Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supplementary Information

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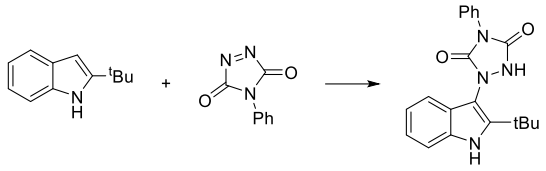
1. General Information

Unless otherwise specified, all reactions were conducted under an inert atmosphere and anhydrous conditions. All the solvents were purified according to the standard procedures. All chemicals which are commercially available were employed without further purification. Thin-layer chromatography (TLC) was performed on silica gel plates using UV-light (254 and 365 nm). Flash chromatography was conducted on silica gel (200–300 mesh). NMR spectra were recorded on a 400 MHz NMR spectrometer with $CDCl_3$, CD_2Cl_2 or d_6-DMSO as the solvent and TMS as an internal standard (400 MHz for ^1H and 100 MHz for ^{13}C). All high-resolution mass spectra were obtained on a Q-TOF Micro LC/MS System ESI spectrometer to be given in m/z. Enantiomeric excesses values were determined with HPLC (chiral column; mobile phase hexane/i-PrOH). Optical rotations were measured using an Anton Paar MCP-4100 digital polarimeter. Indoles **1** and triazolediones **2** were synthesized according to modified literature-reported procedures[1,2,3]. anhydrides/acyl chlorides **3** employed directly from commercial sources.

2. Representative Procedures

2.1 Optimization of the reaction conditions

Table **S1**. Optimization of the reaction conditions of **5a'**.

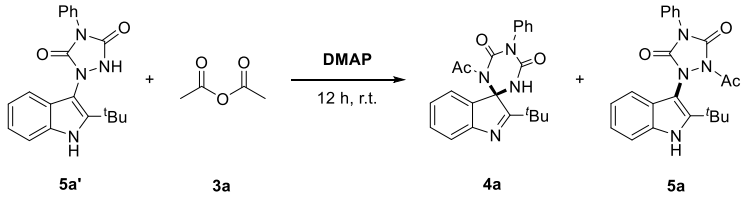


1a **2a** **5a'**

Entry	Solvent	T(℃)	Ratio (1a: 2a)	Time(mins)	Yield (%)
1	CH_2Cl_2	r.t.	1:1.2	20	86
2	PhMe	r.t.	1:1.2	20	67
3	THF	r.t.	1:1.2	20	23
4	CH_2Cl_2	0	1:1.2	30	91
5	CH_2Cl_2	-10	1:1.2	30	92
6	CH_2Cl_2	-78	1:1.2	60	98
7	CH_2Cl_2	-78	1:1	60	88
8	CH_2Cl_2	-78	1.2:1	60	87

Reaction conditions: **1a** (0.1 mmol), and **2a** (0.12 mmol) in the specified solvent (1 mL), isolated yield.

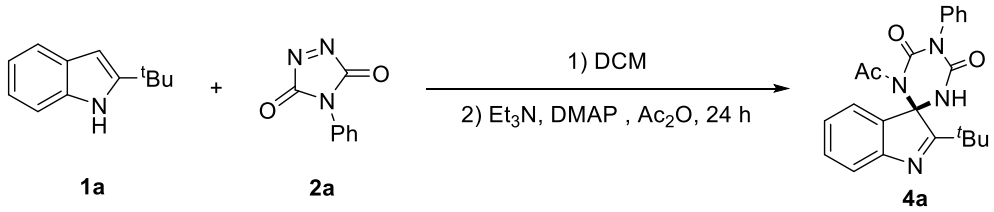
Table **S2**. Optimization of the reaction conditions of **4a**.



Entry	Solvent	Additive (1 eq.)	Yield of 4a (%)	Yield of 5a (%)
1	CH_2Cl_2	-	57	32
2	PhMe	-	14	16
3	MeCN	-	36	58
4	THF	-	11	10
5	CH_2Cl_2	Na_2CO_3	59	30
6	CH_2Cl_2	Et_3N	88	trace
7[a]	CH_2Cl_2	-	0	19

Reaction conditions: **5a'** (0.1 mmol), **3a** (0.15 mmol) and DMAP (0.01 mmol) in the specified solvent (1 mL) at room temperature (r.t.) for 12 h, isolated yield. [a] without DMAP.

Table **S3**. Optimization of reaction conditions for synthesis of **4a** by one-pot method.

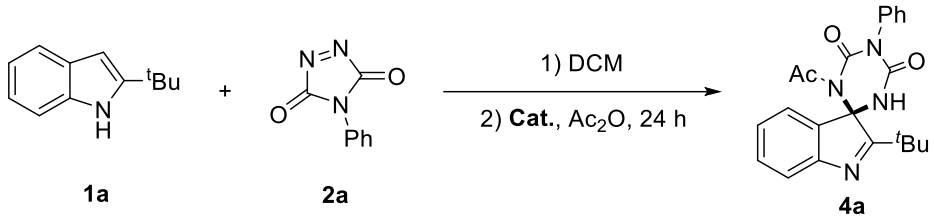


1a **2a** **4a**

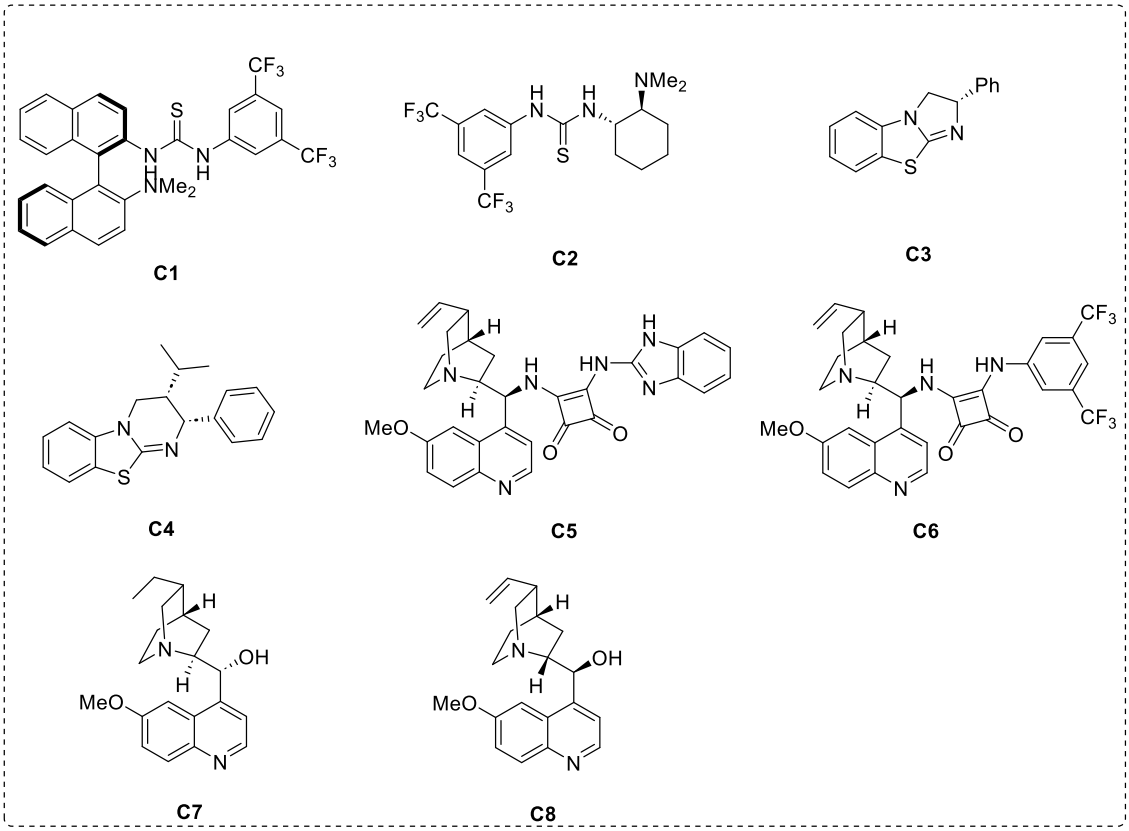
Entry	T(℃)	Ratio (1a: 2a)	Additive	Yield (%)
1	r.t.	1:1.2	Et_3N (1 eq.)	28
2	-78℃ → r.t.	1:1.2	Et_3N (1 eq.)	77
3	-78℃ → r.t.	1.2:1	Et_3N (1 eq.)	54
4	-78℃ → r.t.	1:1.2	Et_3N (2 eq.)	85

Reaction conditions: **1a** (0.1 mmol) and **2a** (0.12 mmol) in CH_2Cl_2 (1 mL) at -78 ℃ for 1 h, then **3** (0.15 mmol), DMAP (0.01 mol), and Et_3N (x mmol) at room temperature (r.t.) for 24 h, isolated yield.

Table **S4**. Optimization of the reaction conditions of Asymmetric version of **4a**.



1a **2a** **4a**

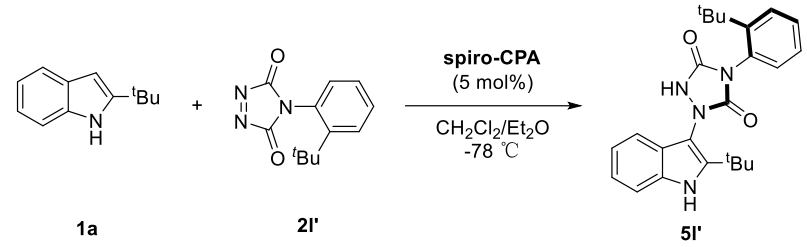


C1 **C2** **C3** **C4** **C5** **C6** **C7** **C8**

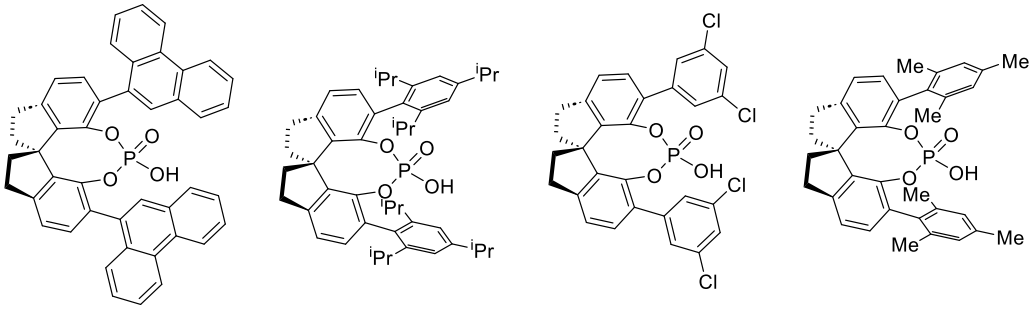
Entry	Cat.	Yield (%)	*Ee* (%)
1	**C1**	0	-
2	**C2**	0	-
3	**C3**	67	0
4	**C4**	74	0
5	**C5**	29	0
6	**C6**	22	0
7	**C7**	54	0
8	**C8**	44	0

Reaction conditions: **1a** (0.1 mmol) and **2a** (0.12 mmol) in CH_2Cl_2 (1 mL) at -78 ℃ for 1 h, then **3** (0.15 mmol), **cat.**(10 mol%) at room temperature (r.t.) for 24 h, isolated yield.

Table **S5**. Optimization of the reaction conditions of Asymmetric version of **5l'**.



1a **2l'** **5l'**

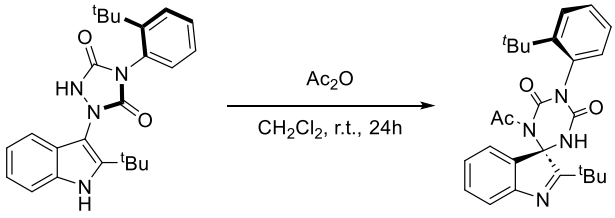


spiro-CPA-1 spiro-CPA-2 spiro-CPA-3 spiro-CPA-4

Entry	Cat.	Yield (%)	*Ee* (%)
1	**spiro-CPA-1**	94	91
7	**spiro-CPA-2**	94	-21
9	**spiro-CPA-3**	91	90
12	**spiro-CPA-4**	96	95

Reaction conditions: **1a** (0.1 mmol) and **2l'** (0.12 mmol) and **spiro-CPA** (5 mol%) in CH_2Cl_2:Et_2O = 1:1 (1 mL) at -78 °C for 0.5 h, isolated yield, *ee* was determined by chiral HPLC.

Table **S6**. Optimization of the reaction conditions of Asymmetric version of **6a.**



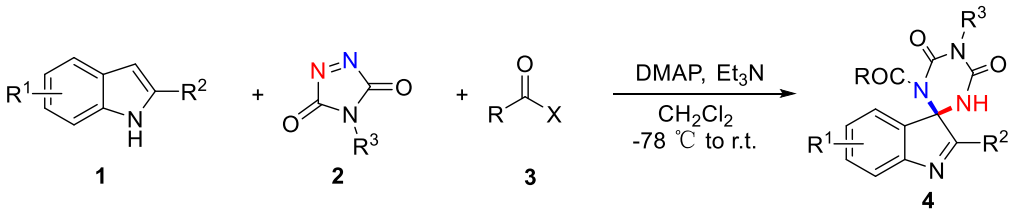
5l'
95 % *ee*

6a

Entry	Base	Yield (%)	*Ee* (%)	Dr (%)
1	DMAP (0.1 eq.) and Et_3N (1 eq.)	96	59	1.5:1
2	DMAP (0.1 eq.)	93	86	4:1
3	Na_2CO_3 (1 eq.)	trace	-	-
4	K_2CO_3 (1 eq.)	18	-	-
5	DABCO (1 eq.)	25	-	-
6	DIPEA (1 eq.)	91	95	>20:1

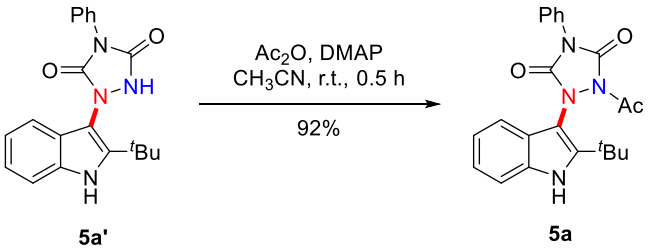
Reaction conditions: **5l'** (0.1 mmol) in CH_2Cl_2 (1 mL) at room temperature (r.t.) for 24 h, isolated yield. *ee* and dr was determined by chiral HPLC.

2.2 General Procedures for the Synthesis of 4.



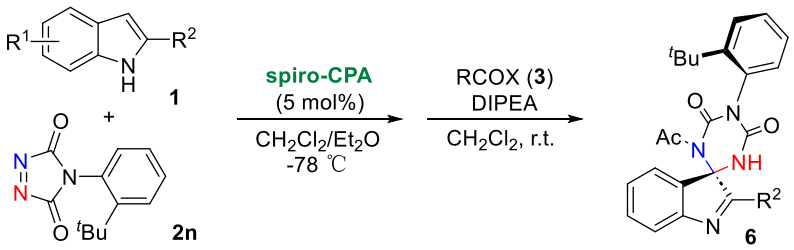
Triazolediones **2** (0.24 mmol) was dissolved in CH_2Cl_2 (2 mL) at -78℃, and indoles **1** (0.2 mmol) was slowly added, stirring for 1 h. After the reaction was completely monitored by TLC, the mixture was moved to room temperature, and Et_3N (0.4 mmol) was added, stirring for 0.5 h, DMAP (0.02 mmol) and corresponding anhydrides/acyl chlorides **3** (0.03 mmol, **4a**,**4c** and **4d** used corresponding anhydrides, otherwise used acyl chlorides) were added, and the reaction was carried out for 24 h. The solvents were removed in vacuo and the crude product was separated by flash column chromatography on silica gel (petroleum ether/ethyl acetate = 2:1) to afford **4**.

2.3 General Procedures for the Synthesis of 5a.



5a' (0.2 mmol) was dissolved in MeCN (2 mL) room temperature (r.t.), and DMAP (0.02 mmol) was added, stirring for 0.5 h, acetic anhydride **3a** (0.03 mmol) was added, and the reaction was carried out for 0.5 h. the reaction mixture is filtered and washed with MeCN to obtain a white solid product **5a**.

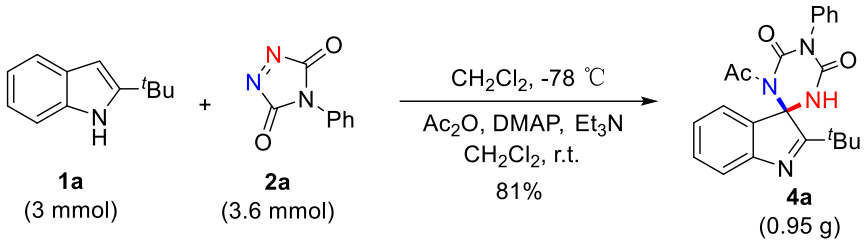
2.4 General Procedures for the Synthesis of 6.



Triazolediones **2** (0.24 mmol) and **spiro-CPA** (5 mmol%) was dissolved in CH_2Cl_2: Et_2O = 1:1 (2 mL) stirring for 0.5 hour at -78℃, and indoles **1** (0.2 mmol) was slowly added, stirring for 1 hour. The reaction mixture was stirred until completion of reaction as monitored by TLC. The solvents were removed in vacuo and the crude product was separated by flash column chromatography on silica gel (petroleum ether/ethyl acetate = 1:1) to afford **5'**.

5' (0.2 mmol) was dissolved in CH_2Cl_2 (2 mL) room temperature (r.t.), and DIPEA (0.2 mmol) was added, stirring for 0.5 h, anhydrides **3** (0.03 mmol) was added, and the reaction was carried out for 24 h. The solvents were removed in vacuo and the crude product was separated by flash column chromatography on silica gel (petroleum ether/ethyl acetate = 2:1) to afford **6**.

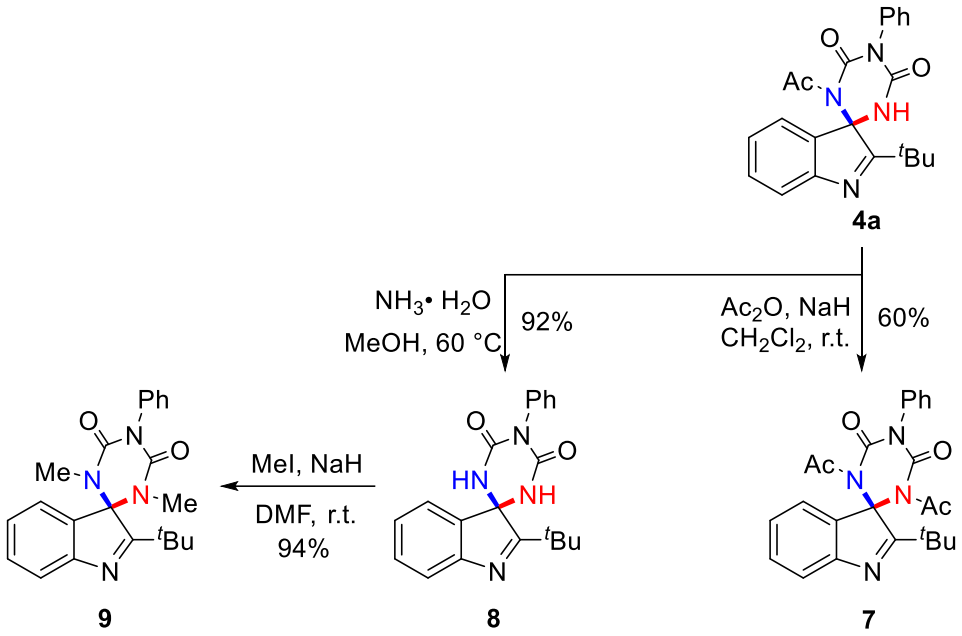
2.5 Large-scale synthesis of 4a.



1a (3 mmol) **2a** (3.6 mmol) **4a** (0.95 g)

Triazolediones **2a** (3.6 mmol) was dissolved in CH_2Cl_2 (2 mL) at -78℃, and indoles **1a** (3 mmol) was slowly added, stirring for 4 hours. The reaction mixture was stirred until completion of reaction as monitored by TLC. The mixture was moved to room temperature, and Et_3N (6 mmol) was added, stirring for 2 h, DMAP (0.3 mmol) and acetic anhydride **3a** (4.5 mmol) were added, and the reaction was carried out for 48 h. Water was added and the mixture was extracted with AcOEt (3 × 20 mL). The combined organic layer was washed with brine, separated, dried over Na_2SO_4 and filtered. The solvent was then removed under reduced pressure and the residue was purified by column chromatography isolation (petroleum ether/ethyl acetate = 2:1) to afford product **4a** (0.95 g) in 81% yield.

2.6 Detailed Procedures for further transformation of 4a:



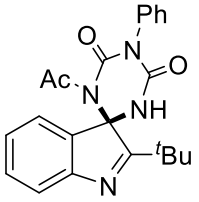
For compound **7:** To a solution of the **4a** (0.2 mmol) in CH_2Cl_2 (2 mL) was added NaH (0.3 mmol) stirring for 0.5 hour at room temperature, and acetic anhydride (0.3 mmol) was slowly added, stirring for 4 hours. After completion, the reaction mixture was quenched with saturated NH_4Cl solution and extracted with CH_2Cl_2. The organic layer was washed with brine and dried over anhydrous Na_2SO_4. The solvent was then removed under reduced pressure and the residue was purified by column chromatography isolation (petroleum ether/ethyl acetate = 2:1) to afford product **7.**

For compound **8:** To a solution of the **4a** (0.2 mmol) in MeOH (2 mL) was added NH_4OH (0.4 mL) stirring for 24 hours at 60°C. After completion, the reaction mixture is filtered and washed with MeOH and water to obtain a white solid product **8**.

For compound **9:** To a solution of the **8** (0.2 mmol) in DMF (2 mL) was added NaH (0.3 mmol) stirring for 0.5 hour at r.t., and MeI (0.3 mmol) was slowly added, stirring for 2 hours. After completion, the reaction mixture was quenched with saturated NH_4Cl solution and extracted with CH_2Cl_2. The organic layer was washed with brine and dried over anhydrous Na_2SO_4. The solvent was then removed under reduced pressure and the residue was purified by column chromatography isolation (petroleum ether/ethyl acetate = 4:1) to afford product **9.**

3. Characterization of Products

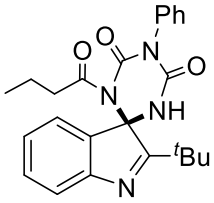
1'-acetyl-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4a:**



4a

A yellow solid; 66.3 mg; isolated yield = 85%; m.p. 155.1 – 156.1 ℃; ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 9.10 (s, 1H), 7.59 – 7.38 (m, 8H), 7.26 (d, J = 1.0 Hz, 1H), 2.42 (s, 3H), 1.36 (s, 9H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 185.7, 172.8, 152.4, 150.7, 150.3, 138.9, 135.2, 130.7, 129.9, 129.3, 129.0, 127.3, 121.0, 120.7, 80.3, 37.1, 29.7, 28.2; HRMS (ESI) Calcd. For $C_{22}H_{23}N_4O_3$ $[M+H]^+$ 391.1765, found 391.1767.

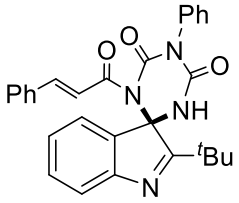
2-(*tert*-butyl)-1'-butyryl-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4b**:



4b

A yellow solid; 61.1 mg; isolated yield = 73%; m.p. 127.7 – 128.7 ℃; ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 9.08 (s, 1H), 7.54 (m, J = 19.9, 7.5 Hz, 3H), 7.48 – 7.36 (m, 5H), 7.26 (d, J = 1.0 Hz, 1H), 2.87 – 2.74 (m, 2H), 1.48 – 1.39 (m, 2H), 1.36 (s, 9H), 0.76 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 186.0, 175.8, 152.5, 150.7, 150.3, 138.9, 135.2, 130.7, 129.9, 129.3, 128.9, 127.2, 120.9, 80.3, 41.6, 37.1, 29.7, 18.3, 13.8; HRMS (ESI) Calcd. For $C_{24}H_{27}N_4O_3$ $[M+H]^+$ 419.2078, found 419.2080.

2-(*tert*-butyl)-1'-cinnamoyl-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4c:**

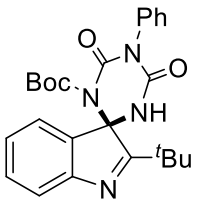


4c

A yellow solid; 83.2 mg; isolated yield = 87%; m.p. 233.8 – 234.8 ℃; ^{1}H NMR (400

MHz, d_6-DMSO) δ ppm: δ 9.21 (s, 1H), 7.66 – 7.57 (m, 3H), 7.56 – 7.51 (m, 2H), 7.50 – 7.37 (m, 9H), 7.30 – 7.24 (m, 2H), 1.40 (s, 9H).; ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 185.8, 168.1, 152.4, 150.7, 150.7, 143.6, 138.8, 135.1, 134.5, 131.2, 130.9, 129.9, 129.5, 129.3, 128.9, 128.9, 127.4, 122.6, 121.1, 80.1, 37.2, 29.8; HRMS (ESI) Calcd. For $C_{29}H_{27}N_4O_3$ $[M+H]^+$ 479.2078, found 479.2090.

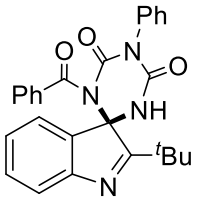
tert-Butyl 2-(*tert*-butyl)-4',6'-dioxo-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-1'-carboxylate **4d**:



4d

A white solid; 78.9 mg; isolated yield = 88%; m.p. 181.8 – 182.8 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.51 – 7.39 (m, 6H), 7.31 – 7.23 (m, 3H), 5.86 (s, 1H), 1.50 (s, 9H), 1.16 (s, 9H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 187.0, 152.2, 150.2, 149.1, 148.7, 138.6, 135.1, 131.6, 129.8, 129.4, 128.8, 127.5, 122.6, 121.2, 85.2, 80.3, 37.0, 29.6, 26.9; HRMS (ESI) Calcd. For $C_{25}H_{28}N_4O_4Na$ $[M+Na]^+$ 471.2003, found 471.2008.

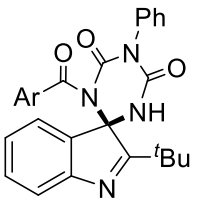
1'-benzoyl-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4e**:



4e

A white solid; 77.8 mg; isolated yield = 86%; m.p. 165.1 – 166.1 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.69 – 7.60 (m, 2H), 7.52 – 7.35 (m, 9H), 7.32 – 7.27 (m, 2H), 7.21 – 7.15 (m, 1H), 6.17 (s, 1H), 1.49 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.0, 170.4, 152.0, 151.2, 150.5, 136.8, 134.4, 133.5, 1323.0, 131.6, 129.3, 129.0, 128.7, 128.7, 128.5, 127.3, 121.7, 120.5, 80.2, 37.6, 29.8; HRMS (ESI) Calcd. For $C_{27}H_{25}N_4O_3$ $[M+H]^+$ 453.1922, found 453.1926.

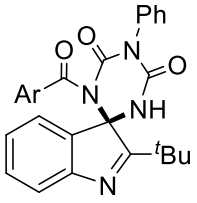
2-(*tert*-butyl)-1'-(4-methylbenzoyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4f**:



4f (Ar = 4-Me-Ph)

A white solid; 74.6 mg; isolated yield = 80%; m.p. 158.6 – 159.6 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.57 (d, *J* = 8.2 Hz, 2H), 7.51 (d, *J* = 7.6 Hz, 1H), 7.48 – 7.36 (m, 5H), 7.30 (d, *J* = 7.3 Hz, 2H), 7.18 (t, 3H), 6.00 (s, 1H), 2.35 (s, 3H), 1.49 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.2, 170.2, 152.0, 151.1, 150.6, 144.1, 136.8, 133.5, 131.6, 131.5, 129.3, 129.0, 128.7, 127.3, 121.6, 120.6, 80.2, 37.3, 29.8, 21.7; HRMS (ESI) Calcd. For $C_{28}H_{27}N_4O_3$ $[M+H]^+$ 467.2078, found 467.2084.

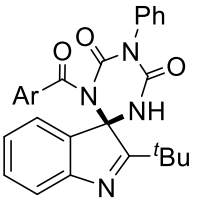
2-(*tert*-butyl)-1'-(4-fluorobenzoyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4g**:



4g (Ar = 4-F-Ph)

A yellow solid; 87.5 mg; isolated yield = 93%; m.p. 128.4 – 129.4 ℃; ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 9.33 (s, 1H), 8.05 – 7.94 (m, 2H), 7.78 (d, *J* = 7.3 Hz, 1H), 7.52 – 7.36 (m, 7H), 7.29 – 7.22 (m, 3H), 1.44 (s, 9H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 186.8, 170.3, 165.3 (d, *J* = 251 Hz), 152.4, 151.1, 150.5, 138.2, 135.0, 132.5 (d, *J* = 9 Hz), 131.6, 131.6, 131.4, 129.8, 129.3, 128.9, 127.4, 122.0, 121.1, 116.1 (d, *J* = 22 Hz) , 80.4, 37.1, 29.7; ^{19}F NMR (376 MHz, d_6-DMSO) δ ppm: δ -105.6; HRMS (ESI) Calcd. For $C_{27}H_{24}N_4O_3F$ $[M+H]^+$ 471.1827, found 471.1838.

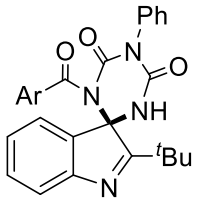
2-(*tert*-butyl)-1'-(4-chlorobenzoyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4h**:



4h (Ar = 4-Cl-Ph)

A yellow solid; 78.7 mg; isolated yield = 83%; m.p. 136.3 – 137.3 ℃; ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 9.34 (s, 1H), 7.92 (d, *J* = 8.6 Hz, 2H), 7.76 (d, *J* = 7.2 Hz, 1H), 7.49 (t, *J* = 7.4 Hz, 4H), 7.46 – 7.36 (m, 5H), 7.27 – 7.20 (m, 1H), 1.43 (s, 9H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 186.6, 170.5, 152.4, 151.0, 150.4, 138.3, 138.1, 134.9, 133.9, 131.4, 131.2, 129.7, 129.3, 129.1, 128.9, 127.5, 121.9, 121.1, 80.4, 37.1, 29.7; HRMS (ESI) Calcd. For $C_{27}H_{24}ClN_4O_3$ $[M+H]^+$ 487.1532, found 487.1540.

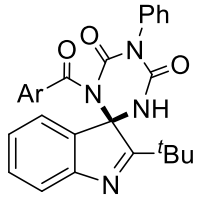
1'-(4-bromobenzoyl)-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4i**:



4i (Ar = 4-Br-Ph)

A white solid; 92.2 mg; isolated yield = 87%; m.p. 185.1 – 186.1 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.37 (m, 10H), 7.35 – 7.28 (m, 2H), 7.24 – 7.14 (m, 2H), 1.50 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.0, 169.7, 152.1, 150.9, 150.7, 137.0, 133.5, 133.4, 131.8, 131.5, 130.1, 129.3, 129.1, 128.7, 127.9, 127.2, 121.6, 120.4, 80.3, 37.3, 29.8; HRMS (ESI) Calcd. For $C_{27}H_{24}BrN_4O_3$ $[M+H]^+$ 531.1027, found 531.1037.

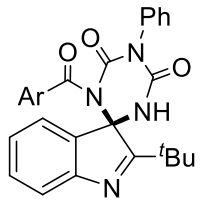
2-(*tert*-butyl)-5'-phenyl-1'-(4-(trifluoromethyl)benzoyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4j**:



4j (Ar = 4-CF_3-Ph)

A yellow solid; 91.6 mg; isolated yield = 88%; m.p. 190.2 – 191.2 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.73 (d, *J* = 8.3 Hz, 2H), 7.65 (d, *J* = 8.4 Hz, 2H), 7.55 (d, *J* = 7.6 Hz, 1H), 7.51 – 7.40 (m, 5H), 7.34 – 7.29 (m, 2H), 7.23 (d, *J* = 7.4 Hz, 1H), 5.89 (s, 1H), 1.51 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.4, 169.4, 152.0, 150.7, 150.4, 137.7, 136.4, 134.1 (d, *J* = 327 Hz), 133.2, 131.8, 129.4, 129.3, 128.7, 128.5, 127.5, 125.6 (d, *J* = 4 Hz), 124.8, 121.9, 120.3, 80.2, 37.4, 29.7; ^{19}F NMR (376 MHz, $CDCl_3$) δ ppm: δ -63.20; HRMS (ESI) Calcd. For $C_{28}H_{24}F_3N_4O_3$ $[M+H]^+$ 521.1796, found 521.1810.

2-(*tert*-butyl)-1'-(3-methylbenzoyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4k**:

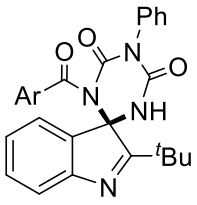


4k (Ar = 3-Me-Ph)

A white solid; 83.9 mg; isolated yield = 90%; m.p. 204.8 – 205.8 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.50 (d, *J* = 7.6 Hz, 1H), 7.48 – 7.43 (m, 4H), 7.42 – 7.34 (m, 3H), 7.29 – 7.24 (m, 4H), 7.17 (t, *J* = 7.5 Hz, 1H), 6.22 (s, 1H), 2.33 (s, 3H), 1.48 (s,

9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.1, 170.6, 152.0, 151.2, 150.5, 138.4, 136.8, 134.4, 133.8, 133.5, 131.6, 129.3, 129.2, 129.0, 128.7, 128.3, 127.3, 125.7, 121.6, 120.5, 80.2, 37.3, 29.8, 21.4; HRMS (ESI) Calcd. For $C_{28}H_{27}N_4O_3$ $[M+H]^+$ 467.2078, found 467.2086.

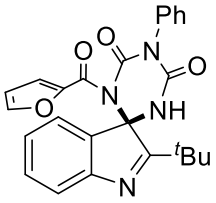
2-(*tert*-butyl)-1'-(2-fluorobenzoyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4l**:



4l (Ar = 2-F-Ph)

A white solid; 88.4 mg; isolated yield = 94%; m.p. 137.3 – 138.3 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.56 – 7.36 (m, 8H), 7.31 – 7.26 (m, 2H), 7.24 – 7.19 (m, 1H), 7.16 – 7.09 (m, 1H), 7.09 – 7.00 (m, 1H), 6.12 (s, 1H), 1.48 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.8, 165.9, 159.2 (d, J = 251 Hz), 152.1, 150.7, 150.1, 136.8, 134.3 (d, J = 9 Hz), 133.6, 131.5, 131.1, 129.3, 129.2, 128.7, 127.5, 124.7, 123.5, 121.5, 120.8, 116.1(d, J = 23 Hz), 80.3, 37.2, 29.6; ^{19}F NMR (376 MHz, $CDCl_3$) δ ppm: δ -113.63; HRMS (ESI) Calcd. For $C_{27}H_{24}FN_4O_3$ $[M+H]^+$ 471.1827, found 471.1836.

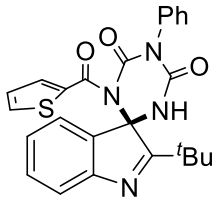
2-(*tert*-butyl)-1'-(furan-2-carbonyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4m**:



4m

A brown solid; 82.2 mg; isolated yield = 93%; m.p. 253.9 – 254.9 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.54 (d, J = 0.9 Hz, 1H), 7.52 – 7.47 (m, 3H), 7.45 – 7.40 (m, 2H), 7.39 – 7.33 (m, 3H), 7.22 – 7.16 (m, 1H), 7.15 – 7.10 (m, 1H), 6.49 – 6.45 (m, 1H), 6.19 (s, 1H), 1.50 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.5, 163.5, 151.9, 151.0, 150.6, 137.6, 136.5, 134.4, 134.2, 133.5, 131.7, 129.3, 129.1, 128.7, 127.9, 127.2, 121.6, 121.0, 80.2, 37.2, 29.8; HRMS (ESI) Calcd. For $C_{25}H_{23}N_4O_4$ $[M+H]^+$ 443.1714, found 443.1726.

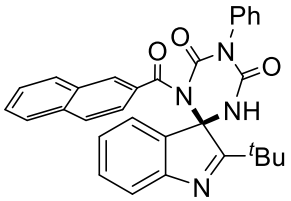
2-(*tert*-butyl)-5'-phenyl-1'-(thiophene-2-carbonyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4n**:



4n

A brown solid; 86.1 mg; isolated yield = 94%; m.p. 180.7 – 181.7 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.69 – 7.62 (m, 1H), 7.61 – 7.57 (m, 1H), 7.56 – 7.27 (m, 9H), 7.20 – 7.14 (m, 1H), 7.06 – 7.02 (m, 1H), 6.09 (s, 1H), 1.50 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.3, 159.3, 151.9, 150.9, 149.7, 147.4, 146.6, 136.8, 133.6, 131.6, 129.3, 129.0, 128.8, 127.3, 121.5, 120.9, 120.0, 112.6, 70.0, 37.2, 29.7; HRMS (ESI) Calcd. For $C_{25}H_{23}N_4O_3S$ $[M+H]^+$ 459.1486, found 459.1494.

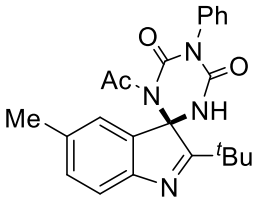
1'-(2-naphthoyl)-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4o**:



4o

A white solid; 94.4 mg; isolated yield = 94%; m.p. 174.5 – 175.5 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 8.21 (s, 1H), 7.89 – 7.78 (m, 3H), 7.67 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.58 – 7.36 (m, 8H), 7.35 – 7.29 (m, 2H), 7.22 – 7.14 (m, 1H), 6.12 (s, 1H), 1.52 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.0, 170.5, 152.0, 151.2, 150.6, 136.8, 135.4, 133.5, 132.4, 131.6, 131.6, 130.5, 129.4, 129.3, 129.1, 128.7, 128.3, 127.8, 127.3, 127.0, 124.3, 121.7, 120.5, 80.3, 37.4, 29.8; HRMS (ESI) Calcd. For $C_{31}H_{27}N_4O_3$ $[M+H]^+$ 503.2078, found 503.2088.

1'-acetyl-2-(*tert*-butyl)-5-methyl-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4p**:

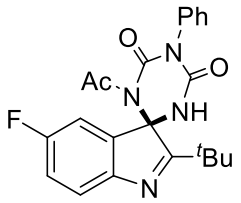


4p

A white solid; 68.7 mg; isolated yield = 85%; m.p. 204.8 – 205.8 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.50 (tdd, *J* = 7.5, 6.5, 4.1 Hz, 3H), 7.39 – 7.30 (m, 3H), 7.20 – 7.15 (m, 1H), 7.12 (s, 1H), 5.68 (s, 1H), 2.52 (s, 3H), 2.37 (s, 3H), 1.42 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 184.7, 171.9, 150.9, 150.2, 149.7, 137.2, 137.2, 133.9, 131.6, 129.5, 129.3, 128.7, 121.1, 120.5, 80.0, 37.2, 29.6, 28.0, 21.5; HRMS

(ESI) Calcd. For $C_{23}H_{25}N_4O_3$ $[M+H]^+$ 405.1922, found 405.1934.

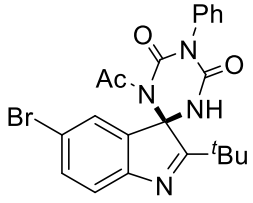
1'-acetyl-2-(*tert*-butyl)-5-fluoro-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4q**:



4q

A yellow solid; 69.4 mg; isolated yield = 85%; m.p. 182.9 – 183.9 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.56 – 7.45 (m, 3H), 7.42 – 7.36 (m, 1H), 7.30 – 7.24 (m, 2H), 7.10 – 6.96 (m, 2H), 6.24 (s, 1H), 2.51 (s, 3H), 1.38 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.7, 172.0, 161.8 (d, J = 247 Hz), 150.8, 149.8, 147.9, 138.9 (d, J = 8 Hz), 133.6, 129.5, 129.3, 128.7, 122.4, 117.4 (d, J = 23 Hz), 107.9, 80.0, 37.3, 29.5, 28.0; ^{19}F NMR δ ppm: (376 MHz, $CDCl_3$) δ -113.55; HRMS (ESI) Calcd. For $C_{22}H_{22}FN_4O_3$ $[M+H]^+$ 409.1671, found 409.1672.

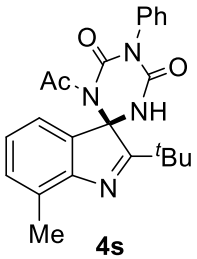
1'-acetyl-5-bromo-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4r**:



4r

A white solid; 79.6 mg; isolated yield = 85%; m.p. 196.3 – 197.3 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.56 – 7.45 (m, 4H), 7.41 – 7.36 (m, 1H), 7.34 – 7.31 (m, 2H), 7.24 – 7.18 (m, 1H), 5.81 (s, 1H), 2.51 (s, 3H), 1.42 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.8, 172.0, 152.0, 151.0, 150.1, 137.0, 133.8, 131.2, 129.5, 129.3, 128.7, 127.2, 121.5, 119.6, 80.1, 37.3, 29.6, 28.0; HRMS (ESI) Calcd. For $C_{22}H_{22}BrN_4O_3$ $[M+H]^+$ 469.0870, found 469.0872.

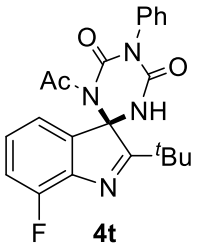
1'-acetyl-2-(*tert*-butyl)-7-methyl-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4s**:



4s

A white solid; 58.2 mg; isolated yield = 72%; m.p. 198.4 – 199.4 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.56 – 7.45 (m, 3H), 7.37 – 7.31 (m, 2H), 7.19 (d, *J* = 7.4 Hz, 1H), 7.15 – 7.07 (m, 2H), 5.52 (s, 1H), 2.51 (s, 6H), 1.43 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 183.8, 171.9, 150.9, 150.4, 150.2, 136.9, 133.9, 132.7, 131.6, 129.4, 129.2, 128.7, 126.8, 116.9, 80.3, 37.3, 29.7, 28.0, 16.3; HRMS (ESI) Calcd. For $C_{23}H_{25}N_4O_3$ $[M+H]^+$ 405.1922, found 405.1922.

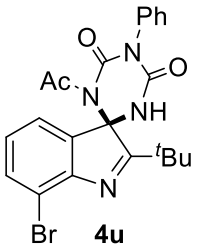
1'-acetyl-2-(*tert*-butyl)-7-fluoro-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4t**:



4t

A white solid; 65.3 mg; isolated yield = 80%; m.p. 190.3 – 191.3 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.57 – 7.45 (m, 3H), 7.30 (d, *J* = 7.0 Hz, 2H), 7.23 – 7.17 (m, 1H), 7.12 (dd, *J* = 10.5, 8.2 Hz, 2H), 6.03 (s, 1H), 2.52 (s, 3H), 1.42 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.4, 172.0, 154.1 (d, *J* = 256 Hz), 150.8, 149.8, 140.3, 138.8 (d, *J* = 12 Hz), 133.6, 129.5, 128.8, 128.7, 128.6, 118.8 (d, *J* = 19 Hz) , 115.3, 80.3, 37.6, 29.6, 27.9; ^{19}F NMR δ ppm: (376 MHz, $CDCl_3$) δ -125.21;HRMS (ESI) Calcd. For $C_{22}H_{22}FN_4O_3$ $[M+H]^+$ 409.1671, found 409.1670.

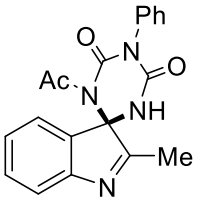
1'-acetyl-7-bromo-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4u**:



4u

A white solid; 71.1 mg; isolated yield = 76%; m.p. 201.6 – 202.6℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 – 7.46 (m, 4H), 7.42 – 7.37 (m, 1H), 7.34 – 7.32 (m, 2H), 7.24 – 7.19 (m, 1H), 5.71 (s, 1H), 2.51 (s, 3H), 1.43 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.8, 172.0, 152.0, 150.9, 150.1, 137.0, 133.8, 131.2, 129.5, 129.3, 128.7, 127.2, 121.5, 119.6, 80.1, 37.3, 29.6, 28.0; HRMS (ESI) Calcd. For $C_{22}H_{22}BrN_4O_3$ $[M+H]^+$ 469.0870, found 469.0871.

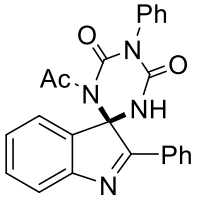
1'-acetyl-2-methyl-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4v**:



4v

A yellow solid; 60.6 mg; isolated yield = 87%; m.p. 221.3 – 222.3 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.55 – 7.44 (m, 3H), 7.41 (d, *J* = 7.3 Hz, 1H), 7.38 – 7.31 (m, 4H), 7.24 – 7.19 (m, 1H), 6.65 (d, *J* = 4.9 Hz, 1H), 2.50 (s, 3H), 2.20 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 177.6, 171.6, 152.7, 151.6, 150.6, 135.9, 133.8, 131.4, 129.4, 129.3, 128.7, 127.0, 121.3, 120.6, 78.8, 27.6, 14.9; HRMS (ESI) Calcd. For $C_{19}H_{17}N_4O_3$ $[M+H]^+$ 349.1296, found 349.1293.

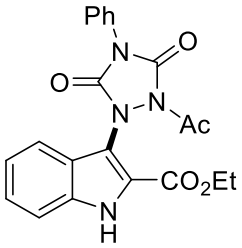
1'-acetyl-2,5'-diphenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4w**:



4w

A brown solid; 62.3 mg; isolated yield = 76%; m.p. 189.3 – 190.3 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 8.02 (d, *J* = 7.6 Hz, 2H), 7.59 – 7.40 (m, 7H), 7.36 – 7.17 (m, 6H), 2.33 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 172.9, 171.2, 151.8, 151.2, 150.4, 136.9, 134.0, 132.1, 131.4, 129.7, 129.5, 129.3, 128.9, 128.8, 127.6, 127.3, 122.0, 119.9, 78.5, 27.3; HRMS (ESI) Calcd. For $C_{24}H_{19}N_4O_3$ $[M+H]^+$ 411.1452, found 411.1460.

Ethyl 3-(2-acetyl-3,5-dioxo-4-phenyl-1,2,4-triazolidin-1-yl)-1H-indole-2-carboxylate **5x**:

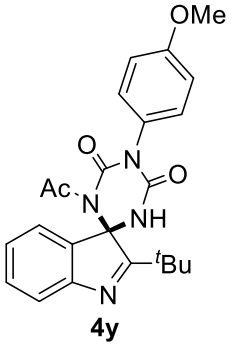


5x

A white solid; 53.6 mg; isolated yield = 66%; m.p. 167.1 – 168.1 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 9.14 (s, 1H), 7.90 (d, *J* = 7.9 Hz, 1H), 7.63 (dd, *J* = 8.4, 1.1 Hz, 2H), 7.58 – 7.51 (m, 2H), 7.50 – 7.44 (m, 1H), 7.33 – 7.26 (m, 2H), 7.25 – 7.20 (m, 1H), 4.28 – 4.13 (m, 2H), 2.56 (s, 3H), 1.28 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 165.2, 159.4, 153.1, 149.2, 134.0, 130.9, 129.4, 129.1, 126.7, 126.5,

126.3, 122.2, 122.0, 120.7, 119.3, 112.4, 61.5, 24.5, 14.2; HRMS (ESI) Calcd. For $C_{21}H_{18}N_4O_5Na$ $[M+Na]^+$ 429.1170, found 429.1180.

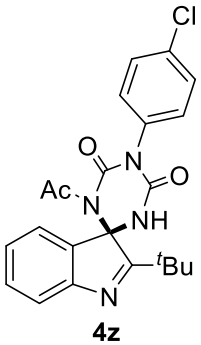
1'-acetyl-2-(*tert*-butyl)-5'-(4-methoxyphenyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4y**:



4y

A white solid; 72.3 mg; isolated yield = 86%; m.p. 126.9 – 127.9 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.49 (d, *J* = 7.7 Hz, 1H), 7.39 (td, *J* = 7.6, 1.1 Hz, 1H), 7.32 (d, *J* = 7.2 Hz, 1H), 7.26 – 7.19 (m, 3H), 7.06 – 7.01 (m, 2H), 5.65 (s, 1H), 3.86 (s, 3H), 2.52 (s, 3H), 1.43 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.9, 172.0, 160.0, 152.0, 151.1, 150.3, 137.0, 131.2, 129.7, 127.1, 126.3, 121.5, 119.6, 114.8, 80.1, 55.6, 37.3, 29.6, 27.9; HRMS (ESI) Calcd. For $C_{23}H_{25}N_4O_4$ $[M+H]^+$ 421.1871, found 421.1877.

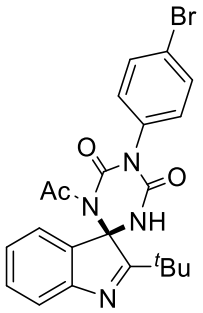
1'-acetyl-2-(*tert*-butyl)-5'-(4-chlorophenyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4z**:



4z

A yellow solid; 63.6 mg; isolated yield = 75%; m.p. 169.2 – 170.2 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.56 – 7.43 (m, 3H), 7.42 – 7.35 (m, 1H), 7.27 – 7.17 (m, 4H), 5.97 (s, 1H), 2.49 (s, 3H), 1.40 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.7, 171.8, 152.0, 150.8, 149.9, 136.9, 135.3, 132.2, 131.2, 130.1, 129.6, 127.2, 121.5, 119.5, 80.0, 37.3, 29.6, 27.9; HRMS (ESI) Calcd. For $C_{22}H_{22}ClN_4O_3$ $[M+H]^+$ 425.1375, found 425.1381.

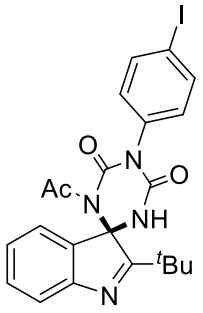
1'-acetyl-5'-(4-bromophenyl)-2-(*tert*-butyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4a'**:



4a'

A yellow solid; 78.6 mg; isolated yield = 84%; m.p. 187.1 – 188.1 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.67 – 7.61 (m, 2H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.38 (td, *J* = 7.5, 1.4 Hz, 1H), 7.25 – 7.15 (m, 4H), 6.03 (s, 1H), 2.49 (s, 3H), 1.39 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.6, 171.8, 152.0, 150.7, 149.8, 137.0, 132.7, 132.6, 131.2, 130.5, 127.1, 123.3, 121.6, 119., 80.04, 37.3, 29.6, 27.9; HRMS (ESI) Calcd. For $C_{22}H_{22}BrN_4O_3$ $[M+H]^+$ 469.0870, found 469.0872.

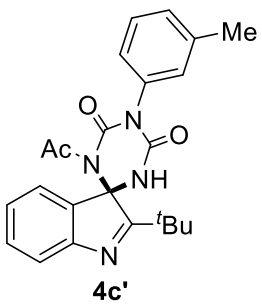
1'-acetyl-2-(*tert*-butyl)-5'-(4-iodophenyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4b'**:



4b'

A yellow solid; 77.4 mg; isolated yield = 75%; m.p. 128.5 – 129.5 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.67 – 7.61 (m, 2H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.38 (td, *J* = 7.5, 1.4 Hz, 1H), 7.26 – 7.15 (m, 4H), 6.03 (s, 1H), 2.49 (s, 3H), 1.39 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.6, 171.8, 152.0, 150.7, 149.8, 137.0, 132.7, 132.6, 131.2, 130.5, 127.1, 123.3, 121.6, 119.5, 80.0, 37.3, 29.6, 27.9; HRMS (ESI) Calcd. For $C_{22}H_{22}IN_4O_3$ $[M+H]^+$ 517.0732, found 517.0736.

1'-acetyl-2-(*tert*-butyl)-5'-(m-tolyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4c'**:

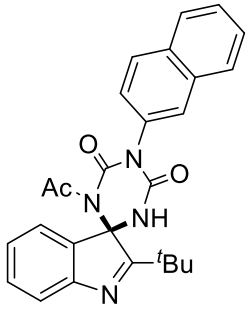


4c'

A yellow solid; 67.1 mg; isolated yield = 83%; m.p. 169.2 – 170.2 ℃; ^{1}H NMR (400

MHz, $CDCl_3$) δ ppm: δ 7.49 (d, *J* = 7.6 Hz, 1H), 7.41 (dt, *J* = 10.8, 7.6 Hz, 2H), 7.34 (d, *J* = 7.3 Hz, 1H), 7.29 (d, *J* = 7.6 Hz, 1H), 7.23 (t, *J* = 7.4 Hz, 1H), 7.14 (d, *J* = 7.4 Hz, 2H), 5.70 – 5.54 (m, 1H), 2.52 (s, 3H), 2.44 (s, 3H), 1.44 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.9, 172.0, 152.0, 150.9, 150.1, 139.6, 137.0, 133.7, 131.2, 130.2, 129.3, 129.2, 127.2, 125.6, 121.5, 119.6, 80.1, 37.3, 29.6, 27.9, 21.4; HRMS (ESI) Calcd. For $C_{23}H_{25}N_4O_3$ $[M+H]^+$ 405.1922, found 405.1931.

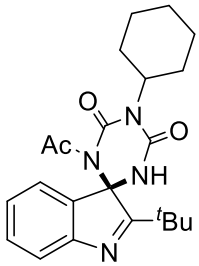
1'-acetyl-2-(*tert*-butyl)-5'-(naphthalen-2-yl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4d'**:



4d'

A white solid; 66.0 mg; isolated yield = 75%; m.p. 148.0 – 149.0 ℃; ^1H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.99 (d, *J* = 8.7 Hz, 1H), 7.91 (dd, *J* = 5.4, 2.9 Hz, 2H), 7.84 (d, *J* = 1.5 Hz, 1H), 7.60 – 7.53 (m, 2H), 7.48 (d, *J* = 7.8 Hz, 1H), 7.38 (t, *J* = 10.6, 4.0 Hz, 3H), 7.23 (t, 1H), 5.92 – 5.76 (m, 1H), 2.51 (s, 3H), 1.43 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.9, 172.0, 152.0, 151.2, 150.2, 137.0, 133.4, 133.3, 131.2, 131.1, 129.5, 128.2, 128.0, 127.9, 127.2, 127.2, 126.8, 125.8, 121.5, 119.7, 80.1, 37.4, 29.7, 28.0; HRMS (ESI) Calcd. For $C_{26}H_{25}N_4O_3$ $[M+H]^+$ 441.1922, found 441.1932.

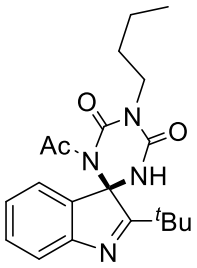
1'-acetyl-2-(*tert*-butyl)-5'-cyclohexylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4e'**:



4e'

A yellow solid; 56.2 mg; isolated yield = 71%; m.p. 177.5 – 178.5 ℃; ^1H NMR (400 MHz, d_6-DMSO) δ ppm: δ 8.77 (s, 1H), 7.35 (q, *J* = 7.2 Hz, 2H), 7.27 (d, *J* = 7.2 Hz, 1H), 7.19 (t, *J* = 7.2 Hz, 1H), 4.49 – 4.41 (m, 1H), 2.40 (s, 3H), 2.25 (dt, *J* = 16.2, 12.3 Hz, 2H), 1.81 (d, *J* = 11.4 Hz, 2H), 1.73 (s, 2H), 1.63 (d, *J* = 11.8 Hz, 1H), 1.32 (s, 1H), 1.25 (s, 9H), 1.17 – 1.09 (m, 1H), 1.05 (t, *J* = 7.0 Hz, 1H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 185.8, 172.9, 152.3, 151.2, 150.3, 138.7, 130.7, 127.2, 120.9, 120.3, 80.0, 54.6, 37.0, 29.6, 28.2, 26.4, 25.4; HRMS (ESI) Calcd. For $C_{22}H_{29}N_4O_3$ $[M+H]^+$ 397.2235, found 397.2238.

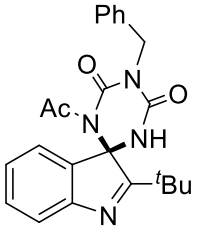
1'-acetyl-2-(*tert*-butyl)-5'-butylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4f'**:



4f'

A yellow solid; 50.3 mg; isolated yield = 68%; m.p. 131.8 – 132.8 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.44 (d, *J* = 7.7 Hz, 1H), 7.37 – 7.29 (m, 1H), 7.16 – 7.09 (m, 1H), 7.08 – 7.01 (m, 1H), 6.44 – 6.25 (m, 1H), 3.89 – 3.77 (m, 2H), 2.50 (s, 3H), 1.67 – 1.56 (m, 2H), 1.35 (s, 9H), 0.98 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.0, 172.0, 151.9, 151.5, 149.8, 137.2, 130.9, 126.9, 121.2, 119.5, 79.8, 41.8, 37.2, 30.3, 29.5, 27.9, 20.1, 13.8; HRMS (ESI) Calcd. For $C_{20}H_{27}N_4O_3$ $[M+H]^+$ 371.2078, found 371.2086.

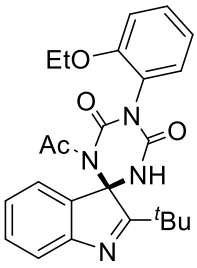
1'-acetyl-5'-benzyl-2-(*tert*-butyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4g'**:



4g'

A yellow solid; 51.7 mg; isolated yield = 64%; m.p. 144.5 – 145.5 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.41 (dt, *J* = 4.1, 2.9 Hz, 3H), 7.38 – 7.32 (m, 3H), 7.31 – 7.26 (m, 1H), 6.97 (td, *J* = 7.5, 0.8 Hz, 1H), 6.71 (d, *J* = 7.4 Hz, 1H), 6.48 (s, 1H), 5.01 (q, *J* = 14.0 Hz, 2H), 2.50 (s, 3H), 1.30 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.8, 172.0, 151.9, 151.8, 149.8, 136.9, 136.3, 130.8, 129.3, 128.7, 128.1, 126.9, 121.2, 119.7, 79.8, 44.8, 37.2, 29.5, 27.9; HRMS (ESI) Calcd. For $C_{23}H_{25}N_4O_3$ $[M+H]^+$ 405.1922, found 405.1926.

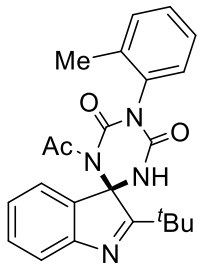
1'-acetyl-2-(*tert*-butyl)-5'-(2-ethoxyphenyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4h'**:



4h'

A white solid; 75.5 mg; isolated yield = 87%; m.p. 221.2 – 222.2 ℃; dr = 1.1:1; **unseparated two isomers**: ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 9.09 – 8.98 (m, 1H), 7.70 – 7.58 (m, 1H), 7.48 – 7.37 (m, 4H), 7.26 – 7.11 (m, 2H), 7.08 – 7.02 (m, 1H), 4.19 – 4.03 (m, 2H), 2.44 – 2.40 (m, 3H), 1.38 – 1.36 (m, 9H), 1.32 – 1.22 (m, 3H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 190.7, 190.5, 177.4, 177.2, 159.9, 159.8, 157.3, 157.2, 155.7, 154.9, 154.6, 154.5, 143.9, 143.5, 136.4, 136.0, 135.6, 135.3, 131.9, 131.6, 129.0, 128.3, 125.7, 125.6, 125.5, 125.4, 125.1, 118.1, 118.0, 85.1, 84.9, 69.3, 69.0, 42.1, 41.9, 34.6, 34.5, 33.1, 32.8, 20.1, 20.0; HRMS (ESI) Calcd. For $C_{24}H_{27}N_4O_4$ $[M+H]^+$ 435.2033, found 435.2033.

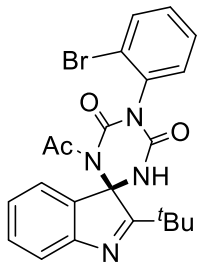
1'-acetyl-2-(*tert*-butyl)-5'-(o-tolyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4i'**:



4i'

A yellow solid; 67.1 mg; isolated yield = 83%; m.p. 116.0 – 117.0 ℃; dr = 1.6:1; **unseparated two isomers**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.51 – 7.46 (m, 1H), 7.42 – 7.31 (m, 5H), 7.25 – 7.18 (m, 2H), 5.77 – 5.69 (m, 1H), 2.54 – 2.50 (m, 3H), 2.36 – 2.25 (m, 3H), 1.44 – 1.39 (m, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.3, 185.9, 171.9, 171.8, 152.1, 151.9, 150.8, 149.9, 149.5, 137.5, 136.9, 136.6, 136.2, 133.1, 133.0, 131.3, 131.2, 131.1, 129.8, 129.7, 129.0, 128.4, 127.3, 127.2, 127.1, 121.6, 121.5, 119.6, 119.4, 80.5, 80.1, 37.4, 37.2, 29.7, 29.6, 28.2, 27.9, 17.9, 17.5; HRMS (ESI) Calcd. For $C_{23}H_{25}N_4O_3$ $[M+H]^+$ 405.1922, found 405.1922.

1'-acetyl-5'-(2-bromophenyl)-2-(*tert*-butyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4j'**:

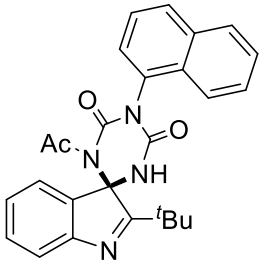


4j'

A yellow solid; 82.3 mg; isolated yield = 88%; m.p. 173.8 – 174.8 ℃; dr = 1.5:1; **unseparated two isomers**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.79 – 7.72 (m, 1H), 7.54 – 7.32 (m, 6H), 7.25 – 7.18 (m, 1H), 5.92 – 5.77 (m, 1H), 2.57 – 2.49 (m, 3H), 1.47 – 1.40 (m, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.1, 185.9, 171.7, 152.1, 151.9, 150.3, 149.4, 149.2, 149.1, 137.2, 136.9, 133.6, 133.5, 131.2, 131.1, 131.0, 130.5, 128.7, 128.6, 127.2, 127.1, 123.9, 123.8, 121.5, 121.4, 120.3, 119.5, 80.6, 80.0, 37.5,

37.2, 29.7, 29.6, 28.1, 27.8; HRMS (ESI) Calcd. For $C_{22}H_{22}BrN_4O_3$ $[M+H]^+$ 469.0870, found 469.0880.

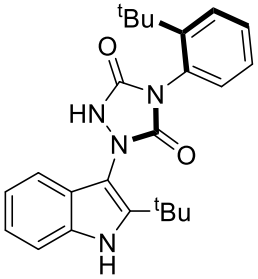
1'-acetyl-2-(*tert*-butyl)-5'-(naphthalen-1-yl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **4k'**:



4k'

A brown solid; 65.1 mg; isolated yield = 74%; m.p. 149.5 – 150.5 ℃; dr = 1.8:1; **unseparated two isomers**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 8.06 – 7.94 (m, 2H), 7.82 – 7.66 (m, 1H), 7.65 – 7.46 (m, 6H), 7.45 – 7.39 (m, 1H), 7.34 – 7.26 (m, 1H), 5.71 – 5.59 (m, 1H), 2.58 – 2.46 (m, 3H), 1.54 – 1.45 (m, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 186.3, 185.9, 172.0, 171.9, 152.1, 152.0, 151.3, 149.9, 137.6, 136.7, 134.6, 131.3, 130.7, 130.4, 130.1, 129.1, 129.0, 127.8, 127.6, 127.4, 127.3, 127.2, 126.8, 126.7, 126.6, 125.5 , 121.7, 121.6, 121.3, 121.1, 119.7, 119.6, 80.7, 80.2, 37.5, 37.2, 29.8, 29.6, 28.2, 27.9; HRMS (ESI) Calcd. For $C_{26}H_{25}N_4O_3$ $[M+H]^+$ 441.1922, found 441.1930.

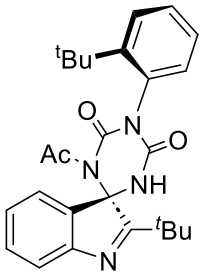
(a*S*)-1-(2-(*tert*-butyl)-1H-indol-3-yl)-4-(2-(*tert*-butyl)phenyl)-1,2,4-triazolidine-3,5-dione **5l'**:



5l'

A white solid; 78.1 mg; isolated yield = 97%; m.p. 169.7 – 170.7 ℃; ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 11.23 (d, J = 32.5 Hz, 1H), 7.70 – 7.58 (m, 1H), 7.57 – 7.32 (m, 4H), 7.33 – 7.25 (m, 1H), 7.19 – 7.13 (m, 1H), 7.10 – 7.04 (m, 1H), 1.45 (s, 9H), 1.38 (d, J = 17.3 Hz, 9H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 152.9, 151.8, 149.3, 146.9, 133.8, 132.8, 130.4, 129.0, 127.7, 125.6, 122.2, 120.3, 117.4, 116.6, 112.1, 105.7, 35.8, 33.2, 31.8, 30.1; HRMS (ESI) Calcd. For $C_{26}H_{25}N_4O_3$ $[M+H]^+$ 405.2286, found 405.2298.

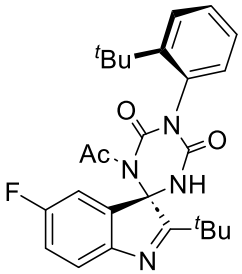
(*aS*,*S*)-1'-acetyl-2-(*tert*-butyl)-5'-(2-*(tert*-butyl)phenyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6a**:



6a

A yellow solid; 76.7 mg; isolated yield = 86%; m.p. 206.0 – 207.0 ℃; dr > 20:1; $[\alpha]_D^{20}$ = -21 (*c* 0.1, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 6.75 min (major), t_2 = 8,79 min (minor), *ee* = 94%; **major isomer**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.68 – 7.63 (m, 1H), 7.52 – 7.33 (m, 5H), 7.27 – 7.23 (m, 1H), 7.12 – 7.06 (m, 1H), 5.47 (s, 1H), 2.53 (s, 3H), 1.44 (s, 18H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.8, 172.0, 151.9, 151.7, 150.4, 147.9, 136.8, 131.4, 131.3, 130.2, 130.1, 129.8, 127.4, 127.2, 121.6, 119.43, 80.1, 37.5, 36.4, 31.8, 29.7, 27.7; HRMS (ESI) Calcd. For $C_{26}H_{31}N_4O_3$ $[M+H]^+$ 447.2391, found 447.2401.

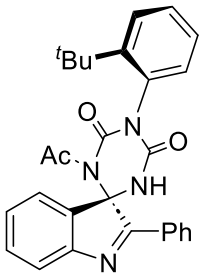
(*aS*,*S*)-1'-acetyl-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)-5-fluorospiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6b**:



6b

A white solid; 69.6 mg; isolated yield = 75%; m.p. 157.9 – 158.9 ℃; dr = 3:1; $[\alpha]_D^{20}$ = 3 (*c* 0.1, MeCN); HPLC (Chiralpak IE-3, *i*-propanol/hexane = 5/95, flow rate 1.0 mL/min, λ = 254 nm), major product: t_1 = 11.77 min (major), t_2 = 19.70 min (minor), ee = 95%; minor product: t_1 = 8.77 min (minor), t_2 = 10.34 min (major), *ee* = 95%; **unseparated two isomers**: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 – 7.58 (m, 1H), 7.48 – 7.42 (m, 1H), 7.41 – 7.26 (m, 2H), 7.11 – 6.93 (m, 3H), 6.24 – 6.14 (m, 1H), 2.57 – 2.47 (m, 3H), 1.46 – 1.34 (m, 18H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.7, 172.1, 165.1, 161.8 (d, *J* = 247 Hz), 151.8, 150.2, 147.8, 138.6, 131.2, 130.2, 130.0, 129.8, 127.5, 122.5, 122.4, 117.5, 117.3, 107.7, 107.5, 80.0, 37.5, 36.3, 31.8, 29.7, 27.7; ^{19}F NMR (376 MHz, $CDCl_3$) δ ppm: δ -113.38, -122.97. HRMS (ESI) Calcd. For $C_{26}H_{29}FN_4O_3Na$ $[M+Na]^+$ 487.2116, found 487.2128.

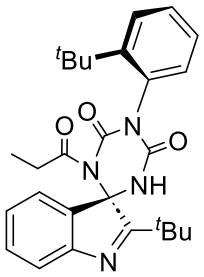
(*aS*,*S*)-1'-acetyl-5'-(2-(*tert*-butyl)phenyl)-2-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6c**:



6c

A yellow solid; 85.7 mg; isolated yield = 92%; m.p. 221.5 – 222.5 °C; dr = 14:1; $[\alpha]_D^{20}$ = 166 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 30/70, flow rate 1.0 mL/min, λ = 254 nm), major product: t_1 = 8.05 min (minor), t_2 = 9.72 min (major), ee = *88*%; minor product: t_1 = 5.68 min (major), t_2 = 7.95 min (minor), *ee* = 88%; **major isomer**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 8.18 – 7.97 (m, 2H), 7.72 – 7.61 (m, 1H), 7.53 – 7.43 (m, 4H), 7.42 – 7.28 (m, 5H), 7.21 – 7.15 (m, 1H), 6.53 – 6.37 (m, 1H), 2.42 – 2.30 (m, 3H), 1.56 – 1.48 (m, 9H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 172.6, 171.2, 151.8, 151.2, 150.6, 147.8, 137.4, 132.0, 131.4, 130.3, 130.2, 129.8, 128.8, 127.6, 127.5, 122.2, 119.9, 78.7, 36.5, 31.8, 27.3; HRMS (ESI) Calcd. For $C_{28}H_{27}N_4O_3$ $[M+H]^+$ 467.2078, found 467.2080.

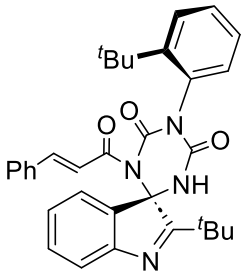
(*aS*,*S*)-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)-1'-propionylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6d**:



6d

A yellow solid; 77.2 mg; isolated yield = 84%; m.p. 118.7 – 119.7 °C; dr > 20:1; $[\alpha]_D^{20}$ = -10 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 5.74 min (major), t_2 = 7.57 min (minor), *ee* = 94%; **major isomer**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.69 – 7.60 (m, 1H), 7.53 – 7.31 (m, 5H), 7.28 – 7.22 (m, 1H), 7.07 – 7.00 (m, 1H), 5.70 (s, 1H), 3.11 – 2.98 (m, 1H), 2.87 – 2.69 (m, 1H), 1.43 (d, *J* = 4.4 Hz, 18H), 1.08 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.9, 176.0, 151.9, 150.3, 147.9, 137.0, 131.4, 131.2, 130.2, 130.0, 129.7, 127.4, 127.1, 121.6, 119.4, 80.2, 37.5, 36.4, 33.3, 31.8, 29.8, 9.1; HRMS (ESI) Calcd. For $C_{27}H_{33}N_4O_3$ $[M+H]^+$ 461.2548, found 461.2555.

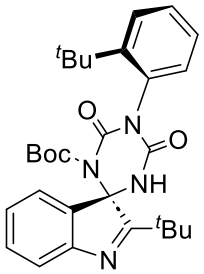
(*aS*,*S*)-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)-1'-cinnamoylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6e**:



6e

A yellow solid; 86.5 mg; isolated yield =81%; m.p. 188.5 – 189.5 ℃; dr > 20:1; $[\alpha]_D^{20}$ = 70 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 7.87 min (major), t_2 = 9.03 min (minor), *ee* = 94%; **major isomer**: ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.70 – 7.61 (m, 2H), 7.55 (d, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 3H), 7.44 – 7.32 (m, 6H), 7.30 (d, *J* = 4.1 Hz, 1H), 7.28 – 7.25 (m, 1H), 7.11 – 7.06 (m, 1H), 5.63 (s, 1H), 1.50 (s, 9H), 1.46 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 185.4, 167.0, 151.9, 150.7, 147.8, 146.1, 137.3, 134.3, 131.4, 131.2, 130.8, 130.3, 123.0, 129.8, 128.9, 128.5, 127.4, 127.2, 121.6, 120.0, 119.6, 80.2, 37.6, 36.4, 31.8, 29.8; HRMS (ESI) Calcd. For $C_{33}H_{35}N_4O_3$ $[M+H]^+$ 535.2704, found 535.2704.

(*tert*-Butyl (*aS,S*)-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)-4',6'-dioxospiro[indole-3,2'-[1,3,5]triazinane]-1'-carboxylate **6f**:

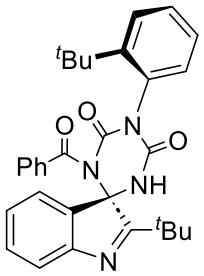


6f

A white solid; 87.7 mg; isolated yield = 87%; dr = 1:1.4; **minor isomer**: m.p. 160.7 – 161.7 ℃; $[\alpha]_D^{20}$ = 10 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 10.64 min (minor), t_2 = 12.85 min (major), *ee* = 95%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.66 – 7.59 (m, 1H), 7.57 – 7.49 (m, 1H), 7.45 – 7.38 (m, 3H), 7.35 – 7.26 (m, 2H), 7.13 – 7.05 (m, 1H), 5.60 (s, 1H), 1.49 (s, 9H), 1.42 (s, 9H), 1.38 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 180.3, 147.2, 146.7, 145.1, 144.4, 143.2, 133.2, 127.1, 126.4, 125.6, 125.0, 124.8, 122.6, 122.5, 116.9, 115.2, 80.7, 75.4, 32.7, 31.4, 26.9, 25.1, 22.9; **major isomer**: m.p. 164.2 – 165.2 ℃; $[\alpha]_D^{20}$ = 12 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 240 nm), t_1 = 6.23 min (minor), t_2 = 7.34 min (major), *ee* = 95%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.61 – 7.52 (m, 1H), 7.46 – 7.34 (m, 3H), 7.30 (d, *J* = 7.1 Hz, 1H), 7.27 – 7.21 (m, 2H), 6.96 (d, *J* = 7.7 Hz, 1H), 6.04 (s, 1H), 1.50 (s, 9H), 1.44 (s, 9H), 1.09 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 188.1, 151.8, 150.5, 148.9, 148.7, 147.8, 137.4, 131.7, 131.5, 130.9, 129.4, 127.2, 127.0, 121.6, 121.4,

85.7, 80.4, 37.0, 36.1, 31.7, 29.7, 27.0; HRMS (ESI) Calcd. For $C_{29}H_{36}N_4O_4Na$ $[M+Na]^+$ 527.2629, found 527.2632.

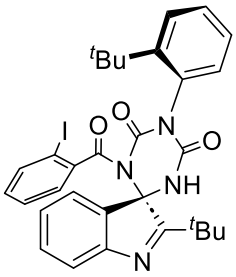
(*aS,S*)-1'-benzoyl-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6g**:



6g

A yellow solid; 83.3 mg; isolated yield = 82%; dr = 3.4:1; **major isomer**: m.p. 120.6 – 121.6 ℃; $[\alpha]_D^{20}$ = -14 (*c* 0.2, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 6.70 min (major), t_2 = 9.45 min (minor), *ee* = 95%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.60 – 7.53 (m, 4H), 7.45 (t, *J* = 7.6 Hz, 2H), 7.40 (d, *J* = 7.2 Hz, 1H), 7.37 – 7.33 (m, 2H), 7.32 – 7.26 (m, 2H), 7.26 – 7.22 (m, 1H), 7.01 – 6.93 (m, 1H), 6.21 (s, 1H), 1.50 (s, 9H), 1.46 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 184.2, 170.4, 152.5, 151.7, 150.6, 147.8, 137.6, 134.9, 132.4, 131.3, 131.1, 130.0, 129.9, 129.7, 128.5, 128.2, 127.4, 127.3, 121.8, 119.5, 80.5, 37.6, 36.4, 31.9, 30.0; **minor isomer**: m.p. 118.2 – 119.2 ℃; $[\alpha]_D^{20}$ = 46 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 30/70, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 4.44 min (major), t_2 = 5.21 min (minor), *ee* = 95%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.62 – 7.55 (m, 3H), 7.50 – 7.40 (m, 4H), 7.39 – 7.31 (m, 4H), 7.24 – 7.19 (m, 1H), 7.04 – 6.97 (m, 1H), 6.27 (s, 1H), 1.58 (s, 9H), 1.53 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 188.6, 171.3, 152.3, 150.7, 150.1, 147.7, 136.5, 135.1, 132.6, 131.8, 130.8, 130.1, 129.5, 129.4, 128.3, 128.0, 127.3, 121.5, 120.9, 80.7, 37.2, 36.5, 31.9, 29.7; HRMS (ESI) Calcd. For $C_{31}H_{33}N_4O_3$ $[M+H]^+$ 509.2548, found 509.2558.

(*aS,S*)-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)-1'-(2-iodobenzoyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6h**:

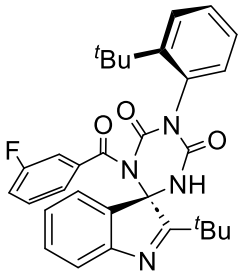


6h

A yellow solid; 95.1 mg; isolated yield = 75%; dr = 1:1.3; **minor isomer**: m.p. 144.0 – 145.0 ℃; $[\alpha]_D^{20}$ = 76 (*c* 0.1, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 5/95, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 13.74 min (major), t_2 = 17.40 min (minor), *ee* = 94%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.73 (d, *J* = 7.9 Hz, 1H), 7.55 (d, *J* =

7.8 Hz, 2H), 7.51 – 7.42 (m, 2H), 7.40 – 7.34 (m, 1H), 7.33 – 7.26 (m, 3H), 7.20 – 7.07 (m, 1H), 7.06 – 6.97 (m, 2H), 5.90 (s, 1H), 1.55 (s, 9H), 1.37 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 169.2, 152.2, 151.8, 149.2, 147.7, 142.4, 139.8, 136.3, 131.5, 131.3, 130.7, 130.3, 129.9, 129.8, 127.4, 127.3, 127.1, 124.8, 121.7, 120.1, 92.3, 80.4, 37.8, 36.3, 31.7, 29.9; **major isomer**: m.p. 153.7 – 154.7 ℃; $[\alpha]_D^{20}$ = 86 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 5/95, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 7.31 min (minor), t_2 = 8.07 min (major), *ee* = 95%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.75 (d, *J* = 7.9 Hz, 1H), 7.55 – 7.48 (m, 2H), 7.46 (d, *J* = 7.3 Hz, 1H), 7.43 – 7.37 (m, 1H), 7.36 – 7.31 (m, 1H), 7.30 – 7.22 (m, 3H), 7.12 – 7.06 (m, 1H), 7.04 – 6.95 (m, 2H), 5.75 (s, 1H), 1.62 (s, 9H), 1.42 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 187.1, 169.6, 152.6, 149.9, 149.2, 147.5, 141.9, 140.1, 136.5, 131.7, 131.4, 131.0, 130.9, 129.7, 129.3, 127.4, 127.3, 127.2, 125.3, 121.7, 120.2, 92.4, 80.8, 37.2, 36.1, 31.8, 29.9; HRMS (ESI) Calcd. For $C_{31}H_{32}IN_4O_3$ $[M+H]^+$ 635.1514, found 635.1519.

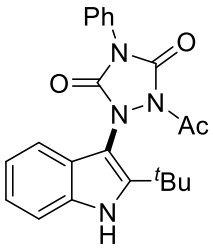
(*aS*,*S*)-2-(*tert*-butyl)-5'-(2-(*tert*-butyl)phenyl)-1'-(3-fluorobenzoyl)spiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **6i**:



6i

A yellow solid; 94.6 mg; isolated yield = 90%; dr = 3.9:1; **major isomer**: m.p. 151.3 – 152.3 ℃; $[\alpha]_D^{20}$ = 16 (*c* 0.15, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 6.71 min (major), t_2 = 7.43 min (minor), *ee* = 95%; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.64 – 7.55 (m, 2H), 7.51 – 7.45 (m, 1H), 7.45 – 7.26 (m, 7H), 7.20 – 7.13 (m, 1H), 7.05 – 6.99 (m, 1H), 5.96 (s, 1H), 1.50 (s, 9H), 1.48 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 184.0, 169.1, 162.1 (d, *J* = 246 Hz) , 152.2, 151.7, 150.5, 147.8, 137.2, 136.9 (d, *J* = 7 Hz), 131.3, 131.2, 130.0, 129.9, 129.8, 127.5, 127.4, 124.1, 121.9, 119.5, 119.2, 115.5 (d, *J* = 24 Hz), 80.5, 37.7, 36.4, 31.8, 30.0; ^{19}F NMR (376 MHz, $CDCl_3$) δ ppm: δ -112.19;**minor isomer**: m.p. 110.7 – 111.7 ℃; $[\alpha]_D^{20}$ = 114 (*c* 0.05, MeCN); HPLC (Chiralpak IK-3, *i*-propanol/hexane = 10/90, flow rate 1.0 mL/min, λ = 254 nm), t_1 = 5.46 min (major), t_2 = 7.09 min (minor), *ee* = 95%;^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.61 – 7.52 (m, 1H), 7.48 – 7.39 (m, 2H), 7.39 – 7.29 (m, 4H), 7.27 – 7.22 (m, 3H), 7.16 – 7.10 (m, 1H), 7.01 – 6.95 (m, 1H), 5.97 (s, 1H), 1.55 (s, 9H), 1.50 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 188.2, 170.1, 162.2 (d, *J* = 247 Hz), 152.3, 150.1, 147.7, 137.2, 136.4, 131.9, 131.2, 130.7, 130.0 (d, *J* = 8 Hz), 129.6, 129.4, 127.3 , 123.5, 123.4, 121.6, 120.7, 119.5, 114.8 (d, *J* = 24 Hz), 80.7, 37.2, 36.2, 31.8, 29.7; ^{19}F NMR (376 MHz, $CDCl_3$) δ ppm: δ -112.15; HRMS (ESI) Calcd. For $C_{31}H_{32}FN_4O_3$ $[M+H]^+$ 527.2453, found 527.2465.

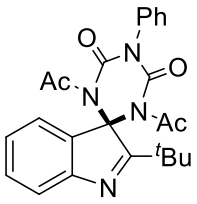
1-acetyl-2-(2-(*tert*-butyl)-1H-indol-3-yl)-4-phenyl-1,2,4-triazolidine-3,5-dione **5a**:



5a

A white solid; 71.7 mg; isolated yield = 92%; m.p. 202.8 – 203.8 ℃; ^{1}H NMR (400 MHz, CD_2Cl_2) δ ppm: δ 8.27 (s, 1H), 7.63 – 7.56 (m, 4H), 7.56 – 7.49 (m, 1H), 7.42 – 7.33 (m, 2H), 7.26 – 7.19 (m, 1H), 7.18 – 7.11 (m, 1H), 2.60 (s, 3H), 1.57 (s, 9H); ^{13}C NMR (100 MHz, CD_2Cl_2) δ ppm: δ 164.8, 151.6, 148.6, 145.0, 132.9, 130.8, 129.3, 129.0, 126.3, 124.5, 122.3, 120.6, 116.5, 111.2, 108.1, 33.2, 29.5, 24.8; HRMS (ESI) Calcd. For $C_{22}H_{23}N_4O_3$ $[M+H]^+$ 391.1765, found 391.1770.

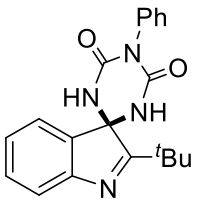
1',3'-diacetyl-2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **7**:



7

A white solid; 51.8 mg; isolated yield = 60%; m.p. 211.1 – 212.1 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: δ 7.60 – 7.48 (m, 4H), 7.44 – 7.35 (m, 3H), 7.30 – 7.25 (m, 1H), 7.21 (t, *J* = 7.4 Hz, 1H), 2.33 (s, 6H), 1.45 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 183.6, 172.2, 154.2, 149.4, 135.5, 133.5, 131.6, 129.6, 129.5, 128.6, 126.8, 121.5, 119.0, 83.2, 37.1, 29.3, 28.6; HRMS (ESI) Calcd. For $C_{24}H_{25}N_4O_4$ $[M+H]^+$ 433.1871, found 433.1872.

2-(*tert*-butyl)-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **8**:

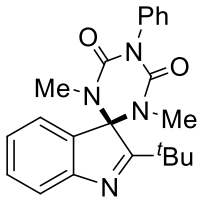


8

A white solid; 64.0 mg; isolated yield = 92%; m.p. 118.2 – 119.2 ℃; ^{1}H NMR (400 MHz, d_6-DMSO) δ ppm: δ 8.72 (s, 2H), 7.61 (d, *J* = 7.1 Hz, 1H), 7.52 – 7.36 (m, 5H), 7.37 – 7.24 (m, 3H), 1.44 (s, 9H); ^{13}C NMR (100 MHz, d_6-DMSO) δ ppm: δ 187.7, 151.8, 151.5, 141.0, 135.7, 131.0, 130.2, 129.0, 128.2, 127.5, 122.9, 120.9, 80.0, 37.2,

29.7; HRMS (ESI) Calcd. For $C_{20}H_{20}N_4O_2Na$ $[M+Na]^+$ 371.1479, found 371.1483.

2-(*tert*-butyl)-1',3'-dimethyl-5'-phenylspiro[indole-3,2'-[1,3,5]triazinane]-4',6'-dione **9**:



9

A yellow solid; 70.6 mg; isolated yield = 96%; m.p. 142.8 – 143.8 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ ppm: ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.6 Hz, 1H), 7.51 – 7.44 (m, 3H), 7.44 – 7.38 (m, 1H), 7.36 – 7.25 (m, 4H), 2.53 (s, 6H), 1.47 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm: δ 187.2, 151.5, 151.1, 135.3, 135.0, 131.9, 129.1, 129.1, 128.5, 127.8, 122.3, 122.0, 86.9, 36.9, 30.7, 29.0; HRMS (ESI) Calcd. For $C_{22}H_{24}N_4O_2Na$ $[M+Na]^+$ 399.1792, found 399.1799.

4. Crystallographic data collections for compounds 4c

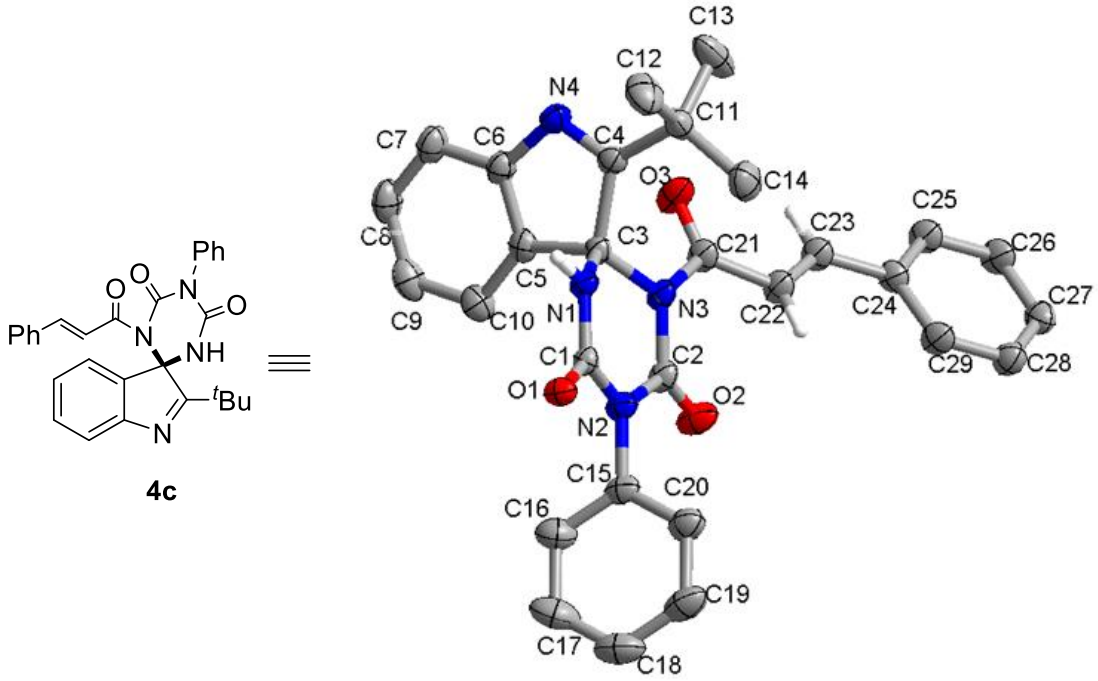


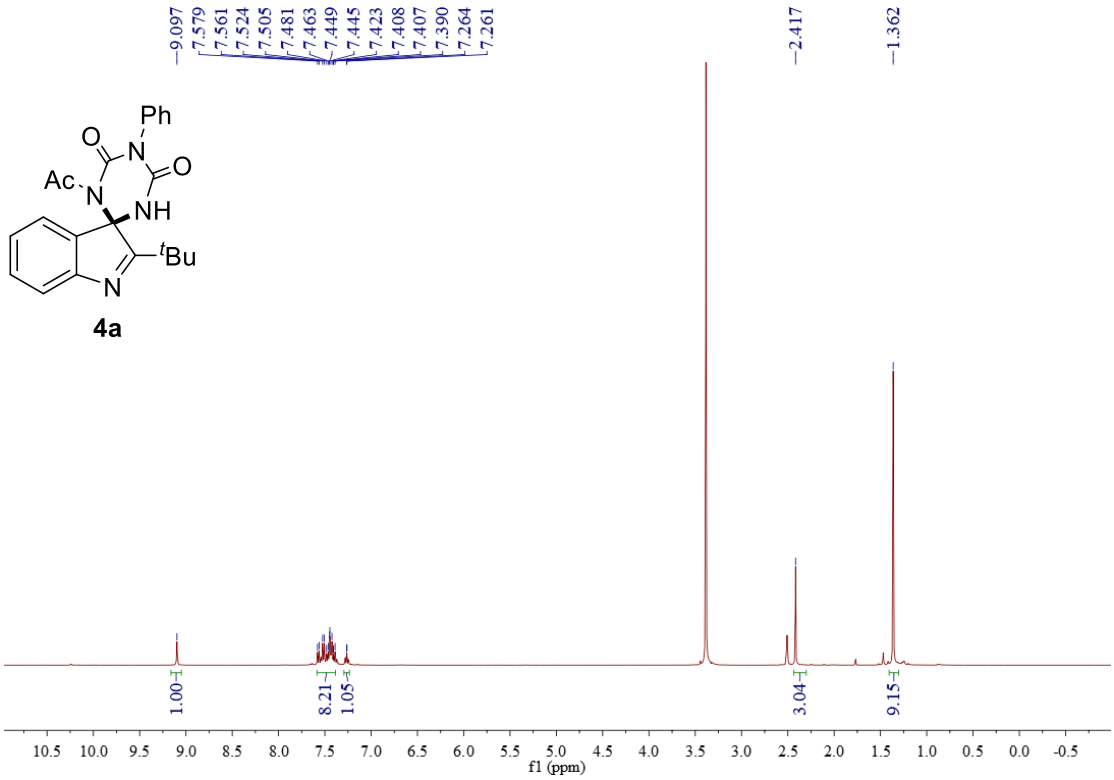
Figure S1. X ray structure of **4c** (CCDC 2310414)

Table S6 Crystal data and structure refinement for 202305130_auto.

Identification code	202305130_auto
Empirical formula	$C_{30}H_{27}Cl_3N_4O_3$
Formula weight	597.90
Temperature/K	293(2)
Crystal system	monoclinic
Space group	$P2_1/n$
a/Å	8.69500(14)
b/Å	18.7885(3)
c/Å	19.1891(3)
α/°	90
β/°	102.4918(17)
γ/°	90
Volume/Å^3	3060.64(9)
Z	4
ρ_{calc}g/cm^3	1.298
μ/mm^{-1}	3.011
F(000)	1240.0
Crystal size/mm^3	0.14 × 0.11 × 0.1
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	6.662 to 134.152
Index ranges	$-9 \le h \le 10$, $-17 \le k \le 22$, $-21 \le l \le 22$
Reflections collected	11650
Independent reflections	5472 [R_{int} = 0.0347, R_{sigma} = 0.0473]
Data/restraints/parameters	5472/14/369
Goodness-of-fit on F^2	1.024
Final R indexes [I>=2σ (I)]	R_1 = 0.0703, wR_2 = 0.1885
Final R indexes [all data]	R_1 = 0.0993, wR_2 = 0.2172
Largest diff. peak/hole / e Å^{-3}	0.36/-0.49

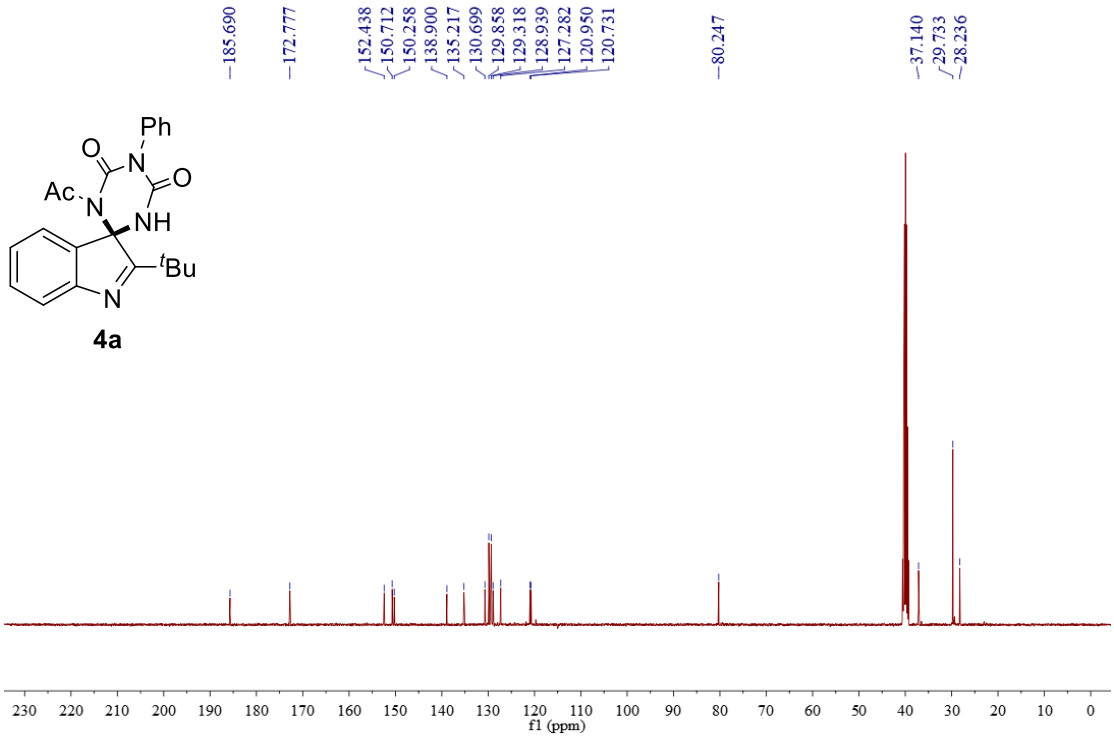
5. NMR Spectra of compounds

^{1}H NMR spectrum of compound **4a** ($(CD_3)_2SO$, 400 MHz)



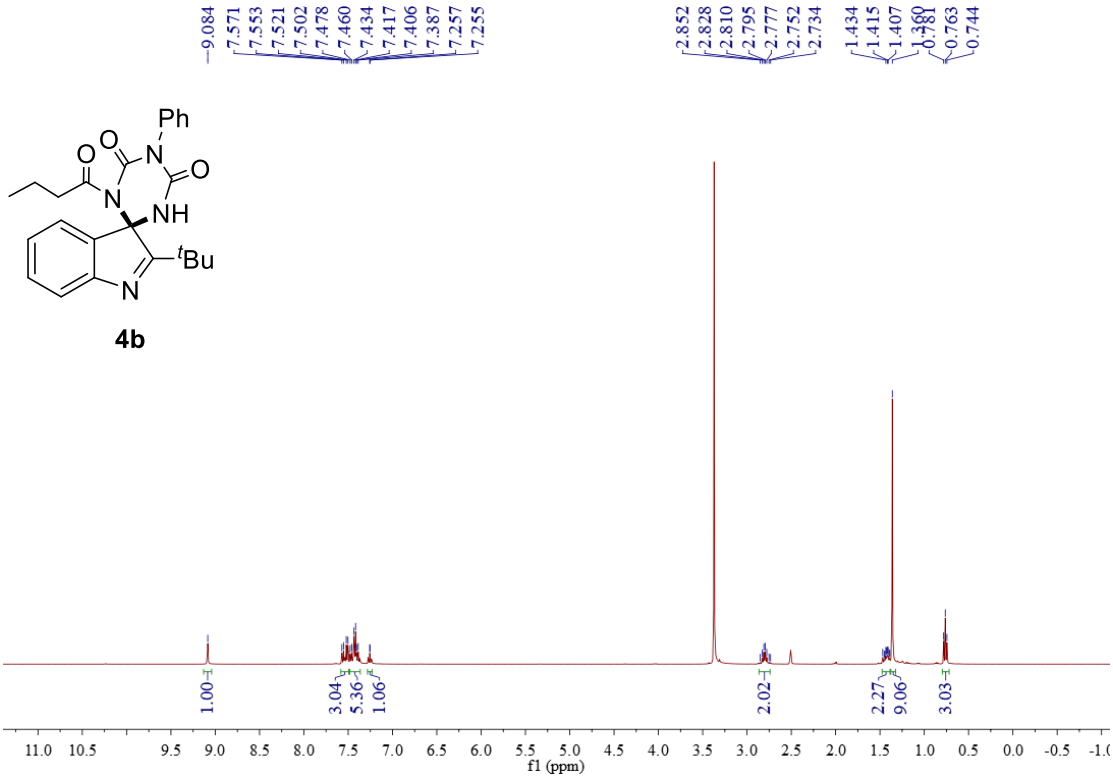
4a

^{13}C NMR spectrum of compound **4a** ($(CD_3)_2SO$, 100 MHz)

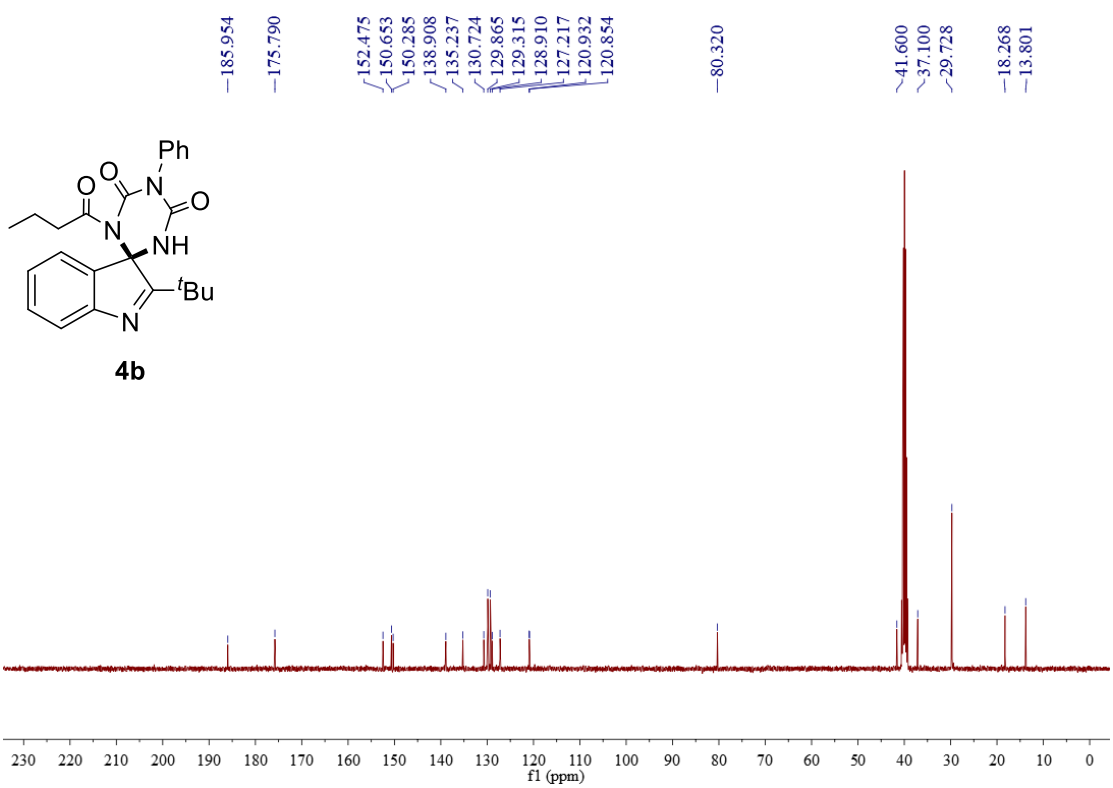


4a

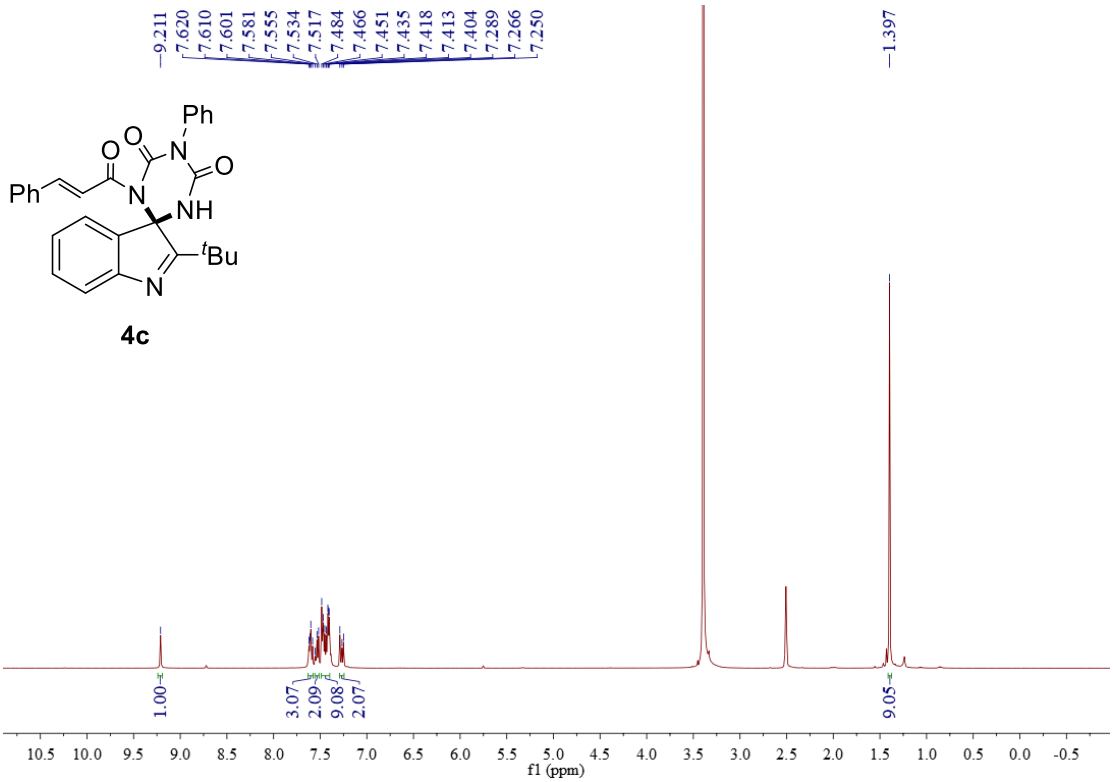
^{1}H NMR spectrum of compound **4b** ($(CD_3)_2SO$, 400 MHz)



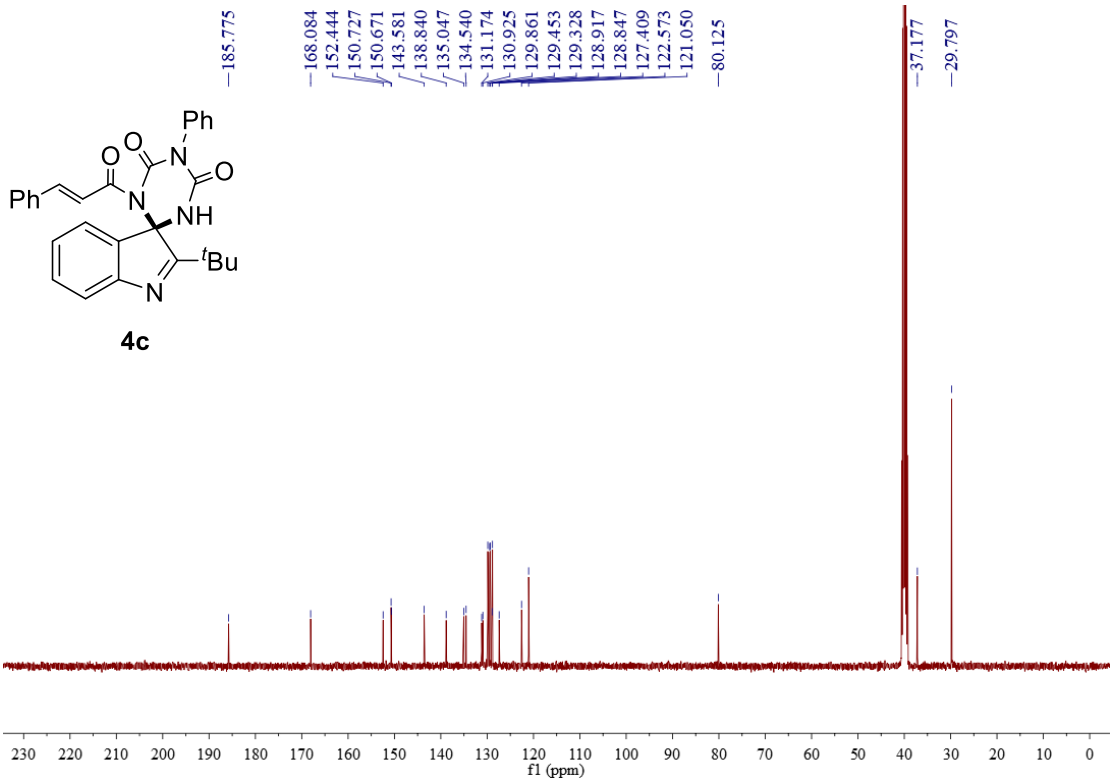
^{13}C NMR spectrum of compound **4b** ($(CD_3)_2SO$, 100 MHz)



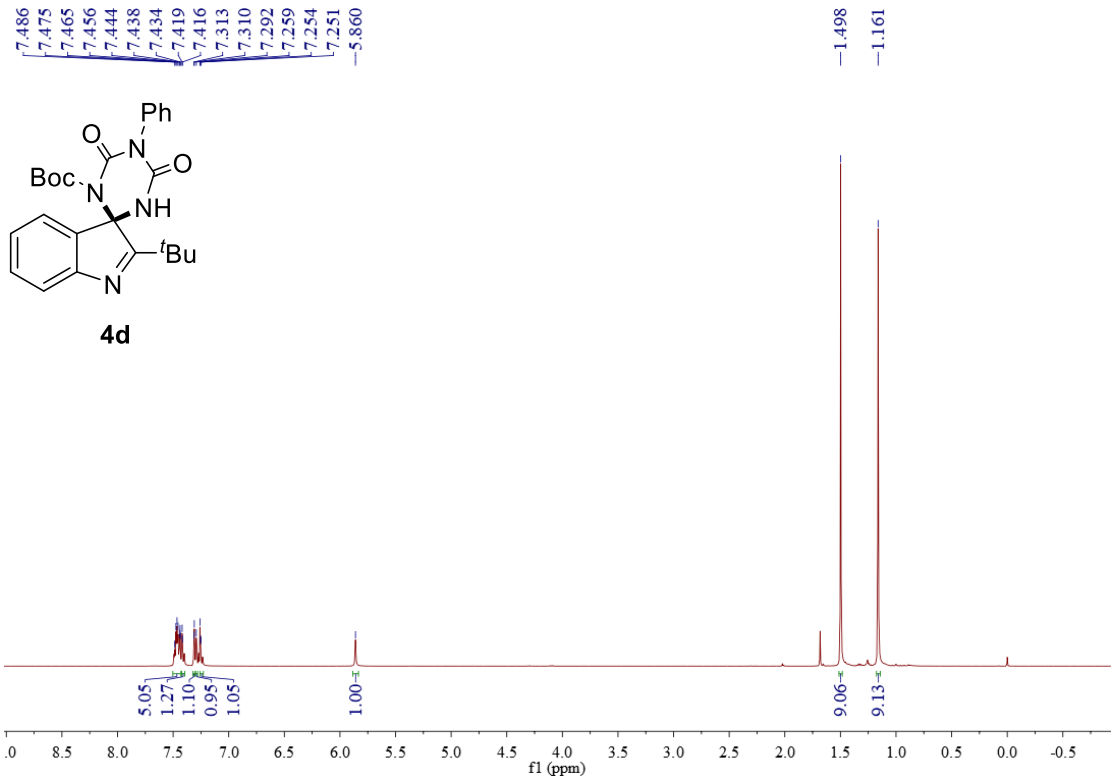
^{1}H NMR spectrum of compound **4c** ($(CD_3)_2SO$, 400 MHz)



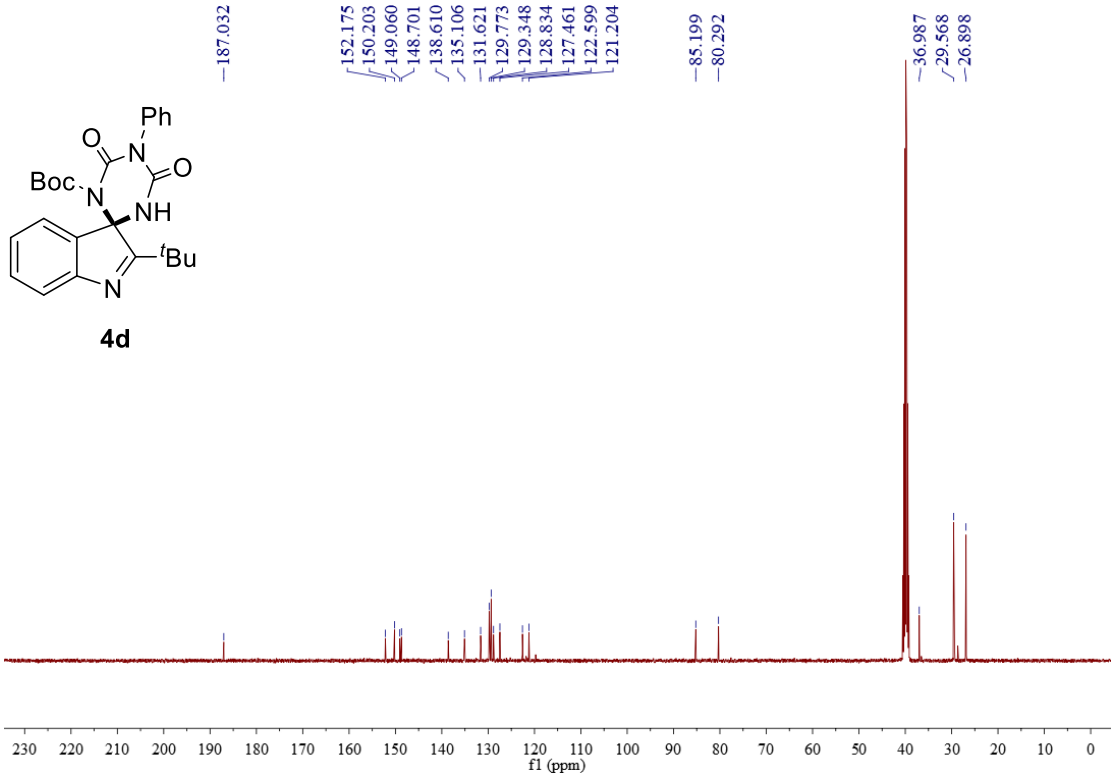
^{13}C NMR spectrum of compound **4c** ($(CD_3)_2SO$, 100 MHz)



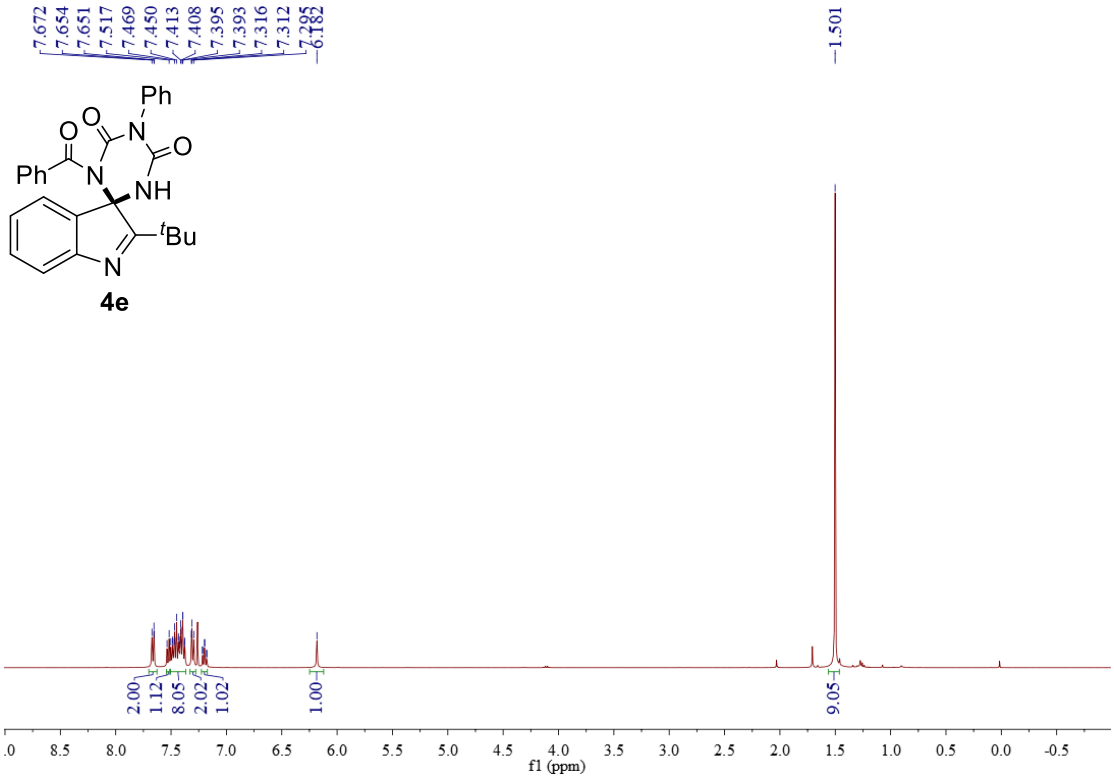
^{1}H NMR spectrum of compound **4d** ($CDCl_3$, 400 MHz)



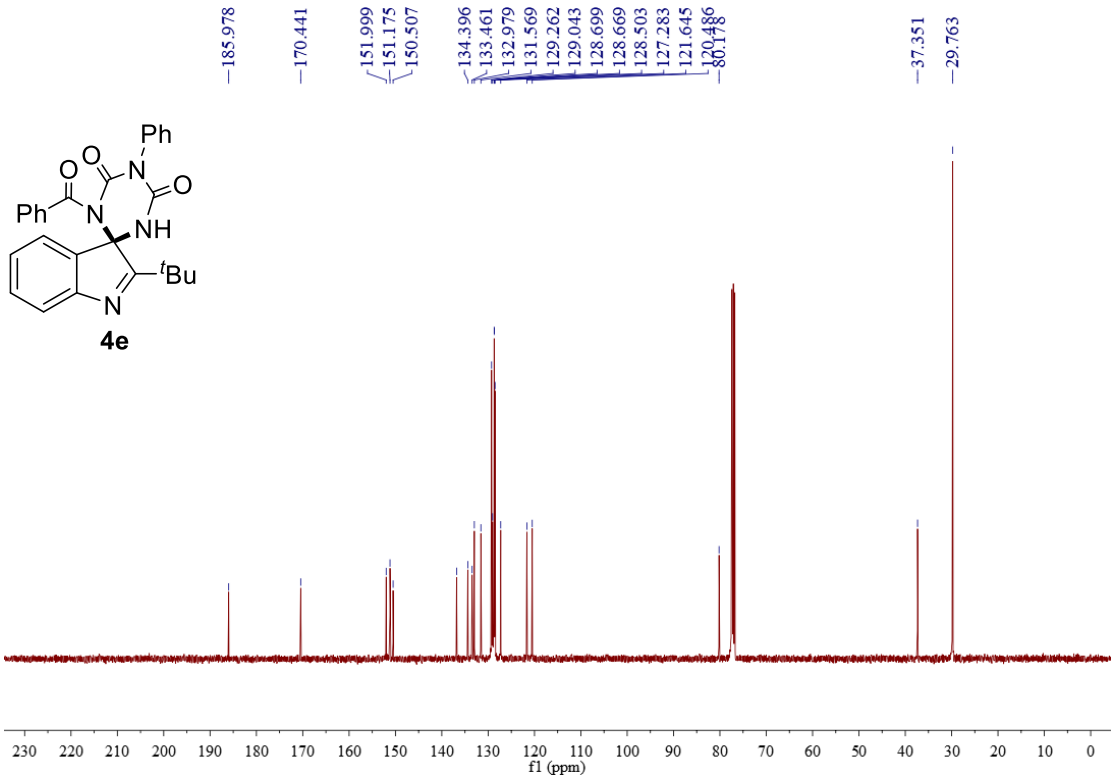
^{13}C NMR spectrum of compound **4d** ($(CD_3)_2SO$, 100 MHz)



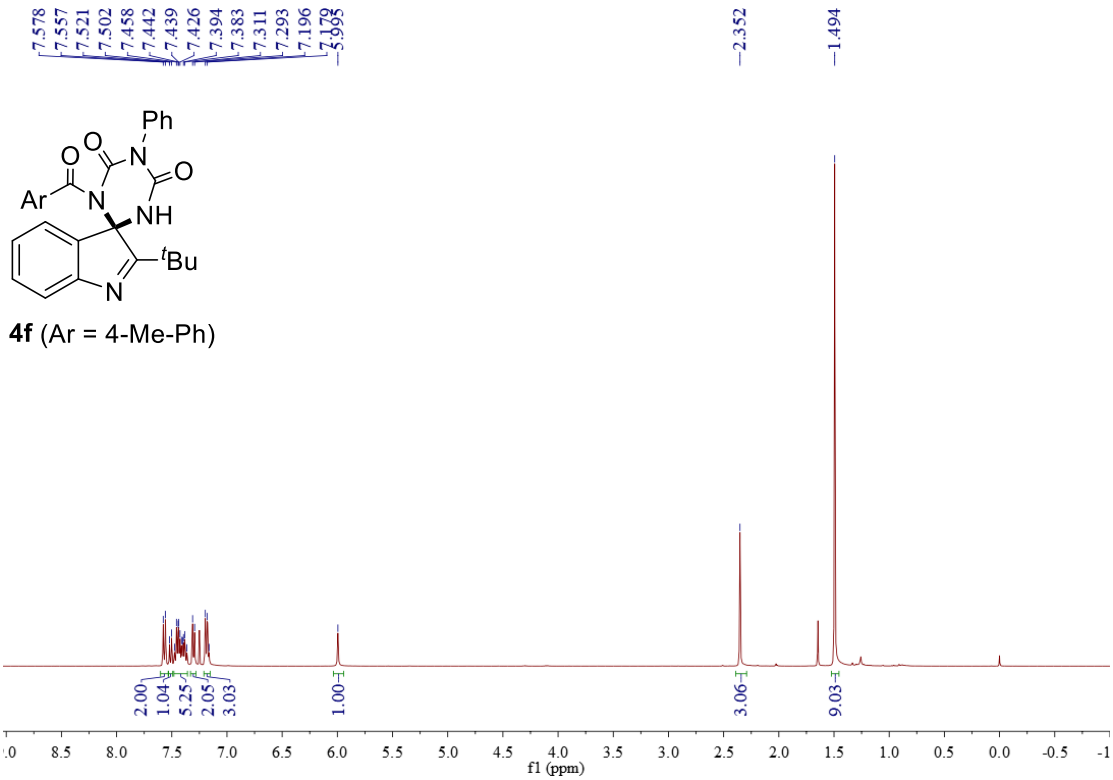
^{1}H NMR spectrum of compound **4e** ($CDCl_3$, 400 MHz)



^{13}C NMR spectrum of compound **4e** ($CDCl_3$, 100 MHz)

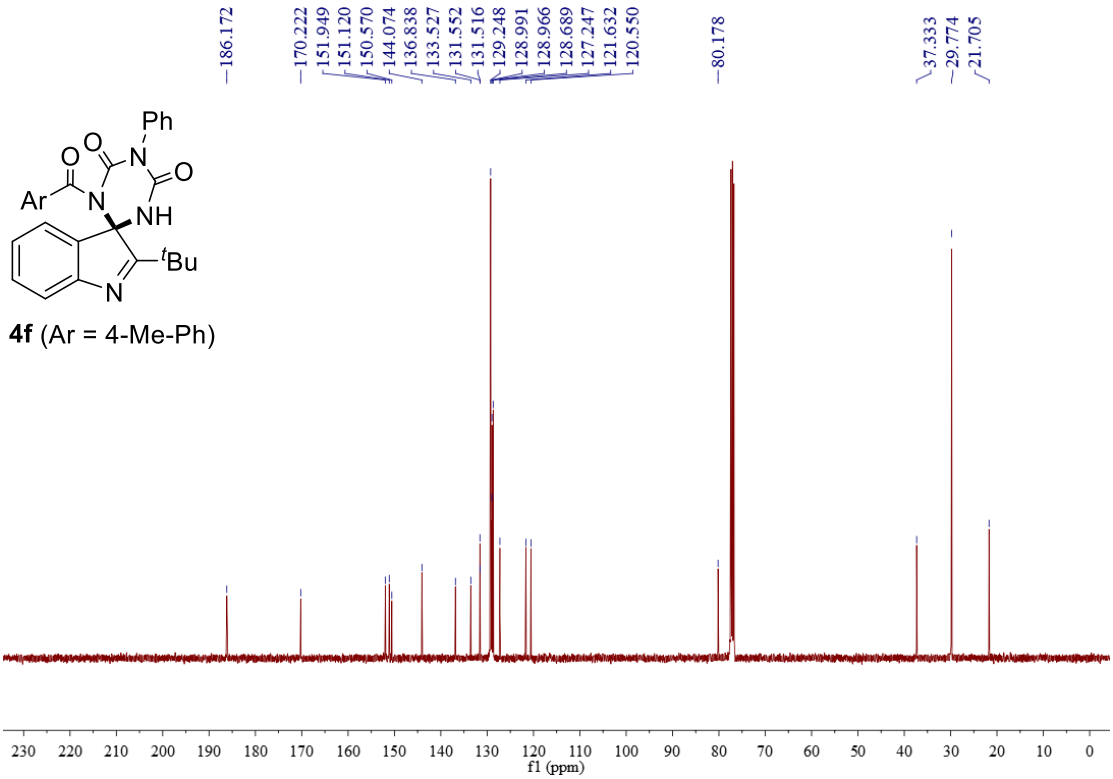


^{1}H NMR spectrum of compound **4f** ($CDCl_3$, 400 MHz)



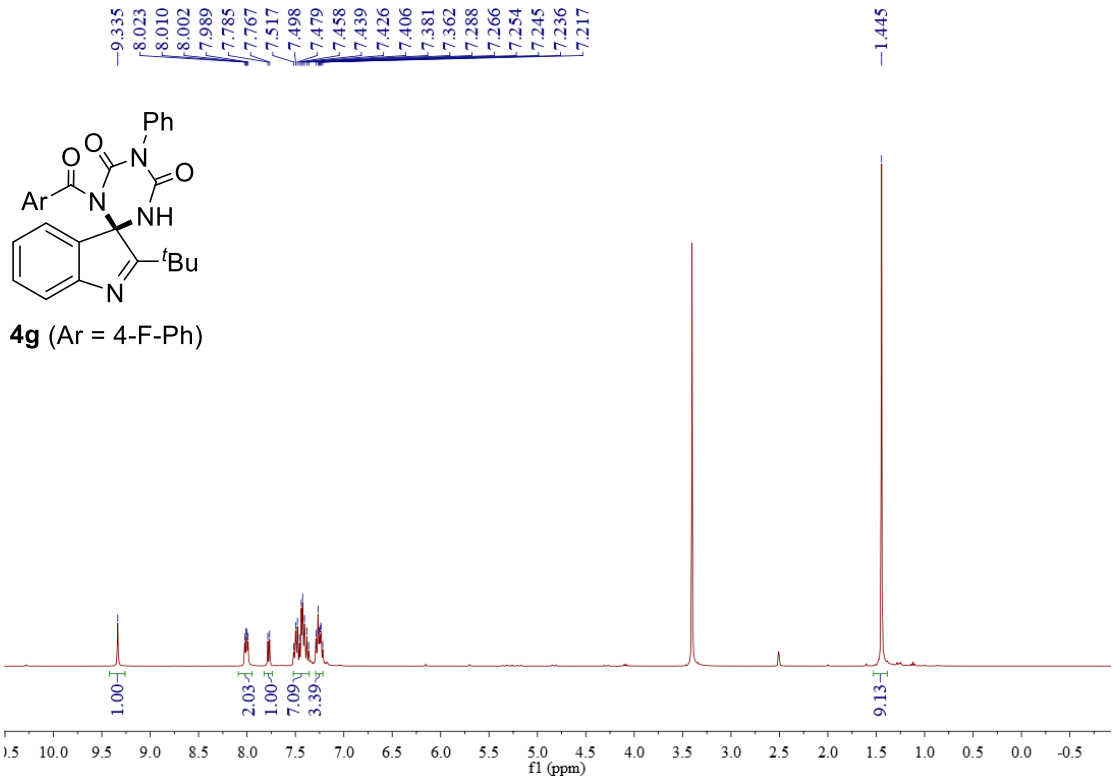
4f (Ar = 4-Me-Ph)

^{13}C NMR spectrum of compound **4f** ($CDCl_3$, 100 MHz)

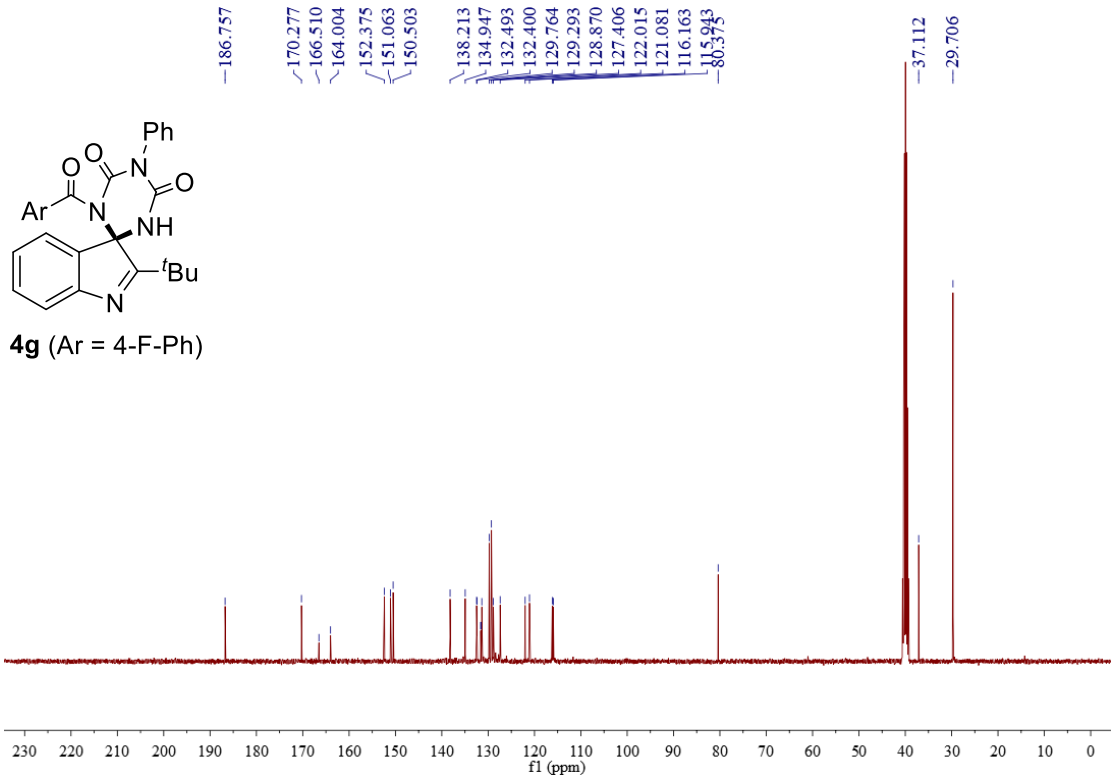


4f (Ar = 4-Me-Ph)

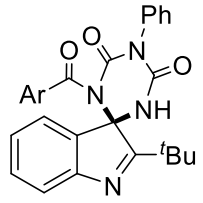
^{1}H NMR spectrum of compound **4g** ($(CD_3)_2SO$, 400 MHz)



^{13}C NMR spectrum of compound **4g** ($(CD_3)_2SO$, 100 MHz)

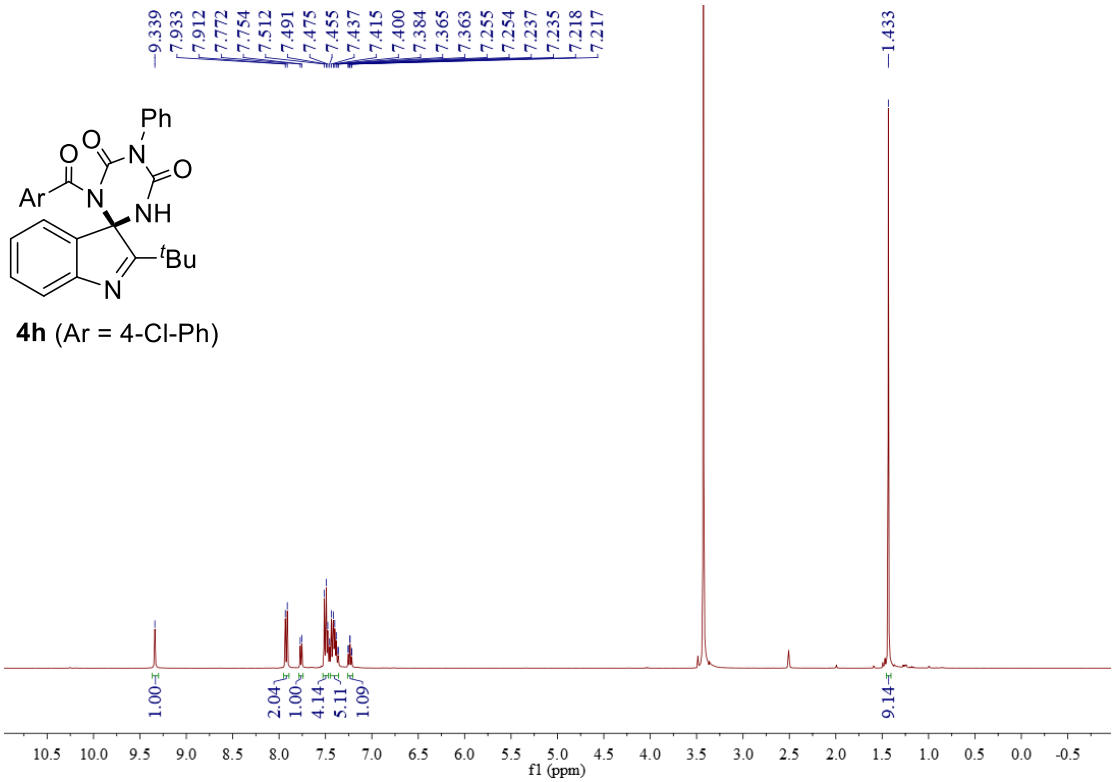


^{19}F NMR spectrum of compound **4g** ($(CD_3)_2SO$, 376 MHz)



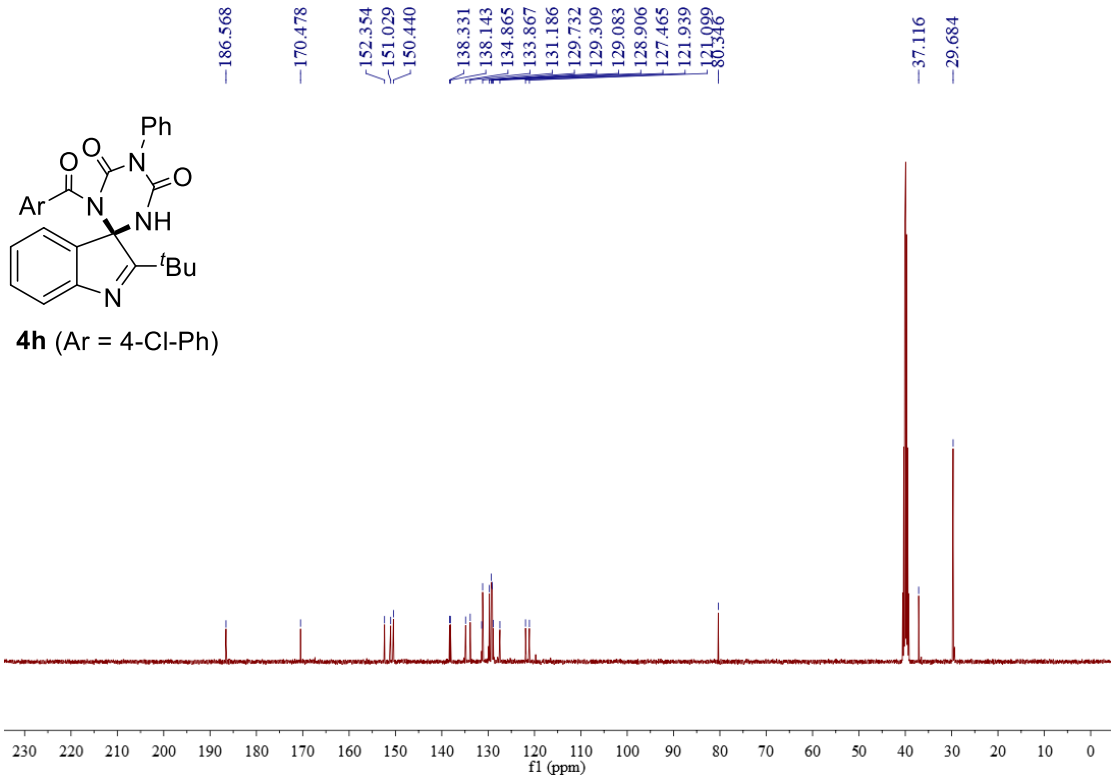
4g (Ar = 4-F-Ph)

^{1}H NMR spectrum of compound **4h** ($(CD_3)_2SO$, 400 MHz)



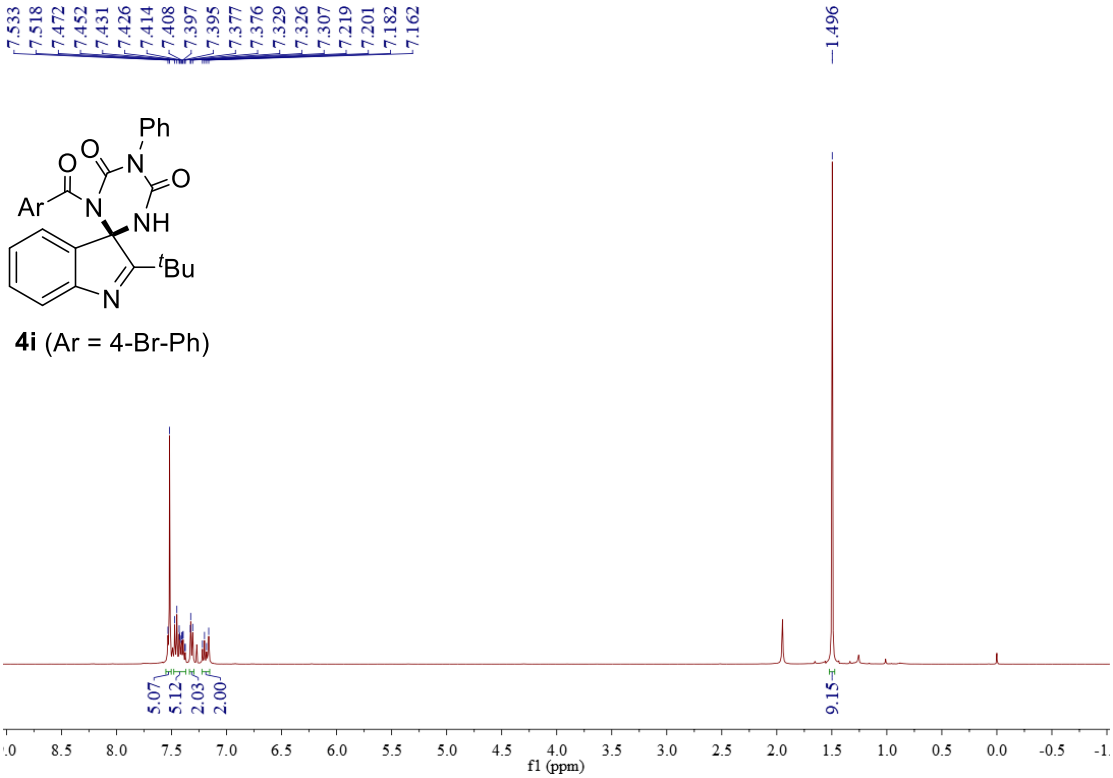
4h (Ar = 4-Cl-Ph)

^{13}C NMR spectrum of compound **4h** ($(CD_3)_2SO$, 100 MHz)

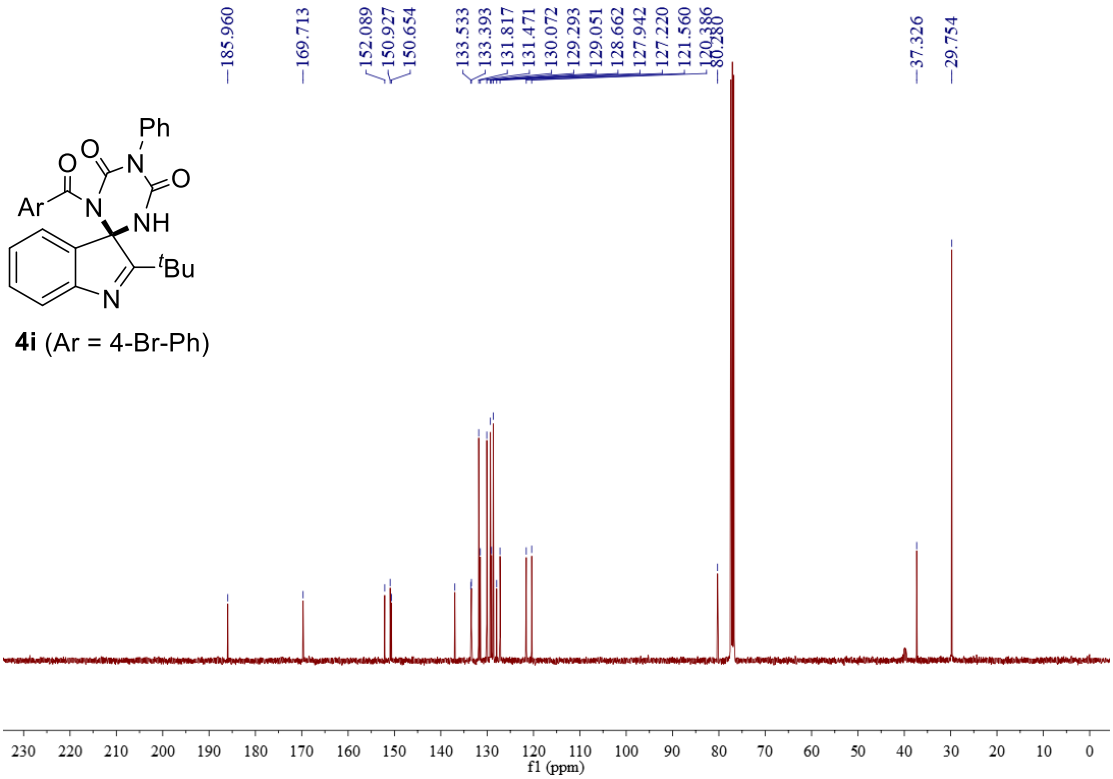


4h (Ar = 4-Cl-Ph)

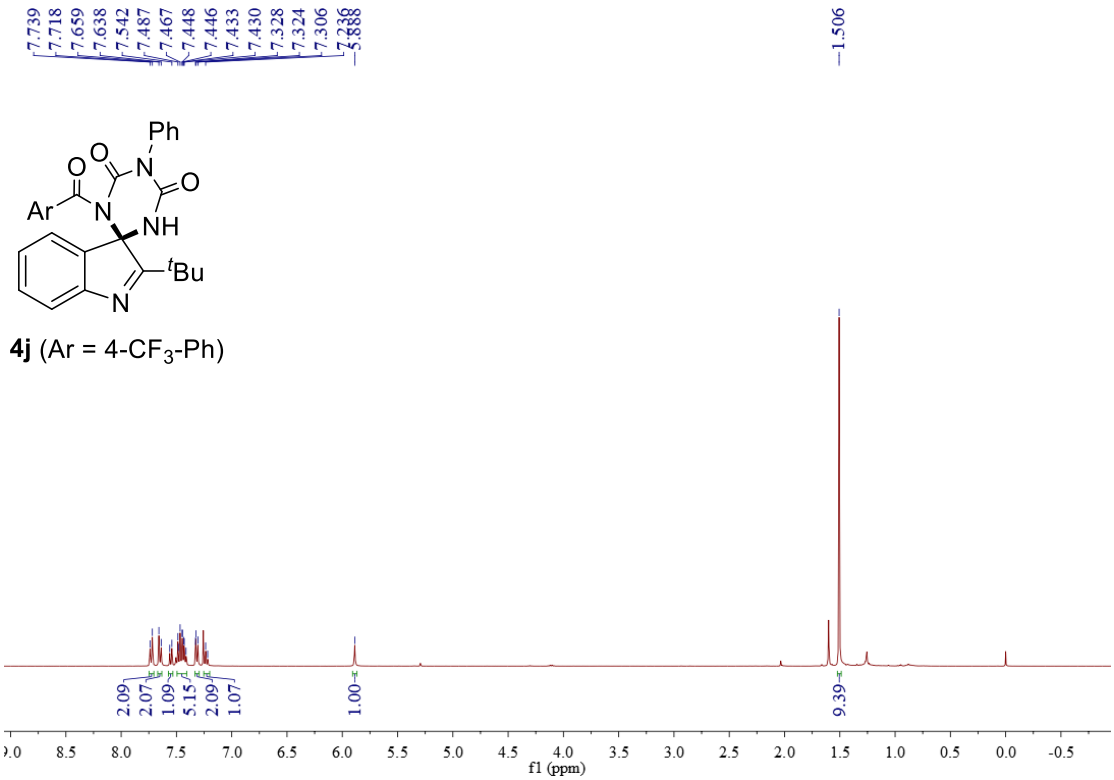
^{1}H NMR spectrum of compound **4i** ($CDCl_3$, 400 MHz)



^{13}C NMR spectrum of compound **4i** ($CDCl_3$, 100 MHz)

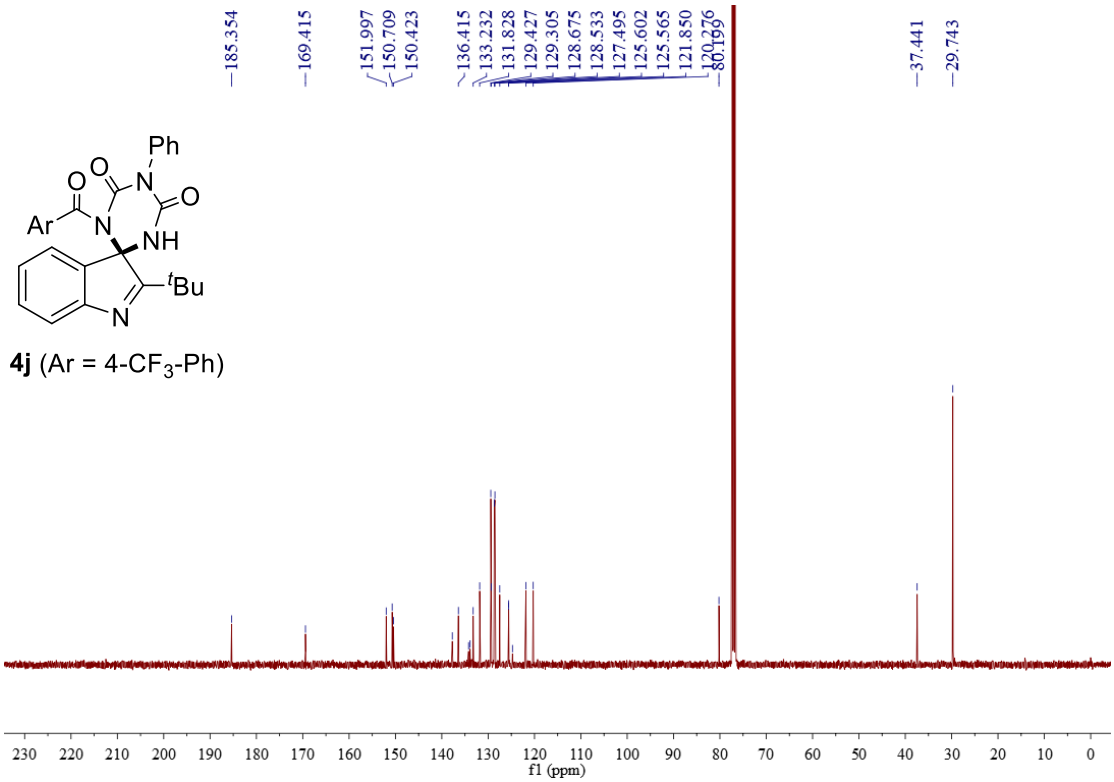


^{1}H NMR spectrum of compound **4j** ($CDCl_3$, 400 MHz)



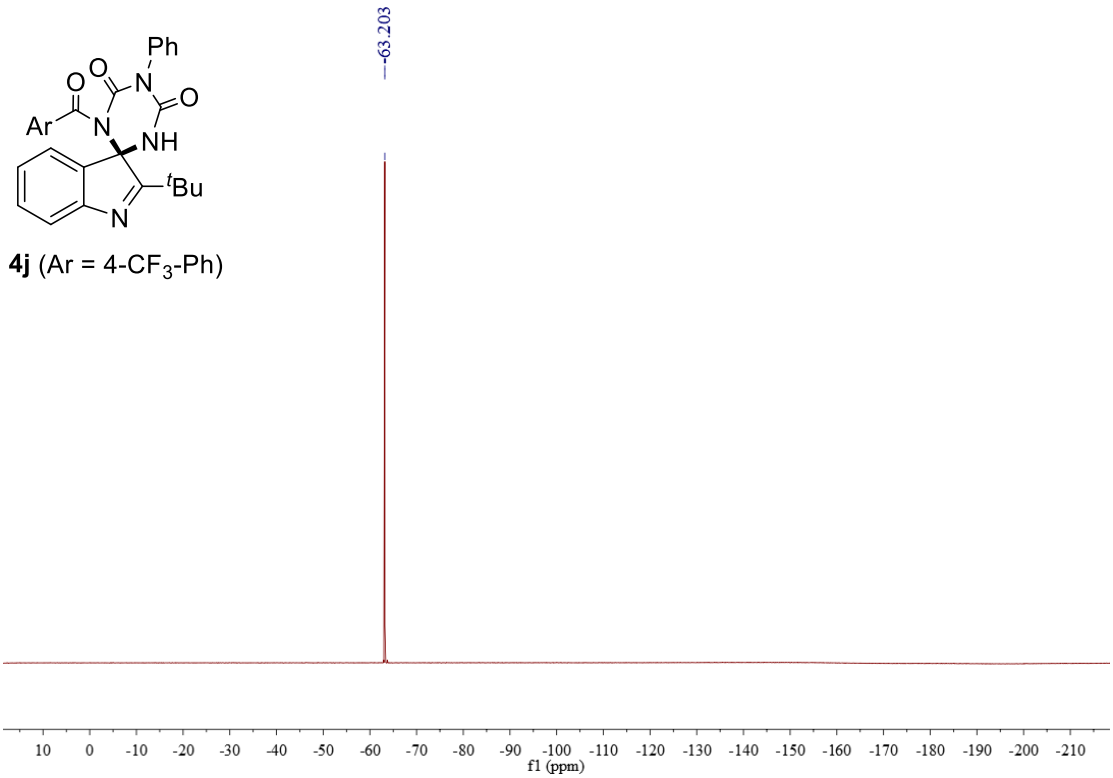
4j (Ar = 4-CF_3-Ph)

^{13}C NMR spectrum of compound **4j** ($CDCl_3$, 100 MHz)



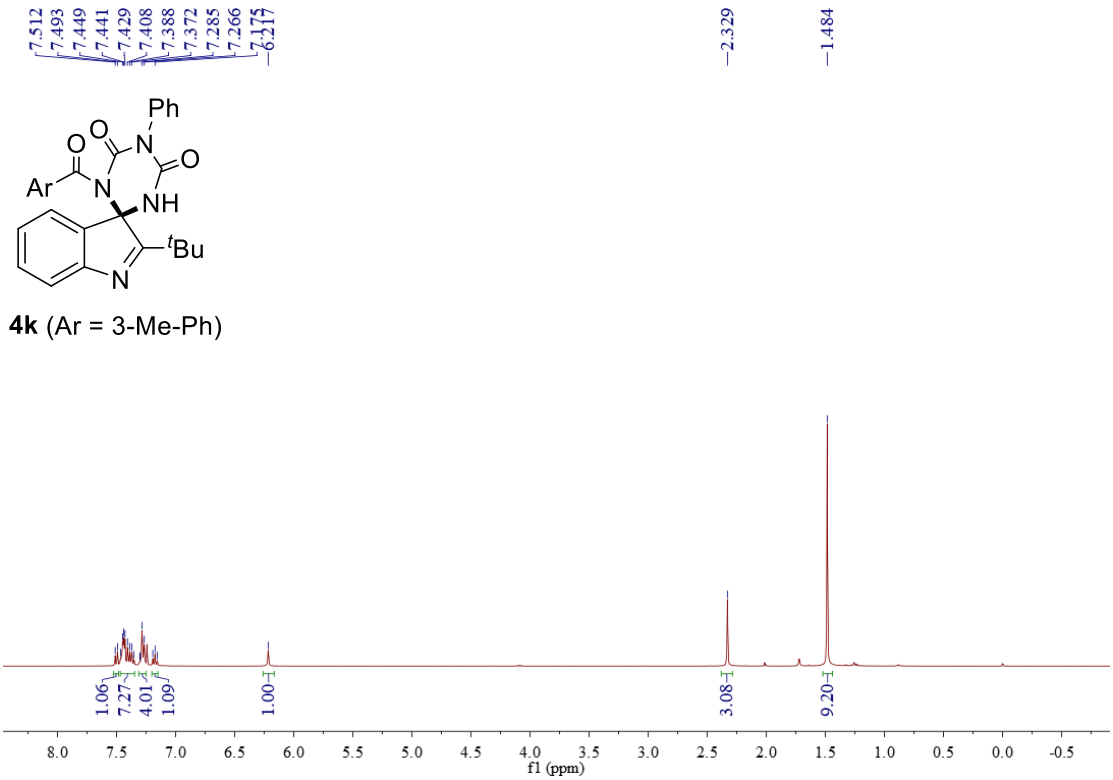
4j (Ar = 4-CF_3-Ph)

^{19}F NMR spectrum of compound **4j** ($CDCl_3$, 376 MHz)



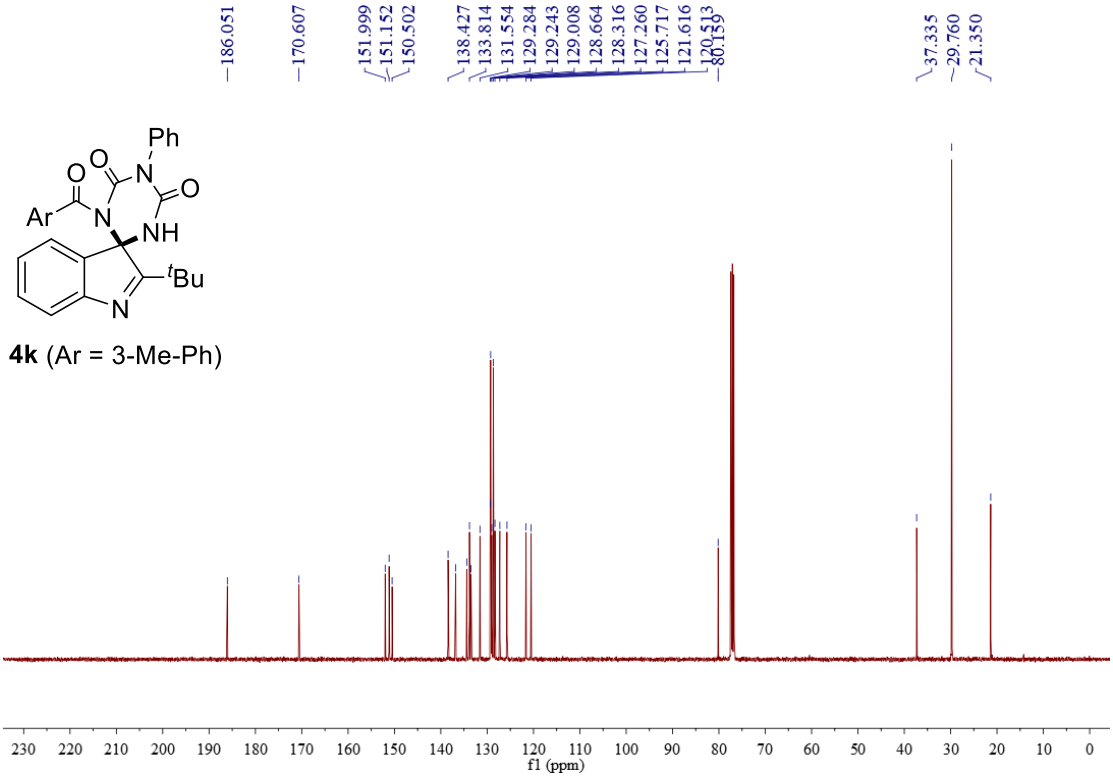
4j (Ar = 4-CF_3-Ph)

^{1}H NMR spectrum of compound **4k** ($CDCl_3$, 400 MHz)



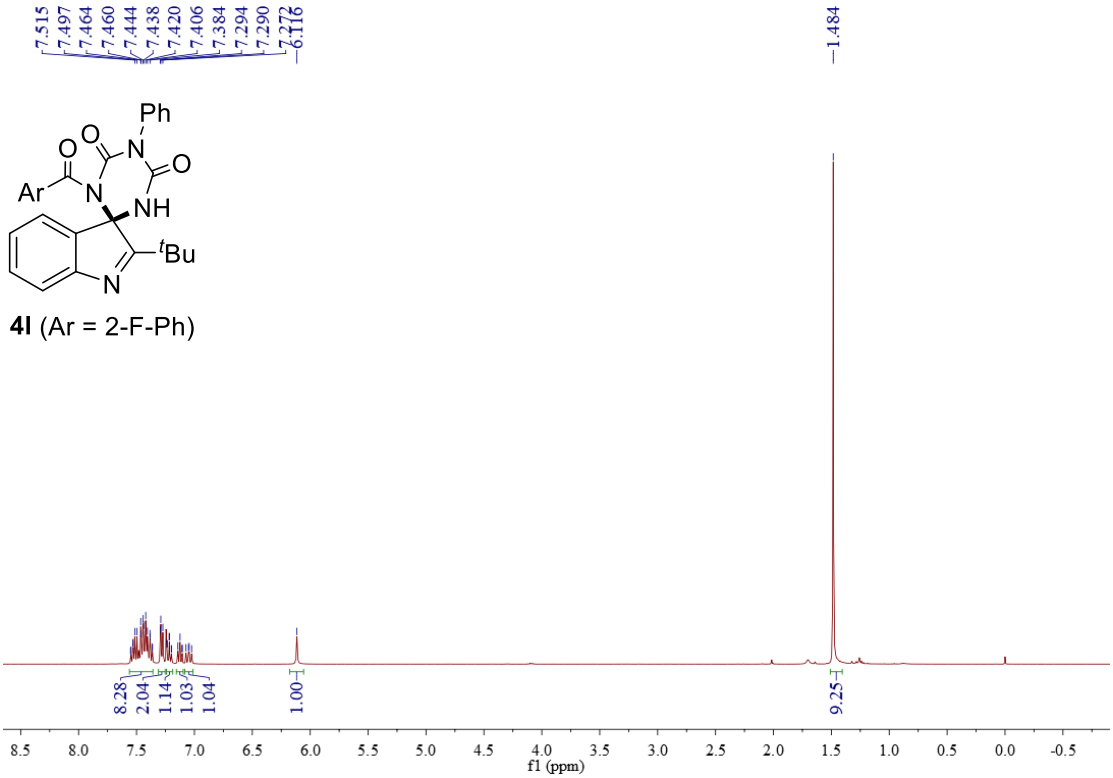
4k (Ar = 3-Me-Ph)

^{13}C NMR spectrum of compound **4k** ($CDCl_3$, 100 MHz)

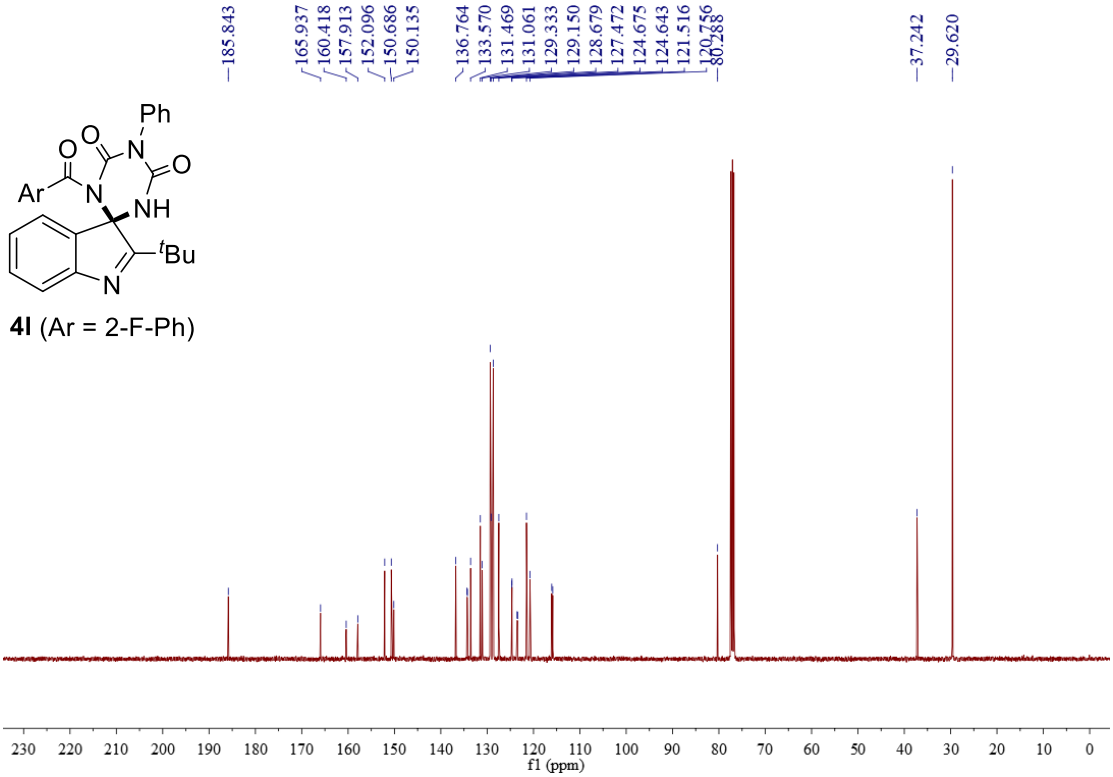


4k (Ar = 3-Me-Ph)

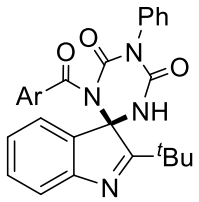
^{1}H NMR spectrum of compound **4l** ($CDCl_3$, 400 MHz)



^{13}C NMR spectrum of compound **4l** ($CDCl_3$, 100 MHz)

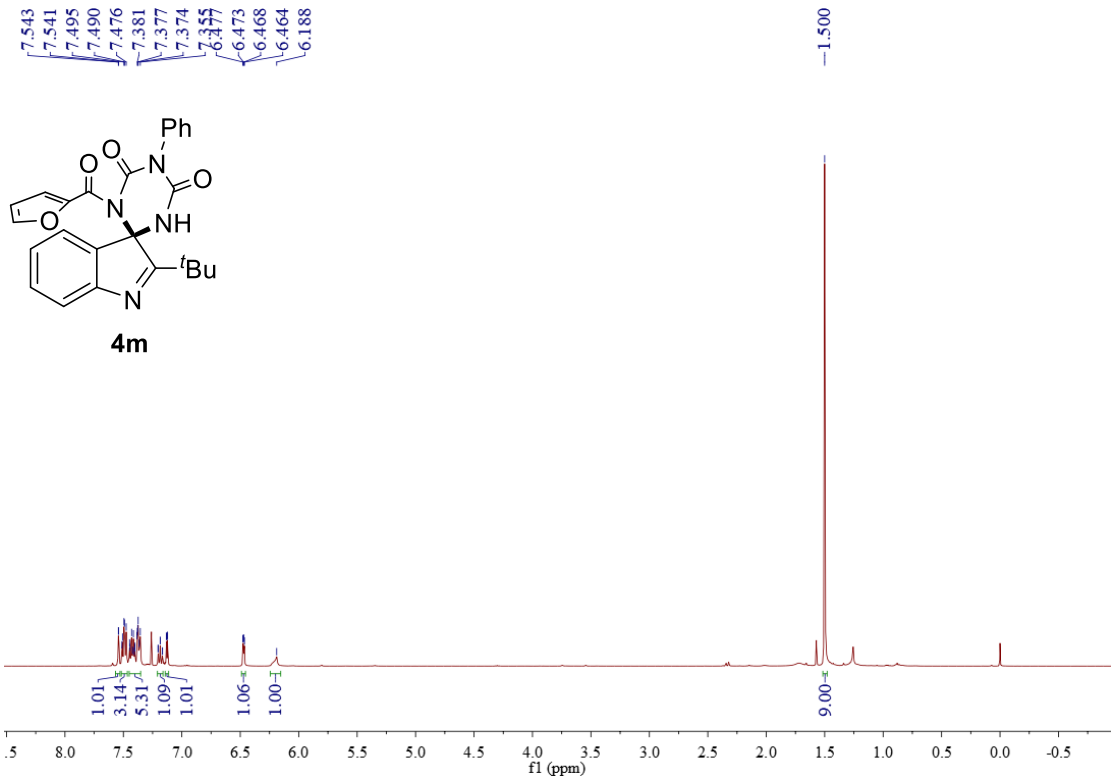


^{19}F NMR spectrum of compound **4l** ($CDCl_3$, 376 MHz)

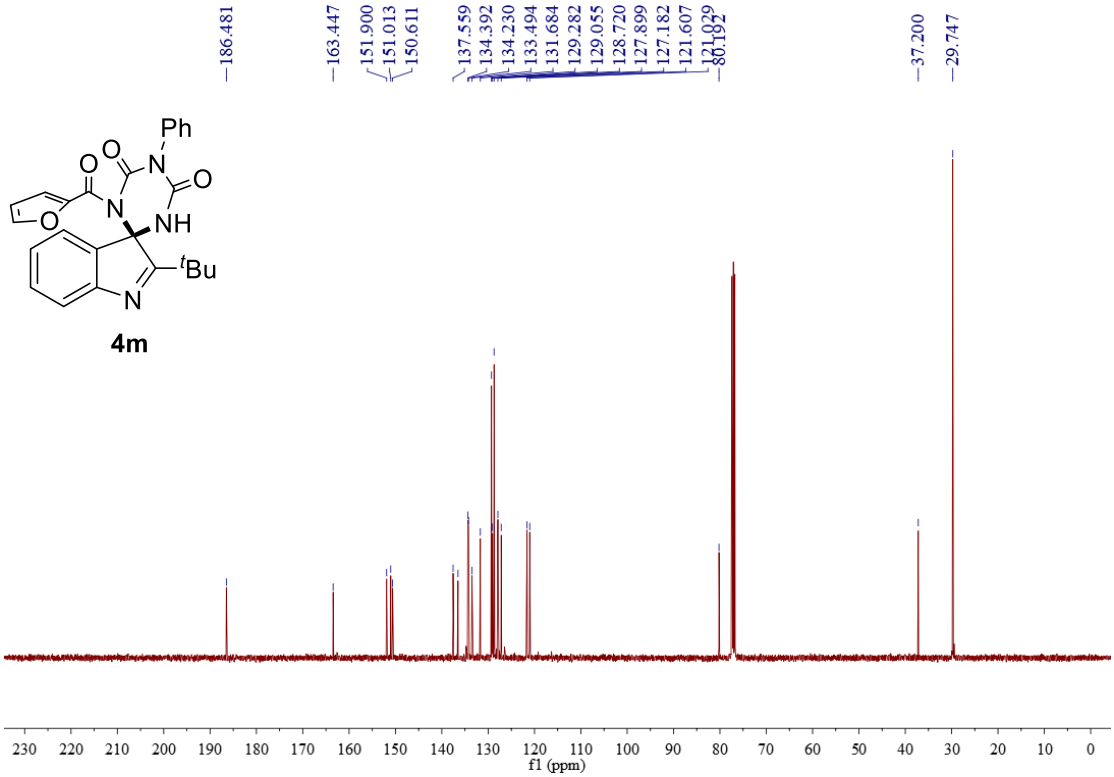


4l (Ar = 2-F-Ph)

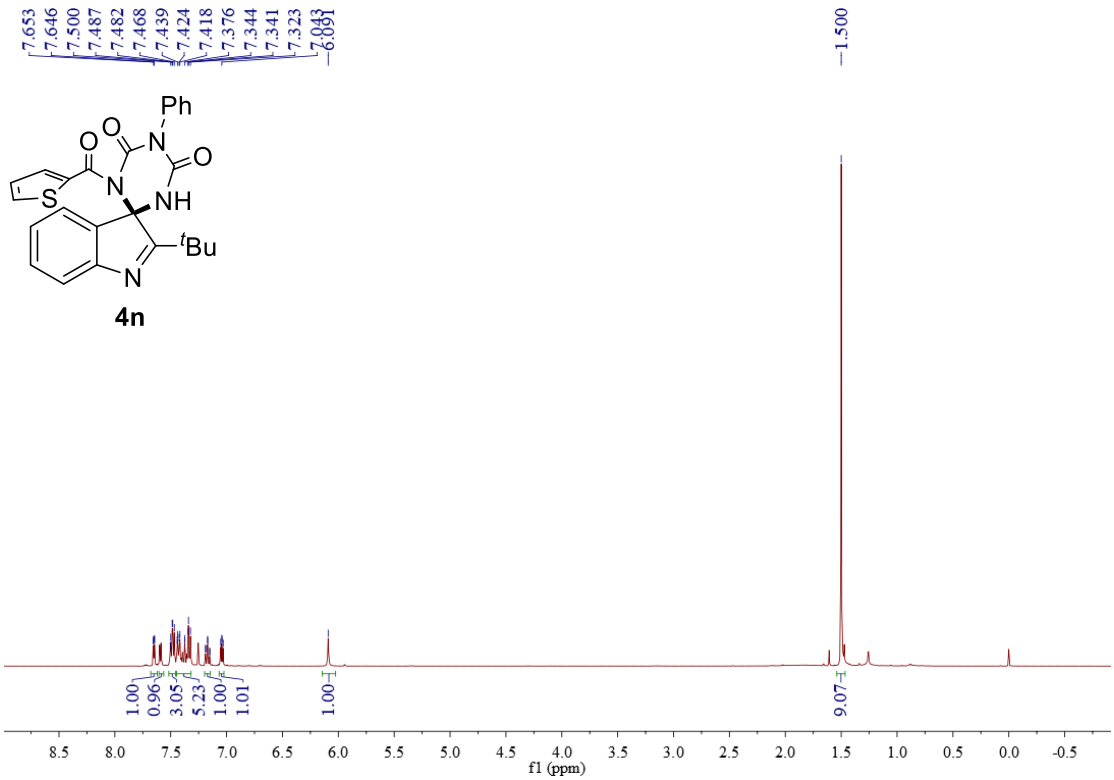
^{1}H NMR spectrum of compound **4m** ($CDCl_3$, 400 MHz)



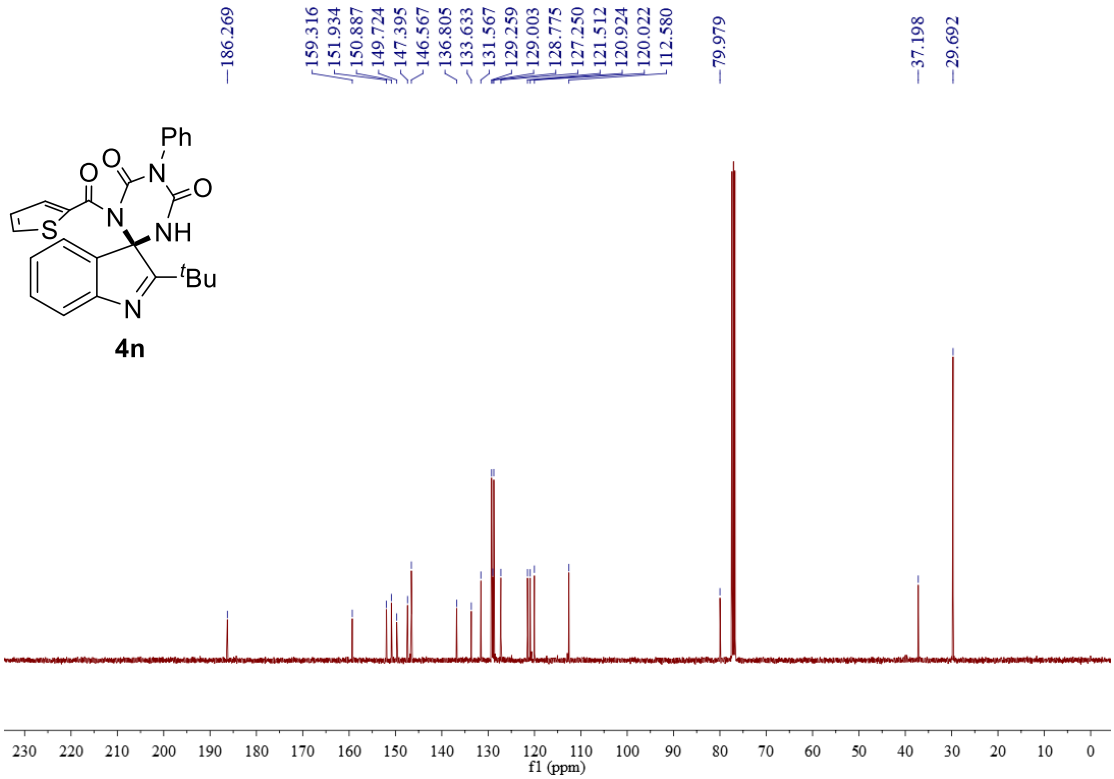
^{13}C NMR spectrum of compound **4m** ($CDCl_3$, 100 MHz)



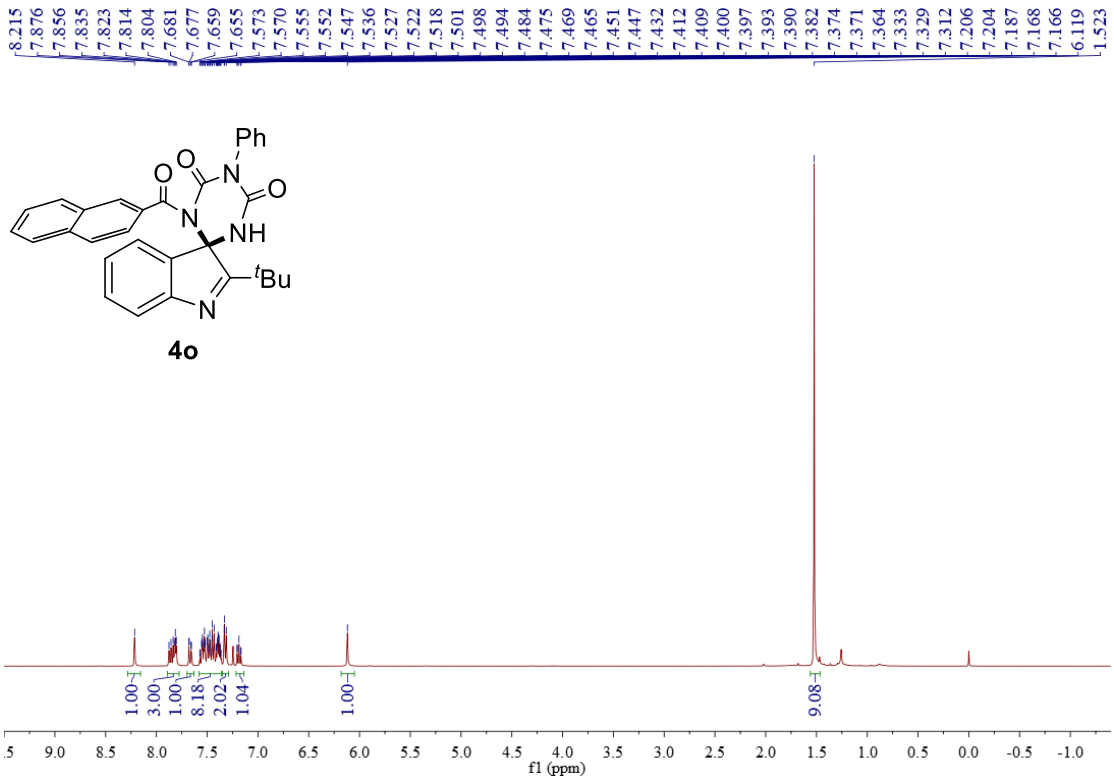
^{1}H NMR spectrum of compound **4n** ($CDCl_3$, 400 MHz)



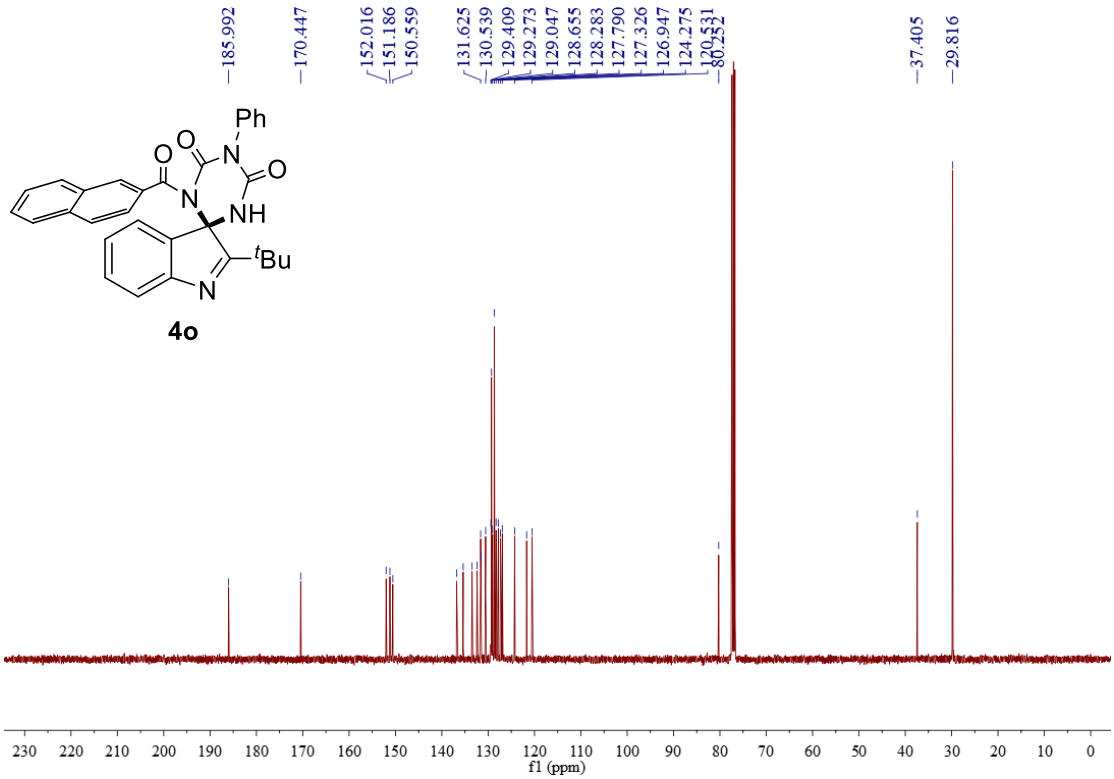
^{13}C NMR spectrum of compound **4n** ($CDCl_3$, 100 MHz)



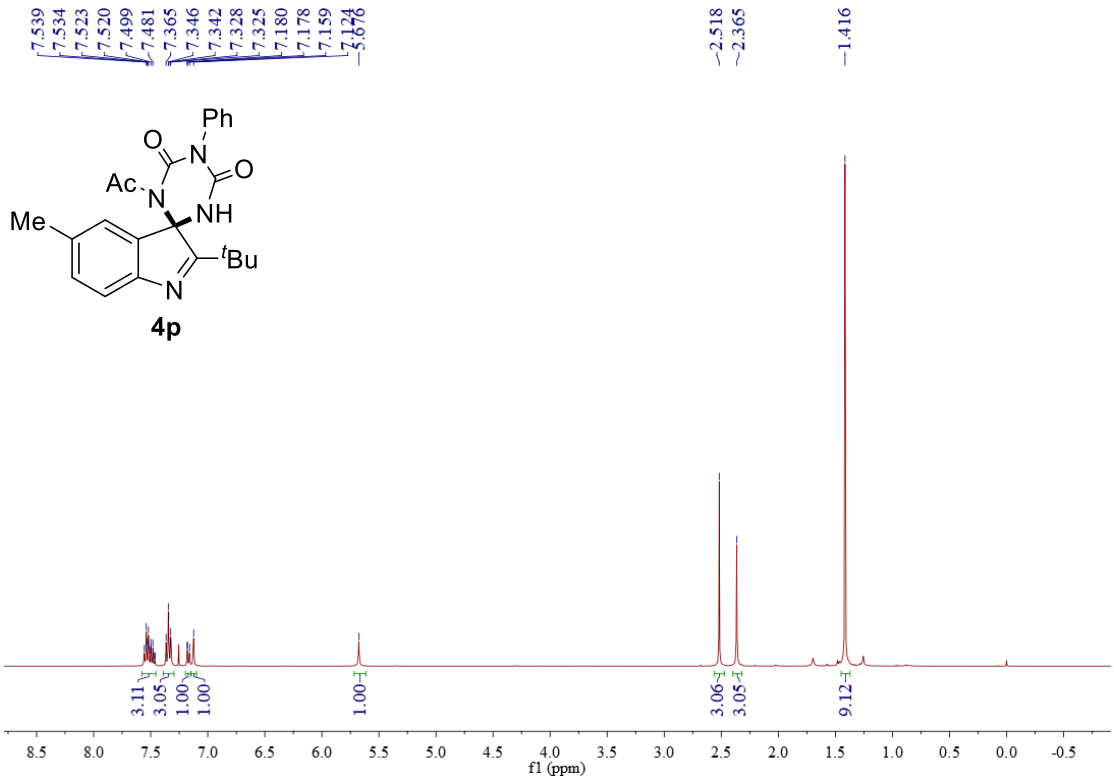
^{1}H NMR spectrum of compound **4o** ($CDCl_3$, 400 MHz)



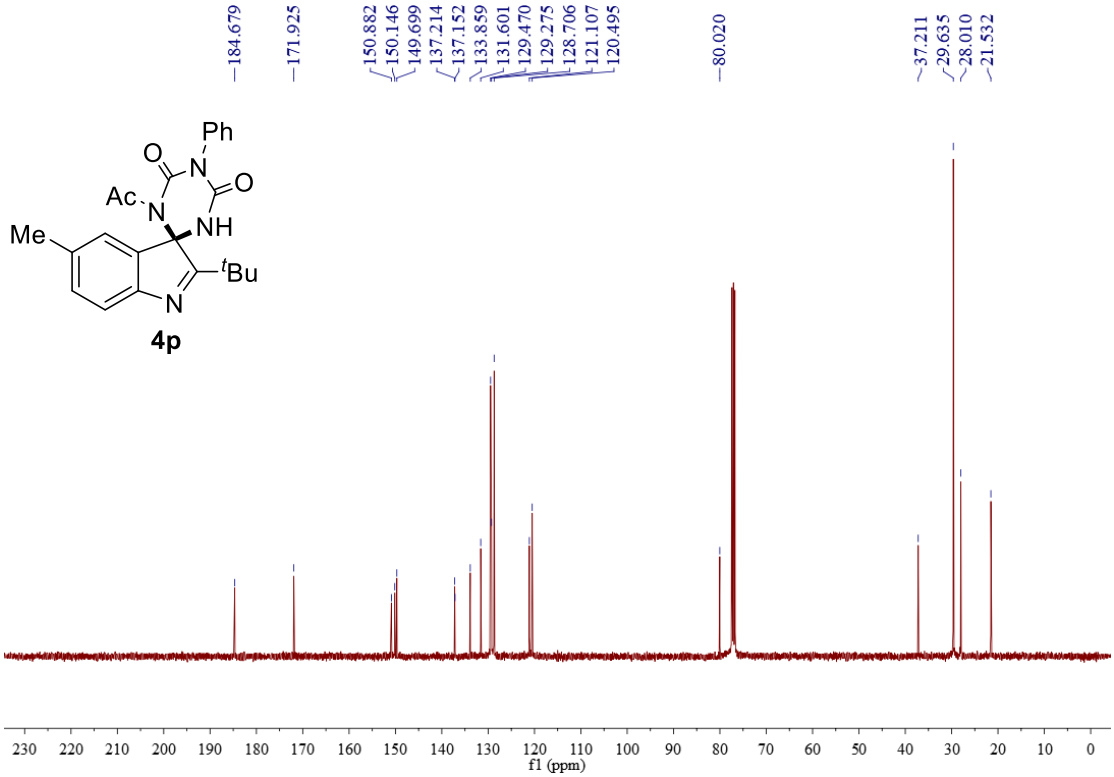
^{13}C NMR spectrum of compound **4o** ($CDCl_3$, 100 MHz)



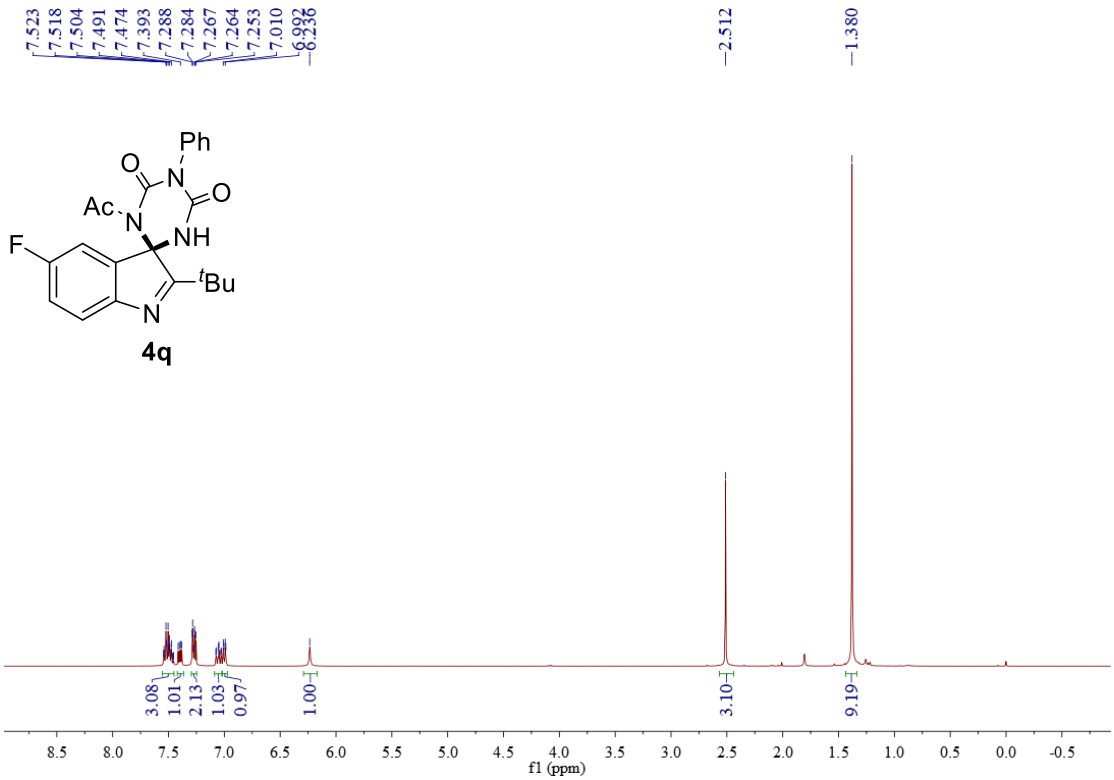
^{1}H NMR spectrum of compound **4p** ($CDCl_3$, 400 MHz)



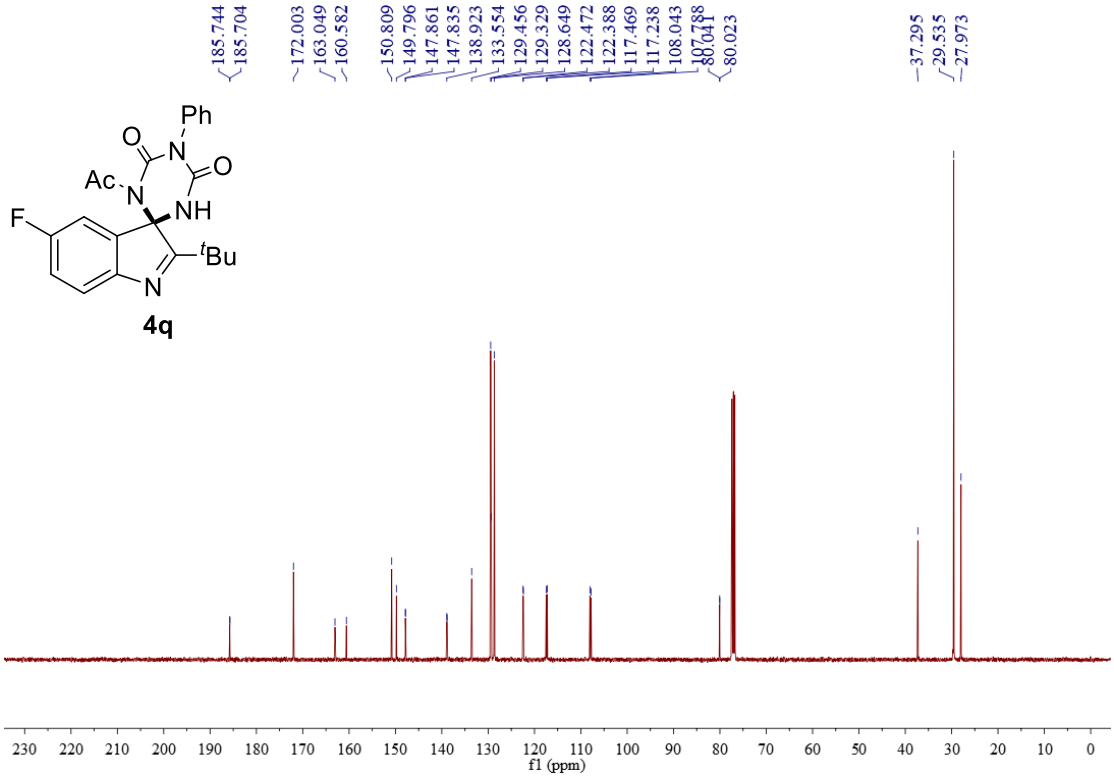
^{13}C NMR spectrum of compound **4p** ($CDCl_3$, 100 MHz)



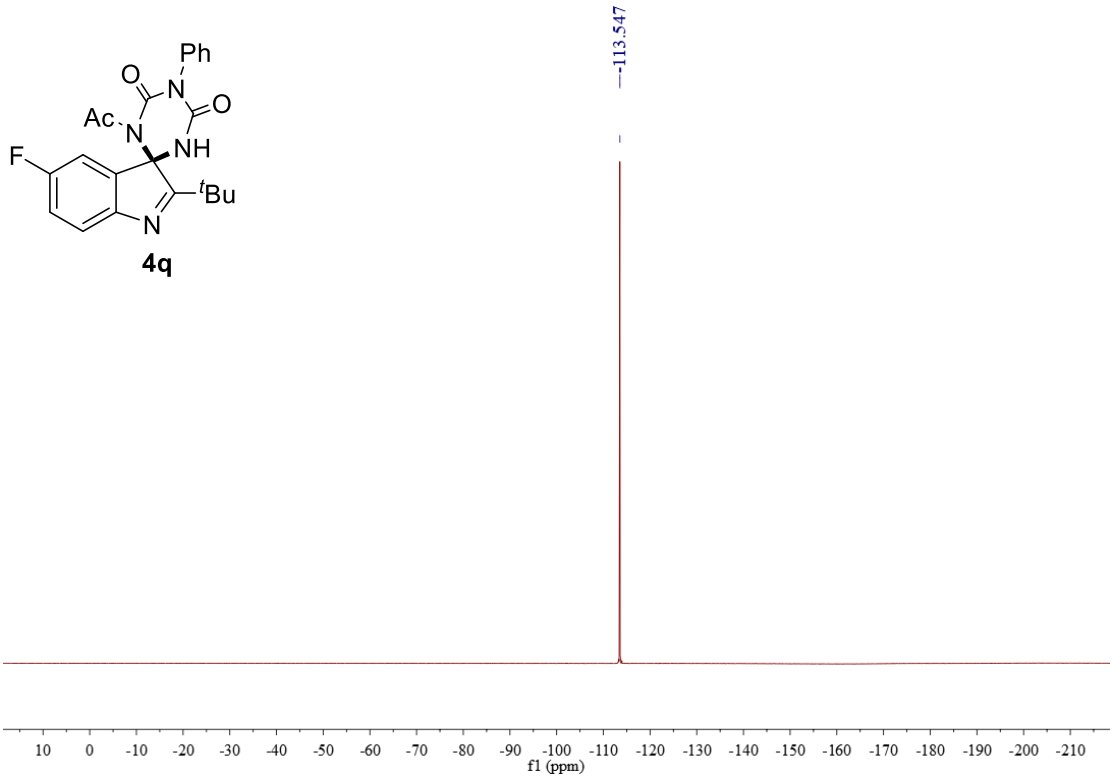
^{1}H NMR spectrum of compound **4q**($CDCl_3$, 400 MHz)



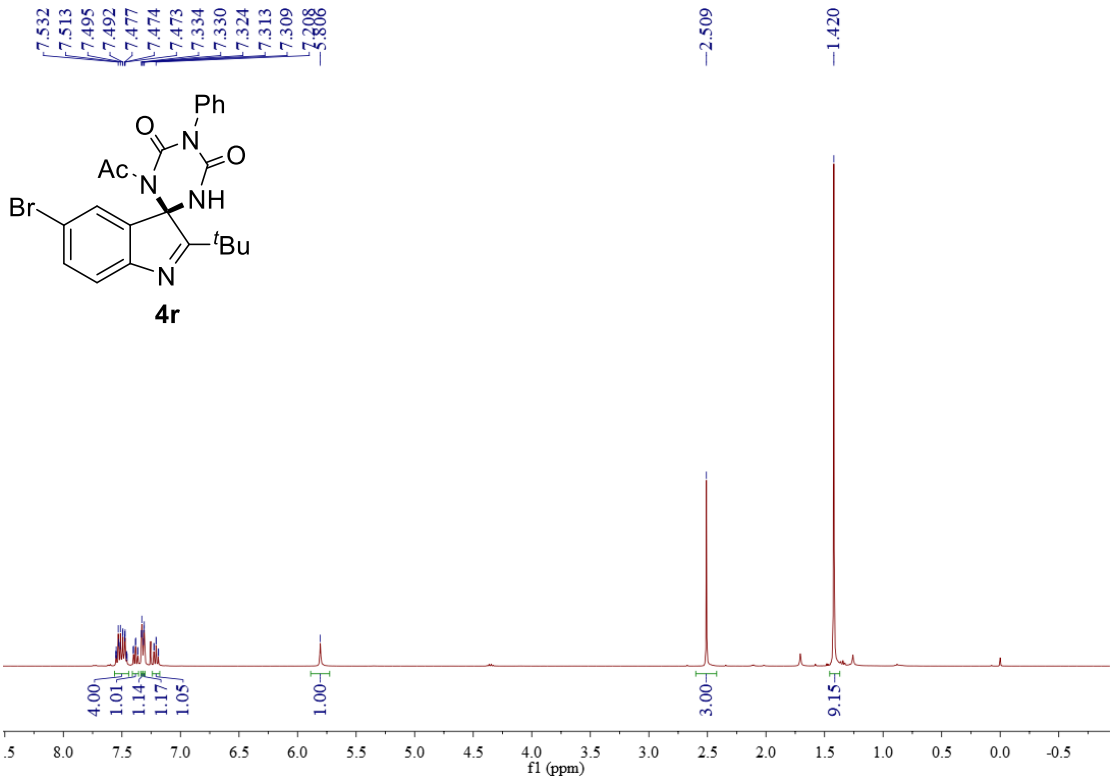
^{13}C NMR spectrum of compound **4q** ($CDCl_3$, 100 MHz)



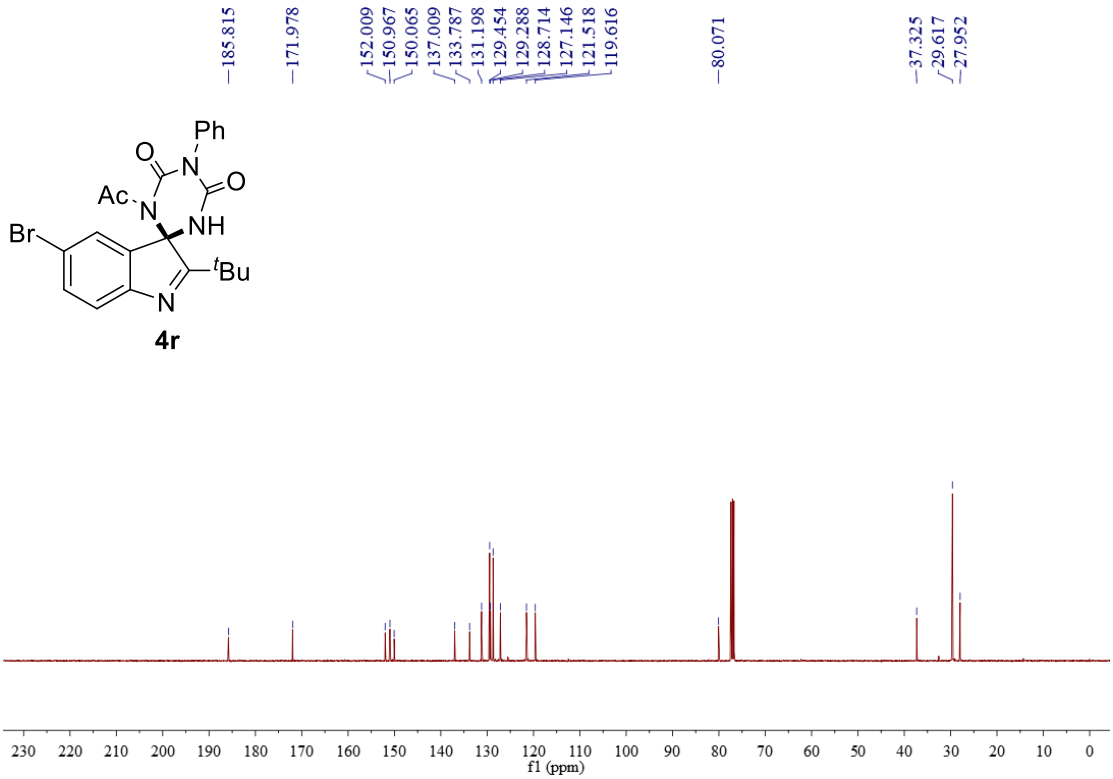
^{19}F NMR spectrum of compound **4q** ($CDCl_3$, 376 MHz)



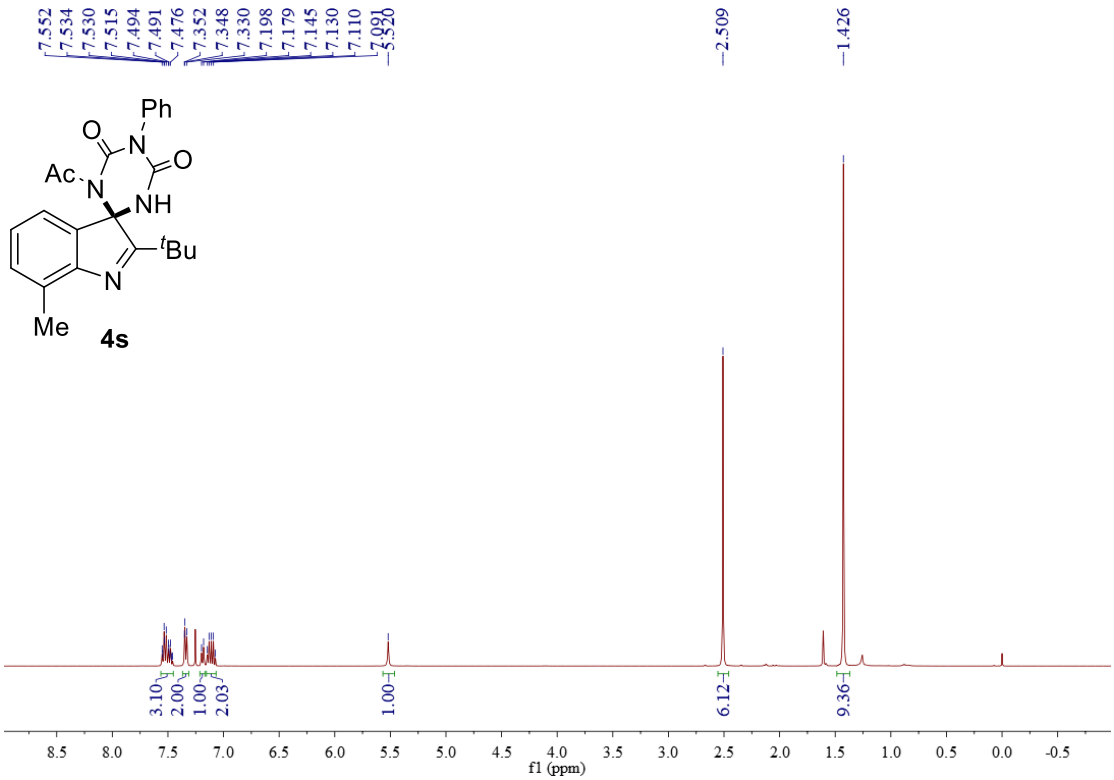
^{1}H NMR spectrum of compound **4r** ($CDCl_3$, 400 MHz)



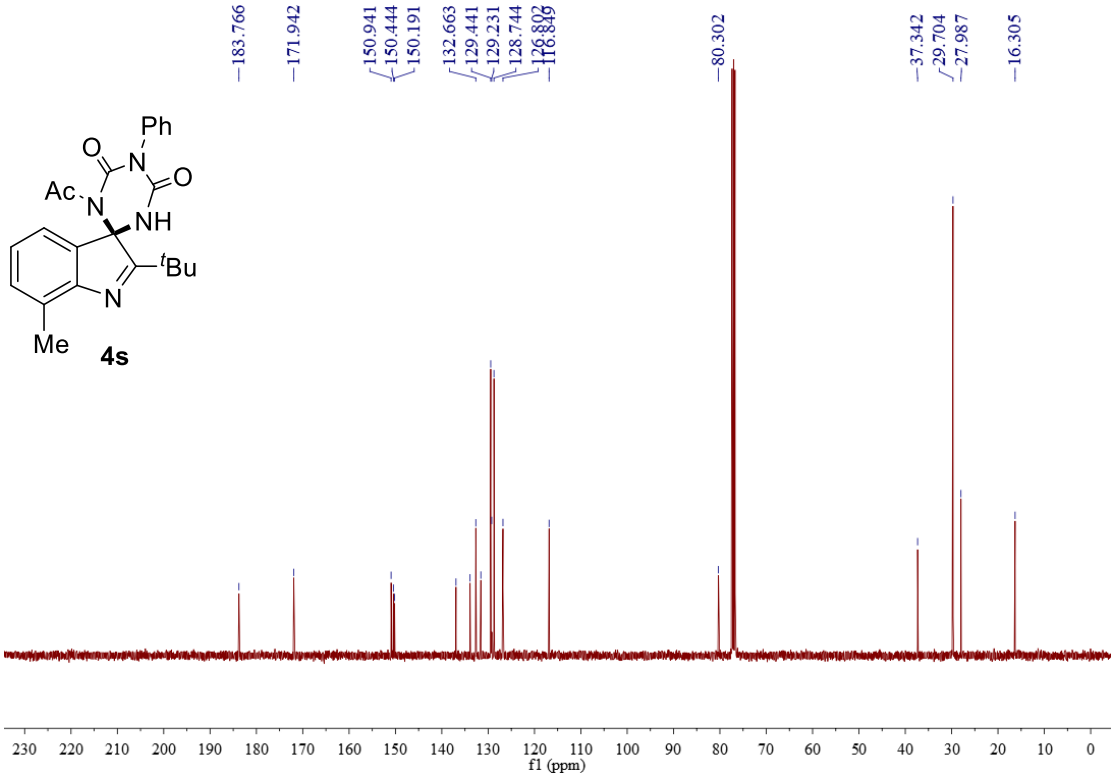
^{13}C NMR spectrum of compound **4r** ($CDCl_3$, 100 MHz)



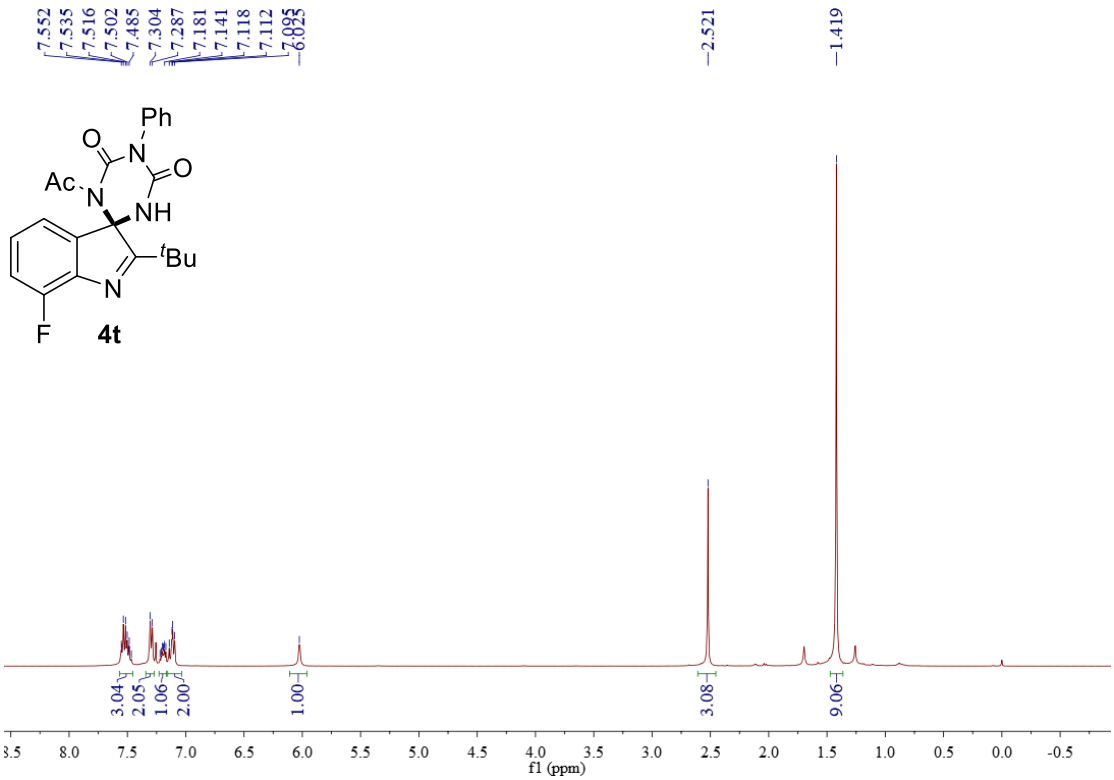
^{1}H NMR spectrum of compound **4s** ($CDCl_3$, 400 MHz)



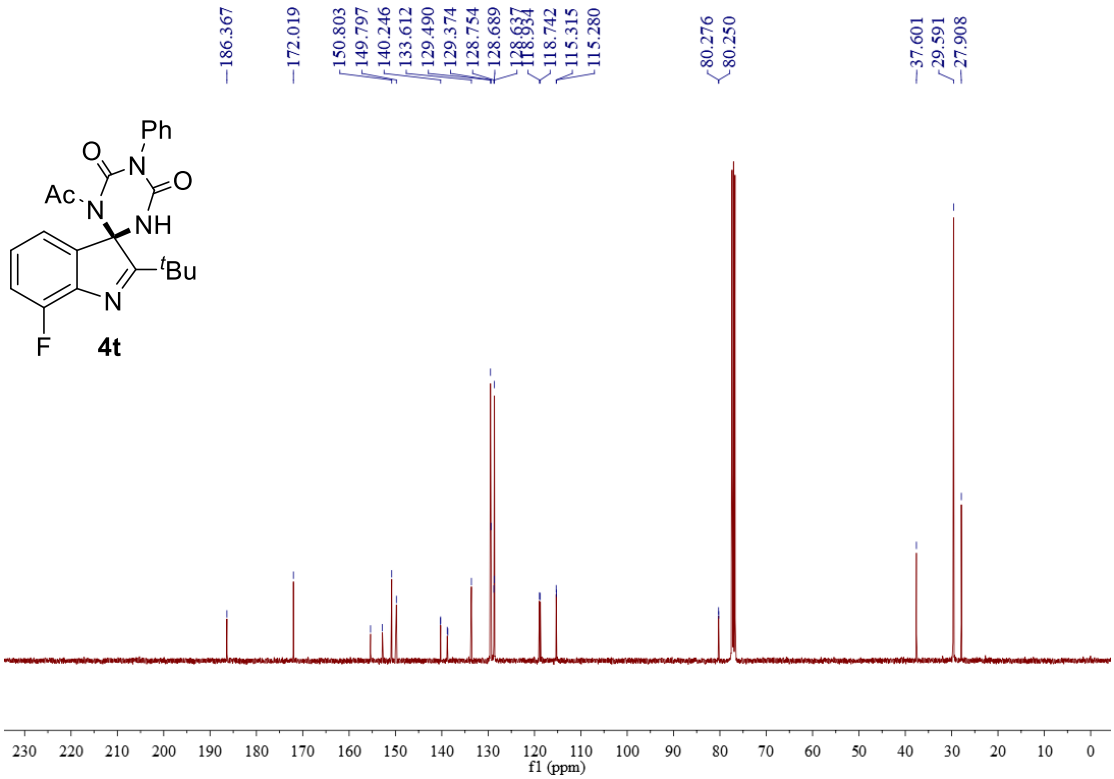
^{13}C NMR spectrum of compound **4s** ($CDCl_3$, 100 MHz)



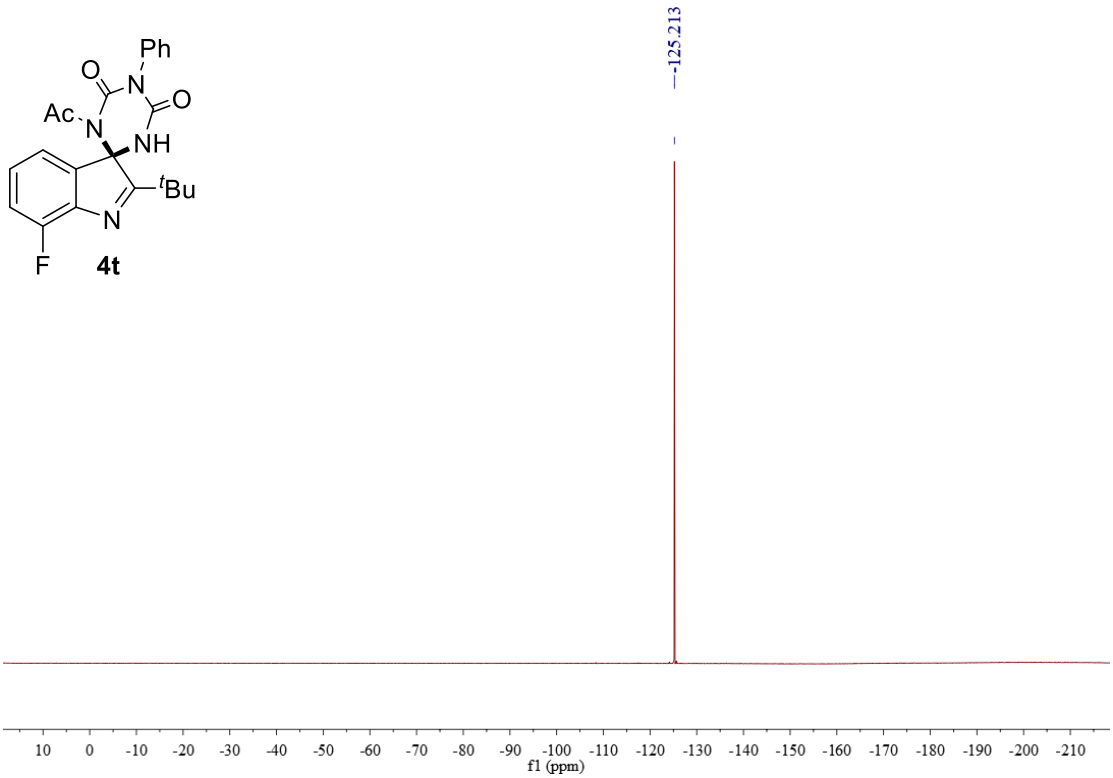
^{1}H NMR spectrum of compound **4t** ($CDCl_3$, 400 MHz)



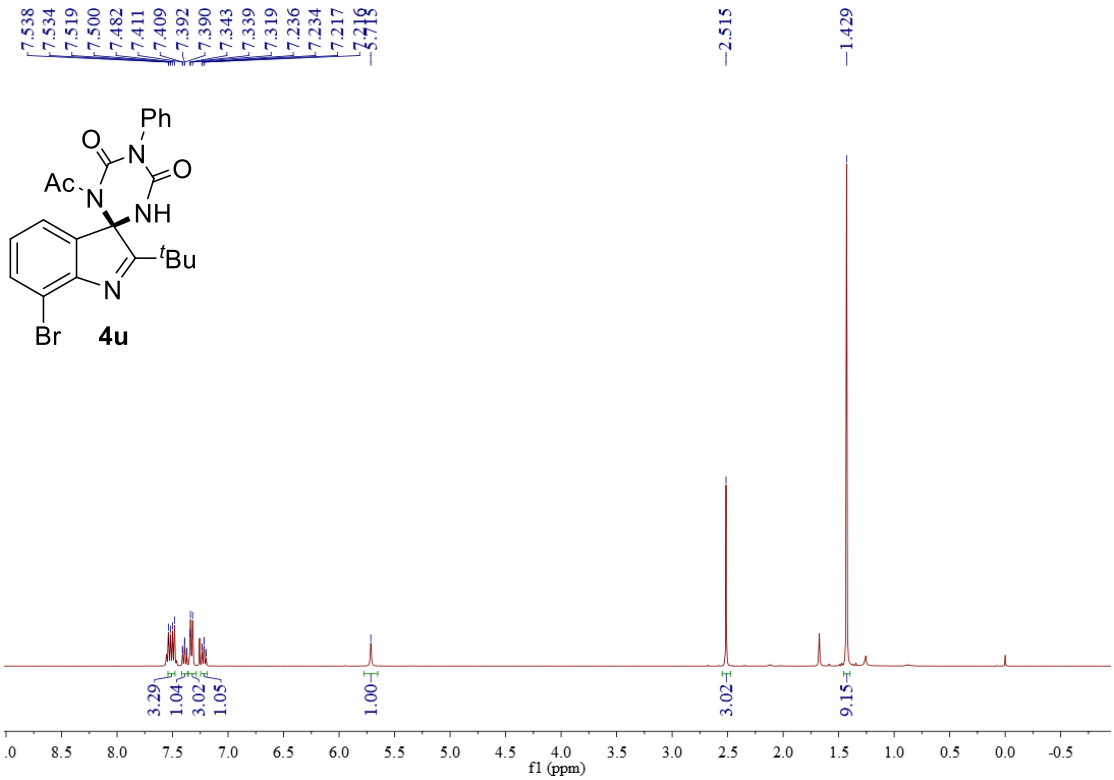
^{13}C NMR spectrum of compound **4t** ($CDCl_3$, 100 MHz)



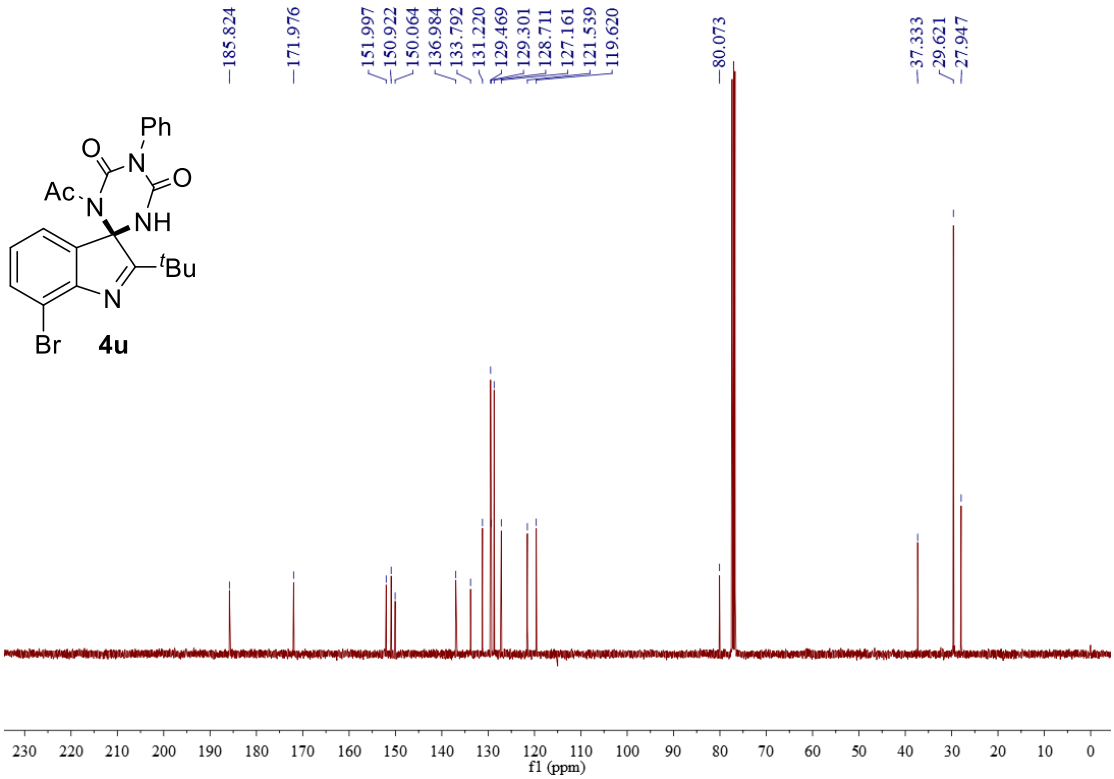
^{19}F NMR spectrum of compound **4t** ($CDCl_3$, 376 MHz)



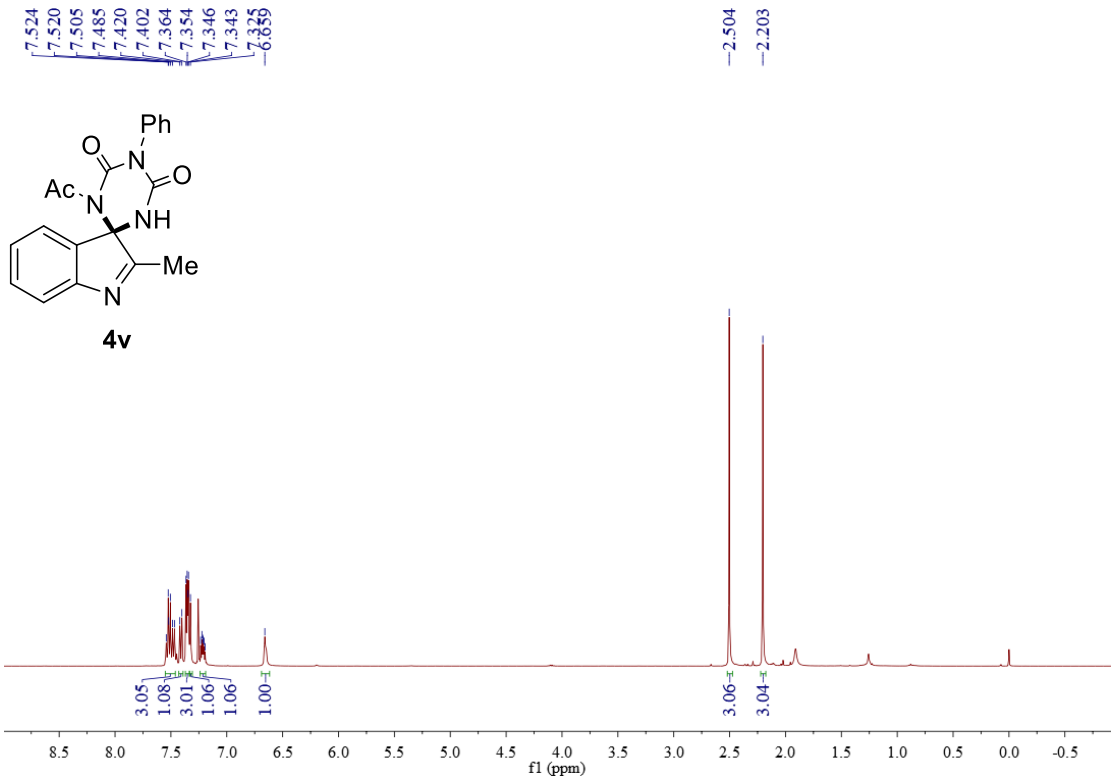
^{1}H NMR spectrum of compound **4u** ($CDCl_3$, 400 MHz)



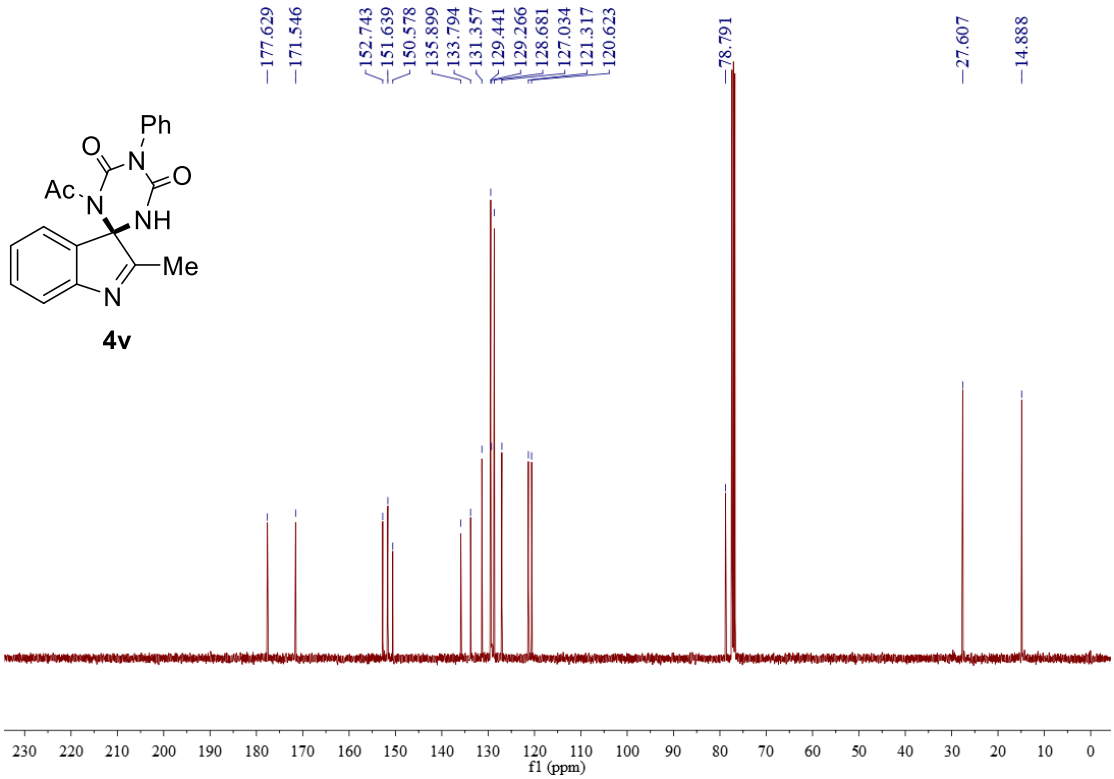
^{13}C NMR spectrum of compound **4u** ($CDCl_3$, 100 MHz)



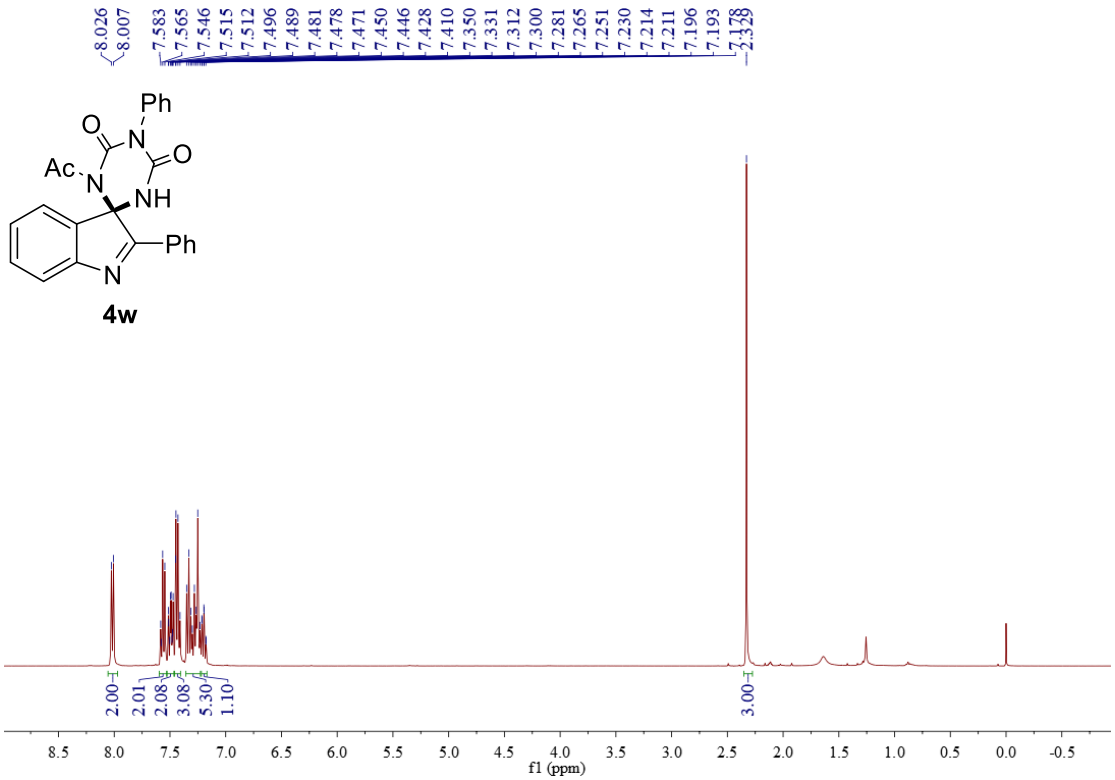
^{1}H NMR spectrum of compound **4v** ($CDCl_3$, 400 MHz)



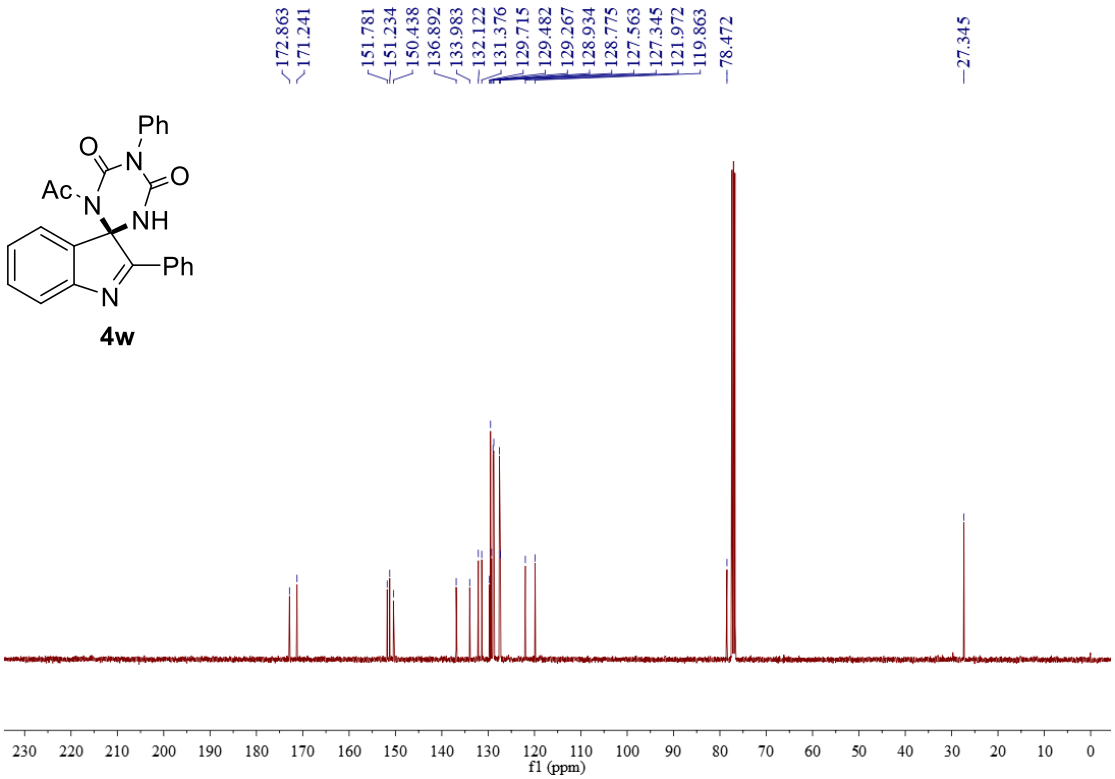
^{13}C NMR spectrum of compound **4v** ($CDCl_3$, 100 MHz)



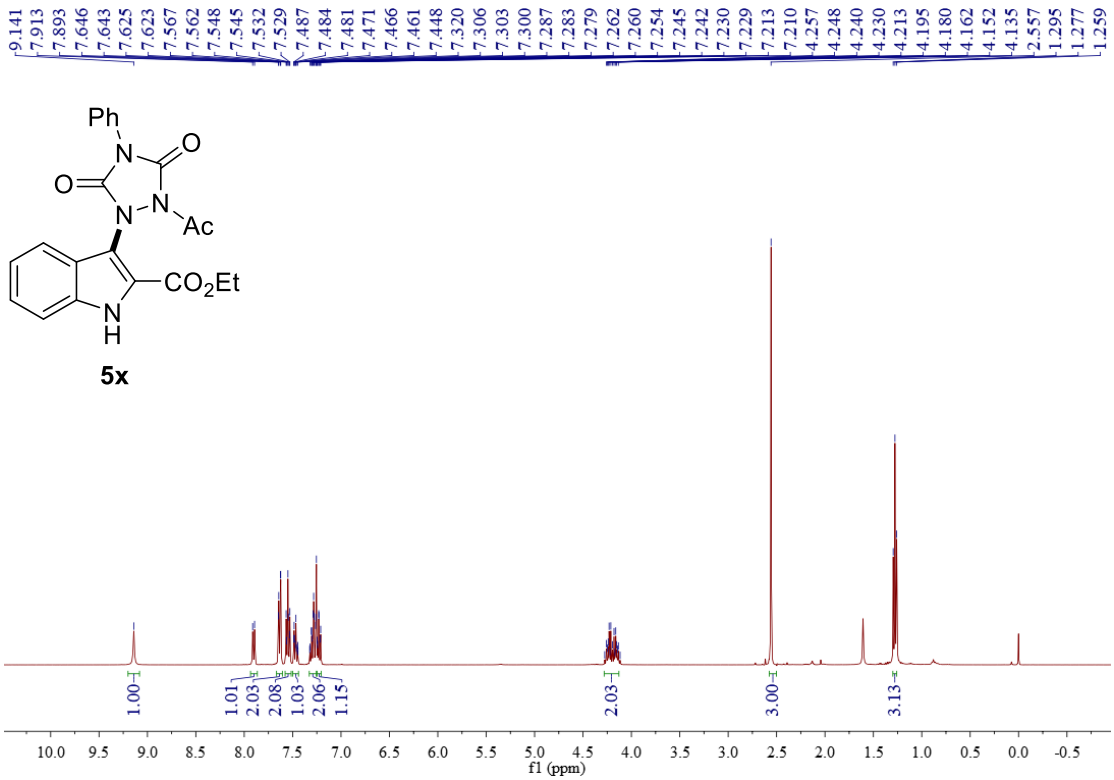
^{1}H NMR spectrum of compound **4w** ($CDCl_3$, 400 MHz)



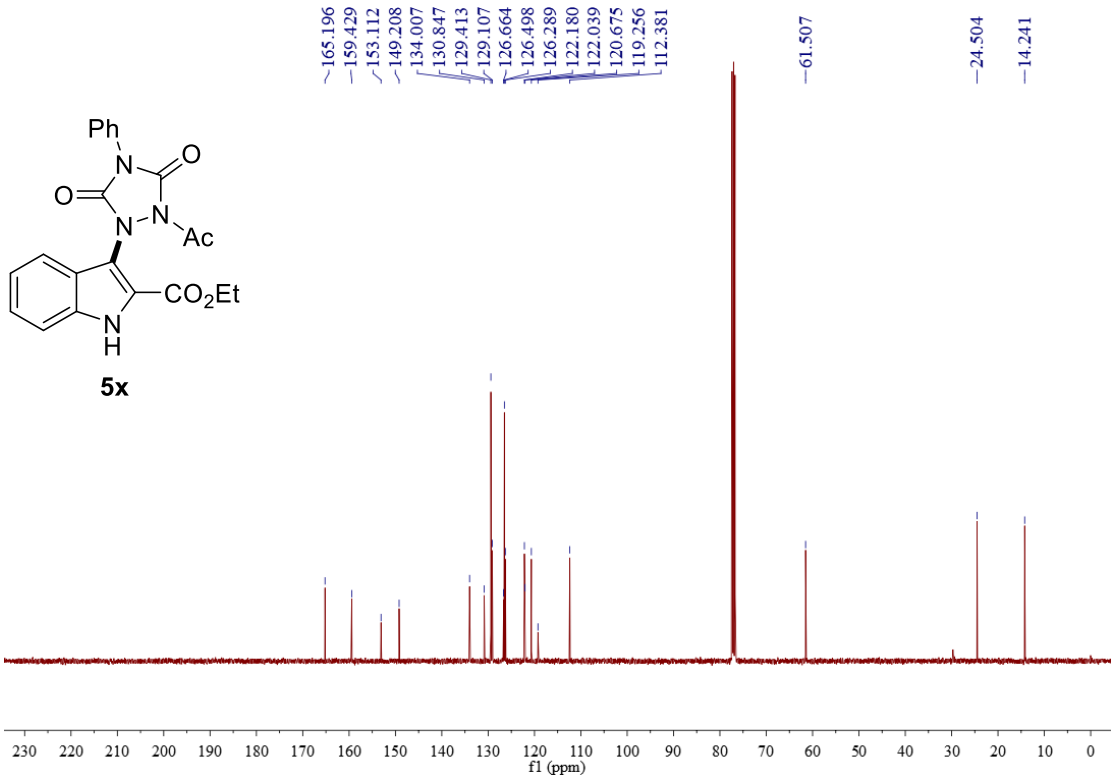
^{13}C NMR spectrum of compound **4w** ($CDCl_3$, 100 MHz)



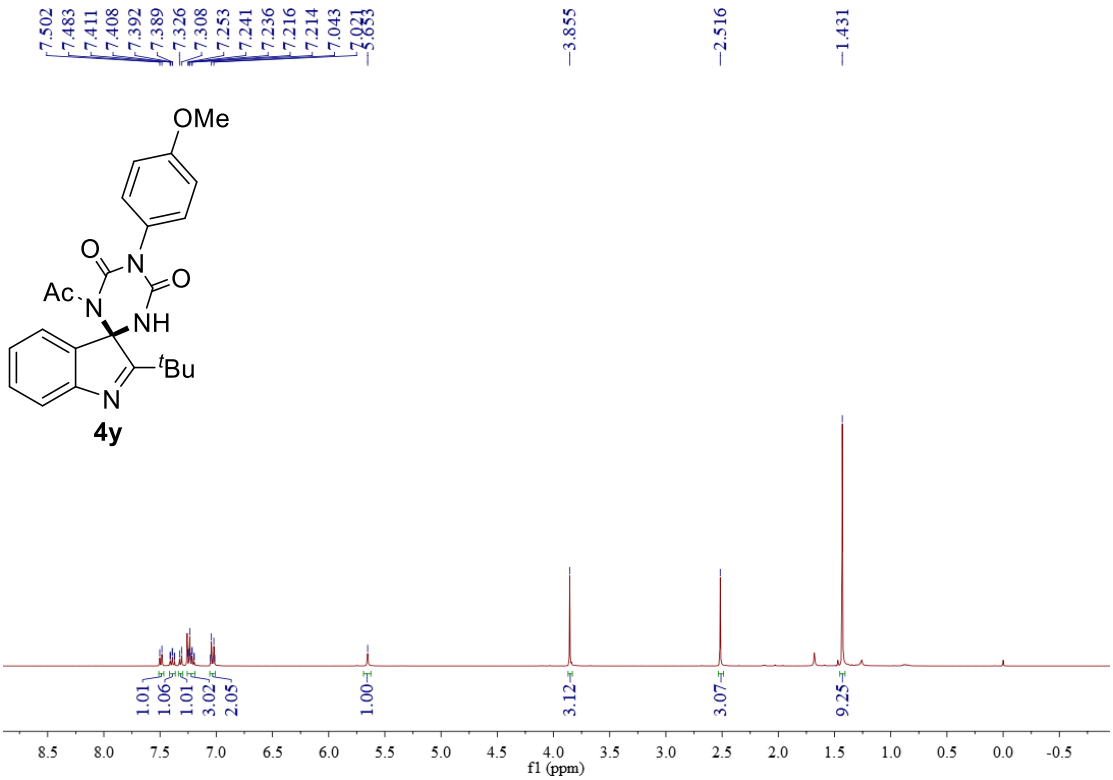
^{1}H NMR spectrum of compound **3aa** ($CDCl_3$, 400 MHz)



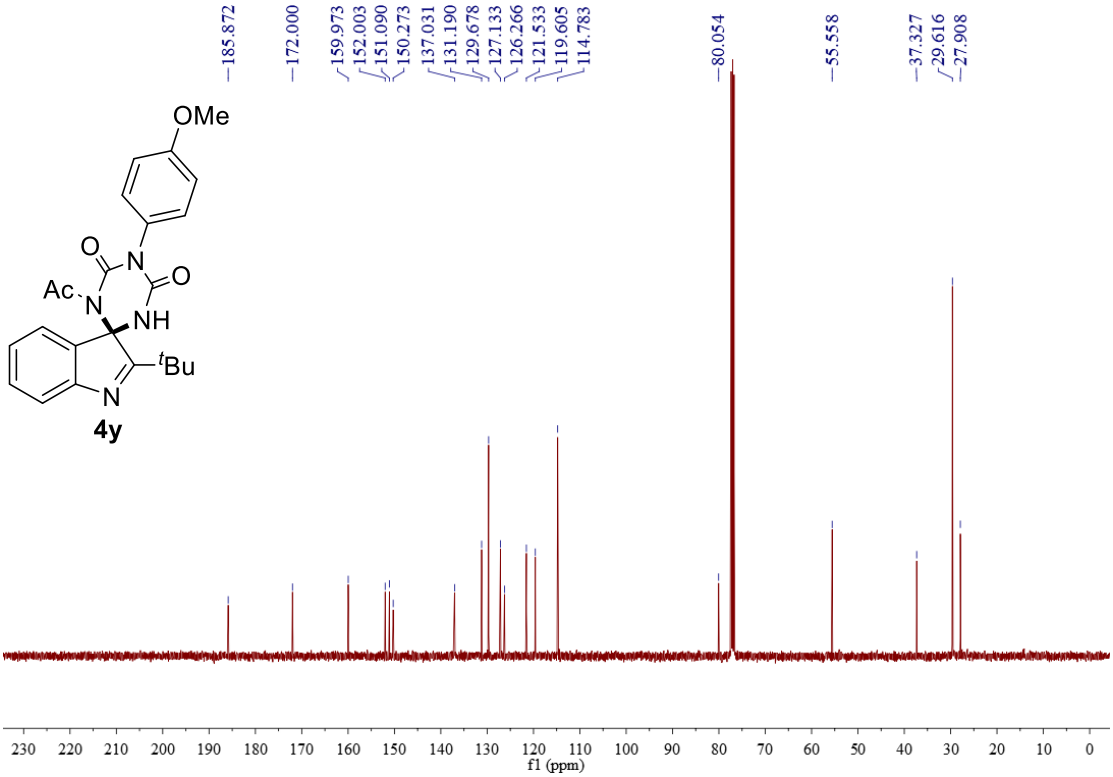
^{13}C NMR spectrum of compound **3aa** ($CDCl_3$, 100 MHz)



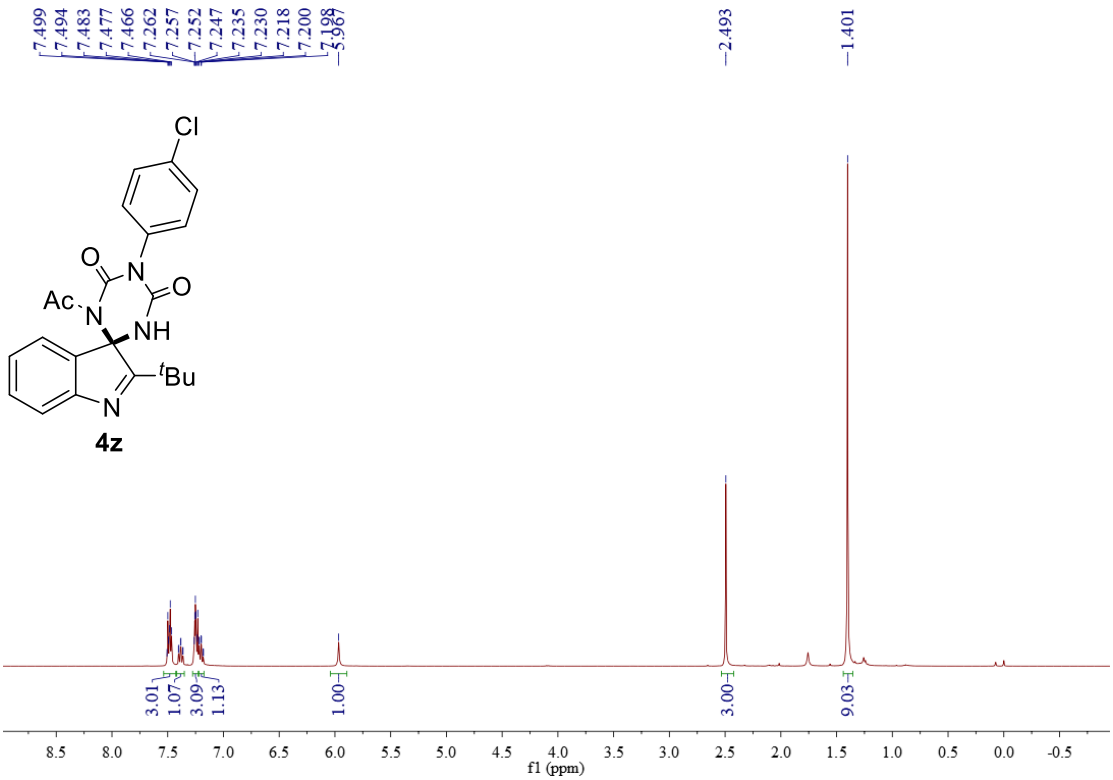
^{1}H NMR spectrum of compound **4y** ($CDCl_3$, 400 MHz)



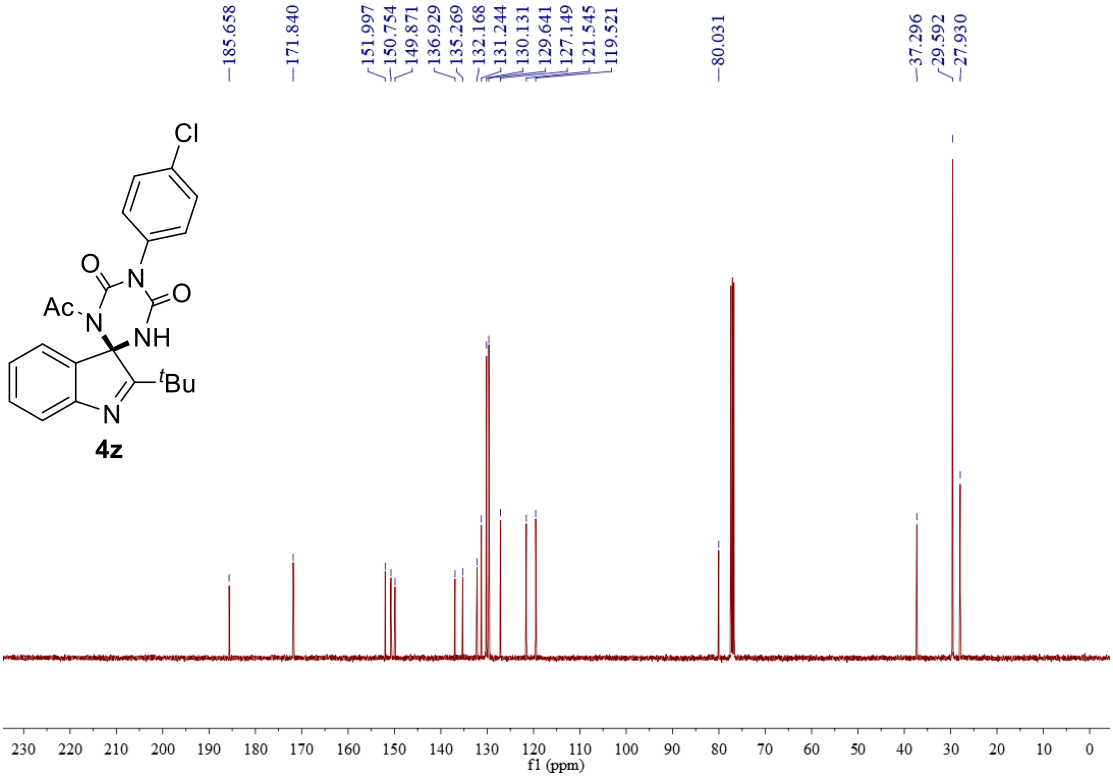
^{13}C NMR spectrum of compound **4y** ($CDCl_3$, 100 MHz)



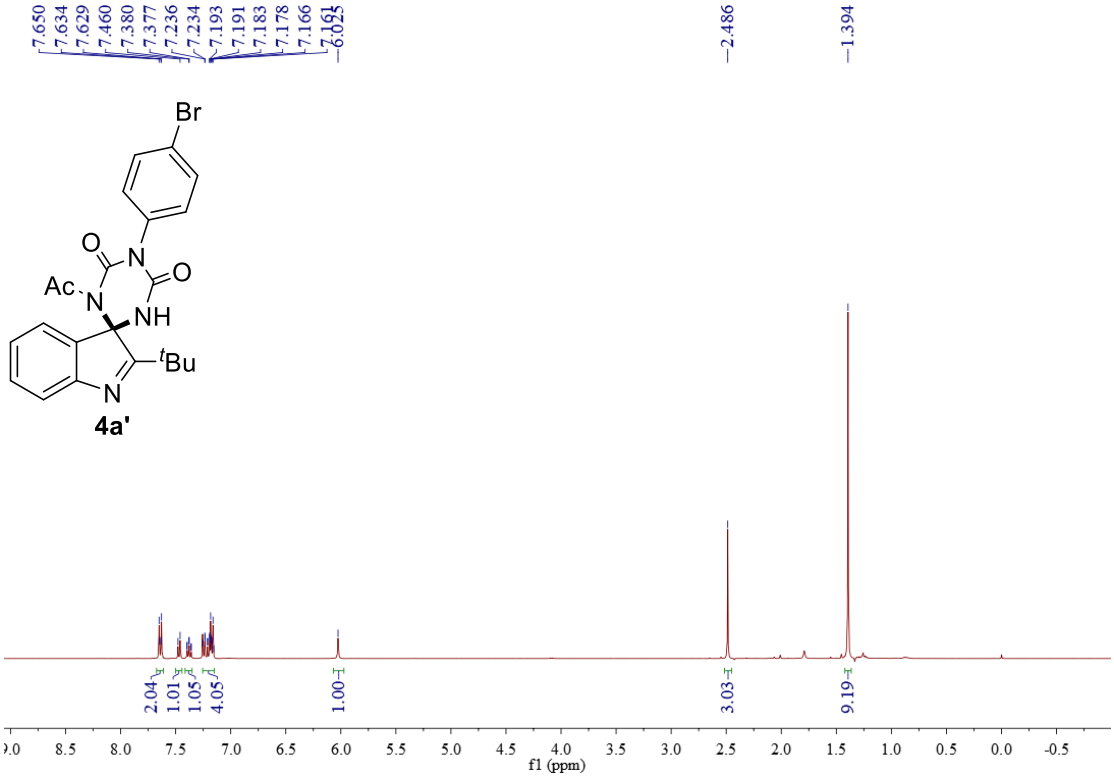
^{1}H NMR spectrum of compound **4z** ($CDCl_3$, 400 MHz)



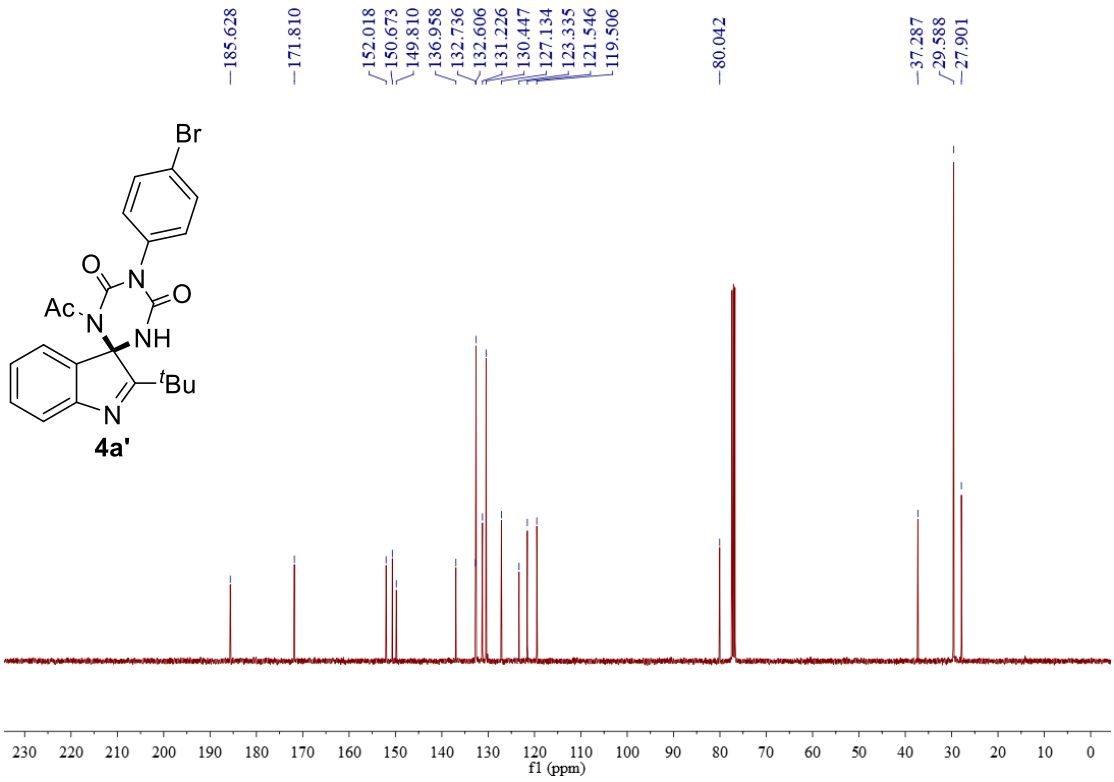
^{13}C NMR spectrum of compound **4z** ($CDCl_3$, 100 MHz)



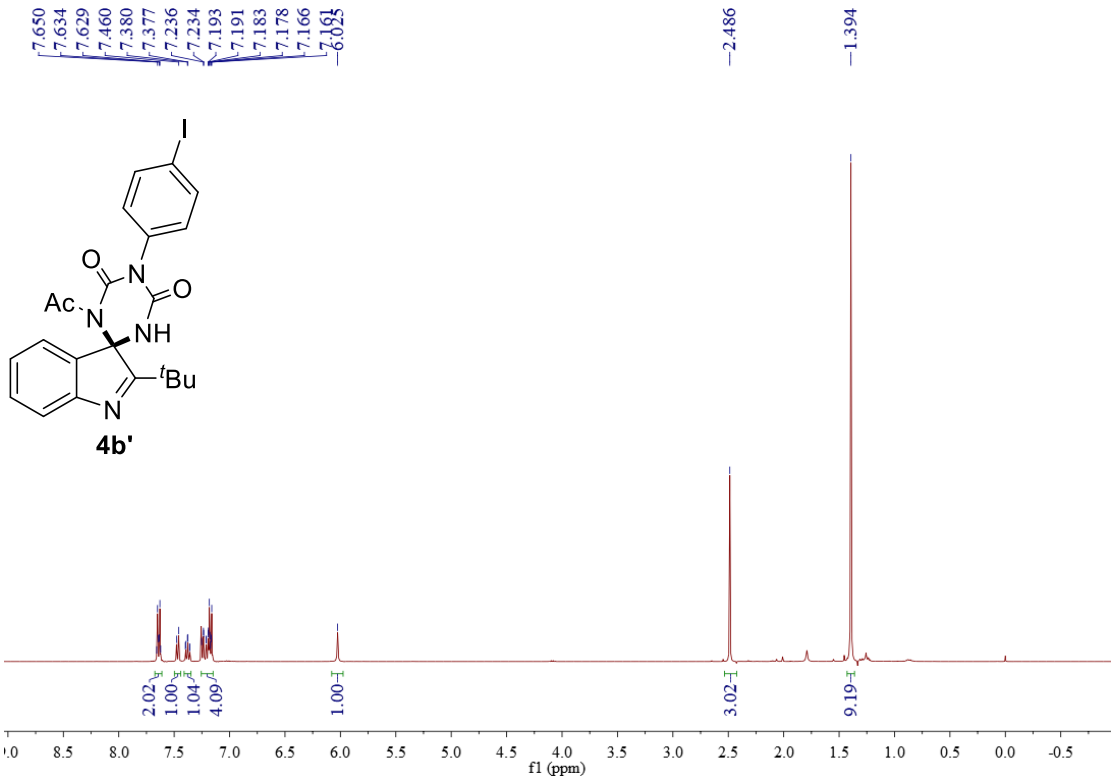
^{1}H NMR spectrum of compound **4a'** ($CDCl_3$, 400 MHz)



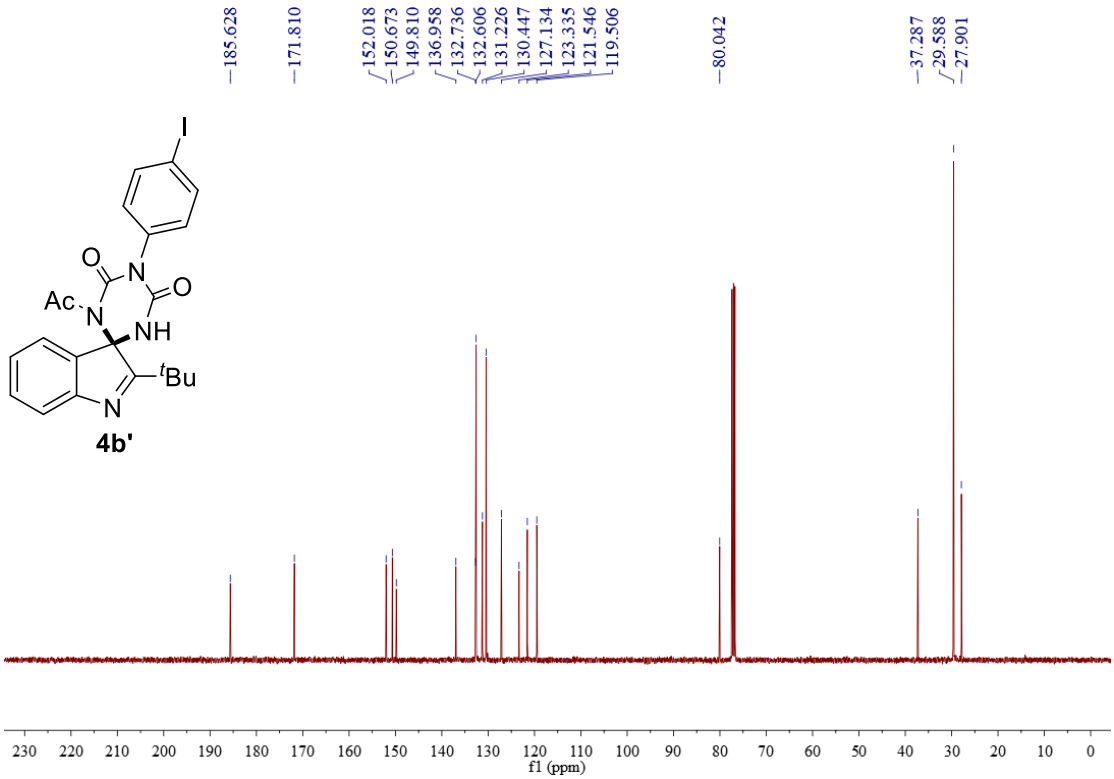
^{13}C NMR spectrum of compound **4a'** ($CDCl_3$, 100 MHz)



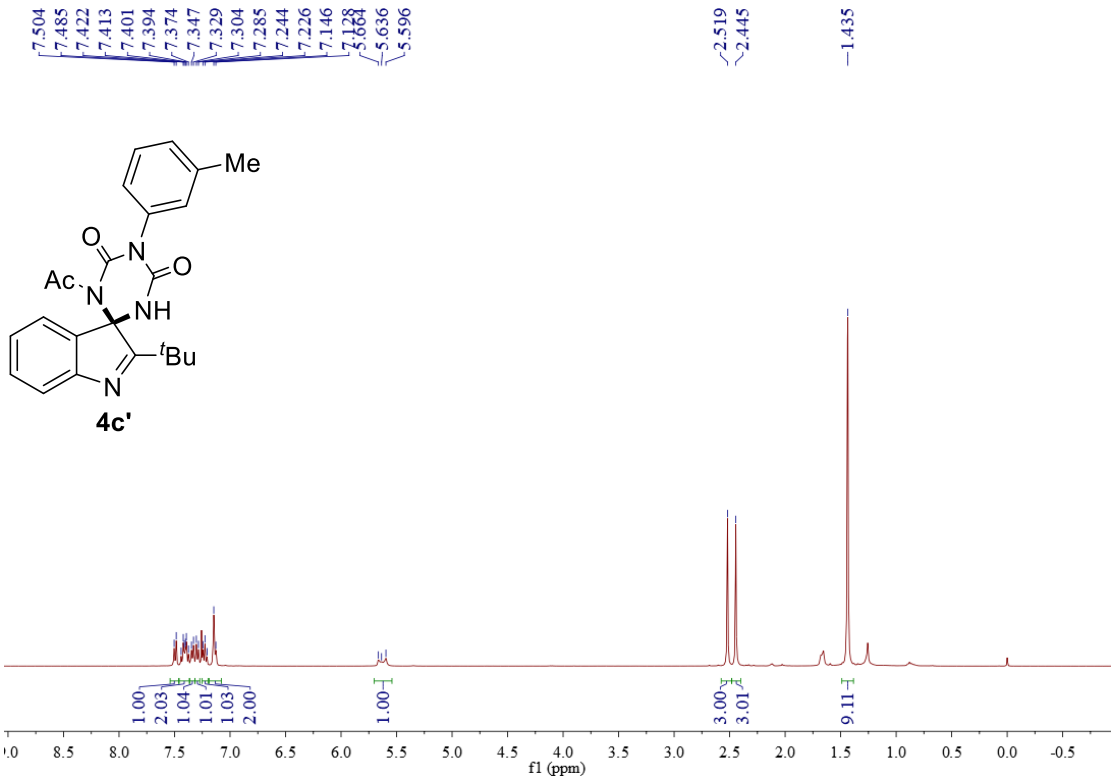
^{1}H NMR spectrum of compound **4b'** ($CDCl_3$, 400 MHz)



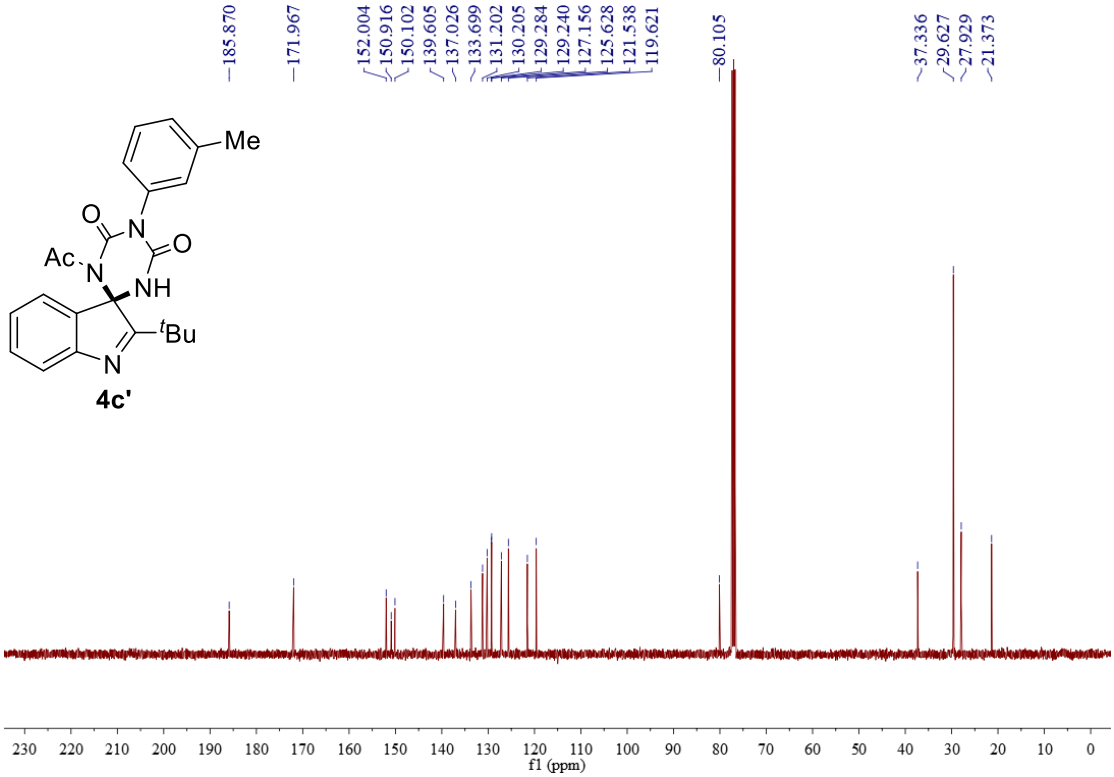
^{13}C NMR spectrum of compound **4b'** ($CDCl_3$, 100 MHz)



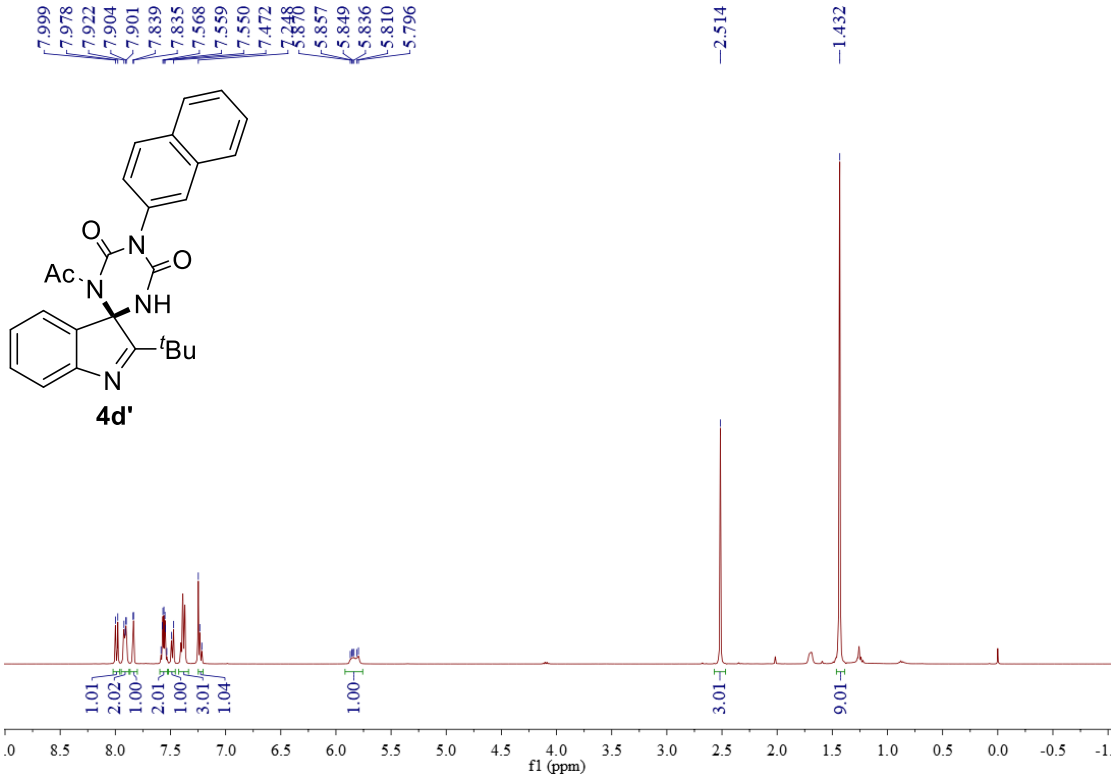
^{1}H NMR spectrum of compound **4c'** ($CDCl_3$, 400 MHz)



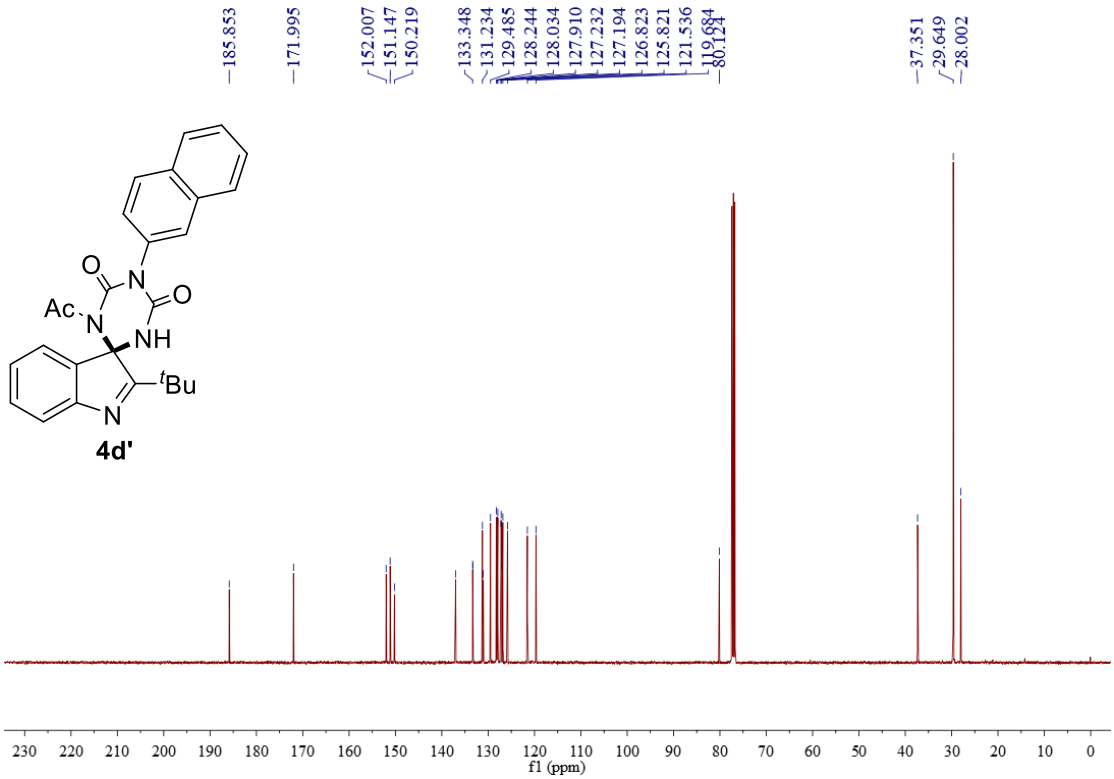
^{13}C NMR spectrum of compound **4c'** ($CDCl_3$, 100 MHz)



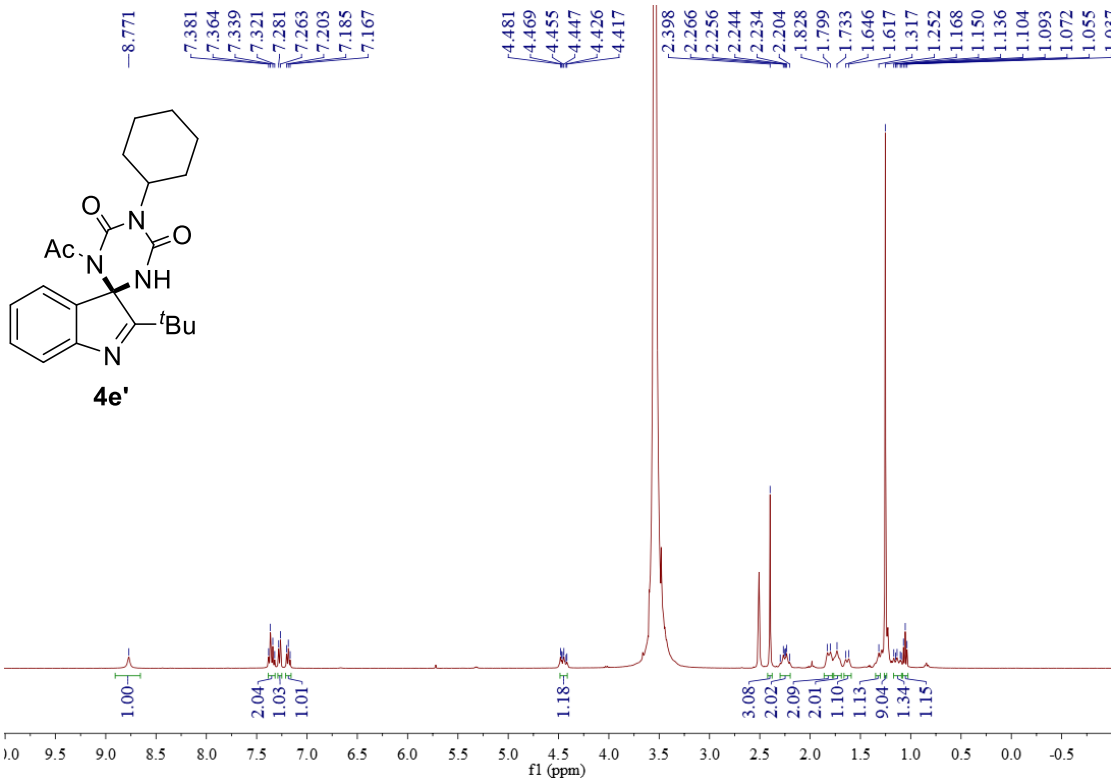
^{1}H NMR spectrum of compound **4d'** ($CDCl_3$, 400 MHz)



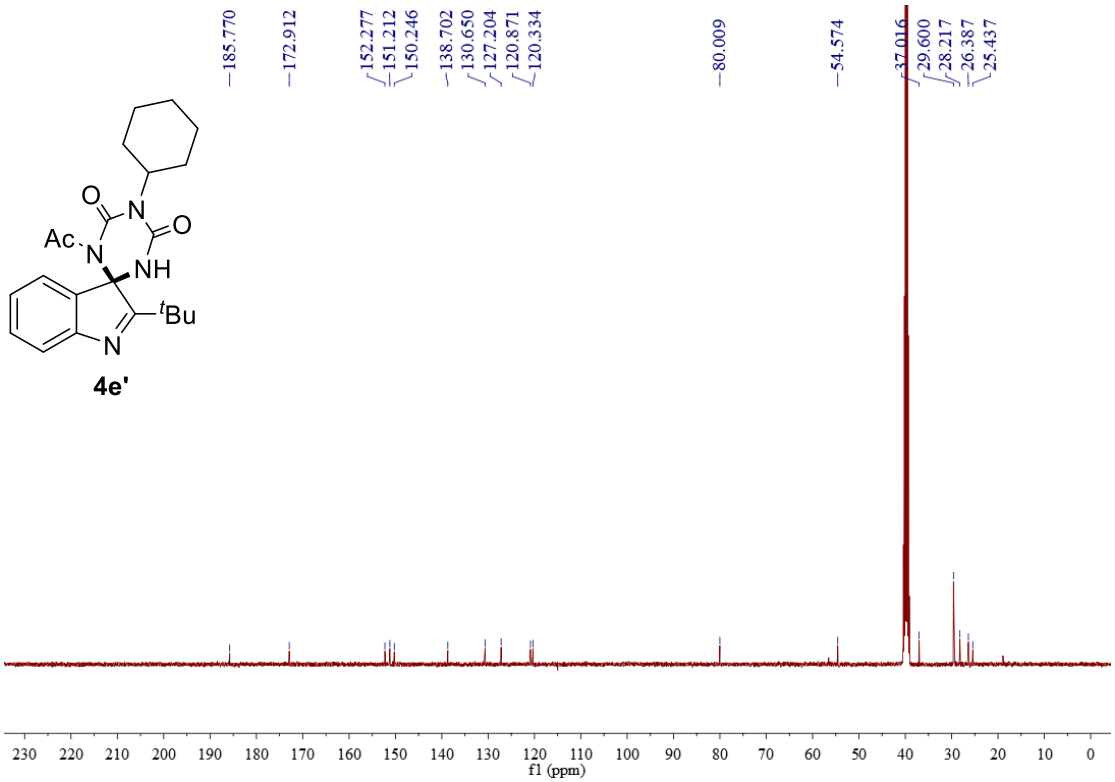
^{13}C NMR spectrum of compound **4d'** ($CDCl_3$, 100 MHz)



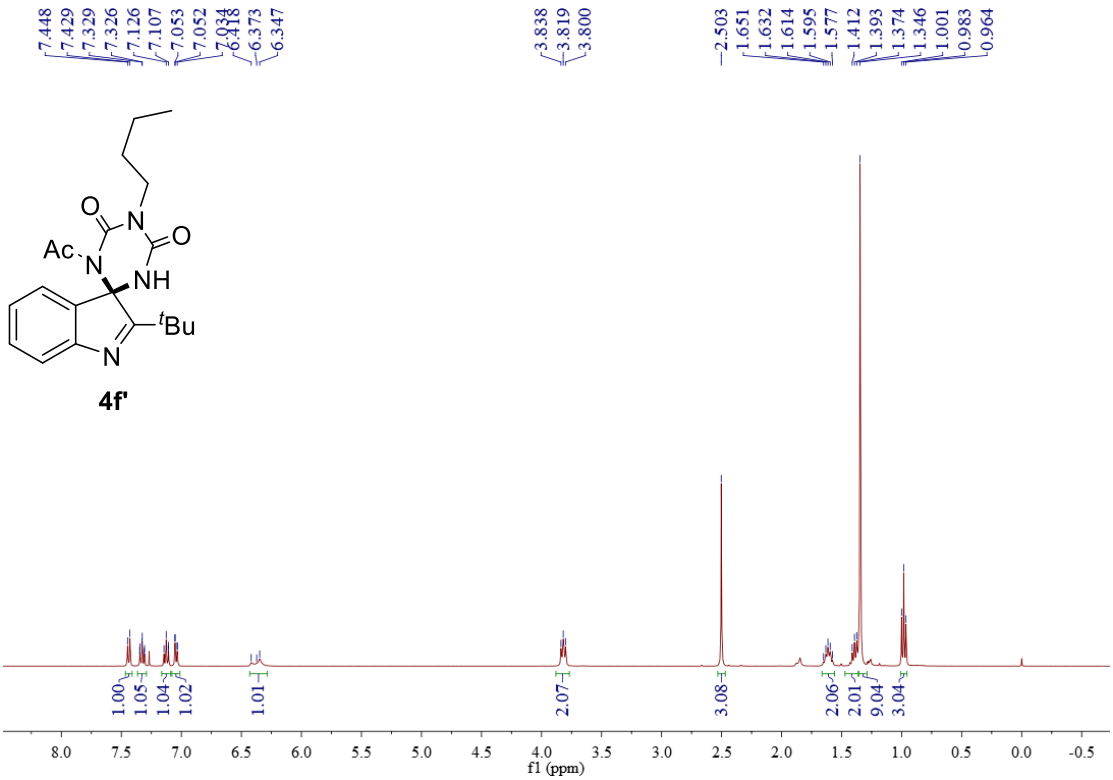
^{1}H NMR spectrum of compound **4e'** ($(CD_3)_2SO$, 400 MHz)



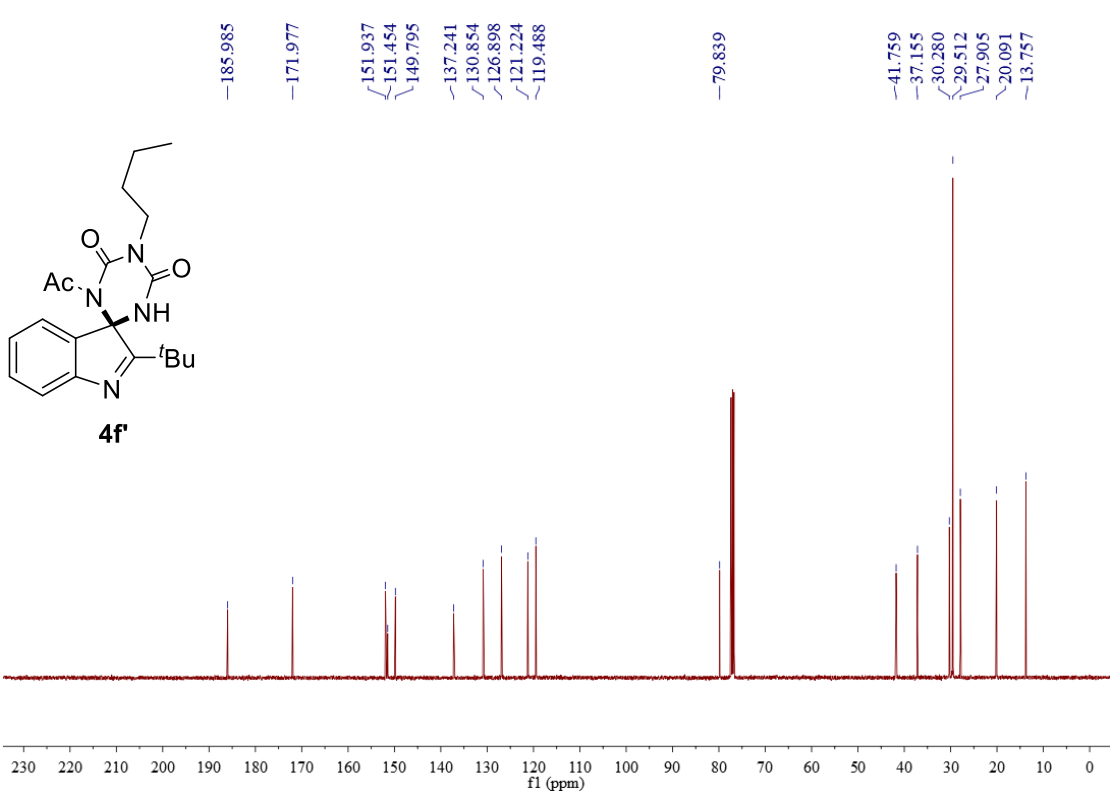
^{13}C NMR spectrum of compound **4e'** ($(CD_3)_2SO$, 100 MHz)



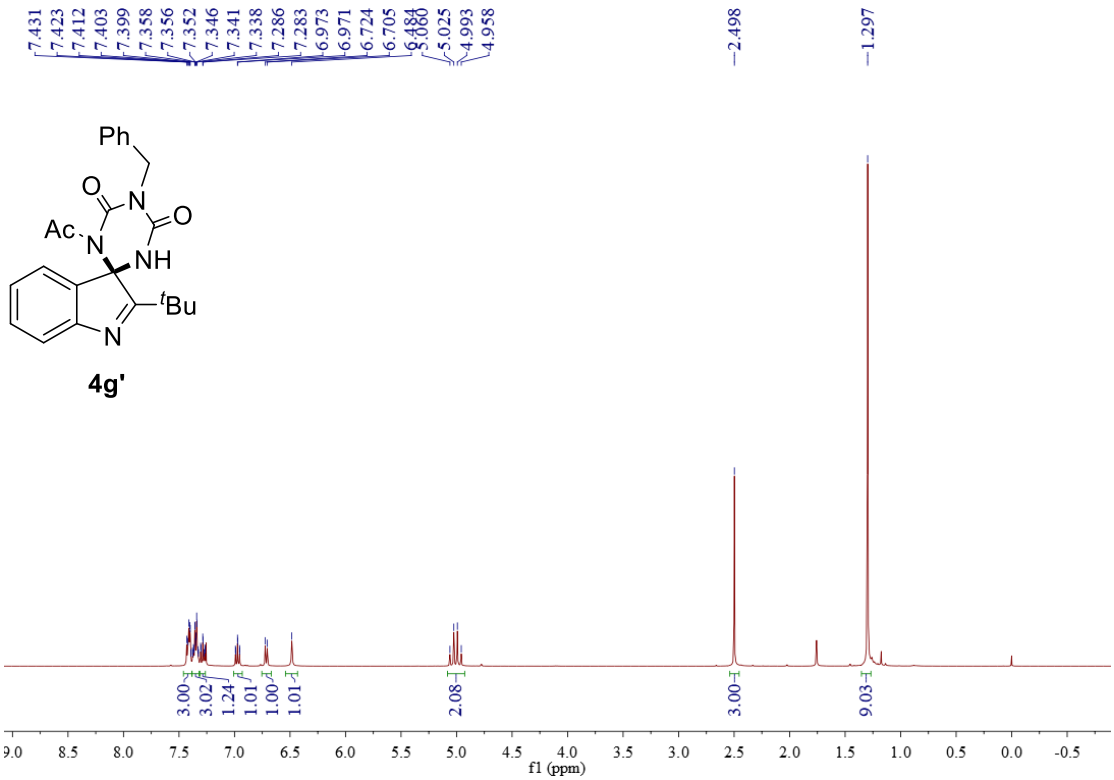
^{1}H NMR spectrum of compound **4f'** ($CDCl_3$, 400 MHz)



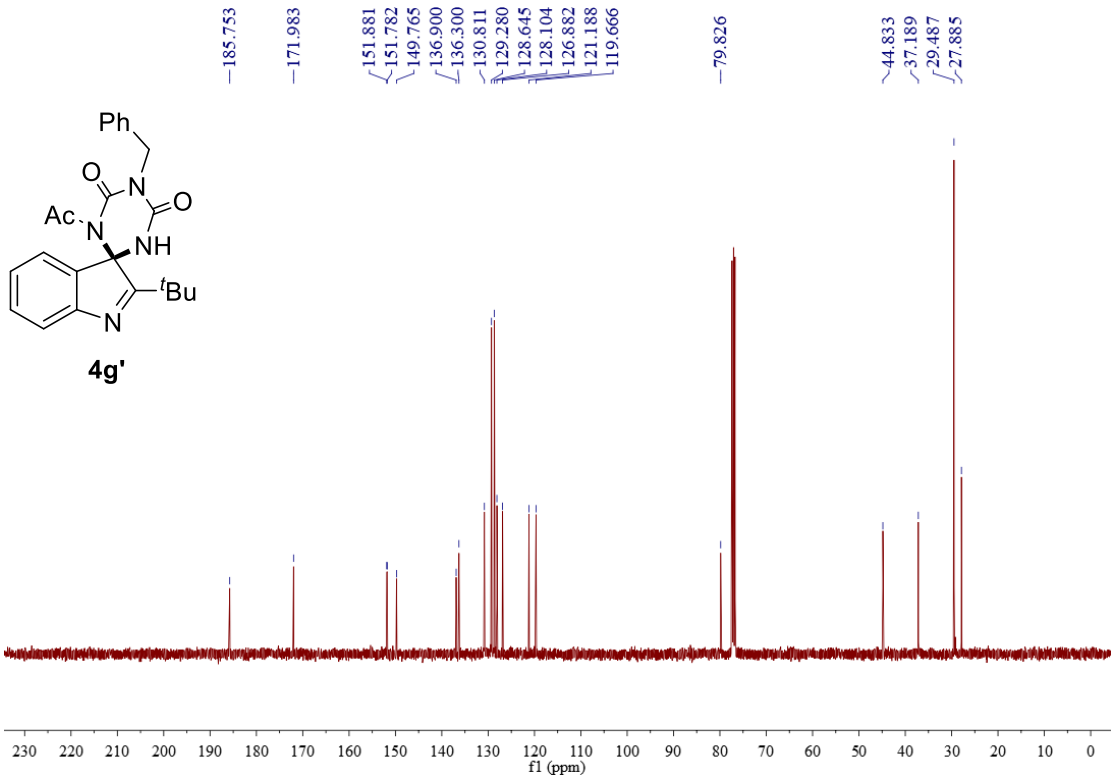
^{13}C NMR spectrum of compound **4f'** ($CDCl_3$, 100 MHz)



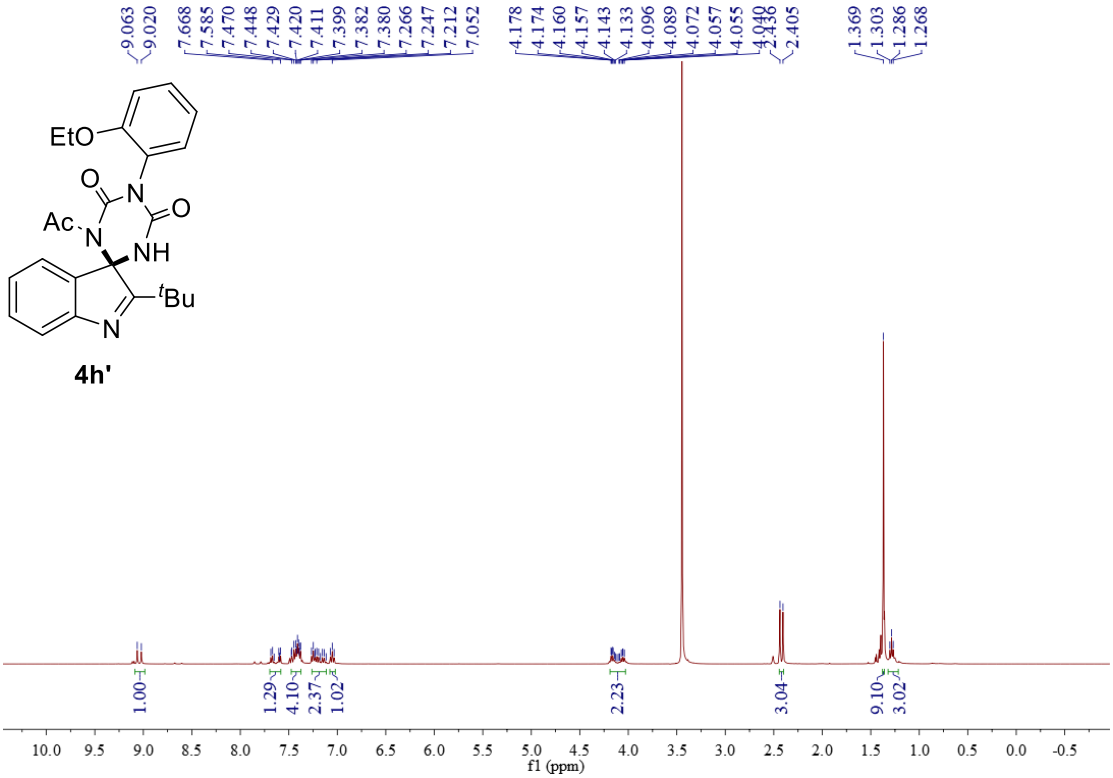
^{1}H NMR spectrum of compound **4g'** ($CDCl_3$, 400 MHz)



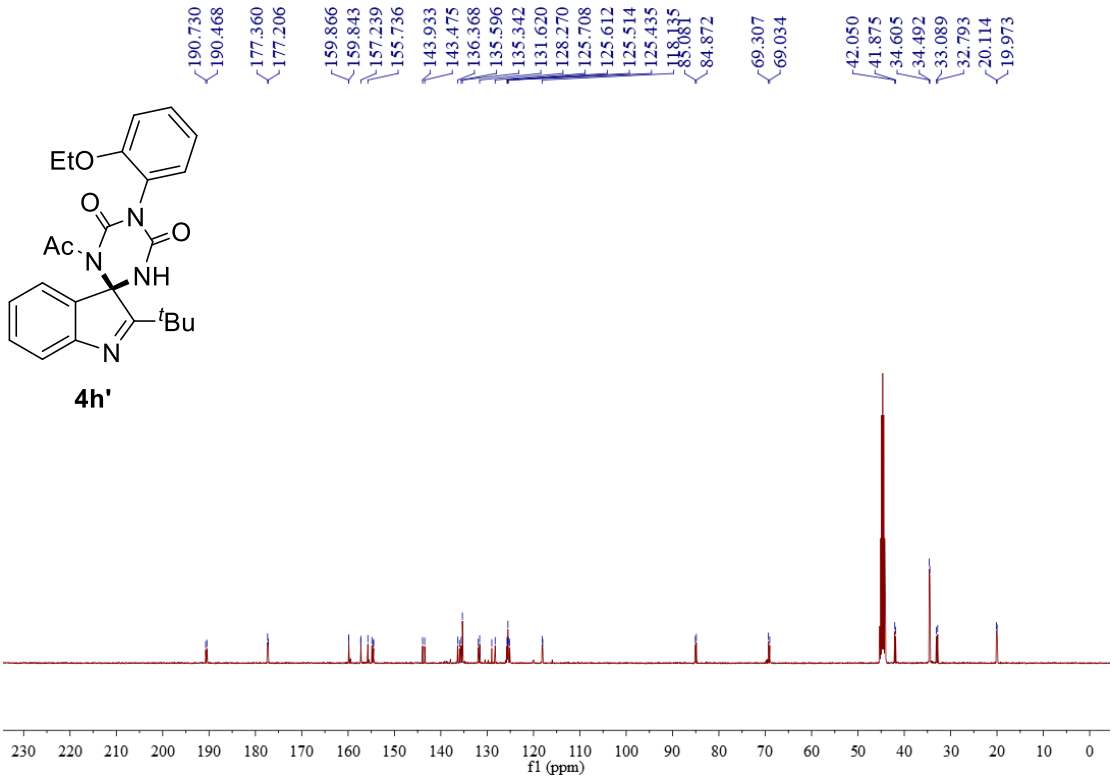
^{13}C NMR spectrum of compound **4g'** ($CDCl_3$, 100 MHz)



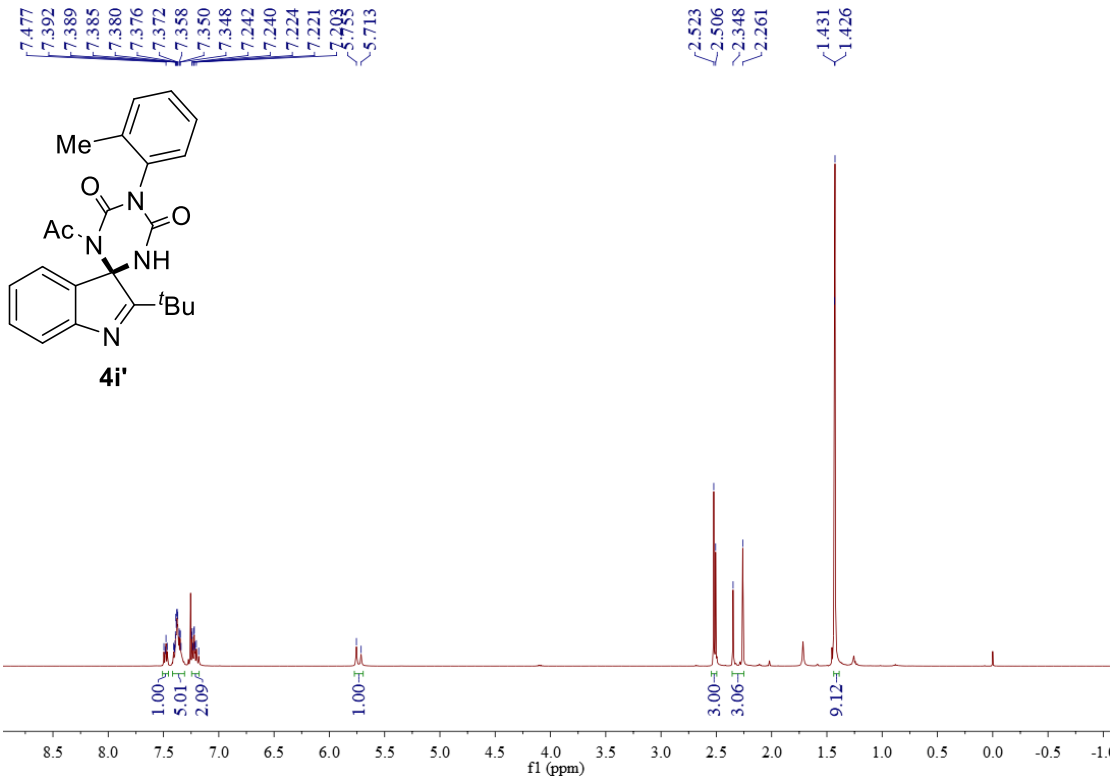
^{1}H NMR spectrum of compound **4h'** ($(CD_3)_2SO$, 400 MHz)



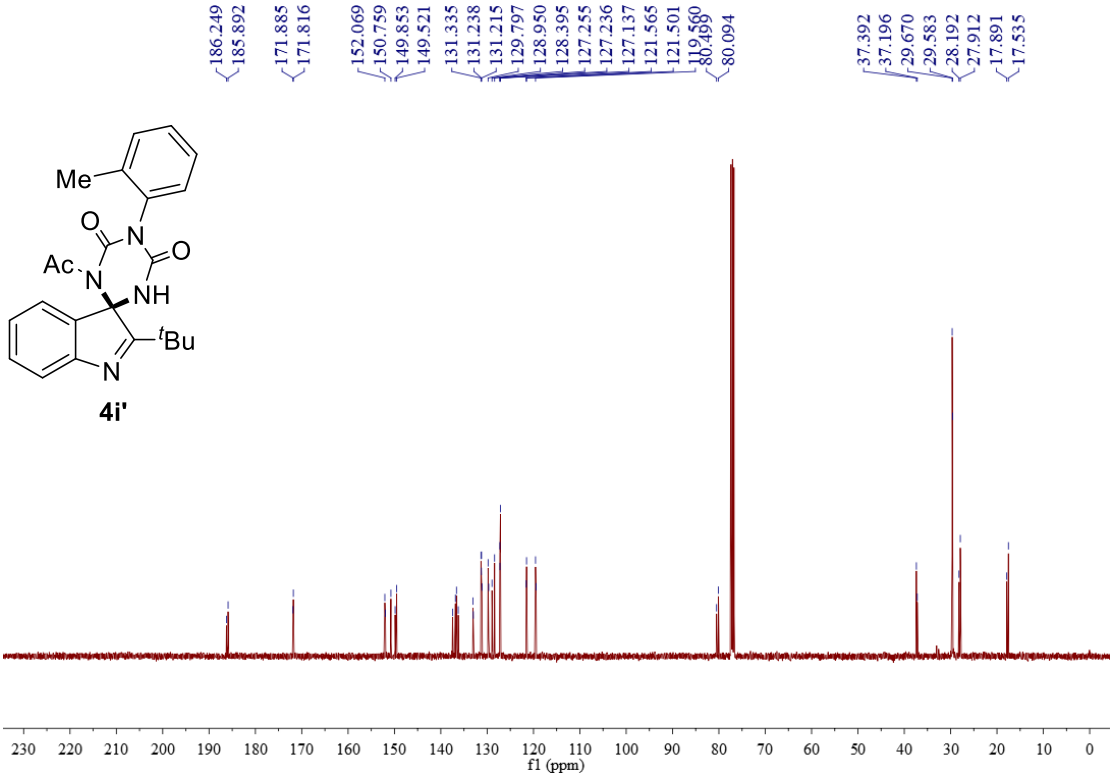
^{13}C NMR spectrum of compound **4h'** ($(CD_3)_2SO$, 100 MHz)



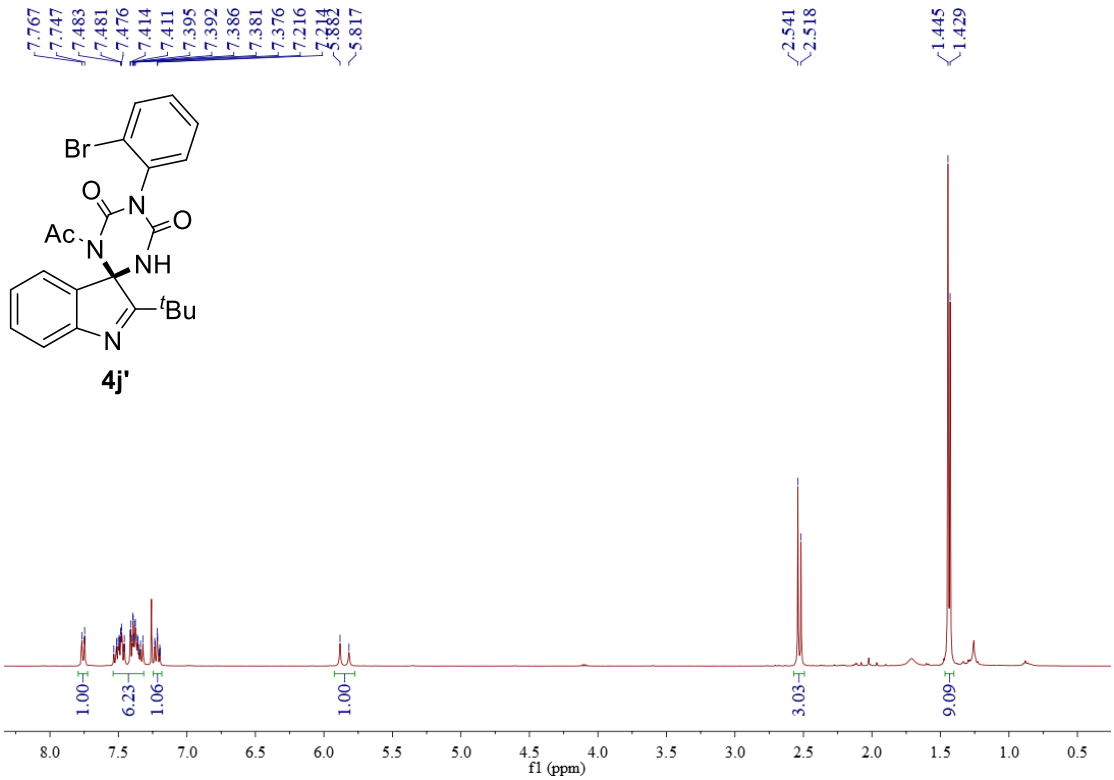
^{1}H NMR spectrum of compound **4i'** ($CDCl_3$, 400 MHz)



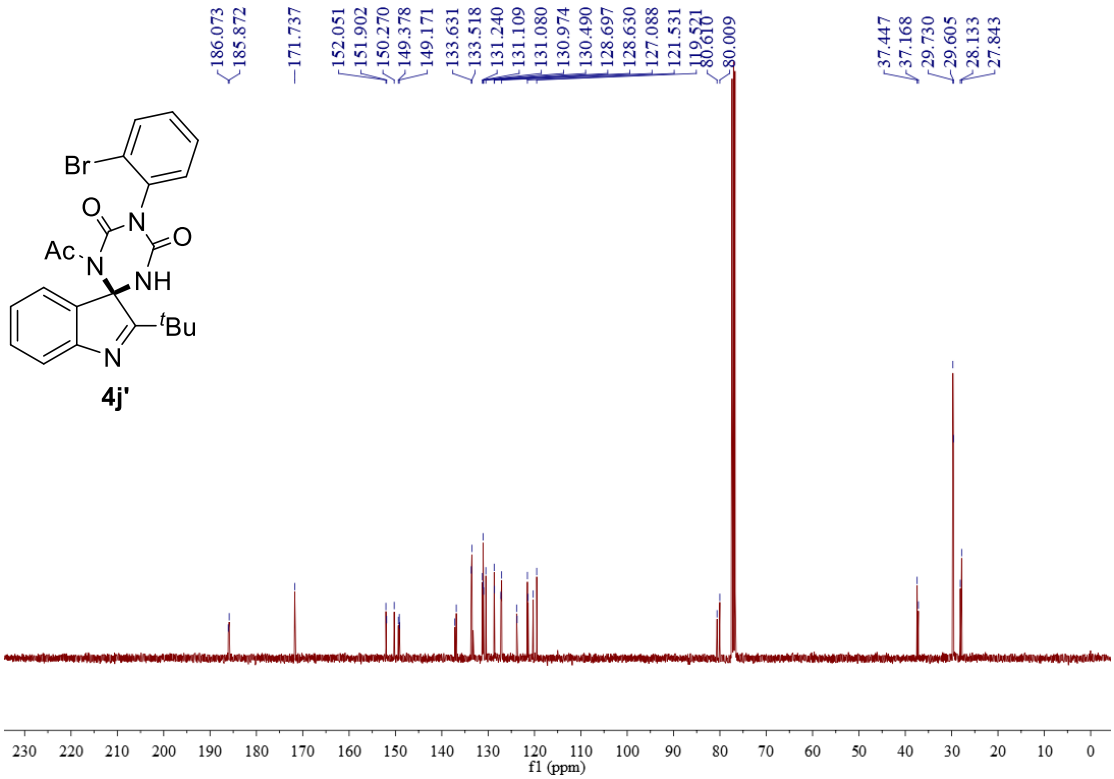
^{13}C NMR spectrum of compound **4i'** ($CDCl_3$, 100 MHz)



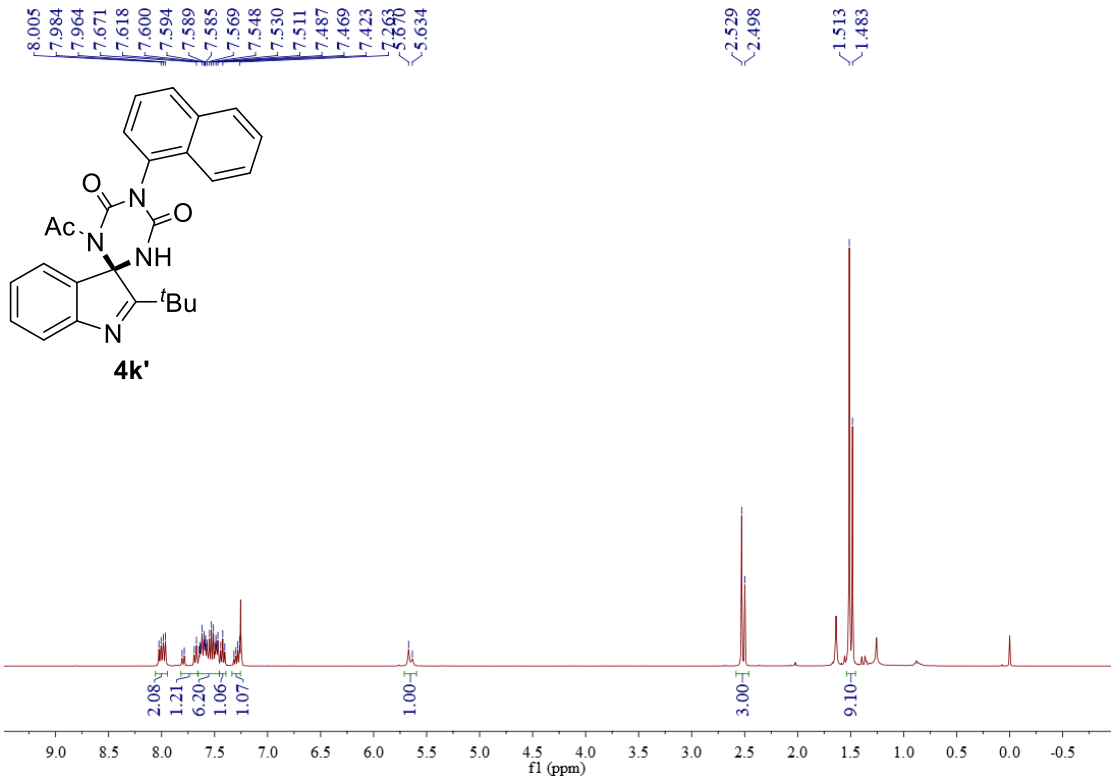
^{1}H NMR spectrum of compound **4j'** ($CDCl_3$, 400 MHz)



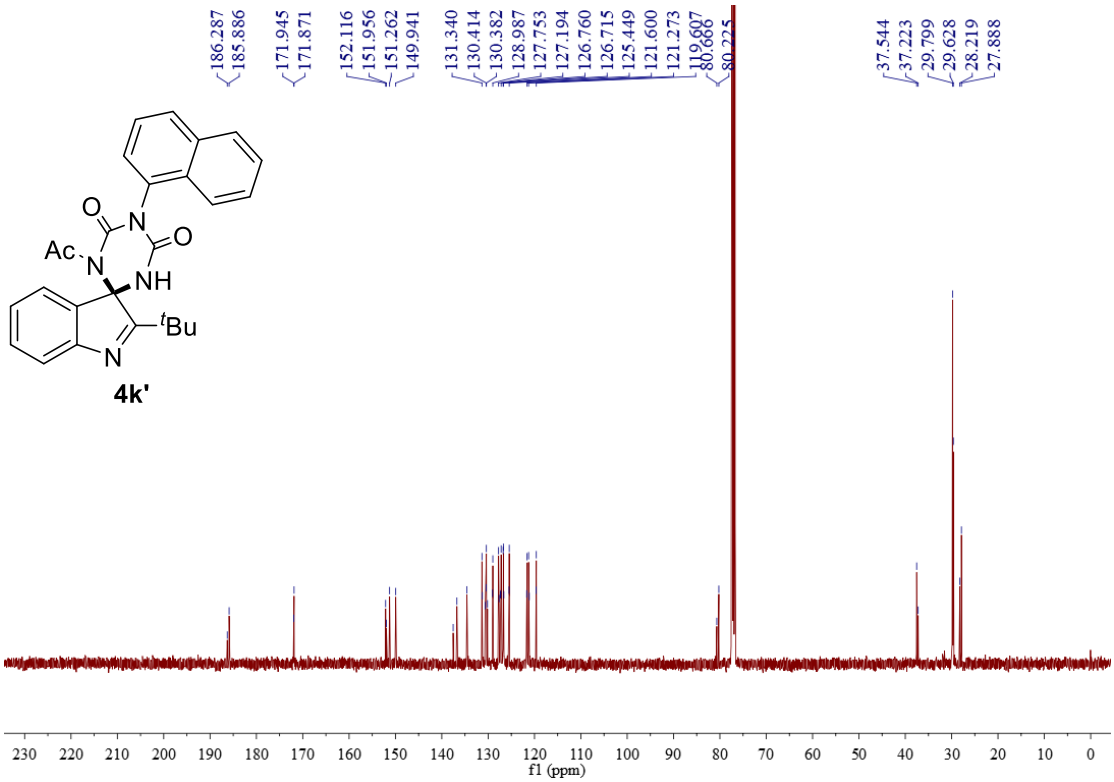
^{13}C NMR spectrum of compound **4j'** ($CDCl_3$, 100 MHz)



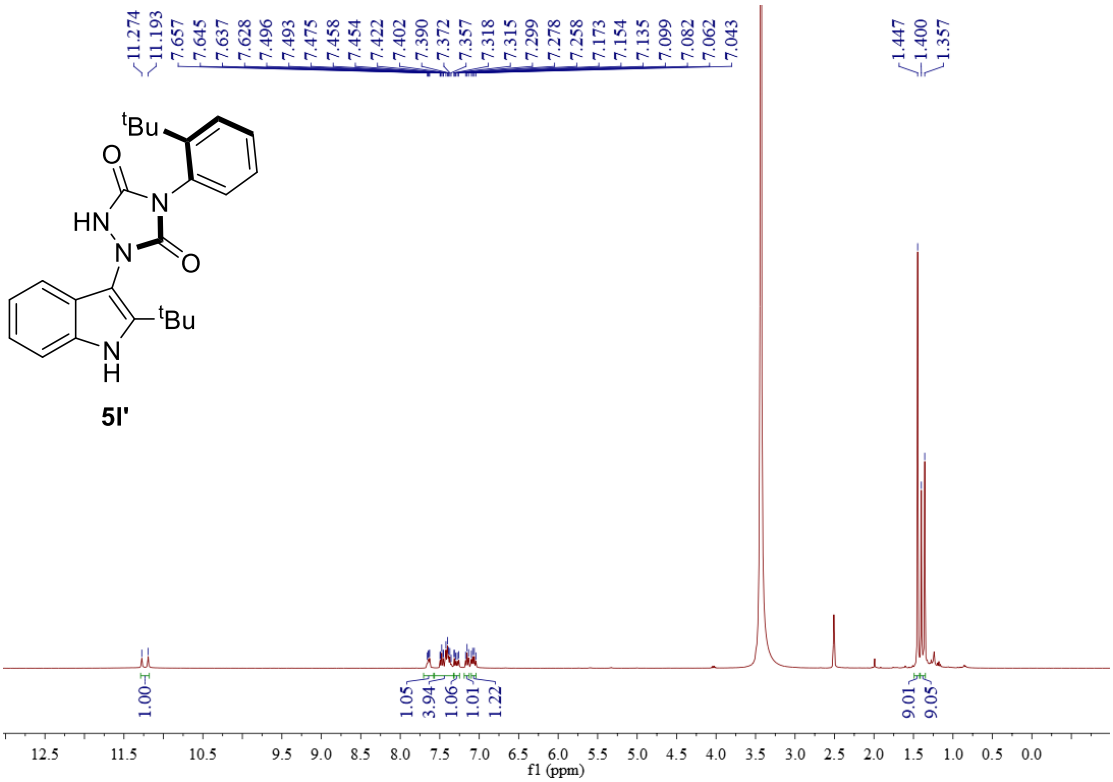
^{1}H NMR spectrum of compound **4k'** ($CDCl_3$, 400 MHz)



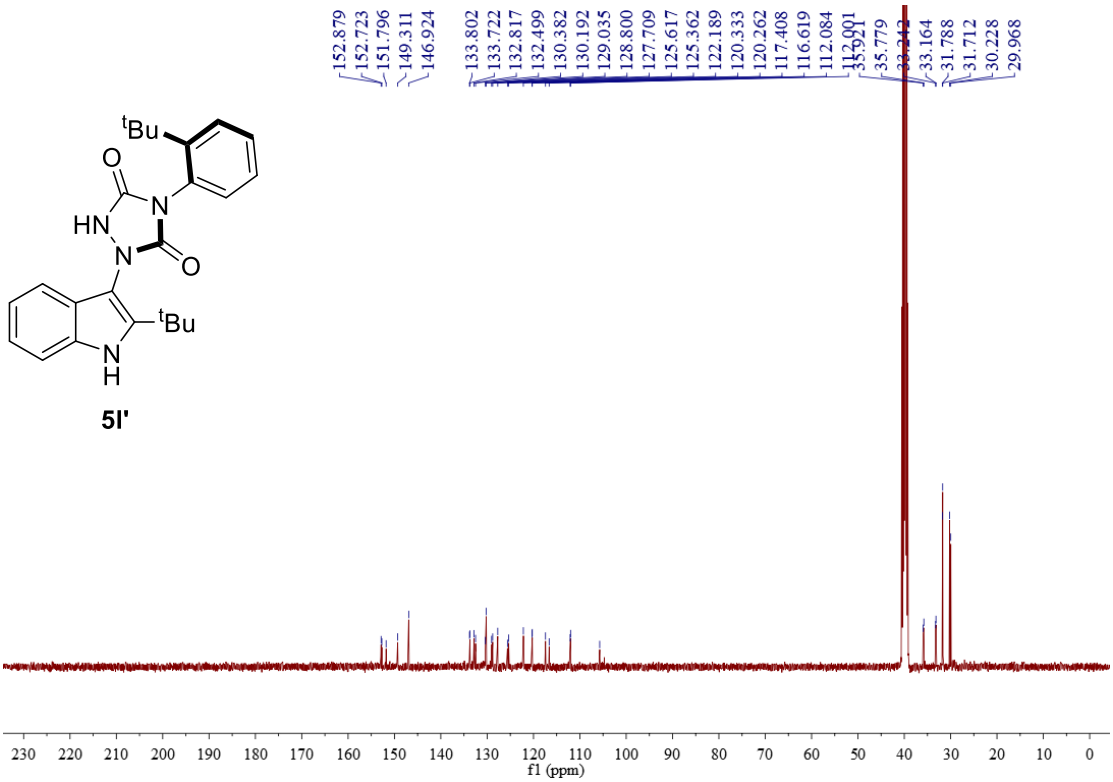
^{13}C NMR spectrum of compound **4k'** ($CDCl_3$, 100 MHz)



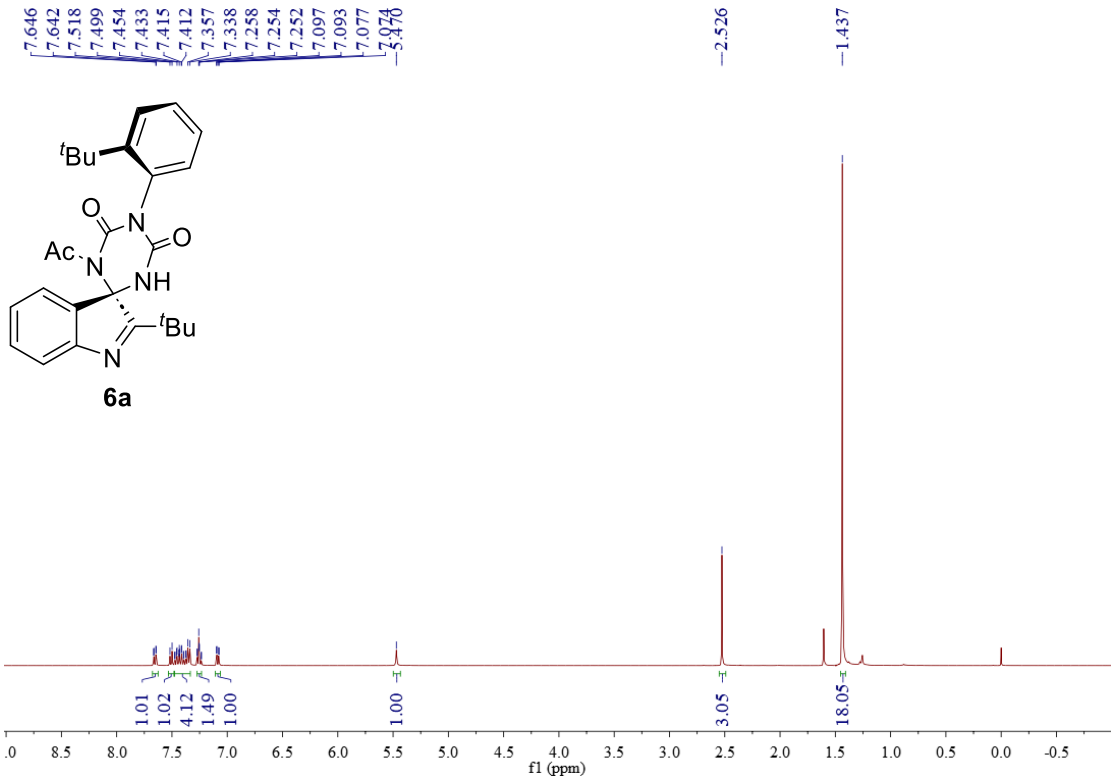
^{1}H NMR spectrum of compound **5l'** ($(CD_3)_2SO$, 400 MHz)



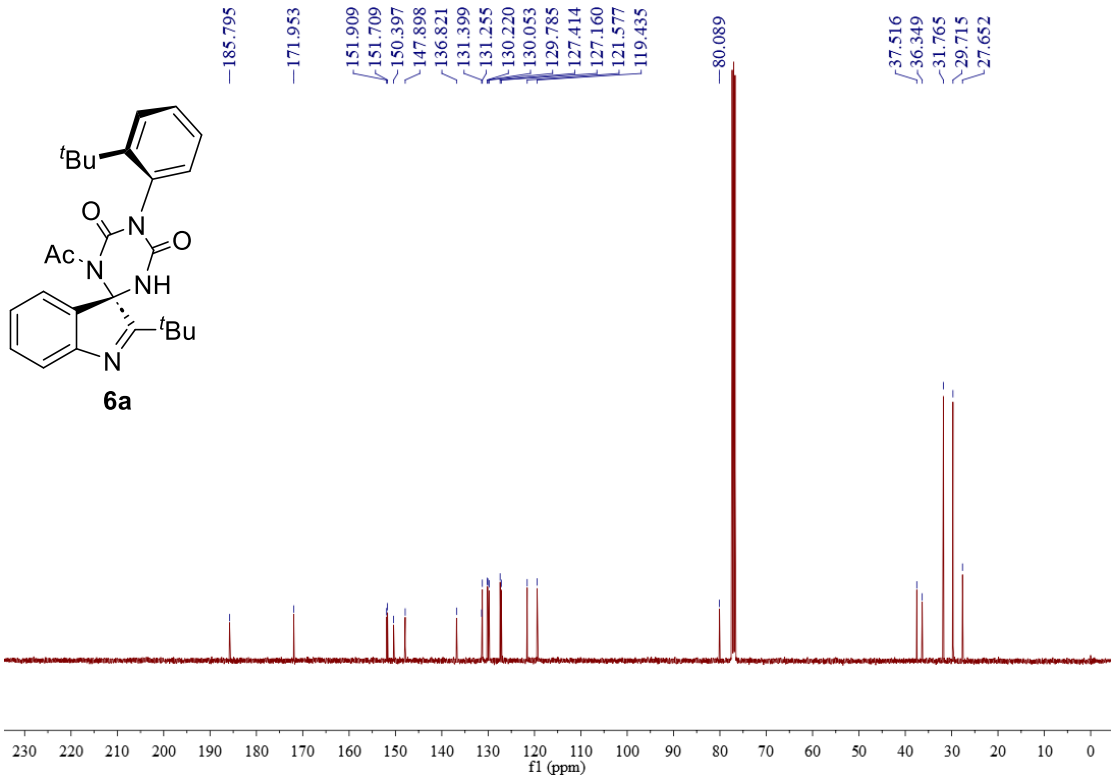
^{13}C NMR spectrum of compound **5l'** ($(CD_3)_2SO$, 100 MHz)



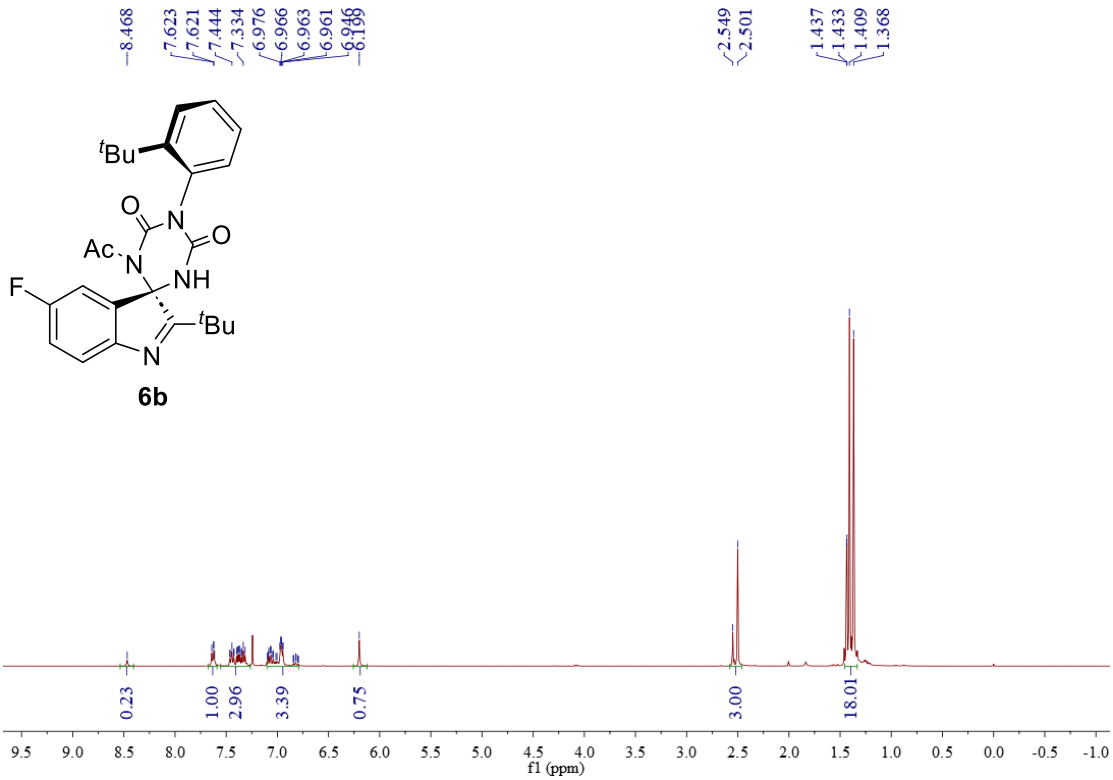
^{1}H NMR spectrum of compound **6a** ($CDCl_3$, 400 MHz)



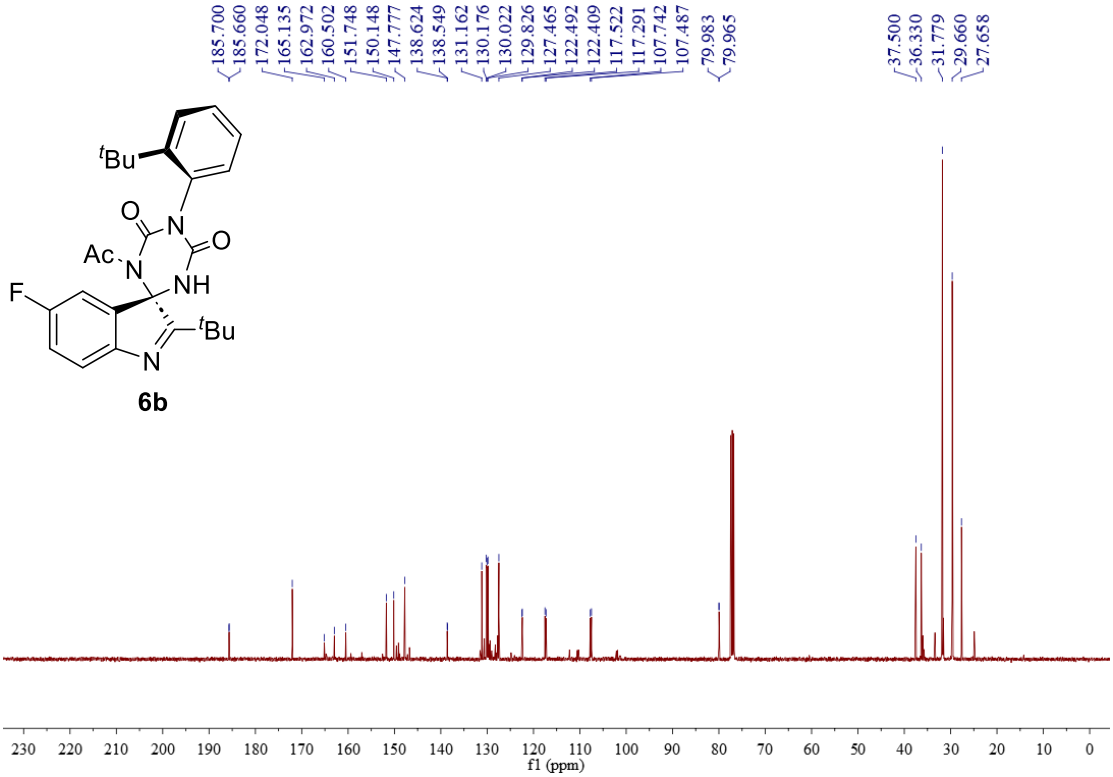
^{13}C NMR spectrum of compound **6a** ($CDCl_3$, 100 MHz)



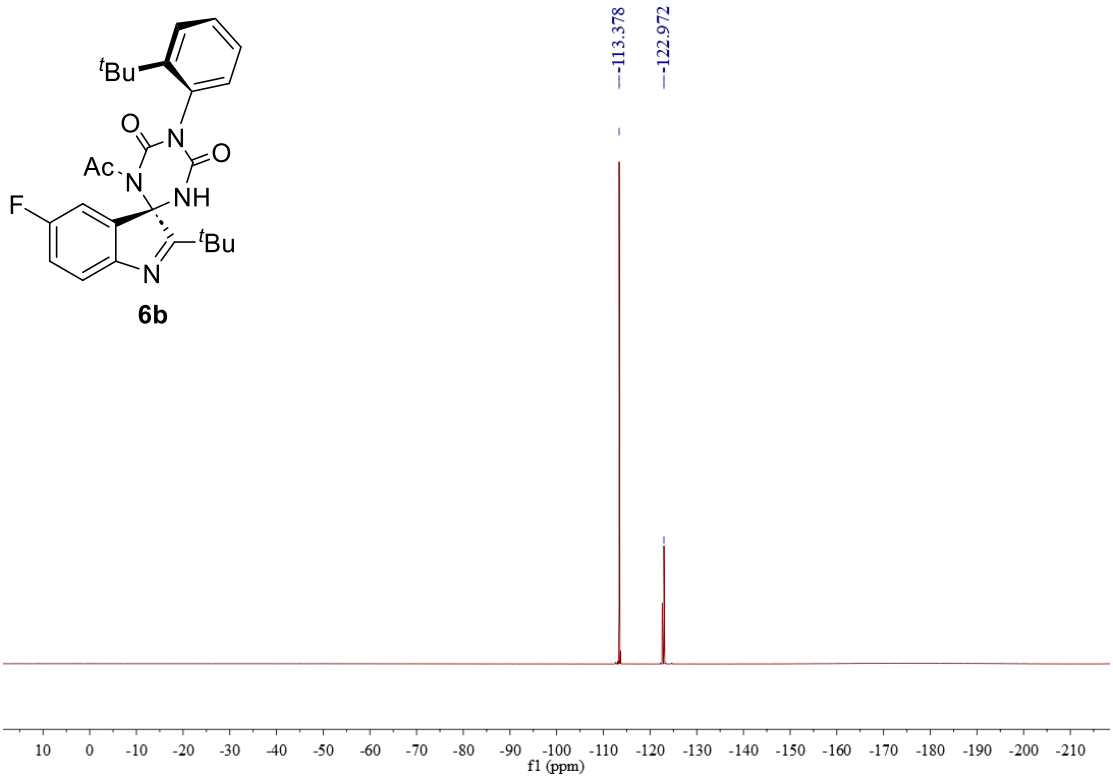
^{1}H NMR spectrum of compound **6b** ($CDCl_3$, 400 MHz)



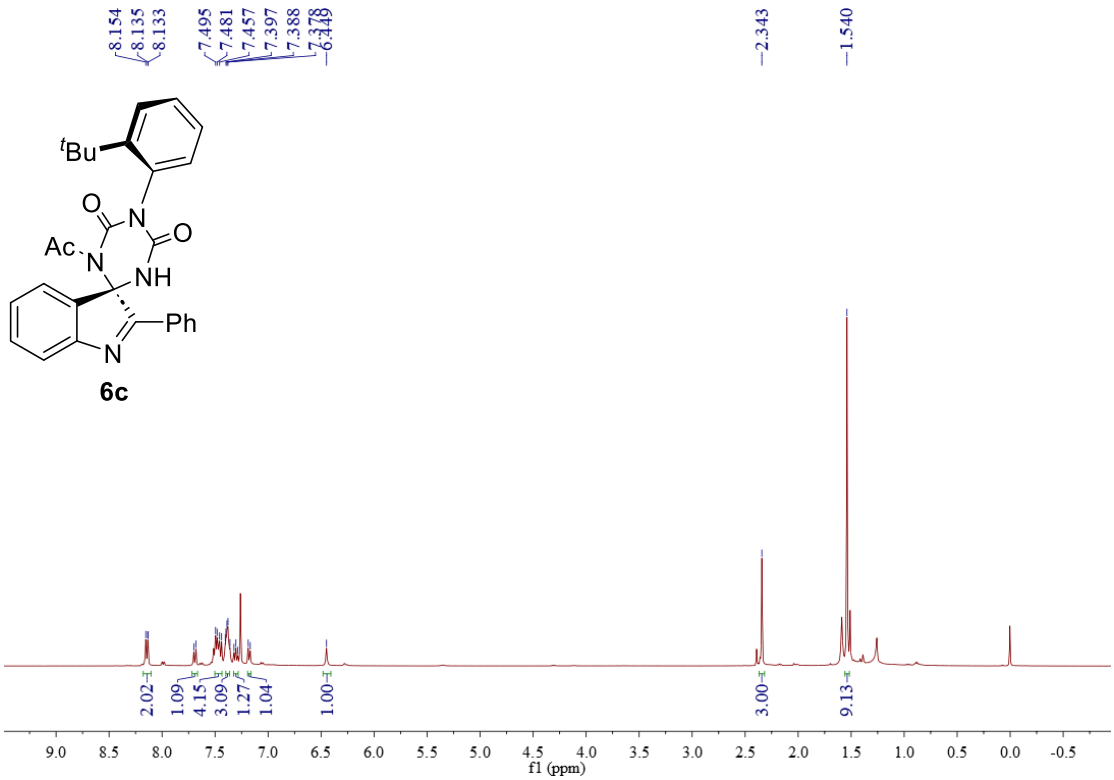
^{13}C NMR spectrum of compound **6b** ($CDCl_3$, 100 MHz)



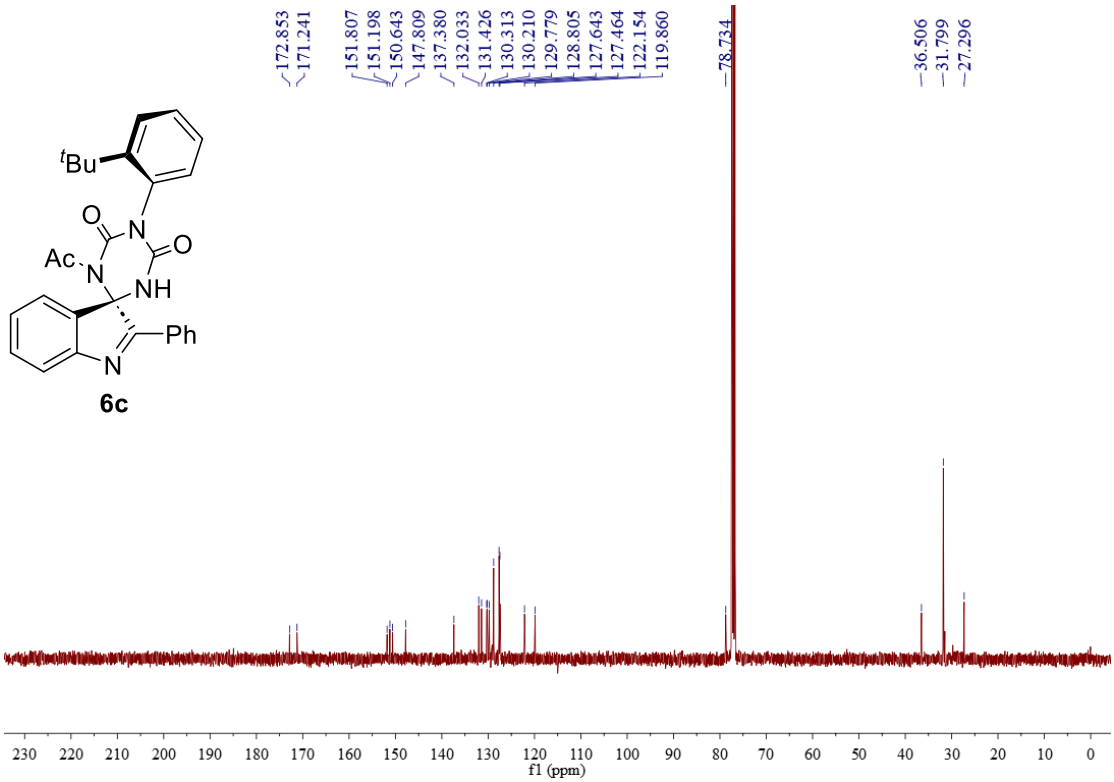
^{19}F NMR spectrum of compound **6b** ($CDCl_3$, 376 MHz)



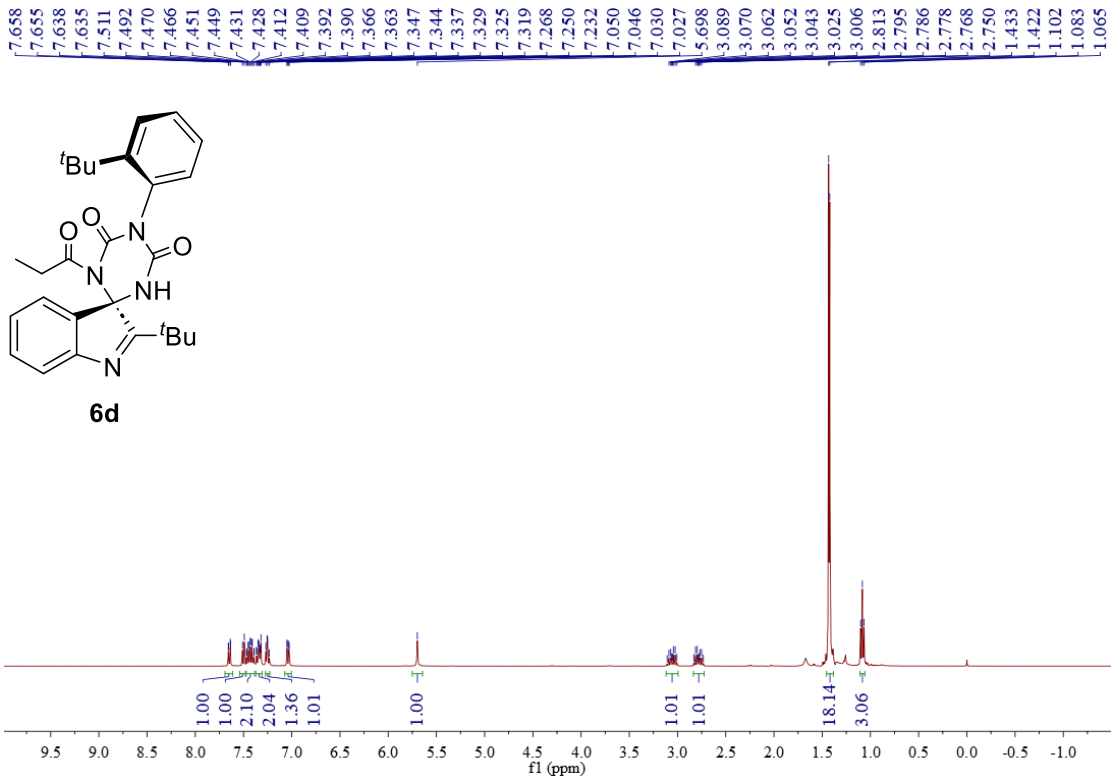
^{1}H NMR spectrum of compound **6c** ($CDCl_3$, 400 MHz)



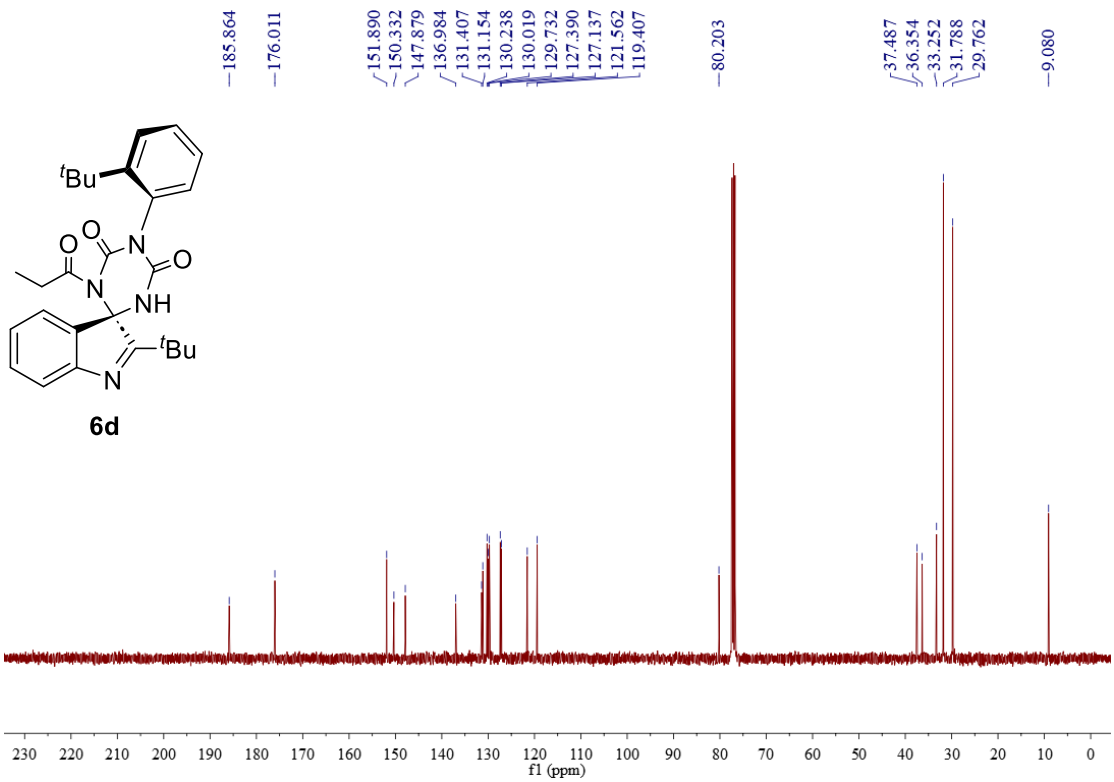
^{13}C NMR spectrum of compound **6c** ($CDCl_3$, 100 MHz)



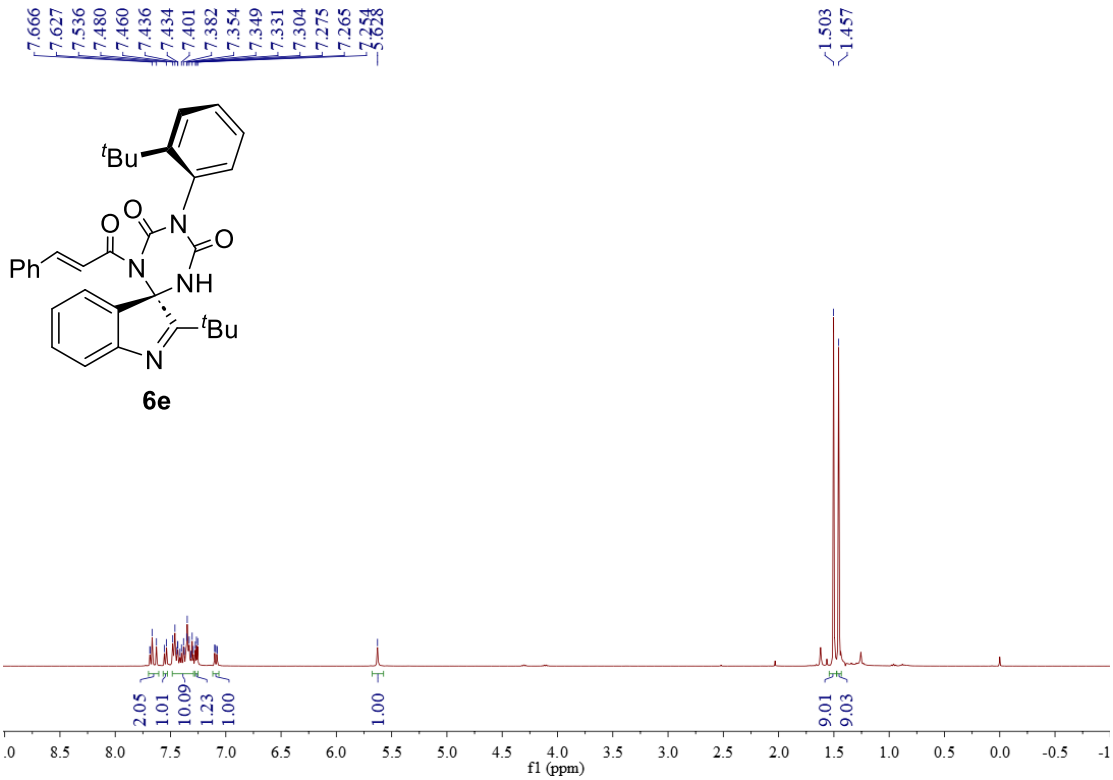
^{1}H NMR spectrum of compound **6d** ($CDCl_3$, 400 MHz)



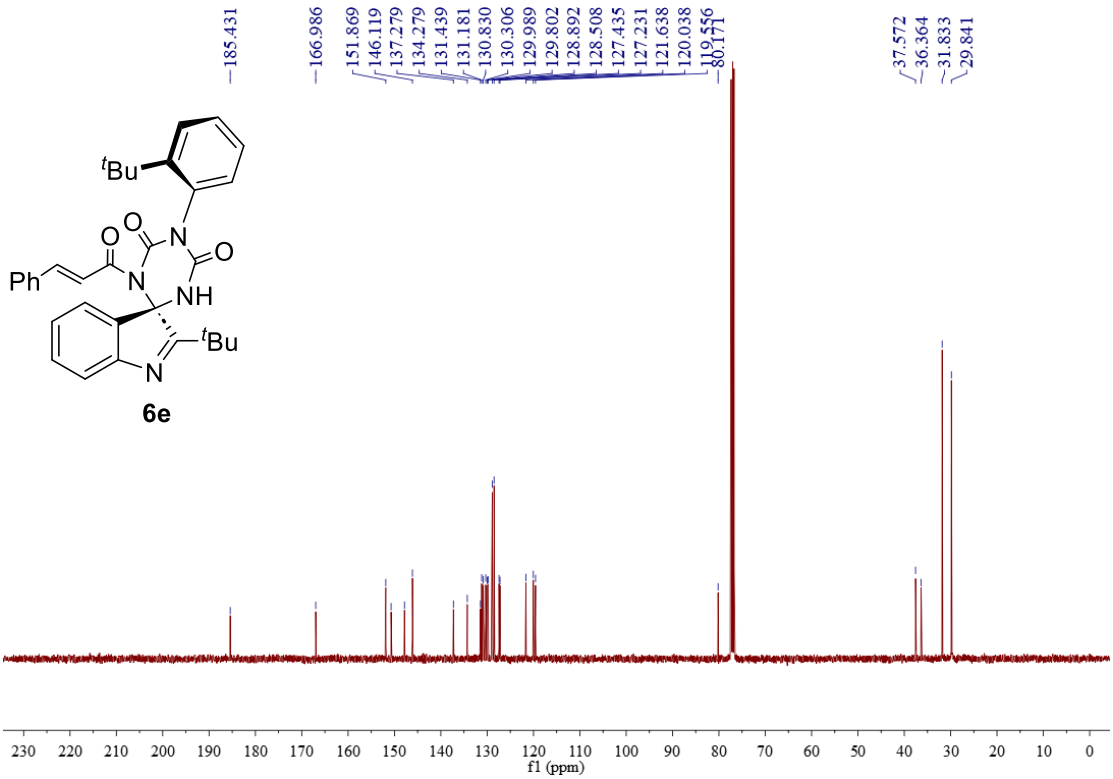
^{13}C NMR spectrum of compound **6d** ($CDCl_3$, 100 MHz)



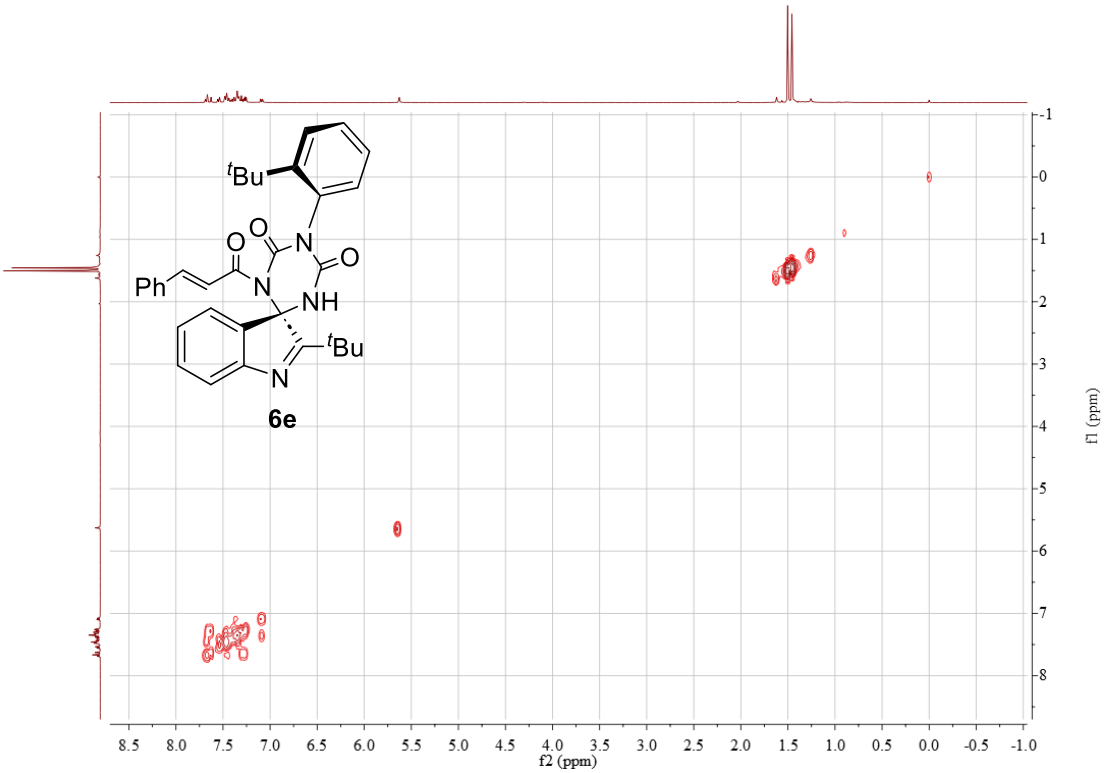
^{1}H NMR spectrum of compound **6e** ($CDCl_3$, 400 MHz)



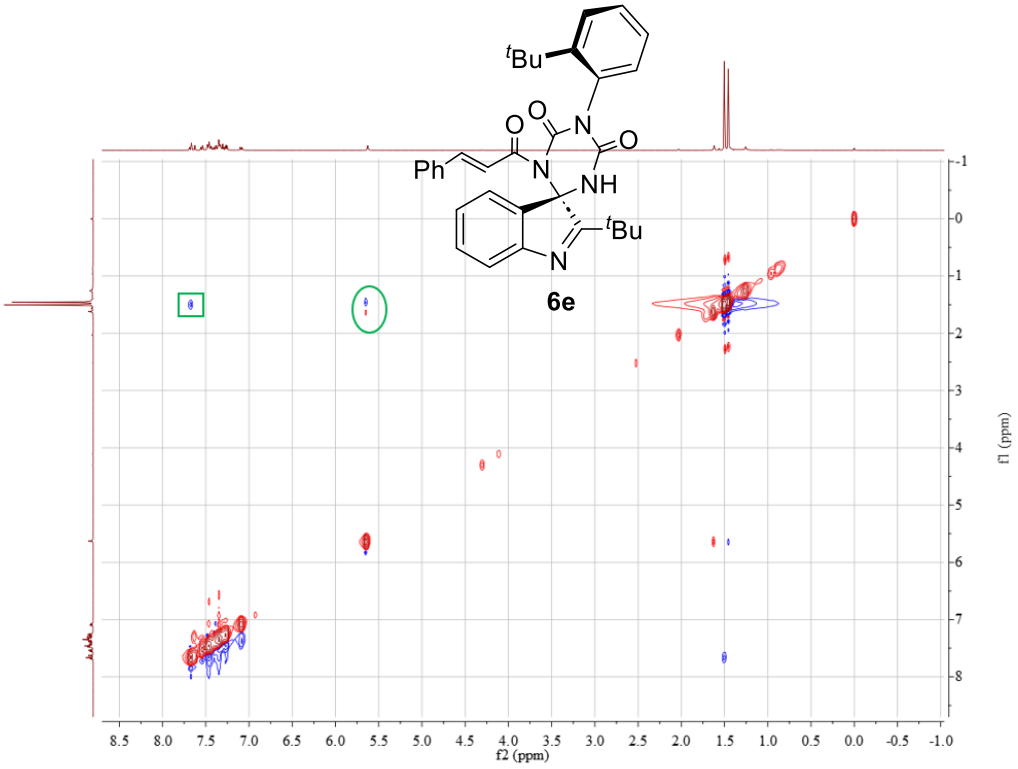
^{13}C NMR spectrum of compound **6e** ($CDCl_3$, 100 MHz)



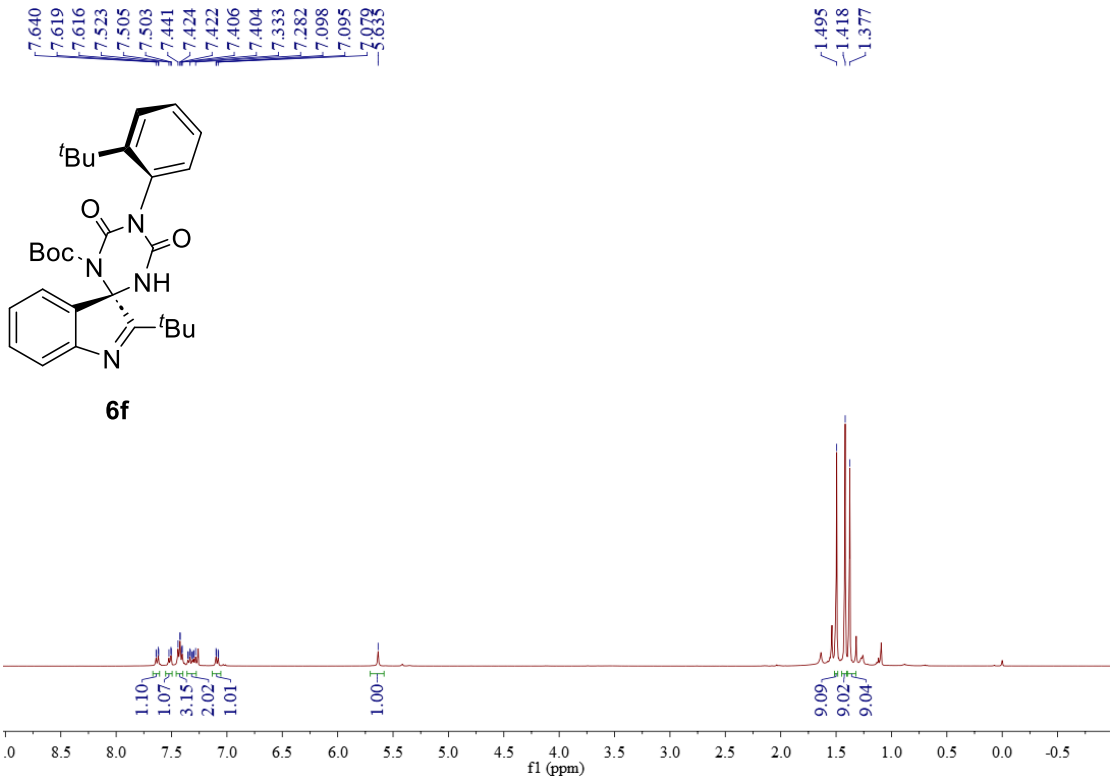
Cosy spectrum of compound **6e** ($CDCl_3$, 400 MHz)



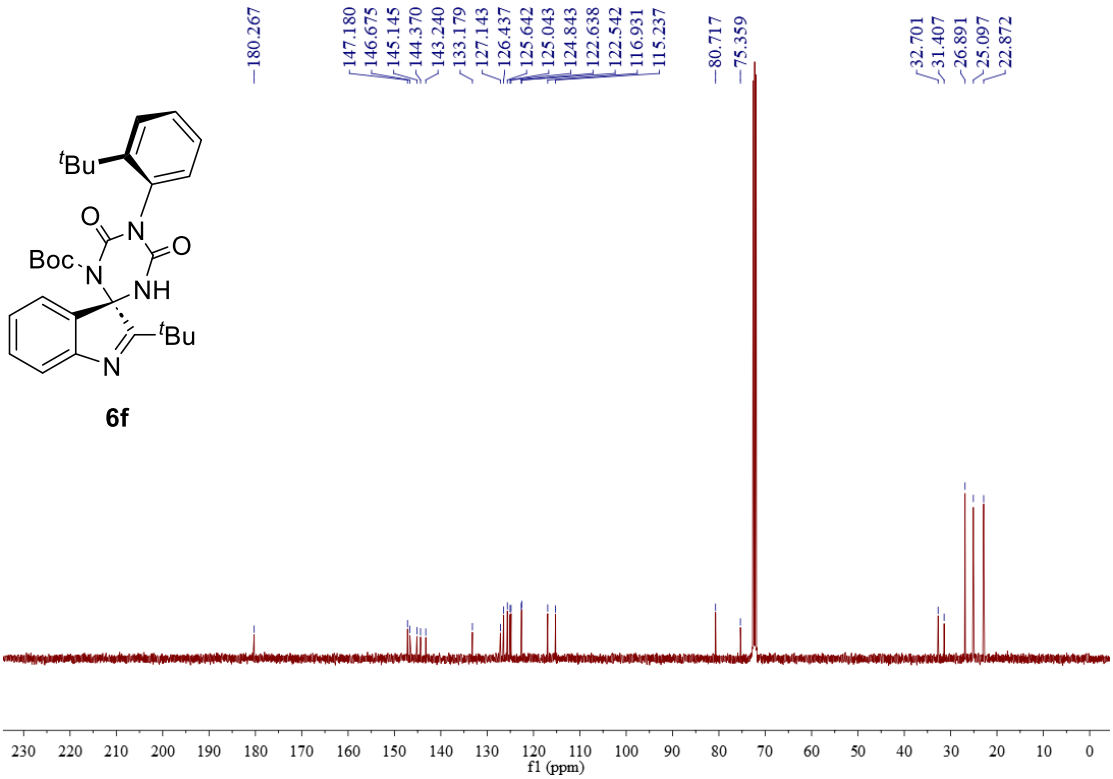
Noesy spectrum of compound **6e** ($CDCl_3$, 400 MHz)



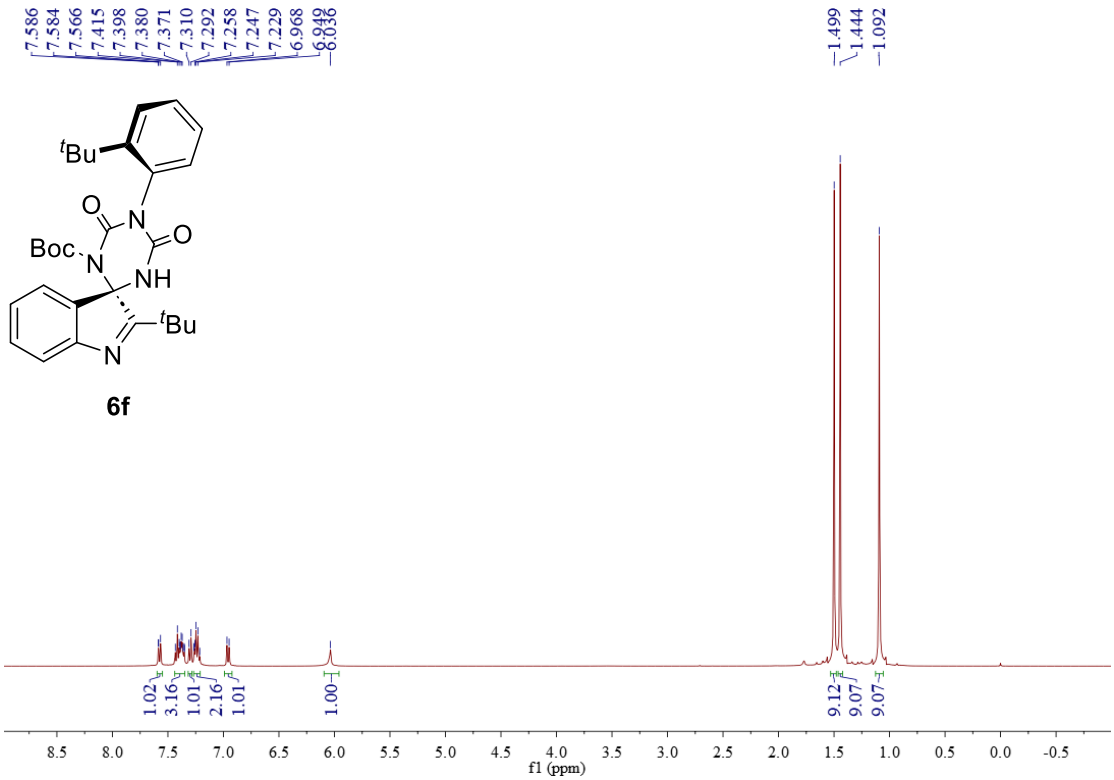
^{1}H NMR spectrum of compound **6f (minor isomer)** ($CDCl_3$, 400 MHz)



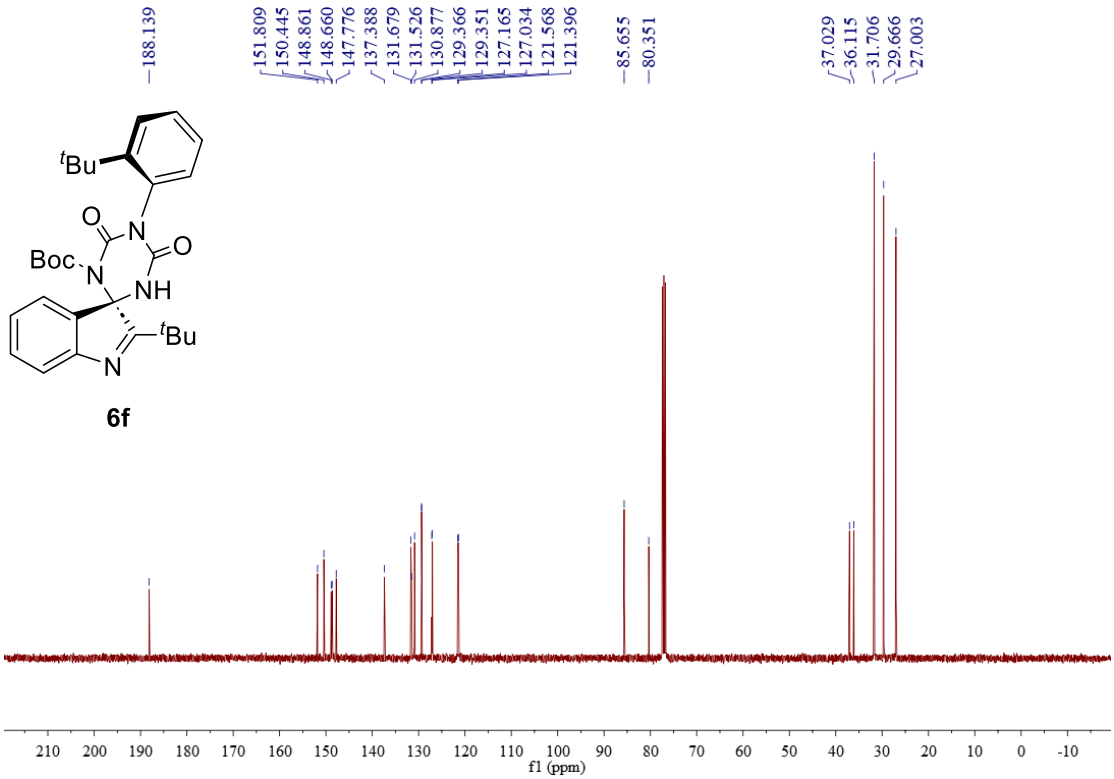
^{13}C NMR spectrum of compound **6f (minor isomer)** ($CDCl_3$, 100 MHz)



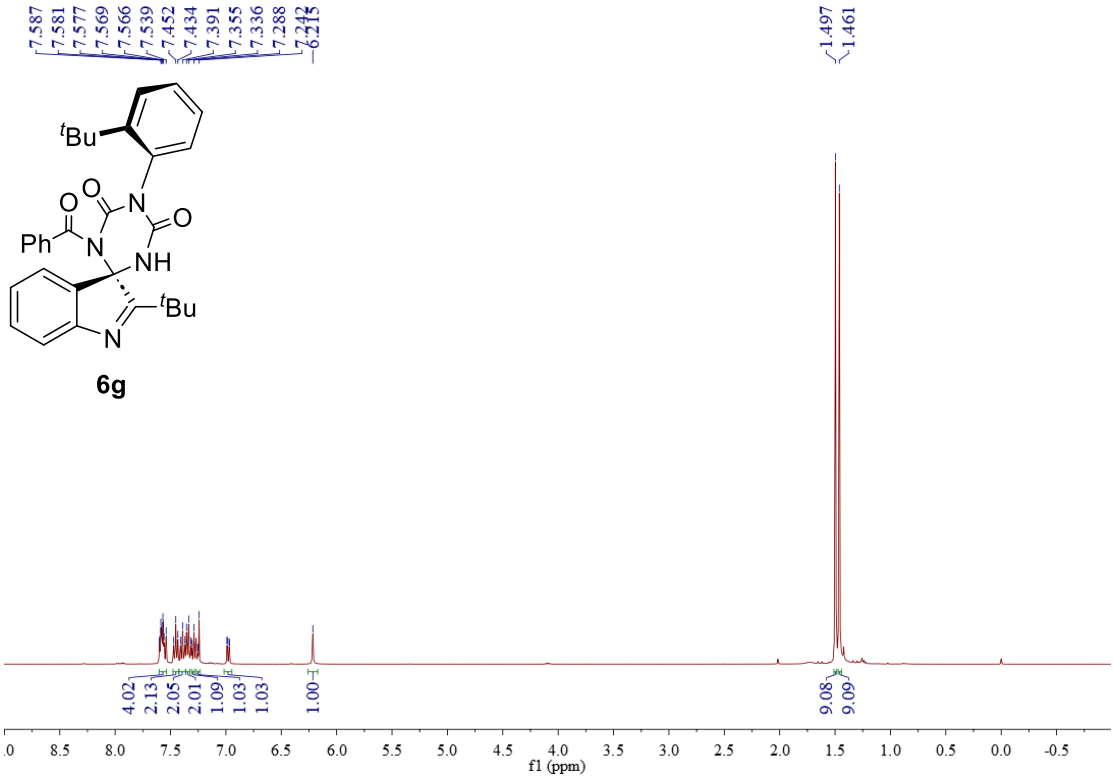
^{1}H NMR spectrum of compound **6f (major isomer)** ($CDCl_3$, 400 MHz)



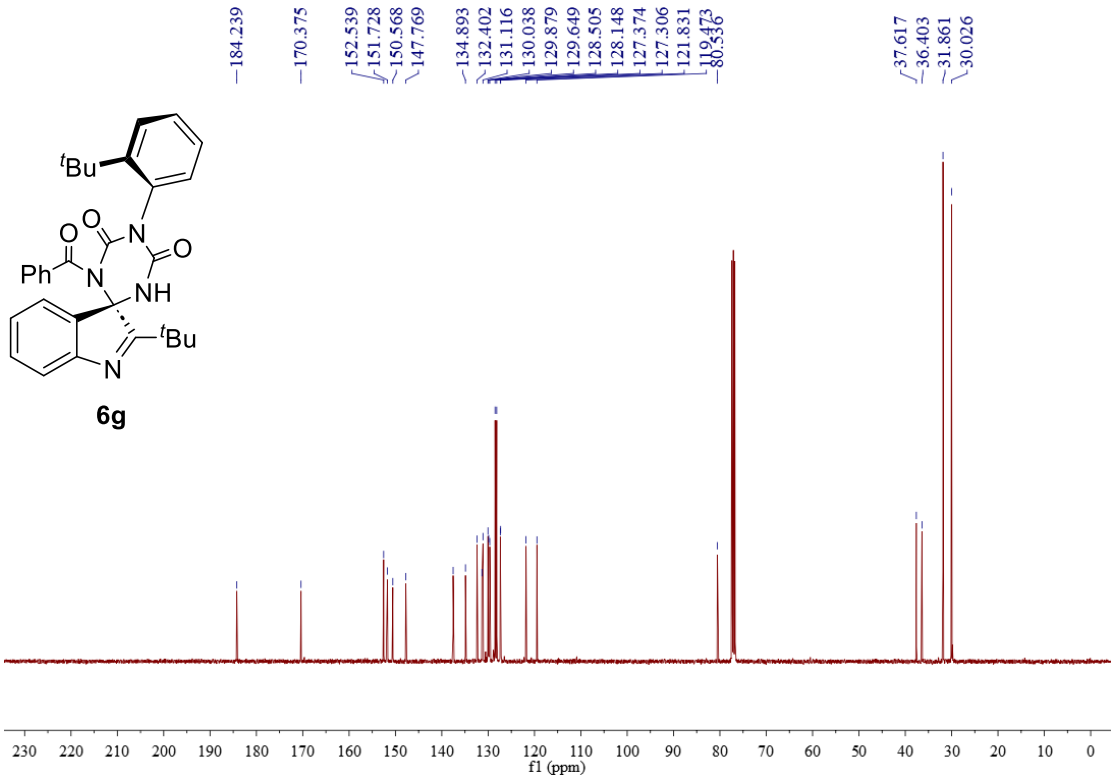
^{13}C NMR spectrum of compound **6f (major isomer)** ($CDCl_3$, 100 MHz)



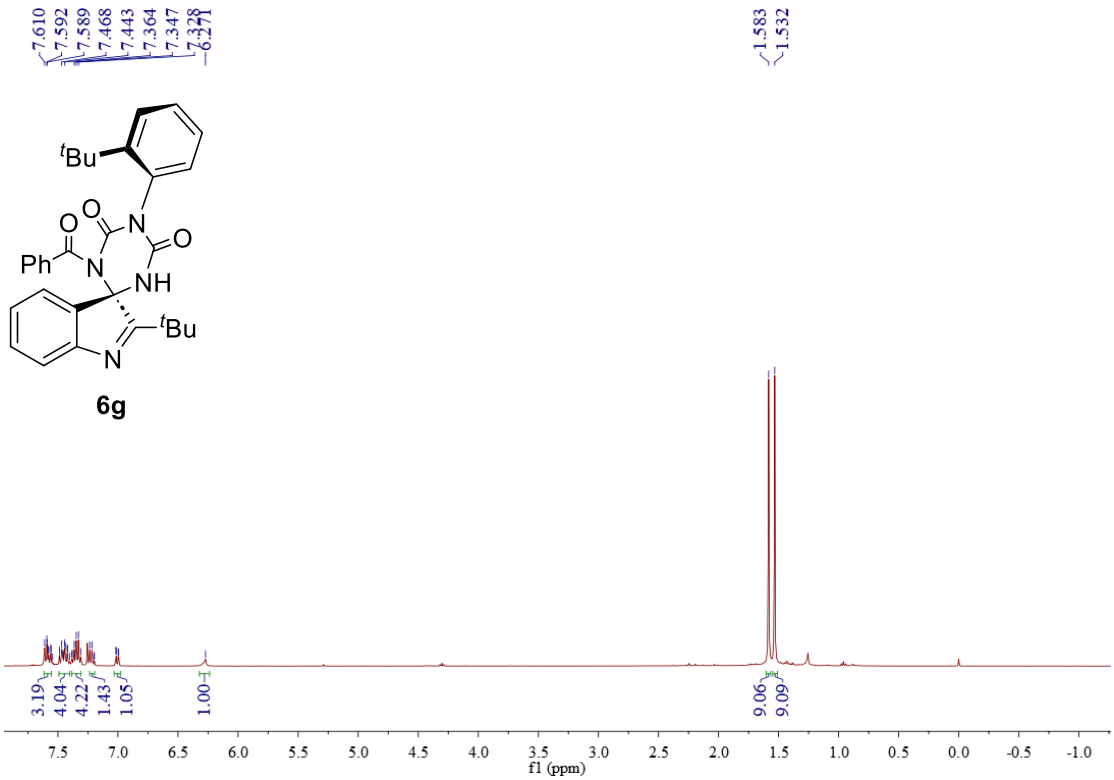
^{1}H NMR spectrum of compound **6g (major isomer)** ($CDCl_3$, 400 MHz)



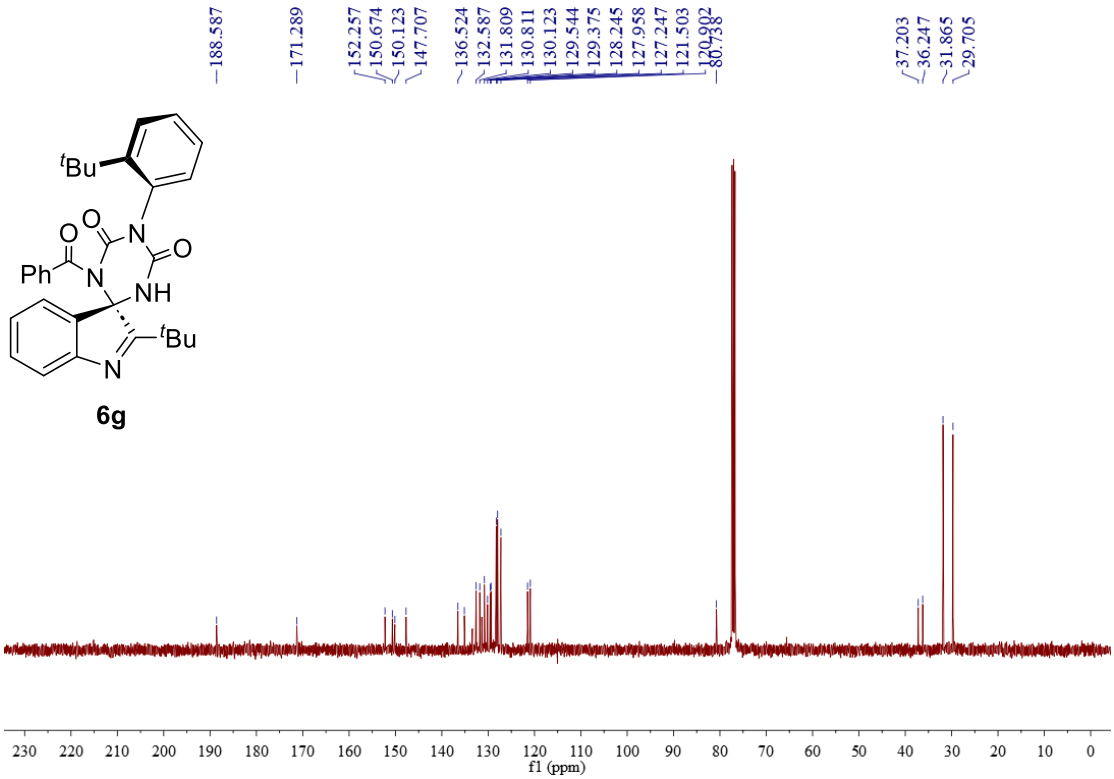
^{13}C NMR spectrum of compound **6g (major isomer)** ($CDCl_3$, 100 MHz)



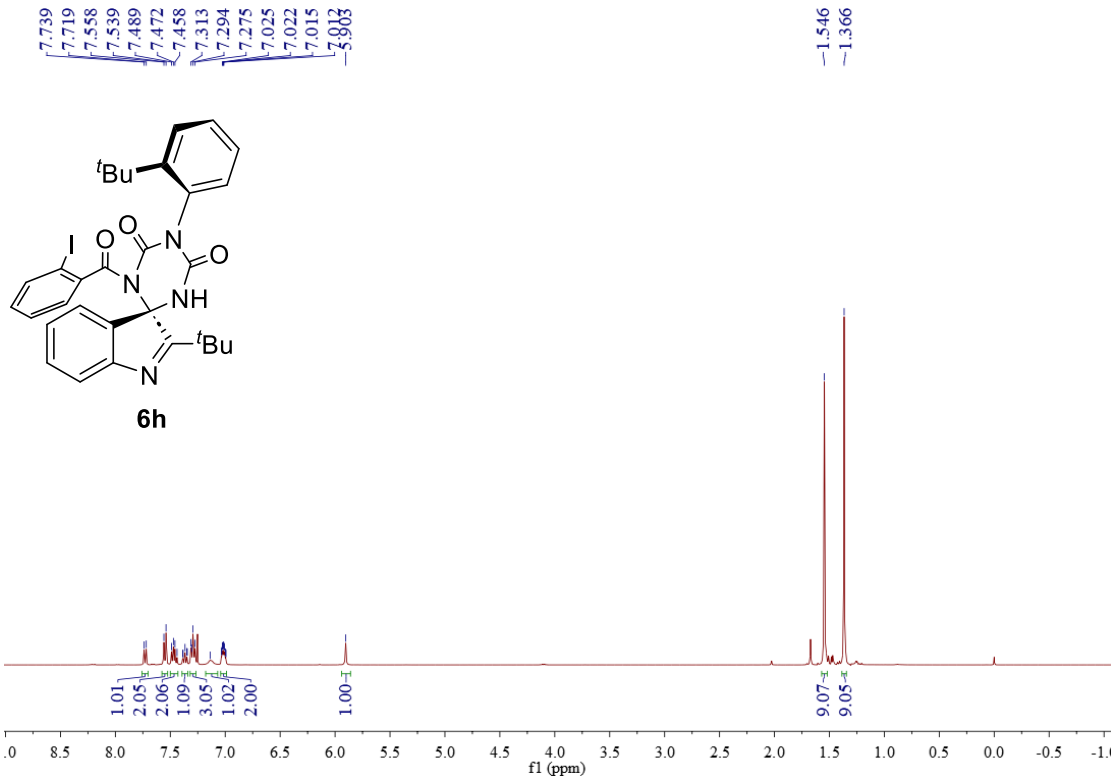
^{1}H NMR spectrum of compound **6g (minor isomer)** ($CDCl_3$, 400 MHz)



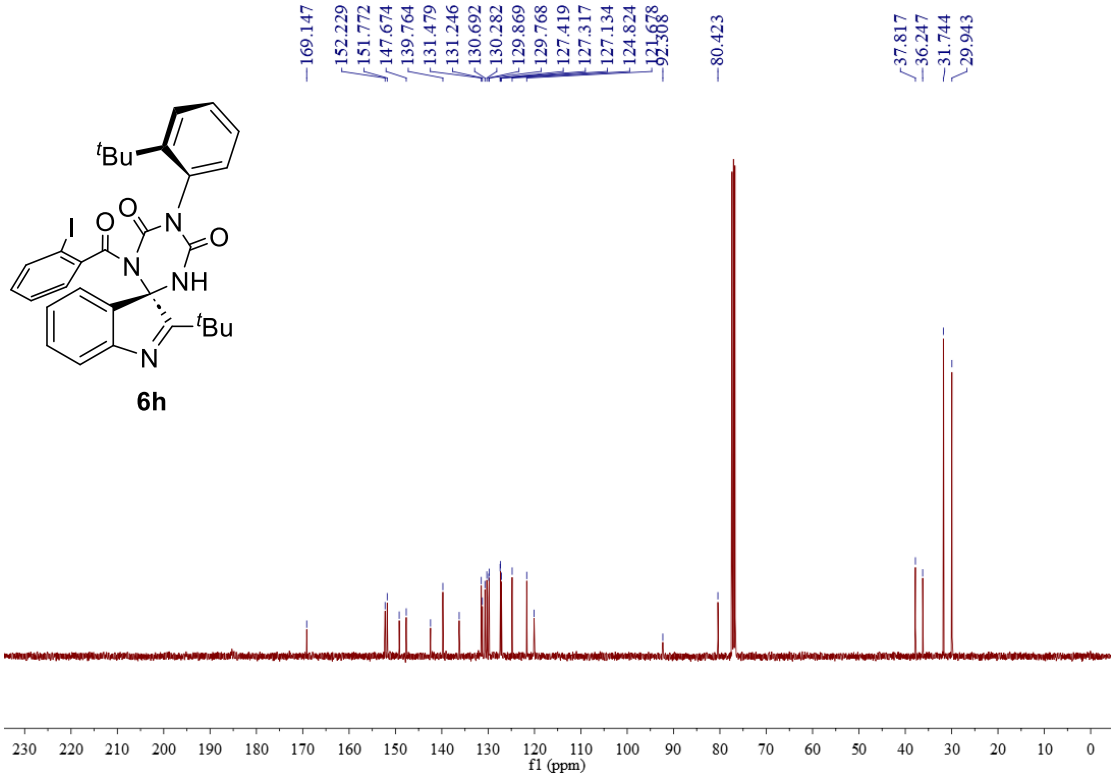
^{13}C NMR spectrum of compound **6g (minor isomer)** ($CDCl_3$, 100 MHz)



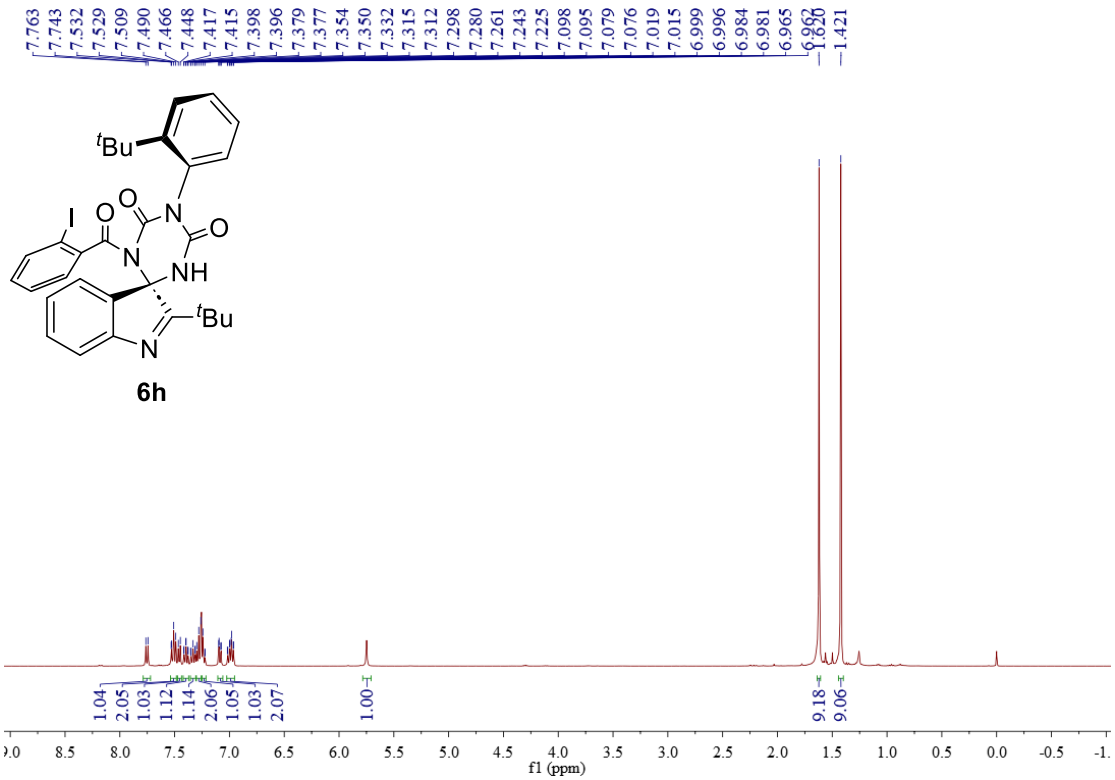
^{1}H NMR spectrum of compound **6h (minor isomer)** ($CDCl_3$, 400 MHz)



^{13}C NMR spectrum of compound **6h (minor isomer)** ($CDCl_3$, 100 MHz)

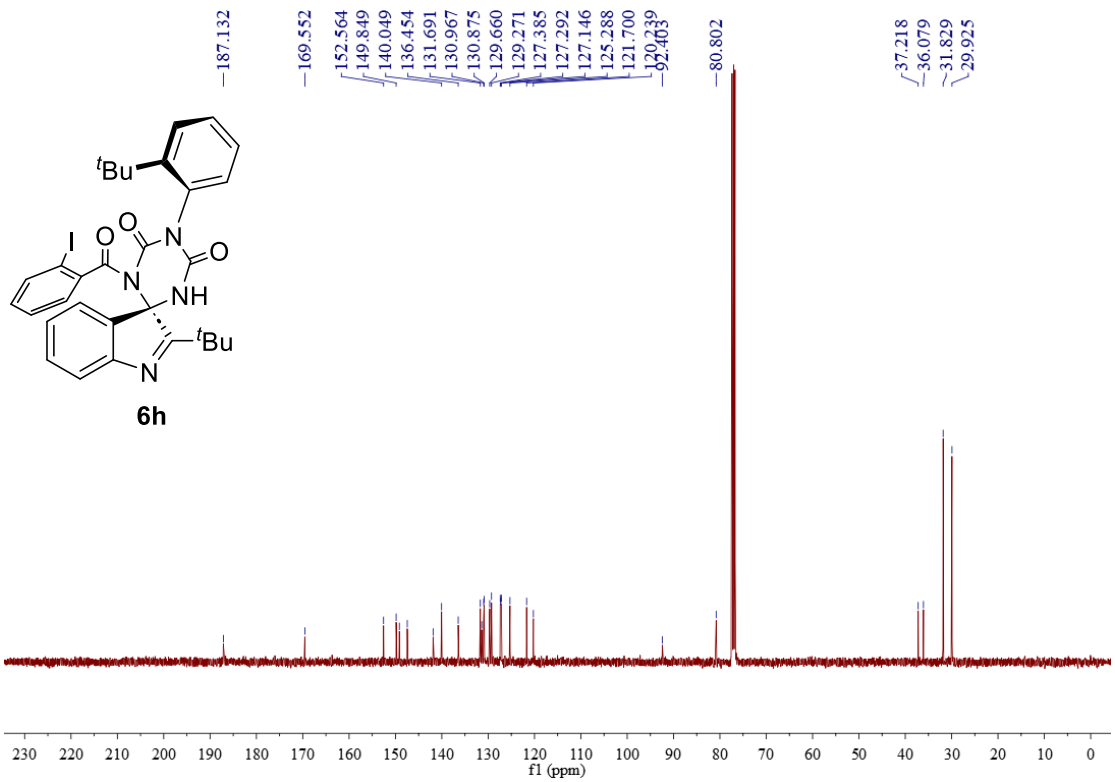


^{1}H NMR spectrum of compound **6h (major isomer)** ($CDCl_3$, 400 MHz)



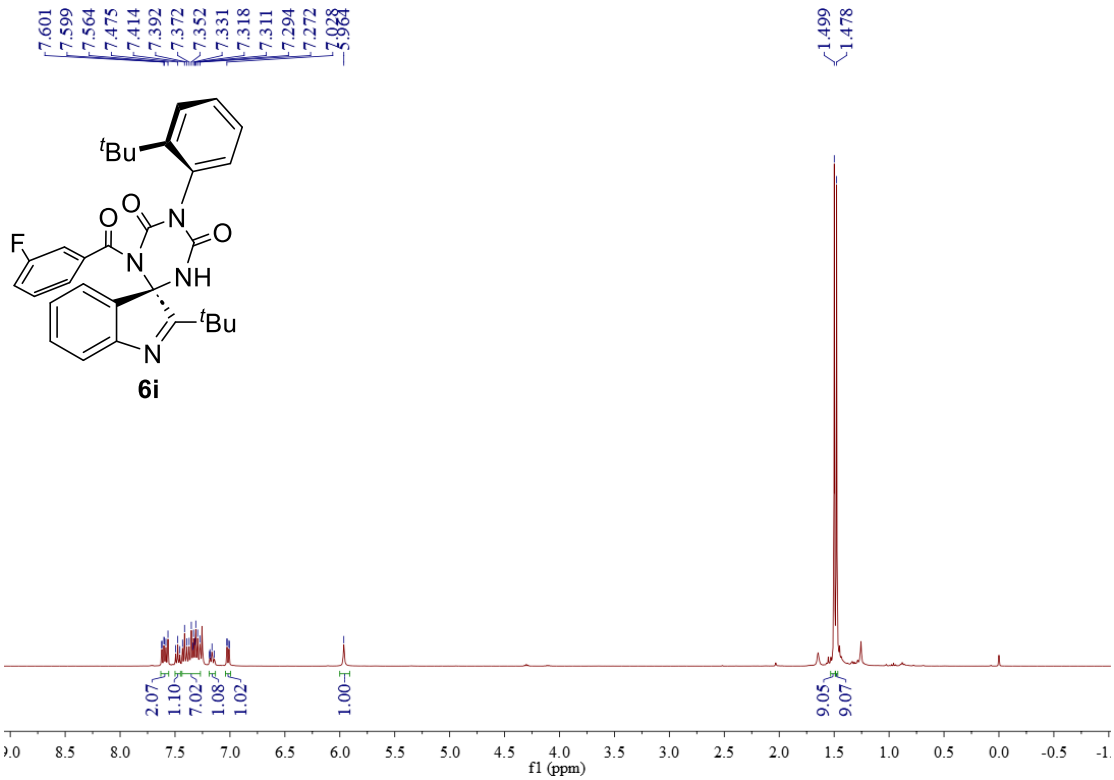
6h

^{13}C NMR spectrum of compound **6g (major isomer)** ($CDCl_3$, 100 MHz)

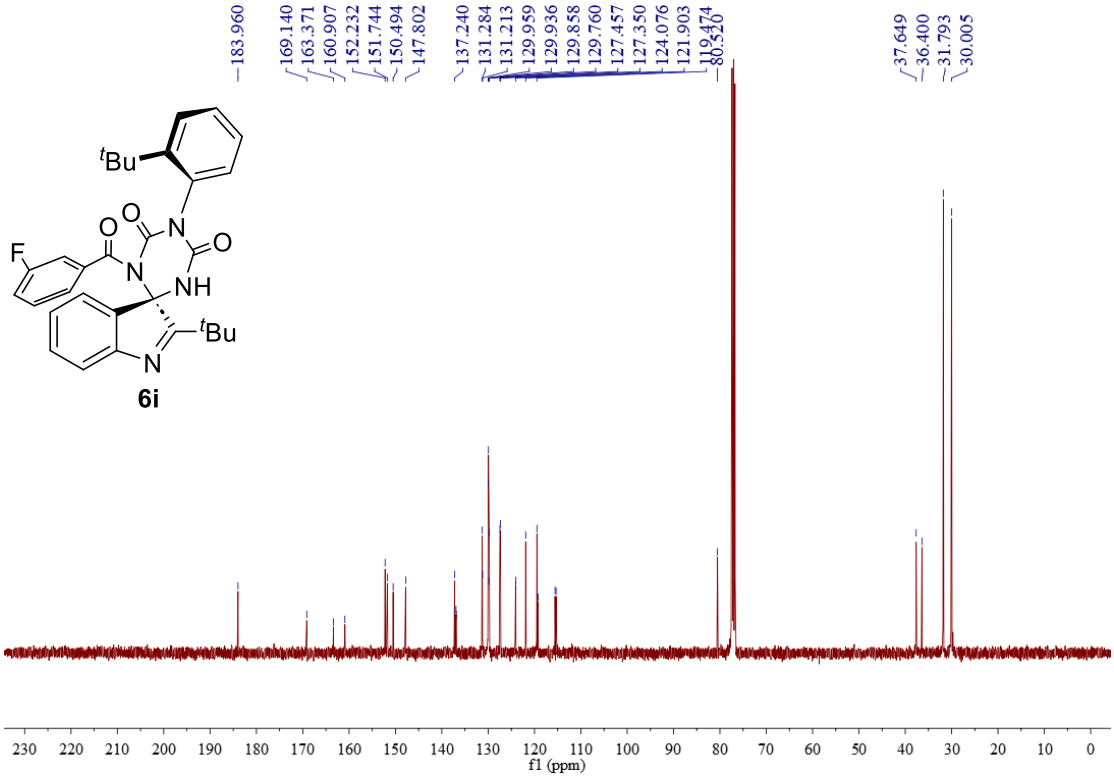


6h

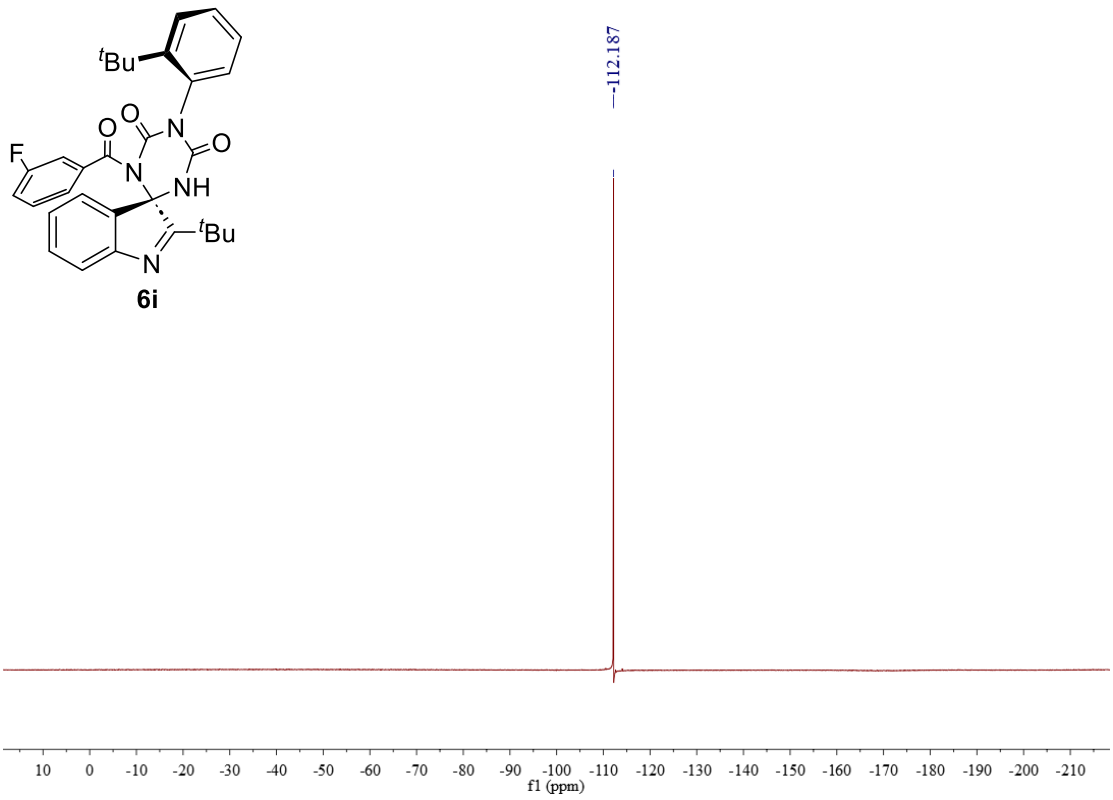
^{1}H NMR spectrum of compound **6i (major isomer)** ($CDCl_3$, 400 MHz)



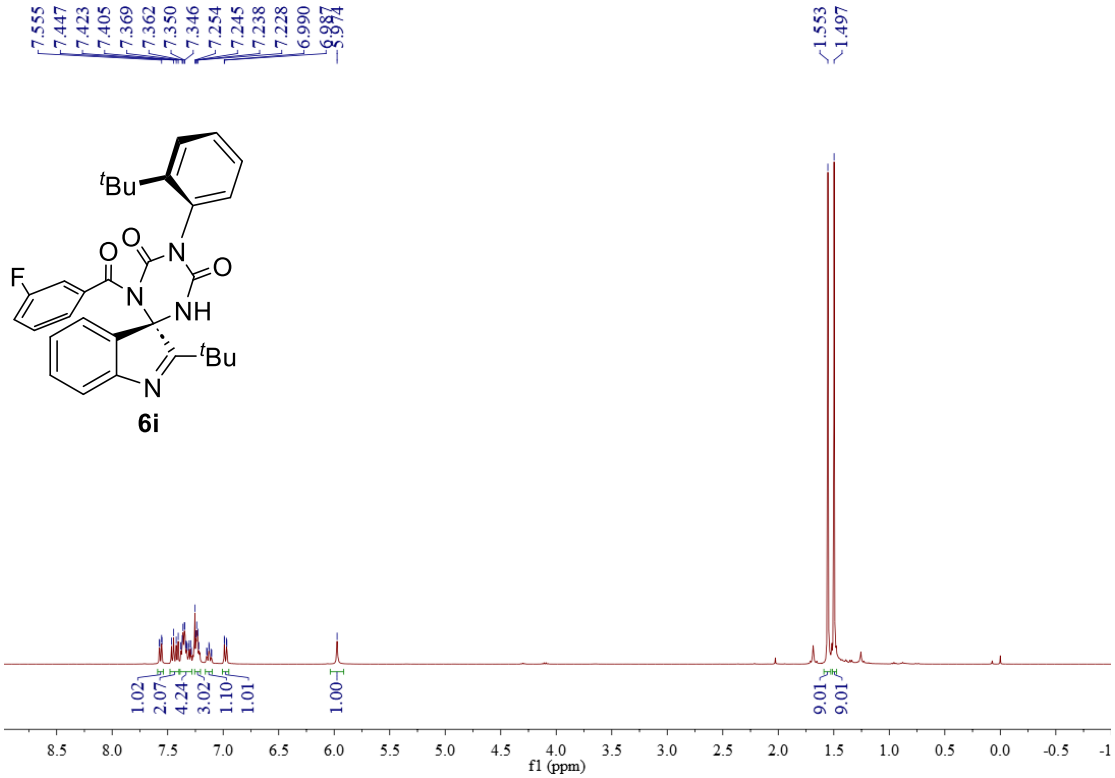
^{13}C NMR spectrum of compound **6g (major isomer)** ($CDCl_3$, 100 MHz)



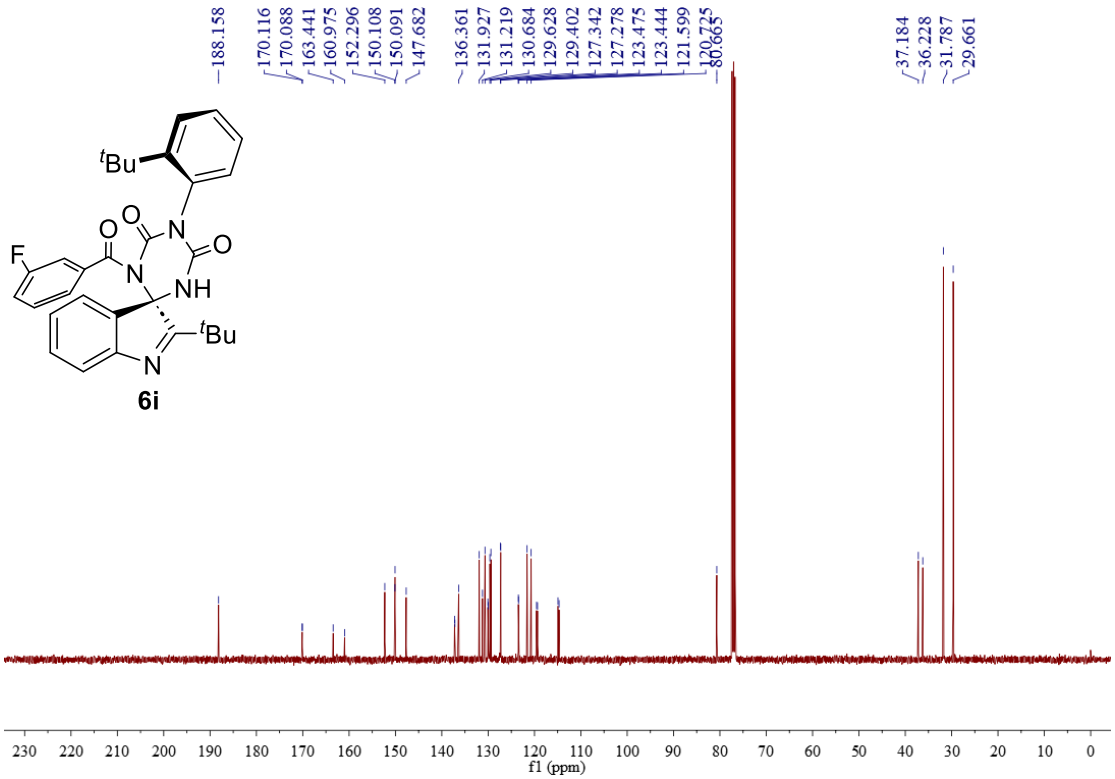
^{19}F NMR spectrum of compound **6i (major isomer)** ($CDCl_3$, 376 MHz)



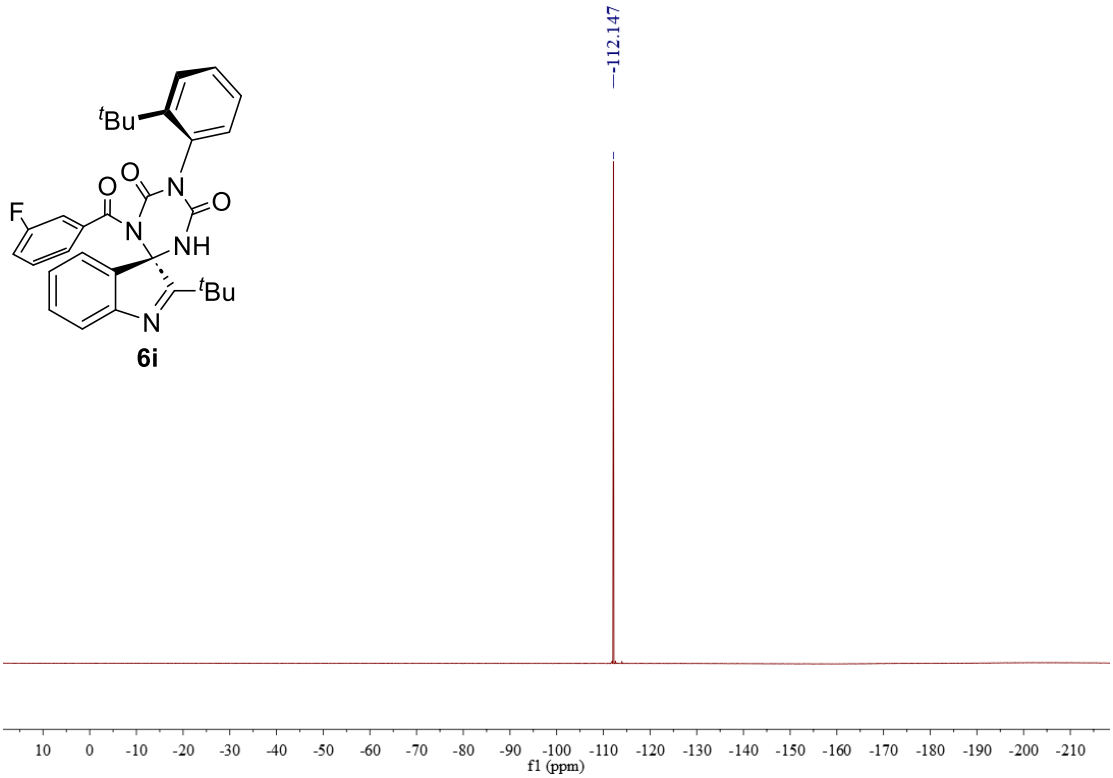
^{1}H NMR spectrum of compound **6i (minor isomer)** ($CDCl_3$, 400 MHz)



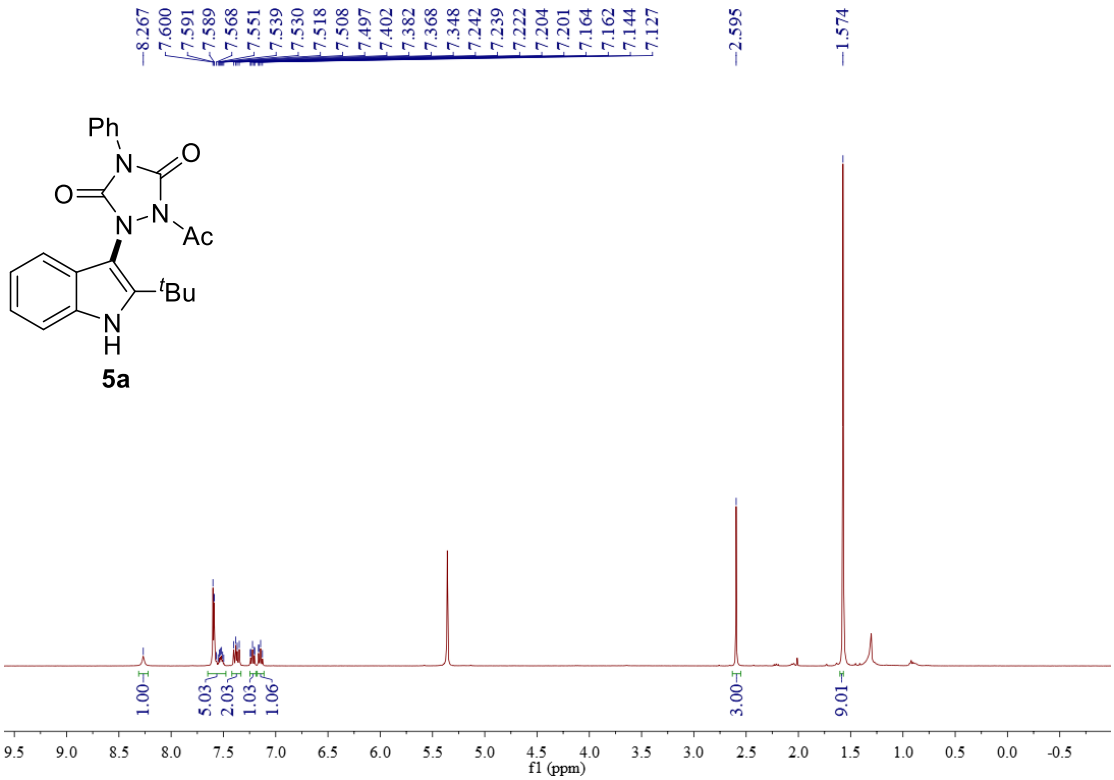
^{13}C NMR spectrum of compound **6i (minor isomer)** ($CDCl_3$, 100 MHz)



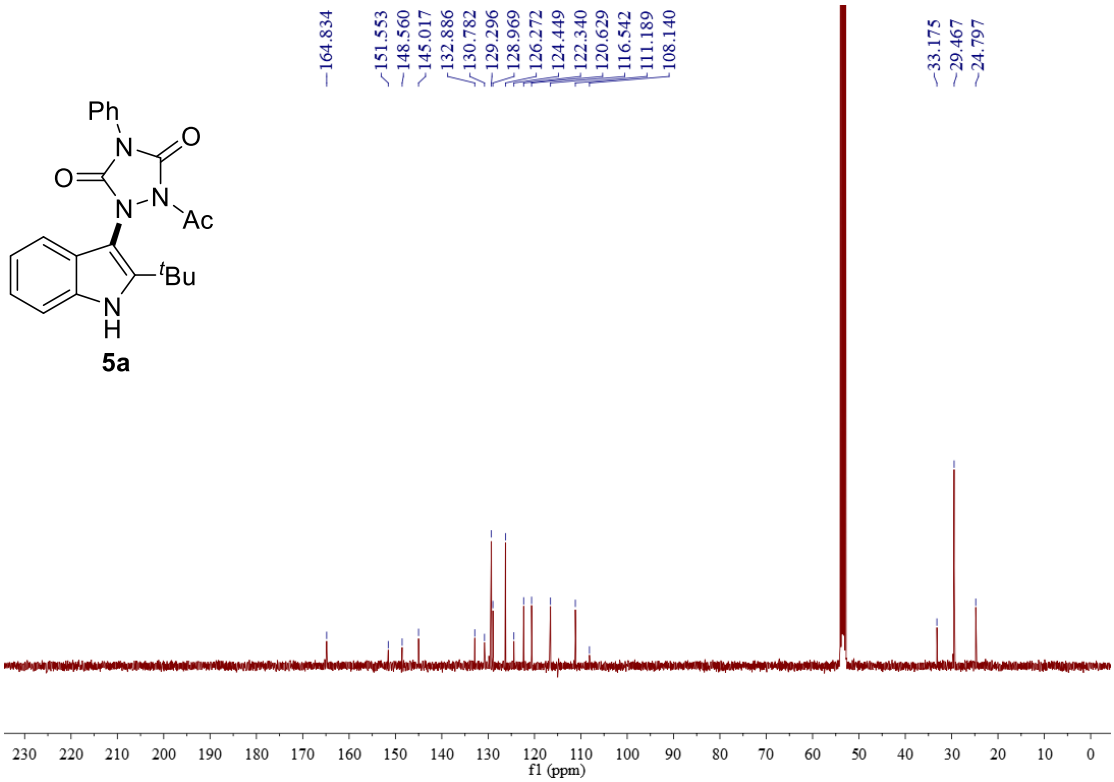
^{19}F NMR spectrum of compound **6i (minor isomer)** ($CDCl_3$, 376 MHz)



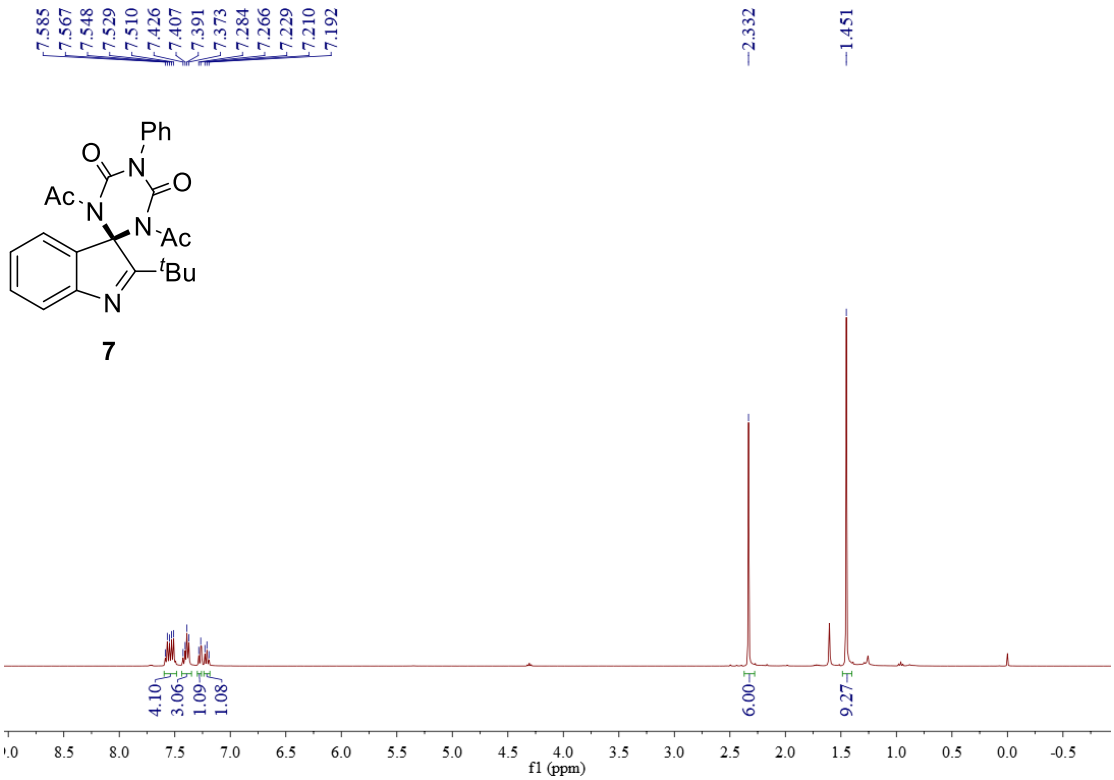
^{1}H NMR spectrum of compound **5a** (CD_2Cl_2, 400 MHz)



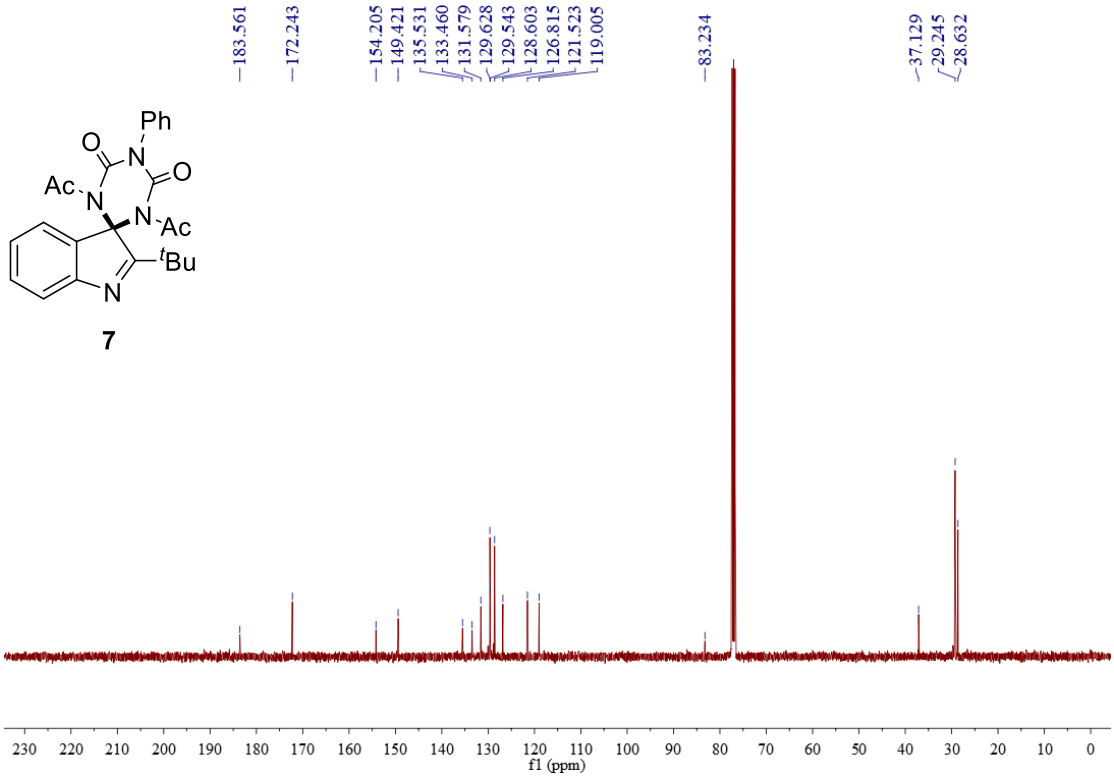
^{13}C NMR spectrum of compound **5a** (CD_2Cl_2, 100 MHz)



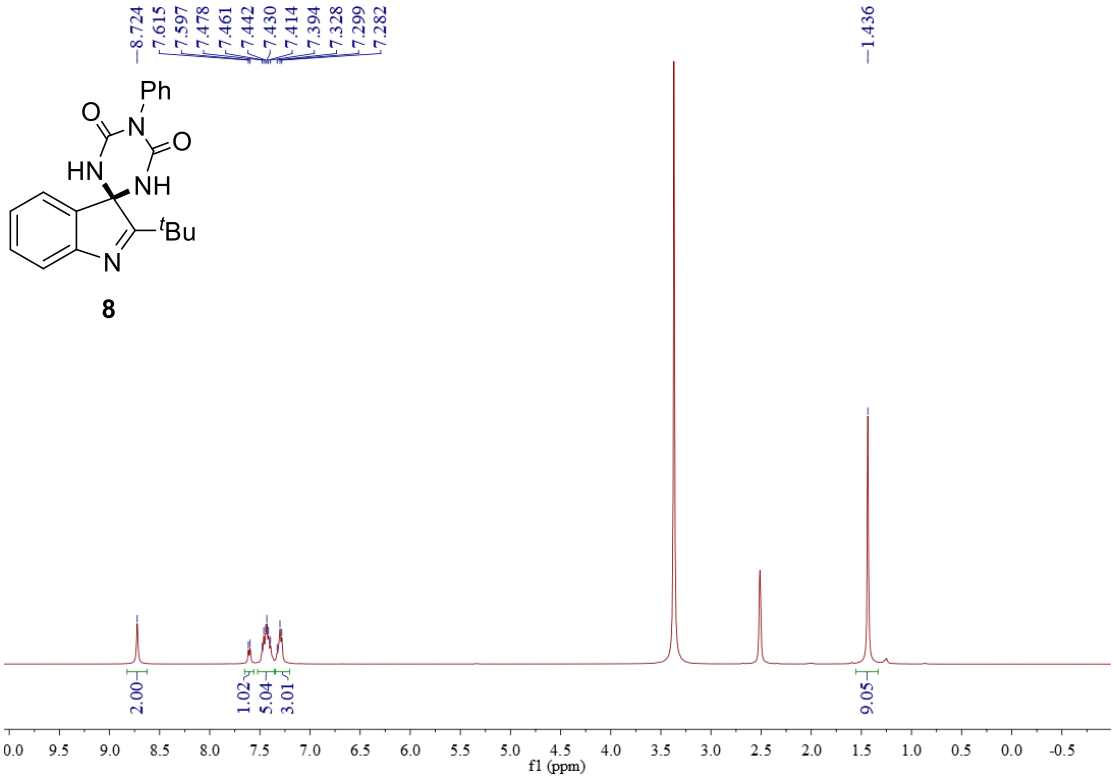
^{1}H NMR spectrum of compound **7** ($CDCl_3$, 400 MHz)



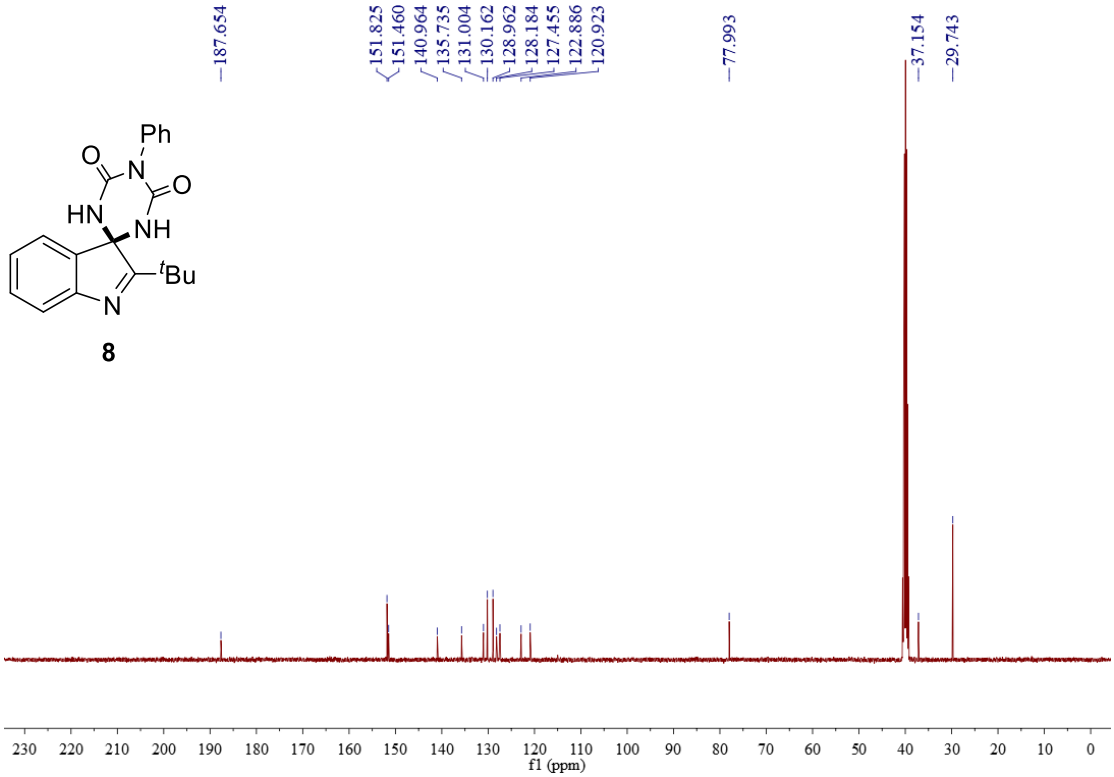
^{13}C NMR spectrum of compound **7** ($CDCl_3$, 100 MHz)



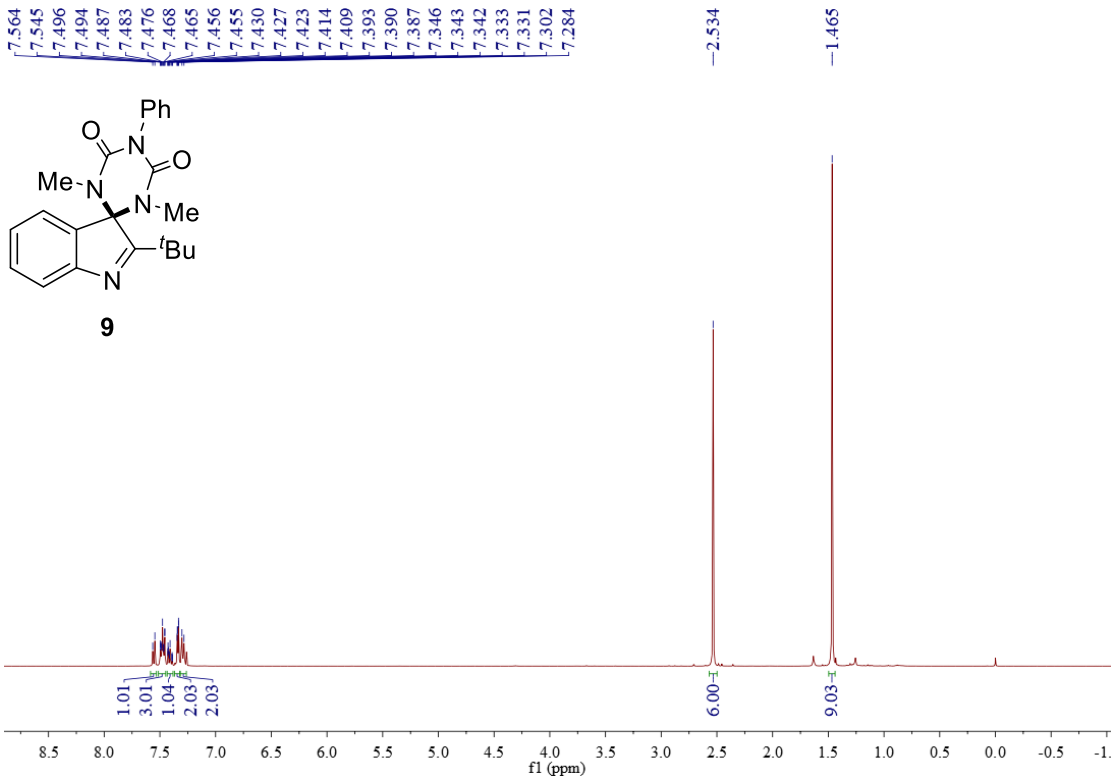
^{1}H NMR spectrum of compound **8** ($(CD_3)_2SO$, 400 MHz)



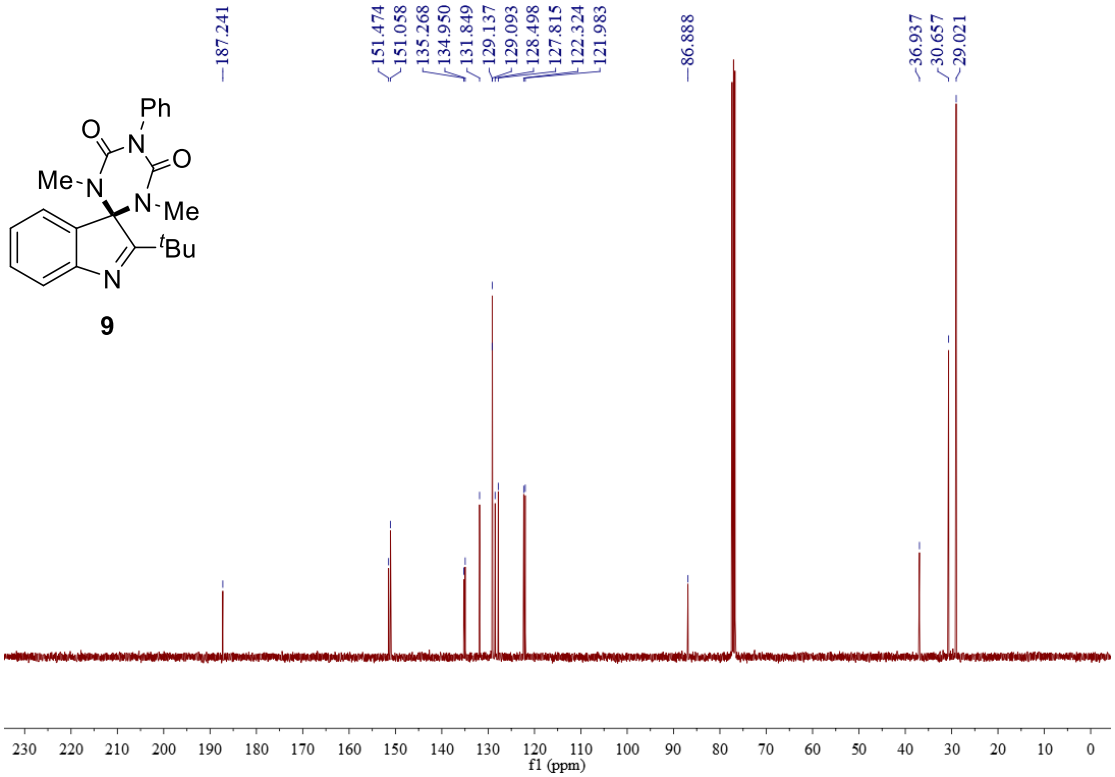
^{13}C NMR spectrum of compound **8** ($(CD_3)_2SO$, 100 MHz)



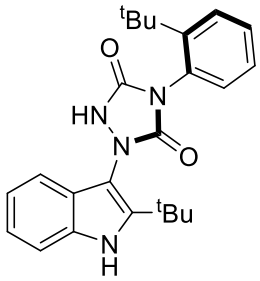
^{1}H NMR spectrum of compound **9** ($CDCl_3$, 400 MHz)



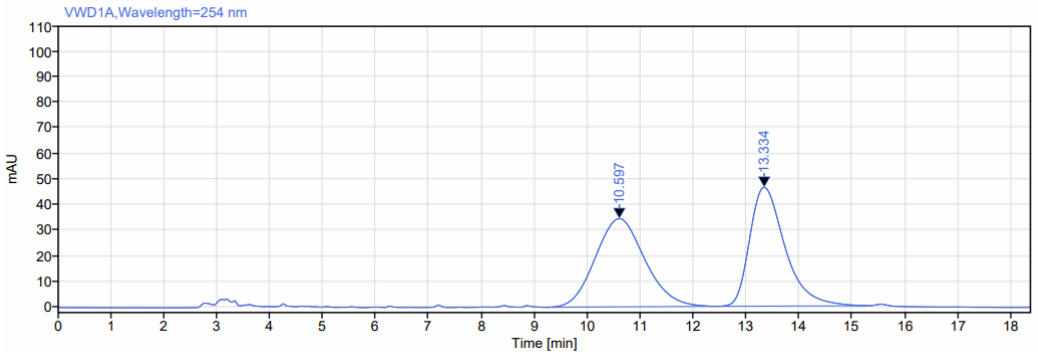
^{13}C NMR spectrum of compound **9** ($CDCl_3$, 100 MHz)



6. HPLC spectra of compounds

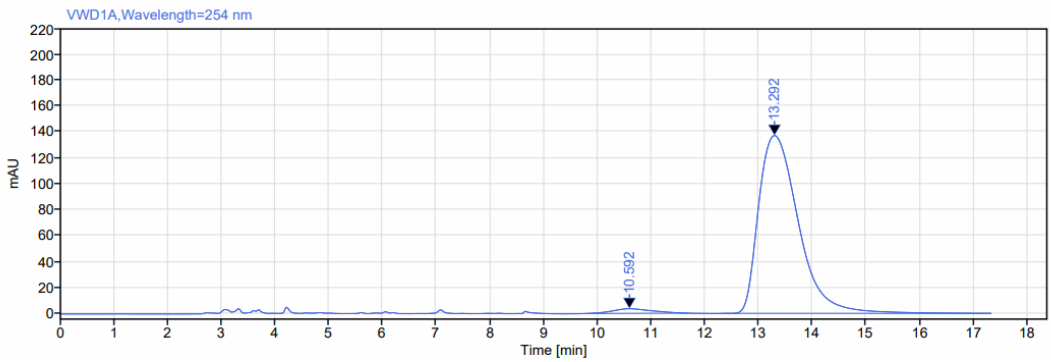


5l'



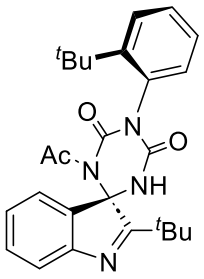
Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
10.597	BB	3.22	2239.36	34.43	51.04	
13.334	BB	2.84	2148.05	46.38	48.96	
		Sum	**4387.42**			

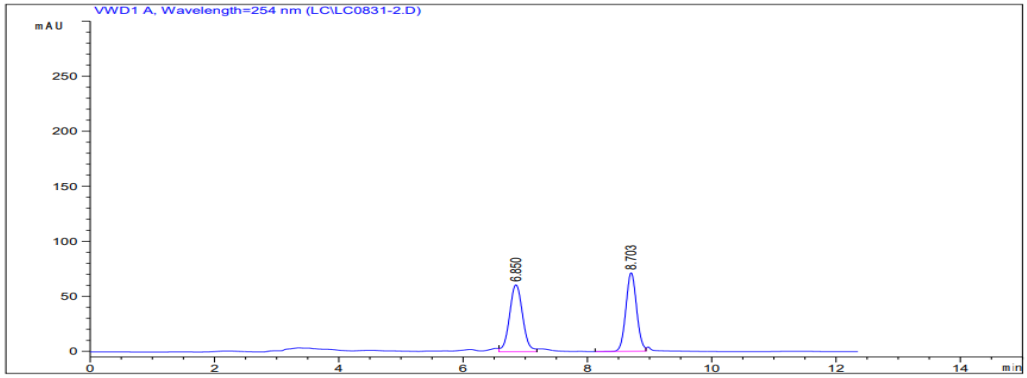


Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
10.592	MM m	1.90	182.19	3.60	2.52	
13.292	MB m	4.98	7054.10	136.97	97.48	
		Sum	**7236.29**			



6a

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================================================================================
                              Area Percent Report
================================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1   6.850 VV    0.2297  893.37567   60.80340  50.9445
   2   8.703 VV    0.1872  860.24872   71.40202  49.0555
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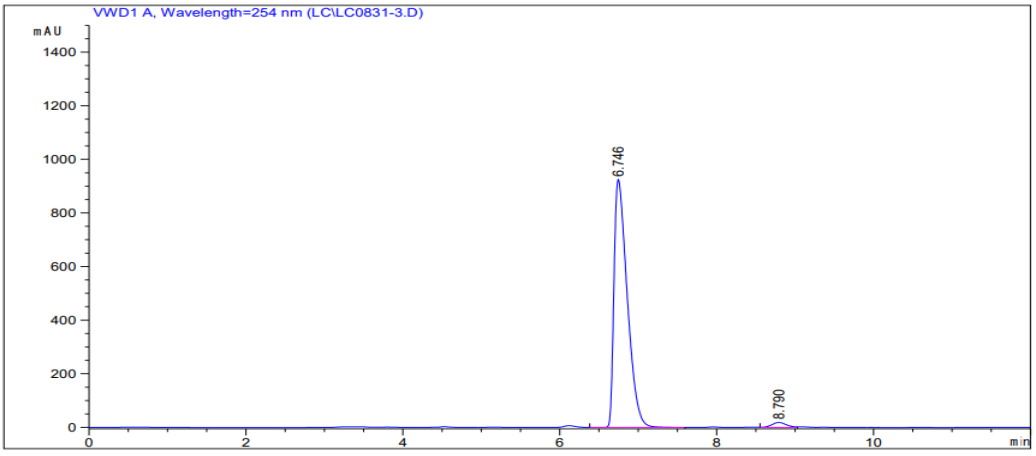


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                              Area Percent Report
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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1   6.746 VB    0.1802 1.08176e4  924.49097  97.8729
   2   8.790 VV    0.1992  235.09984   18.14377   2.1271
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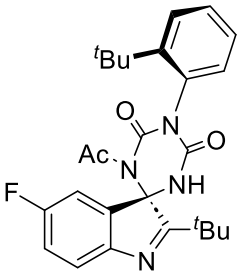
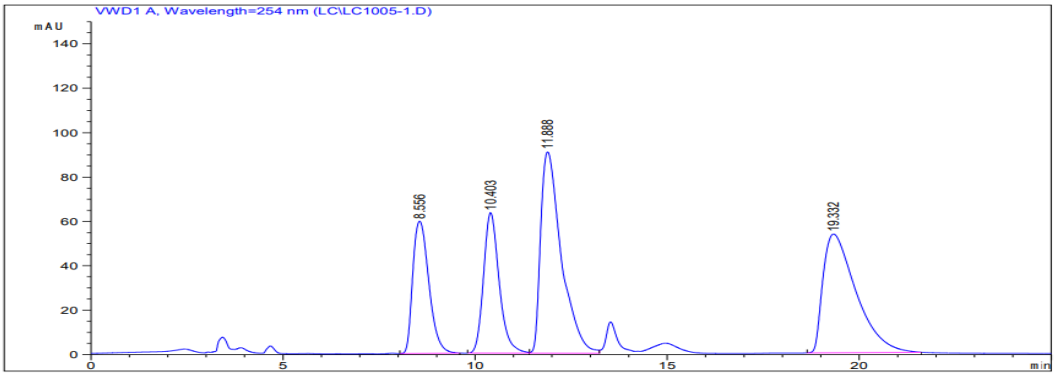


6b

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Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000  [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
  #   [min]       [min]  mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1    8.556 VB     0.4606 1738.13403   59.68402  17.1936
   2   10.403 BV     0.4308 1792.17517   63.29681  17.7281
   3   11.888 VB     0.5709 3386.83203   90.72614  33.5024
   4   19.332 BB     0.9216 3192.07080   53.40447  31.5759
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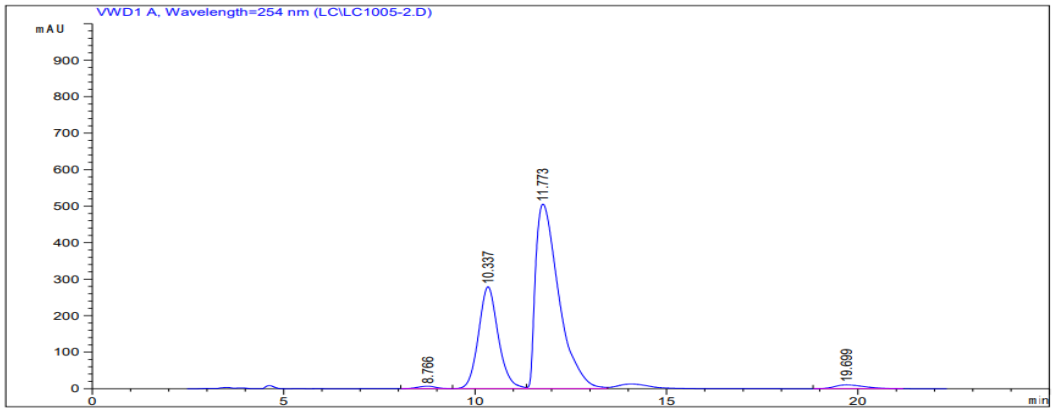


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================================================================================
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Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000  [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
  #   [min]       [min]  mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1    8.766 BV     0.5259  216.69437    6.44962   0.6754
   2   10.337 VV     0.5423 9968.01367  278.81366  31.0697
   3   11.773 VV     0.6556 2.13374e4   505.42941  66.5075
   4   19.699 BB     0.8188  560.59705   10.24697   1.7473
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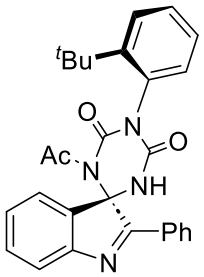
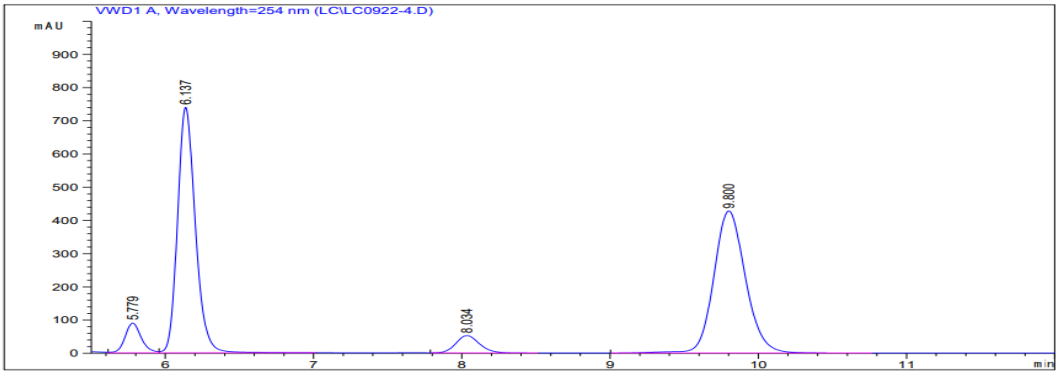


6c

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                          Area Percent Report
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Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000   [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
  #    [min]        [min]   mAU    *s    [mAU    ]     %
----|-------|----|-------|----------|----------|--------|
   1    5.779 VV     0.1158  676.32928    89.52390    4.9144
   2    6.137 VB     0.1280 6172.18604   739.45642   44.8489
   3    8.034 VB     0.1709  571.68225    51.84820    4.1540
   4    9.800 BB     0.2284 6341.99609   427.43359   46.0827
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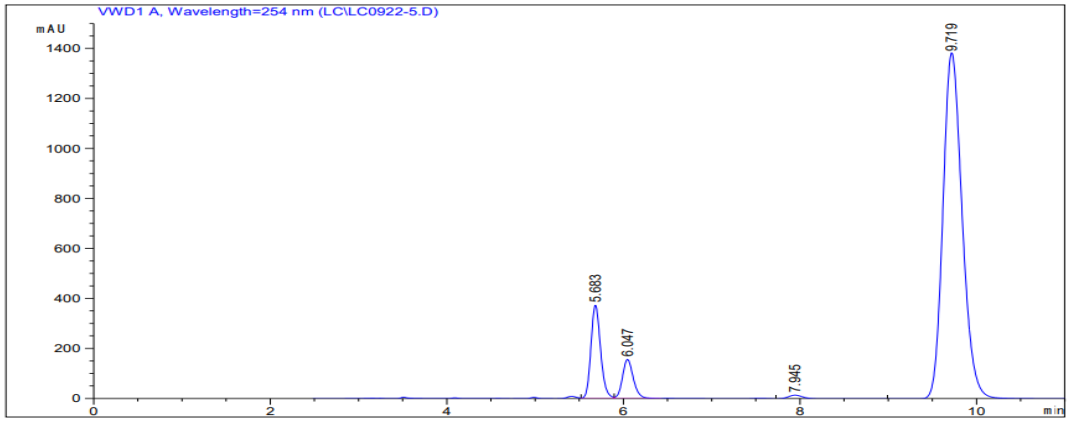


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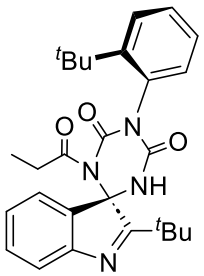
================================================================================
                          Area Percent Report
================================================================================

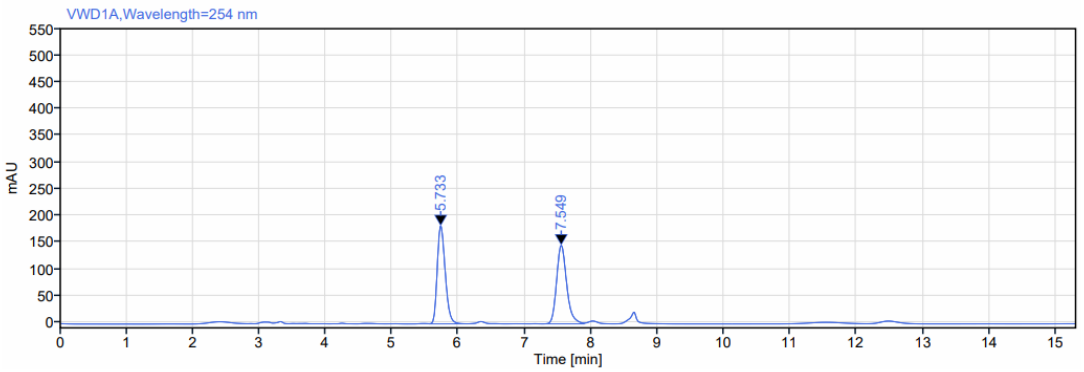
Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000   [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
  #    [min]        [min]   mAU    *s    [mAU    ]     %
----|-------|----|-------|----------|----------|--------|
   1    5.683 VV     0.1169 2862.22803   374.31229   11.3399
   2    6.047 VV     0.1337 1369.02502   157.12904    5.4239
   3    7.945 VB     0.1752  161.51970    14.16795    0.6399
   4    9.719 BB     0.2340 2.08476e4   1383.61743   82.5963
```

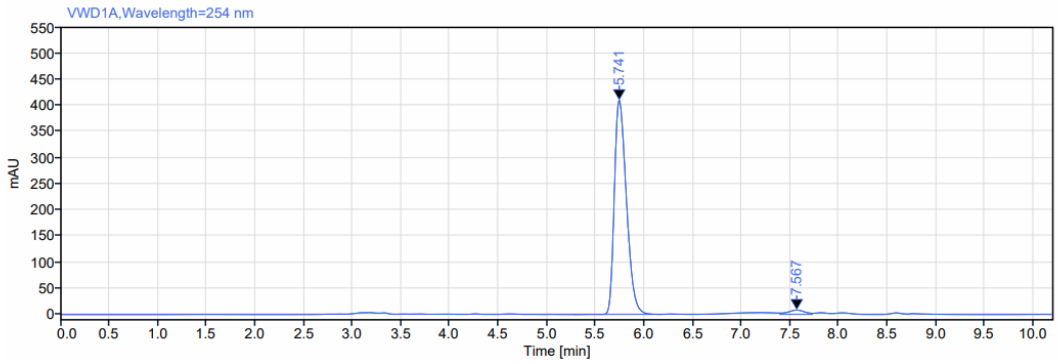


6d



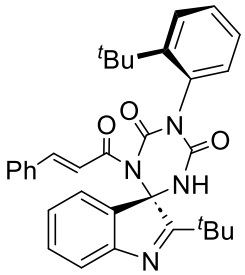
Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
5.733	VB	0.58	1529.84	183.06	49.58	
7.549	BV	0.64	1555.75	146.83	50.42	
		Sum	**3085.59**			

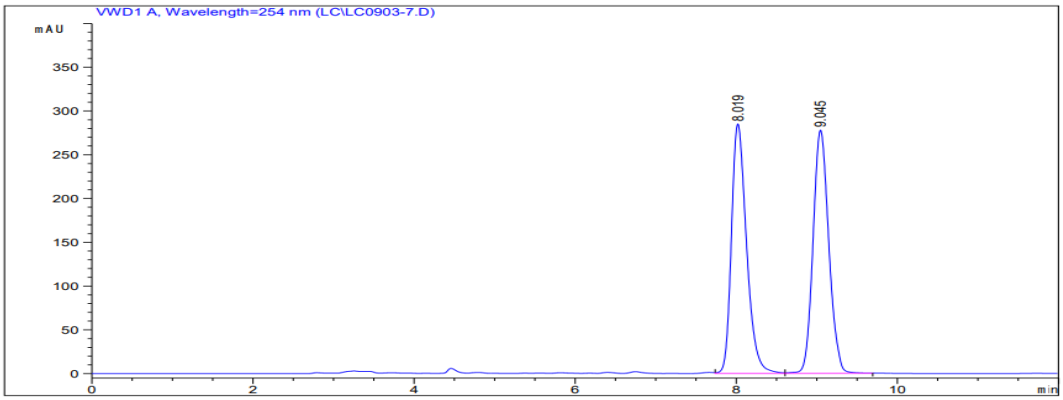


Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
5.741	BV	0.89	3543.38	410.17	97.20	
7.567	VV	0.34	102.16	8.34	2.80	
		Sum	**3645.54**			



6e

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================================================================================
                          Area Percent Report
================================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height      Area
  #    [min]        [min]  mAU   *s    [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1    8.019 VV     0.1986 3712.78345  284.95438  49.5746
   2    9.045 VB     0.2109 3776.49634  277.92007  50.4254
```

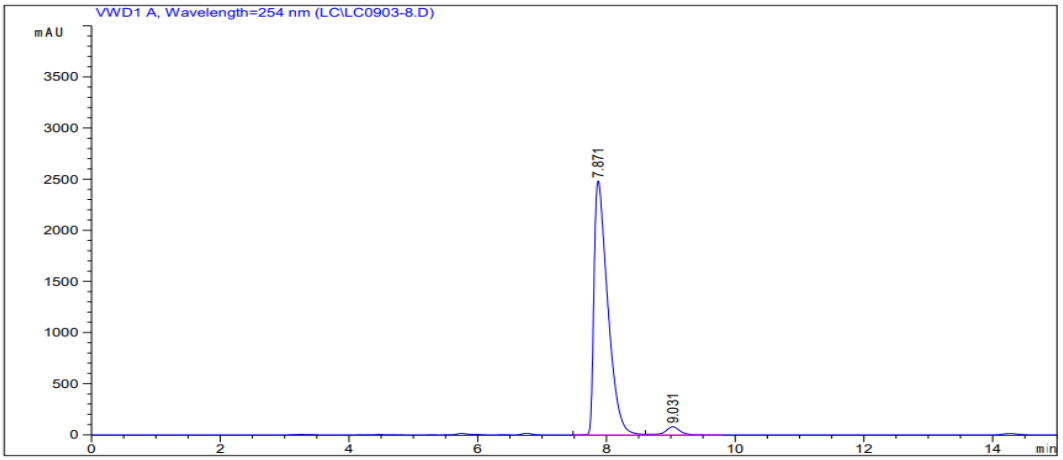


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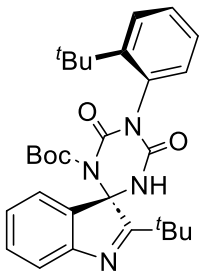
================================================================================
                          Area Percent Report
================================================================================

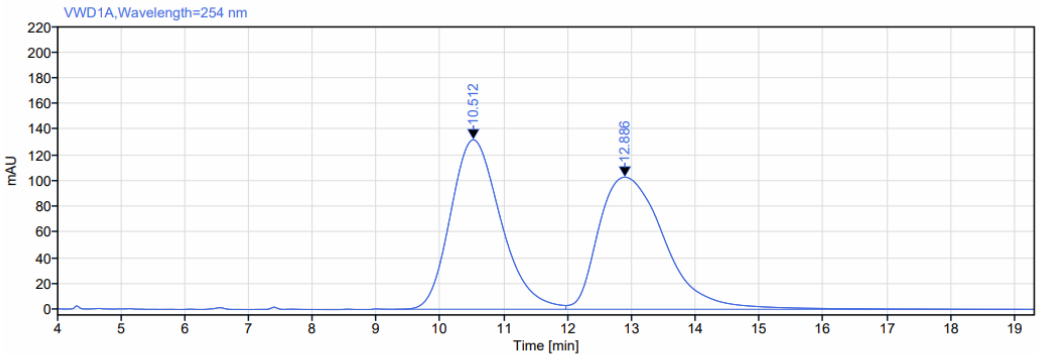
Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height      Area
  #    [min]        [min]  mAU   *s    [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1    7.871 VV     0.2231 3.66160e4  2482.02637  96.7932
   2    9.031 VB     0.2334 1213.08911   78.18594   3.2068
```

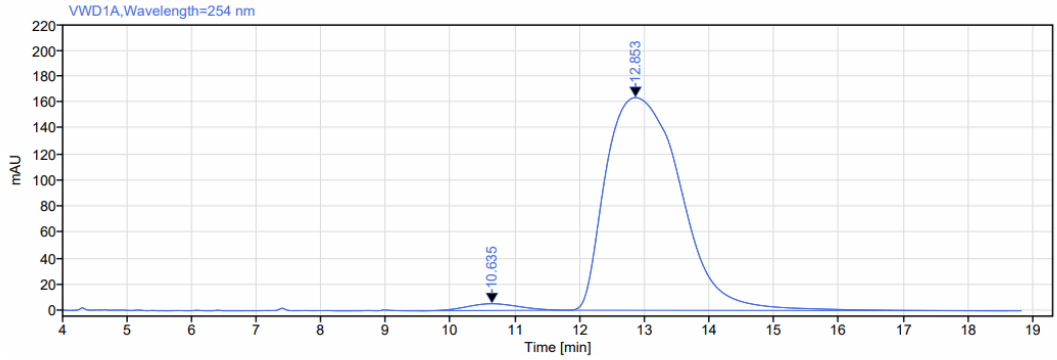


6f **(minor isomer)**



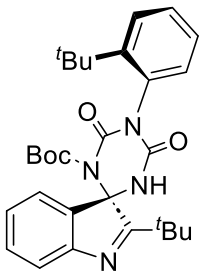
Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
10.512	BV	2.68	7217.09	131.84	49.31	
12.886	VB	7.16	7420.20	102.79	50.69	

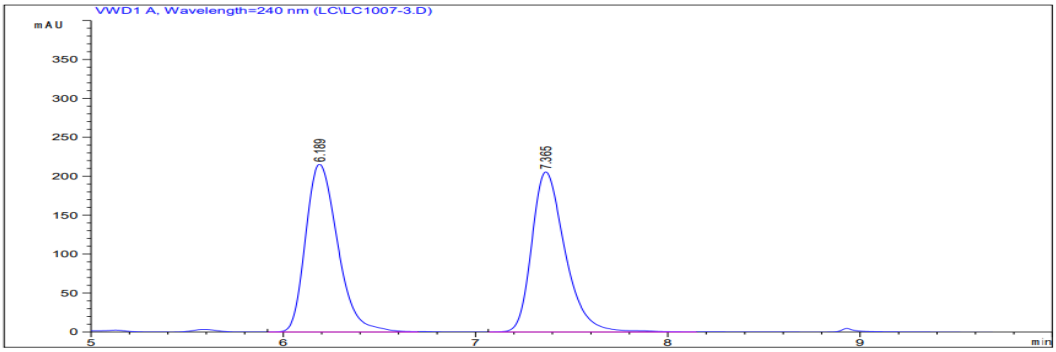


Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
10.635	BB	2.27	296.53	5.25	2.21	
12.853	BB	6.83	13135.64	163.30	97.79	
		Sum	**13432.17**			



6f **(major isomer)**

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================================================================================
                          Area Percent Report
================================================================================

Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000   [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=240 nm

Peak RetTime Type  Width      Area       Height      Area
  #   [min]        [min]  mAU    *s    [mAU    ]      %
----|-------|----|-------|----------|----------|--------|
   1   6.189 VB     0.1818 2499.08545   215.61324  50.2448
   2   7.365 BB     0.1841 2474.73413   205.57724  49.7552
```
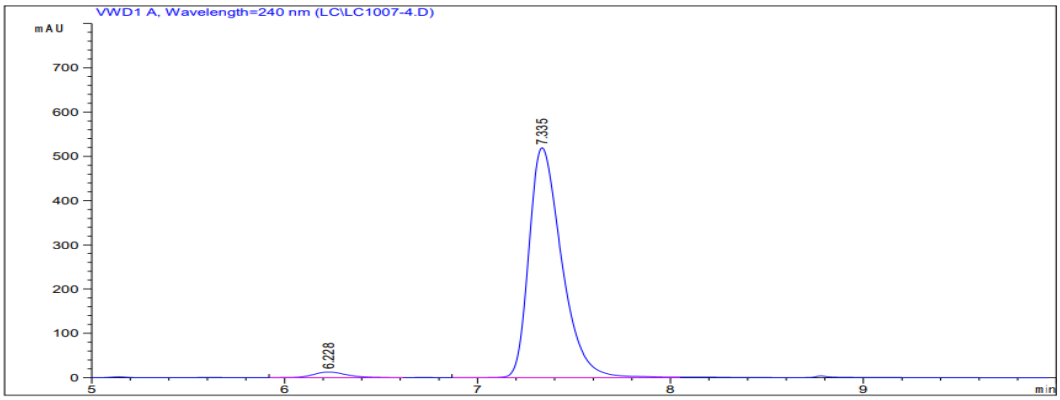
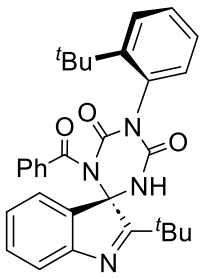
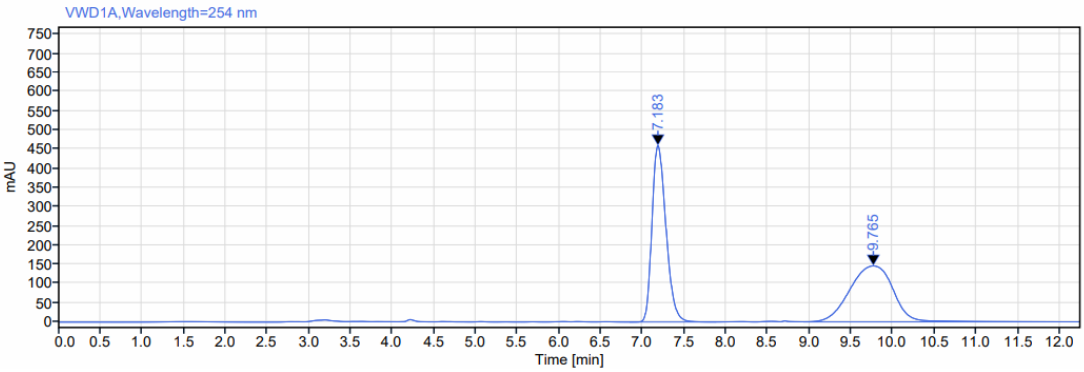




```
================================================================================
                          Area Percent Report
================================================================================

Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000   [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=240 nm

Peak RetTime Type  Width      Area       Height      Area
  #   [min]        [min]  mAU    *s    [mAU    ]      %
----|-------|----|-------|----------|----------|--------|
   1   6.228 VV     0.1905  153.40443   12.43845   2.4515
   2   7.335 VB     0.1808 6104.14209  519.23035  97.5485
```

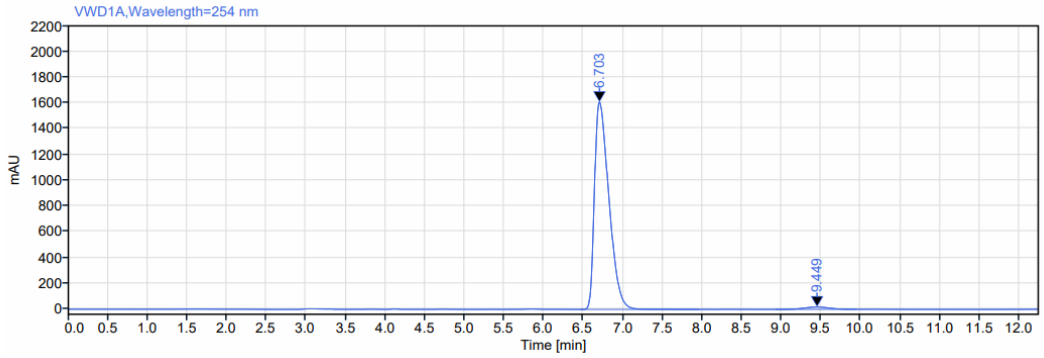


6g **((major isomer)**



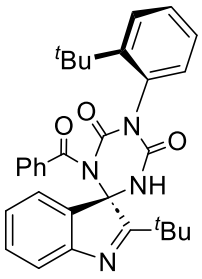
Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
7.183	BB	1.04	5371.27	459.12	50.33	
9.765	VB	3.33	5300.13	145.80	49.67	

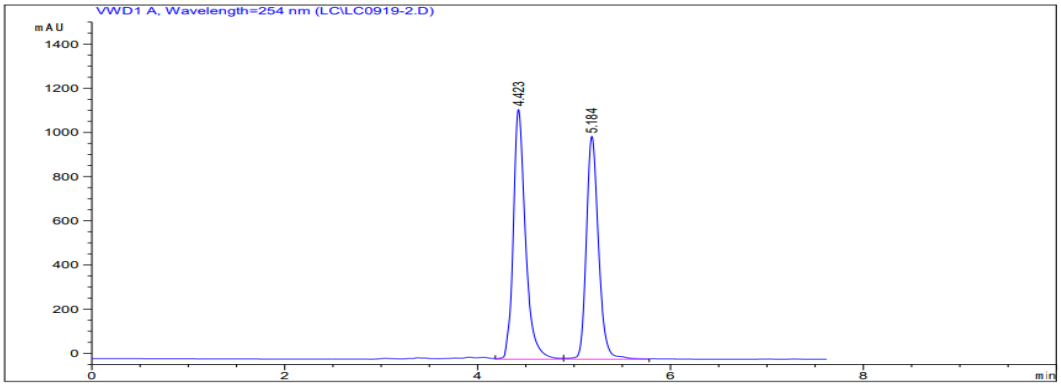


Signal: VWD1A,Wavelength=254 nm

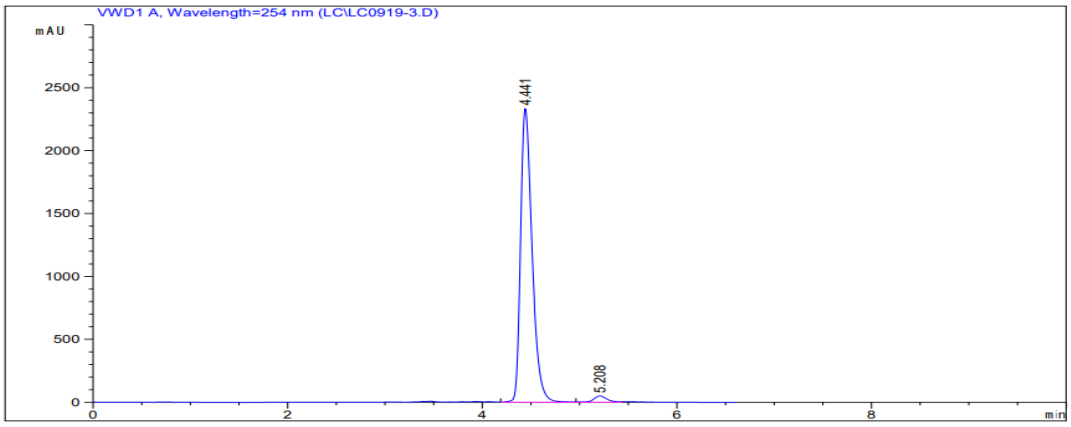
RT [min]	Type	Width [min]	Area	Height	Area%	Name
6.703	BB	1.50	20386.98	1610.04	98.06	
9.449	BB	1.02	402.34	18.57	1.94	
		Sum	**20789.31**			



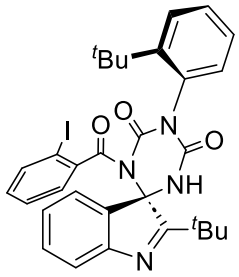
6g **(minor isomer)**



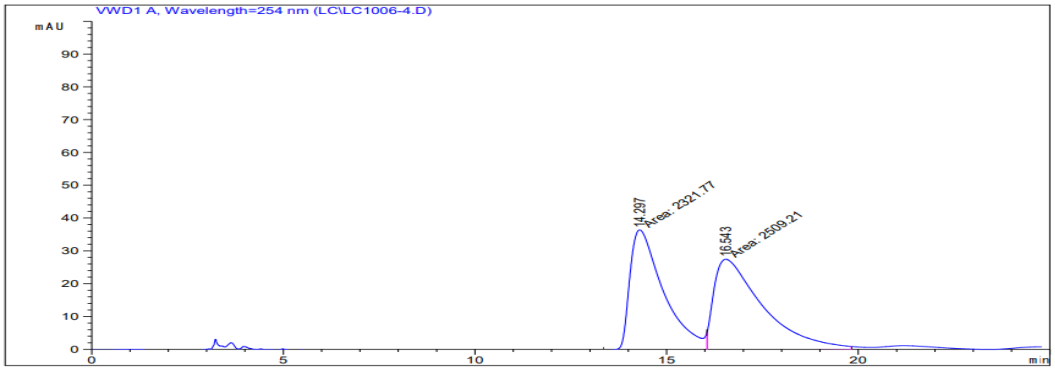

```
=====================================================================
                    Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Sample Amount         :      1.00000  [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
   #   [min]        [min]  mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1   4.423 VV     0.1312 9898.74414 1130.78650  52.9184
   2   5.184 VV     0.1324 8806.94727 1008.65759  47.0816
```



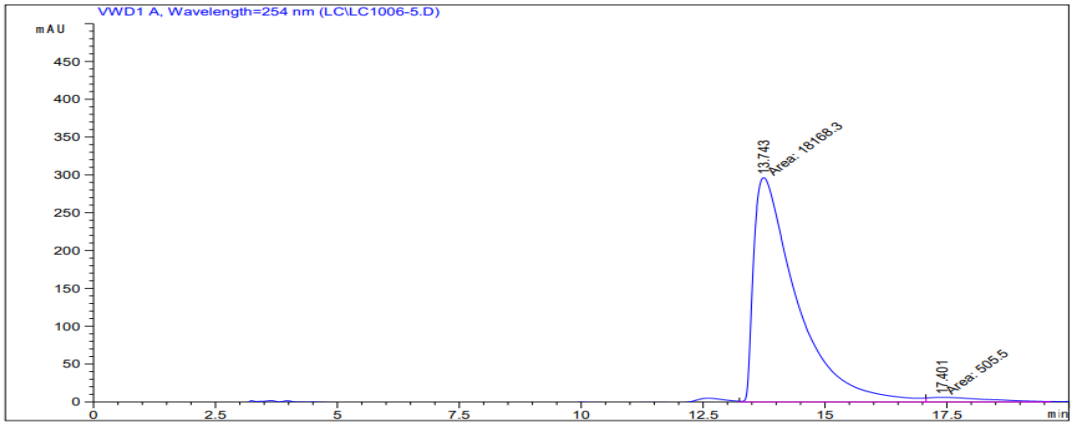

```
=====================================================================
                    Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Sample Amount         :      1.00000  [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
   #   [min]        [min]  mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1   4.441 VV     0.1247 1.91157e4 2332.15942  97.4911
   2   5.208 VV     0.1455  491.93744   49.95818   2.5089
```



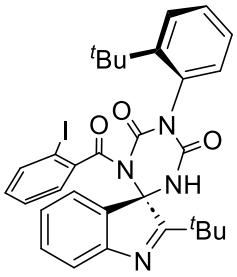
6h **(minor isomer)**



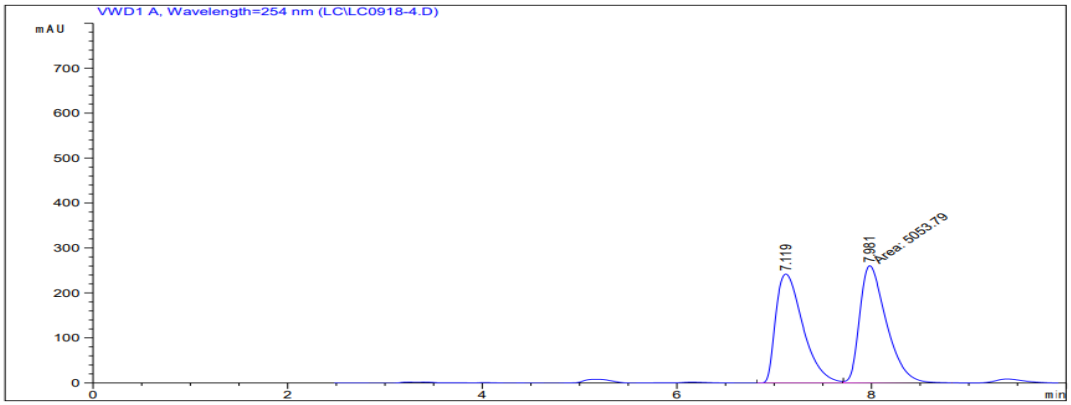

```
================================================================================
                          Area Percent Report
================================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Sample Amount         :      1.00000  [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area       Height      Area
  #   [min]      [min]  mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1  14.297 MF    1.0396 2321.76709   37.22367  48.0600
   2  16.543 FM    1.4955 2509.20508   27.96404  51.9400
```



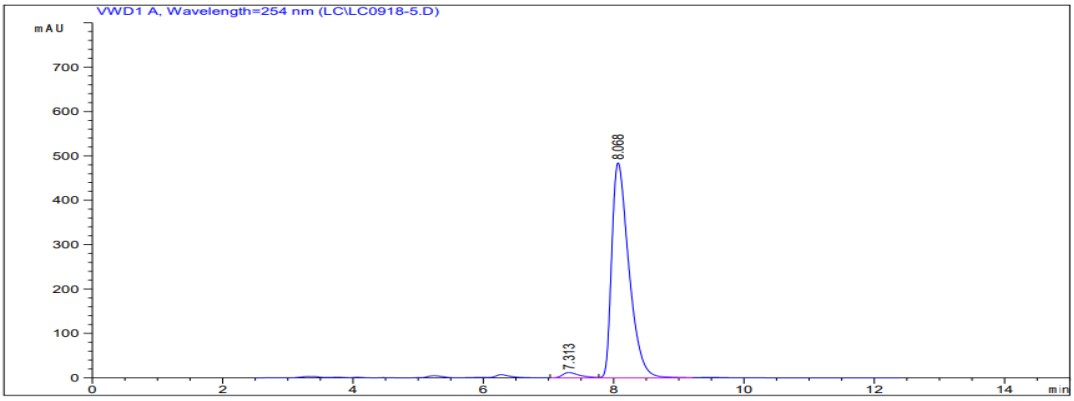

```
================================================================================
                          Area Percent Report
================================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Sample Amount         :      1.00000  [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area       Height      Area
  #   [min]      [min]  mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1  13.743 MF    1.0213 1.81683e4   296.48184  97.2930
   2  17.401 FM    1.4043  505.50046    5.99954   2.7070
```



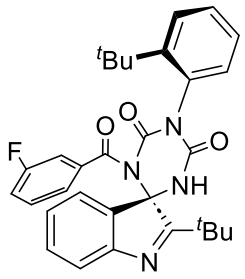
6h **(major isomer)**



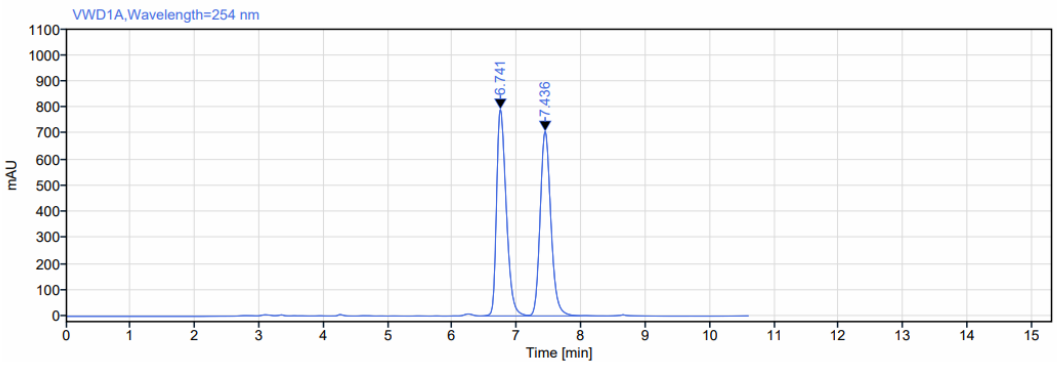

```
================================================================================
                          Area Percent Report
================================================================================

Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000   [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
  #   [min]        [min]   mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1   7.119 VV     0.3045 4731.79199  242.80128  48.3547
   2   7.981 MM     0.3218 5053.79346  261.73889  51.6453
```




```
================================================================================
                          Area Percent Report
================================================================================

Sorted By             :       Signal
Multiplier            :       1.0000
Dilution              :       1.0000
Sample Amount         :       1.00000   [ng/ul]    (not used in calc.)
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width      Area       Height      Area
  #   [min]        [min]   mAU   *s    [mAU   ]       %
----|-------|----|-------|----------|----------|--------|
   1   7.313 BV     0.2738  219.19231   11.86287   2.4188
   2   8.068 VB     0.2785 8842.97363  484.29645  97.5812
```

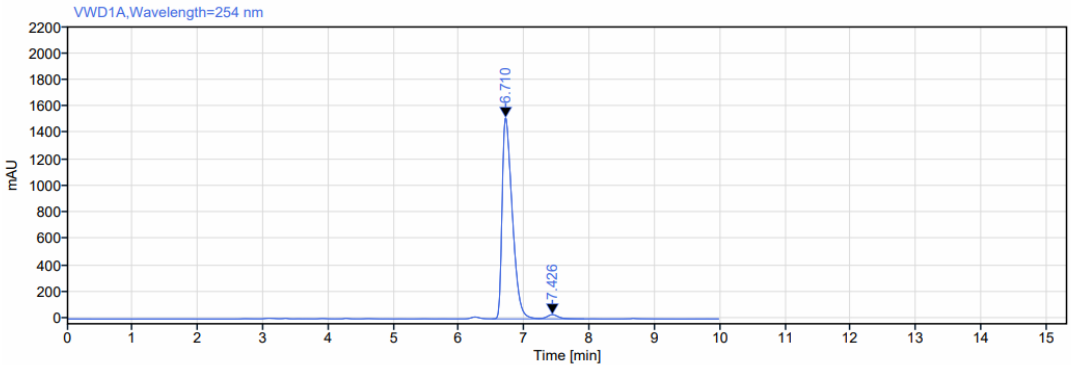


6i **(major isomer)**



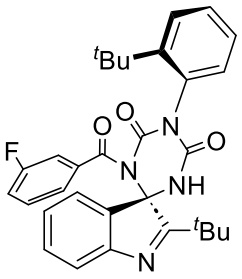
Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
6.741	BV	0.74	8293.70	790.87	50.25	
7.436	VV	0.80	8210.03	706.01	49.75	
		Sum	**16503.72**			

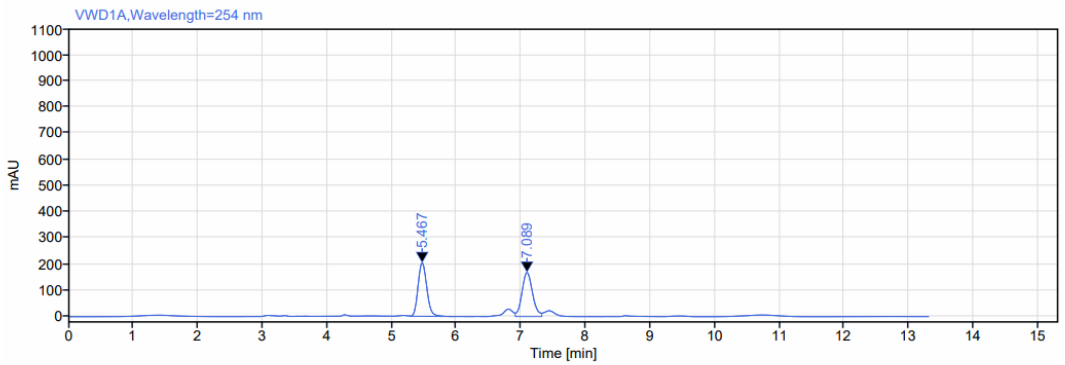


Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
6.710	VV	0.72	16381.35	1515.93	97.66	
7.426	VB	0.69	392.49	32.02	2.34	
		Sum	**16773.84**			

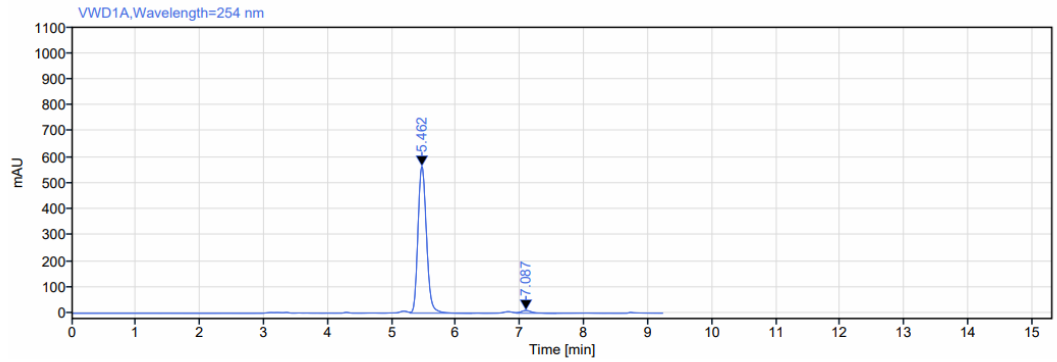


6i **(minor isomer)**



Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
5.467	VB	0.65	1927.65	204.00	50.22	
7.089	VV	0.41	1910.74	168.01	49.78	
		Sum	**3838.39**			



Signal: VWD1A,Wavelength=254 nm

RT [min]	Type	Width [min]	Area	Height	Area%	Name
5.462	VV	0.96	5252.10	564.19	97.71	
7.087	VB	0.63	123.35	10.64	2.29	
		Sum	**5375.45**			

7. References

[1] L-W. Qi, J-H. Mao, J. Zhang, B. Tan, *Nature Chemistry.* **2017**, *10*, 58-64.

[2] J. Qin, T. Zhou, T.-P. Zhou, L. Tang, H. Zuo, H. Yu, G. Wu, Y. Wu, R.-Z. Liao, F. Zhong, *Angew. Chem. Int. Ed.* **2022**, *61*, e202205159; *Angew. Chem.* **2022**, *134*, e202205159.

[3] J-W. Zhang, J-H. Xu, D-J. Cheng, C. Shi, X-Y. Liu, B. Tan, *Nat Commun* **2016,** *7*, 10677.