*J* = 7.8 Hz), 113.4 (*J* = 23.3 Hz), 112.2 (*J* = 25.0 Hz), 108.1 (*J* = 8.2 Hz), 47.9, 32.9, 26.3, 25.0, 21.1; HRMS (ESI) for $C_{14}H_{17}FNO$ $[M+H]^+$ calcd. 234.1289, found 234.1289.

6'-Fluoro-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2h)



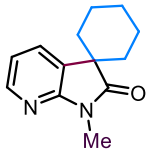
Purification by flash chromatography (*n*-hexane/ethyl acetate = 10/1); Colorless oil; 10.7 mg, 23% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.21 (td, *J* = 8.1, 5.3 Hz, 1H), 6.72 (t, *J* = 9.1 Hz, 1H), 6.61 (d, *J* = 7.7 Hz, 1H), 3.17 (s, 3H), 2.19–2.04 (m, 2H), 2.04–1.93 (m, 2H), 1.85–1.72 (m, 3H), 1.72–1.62 (m, 2H), 1.55–1.40 (m, 1H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 179.8, 158.9 (*J* = 247.0 Hz), 145.1 (*J* = 10.2 Hz), 129.2 (*J* = 9.0 Hz), 120.6 (*J* = 19.0 Hz), 110.3 (*J* = 22.4 Hz), 103.9 (*J* = 2.9 Hz), 47.6, 31.6, 26.3, 25.1, 20.7; HRMS (ESI) for $C_{14}H_{17}FNO$ $[M+H]^+$ calcd. 234.1289, found 234.1287.

1'-Methylspiro[cyclohexane-1,3'-pyrrolo[3,2-b]pyridin]-2'(1'H)-one (2i)



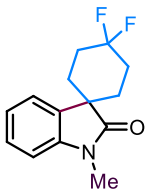
Purification by flash chromatography (*n*-hexane/ethyl acetate = 15/1); White solid; mp 72–73 ℃; 33.3 mg, 77% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 8.22 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.16 (dd, *J* = 7.8, 5.1 Hz, 1H), 7.05 (dd, *J* = 7.8, 1.2 Hz, 1H), 3.21 (s, 3H), 2.06–1.85 (m, 4H), 1.83–1.57 (m, 6H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 179.2, 156.2, 142.1, 137.5, 122.0, 113.6, 47.3, 31.7, 25.8, 25.4, 20.7; HRMS (ESI) for $C_{13}H_{17}N_2O$ $[M+H]^+$ calcd. 217.1335, found 217.1335.

1'-methylspiro[cyclohexane-1,3'-pyrrolo[2,3-b]pyridin]-2'(1'H)-one (2j)



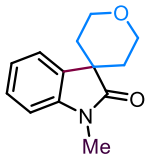
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); White solid; mp 64–66 ℃; 32.8 mg, 76% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 8.18 (dd, *J* = 5.3, 1.6 Hz, 1H), 7.70 (dd, *J* = 7.3, 1.4 Hz, 1H), 6.94 (dd, *J* = 7.3, 5.3 Hz, 1H), 3.29 (s, 3H), 2.00–1.82 (m, 4H), 1.82–1.50 (m, 6H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 180.3, 156.3, 146.2, 131.1, 129.5, 117.6, 47.5, 32.5, 25.4, 25.0, 21.4; HRMS (ESI) for $C_{13}H_{17}N_2O$ $[M+H]^+$ calcd. 217.1335, found 217.1334.

4,4-Difluoro-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2k)



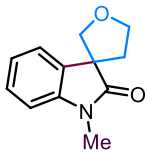
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); White solid; mp 70–71 ℃; 39.3 mg, 91% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.30 (td, *J* = 7.7, 1.1 Hz, 1H), 7.25 (d, *J* = 7.7 Hz, 1H), 7.08 (td, *J* = 7.6, 0.8 Hz, 1H), 6.86 (d, *J* = 7.8 Hz, 1H), 3.21 (s, 3H), 2.74–2.53 (m, 2H), 2.18–2.03 (m, 2H), 2.05–1.85 (m, 4H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 179.2, 142.8, 133.4, 128.2, 123.2 (*J* = 240.2 Hz), 122.6, 122.6, 108.2, 45.1, 30.3 (*J* = 3.2 Hz), 29.2 (*J* = 24.6 Hz), 26.1; HRMS (ESI) for $C_{14}H_{16}F_2NO$ $[M+H]^+$ calcd. 252.1194, found 252.1193.

1-Methyl-2',3',5',6'-tetrahydrospiro[indoline-3,4'-pyran]-2-one (2l)



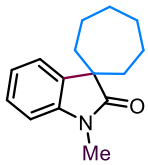
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); White solid; mp 94-95 °C; 28.0 mg, 64% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.38 (d, *J* = 7.4 Hz, 1H), 7.30 (t, *J* = 7.4 Hz, 1H), 7.09 (t, *J* = 7.0 Hz, 1H), 6.86 (d, *J* = 7.7 Hz, 1H), 4.34–4.19 (m, 2H), 3.98–3.88 (m, 2H), 3.21 (s, 3H), 1.86 (t, *J* = 5.4 Hz, 4H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 179.7, 142.8, 134.1, 128.0, 123.1, 122.5, 108.1, 63.0, 44.3, 32.9, 26.1.

1'-Methyl-4,5-dihydro-2H-spiro[furan-3,3'-indolin]-2'-one (2m)



Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); White solid; mp 84–85 °C; 22.7 mg, 56% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.35–7.23 (m, 2H), 7.09 (t, *J* = 7.2 Hz, 1H), 6.86 (d, *J* = 7.6 Hz, 1H), 4.28–4.15 (m, 2H), 4.03 (d, *J* = 8.4 Hz, 1H), 3.93 (d, *J* = 8.5 Hz, 1H), 3.24 (s, 3H), 2.58–2.47 (m, 1H), 2.20–2.09 (m, 1H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 178.2, 142.9, 134.0, 128.1, 123.0, 122.6, 108.0, 69.1, 54.3, 38.6, 26.4; HRMS (ESI) for $C_{12}H_{14}NO_2$ $[M+H]^+$ calcd. 204.1019, found 204.1019.

1'-Methylspiro[cycloheptane-1,3'-indolin]-2'-one (2n)



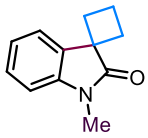
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 26.2 mg, 57% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.34 (d, *J* = 7.4 Hz, 1H), 7.25 (t, *J* = 7.2 Hz, 1H), 7.04 (t, *J* = 7.5 Hz, 1H), 6.82 (d, *J* = 7.7 Hz, 1H), 3.18 (s, 3H), 2.05–1.86 (m, 4H), 1.81–1.62 (m, 8H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 182.2, 142.5, 137.4, 127.4, 122.7, 122.3, 107.8, 50.1, 36.9, 31.3, 26.1, 23.8.

1'-Methylspiro[cyclopentane-1,3'-indolin]-2'-one (2o)

Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); White solid; mp 55–56 °C; 19.3 mg, 48% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.24 (t, *J* = 7.7 Hz, 1H), 7.20 (d, *J* = 7.3 Hz, 1H), 7.04 (t, *J* = 7.5 Hz, 1H), 6.82 (d, *J* = 7.7 Hz, 1H), 3.21 (s, 3H), 2.20–2.02 (m, 4H), 2.02–1.91 (m, 2H), 1.90–1.77 (m, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 182.0, 142.9,

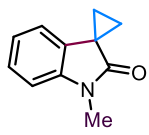
136.9, 127.4, 122.5, 122.2, 107.7, 53.9, 38.3, 26.7, 26.3.

1'-Methylspiro[cyclobutane-1,3'-indolin]-2'-one (2p)



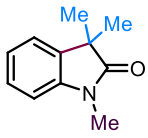
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 9.3 mg, 25% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.51 (dd, *J* = 7.3, 0.6 Hz, 1H), 7.26 (td, *J* = 7.7, 1.2 Hz, 1H), 7.10 (td, *J* = 7.6, 0.9 Hz, 1H), 6.79 (d, *J* = 7.7 Hz, 1H), 3.19 (s, 3H), 2.74–2.58 (m, 2H), 2.44–2.19 (m, 4H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.2, 143.0, 134.4, 127.8, 122.6, 122.2, 107.6, 48.1, 31.3, 26.2, 16.8.

1'-Methylspiro[cyclopropane-1,3'-indolin]-2'-one (2q)



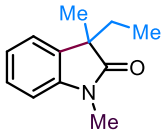
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); White solid; mp 78–79 °C; 28.4 mg, 82% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.26 (t, *J* = 7.7 Hz, 1H), 7.03 (t, *J* = 7.5 Hz, 1H), 6.91 (d, *J* = 7.8 Hz, 1H), 6.84 (d, *J* = 7.1 Hz, 1H), 3.30 (s, 3H), 1.74 (dd, *J* = 4.0, 7.6 Hz, 2H), 1.51 (q, *J* = 4.0, 7.6 Hz, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 177.1, 143.6, 130.9, 126.8, 122.0, 118.3, 108.0, 27.1, 26.6, 19.2.

1,3,3-Trimethylindolin-2-one (2r)



Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 20.3 mg, 58% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.26 (td, *J* = 7.7, 1.1 Hz, 1H), 7.21 (d, *J* = 7.3 Hz, 1H), 7.06 (td, *J* = 7.6, 0.1 Hz, 1H), 6.85 (d, *J* = 7.8 Hz, 1H), 3.22 (s, 3H), 1.37 (s, 6H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 181.4, 142.6, 135.8, 127.7, 122.5, 122.3, 108.0, 44.2, 26.2, 24.4.

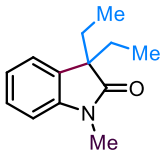
3-Ethyl-1,3-dimethylindolin-2-one (2s)



Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 24.6 mg, 65% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.27 (t, *J* = 7.7 Hz, 1H), 7.17 (d, *J* = 7.2Hz, 1H), 7.07 (t, *J* = 7.4 Hz, 1H), 6.84 (d, *J* = 7.8 Hz, 1H), 3.22 (s, 3H), 2.00–1.86 (m, 1H), 1.84–1.71 (m, 1H), 1.35

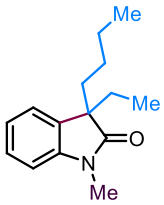
(s, 3H), 0.59 (t, J = 7.4 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.8, 143.5, 134.0, 127.6, 122.5, 122.4, 107.8, 49.0, 31.5, 26.1, 23.3, 8.9.

3,3-Diethyl-1-methylindolin-2-one (2t)



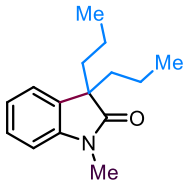
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 31.5 mg, 77% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.27 (t, J = 7.6, 1.4 Hz, 1H), 7.14 (d, J = 6.4 Hz, 1H), 7.08 (t, J = 7.4, 0.8 Hz, 1H), 6.84 (d, J = 7.7 Hz, 1H), 3.22 (s, 3H), 1.99–1.86 (m, 2H), 1.85–1.72 (m, 2H), 0.56 (t, J = 7.4 Hz, 6H).; **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.1, 144.4, 132.0, 127.6, 122.7, 122.3, 107.7, 54.4, 30.6, 25.9, 8.7.

3-Butyl-3-ethyl-1-methylindolin-2-one (2u)



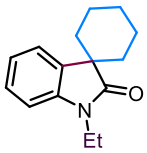
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 33.7 mg, 73% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.27 (t, J = 7.5, 1.3 Hz, 1H), 7.14 (d, J = 7.3, 0.9 Hz, 1H), 7.07 (t, J = 7.4, 0.8 Hz, 1H), 6.84 (d, J = 7.7 Hz, 1H), 3.22 (s, 3H), 1.97–1.81 (m, 2H), 1.81–1.69 (m, 4H), 1.31–1.06 (m, 1H), 1.02–0.86 (m, 1H), 0.76 (t, J = 7.3 Hz, 3H), 0.55 (t, J = 7.4 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.3, 144.2, 132.4, 127.5, 122.7, 122.4, 107.7, 53.7, 37.6, 31.0, 26.4, 26.0, 22.9, 13.8, 8.6.

1-Ethyl-3,3-dipropylindolin-2-one (2v)



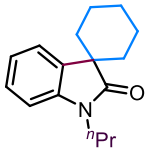
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 25.9 mg, 56% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.26 (t, J = 7.4 Hz, 1H), 7.14 (d, J = 7.2 Hz, 1H), 7.06 (t, J = 7.4 Hz, 1H), 6.82 (d, J = 7.7 Hz, 1H), 3.20 (s, 3H), 1.92–1.80 (m, 2H), 1.71 (td, J = 12.5, 4.0 Hz, 2H), 1.07–0.92 (m, 2H), 0.88–0.79 (m, 2H), 0.76 (t, J = 6.7 Hz, 6H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.4, 144.0, 132.8, 127.5, 122.6, 122.3, 107.6, 53.3, 40.3, 25.9, 17.5, 14.2.

1'-Ethylspiro[cyclohexane-1,3'-indolin]-2'-one (2w)



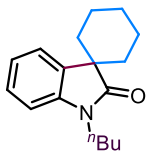
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Yellow oil; 30.9 mg, 67% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.46 (d, *J* = 7.4 Hz, 1H), 7.26 (t, *J* = 7.7 Hz, 1H), 7.03 (t, *J* = 7.6, 0.7 Hz, 1H), 6.87 (d, *J* = 7.8 Hz, 1H), 3.75 (q, *J* = 7.2 Hz, 2H), 2.01–1.89 (m, 2H), 1.88–1.80 (m, 2H), 1.80–1.68 (m, 3H), 1.68–1.60 (m, 1H), 1.59–1.51 (m, 2H), 1.25 (t, *J* = 7.2 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.3, 141.9, 135.7, 127.4, 124.1, 121.7, 108.0, 47.3, 34.4, 33.0, 25.2, 21.2, 12.7; HRMS (ESI) for $C_{15}H_{20}NO$ $[M+H]^+$ calcd. 230.1539, found 230.1538.

1'-Propylspiro[cyclohexane-1,3'-indolin]-2'-one (2x)



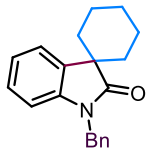
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 37.9 mg, 77% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.46 (d, *J* = 7.3 Hz, 1H), 7.25 (td, *J* = 7.7, 1.1 Hz, 1H), 7.03 (t, *J* = 7.6, 0.9 Hz, 1H), 6.86 (d, *J* = 7.8 Hz, 1H), 3.72–3.61 (m, 2H), 2.00–1.89 (m, 2H), 1.89–1.80 (m, 2H), 1.80–1.66 (m, 5H), 1.66–1.60 (m, 1H), 1.60–1.50 (m, 2H), 0.94 (t, *J* = 7.4 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.7, 142.3, 135.6, 127.3, 124.0, 121.6, 108.2, 47.3, 41.2, 33.1, 25.2, 21.2, 20.7, 11.3; HRMS (ESI) for $C_{16}H_{22}NO$ $[M+H]^+$ calcd. 244.1696, found 244.1694.

1'-Butylspiro[cyclohexane-1,3'-indolin]-2'-one (2y)



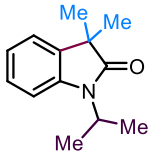
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 37.7 mg, 73% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.46 (d, *J* = 7.4 Hz, 1H), 7.25 (td, *J* = 7.7, 1.0 Hz, 1H), 7.02 (t, *J* = 7.5 Hz, 1H), 6.86 (d, *J* = 7.8 Hz, 1H), 3.70 (t, *J* = 7.3 Hz, 2H), 2.03–1.89 (m, 2H), 1.89–1.80 (m, 2H), 1.80–1.69 (m, 3H), 1.69–1.60 (m, 3H), 1.60–1.51 (m, 2H), 1.43–1.30 (m, 2H), 0.94 (t, *J* = 7.4 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.6, 142.2, 135.6, 127.3, 124.0, 121.6, 108.2, 47.3, 39.5, 33.1, 29.5, 25.2, 21.2, 20.1, 13.8; HRMS (ESI) for $C_{17}H_{24}NO$ $[M+H]^+$ calcd. 258.1852, found 258.1850.

1'-Benzylspiro[cyclohexane-1,3'-indolin]-2'-one (2z)



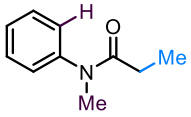
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 29.7 mg, 51% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.46 (d, *J* = 7.3 Hz, 1H), 7.32–7.19 (m, 5H), 7.14 (t, *J* = 7.7, 1.0 Hz, 1H), 7.00 (t, *J* = 7.9 Hz, 1H), 6.71 (d, *J* = 7.7 Hz, 1H), 4.90 (s, 2H), 2.05–1.86 (m, 4H), 1.84–1.68 (m, 4H), 1.68–1.58 (m, 2H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 180.8, 141.9, 136.2, 135.4, 128.8, 127.5, 127.4, 127.1, 123.9, 122.0, 109.0, 47.5, 43.4, 33.2, 25.3, 21.2; HRMS (ESI) for $C_{20}H_{22}NO$ $[M+H]^+$ calcd. 292.1696, found 292.1694.

1-Isopropyl-3,3-dimethylindolin-2-one (2aa)



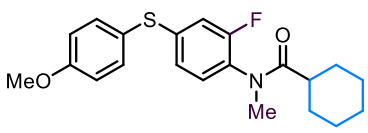
Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 30.6 mg, 75% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.24–7.17 (m, 2H), 7.03 (t, *J* = 7.6 Hz, 2H), 4.73–4.58 (m, 1H), 1.48 (d, *J* = 7.0 Hz, 6H), 1.35 (s, 6H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 181.1, 141.2, 136.4, 127.3, 122.5, 121.9, 109.9, 43.9, 43.4, 24.5, 19.4.

N-Methyl-N-phenylpropionamide (2ab')



Purification by flash chromatography (*n*-hexane/ethyl acetate = 5/1); White solid; mp 50–52 °C; 8.8 mg, 27% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.42 (t, *J* = 7.5 Hz, 2H), 7.33 (t, *J* = 7.4 Hz, 1H), 7.19 (d, *J* = 7.4 Hz, 2H), 3.27 (s, 3H), 2.09 (q, *J* = 7.5 Hz, 2H), 1.05 (t, *J* = 7.5 Hz, 3H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ (ppm) = 174.0, 144.3, 129.7, 127.7, 127.3, 37.3, 27.5, 9.7.

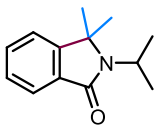
N-(2-Fluoro-4-((4-methoxyphenyl)thio)phenyl)-N-methylcyclohexanecarboxamide (2ac')



Purification by flash chromatography (*n*-hexane/ethyl acetate = 3/1); Colorless oil; 13.4 mg, 18% yield; **^{1}H NMR (400 MHz, CDCl$_3$)** δ (ppm) = 7.50 (d, *J* = 8.8 Hz, 2H), 7.04 (t, *J* = 8.1 Hz, 1H), 6.98 (d, *J* = 8.8 Hz, 2H), 6.88 (dd, *J* = 10.3, 2.0 Hz, 1H), 6.81 (dd, *J* = 10.4, 2.1 Hz, 1H), 3.86 (s, 3H), 3.14 (s, 3H), 2.17–2.04 (m, 1H), 1.73–

1.57 (m, 4H), 1.56–1.42 (m, 3H), 1.24–1.10 (m, 1H), 1.09–0.93 (m, 2H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 176.8, 160.8, 158.2 (*J* = 251.7 Hz), 142.3 (d, *J* = 7.5 Hz), 136.9, 129.6, 128.5 (*J* = 13.9 Hz), 122.6 (*J* = 3.6 Hz), 121.4, 115.5, 114.5 (*J* = 23.0 Hz), 55.5, 41.4, 36.6, 29.6, 29.1, 25.6, 25.5, 25.5; HRMS (ESI) for $C_{21}H_{25}FNO_2S$ $[M+H]^+$ calcd. 374.1585, found 374.1585.

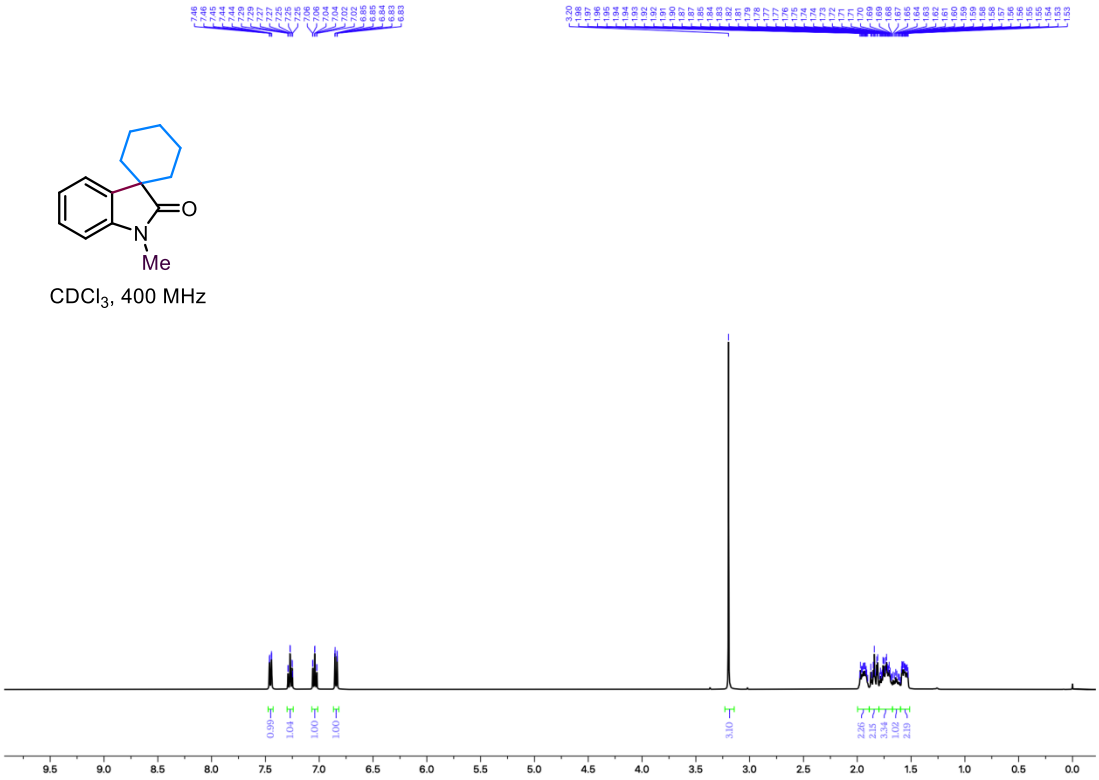
7-Fluoro-2-isopropyl-3,3-dimethylisoindolin-1-one (4)

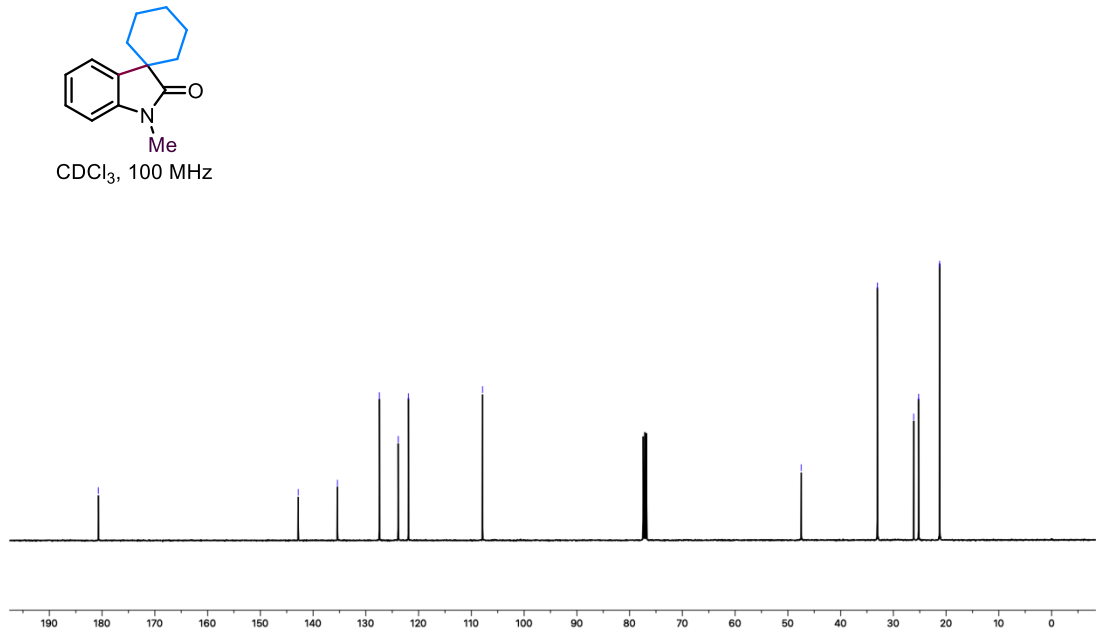


Purification by flash chromatography (*n*-hexane/ethyl acetate = 30/1); Colorless oil; 30.6 mg, 75% yield; **^{1}H NMR (400 MHz, $CDCl_3$)** δ (ppm) = 7.77 (d, *J* = 7.5 Hz, 1H), 7.51 (td, *J* = 7.5, 1.2 Hz, 1H), 7.40 (t, *J* = 7.4 Hz, 1H), 7.34 (d, *J* = 7.5 Hz, 1H), 3.72–3.58 (m, 1H), 1.56 (d, *J* = 6.9 Hz, 6H), 1.48 (s, 6H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ (ppm) = 167.2, 151.3, 132.0, 131.2, 127.9, 123.2, 120.6, 63.3, 44.6, 25.5, 20.5.

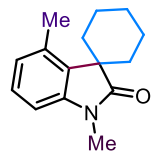
9. NMR spectra of compounds

1'-Methylspiro[cyclohexane-1,3'-indolin]-2'-one (2a)

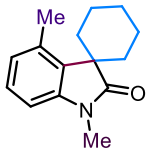




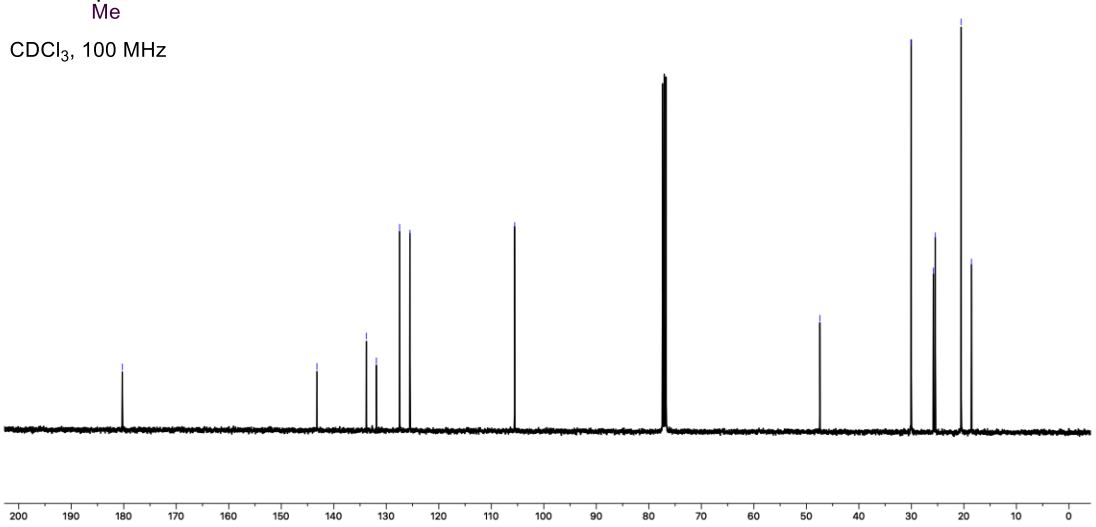
1',4'-Dimethylspiro[cyclohexane-1,3'-indolin]-2'-one (2b)



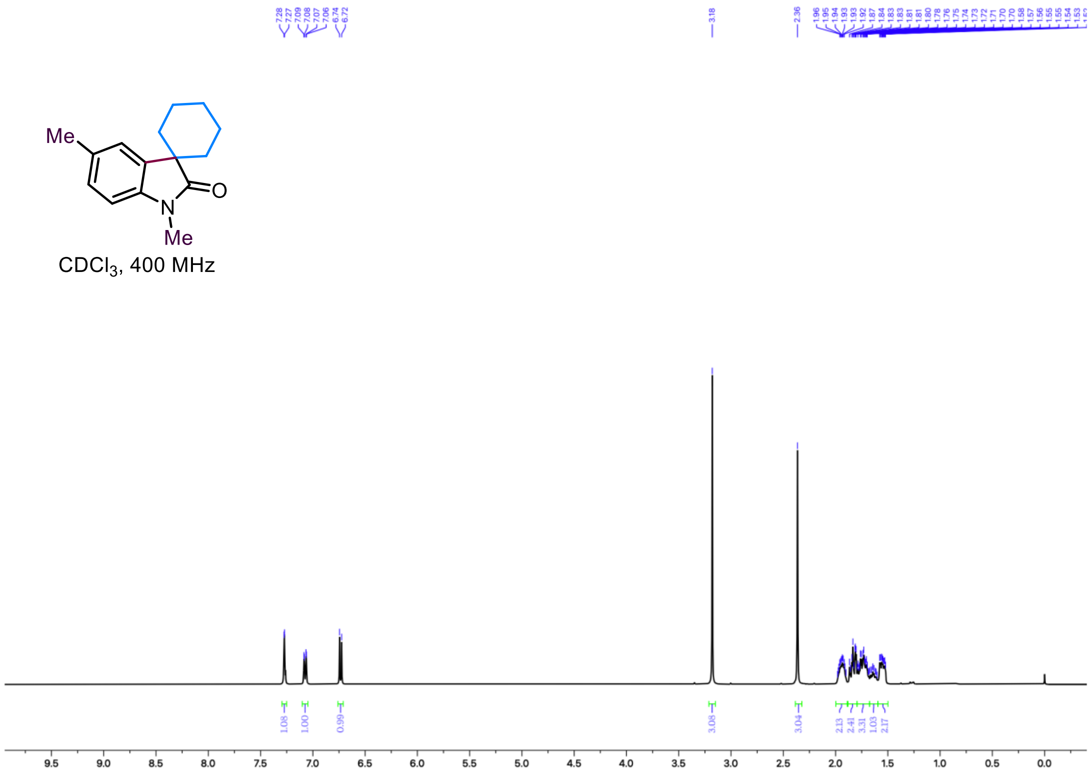
$CDCl_3$, 400 MHz

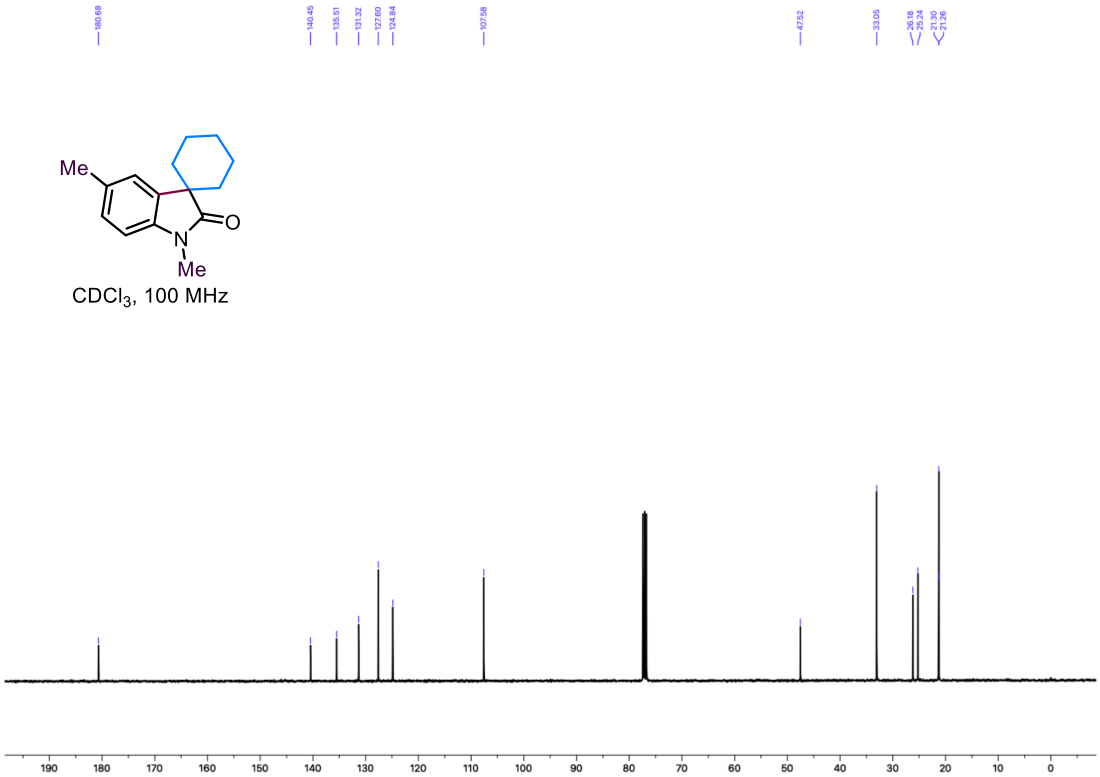


$CDCl_3$, 100 MHz

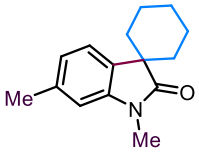


1',5'-Dimethylspiro[cyclohexane-1,3'-indolin]-2'-one (2c)

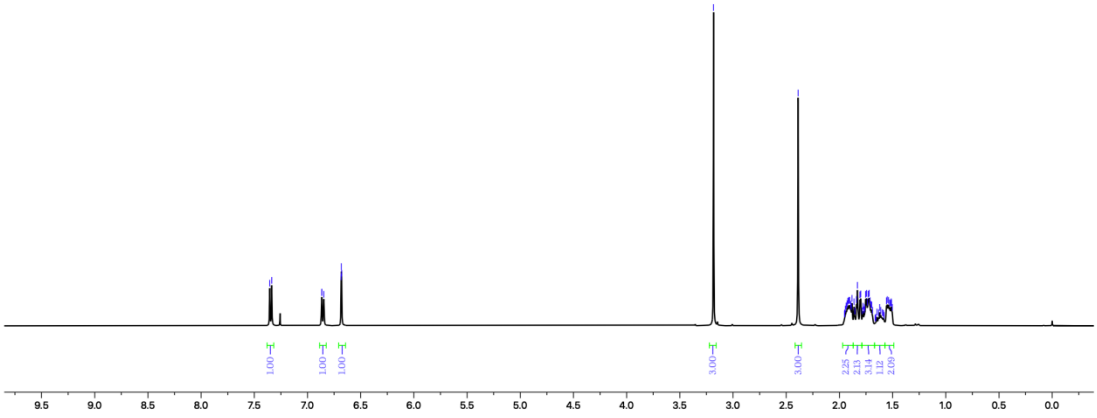


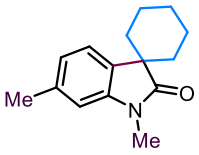


1',6'-Dimethylspiro[cyclohexane-1,3'-indolin]-2'-one (2d)

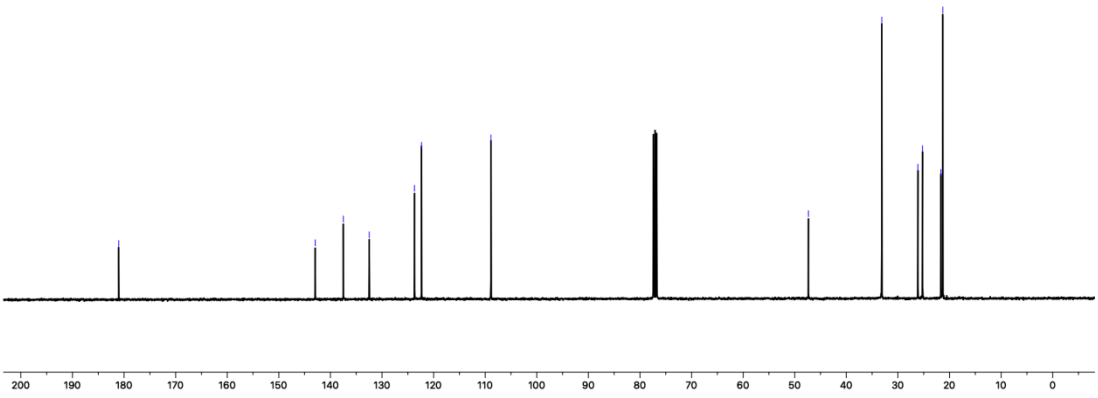


$CDCl_3$, 400 MHz



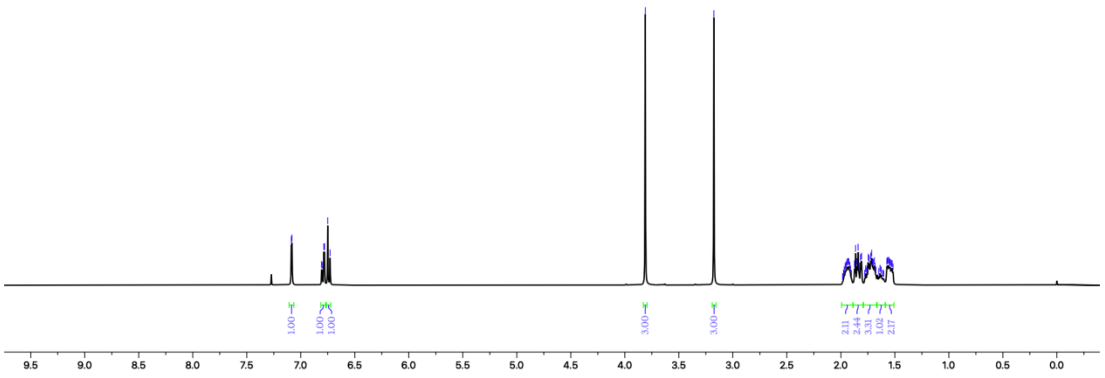


$CDCl_3$, 100 MHz

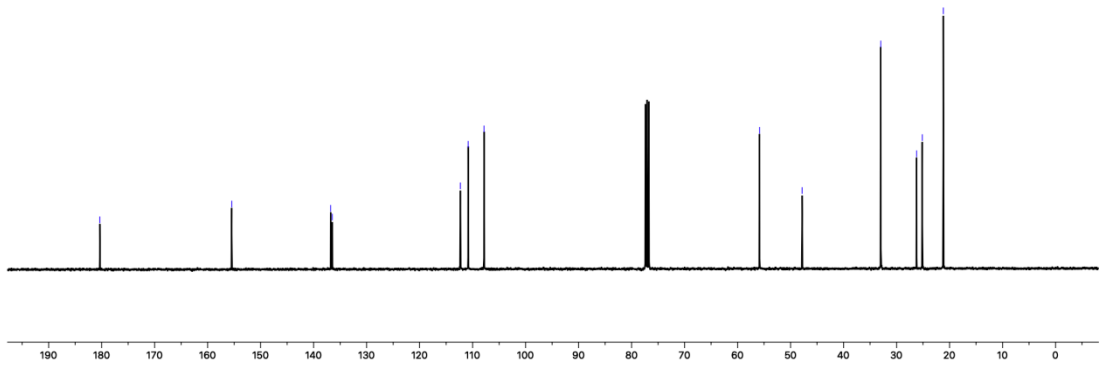


5'-Methoxy-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2e)

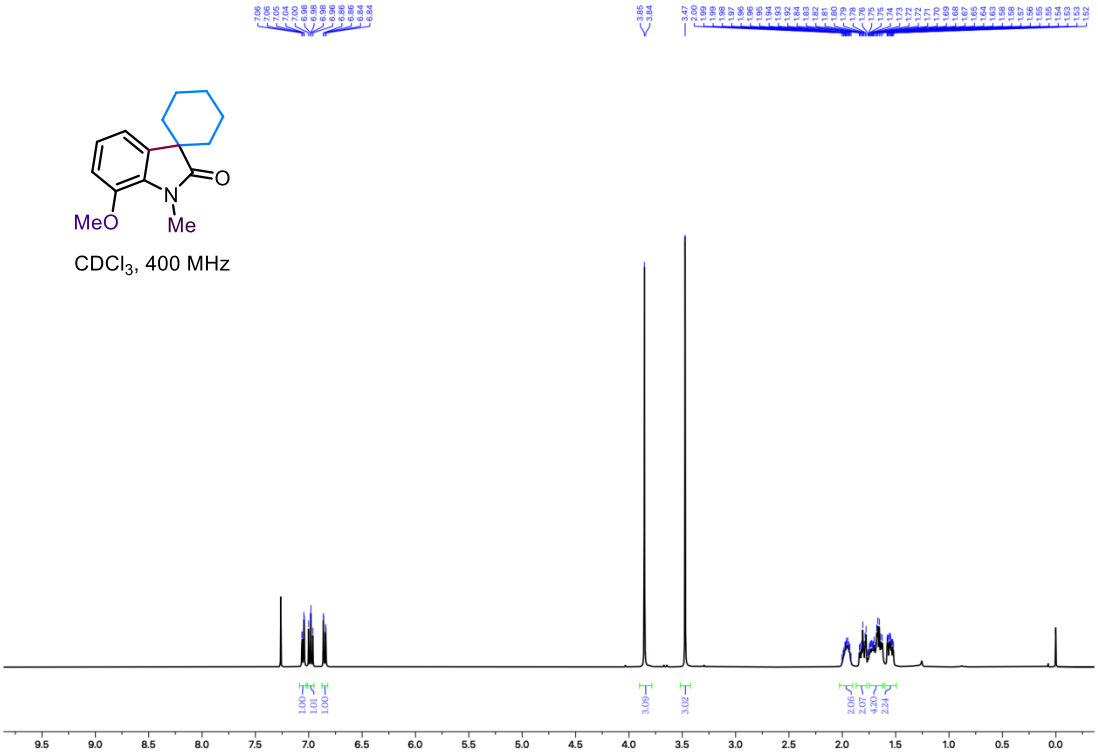
$CDCl_3$, 400 MHz

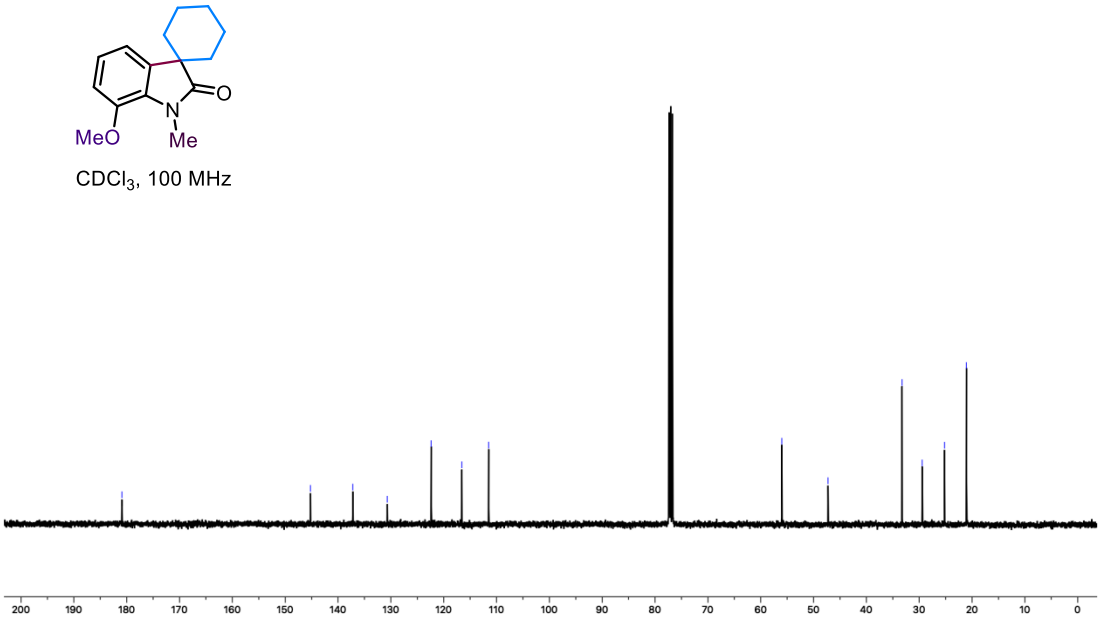


$CDCl_3$, 100 MHz

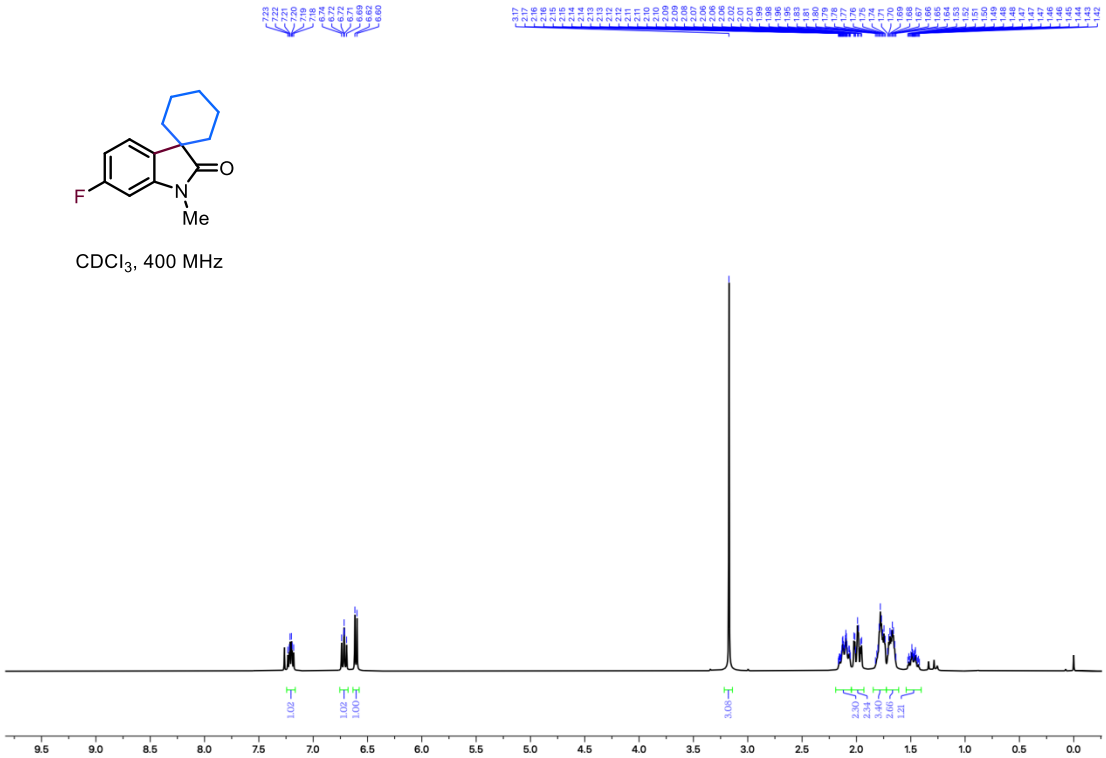


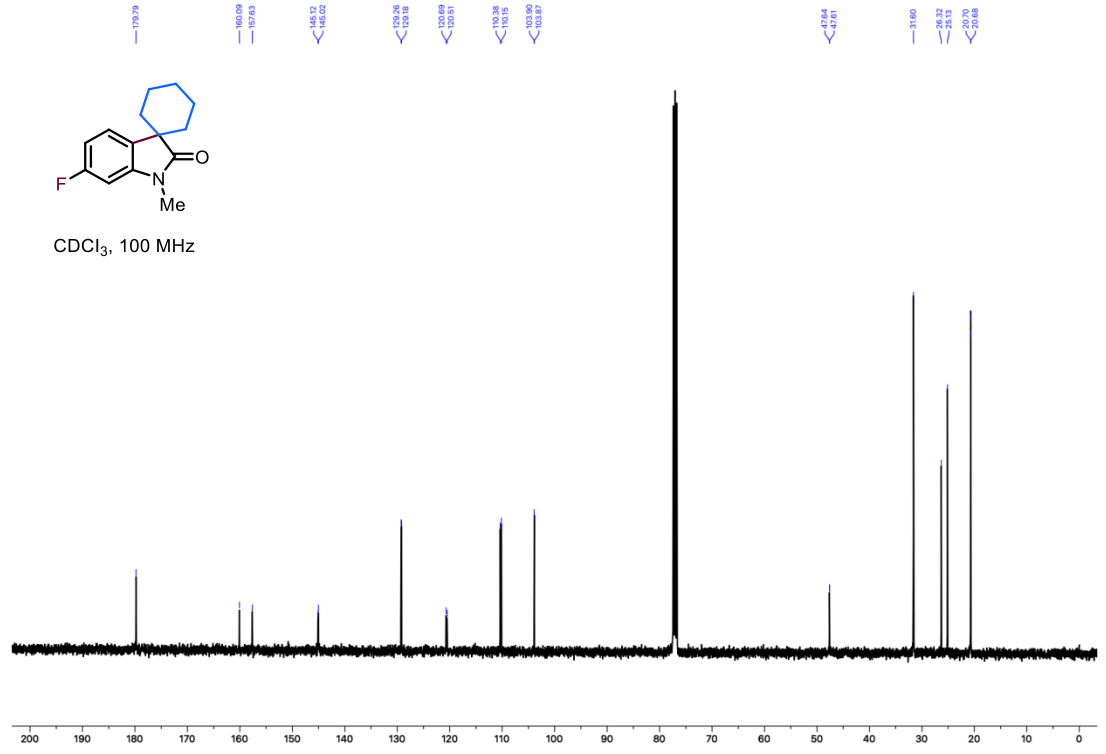
7'-Methoxy-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2f)



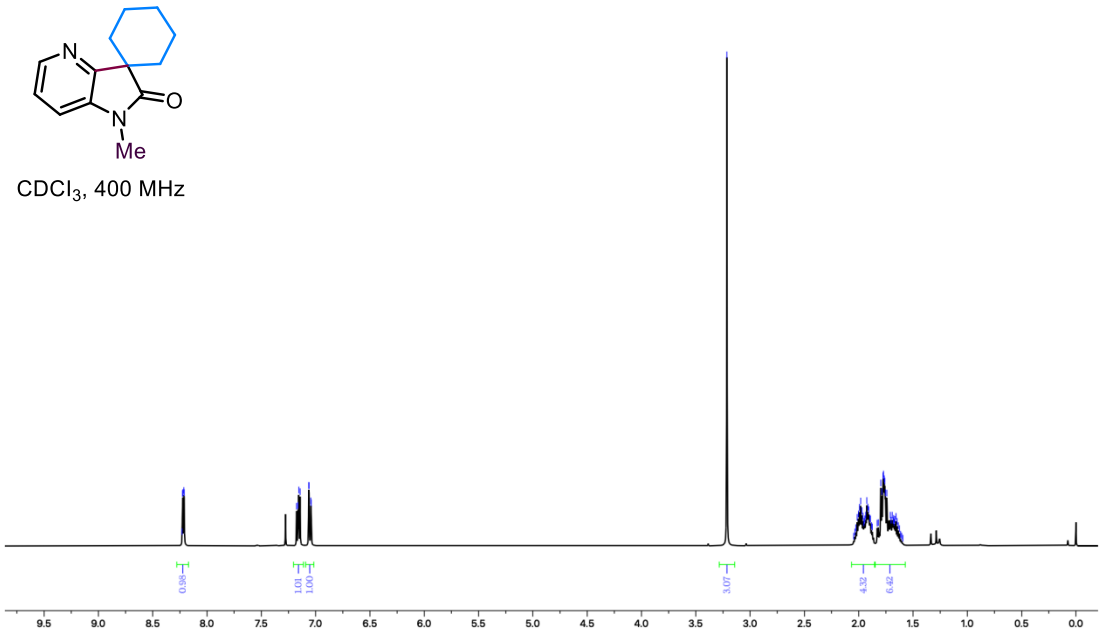


6'-Fluoro-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2g)

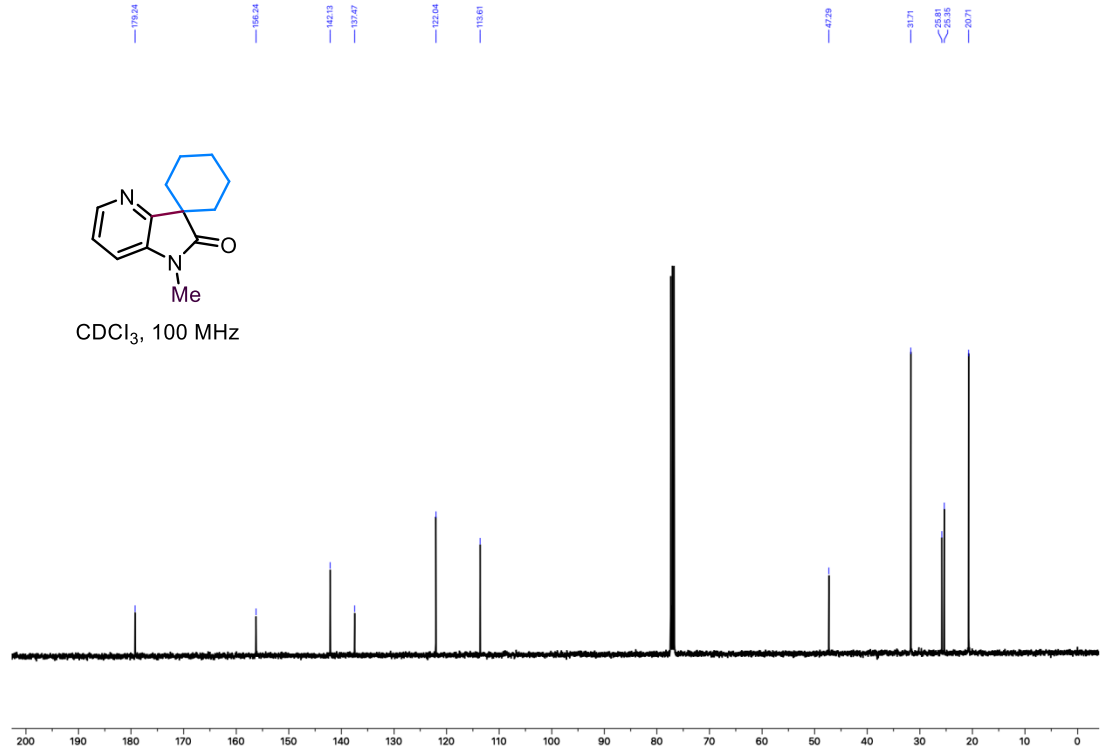




1'-Methylspiro[cyclohexane-1,3'-pyrrolo[3,2-b]pyridin]-2'(1'H)-one (2h)

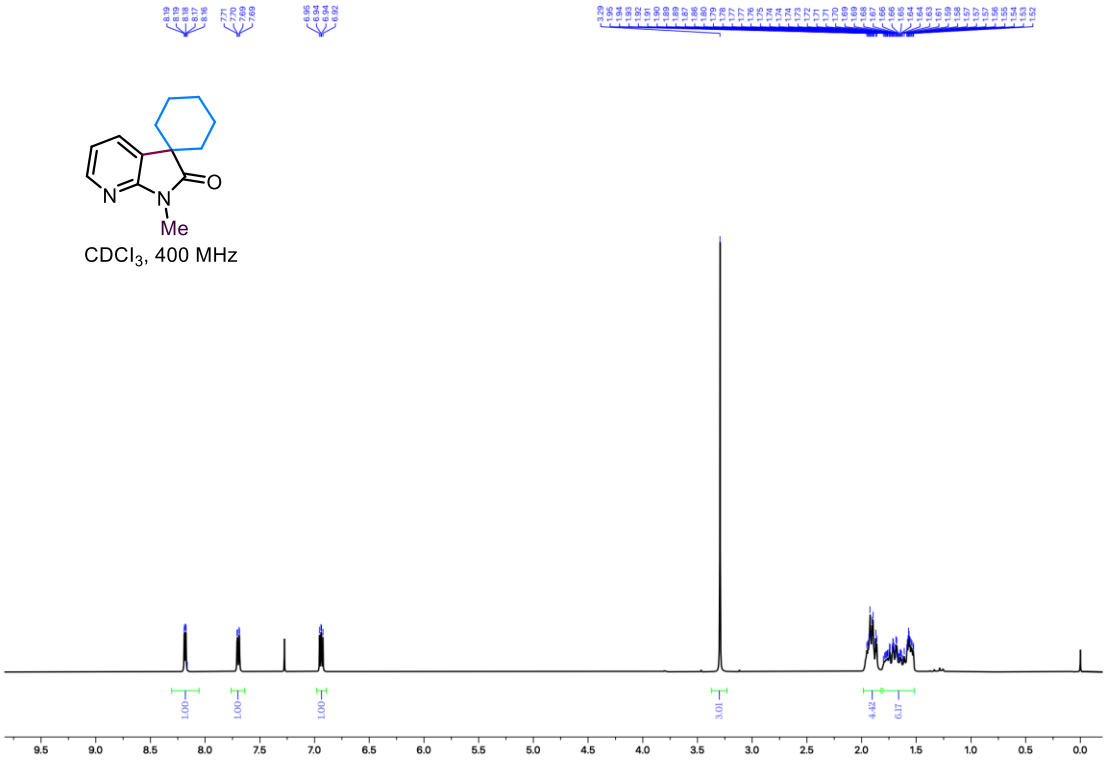


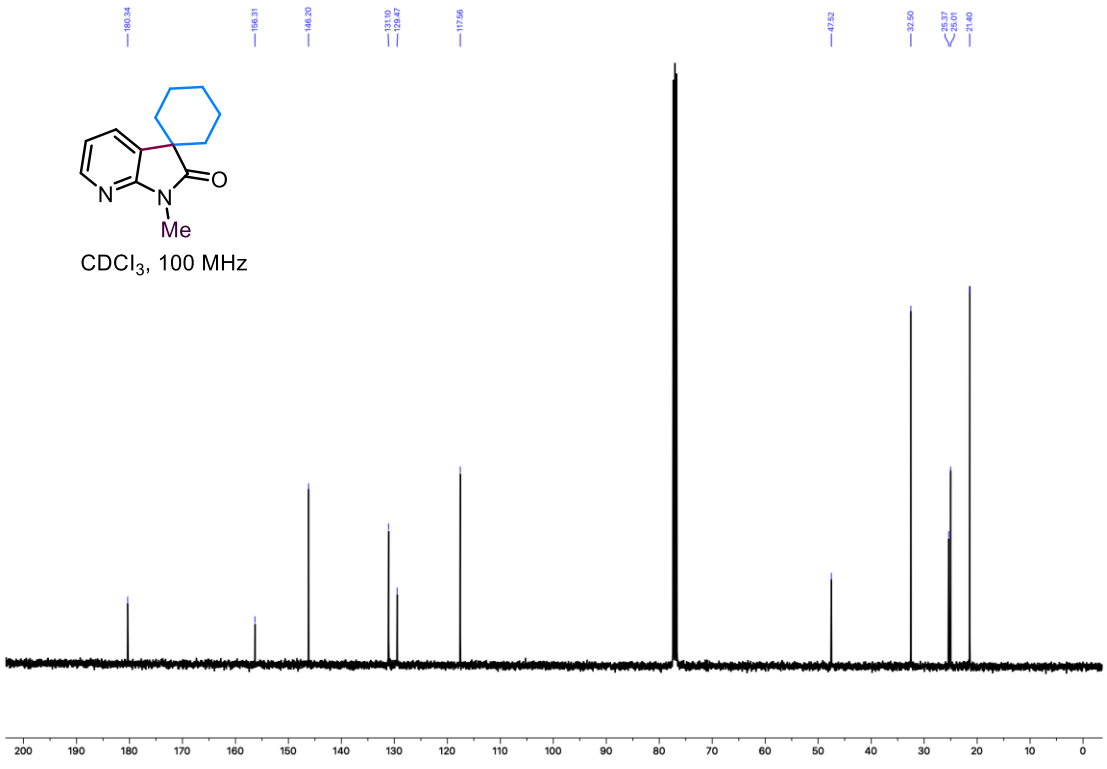
$CDCl_3$, 400 MHz



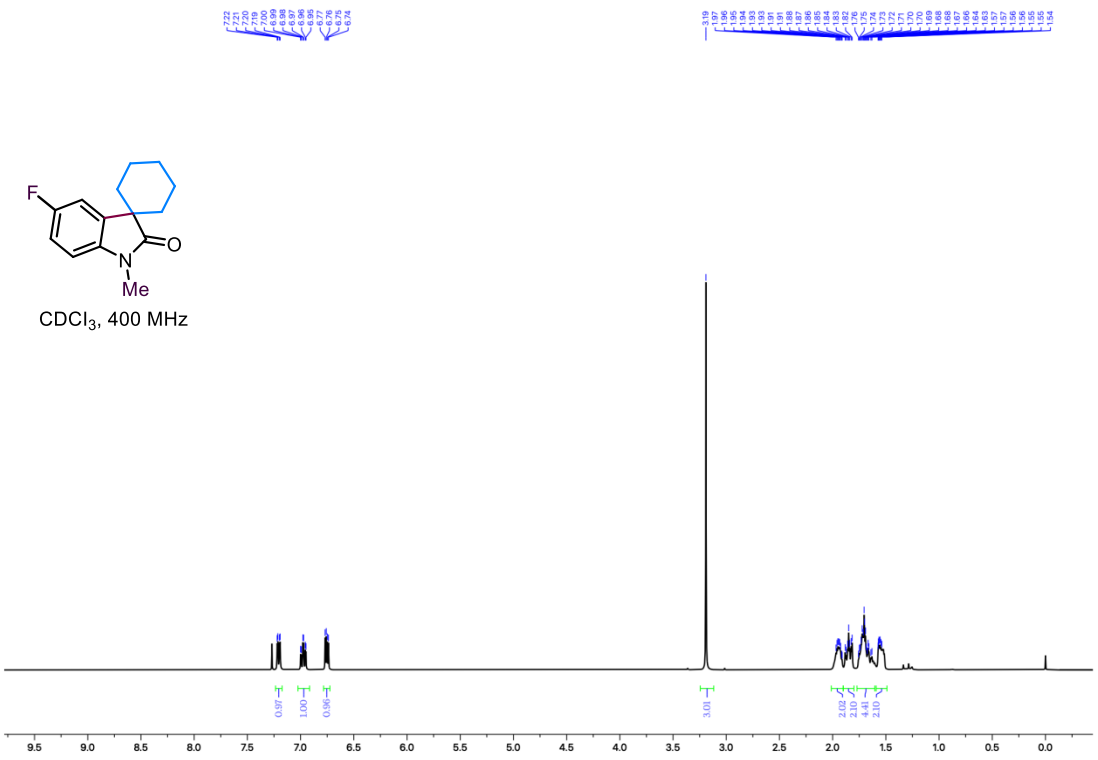
$CDCl_3$, 100 MHz

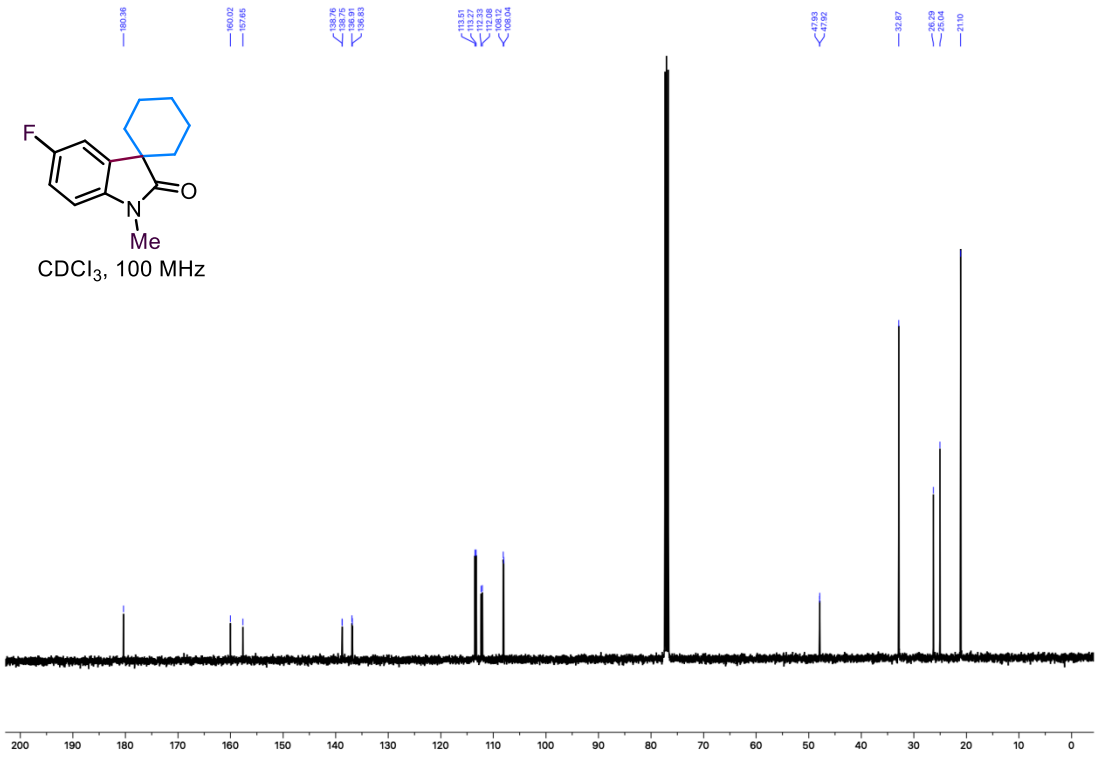
1'-Methylspiro[cyclohexane-1,3'-pyrrolo[2,3-b]pyridin]-2'(1'H)-one (2i)





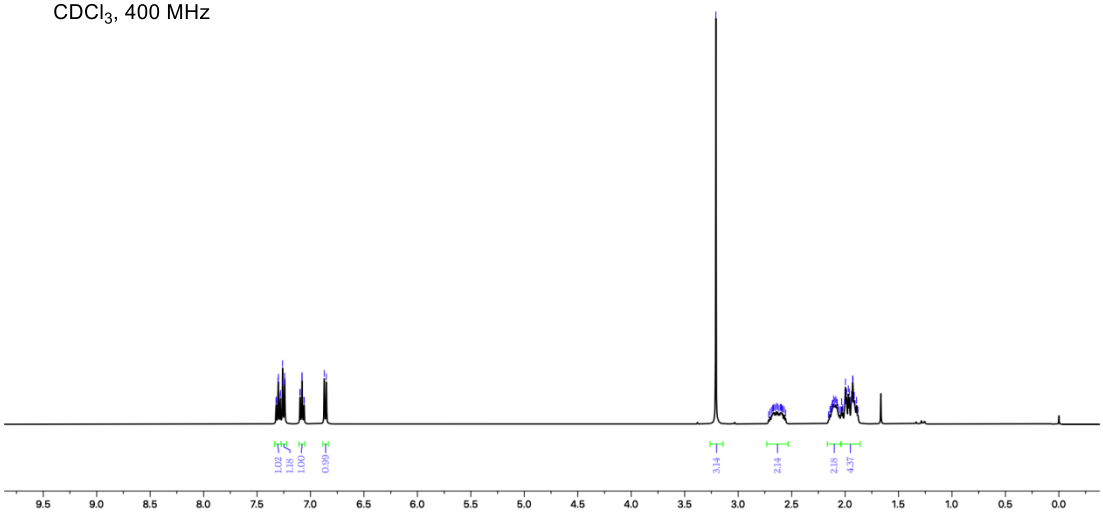
5'-Fluoro-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2j)

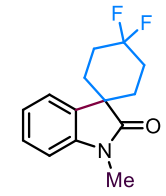




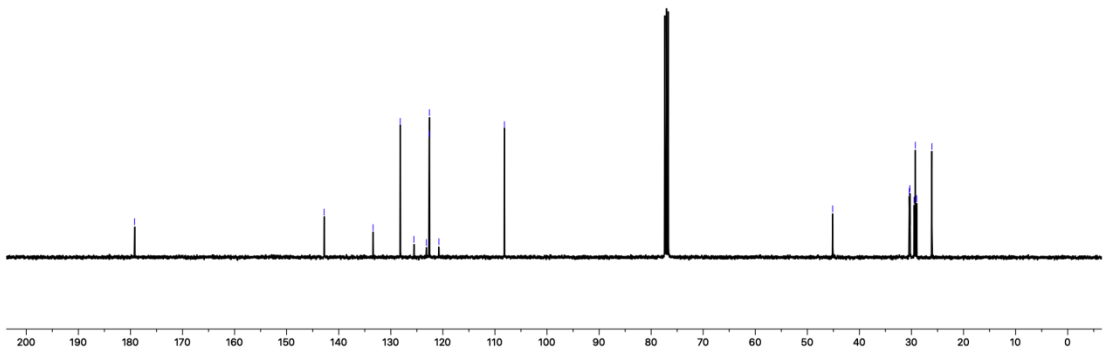
4,4-Difluoro-1'-methylspiro[cyclohexane-1,3'-indolin]-2'-one (2k)

$CDCl_3$, 400 MHz

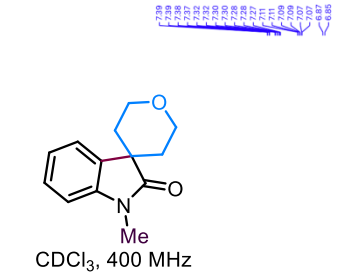




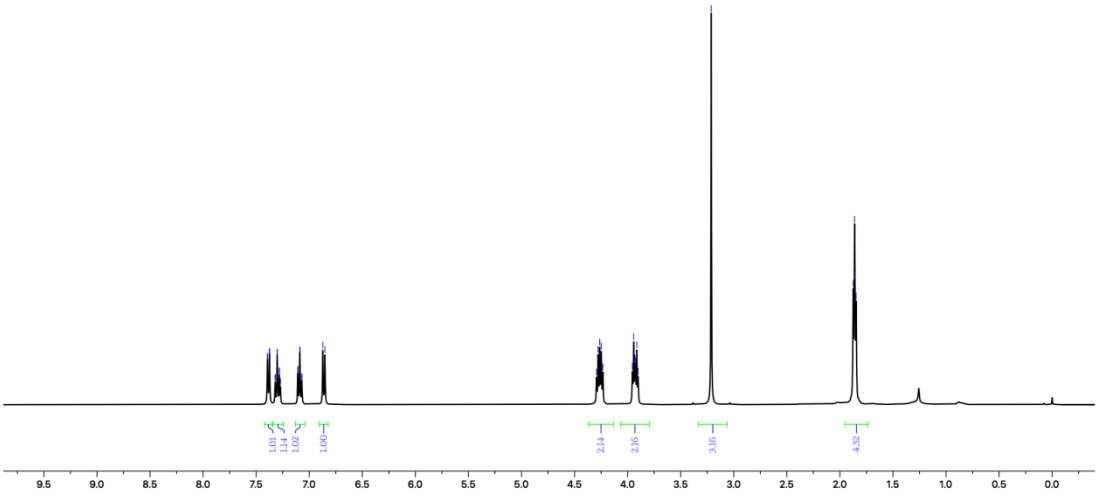
$CDCl_3$, 100 MHz



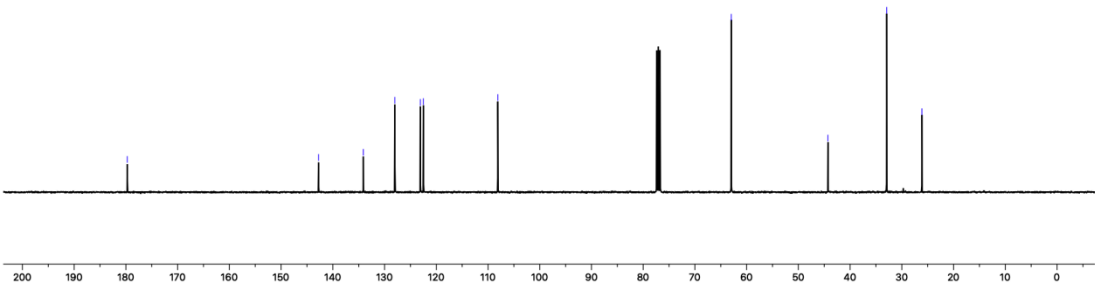
1-Methyl-2',3',5',6'-tetrahydrospiro[indoline-3,4'-pyran]-2-one (2l)



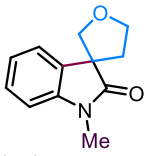
$CDCl_3$, 400 MHz



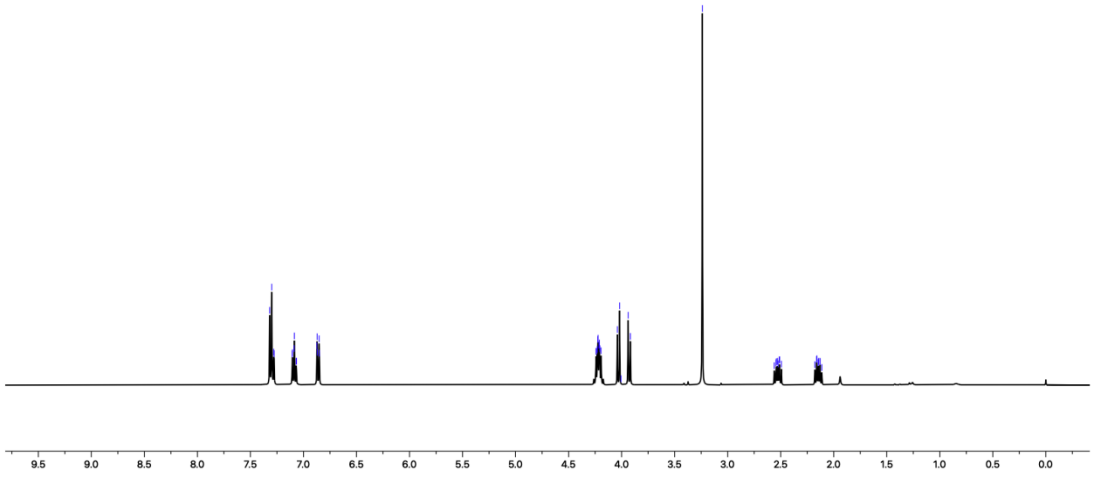
$CDCl_3$, 100 MHz

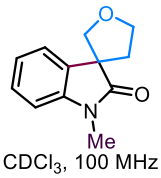


1'-Methyl-4,5-dihydro-2H-spiro[furan-3,3'-indolin]-2'-one (2m)

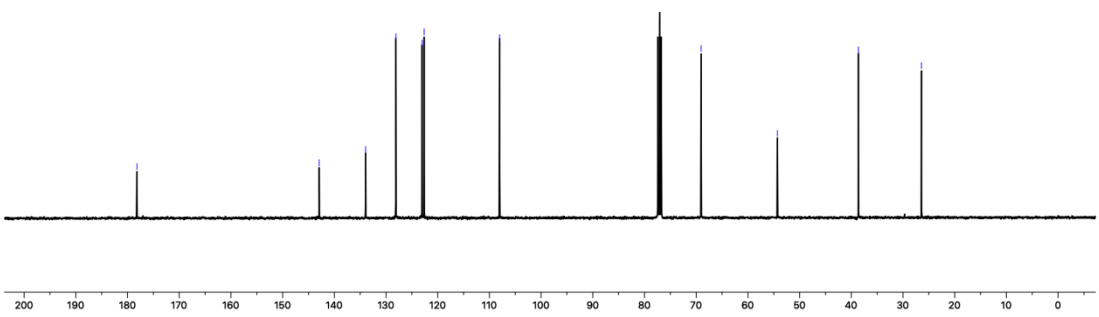


$CDCl_3$, 400 MHz

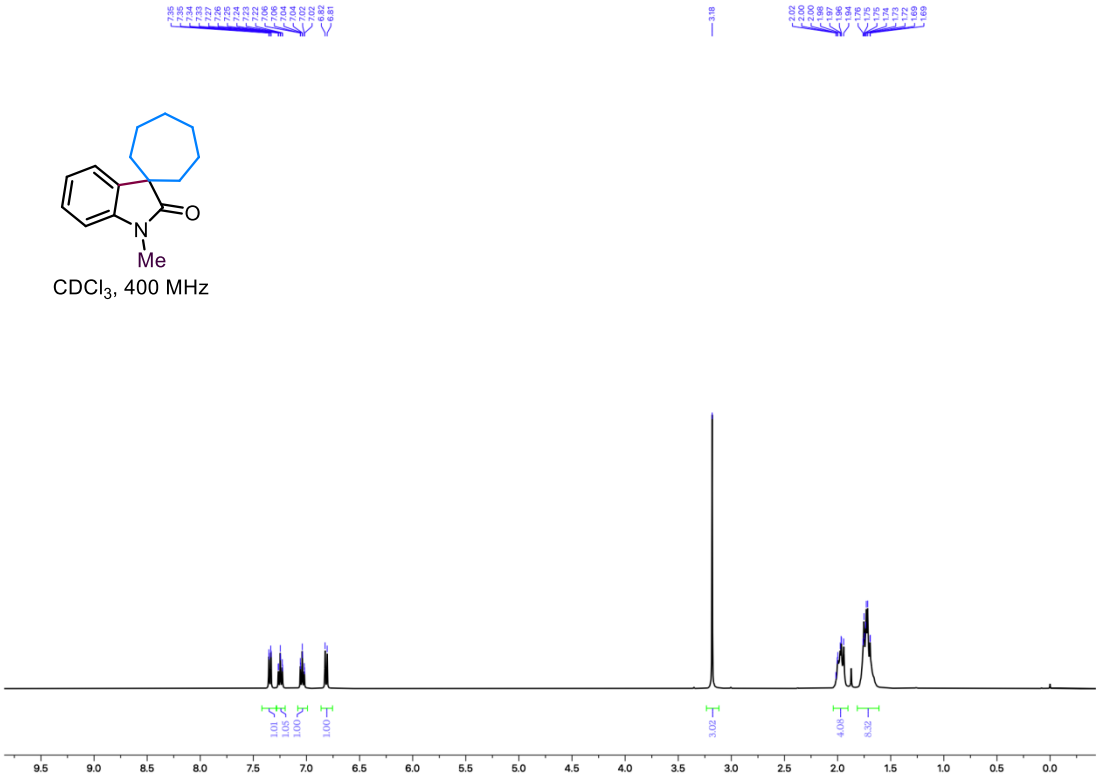


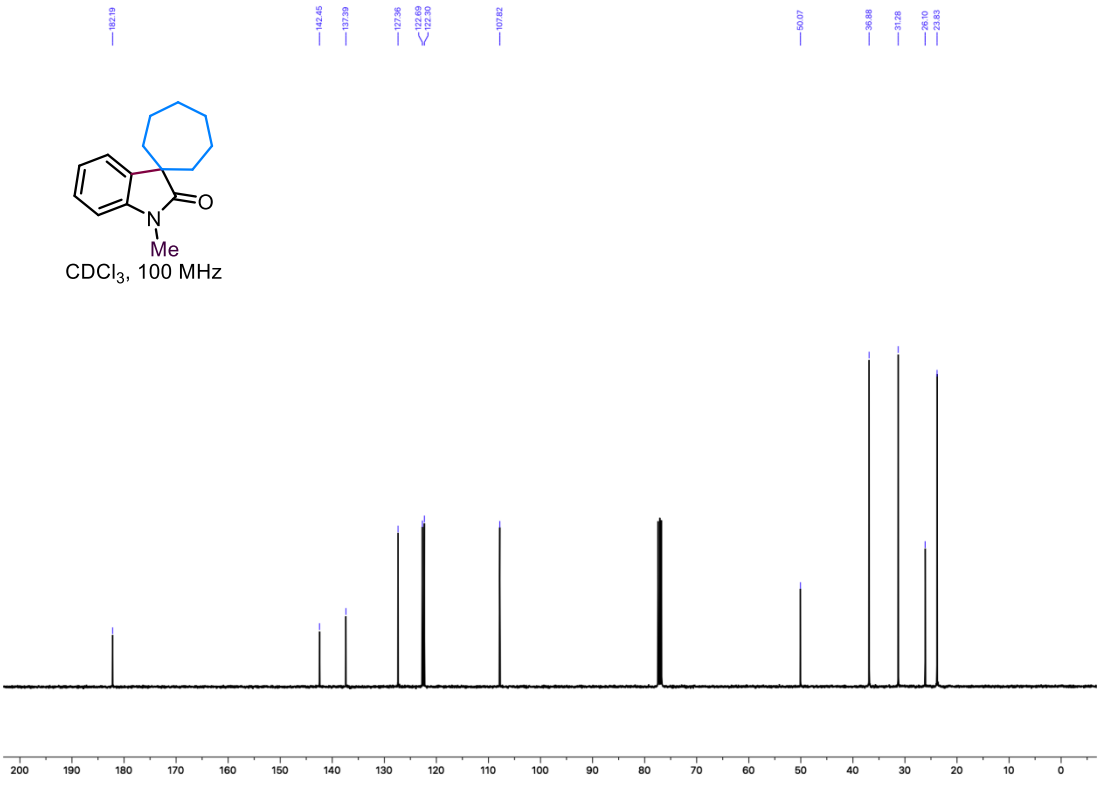


$CDCl_3$, 100 MHz

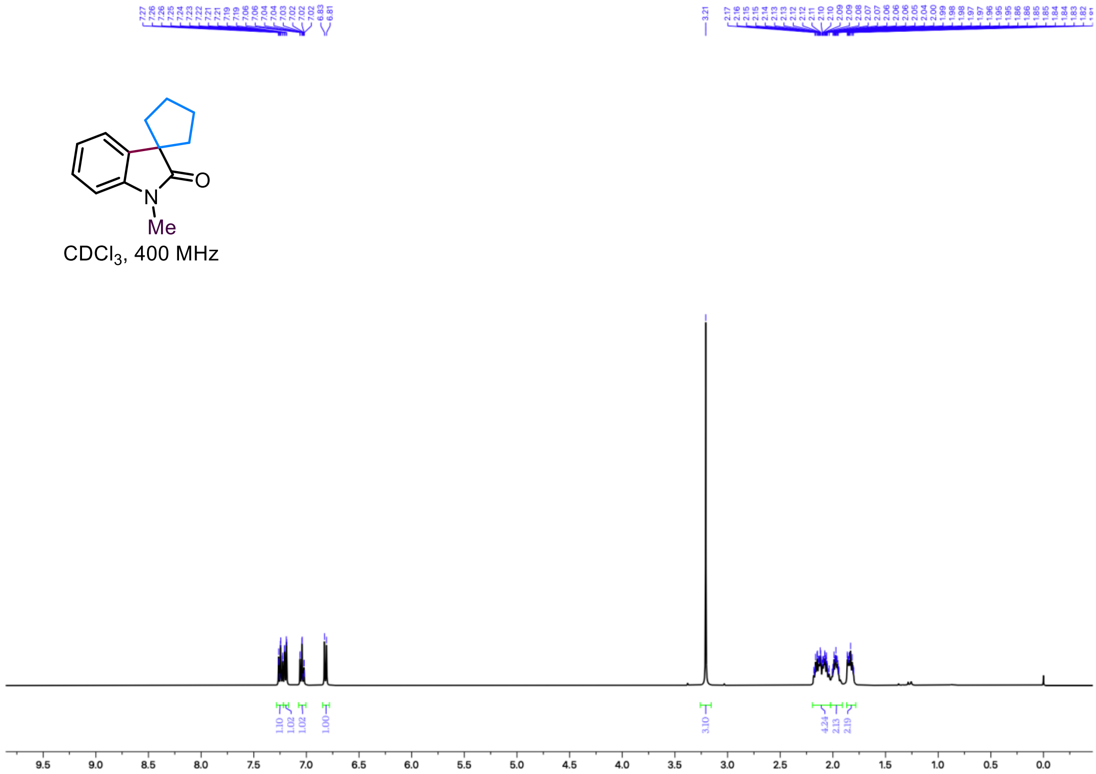


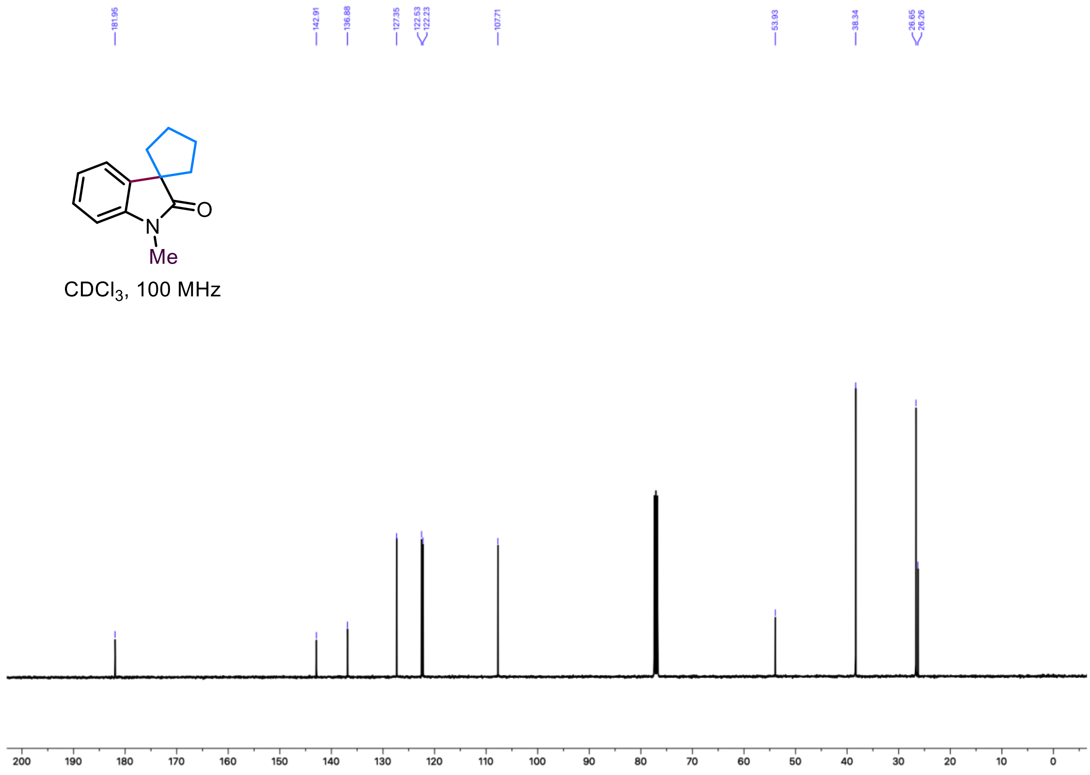
1'-Methylspiro[cycloheptane-1,3'-indolin]-2'-one (2n)



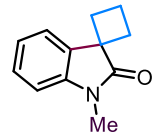


1'-Methylspiro[cyclopentane-1,3'-indolin]-2'-one (2o)

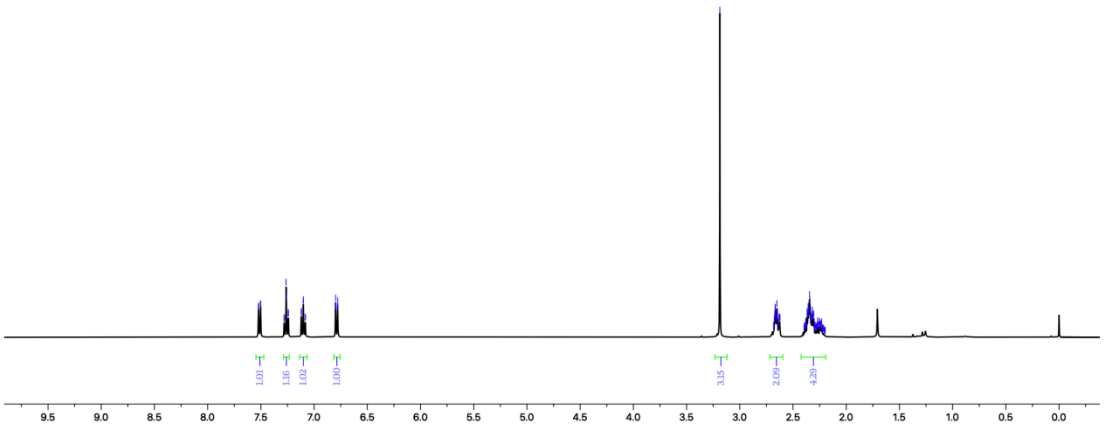


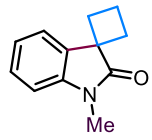


1'-Methylspiro[cyclobutane-1,3'-indolin]-2'-one (2p)

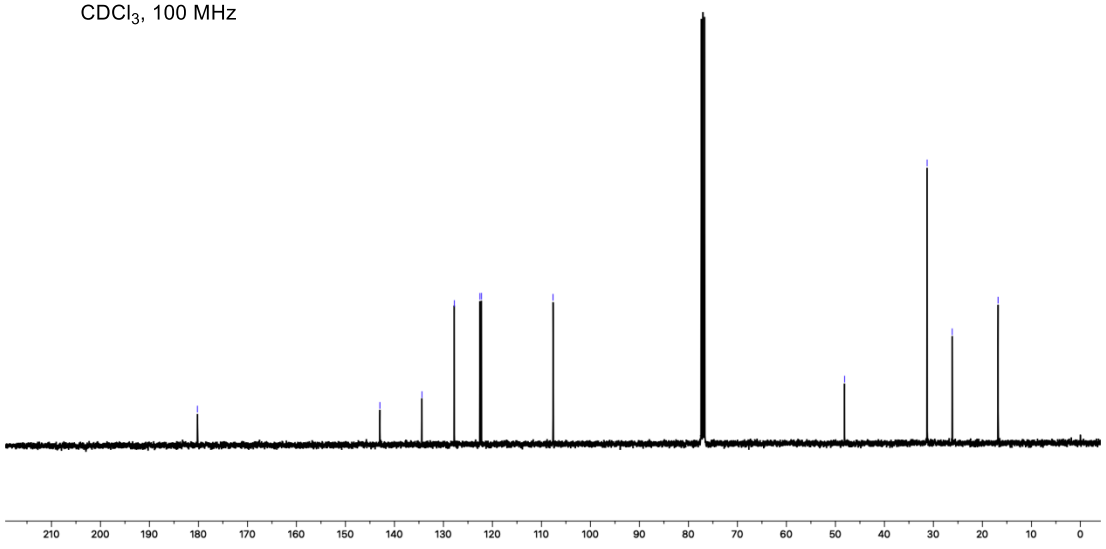


$CDCl_3$, 400 MHz

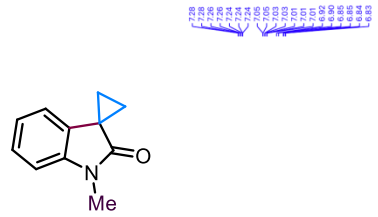




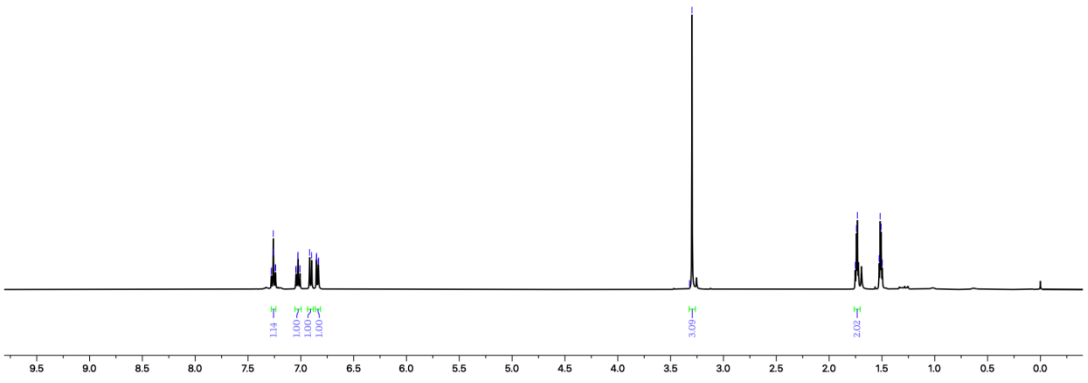
$CDCl_3$, 100 MHz

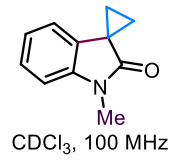


1'-Methylspiro[cyclopropane-1,3'-indolin]-2'-one (2q)

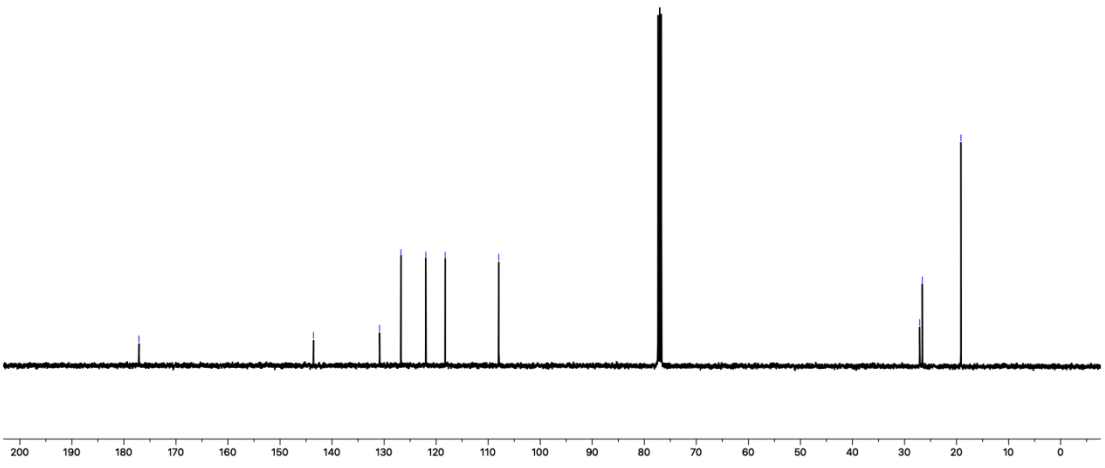


$CDCl_3$, 400 MHz

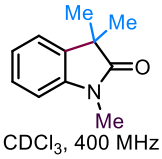




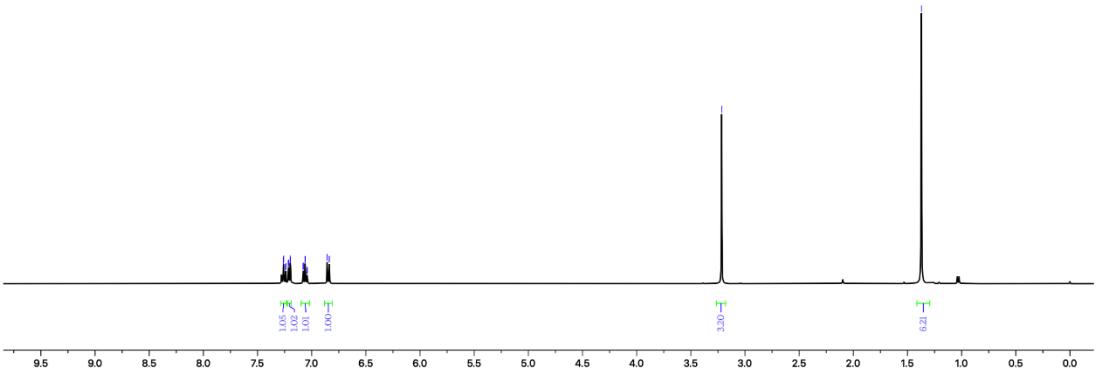
$CDCl_3$, 100 MHz

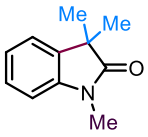


1,3,3-Trimethylindolin-2-one (2r)

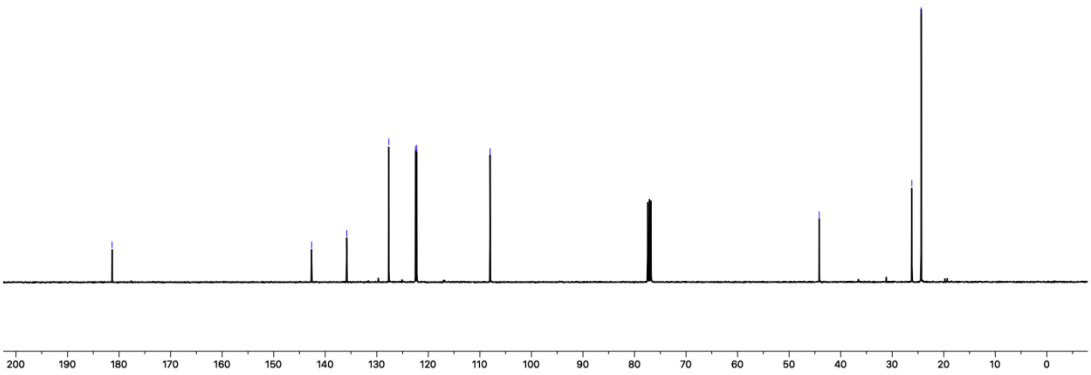


$CDCl_3$, 400 MHz

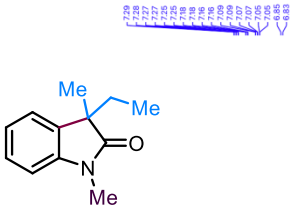




$CDCl_3$, 100 MHz



2-Ethyl-1,3-dimethylindolin-2-one (2s)



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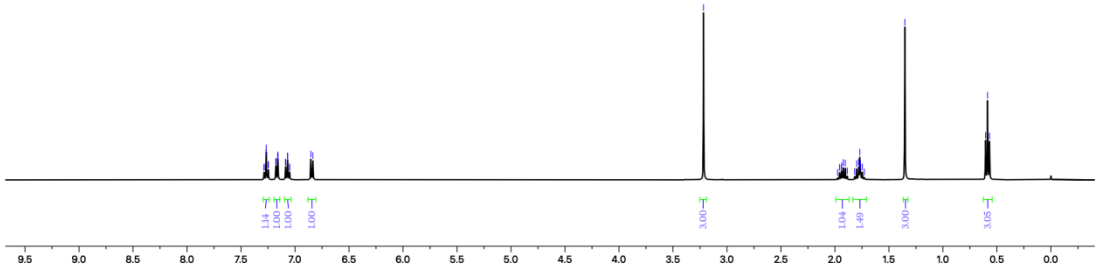
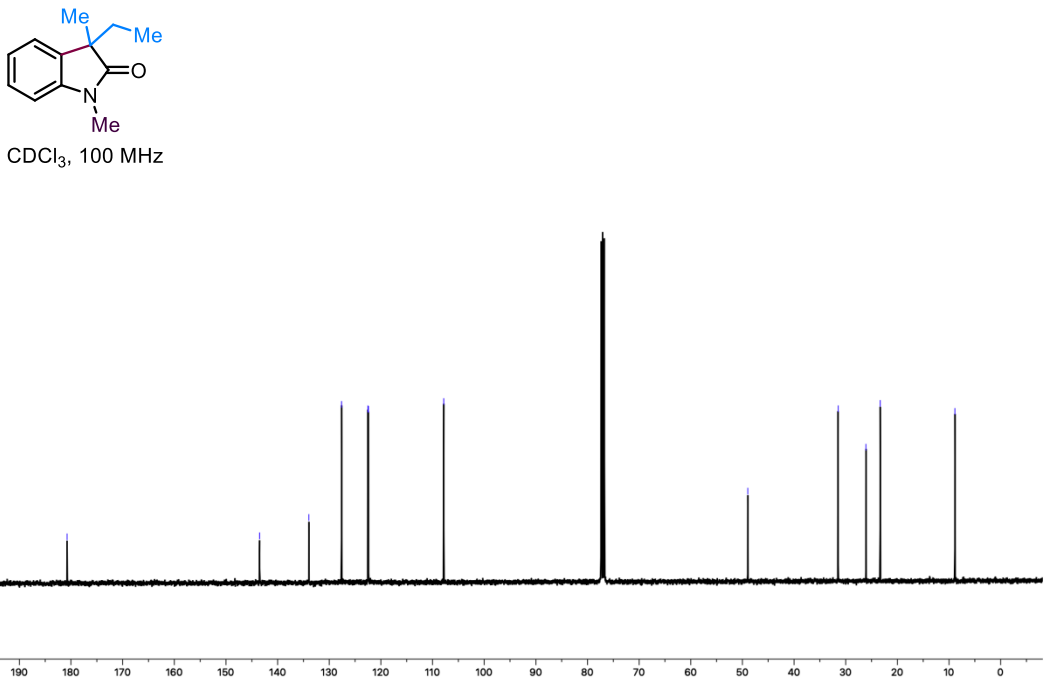
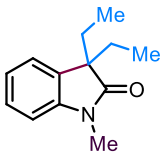


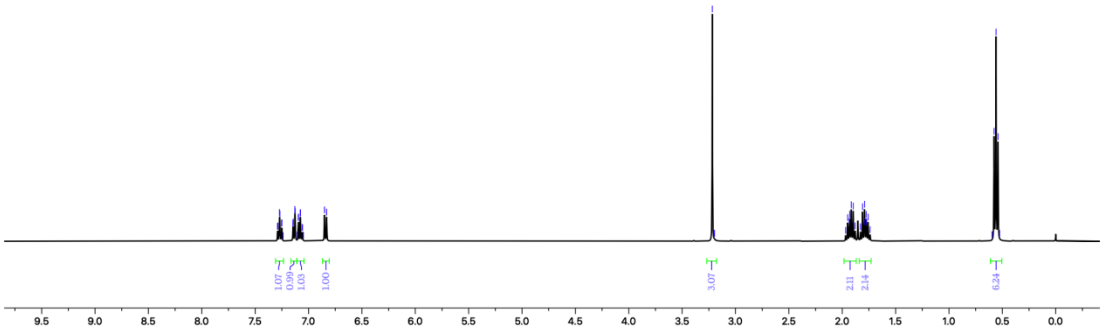


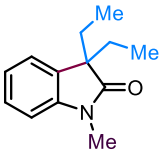
$CDCl_3$, 100 MHz

3,3-Diethyl-1-methylindolin-2-one (2t)

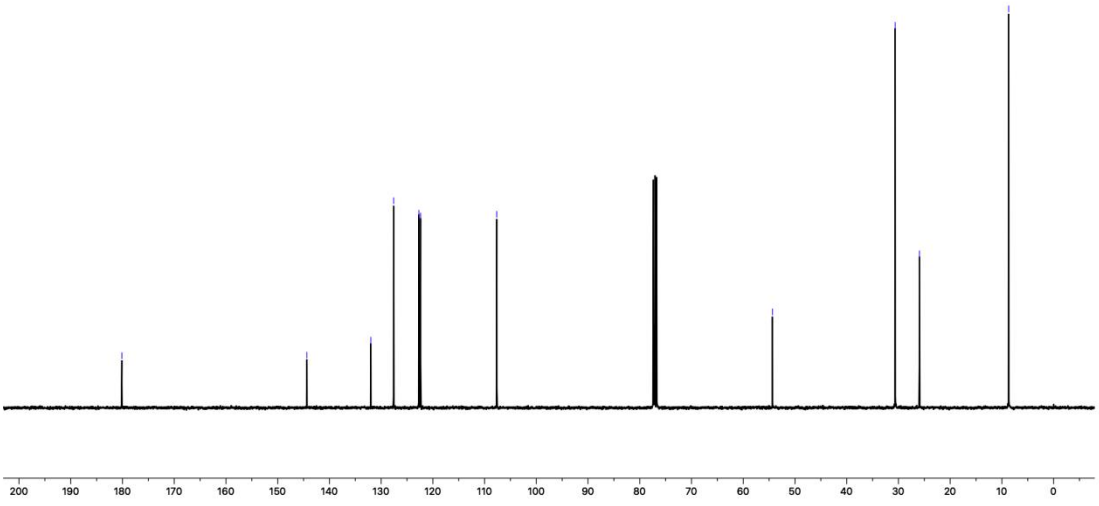


$CDCl_3$, 400 MHz

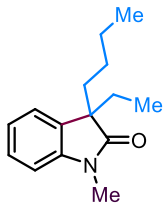




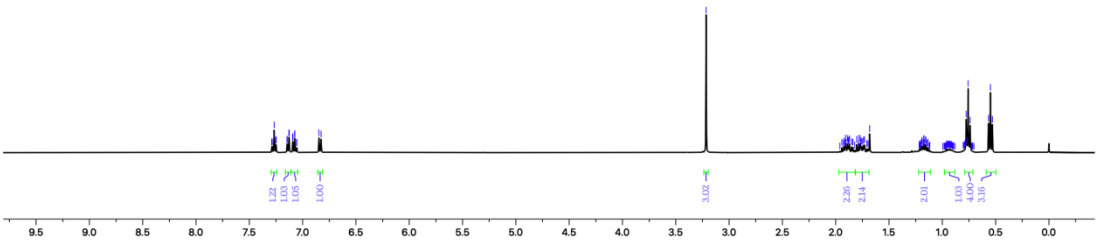
$CDCl_3$, 100 MHz

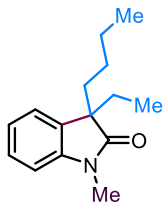


3-Butyl-3-ethyl-1-methylindolin-2-one (2u)

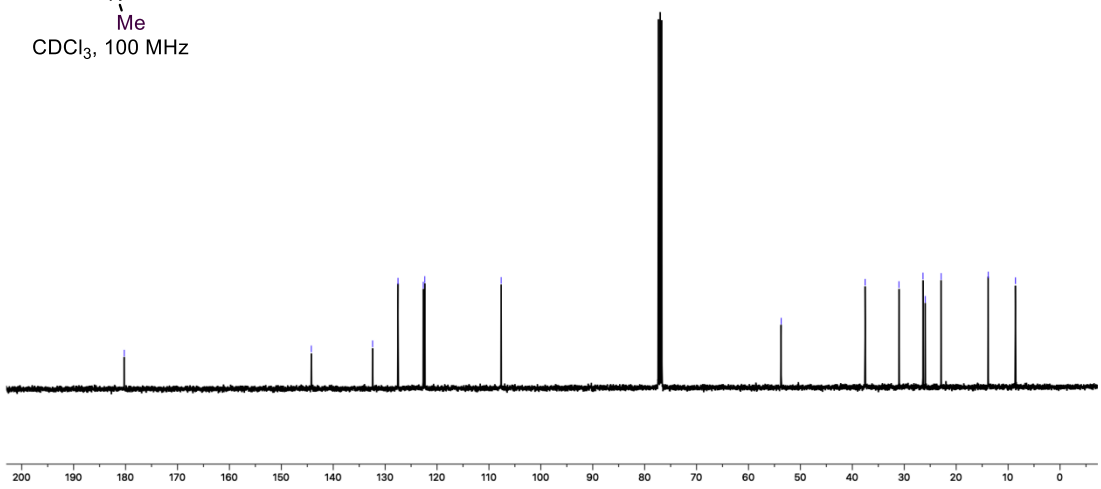


$CDCl_3$, 400 MHz

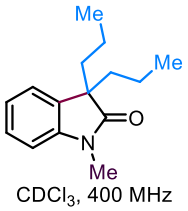




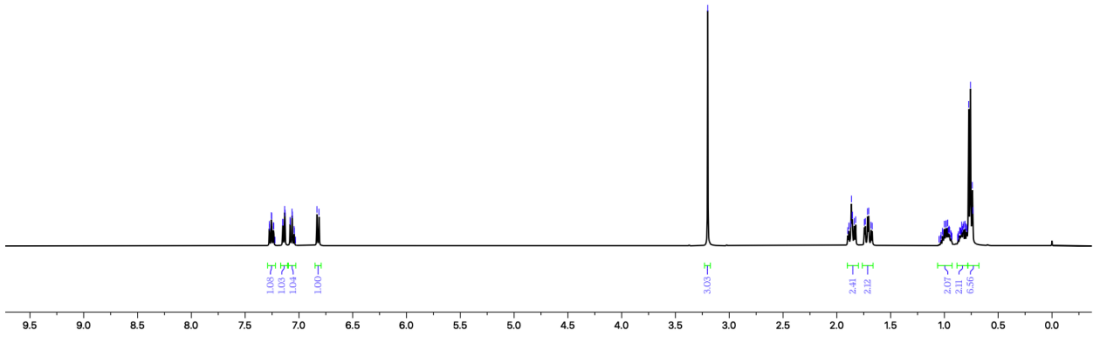
$CDCl_3$, 100 MHz

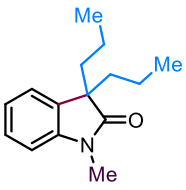


1-Methyl-3,3-dipropylindolin-2-one (2v)



$CDCl_3$, 400 MHz





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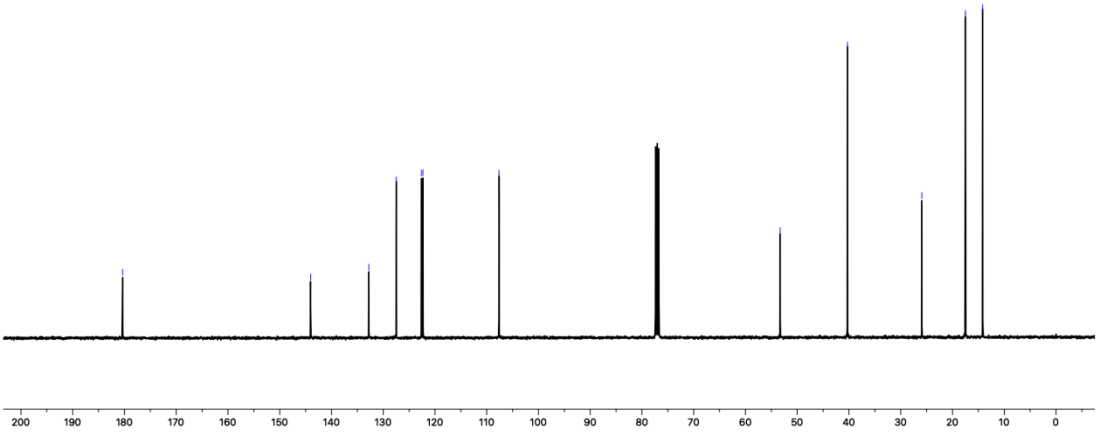
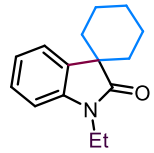
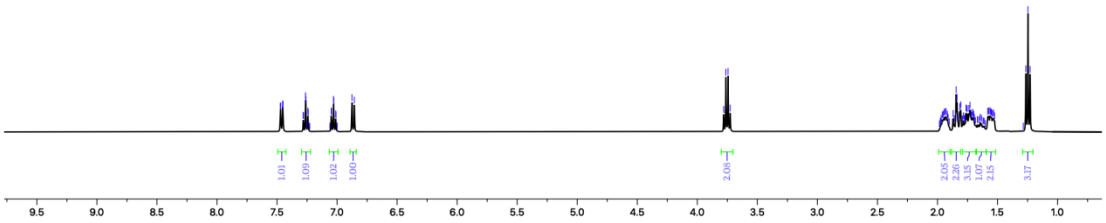


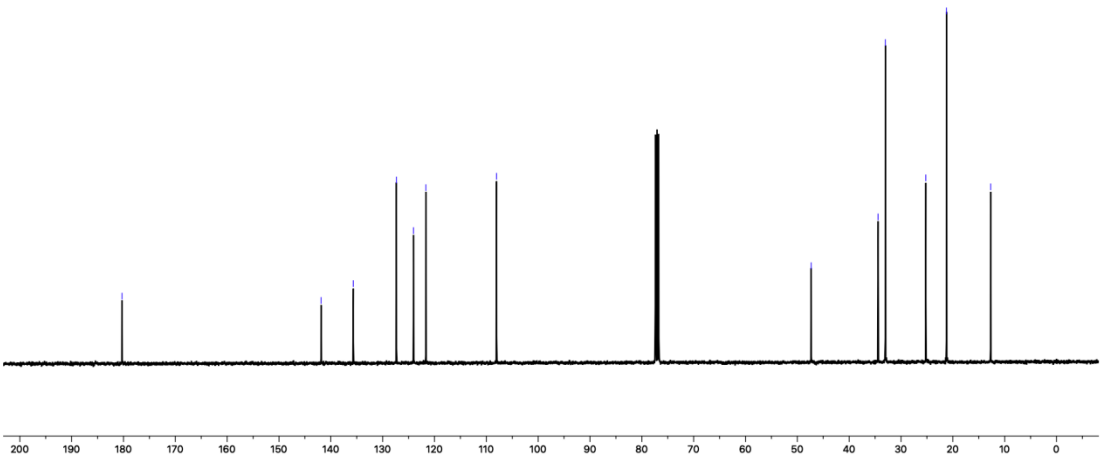
1'-Ethylspiro[cyclohexane-1,3'-indolin]-2'-one (2w)



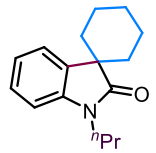
$CDCl_3$, 400 MHz



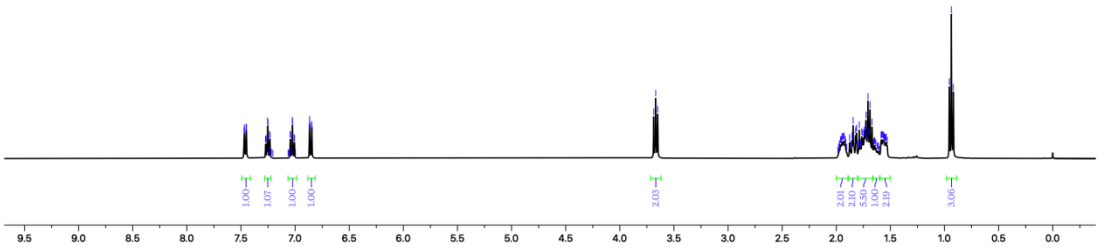
$CDCl_3$, 100 MHz

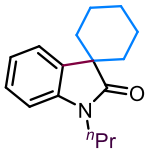


1'-Propylspiro[cyclohexane-1,3'-indolin]-2'-one (2x)

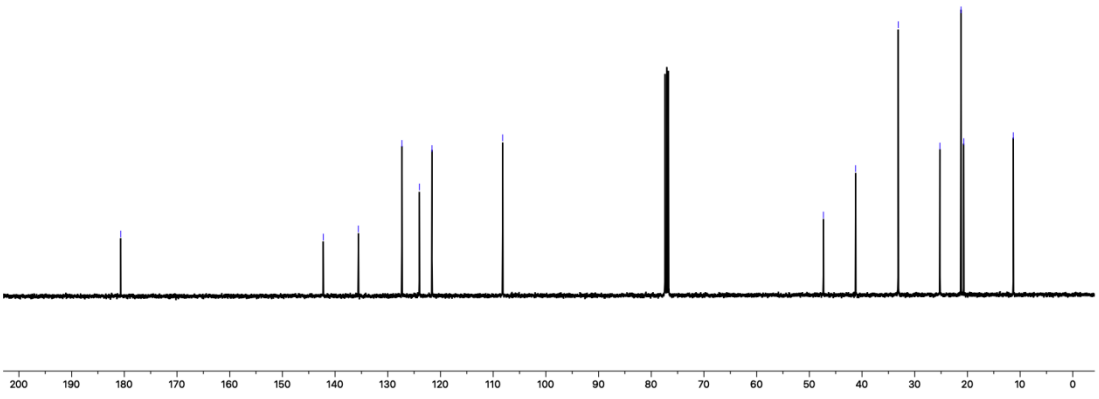


$CDCl_3$, 400 MHz

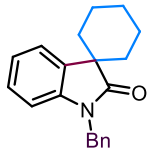




$CDCl_3$, 100 MHz



1'-Butylspiro[cyclohexane-1,3'-indolin]-2'-one (2y)



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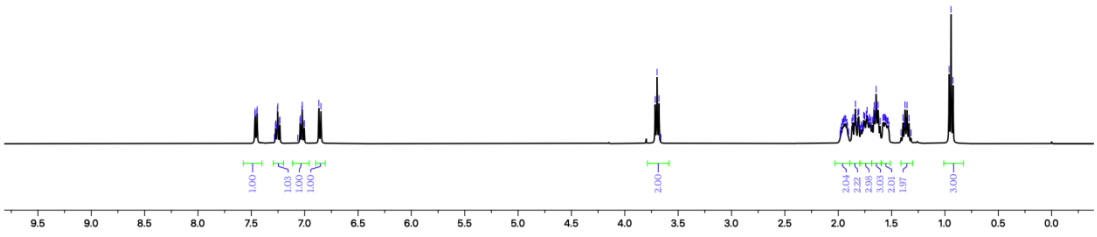
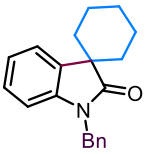
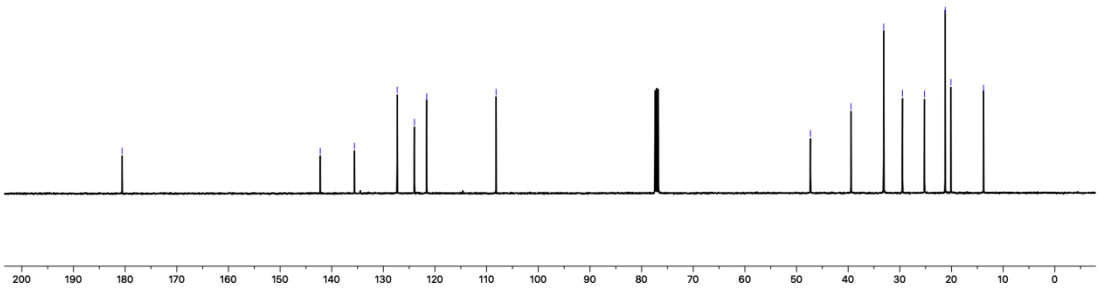
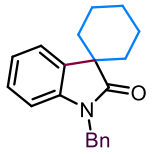




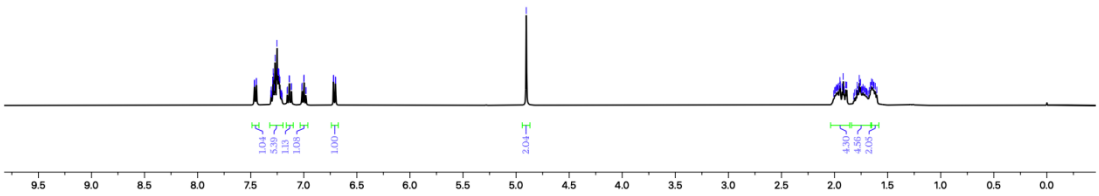
$CDCl_3$, 100 MHz

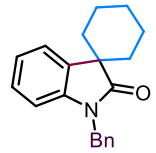


1'-Benzylspiro[cyclohexane-1,3'-indolin]-2'-one (2z)

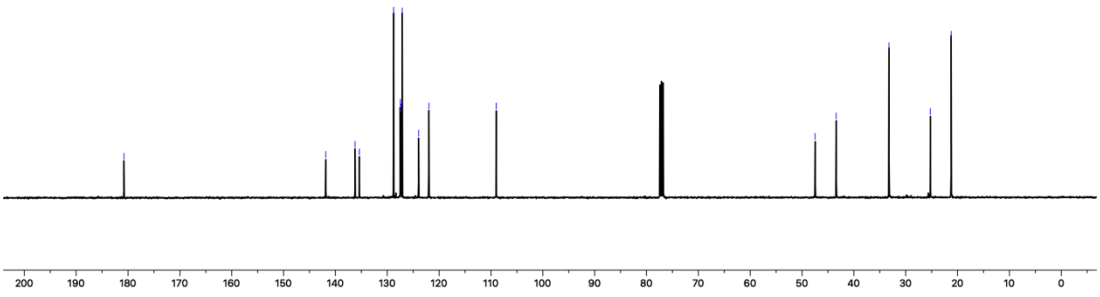


$CDCl_3$, 400 MHz

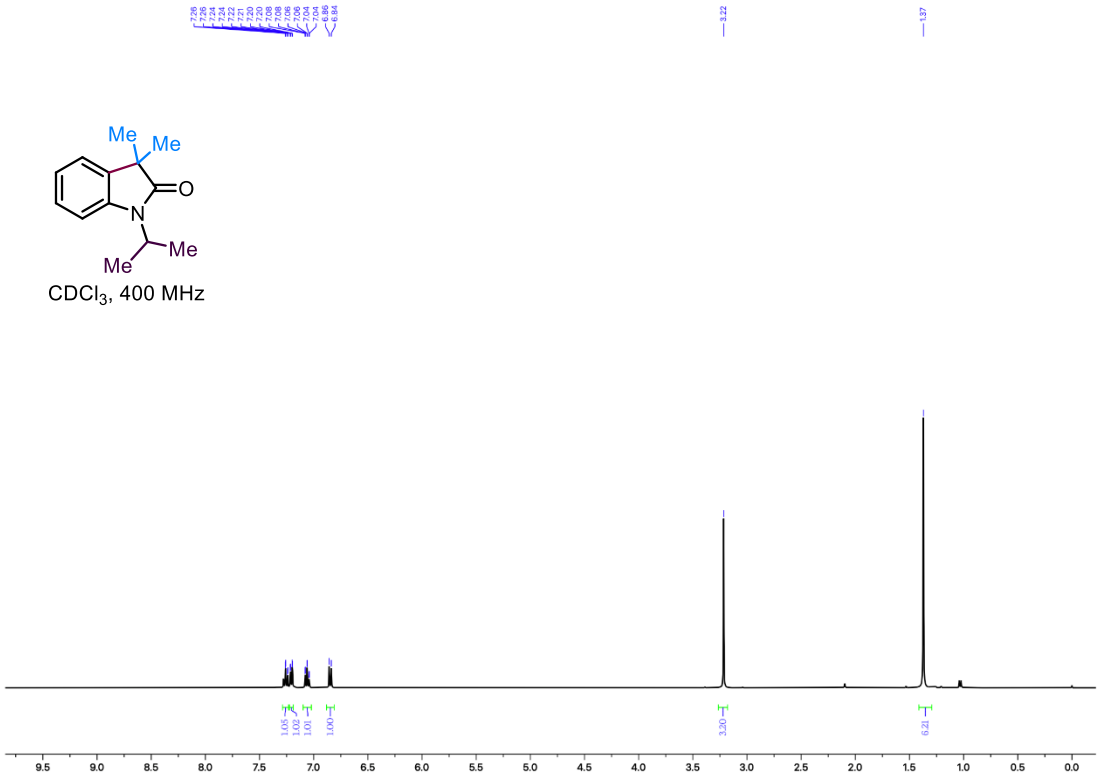




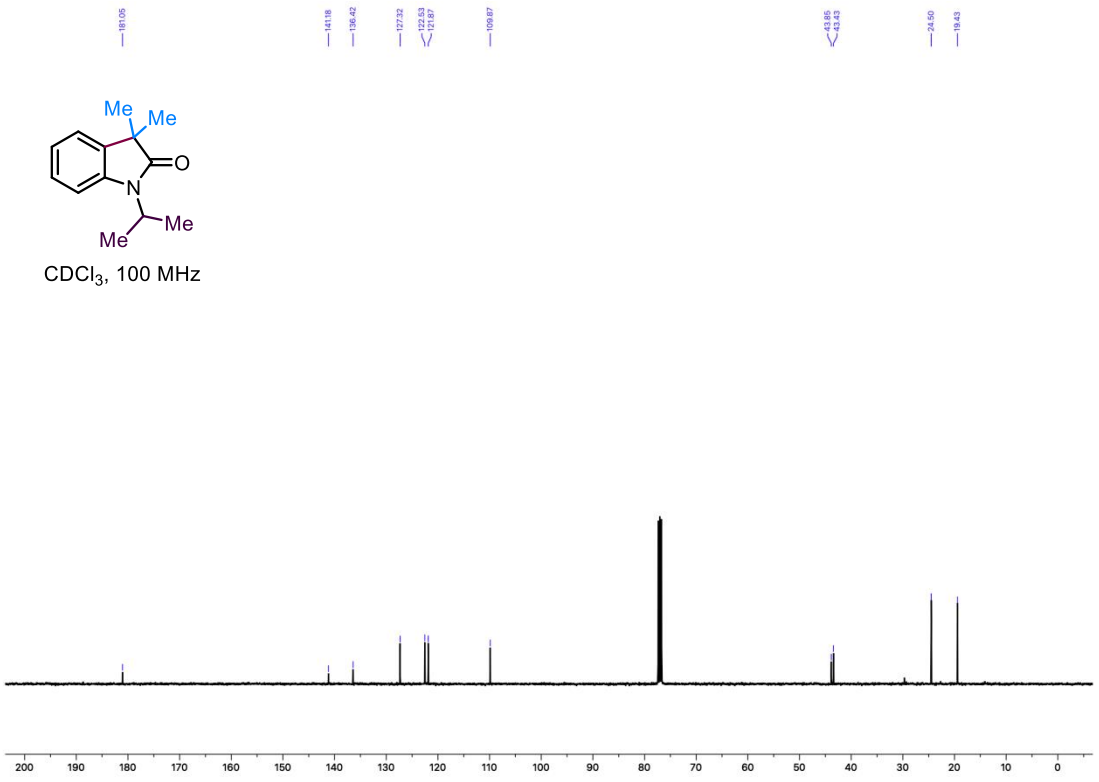
$CDCl_3$, 100 MHz



1-Isopropyl-3,3-dimethylindolin-2-one (2aa)

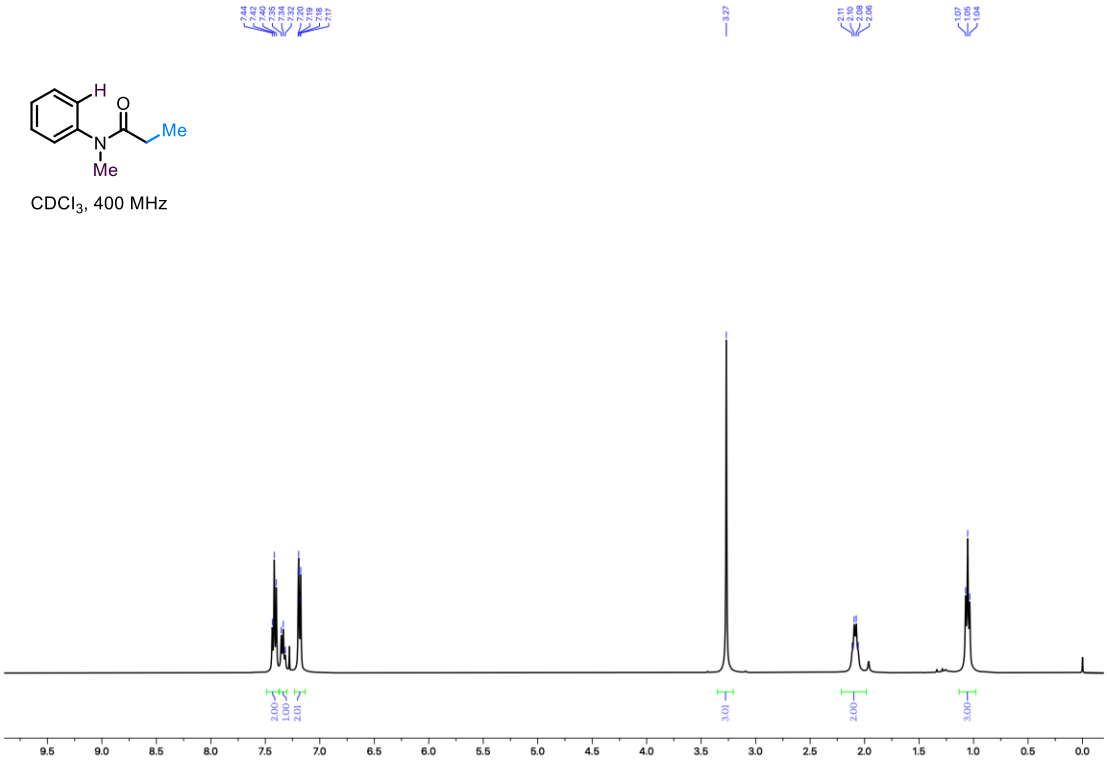


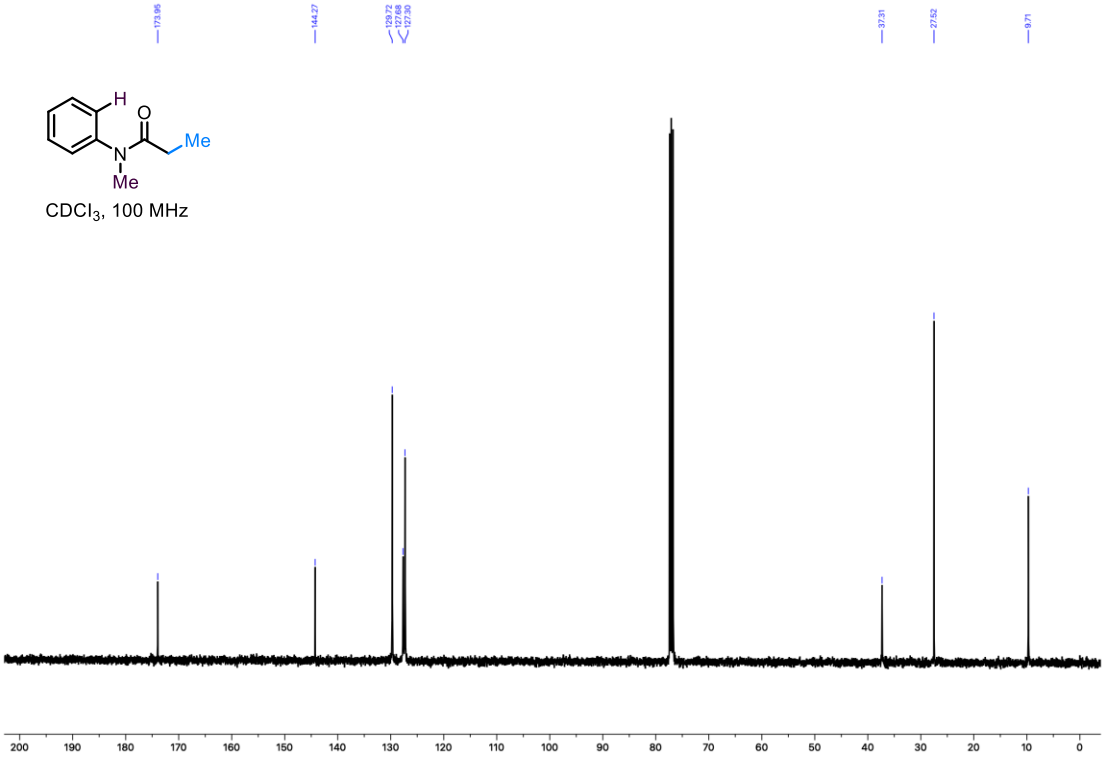
$CDCl_3$, 400 MHz



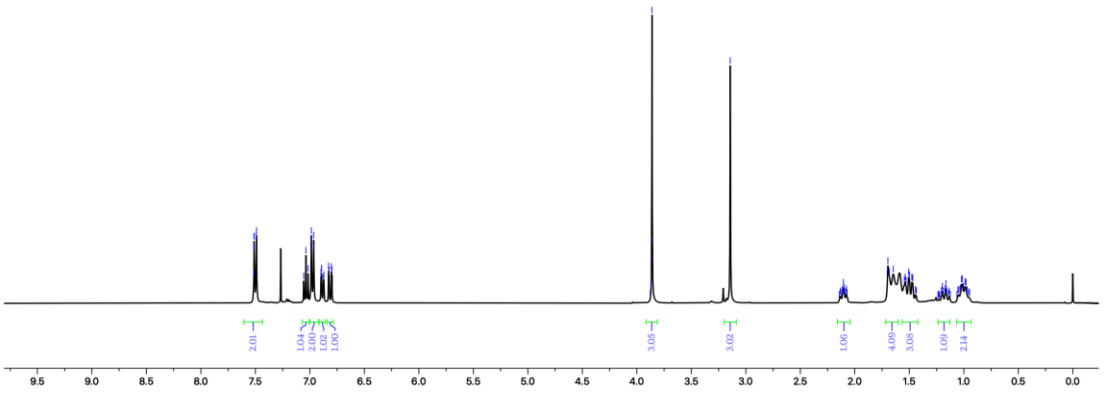
$CDCl_3$, 100 MHz

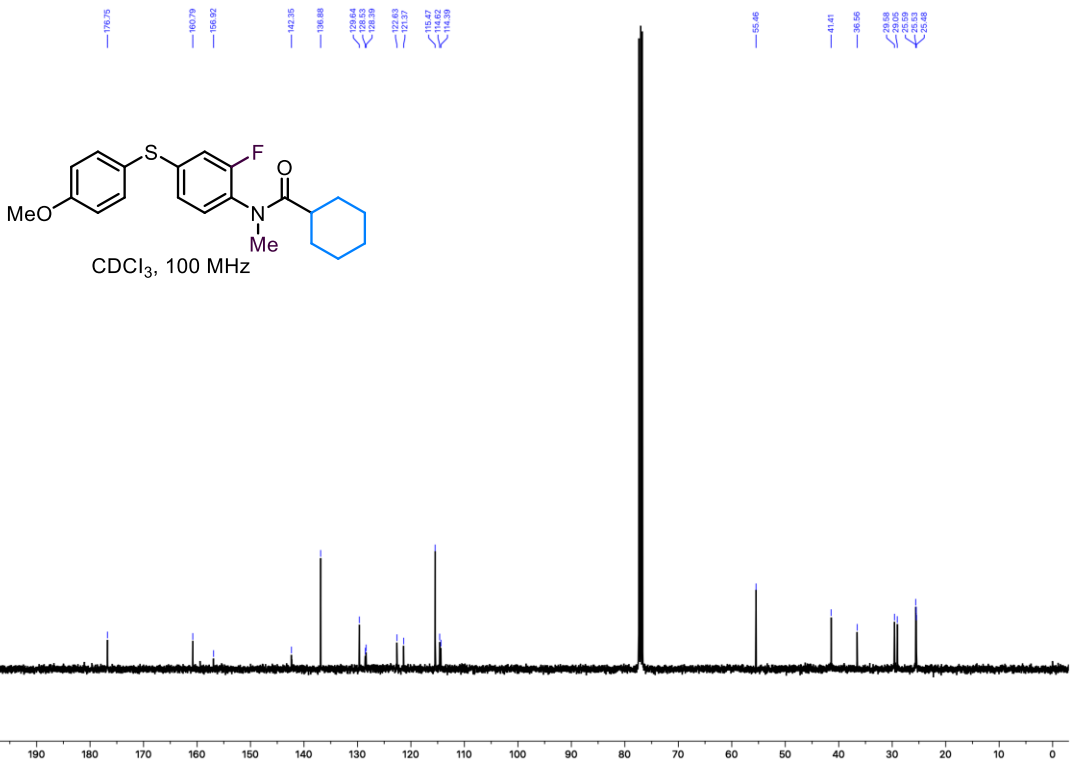
N-Methyl-N-phenylpropionamide (2ab')



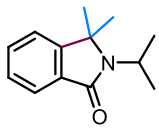


N-(2-Fluoro-4-((4-methoxyphenyl)thio)phenyl)-N-methylcyclohexanecarboxamide (2ac')

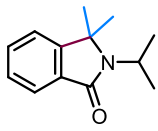




7-Fluoro-2-isopropyl-3,3-dimethylisoindolin-1-one (4)



$CDCl_3$, 400 MHz



$CDCl_3$, 100 MHz