Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

Palladium-Catalyzed Highly Chemoselective Dearomative Spirocyclization of Ugi Adducts: Facile Access to Functionalized Benzoazepinespiroindolenines with Diastereoselectivity

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Table of Contents

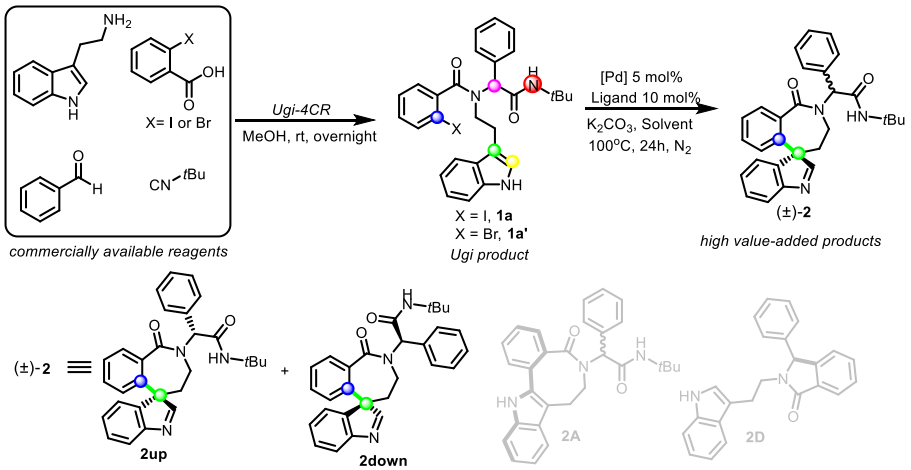
1. General Information

^{1}H NMR, ^{19}F NMR and ^{13}C NMR spectra were measured on 400 MHz spectrometer, using $CDCl_3$ as the solvent with tetramethylsilane (TMS) as the internal standard at room temperature. Chemical shifts (δ) are given in ppm relative to TMS, the coupling constants *J* are given in Hz. HRMS were obtained in the ESI mode. The products were purified by Biotage Isolera™ Spektra Systems and Petroleum Ether/EtOAc solvent systems. Unless otherwise noted, all reagents and solvents were obtained from commercial sources and used without further purification.

2. Optimization of Reaction Conditions

Reaction Optimization 1

Table S1: Optimization of Reaction Conditions[a]



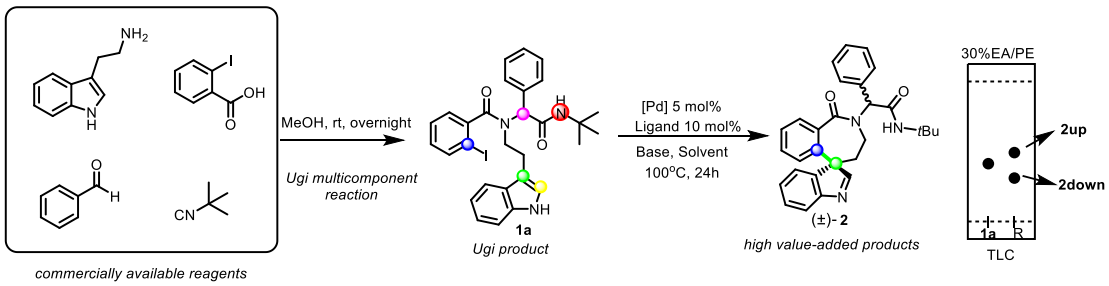
entry	[Pd]	Ligand	Base	Solvent	Yield of (**2down**)[b]	Yield of (**2up**)[b]	Yield of (**2A+2D**)[b]
1	$Pd(OAc)_2$	PPh_3	K_2CO_3	PhMe	56	34	-
2	$Pd(OAc)_2$	PCy_3	K_2CO_3	PhMe	41	16	-
3	$Pd(OAc)_2$	dppp	K_2CO_3	PhMe	20	<10	-
4	$Pd(OAc)_2$	Xantphos	K_2CO_3	PhMe	32	35	-
5	$Pd(OAc)_2$	PPh_3	Na_2CO_3	PhMe	mess	20	-
6	$Pd(OAc)_2$	PPh_3	Cs_2CO_3	PhMe	unstable	unstable	-
7	$Pd(OAc)_2$	PPh_3	KOAc	PhMe	trace	<10	-
8	$Pd(OAc)_2$	PPh_3	K_3PO_4	PhMe	36	20	-
9	$Pd(OAc)_2$	PPh_3	DABCO	PhMe	54	18	-
10^{repeat}	$Pd(OAc)_2$	PPh_3	Cs_2CO_3	PhMe	unstable	unstable	-
11	$Pd(OAc)_2$	PPh_3	NaO*t*Bu	PhMe	trace	trace	-
12	$Pd(OAc)_2$	PPh_3	DMAP	PhMe	trace	trace	-
13	$Pd(OAc)_2$	PPh_3	DBU	PhMe	trace	trace	-
14	**$Pd(OAc)_2$**	**PPh_3**	**K_2CO_3**	**DMSO**	**0**	**0**	**2A+2D**
15	**$Pd(OAc)_2$**	**PPh_3**	**K_2CO_3**	**DMF**	**0**	**0**	**2A+2D**
16	$Pd(OAc)_2$	PPh_3	K_2CO_3	Xylene	38	25	-
17	$Pd(OAc)_2$	PPh_3	K_2CO_3	PhCl	44	52	-

18	$Pd(OAc)_2$	PPh_3	K_2CO_3	o-DCB	76	13	-
19	$Pd(OAc)_2$	PPh_3	K_2CO_3	DCE	53	16	-
20	$Pd_2(dba)_2$	PPh_3	K_2CO_3	o-DCB	69	<10	-
21	$PdCl_2(PPh_3)_3$	PPh_3	K_2CO_3	o-DCB	63	<10	-
22	$PdCl_2(dppf)$	PPh_3	K_2CO_3	o-DCB	66	20	-
23	$Pd(PPh_3)_4$	PPh_3	K_2CO_3	o-DCB	72	15	-
24[c]	$Pd(OAc)_2$	PPh_3	K_2CO_3	o-DCB	78	11	-

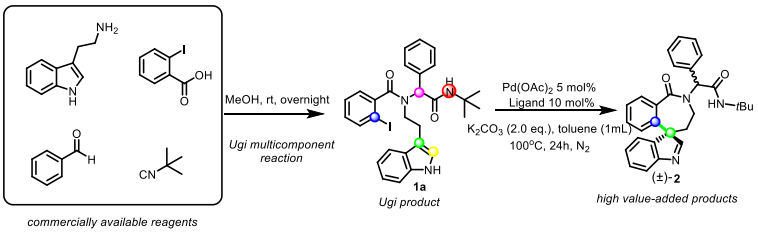
[a]Reaction was performed on a 0.1 mmol scale using 5 mol% [Pd], 10 mol% ligand and 2.0 eq. of base in 1 mL solvent, 100 °C, 24 h, N_2. [b]Yield are those of products isolated by column chromatography. [c] 120 °C oil bath was used for 16h.

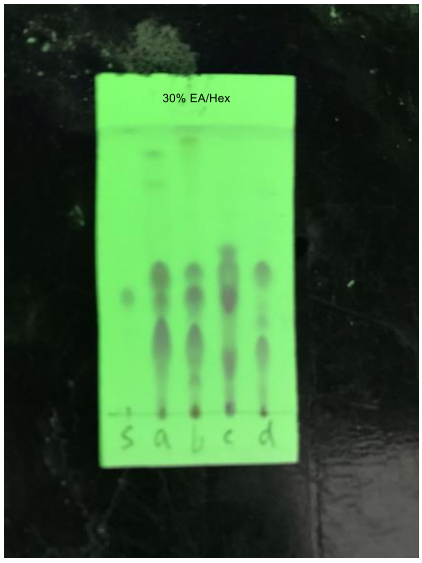
Reaction Optimization 2

Refinement of reaction conditions screening using TLC detection

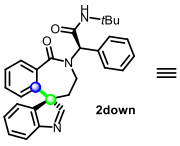


TLC-1: Ligand screening





S: **1a**
a: PPh_3
b: PCy_3
c: dppp
d: Xantphos



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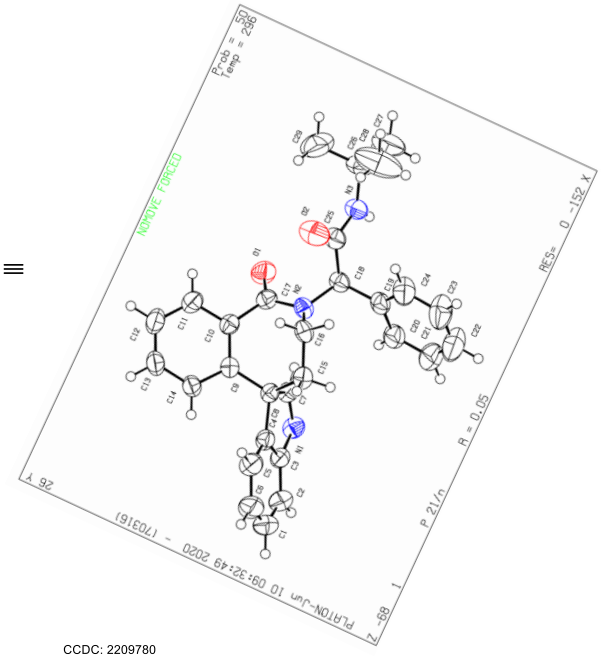

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Cell: a=14.2334(18) b=10.4915(13) c=17.043(2)
alpha=90 beta=94.763(2) gamma=90
Temperature: 296 K

	Calculated	Reported
Volume	2536.2(5)	2536.3(5)
Space group	P 21/n	P 21/n
Hall group	-P 2yn	-P 2yn
Moiety formula	C29 H29 N3 O2	?
Sum formula	C29 H29 N3 O2	C29 H29 N3 O2
Mr	451.55	451.55
Dx,g cm-3	1.183	1.183
Z	4	4
Mu (mm-1)	0.075	0.075
F000	960.0	960.0
F000'	960.37	
h,k,lmax	17,12,20	17,12,20
Nref	4727	4715
Tmin,Tmax	0.981,0.982	
Tmin'	0.981	

Correction method= Not given

Data completeness= 0.997 Theta(max)= 25.500

R(reflections)= 0.0530(2910) wR2(reflections)= 0.1504(4715)

S = 0.906 Npar= 310

The following ALERTS were generated. Each ALERT has the format
test-name_ALERT_alert-type_alert-level.
Click on the hyperlinks for more details of the test.

Alert level C

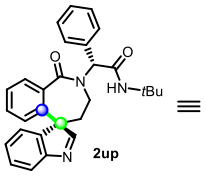
PLAT220_ALERT_2_C	NonSolvent Resd 1 C Ueq(max) / Ueq(min) Range	3.8 Ratio
PLAT222_ALERT_3_C	NonSolvent Resd 1 H Uiso(max)/Uiso(min) Range	4.3 Ratio
PLAT242_ALERT_2_C	Low 'MainMol' Ueq as Compared to Neighbors of	C26 Check
PLAT906_ALERT_3_C	Large K Value in the Analysis of Variance	6.841 Check
PLAT910_ALERT_3_C	Missing # of FCF Reflection(s) Below Theta(Min).	6 Note
PLAT911_ALERT_3_C	Missing FCF Refl Between Thmin & STh/L= 0.600	5 Report

Alert level G

PLAT007_ALERT_5_G	Number of Unrefined Donor-H Atoms	1 Report
PLAT793_ALERT_4_G	Model has Chirality at C8 (Centro SPGR)	S Verify
PLAT793_ALERT_4_G	Model has Chirality at C18 (Centro SPGR)	R Verify
PLAT883_ALERT_1_G	No Info/Value for _atom_sites_solution_primary .	Please Do !
PLAT911_ALERT_4_G	Missing # of FCF Reflections Above STh/L= 0.600	2 Note
PLAT933_ALERT_2_G	Number of OMIT Records in Embedded .res File ...	3 Note
PLAT941_ALERT_3_G	Average HKL Measurement Multiplicity	2.8 Low
PLAT961_ALERT_5_G	Dataset Contains no Negative Intensities	Please Check
PLAT965_ALERT_2_G	The SHELXL WEIGHT Optimisation has not Converged	Please Check
PLAT978_ALERT_2_G	Number C-C Bonds with Positive Residual Density.	1 Info
PLAT999_ALERT_5_G	Repd & Actual _refins_number_gt Values Differ by	1 Check

0 **ALERT level A** = Most likely a serious problem - resolve or explain
0 **ALERT level B** = A potentially serious problem, consider carefully
6 **ALERT level C** = Check. Ensure it is not caused by an omission or oversight
11 **ALERT level G** = General information/check it is not something unexpected

1 ALERT type 1 CIF construction/syntax error, inconsistent or missing data
5 ALERT type 2 Indicator that the structure model may be wrong or deficient
5 ALERT type 3 Indicator that the structure quality may be low
3 ALERT type 4 Improvement, methodology, query or suggestion
3 ALERT type 5 Informative message, check



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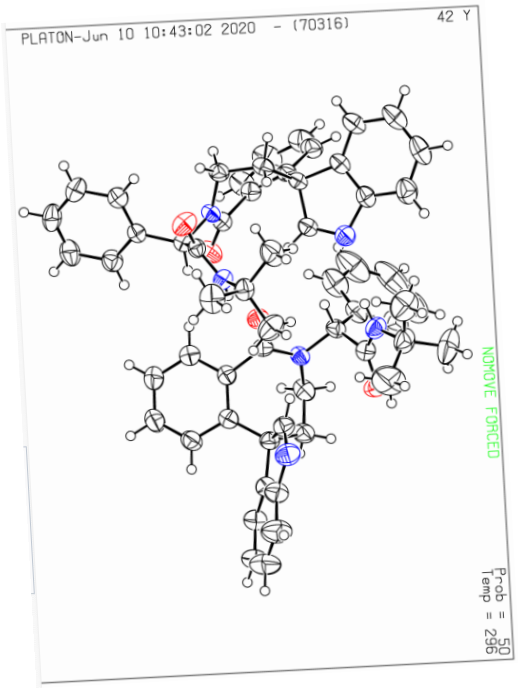

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Datablock: 1

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Cell: a=10.7591(10) b=11.7873(11) c=19.9651(19)
alpha=93.982(2) beta=95.015(2) gamma=91.346(2)
Temperature: 296 K

	Calculated	Reported
Volume	2515.1(4)	2515.1(4)
Space group	P -1	P -1
Hall group	-P 1	-P 1
Moiety formula	C29 H29 N3 O2	?
Sum formula	C29 H29 N3 O2	C58 H58 N6 O4
Mr	451.55	903.10
Dx,g cm-3	1.192	1.193
Z	4	2
Mu (mm-1)	0.076	0.076
F000	960.0	960.0
F000'	960.37	
h,k,lmax	12,14,23	12,14,23
Nref	8854	8795
Tmin,Tmax	0.980,0.983	
Tmin'	0.980	

Correction method= Not given

Data completeness= 0.993 Theta(max)= 24.999

R(reflections)= 0.0494(5596) wR2(reflections)= 0.1182(8795)

S = 0.968 Npar= 619

```
 Alert level C
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PLAT242_ALERT_2_C Low    'MainMol' Ueq as Compared to Neighbors of        C25 Check
PLAT242_ALERT_2_C Low    'MainMol' Ueq as Compared to Neighbors of        C54 Check
PLAT480_ALERT_4_C Long H...A H-Bond Reported H46       ..N1        .     2.66 Ang.
PLAT480_ALERT_4_C Long H...A H-Bond Reported H46       ..N1        .     2.66 Ang.
PLAT601_ALERT_2_C Structure Contains Solvent Accessible VOIDS of .       37 Ang**3

 Alert level G
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PLAT045_ALERT_1_G Calculated and Reported Z Differ by a Factor ...     2.00 Check
PLAT154_ALERT_1_G The s.u.'s on the Cell Angles are Equal ..(Note)    0.002 Degree
PLAT720_ALERT_4_G Number of Unusual/Non-Standard Labels ..........        1 Note
PLAT793_ALERT_4_G Model has Chirality at C8          (Centro SPGR)       R Verify
PLAT793_ALERT_4_G Model has Chirality at C17         (Centro SPGR)       R Verify
PLAT793_ALERT_4_G Model has Chirality at C36         (Centro SPGR)       R Verify
PLAT793_ALERT_4_G Model has Chirality at C46         (Centro SPGR)       R Verify
PLAT883_ALERT_1_G No Info/Value for _atom_sites_solution_primary .   Please Do !
PLAT933_ALERT_2_G Number of OMIT Records in Embedded .res File ...       14 Note
PLAT941_ALERT_3_G Average HKL Measurement Multiplicity ...........      1.5 Low

   0 ALERT level A = Most likely a serious problem - resolve or explain
   0 ALERT level B = A potentially serious problem, consider carefully
   6 ALERT level C = Check. Ensure it is not caused by an omission or oversight
  11 ALERT level G = General information/check it is not something unexpected

   3 ALERT type 1 CIF construction/syntax error, inconsistent or missing data
   5 ALERT type 2 Indicator that the structure model may be wrong or deficient
   1 ALERT type 3 Indicator that the structure quality may be low
   7 ALERT type 4 Improvement, methodology, query or suggestion
   1 ALERT type 5 Informative message, check
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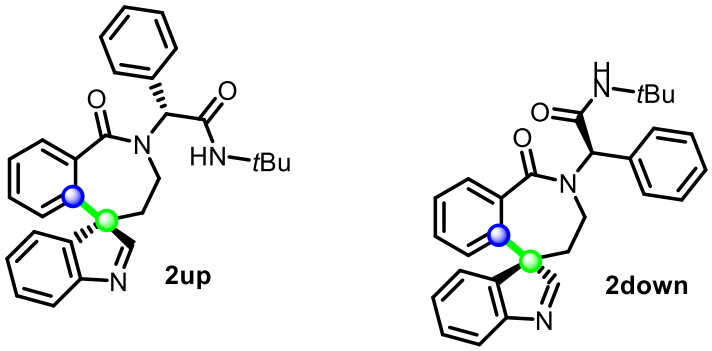
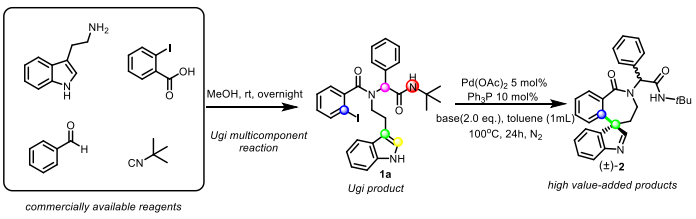
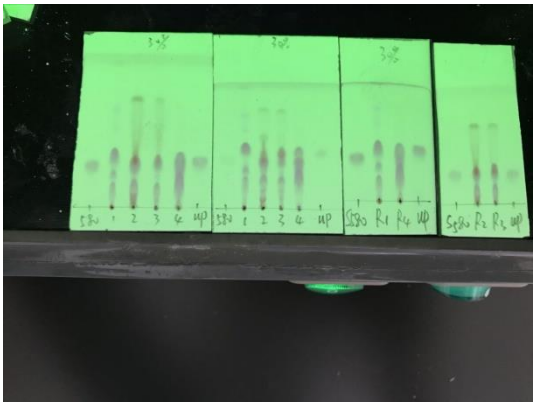


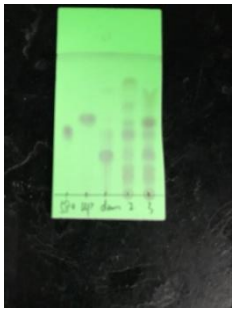
A pair of diastereomers of product **2**

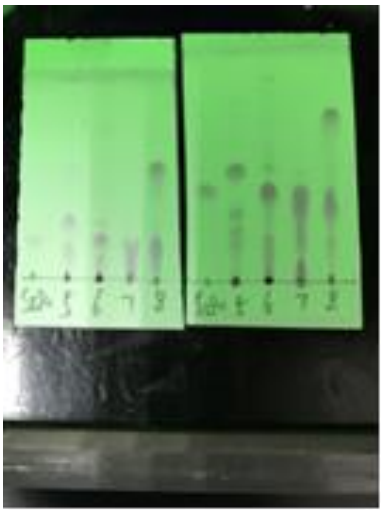
TLC-2: Base screening

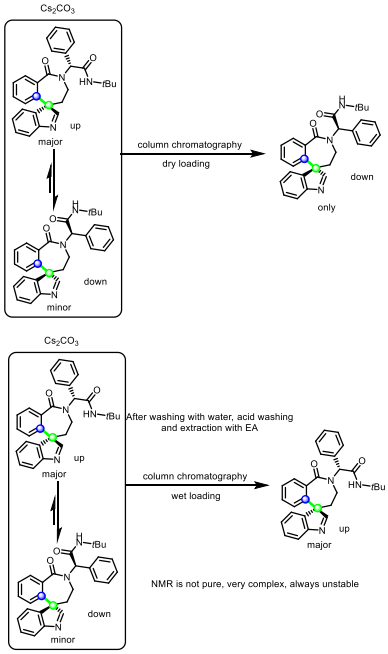


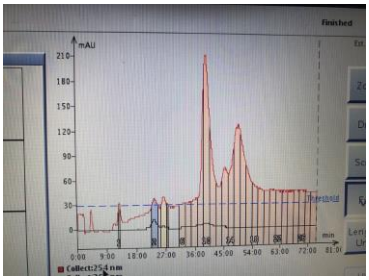
S580: **1a**, 1: Cs_2CO_3, 2: KOAc, 3: K_3PO_4, 4: DABCO, 5: Na_2CO_3, 6: *t*BuONa, 7: DMAP, 8: DBU



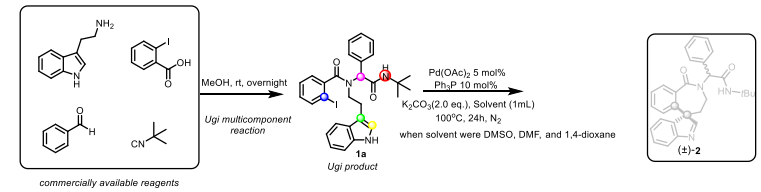


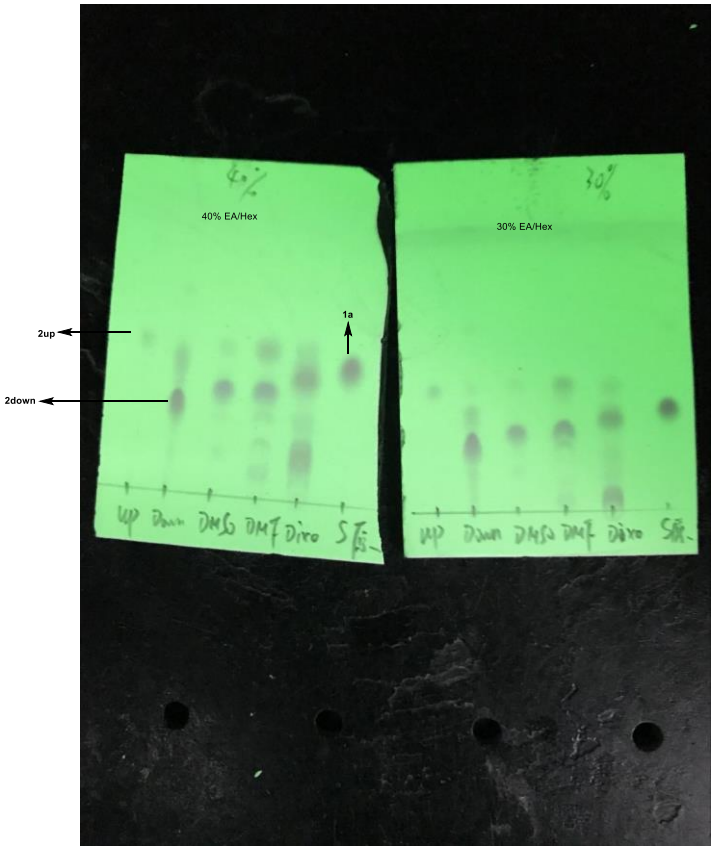




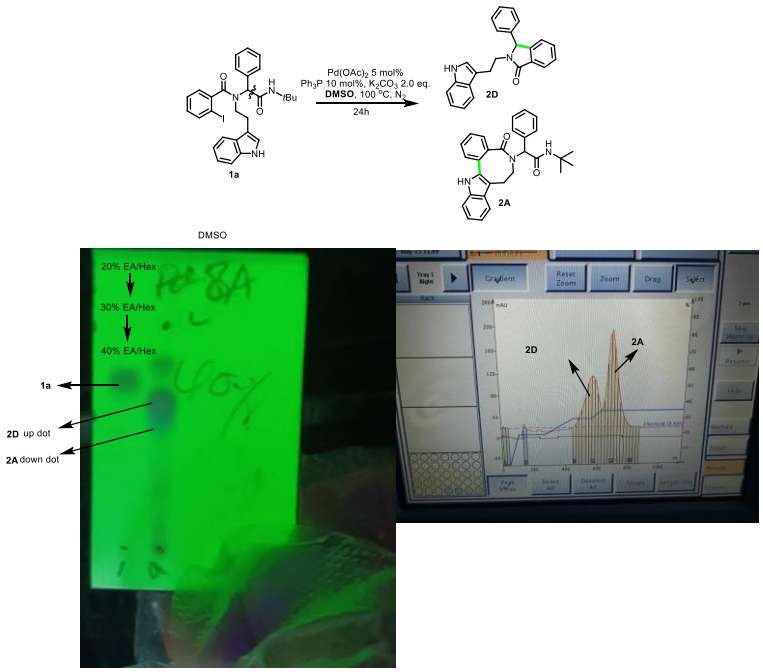


TLC-3: Solvent screening (very important)

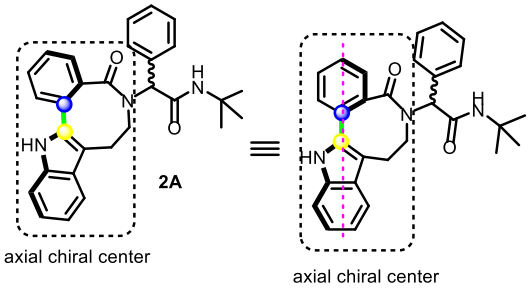


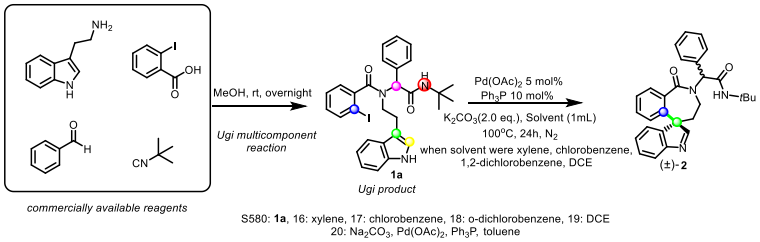


The starting materials **1a** were all reacted completely, but the reaction products of DMSO and DMF are not the same as the reaction product of 1,4-dioxane. We have separately carefully analyzed the case of the DMSO reaction solution, as shown below. The DMSO reaction solution is passed through the column with 30 -35% EA/Hex polarity to obtain two products, namely **2A** and **2D**. The structures of these two products were deduced by NMR analysis.

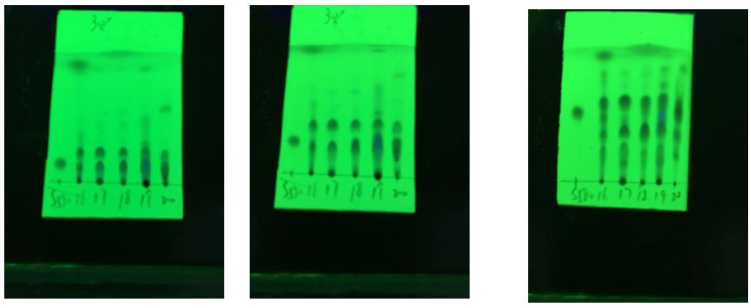


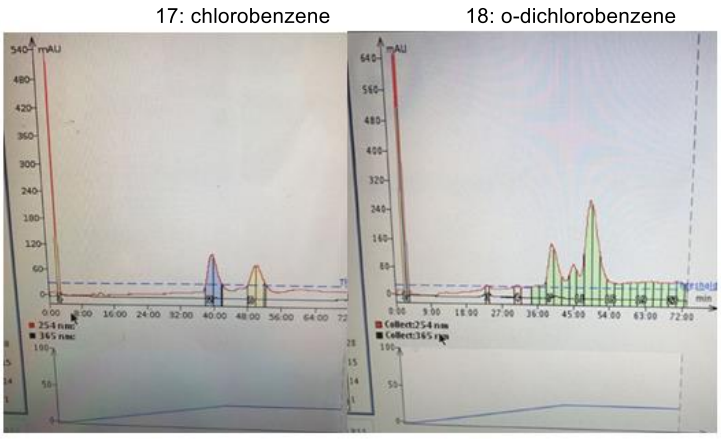
Accordingly, we judged that the 2-position of indole was involved in the reaction. This compound has an axial chiral center, so we can see the existence of obvious diastereomers in the ^{1}H-NMR , ^{13}C-NMR and dept spectrum.

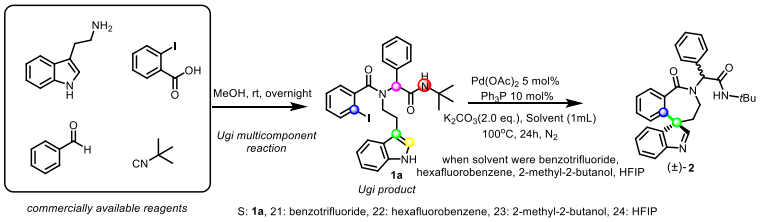




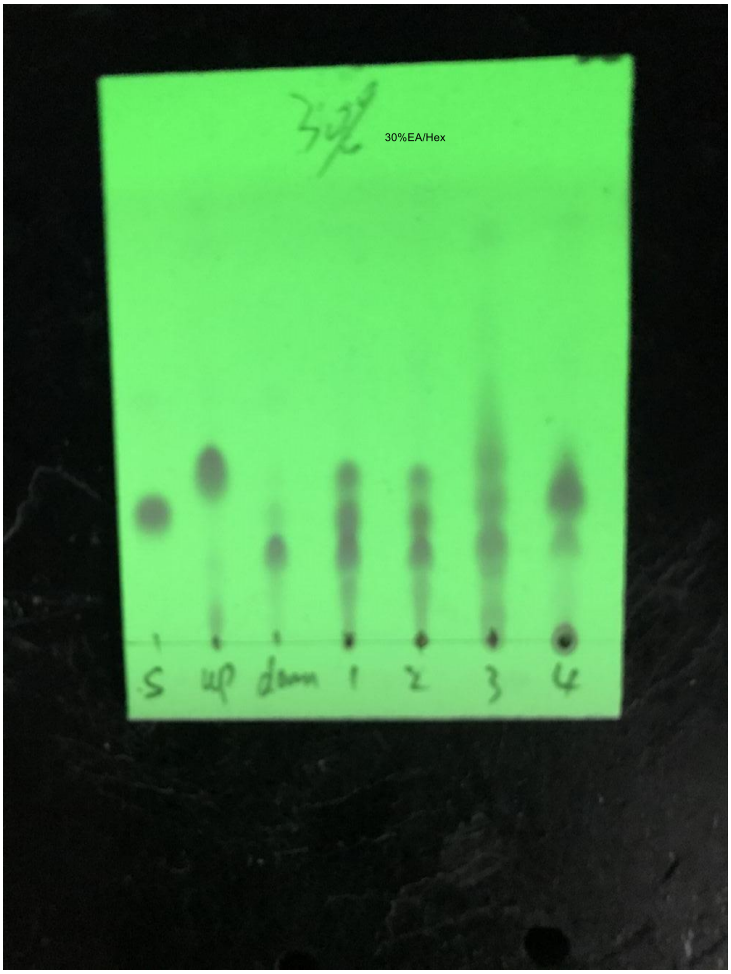
S580: **1a**, 16: xylene, 17: chlorobenzene, 18: o-dichlorobenzene, 19: DCE
20: Na_2CO_3, $Pd(OAc)_2$, Ph_3P, toluene



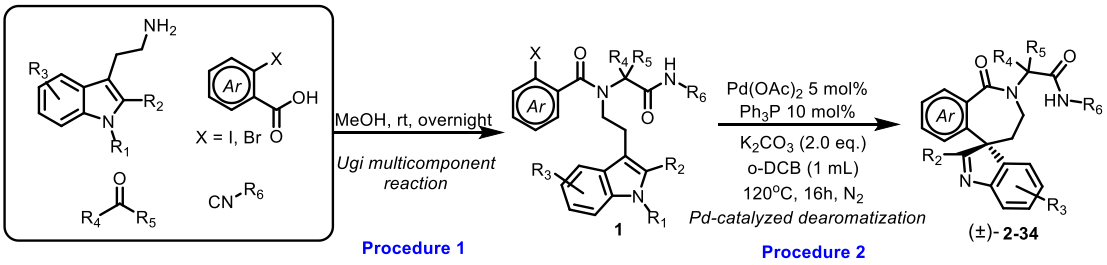




S: **1a**, 21: benzotrifluoride, 22: hexafluorobenzene, 23: 2-methyl-2-butanol, 24: HFIP



3. General Procedure for Synthesis of Benzoazepinespiroindolenines and Characterization Data of Compounds



Procedure 1: synthesis of Ugi products 1

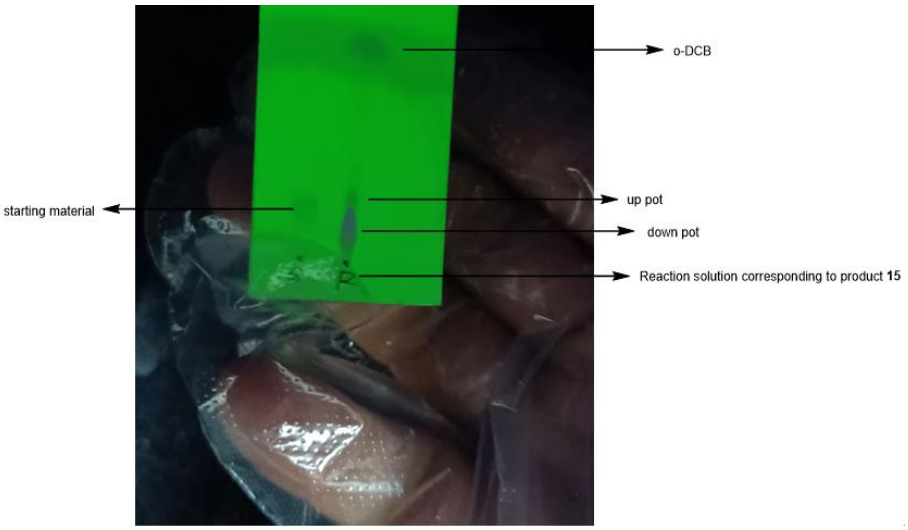
To a solution of aldehydes or ketones (3 mmol, 1.0 equiv.) in methanol (10 mL) were added successively tryptamine derivatives (3 mmol, 1.0 equiv.), *o*-iodobenzoic acid or *o*-bromobenzoic acid derivatives (3 mmol, 1.0 equiv) and isonitrile (2.8 mmol, 0.93 equiv.) in a screw capped vial equipped with a magnetic stir bar. The reaction mixture was stirred at room temperature overnight. After completion of the reaction, the product would be precipitated in solid form, and the desired Ugi products **1** could be obtained directly by filtration.

Procedure 2: synthesis of 3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-1(2H)-one derivatives

Ugi products **1** (0.1 mmol), $Pd(OAc)_2$ (0.005 mmol, 1.1 mg, 0.05 eq), Ph_3P (0.01 mmol, 2.6 mg, 0.1 eq), and K_2CO_3 (0.2 mmol, 28 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous *o*-DCB (1 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 ^oC for 16 h and monitored by TLC. Then the reaction mixture is subjected to wet loading and column chromatography to obtain the target product （±）**-2-34** over silica gel using EtOAc/ n-hexane = 30%~40% as eluent.

Elaboration on the diastereomeric ratio of dearomatization products

The diastereomeric ratios of the dearomatization products were judged according to the crude ^1H NMR of the reaction solution, which was based on the ratio of imine $C(sp^2)$-H. Overall most of the dearomatization products are mainly diastereoisomers at the down points. It should be noted here that most of the substituted aromatic acids or tryptophan-derived dearomatization products possess good diastereoselectivity and their TLC spot plates show almost a single diastereomer, which is beyond our separation ability, so we set their diastereomeric ratios to >15/1, and thus we isolated only one diastereoisomer. We did not perform crude ^1H NMR to determine the diastereomeric ratio of this part of the product, e.g. **14, 15, 16, 17, 20, 21, 23, 25, 27, 29**. For example, the reaction solution spot plate corresponding to product **15** is shown in the figure below.

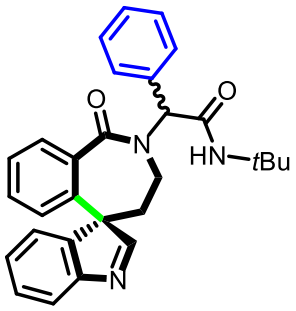


30% EA/hexane

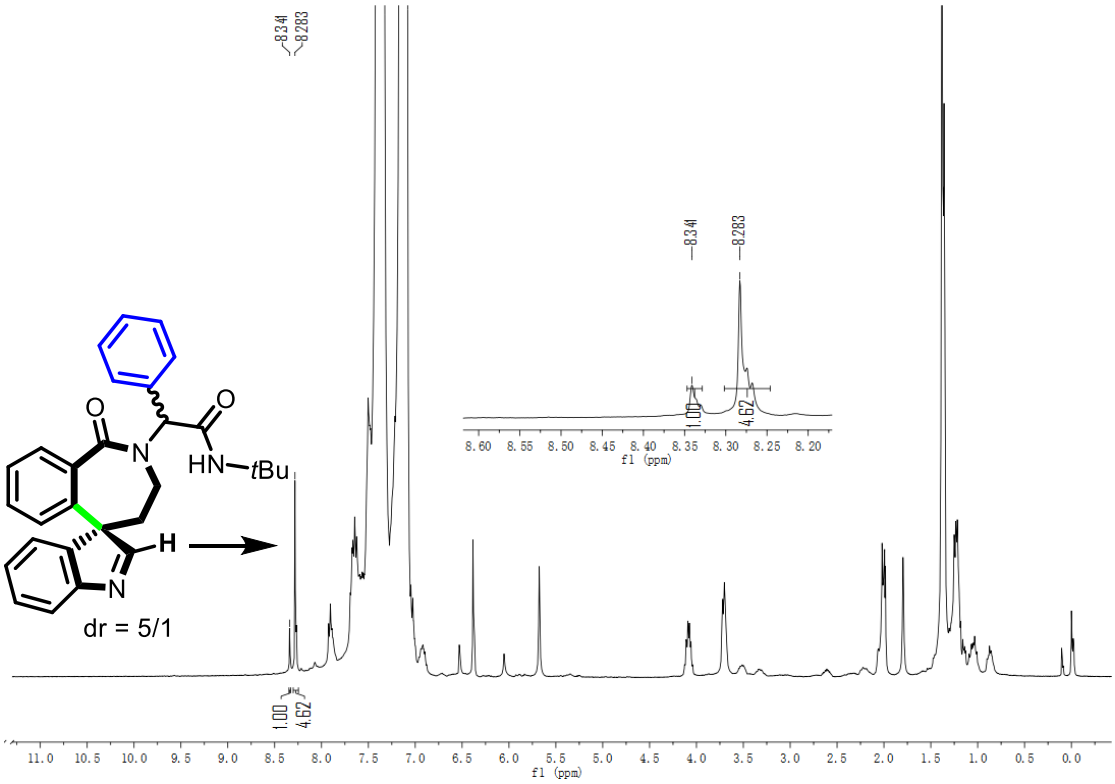
In addition, we have isolated and identified all the product sites generated after the reaction to the extent possible. For example, the dearomatization products **10** and **11** were accompanied by the formation of C_{sp}^3-H aromatization by-products, and the reaction was extremely complex, and we did our best to isolate each product.

The specific steps of the crude ^{1}H NMR procedure are as follows: Re-performing of each reaction involving the dearomatization products under standard conditions. After the reaction, the reaction solution was extracted with water and ethyl acetate to remove the residual palladium salt, then a small amount of the organic phase was concentrated under reduced pressure to remove the ethyl acetate (*o*-DCB boiling point 179^{o}C, difficult to remove), and finally the residue was diluted by adding an excess of deuterated chloroform.

***N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-2**



2 crude ^{1}H NMR



dr = 2down/2up =5/1

White solid, **2down**, 35 mg, 78% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (s, 1H), 7.92 (d, *J* = 7.6 Hz, 1H), 7.65 (d, *J* = 7.4 Hz, 1H), 7.52 (d, *J* = 7.5 Hz, 2H), 7.46 (d, *J* = 7.2 Hz, 1H), 7.42 – 7.35 (m, 5H), 7.33 – 7.29 (m, 2H), 7.05 (d, *J* = 7.8 Hz, 1H), 6.34 (s, 1H), 5.63 (s, 1H), 3.72 – 3.69 (m, 2H), 2.10 – 2.05 (m, 1H), 1.40 (s, 9H), 1.09 – 1.01 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 171.5, 168.7, 154.5, 140.1, 136.7, 135.1, 131.5, 131.2, 131.1, 129.8, 129.3, 129.1, 128.6, 128.4, 126.4, 125.6, 125.0, 122.0, 64.5, 61.2, 52.0, 43.2, 40.8, 28.7 ppm;

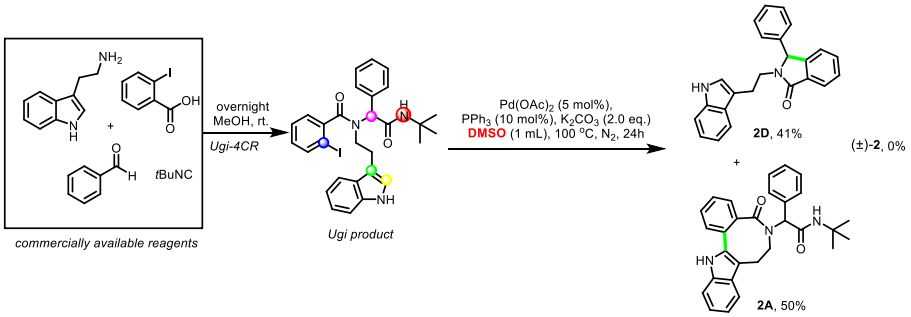
HRMS (ESI) m/z calcd for $C_{29}H_{30}N_3O_2^+$ $(M+H)^+$ 452.2333, found *m/z* 452.2337.

Yellow solid, **2up**, 5 mg, 11% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

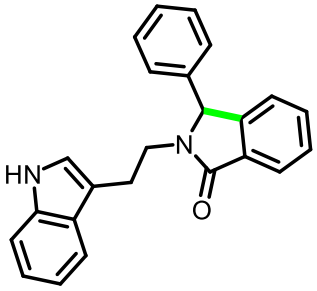
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (s, 1H), 7.89 (d, *J* = 7.2 Hz, 1H), 7.70 (d, *J* = 6.3 Hz, 1H), 7.52 (d, *J* = 5.6 Hz, 1H), 7.40 – 7.31 (m, 9H), 7.12 (d, *J* = 7.5 Hz, 1H), 6.49 (s, 1H), 6.05 (s, 1H), 3.55 – 3.52 (m, 1H), 3.39 –3.33 (m, 1H), 2.65 – 2.58 (m, 1H), 2.27 – 2.23 (m, 1H), 1.41 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.7, 171.9, 167.9, 154.8, 140.3, 136.7, 135.6, 132.4, 131.5, 130.4, 129.0, 128.5 (t, *J* = 8.8 Hz), 126.3, 125.7, 125.0, 122.1, 64.6, 60.7, 52.1, 42.9, 40.1, 28.6 ppm;

HRMS (ESI) m/z calcd for $C_{29}H_{30}N_3O_2^+$ $(M+H)^+$ 452.2333, found *m/z* 452.2335.

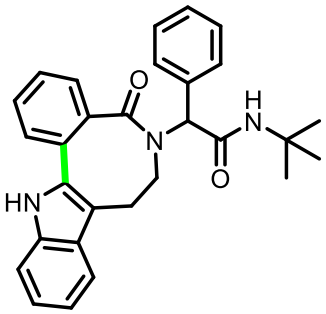


2-(2-(1H-indol-3-yl)ethyl)-3-phenylisoindolin-1-one (2D)



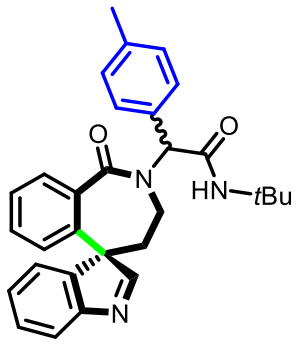
Colorless oil, **2D**, 14 mg, 41% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (s, 1H), 7.90 (dd, *J* = 5.9, 2.6 Hz, 1H), 7.43 (p, *J* = 7.6 Hz, 3H), 7.37–7.28 (m, 4H), 7.17 (dd, *J* = 15.1, 7.5 Hz, 1H), 7.06 (t, *J* = 7.6 Hz, 2H), 7.03–6.95 (m, 3H), 5.21 (s, 1H), 4.51–4.04 (m, 1H), 3.31–3.19 (m, 1H), 3.18–3.05 (m, 1H), 3.04–2.89 (m, 1H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 168.7, 146.4, 136.9, 136.3, 131.7, 131.6, 129.0, 128.6, 128.2, 127.7, 127.3, 123.4, 123.0, 122.1, 122.0, 119.4, 118.7, 112.9, 111.2, 65.0, 40.6, 24.2 ppm;
HRMS (ESI) m/z calcd for $C_{24}H_{21}N_2O^+$ $(M+H)^+$ 353.1648, found *m/z* 353.1651.

***N*-(tert-butyl)-2-(5-oxo-5,7,8,13-tetrahydro-6H-benzo[6,7]azocino[5,4-b]indol-6-yl)-2-phenylacetamide (2A)**

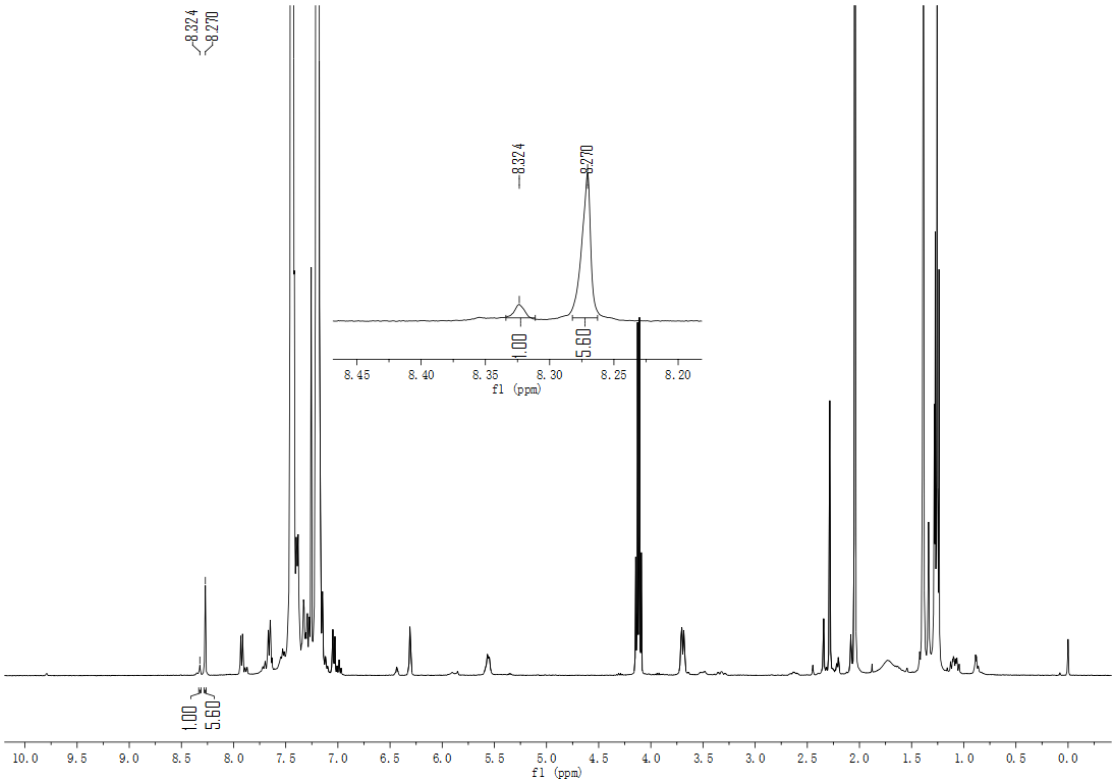


Colorless oil, **2A**, 23 mg, dr = 3/1, 50% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48-8.32 (m, 1H), 7.58 (dd, *J* = 7.7, 5.9 Hz, 1H), 7.42 (ddd, *J* = 8.7, 6.8, 1.7 Hz, 3H), 7.38–7.32 (m, 5H), 7.32–7.25 (m, 1.8H), 7.25–7.14 (m, 1.3H), 7.07-7.05 (m, 1.52H), 6.23 (s, 0.25H), 5.84 (d, *J* = 13.2 Hz, 1H), 5.65 (s, 0.75H), 4.00 (tt, *J* = 18.0, 9.0 Hz, 1H), 3.84 (dd, *J* = 15.6, 5.4 Hz, 0.74H), 3.45–3.26 (m, 0.53H), 2.86–2.62 (m, 0.29H), 2.38 (dd, *J* = 16.6, 3.7 Hz, 0.76H), 2.23–1.99 (m, 0.93H), 1.24 (s, 6.71H), 0.91 (s, 2.47H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 172.2, 172.0, 168.7, 168.5, 136.5, 136.3, 135.9, 135.6, 135.2, 134.8, 131.8, 131.6, 131.3, 131.0, 130.2, 130.0, 129.8, 129.5, 129.4, 129.1, 129.0, 128.9, 128.8, 128.7, 128.6, 128.5, 128.2, 123.1, 122.6, 119.9, 119.3, 118.8, 110.9, 110.8, 109.2, 108.8, 65.0, 62.3, 51.6, 51.1, 45.72, 44.9, 28.5, 27.9, 25.1, 24.5 ppm;
HRMS (ESI) m/z calcd for $C_{29}H_{30}N_3O_2^+$ $(M+H)^+$ 452.2333, found *m/z* 452.2341.

***N-(tert-buty l)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(p-tolyl)acetamide* (±)-3**



3 crude ^{1}H NMR



dr = 3down/3up =6/1

White solid, **3down**, 33 mg, 70% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (s, 1H), 7.91 (d, *J* = 7.5 Hz, 1H), 7.65 (d, *J* = 7.2 Hz, 1H), 7.47 – 7.35 (m, 6H), 7.28 (d, *J* = 7.7 Hz, 1H), 7.16 (d, *J* = 7.1 Hz, 2H), 7.04 (d, *J* = 7.7 Hz, 1H), 6.30 (s, 1H), 5.65 (s, 1H), 3.70 – 3.68 (m, 2H), 2.29 (s, 3H), 2.08 – 2.04 (m, 1H), 1.38 (s, 9H), 1.14 – 1.06 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.2, 171.4, 168.9, 154.5, 140.2, 139.0, 136.8, 132.0, 131.4, 131.3, 131.1, 129.9, 129.7, 128.5, 128.3, 126.4, 125.5, 125.1, 122.0, 64.6, 60.9, 51.9, 43.1, 40.8, 28.7, 21.1 ppm;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2493.

Yellow solid, **3up**, 6 mg, 12% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

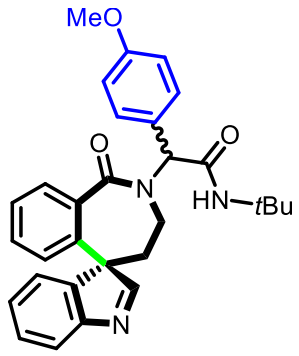
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 7.88 (d, *J* = 7.6 Hz, 1H), 7.70 (d, *J* = 7.3 Hz, 1H), 7.52 (d, *J* = 7.4 Hz, 1H), 7.45 – 7.38 (m, 3H), 7.31 – 7.29 (m, 3H), 7.17 (d, *J* = 7.9 Hz, 2H), 7.11 (d, *J* = 7.8 Hz,

1H), 6.45 (s, 1H), 6.02 (s, 1H), 3.52 (dd, *J* = 14.6, 4.9 Hz, 1H), 3.38 – 3.28 (m, 1H), 2.68 – 2.55 (m, 1H), 2.34 (s, 3H), 2.23 (dd, *J* = 14.2, 2.6 Hz, 1H), 1.39 (s, 9H). ppm;

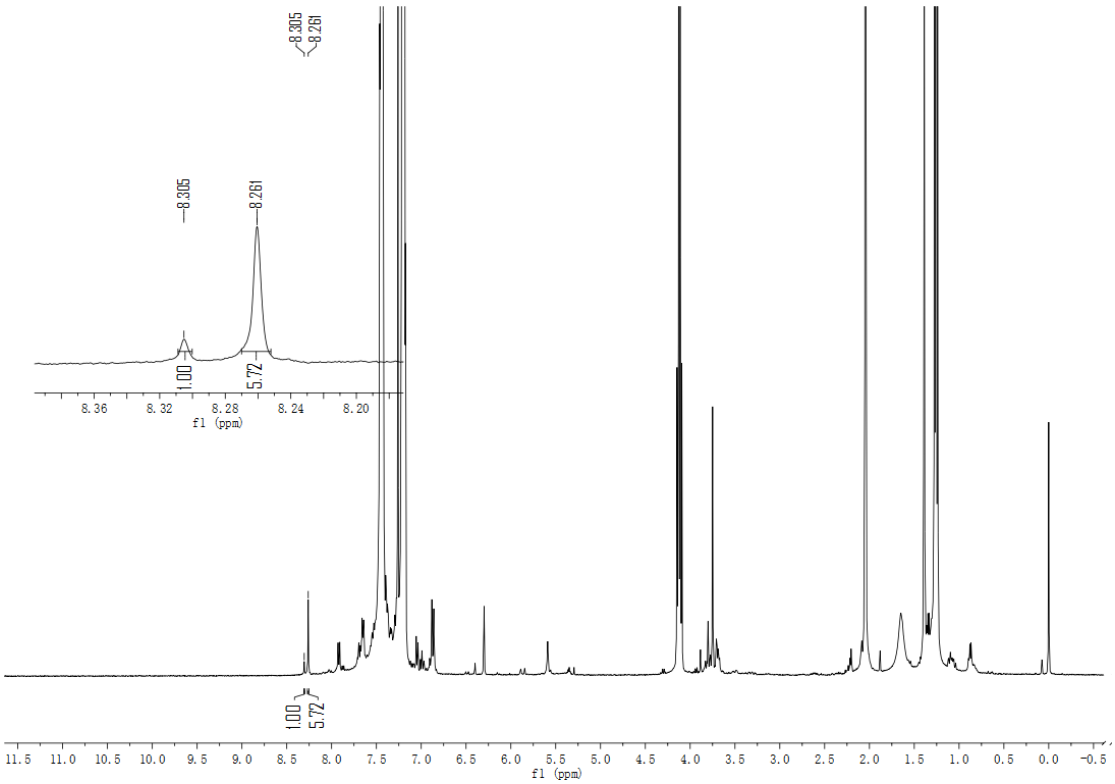
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.8, 171.8, 168.1, 154.8, 140.4, 138.3, 136.7, 132.4 (d, *J* = 10.9 Hz), 131.4, 130.4, 129.7, 128.5 (d, *J* = 2.1 Hz), 128.2, 126.3, 125.7, 125.0, 122.0, 64.6, 60.7, 52.0, 42.7, 40.1, 28.6, 21.1 ppm;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2497.

***N-(tert-butyl)-2-(4-methoxyphenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl) acetamide* (±)-4**



4 crude ^{1}H NMR



dr = 4down/4up =6/1

Yellow solid, **4down**, 36 mg, 74% yield, Rf = 0.25 (ethyl acetate/hexane = 40%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (s, 1H), 7.92 (dd, *J* = 7.7, 1.3 Hz, 1H), 7.67 – 7.63 (m), 7.46 – 7.37 (m, 7H), 7.29 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.08 – 7.02 (m, 1H), 6.88 (d, *J* = 8.7 Hz, 2H), 6.29 (s, 1H), 5.59 (s, 1H), 3.76 (s, 3H), 3.69 (dd, *J* = 10.3, 4.6 Hz), 2.09 – 2.05 (m, 1H), 1.39 (s, 9H), 1.12 – 1.04 (m, 1H)

ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 171.4, 169.0, 159.9, 154.5, 140.1, 136.8, 131.4, 131.12 (t, *J* = 6.9 Hz), 128.6, 128.4, 126.8, 126.4, 125.6, 125.1, 122.1, 114.5, 64.5, 60.5, 55.3, 51.9, 43.0, 40.9, 28.7 ppm;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_3^+$ $(M+H)^+$ 482.2438, found *m/z* 482.2443.

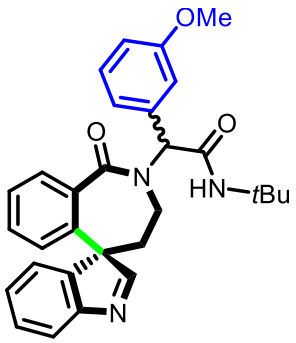
Yellow solid, **4up**, 4 mg, 9% yield, Rf = 0.5 (ethyl acetate/hexane = 40%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 7.88 (d, *J* = 7.6 Hz, 1H), 7.70 (d, *J* = 7.6 Hz, 1H), 7.52 (d, *J* = 6.8 Hz, 1H), 7.41 (dd, *J* = 14.2, 7.0 Hz, 3H), 7.33 (dd, *J* = 13.9, 8.2 Hz, 3H), 7.11 (d, J = 7.8 Hz, 1H), 6.89 (d, *J* = 8.6 Hz, 2H), 6.42 (s, 1H), 6.15 (d, *J* = 14.1 Hz, 1H), 3.80 (s, 3H), 3.54 (dd, *J* = 14.9, 4.1 Hz, 1H), 3.38–3.27 (m, 1H), 2.60 (td, *J* = 13.3, 5.6 Hz, 1H), 2.24 (dd, *J* = 17.9, 5.6 Hz, 1H), 1.39 (s, 9H) ppm;

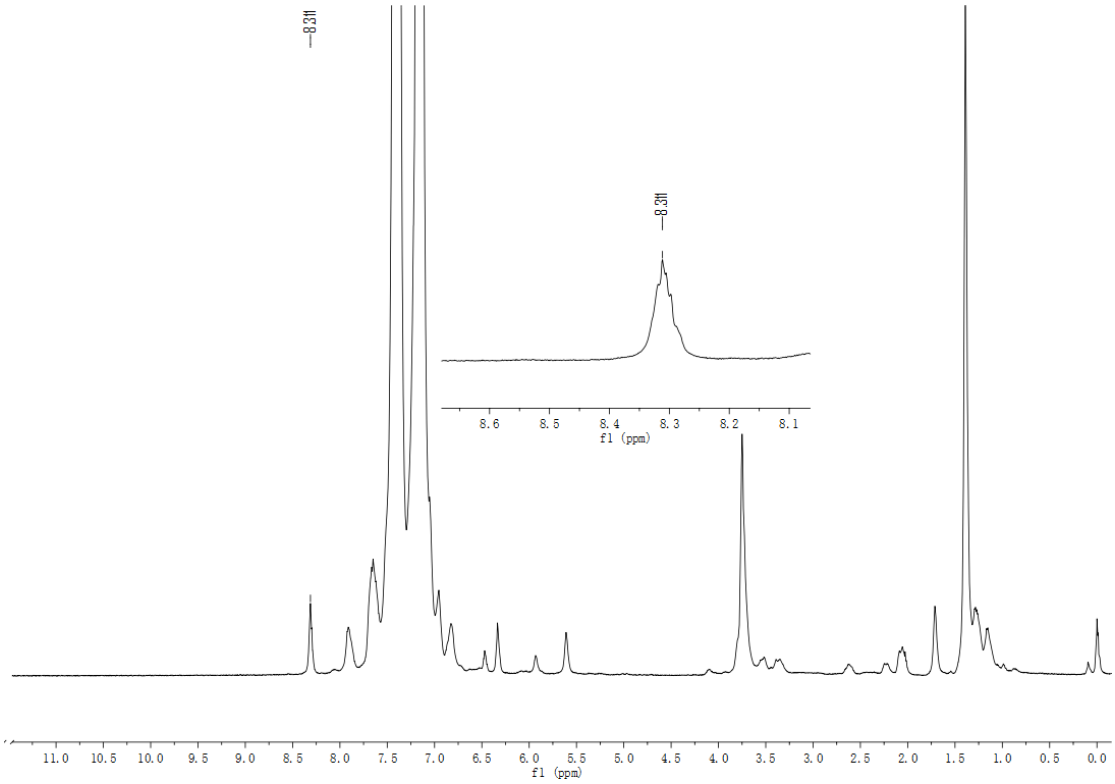
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.9, 171.8, 168.1, 159.6, 154.6, 140.3, 136.7, 132.3, 131.4, 130.4, 129.9, 128.6, 128.2, 127.4, 126.3, 125.7, 125.0, 122.0, 114.3, 64.5, 60.4, 55.3, 52.0, 42.6, 40.0, 28.6 ppm;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_3^+$ $(M+H)^+$ 482.2438, found *m/z* 482.2446.

***N-(tert-butyl)-2-(3-methoxyphenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl) acetamide* (±)-5**



5 crude ^{1}H NMR



dr = 5down/5up > 15/1

Yellow solid, **5down**, 38 mg, 78% yield, Rf = 0.25 (ethyl acetate/hexane = 40%);

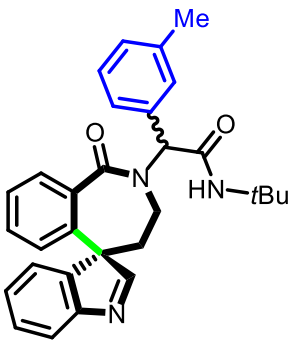
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (s, 1H), 7.92 (d, *J* = 7.4 Hz, 1H), 7.65 (d, *J* = 7.2 Hz, 1H), 7.47 (d, *J* = 6.6 Hz, 1H), 7.42 – 7.35 (m, 3H), 7.30 – 7.25 (m, 2H), 7.10 – 7.04 (m, 3H), 6.84 (d, *J* = 8.2 Hz, 1H), 6.32 (s, 1H), 5.65 (s, 1H), 3.77 (s, 3H), 3.77 – 3.64 (m, 2H), 2.11 – 2.07 (m, 1H), 1.40 (s, 9H), 1.19 – 1.11 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.2, 171.5, 168.6, 160.0, 154.6, 140.1, 136.7, 136.5, 131.5, 131.3, 131.1, 130.2, 128.6, 128.3, 126.4, 125.6, 125.1, 122.1, 115.1, 114.8, 64.5, 61.1, 55.3, 52.0, 43.2, 40.8, 28.7 ppm;

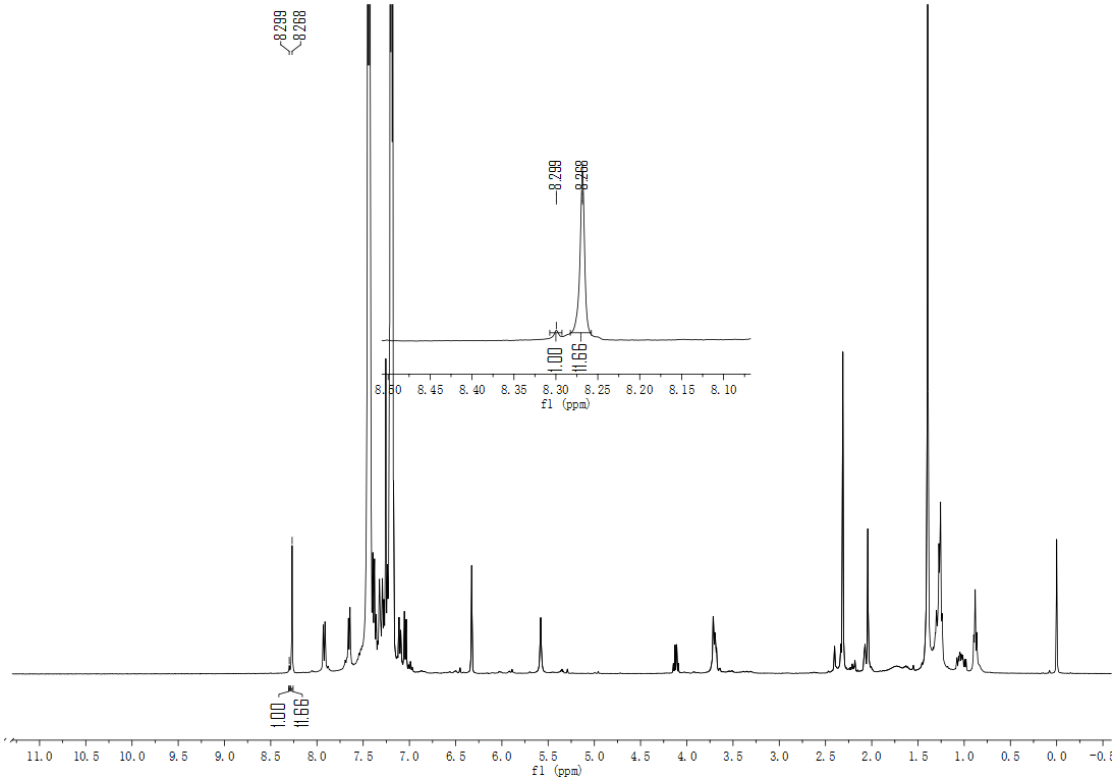
HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_3^+$ $(M+H)^+$ 482.2438, found *m/z* 482.2448.

5up is trace and not separated

***N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(m-tolyl)acetamide* (±)-6**



6 crude ^{1}H NMR



dr = 6down/6up = 12/1

White solid, **6down**, 37 mg, 79% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (s, 1H), 7.91 (d, *J* = 7.6 Hz, 1H), 7.65 (d, *J* = 7.1 Hz, 1H), 7.46 (d, *J* = 7.1 Hz, 1H), 7.41–7.34 (m, 3H), 7.32–7.27 (m, 3H), 7.26–7.22 (m, 1H), 7.10 (d, *J* = 7.5 Hz, 1H), 7.04 (d, *J* = 7.8 Hz, 1H), 6.34 (s, 1H), 5.72 (s, 1H), 3.76–3.62 (m, 2H), 2.31 (s, 3H), 2.07–2.03 (m, 1H), 1.08–0.99 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.2, 171.4, 168.8, 154.5, 140.1, 139.1, 136.8, 135.1, 131.4, 131.2, 131, 130.5, 129.7, 129.1, 128.6, 128.3, 126.8, 126.4, 125.5, 125.1, 122.0, 64.5, 61.1, 51.9, 43.2, 40.9, 28.7, 21.4 ppm;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2493.

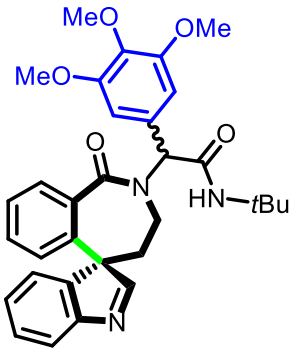
White solid, **6up**, 3 mg, 6% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30 (s, 1H), 7.89 (d, *J* = 7.6 Hz, 1H), 7.70 (d, *J* = 7.4 Hz, 1H), 7.52 (d, *J* = 6.8 Hz, 1H), 7.45 – 7.38 (m, 3H), 7.30 (t, *J* = 7.7 Hz, 1H), 7.26 – 7.22 (m, 1H), 7.20 (s, 2H), 7.13 (t, *J* = 8.0 Hz, 2H), 6.46 (s, 1H), 6.06 (s, 1H), 3.54 (dd, *J* = 14.9, 4.1 Hz, 1H), 3.41 – 3.30 (m, 1H), 2.62 (td, *J* = 13.4, 5.6 Hz, 1H), 2.33 (s, 3H), 2.23 (dd, *J* = 14.5, 2.4 Hz, 1H), 1.40 (s, 9H) ppm;

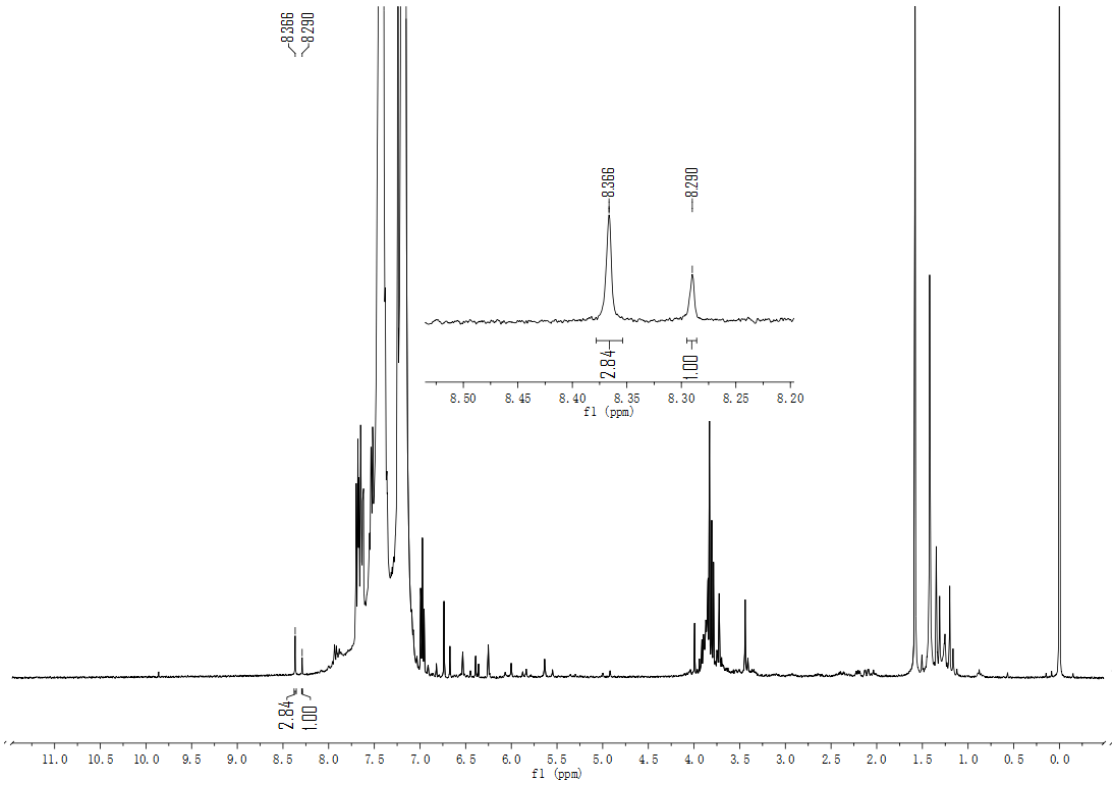
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.8, 171.8, 168.0, 154.8, 140.4, 138.7, 136.7, 135.5, 132.4, 131.4, 130.4, 129.2 (d, *J* = 5.6 Hz), 128.8, 128.6, 128.2, 126.3, 125.7, 125.5, 125.0, 122.0, 64.6, 60.8, 52.1, 42.9, 40.0, 28.6, 21.5 ppm;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2497.

***N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(3,4,5-trimethoxyphenyl)acetamide* (±)-7**



7 crude ^{1}H NMR



dr = 7down/7up = 3/1

White solid, **7down**, 38 mg, 71% yield, Rf = 0.25 (ethyl acetate/hexane = 45%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.36 (s, 1H), 7.92 (d, *J* = 7.5 Hz, 1H), 7.65 (d, *J* = 7.1 Hz, 1H), 7.48 (d, *J* = 6.7 Hz, 1H), 7.45 – 7.35 (m, 3H), 7.30 (t, *J* = 7.6 Hz, 1H), 7.09 (d, *J* = 7.7 Hz, 1H), 6.73 (s, 2H), 6.24 (s, 1H), 5.71 (s, 1H), 3.82 (s, 9H), 3.74 – 3.62 (m, 2H), 2.13 – 2.06 (m, 1H), 1.23 – 1.19 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 171.6, 168.8, 154.5, 153.5, 140.0, 138.2, 136.6, 131.6, 131.2, 131.1, 130.3, 128.7, 128.4, 126.6, 125.6, 125.1, 122.1, 106.7, 64.6, 61.1, 60.9, 56.2, 52.0, 43.2, 41.3, 28.7 ppm;

HRMS (ESI) m/z calcd for $C_{32}H_{36}N_3O_5^+$ $(M+H)^+$ 542.2649, found *m/z* 542.2655.

White solid, **7up**, 7 mg, 13% yield, Rf = 0.5 (ethyl acetate/hexane = 45%);

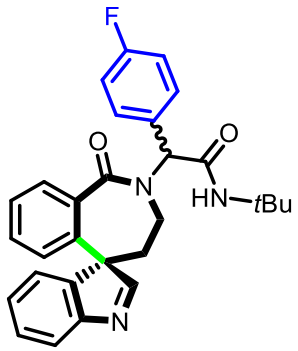
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.28 (s, 1H), 7.89 (d, *J* = 7.6 Hz, 1H), 7.69 (d, *J* = 7.6 Hz, 1H), 7.54 (d, *J* = 6.8 Hz, 1H), 7.45 – 7.36 (m, 3H), 7.32 (t, *J* = 7.6 Hz, 1H), 7.13 (d, *J* = 7.8 Hz, 1H), 6.66 (s, 2H), 6.36 (s, 1H), 6.01 (s, 1H), 3.84 (s, 3H), 3.78 (s, 6H), 3.59 – 3.51 (m, 1H), 3.42 – 3.31 (m, 1H), 2.69 –

2.58 (m, 1H), 2.25 – 2.18 (m, 1H), 1.42 (s, 9H) ppm;

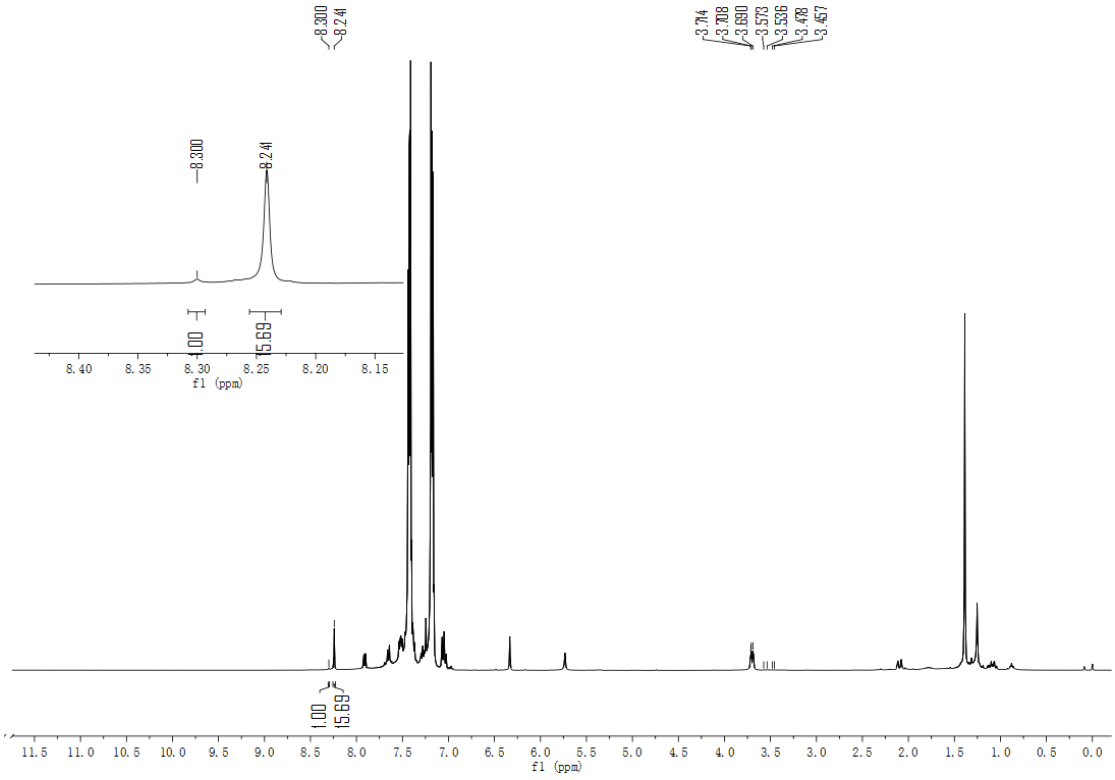
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.9, 171.9, 167.9, 154.8, 153.5, 140.5, 138.1, 136.6, 132.7, 131.5, 130.8, 130.4, 128.6, 128.3, 126.3, 125.7, 124.9, 122.1, 105.9, 64.5, 61.1, 60.9, 56.2, 52.0, 42.8, 39.9, 28.6 ppm;

HRMS (ESI) m/z calcd for $C_{32}H_{36}N_3O_5^+$ $(M+H)^+$ 542.2649, found *m/z* 542.2651.

***N-(tert-butyl)-2-(4-fluorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide* (±)-8**



8 crude ^{1}H NMR



dr = 8down/8up > 15/1

Yellow solid, **8down**, 39 mg, 83% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (s, 1H), 7.91 (d, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 7.3 Hz, 1H), 7.52 (dd, *J* = 8.3, 5.3 Hz, 2H), 7.47 (d, *J* = 7.0 Hz, 1H), 7.44 – 7.36 (m, 3H), 7.30 (t, *J* = 7.7 Hz, 1H), 7.06 (t, *J* = 8.0 Hz, 3H), 6.32 (s, 1H), 5.75 (d, *J* = 6.6 Hz, 1H), 3.71 – 3.69 (m, 2H), 2.12 – 2.08 (m, 1H), 1.39 (s, 9H), 1.13 – 1.05 (m, 1H) ppm;

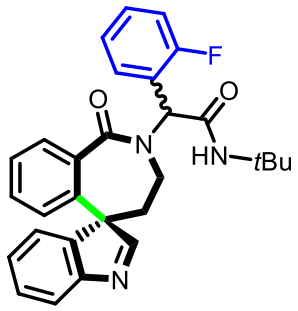
^{13}C NMR (100 MHz, $CDCl_3$) δ 173.9, 171.5, 168.6, 164.1, 161.6, 154.4, 140.0, 136.5, 131.6 (d, *J* = 8.1 Hz), 131.2, 131.1, 130.9, 128.7, 128.4, 126.5, 125.6, 125.0, 122.1, 116.4, 116.2, 64.5, 60.2, 52.0, 43.0, 40.9, 28.7 ppm;

^{19}F NMR (376 MHz, $CDCl_3$) δ -111.69 – -111.73 (m) ppm;

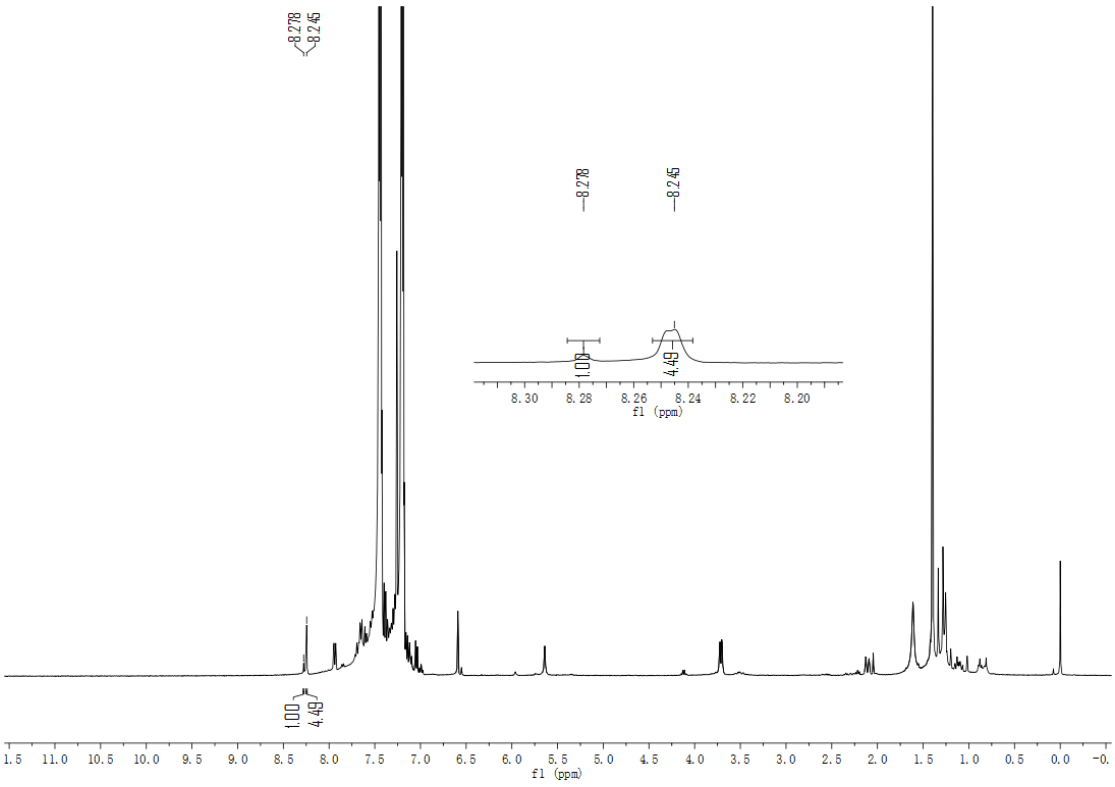
HRMS (ESI) m/z calcd for $C_{29}H_{29}FN_3O_2^+$ $(M+H)^+$ 470.2238, found *m/z* 470.2241.

8up is trace and not separated

***N-(tert-butyl)-2-(2-fluorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide* (±)-9**



9 crude ^{1}H NMR



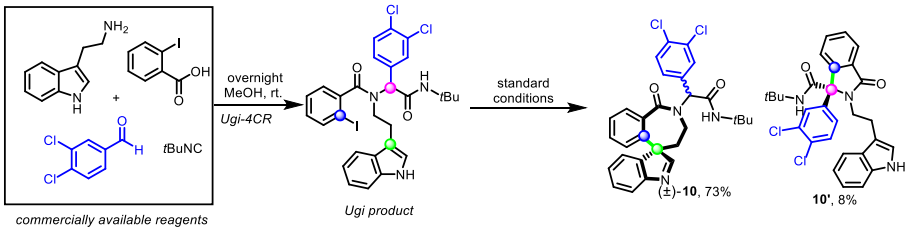
dr = 9down/9up = 4/1

Yellow solid, **9down**, 36 mg, 77% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

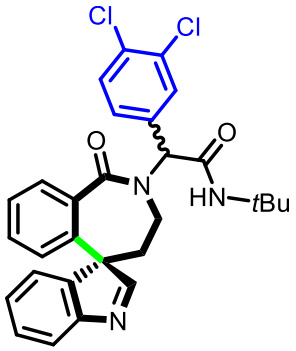
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (s, 1H), 7.93 (d, *J* = 7.6 Hz, 1H), 7.63 (dd, *J* = 16.0, 7.4 Hz, 2H), 7.46 (d, *J* = 7.2 Hz, 1H), 7.39 (dd, *J* = 15.1, 7.4 Hz, 3H), 7.31 (dd, *J* = 14.7, 7.8 Hz, 2H), 7.20 – 7.08 (m, 2H), 7.04 (d, *J* = 7.8 Hz, 1H), 6.60 (s, 1H), 5.70 (s, 1H), 3.78 – 3.63 (m, 2H), 2.11 (d, *J* = 14.3 Hz, 1H), 1.40 (s, 9H), 1.12 (dt, *J* = 14.3, 9.5 Hz, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.4 (d, *J* = 5.4 Hz), 171.3, 168.1, 161.1 (d, *J* = 247.5 Hz), 154.7, 140.1, 136.6, 131.5, 131.2 (d, *J* = 8.7 Hz), 131.1, 130.9, 128.5, 128.3, 126.3, 125.6, 125.0, 124.7 (d, *J* = 3.7 Hz), 122.6 (d, *J* = 14.3 Hz), 122.0, 116.4, 116.2, 64.5, 54.5, 52.0, 43.2, 40.4, 28.7 ppm;
^{19}F NMR (376 MHz, $CDCl_3$) δ -109.5 – -114.2 (m);
HRMS (ESI) m/z calcd for $C_{29}H_{29}FN_3O_2^+$ $(M+H)^+$ 470.2238, found *m/z* 470.2249.

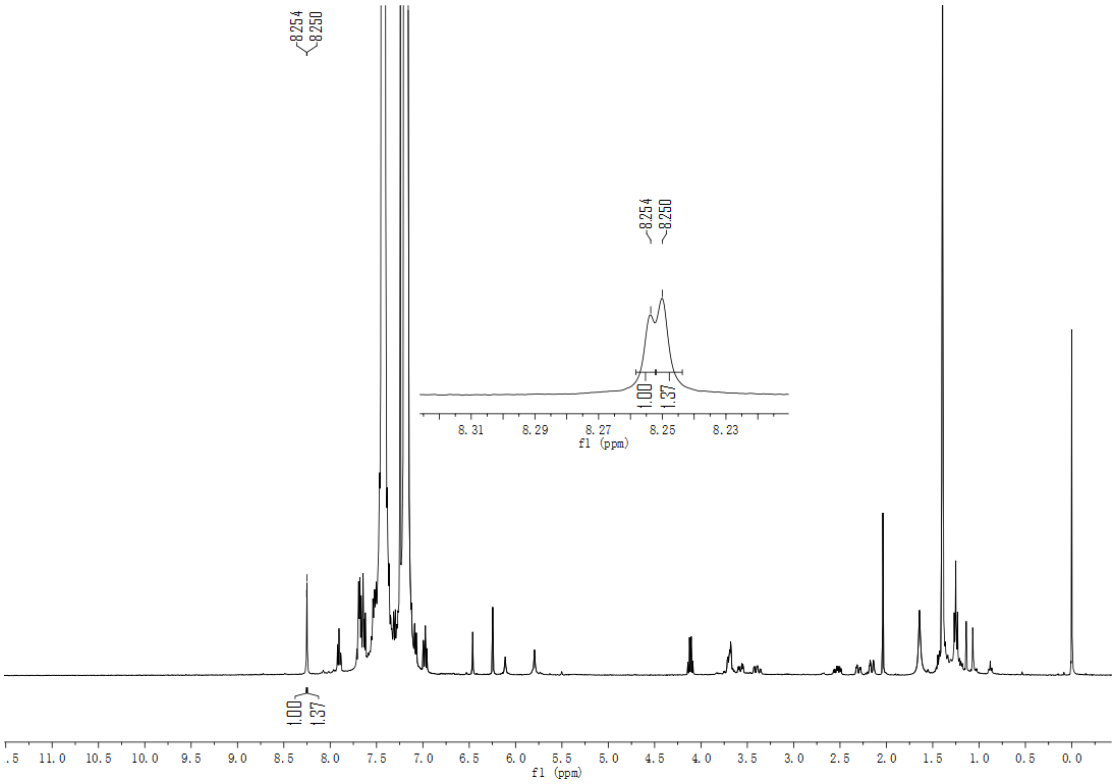
Yellow solid, **9up**, 7 mg, 15% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 7.86 (d, *J* = 7.6 Hz, 1H), 7.70 (d, *J* = 7.3 Hz, 1H), 7.54 – 7.45 (m, 2H), 7.44 – 7.38 (m, 3H), 7.35 – 7.29 (m, 2H), 7.18 – 7.05 (m, 3H), 6.61 (s, 1H), 6.27 (s, 1H), 3.58 – 3.43 (m, 2H), 2.62– 2.53 (m, 1H), 2.30– 2.27 (m, 1H), 1.38 (s, 9H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.7, 171.5, 161.1 (d, *J* = 249.0 Hz), 159.9, 154.8, 140.3, 136.7, 132.1, 131.4, 130.4 (d, *J* = 8.4 Hz), 129.8, 128.6, 128.3, 126.3, 125.7, 125.0, 124.5 (d, *J* = 3.6 Hz), 122.1, 116.0 (d, *J* = 21.6 Hz), 64.5, 56.5, 52.1, 43.0, 40.1, 28.5 ppm;
^{19}F NMR (376 MHz, $CDCl_3$) δ -114.16 – -114.34 (m)
HRMS (ESI) m/z calcd for $C_{29}H_{29}FN_3O_2^+$ $(M+H)^+$ 470.2238, found *m/z* 470.2245.



***N-(tert-butyl)-2-(3,4-dichlorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide* (±)-10**



10 crude ^{1}H NMR



dr = 10down/10up = 1.4/1

Yellow solid, **10down**, 21 mg, 41% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (s, 1H), 7.90 (d, *J* = 7.6 Hz, 1H), 7.68 (d, *J* = 7.5 Hz, 2H), 7.49 (d, *J* = 6.7 Hz, 1H), 7.45 – 7.29 (m, 6H), 7.08 (d, *J* = 7.8 Hz, 1H), 6.27 (s, 1H), 5.97 (s, 1H), 3.70 (dd, *J* = 10.7, 3.1 Hz, 2H), 2.20 – 2.13 (m, 1H), 1.39 (s, 9H), 1.24 – 1.17 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.8, 171.8, 167.9, 154.4, 140.0, 136.2, 135.2, 133.4, 131.8, 131.4, 131.1, 129.2, 128.8, 128.5, 126.7, 125.7, 125.0, 122.2, 64.4, 59.9, 52.1, 43.2, 40.8, 28.6 ppm;

HRMS (ESI) m/z calcd for $C_{29}H_{28}Cl_2N_3O_2^+$ $(M+H)^+$ 520.1553, found *m/z* 520.1558.

Yellow solid, **10up**, 17 mg, 32% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

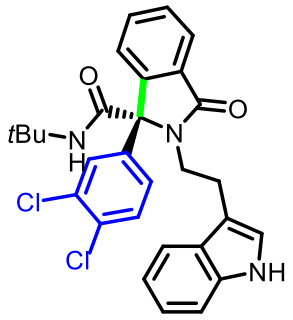
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (s, 1H), 7.83 (d, *J* = 7.6 Hz, 1H), 7.63 (d, *J* = 6.5 Hz, 1H), 7.47 (d, *J* = 7.5 Hz, 1H), 7.40 (s, 1H), 7.37 – 7.31 (m, 2H), 7.32 (d, *J* = 8.2 Hz, 1H), 7.27 (d, *J* = 7.2 Hz, 1H), 7.19 (s, 1H), 7.16 (d, *J* = 8.3 Hz, 1H), 7.06 (d, *J* = 7.8 Hz, 1H), 6.63 (s, 1H), 6.45 (s, 1H), 3.59 (dd, *J* = 14.7, 4.8 Hz, 1H), 3.35 (td, *J* = 14.5, 4.3 Hz, 1H), 2.51 – 2.38 (m, 1H), 2.25 (dd, *J* = 14.4, 3.5 Hz, 1H), 1.29 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.3, 170.9, 166.0, 153.5, 139.0, 135.2, 135.1, 132.0, 131.5, 131.1, 130.8, 129.8, 129.5, 129.2, 127.7, 127.4, 126.6, 125.5, 124.8, 124.1, 121.1, 63.5, 58.0, 51.2, 41.8, 39.0, 27.5 ppm;

HRMS (ESI) m/z calcd for $C_{29}H_{28}Cl_2N_3O_2^+$ $(M+H)^+$ 520.1553, found *m/z* 520.1558.

2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-1-(3,4-dichlorophenyl)-3-oxoisoindoline-1-carboxamide

（10’）

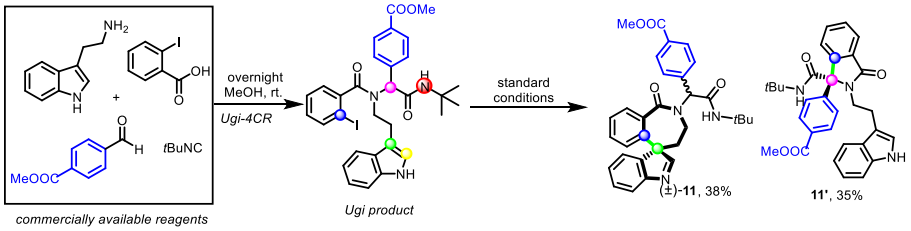


White solid, **10'**, 4 mg, 8% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

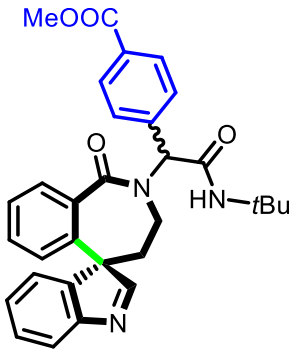
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11 (s, 1H), 7.94 (d, *J* = 6.5 Hz, 1H), 7.60 (p, *J* = 6.7 Hz, 2H), 7.53 (d, *J* = 7.6 Hz, 2H), 7.38 (d, *J* = 8.4 Hz, 1H), 7.32 (d, *J* = 7.9 Hz, 1H), 7.25 (d, *J* = 2.0 Hz, 1H), 7.16 (dt, *J* = 20.7, 7.2 Hz, 2H), 7.05 (s, 1H), 6.98 (dd, *J* = 8.5, 2.0 Hz, 1H), 5.86 (s, 1H), 3.69 (t, *J* = 8.0 Hz, 2H), 3.16 – 2.96 (m, 1H), 2.58-2.51 (m, 1H), 1.15 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.6, 167.4, 145.9, 138.0, 136.3, 133.2, 133.0, 132.9, 130.7, 130.6, 129.7, 128.1, 127.1, 123.9, 123.7, 122.3, 122.0, 119.6, 118.8, 112.5, 111.2, 75.4, 52.0, 42.8, 28.2, 23.8 ppm;

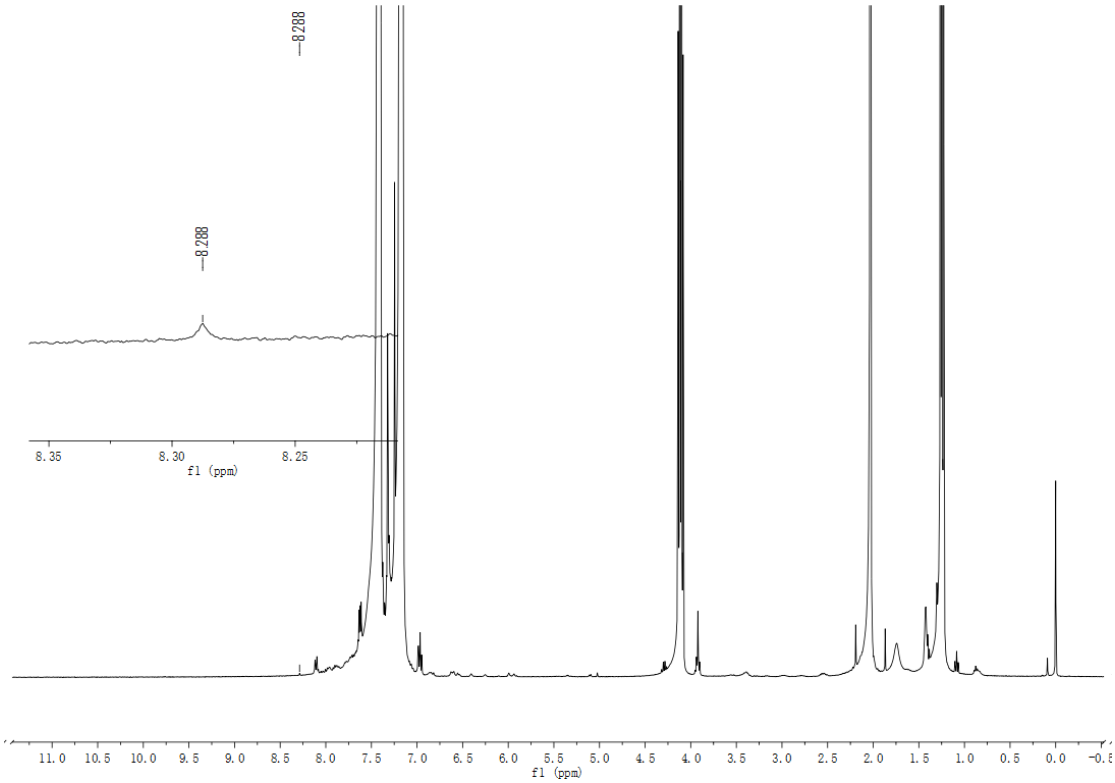
HRMS (ESI) m/z calcd for $C_{29}H_{28}Cl_2N_3O_2^+$ $(M+H)^+$ 520.1553, found *m/z* 520.1557.



methyl-4-(2-(tert-butylamino)-2-oxo-1-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)ethyl)benzoate **(±)-11**



11 crude ^{1}H NMR



dr = 11down/11up > 15/1

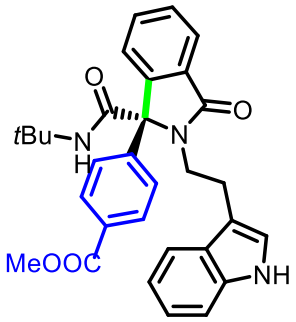
White solid, **11up**, 19 mg, 38% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 8.02 (d, *J* = 8.2 Hz, 2H), 7.91 (d, *J* = 7.5 Hz, 1H), 7.70 (d, *J* = 6.7 Hz, 1H), 7.53 (d, *J* = 7.4 Hz, 1H), 7.45 – 7.41 (m, 5H), 7.33 (t, *J* = 7.2 Hz, 1H), 7.13 (d, *J* = 7.8 Hz, 1H), 6.58 (s, 1H), 6.49 (s, 1H), 3.92 (s, 3H), 3.62 – 3.57 (m, 1H), 3.45 – 3.37 (m, 1H), 2.59 – 2.51 (m, 1H), 2.31 – 2.27 (m, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.4, 172.0, 167.4, 166.6, 154.6, 140.7, 140.1, 136.3, 132.2, 131.7, 130.4, 130.1, 128.7, 128.4, 128.2, 126.5, 125.8, 125.0, 122.1, 64.5, 60.1, 52.3, 43.0, 40.0, 28.6 ppm;

HRMS (ESI) m/z calcd for $C_{31}H_{32}N_3O_4^+$ 510.2387, found *m/z* 510.2391.

11down is trace and not separated



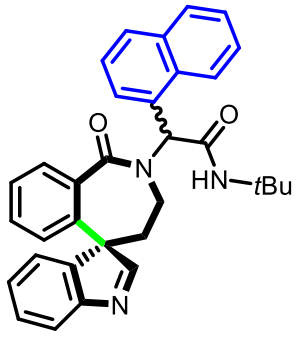
Yellow solid, **11'**, 18 mg, 35% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (s, 1H), 8.00 (d, *J* = 8.3 Hz, 2H), 7.94 (d, *J* = 7.0 Hz, 1H), 7.62 – 7.54 (m, 3H), 7.52 (d, *J* = 7.7 Hz, 1H), 7.30 (d, *J* = 8.0 Hz, 1H), 7.24 (s, 1H), 7.16 (t, *J* = 7.5 Hz, 1H), 7.09 (t, *J* = 7.4 Hz, 1H), 6.99 (s, 1H), 5.91 (s, 1H), 3.91 (s, 3H), 3.71 – 3.67 (m, 2H), 3.05 – 2.98 (m, 1H), 2.44 – 2.37 (m, 1H), 1.18 (s, 9H) ppm;

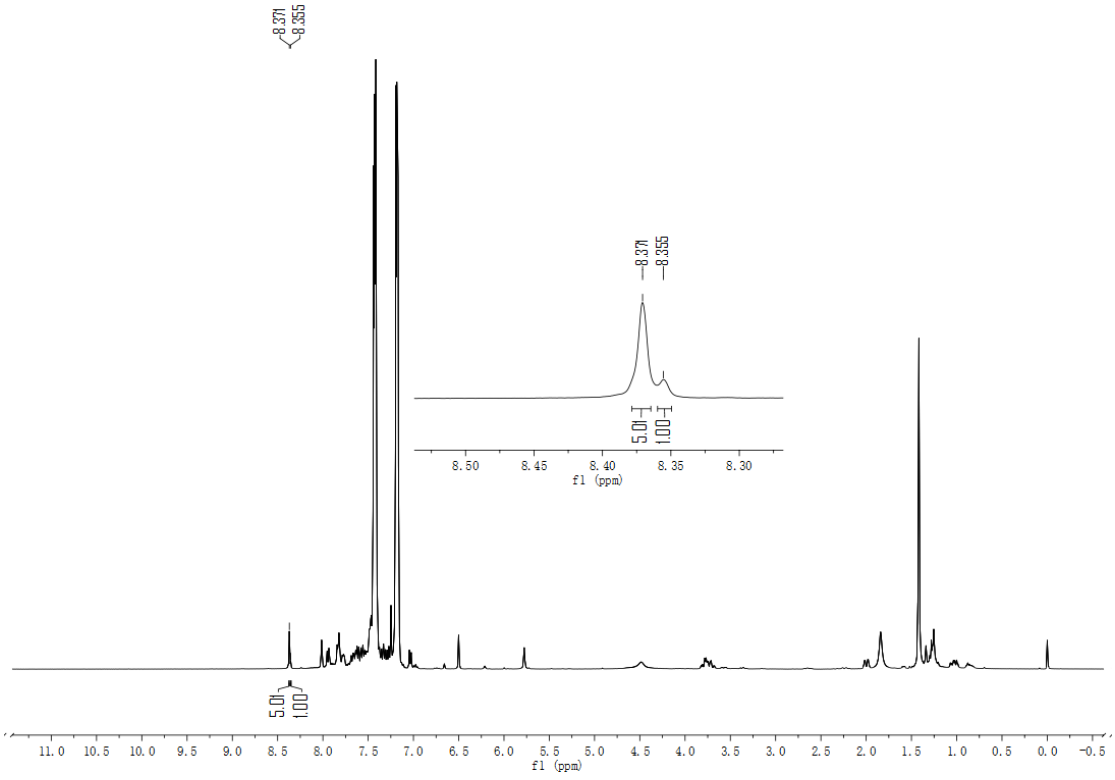
^{13}C NMR (100 MHz, $CDCl_3$) δ 169.7, 167.8, 166.5, 146.2, 142.9, 136.3, 133.0, 130.9, 130.3, 129.9, 129.6, 128.7, 127.2, 123.8, 123.7, 122.1, 122.0, 119.5, 118.9, 112.6, 111.2, 76.0, 52.3, 52.0, 42.9, 28.2, 23.7 ppm;

HRMS (ESI) m/z calcd for $C_{31}H_{32}N_3O_4^+$ $(M+H)^+$ 510.2387, found *m/z* 510.2388.

***N-(tert-butyl)-2-(naphthalen-1-yl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide* (±)-12**



12 crude ^{1}H NMR



dr = 12down/12up = 5/1

Yellow solid, **12down**, 35 mg, 70% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

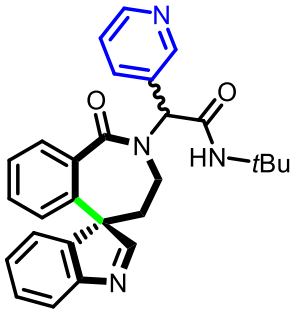
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.36 (s, 1H), 8.01 (s, 1H), 7.94 (d, *J* = 7.6 Hz, 1H), 7.85 – 7.78 (m, 3H), 7.62 (d, *J* = 7.5 Hz, 1H), 7.57 (d, *J* = 8.5 Hz, 1H), 7.49 (dd, *J* = 6.2, 3.2 Hz, 2H), 7.42 – 7.36 (m, 3H), 7.34 – 7.28 (m, 2H), 7.04 (d, *J* = 7.8 Hz, 1H), 6.49 (s, 1H), 5.74 (s, 1H), 3.82 – 3.67 (m, 2H), 2.03 – 1.98 (m, 1H), 1.42 (s, 9H), 1.07 – 0.99 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 171.7, 168.8, 154.4, 140.0, 136.7, 133.2, 133.1, 132.4, 131.5, 131.3, 131.1, 129.1, 128.6, 128.4, 128.2, 127.7, 127.2, 127.0, 126.8, 126.4, 125.6, 125.0, 122.0, 64.5,

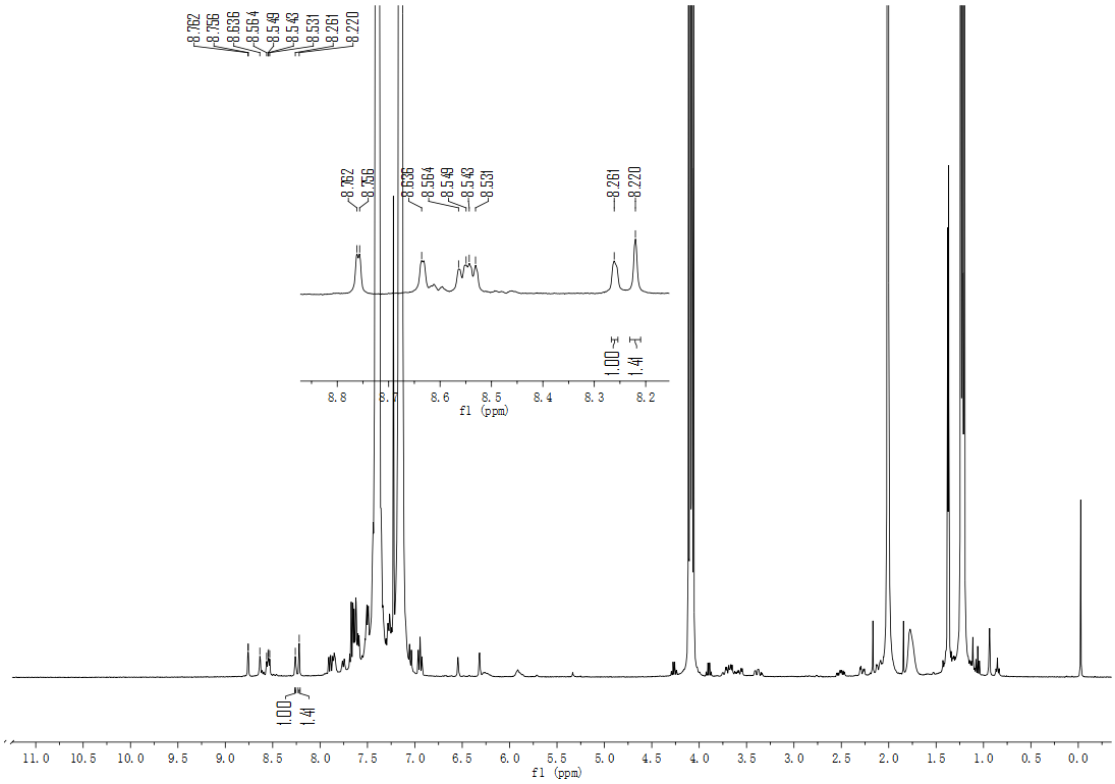
61.3, 52.0, 43.2, 40.8, 28.8 ppm;
HRMS (ESI) m/z calcd for $C_{33}H_{32}N_3O_2^+$ $(M+H)^+$ 502.2489, found *m/z* 502.2494.

Yellow solid, **12up**, 8 mg, 15% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (s, 1H), 7.93 (d, *J* = 5.4 Hz, 2H), 7.84 – 7.78 (m, 3H), 7.71 (d, *J* = 7.4 Hz, 1H), 7.53 – 7.49 (m, 3H), 7.47 – 7.38 (m, 4H), 7.31 (t, *J* = 7.6 Hz, 1H), 7.12 (d, *J* = 7.8 Hz, 1H), 6.67 (s, 1H), 6.17 (s, 1H), 3.60 – 3.55 (m, 1H), 3.42 – 3.28 (m, 1H), 2.74 – 2.58 (m, 1H), 2.26 – 2.22 (m, 1H), 1.43 (s, 9H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.8, 171.9, 167.9, 154.8, 140.3, 136.7, 133.2, 133.0, 132.4, 131.5, 130.4, 128.9, 128.6, 128.2, 128.0, 127.6, 126.7, 126.6, 126.3, 126.0, 125.8, 125.0, 122.1, 64.6, 60.9, 52.1, 42.8, 40.1, 28.7 ppm;
HRMS (ESI) m/z calcd for $C_{33}H_{32}N_3O_2^+$ $(M+H)^+$ 502.2489, found *m/z* 502.2499.

***N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(pyridin-3-yl)aceta mide* (±)-13**



13 crude ^{1}H NMR



dr = 13down/13up = 1.4/1

Yellow solid, **13down**, 28 mg, 63% yield, Rf = 0.25 (ethyl acetate/hexane = 40%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.77 (s, 1H), 8.58 (d, *J* = 4.2 Hz, 1H), 8.22 (s, 1H), 7.91 (t, *J* = 8.4 Hz, 2H), 7.65 (d, *J* = 7.0 Hz, 1H), 7.47 (d, *J* = 7.0 Hz, 1H), 7.44 – 7.30 (m, 5H), 7.08 (d, *J* = 7.8 Hz, 1H), 6.34 (s, 1H), 6.01 (s, 1H), 3.78 – 3.64 (m, 2H), 2.16 – 2.13 (m, 1H), 1.39 (s, 9H), 1.20 – 1.12 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ173.6, 171.8, 167.7, 154.4, 150.6, 150.2, 139.9, 137.5, 136.2, 131.8, 131.4, 131.1, 128.7, 128.5, 126.6, 125.7, 125.0, 123.9, 122.2, 64.4, 59.2, 52.1, 43.2, 40.7, 28.7 ppm;

HRMS (ESI) m/z calcd for $C_{28}H_{29}N_4O_2^+$ $(M+H)^+$ 453.2285, found *m/z* 453.2286.

Yellow oil, **13up**, 9 mg, 21% yield, Rf = 0.4 (ethyl acetate/hexane = 40%);

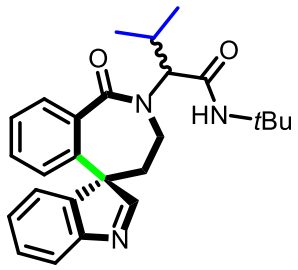
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.56 (s, 1H), 8.50 (s, 1H), 8.24 (s, 1H), 7.83 (d, *J* = 7.6 Hz, 1H), 7.68 (d, *J* = 7.9 Hz, 1H), 7.63 (d, *J* = 6.7 Hz, 1H), 7.47 (d, *J* = 7.5 Hz, 1H), 7.41 – 7.32 (m, 3H), 7.29 – 7.20 (m, 2H), 7.06 (d, *J* = 7.8 Hz, 1H), 6.60 (s, 1H), 6.55 (s, 1H), 3.56 (dd, *J* = 14.7, 5.1 Hz, 1H), 3.40 – 3.29 (m, 1H), 2.51 – 2.40 (m, 1H), 2.25 (dd, *J* = 14.4, 3.4 Hz, 1H), 1.32 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.2, 171.0, 166.0, 153.6, 148.7, 148.4, 139.0, 135.2, 135.0, 131.1, 130.7, 129.4, 127.7, 127.4, 125.50 (s), 124.8, 124.0, 122.6, 121.1, 63.5, 57.1, 51.3, 41.8, 39.0, 27.5;

HRMS (ESI) m/z calcd for $C_{28}H_{29}N_4O_2^+$ $(M+H)^+$ 453.2285, found *m/z* 453.2284.

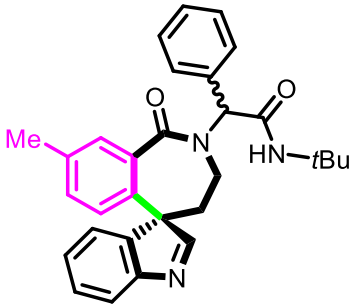
N-(tert-butyl)-3-methyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)butanamide

(±)-14



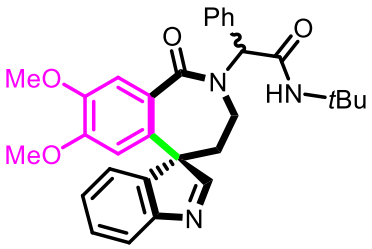
Yellow solid, **14down**, 34 mg, 82% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (s, 1H), 7.79 (d, *J* = 7.5 Hz, 1H), 7.74 – 7.65 (m, 1H), 7.61 – 7.50 (m, 1H), 7.47 – 7.37 (m, 3H), 7.30 (dd, *J* = 10.8, 4.5 Hz, 1H), 7.10 (d, *J* = 7.8 Hz, 1H), 6.35 (s, 1H), 4.82 (d, *J* = 10.9 Hz, 1H), 3.88 (dd, *J* = 14.5, 4.4 Hz, 1H), 3.47 (td, *J* = 14.4, 4.2 Hz, 1H), 2.40 – 2.30 (m, 2H), 2.28 – 2.20 (m, 1H), 1.34 (s, 9H), 1.01 (d, *J* = 6.4 Hz, 3H), 0.90 (d, *J* = 6.7 Hz, 3H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.3, 171.8, 169.0, 154.6, 140.0, 137.1, 131.4, 131.3, 130.0, 128.7, 128.3, 126.6, 125.6, 125.1, 122.1, 64.3, 62.7, 51.9, 41.1, 39.9, 28.5, 27.5, 19.2, 18.3;
HRMS (ESI) m/z calcd for $C_{26}H_{32}N_3O_2^+$ $(M+H)^+$ 418.2489, found *m/z* 418.2488.
14up is trace and not separated

***N-(tert-butyl)-2-(8-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-15**



White solid, **15down**, 35 mg, 76% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (s, 1H), 7.74 (s, 1H), 7.64 (d, *J* = 7.3 Hz, 1H), 7.51 (d, *J* = 7.4 Hz, 2H), 7.44 (d, *J* = 6.9 Hz, 1H), 7.41 – 7.28 (m, 5H), 7.07 (d, *J* = 7.8 Hz, 1H), 6.91 (d, *J* = 7.9 Hz, 1H), 6.34 (s, 1H), 5.64 (s, 1H), 3.76 – 3.62 (m, 2H), 2.35 (s, 3H), 2.04 – 2.01 (m, 1H), 1.40 (s, 9H), 1.09 – 0.98 (m, 1H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.3, 171.7, 168.7, 154.6, 140.3, 138.3, 136.4, 135.1, 132.1, 131.7, 129.8, 129.2, 129.0, 128.5, 128.2, 126.3, 125.6, 125.0, 122.0, 64.2, 61.2, 51.9, 43.2, 40.6, 28.7, 20.8;
HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ 466.2489, found *m/z* 466.2497.
15up is trace and not separated

***N-(tert-butyl)-2-(7,8-dimethoxy-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-16**



Yellow solid, **16down**, 43 mg, 83% yield, Rf = 0.3 (ethyl acetate/hexane = 40%);

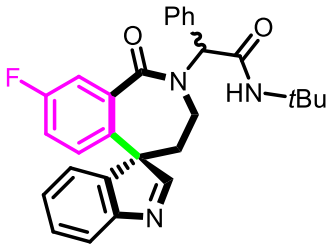
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 7.65 (d, *J* = 7.4 Hz, 1H), 7.51 – 7.46 (m, 4H), 7.42 – 7.33 (m, 5H), 6.51 (s, 1H), 6.31 (s, 1H), 5.59 (s, 1H), 3.94 (s, 3H), 3.78 – 3.67 (m, 2H), 3.64 (s, 3H), 2.08 – 2.03 (m, 1H), 1.40 (s, 9H), 1.06 – 0.98 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.5, 171.4, 168.8, 154.6, 150.9, 148.5, 140.6, 135.3, 129.9, 129.2, 129.1, 129.0, 128.6, 126.4, 124.5, 124.4, 122.2, 114.0, 109.0, 64.3, 61.4, 56.1, 55.7, 52.0, 43.4, 40.9, 28.8;

HRMS (ESI) m/z calcd for $C_{31}H_{34}N_3O_4^+$ 512.2544, found *m/z* 512.2548.

16up is trace and not separated

***N-(tert-butyl)-2-(8-fluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-17**



Yellow solid, **17down**, 38 mg, 80% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

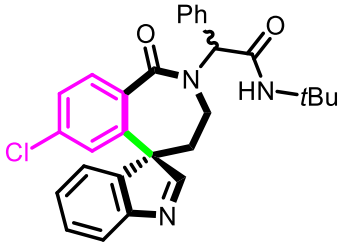
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (s, 1H), 7.66 – 7.61 (m, 2H), 7.50 (d, *J* = 7.5 Hz, 2H), 7.46 – 7.40 (m, 2H), 7.39 – 7.30 (m, 4H), 7.03 (dd, *J* = 8.4, 5.4 Hz, 1H), 6.99 – 6.92 (m, 1H), 6.34 (s, 1H), 5.74 (s, 1H), 3.79 – 3.60 (m, 2H), 2.07 – 2.02 (m, 1H), 1.39 (s, 9H), 1.11 – 0.97 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.9, 170.2, 168.5, 162.4 (d, *J* = 248.9 Hz), 154.4, 140.0, 138.7 (d, *J* = 7.3 Hz), 134.9, 129.8, 129.3, 129.1, 128.7, 127.6 (d, *J* = 7.6 Hz), 127.2 (d, *J* = 3.3 Hz), 126.6, 124.9, 122.1, 118.2 (dd, *J* = 22.2, 15.1 Hz), 63.9, 61.3, 52.0, 43.2, 40.6, 28.7;

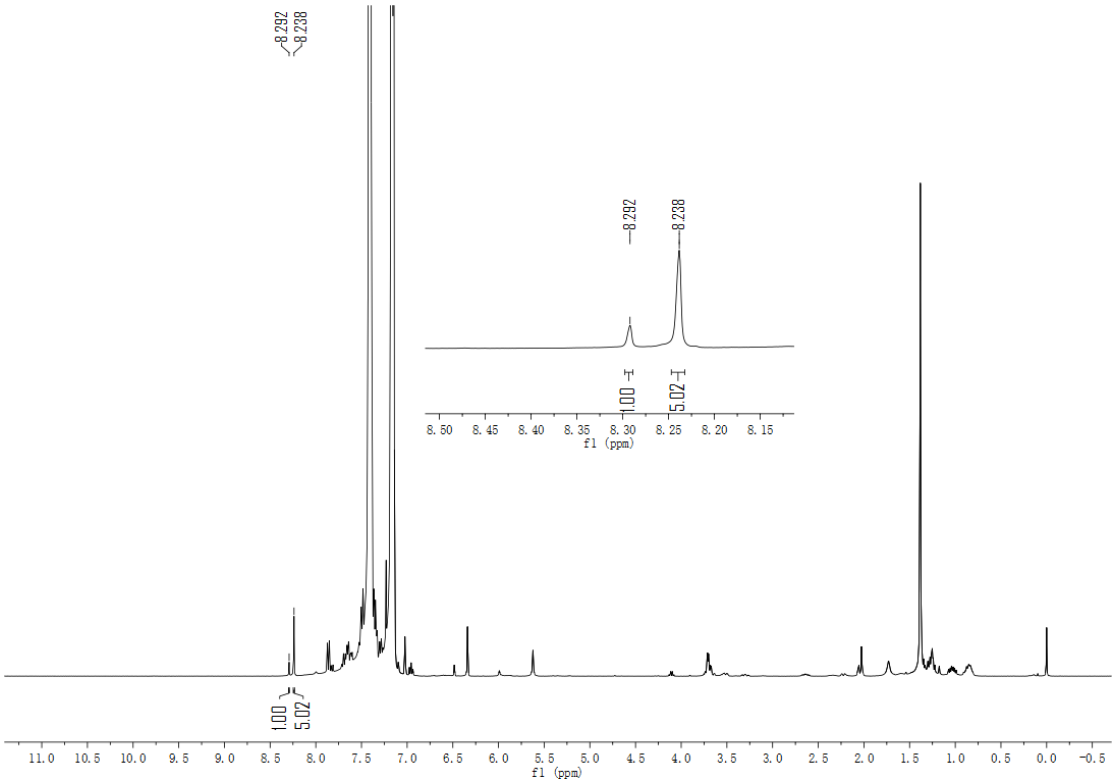
HRMS (ESI) m/z calcd for $C_{29}H_{29}FN_3O_2^+$ $(M+H)^+$ 470.2238, found *m/z* 470.2242.

±17up is trace and not separated

***N-(tert-butyl)-2-(7-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-18**



18 crude ^{1}H NMR



dr = 18down/18up = 5/1

Yellow solid, **18down**, 34 mg, 70% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (s, 1H), 7.86 (d, *J* = 8.3 Hz, 1H), 7.66 (d, *J* = 7.2 Hz, 1H), 7.49 (d, *J* = 7.3 Hz, 2H), 7.46 – 7.35 (m, 6H), 7.32 – 7.29 (m, 1H), 7.02 (s, 1H), 6.34 (s, 1H), 5.72 (s, 1H), 3.75 – 3.62 (m, 2H), 2.07 – 2.03 (m, 1H), 1.39 (s, 9H), 1.08 – 0.99 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.3, 170.6, 168.6, 154.4, 139.4, 137.6, 135.1, 134.9, 133.4, 132.6, 129.8, 129.3, 129.1, 128.9, 128.4, 126.9, 125.8, 124.8, 122.2, 64.2, 61.2, 52.0, 43.1, 40.7, 28.7;

HRMS (ESI) m/z calcd for $C_{29}H_{29}ClN_3O_2^+$ $(M+H)^+$ 486.1943, found *m/z* 486.1942.

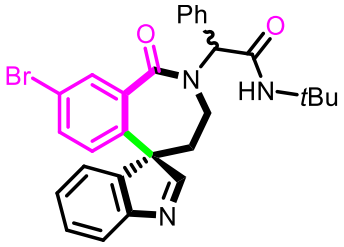
Yellow solid, **18up**, 4 mg, 8% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (s, 1H), 7.83 (d, *J* = 8.3 Hz, 1H), 7.71 (d, *J* = 7.0 Hz, 1H), 7.51 (d, *J* = 8.0 Hz, 1H), 7.48 – 7.42 (m, 2H), 7.41 – 7.32 (m, 6H), 7.10 (s, 1H), 6.47 (s, 1H), 6.14 (s, 1H), 3.57 – 3.52 (m, 1H), 3.36 – 3.28 (m, 1H), 2.66 – 2.58 (m, 1H), 2.26 – 2.22 (m, 1H), 1.40 (s, 9H) ppm;

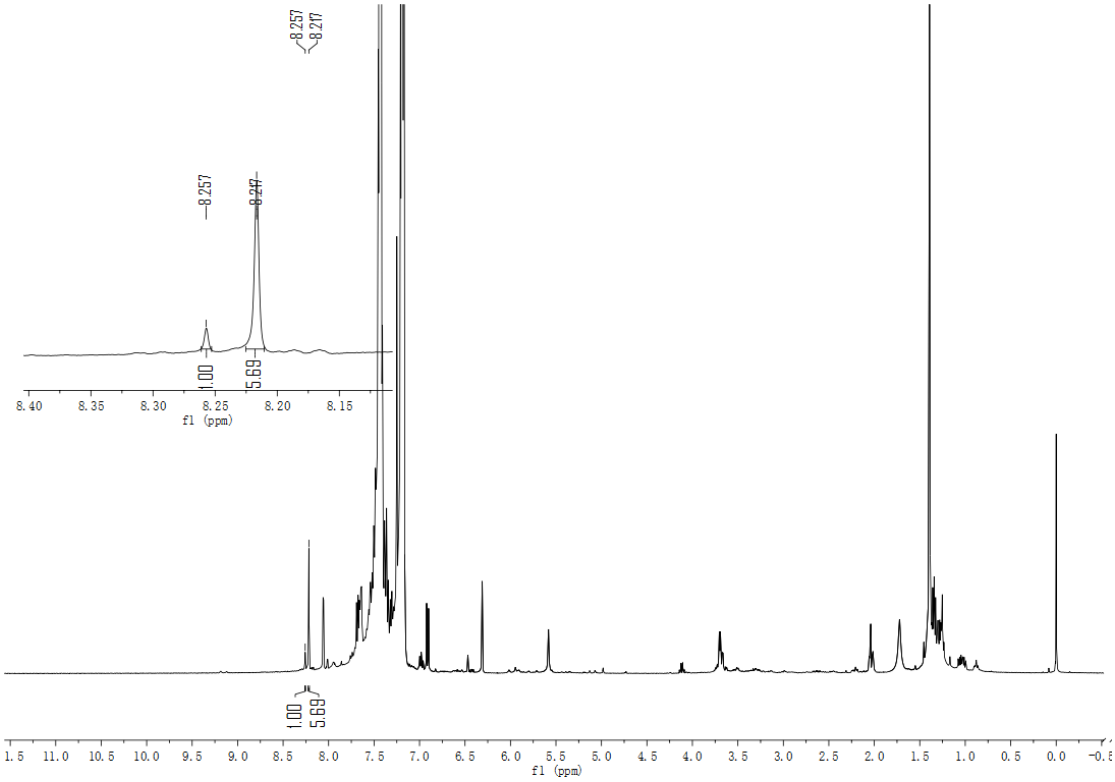
^{13}C NMR (100 MHz, $CDCl_3$) δ 173.9, 171.0, 167.7, 154.6, 139.6, 137.6, 135.4, 135.0, 134.4, 131.9, 129.0, 128.9, 128.5, 128.3, 126.8, 125.9, 124.8, 122.2, 64.3, 60.9, 52.1, 42.8, 40.0, 28.6;

HRMS (ESI) m/z calcd for $C_{29}H_{29}ClN_3O_2^+$ $(M+H)^+$ 486.1943, found *m/z* 486.1949.

***2-(8-bromo-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-N-(tert-butyl)-2-phenylacetamide* (±)-19**



19 crude ^{1}H NMR



dr = 19down/19up = 6/1

White solid, **19down**, 39mg, 74% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 8.06 – 8.05 (m, 1H), 7.65 (d, *J* = 6.9 Hz, 1H), 7.50 (d, *J* = 6.9 Hz, 2H), 7.43 – 7.35 (m, 6H), 7.34 – 7.29 (m, 1H), 6.93 – 6.90 (m, 1H), 6.30 (s, 1H), 5.57 (s, 1H), 3.70 – 3.63 (m, 2H), 2.05 – 2.02 (m, 1H), 1.40 (s, 9H), 1.08 – 1.00 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.5, 170.0, 168.4, 154.5, 139.7, 138.3, 134.8, 134.3, 133.9, 130.3, 129.8, 129.3, 129.2, 128.8, 127.3, 126.7, 124.9, 122.5, 122.2, 64.1, 61.3, 52.1, 43.1, 40.5, 28.7;

HRMS (ESI) m/z calcd for $C_{29}H_{29}BrN_3O_2^+$ $(M+H)^+$ 530.1438, found *m/z* 530.1444.

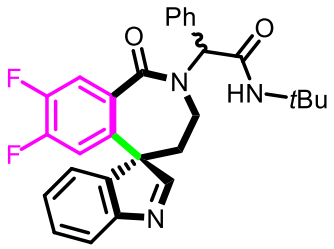
Yellow solid, **19up**, 5 mg, 10% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (s, 1H), 8.02 (d, *J* = 2.2 Hz, 1H), 7.71 – 7.69 (m, 1H), 7.49 – 7.44 (m, 2H), 7.43 – 7.42 (m, 1H), 7.40 (d, *J* = 2.2 Hz, 1H), 7.39 – 7.34 (m, 5H), 6.99 (d, *J* = 8.4 Hz, 1H), 6.48 (s, 1H), 6.02 (s, 1H), 3.56 – 3.51 (m, 1H), 3.35 – 3.27 (m, 1H), 2.68 – 2.60 (m, 1H), 2.25 – 2.21 (m, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 170.3, 167.7, 154.7, 139.9, 138.3, 135.3, 134.3, 133.2, 131.4, 129.1, 128.8, 128.6, 128.5, 127.5, 126.5, 124.8, 122.3, 122.0, 64.1, 60.9, 52.2, 42.8, 39.8, 28.6;

HRMS (ESI) m/z calcd for $C_{29}H_{29}BrN_3O_2^+$ $(M+H)^+$ 530.1438, found *m/z* 530.1446.

***N-(tert-butyl)-2-(7,8-difluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide* (±)-20**



Yellow oil, **20down**, 37 mg, 76% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (s, 1H), 7.81 – 7.76 (m, 1H), 7.66 (d, *J* = 7.7 Hz, 1H), 7.49 (d, *J* = 7.4 Hz, 2H), 7.45 – 7.30 (m, 6H), 6.89 – 6.84 (m, 1H), 6.28 (s, 1H), 5.61 (s, 1H), 3.76 – 3.63 (m, 2H), 2.07 – 2.03 (m, 1H), 1.39 (s, 9H), 1.08 – 1.00 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.1, 169.4, 168.4, 154.4, 139.6, 134.8, 129.8, 129.3, 129.1 (d, *J* = 16.8 Hz), 127.0, 124.6, 122.3, 121.9, 120.8 (d, *J* = 18.8 Hz), 119.2, 115.4 (d, *J* = 19.9 Hz), 63.8, 61.5, 52.1, 43.2, 40.5, 28.7 ppm;

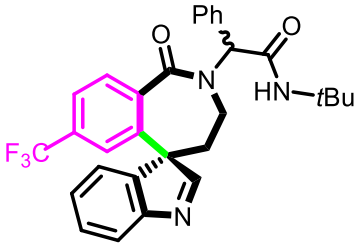
^{19}F NMR (376 MHz, $CDCl_3$) δ -131.46 – -131.76 (m), -137.50 – -137.77 (m) ppm;

HRMS (ESI) m/z calcd for $C_{29}H_{28}F_2N_3O_2^+$ 488.2144, found *m/z* 488.2151.

20up is trace and not separated

^{13}C NMR (101 MHz, $CDCl_3$) δ 129.15 (d, *J* = 16.8 Hz), 120.82 (d, *J* = 18.8 Hz), 115.42 (d, *J* = 19.9 Hz).

***N-(tert-butyl)-2-(1-oxo-7-(trifluoromethyl)-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-21**



Yellow oil, **21down**, 43 mg, 82% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (s, 1H), 8.05 (d, *J* = 8.0 Hz, 1H), 7.67 (t, *J* = 6.0 Hz, 2H), 7.51 (d, *J* = 7.4 Hz, 2H), 7.47 – 7.36 (m, 5H), 7.33 (d, *J* = 8.2 Hz, 2H), 6.35 (s, 1H), 5.59 (s, 1H), 3.78 – 3.59 (m, 2H), 2.08 (dd, *J* = 14.3, 2.9 Hz, 1H), 1.40 (s, 9H), 1.06 (td, *J* = 13.7, 5.9 Hz, 1H) ppm;

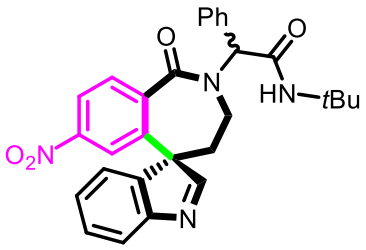
^{13}C NMR (100 MHz, $CDCl_3$) δ 173.0, 170.2, 168.4, 154.4, 140.0, 139.2, 134.7, 133.1 (q, *J* = 32.7 Hz), 132.5, 131.7, 129.8, 129.4, 129.3, 129.0, 127.0, 125.2, 124.7, 122.4, 64.3, 61.2, 52.1, 43.0, 40.8, 28.7;

^{19}F NMR (376 MHz, $CDCl_3$) δ -63.01 (t, *J* = 5.7 Hz).

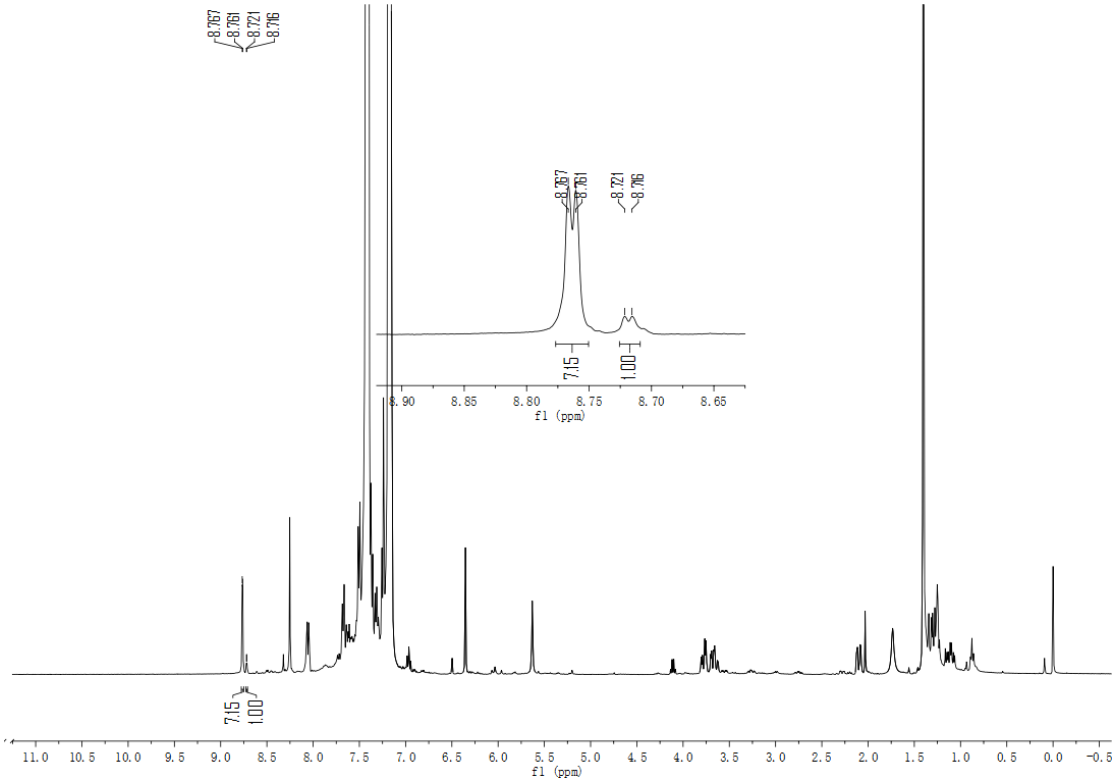
HRMS (ESI) m/z calcd for $C_{30}H_{29}F_3N_3O_2^+$ $(M+H)^+$ 520.2206, found *m/z* 520.2211.

21up is trace and not separated

***N-(tert-butyl)-2-(7-nitro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-22**



22 crude ^{1}H NMR



dr = 22down/22up = 7/1

Yellow solid, **22down**, 37 mg, 75% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.78 (d, *J* = 1.5 Hz, 1H), 8.24 (s, 1H), 8.11 (dd, *J* = 8.6, 1.4 Hz, 1H), 7.68 (d, *J* = 7.1 Hz, 1H), 7.51 – 7.44 (m, 5H), 7.39 (t, *J* = 7.8 Hz, 2H), 7.35 – 7.32 (m, 1H), 7.28 (d, *J* = 6.5 Hz, 1H), 6.34 (s, 1H), 5.61 (s, 1H), 3.80 – 3.61 (m, 2H), 2.13 – 2.09 (m, 1H), 1.41 (s, 9H), 1.15 – 1.06 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 172.3, 169.2, 168.2, 154.4, 147.8, 139.1, 138.4, 138.3, 134.6, 129.7, 129.4, 129.2, 127.0, 126.2, 125.8, 124.8, 122.5, 64.6, 61.4, 52.2, 43.1, 40.7, 28.7;

HRMS (ESI) m/z calcd for $C_{29}H_{29}N_4O_4^+$ $(M+H)^+$ 497.2183, found *m/z* 497.2189.

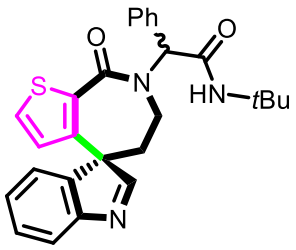
Yellow solid, **22up**, 5 mg, 11% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.74 (d, *J* = 2.3 Hz, 1H), 8.30 (s, 1H), 8.12 (dd, *J* = 8.6, 2.3 Hz, 1H), 7.74 (d, *J* = 7.3 Hz, 1H), 7.53 – 7.45 (m, 3H), 7.43 – 7.33 (m, 6H), 6.53 (s, 1H), 6.13 (s, 1H), 3.59 – 3.54 (m, 1H), 3.31 – 3.23 (m, 1H), 2.81 – 2.73 (m, 1H), 2.32 – 2.27 (m, 1H), 1.41 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.0, 169.5, 167.5, 154.7, 147.7, 139.5, 139.3, 138.2, 135.1, 129.2, 128.8, 128.6, 127.2, 126.9, 125.7, 125.6, 124.7, 122.5, 64.7, 61.1, 52.2, 42.7, 40.1, 28.6;

HRMS (ESI) m/z calcd for $C_{29}H_{29}N_4O_4^+$ $(M+H)^+$ 497.2183, found *m/z* 497.2183.

***N-(tert-butyl)-2-(8'-oxo-5',6'-dihydrospiro[indole-3,4'-thieno[2,3-c]azepin]-7'(8'H)-yl)-2-phenylacetamide* (±)-23**



Yellow solid, **23down**, 39 mg, 86% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

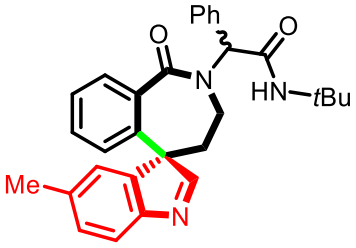
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.63 (d, *J* = 7.5 Hz, 1H), 7.45 – 7.35 (m, 6H), 7.31 – 7.22 (m, 3H), 6.42 (s, 1H), 6.08 (d, *J* = 5.2 Hz, 1H), 5.75 (s, 1H), 3.94 (dd, *J* = 15.1, 9.4 Hz, 1H), 3.60 (dd, *J* = 15.2, 6.8 Hz, 1H), 2.20 (dd, *J* = 15.1, 6.9 Hz, 1H), 1.81 (dd, *J* = 14.7, 9.3 Hz, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.9, 168.6, 164.3, 154.5, 143.7, 138.0, 136.9, 135.6, 130.9, 129.2, 129.1, 128.7, 128.3, 127.2, 123.0, 121.6, 63.3, 61.8, 52.0, 43.1, 35.0, 28.7;

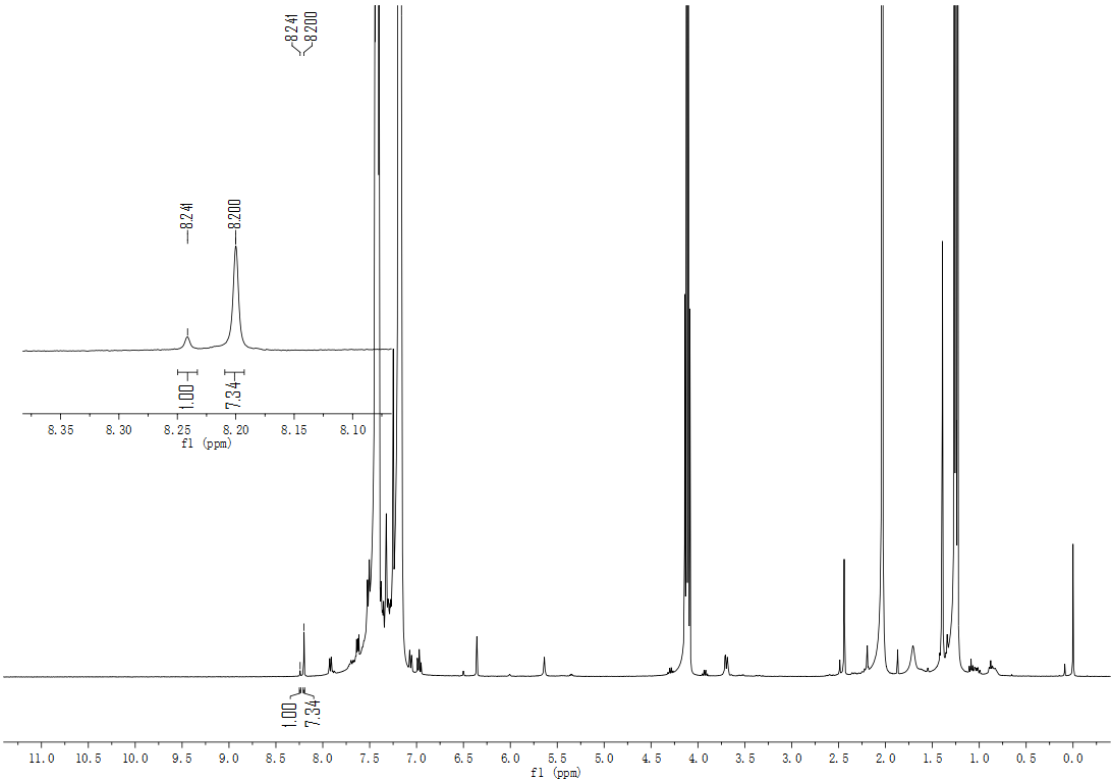
HRMS (ESI) m/z calcd for $C_{23}H_{28}NO^+$ $(M+H)^+$ 458.1897, found *m/z* 458.1899.

23up is trace and not separated

***N-(tert-butyl)-2-(5'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-24**



24 crude ^{1}H NMR



dr = 24down/24up = 7/1

Yellow solid, **24down**, 37 mg, 79% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (s, 1H), 7.92 (d, *J* = 7.6 Hz, 1H), 7.52 (d, *J* = 7.8 Hz, 3H), 7.42 – 7.34 (m, 3H), 7.33 – 7.26 (m, 3H), 7.19 (d, *J* = 7.9 Hz, 1H), 7.06 (d, *J* = 7.8 Hz, 1H), 6.34 (s, 1H), 5.60 (s, 1H), 3.70 – 3.67 (m, 2H), 2.45 (s, 3H), 2.05 – 2.02 (m, 1H), 1.40 (s, 9H), 1.08 – 1.00 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.2, 171.5, 168.7, 152.4, 140.2, 136.7, 136.4, 135.1, 131.5, 131.4, 131.0, 129.8, 129.2, 129.0, 128.3, 125.7, 125.6, 121.6, 64.4, 61.1, 52.0, 43.2, 41.0, 28.7, 21.6;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2494.

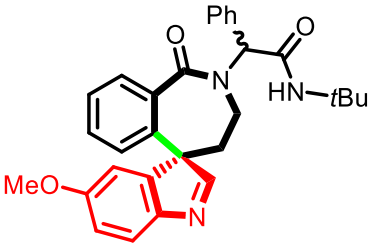
Yellow solid, **24up**, 6 mg, 13% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (s, 1H), 7.89 (dd, *J* = 7.6, 1.4 Hz, 1H), 7.57 (d, *J* = 7.9 Hz, 1H), 7.43 – 7.38 (m, 4H), 7.37 (s, 1H), 7.35 – 7.34 (m, 1H), 7.32 – 7.30 (m, 2H), 7.23 (dd, *J* = 7.9, 0.8 Hz, 1H), 7.14 (dd, *J* = 7.8, 0.9 Hz, 1H), 6.50 (s, 1H), 6.13 (s, 1H), 3.58 – 3.53 (m, 1H), 3.39 – 3.32 (m, 1H), 2.62 – 2.54 (m, 1H), 2.50 (s, 3H), 2.26 – 2.21 (m, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.8, 171.9, 167.9, 152.6, 140.4, 136.6, 136.3, 135.6, 132.5, 131.5, 130.3, 129.2, 128.9, 128.4, 128.3, 128.2, 125.8, 125.7, 121.6, 64.4, 60.6, 52.1, 42.9, 40.2, 28.6, 21.7;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2496.

N-(tert-butyl)-2-(5'-methoxy-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide **(±)-25**



Yellow solid, **25up**, 37 mg, 78% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

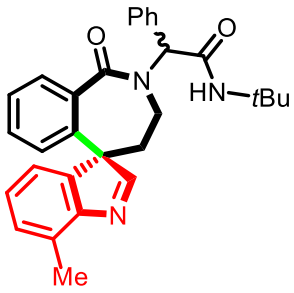
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (s, 1H), 7.89 (d, *J* = 7.5 Hz, 1H), 7.61 – 7.58 (m, 1H), 7.41 – 7.31 (m, 7H), 7.15 (d, *J* = 7.6 Hz, 1H), 7.06 (s, 1H), 6.95 (d, *J* = 8.4 Hz, 1H), 6.51 (s, 1H), 6.15 (s, 1H), 3.90 (s, 3H), 3.58 – 3.53 (m, 1H), 3.34 (dd, *J* = 19.2, 7.9 Hz, 1H), 2.61 (td, *J* = 12.8, 4.2 Hz, 1H), 2.21 – 2.18 (m, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 172.8, 171.9, 167.9, 158.6, 148.4, 142.0, 136.6, 135.6, 132.4, 131.5, 130.4, 128.9, 128.4, 128.3, 128.2, 125.7, 122.4, 112.9, 111.8, 64.7, 60.6, 55.9, 52.1, 42.8, 40.4, 28.6;

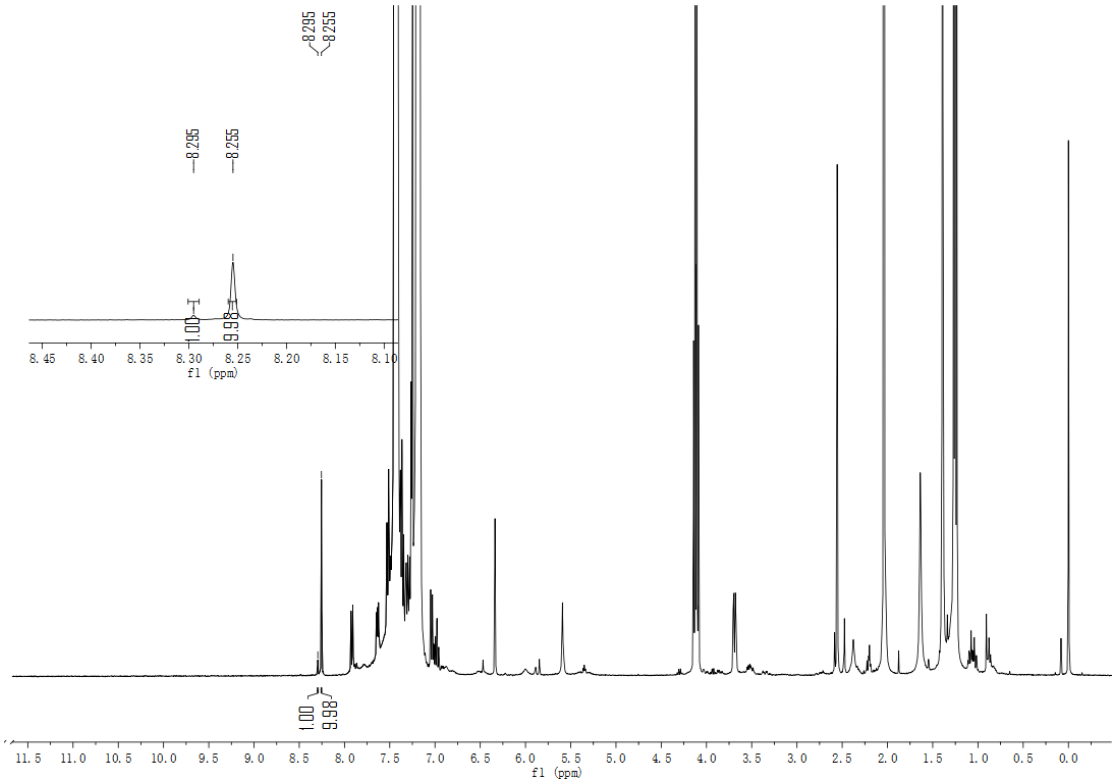
HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_3^+$ $(M+H)^+$ 482.2438, found *m/z* 482.2455.

25down is trace and not separated

***N-(tert-butyl)-2-(7'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-26**



26 crude ^{1}H NMR



dr = 26down/26up = 10/1

White solid, **26down**, 37 mg, 80% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δδ 8.24 (s, 1H), 7.92 (d, *J* = 7.5 Hz, 1H), 7.53 – 7.43 (m, 4H), 7.41 – 7.29 (m, 5H), 7.24 – 7.19 (m, 1H), 7.04 (d, *J* = 7.9 Hz, 1H), 6.33 (s, 1H), 5.60 (s, 1H), 3.69 – 3.67 (m, 2H), 2.56 (s, 3H), 2.06 – 2.02 (m, 1H), 1.39 (s, 9H), 1.10 – 1.02 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.0, 171.5, 168.7, 153.0, 140.0, 136.7, 135.1, 131.9, 131.6, 131.4, 131.0, 129.9, 129.2, 129.0, 128.3, 126.3, 125.6, 122.5, 64.7, 61.2, 51.9, 43.2, 40.7, 28.7, 16.9;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2495.

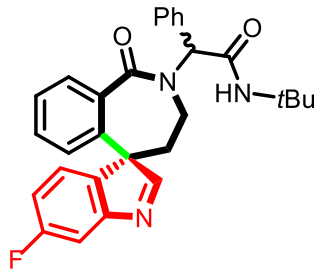
Yellow solid, **26up**, 4 mg, 8% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.28 (s, 1H), 7.87 (d, *J* = 7.6 Hz, 1H), 7.41 – 7.33 (m, 6H), 7.32 – 7.26 (m, 3H), 7.23 (d, *J* = 7.3 Hz, 1H), 7.12 (d, *J* = 7.8 Hz, 1H), 6.47 (s, 1H), 5.96 (s, 1H), 3.54 – 3.49 (m, 1H), 3.38 – 3.30 (m, 1H), 2.62 – 2.54 (m, 1H), 2.59 (s, 3H), 2.23 – 2.20 (m, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.6, 171.9, 167.9, 153.3, 140.3, 136.6, 135.7, 132.7, 131.8, 131.4, 130.4, 129.9, 129.0, 128.5, 128.4, 128.1, 128.11 (s), 126.2, 125.8, 122.4, 64.8, 60.8, 52.1, 42.9, 40.1, 28.6, 17.;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2491.

***N-(tert-butyl)-2-(6'-fluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-27**



Yellow solid, **27down**, 39 mg, 84% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 7.93 (dd, *J* = 7.7, 1.3 Hz, 1H), 7.51 (d, *J* = 7.1 Hz, 2H), 7.43 – 7.37 (m, 3H), 7.37 – 7.28 (m, 4H), 7.10 – 7.05 (m, 1H), 7.02 – 7.00 (m, 1H), 6.34 (s, 1H), 5.62 (s, 1H), 3.71 – 3.67 (m, 2H), 2.06 – 2.01 (m, 1H), 1.39 (s, 9H), 1.08 – 1.00 (m, 1H) ppm;

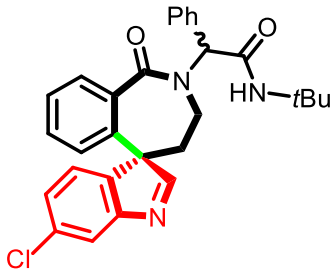
^{13}C NMR (100 MHz, $CDCl_3$) δ 176.1, 171.4, 168.6, 163.1 (d, *J* = 246.0 Hz), 155.98 (d, *J* = 10.9 Hz), 136.6, 135.60 (d, *J* = 2.9 Hz), 135.1, 131.6, 131.2, 130.9, 129.8, 129.3, 129.1, 128.5, 125.6, 125.4, 113.3 (d, *J* = 23.3 Hz), 109.7 (d, *J* = 23.8 Hz), 64.2, 61.1, 52.0, 43.1, 40.7, 28.7 ppm;

^{19}F NMR (376 MHz, $CDCl_3$) δ -113.21 – - 113.27 (m)

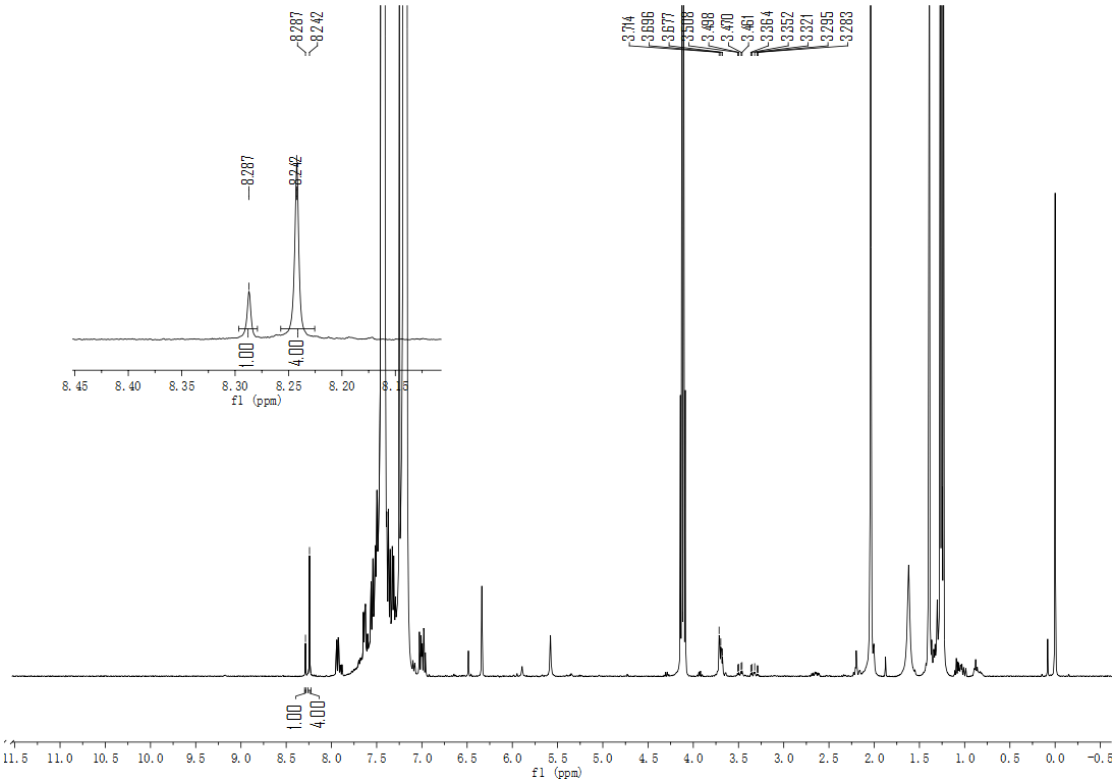
HRMS (ESI) m/z calcd for $C_{29}H_{29}FN_3O_2^+$ $(M+H)^+$ 470.2238, found *m/z* 470.2244.

27up is trace and not separated

***N-(tert-butyl)-2-(6'-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-28**



28 crude ^{1}H NMR



dr = 28down/28up = 4/1

Yellow solid, **28down**, 34 mg, 71% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (d, *J* = 2.5 Hz, 1H), 7.93 (d, *J* = 7.3 Hz, 1H), 7.58 – 7.47 (m, 3H), 7.45 – 7.29 (m, 7H), 7.02 (d, *J* = 7.7 Hz, 1H), 6.34 (s, 1H), 5.66 (s, 1H), 3.78 – 3.56 (m, 2H), 2.08 – 2.01 (m, 1H), 1.39 (s, 9H), 1.10 – 0.99 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.5, 171.3, 168.6, 153.1, 142.0, 136.6, 135.1, 132.4, 131.6, 131.3, 130.5, 129.8, 129.3, 129.1, 128.8, 128.6, 125.5, 125.4, 122.9, 64.9, 61.1, 52.0, 43.1, 40.7, 28.7;

HRMS (ESI) m/z calcd for $C_{29}H_{29}ClN_3O_2^+$ $(M+H)^+$ 486.1943, found *m/z* 486.1949.

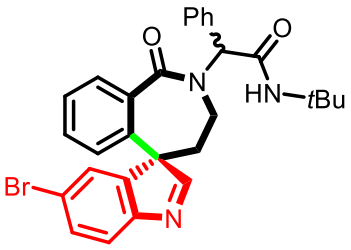
Yellow solid, **28up**, 7 mg, 14% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (s, 1H), 7.89 (d, *J* = 7.6 Hz, 1H), 7.61 (d, *J* = 8.3 Hz, 1H), 7.50 (s, 1H), 7.44 – 7.39 (m, 5H), 7.38 – 7.33 (m, 3H), 7.09 (d, *J* = 7.8 Hz, 1H), 6.51 (s, 1H), 6.05 (s, 1H), 3.50 (dd, *J* = 14.9, 4.7 Hz, 1H), 3.40 – 3.28 (m, 1H), 2.65 (td, *J* = 13.3, 5.6 Hz, 1H), 2.21 – 2.17 (m, 1H), 1.40 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 175.1, 171.6, 167.9, 153.4, 142.3, 136.6, 135.5, 132.2, 131.6, 130.6, 129.0, 128.8, 128.6, 128.5, 125.5, 125.4, 122.9, 65.0, 60.9, 52.1, 42.7, 40.0, 28.6;

HRMS (ESI) m/z calcd for $C_{29}H_{29}ClN_3O_2^+$ $(M+H)^+$ 486.1943, found *m/z* 486.1947.

***2-(5'-bromo-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-N-(tert-butyl)-2-phenylacetamide* (±)-29**



Yellow solid, **29down**, 43 mg, 81% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

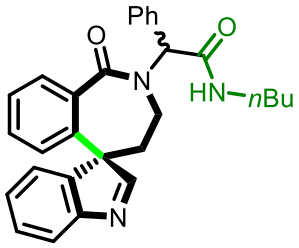
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (s, 1H), 7.93 (dd, *J* = 7.7, 1.4 Hz, 1H), 7.60 (d, *J* = 1.1 Hz, 1H), 7.52 – 7.49 (m, 4H), 7.46 – 7.43 (m, 1H), 7.41 – 7.31 (m, 4H), 7.02 (dd, *J* = 7.8, 0.8 Hz, 1H), 6.33 (s, 1H), 5.62 (s, 1H), 3.75 – 3.63 (m, 2H), 2.06 – 2.01 (m, 1H), 1.39 (s, 9H), 1.09 – 1.00 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.5, 171.3, 168.6, 153.5, 142.4, 136.6, 135.1, 131.8, 131.7, 131.3, 130.5, 129.8, 129.3, 129.1, 128.6, 128.3, 125.4, 123.4, 120.3, 65.0, 61.1, 52.0, 43.1, 40.7, 28.7;

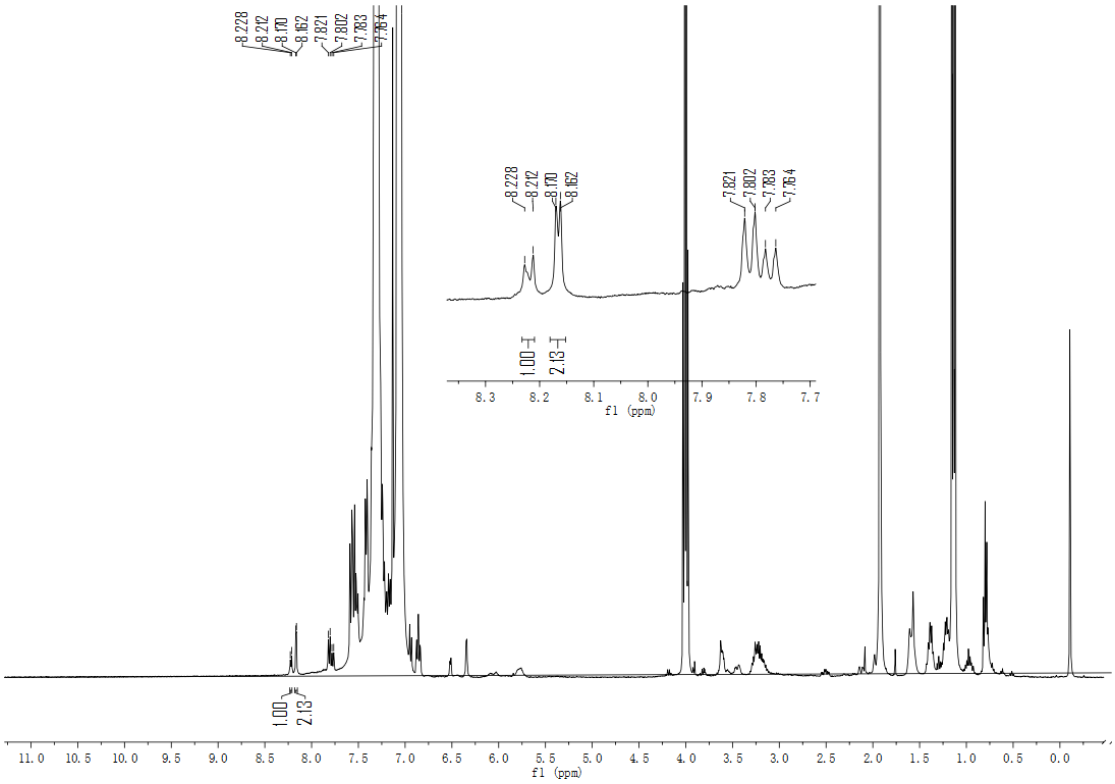
HRMS (ESI) m/z calcd for $C_{29}H_{29}BrN_3O_2^+$ $(M+H)^+$ 530.1438, found *m/z* 530.1443.

29up is trace and not separated

***N-butyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-30**



30 crude ^{1}H NMR



dr = 30down/30up = 2/1

Yellow solid, **30down**, 29 mg, 64% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (s, 1H), 7.84 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.57 (d, *J* = 7.0 Hz, 1H), 7.46 (d, *J* = 7.2 Hz, 2H), 7.40 – 7.37 (m, 1H), 7.35 – 7.25 (m, 6H), 7.23 (d, *J* = 7.6 Hz, 1H), 6.36 (s, 1H), 5.75 (s, 1H), 3.71 – 3.58 (m, 2H), 3.37 – 3.13 (m, 2H), 2.01 (dd, *J* = 13.3, 2.6 Hz, 1H), 1.44 (dd, *J* = 15.0, 7.5 Hz, 2H), 1.27 (dd, *J* = 14.9, 7.5 Hz, 2H), 1.01 (ddd, *J* = 14.2, 11.8, 7.2 Hz, 1H), 0.85 (t, *J* = 7.3 Hz, 3H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.0, 171.5, 169.2, 154.6, 140.1, 136.6, 134.8, 131.5, 131.3, 131.1, 129.9, 129.2, 129.1, 128.6, 128.4, 126.4, 125.6, 125.0, 122.1, 64.5, 60.9, 43.1, 40.8, 39.6, 31.5, 20.0, 13.7 ppm;

HRMS (ESI) m/z calcd for $C_{29}H_{30}N_3O_2^+$ $(M+H)^+$ 452.2333, found *m/z* 452.2341.

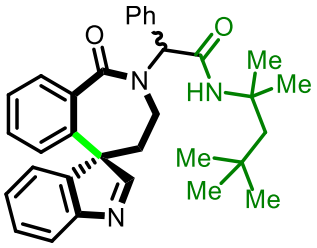
Yellow solid, **30up**, 11 mg, 24% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 7.81 (d, *J* = 6.8 Hz, 1H), 7.62 (d, *J* = 7.2 Hz, 1H), 7.44 (d, *J* = 7.1 Hz, 1H), 7.32 (dt, *J* = 14.1, 7.5 Hz, 8H), 7.24 (dd, *J* = 8.7, 5.3 Hz, 1H), 7.05 (d, *J* = 7.7 Hz, 1H), 6.53 (s, 1H), 3.48 (dd, *J* = 14.8, 3.9 Hz, 1H), 3.38–3.16 (m, 3H), 2.62–2.47 (m, 1H), 2.21–2.10 (m, 1H), 1.49–1.40 (m, 2H), 1.27 (dd, *J* = 14.9, 7.5 Hz, 2H), 0.84 (t, *J* = 7.3 Hz, 3H) ppm;

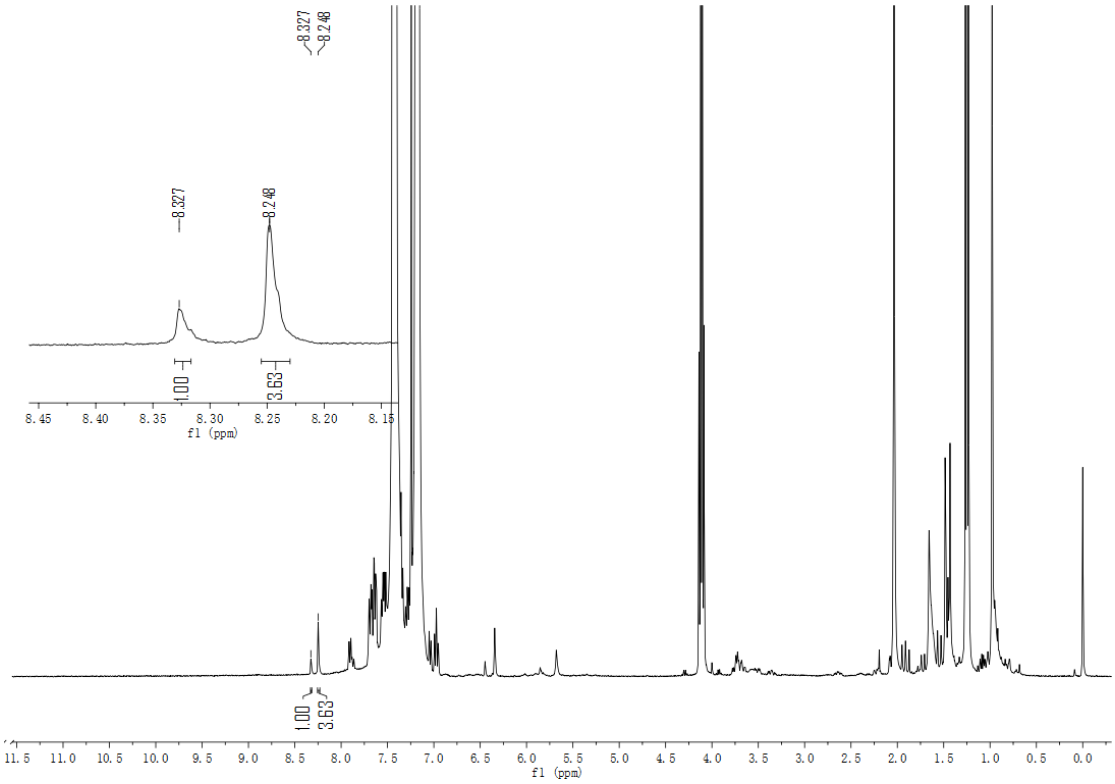
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.6, 171.8, 168.5, 154.9, 140.4, 136.6, 135.4, 132.4, 131.5, 130.4, 129.0, 128.7, 128.7, 128.5, 128.2, 126.3, 125.7, 124.9, 122.1, 64.6, 60.6, 43.0, 40.0, 39.6, 31.5, 20.1, 13.7;

HRMS (ESI) m/z calcd for $C_{29}H_{30}N_3O_2^+$ $(M+H)^+$ 452.2333, found *m/z* 452.2338.

***2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl-N-(2,4,4-trimethylpentan-2-yl)acetamide* (±)-31**



31 crude ^{1}H NMR



dr = 31down/31up = 4/1

White solid, **31down**, 40 mg, 79% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (s, 1H), 7.82 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.59 – 7.54 (m, 1H), 7.48 (d, *J* = 7.2 Hz, 2H), 7.41 – 7.36 (m, 1H), 7.34 – 7.26 (m, 5H), 7.22 (dd, *J* = 10.7, 4.2 Hz, 2H), 6.97 (d, *J* = 7.6 Hz, 1H), 6.26 (s, 1H), 5.63 (s, 1H), 3.76 – 3.41 (m, 2H), 1.99 (dd, *J* = 14.4, 3.0 Hz, 1H), 1.85 (d, *J* = 14.9 Hz, 1H), 1.48 (d, *J* = 14.9 Hz, 1H), 1.41 (s, 3H), 1.36 (s, 3H), 1.05 – 0.94 (m, 1H), 0.91 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 171.1, 168.2, 154.6, 140.1, 136.8, 134.9, 131.4, 131.3, 131.0, 130.0, 129.2, 129.0, 128.5, 128.3, 126.4, 125.6, 125.0, 122.0, 64.5, 61.2, 55.9, 52.4, 43.11, 40.7, 31.6, 31.5, 29.2, 28.5;

HRMS (ESI) m/z calcd for $C_{33}H_{38}N_3O_2^+$ $(M+H)^+$ 508.2959, found *m/z* 508.2966.

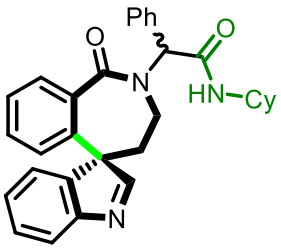
White solid, **31up**, 10 mg, 20% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (s, 1H), 7.80 (dd, *J* = 7.6, 1.4 Hz, 1H), 7.65 – 7.61 (m, 1H), 7.44 (dd, *J* = 7.1, 1.1 Hz, 1H), 7.35 (ddd, *J* = 5.5, 4.9, 1.8 Hz, 4H), 7.32 – 7.27 (m, 4H), 7.25 – 7.19 (m, 1H), 7.04 (dd, *J* = 7.8, 0.8 Hz, 1H), 6.38 (s, 1H), 5.86 (s, 1H), 3.45 (ddd, *J* = 14.7, 5.4, 1.8 Hz, 1H), 3.36 – 3.21 (m, 1H), 2.56 (ddd, *J* = 14.1, 12.3, 5.5 Hz, 1H), 2.23 – 2.09 (m, 1H), 1.64 (s, 2H), 1.40 (s, 3H), 1.38 (s, 3H), 0.90 (s, 9H) ppm;

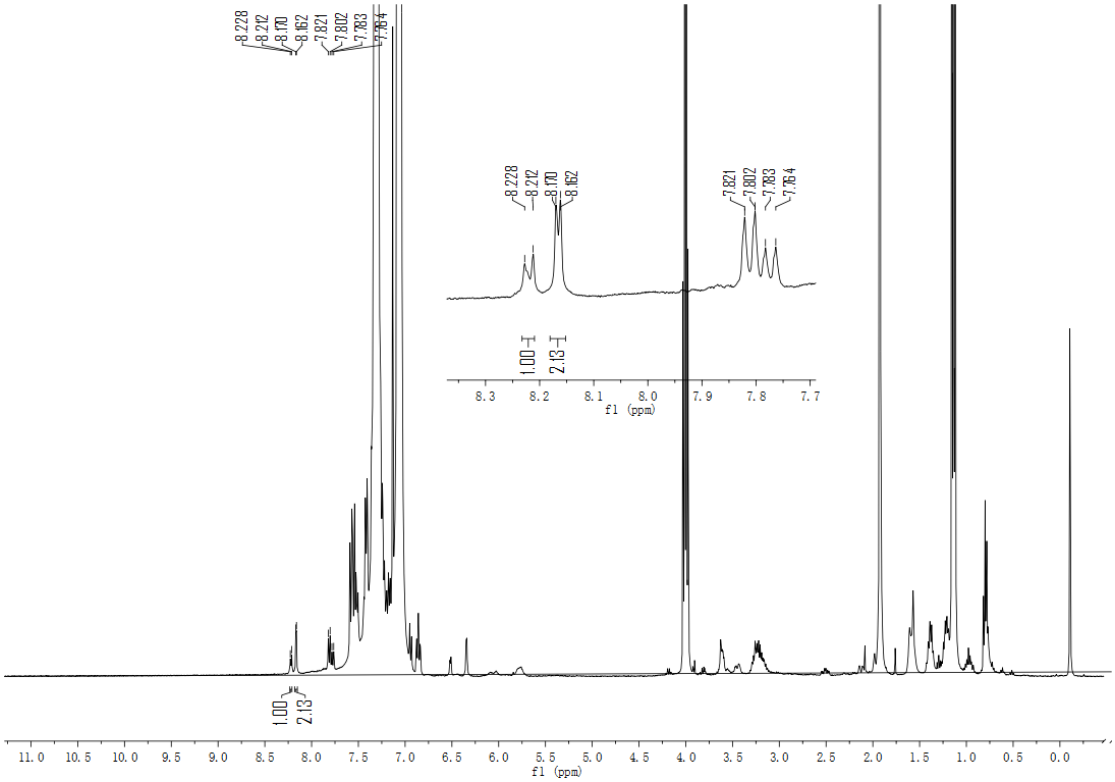
^{13}C NMR (100 MHz, $CDCl_3$) δ 174.8, 171.8, 167.6, 154.9, 140.5, 136.7, 135.5, 132.48, 131.4, 130.4, 129.0, 128.7, 128.5, 128.5, 128.2, 126.2, 125.7, 124.9, 122.1, 64.6, 61.5, 56.1, 52.5, 43.0, 40.0, 31.6, 31.5, 28.8, 28.4 ppm;

HRMS (ESI) m/z calcd for $C_{33}H_{38}N_3O_2^+$ $(M+H)^+$ 508.2959, found *m/z* 508.2963.

N-cyclohexyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide
(±)-32



32 crude ^{1}H NMR



dr = 32down/32up = 2/1

Yellow solid, **32down**, 26 mg, 54% yield, Rf = 0.3 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (s, 1H), 7.81 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.65 – 7.58 (m, 1H), 7.46 – 7.42 (m, 1H), 7.37 – 7.26 (m, 7H), 7.24 (d, *J* = 7.7 Hz, 2H), 7.05 (d, *J* = 7.7 Hz, 1H), 6.56 (s, 1H), 6.16 (d, *J* = 7.9 Hz, 1H), 3.83 – 3.70 (m, 1H), 3.50 (dd, *J* = 14.9, 4.1 Hz, 1H), 3.36 – 3.23 (m, 1H), 2.64 – 2.50 (m, 1H), 2.18 (dd, *J* = 14.2, 2.5 Hz, 1H), 1.94 – 1.81 (m, 2H), 1.69 – 1.56 (m, 2H), 1.51 (dd, *J* = 9.1, 3.7 Hz, 2H), 1.29 – 1.23 (m, 2H), 1.08 (ddd, *J* = 12.5, 10.5, 3.2 Hz, 2H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.6, 171.9, 167.6, 154.8, 140.3, 136.6, 135.6, 132.4, 131.5, 130.4, 128.9, 128.8, 128.6, 128.4, 128.2, 126.3, 125.7, 124.9, 122.1, 64.6, 60.4, 48.8, 43.0, 40.0, 32.9, 32.8, 25.4, 24.8, 24.8 ppm;

HRMS (ESI) m/z calcd for $C_{31}H_{32}N_3O_2^+$ $(M+H)^+$ 478.2489, found *m/z* 478.2492.

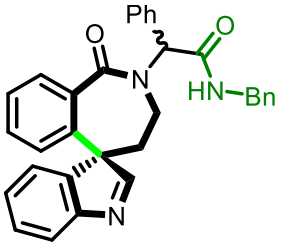
Yellow solid, **32up**, 13 mg, 27% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (s, 1H), 7.84 (d, *J* = 6.8 Hz, 1H), 7.57 (d, *J* = 7.0 Hz, 1H), 7.45 (d, *J* = 7.2 Hz, 2H), 7.38 (d, *J* = 7.9 Hz, 1H), 7.30 (td, *J* = 15.7, 7.7 Hz, 6H), 7.22 (d, *J* = 7.2 Hz, 1H), 6.98 (d, *J* = 7.7 Hz, 1H), 6.35 (s, 1H), 5.62 (d, *J* = 7.8 Hz, 1H), 3.79 (dd, *J* = 7.3, 3.5 Hz, 1H), 3.63 (dd, *J* = 10.4, 2.8 Hz, 2H), 2.00 (d, *J* = 13.8 Hz, 1H), 1.89 (s, 2H), 1.67 (s, 1H), 1.57 – 1.49 (m, 2H), 1.32 – 1.24 (m, 2H), 1.14 – 0.96 (m, 4H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 171.5, 168.3, 154.6, 140.1, 136.7, 134.9, 131.5, 131.3, 131.0, 129.9, 129.2, 129.1, 128.6, 128.4, 126.4, 125.6, 125.0, 122.1, 64.5, 60.8, 48.8, 43.2, 40.7, 32.9, 25.5, 24.8, 24.7ppm;

HRMS (ESI) m/z calcd for $C_{31}H_{32}N_3O_2^+$ $(M+H)^+$ 478.2489, found *m/z* 478.2495.

***N-benzyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-33**



Yellow solid, **33down**, 27 mg, 56% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

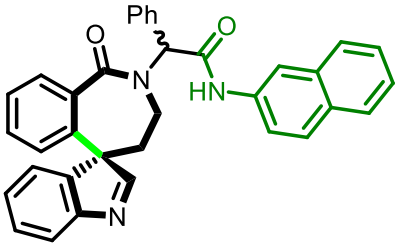
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (s, 1H), 7.86 (d, *J* = 7.6 Hz, 1H), 7.70 (d, *J* = 7.3 Hz, 1H), 7.52 (d, *J* = 7.0 Hz, 1H), 7.46 – 7.38 (m, 5H), 7.38 – 7.30 (m, 5H), 7.27 (d, *J* = 9.2 Hz, 4H), 7.13 (d, *J* = 7.8 Hz, 1H), 6.65 (s, 1H), 6.62 (s, 1H), 4.60 (dd, *J* = 14.7, 6.1 Hz, 1H), 4.43 (dd, *J* = 14.7, 5.1 Hz, 1H), 3.57 (dd, *J* = 14.9, 4.0 Hz, 1H), 3.46 – 3.32 (m, 1H), 2.57 (td, *J* = 13.1, 5.5 Hz, 1H), 2.24 – 2.21 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.7, 171.9, 168.6, 154.8, 140.4, 137.6, 136.5, 135.2, 132.4, 131.5, 130.5, 129.0, 128.8, 128.7, 128.6, 128.2, 127.9, 127.6, 126.3, 125.7, 124.9, 122.1, 64.5, 60.7, 43.9, 43.0, 40.0;

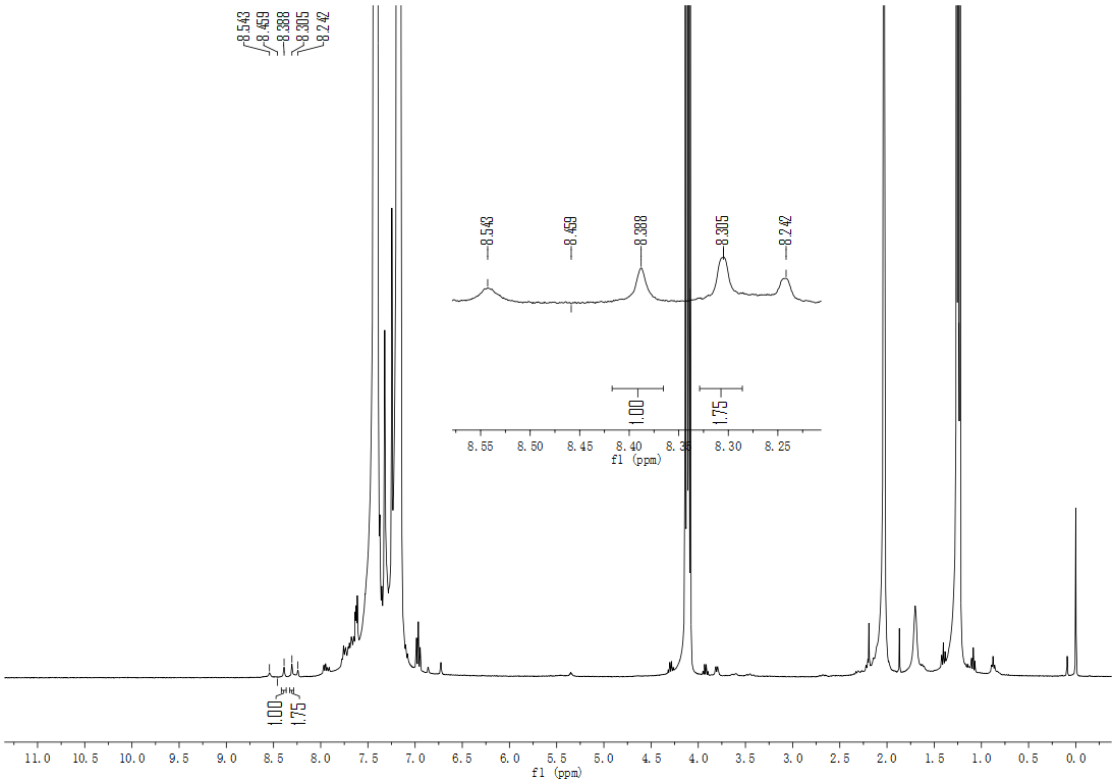
HRMS (ESI) m/z calcd for $C_{32}H_{28}N_3O_2^+$ $(M+H)^+$ 486.2176, found *m/z* 486.2180.

33up is trace and not separated

***N-(naphthalen-2-yl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide* (±)-34**



34 crude ^{1}H NMR



dr = 34down/34up = 2/1

White solid, **34down**, 11 mg, 21% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (s, 1H), 8.29 (s, 1H), 8.15 (s, 1H), 7.94 (d, *J* = 6.8 Hz, 1H), 7.76 (d, *J* = 8.3 Hz, 3H), 7.68 – 7.63 (m, 3H), 7.49 – 7.45 (m, 3H), 7.43 – 7.37 (m, 6H), 7.36 – 7.30 (m, 2H), 7.09 (d, *J* = 7.6 Hz, 1H), 6.72 (s, 1H), 3.81 – 3.79 (m, 2H), 2.15 – 2.11 (m, 1H), 1.18 – 1.12 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.0, 171.9, 168.0, 154.4, 140.0, 136.4, 134.9, 134.0, 133.8, 131.8, 131.4, 131.2, 130.8, 130.1, 129.5, 128.8, 128.7, 128.5, 127.7, 127.6, 126.6, 125.7, 125.2, 125.1, 122.1, 119.8, 116.8, 64.5, 61.8, 43.2, 40.8;

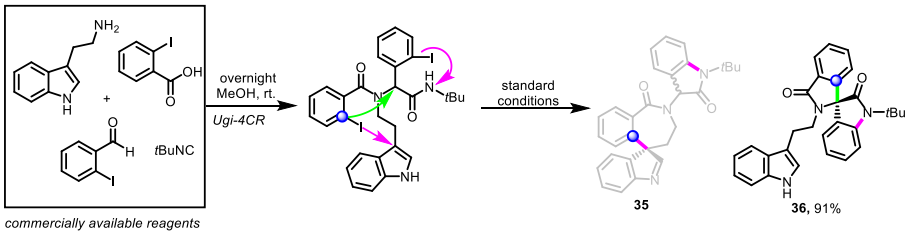
HRMS (ESI) m/z calcd for $C_{35}H_{28}N_3O_2^+$ $(M+H)^+$ 522.2176, found *m/z* 522.2179.

Yellow solid, **34up**, 8 mg, 15% yield, Rf = 0.5 (ethyl acetate/hexane = 30%);

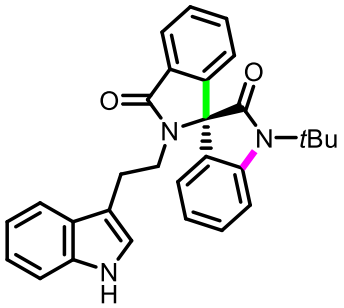
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.81 (s, 1H), 8.55 (s, 1H), 8.21 (s, 1H), 7.95 (d, *J* = 7.5 Hz, 1H), 7.71 – 7.65 (m, 4H), 7.55 – 7.49 (m, 3H), 7.44 – 7.30 (m, 12H), 7.14 (d, *J* = 7.7 Hz, 1H), 6.93 (s, 1H), 3.69 – 3.65 (m, 1H), 3.52 – 3.45 (m, 1H), 2.72 – 2.64 (m, 1H), 2.32 – 2.29 (d, *J* = 13.5 Hz, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.9, 172.2, 167.4, 154.6, 140.3, 136.4, 135.0, 134.9, 133.7, 132.5, 131.7, 130.8, 130.7, 129.2, 128.8, 128.6, 128.3, 127.7, 127.5, 126.4, 125.8, 125.0, 124.9, 122.1, 119.9, 117.1, 64.5, 61.9, 43.2, 40.0;

HRMS (ESI) m/z calcd for $C_{35}H_{28}N_3O_2^+$ $(M+H)^+$ 522.2176, found *m/z* 522.2177.



***2'-(2-(1H-indol-3-yl)ethyl)-1-(tert-butyl)spiro[indoline-3,1'-isoindoline]-2,3'-dione* (36)**

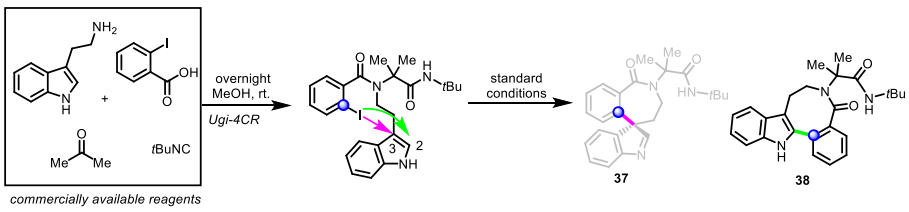


Yellow solid, **36**, 41 mg, 91% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

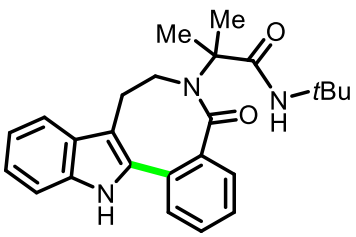
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (s, 1H), 7.86 (d, *J* = 6.8 Hz, 1H), 7.44 – 7.33 (m, 4H), 7.31 – 7.25 (m, 1H), 7.22 (d, *J* = 8.1 Hz, 1H), 7.06 (t, *J* = 7.0 Hz, 2H), 6.94 – 6.86 (m, 3H), 6.76 (dd, *J* = 7.4, 1.2 Hz, 1H), 3.66 – 3.23 (m, 2H), 3.10 – 2.48 (m, 2H), 1.72 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.8, 169.7, 144.8, 144.5, 136.2, 132.2, 132.0, 130.0, 129.2, 127.2, 126.5, 125.0, 124.0, 123.0, 122.0, 121.8, 120.8, 119.1, 118.5, 114.0, 112.9, 111.1, 72.2, 58.7, 42.2, 29.2, 24.3;

HRMS (ESI) m/z calcd for $C_{29}H_{28}N_3O_2^+$ $(M+H)^+$ 450.2176, found *m/z* 450.2179.



***N-(tert-butyl)-2-methyl-2-(5-oxo-5,7,8,13-tetrahydro-6H-benzo[6,7]azocino[5,4-b]indol-6-yl)propanamide* (38)**



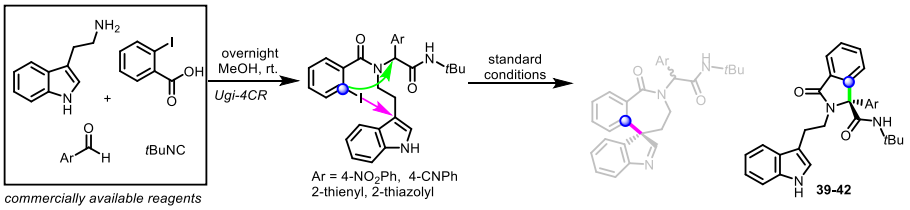
Yellow solid, **38**, 26 mg, 65% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (s, 1H), 7.68 – 7.64 (m, 1H), 7.58 (d, *J* = 7.8 Hz, 1H), 7.50 – 7.42

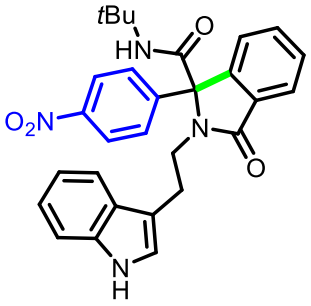
(m, 4H), 7.36 (d, *J* = 8.0 Hz, 1H), 7.18 (t, *J* = 7.3 Hz, 1H), 5.11 (s, 1H), 4.04 (td, *J* = 15.2, 4.4 Hz, 1H), 3.76 (dd, *J* = 15.8, 5.4 Hz, 1H), 3.48 – 3.35 (m, 1H), 2.98 (dd, *J* = 16.6, 4.0 Hz, 1H), 1.58 (s, 3H), 1.57 (s, 3H), 0.73 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.5, 171.3, 137.2, 136.5, 132.4, 132.2, 132.1, 130.4, 129.9, 129.0, 128.9, 128.5, 123.2, 120.3, 118.1, 111.1, 108.0, 63.2, 50.0, 43.5, 29.7, 27.7, 26.8, 25.6, 22.2;

HRMS (ESI) m/z calcd for $C_{25}H_{30}N_3O_2^+$ $(M+H)^+$ 404.2333, found *m/z* 404.2339.



***2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-1-(4-nitrophenyl)-3-oxoisoindoline-1-carboxamide* (39)**



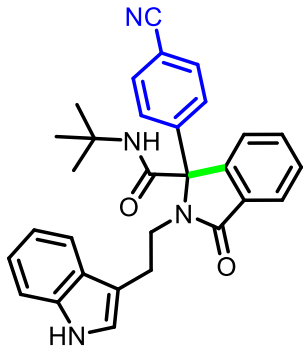
Yellow solid, **39**, 44 mg, 88% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (d, *J* = 8.7 Hz, 3H), 7.96 – 7.94 (m, 1H), 7.63 – 7.58 (m, 2H), 7.50 (d, *J* = 7.6 Hz, 2H), 7.29 (d, *J* = 8.8 Hz, 3H), 7.15 (t, *J* = 7.5 Hz, 1H), 7.08 (t, *J* = 7.4 Hz, 1H), 6.99 (s, 1H), 5.91 (s, 1H), 3.78 – 3.65 (m, 2H), 3.05 – 2.98 (m, 1H), 2.73 – 2.65 (m, 1H), 1.19 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.5, 167.3, 147.6, 145.8, 145.0, 136.3, 133.3, 130.7, 129.9, 129.6, 127.1, 124.0, 123.6, 122.3, 121.9, 119.6, 118.7, 112.3, 111.2, 75.6, 52.2, 42.9, 28.2, 23.7;

HRMS (ESI) m/z calcd for $C_{23}H_{28}NO^+$ $(M+H)^+$ 497.2183, found *m/z* 497.2188.

***2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-1-(4-cyanophenyl)-3-oxoisoindoline-1-carboxamide* (40)**



Yellow solid, **40**, 43 mg, 90% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

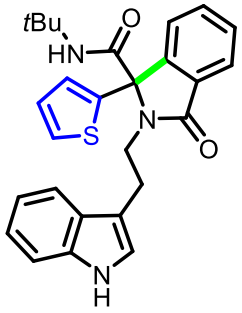
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (s, 1H), 7.95 – 7.93 (m, 1H), 7.63 – 7.58 (m, 4H), 7.53 – 7.49 (m, 2H), 7.32 (d, *J* = 8.0 Hz, 1H), 7.27 (d, *J* = 7.1 Hz, 2H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.11 (t, *J* = 7.4 Hz, 1H), 7.01 (s, 1H), 5.92 (s, 1H), 3.75 – 3.62 (m, 2H), 3.06 – 2.98 (m, 1H), 2.62 – 2.54 (m, 1H), 1.17 (s, 9H)

ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.5, 167.4, 145.8, 143.2, 136.3, 133.2, 132.4, 130.8, 129.9, 129.4, 127.1, 123.9, 123.6, 122.3, 122.0, 119.6, 118.7, 118.3, 112.4, 112.3, 111.3, 75.8, 52.2, 42.9, 28.2, 23.8;

HRMS (ESI) m/z calcd for $C_{30}H_{29}N_4O_2^+$ $(M+H)^+$ 477.2285, found *m/z* 477.2288.

2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-3-oxo-1-(thiophen-2-yl)isoindoline-1-carboxamide **(41)**



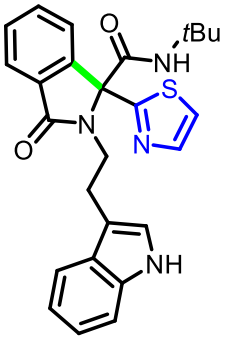
Yellow solid, **42**, 39 mg, 85% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, DMSO-D_6) δ 10.82 (s, 1H), 7.85 (d, *J* = 7.5 Hz, 1H), 7.79 (d, *J* = 7.3 Hz, 1H), 7.68 (t, *J* = 7.4 Hz, 1H), 7.63 – 7.59 (m, 2H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.37 (s, 1H), 7.33 (d, *J* = 8.0 Hz, 1H), 7.12 (d, *J* = 3.2 Hz, 2H), 7.08 – 7.04 (m, 2H), 6.98 (t, *J* = 7.4 Hz, 1H), 3.73 (td, *J* = 13.5, 4.6 Hz, 1H), 2.88 (td, *J* = 13.0, 4.5 Hz, 1H), 2.06 (td, *J* = 12.8, 5.1 Hz, 1H), 1.22 (s, 9H) ppm;

^{13}C NMR (100 MHz, DMSO-D_6) δ 167.9, 167.0, 146.8, 141.7, 136.7, 132.8, 131.3, 130.0, 129.2, 128.0, 127.5, 127.4, 123.8, 123.2, 123.0, 121.5, 118.8, 118.6, 111.9, 111.7, 73.5, 52.1, 43.1, 28.6, 23.7;

HRMS (ESI) m/z calcd for $C_{27}H_{28}N_3O_2S^+$ $(M+H)^+$ 458.1897, found *m/z* 458.1899.

2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-3-oxo-1-(thiazol-2-yl)isoindoline-1-carboxamide **(42)**

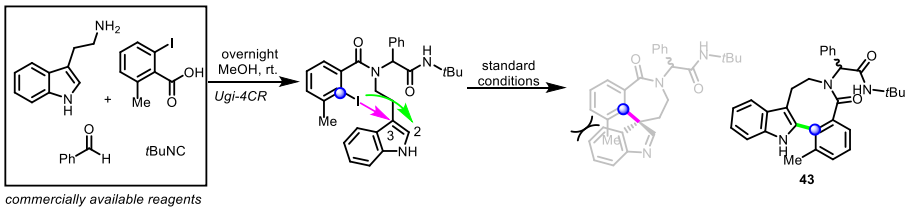


Yellow solid, **43**, 40 mg, 87% yield, Rf = 0.25 (ethyl acetate/hexane = 30%);

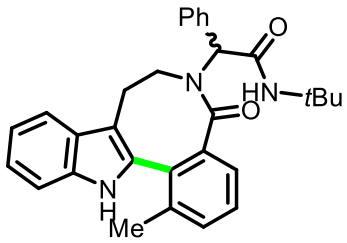
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (s, 1H), 8.11 (s, 1H), 7.92 – 7.90 (m, 1H), 7.83 (d, *J* = 3.3 Hz, 1H), 7.69 (d, *J* = 7.8 Hz, 1H), 7.53 – 7.51 (m, 3H), 7.33 (t, *J* = 5.3 Hz, 2H), 7.17 (t, *J* = 7.4 Hz, 1H), 7.12 – 7.08 (m, 2H), 3.93 – 3.86 (m, 1H), 3.76 – 3.69 (m, 1H), 3.36 – 3.28 (m, 1H), 3.09 – 3.01 (m, 1H), 1.31 (s, 9H)ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.2, 168.0, 165.1, 145.8, 142.8, 136.3, 132.5, 130.6, 129.7, 127.4, 124.1, 122.1, 122.0, 120.8, 119.3, 119.1, 113.3, 111.1, 74.3, 52.1, 44.2, 28.4, 23.6;

HRMS (ESI) m/z calcd for $C_{26}H_{27}N_4O_2S^+$ $(M+H)^+$ 459.1849, found *m/z* 459.1854.



***N-(tert-butyl)-2-(1-methyl-5-oxo-5,7,8,13-tetrahydro-6H-benzo[6,7]azocino[5,4-b]indol-6-yl)-2-phenylacetamide* (43)**



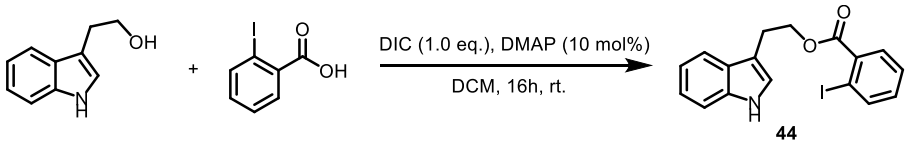
Yellow solid, **43**, 32 mg, 69% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (s, 1H), 7.40 – 7.35 (m, 3H), 7.33 – 7.27 (m, 5H), 7.23 (s, 1H), 7.11 (t, *J* = 7.0 Hz, 2H), 7.03 – 7.00 (m, 1H), 6.32 (s, 1H), 5.88 (s, 1H), 3.85 – 3.76 (m, 1H), 3.42 – 3.29 (m, 2H), 2.90 – 2.86 (m, 1H), 2.17 (s, 3H), 1.06 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.6, 168.3, 138.4, 137.4, 135.6, 134.9, 131.8, 131.6, 131.5, 129.0, 128.7, 128.6, 128.1, 127.5, 124.8, 121.5, 119.7, 119.6, 110.8, 110.6, 62.4, 51.2, 44.2, 28.3, 27.9, 20.9;

HRMS (ESI) m/z calcd for $C_{30}H_{32}N_3O_2^+$ $(M+H)^+$ 466.2489, found *m/z* 466.2495.

4. Investigation of Other Similar Substrates

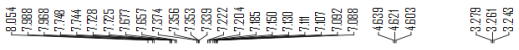


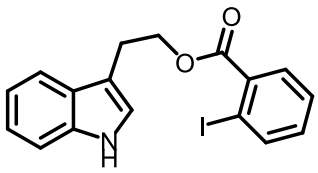
To a solution of chromohydrin (10 mmol, 1.61 g, 1.0 equiv.) and *o*-iodobenzoic acid (10 mmol, 2.48g, 1.0 eq.iv.) in DCM (30 mL) were added successively DIC (0 mmol, 1.6 mL, 1.0 equiv.) and DMAP (1 mmol, 126 mg, 0.1 equiv) in a screw capped vial equipped with a magnetic stir bar. The reaction mixture was stirred at room temperature for 16h. After completion of the reaction, the reaction mixture was concentrated under reduced pressure followed by column chromatography over silica gel using petroleum / EtOAc = 10/2~5/1 as eluent to afford the desired product **44** yellow solid, 3.3 g, 85% yield.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (s, 1H), 7.98 (d, *J* = 7.9 Hz, 1H), 7.74 (dd, *J* = 7.8, 1.3 Hz, 1H), 7.67 (d, *J* = 7.9 Hz, 1H), 7.36 (dd, *J* = 7.3, 6.4 Hz, 2H), 7.20 (t, *J* = 7.5 Hz, 1H), 7.16 – 7.07 (m, 3H), 4.62 (t, *J* = 7.2 Hz, 2H), 3.26 (t, *J* = 7.2 Hz, 2H) ppm;

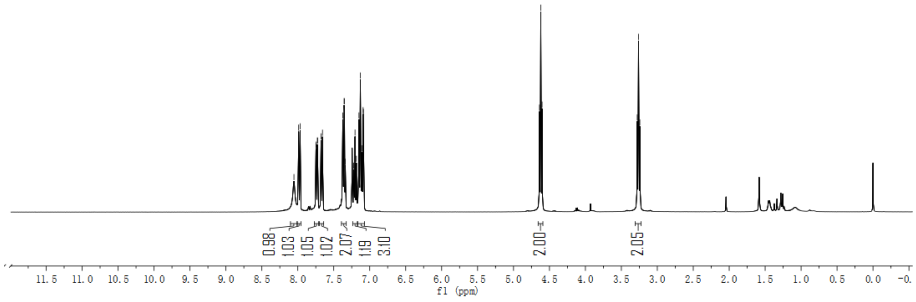
^{13}C NMR (100 MHz, $CDCl_3$) δ 166.6, 141.3, 136.2, 135.3, 132.6, 131.0, 127.9, 127.5, 122.2, 122.2, 119.5, 118.8, 111.8, 111.2, 94.1, 65.7, 24.8 ppm;

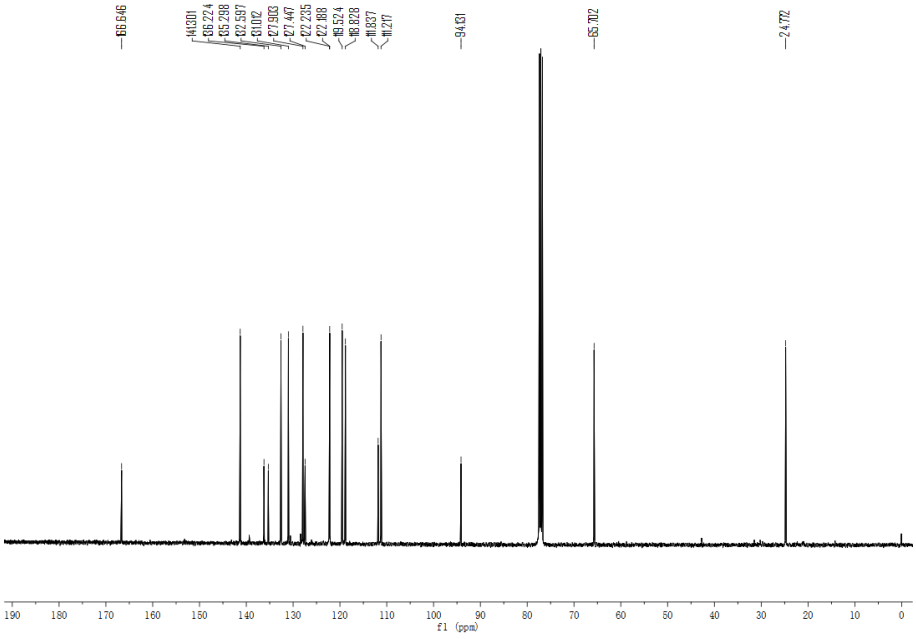
LCMS (ESI) m/z calcd for $C_{17}H_{15}INO_2^+$ $(M+H)^+$ 392, found *m/z* 392.

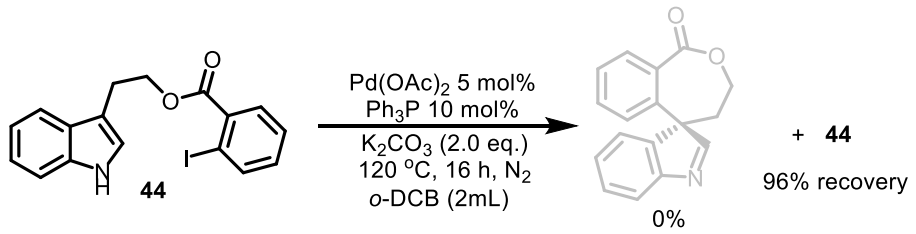




44

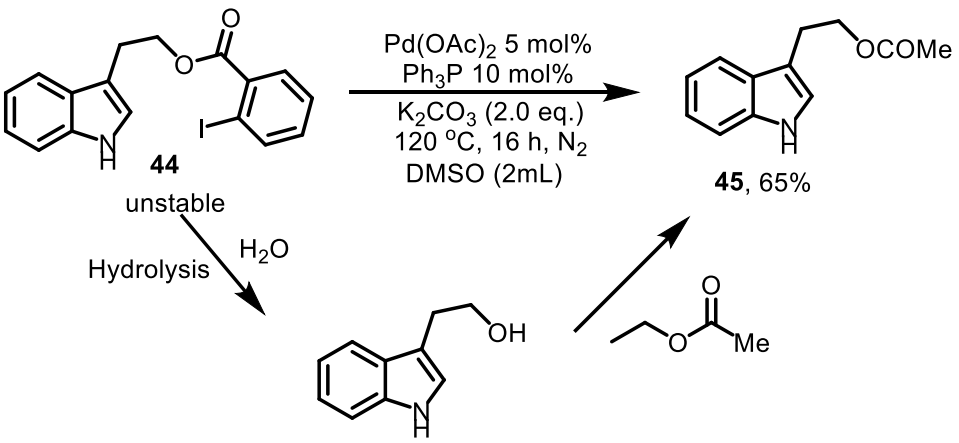






44 (0.2 mmol, 78 mg, 1.0eq.), $Pd(OAc)_2$ (0.01 mmol, 2.2 mg, 0.05 eq), Ph_3P (0.02 mmol, 5.2 mg, 0.1 eq), and K_2CO_3 (0.4 mmol, 56 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous *o*-DCB (2 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 ^oC for 16 h and monitored by TLC. Then the reaction mixture is subjected to dry loading and column

chromatography to obtain **44** (75 mg, 96% recovery) over silica gel using EtOAc/ n-hexane = 10%~20% as eluent.

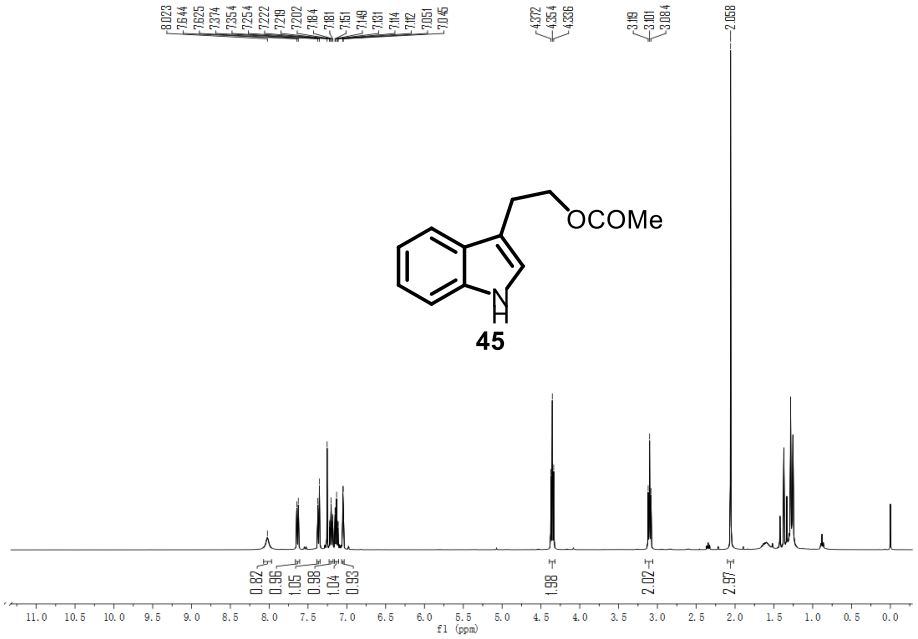


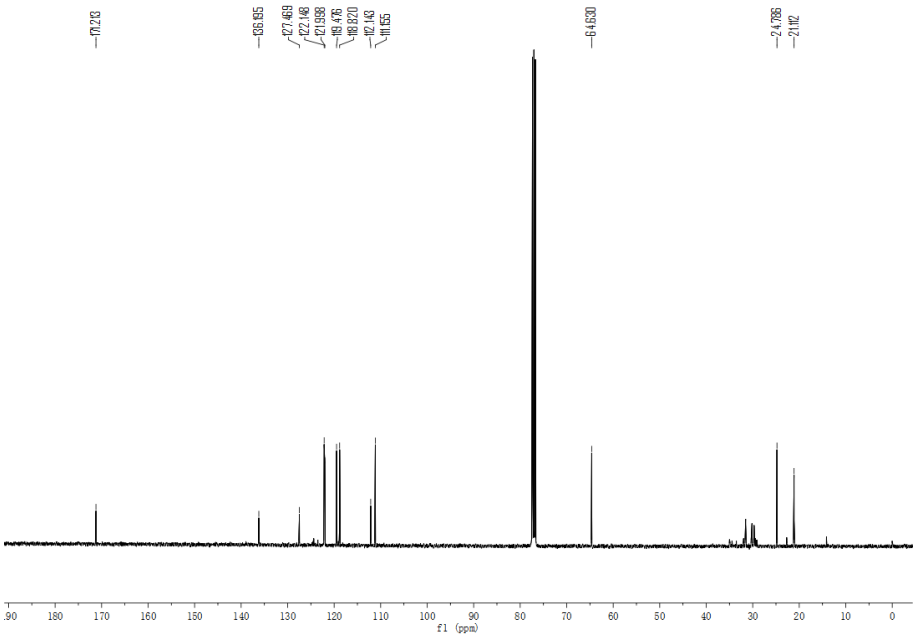
44 (0.2 mmol, 78 mg, 1.0eq.), $Pd(OAc)_2$ (0.01 mmol, 2.2 mg, 0.05 eq), Ph_3P (0.02 mmol, 5.2 mg, 0.1 eq), and K_2CO_3 (0.4 mmol, 56 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous DMSO (2 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 °C for 16 h and monitored by TLC. The reaction mixture was then extracted three times with **ethyl acetate** (3 mL) and water (3 mL). The organic phase was collected and subjected to dry loading and column chromatography to give **45** (26 mg, 65%) over silica gel using EtOAc/ n-hexane = 10%~20% as eluent.

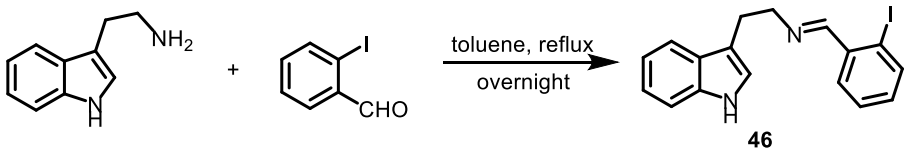
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (s, 1H), 7.63 (d, *J* = 7.8 Hz, 1H), 7.36 (d, *J* = 8.1 Hz, 1H), 7.24 – 7.17 (m, 1H), 7.17 – 7.10 (m, 1H), 7.05 (d, *J* = 2.2 Hz, 1H), 4.35 (t, *J* = 7.2 Hz, 2H), 3.10 (t, *J* = 7.2 Hz, 2H), 2.06 (s, 3H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.2, 136.2, 127.5, 122.1, 122.0, 119.5, 118.8, 112.1, 111.2, 64.6, 24.8, 21.1 ppm;

LCMS (ESI) m/z calcd for $C_{12}H_{14}NO_2^+$ $(M+H)^+$ 204, found *m/z* 204.







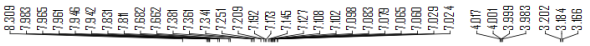
46

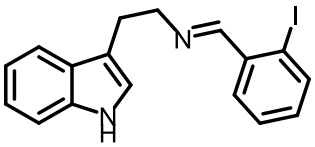
To a solution of tryptamine (10 mmol, 1.60 g, 1.0 equiv.) and *o*-iodobenzaldehyde (10 mmol, 2.32 g, 1.0 equiv.) in toluene (30 mL) in a round bottom flask equipped with a magnetic stir bar. The reaction mixture was refluxed overnight. After completion of the reaction, the reaction mixture was concentrated under reduced pressure and recrystallized by methanol to afford **46** white solid, 2.9 g, 77% yield.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 8.03 – 7.90 (m, 2H), 7.82 (d, *J* = 7.8 Hz, 1H), 7.67 (d, *J* = 7.8 Hz, 1H), 7.36 (t, *J* = 8.1 Hz, 2H), 7.19 (t, *J* = 7.2 Hz, 1H), 7.13 (t, *J* = 7.4 Hz, 1H), 7.08 (td, *J* = 7.7, 1.7 Hz, 1H), 7.03 (d, *J* = 2.0 Hz, 1H), 4.00 (dd, *J* = 7.2, 6.6 Hz, 2H), 3.18 (t, *J* = 7.2 Hz, 2H) ppm;

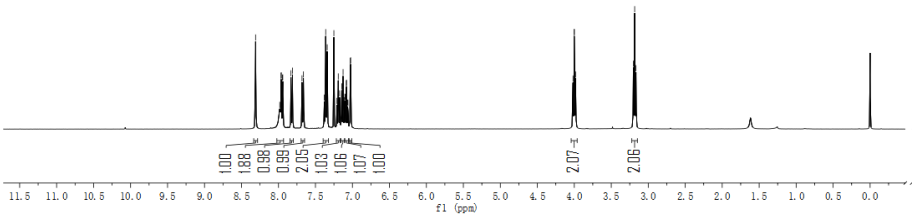
^{13}C NMR (100 MHz, $CDCl_3$) δ 164.7, 139.6, 137.2, 136.3, 131.9, 128.7, 128.4, 127.6, 122.1, 122.0, 119.3, 119.0, 114.0, 111.1, 99.9, 61.7, 26.8 ppm;

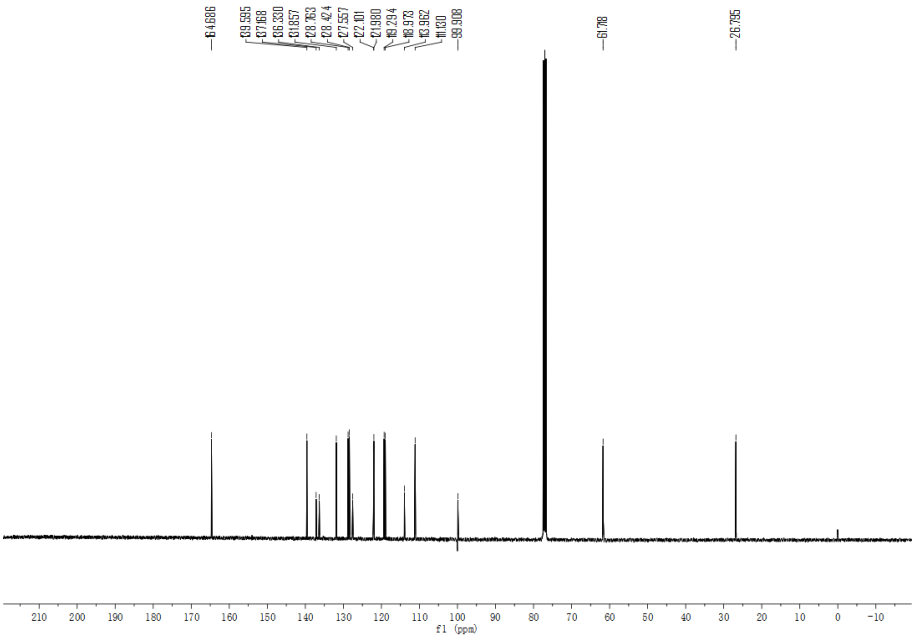
LCMS (ESI) m/z calcd for $C_{17}H_{16}IN_2^+$ $(M+H)^+$ 375, found *m/z* 375.

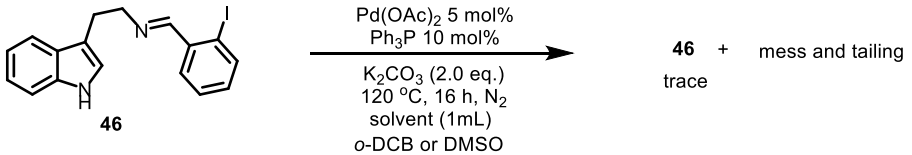




46







46

$Pd(OAc)_2$ 5 mol%
Ph_3P 10 mol%

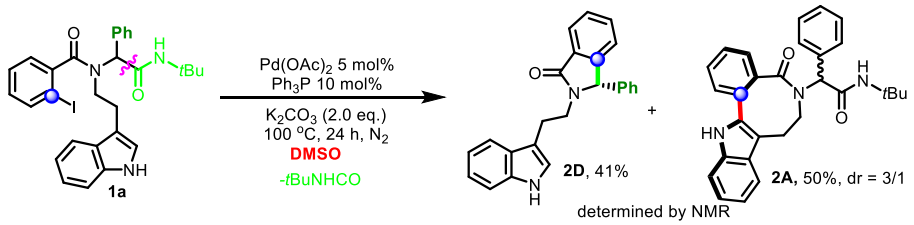
K_2CO_3 (2.0 eq.)
120 °C, 16 h, N_2
solvent (1mL)
o-DCB or DMSO

46 + mess and tailing
trace

46 (0.2 mmol, 75 mg, 1.0eq.), $Pd(OAc)_2$ (0.01 mmol, 2.2 mg, 0.05 eq), Ph_3P (0.02 mmol, 5.2 mg, 0.1 eq), and K_2CO_3 (0.4 mmol, 56 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous *o*-DCB or DMSO (2 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 °C for 16 h. The reaction mixture was then extracted three times with **ethyl acetate** (3 mL) and water (3 mL). The organic phase was collected and monitored by TLC. Substrate **46** was almost completely converted, but the reaction TLC spot plate was confused and trailing.

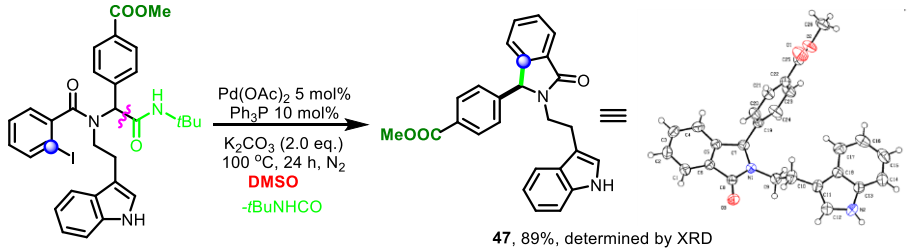
5. Solvent Effects of this Reaction

5.1 Effect of neutral aryl aldehyde subunits on the reaction with DMSO as solvent



Ugi products **1a** (0.1 mmol, 58 mg), $Pd(OAc)_2$ (0.005 mmol, 1.1 mg, 0.05 eq), Ph_3P (0.01 mmol, 2.6 mg, 0.1 eq), and K_2CO_3 (0.2 mmol, 28 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous **DMSO** (1 ml) was added and the flask was sealed. The reaction mixture was stirred at 100 ^oC for 24 h and monitored by TLC. The reaction mixture was then extracted three times with ethyl acetate (3 mL) and water (3 mL). The organic phase was collected and subjected to dry loading and column chromatography to give **2D** (14 mg, 41%) and **2A** (23 mg, 50%, dr = 3/1) over silica gel using EtOAc/ n-hexane = 20%~30% as eluent.

5.2 Effect of electron-deficient aryl aldehyde subunits on the reaction with DMSO as solvent

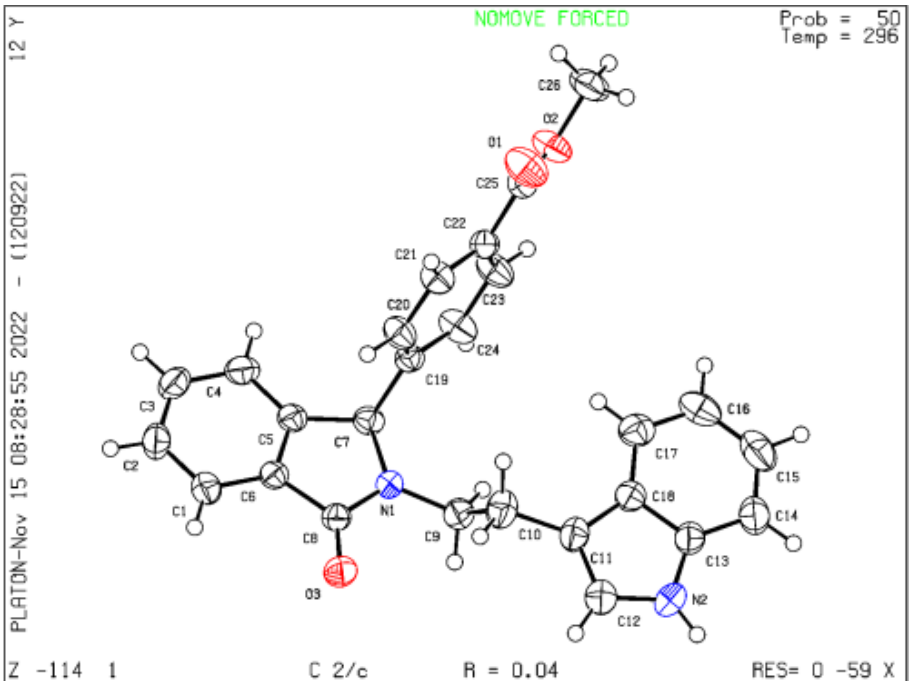


Ugi products (0.1 mmol, 64 mg), $Pd(OAc)_2$ (0.005 mmol, 1.1 mg, 0.05 eq), Ph_3P (0.01 mmol, 2.6 mg, 0.1 eq), and K_2CO_3 (0.2 mmol, 28 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous **DMSO** (1 ml) was added and the flask was sealed. The reaction mixture was stirred at 100 ^oC for 24 h and monitored by TLC. T The reaction mixture was then extracted three times with ethyl acetate (3 mL) and water (3 mL). The organic phase was collected and subjected to dry loading and column chromatography to give **47** (36 mg, 89%) white solid over silica gel using EtOAc/ n-hexane = 20%~30% as eluent.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (s, 1H), 8.01 – 7.82 (m, 3H), 7.48 – 7.39 (m, 3H), 7.35 (d, *J* = 8.1 Hz, 1H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.05 (t, *J* = 7.5 Hz, 1H), 7.01 (d, *J* = 7.1 Hz, 1H), 6.98 (dd, *J* = 5.6, 2.6 Hz, 3H), 5.17 (s, 1H), 4.38 – 4.21 (m, 1H), 3.90 (s, 3H), 3.26 – 3.17 (m, 1H), 3.12 (dt, *J* = 14.7, 7.3 Hz, 1H), 3.06 – 2.92 (m, 1H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.7, 166.5, 145.7, 142.2, 136.3, 131.8, 131.6, 130.5, 130.23, 128.5, 127.7, 127.2, 123.6, 122.9, 122.2, 122.1, 119.4, 118.6, 112.7, 111.3, 64.6, 52.3, 40.7, 24.4 ppm;

HRMS (ESI) m/z calcd for $C_{26}H_{23}N_2O_3^+$ $(M+H)^+$ 411.1703, found *m/z* 411.1700.



Datablock: 1

Bond precision: C-C = 0.0027 A Wavelength=0.71073

Cell: a=36.487(3) b=6.1129(5) c=18.5679(16)
alpha=90 beta=97.336(1) gamma=90
Temperature: 296 K

	Calculated	Reported
Volume	4107.5(6)	4107.5(6)
Space group	C 2/c	C 2/c
Hall group	-C 2yc	-C 2yc
Moiety formula	C26 H22 N2 O3	?
Sum formula	C26 H22 N2 O3	C26 H22 N2 O3
Mr	410.46	410.45
Dx,g cm-3	1.327	1.327
Z	8	8
Mu (mm-1)	0.088	0.088
F000	1728.0	1728.0
F000'	1728.76	
h,k,lmax	42,7,22	42,7,22
Nref	3623	3608
Tmin,Tmax	0.977,0.981	
Tmin'	0.977	

Correction method= Not given

Data completeness= 0.996 Theta(max)= 24.999

R(reflections)= 0.0416(2667) wR2(reflections)= 0.1087(3608)

S = 0.937 Npar= 281

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The following ALERTS were generated. Each ALERT has the format
      test-name_ALERT_alert-type_alert-level.
Click on the hyperlinks for more details of the test.

 Alert level C
PLAT230_ALERT_2_C Hirshfeld Test Diff for    N1       --C9       .       5.5 s.u.
PLAT906_ALERT_3_C Large K Value in the Analysis of Variance ......      4.816 Check
PLAT910_ALERT_3_C Missing # of FCF Reflection(s) Below Theta(Min).         5 Note
PLAT911_ALERT_3_C Missing FCF Refl Between Thmin & STh/L=    0.595        10 Report

 Alert level G
PLAT007_ALERT_5_G Number of Unrefined Donor-H Atoms ..............         1 Report
PLAT793_ALERT_4_G Model has Chirality at C7          (Centro SPGR)        R Verify
PLAT883_ALERT_1_G No Info/Value for _atom_sites_solution_primary .    Please Do !
PLAT909_ALERT_3_G Percentage of I>2sig(I) Data at Theta(Max) Still       51% Note
PLAT933_ALERT_2_G Number of HKL-OMIT Records in Embedded .res File        8 Note
PLAT941_ALERT_3_G Average HKL Measurement Multiplicity ...........      2.8 Low
PLAT961_ALERT_5_G Dataset Contains no Negative Intensities .......    Please Check
PLAT965_ALERT_2_G The SHELXL WEIGHT Optimisation has not Converged    Please Check
PLAT967_ALERT_5_G Note: Two-Theta Cutoff Value in Embedded .res ..     50.0 Degree
PLAT978_ALERT_2_G Number C-C Bonds with Positive Residual Density.        4 Info

   0 ALERT level A = Most likely a serious problem - resolve or explain
   0 ALERT level B = A potentially serious problem, consider carefully
   4 ALERT level C = Check. Ensure it is not caused by an omission or oversight
  10 ALERT level G = General information/check it is not something unexpected

   1 ALERT type 1 CIF construction/syntax error, inconsistent or missing data
   4 ALERT type 2 Indicator that the structure model may be wrong or deficient
   5 ALERT type 3 Indicator that the structure quality may be low
   1 ALERT type 4 Improvement, methodology, query or suggestion
   3 ALERT type 5 Informative message, check
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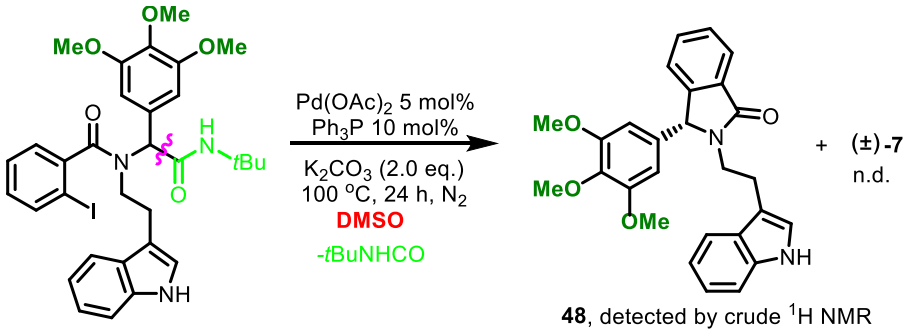
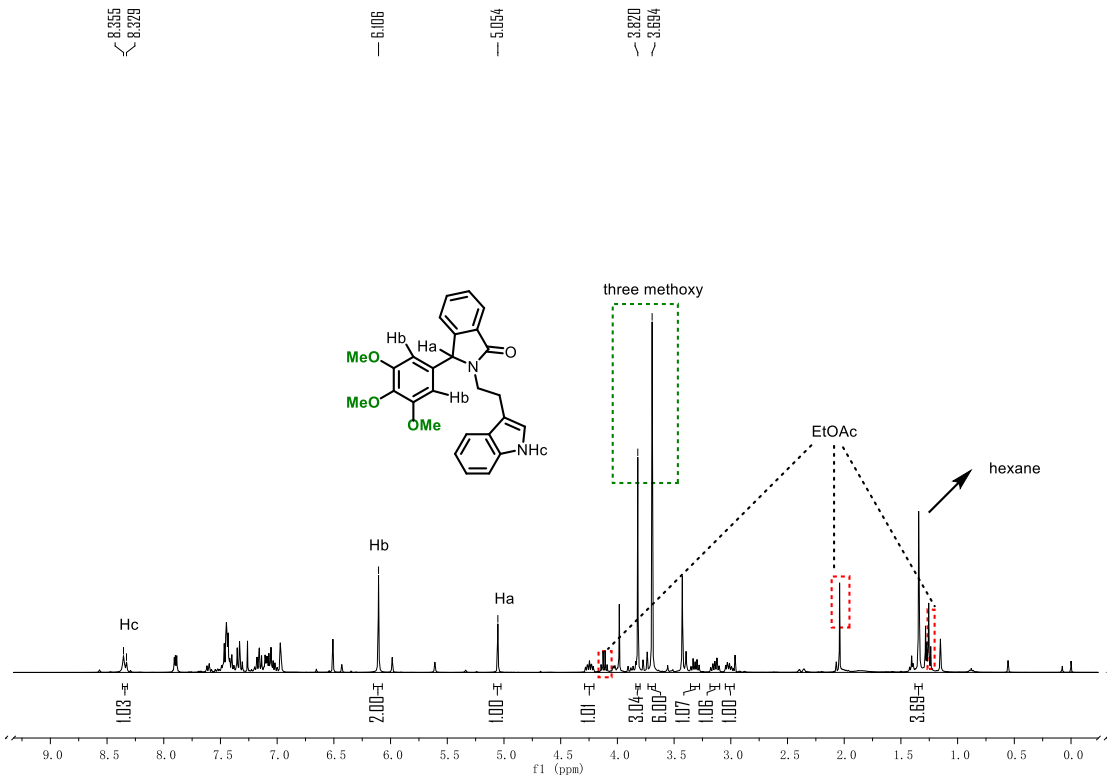
5.3 Effect of electron-rich aryl aldehyde subunits on the reaction with DMSO as solvent

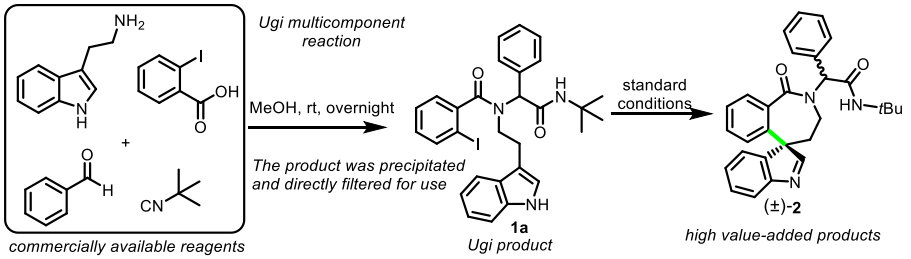


48, detected by crude ^{1}H NMR

Ugi products (0.1 mmol, 67 mg), $Pd(OAc)_2$ (0.005 mmol, 1.1 mg, 0.05 eq), Ph_3P (0.01 mmol, 2.6 mg, 0.1 eq), and K_2CO_3 (0.2 mmol, 28 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous **DMSO** (1 ml) was added and the flask was sealed. The reaction mixture was stirred at 100 ^oC for 24 h and monitored by TLC. After complete conversion of the Ugi product, The reaction mixture was then extracted three times with ethyl acetate (3 mL) and water (3 mL). The organic phase was collected, the organic solvent was removed under reduced pressure and the crude NMR was made directly.



6. Gram Scale-up Experiment



Gram-scale reaction: 3 mmol scale, 24h, 83% (±**2** :1.29g, dr = 4.9/1)

Procedure 1: synthesis of Ugi products 1a

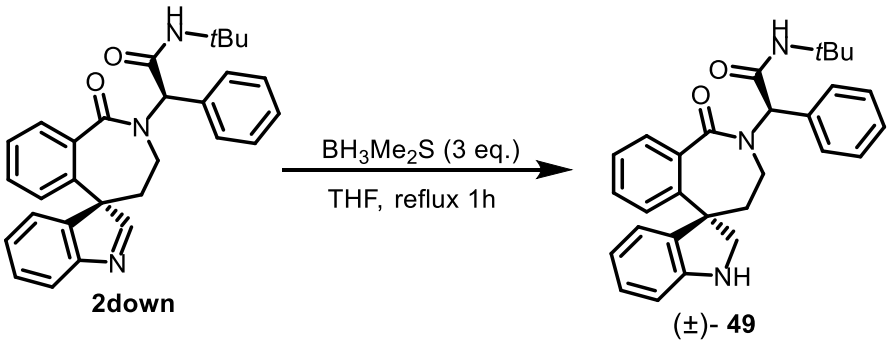
To a solution of benzaldehyde (4 mmol, 408 uL, 1.0 equiv.) in methanol (10 mL) were added successively tryptamine (4 mmol, 641 mg, 1.0 equiv.), *o*-iodobenzoic acid (4 mmol, 992 mg, 1.0 equiv) and isonitrile (3.72 mmol, 389 uL, 0.93 equiv.) in a screw capped vial equipped with a magnetic stir bar. The reaction mixture was stirred at room temperature overnight. After completion of the reaction, the product would be precipitated in solid form, and the desired yellow solid Ugi products **1a** could be obtained directly by filtration (1.85g, 86%).

Procedure 2: synthesis of 3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-1(2H)-one (±)-2

Ugi products **1a** (3 mmol, 1.74g, 1.0 eq.), $Pd(OAc)_2$ (0.15 mmol, 34 mg, 0.05 eq), Ph_3P (0.3 mmol, 79 mg, 0.1 eq), and K_2CO_3 (6 mmol, 829 mg, 2.0 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous o-DCB (30 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 ^oC for 24 h and monitored by TLC. After the reaction was finished, the mixture was extracted with

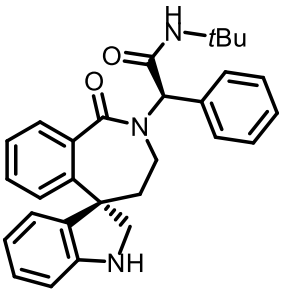
ethyl acetate and water, and the organic phase was dried with anhydrous sodium sulfate and concentrated, the residue was purified by chromatography on silica gel (EtOAc/ n-hexane = 30%~40% as eluent) to afford the **(±)-2** (**2down** 0.93g + **2up** 0.19 g = 1.12 g, 83% yield).

7. Follow-Up Experiment



An oven-dried glass tube (10 mL) was equipped with a magnetic stir bar, **2down** (0.1 mmol, 45 mg, 1.0 eq.), BH_3Me_2S (0.4 mmol, 46 uL, 4.0 eq.), and 2.0 ml THF were added and the flask was sealed. The resulting solution was stirred at 80 ^oC for 1h and monitored by TLC. After the reaction was finished, the mixture was extracted with ethyl acetate and water, and the organic phase was dried with anhydrous sodium sulfate and concentrated, the residue was purified by chromatography on silica gel (EA/PE = 3/10) to afford the **(±)-49** (28 mg, 63% yield).

***N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide* (±)-44**

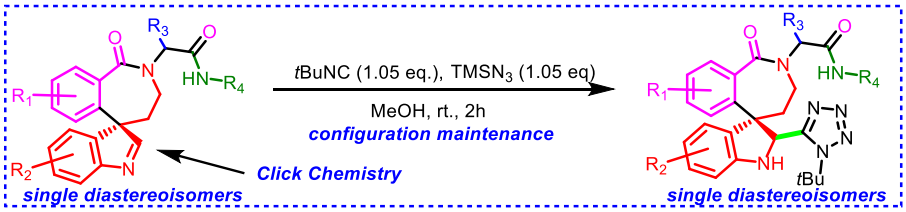


White solid, (**±)-44**, 28 mg, 63% yield, Rf = 0.4 (ethyl acetate/hexane = 40%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.47 (dd, *J* = 7.8, 1.4 Hz, 2H), 7.35 – 7.28 (m, 3H), 7.23 (td, *J* = 7.5, 1.1 Hz, 1H), 7.13 (td, *J* = 7.6, 1.5 Hz, 1H), 7.08 – 7.00 (m, 2H), 6.76 (t, *J* = 7.5 Hz, 1H), 6.65 – 6.55 (m, 2H), 6.21 (s, 1H), 5.53 (s, 1H), 3.65 – 3.56 (m, 2H), 3.48 – 3.36 (m, 1H), 3.21 (d, *J* = 9.2 Hz, 1H), 2.08 (dd, *J* = 14.4, 3.9 Hz, 1H), 1.30 (s, 9H), 0.81 (t, *J* = 6.8 Hz, 1H) ppm;

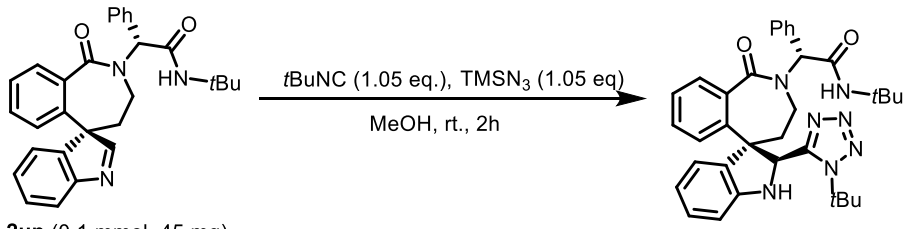
^{13}C NMR (100 MHz, $CDCl_3$) δ 172.2, 168.7, 150.9, 142.5, 135.3, 135.0, 132.6, 130.6, 130.5, 130.1, 129.0, 128.9, 128.6, 127.3, 126.6, 125.9, 118.7, 110.6, 66.0, 60.8, 52.9, 51.8, 43.3, 43.2, 31.4, 30.2, 28.7;

HRMS (ESI) m/z calcd for $C_{29}H_{32}N_3O_2^+$ $(M+H)^+$ 454.2489, found *m/z* 454.2493.



To a solution of dearomatization products (1.0 equiv.) in methanol (1 mL) were added successively $TMSN_3$ (1.05 equiv.) and *tert*-butyl isonitrile (1.05 equiv.) in a screw capped vial equipped with a magnetic stir bar. The reaction mixture was stirred at room temperature for 2h. After completion of the reaction, the reaction mixture was concentrated under reduced pressure followed by column chromatography over silica gel using petroleum / EtOAc = 10/3~5/2 as eluent to afford the conformation-maintaining **(±)-50**-**(±)-57**

***N-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide* (±)-50**



2up (0.1 mmol, 45 mg)

(±)-**50**, 94%

From **2up** (0.1 mmol scale, 45 mg)

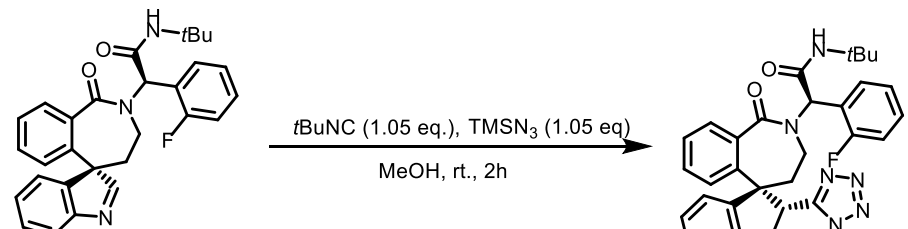
Yellow solid, (±)-**50**, 54 mg, 94% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 7.9 Hz, 1H), 7.64 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.39 – 7.30 (m, 5H), 7.28 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.21 (dd, *J* = 10.2, 4.3 Hz, 2H), 7.11 (t, *J* = 7.6 Hz, 1H), 6.88 (t, *J* = 7.5 Hz, 1H), 6.74 (d, *J* = 7.8 Hz, 1H), 6.46 (s, 1H), 6.02 (s, 1H), 5.64 (s, 1H), 3.47 – 3.36 (m, 1H), 3.18 (dd, *J* = 8.0, 3.0 Hz, 2H), 2.08 (d, *J* = 14.1 Hz, 1H), 1.61 (s, 9H), 1.42 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 168.9, 154.1, 148.1, 136.7, 136.7, 135.9, 135.5, 131.3, 130.8, 130.3, 129.1, 129.0, 128.6, 128.0, 127.4, 125.1, 120.3, 111.6, 63.1, 62.2, 62.0, 59.7, 51.9, 44.3, 42.0, 30.5, 28.8;

HRMS (ESI) m/z calcd for $C_{34}H_{40}N_7O_2^+$ $(M+H)^+$ 578.3238, found *m/z* 578.3235.

***N-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-(2-fluorophenyl)acetamide* (±)-51**



9down (0.064 mmol, 30 mg)

(±)-**51**, 92%

From **9down** (0.064 mmol scale, 30 mg)

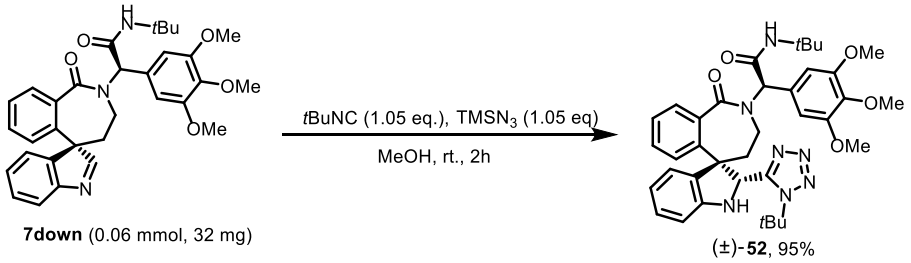
Yellow solid, (**±)-51**, 35 mg, 92% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 7.4, 1.8 Hz, 1H), 7.71–7.66 (m, 1H), 7.59 (t, *J* = 7.0 Hz, 1H), 7.42 (dd, *J* = 13.4, 6.1 Hz, 1H), 7.28 – 7.24 (m, 1H), 7.21 (dd, *J* = 13.4, 7.1 Hz, 3H), 7.08 (t, *J* = 7.6 Hz, 1H), 6.86 (t, *J* = 7.5 Hz, 1H), 6.67 (d, *J* = 7.8 Hz, 1H), 6.39 (s, 1H), 5.62 (s, 1H), 5.46 (s, 1H), 4.01 (brs, 1H), 3.66 (ddd, J = 15.2, 12.3, 2.6 Hz, 1H), 3.34 (dt, J = 15.5, 3.5 Hz, 1H), 2.29 – 2.17 (m, 1H), 1.84 (dt, *J* = 14.9, 2.9 Hz, 1H), 1.59 (s, 9H), 1.37 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.3, 167.9, 161.2 (d, *J* = 247.2 Hz), 153.9, 147.6, 136.7, 135.8, 135.3, 131.8, 131.7, 131.4 (d, *J* = 2.9 Hz), 131.1 (d, *J* = 8.4 Hz), 130.5, 128.0, 127.7, 125.0 (d, *J* = 3.3 Hz), 124.8, 122.5 (d, *J* = 14.3 Hz), 120.6, 115.9 (d, *J* = 22.0 Hz), 111.1, 64.4, 61.9, 59.7, 56.1, 52.0, 44.7, 42.6, 30.5, 30.4, 28.6 ppm;

HRMS (ESI) m/z calcd for $C_{34}H_{39}FN_7O_2^+$ $(M+H)^+$ 596.3144, found *m/z* 596.3149.

***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-(3,4,5-trimethoxyphenyl)acetamide (±)-52**



From **7down** (0.06 mmol scale, 32 mg)

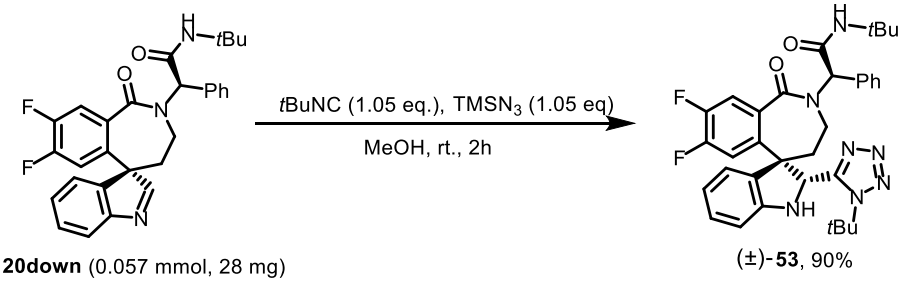
Yellow solid, (**±)-52**, 38 mg, 95% yield, Rf = 0.2 (ethyl acetate/hexane = 40%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.7 Hz, 1H), 7.23 (dd, *J* = 11.3, 4.8 Hz, 1H), 7.15 (q, *J* = 7.7 Hz, 3H), 7.02 (d, *J* = 7.5 Hz, 1H), 6.86 – 6.72 (m, 4H), 6.23 (s, 1H), 5.56 (s, 1H), 5.32 (s, 1H), 4.22 (s, 1H), 3.88 (s, 3H), 3.87 (s, 6H), 3.78 – 3.61 (m, 1H), 3.53 (dd, *J* = 11.9, 4.0 Hz, 1H), 2.16 – 2.10 (m, 2H), 1.42 (s, 9H), 1.37 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.2, 168.4, 154.3, 153.6, 148.0, 138.4, 136.6, 136.3, 136.2, 132.2, 132.1, 131.9, 131.1, 130.3, 128.6, 128.5, 127.9, 124.6, 120.4, 110.9, 106.5, 66.6, 62.2, 62.0, 61.0, 60.6, 56.3, 51.9, 45.7, 42.2, 30.4, 28.7 ppm;

HRMS (ESI) m/z calcd for $C_{37}H_{46}N_7O_5^+$ $(M+H)^+$ 668.3555, found *m/z* 668.3552.

***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-7,8-difluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (±)-53**

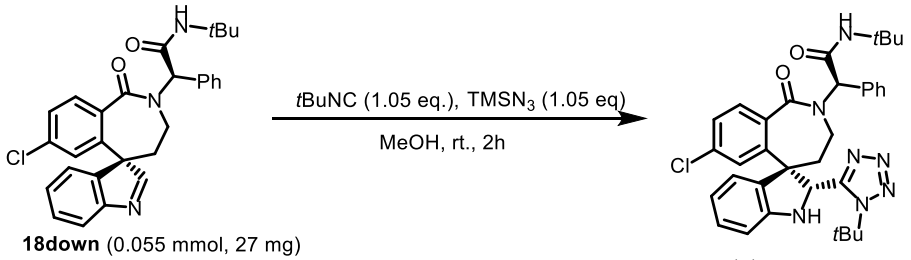


From **20down** (0.057 mmol scale, 28 mg)

Yellow solid, (**±)-53**, 31 mg, 90% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (dd, *J* = 12.3, 7.8 Hz, 1H), 7.46 (d, *J* = 8.3 Hz, 3H), 7.38 (d, *J* = 7.0 Hz, 2H), 7.28 (t, *J* = 2.0 Hz, 1H), 7.14 (d, *J* = 7.5 Hz, 1H), 7.10 – 7.00 (m, 1H), 6.84 (t, *J* = 7.5 Hz, 1H), 6.56 (d, *J* = 7.8 Hz, 1H), 6.12 (s, 1H), 5.38 (s, 1H), 5.25 (s, 1H), 3.80 (s, 1H), 3.64 – 3.51 (m, 1H), 3.44 (dd, *J* = 11.4, 7.9 Hz, 1H), 2.09 – 1.95 (m, 1H), 1.79 – 1.68 (m, 1H), 1.59 (s, 9H), 1.28 (s, 9H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 169.5, 168.0, 153.3, 147.6 (d, *J* = 7.0 Hz), 147.3, 147.1, 138.5 (d, *J* = 9.2 Hz), 135.3 (d, *J* = 25.7 Hz), 129.5, 129.4, 129.3, 128.4, 124.6, 124.5, 124.0, 120.7 (dd, *J* = 19.3, 13.0 Hz), 120.5, 119.1, 111.4, 63.8, 62.0, 58.7, 52.0, 44.5, 42.8, 30.7, 28.7 ppm;
^{19}F NMR (376 MHz, $CDCl_3$) δ -131.35 – -133.49 (m), -138.19 (ddd, *J* = 22.5, 10.9, 8.2 Hz) ppm;
HRMS (ESI) m/z calcd for $C_{34}H_{38}F_2N_7O_2^+$ $(M+H)^+$ 614.3050, found *m/z* 614.3051.

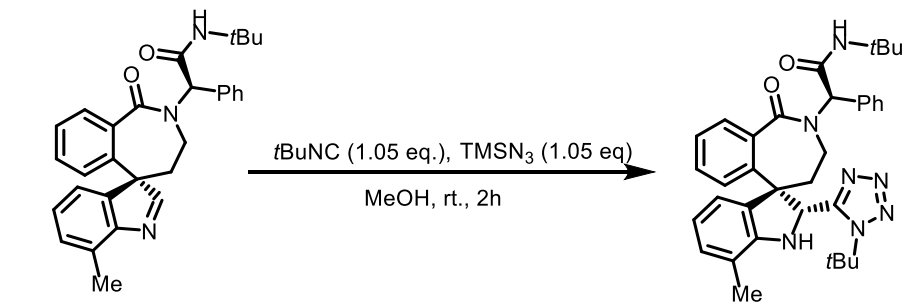
***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-7-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (±)-54**



18down (0.055 mmol, 27 mg)
(±)-**54**, 95%

From **18down** (0.055 mmol scale, 27 mg)
White solid, (**±**)**-54**, 32 mg, 95% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.4 Hz, 1H), 7.63 (d, *J* = 2.0 Hz, 1H), 7.53 (d, *J* = 7.3 Hz, 2H), 7.49 – 7.40 (m, 3H), 7.24 – 7.17 (m, 2H), 7.10 (t, *J* = 7.5 Hz, 1H), 6.89 (t, *J* = 7.5 Hz, 1H), 6.65 (d, *J* = 7.8 Hz, 1H), 6.25 (s, 1H), 5.49 (s, 1H), 5.31 (s, 1H), 3.98 (s, 1H), 3.64 (ddd, *J* = 15.2, 12.0, 2.9 Hz, 1H), 3.50 (dt, *J* = 15.7, 3.7 Hz, 1H), 2.10 – 1.98 (m, 1H), 1.84 (dt, *J* = 15.0, 3.0 Hz, 1H), 1.60 (s, 9H), 1.35 (s, 9H) ppm;
^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 168.2, 153.5, 147.5, 137.9, 136.8, 135.6, 135.4, 134.0, 133.1, 131.3, 129.5, 129.3, 129.2, 128.4, 128.0, 124.7, 120.8, 111.2, 64.4, 62.0, 61.8, 59.4, 52.0, 44.7, 42.6, 30.6, 28.7 ppm;
HRMS (ESI) m/z calcd for $C_{34}H_{39}ClN_7O_2^+$ $(M+H)^+$ 612.2848, found *m/z* 612.2844.

***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-7'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (±)-55**



26down (0.064 mmol, 30 mg)
(±)-**55**, 91%

From **26down** (0.064 mmol scale, 30 mg)

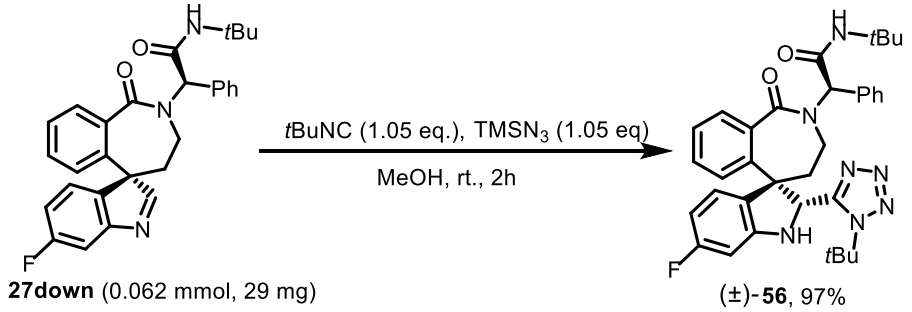
Yellow solid, (**±)-55**, 34 mg, 91% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 – 7.79 (m, 1H), 7.54 (dd, *J* = 7.5, 1.7 Hz, 2H), 7.42 (d, *J* = 6.6 Hz, 3H), 7.25 – 7.18 (m, 1H), 7.16 – 7.07 (m, 2H), 6.95 (d, *J* = 7.3 Hz, 1H), 6.82 (d, *J* = 7.3 Hz, 1H), 6.74 (t, *J* = 7.5 Hz, 1H), 6.40 (s, 1H), 5.52 (s, 1H), 5.23 (s, 1H), 3.99 (s, 1H), 3.73 (ddd, *J* = 15.5, 10.3, 1.8 Hz, 1H), 3.51 (ddd, *J* = 15.8, 5.4, 2.4 Hz, 1H), 2.14 (s, 3H), 2.10 – 1.98 (m, 1H), 1.93 – 1.83 (m, 1H), 1.44 (s, 9H), 1.35 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 168.4, 154.7, 146.4, 136.6, 136.5, 136.2, 135.9, 132.3, 132.1, 130.2, 129.4, 129.3, 129.2, 129.0, 127.6, 121.9, 120.6, 120.2, 66.6, 62.2, 61.7, 61.0, 51.9, 45.7, 42.0, 30.5, 28.7, 16.7 ppm;

HRMS (ESI) m/z calcd for $C_{35}H_{42}N_7O_2^+$ $(M+H)^+$ 592.3395, found *m/z* 592.3392.

***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-6'-fluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (±)-56**



27down (0.062 mmol, 29 mg) (±)-**56**, 97%

From **27down** (0.062 mmol scale, 29 mg)

Yellow solid, (**±)-56**, 36 mg, 97% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.6 Hz, 1H), 7.53 (d, *J* = 6.8 Hz, 2H), 7.44 (d, *J* = 6.4 Hz, 3H), 7.26 (t, *J* = 3.9 Hz, 1H), 7.22 (d, *J* = 7.5 Hz, 1H), 7.20 – 7.12 (m, 1H), 6.95 (dd, *J* = 8.0, 5.6 Hz, 1H), 6.49 (t, *J* = 8.7 Hz, 1H), 6.40 (d, *J* = 9.3 Hz, 1H), 6.35 (s, 1H), 5.52 (s, 1H), 5.25 (s, 1H), 4.22 (s, 1H), 3.74 – 3.62 (m, 1H), 3.53 (dd, *J* = 12.2, 3.7 Hz, 1H), 2.06 – 1.88 (m, 2H), 1.47 (s, 9H), 1.35 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.0, 168.3, 163.35 (d, *J* = 243.6 Hz), 154.0, 149.38 (d, *J* = 11.7 Hz), 136.02, 135.74 (d, *J* = 3.3 Hz), 132.48 (d, *J* = 2.6 Hz), 132.08, 131.67, 130.35, 129.40, 129.24, 129.08, 127.84, 125.23 (d, *J* = 10.3 Hz), 106.68 (d, *J* = 22.7 Hz), 98.61 (d, *J* = 26.4 Hz), 66.37, 62.25, 61.69, 59.62, 51.92, 45.29, 42.14, 30.46, 28.69 ppm;

^{19}F NMR (376 MHz, $CDCl_3$) δ -114.51 (td, *J* = 9.2, 5.4 Hz) ppm;

HRMS (ESI) m/z calcd for $C_{34}H_{39}FN_7O_2^+$ $(M+H)^+$ 596.3144, found *m/z* 596.3146.

2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenyl-N-(2,4,4-trimethylpentan-2-yl)acetamide (±)-57

From **31down** (0.069 mmol scale, 35 mg)

White solid, (**±)-57**, 43 mg, 99% yield, Rf = 0.4 (ethyl acetate/hexane = 30%);

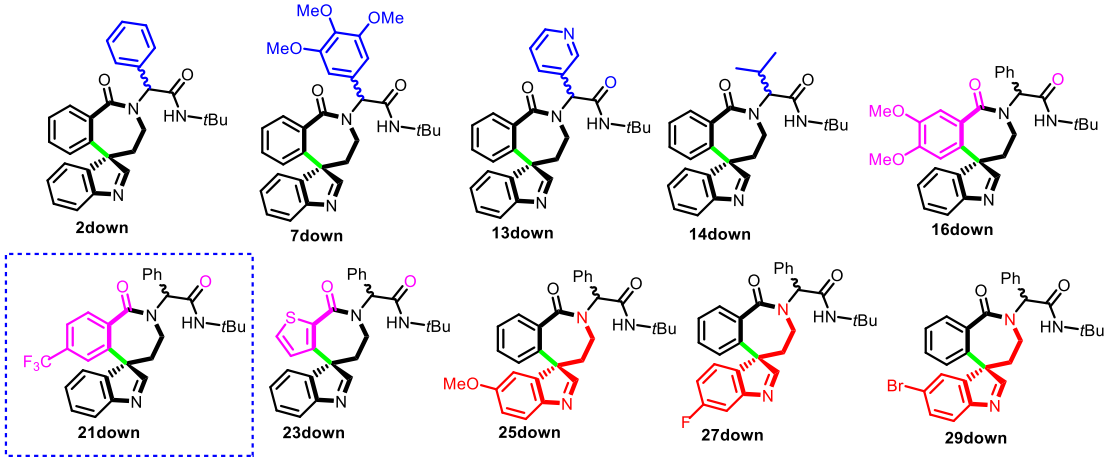
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 7.5, 1.5 Hz, 1H), 7.59 – 7.55 (m, 2H), 7.42 (dt, *J* = 13.1, 6.5 Hz, 3H), 7.25 – 7.15 (m, 3H), 7.12 – 7.04 (m, 2H), 6.83 (t, *J* = 7.5 Hz, 1H), 6.68 (d, *J* = 7.8 Hz, 1H), 6.33 (s, 1H), 5.62 (s, 1H), 5.21 (s, 1H), 4.11 (s, 1H), 3.78 – 3.66 (m, 1H), 3.55 (dt, *J* = 15.5, 3.6 Hz, 1H), 2.12 – 1.94 (m, 2H), 1.72 (d, *J* = 4.8 Hz, 2H), 1.48 (s, 9H), 1.44 (s, 3H), 1.40 (s, 3H), 0.93 (s, 9H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.1, 167.9, 154.1, 147.7, 136.8, 135.9, 135.9, 135.6, 131.8, 130.3, 129.6, 129.2, 129.0, 128.2, 127.7, 124.6, 120.4, 111.0, 65.5, 62.1, 62.0, 60.1, 55.9, 52.5, 45.1, 42.4, 31.6, 31.4, 30.5, 29.0, 28.5 ppm;

HRMS (ESI) m/z calcd for $C_{38}H_{48}N_7O_2^+$ $(M+H)^+$ 634.3864, found *m/z* 634.3860.

8. Biological experiments

8.1 Antitumor activity test of some dearomatization products



Selected compounds (renumbered sequentially as a, b, c, d, e, f, g, h, i, j for simplicity)

The anti-tumor activity of the benzazepine spirodihydroindole compounds synthesized in examples **a-j** was assayed using human-derived tumor cell lines A549, MCF7, HELA, HEPG2, and HCT116, which were purchased from the American Type Culture Collection (ATCC). The experimental steps were as follows.

(1) Routine culture of cells.

A549, MCF7, HELA, HEPG2, HCT116 cells were inoculated in DMEM culture medium containing 10% fetal bovine serum (FBS), cultured and passaged at 37 ℃, 5% CO_2 and saturated humidity. Leave the cells in logarithmic growth phase for experiments.

(2) Cell spreading plate

A549, MCF7, HELA, HEPG2 and HCT116 cells in the logarithmic growth phase were digested 24 h before drug treatment, prepared into cell suspensions, counted, and the cell concentration was adjusted to $1x10^5$/ml, and the cells were inoculated into 96-well plates with approximately $2x10^4$ cells per well, and the cells were incubated in an incubator.

(3) Drug treatment

Examples **a-j** were diluted with the complete medium corresponding to the cells to a compound concentration of 20 μM and added to each well of a 96-well plate, respectively, with 3 replicate wells for each compound. Controls were equal volume of DMSO with the compounds and the cells were placed back into the cell culture incubator for 72 hours.

(4) CCK8 assay results

1) Incubate the plate in the incubator for 72h, and then use an enzyme marker and perform the assay at absorbance value 450nm.

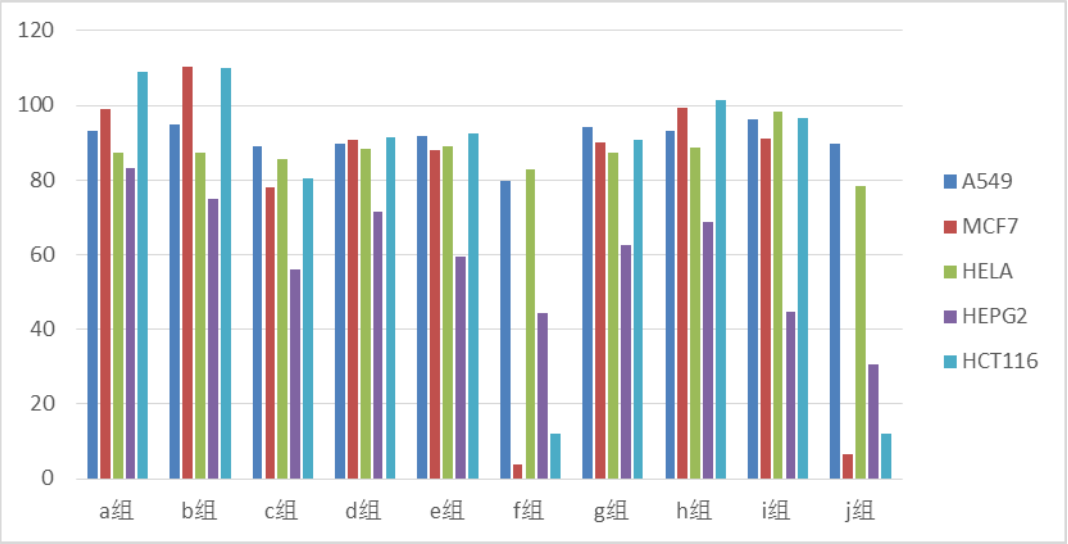
2) Add 10 ul of CCK8 solution to each well (be careful not to create air bubbles in the wells, it will affect the reading).

3) Place the plate in an incubator and incubate for 2h.

4) Readings were taken at 450 nm and the results were as follows.

The cell viability of the benzazepinespirodihydroindole compounds in examples **a-j** against each tumor cell is shown below.

Example	72h cell viability of 20μM compound (%)				
	A549	MCF7	HELA	HEPG2	HCT116
1	93.03	99.09	87.20	83.05	108.84
2	94.77	110.24	87.48	75.06	109.93
3	89.04	78.15	85.65	56.16	80.50
4	89.89	90.66	88.39	71.65	91.40
5	91.79	88.06	89.04	59.51	92.37
6	79.91	3.96	82.80	44.44	12.13
7	94.07	90.12	87.15	62.60	90.74
8	93.07	99.22	88.57	68.76	101.39
9	96.35	91.18	98.33	44.57	96.58
10	89.84	6.48	78.45	30.76	11.89



8.2 Antitumor activity and IC_{50} test assay of 21down

(1) Conventional culture of cells

To test the effect of different concentrations of **21down** on the viability of breast cancer cells (MCF7), MCF7 cells were inoculated in DMEM culture medium with 10% FBS, cultured and passaged at 37 ^{o}C, 5% CO_2 and saturated humidity, and then used for experiments when the cells were in logarithmic growth phase.

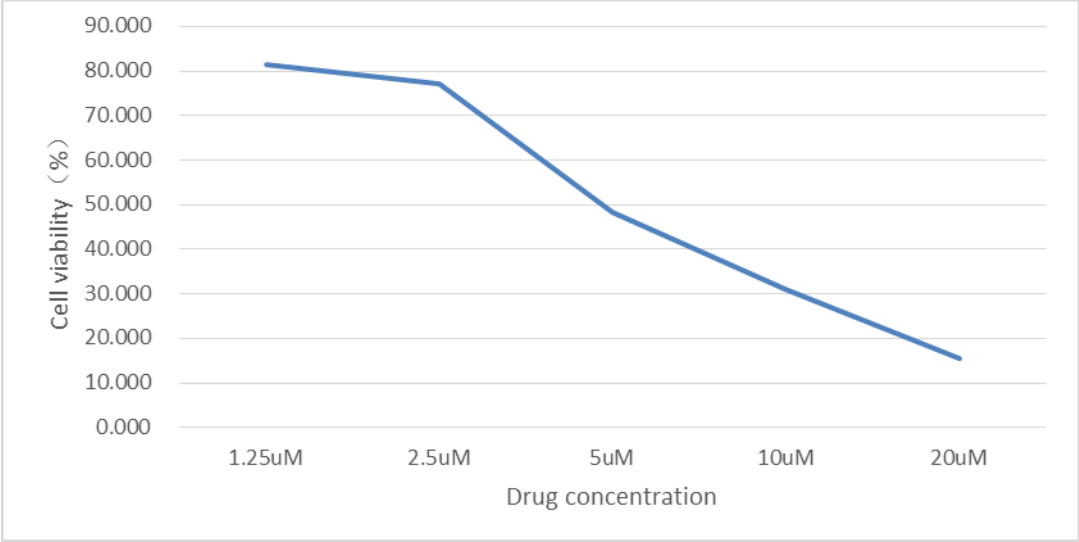
(2) Cell spreading

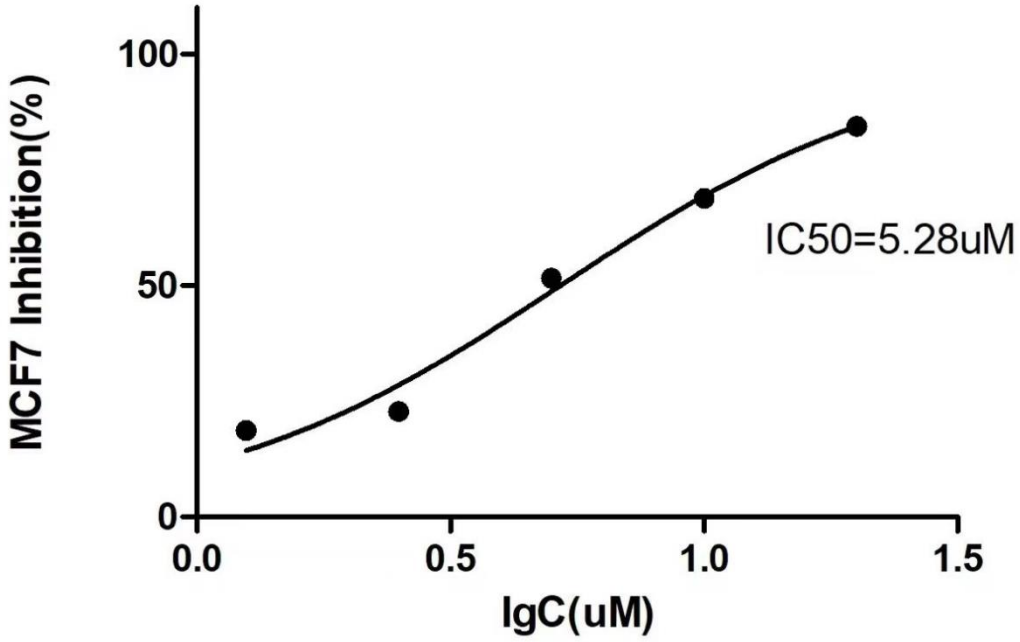
The MCF7 cells in the growth phase were digested 24 h before drug treatment, prepared into cell suspension, and counted, and the cell concentration was adjusted to 1x10^5/mL.

(3) Drug treatment

After cell apposition, compound **21down** was added to a final concentration of 0 μM, 1.25 μM, 2.5 μM, 5 μM, 10 μM, 20 μM. After 72 h of compound treatment, the cells were detected at an absorbance value of 450 nm using an enzyme marker, 10 ul of CCK solution was added to each well (be careful not to create bubbles in the wells), and the plate was placed The results are shown below. The viability of breast cancer cells decreased significantly with the increase of compound concentration, indicating that the benzazepine spirodihydroindole compound **21down** has certain inhibitory activity on breast cancer tumor cells. The IC_{50} of the benzodiazepine spirodihydroindole **21down** was 5.28 μM against breast cancer cells MCF7 as shown below.

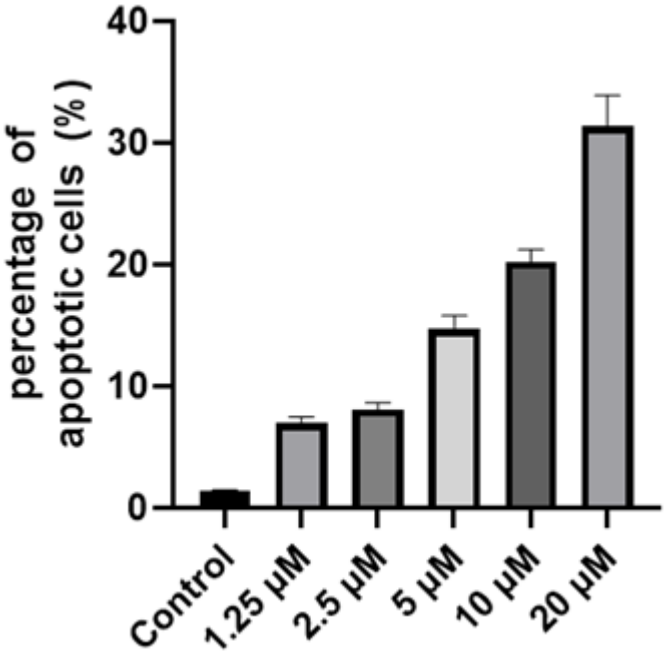
		Group	1.25uM	2.5uM	5uM	10uM	20uM	Contrast	Blank
		OD value 1	0.713	0.75	0.55	0.434	0.301	0.891	0.172
MCF7		OD value 2	0.834	0.771	0.522	0.37	0.266	0.891	0.175
		OD value 3	0.766	0.701	0.514	0.4	0.292	0.944	0.167
		OD mean value	0.771	0.741	0.529	0.401	0.286	0.909	0.171
		Cell viability %	81.329	77.215	48.463	31.193	15.597		



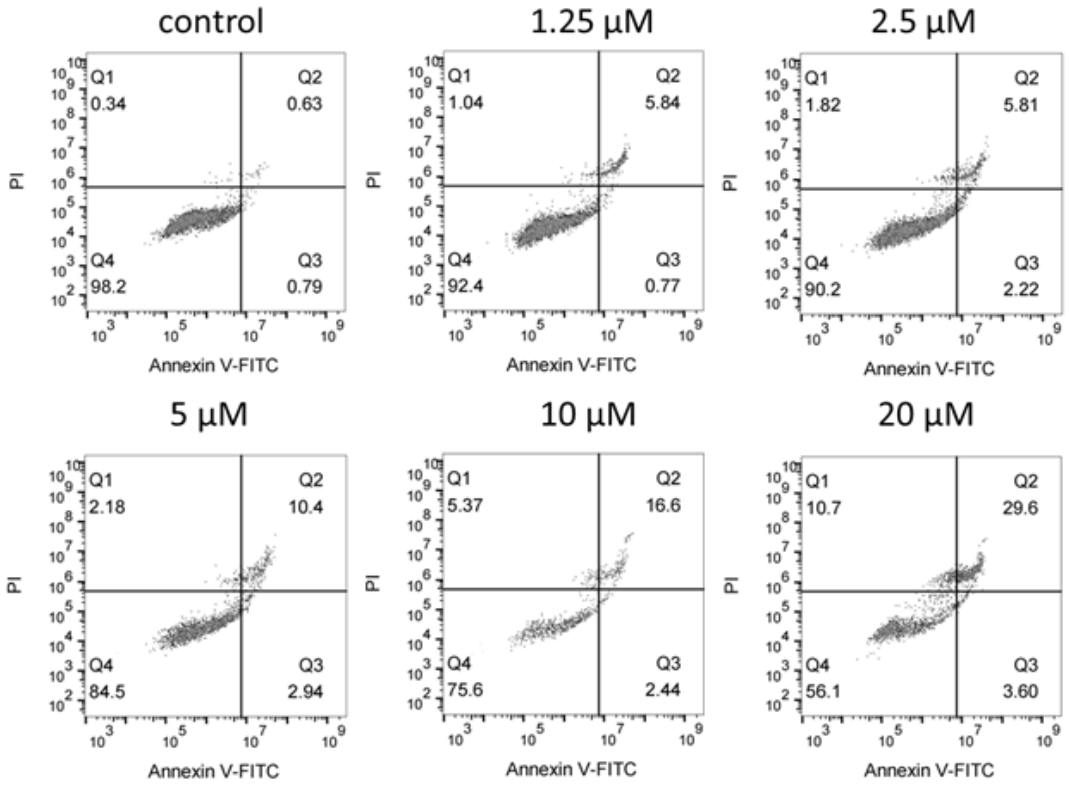


8.3 Flow cytometry experiments

The effect of compound **21down** on apoptosis of breast cancer cells (MCF7) was detected by flow cytometry on cultured tumor cells using a flow cytometer made by Beckman coulter and an apoptosis detection kit (Annexin V-FITC/PI) made by YEASEN. The cells were treated with 0 μM, 1.25 μM, 2.5 μM, 5 μM, 10 μM and 20 μM of **21down**, and then immediately assayed on the machine, each repeated three times, and a total of 18 samples were collected, and the statistical graphs are shown below.



The data showed that the higher the concentration of drug, the more apoptotic cells; the flow cytogram showed that the percentage of cells in the Q2+Q3 quadrant increased with the increase of drug concentration. The flow cytogram shows that the proportion of cells in the Q2+Q3 quadrant increased with increasing drug concentration, which means that the number of apoptotic cells also increased with increasing drug concentration.

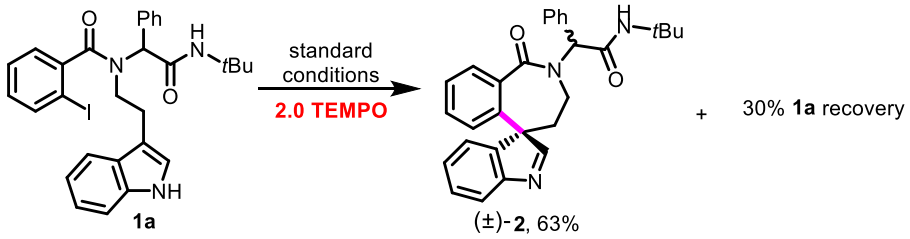


In conclusion, the benzodiazepine spirodihydroindole compounds herein may be applied in the

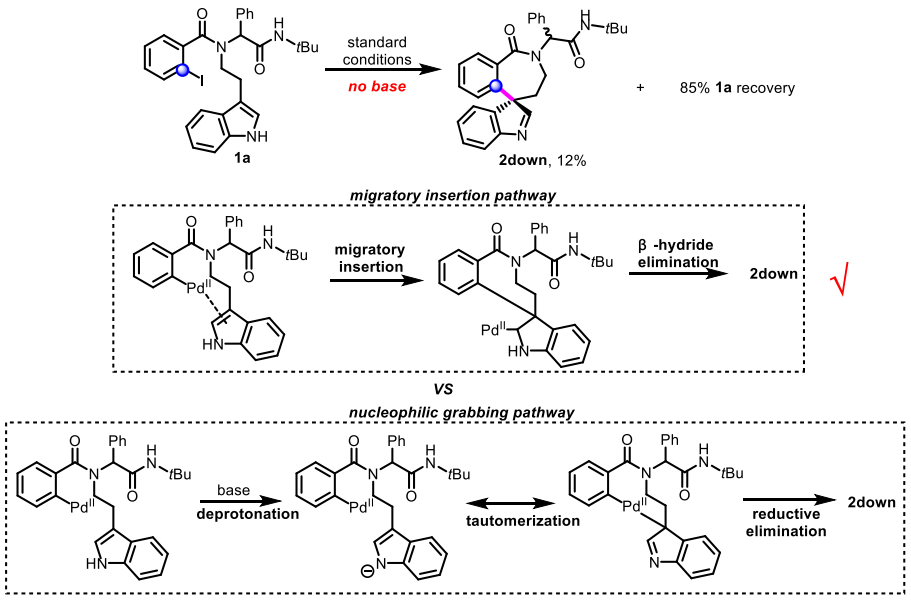
preparation of antitumor drugs, especially they can be used in the preparation of drugs against breast cancer.

9. Mechanistic Studies and Computational Details of Mechanistic Studies

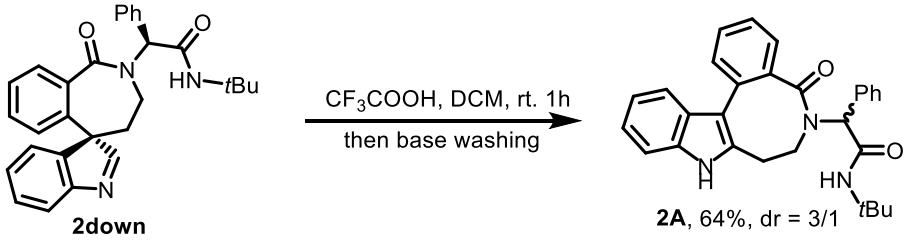
All calculations in this work were performed using Gaussian 09 program package[1]. Full geometry optimizations were performed to locate all the stationary points, using the B3LYP method[2] with the def2svp**[3-4] basis, namely B3LYP/ def2svp**. Dispersion corrections were computed with Grimme's D3(BJ) method in optimization[5]. The intrinsic reaction coordinate (IRC) path was traced to check the energy profiles connecting each transition state to two associated minima of the proposed mechanism[6]. Harmonic vibrational frequency was performed at the same level to guarantee that there is no imaginary frequency in the molecules, i.e. they locate on the minima of potential energy surface. Convergence parameters of the default threshold were retained (maximum force within 4.5×10^{-4} Hartrees/Bohr and root mean square (RMS) force within 3.0×10^{-4} Hartrees/Radian) to obtain the optimized structure. The optimal structure was identified given that all calculations for structural optimization were successfully converged within the convergence threshold of no imaginary frequency, during the process of vibration analysis.



Ugi products **1a** (0.1 mmol, 58 mg), $Pd(OAc)_2$ (0.005 mmol, 1.1 mg, 0.05 eq), Ph_3P (0.01 mmol, 2.6 mg, 0.1 eq), K_2CO_3 (0.2 mmol, 28 mg, 2.0 eq), and 2,2,6,6-tetramethylpiperidine 1-oxyl (0.2 mmol, 31 mg) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous *o*-DCB (1 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 ^oC for 16 h and monitored by TLC. Then the reaction mixture is subjected to wet loading and column chromatography to obtain the target product **(±)-2** (28 mg, dr = 5/1, 63%) and **1a** (17 mg, 30% recovery) over silica gel using EtOAc/ n-hexane = 20%~30% as eluent.

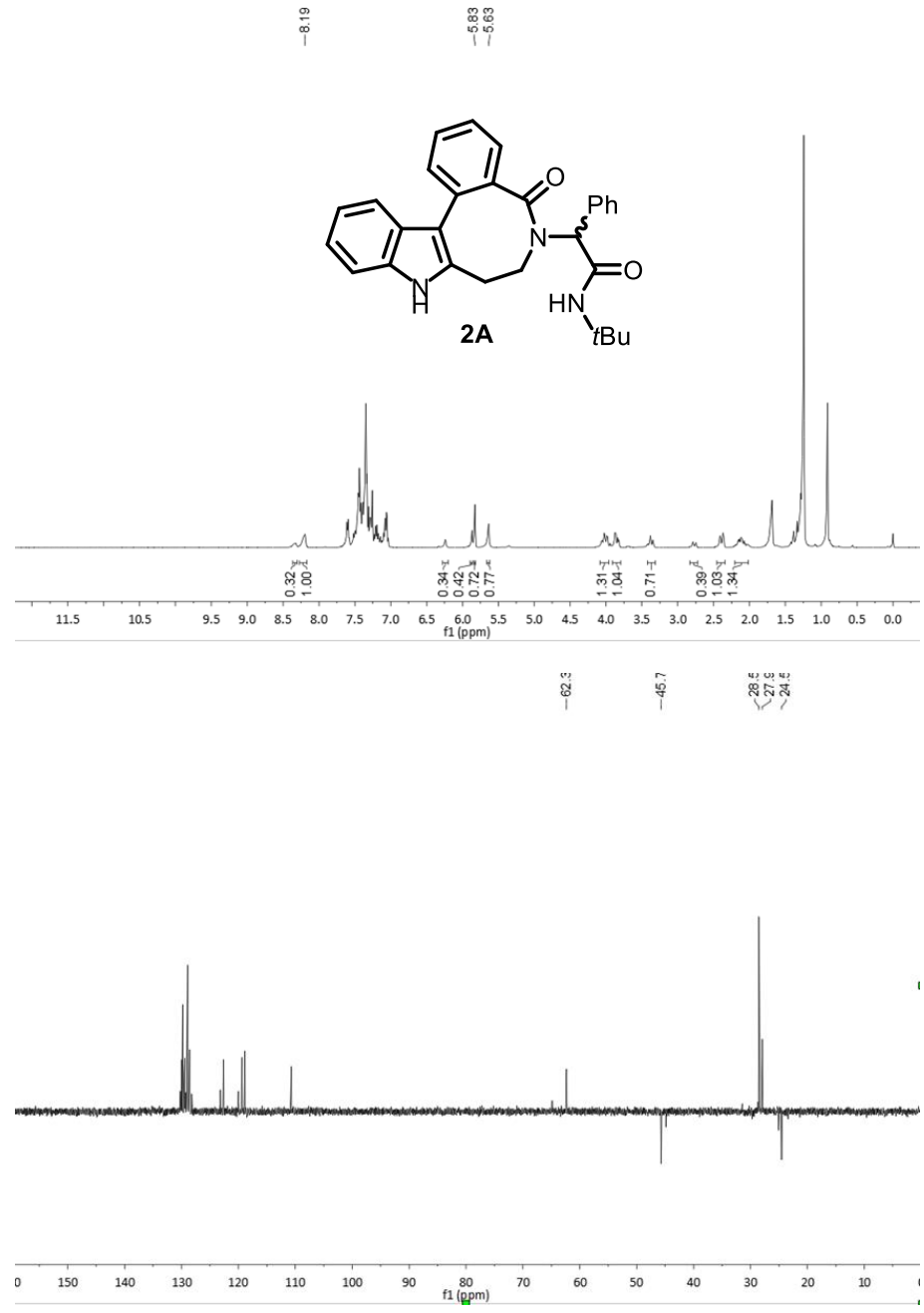


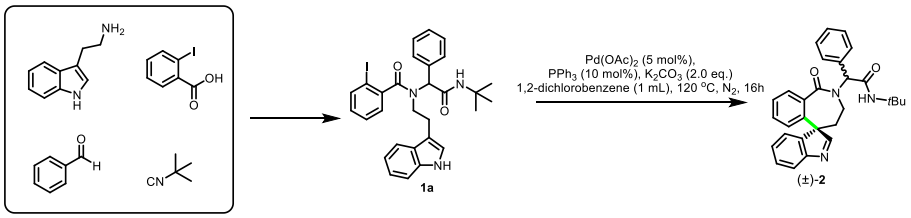
Ugi products **1a** (0.1 mmol, 58 mg), $Pd(OAc)_2$ (0.005 mmol, 1.1 mg, 0.05 eq), and Ph_3P (0.01 mmol, 2.6 mg, 0.1 eq) were added to a flame-dried Schlenk flask containing a stirring bar and purged by evacuating the flask and backfilling with N_2 three times. Then, anhydrous *o*-DCB (1 ml) was added and the flask was sealed. The reaction mixture was stirred at 120 ^oC for 16 h and monitored by TLC. Then the reaction mixture is subjected to wet loading and column chromatography to obtain the target product **2down** (5 mg, 12%), trace amount of **2up**, and **1a** (49 mg, 85% recovery) over silica gel using EtOAc/ n-hexane = 20%~30% as eluent.



To a solution of indolenine **2down** (0.1 mmol, 45 mg) in CH_2Cl_2 (1 mL) was added trifluoroacetic acid (0.4 mmol, 46 mg). This was allowed to stir for 1h at ambient temperature. The reaction mixture was diluted with CH_2Cl_2 (10 mL), washed with sat. $NaHCO_3$ (10 mL) and brine. The organic layer was concentrated in vacuo. The residue was purified by flash column chromatography to give the product **2A** (30 mg, 64%, dr = 3/1).

This ^1H NMR and DEPT spectrum are similar to the **2A** spectrum obtained in the aforementioned condition screening.





Scheme S1. Modeled reaction conditions

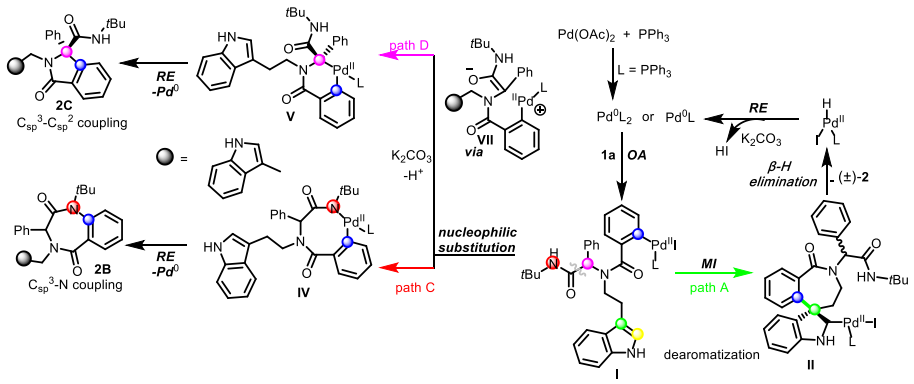
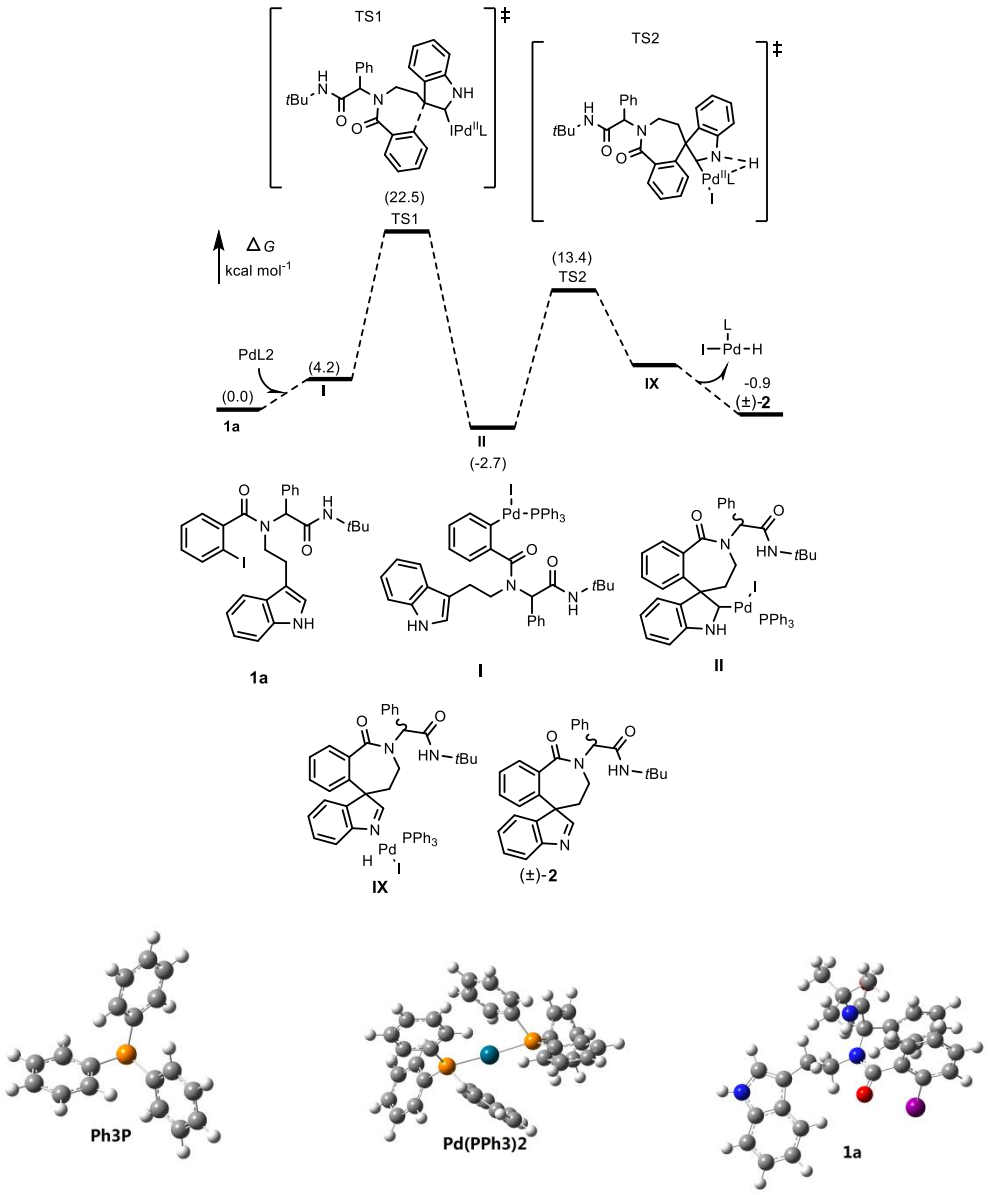


Figure S1. Proposed mechanism



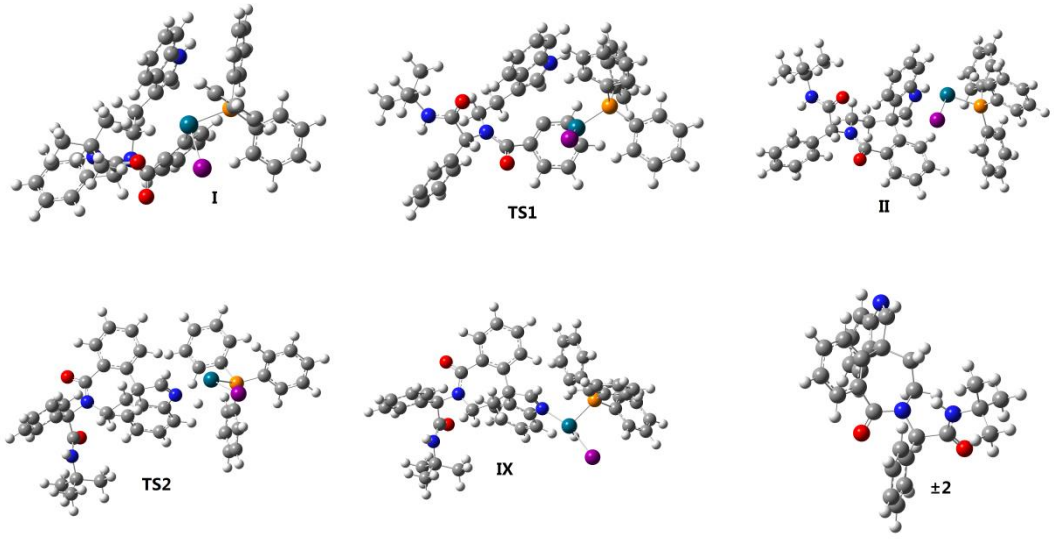
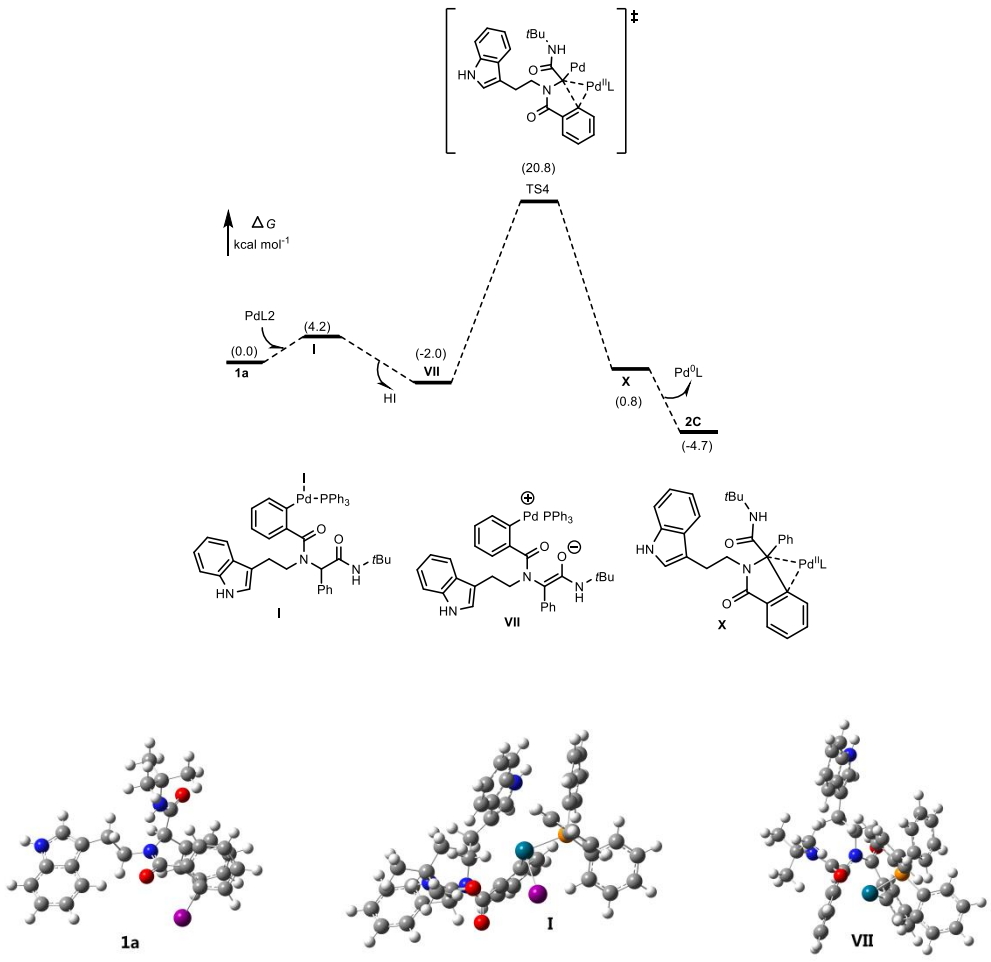


Figure S2. Computed Gibbs free energy (in kcal/mol) for path A and the optimized structures



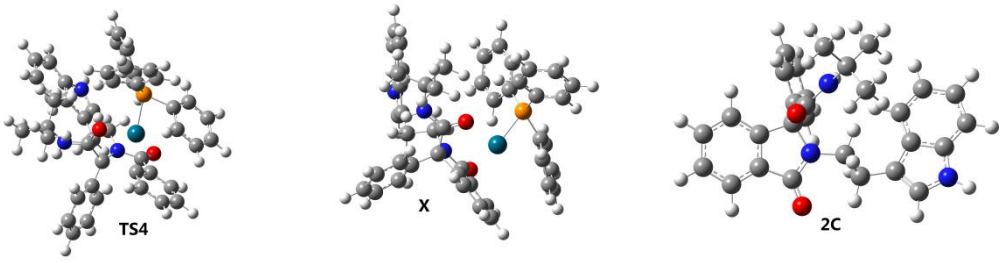


Figure S3. Computed Gibbs free energy (in kcal/mol) for path D and the optimized structures

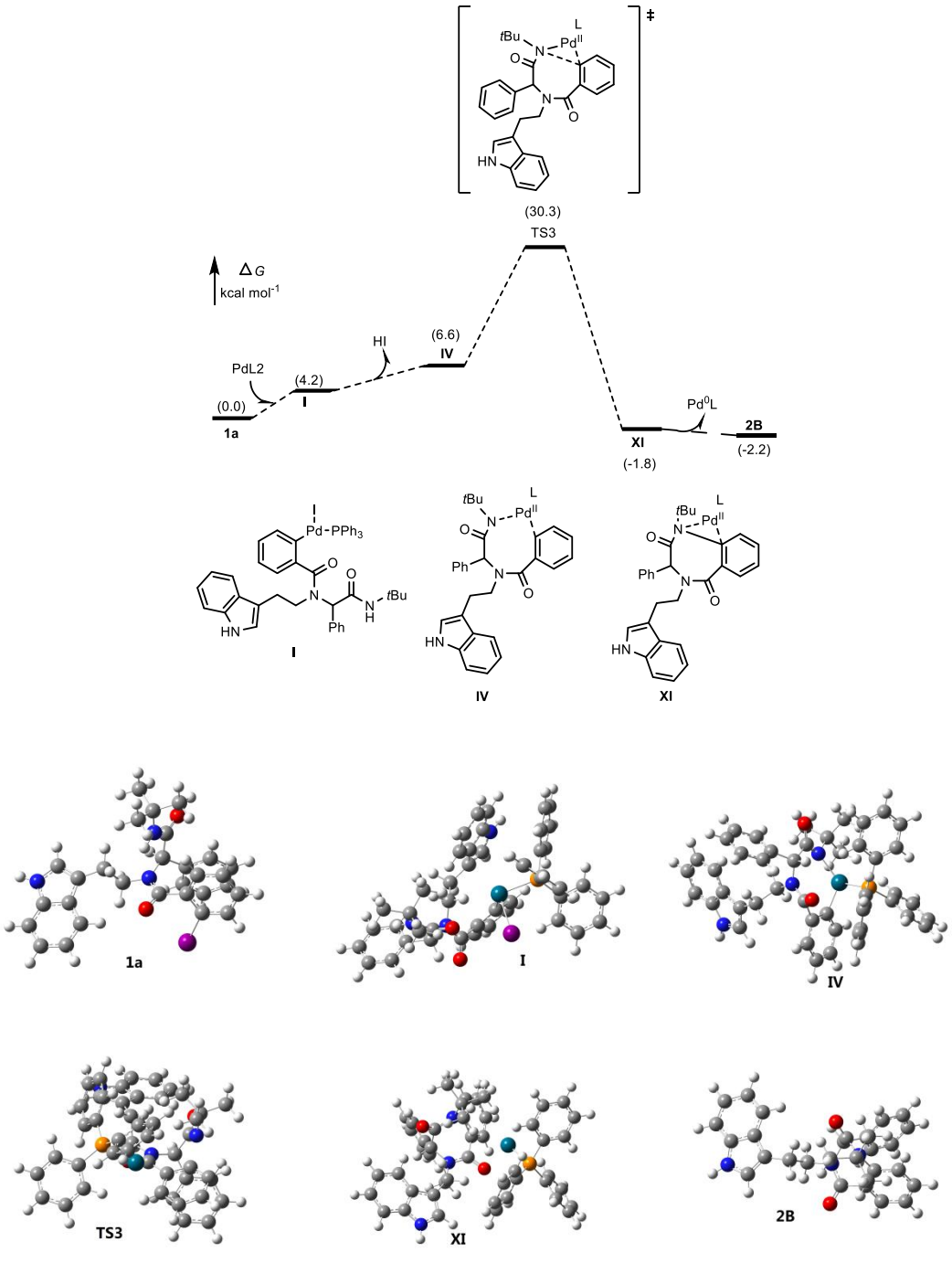


Figure S4. Computed Gibbs free energy (in kcal/mol) for path C and the optimized structures

Table S2. Computed energies and Cartesian coordinates of all species

Ph_3P

P	-0.00030000	0.00000000	-1.25650000
C	-1.56750000	-0.53470000	-0.43660000
C	-1.62040000	-1.38070000	0.68230000
C	-2.77170000	-0.06200000	-0.98790000
C	-2.85100000	-1.74020000	1.24080000
H	-0.69670000	-1.76080000	1.12250000
C	-3.99970000	-0.41050000	-0.42140000
H	-2.74420000	0.58810000	-1.86740000
C	-4.04210000	-1.25300000	0.69490000
H	-2.87740000	-2.40130000	2.11110000
H	-4.92710000	-0.03000000	-0.85730000
H	-5.00260000	-1.53340000	1.13460000
C	0.31970000	1.62510000	-0.43740000
C	-0.38540000	2.09340000	0.68230000
C	1.33030000	2.43210000	-0.98930000
C	-0.07890000	3.33760000	1.24280000
H	-1.17520000	1.48310000	1.12390000
C	1.64410000	3.66880000	-0.42200000
H	1.87910000	2.08390000	-1.86930000
C	0.93740000	4.12620000	0.69570000
H	-0.63680000	3.69010000	2.11430000
H	2.43690000	4.28180000	-0.85860000
H	1.17620000	5.09760000	1.13610000
C	1.24690000	-1.08920000	-0.43620000
C	2.00280000	-0.71410000	0.68570000
C	1.44280000	-2.36670000	-0.99020000
C	2.92880000	-1.60090000	1.24430000
H	1.86730000	0.27370000	1.12980000
C	2.35810000	-3.25650000	-0.42400000
H	0.86810000	-2.66690000	-1.87130000
C	3.10620000	-2.87400000	0.69480000
H	3.51120000	-1.29530000	2.11740000
H	2.49450000	-4.24830000	-0.86270000
H	3.82900000	-3.56620000	1.13410000

$Pd(Ph_3P)_2$

Pd	0.00250000	-0.41490000	0.02340000
P	-2.29560000	-0.15180000	0.29720000
C	-3.37620000	-1.56390000	0.57360000

C	-4.07840000	-1.71150000	1.78250000
C	-3.52210000	-2.50820000	-0.45740000
C	-4.92740000	-2.80650000	1.95030000
H	-3.96860000	-0.97440000	2.58050000
C	-4.37820000	-3.59520000	-0.27920000
H	-2.97210000	-2.39020000	-1.39400000
C	-5.07700000	-3.74500000	0.92360000
H	-5.47610000	-2.92600000	2.88700000
H	-4.49610000	-4.33060000	-1.07790000
H	-5.74330000	-4.59930000	1.06250000
C	-3.14340000	1.20880000	-0.51070000
C	-4.53180000	1.17990000	-0.72030000
C	-2.37460000	2.29500000	-0.96960000
C	-5.14800000	2.25120000	-1.36900000
H	-5.12510000	0.33120000	-0.37510000
C	-3.00250000	3.36180000	-1.61040000
H	-1.29220000	2.30110000	-0.82350000
C	-4.38780000	3.34000000	-1.80930000
H	-6.22810000	2.23660000	-1.52940000
H	-2.40990000	4.20850000	-1.96310000
H	-4.87710000	4.17500000	-2.31570000
C	-1.46640000	0.35380000	1.82620000
C	-1.41030000	1.67170000	2.32570000
C	-0.54110000	-0.63010000	2.30840000
C	-0.47720000	1.99050000	3.30390000
H	-2.10150000	2.42670000	1.94790000
C	0.41290000	-0.26690000	3.28540000
H	-0.68670000	-1.69100000	2.07210000
C	0.44410000	1.03080000	3.77220000
H	-0.45200000	3.00320000	3.71230000
H	1.10240000	-1.02270000	3.66580000
H	1.17630000	1.31290000	4.53100000
P	2.30100000	-0.17760000	-0.28440000
C	3.38340000	-1.59020000	-0.54390000
C	3.88090000	-1.90930000	-1.81850000
C	3.73490000	-2.36510000	0.57580000
C	4.73390000	-3.00460000	-1.96480000
H	3.61120000	-1.30320000	-2.68540000
C	4.59360000	-3.45230000	0.41730000
H	3.33840000	-2.11580000	1.56360000
C	5.09020000	-3.77260000	-0.85150000
H	5.12670000	-3.25500000	-2.95260000
H	4.87270000	-4.05480000	1.28430000
H	5.76030000	-4.62660000	-0.97290000

C	3.16840000	1.21140000	0.45340000
C	4.57060000	1.29060000	0.43240000
C	2.40400000	2.21980000	1.06870000
C	5.20080000	2.39050000	1.01650000
H	5.16240000	0.50310000	-0.03830000
C	3.04540000	3.31500000	1.64580000
H	1.31530000	2.14040000	1.09830000
C	4.44210000	3.39950000	1.61990000
H	6.29040000	2.46080000	0.99920000
H	2.45590000	4.09950000	2.12490000
H	4.94300000	4.25550000	2.07750000
C	1.43430000	0.29580000	-1.80150000
C	1.35370000	1.61630000	-2.29480000
C	0.50870000	-0.69470000	-2.26910000
C	0.39840000	1.92940000	-3.25210000
H	2.04230000	2.37810000	-1.92560000
C	-0.46430000	-0.33810000	-3.22980000
H	0.66570000	-1.75330000	-2.03370000
C	-0.51990000	0.96120000	-3.70940000
H	0.35180000	2.94450000	-3.65240000
H	-1.15090000	-1.10000000	-3.60330000
H	-1.26910000	1.23870000	-4.45300000

1a

C	-4.59410000	-0.53690000	0.01990000
C	-5.91800000	-0.63790000	-0.50510000
C	-6.80040000	-1.64960000	-0.09910000
C	-6.34030000	-2.56590000	0.84430000
C	-5.03240000	-2.48220000	1.37440000
C	-4.15500000	-1.47860000	0.97210000
C	-3.97610000	0.60990000	-0.60620000
C	-4.92040000	1.13770000	-1.46180000
H	-7.81150000	-1.71550000	-0.50800000
H	-7.00420000	-3.36680000	1.18020000
H	-4.70650000	-3.22130000	2.11080000
H	-3.14040000	-1.42060000	1.37480000
H	-4.85220000	2.00510000	-2.11680000
H	-6.92350000	0.58390000	-1.93060000
N	-6.08120000	0.39420000	-1.40050000
C	-2.57660000	1.08510000	-0.36670000
H	-2.40690000	1.18570000	0.71860000
H	-2.42960000	2.07990000	-0.81420000
C	-1.52680000	0.10390000	-0.91670000
H	-1.79480000	-0.91660000	-0.61690000

H	-1.51950000	0.14060000	-2.01470000
C	2.42120000	-1.37790000	1.09380000
C	1.62540000	-0.22400000	1.18830000
C	2.17260000	0.91460000	1.79620000
C	3.48850000	0.91850000	2.26100000
C	4.27830000	-0.22410000	2.12260000
C	3.74370000	-1.37800000	1.54290000
H	1.56200000	1.81120000	1.89480000
H	3.89640000	1.81880000	2.72580000
H	5.31370000	-0.22780000	2.47120000
H	4.35520000	-2.27560000	1.44110000
C	0.18350000	-0.25080000	0.74130000
N	-0.15840000	0.35170000	-0.44460000
O	-0.64640000	-0.83410000	1.42890000
C	0.72640000	1.17660000	-1.28410000
H	0.16350000	1.30750000	-2.22050000
C	2.02280000	0.47980000	-1.69020000
C	3.29880000	0.92250000	-1.31970000
C	1.91230000	-0.67990000	-2.46970000
C	4.43480000	0.20730000	-1.70370000
H	3.41040000	1.82760000	-0.72680000
C	3.04710000	-1.39370000	-2.86000000
H	0.92230000	-1.03760000	-2.76320000
C	4.31540000	-0.95380000	-2.47320000
H	5.42140000	0.55960000	-1.39270000
H	2.93720000	-2.30070000	-3.45920000
H	5.20650000	-1.51240000	-2.76990000
C	0.90400000	2.64180000	-0.81690000
O	1.65290000	3.38580000	-1.43890000
N	0.13980000	3.02660000	0.22810000
C	0.05400000	4.39220000	0.78930000
C	-0.91660000	4.30870000	1.97220000
H	-1.02420000	5.29540000	2.44620000
H	-1.91590000	3.97770000	1.64650000
H	-0.55000000	3.60300000	2.73500000
C	-0.48720000	5.35960000	-0.27400000
H	-1.48370000	5.03970000	-0.61790000
H	-0.57790000	6.37430000	0.14380000
H	0.18610000	5.39780000	-1.14130000
C	1.43630000	4.84690000	1.28070000
H	2.15610000	4.87000000	0.45210000
H	1.36760000	5.85590000	1.71570000
H	1.81720000	4.16530000	2.05730000
I	1.65330000	-3.18280000	0.26100000

H	-0.47700000	2.33190000	0.63060000

I

C	0.00850000	2.10850000	1.97880000
C	-1.18870000	2.56810000	2.58730000
C	-1.63130000	3.88580000	2.48130000
C	-0.83570000	4.76680000	1.74450000
C	0.36270000	4.33870000	1.14250000
C	0.79700000	3.01730000	1.25190000
C	0.13100000	0.68280000	2.30220000
C	-1.00960000	0.38320000	3.09370000
H	-2.55660000	4.21410000	2.95530000
H	-1.14740000	5.80800000	1.64010000
H	0.96580000	5.05400000	0.57940000
H	1.72670000	2.71100000	0.77360000
H	-1.27550000	-0.56390000	3.56010000
H	-2.63910000	1.51300000	3.76140000
N	-1.75940000	1.48190000	3.25110000
C	1.42030000	-0.10360000	2.30650000
H	1.22960000	-1.13620000	2.61440000
H	2.08410000	0.32600000	3.07400000
C	2.11580000	-0.02030000	0.93220000
H	1.45590000	0.43810000	0.15960000
H	2.91390000	0.72650000	1.00900000
C	-0.47840000	-2.08010000	0.84640000
C	0.76190000	-2.72690000	0.85400000
C	0.82810000	-3.95310000	1.55460000
C	-0.27110000	-4.49070000	2.21410000
C	-1.49540000	-3.82480000	2.16610000
C	-1.60020000	-2.61930000	1.46680000
H	1.78160000	-4.48380000	1.55020000
H	-0.17430000	-5.43810000	2.74790000
H	-2.37980000	-4.23280000	2.66050000
H	-2.56240000	-2.12330000	1.43020000
C	2.06100000	-2.40110000	0.13500000
N	2.70670000	-1.20870000	0.34780000
O	2.56220000	-3.28940000	-0.53730000
C	3.97370000	-1.01940000	-0.37360000
H	3.96730000	-1.74090000	-1.20060000
C	5.19480000	-1.30230000	0.48190000
C	5.15820000	-1.26760000	1.88210000
C	6.41540000	-1.57490000	-0.15780000
C	6.31980000	-1.49220000	2.62820000
H	4.21530000	-1.08490000	2.39960000

C	7.57600000	-1.79510000	0.58570000
H	6.45200000	-1.61230000	-1.24980000
C	7.53170000	-1.75180000	1.98340000
H	6.27540000	-1.46730000	3.71980000
H	8.51660000	-2.00890000	0.07260000
H	8.43850000	-1.92840000	2.56680000
C	3.94230000	0.37010000	-1.07210000
O	3.00190000	0.63910000	-1.81270000
N	4.95390000	1.20760000	-0.77740000
C	5.14240000	2.57310000	-1.31730000
C	6.44810000	3.09730000	-0.71170000
H	6.64660000	4.11920000	-1.06560000
H	6.39290000	3.12190000	0.38900000
H	7.30110000	2.46310000	-1.00190000
C	3.96820000	3.46630000	-0.88730000
H	3.90370000	3.51890000	0.21110000
H	4.11060000	4.48860000	-1.26940000
H	3.01970000	3.07720000	-1.28140000
C	5.25370000	2.52120000	-2.84730000
H	4.33030000	2.12790000	-3.29310000
H	5.43580000	3.53090000	-3.24640000
H	6.09220000	1.87490000	-3.15050000
I	-0.18980000	-1.06530000	-2.36790000
H	5.67410000	0.86140000	-0.15170000
Pd	-0.64100000	-0.20720000	0.06330000
P	-2.94830000	0.04870000	-0.27410000
C	-2.79650000	1.36780000	-1.49630000
C	-3.36060000	1.21600000	-2.77330000
C	-2.00320000	2.49240000	-1.19390000
C	-3.15260000	2.20750000	-3.73090000
H	-3.94940000	0.33230000	-3.02080000
C	-1.79640000	3.47150000	-2.16420000
H	-1.54250000	2.60160000	-0.21210000
C	-2.37190000	3.33060000	-3.43070000
H	-3.59960000	2.10060000	-4.72130000
H	-1.18270000	4.34300000	-1.92880000
H	-2.20870000	4.09730000	-4.19100000
C	-3.86460000	0.65510000	1.15910000
C	-4.14910000	2.02560000	1.30740000
C	-4.39850000	-0.27330000	2.08030000
C	-4.95850000	2.45560000	2.35900000
H	-3.76620000	2.75500000	0.59690000
C	-5.19790000	0.16750000	3.13030000
H	-4.22800000	-1.34300000	1.96090000

C	-5.47840000	1.53380000	3.27290000
H	-5.19200000	3.51750000	2.45720000
H	-5.61770000	-0.55680000	3.83100000
H	-6.11410000	1.87690000	4.09220000
C	-3.90330000	-1.34690000	-0.91270000
C	-5.30160000	-1.15740000	-0.97330000
C	-3.33410000	-2.53930000	-1.38450000
C	-6.10560000	-2.14780000	-1.53370000
H	-5.75880000	-0.23830000	-0.60360000
C	-4.15350000	-3.52850000	-1.92890000
H	-2.26110000	-2.70490000	-1.32190000
C	-5.53460000	-3.33320000	-2.01020000
H	-7.18430000	-1.99070000	-1.59670000
H	-3.70490000	-4.45620000	-2.28950000
H	-6.17120000	-4.10930000	-2.44090000

TS1

C	1.10960000	2.32640000	1.06170000
C	-0.05900000	3.04410000	1.42090000
C	-0.71680000	3.91150000	0.55940000
C	-0.17760000	4.05020000	-0.72560000
C	0.95940000	3.32750000	-1.11560000
C	1.61730000	2.45880000	-0.23570000
C	1.50630000	1.54990000	2.24430000
C	0.51650000	1.87080000	3.24920000
H	-1.60430000	4.46220000	0.87000000
H	-0.65700000	4.72760000	-1.43430000
H	1.34790000	3.44390000	-2.12920000
H	2.49100000	1.90560000	-0.58480000
H	0.47450000	1.51370000	4.27750000
H	-1.18560000	3.06390000	3.25960000
N	-0.37060000	2.71260000	2.75450000
C	2.82400000	0.96440000	2.65490000
H	2.65400000	0.17220000	3.39810000
H	3.37290000	1.75910000	3.19100000
C	3.76510000	0.52780000	1.55440000
H	4.00040000	1.41700000	0.95630000
H	4.70980000	0.23120000	2.03470000
C	0.36240000	-0.51670000	2.02730000
C	1.16980000	-1.50950000	1.52080000
C	0.59700000	-2.81580000	1.63280000
C	-0.66730000	-3.03490000	2.16650000
C	-1.46730000	-1.95000000	2.56380000
C	-0.93350000	-0.63910000	2.50900000

H	1.17540000	-3.64480000	1.22280000
H	-1.05530000	-4.05210000	2.23650000
H	-2.46590000	-2.10750000	2.97490000
H	-1.50420000	0.20560000	2.89170000
C	2.37980000	-1.45710000	0.58790000
N	3.38860000	-0.53240000	0.60900000
O	2.38140000	-2.34650000	-0.25710000
C	4.42670000	-0.79350000	-0.41270000
H	3.90460000	-1.20760000	-1.28280000
C	5.45790000	-1.82590000	0.02100000
C	5.55860000	-2.30540000	1.33320000
C	6.34050000	-2.32960000	-0.94980000
C	6.52920000	-3.25400000	1.67260000
H	4.86890000	-1.95400000	2.10210000
C	7.31110000	-3.27320000	-0.61220000
H	6.26330000	-1.97600000	-1.98130000
C	7.41100000	-3.73740000	0.70390000
H	6.59170000	-3.61780000	2.70110000
H	7.98750000	-3.65410000	-1.38120000
H	8.16880000	-4.47800000	0.96990000
C	4.98970000	0.55010000	-0.94020000
O	4.23090000	1.31180000	-1.53810000
N	6.28490000	0.79760000	-0.69430000
C	7.04440000	1.99360000	-1.12450000
C	8.47380000	1.79710000	-0.60960000
H	9.10280000	2.65160000	-0.89820000
H	8.49040000	1.71740000	0.48960000
H	8.92370000	0.88360000	-1.03090000
C	6.42410000	3.25180000	-0.49890000
H	6.42590000	3.17930000	0.60060000
H	7.00660000	4.14150000	-0.78360000
H	5.38960000	3.38790000	-0.84190000
C	7.04120000	2.08720000	-2.65670000
H	6.01790000	2.20450000	-3.03830000
H	7.63760000	2.95280000	-2.98360000
H	7.47860000	1.17870000	-3.10000000
I	-1.44750000	-1.47810000	-2.40330000
H	6.80590000	0.07870000	-0.20270000
Pd	-1.63110000	-0.95930000	0.10550000
P	-3.63710000	-0.01690000	-0.14410000
C	-3.81360000	1.11370000	-1.55310000
C	-5.04570000	1.23970000	-2.21080000
C	-2.72030000	1.90710000	-1.93850000
C	-5.17940000	2.16450000	-3.25010000

H	-5.89620000	0.61920000	-1.92580000
C	-2.86570000	2.82950000	-2.97280000
H	-1.75430000	1.79170000	-1.44580000
C	-4.09480000	2.95880000	-3.63000000
H	-6.13670000	2.25750000	-3.76750000
H	-2.01260000	3.44000000	-3.27530000
H	-4.20310000	3.67570000	-4.44710000
C	-3.86080000	0.99090000	1.35420000
C	-3.69630000	2.38470000	1.31180000
C	-4.15940000	0.35780000	2.57640000
C	-3.82260000	3.13590000	2.48270000
H	-3.48520000	2.88540000	0.36730000
C	-4.27840000	1.11310000	3.74150000
H	-4.30820000	-0.72260000	2.61130000
C	-4.10420000	2.50300000	3.69790000
H	-3.71440000	4.22200000	2.44260000
H	-4.51720000	0.61900000	4.68570000
H	-4.20820000	3.09360000	4.61100000
C	-4.95140000	-1.26360000	-0.14830000
C	-6.24140000	-0.90650000	0.28950000
C	-4.69750000	-2.56680000	-0.60400000
C	-7.26900000	-1.84870000	0.24890000
H	-6.44420000	0.10190000	0.65390000
C	-5.73260000	-3.50330000	-0.63330000
H	-3.69550000	-2.84470000	-0.93270000
C	-7.01590000	-3.14570000	-0.21070000
H	-8.27120000	-1.56850000	0.58050000
H	-5.53290000	-4.51720000	-0.98630000
H	-7.82280000	-3.88190000	-0.23490000

II

C	-1.05410000	-0.78160000	0.90660000
C	-0.05260000	-1.47760000	1.60250000
C	0.54090000	-2.65930000	1.14500000
C	0.05350000	-3.16170000	-0.07790000
C	-0.95660000	-2.49110000	-0.77620000
C	-1.50960000	-1.28970000	-0.30450000
C	-1.39360000	0.48310000	1.69640000
C	-0.50760000	0.31030000	2.89900000
H	1.27940000	-3.20240000	1.73780000
H	0.46830000	-4.09020000	-0.47390000
H	-1.32230000	-2.90240000	-1.71820000
H	-2.29150000	-0.80150000	-0.88440000
H	-0.46080000	0.96870000	3.76840000
H	0.84440000	-1.09700000	3.53760000

N	0.20080000	-0.76920000	2.81170000
C	-2.84860000	0.56400000	2.24730000
H	-3.00210000	1.57830000	2.64170000
H	-2.96220000	-0.13850000	3.08680000
C	-3.91120000	0.17200000	1.25100000
H	-3.77220000	-0.89080000	1.00050000
H	-4.87880000	0.23530000	1.77250000
C	-1.03550000	1.77180000	0.95350000
C	-1.91520000	2.40350000	0.04760000
C	-1.48970000	3.61780000	-0.53130000
C	-0.25410000	4.19080000	-0.25080000
C	0.62430000	3.53720000	0.61110000
C	0.22760000	2.33770000	1.19540000
H	-2.16530000	4.09720000	-1.23740000
H	0.02490000	5.13680000	-0.71940000
H	1.61230000	3.94700000	0.82530000
H	0.93760000	1.82840000	1.85090000
C	-3.24100000	1.92320000	-0.53330000
N	-4.02690000	0.93130000	0.01050000
O	-3.60910000	2.46740000	-1.56980000
C	-5.21650000	0.57360000	-0.77710000
H	-5.01620000	0.92520000	-1.79640000
C	-6.49140000	1.26070000	-0.31210000
C	-6.51040000	2.16490000	0.75720000
C	-7.68480000	1.02990000	-1.01930000
C	-7.69650000	2.80590000	1.12980000
H	-5.58690000	2.38980000	1.29270000
C	-8.86970000	1.66650000	-0.64680000
H	-7.68390000	0.34850000	-1.87380000
C	-8.88110000	2.55410000	0.43460000
H	-7.69060000	3.51040000	1.96520000
H	-9.78710000	1.47510000	-1.20880000
H	-9.80760000	3.05510000	0.72510000
C	-5.25450000	-0.97010000	-0.91490000
O	-4.34190000	-1.52210000	-1.52570000
N	-6.27420000	-1.61140000	-0.31850000
C	-6.50330000	-3.07300000	-0.31420000
C	-7.80100000	-3.30060000	0.46700000
H	-8.03810000	-4.37380000	0.50400000
H	-7.71050000	-2.93400000	1.50260000
H	-8.64550000	-2.78060000	-0.01300000
C	-5.33260000	-3.77670000	0.38900000
H	-5.22180000	-3.40410000	1.42000000
H	-5.51480000	-4.86140000	0.43360000

H	-4.39310000	-3.60230000	-0.15230000
C	-6.66010000	-3.58380000	-1.75380000
H	-5.74630000	-3.40250000	-2.33530000
H	-6.86510000	-4.66550000	-1.74960000
H	-7.49980000	-3.07650000	-2.25440000
I	1.44160000	0.37520000	-1.98390000
H	-6.96570000	-1.03970000	0.15550000
Pd	2.21680000	-0.92420000	0.10900000
P	4.22700000	-0.03440000	0.02650000
C	5.28140000	-0.48450000	-1.35660000
C	6.45840000	0.24360000	-1.59980000
C	4.93720000	-1.58190000	-2.16520000
C	7.29320000	-0.13930000	-2.65080000
H	6.71930000	1.10220000	-0.97860000
C	5.78110000	-1.95510000	-3.20960000
H	4.00730000	-2.12630000	-1.98530000
C	6.95640000	-1.23430000	-3.45250000
H	8.20830000	0.42360000	-2.84650000
H	5.51600000	-2.80370000	-3.84340000
H	7.60990000	-1.52480000	-4.27820000
C	4.43490000	-1.15490000	1.43620000
C	5.13090000	-2.37600000	1.30100000
C	3.72320000	-0.87860000	2.63250000
C	5.12720000	-3.29200000	2.34920000
H	5.67830000	-2.59410000	0.38250000
C	3.72500000	-1.81220000	3.67130000
H	3.20450000	0.07480000	2.75450000
C	4.42330000	-3.01480000	3.52990000
H	5.67850000	-4.22910000	2.24940000
H	3.19430000	-1.59180000	4.60040000
H	4.42820000	-3.74080000	4.34610000
C	4.50490000	1.67850000	0.50690000
C	5.20750000	1.98110000	1.68800000
C	4.07820000	2.70880000	-0.34990000
C	5.46740000	3.31420000	2.01010000
H	5.56910000	1.18700000	2.34210000
C	4.34980000	4.03540000	-0.01810000
H	3.53120000	2.47240000	-1.26400000
C	5.03870000	4.33950000	1.16160000
H	6.01720000	3.55020000	2.92380000
H	4.01740000	4.83580000	-0.68240000
H	5.24650000	5.38080000	1.41820000

TS2

C	1.46840000	0.11700000	-0.77550000
C	0.15570000	0.58650000	-0.60850000
C	-0.39660000	1.59520000	-1.39530000
C	0.41450000	2.13060000	-2.40510000
C	1.72390000	1.66110000	-2.59210000
C	2.26400000	0.64450000	-1.78570000
C	1.70310000	-0.98770000	0.25390000
C	0.35600000	-0.97170000	0.95790000
H	-1.41380000	1.95460000	-1.23970000
H	0.02220000	2.91910000	-3.04620000
H	2.34240000	2.09720000	-3.38230000
H	3.29190000	0.32080000	-1.94850000
H	0.10990000	-1.60790000	1.81500000
N	-0.46860000	-0.11140000	0.46450000
C	2.77410000	-0.69070000	1.33750000
H	2.94470000	-1.61040000	1.91310000
H	2.38140000	0.06420000	2.03560000
C	4.06590000	-0.12570000	0.80160000
H	3.84720000	0.80240000	0.26080000
H	4.67890000	0.16750000	1.66890000
C	1.94710000	-2.34360000	-0.40490000
C	3.22920000	-2.82280000	-0.75730000
C	3.31180000	-4.11650000	-1.31630000
C	2.19390000	-4.90620000	-1.55830000
C	0.92760000	-4.39960000	-1.26590000
C	0.82190000	-3.13700000	-0.69430000
H	4.30060000	-4.48430000	-1.58680000
H	2.31330000	-5.90290000	-1.98560000
H	0.02760000	-4.98310000	-1.47420000
H	-0.17430000	-2.75460000	-0.47090000
C	4.58330000	-2.11380000	-0.76780000
N	4.89660000	-0.98700000	-0.03560000
O	5.45250000	-2.62550000	-1.46700000
C	6.23990000	-0.44280000	-0.26020000
H	6.63430000	-0.97730000	-1.13520000
C	7.20180000	-0.69530000	0.89060000
C	6.82540000	-1.38710000	2.04760000
C	8.53730000	-0.27110000	0.76910000
C	7.74790000	-1.62750000	3.07190000
H	5.80850000	-1.77040000	2.14220000
C	9.45810000	-0.50340000	1.79230000
H	8.86490000	0.24340000	-0.13900000
C	9.06470000	-1.17830000	2.95270000
H	7.43420000	-2.16850000	3.96580000

H	10.49470000	-0.16870000	1.67810000
H	9.78490000	-1.36240000	3.75340000
C	6.08500000	1.01650000	-0.76290000
O	5.46590000	1.20320000	-1.80920000
N	6.60760000	1.99220000	-0.00140000
C	6.58800000	3.44020000	-0.30410000
C	7.35100000	4.12390000	0.83250000
H	7.40530000	5.20740000	0.65290000
H	6.84960000	3.96650000	1.80070000
H	8.38060000	3.73830000	0.90600000
C	5.13520000	3.93810000	-0.34210000
H	4.63340000	3.74170000	0.61900000
H	5.11620000	5.02350000	-0.52540000
H	4.57320000	3.43610000	-1.14090000
C	7.28800000	3.70220000	-1.64480000
H	6.77170000	3.18760000	-2.46360000
H	7.29780000	4.78160000	-1.86090000
H	8.33170000	3.35180000	-1.61120000
H	7.09640000	1.71010000	0.84160000
Pd	-2.78940000	-0.51500000	0.81180000
P	-4.55550000	0.21940000	-0.47170000
C	-4.13450000	-1.11680000	-1.59670000
C	-4.99880000	-2.21900000	-1.78130000
C	-2.84300000	-1.11620000	-2.19020000
C	-4.56610000	-3.29970000	-2.54660000
H	-5.99670000	-2.22060000	-1.34180000
C	-2.42040000	-2.21740000	-2.93280000
H	-2.19010000	-0.24590000	-2.08470000
C	-3.27870000	-3.30770000	-3.10570000
H	-5.23990000	-4.14400000	-2.71170000
H	-1.42320000	-2.21720000	-3.38270000
H	-2.94880000	-4.16820000	-3.69250000
C	-4.15480000	1.82440000	-1.15430000
C	-4.03320000	1.98520000	-2.54730000
C	-3.96610000	2.91490000	-0.28030000
C	-3.70960000	3.24490000	-3.05680000
H	-4.19610000	1.15030000	-3.22570000
C	-3.64420000	4.16210000	-0.81050000
H	-4.06550000	2.77730000	0.79920000
C	-3.50800000	4.32530000	-2.19520000
H	-3.61570000	3.37560000	-4.13630000
H	-3.49120000	5.01330000	-0.13890000
H	-3.24500000	5.30360000	-2.60250000
C	-6.22080000	0.11320000	0.16510000

C	-7.11390000	1.17180000	-0.07730000
C	-6.62240000	-1.01090000	0.90840000
C	-8.41710000	1.08900000	0.41110000
H	-6.80280000	2.05000000	-0.64690000
C	-7.92620000	-1.08280000	1.38610000
H	-5.91310000	-1.80930000	1.13830000
C	-8.82430000	-0.03670000	1.13950000
H	-9.11750000	1.90330000	0.22290000
H	-8.24480000	-1.95370000	1.96660000
H	-9.84540000	-0.09490000	1.52440000
H	-1.57360000	0.66970000	1.18870000
I	-3.81690000	0.51430000	2.92860000

IX

C	-1.31690000	0.24460000	-1.21830000
C	-0.05320000	-0.36250000	-1.31110000
C	0.33460000	-1.13080000	-2.40290000
C	-0.59530000	-1.28840000	-3.43810000
C	-1.85750000	-0.68770000	-3.36170000
C	-2.23150000	0.08780000	-2.25320000
C	-1.38580000	0.98770000	0.11180000
C	0.01980000	0.73610000	0.62210000
H	1.32030000	-1.59640000	-2.45420000
H	-0.33080000	-1.88680000	-4.31230000
H	-2.57310000	-0.82850000	-4.17370000
H	-3.22890000	0.52220000	-2.21170000
H	0.39640000	1.09400000	1.58350000
N	0.70810000	-0.04040000	-0.14660000
C	-2.31960000	0.32410000	1.17310000
H	-2.42570000	1.02280000	2.01600000
H	-1.84430000	-0.58900000	1.56310000
C	-3.65640000	-0.12110000	0.63420000
H	-3.47790000	-0.91320000	-0.10780000
H	-4.20310000	-0.59620000	1.46440000
C	-1.71570000	2.46730000	0.00170000
C	-3.03770000	2.96460000	-0.03860000
C	-3.21150000	4.36420000	-0.04170000
C	-2.13850000	5.24930000	-0.02380000
C	-0.83700000	4.74810000	-0.03880000
C	-0.64190000	3.36960000	-0.02750000
H	-4.23160000	4.74250000	-0.08110000
H	-2.32190000	6.32580000	-0.01670000
H	0.02440000	5.41860000	-0.05780000
H	0.37650000	2.98120000	-0.05030000

C	-4.35280000	2.21740000	-0.22040000
N	-4.53580000	0.87690000	0.03370000
O	-5.30170000	2.87380000	-0.64040000
C	-5.87210000	0.35920000	-0.29850000
H	-6.26730000	1.01880000	-1.07990000
C	-6.85370000	0.40160000	0.86270000
C	-6.49460000	0.86470000	2.13470000
C	-8.18370000	0.00340000	0.64260000
C	-7.43360000	0.90870000	3.17070000
H	-5.47710000	1.21290000	2.31770000
C	-9.12190000	0.04660000	1.67490000
H	-8.48710000	-0.34290000	-0.34860000
C	-8.74850000	0.49590000	2.94640000
H	-7.13410000	1.27430000	4.15610000
H	-10.15180000	-0.26500000	1.48440000
H	-9.48330000	0.53140000	3.75430000
C	-5.70140000	-1.00920000	-1.00610000
O	-5.18050000	-1.03490000	-2.11720000
N	-6.10040000	-2.09610000	-0.31910000
C	-5.99230000	-3.49940000	-0.77320000
C	-6.59240000	-4.36000000	0.34250000
H	-6.54240000	-5.42440000	0.07040000
H	-6.04170000	-4.22340000	1.28750000
H	-7.64940000	-4.10150000	0.51620000
C	-4.51290000	-3.86040000	-0.97840000
H	-3.95130000	-3.73000000	-0.03960000
H	-4.41870000	-4.91200000	-1.29050000
H	-4.06170000	-3.22450000	-1.75200000
C	-6.78530000	-3.69380000	-2.07340000
H	-6.38330000	-3.05770000	-2.87320000
H	-6.72970000	-4.74480000	-2.39690000
H	-7.84530000	-3.43680000	-1.92090000
H	-6.52800000	-1.93950000	0.58780000
Pd	2.39370000	-1.12400000	0.45900000
P	3.98250000	0.49770000	-0.08800000
C	3.12590000	1.91100000	-0.78850000
C	3.26600000	3.17500000	-0.18520000
C	2.43060000	1.77230000	-2.00570000
C	2.73020000	4.29630000	-0.82100000
H	3.80870000	3.28830000	0.75350000
C	1.89150000	2.89760000	-2.62030000
H	2.31810000	0.79410000	-2.47450000
C	2.04650000	4.16000000	-2.03230000
H	2.85030000	5.28070000	-0.36440000

H	1.34760000	2.79120000	-3.56070000
H	1.62210000	5.04000000	-2.51960000
C	5.27940000	-0.03890000	-1.20530000
C	5.51950000	0.69660000	-2.38600000
C	6.11480000	-1.12050000	-0.86560000
C	6.59010000	0.34510000	-3.20670000
H	4.89780000	1.55000000	-2.65240000
C	7.18280000	-1.45500000	-1.69110000
H	5.92720000	-1.70030000	0.03820000
C	7.41870000	-0.72750000	-2.86490000
H	6.77950000	0.91870000	-4.11610000
H	7.82910000	-2.29270000	-1.42270000
H	8.25250000	-1.00080000	-3.51530000
C	4.59020000	0.86950000	1.55770000
C	5.96880000	0.88450000	1.83310000
C	3.65180000	1.13190000	2.57830000
C	6.40050000	1.17430000	3.12740000
H	6.69630000	0.68640000	1.04570000
C	4.09760000	1.40920000	3.86690000
H	2.57910000	1.11640000	2.36540000
C	5.47120000	1.42980000	4.14090000
H	7.47010000	1.20050000	3.34480000
H	3.37590000	1.61020000	4.66080000
H	5.81780000	1.64830000	5.15340000
H	2.72200000	-1.78870000	-0.84580000
I	3.84840000	-3.07470000	1.25110000

±2

C	-3.44130000	0.43240000	-0.58260000
C	-4.61530000	1.15740000	-0.29060000
C	-5.68020000	1.21610000	-1.18650000
C	-5.55710000	0.52070000	-2.39750000
C	-4.40160000	-0.21530000	-2.68720000
C	-3.33230000	-0.27050000	-1.77710000
C	-2.50800000	0.59400000	0.61310000
C	-3.42440000	1.43250000	1.50920000
H	-6.57960000	1.78400000	-0.93980000
H	-6.37580000	0.54570000	-3.12080000
H	-4.33090000	-0.76050000	-3.63140000
H	-2.44950000	-0.86990000	-2.00830000
H	-3.11230000	1.78160000	2.50010000
N	-4.55130000	1.76420000	0.99100000
C	-1.29240000	1.51050000	0.31950000
H	-0.71440000	1.63500000	1.24910000

H	-1.68400000	2.50240000	0.04600000
C	-0.36610000	1.09060000	-0.80260000
H	-0.93510000	0.92560000	-1.73350000
H	0.29880000	1.93820000	-1.00120000
C	-2.13180000	-0.75180000	1.22500000
C	-1.09800000	-1.58010000	0.72920000
C	-0.90150000	-2.84860000	1.31400000
C	-1.67510000	-3.29670000	2.37970000
C	-2.70220000	-2.48540000	2.86280000
C	-2.92450000	-1.23970000	2.27950000
H	-0.11370000	-3.48220000	0.90650000
H	-1.48330000	-4.27750000	2.82080000
H	-3.33750000	-2.82010000	3.68620000
H	-3.75230000	-0.63160000	2.64780000
C	-0.12980000	-1.32620000	-0.40750000
N	0.48820000	-0.07480000	-0.52380000
O	0.22460000	-2.26490000	-1.09940000
C	1.75460000	-0.05540000	-1.27010000
H	1.58430000	-0.05020000	-2.35830000
C	2.70490000	-1.19130000	-0.92280000
C	2.92820000	-1.57930000	0.40660000
C	3.45810000	-1.79120000	-1.93840000
C	3.87160000	-2.56290000	0.70920000
H	2.35290000	-1.12090000	1.21360000
C	4.40830000	-2.77020000	-1.63680000
H	3.29340000	-1.49080000	-2.97590000
C	4.61740000	-3.16190000	-0.31160000
H	4.02660000	-2.86200000	1.74900000
H	4.98460000	-3.23180000	-2.44260000
H	5.35720000	-3.93040000	-0.07420000
C	2.55140000	1.23990000	-0.96400000
O	3.24320000	1.75230000	-1.83310000
N	2.46130000	1.66020000	0.31730000
C	3.23310000	2.75660000	0.93500000
C	2.78480000	2.82950000	2.39820000
H	3.33090000	3.62580000	2.92510000
H	1.70760000	3.05120000	2.47180000
H	2.98030000	1.87930000	2.92170000
C	2.92130000	4.08250000	0.22530000
H	1.84450000	4.30940000	0.28280000
H	3.47190000	4.90820000	0.70240000
H	3.21100000	4.03260000	-0.83270000
C	4.73430000	2.44000000	0.85690000
H	5.05640000	2.35470000	-0.18990000

H	5.31980000	3.23790000	1.33970000
H	4.95640000	1.48920000	1.36680000
H	1.84350000	1.12450000	0.91960000

VII

C	4.83190000	-0.49190000	-1.12810000
C	5.78050000	-1.31450000	-1.80640000
C	6.68090000	-2.13330000	-1.11020000
C	6.62050000	-2.12390000	0.28190000
C	5.68800000	-1.31690000	0.97230000
C	4.79550000	-0.50390000	0.27890000
C	4.07900000	0.20930000	-2.13990000
C	4.57830000	-0.21350000	-3.35660000
H	7.40440000	-2.75610000	-1.64110000
H	7.31020000	-2.75180000	0.85100000
H	5.67410000	-1.32980000	2.06510000
H	4.08010000	0.12230000	0.81460000
H	4.27950000	0.07300000	-4.36370000
H	6.13990000	-1.55270000	-3.89290000
N	5.59590000	-1.11690000	-3.15640000
C	2.93110000	1.13710000	-1.89890000
H	2.59780000	1.58850000	-2.84270000
H	3.22720000	1.95840000	-1.22230000
C	1.75830000	0.36280000	-1.27340000
H	1.50140000	-0.48980000	-1.90770000
H	2.04120000	-0.02270000	-0.28750000
C	-2.56980000	0.97960000	-0.90060000
C	-1.83910000	1.24650000	-2.07630000
C	-2.55150000	1.57430000	-3.24640000
C	-3.94110000	1.64670000	-3.24600000
C	-4.64970000	1.37760000	-2.07230000
C	-3.96190000	1.03580000	-0.90120000
H	-1.98640000	1.77580000	-4.15740000
H	-4.47280000	1.90740000	-4.16320000
H	-5.74140000	1.41780000	-2.06260000
H	-4.52700000	0.78970000	-0.00050000
C	-0.36140000	1.11970000	-2.26390000
N	0.53780000	1.17900000	-1.12240000
O	0.13080000	0.89450000	-3.34340000
C	0.23170000	1.81550000	0.02780000
C	-0.52530000	3.08140000	0.04650000
C	-0.63750000	3.87540000	-1.11610000
C	-1.19030000	3.49370000	1.23260000
C	-1.43710000	5.01040000	-1.10870000

H	-0.07200000	3.62230000	-2.01290000
C	-2.01720000	4.61670000	1.21480000
H	-1.05090000	2.95700000	2.17300000
C	-2.15100000	5.36830000	0.04510000
H	-1.50620000	5.62630000	-2.00720000
H	-2.54110000	4.91370000	2.12510000
H	-2.79080000	6.25310000	0.03540000
C	0.96210000	1.52990000	1.35230000
O	0.27190000	0.95110000	2.21450000
N	2.17410000	2.02470000	1.53290000
C	2.89190000	2.14530000	2.84440000
C	4.26550000	2.73320000	2.51560000
H	4.83250000	2.88400000	3.44500000
H	4.84510000	2.05980000	1.86660000
H	4.16810000	3.71040000	2.01570000
C	3.03880000	0.77080000	3.50640000
H	3.57760000	0.07170000	2.85160000
H	3.62040000	0.88440000	4.43270000
H	2.06420000	0.33650000	3.76090000
C	2.09490000	3.10480000	3.73780000
H	1.10480000	2.69370000	3.98130000
H	2.63670000	3.26450000	4.68170000
H	1.96460000	4.08060000	3.24520000
H	2.57730000	2.53740000	0.75000000
Pd	-1.63010000	0.72520000	0.82200000
P	-1.66010000	-1.55150000	0.40720000
C	-0.62660000	-2.31300000	1.69110000
C	-1.20400000	-3.17260000	2.64160000
C	0.75190000	-2.03660000	1.74500000
C	-0.40050000	-3.75850000	3.62220000
H	-2.27200000	-3.39190000	2.61440000
C	1.54740000	-2.63520000	2.71890000
H	1.20720000	-1.36220000	1.02160000
C	0.97130000	-3.49460000	3.66130000
H	-0.85140000	-4.42960000	4.35630000
H	2.61870000	-2.42700000	2.74390000
H	1.59480000	-3.95880000	4.42860000
C	-1.10800000	-2.10500000	-1.22670000
C	0.12610000	-2.75390000	-1.40280000
C	-1.93090000	-1.85380000	-2.34210000
C	0.54090000	-3.12250000	-2.68380000
H	0.76390000	-2.98050000	-0.54980000
C	-1.50720000	-2.22560000	-3.61540000
H	-2.90130000	-1.37440000	-2.21660000

C	-0.26720000	-2.84980000	-3.79040000
H	1.50150000	-3.62530000	-2.81360000
H	-2.14640000	-2.02040000	-4.47640000
H	0.06440000	-3.13180000	-4.79220000
C	-3.36630000	-2.09700000	0.67050000
C	-3.88230000	-3.21730000	0.00130000
C	-4.15500000	-1.40680000	1.60660000
C	-5.18650000	-3.63870000	0.27050000
H	-3.27110000	-3.76070000	-0.72100000
C	-5.45470000	-1.83660000	1.87170000
H	-3.74920000	-0.53600000	2.13110000
C	-5.97110000	-2.95120000	1.20130000
H	-5.58970000	-4.51060000	-0.24910000
H	-6.06670000	-1.30060000	2.60020000
H	-6.99110000	-3.28410000	1.40610000

TS4

C	4.76750000	-1.25930000	-0.83380000
C	5.61770000	-2.07030000	-1.64170000
C	6.10770000	-3.30780000	-1.19570000
C	5.73240000	-3.72780000	0.07990000
C	4.89600000	-2.93720000	0.89740000
C	4.41400000	-1.70730000	0.45390000
C	4.45320000	-0.07700000	-1.59970000
C	5.10850000	-0.21650000	-2.80950000
H	6.75980000	-3.91730000	-1.82540000
H	6.09870000	-4.68790000	0.45270000
H	4.62810000	-3.29550000	1.89440000
H	3.77280000	-1.09870000	1.09050000
H	5.12860000	0.45860000	-3.66430000
H	6.38180000	-1.72630000	-3.60090000
N	5.80260000	-1.40370000	-2.83340000
C	3.53200000	1.02900000	-1.18740000
H	3.62560000	1.87900000	-1.87770000
H	3.78920000	1.39670000	-0.18040000
C	2.07160000	0.55000000	-1.18260000
H	1.78230000	0.23850000	-2.19210000
H	1.95350000	-0.31740000	-0.51750000
C	-1.22560000	2.61790000	0.06970000
C	-0.81030000	2.95710000	-1.22300000
C	-1.50050000	3.93440000	-1.94520000
C	-2.54940000	4.61140000	-1.31380000
C	-2.89290000	4.33850000	0.01920000

C	-2.20300000	3.35820000	0.74420000
H	-1.19000000	4.18130000	-2.96260000
H	-3.08360000	5.39640000	-1.85480000
H	-3.70260000	4.89060000	0.49610000
H	-2.46870000	3.14640000	1.78490000
C	0.40090000	2.27440000	-1.77500000
N	1.11410000	1.58820000	-0.77640000
O	0.71890000	2.25620000	-2.95290000
C	0.92720000	1.89850000	0.57390000
C	1.47930000	3.13490000	1.14200000
C	2.25590000	3.99830000	0.34340000
C	1.22420000	3.48550000	2.48610000
C	2.76600000	5.17870000	0.87970000
H	2.47370000	3.73410000	-0.69140000
C	1.73920000	4.66290000	3.01390000
H	0.60360000	2.84220000	3.11130000
C	2.51070000	5.51680000	2.21280000
H	3.37440000	5.83740000	0.25470000
H	1.53510000	4.92830000	4.05450000
H	2.91530000	6.44090000	2.63130000
C	0.74910000	0.68490000	1.47030000
O	-0.26030000	-0.05420000	1.34610000
N	1.69810000	0.40870000	2.34860000
C	1.65490000	-0.66410000	3.39200000
C	3.02280000	-0.63270000	4.07530000
H	3.04780000	-1.37170000	4.88830000
H	3.82910000	-0.87590000	3.36660000
H	3.22740000	0.35970000	4.51230000
C	1.40690000	-2.03740000	2.75640000
H	2.12700000	-2.24810000	1.95590000
H	1.52300000	-2.81100000	3.53280000
H	0.39090000	-2.12170000	2.34040000
C	0.54270000	-0.31790000	4.39240000
H	-0.44090000	-0.29190000	3.90200000
H	0.51070000	-1.08210000	5.18320000
H	0.72740000	0.65810000	4.86880000
H	2.48540000	1.05140000	2.39130000
Pd	-1.82680000	0.46600000	0.11070000
P	-2.52500000	-1.63770000	-0.35260000
C	-3.38220000	-0.60720000	-1.55690000
C	-3.08390000	-0.60480000	-2.93600000
C	-4.08180000	0.49390000	-0.97330000
C	-3.49890000	0.46720000	-3.71800000
H	-2.53340000	-1.43520000	-3.37920000

C	-4.47280000	1.57450000	-1.78790000
H	-4.43080000	0.44660000	0.06200000
C	-4.17640000	1.56140000	-3.14380000
H	-3.28470000	0.46390000	-4.78820000
H	-5.01650000	2.40870000	-1.34450000
H	-4.47930000	2.39690000	-3.77710000
C	-3.57570000	-2.48600000	0.82120000
C	-4.93780000	-2.71170000	0.55130000
C	-2.99960000	-2.92570000	2.02770000
C	-5.71780000	-3.38270000	1.49250000
H	-5.37780000	-2.37340000	-0.39000000
C	-3.79120000	-3.59720000	2.95880000
H	-1.94250000	-2.74310000	2.23610000
C	-5.14870000	-3.82530000	2.68940000
H	-6.77310000	-3.56810000	1.28470000
H	-3.35140000	-3.94480000	3.89420000
H	-5.76440000	-4.35300000	3.42180000
C	-1.23980000	-2.68710000	-1.01440000
C	-1.23530000	-4.07620000	-0.79230000
C	-0.16940000	-2.06700000	-1.68770000
C	-0.15920000	-4.83410000	-1.25610000
H	-2.06300000	-4.55700000	-0.26510000
C	0.89840000	-2.83410000	-2.14270000
H	-0.18910000	-0.98810000	-1.83490000
C	0.90650000	-4.21790000	-1.92190000
H	-0.14780000	-5.91400000	-1.08890000
H	1.73400000	-2.35420000	-2.65830000
H	1.75130000	-4.81650000	-2.26680000

X

C	-4.88750000	1.21510000	-0.82840000
C	-5.80040000	1.92920000	-1.66250000
C	-6.26470000	3.20920000	-1.32480000
C	-5.80350000	3.77320000	-0.13700000
C	-4.90430000	3.07990000	0.70530000
C	-4.44810000	1.80880000	0.36940000
C	-4.61420000	-0.04580000	-1.47580000
C	-5.35210000	-0.04510000	-2.64250000
H	-6.96420000	3.74440000	-1.97100000
H	-6.14770000	4.76930000	0.15170000
H	-4.56920000	3.55000000	1.63320000
H	-3.75940000	1.27140000	1.02240000
H	-5.42360000	-0.80980000	-3.41440000
H	-6.69000000	1.36450000	-3.51260000

N	-6.06250000	1.13120000	-2.75130000
C	-3.65690000	-1.09840000	-1.00280000
H	-3.72230000	-1.98130000	-1.65490000
H	-3.91740000	-1.43260000	0.01470000
C	-2.21590000	-0.56200000	-1.02320000
H	-2.00990000	-0.18040000	-2.03090000
H	-2.11610000	0.28680000	-0.33320000
C	0.62030000	-2.66520000	0.23250000
C	0.71440000	-2.80020000	-1.16260000
C	1.70080000	-3.58380000	-1.76020000
C	2.62850000	-4.21600000	-0.92590000
C	2.57610000	-4.04260000	0.46470000
C	1.56670000	-3.27490000	1.06680000
H	1.73830000	-3.69120000	-2.84530000
H	3.41140000	-4.84100000	-1.35990000
H	3.32100000	-4.52950000	1.09740000
H	1.50480000	-3.18820000	2.15280000
C	-0.37820000	-2.00930000	-1.78980000
N	-1.15480000	-1.52240000	-0.75330000
O	-0.54620000	-1.77610000	-2.97250000
C	-0.70090000	-1.95500000	0.57970000
C	-1.61790000	-2.98910000	1.25230000
C	-2.44130000	-3.80790000	0.46980000
C	-1.53940000	-3.22350000	2.63470000
C	-3.20100000	-4.81950000	1.06110000
H	-2.48390000	-3.66190000	-0.60890000
C	-2.29960000	-4.23590000	3.22470000
H	-0.88470000	-2.61970000	3.26460000
C	-3.13730000	-5.03330000	2.44060000
H	-3.84370000	-5.44500000	0.43760000
H	-2.23300000	-4.40200000	4.30230000
H	-3.73350000	-5.82320000	2.90290000
C	-0.45680000	-0.69430000	1.44450000
O	0.65510000	-0.10440000	1.39800000
N	-1.43710000	-0.22820000	2.19300000
C	-1.36410000	0.95680000	3.10500000
C	-2.71610000	1.02920000	3.81870000
H	-2.72190000	1.88190000	4.51190000
H	-3.54350000	1.16610000	3.10700000
H	-2.90500000	0.11500000	4.40340000
C	-1.11420000	2.22760000	2.28190000
H	-1.92730000	2.40610000	1.56560000
H	-1.06120000	3.09320000	2.95870000
H	-0.16960000	2.16770000	1.72700000

C	-0.24590000	0.73720000	4.13430000
H	0.74290000	0.69660000	3.65920000
H	-0.25000000	1.56840000	4.85490000
H	-0.40730000	-0.19710000	4.69370000
H	-2.29610000	-0.77420000	2.21350000
Pd	2.09620000	-0.60980000	-0.00110000
P	2.62200000	1.49850000	-0.47040000
C	3.42750000	0.53050000	-1.74090000
C	3.04180000	0.52110000	-3.09970000
C	4.21140000	-0.54190000	-1.20330000
C	3.44830000	-0.53080000	-3.90780000
H	2.43210000	1.33160000	-3.50200000
C	4.59240000	-1.60090000	-2.04710000
H	4.64250000	-0.46740000	-0.19920000
C	4.20520000	-1.59690000	-3.38110000
H	3.17000000	-0.53640000	-4.96360000
H	5.20430000	-2.41060000	-1.64730000
H	4.50100000	-2.41930000	-4.03550000
C	3.68900000	2.27860000	0.72780000
C	5.02470000	2.58220000	0.41120000
C	3.16350000	2.55680000	2.00550000
C	5.83110000	3.17940000	1.38040000
H	5.42270000	2.36550000	-0.58180000
C	3.98350000	3.15340000	2.96050000
H	2.12750000	2.30650000	2.24480000
C	5.31320000	3.46340000	2.64830000
H	6.86730000	3.42790000	1.14220000
H	3.58660000	3.37550000	3.95310000
H	5.95120000	3.93130000	3.40140000
C	1.20110000	2.47500000	-0.92340000
C	1.08010000	3.79930000	-0.46140000
C	0.16110000	1.87300000	-1.66180000
C	-0.08420000	4.51370000	-0.74010000
H	1.88380000	4.26330000	0.11160000
C	-0.98860000	2.60560000	-1.94250000
H	0.24850000	0.84060000	-2.00540000
C	-1.11600000	3.91940000	-1.47470000
H	-0.18580000	5.53990000	-0.38170000
H	-1.79570000	2.14670000	-2.51550000
H	-2.03060000	4.47960000	-1.68100000

2C

C	-3.50070000	-0.96510000	0.36310000
C	-4.83040000	-1.10990000	-0.13920000

C	-5.82470000	-0.15140000	0.10280000
C	-5.47700000	0.96430000	0.86140000
C	-4.16960000	1.12380000	1.37440000
C	-3.18230000	0.17090000	1.13460000
C	-2.74940000	-2.11670000	-0.08420000
C	-3.62880000	-2.88680000	-0.81620000
H	-6.83620000	-0.27610000	-0.29110000
H	-6.23010000	1.72960000	1.06540000
H	-3.93370000	2.00820000	1.97160000
H	-2.17800000	0.30020000	1.54520000
H	-3.45500000	-3.83100000	-1.33010000
H	-5.68750000	-2.66340000	-1.31600000
N	-4.87210000	-2.28950000	-0.84480000
C	-1.28800000	-2.35600000	0.14640000
H	-0.99200000	-3.35290000	-0.20570000
H	-1.06450000	-2.31520000	1.22520000
C	-0.45270000	-1.28870000	-0.57910000
H	-0.56640000	-1.42390000	-1.66860000
H	-0.85750000	-0.29980000	-0.34210000
C	3.13090000	-0.47480000	0.04200000
C	3.18430000	-1.82110000	-0.31770000
C	4.39410000	-2.50610000	-0.42200000
C	5.57010000	-1.80200000	-0.14850000
C	5.51910000	-0.44690000	0.21530000
C	4.29820000	0.23180000	0.31570000
H	4.41010000	-3.55920000	-0.71140000
H	6.53710000	-2.30590000	-0.21820000
H	6.44850000	0.08910000	0.42290000
H	4.27240000	1.28540000	0.59850000
C	1.80300000	-2.30800000	-0.56840000
N	0.96170000	-1.26750000	-0.23430000
O	1.44870000	-3.39610000	-0.99390000
C	1.67980000	-0.01280000	0.06230000
C	1.32320000	0.58780000	1.42120000
C	0.66420000	-0.16940000	2.39750000
C	1.72010000	1.89860000	1.73930000
C	0.38170000	0.37480000	3.65390000
H	0.37830000	-1.19590000	2.17350000
C	1.44230000	2.44140000	2.99540000
H	2.24000000	2.50680000	0.99670000
C	0.76600000	1.68320000	3.95660000
H	-0.14020000	-0.23140000	4.39840000
H	1.75450000	3.46350000	3.22300000
H	0.54260000	2.11040000	4.93710000

C	1.40600000	0.93750000	-1.16100000
O	2.02040000	0.77570000	-2.20510000
N	0.40650000	1.82590000	-0.98130000
C	-0.15300000	2.73150000	-2.00740000
C	-1.24780000	3.54250000	-1.30630000
H	-1.71370000	4.24420000	-2.01350000
H	-2.03700000	2.88410000	-0.90870000
H	-0.82920000	4.12650000	-0.47050000
C	-0.75550000	1.90630000	-3.15400000
H	-1.56070000	1.25350000	-2.78190000
H	-1.18010000	2.57370000	-3.92000000
H	0.01340000	1.27910000	-3.62560000
C	0.94520000	3.66980000	-2.52840000
H	1.74870000	3.09760000	-3.01070000
H	0.52560000	4.37530000	-3.26220000
H	1.37930000	4.25240000	-1.70010000
H	-0.02360000	1.86260000	-0.06430000

IV

C	-5.56880000	-1.24800000	-0.47810000
C	-6.26410000	-2.21760000	-1.25910000
C	-7.42920000	-1.91250000	-1.95710000
C	-7.90790000	-0.59540000	-1.86670000
C	-7.24110000	0.37720000	-1.10020000
C	-6.07440000	0.06520000	-0.39960000
C	-4.43160000	-1.90460000	0.10200000
C	-4.47800000	-3.23030000	-0.34890000
H	-7.95300000	-2.66520000	-2.54940000
H	-8.82080000	-0.32560000	-2.40200000
H	-7.64710000	1.38970000	-1.04860000
H	-5.56750000	0.81960000	0.20400000
H	-3.79970000	-4.05280000	-0.12720000
H	-5.82840000	-4.28670000	-1.58340000
N	-5.56040000	-3.40770000	-1.15050000
C	-3.38100000	-1.28900000	0.96230000
H	-2.88630000	-2.06860000	1.56120000
H	-3.83460000	-0.57270000	1.66410000
C	-2.31750000	-0.54710000	0.12910000
H	-1.86490000	-1.23630000	-0.59700000
H	-2.79780000	0.24690000	-0.45470000
C	0.58440000	-1.89240000	-0.16250000
C	-0.02980000	-1.95950000	1.08610000
C	-0.15710000	-3.20770000	1.69930000
C	0.29170000	-4.35640000	1.03710000

C	0.87420000	-4.26710000	-0.23110000
C	1.02040000	-3.02020000	-0.85950000
H	-0.61180000	-3.27310000	2.69010000
H	0.17870000	-5.33270000	1.51320000
H	1.22130000	-5.16510000	-0.74700000
H	1.48600000	-2.95870000	-1.84660000
C	-0.40980000	-0.65010000	1.71060000
N	-1.29760000	0.07390000	0.97220000
O	0.17350000	-0.22630000	2.69830000
C	-1.23200000	1.52130000	1.05700000
H	-0.43730000	1.73800000	1.78560000
C	-2.51430000	2.12360000	1.61500000
C	-2.72290000	2.02360000	2.99930000
C	-3.52610000	2.66820000	0.81370000
C	-3.91730000	2.46190000	3.57370000
H	-1.94110000	1.58760000	3.62650000
C	-4.72080000	3.11240000	1.38890000
H	-3.38510000	2.76070000	-0.26290000
C	-4.92150000	3.00930000	2.76800000
H	-4.06390000	2.38030000	4.65330000
H	-5.49870000	3.54190000	0.75310000
H	-5.85510000	3.35900000	3.21510000
C	-0.77060000	2.14540000	-0.26900000
O	-0.96830000	3.34130000	-0.44560000
N	-0.22290000	1.34580000	-1.25060000
C	0.02260000	1.93790000	-2.60760000
C	-1.35100000	2.30800000	-3.20490000
H	-1.20930000	2.63760000	-4.24530000
H	-2.02400000	1.43700000	-3.20610000
H	-1.81760000	3.12280000	-2.63870000
C	0.64010000	0.85640000	-3.51130000
H	0.03250000	-0.06350000	-3.54590000
H	0.71640000	1.23950000	-4.53880000
H	1.68050000	0.60470000	-3.22310000
C	0.97670000	3.14120000	-2.59710000
H	1.94700000	2.86310000	-2.16420000
H	1.15060000	3.47380000	-3.63160000
H	0.56360000	3.97470000	-2.02180000
Pd	1.09580000	-0.24150000	-1.12110000
P	3.04550000	0.01080000	0.14000000
C	3.33400000	1.77790000	-0.01670000
C	2.45850000	2.66120000	0.64370000
C	4.37650000	2.27330000	-0.81920000
C	2.63220000	4.03440000	0.50590000

H	1.65720000	2.27110000	1.27010000
C	4.53660000	3.65330000	-0.95270000
H	5.05930000	1.59180000	-1.32820000
C	3.66690000	4.53060000	-0.29720000
H	1.95010000	4.71950000	1.01260000
H	5.34700000	4.04430000	-1.57130000
H	3.79440000	5.60920000	-0.41290000
C	4.25460000	-0.93800000	-0.81660000
C	4.16760000	-0.97890000	-2.22350000
C	5.29980000	-1.61450000	-0.15910000
C	5.11340000	-1.68720000	-2.96050000
H	3.36190000	-0.45430000	-2.74060000
C	6.24420000	-2.31580000	-0.90850000
H	5.38700000	-1.57950000	0.92670000
C	6.15060000	-2.35900000	-2.30350000
H	5.04140000	-1.71560000	-4.04950000
H	7.06160000	-2.82860000	-0.39750000
H	6.89140000	-2.91520000	-2.88200000
C	3.10820000	-0.52660000	1.84660000
C	3.32870000	0.39430000	2.88680000
C	2.97950000	-1.90160000	2.12990000
C	3.42240000	-0.06370000	4.19900000
H	3.44620000	1.45680000	2.67830000
C	3.07980000	-2.34480000	3.44390000
H	2.81340000	-2.62070000	1.32710000
C	3.29410000	-1.42720000	4.47980000
H	3.60050000	0.64940000	5.00630000
H	2.98310000	-3.40980000	3.66410000
H	3.36410000	-1.77850000	5.51160000

TS3

C	-4.75930000	-2.51720000	-0.02510000
C	-5.46890000	-3.70020000	-0.35230000
C	-6.86450000	-3.77330000	-0.26330000
C	-7.54310000	-2.63400000	0.17750000
C	-6.84510000	-1.45390000	0.52340000
C	-5.45800000	-1.37940000	0.43320000
C	-3.36540000	-2.80080000	-0.19710000
C	-3.27530000	-4.10640000	-0.60470000
H	-7.40590000	-4.68640000	-0.51540000
H	-8.63220000	-2.65760000	0.26220000
H	-7.41090000	-0.59000000	0.88050000
H	-4.92860000	-0.47260000	0.74250000
H	-2.39750000	-4.70710000	-0.83530000
H	-4.74340000	-5.59630000	-1.00940000

N	-4.53800000	-4.64660000	-0.72200000
C	-2.28000000	-1.79280000	-0.05960000
H	-1.32940000	-2.29440000	0.15790000
H	-2.50990000	-1.13700000	0.79440000
C	-2.09040000	-0.92620000	-1.34020000
H	-1.32310000	-1.35930000	-1.99550000
H	-3.03830000	-0.86770000	-1.89620000
C	-0.51230000	3.03880000	0.21850000
C	0.06530000	2.13710000	-0.66500000
C	1.19270000	2.62600000	-1.30170000
C	1.65220000	3.92830000	-1.10120000
C	0.99430000	4.75620000	-0.18410000
C	-0.11540000	4.32980000	0.53060000
H	1.60370000	2.02710000	-2.11580000
H	2.49530000	4.30030000	-1.68810000
H	1.31140000	5.78830000	-0.05380000
H	-0.65140000	4.91360000	1.23040000
C	-0.38560000	0.77150000	-0.92520000
N	-1.69330000	0.45590000	-1.06010000
O	0.51290000	-0.10650000	-1.15850000
C	-2.78040000	1.40720000	-0.72740000
H	-3.72340000	0.88170000	-0.91490000
C	-2.75920000	2.67060000	-1.57660000
C	-3.39890000	3.83170000	-1.08330000
C	-2.20590000	2.68640000	-2.85470000
C	-3.42570000	4.99720000	-1.84450000
H	-3.83950000	3.82620000	-0.08980000
C	-2.24290000	3.85770000	-3.61720000
H	-1.73820000	1.78390000	-3.26420000
C	-2.83470000	5.01920000	-3.11070000
H	-3.89710000	5.89940000	-1.44100000
H	-1.79640000	3.86000000	-4.61320000
H	-2.85070000	5.93070000	-3.70620000
C	-2.79340000	1.60400000	0.82680000
O	-3.72310000	1.15510000	1.48700000
N	-1.79230000	2.18300000	1.48320000
C	-1.46340000	1.83200000	2.92900000
C	-2.34320000	2.68450000	3.86750000
H	-2.17890000	2.38950000	4.91420000
H	-2.10800000	3.75220000	3.75600000
H	-3.41230000	2.53560000	3.63560000
C	0.01250000	2.09640000	3.21490000
H	0.31610000	3.13620000	3.08460000
H	0.20980000	1.83750000	4.25860000

H	0.64990000	1.45640000	2.57650000
C	-1.66820000	0.32990000	3.19910000
H	-1.11060000	-0.26650000	2.45660000
H	-1.27570000	0.08630000	4.19580000
H	-2.72760000	0.04940000	3.15420000
Pd	2.21540000	0.67470000	-0.15260000
P	3.18710000	-1.30210000	0.08340000
C	4.12390000	-0.44260000	1.35430000
C	3.43740000	0.04160000	2.50310000
C	5.47780000	-0.06410000	1.13980000
C	4.10480000	0.86650000	3.40830000
H	2.39700000	-0.23530000	2.70700000
C	6.13260000	0.73210000	2.07740000
H	6.02820000	-0.44250000	0.27440000
C	5.44650000	1.20090000	3.20990000
H	3.57000000	1.23400000	4.29490000
H	7.18280000	0.98320000	1.93610000
H	5.96010000	1.82930000	3.93960000
C	4.13850000	-1.77150000	-1.36490000
C	4.65400000	-0.74260000	-2.17320000
C	4.37070000	-3.12070000	-1.67760000
C	5.37830000	-1.05980000	-3.32720000
H	4.48070000	0.30160000	-1.87210000
C	5.11670000	-3.42610000	-2.81970000
H	3.97260000	-3.90560000	-1.04380000
C	5.60600000	-2.40400000	-3.64330000
H	5.77080000	-0.26630000	-3.95930000
H	5.31410000	-4.47030000	-3.07820000
H	6.17590000	-2.65870000	-4.53760000
C	2.01720000	-2.57010000	0.57130000
C	1.78340000	-2.88550000	1.91740000
C	1.23080000	-3.16460000	-0.43780000
C	0.77110000	-3.77860000	2.25150000
H	2.36370000	-2.39210000	2.70090000
C	0.24920000	-4.07200000	-0.08760000
H	1.39030000	-2.90240000	-1.48920000
C	0.00890000	-4.37280000	1.25240000
H	0.58270000	-4.00770000	3.30200000
H	-0.34400000	-4.57110000	-0.86480000
H	-0.78320000	-5.07170000	1.51470000

XI

C	-4.65970000	-2.73480000	0.11460000
C	-5.31000000	-3.94880000	-0.25990000

C	-6.67080000	-4.17160000	-0.00610000
C	-7.38160000	-3.15620000	0.62940000
C	-6.75560000	-1.94710000	1.00900000
C	-5.40380000	-1.72600000	0.76020000
C	-3.27640000	-2.85450000	-0.28640000
C	-3.15100000	-4.09670000	-0.87840000
H	-7.15440000	-5.10730000	-0.29560000
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H	-2.27890000	-4.57290000	-1.31960000
H	-4.52930000	-5.68160000	-1.22010000
N	-4.36400000	-4.74900000	-0.85930000
C	-2.25260000	-1.76960000	-0.15140000
H	-1.24890000	-2.18100000	0.02620000
H	-2.51040000	-1.16050000	0.72700000
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H	-3.20810000	-0.76640000	-1.84090000
C	-0.57690000	2.83300000	0.48430000
C	-0.08860000	2.22630000	-0.69200000
C	0.79160000	2.92860000	-1.54540000
C	1.15070000	4.24250000	-1.24500000
C	0.62400000	4.85800000	-0.10450000
C	-0.23270000	4.16210000	0.75010000
H	1.13190000	2.45800000	-2.47020000
H	1.81210000	4.79320000	-1.91600000
H	0.87480000	5.89680000	0.11950000
H	-0.64040000	4.64630000	1.63730000
C	-0.49760000	0.84970000	-1.07810000
N	-1.77920000	0.51660000	-1.07600000
O	0.42680000	0.02920000	-1.39400000
C	-2.80600000	1.43780000	-0.54430000
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C	-2.58290000	2.84860000	-2.65610000
C	-3.81750000	5.01220000	-1.39240000
H	-3.93150000	3.74350000	0.34660000
C	-2.79650000	4.04000000	-3.35480000
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C	-3.41000000	5.12590000	-2.72490000
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H	-3.57420000	6.05730000	-3.27160000
C	-2.59180000	1.59020000	0.98170000
O	-3.45110000	1.19560000	1.74850000
N	-1.37560000	2.08960000	1.39060000
C	-0.89380000	1.86730000	2.81670000
C	-1.70790000	2.72620000	3.78840000
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C	-1.02410000	0.36820000	3.13430000
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P	3.09500000	-1.15520000	-0.00980000
C	4.01240000	-0.54110000	1.40630000
C	3.32530000	-0.23060000	2.60580000
C	5.39160000	-0.25900000	1.28530000
C	4.02170000	0.33530000	3.67060000
H	2.25860000	-0.43620000	2.70460000
C	6.07110000	0.30380000	2.36130000
H	5.92340000	-0.49420000	0.36210000
C	5.39010000	0.60070000	3.54980000
H	3.49570000	0.56850000	4.59820000
H	7.14000000	0.50980000	2.27750000
H	5.93250000	1.04280000	4.38840000
C	4.13560000	-1.41760000	-1.44630000
C	4.50970000	-0.30850000	-2.22690000
C	4.59110000	-2.70830000	-1.77010000
C	5.34080000	-0.49380000	-3.33040000
H	4.14590000	0.69220000	-1.97670000
C	5.42760000	-2.87810000	-2.87320000
H	4.30150000	-3.56900000	-1.16420000
C	5.79870000	-1.77660000	-3.65190000
H	5.62980000	0.36260000	-3.94290000
H	5.79000000	-3.87650000	-3.12670000
H	6.44910000	-1.91910000	-4.51780000
C	2.02320000	-2.55800000	0.26710000
C	1.79030000	-3.10140000	1.54410000
C	1.37930000	-3.09730000	-0.86680000

C	0.92140000	-4.18360000	1.67850000
H	2.29740000	-2.70380000	2.42280000
C	0.52650000	-4.18690000	-0.71670000
H	1.55080000	-2.67270000	-1.85680000
C	0.29240000	-4.72720000	0.55280000
H	0.74440000	-4.61350000	2.66630000
H	0.03890000	-4.61290000	-1.59520000
H	-0.38520000	-5.57580000	0.66610000

2B

C	4.55150000	0.00080000	-0.10150000
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C	5.50450000	1.27140000	-1.91930000
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H	4.11430000	-1.74660000	2.69810000
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N	5.73140000	-0.79600000	1.64970000
C	2.16440000	-0.83080000	0.60830000
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C	1.42280000	0.44290000	1.05090000
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C	-0.81480000	-0.14710000	1.80170000
N	-0.01710000	0.37260000	0.81490000
O	-0.37710000	-0.47330000	2.89950000

C	-0.50600000	0.70620000	-0.52310000
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C	-1.62240000	2.78940000	0.43760000
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H	-2.19940000	1.29840000	-2.57060000
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H	-1.01860000	2.67390000	1.33920000
C	-3.30260000	4.00600000	-0.81640000
H	-3.78820000	3.18920000	-2.76130000
H	-2.60280000	4.57490000	1.14990000
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H	-3.16900000	-4.50600000	-0.38420000
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H	-1.00170000	-4.56090000	-1.25310000
H	-0.10160000	-3.10350000	-1.74040000

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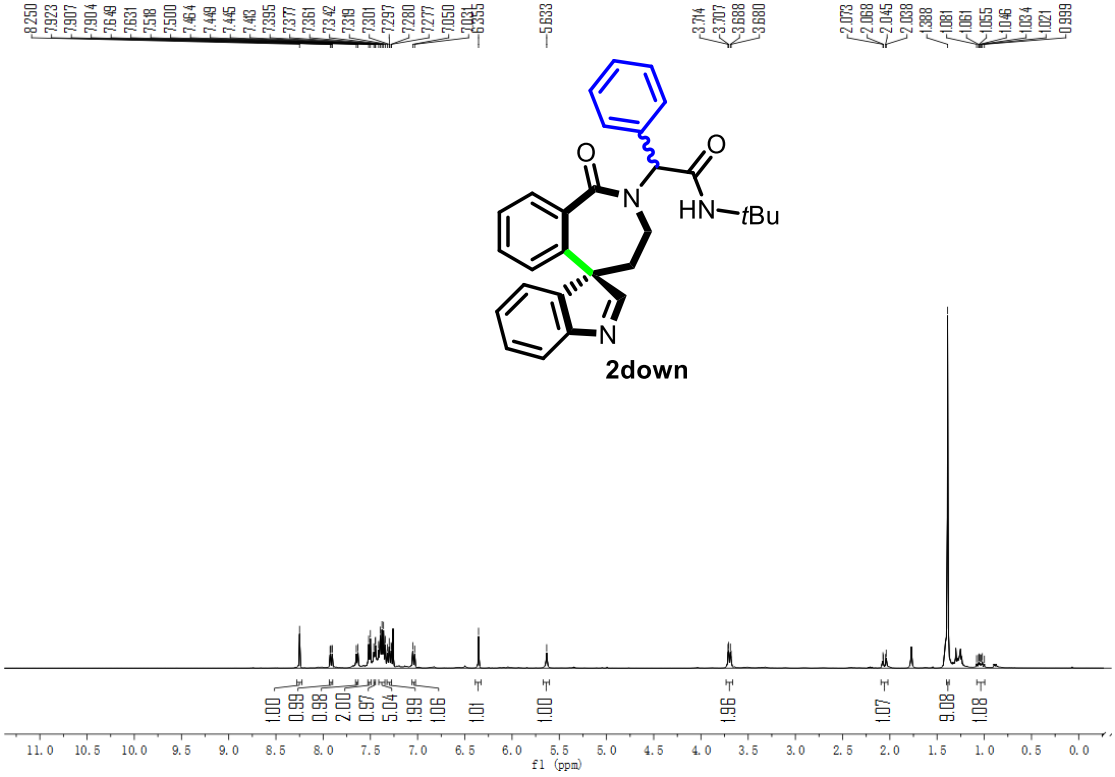
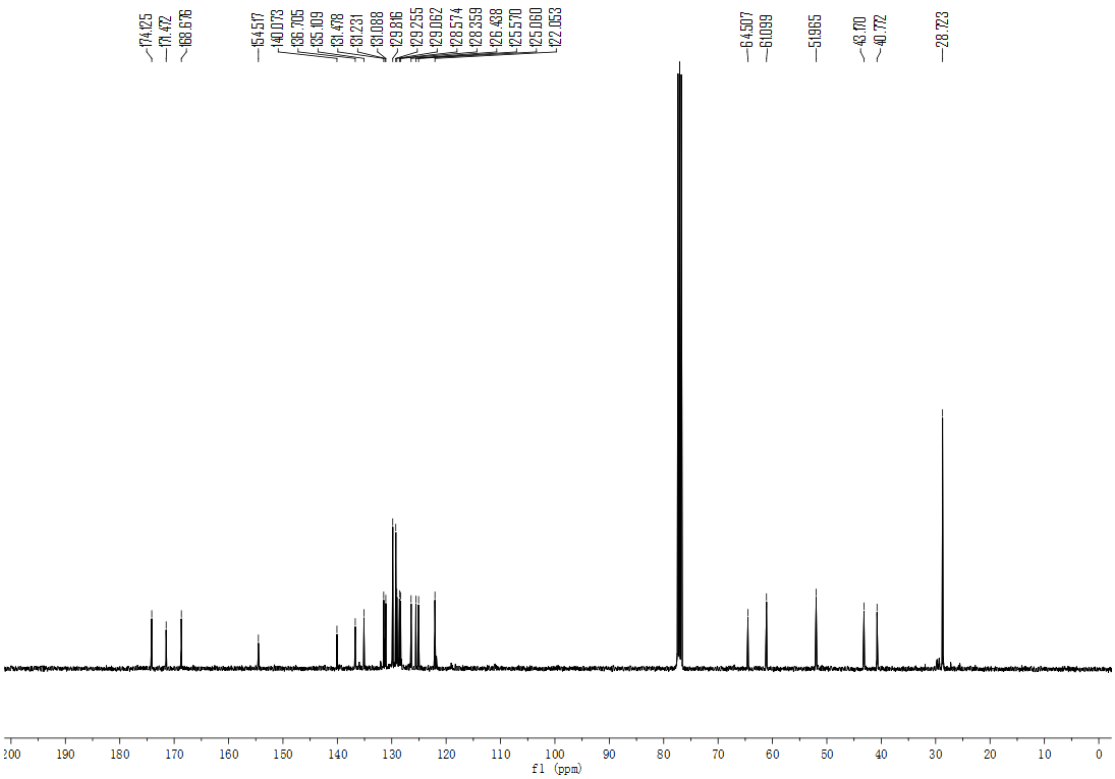
11. Copies ^{1}H NMR, ^{13}C NMR, ^{19}F NMRN-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (2down)

^{1}H NMR (400 MHz, $CDCl_3$)：



^{13}C NMR (100 MHz, $CDCl_3$):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171.472
168.676
154.517
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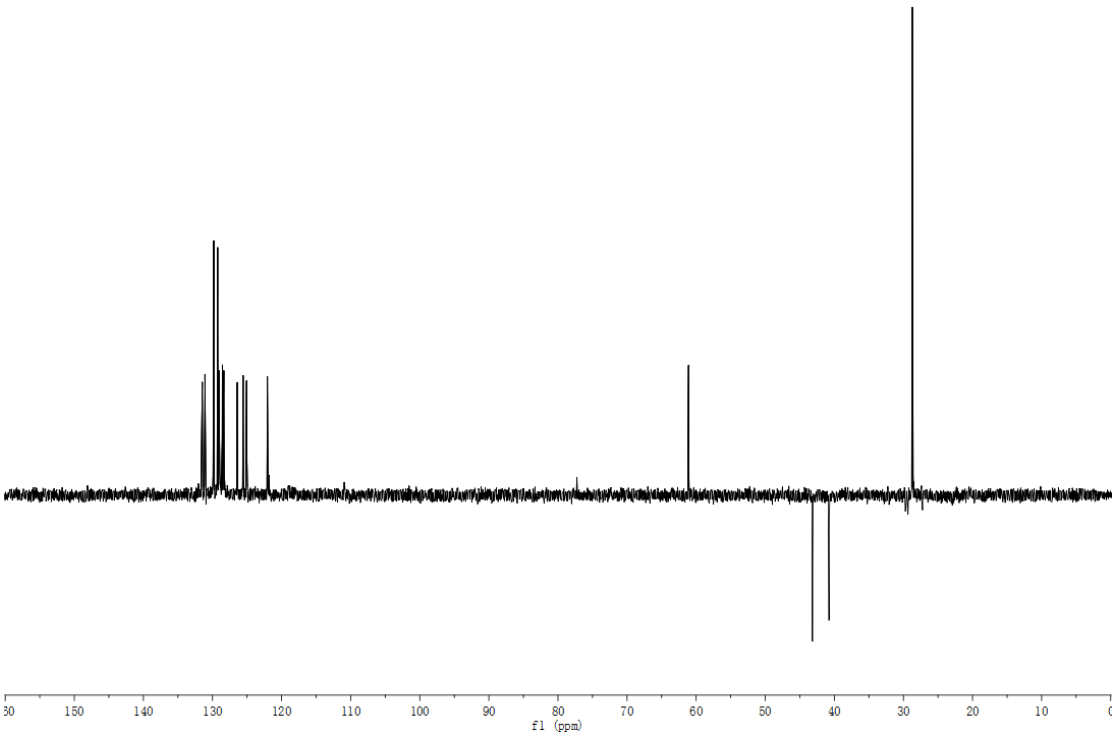
128.574
128.359
126.438
125.570
125.060
122.053
64.507
61.099
51.965
43.170
40.772
28.723
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

DEPT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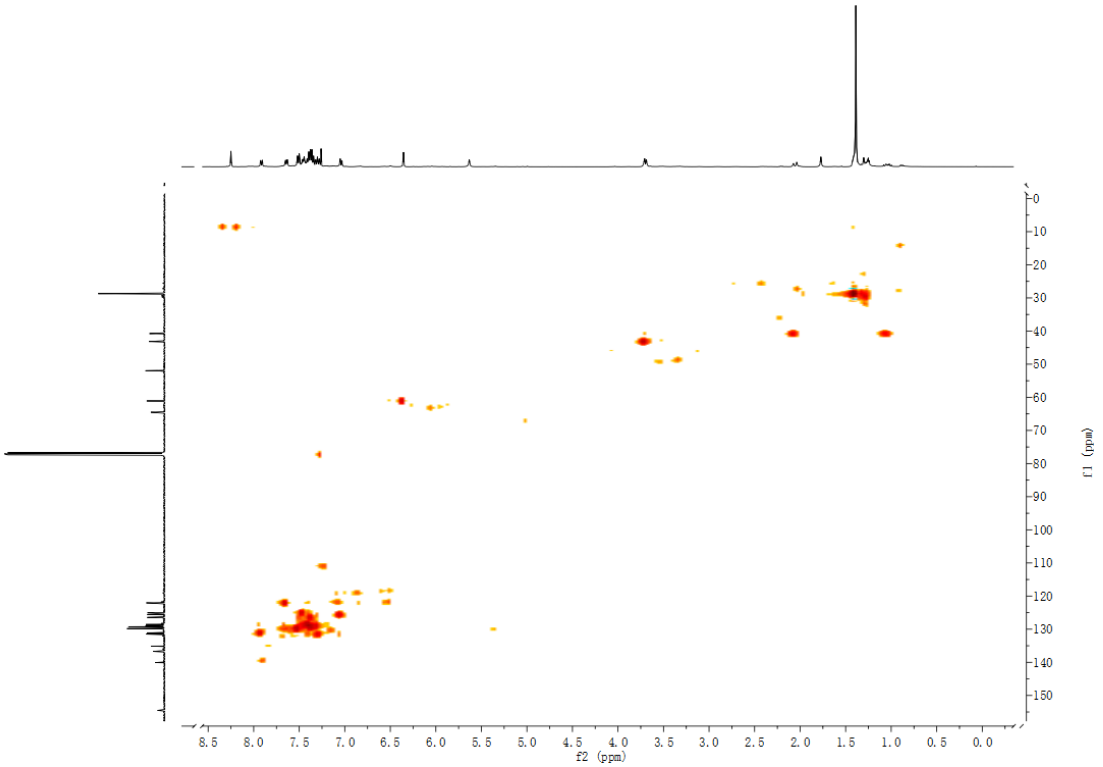
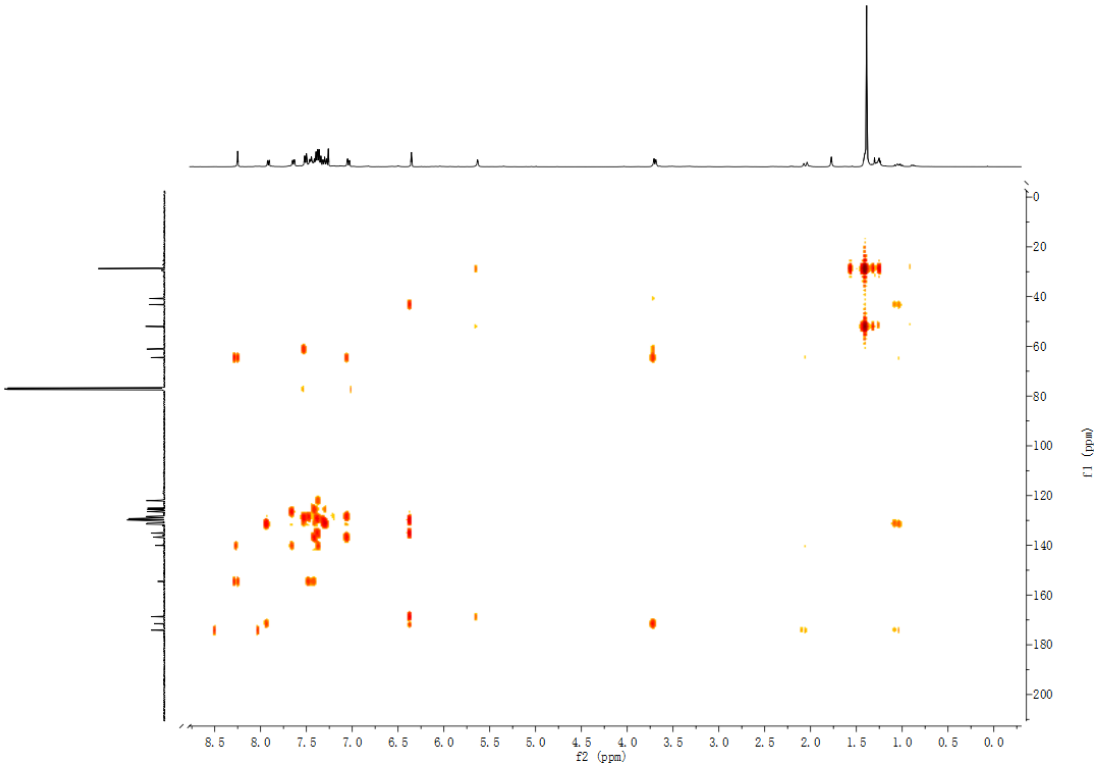
f1 (ppm)

HSQC

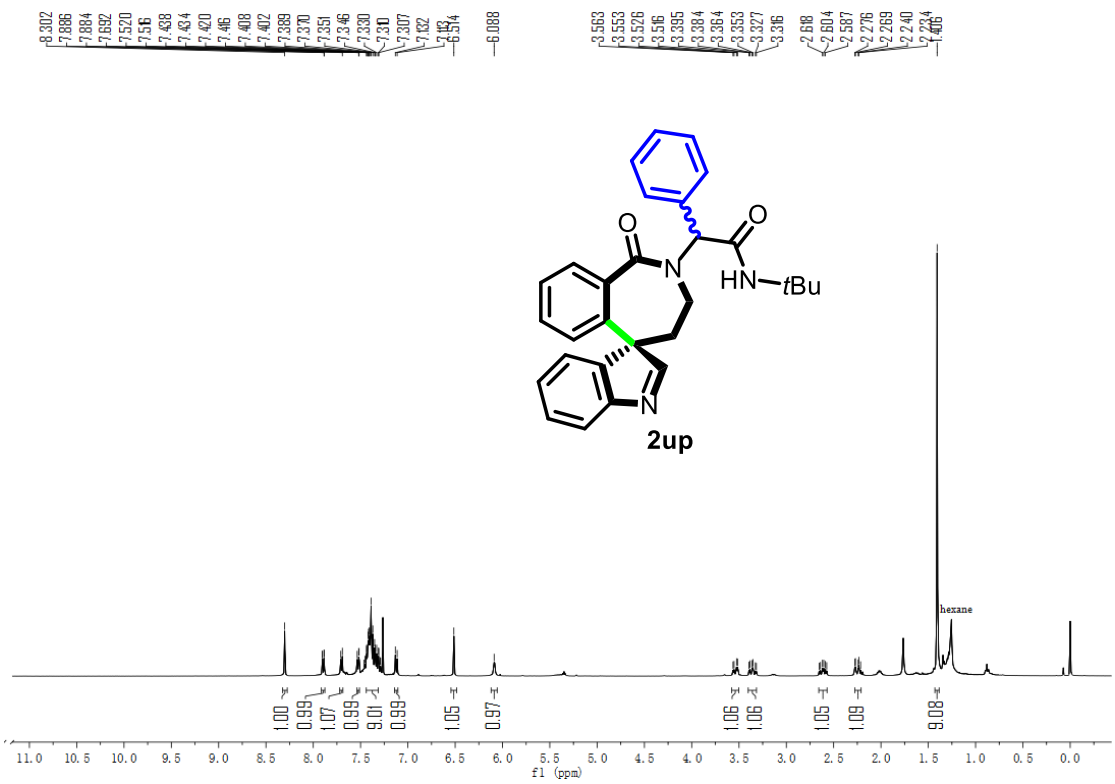

0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
f1 (ppm)
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f2 (ppm)

HMBC

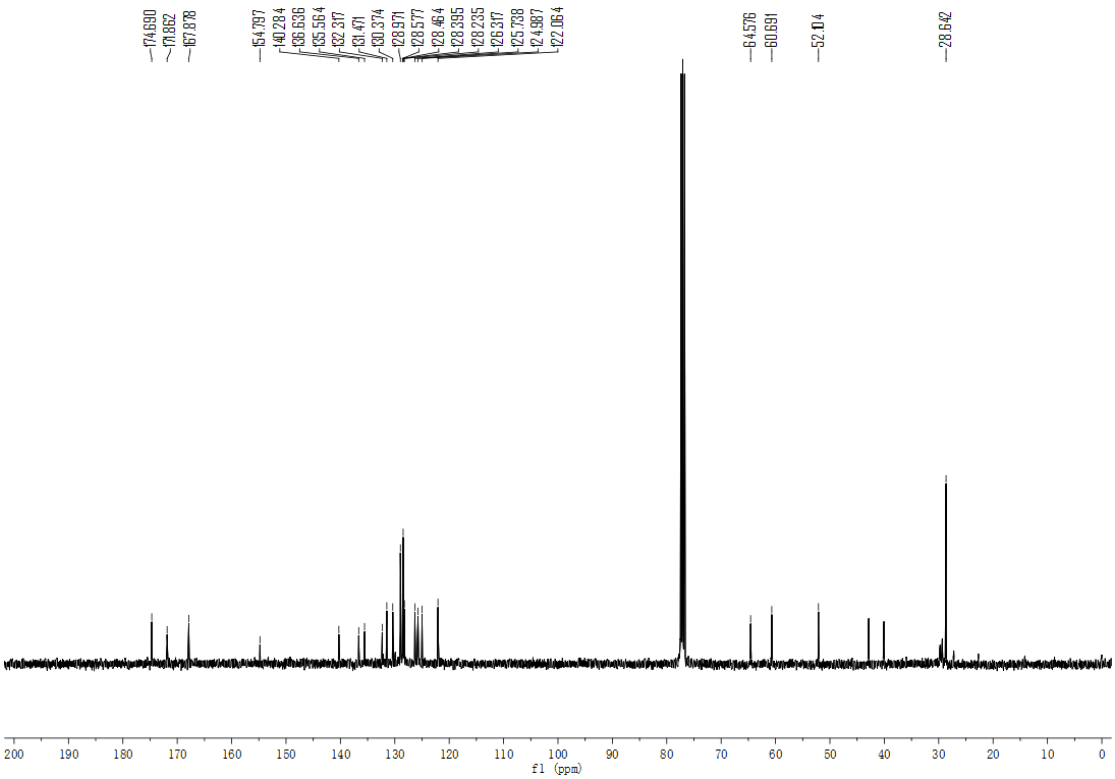


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (2up)

^{1}H NMR (400 MHz, $CDCl_3$):



^{13}C NMR (100 MHz, $CDCl_3$):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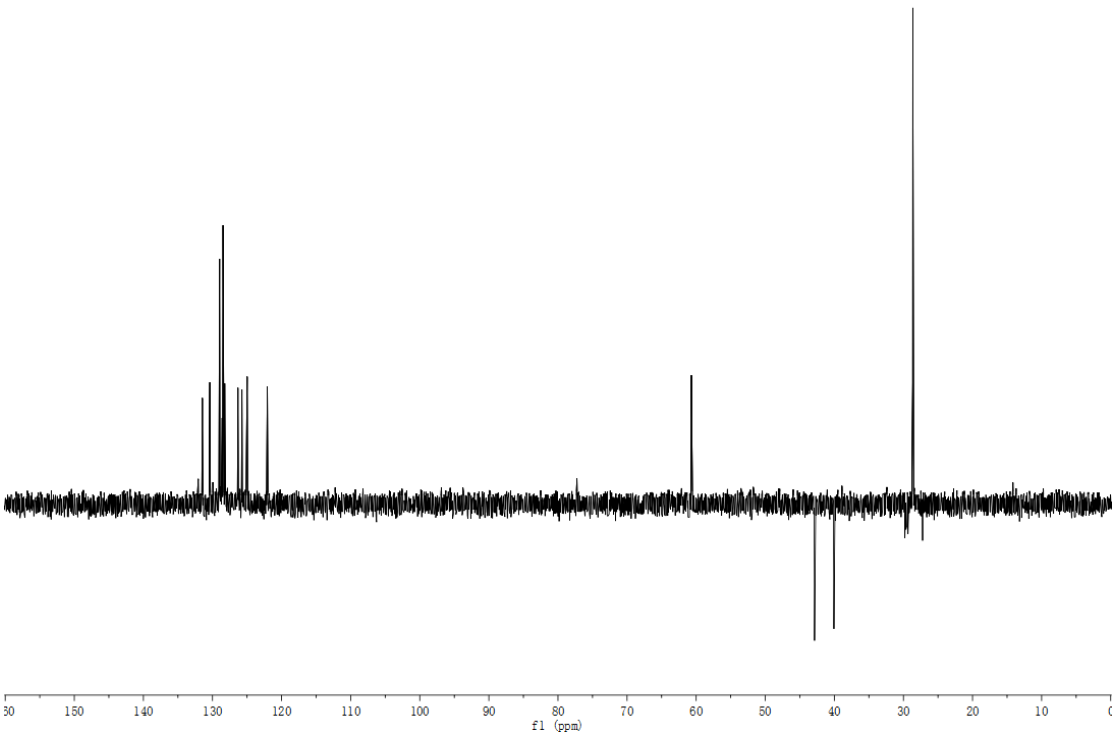
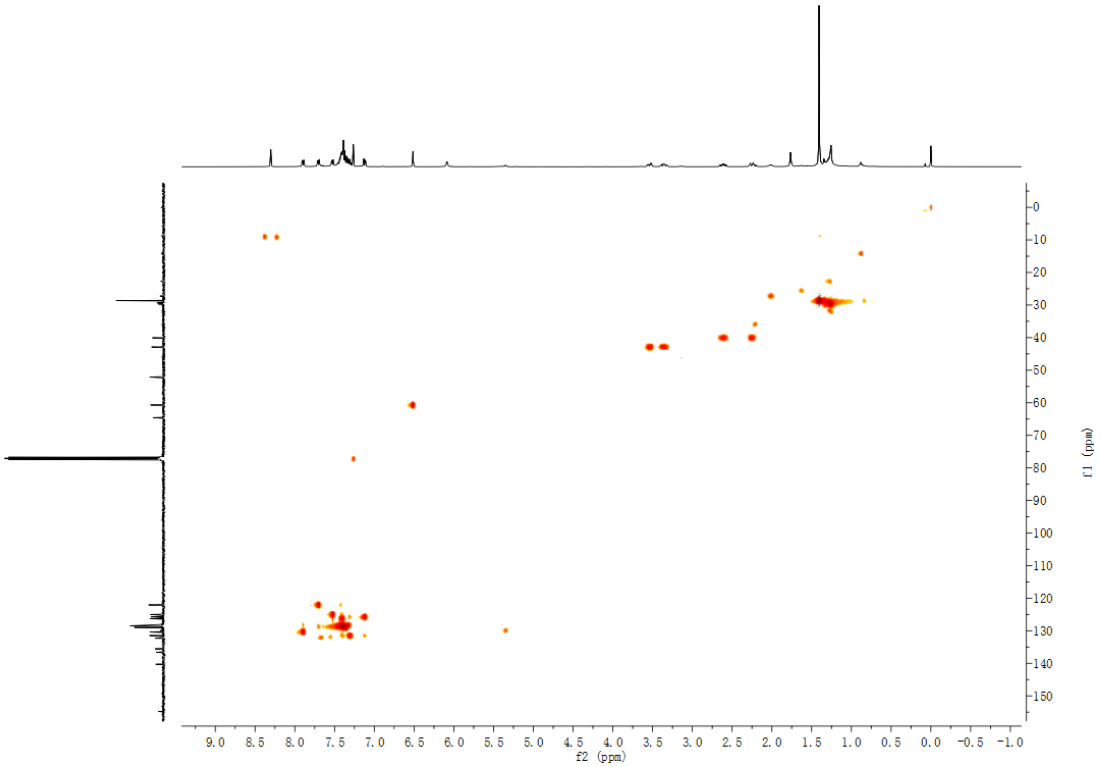
28.6442
f1 (ppm)

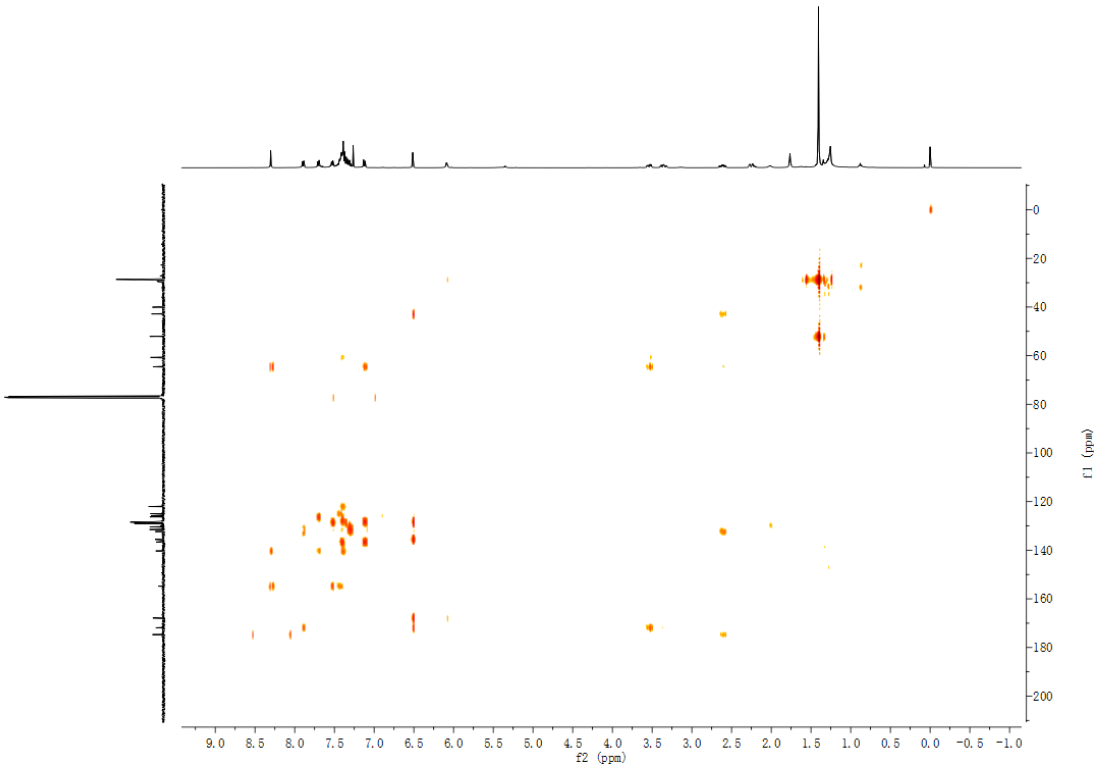
DEPT


f1 (ppm)

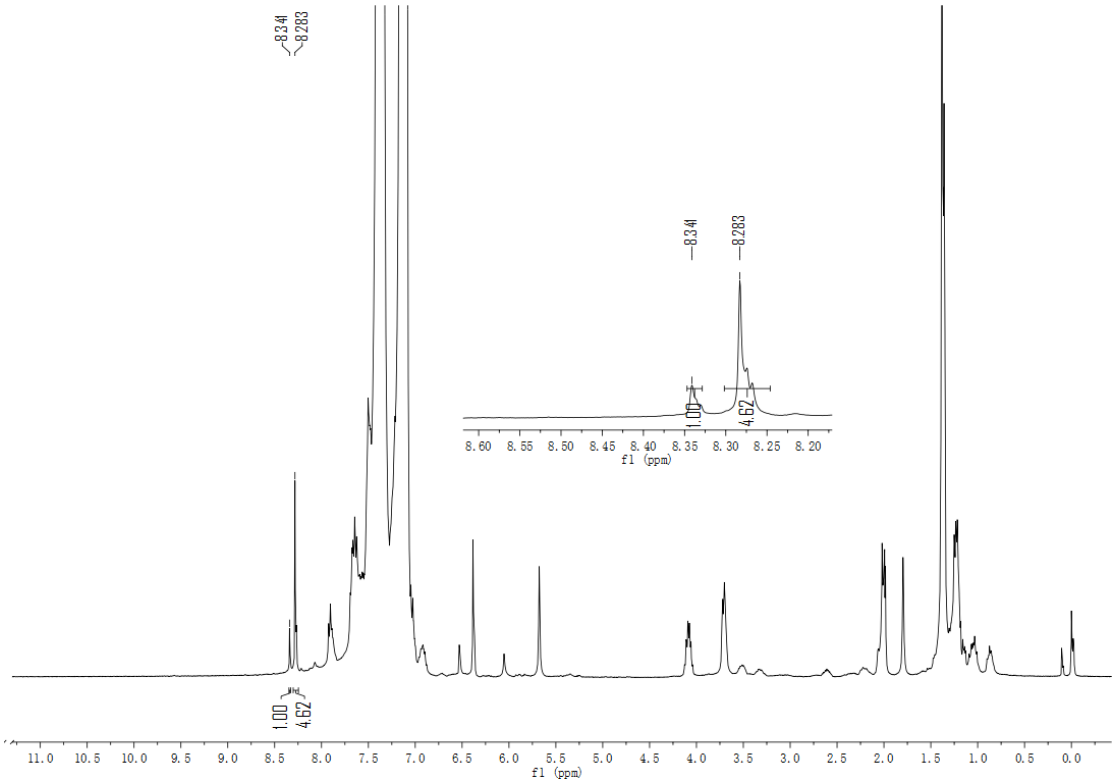
HSQC



HMBC

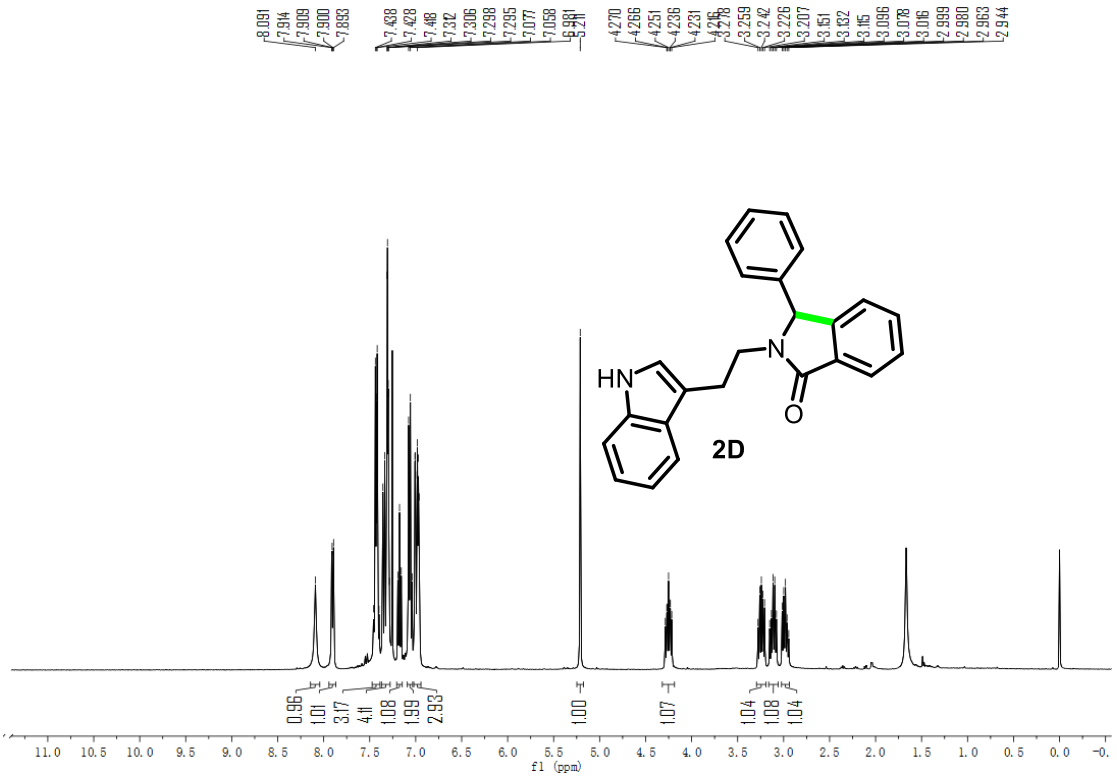


2 crude ^{1}H NMR

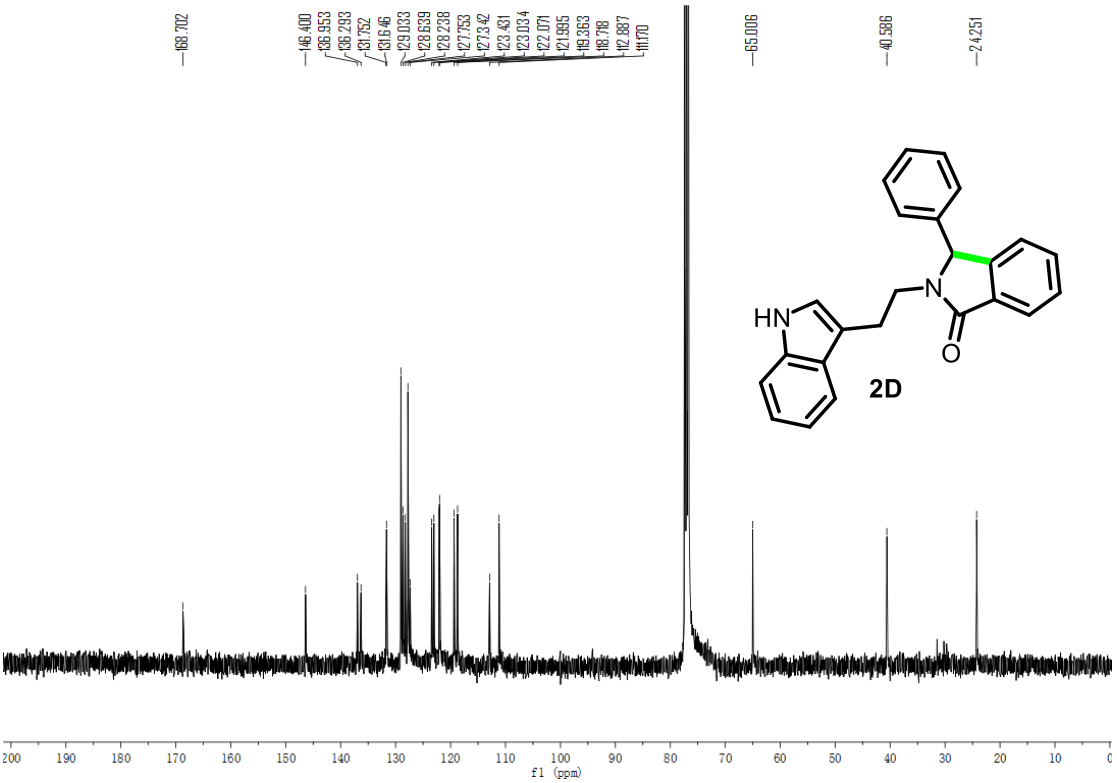


2-(2-(1H-indol-3-yl)ethyl)-3-phenylisoindolin-1-one (2D)

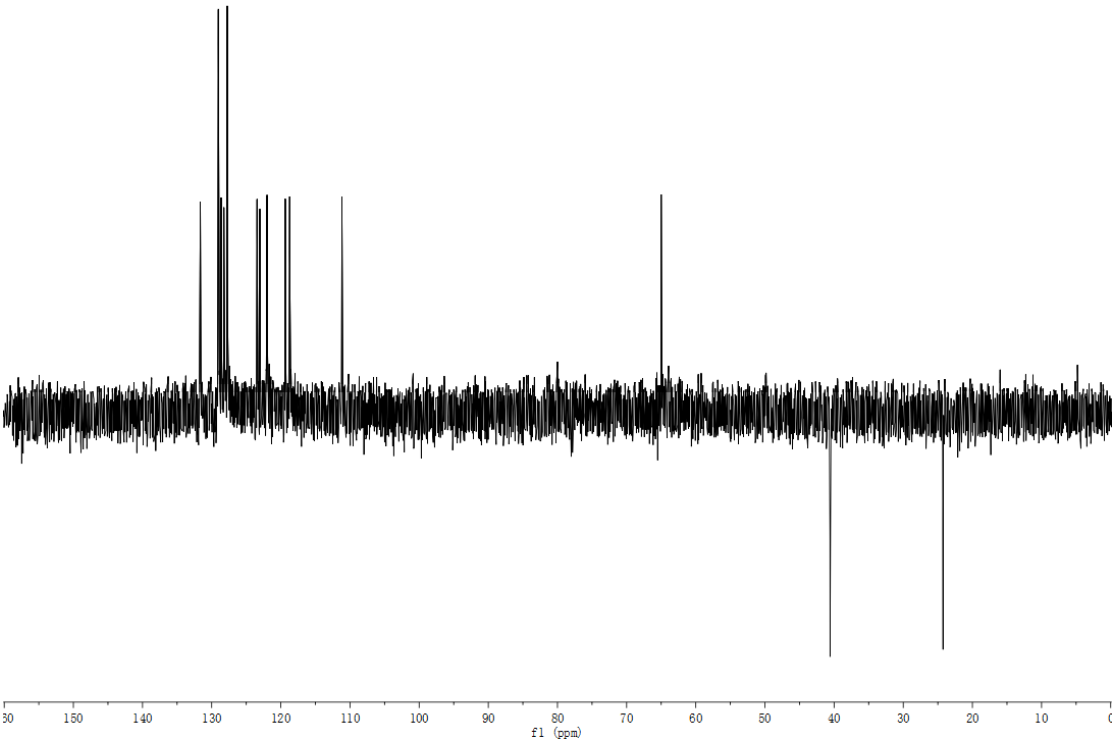
^{1}H NMR of 2D (400 MHz, $CDCl_3$):



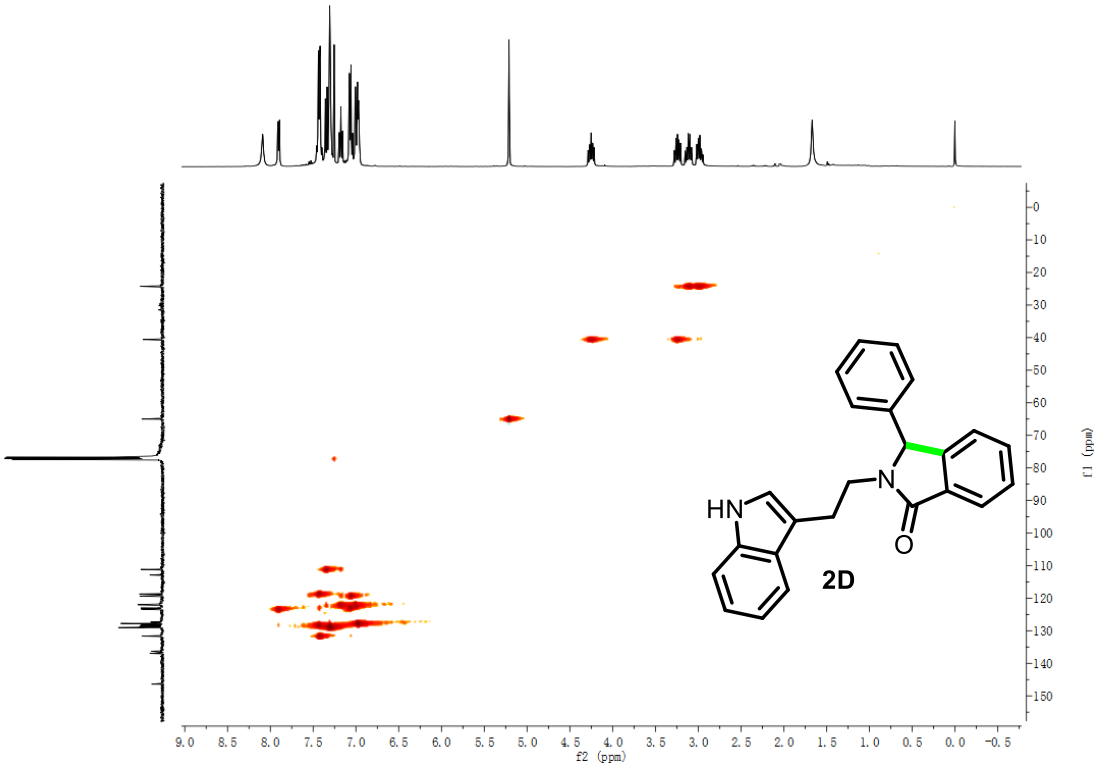
^{13}C NMR of 2D (100 MHz, $CDCl_3$):



DEPT of 2D



HSQC of 2D:



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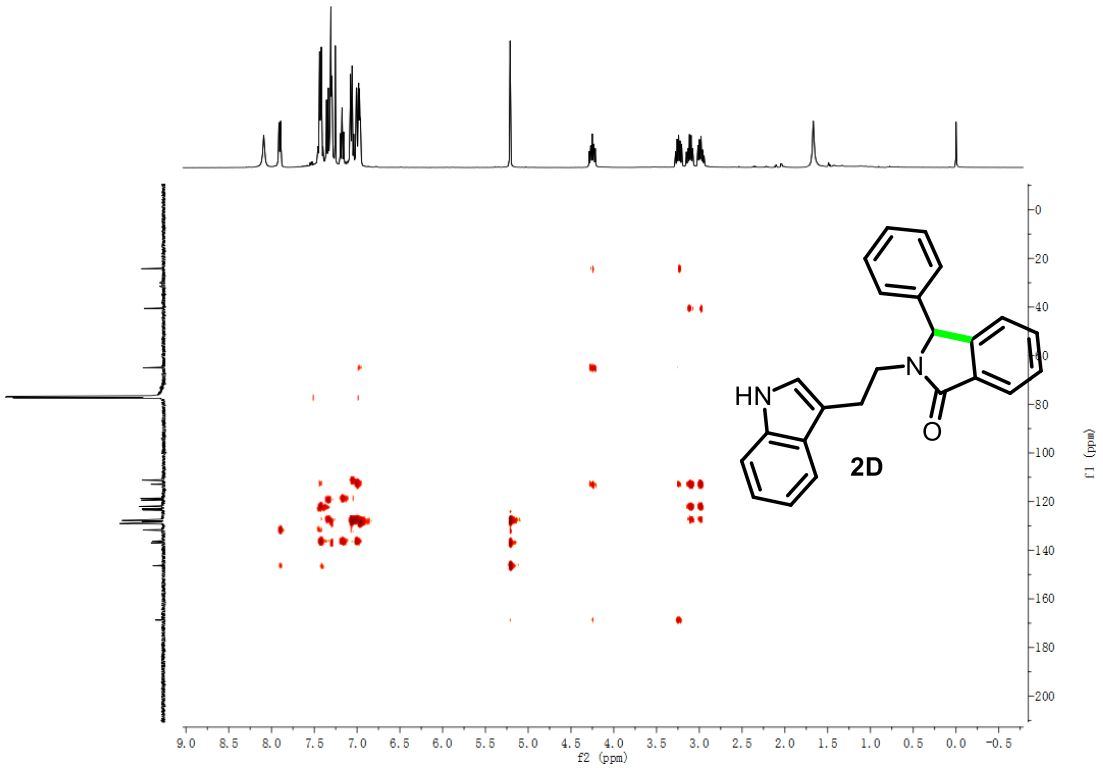
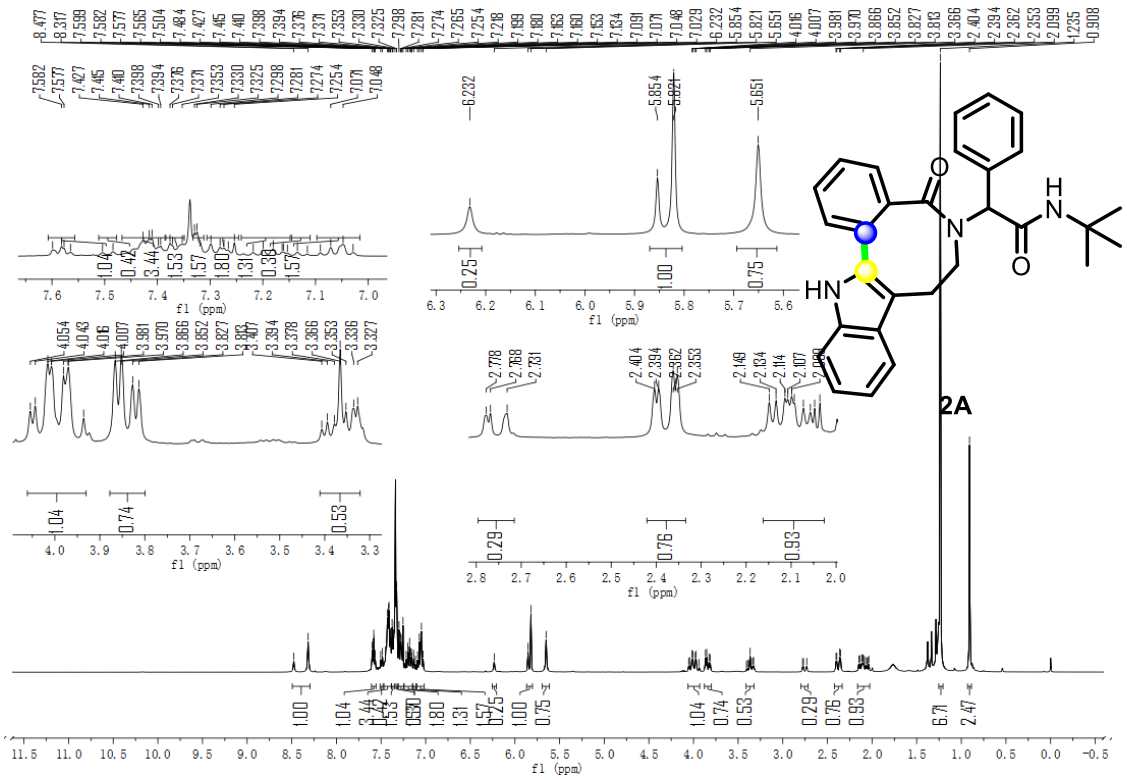
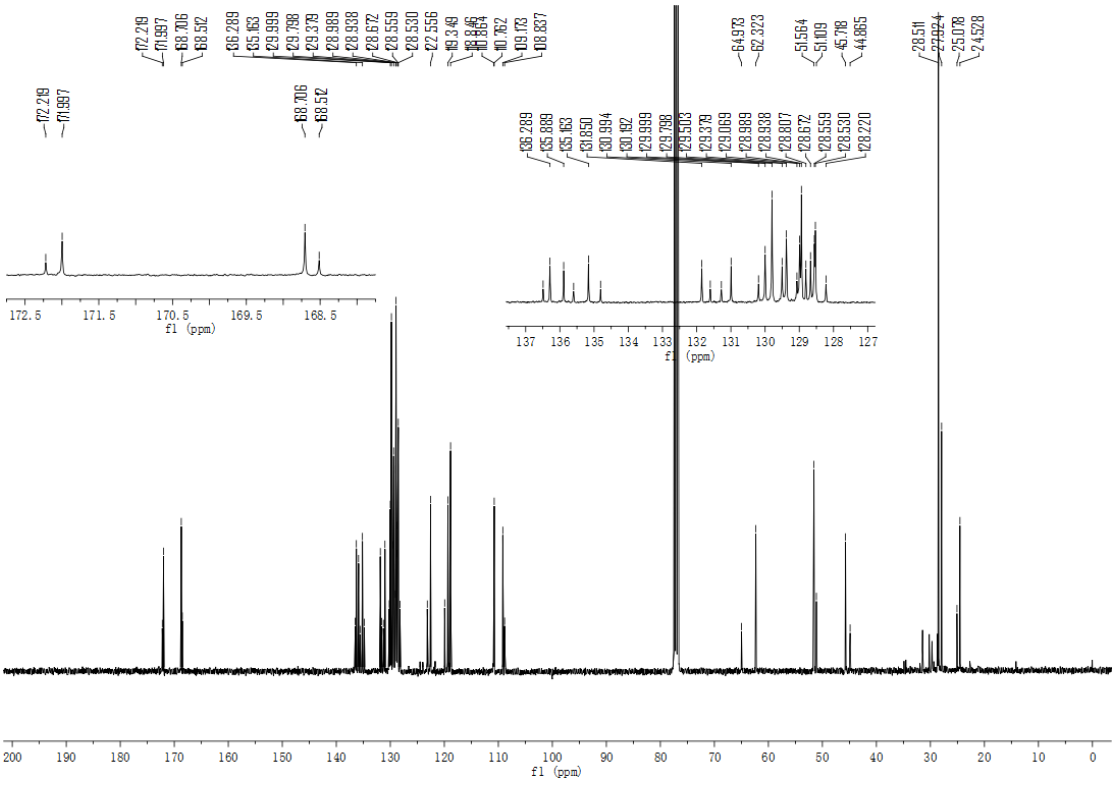


N-(tert-butyl)-2-(5-oxo-5,7,8,13-tetrahydro-6H-benzo[6,7]azocino[5,4-b]indol-6-yl)-2-phenylacetamide (2A)

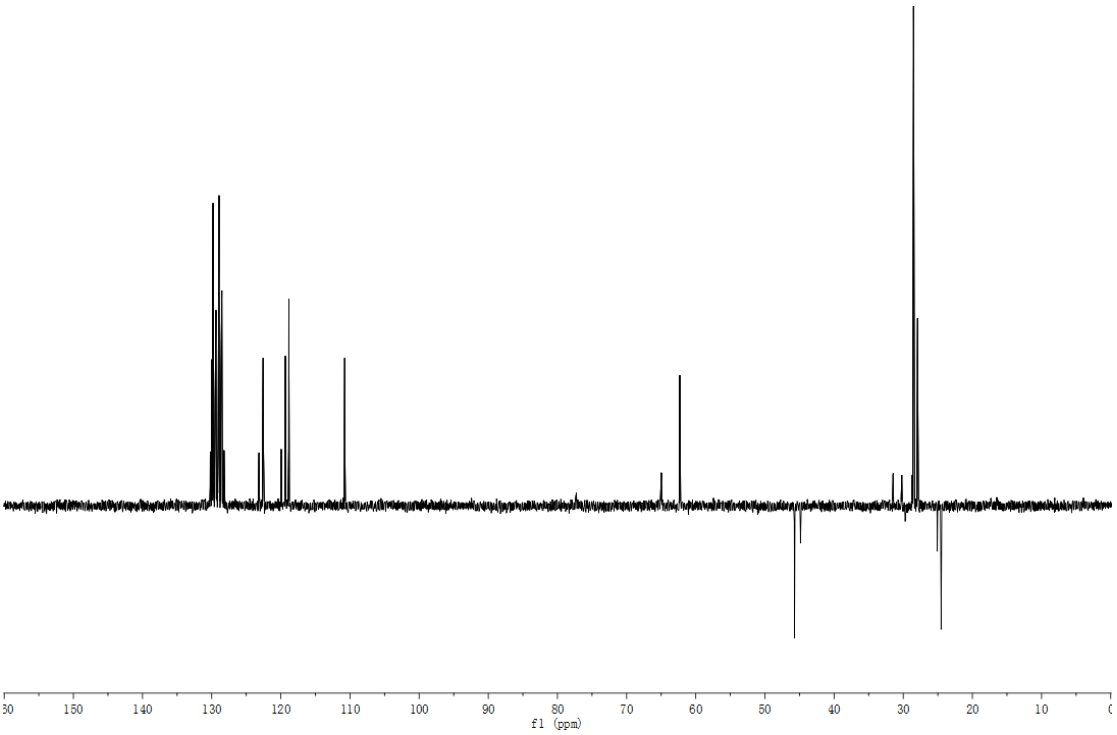
^{1}H NMR of 2A (400 MHz, $CDCl_3$):



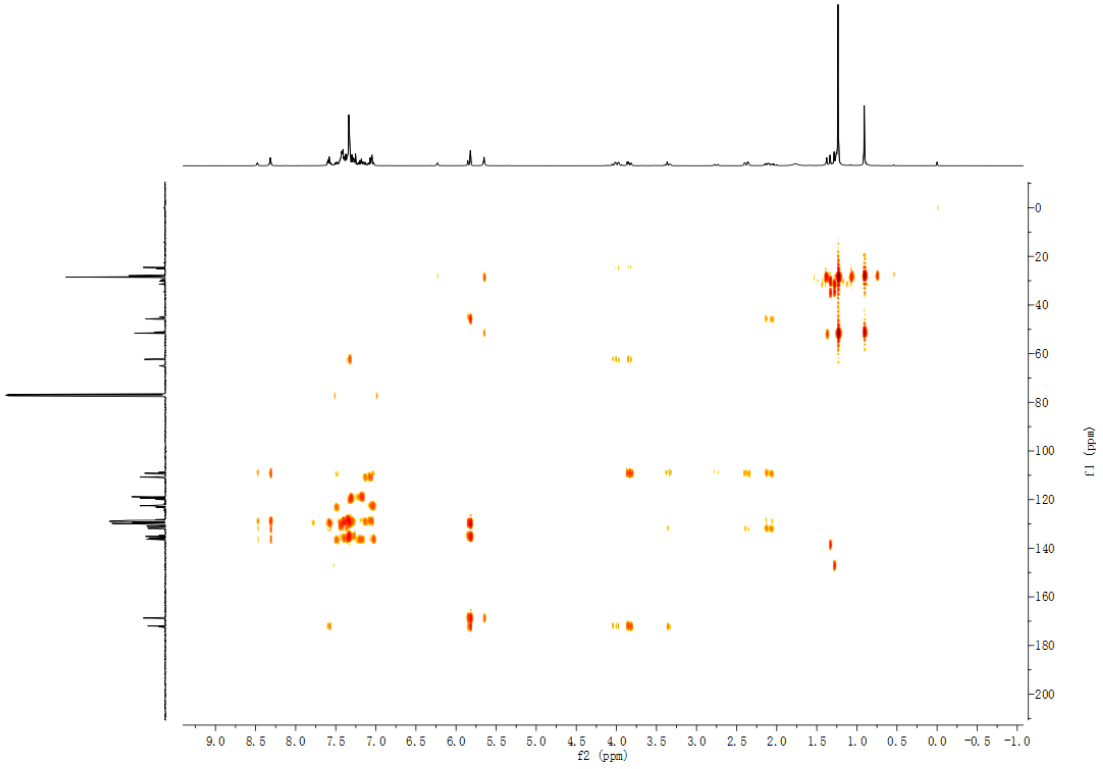
^{13}C NMR of 2A (100 MHz, $CDCl_3$):



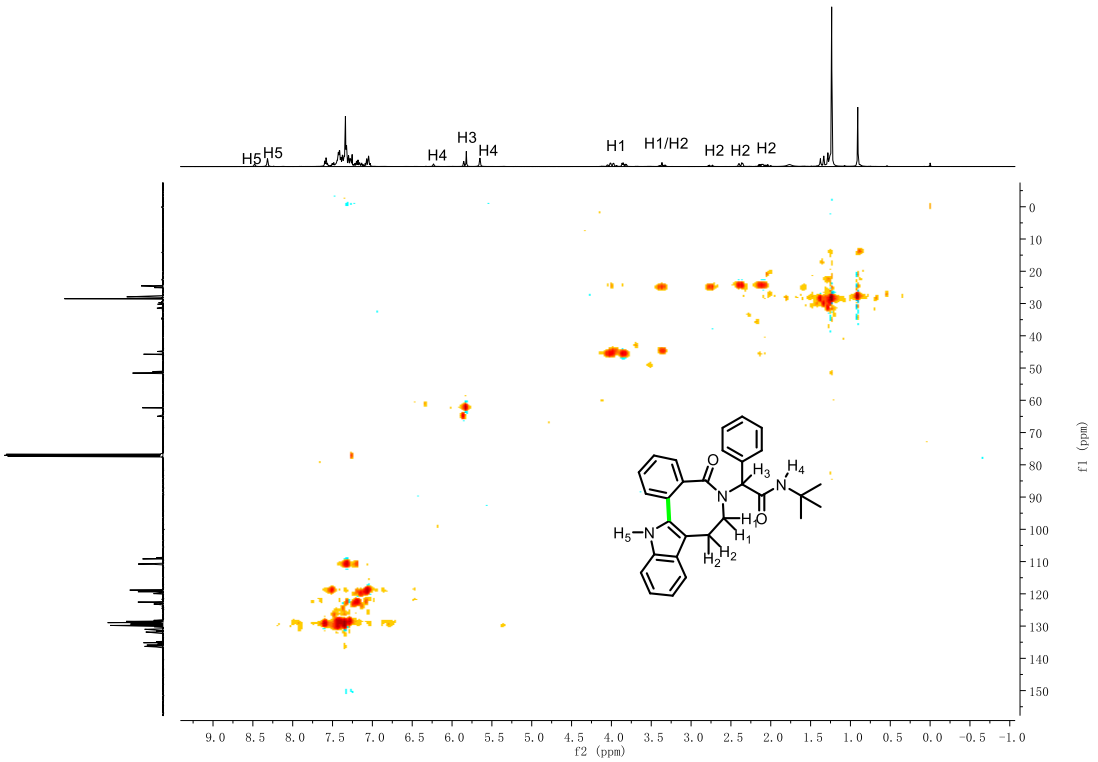
DEPT of 2A:



HMBC of 2A:

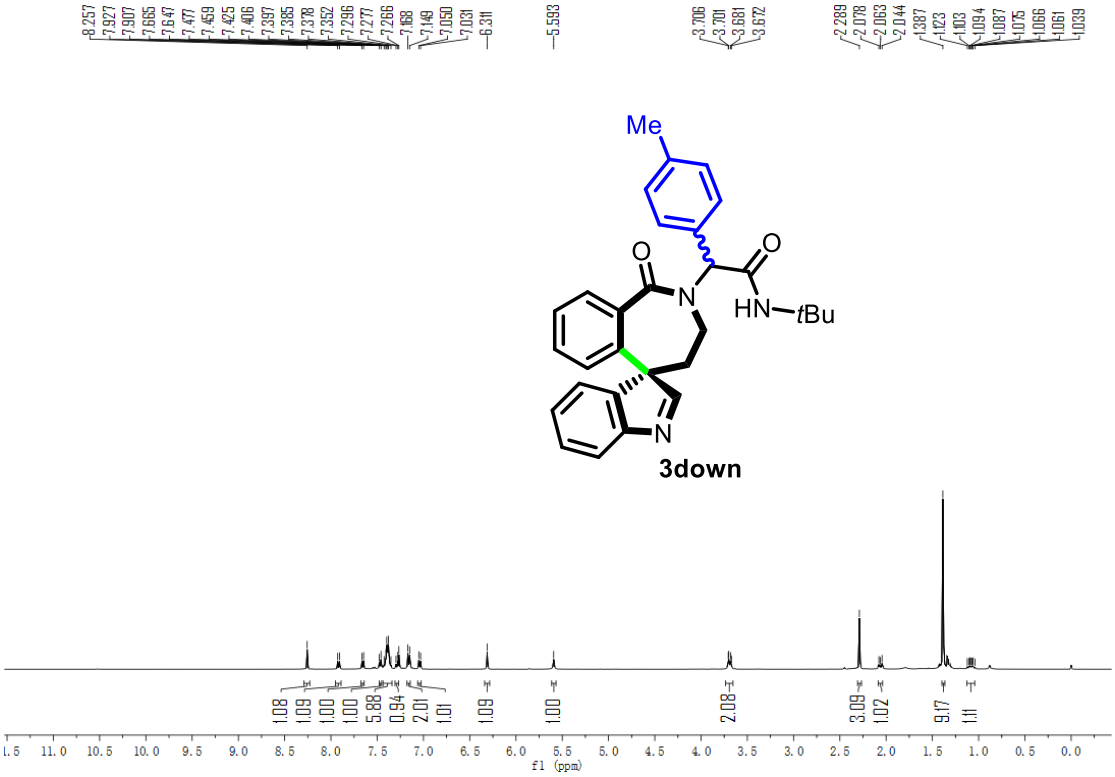


HSQC of 2A:

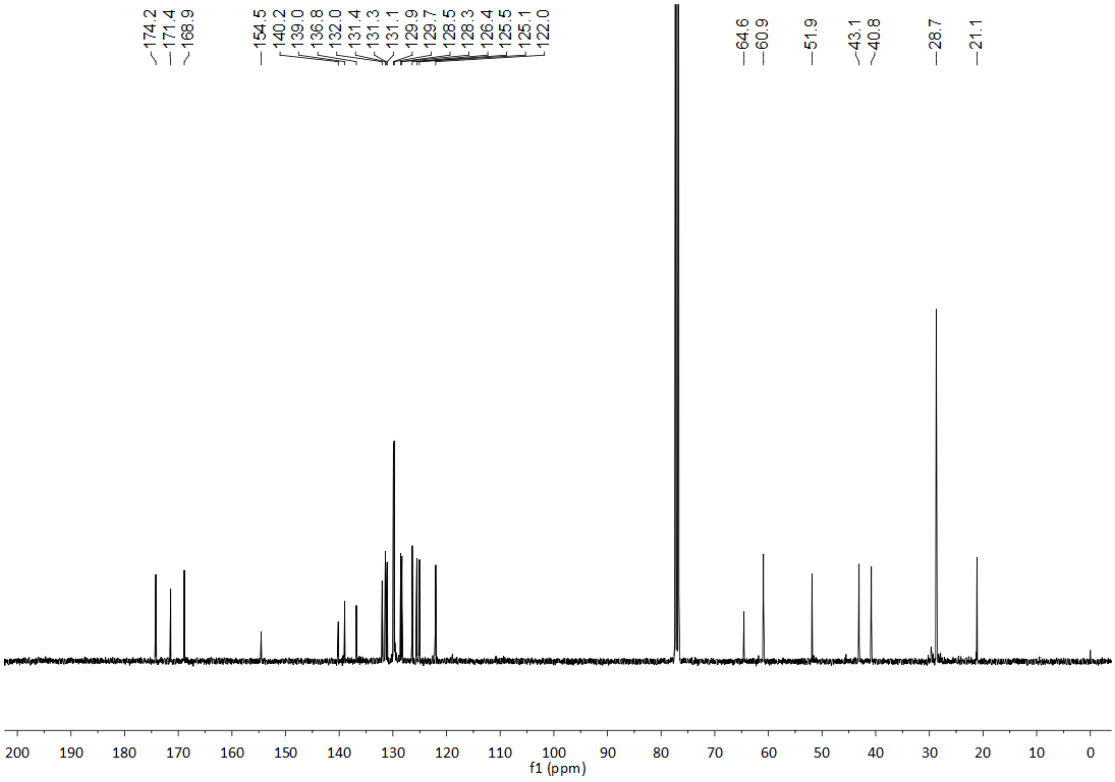


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(p-tolyl)acetamide (3down)

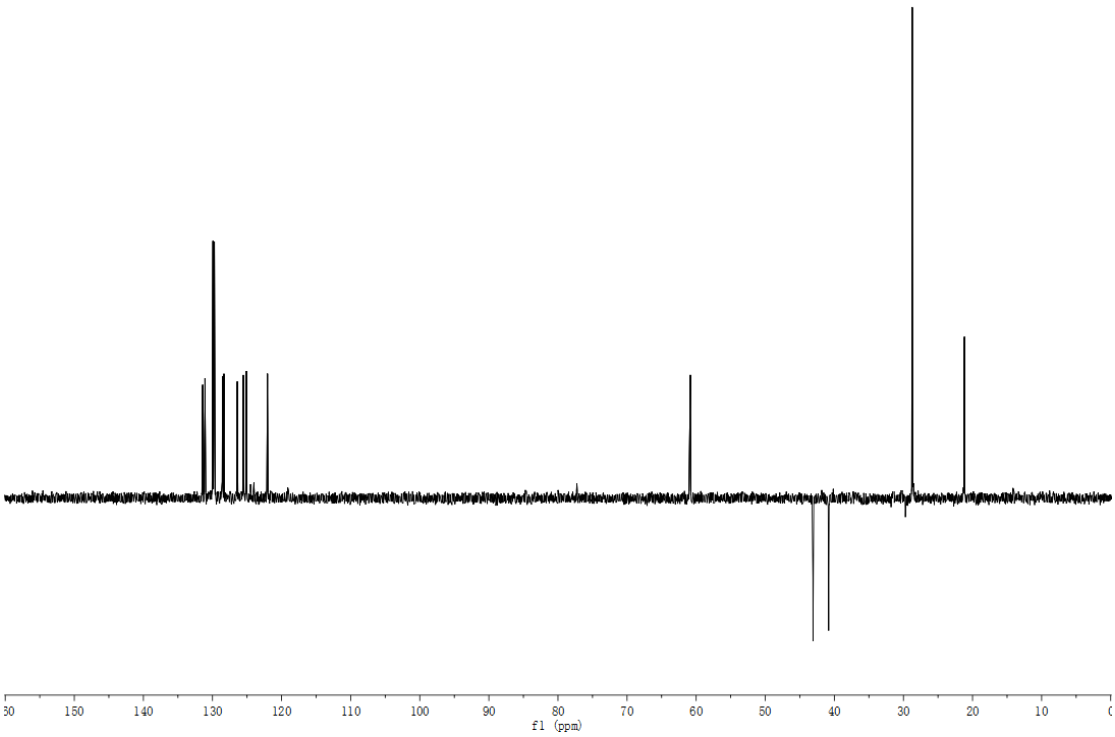
^{1}H NMR (400 MHz, $CDCl_3$):



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

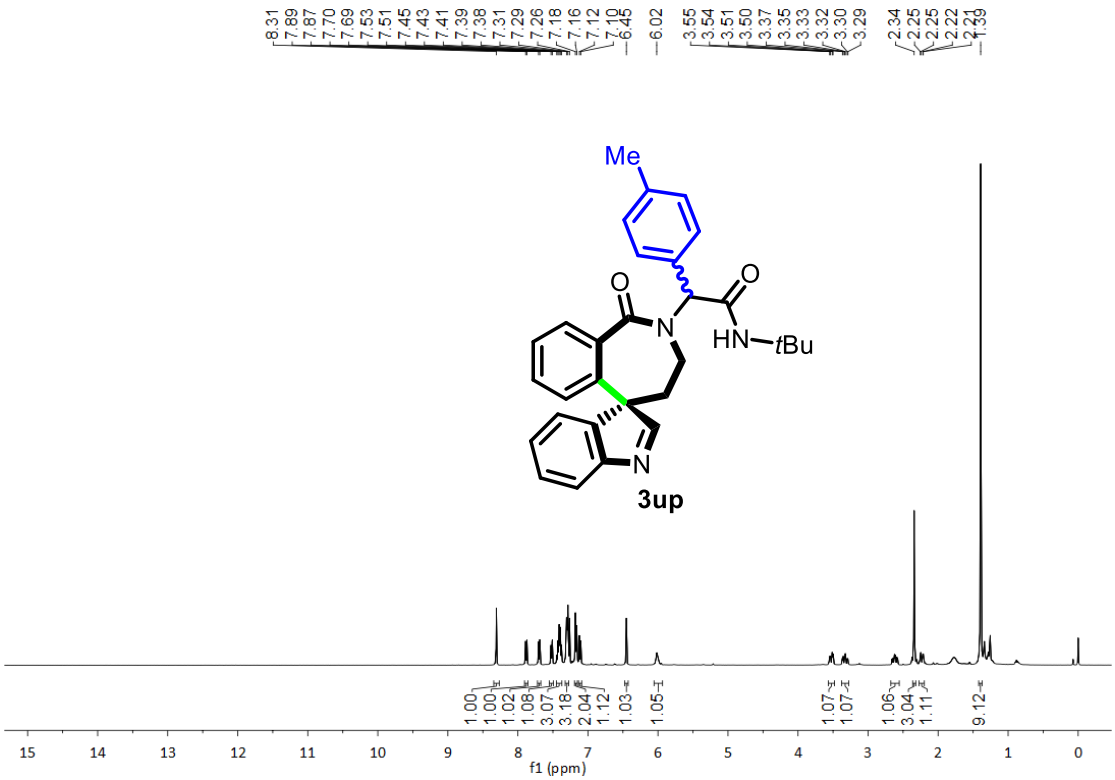


DEPT

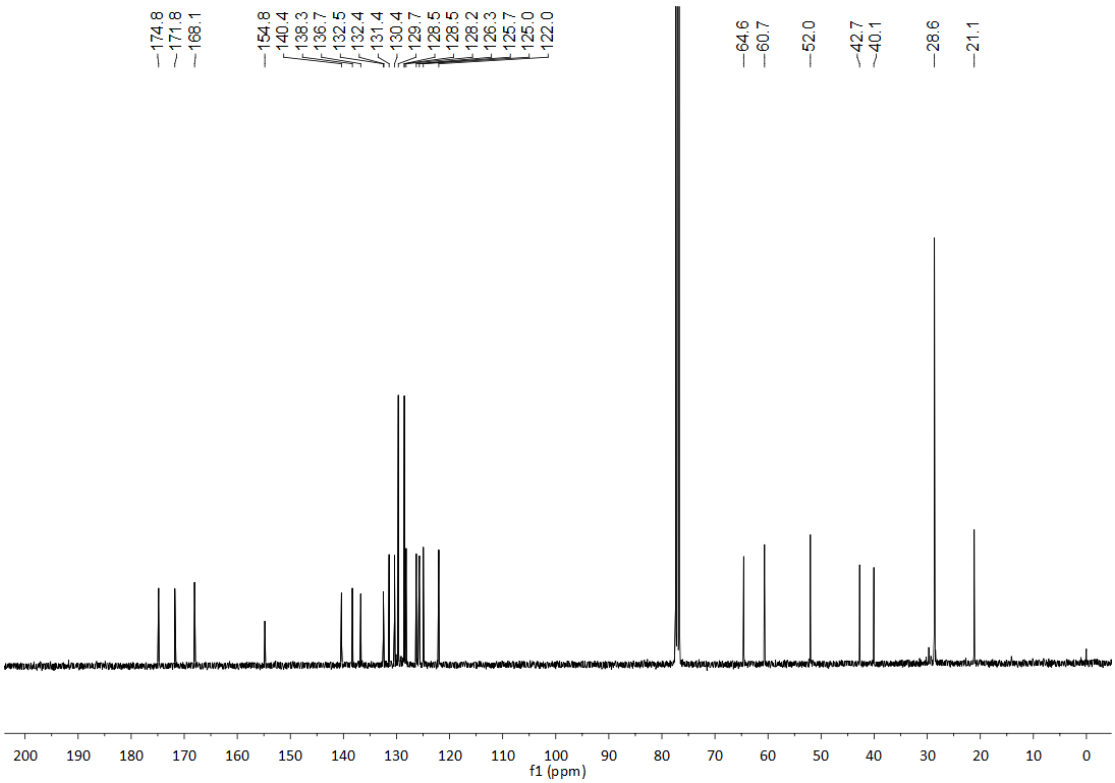


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(p-tolyl)acetamide (3up)

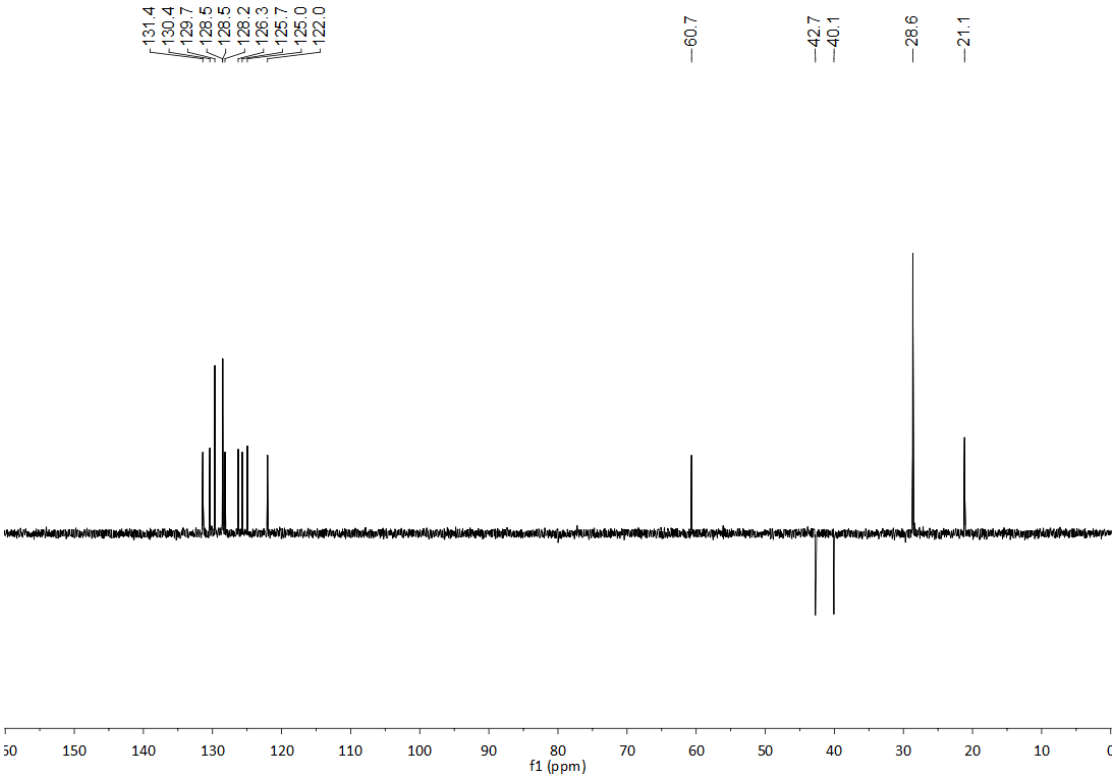
^{1}H NMR (400 MHz, $CDCl_3$):



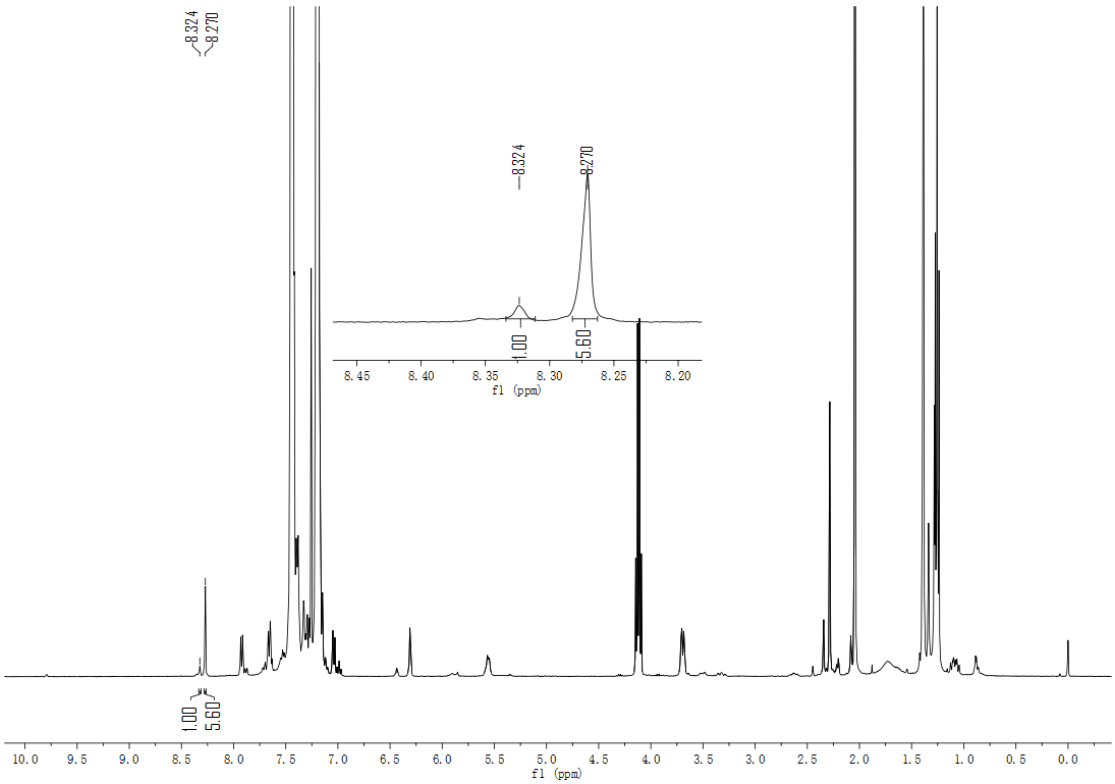
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

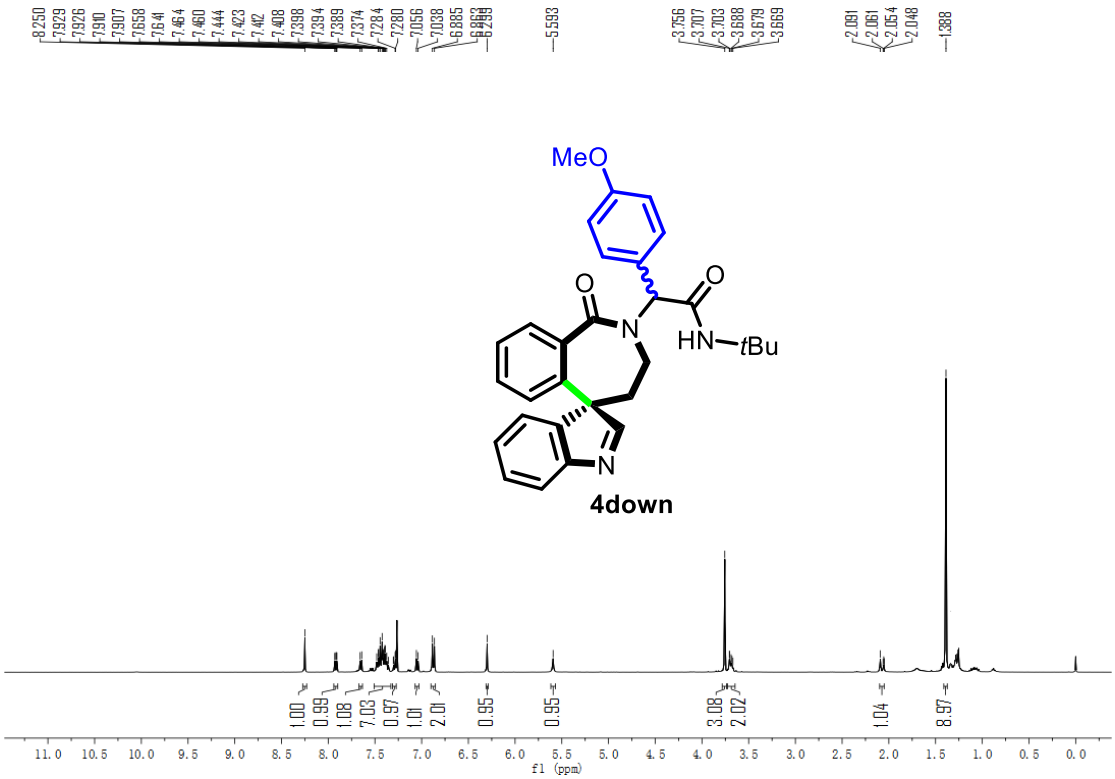


3 crude ^{1}H NMR

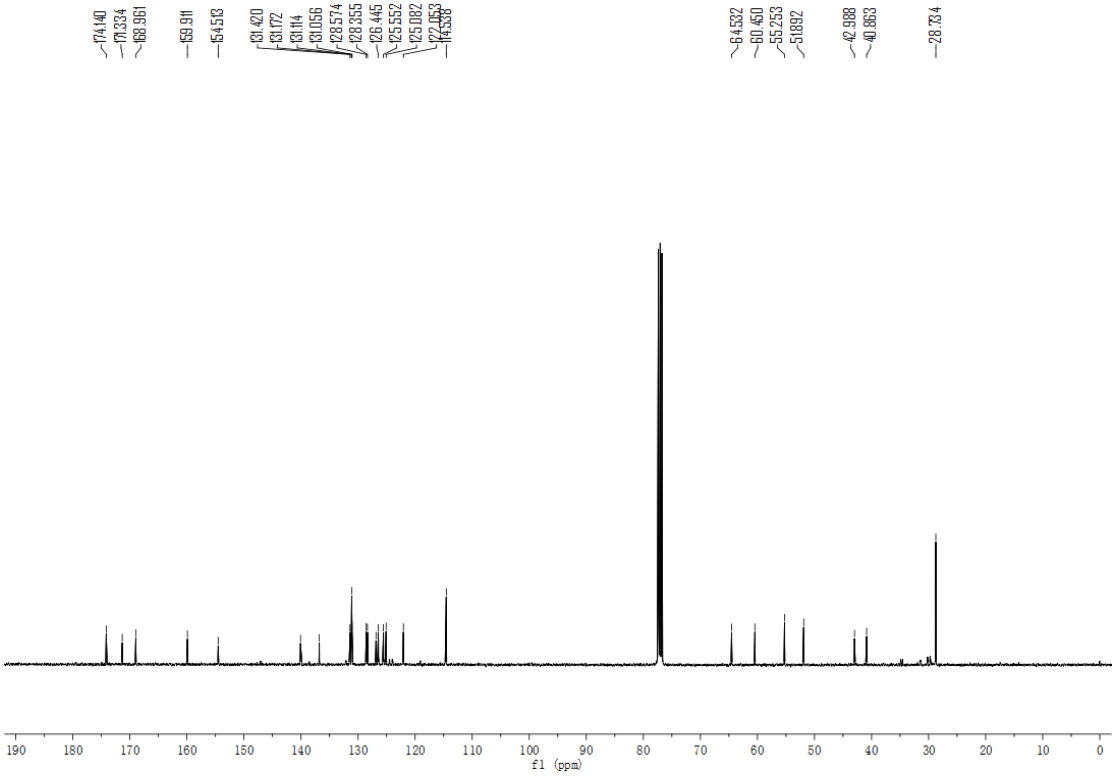


N-(tert-butyl)-2-(4-methoxyphenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (4down)

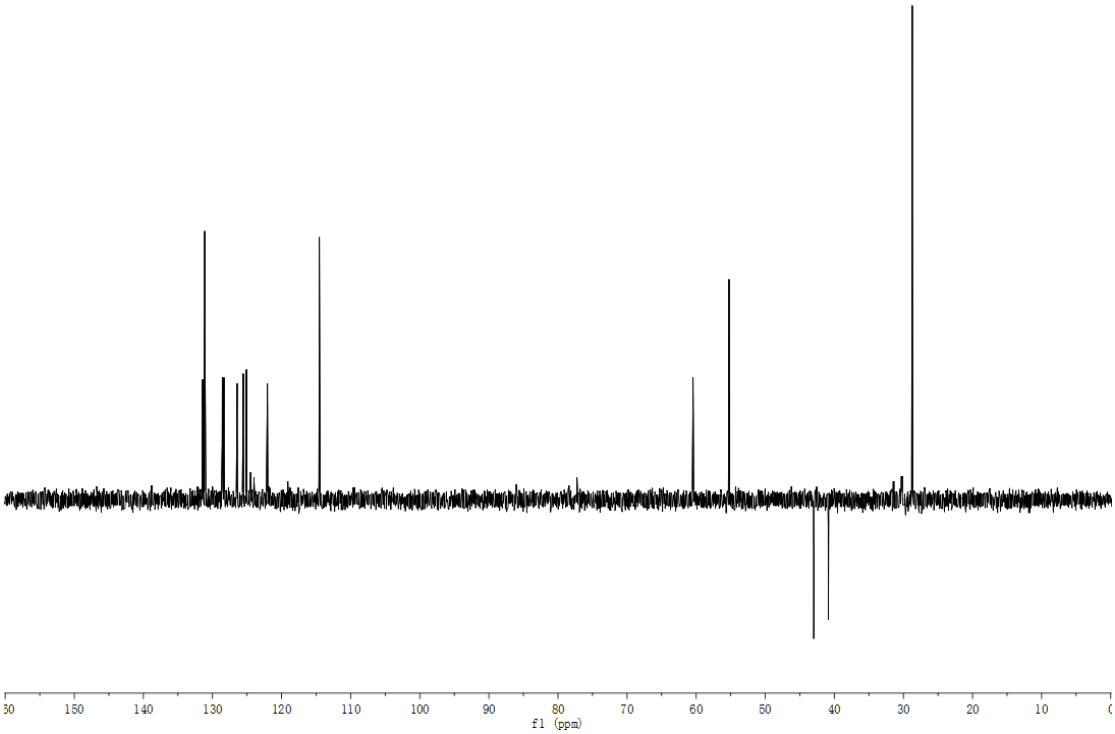
^{1}H NMR (400 MHz, $CDCl_3$)：



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

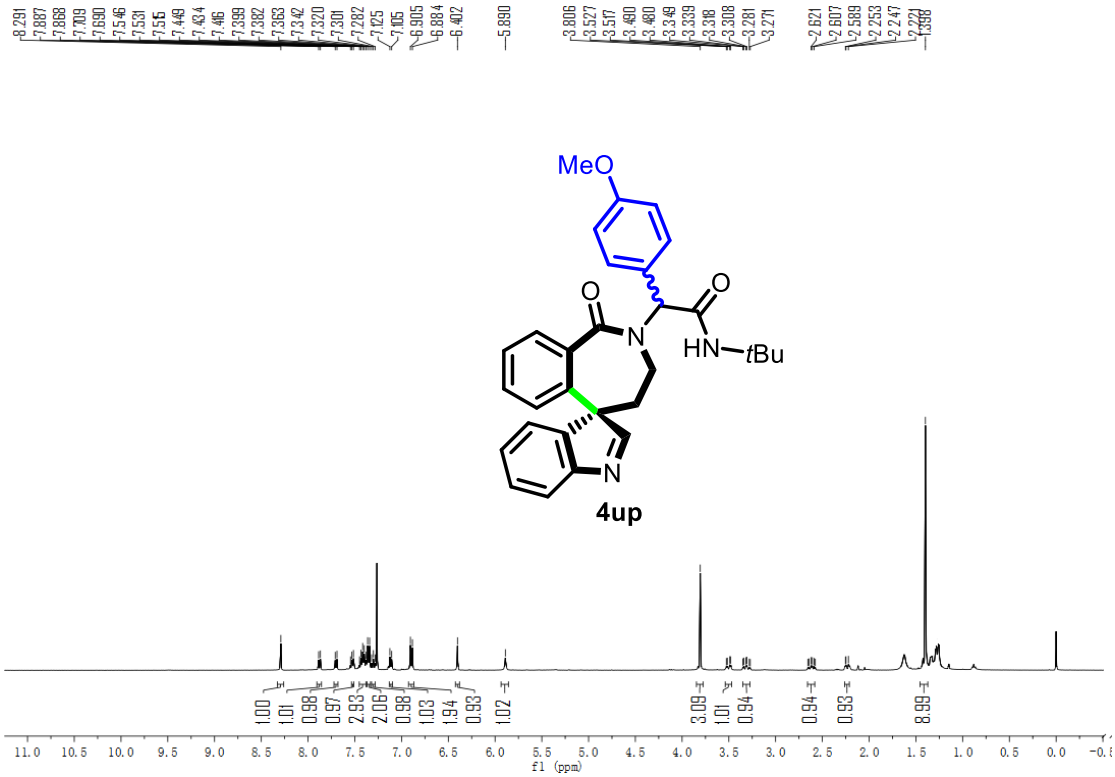


Dept

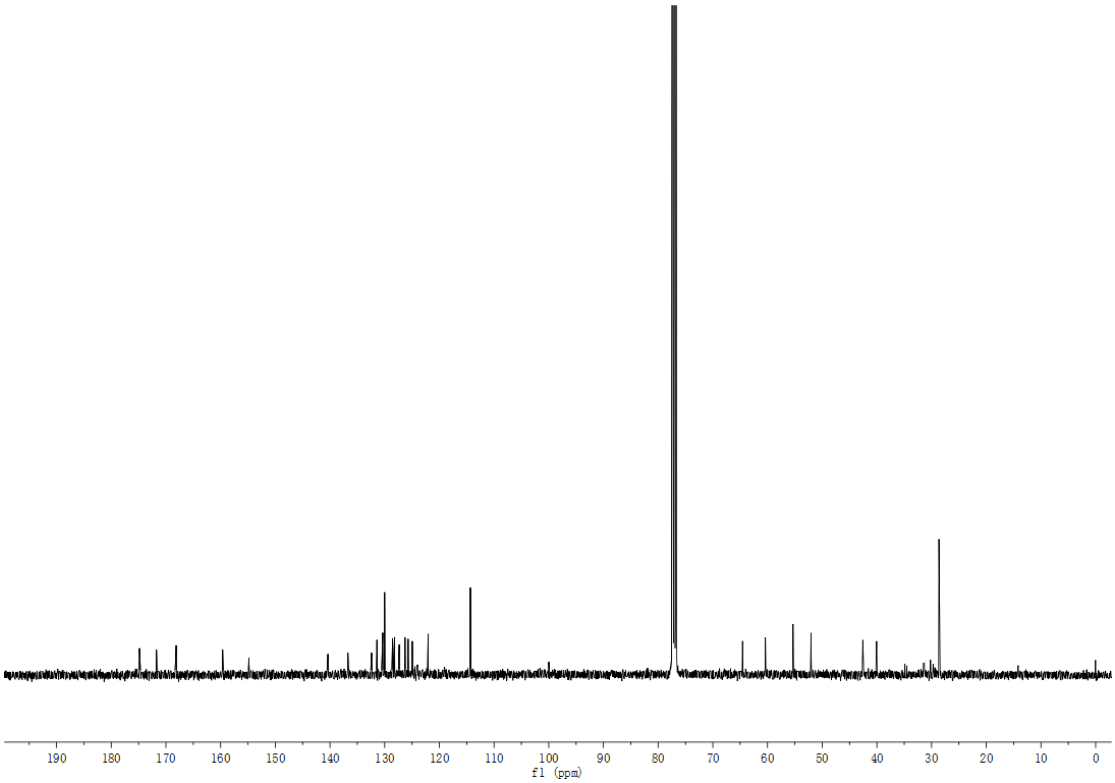


N-(tert-butyl)-2-(4-methoxyphenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (4up)

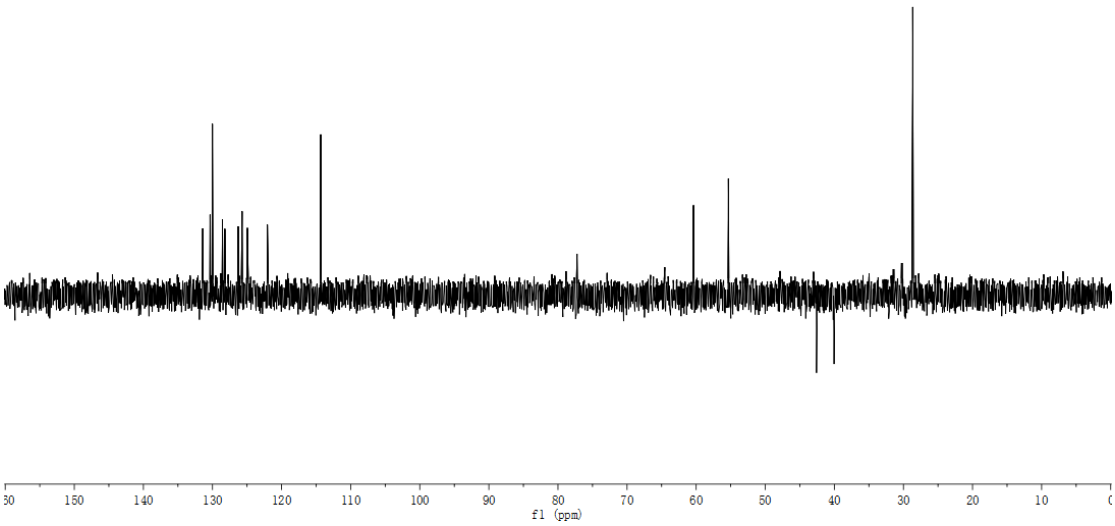
^{1}H NMR (400 MHz, $CDCl_3$):



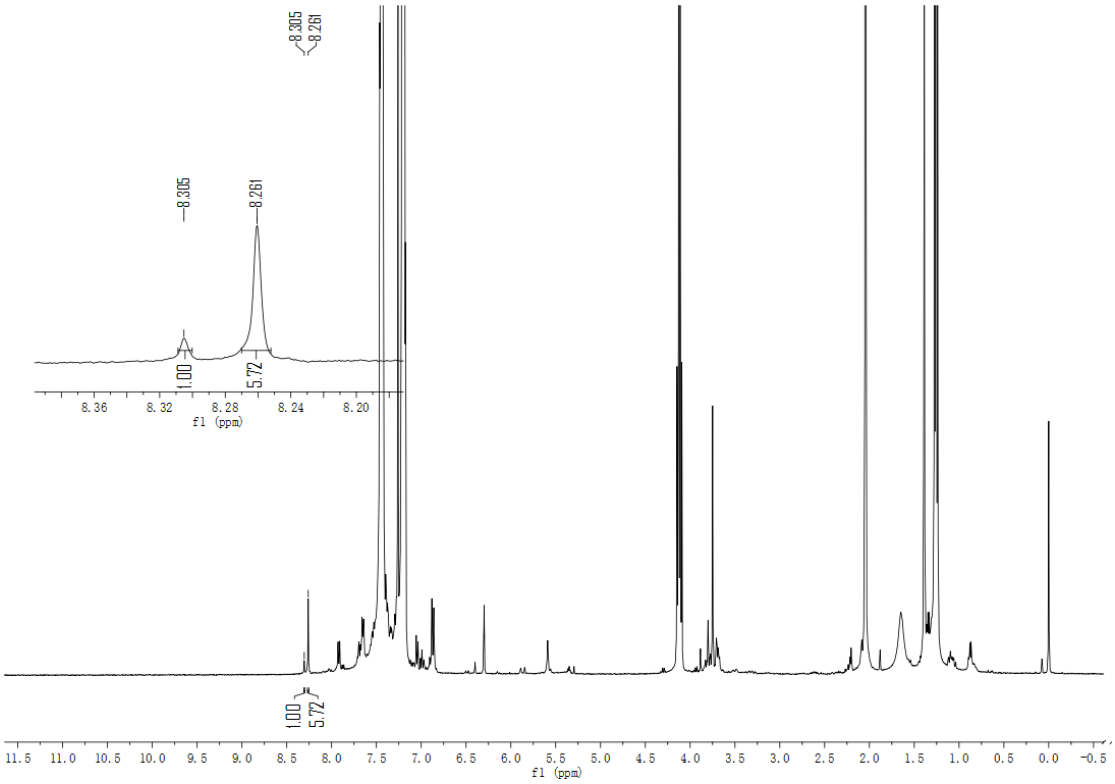
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

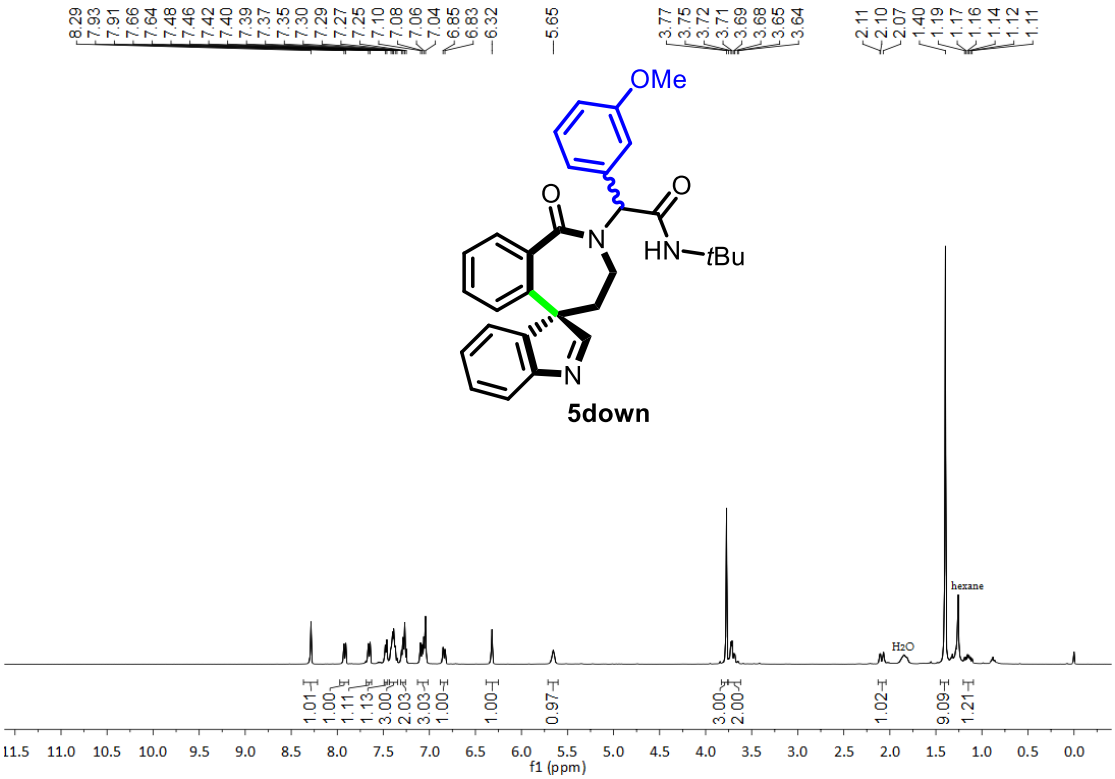


4 crude ^{1}H NMR

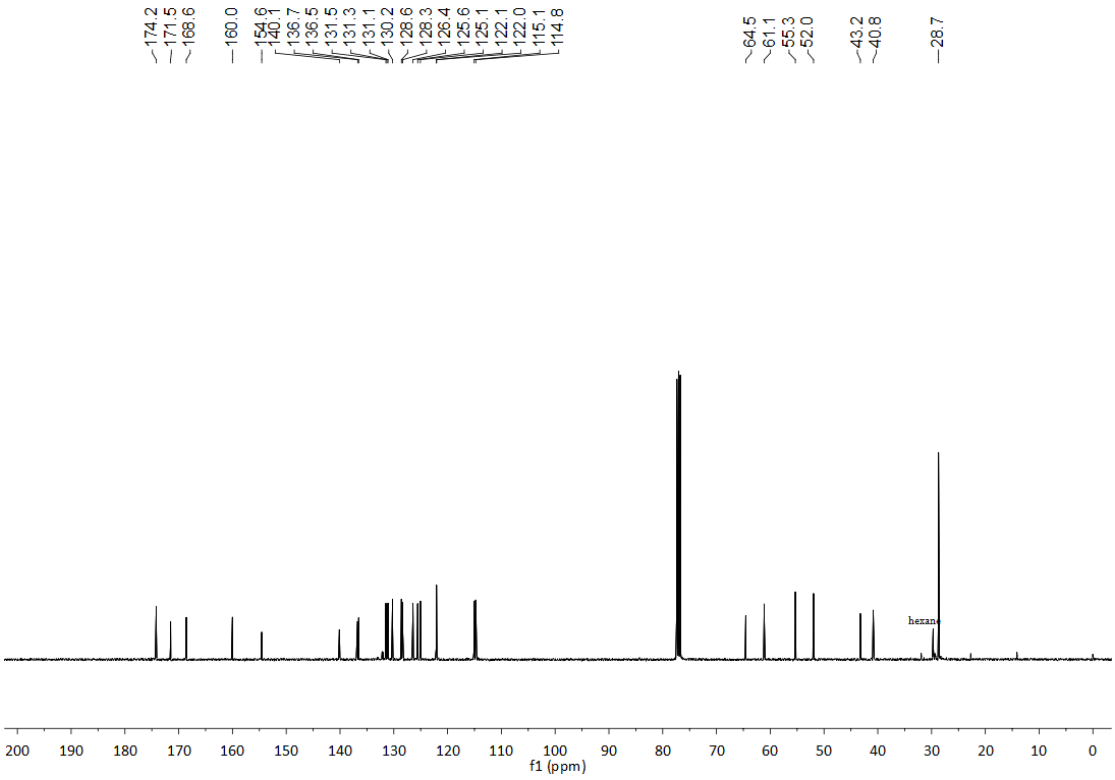


N-(tert-butyl)-2-(3-methoxyphenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (5down)

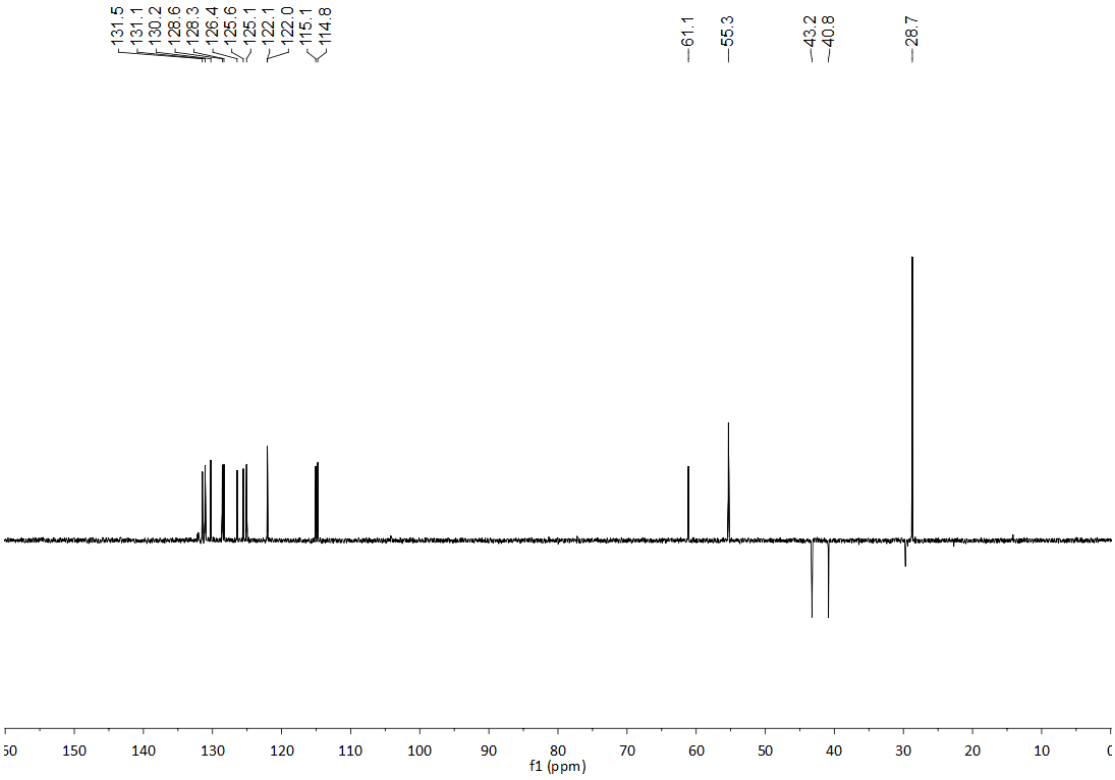
^{1}H NMR (400 MHz, $CDCl_3$):



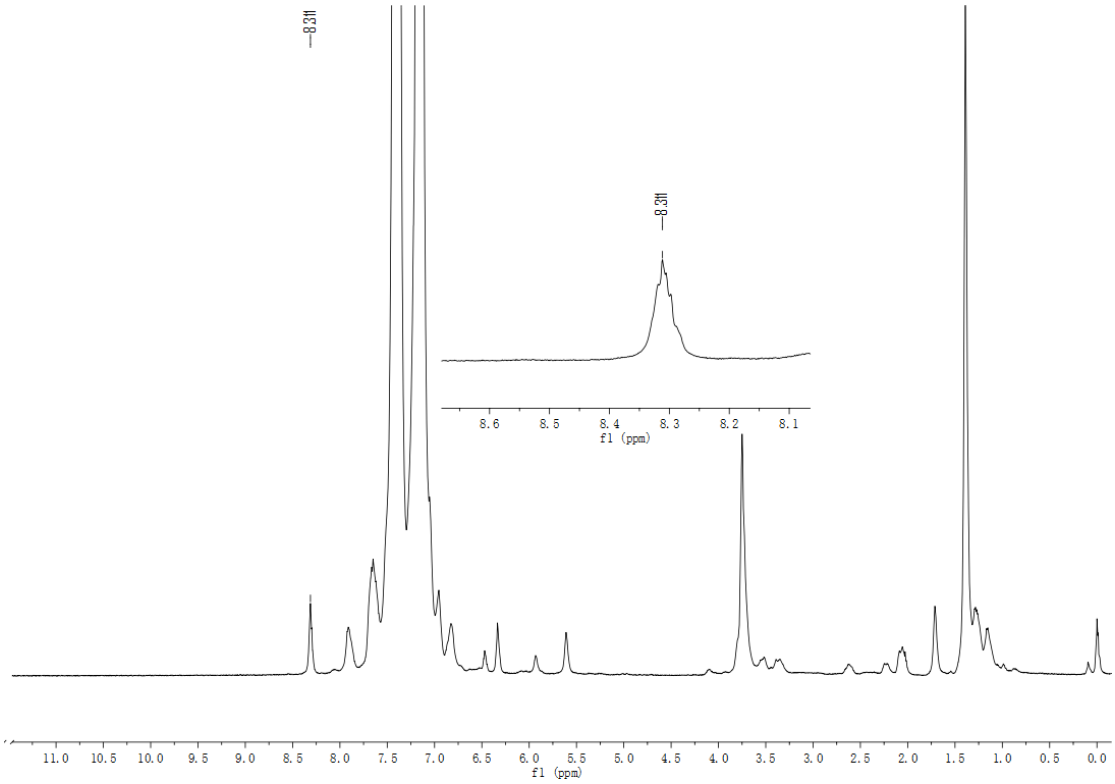
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

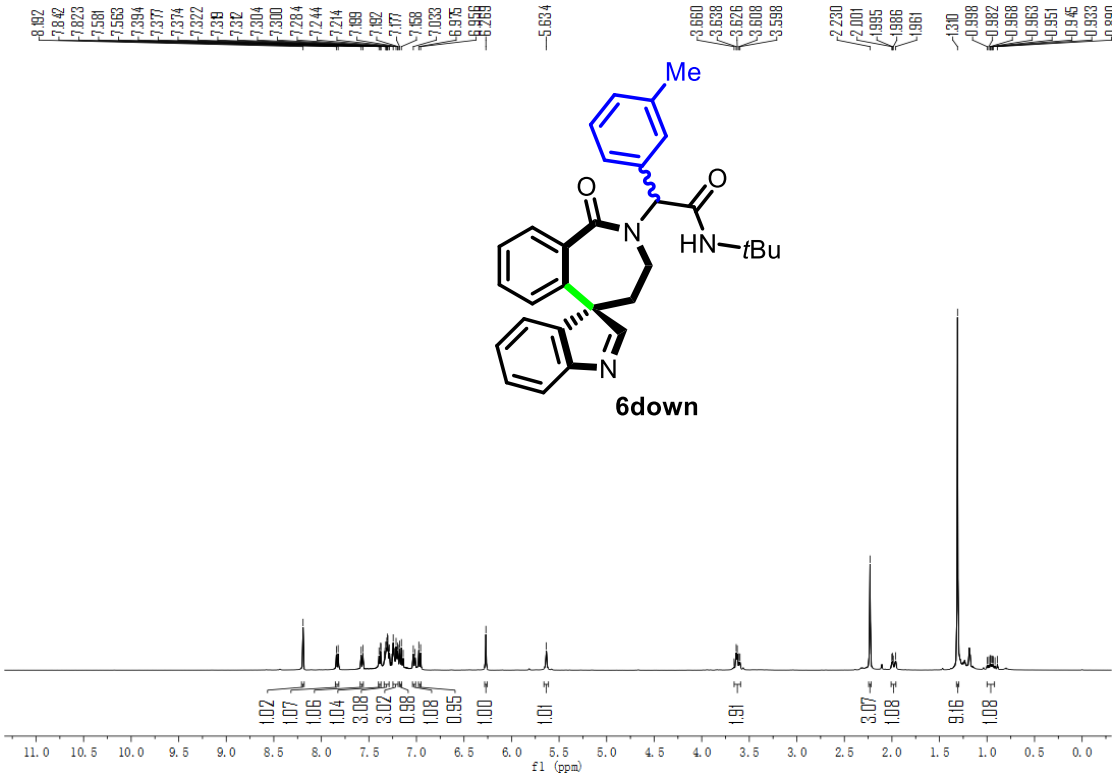


5 crude ^{1}H NMR

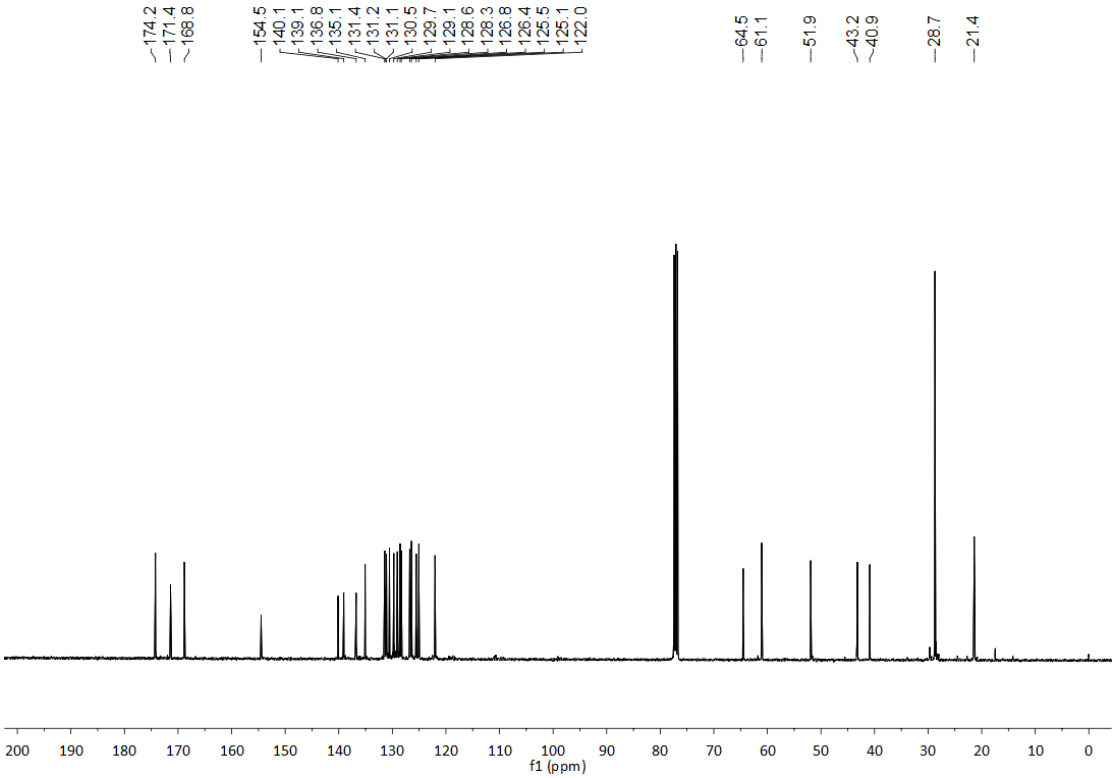


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(m-tolyl)acetamide (6down)

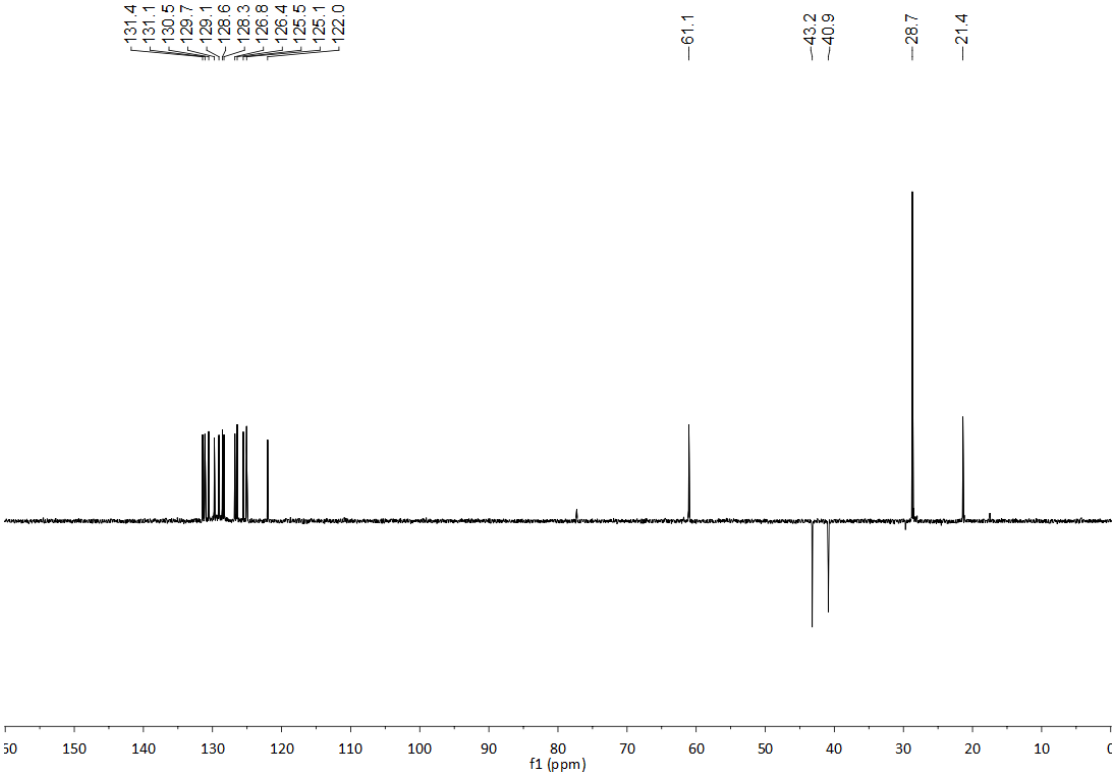
^{1}H NMR (400 MHz, $CDCl_3$):



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

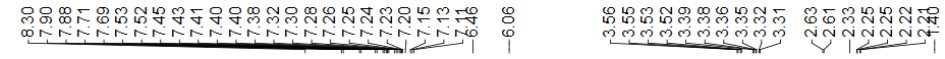


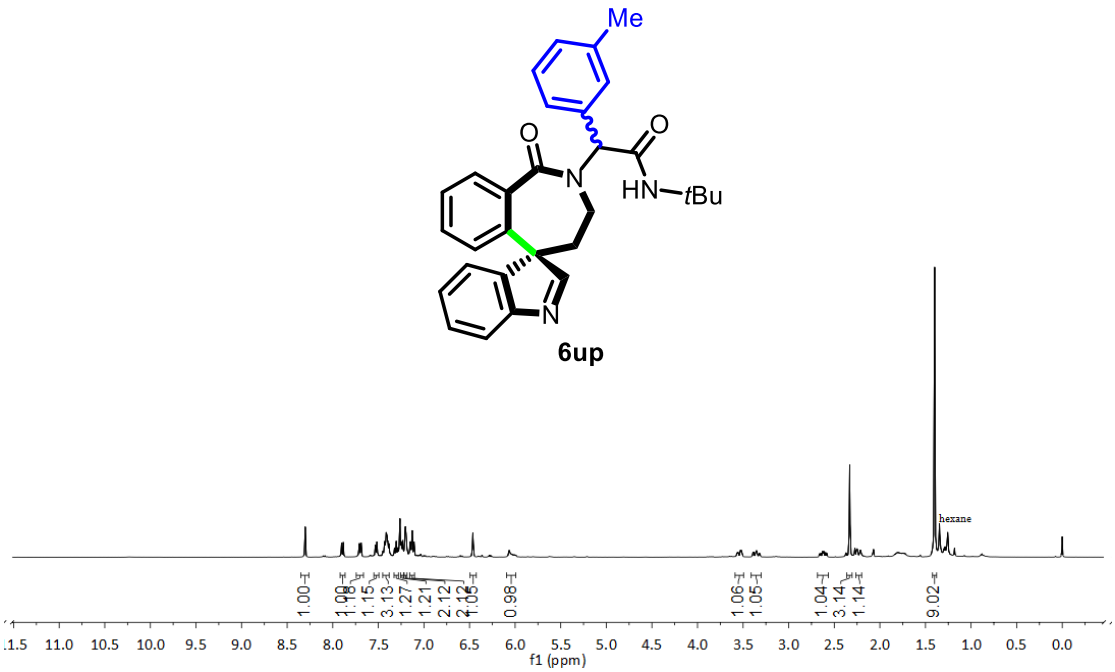
Dept



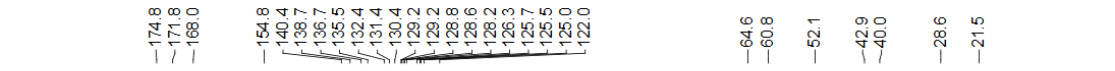
N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(m-tolyl)acetamide (6up)

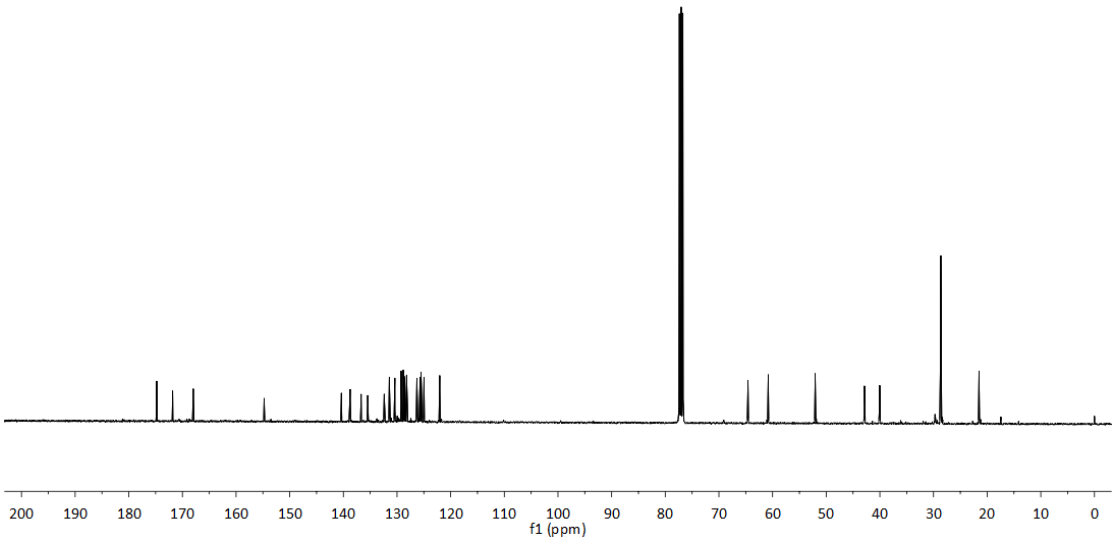
^{1}H NMR (400 MHz, $CDCl_3$)：



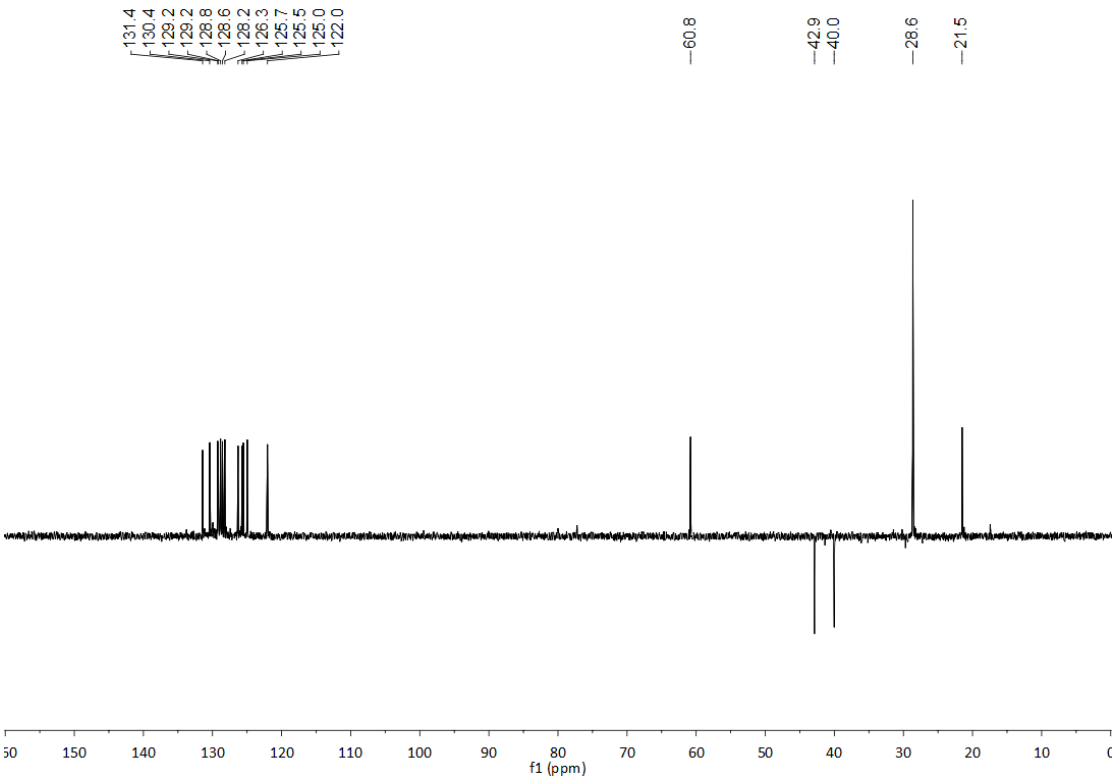


^{13}C NMR (100 MHz, $CDCl_3$):

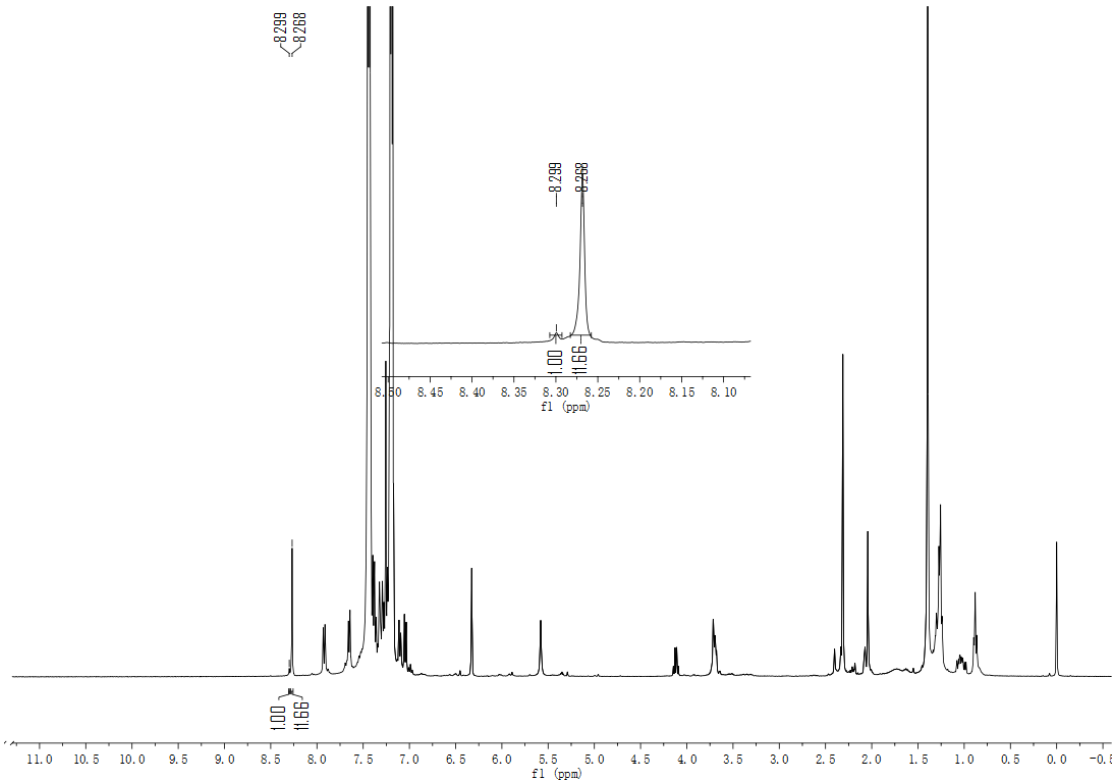




DEPT

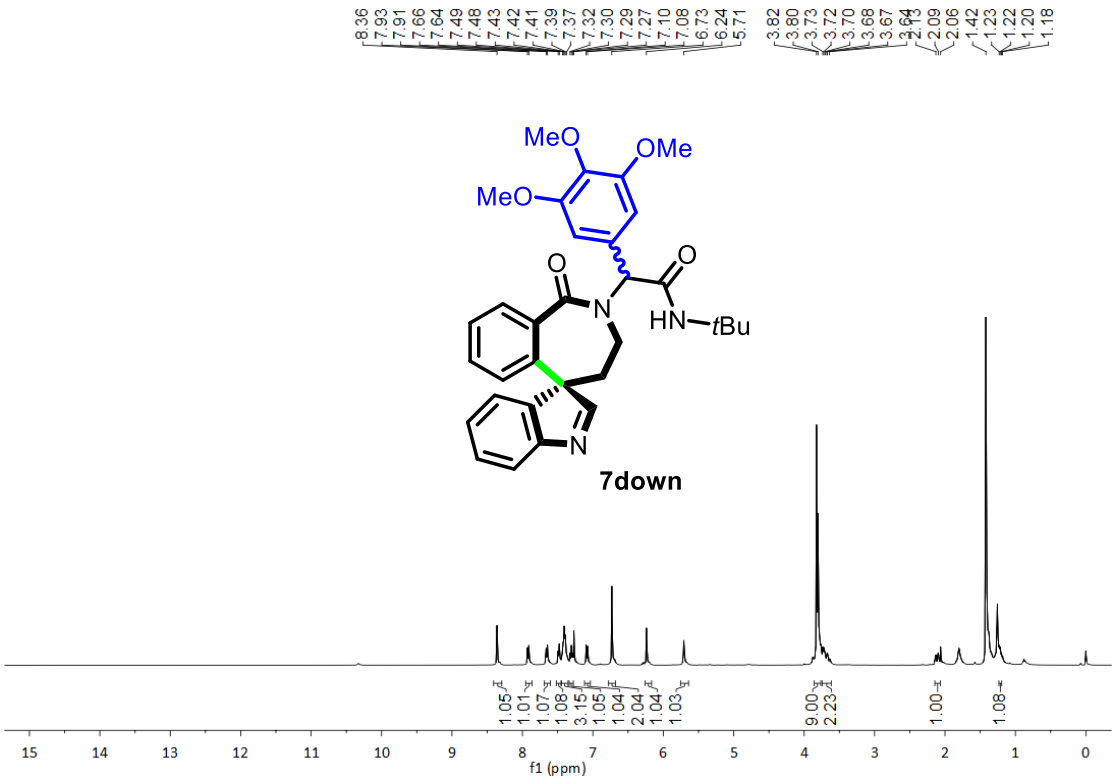


6 crude ^{1}H NMR

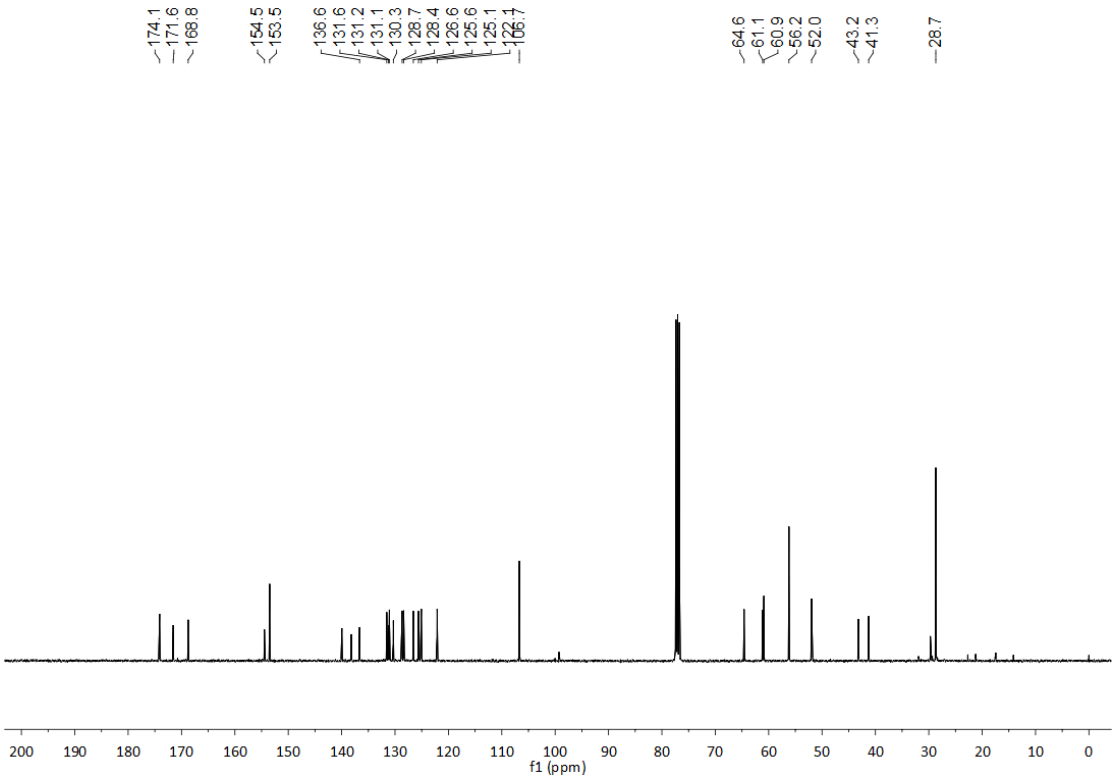


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(3,4,5-trimethoxyphenyl)acetamide (7down)

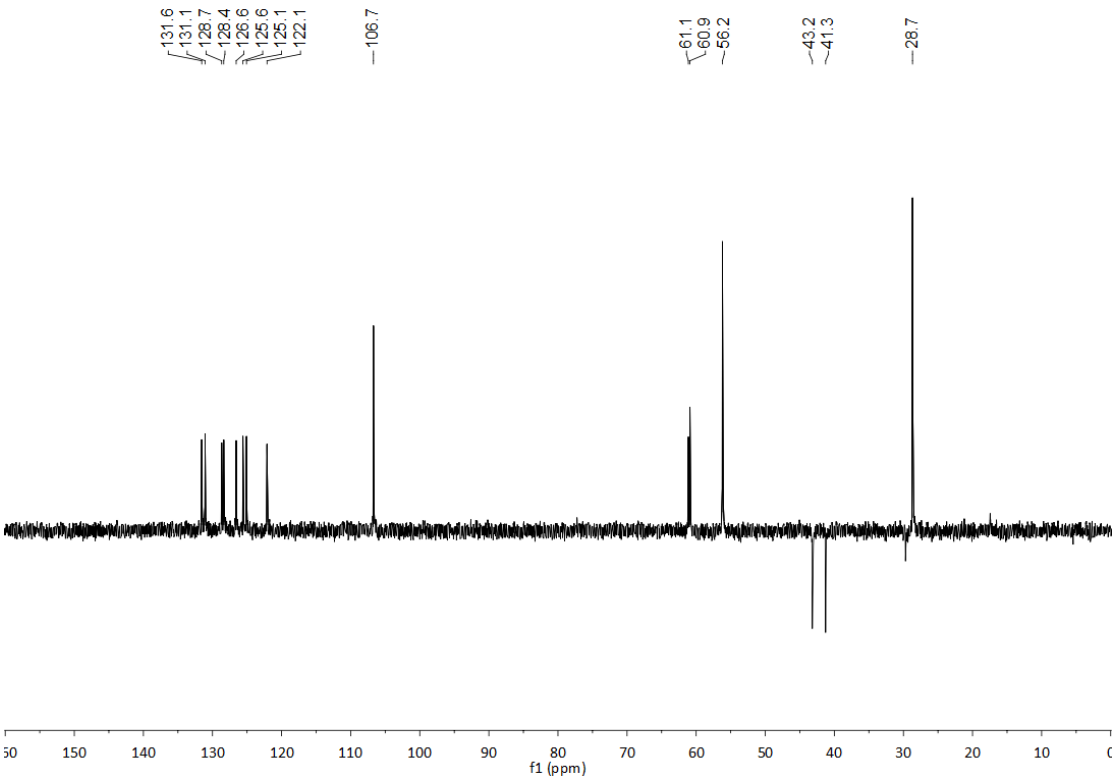
^{1}H NMR (400 MHz, $CDCl_3$)：



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

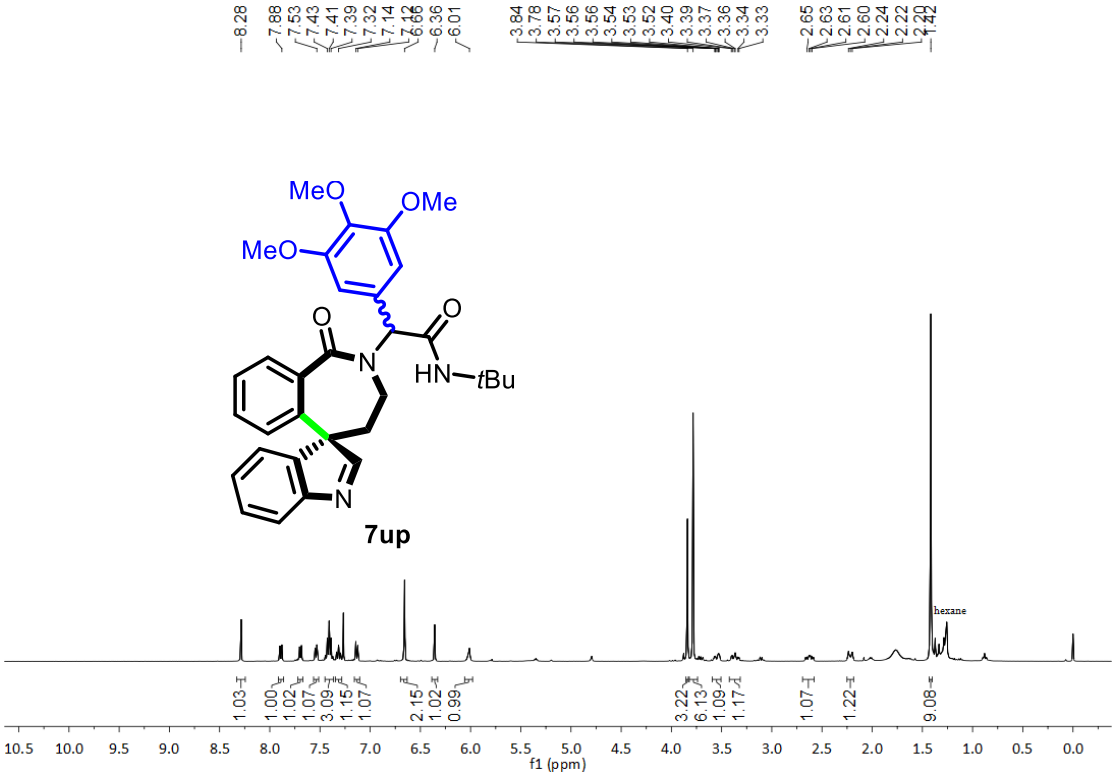


DEPT

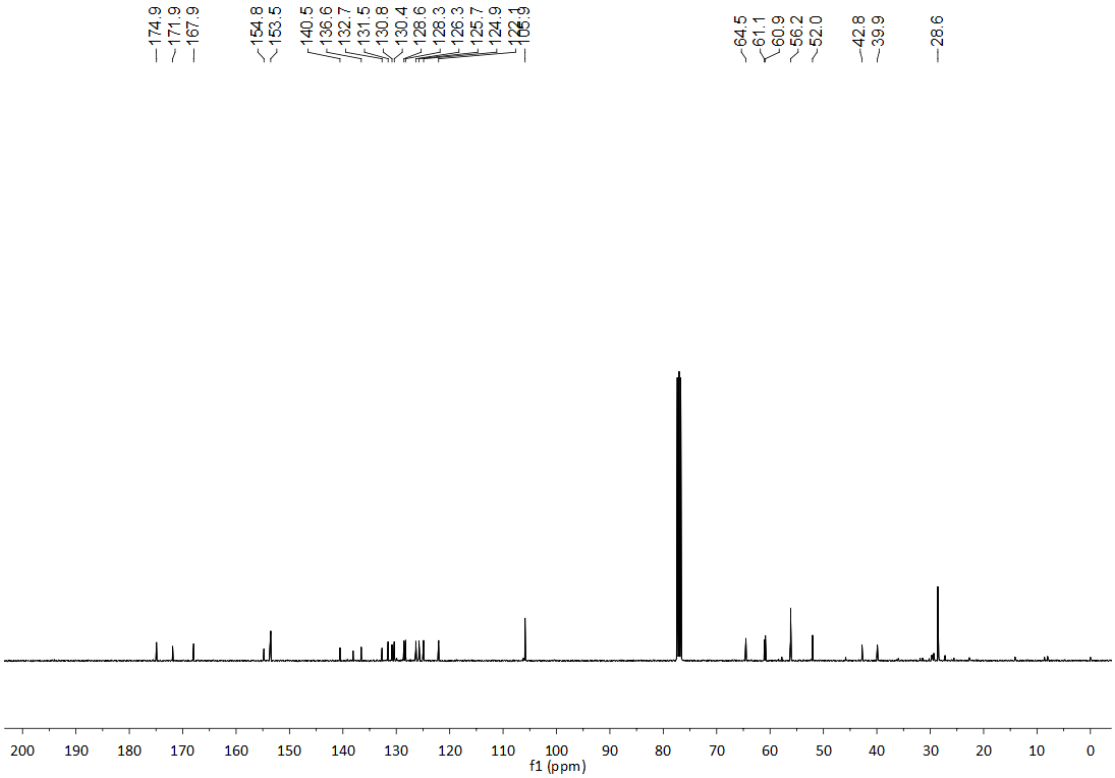


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(3,4,5-trimethoxyphenyl)acetamide (7up)

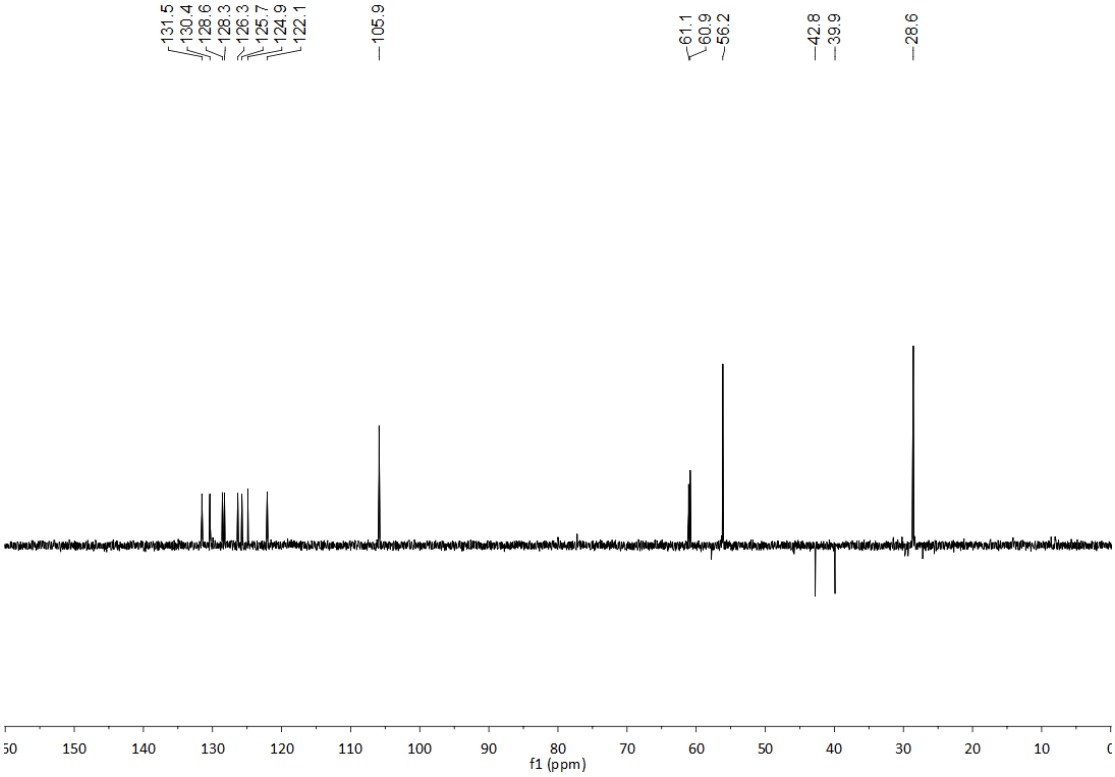
^{1}H NMR (400 MHz, $CDCl_3$):



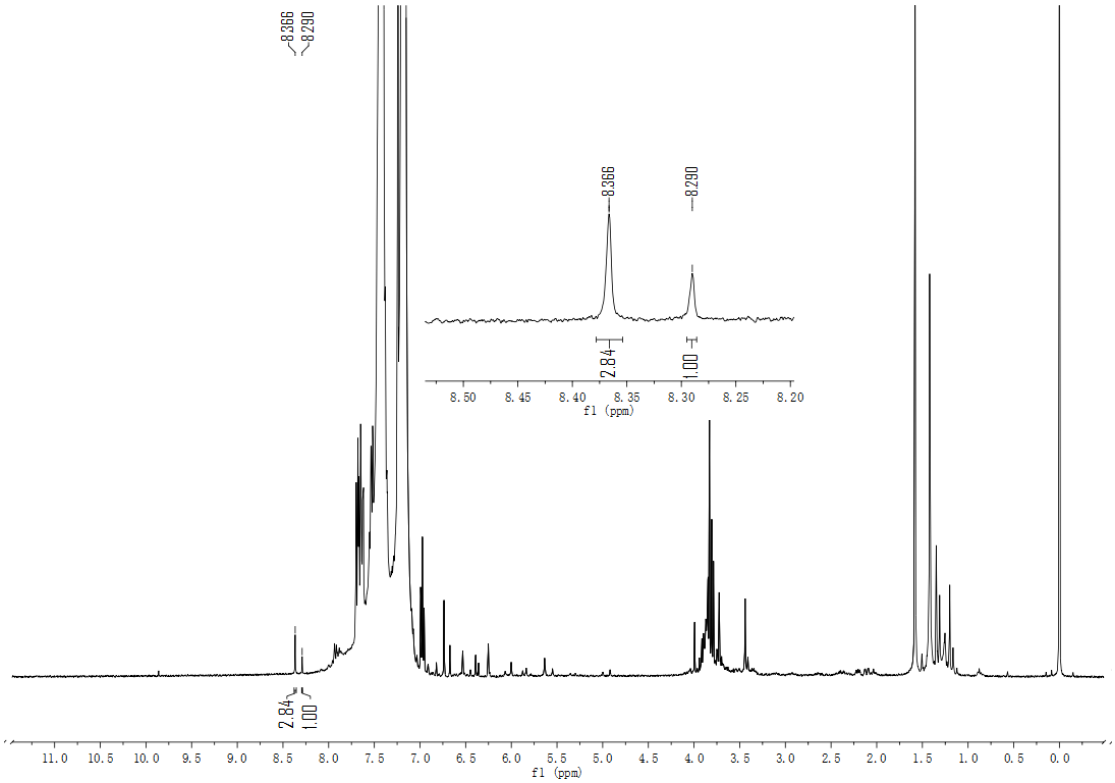
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

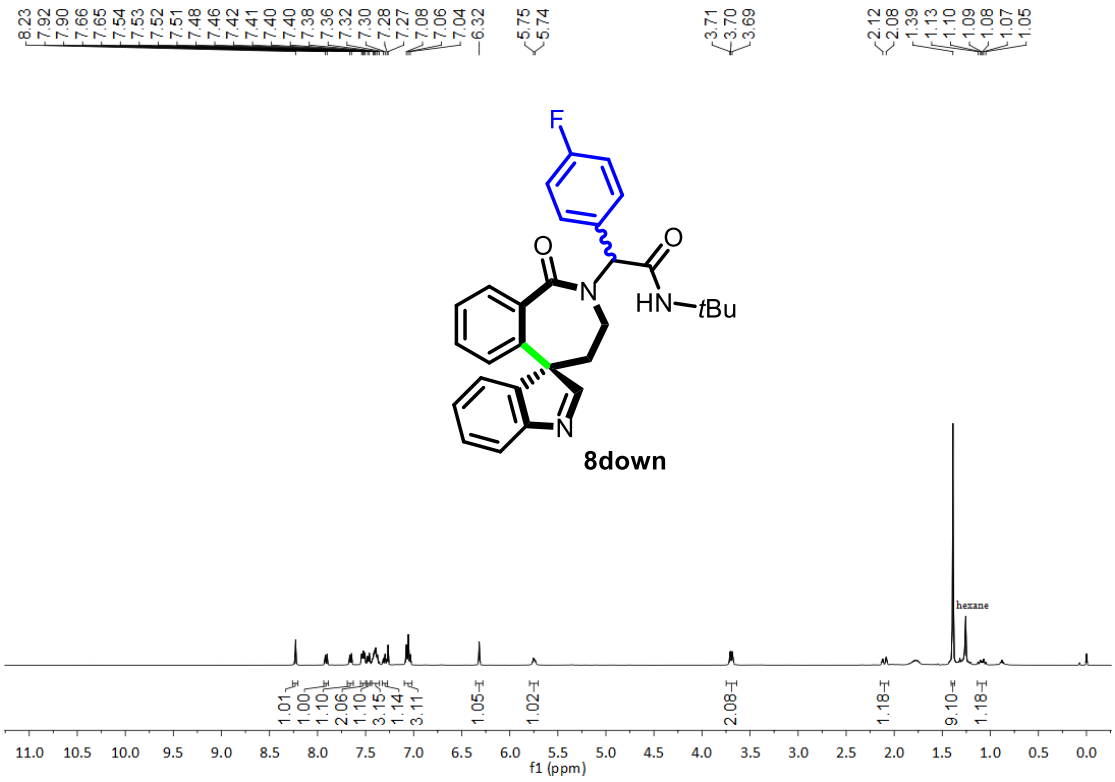


7 crude ^{1}H NMR

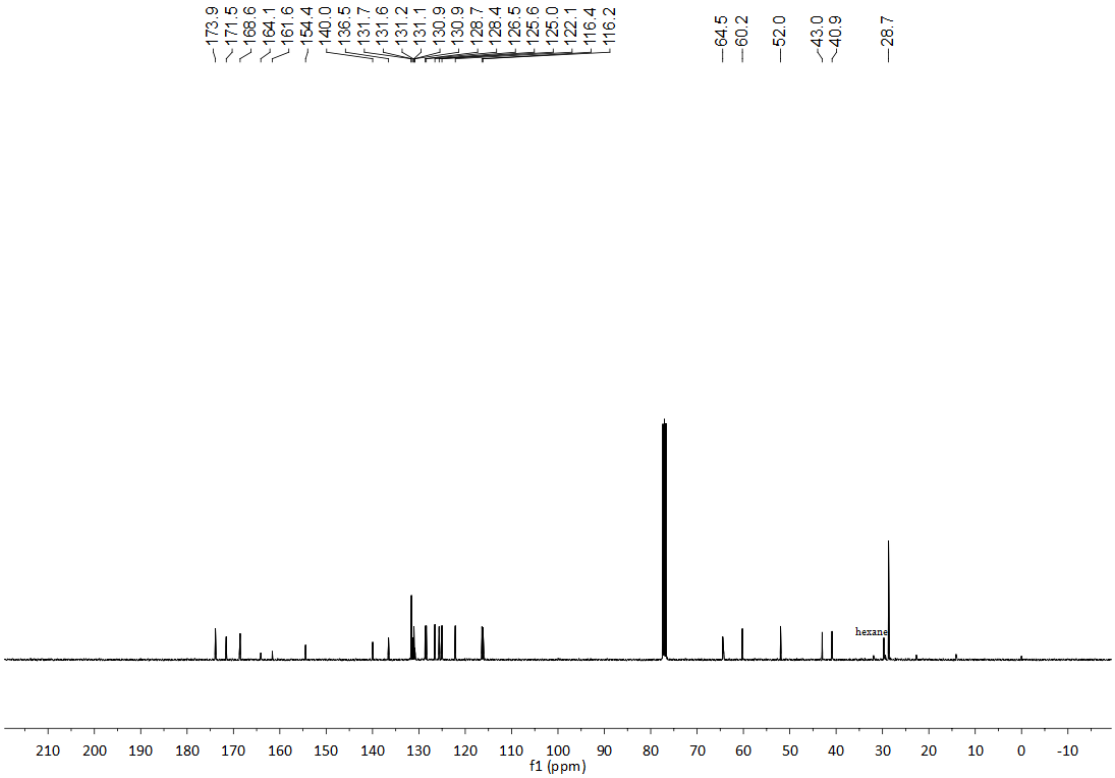


N-(tert-butyl)-2-(4-fluorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl) acetamide (8down)

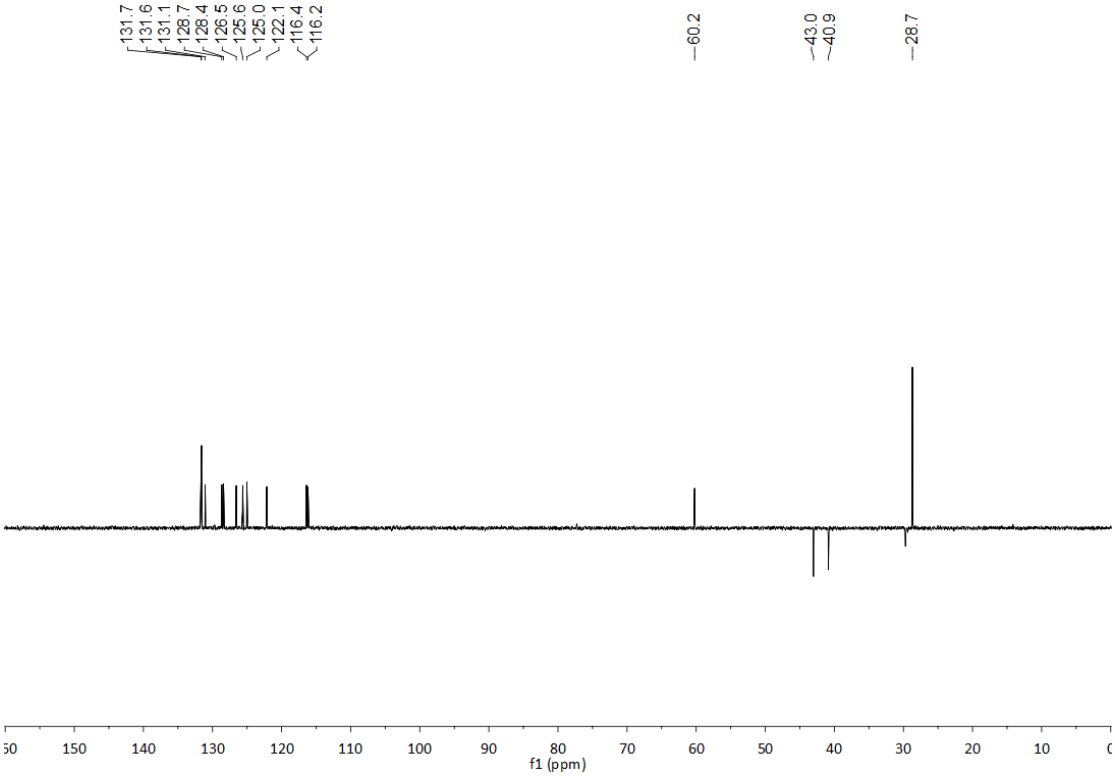
^{1}H NMR (400 MHz, $CDCl_3$):



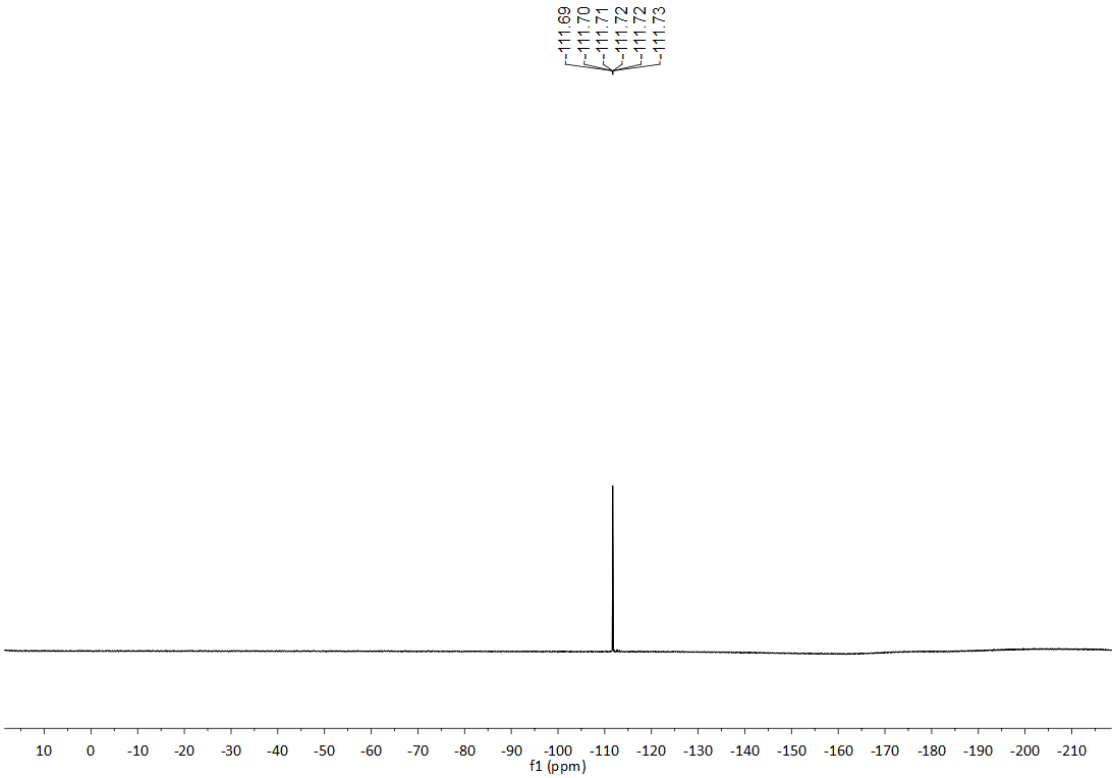
^{13}C NMR (100 MHz, $CDCl_3$):



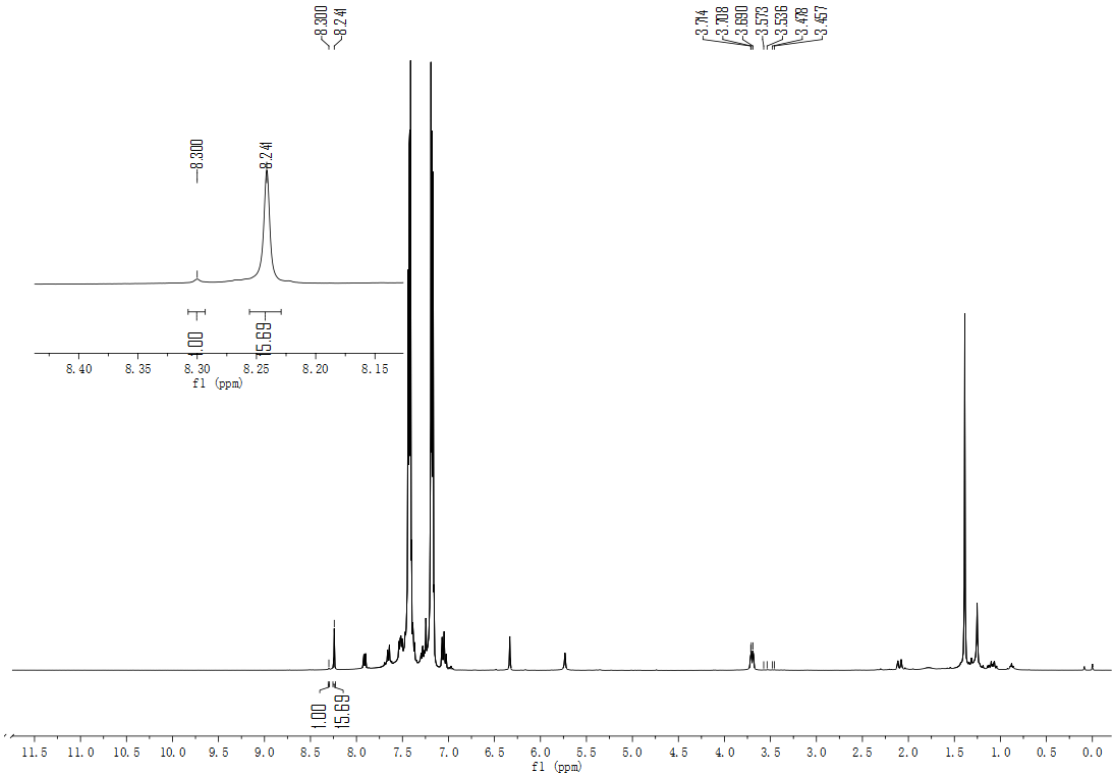
DEPT



^{19}F NMR (376 MHz, $CDCl_3$)

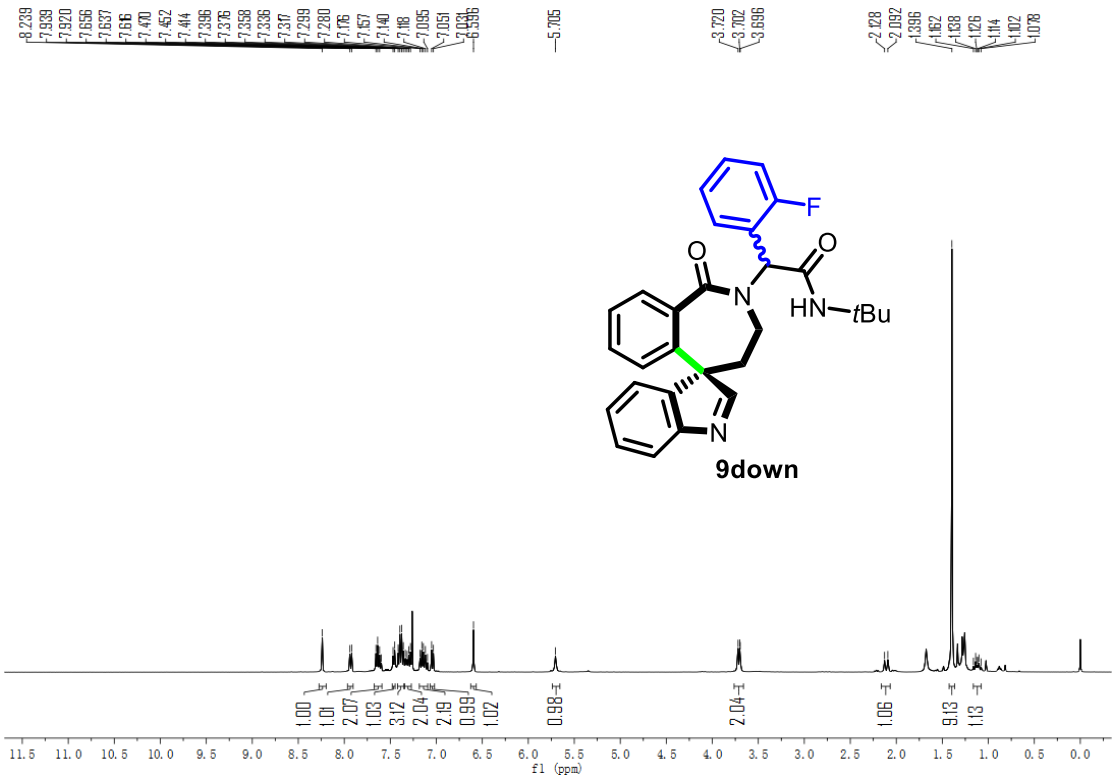


8 crude ^{1}H NMR

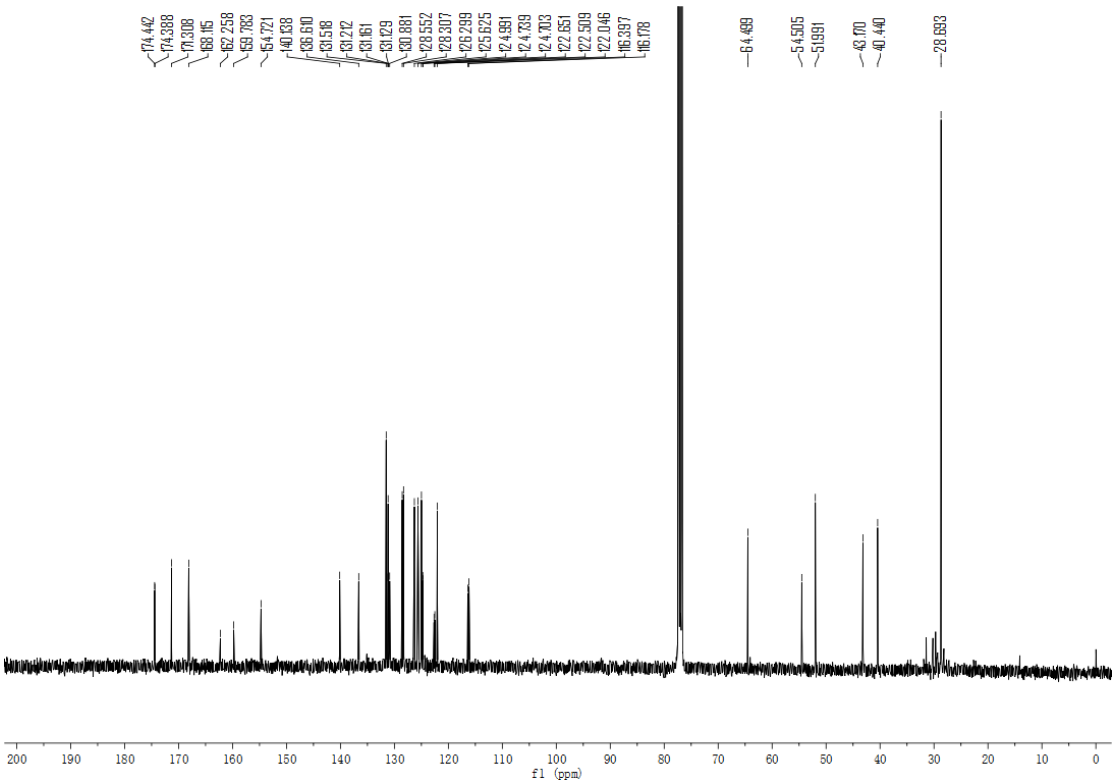


N-(tert-butyl)-2-(2-fluorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl) acetamide (9down)

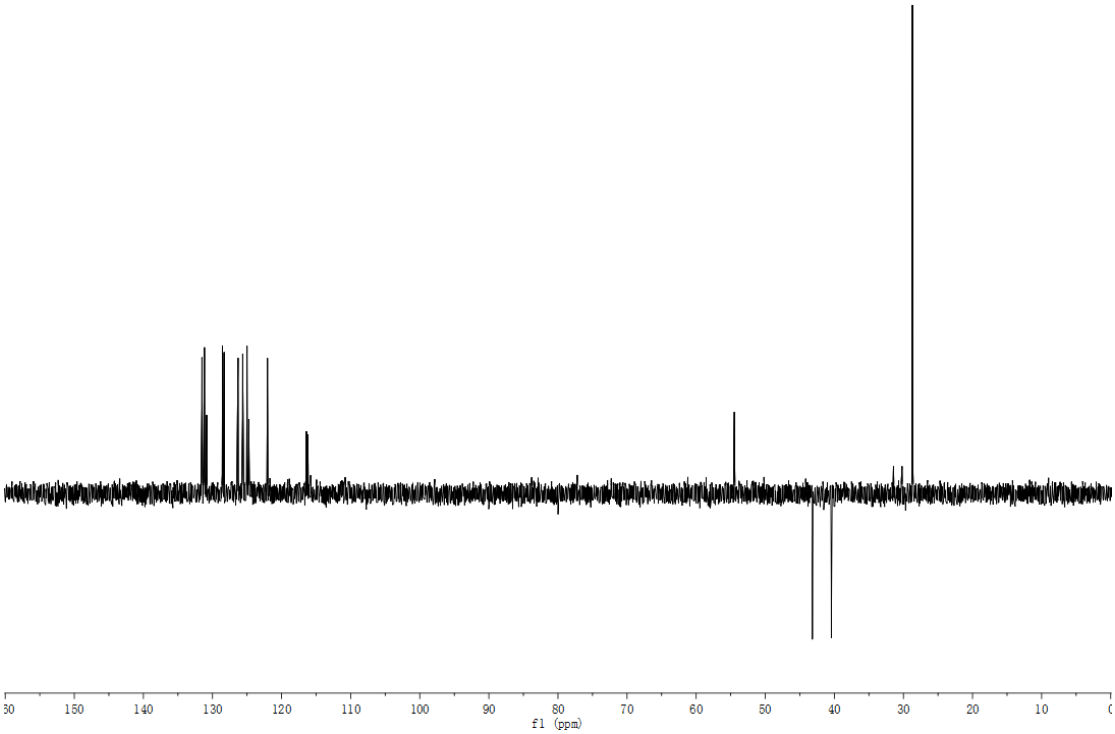
^{1}H NMR (400 MHz, $CDCl_3$)：



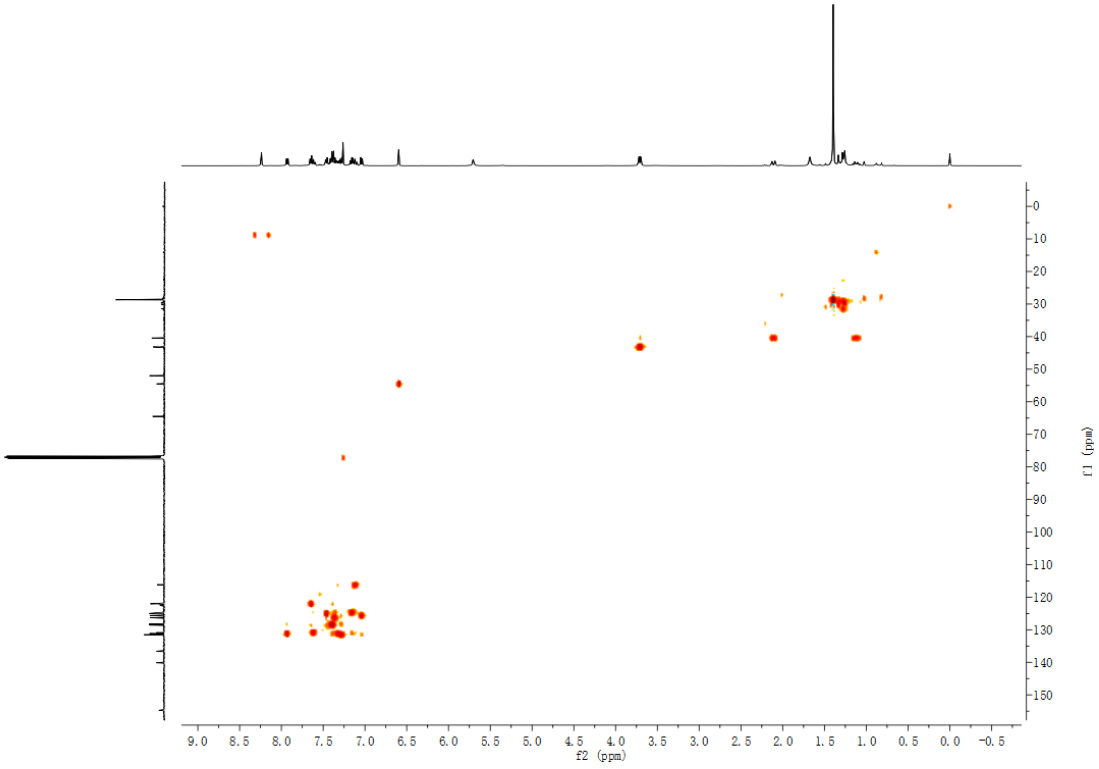
^{13}C NMR (100 MHz, $CDCl_3$):



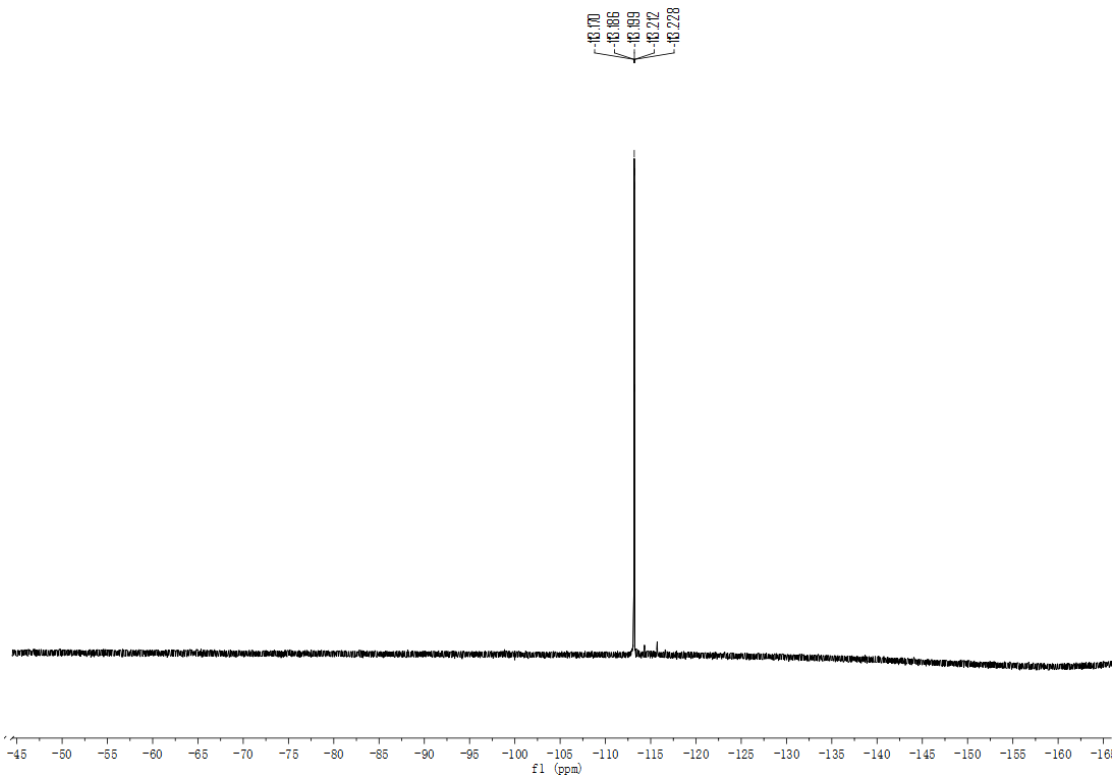
DEPT



HSQC

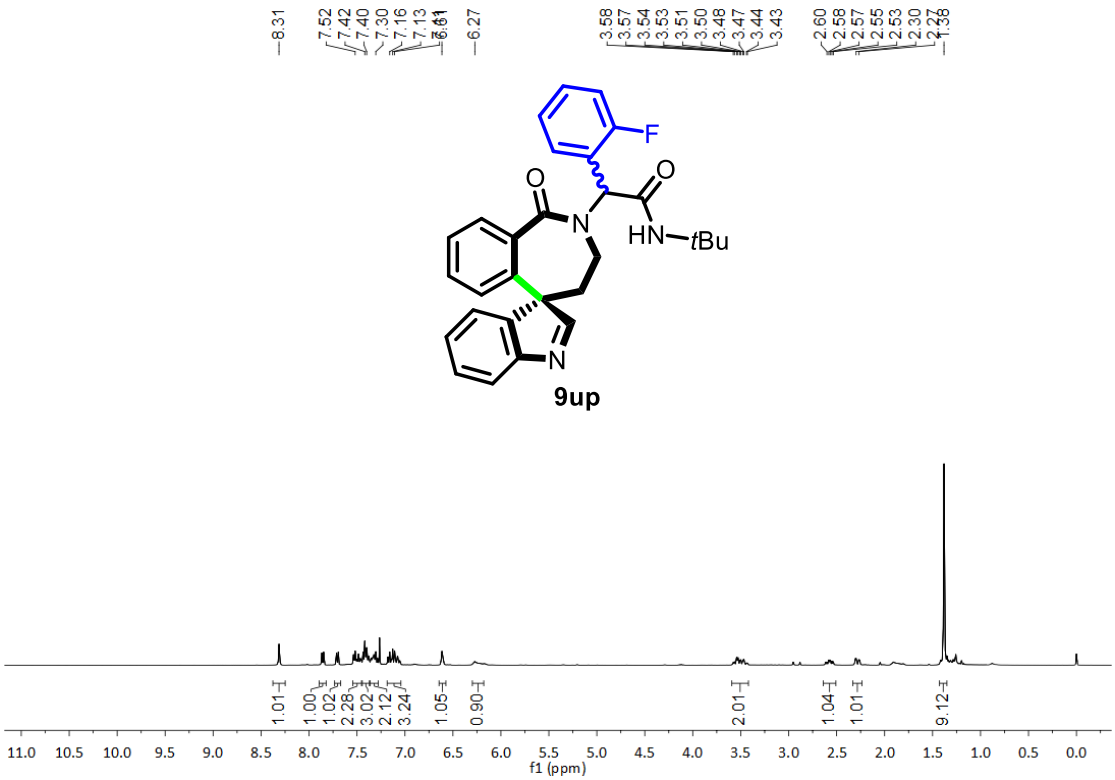


^{19}F NMR (376 MHZ, $CDCl_3$)

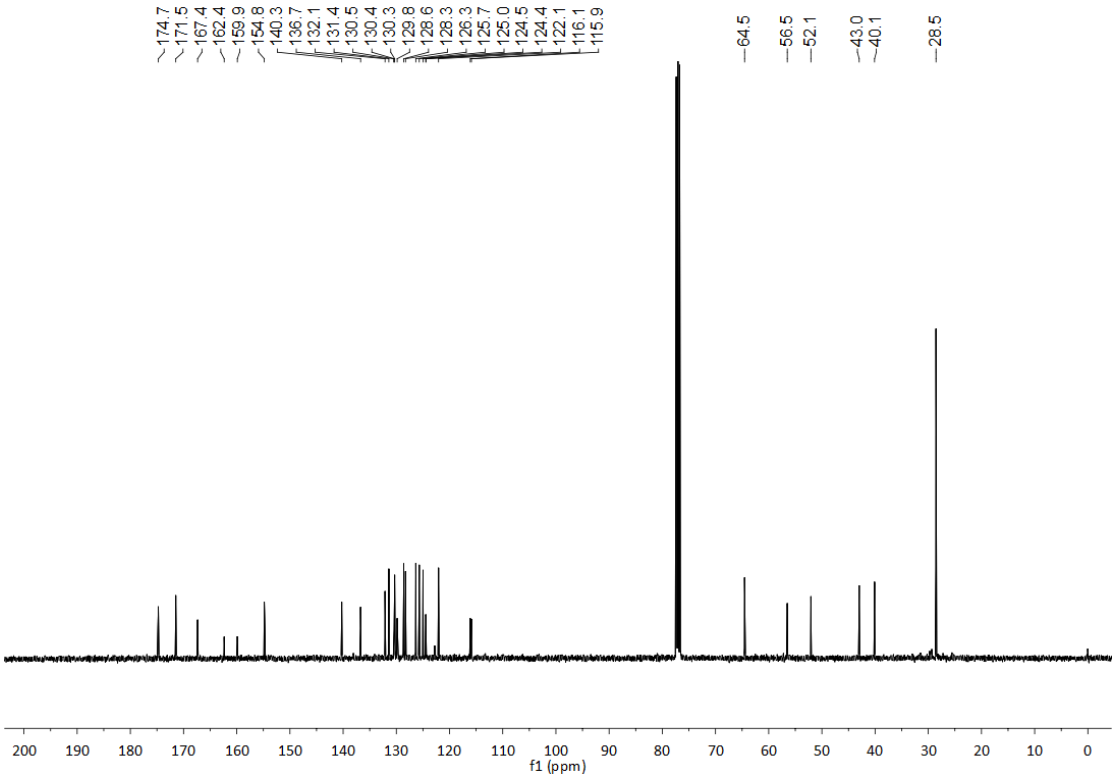


N-(tert-butyl)-2-(2-fluorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl) acetamide (9up)

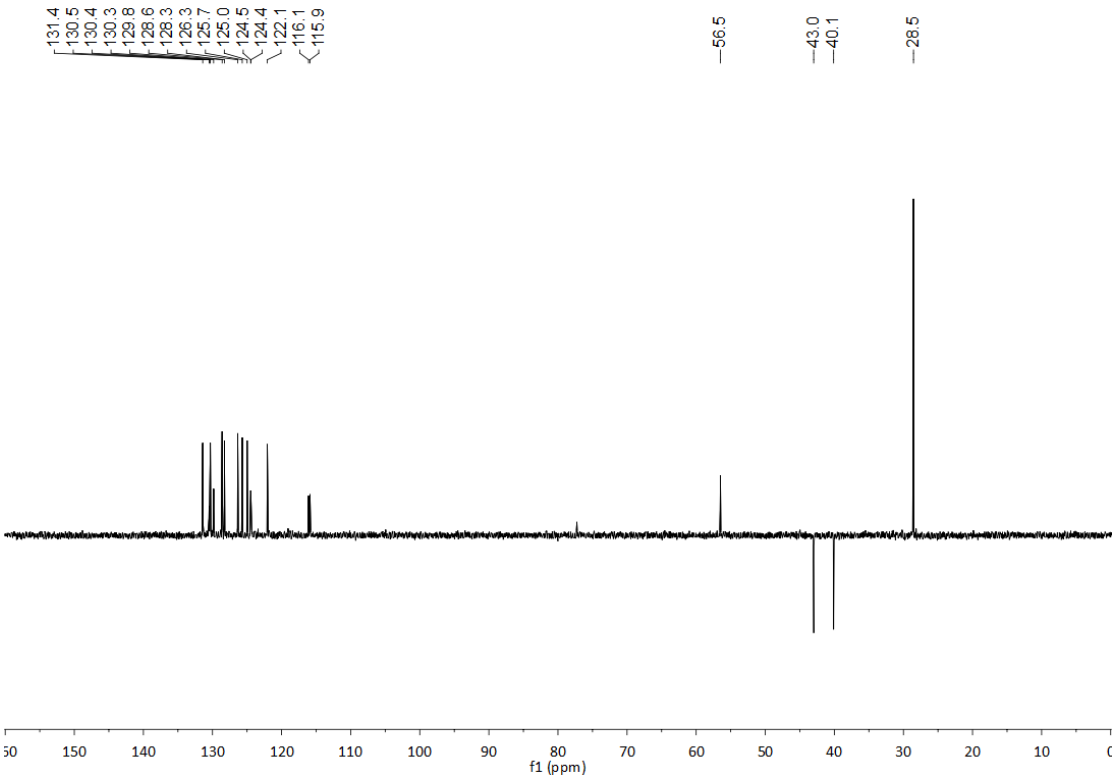
^{1}H NMR (400 MHz, $CDCl_3$):



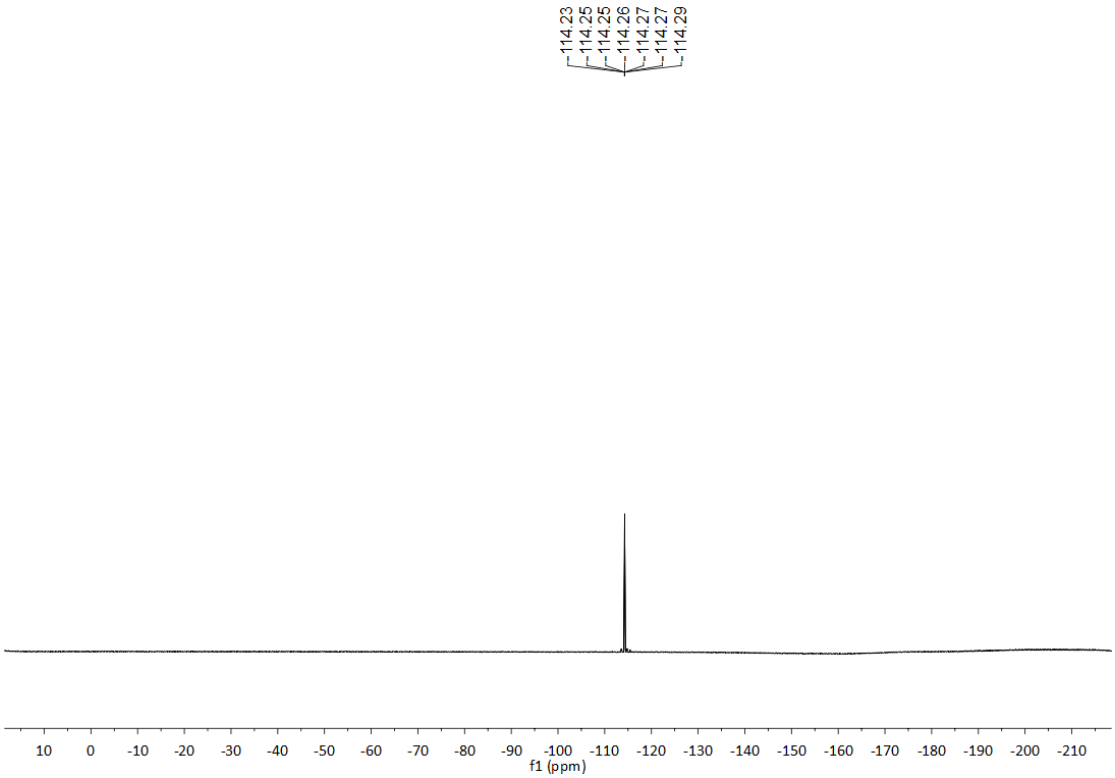
^{13}C NMR (100 MHz, $CDCl_3$):



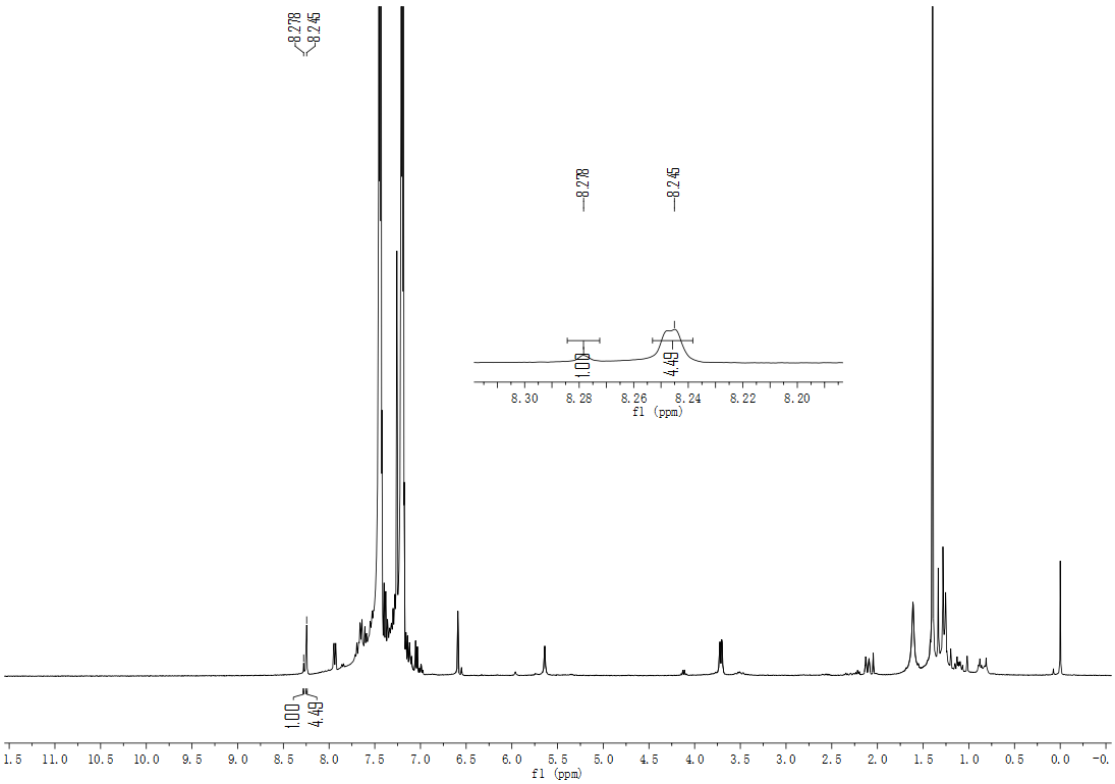
DEPT



^{19}F NMR (376 MHZ, $CDCl_3$)

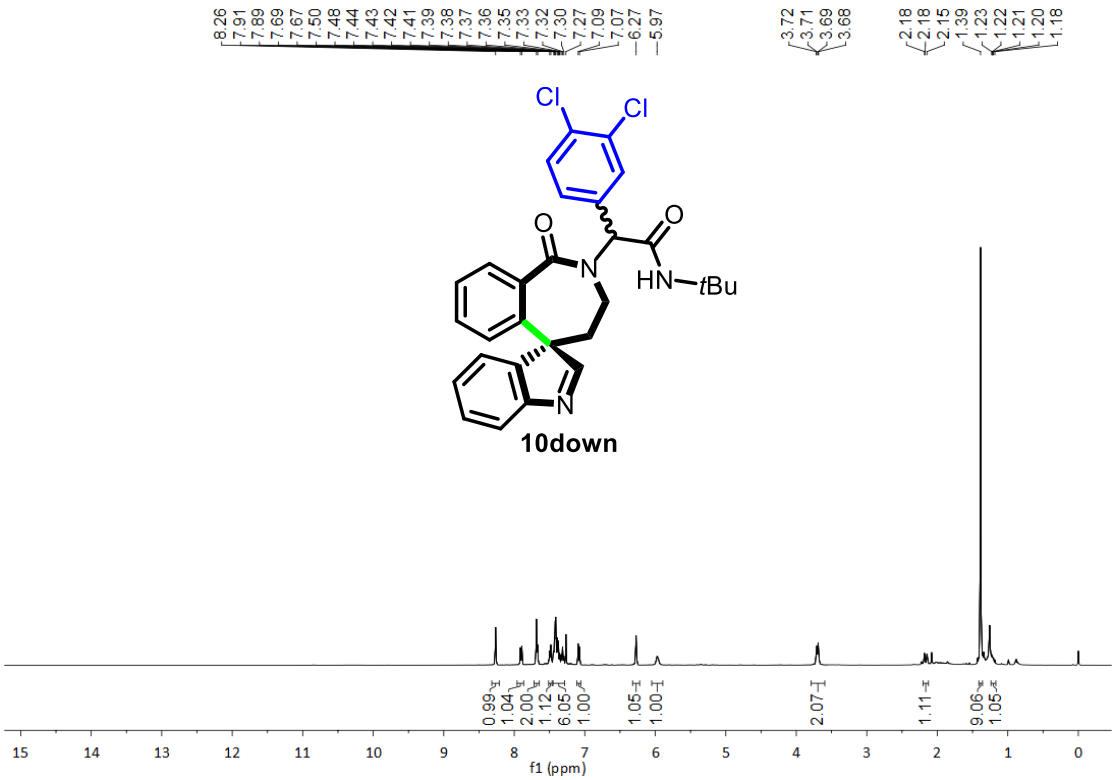


9 crude ^{1}H NMR

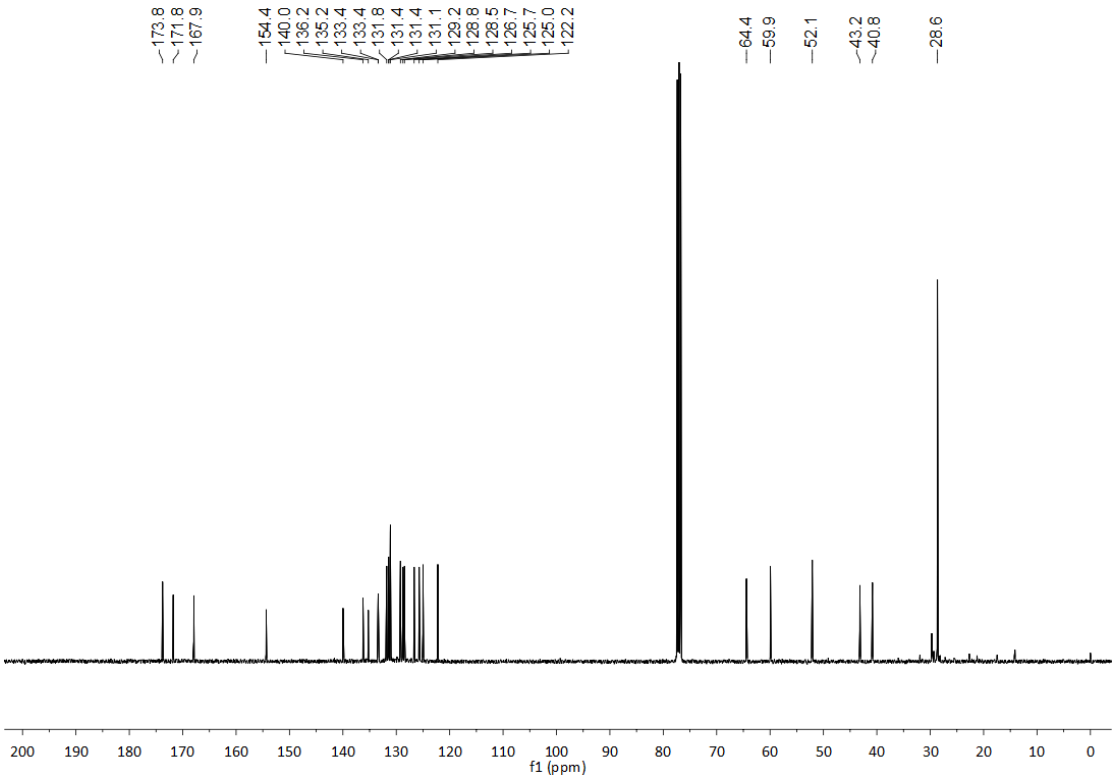


N-(tert-butyl)-2-(3,4-dichlorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (10down)

^{1}H NMR (400 MHz, $CDCl_3$)：



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



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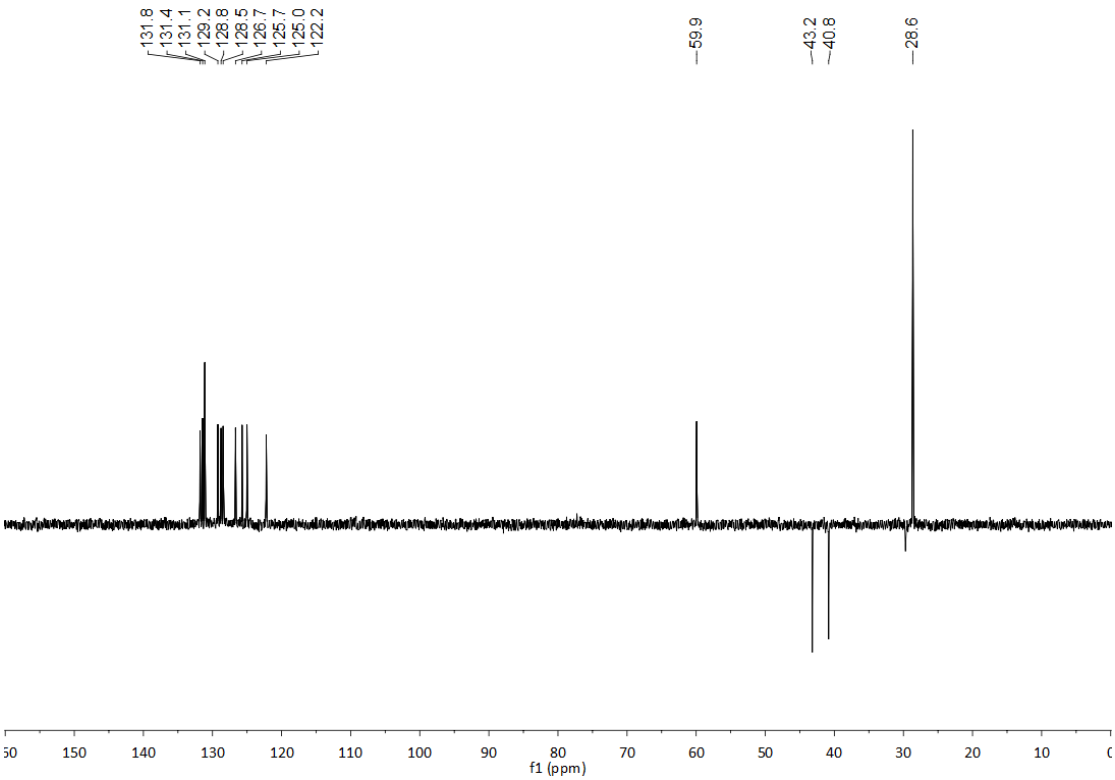
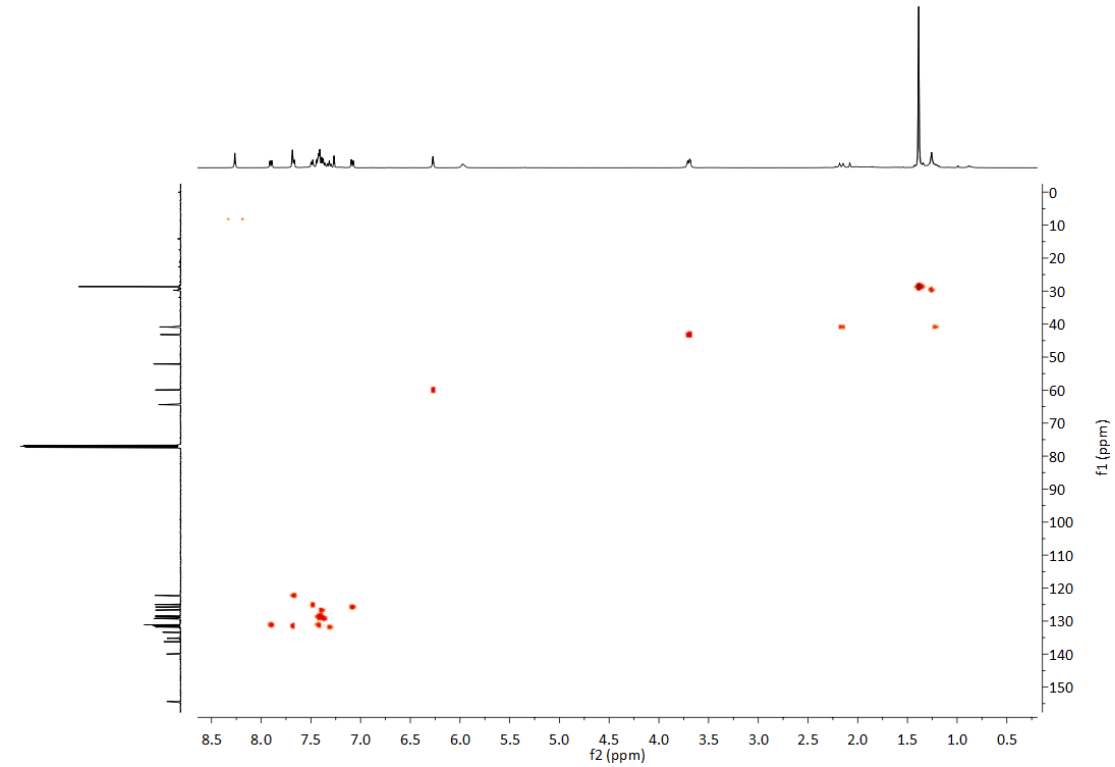
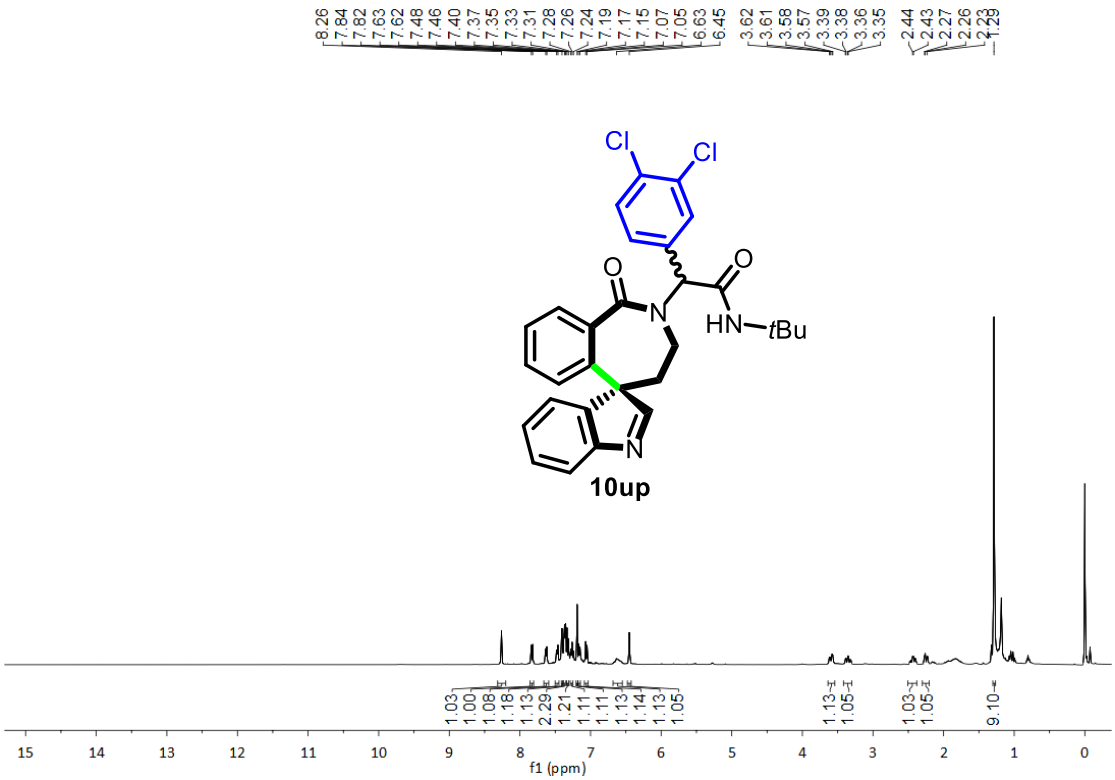


HSQC

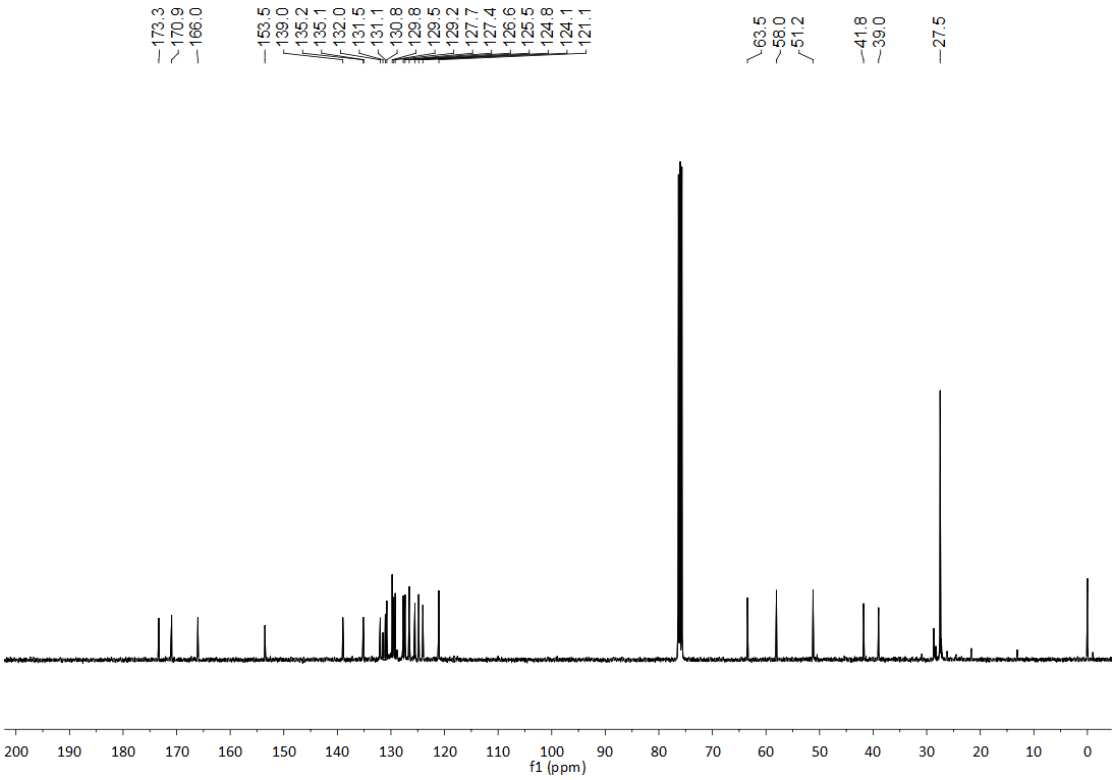


N-(tert-butyl)-2-(3,4-dichlorophenyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (10up)

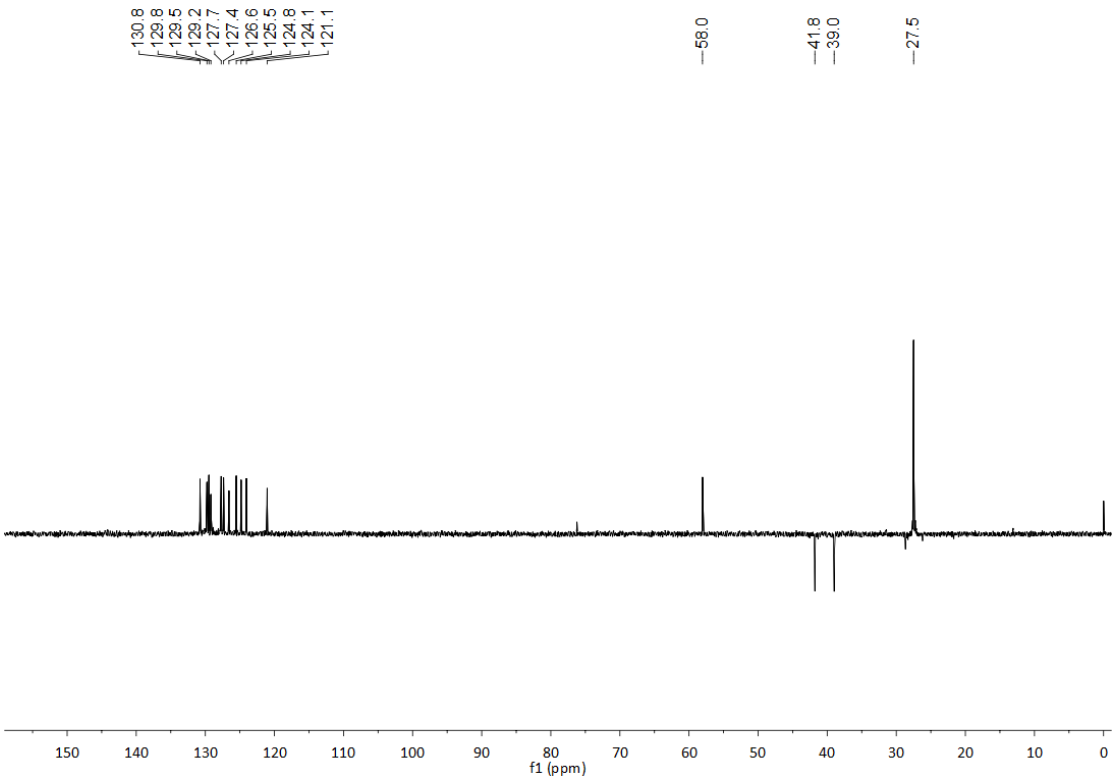
^{1}H NMR (400 MHz, $CDCl_3$)：



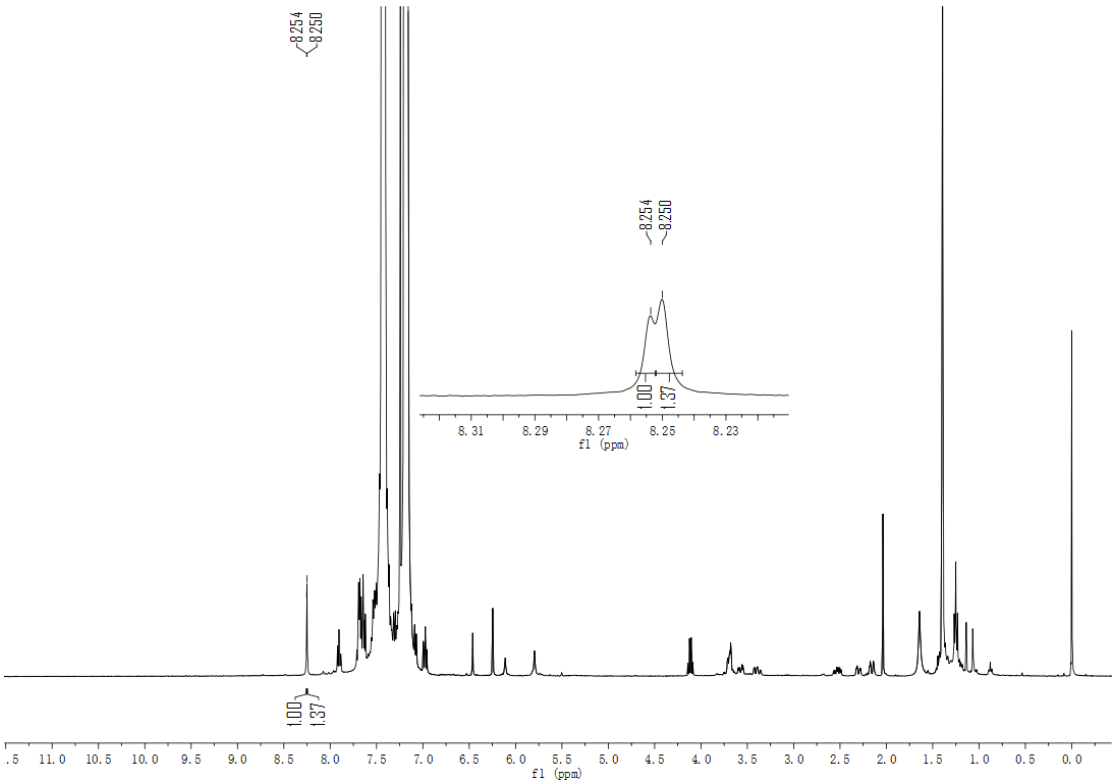
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

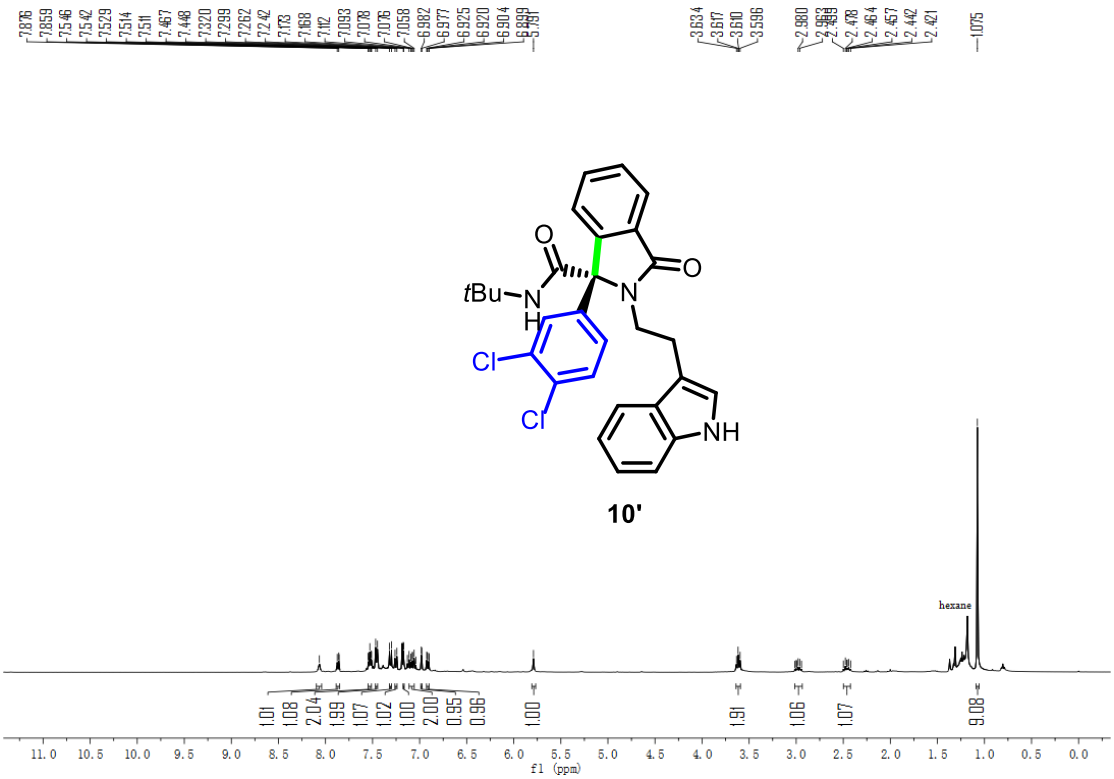


10 crude ^{1}H NMR

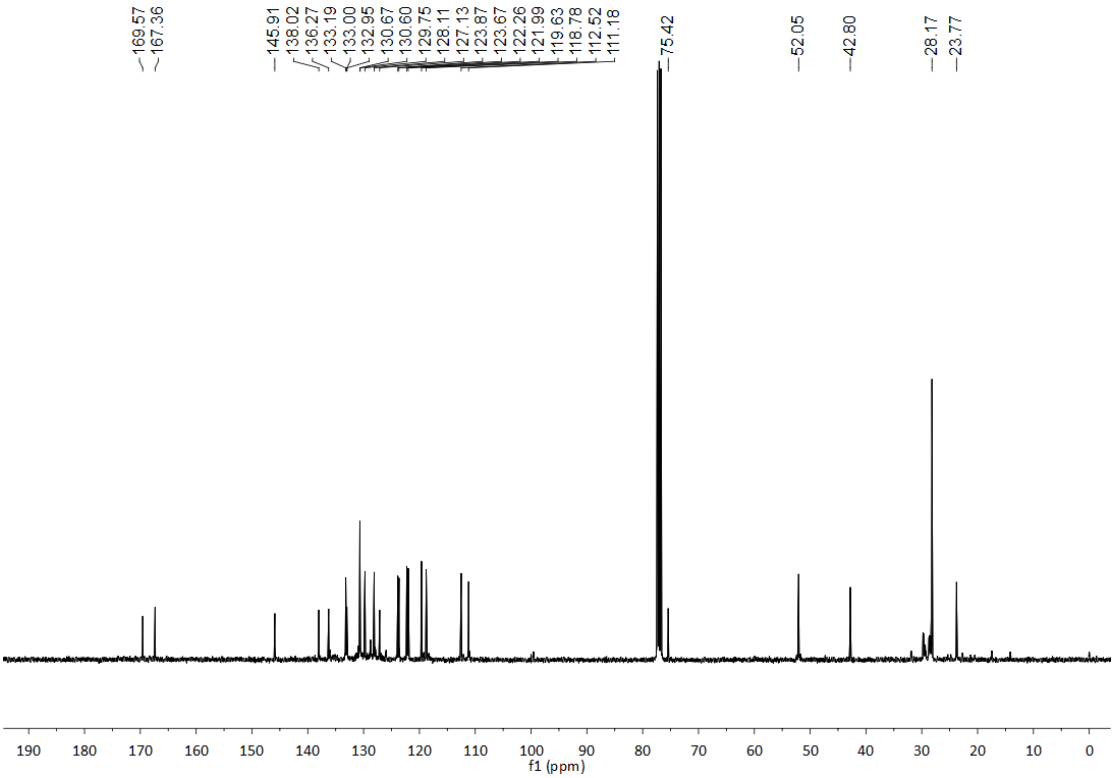


2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-1-(3,4-dichlorophenyl)-3-oxoisoindoline-1-carboxamide (10')

^{1}H NMR (400 MHz, $CDCl_3$)：



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



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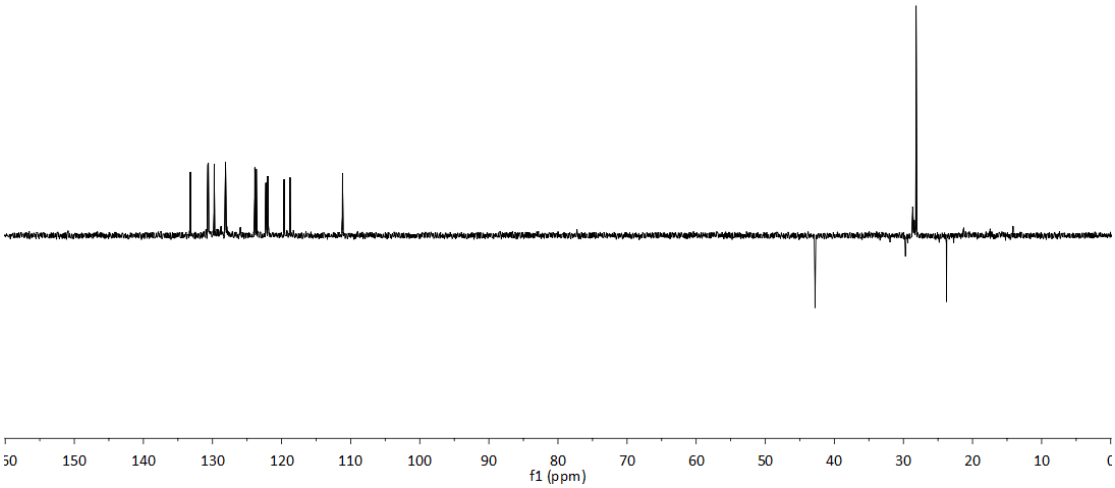
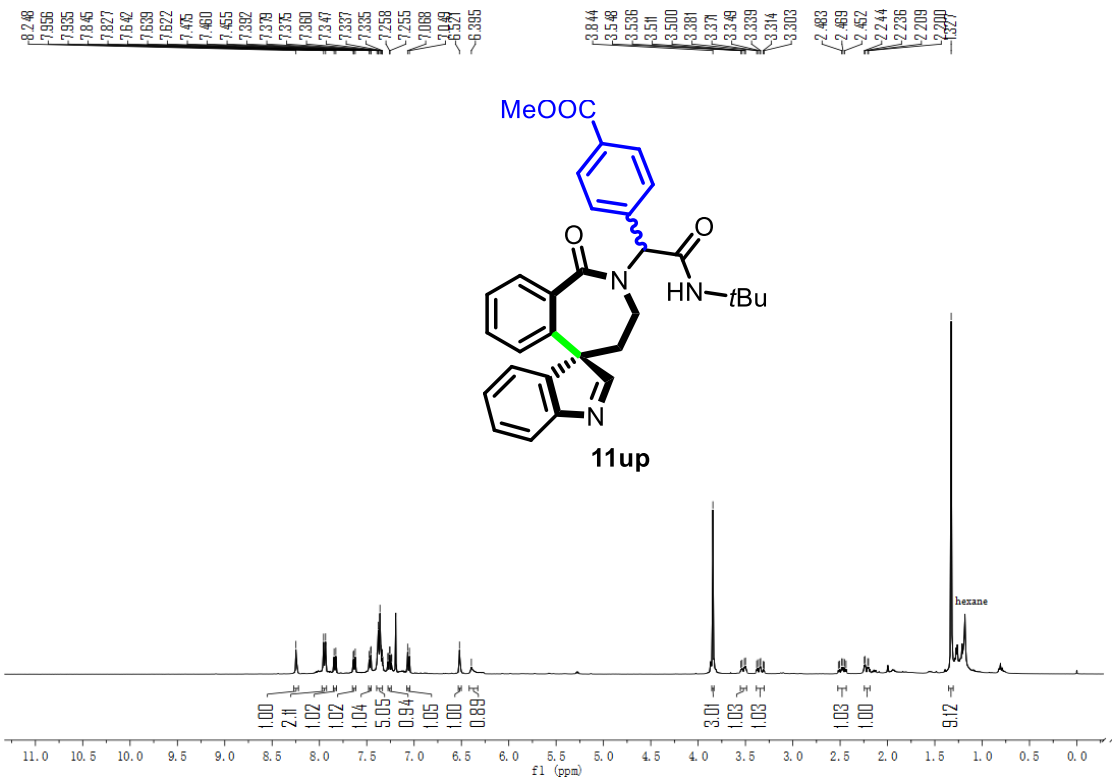
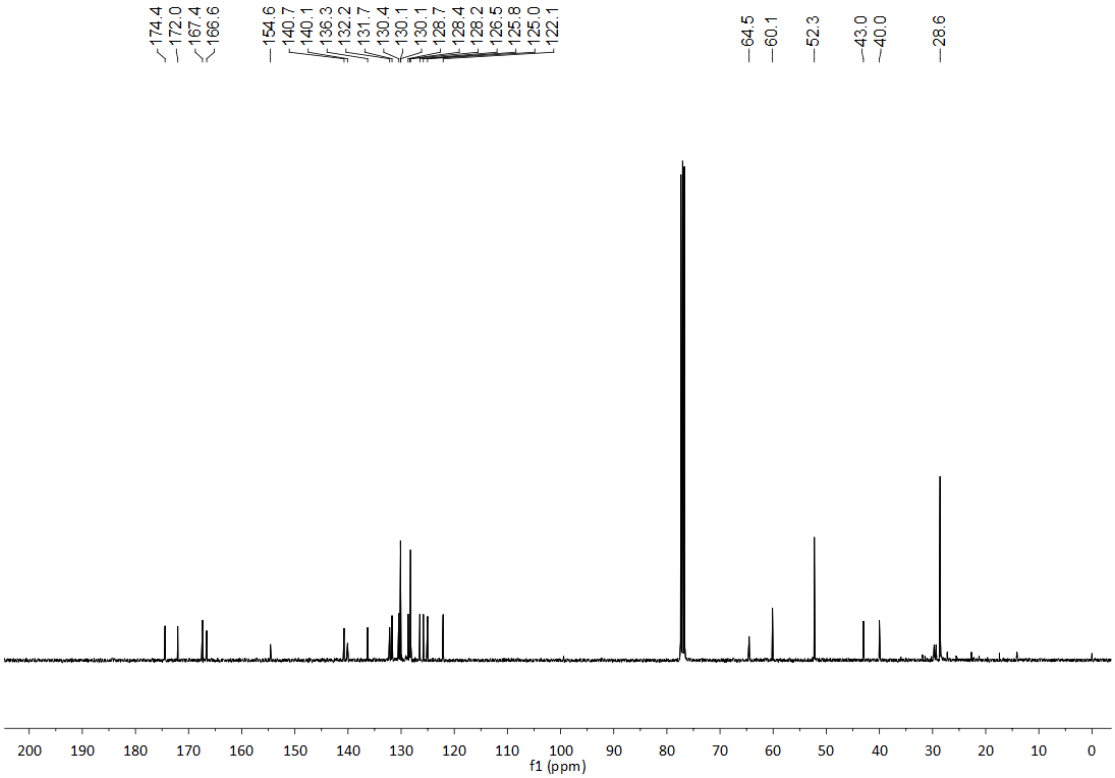


methyl-4-(2-(tert-butylamino)-2-oxo-1-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)ethyl)benzoate (11up)

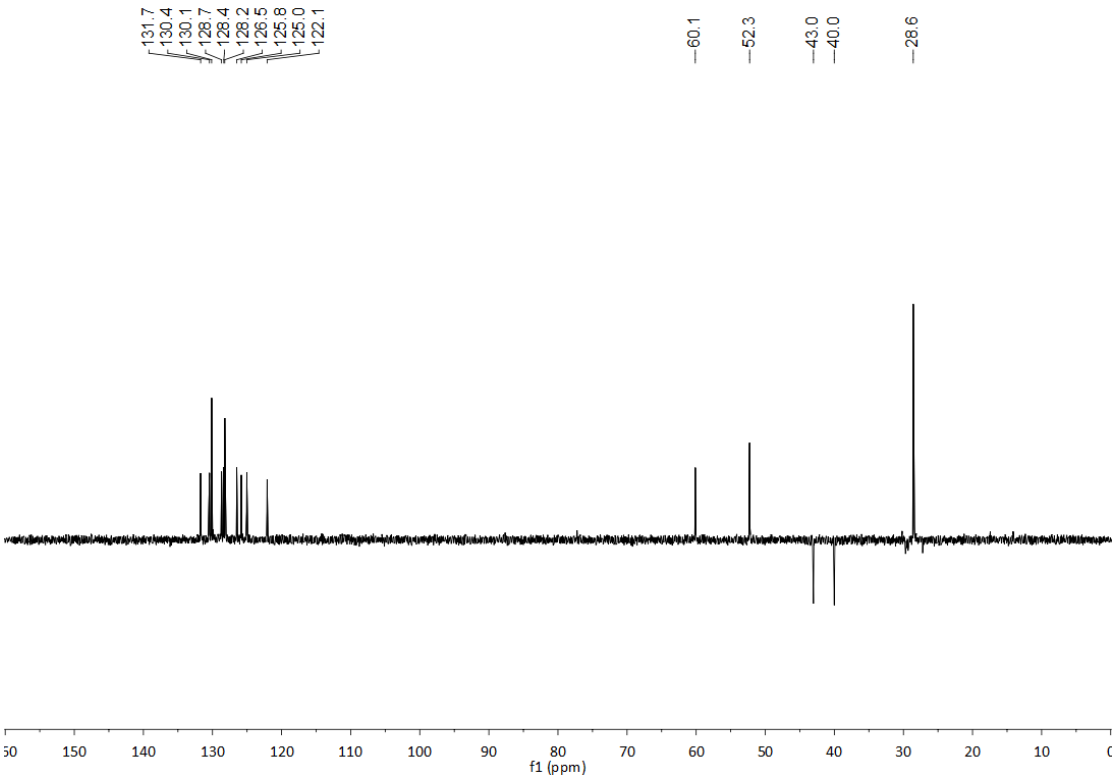
^{1}H NMR (400 MHz, $CDCl_3$):



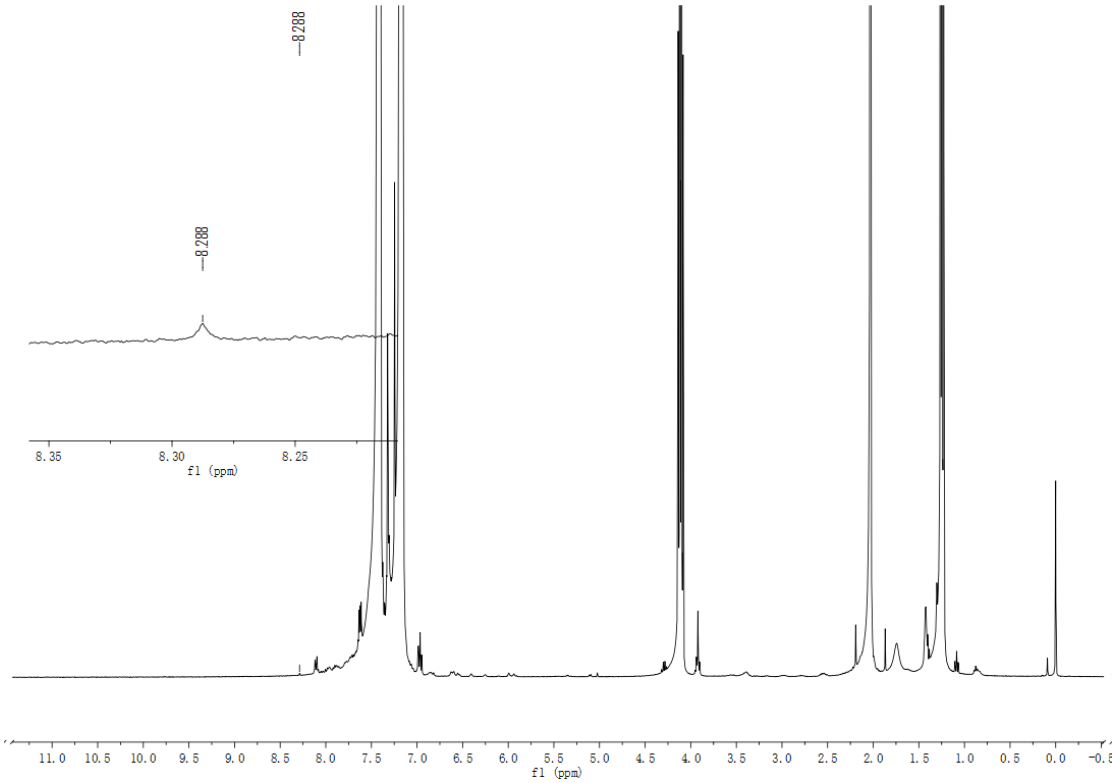
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

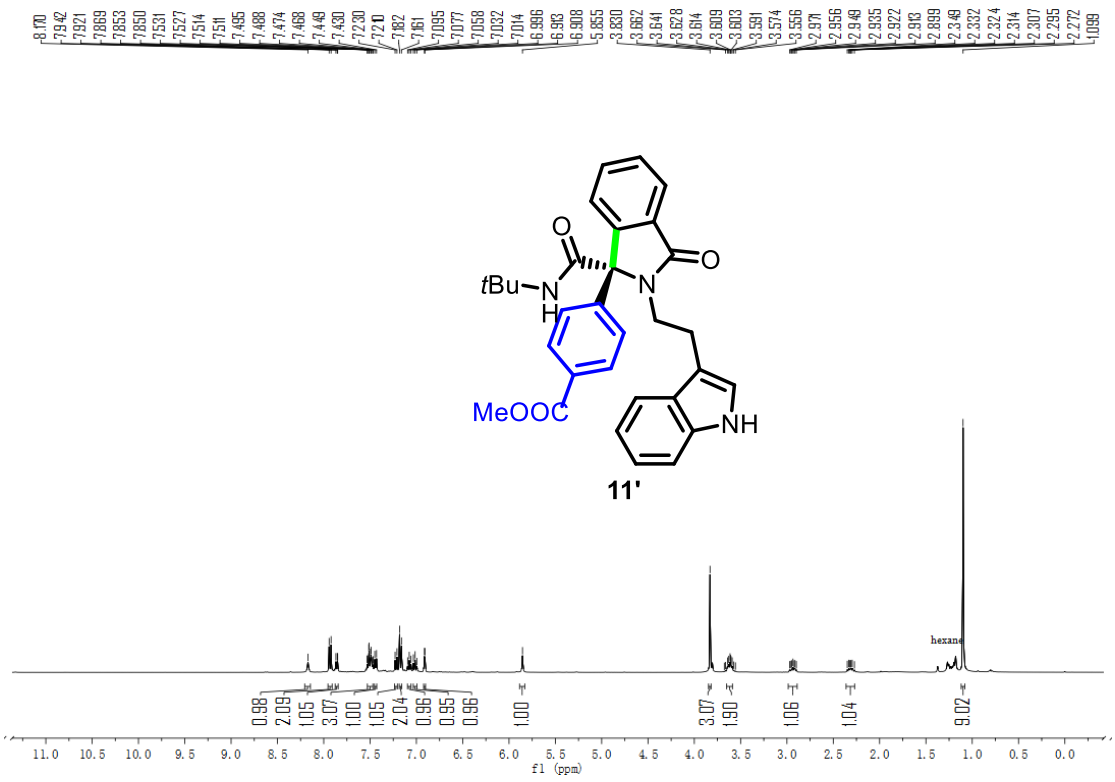


11 crude ^{1}H NMR

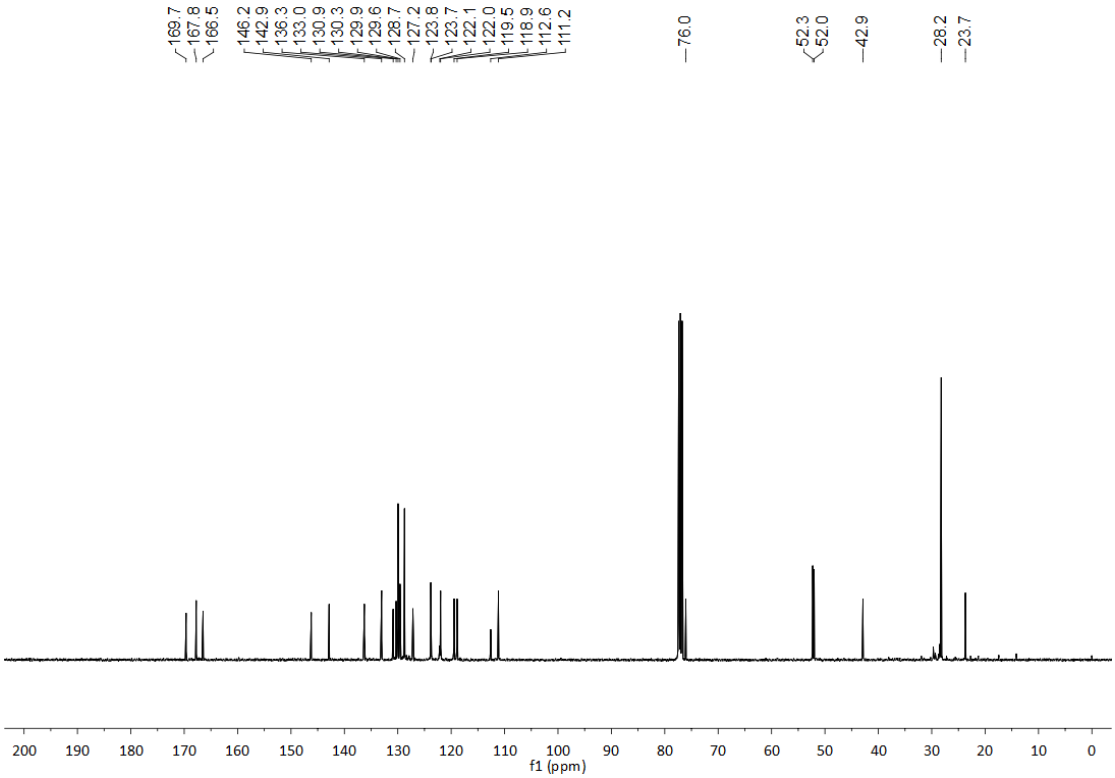


methyl-4-(2-(2-(1H-indol-3-yl)ethyl)-1-(tert-butylcarbamoyl)-3-oxoisoindolin-1-yl)benzoate (11')

^{1}H NMR (400 MHz, $CDCl_3$):



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



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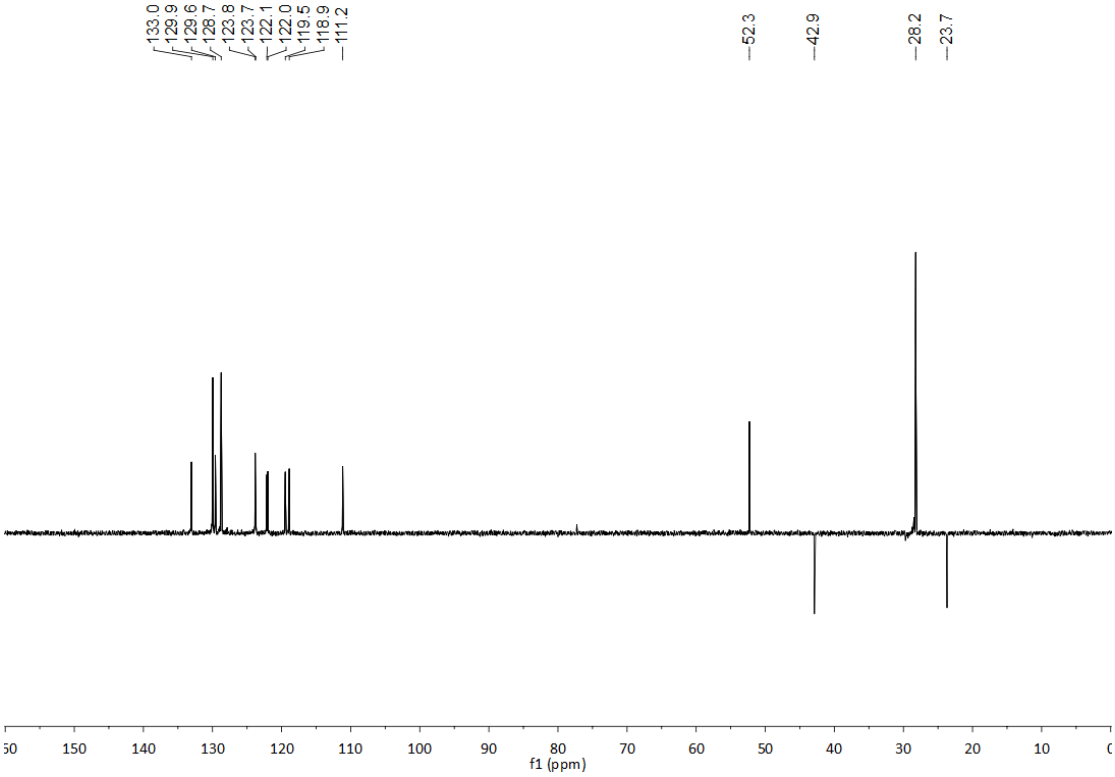
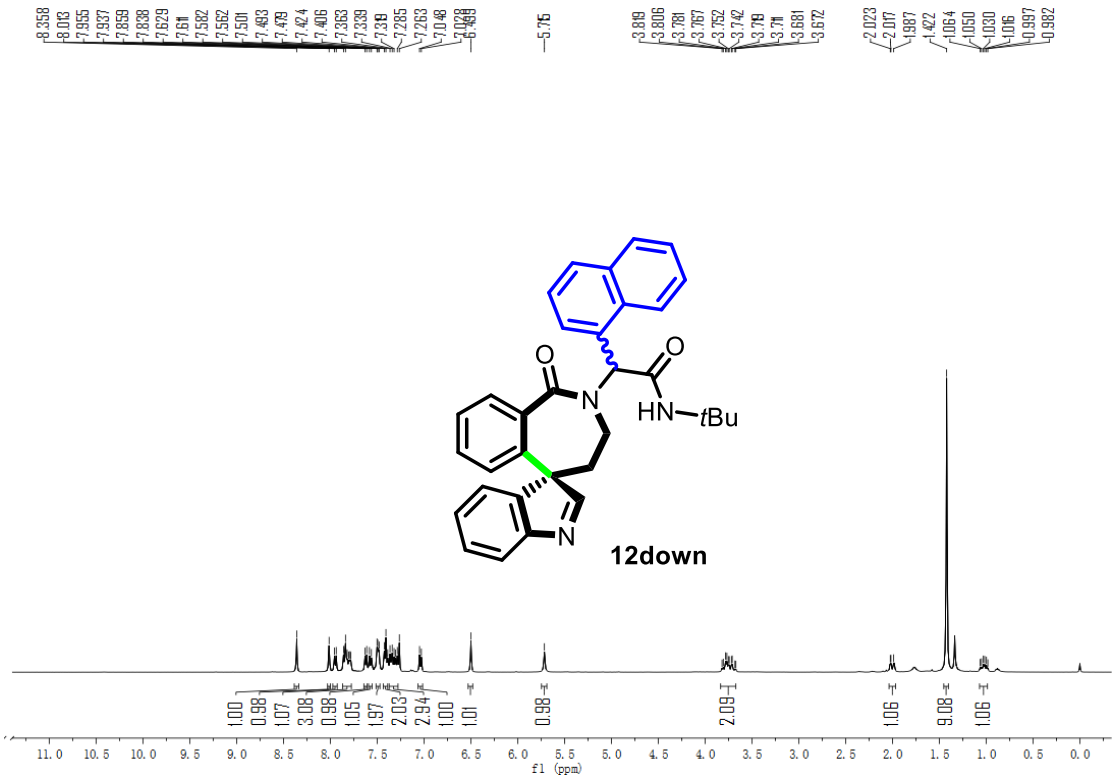
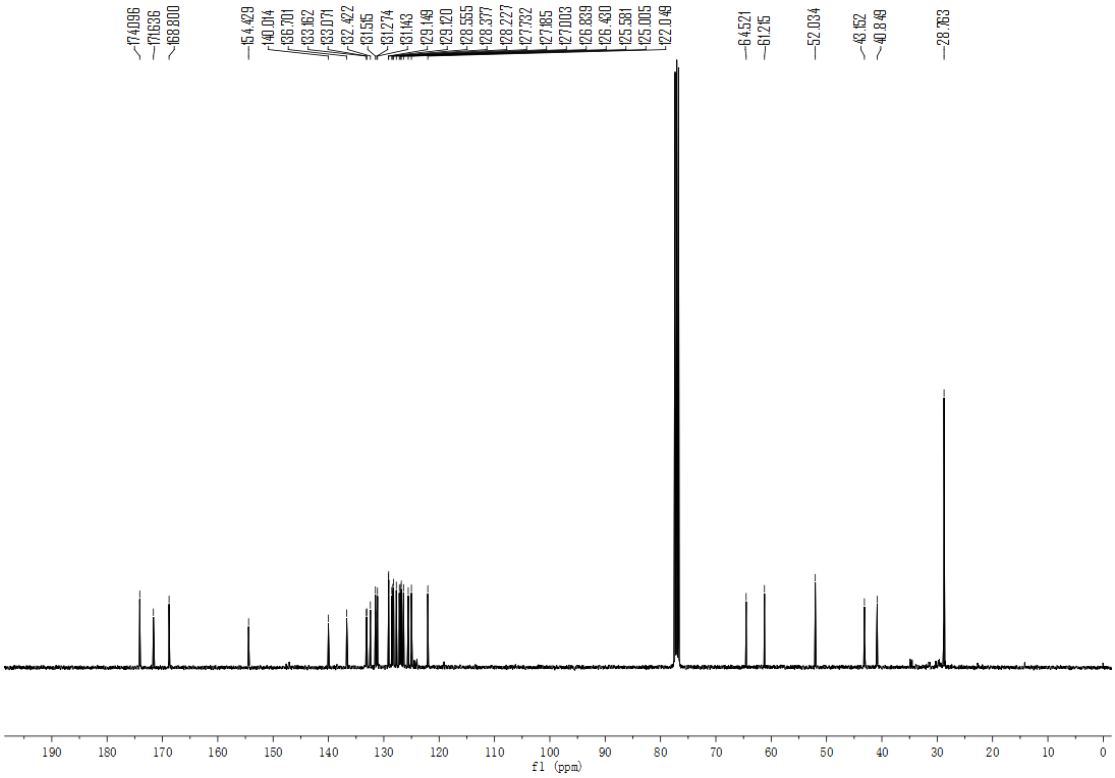


N-(tert-butyl)-2-(naphthalen-1-yl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (12down)

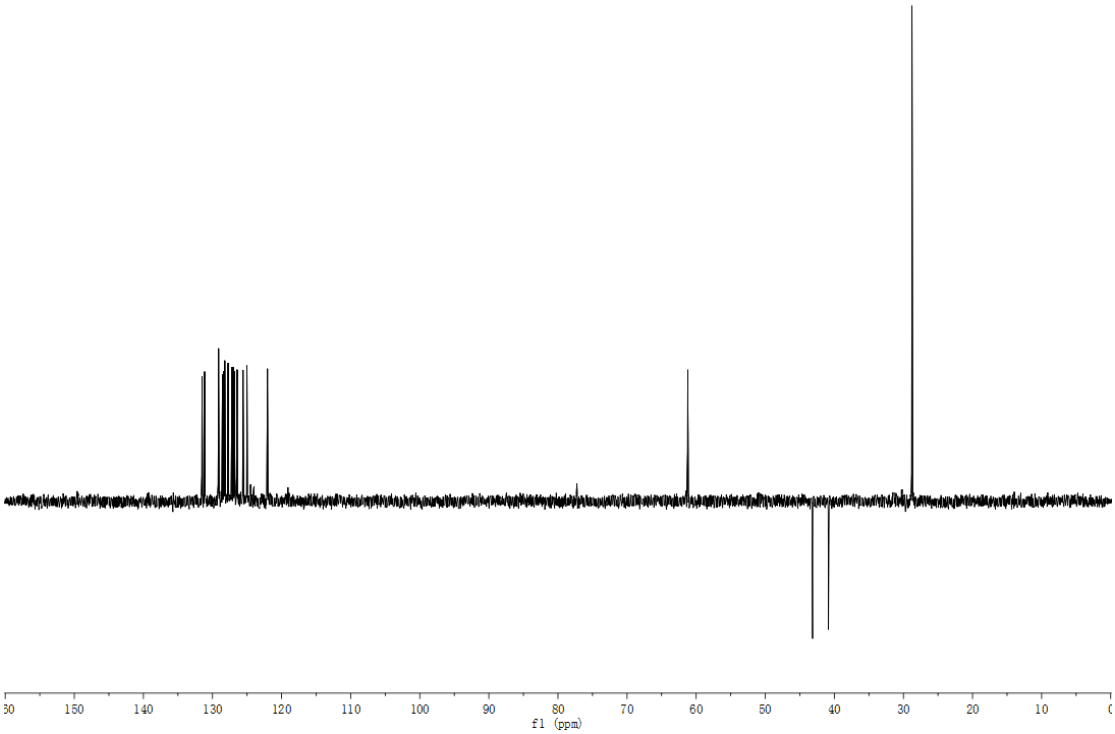
^{1}H NMR (400 MHz, $CDCl_3$):



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

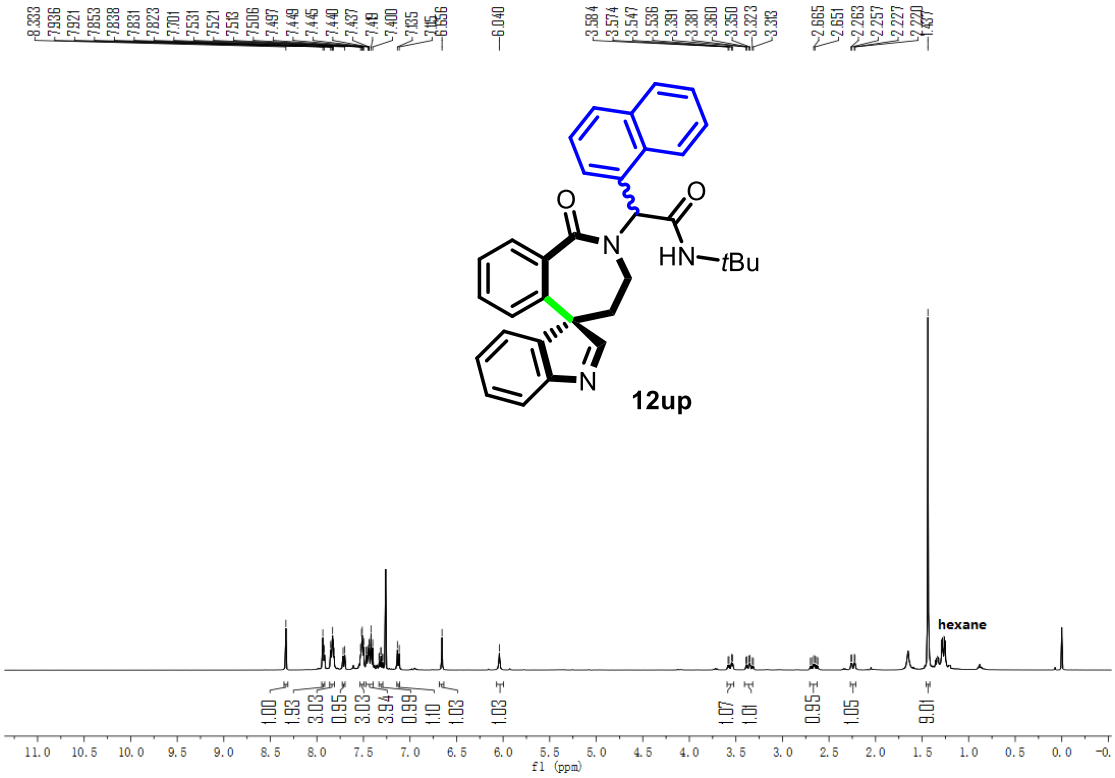


DEPT

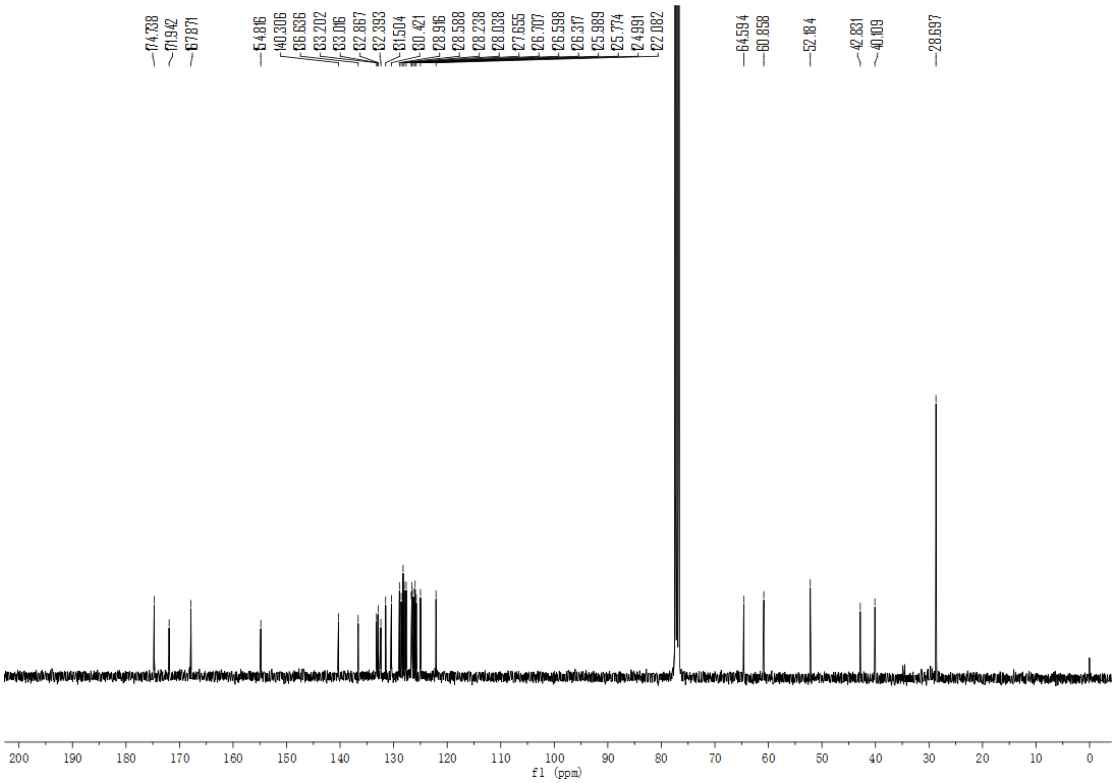


N-(tert-butyl)-2-(naphthalen-1-yl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)acetamide (12up)

^{1}H NMR (400 MHz, $CDCl_3$):



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



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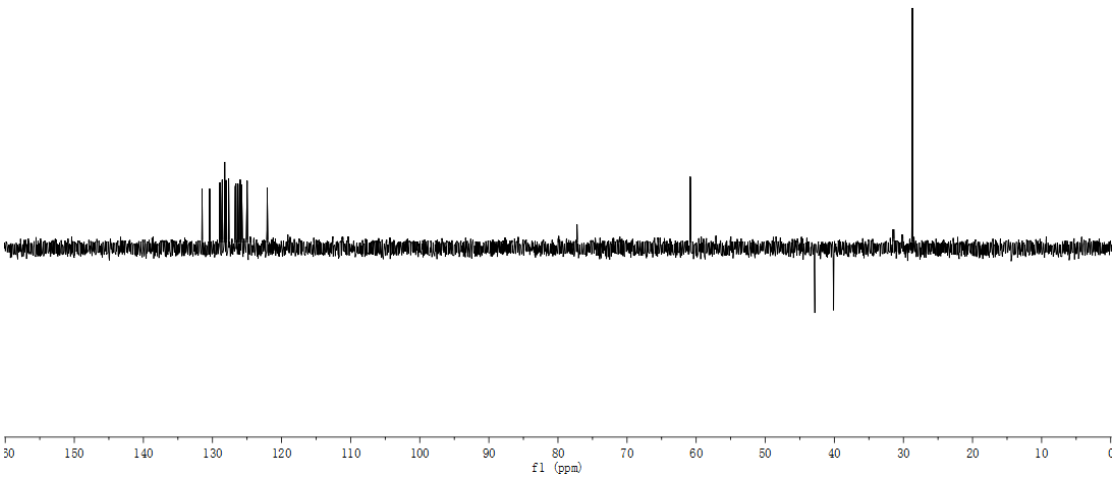
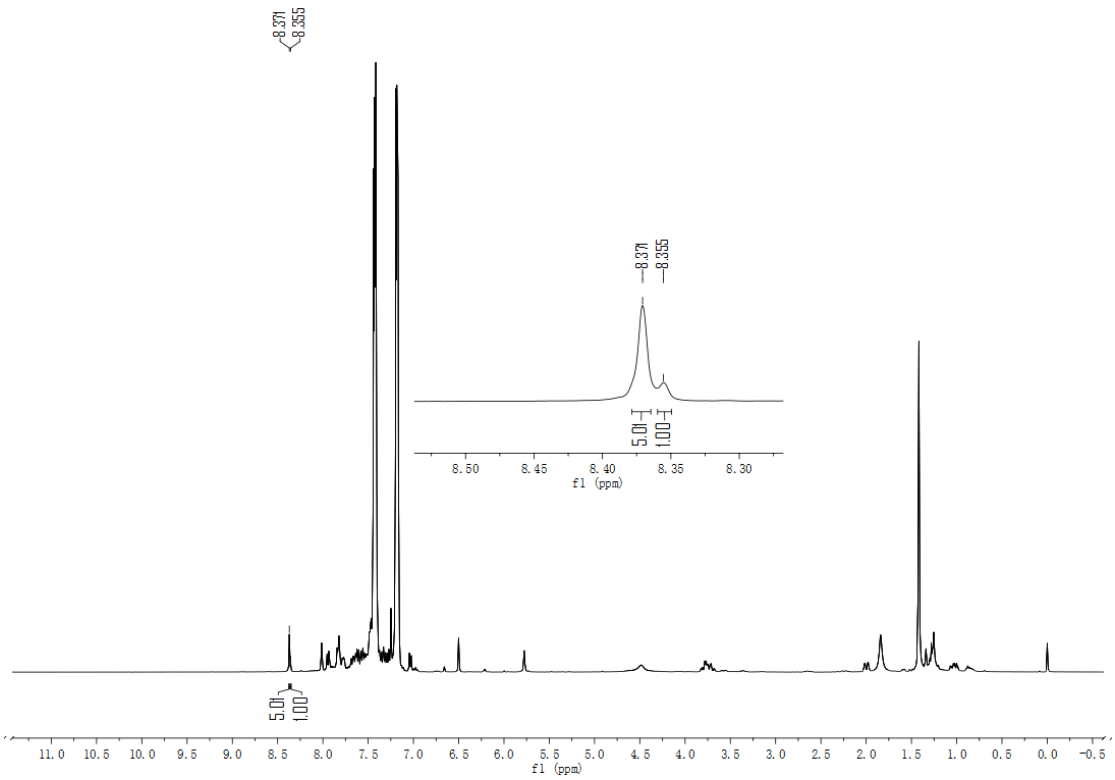
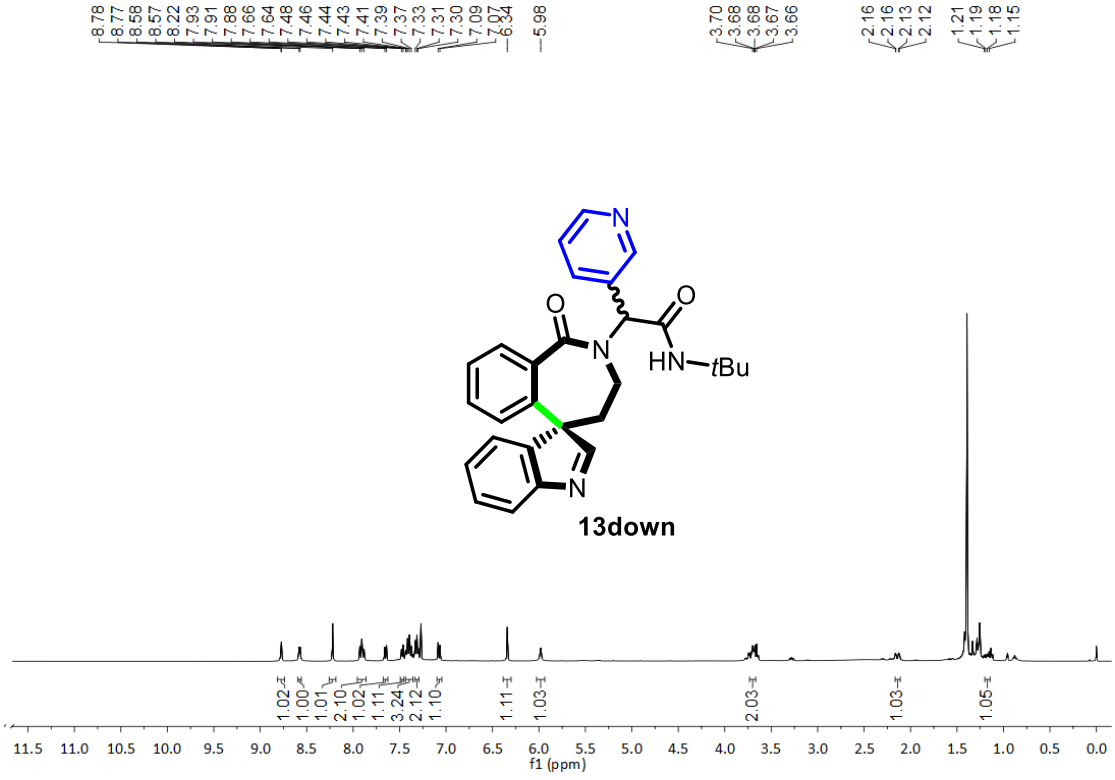


12 crude ^{1}H NMR

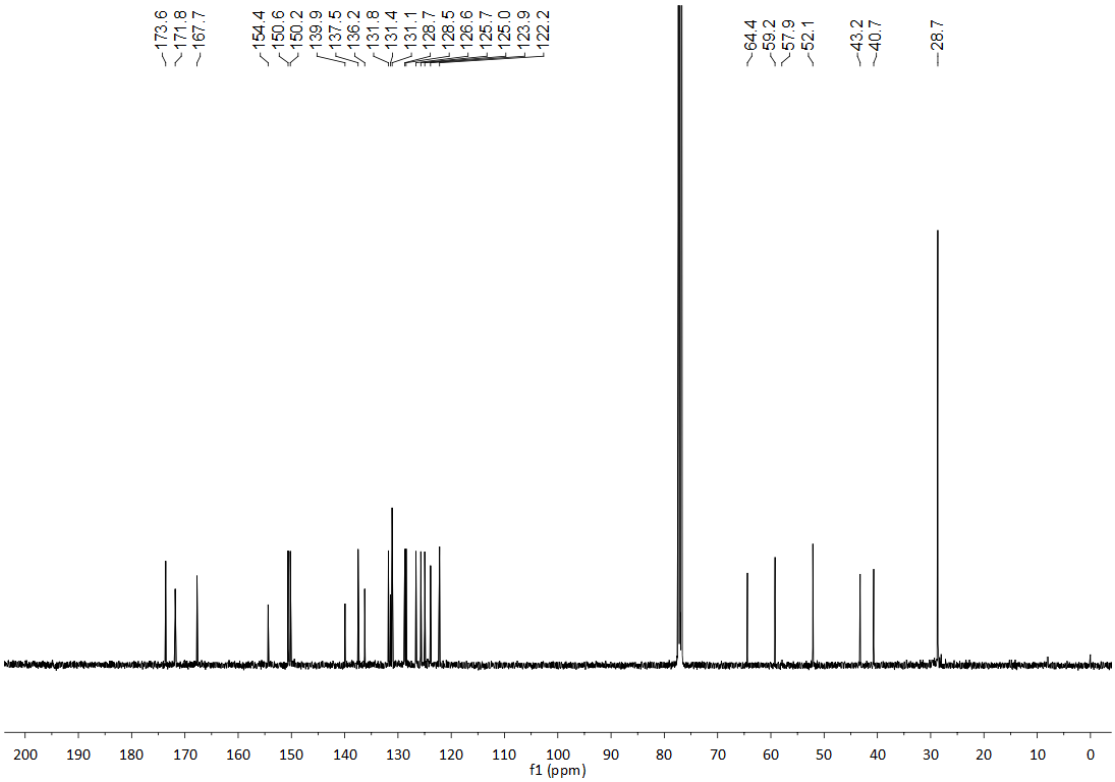


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(pyridin-3-yl)aceta mide **(13down)**

^{1}H NMR (400 MHz, $CDCl_3$):



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



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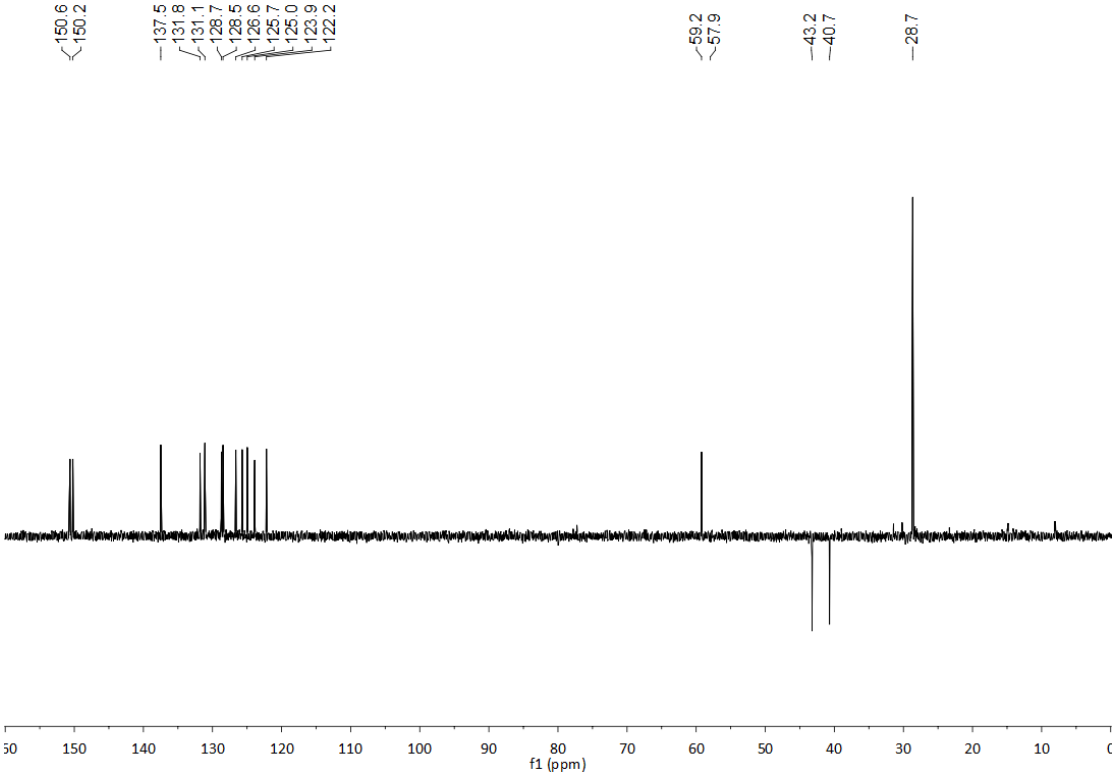
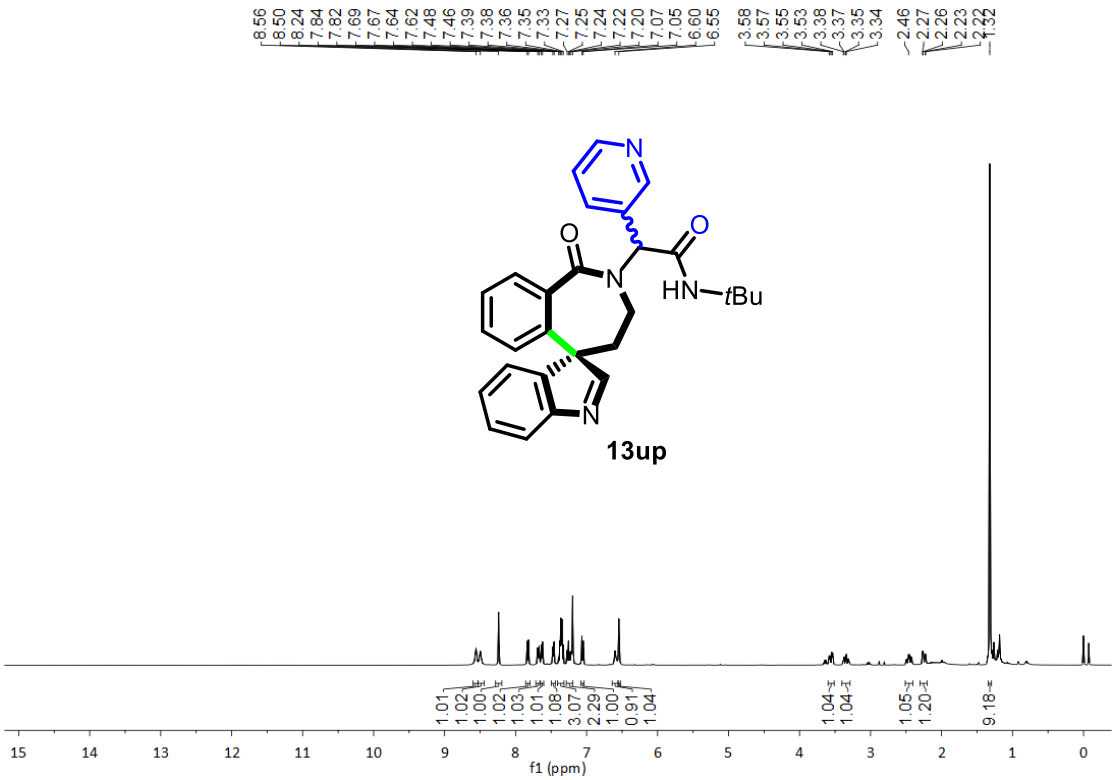
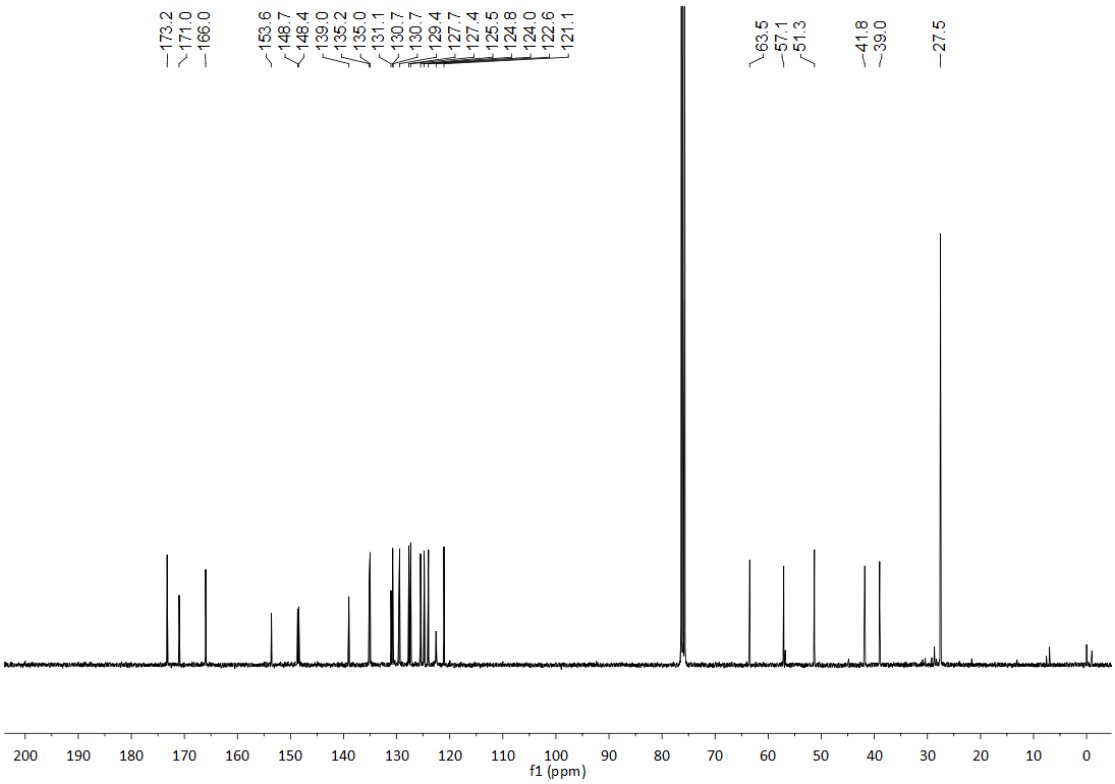


N-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-(pyridin-3-yl)acetamide (13up)

^{1}H NMR (400 MHz, $CDCl_3$)：



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



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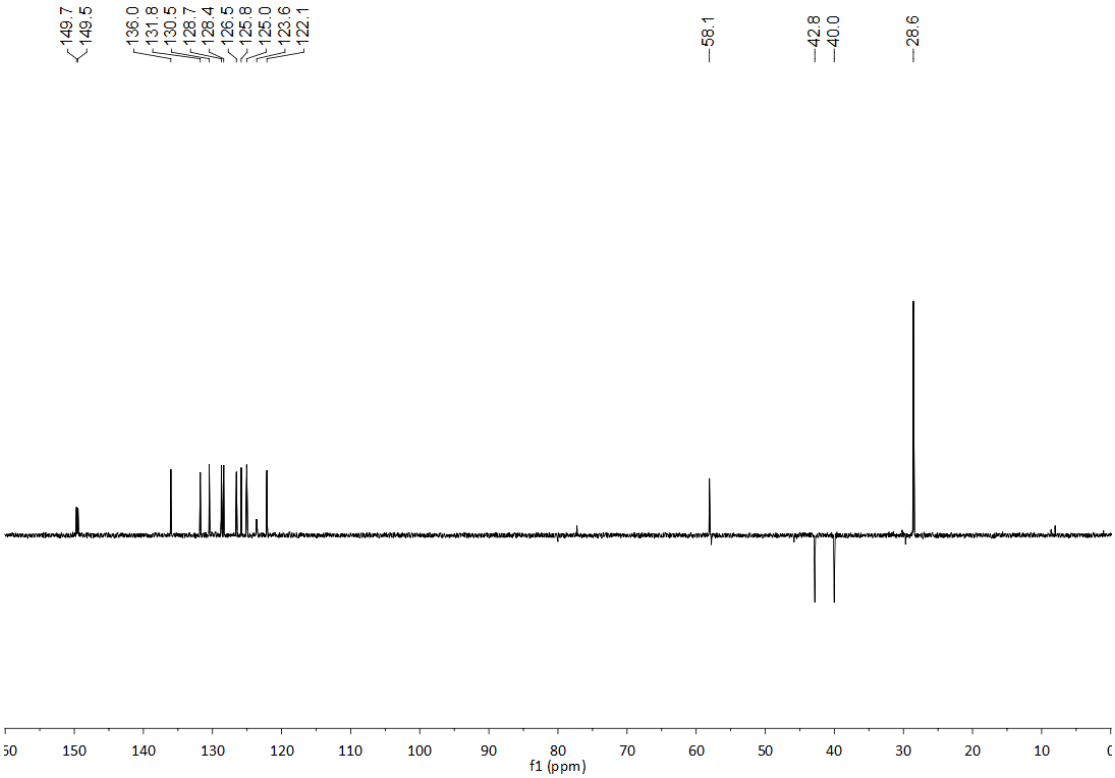
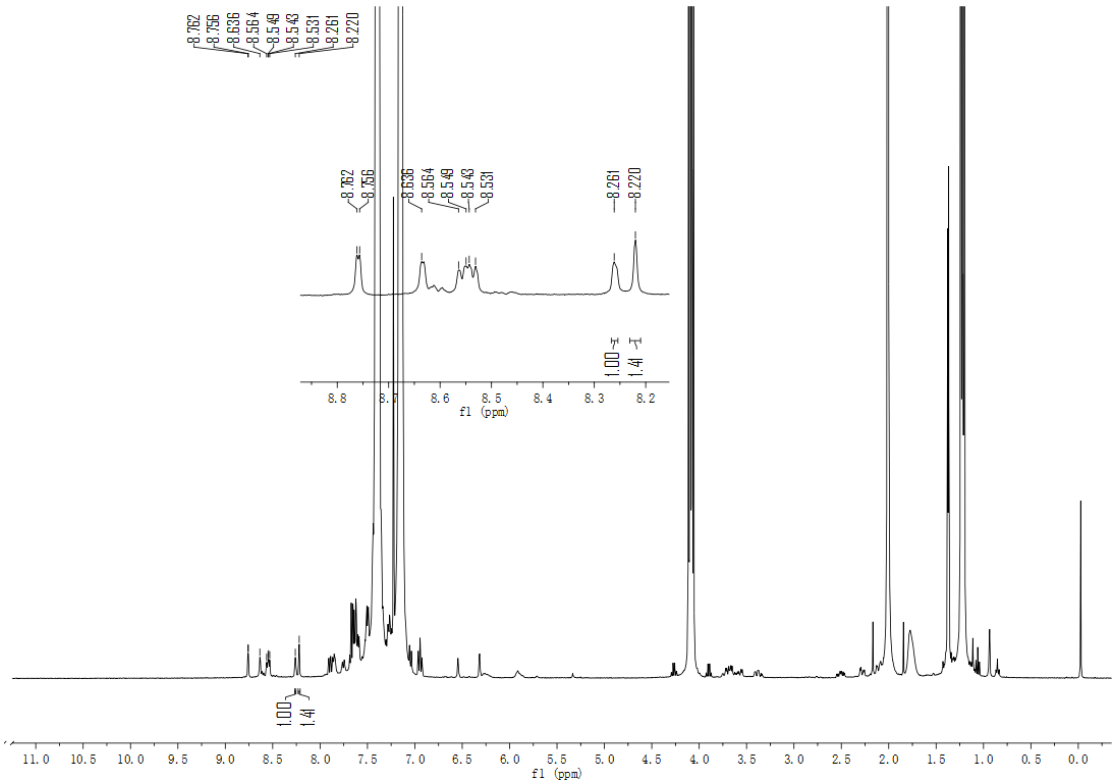
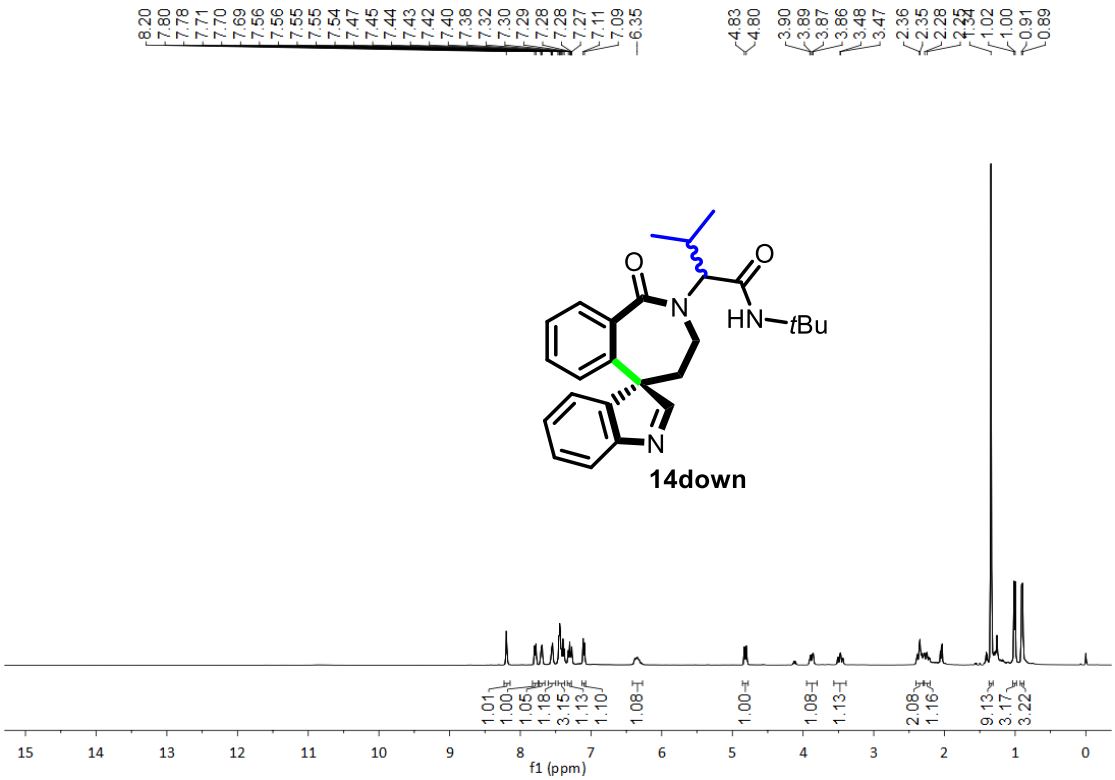


13 crude ^{1}H NMR

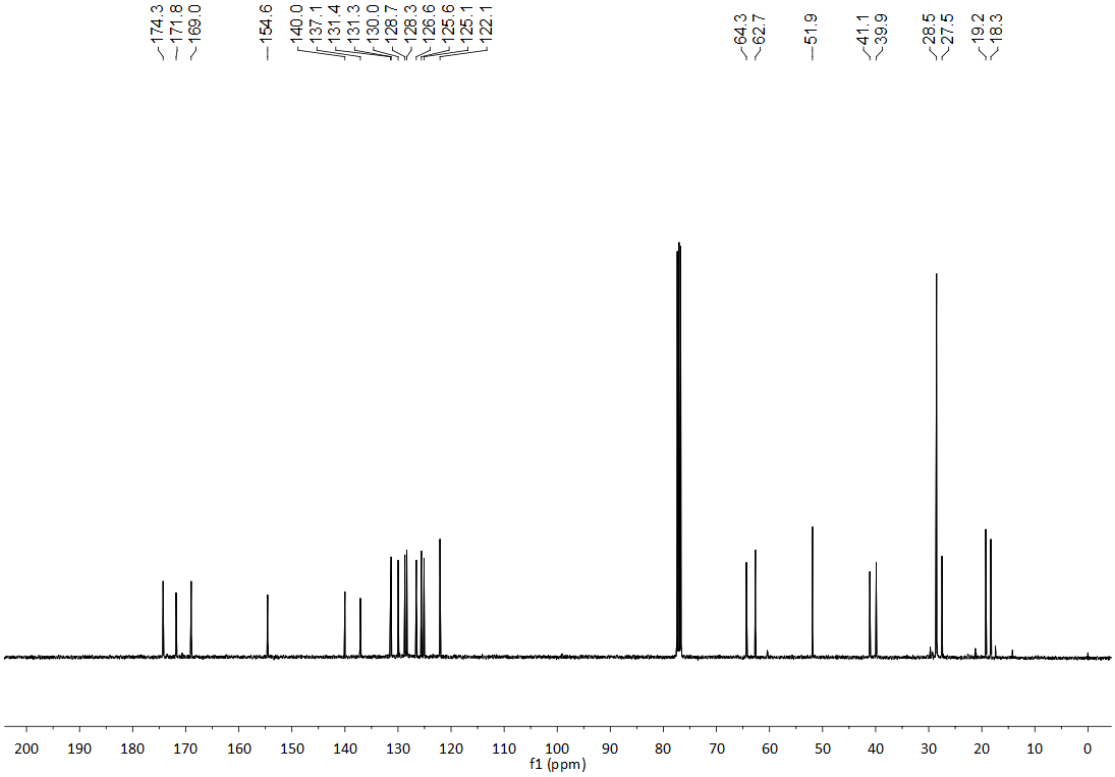


N-(tert-butyl)-3-methyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)butanamide (14down)

^{1}H NMR (400 MHz, $CDCl_3$)：



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



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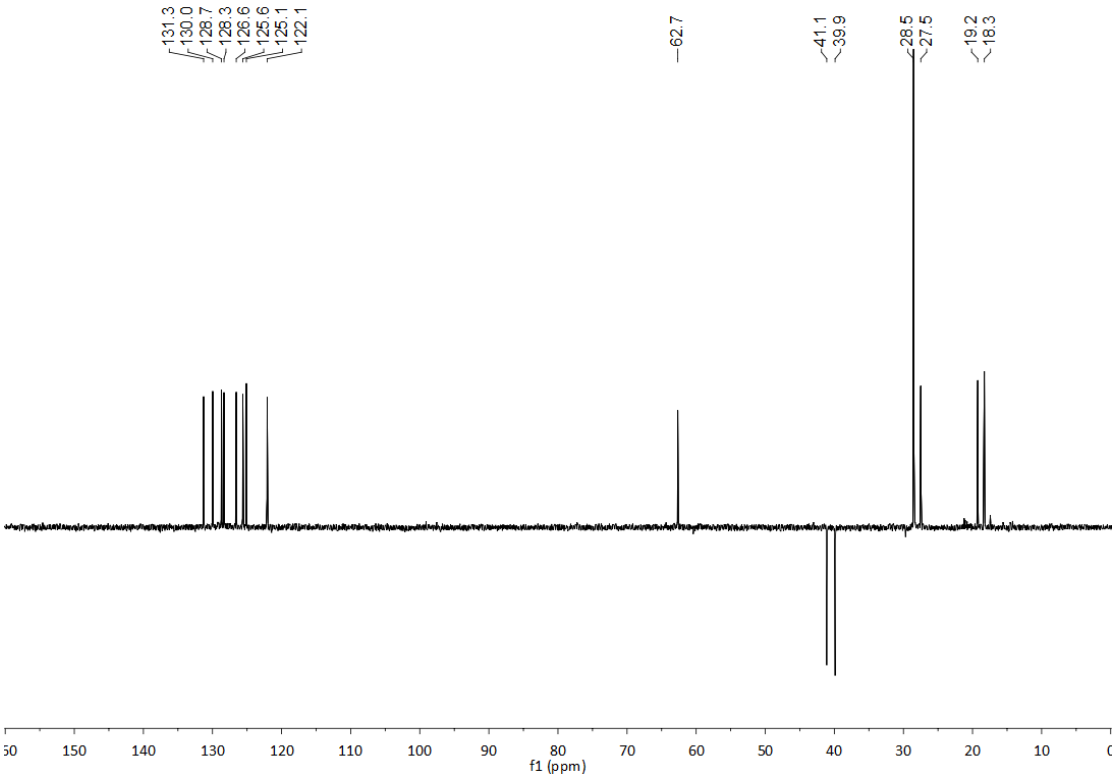
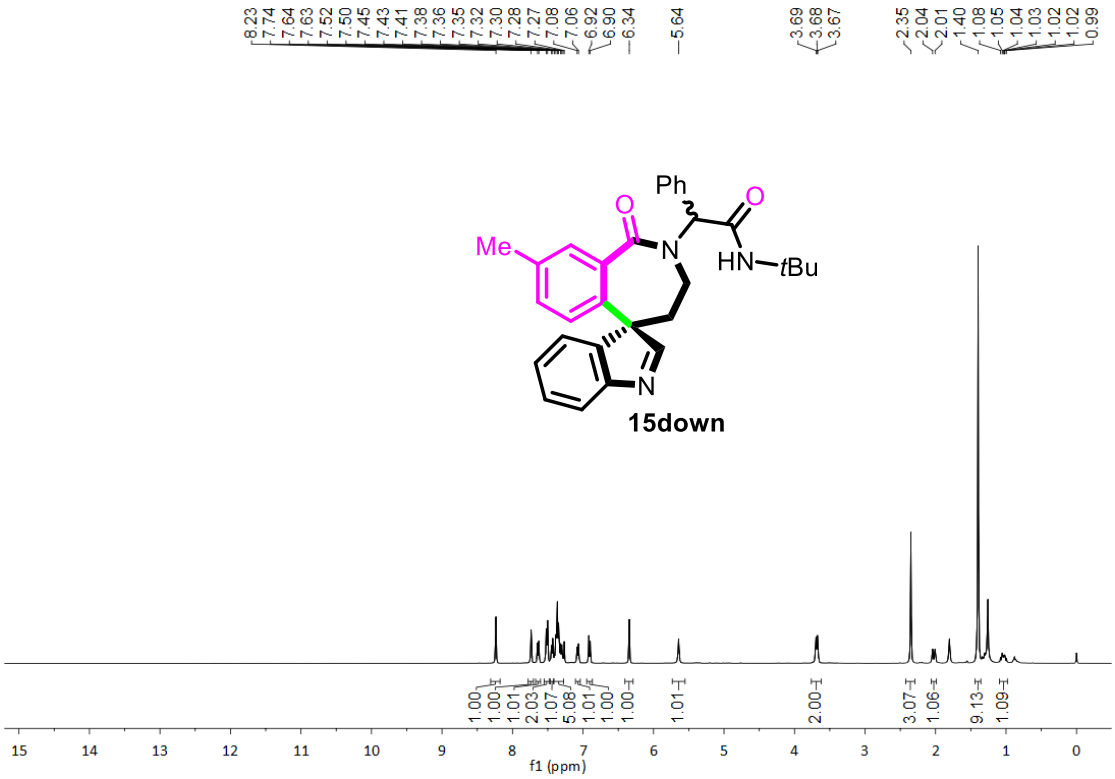
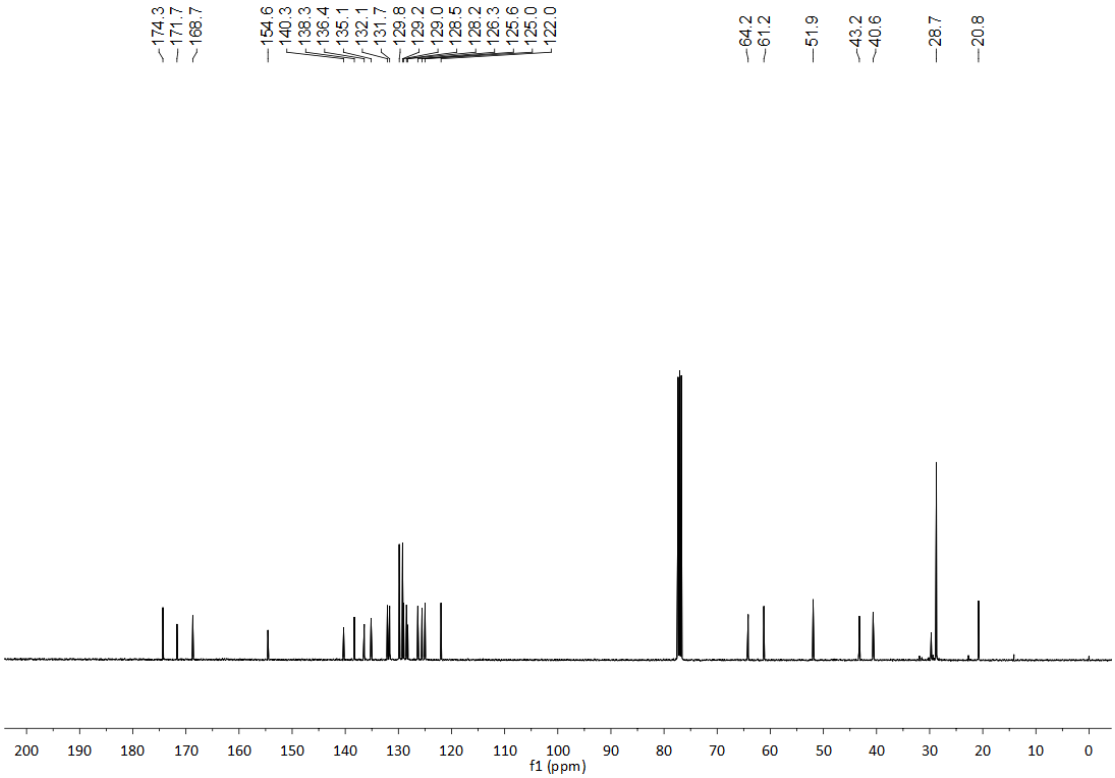


N-(tert-butyl)-2-(8-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide (15down)

^{1}H NMR (400 MHz, $CDCl_3$):



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



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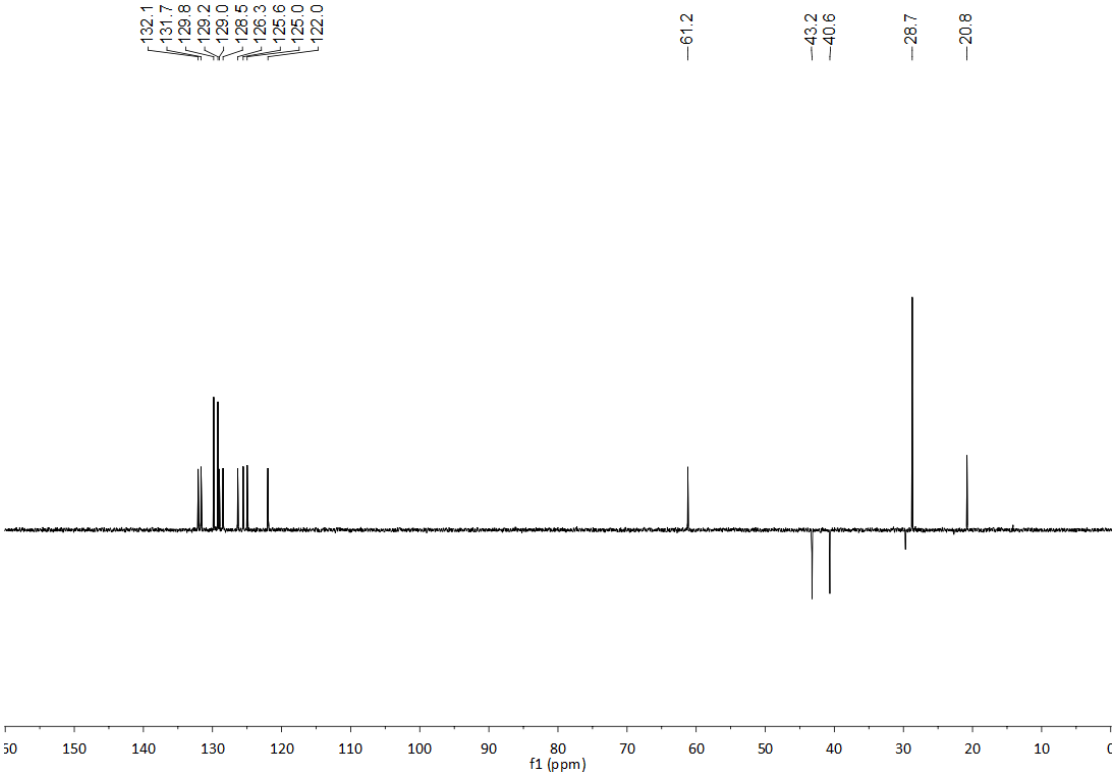
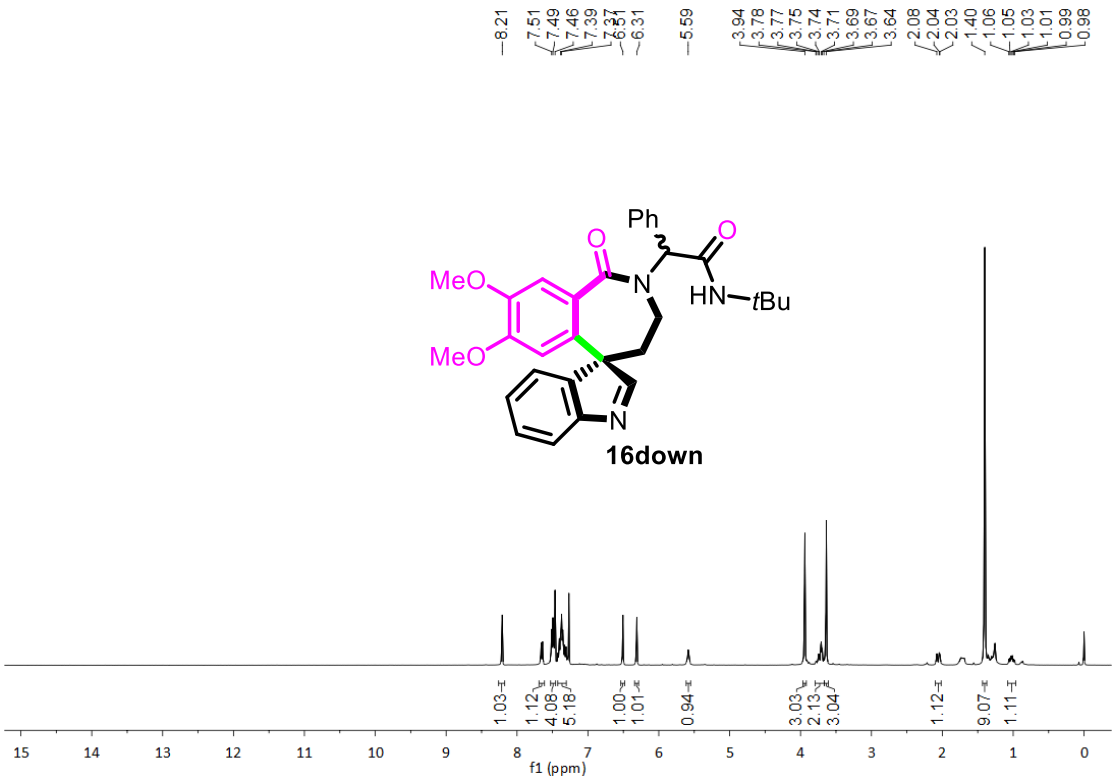
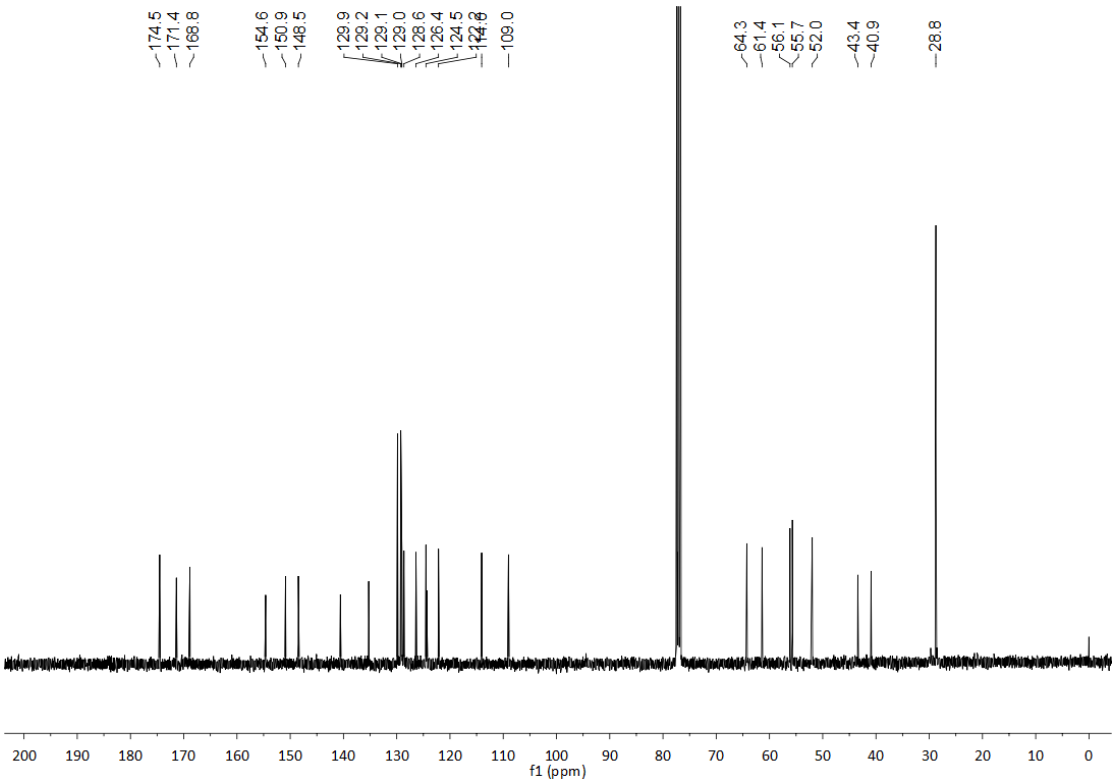


N-(tert-butyl)-2-(7,8-dimethoxy-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (16down)

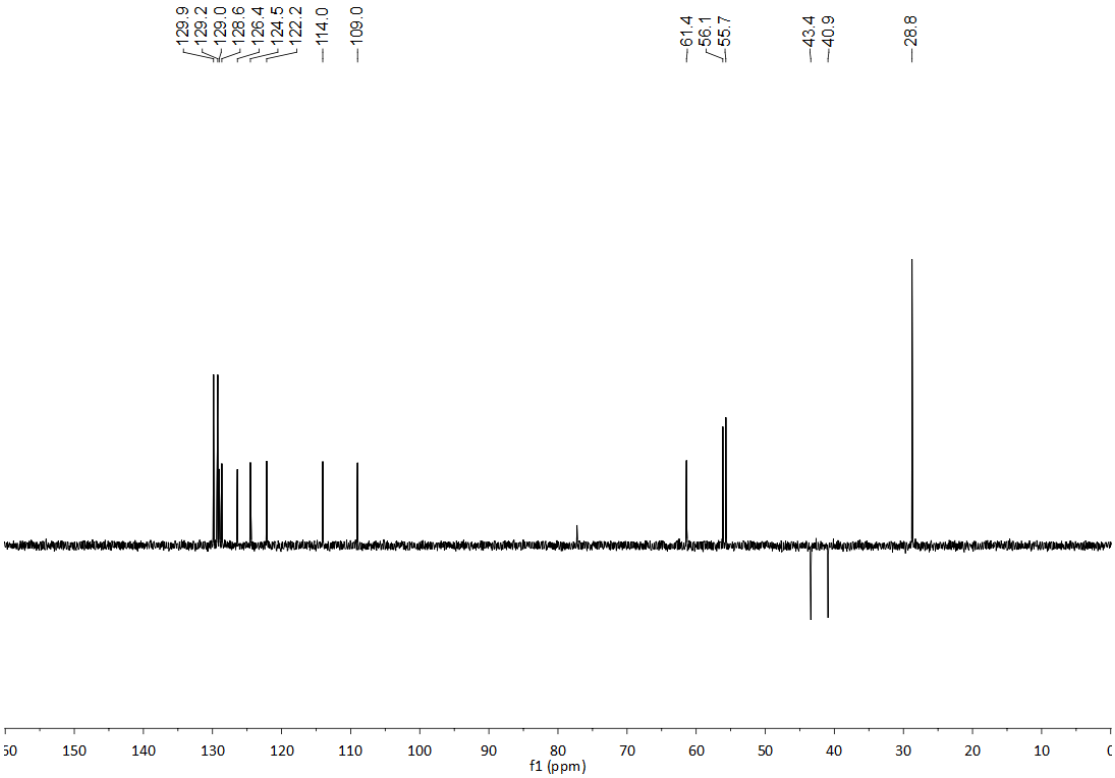
^{1}H NMR (400 MHz, $CDCl_3$)：



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

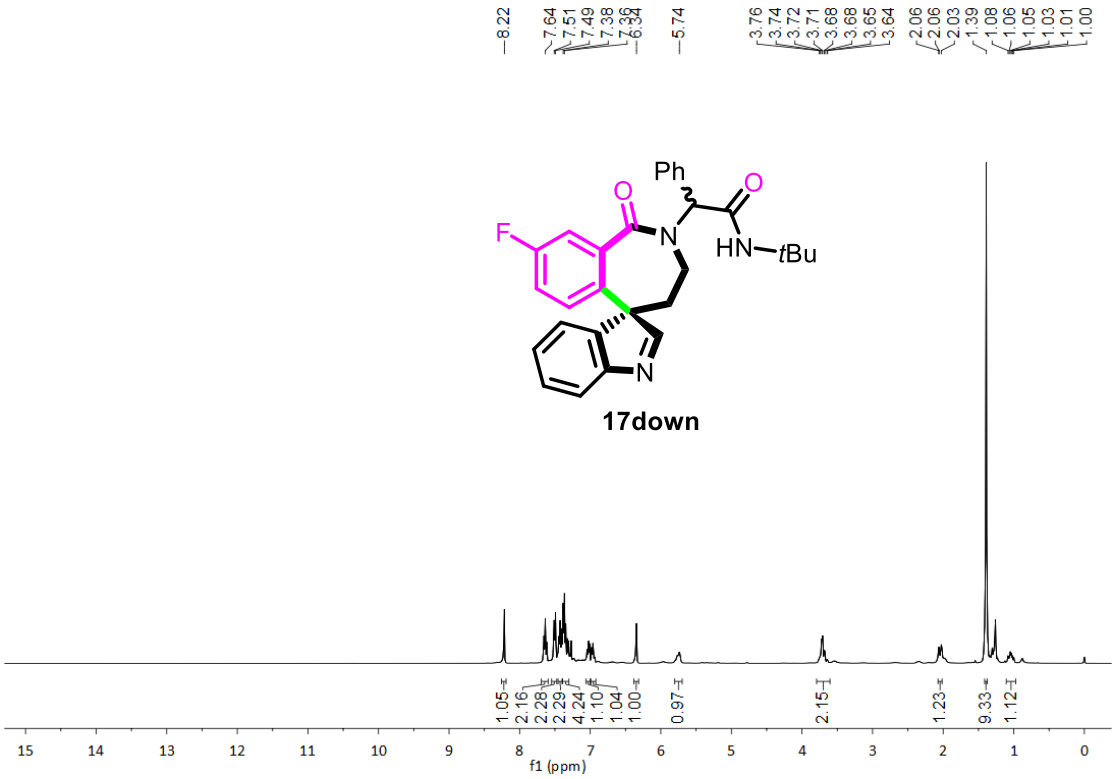


DEPT

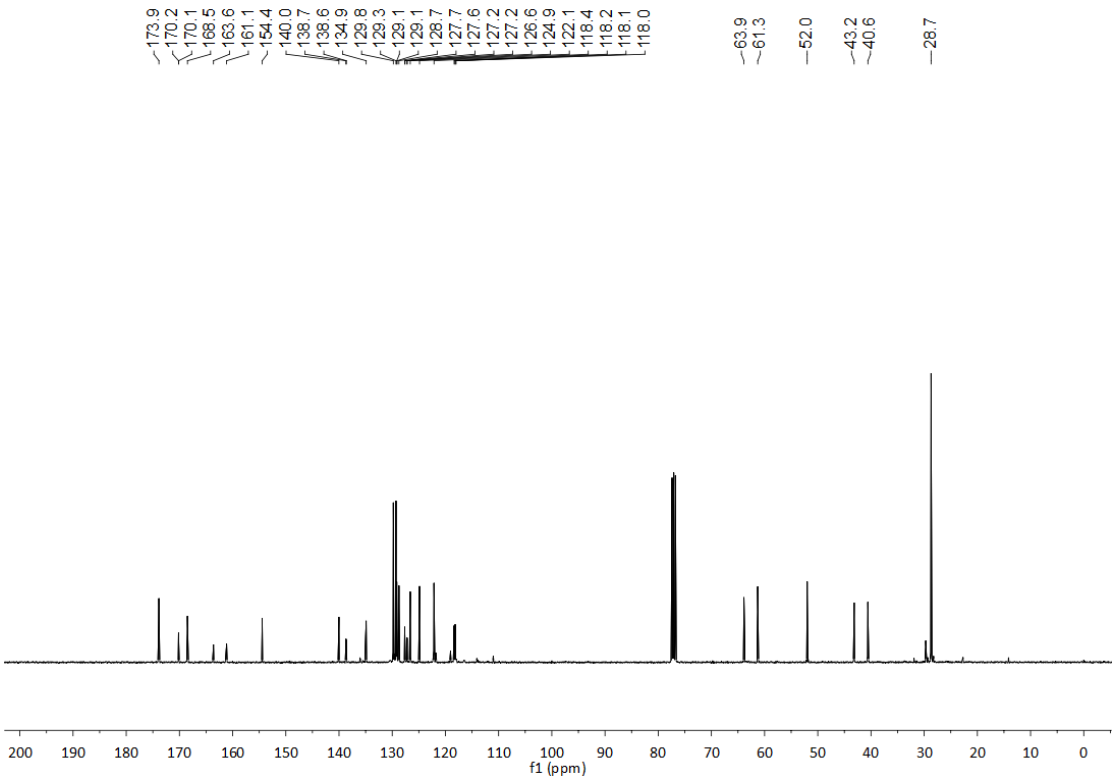


N-(tert-butyl)-2-(8-fluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (17down)

^{1}H NMR (400 MHz, $CDCl_3$):



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



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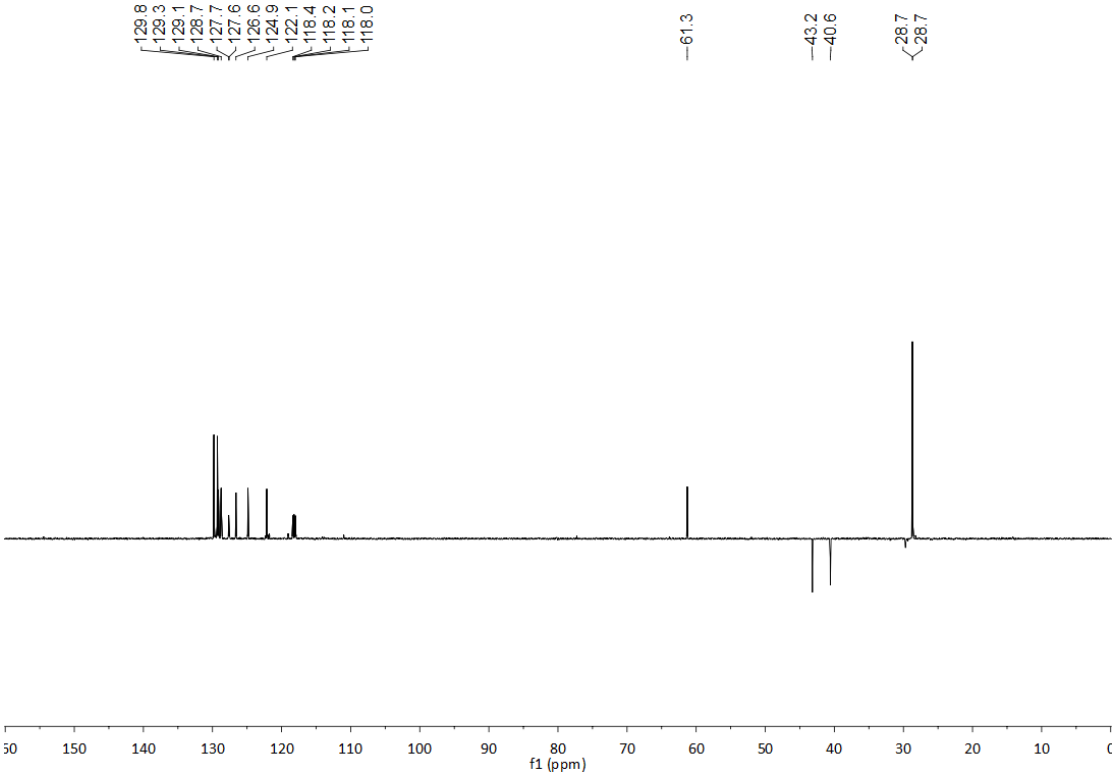
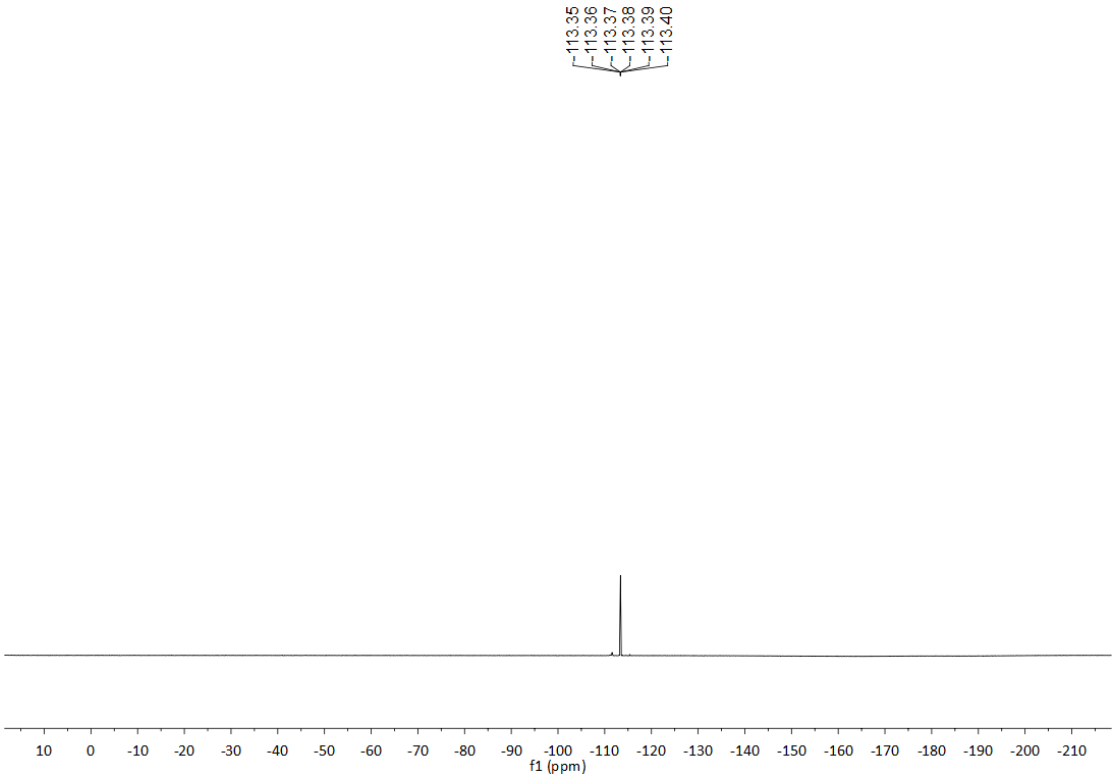
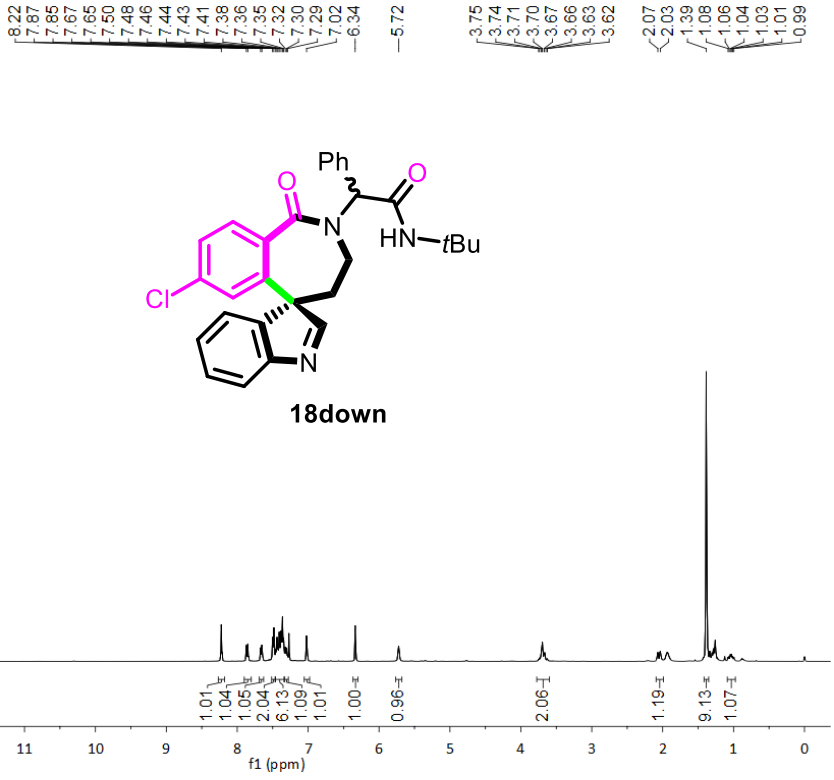


^{19}F NMR (376MHz, $CDCl_3$)

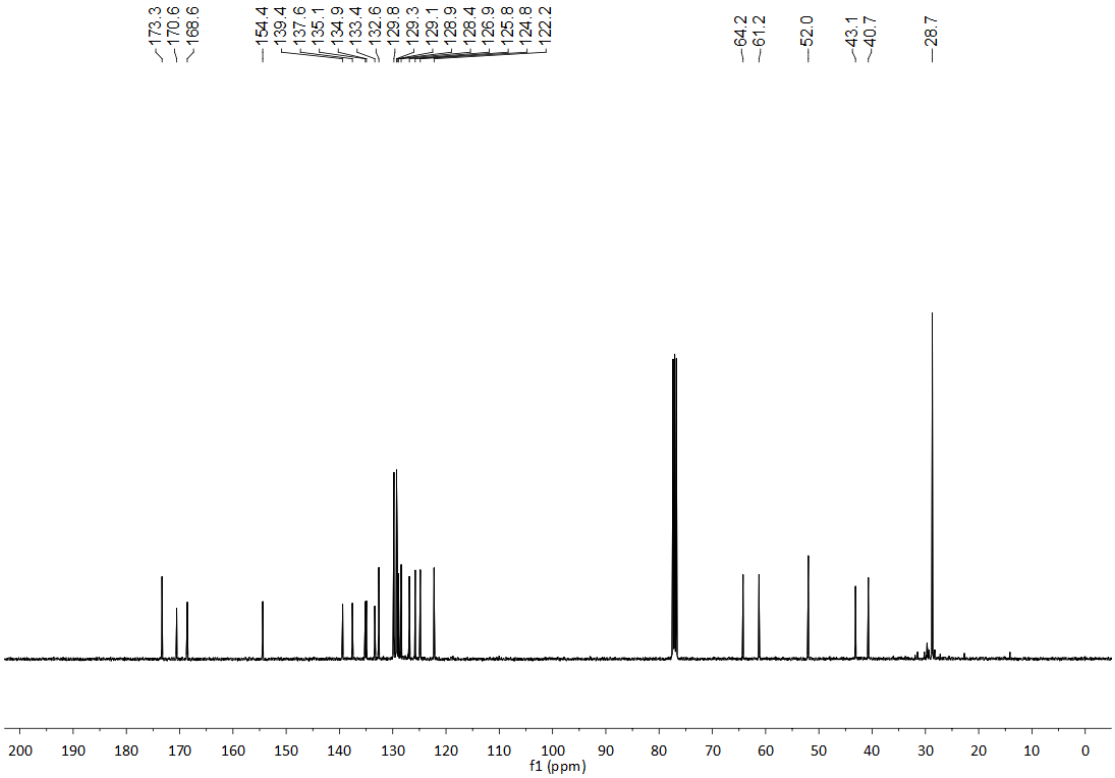


N-(tert-butyl)-2-(7-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide (18down)

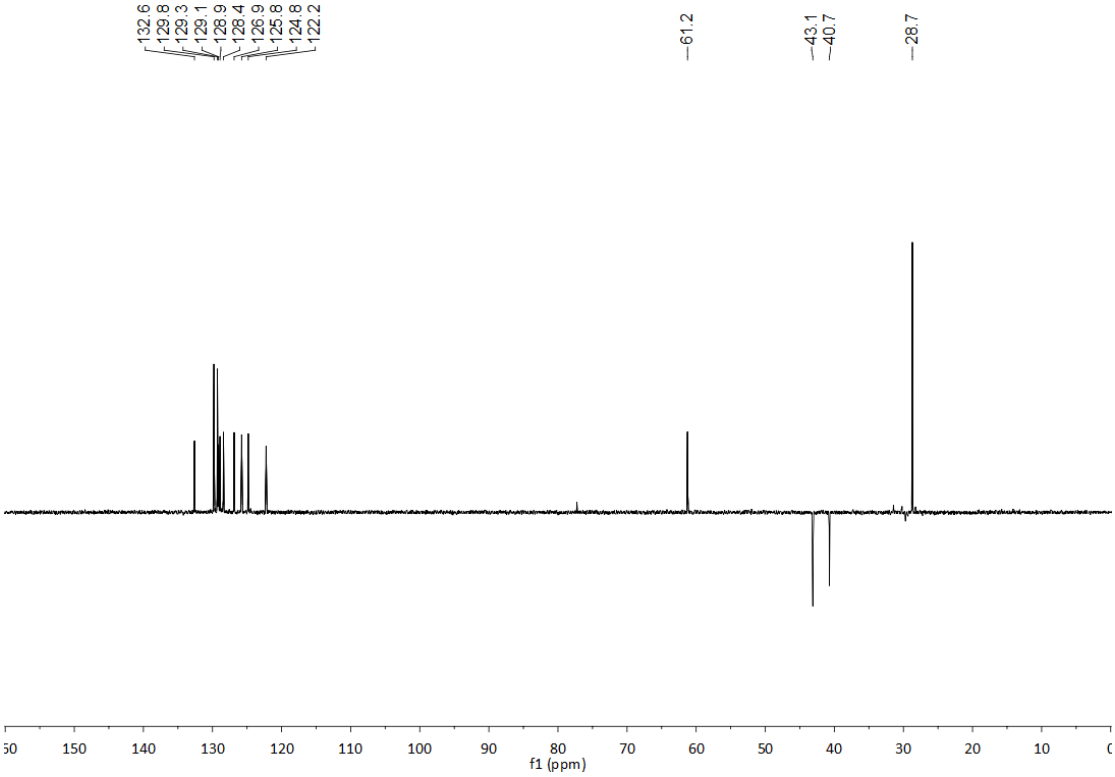
^{1}H NMR (400 MHz, $CDCl_3$):



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

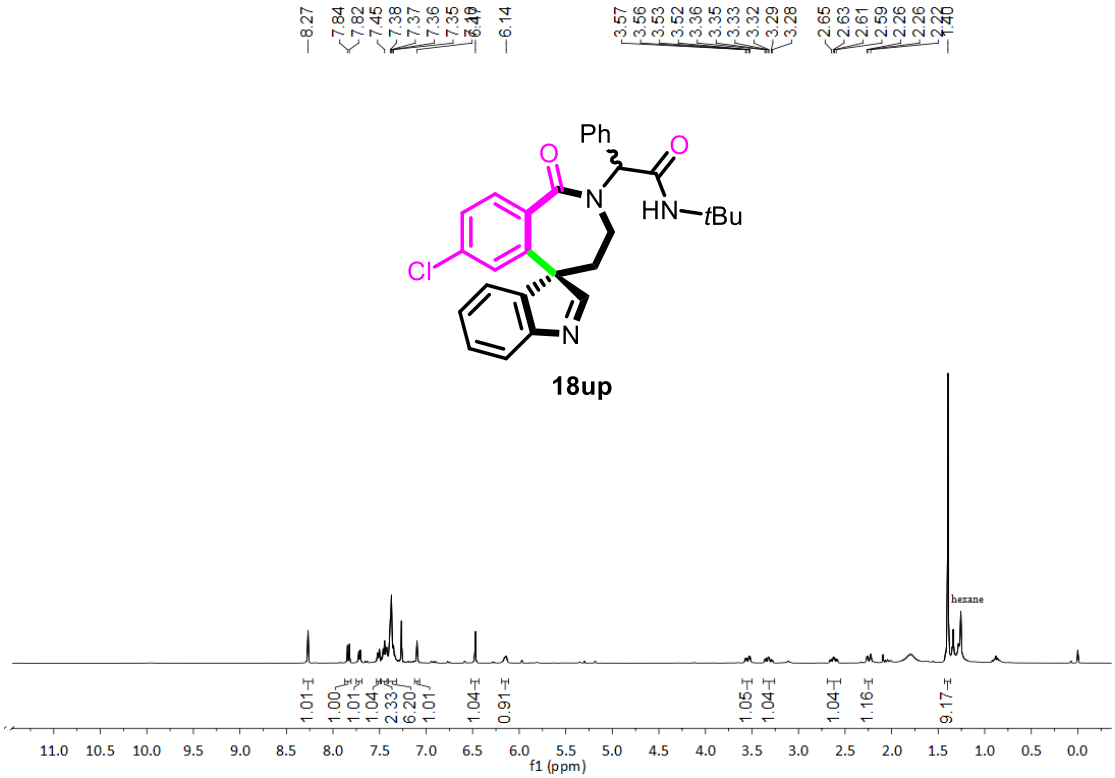


DEPT

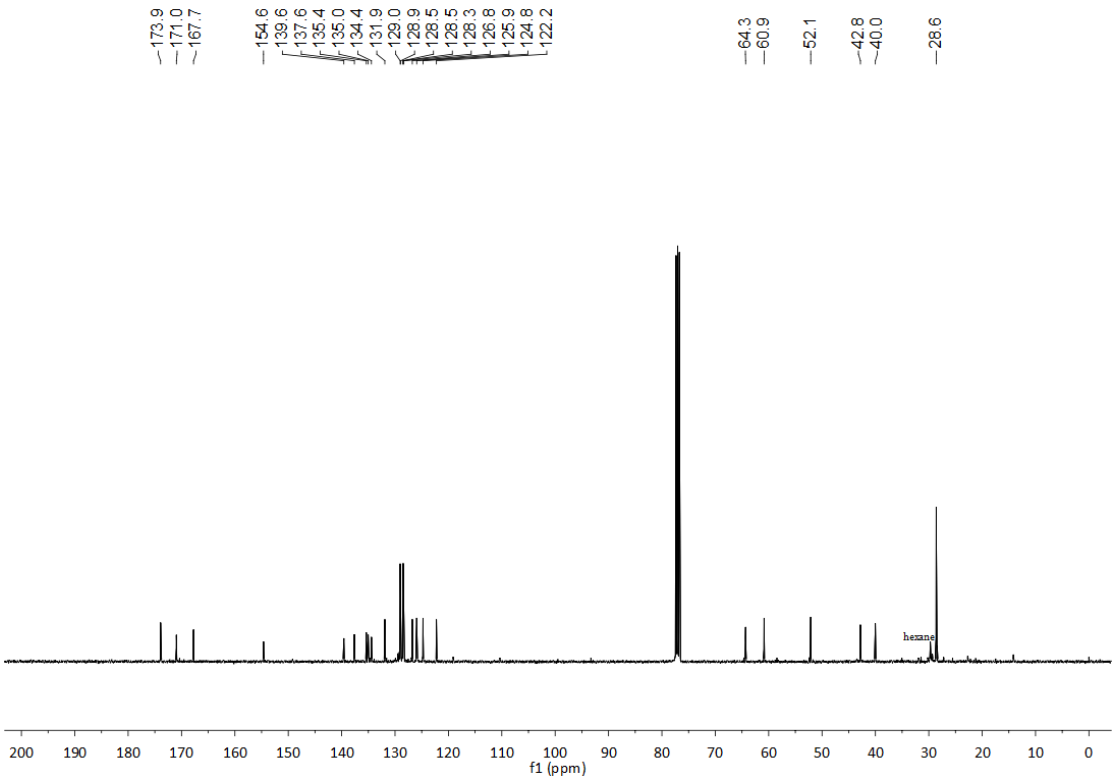


N-(tert-butyl)-2-(7-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide (18up)

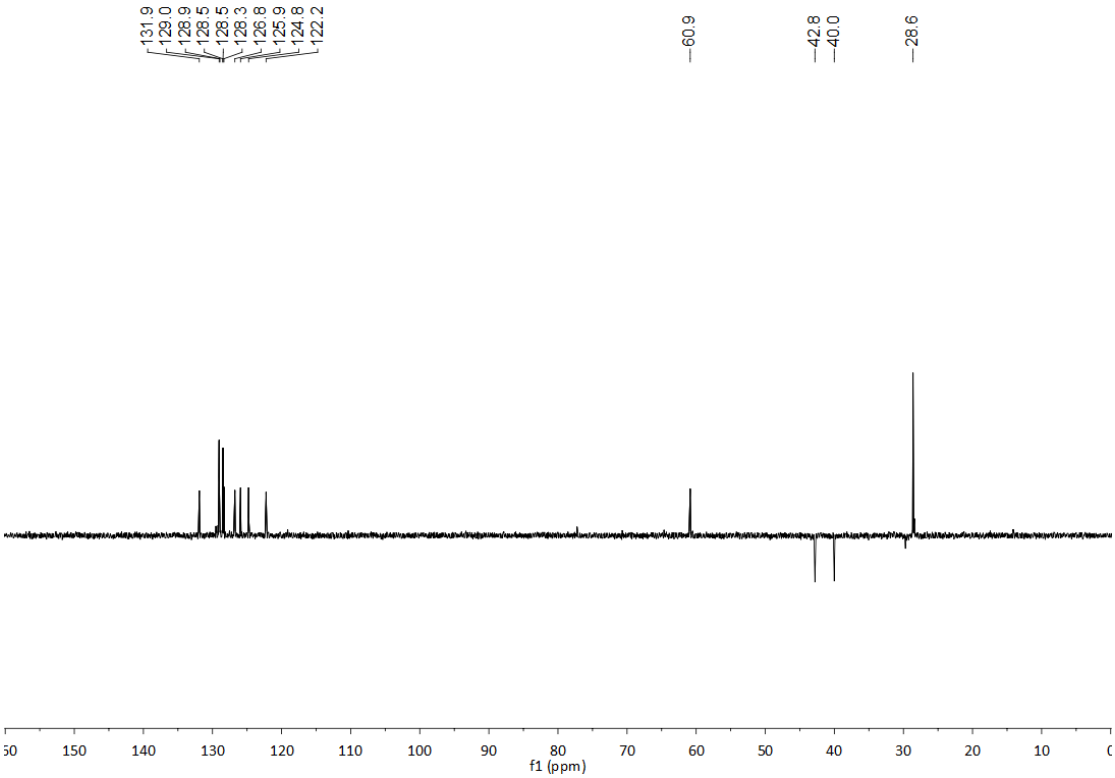
^{1}H NMR (400 MHz, $CDCl_3$):



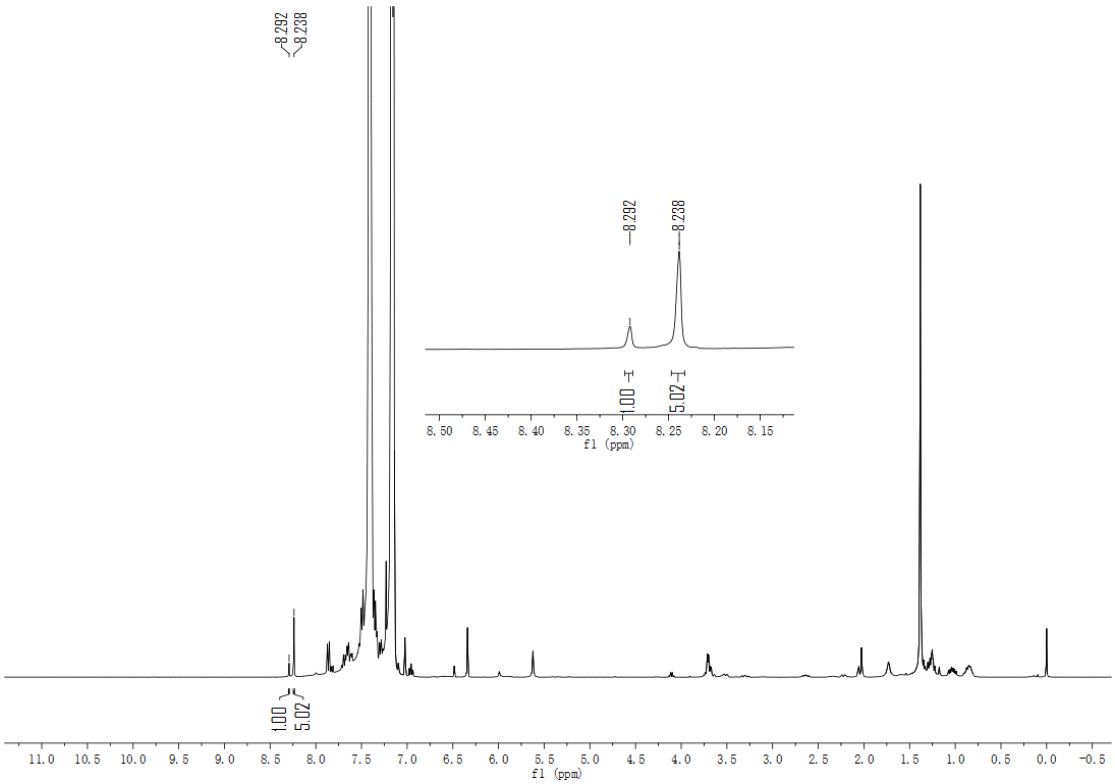
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

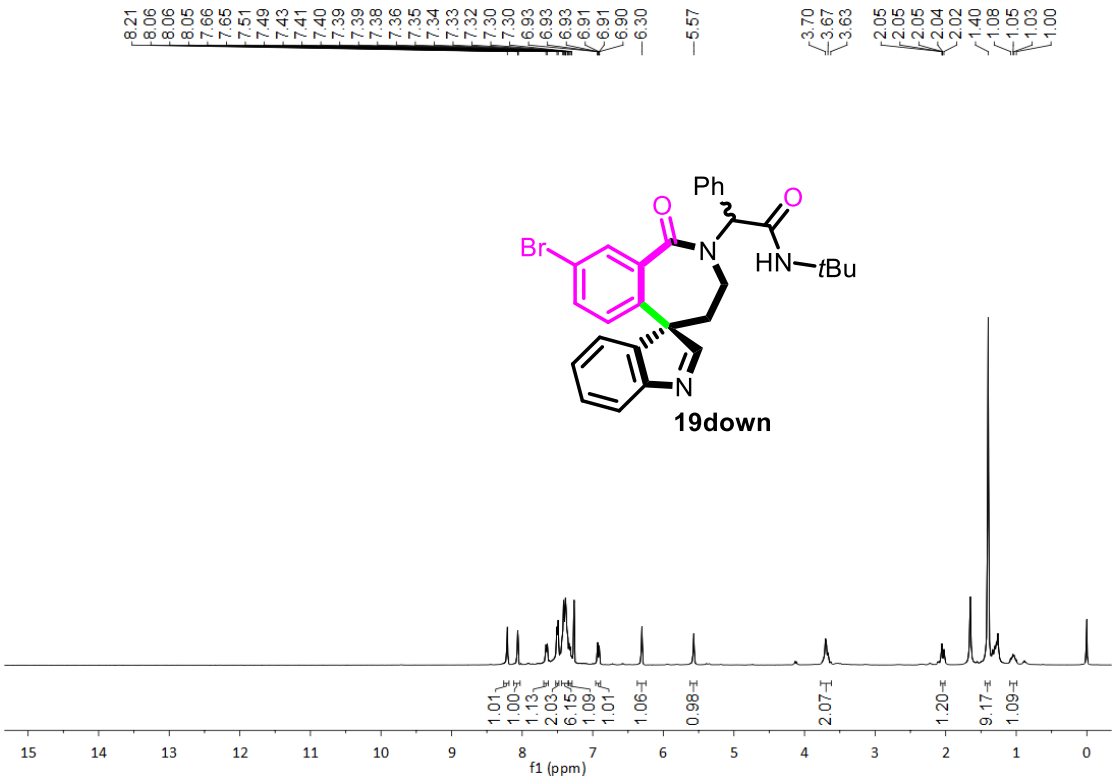


18 crude ^{1}H NMR

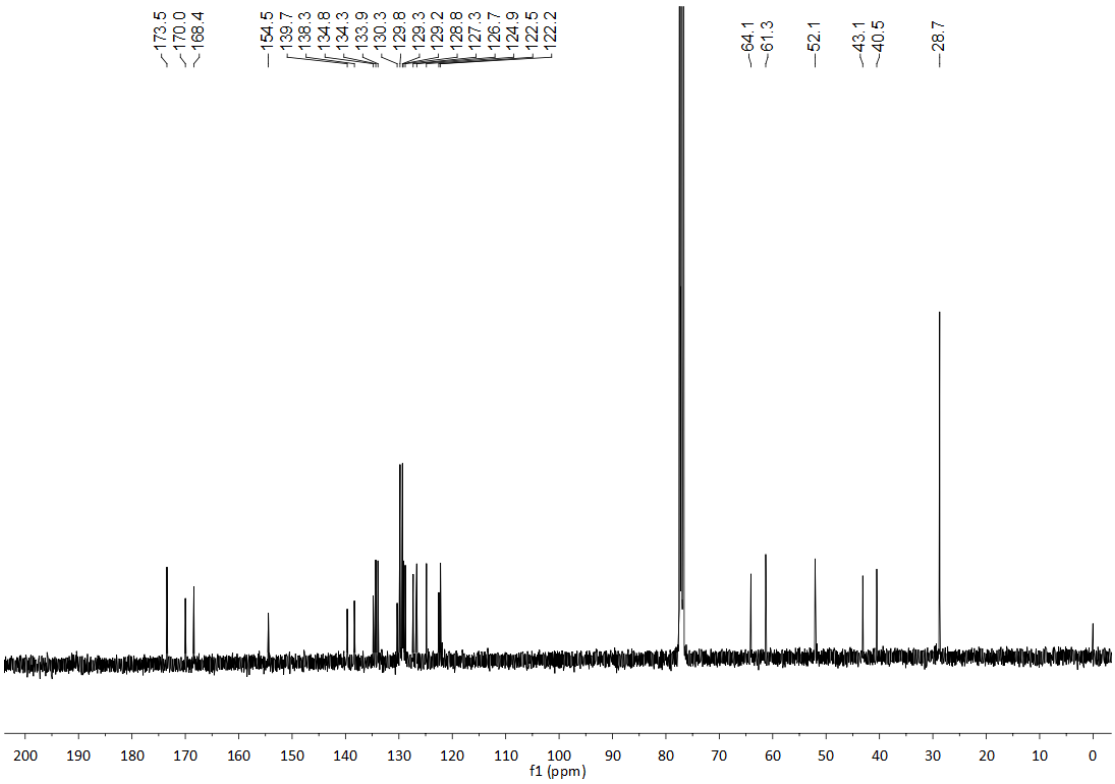


2-(8-bromo-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-N-(tert-butyl)-2-phenyl acetamide (19down)

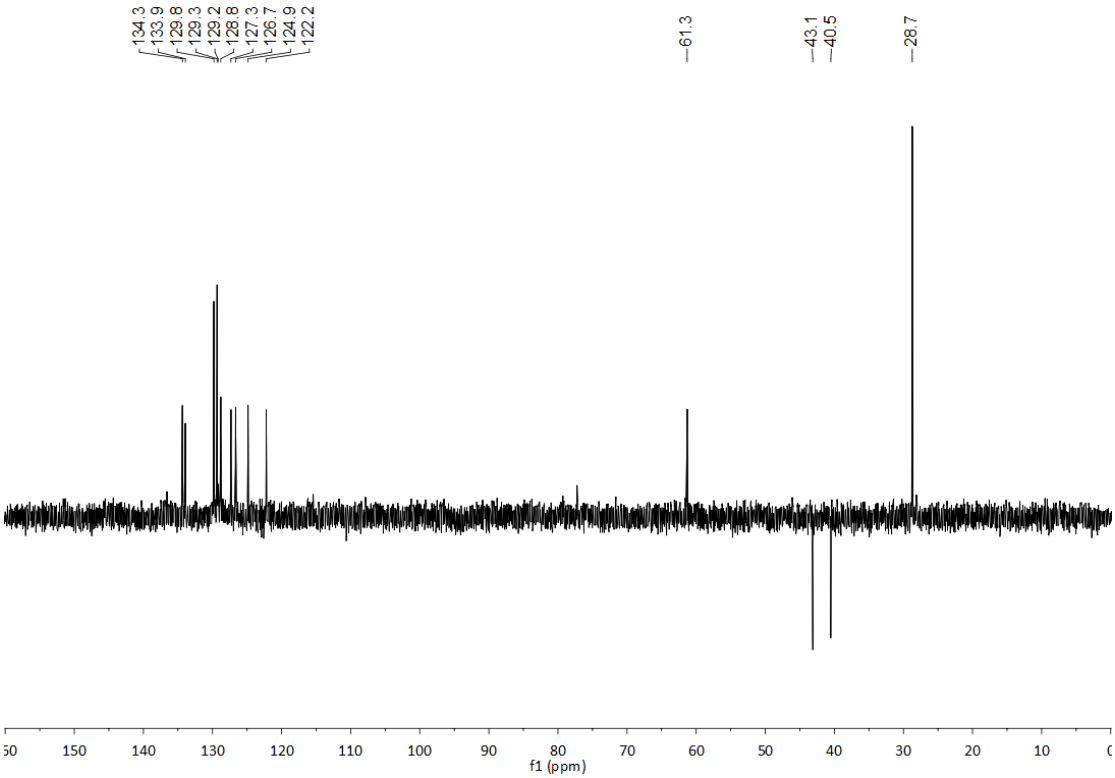
^{1}H NMR (400 MHz, $CDCl_3$)：



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

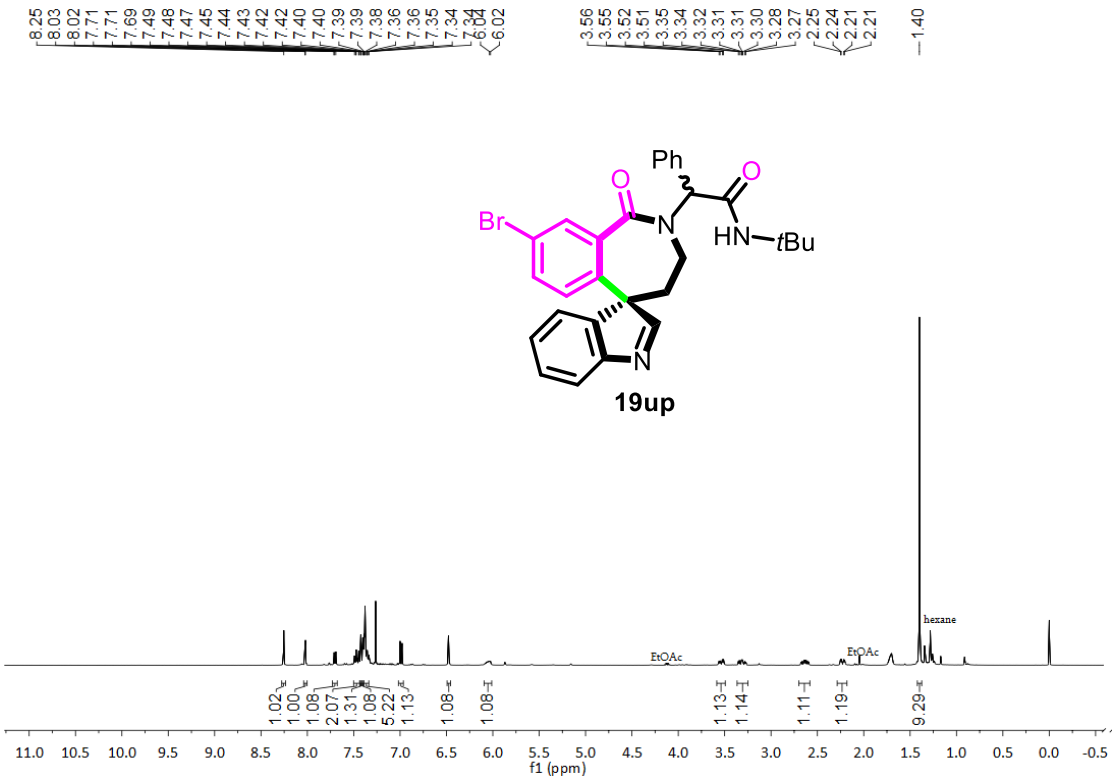


DEPT

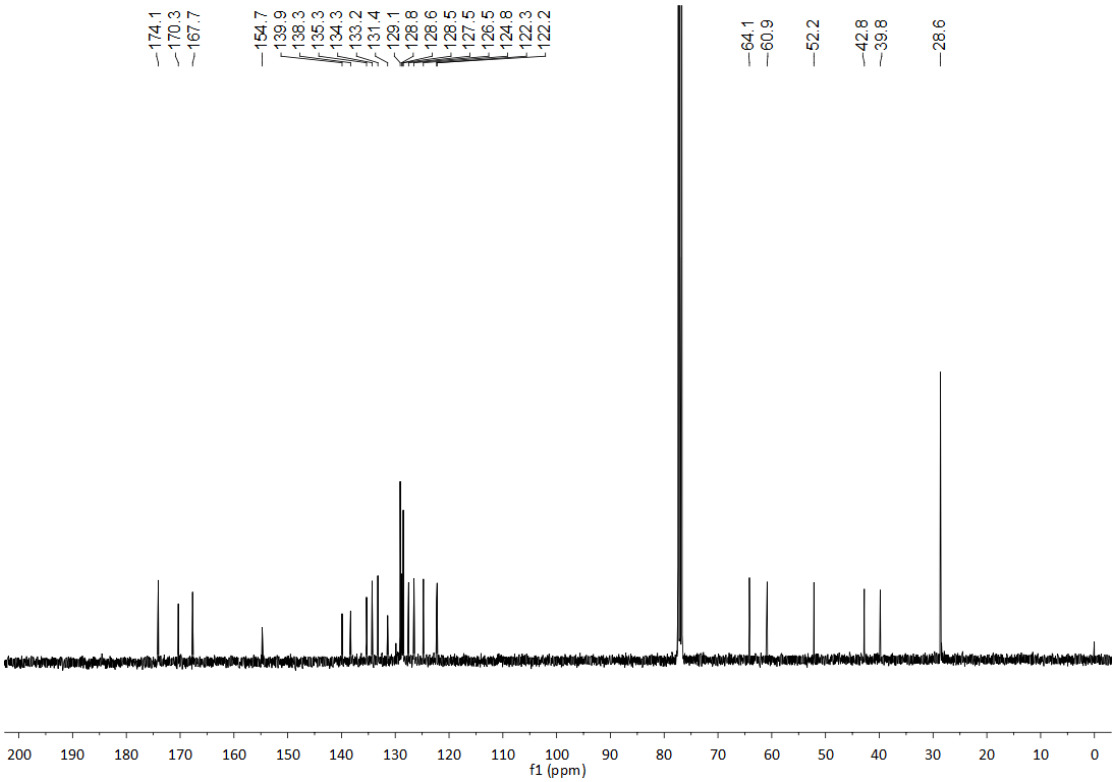


2-(8-bromo-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-N-(tert-butyl)-2-phenyl acetamide (19up)

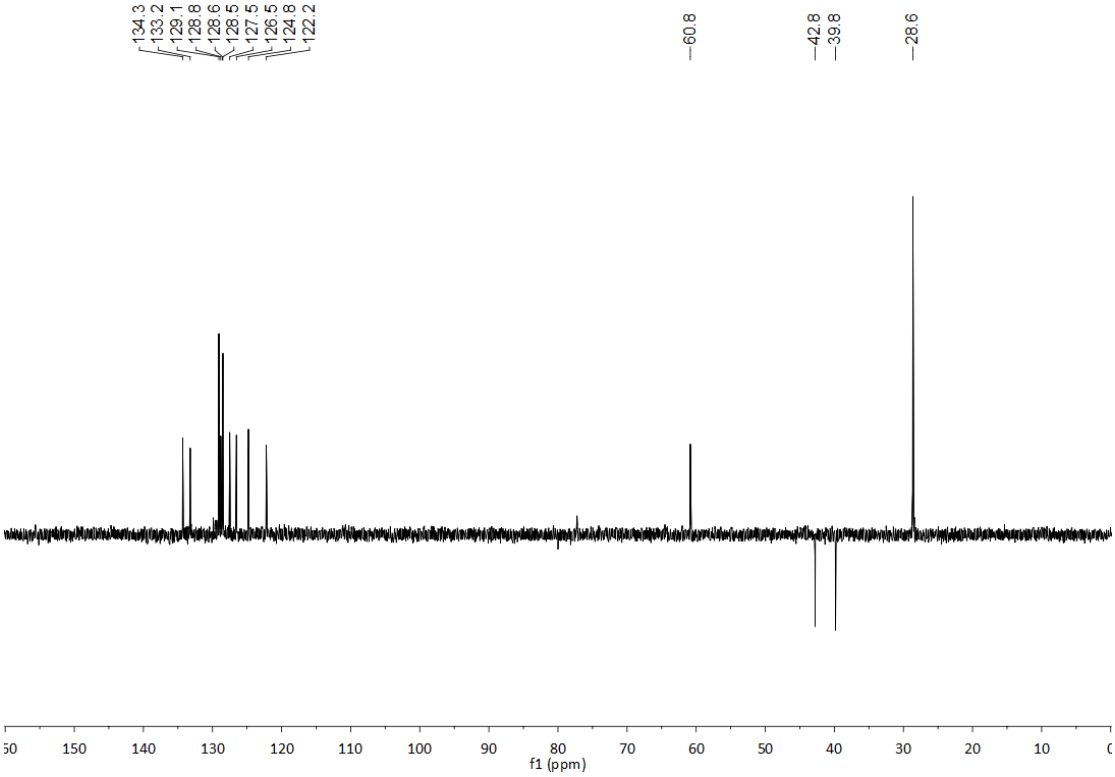
^{1}H NMR (400 MHz, $CDCl_3$):



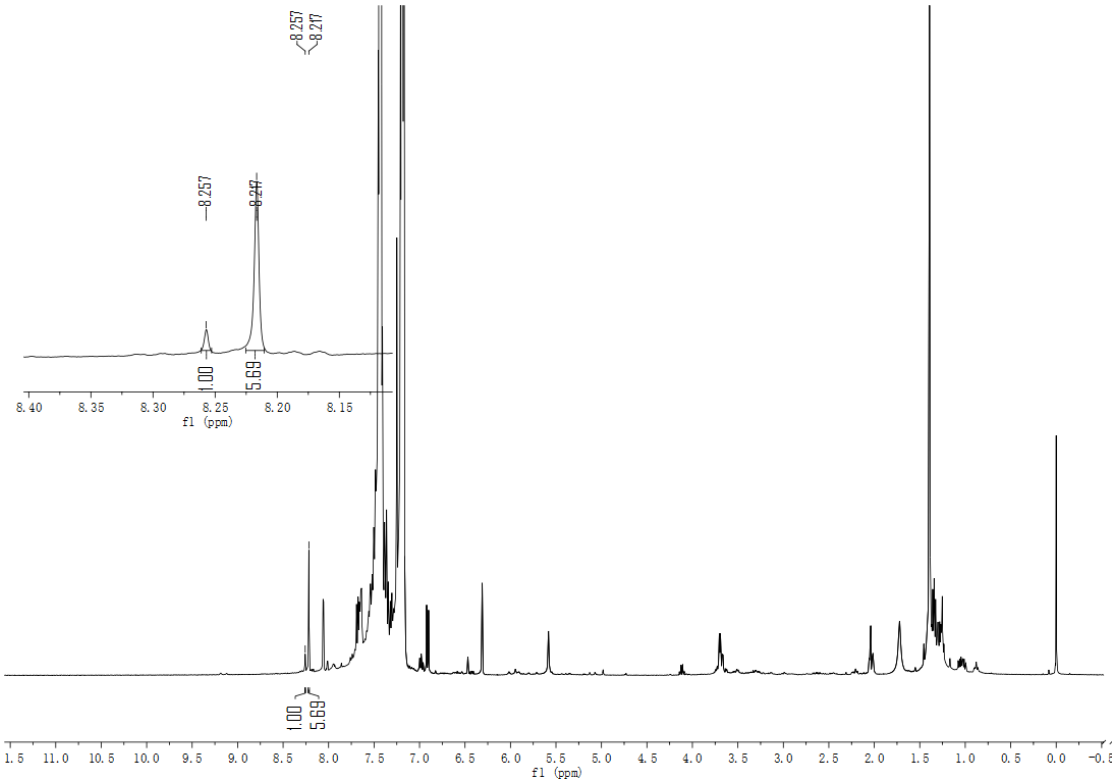
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

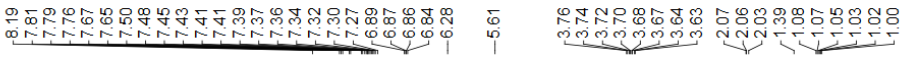


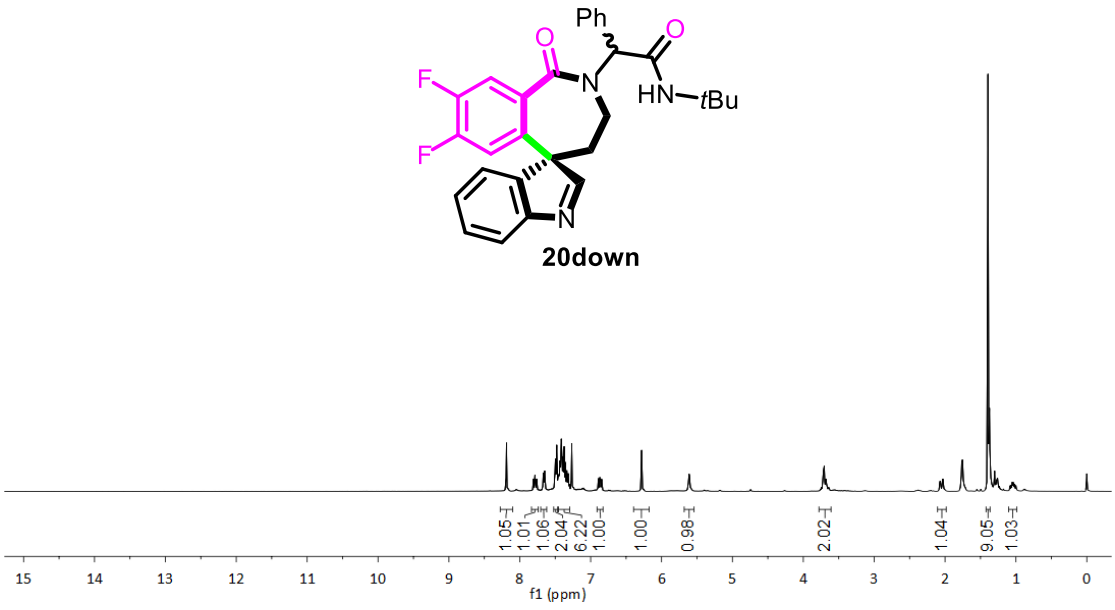
19 crude ^{1}H NMR



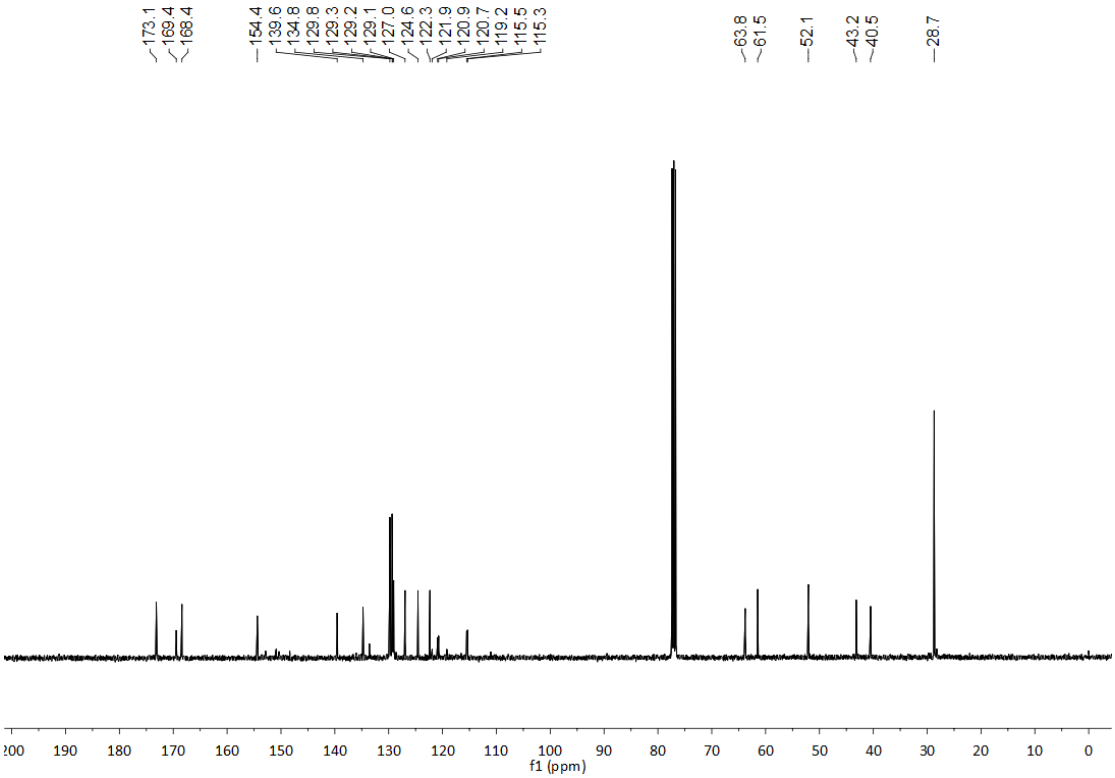
N-(tert-butyl)-2-(7,8-difluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (20down)

^{1}H NMR (400 MHz, $CDCl_3$):

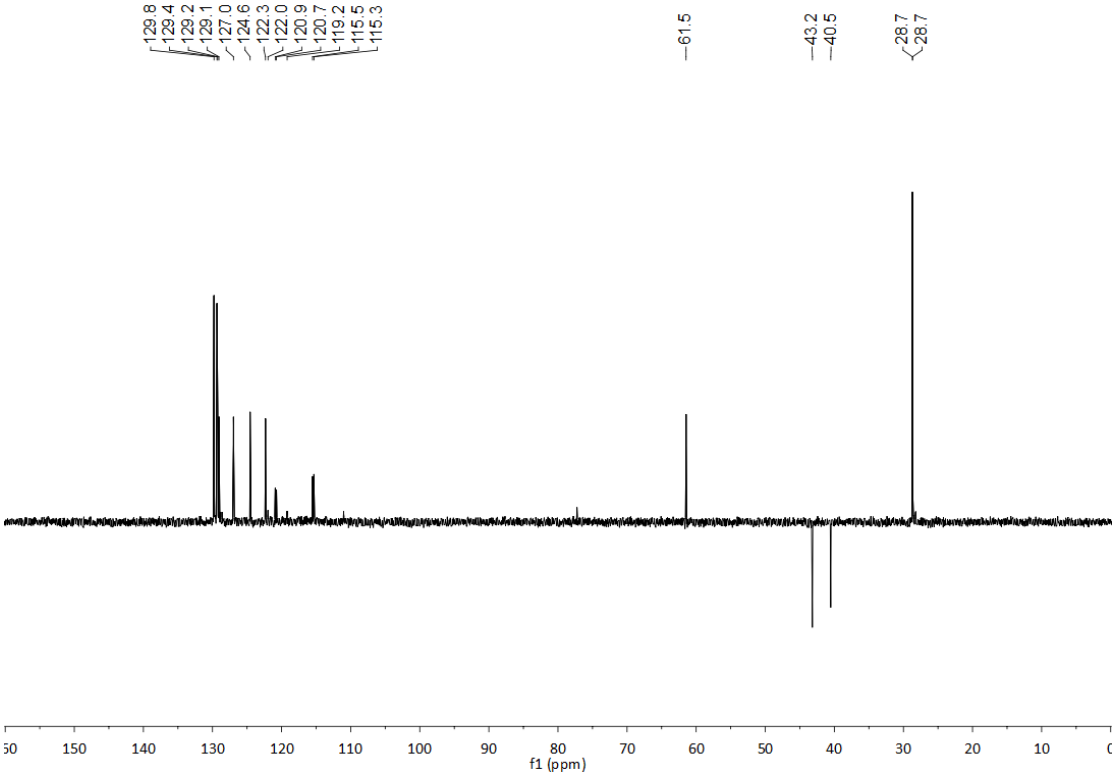




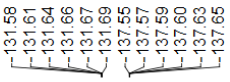
^{13}C NMR (100 MHz, $CDCl_3$):

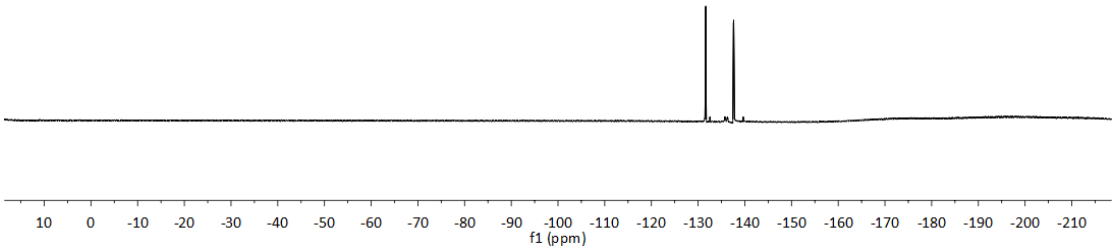


DEPT



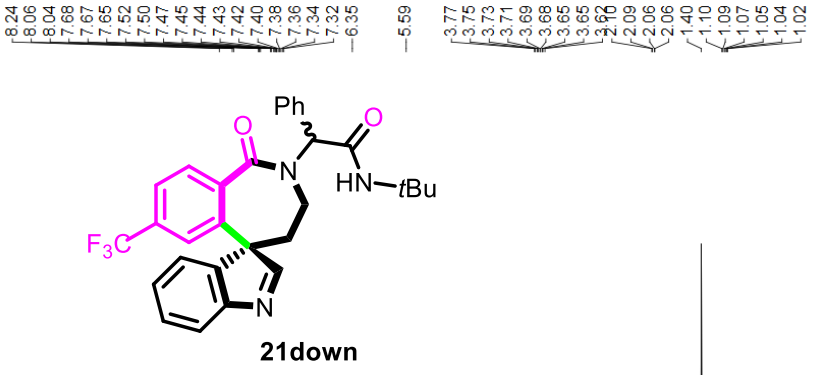
^{19}F NMR (376 MHz, $CDCl_3$)



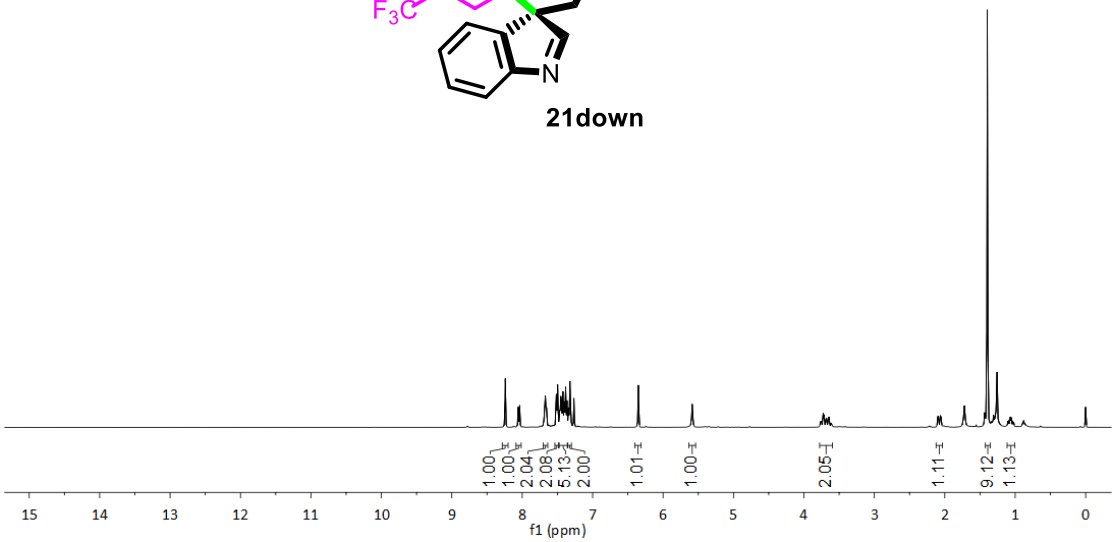


N-(tert-butyl)-2-(1-oxo-7-(trifluoromethyl)-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (21down)

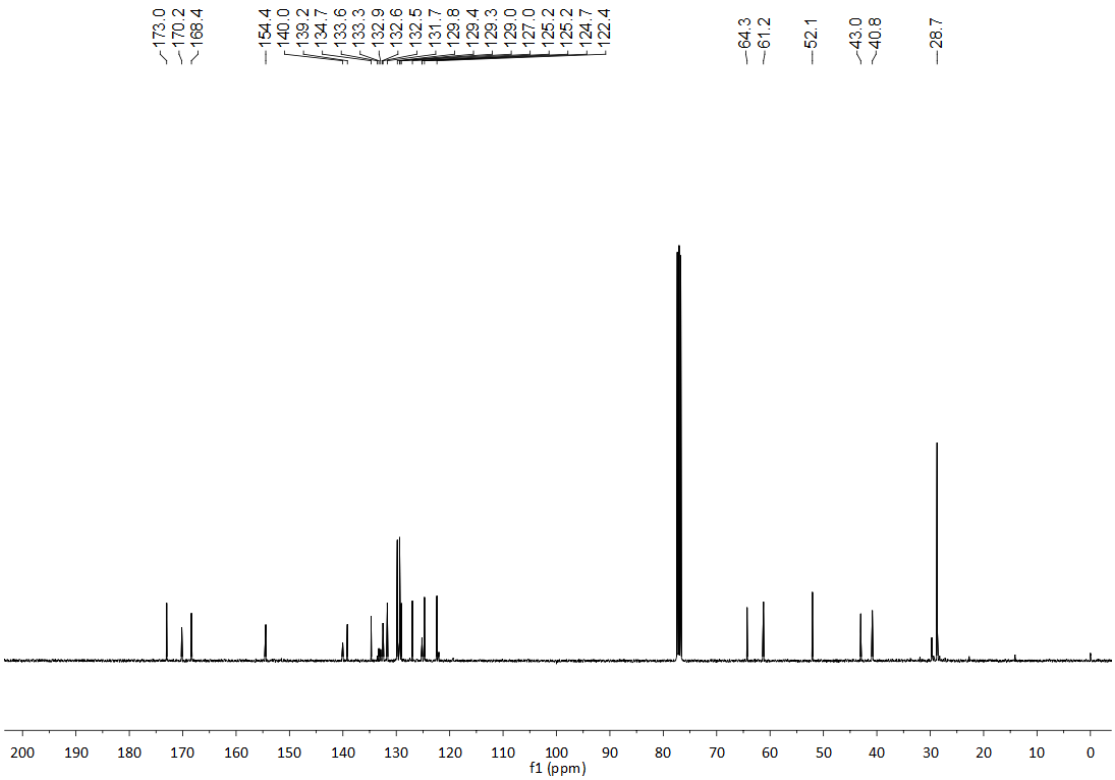
^{1}H NMR (400 MHz, $CDCl_3$):



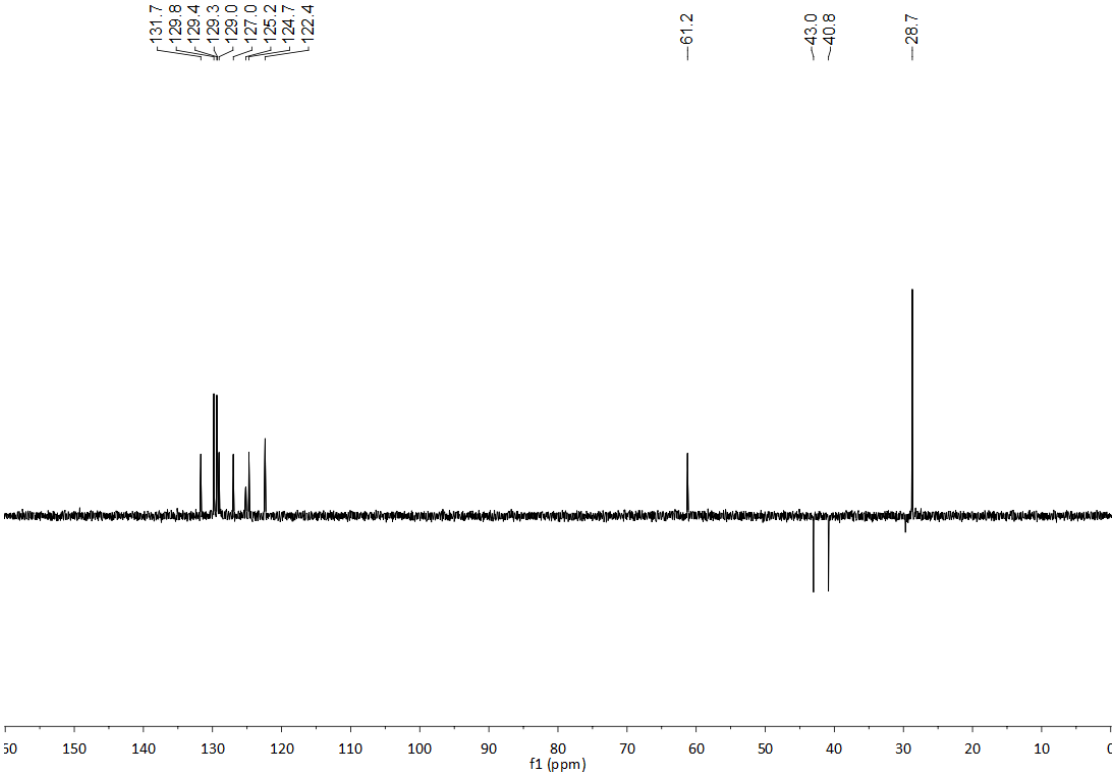
21down



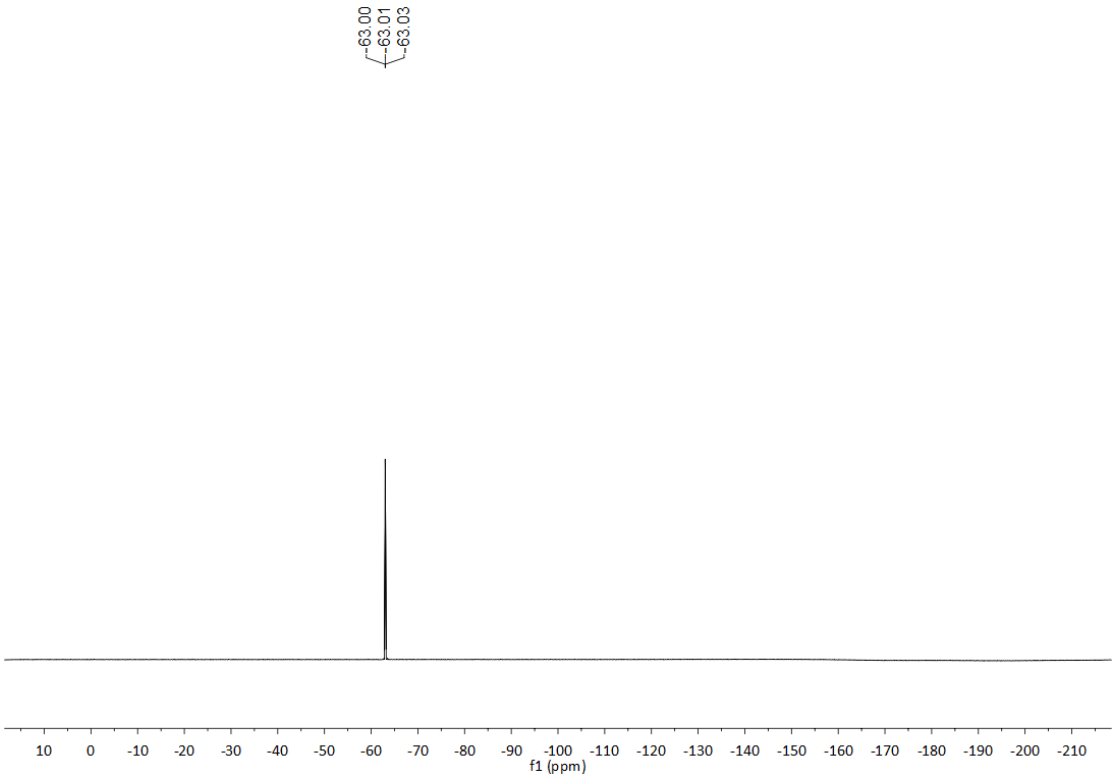
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

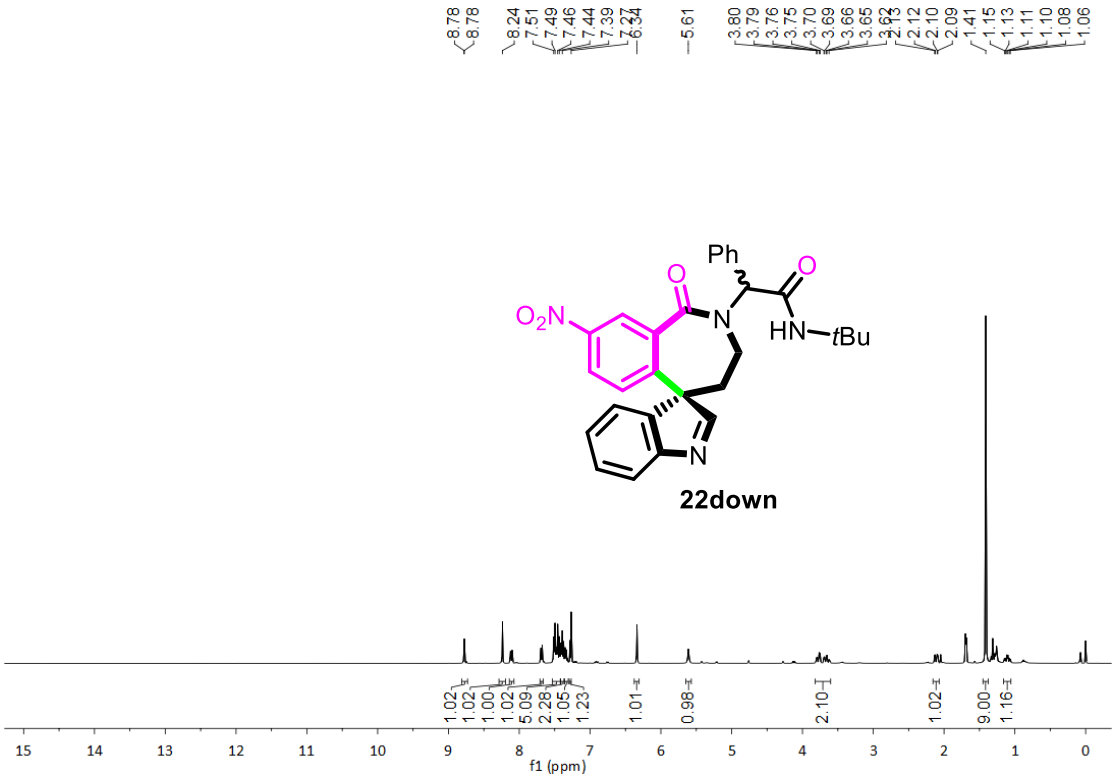


^{19}F NMR (376 MHz, $CDCl_3$)

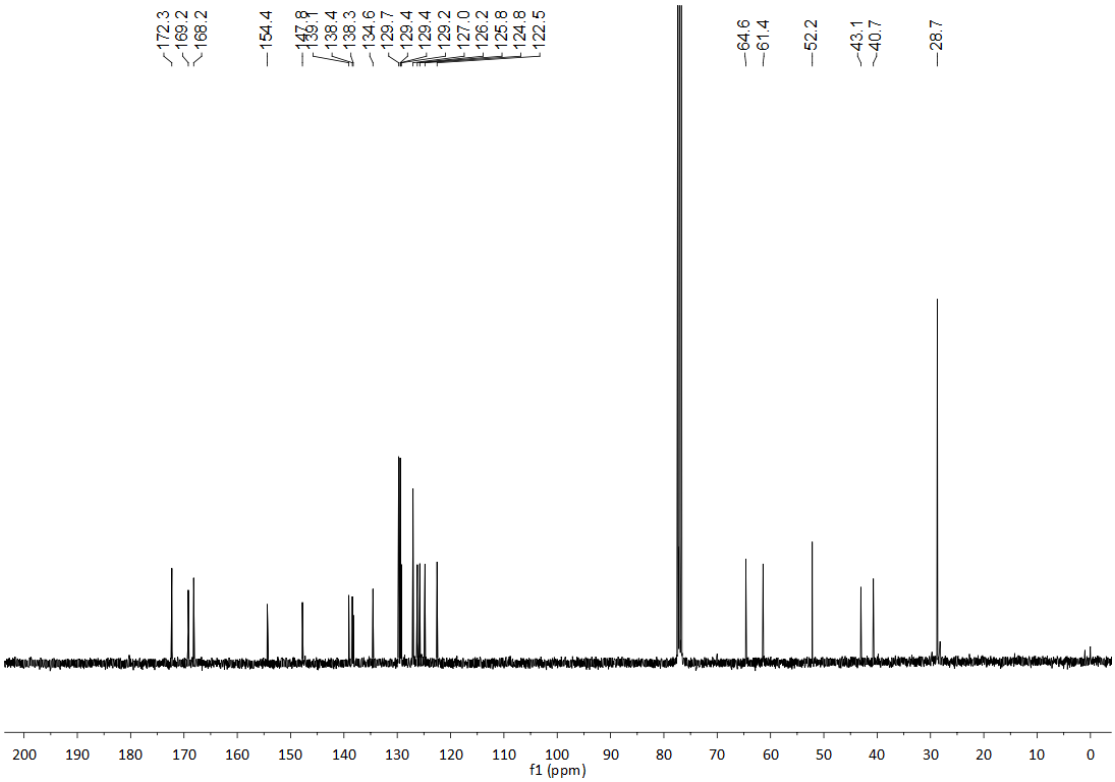


N-(tert-butyl)-2-(8-nitro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (22down)

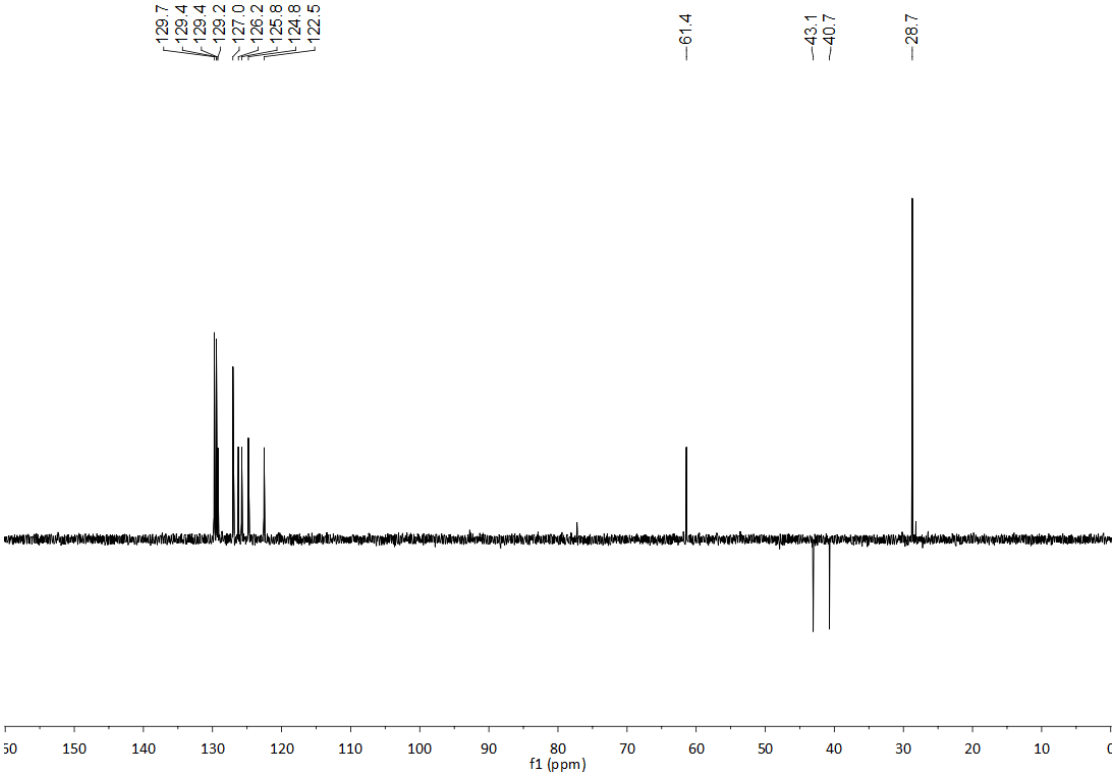
^{1}H NMR (400 MHz, $CDCl_3$):



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

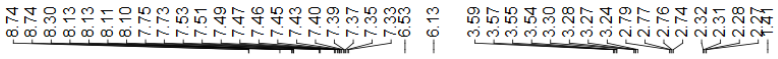


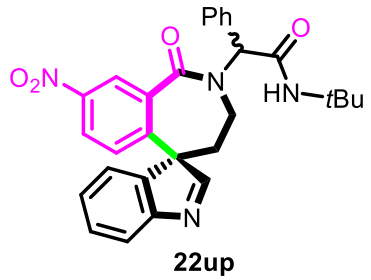
DEPT



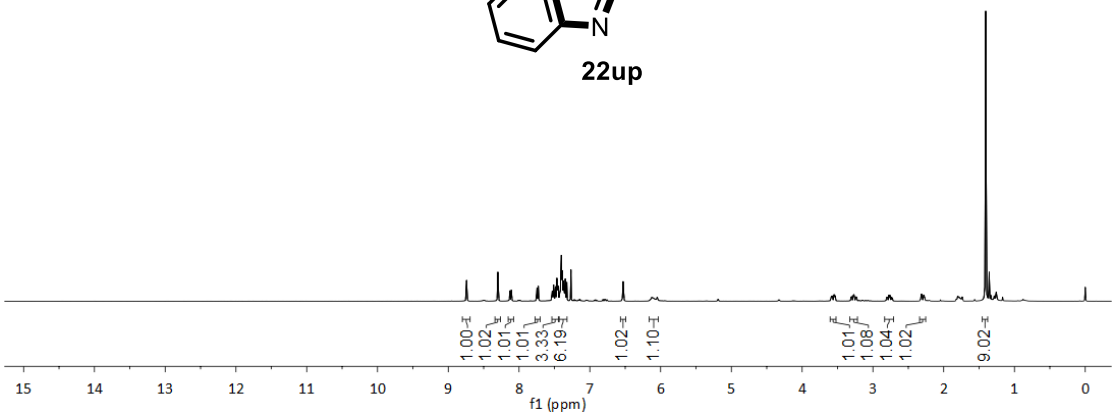
N-(tert-butyl)-2-(8-nitro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (22up)

^{1}H NMR (400 MHz, $CDCl_3$)：

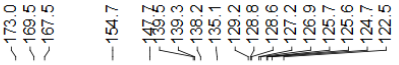


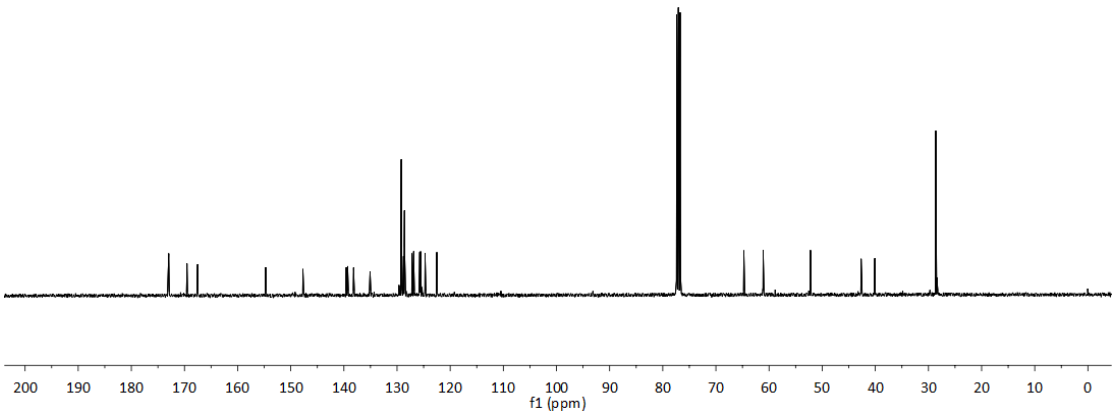


22up



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





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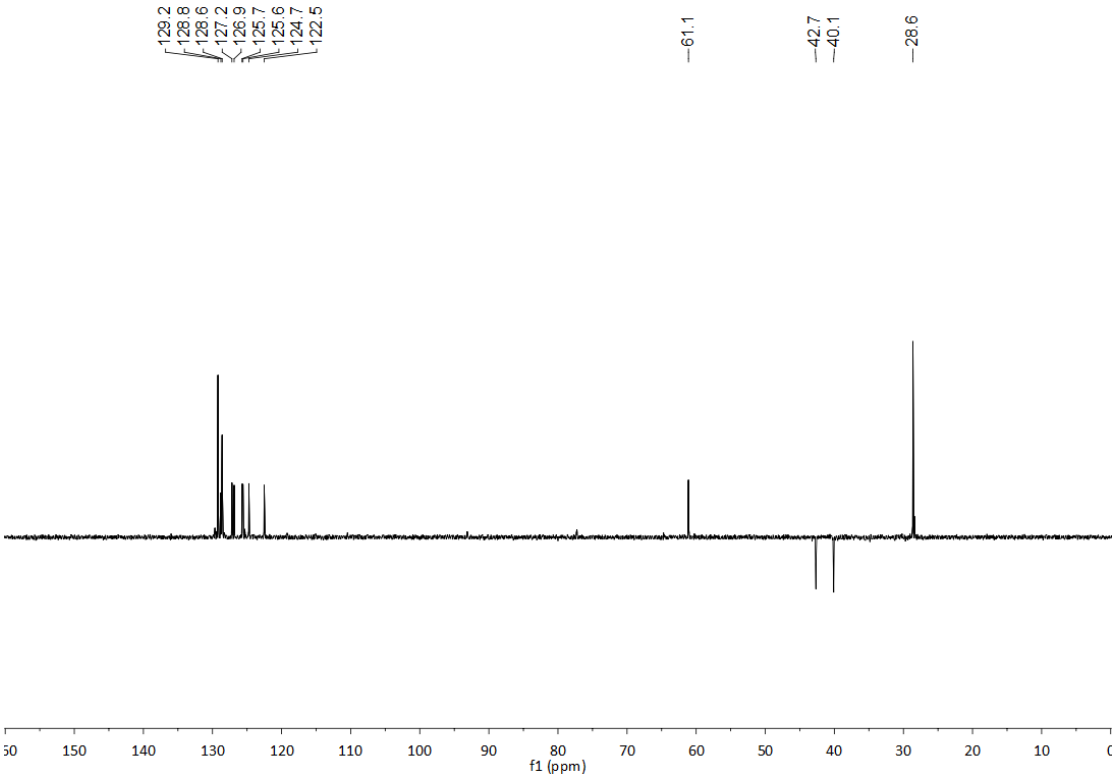
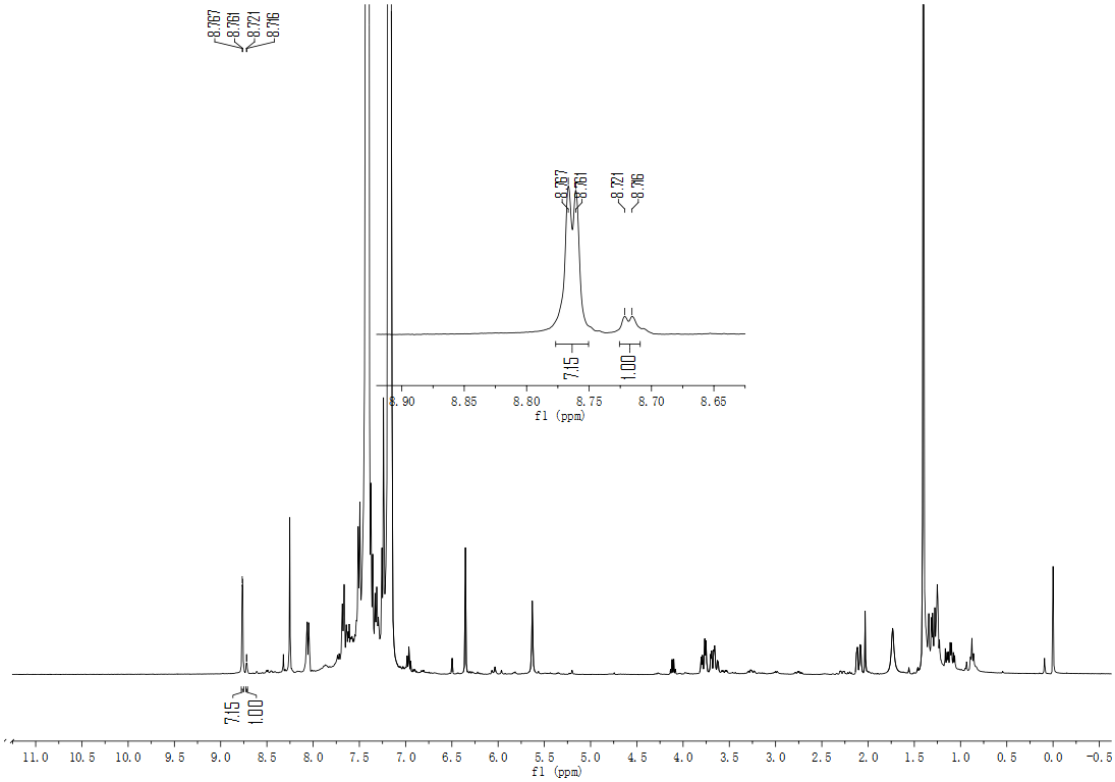
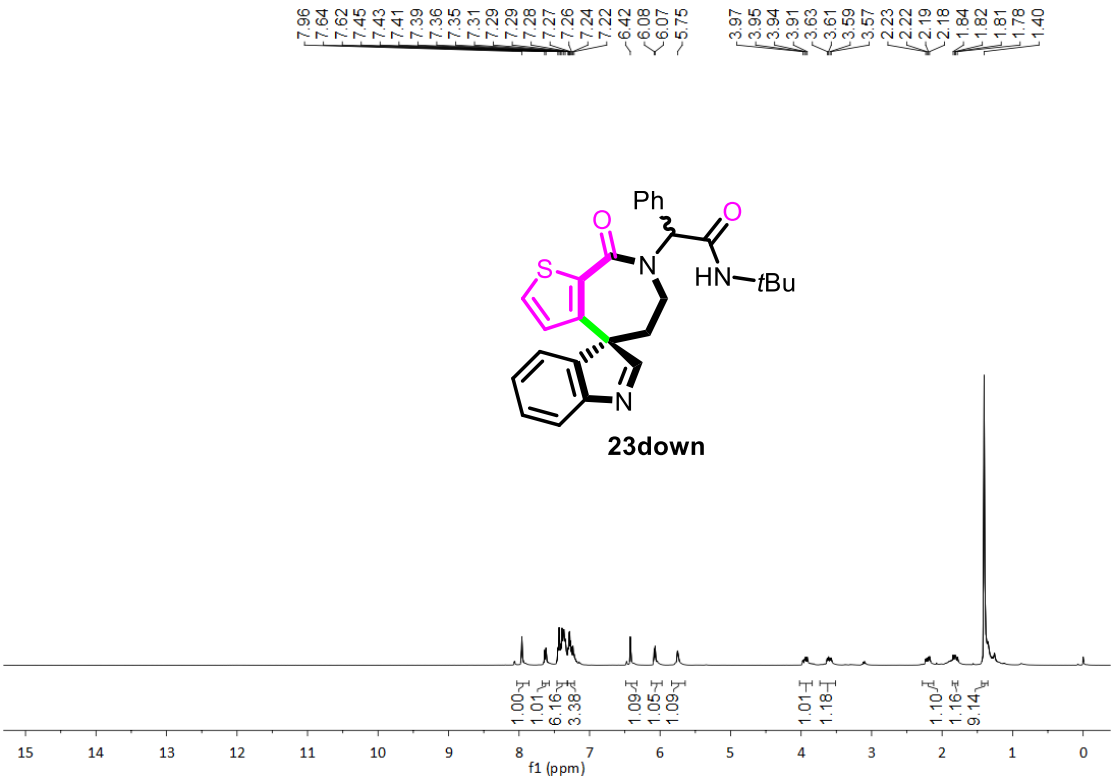


22 crude ^{1}H NMR

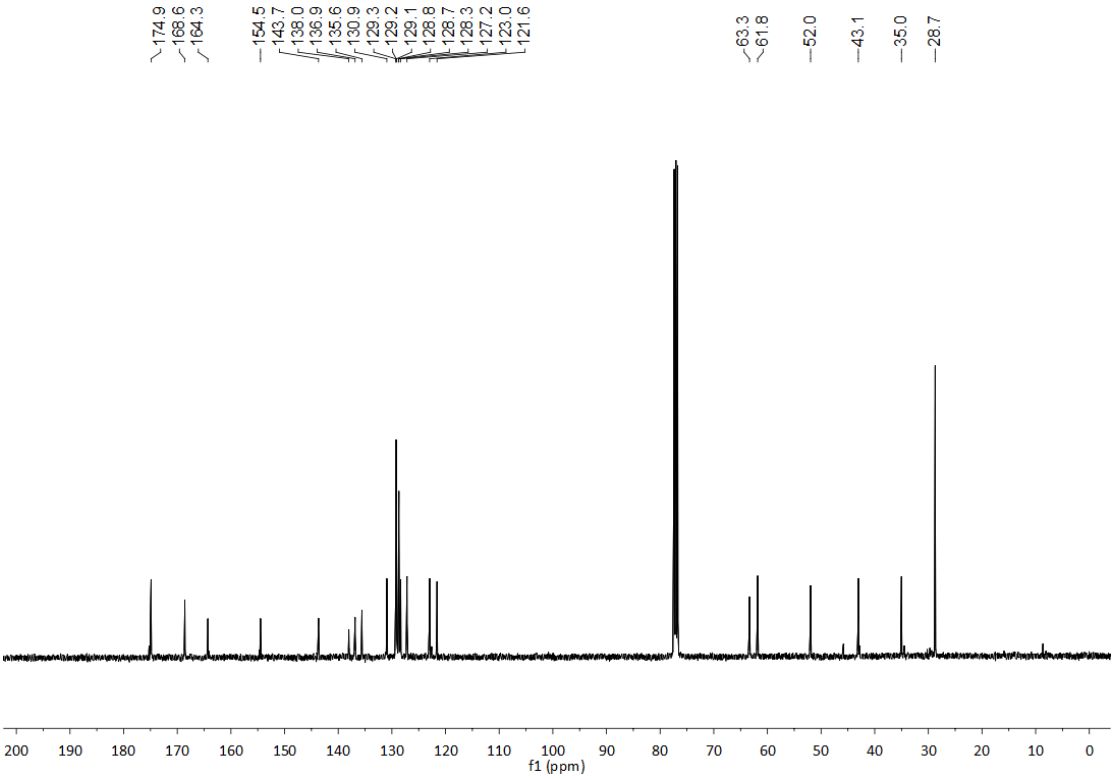


N-(tert-butyl)-2-(8'-oxo-5',6'-dihydrospiro[indole-3,4'-thieno[2,3-c]azepin]-7'(8'H)-yl)-2-phenylacetamide (23down)

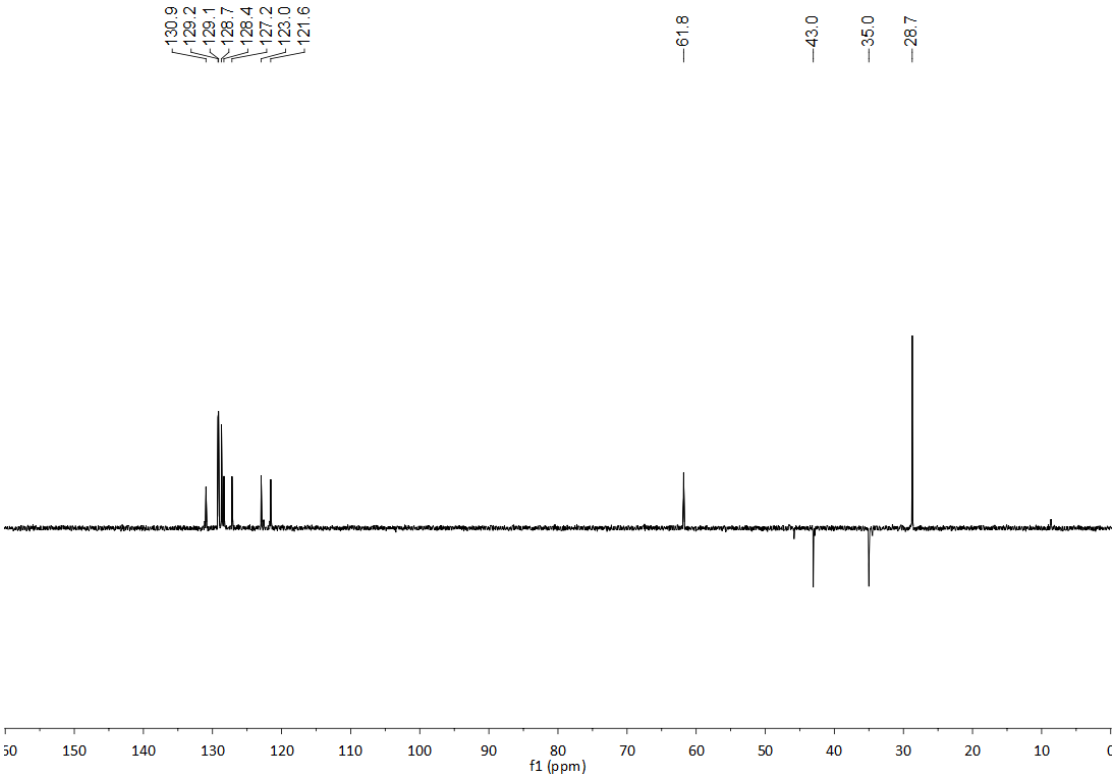
^{1}H NMR (400 MHz, $CDCl_3$)：



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

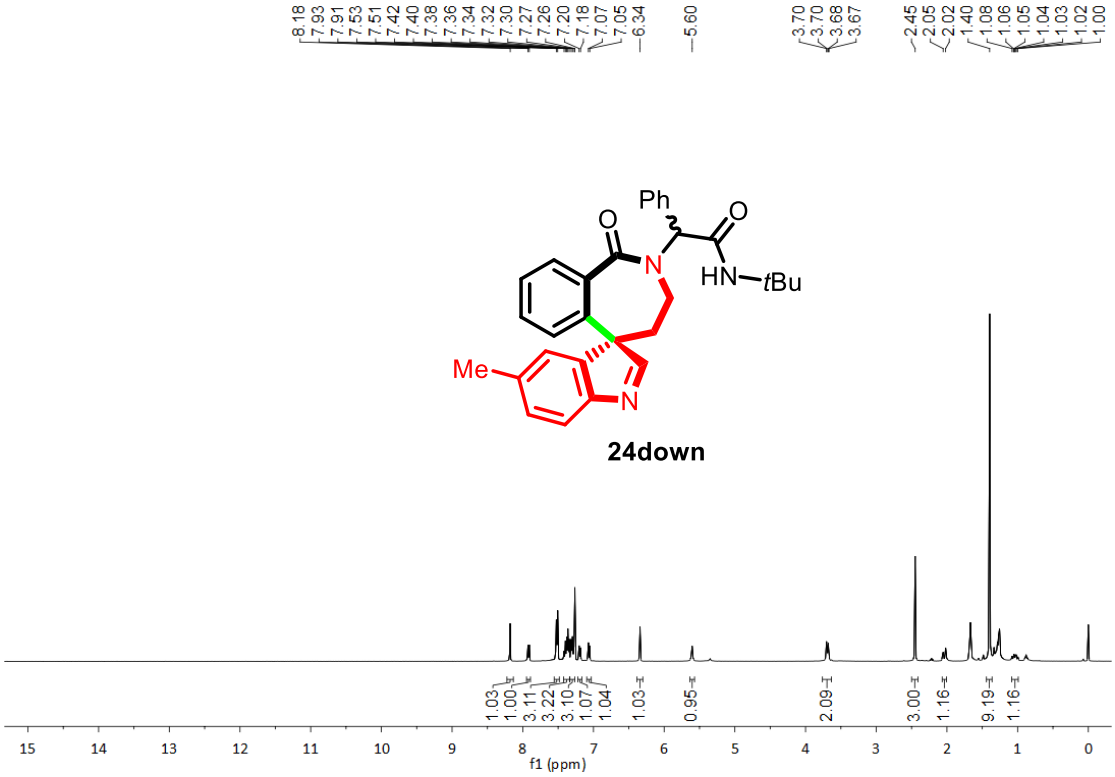


DEPT

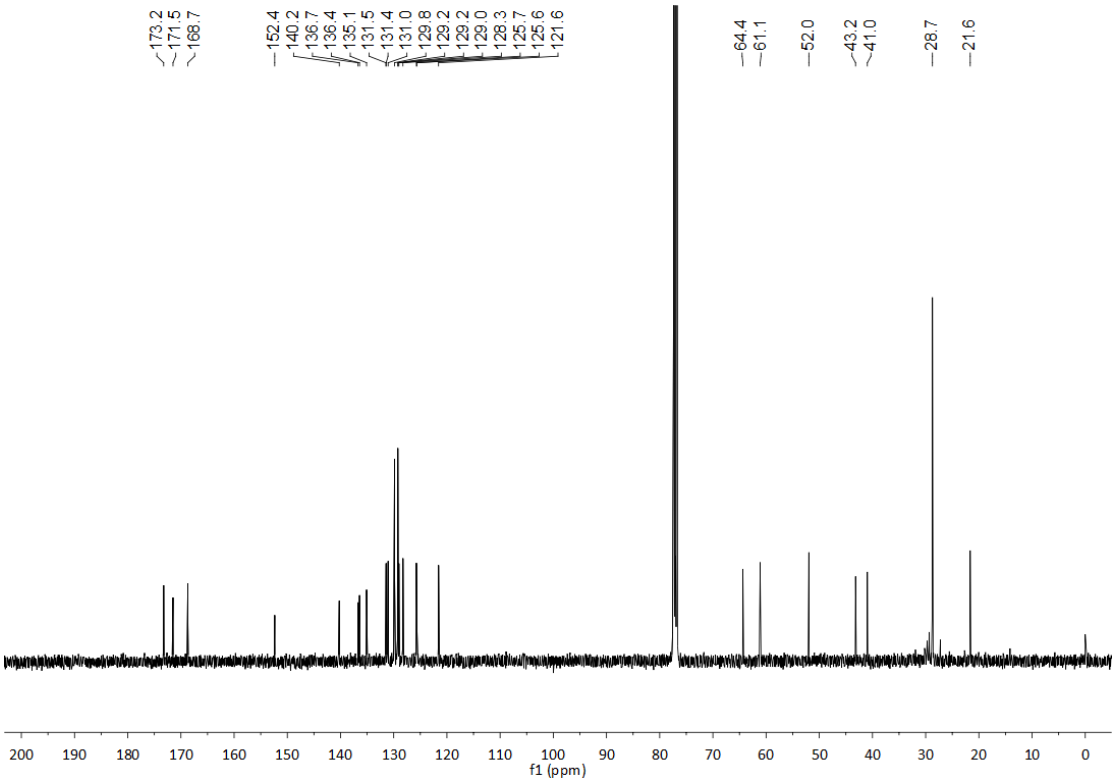


N-(tert-butyl)-2-(5'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (24down)

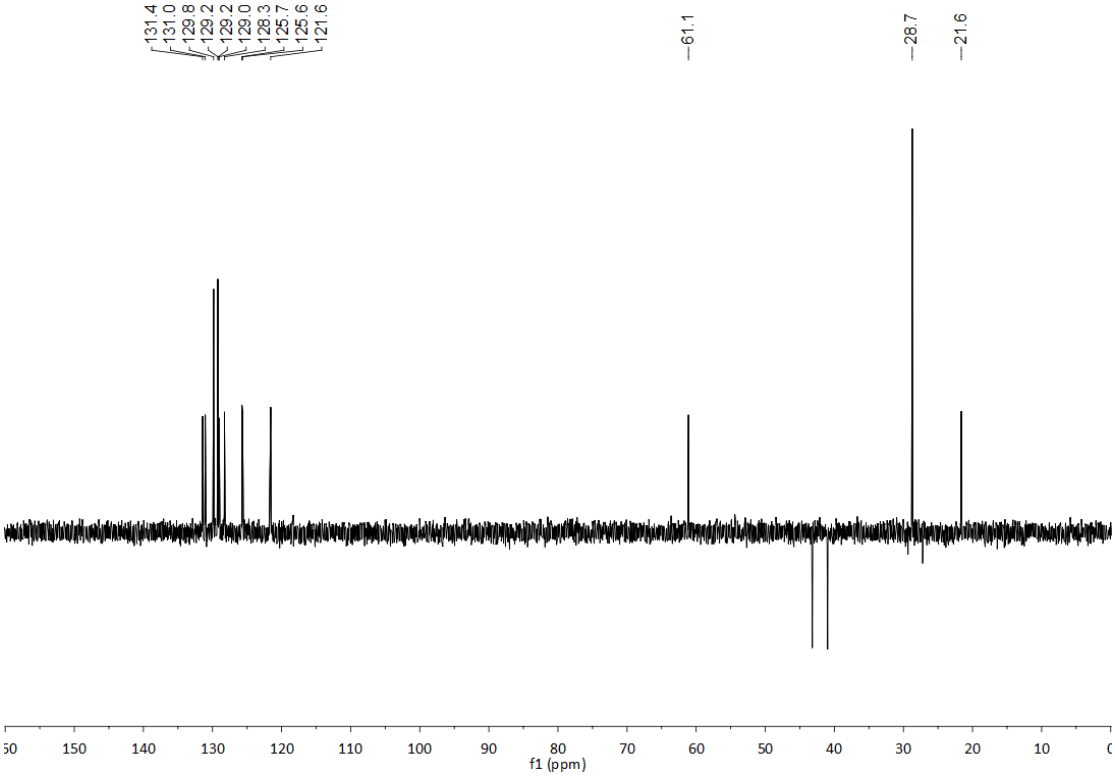
^{1}H NMR (400 MHz, $CDCl_3$):



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

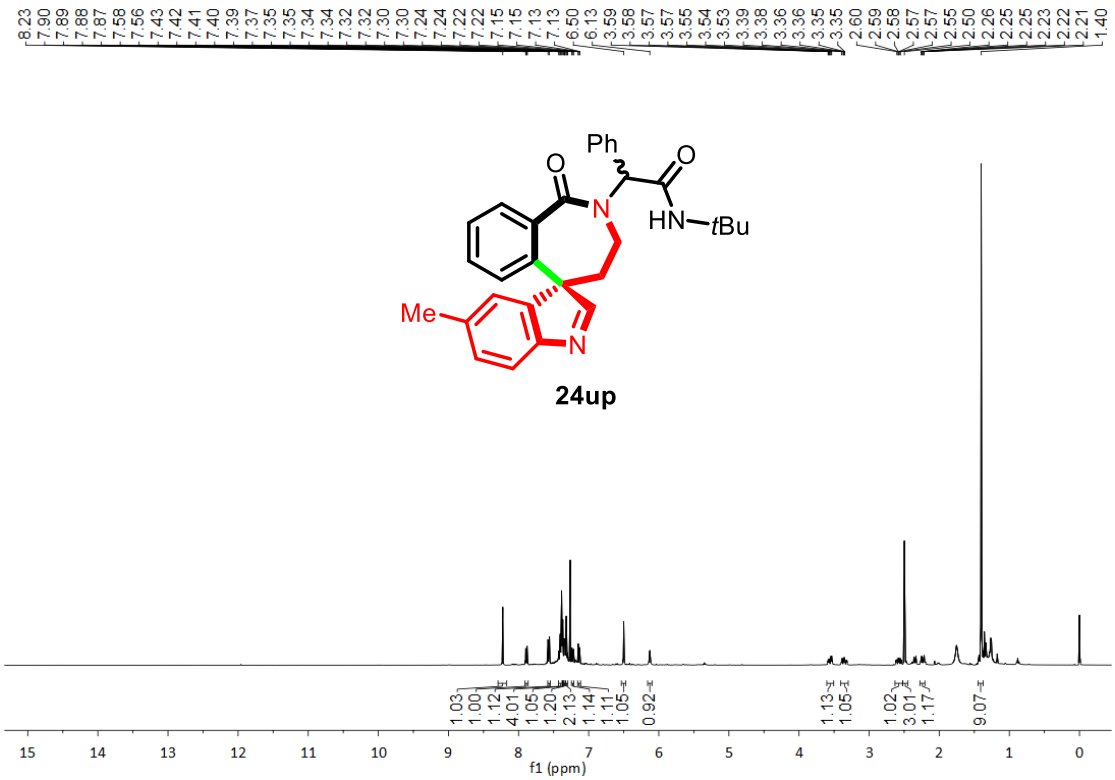


DEPT

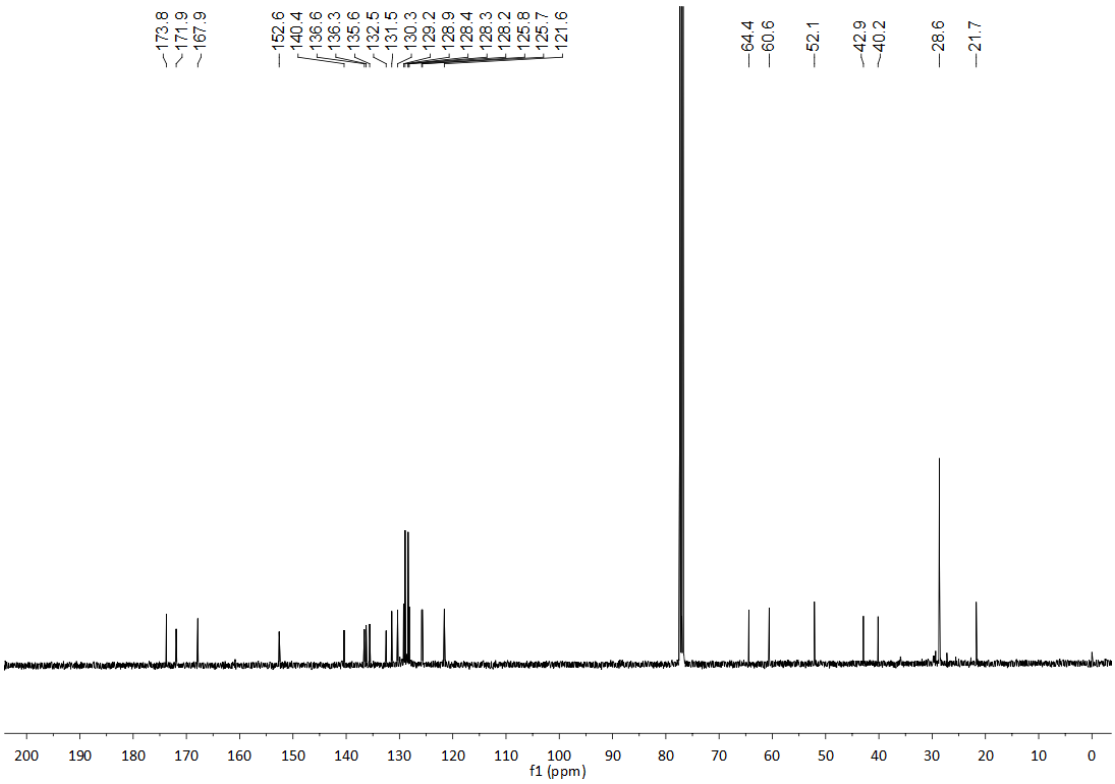


N-(tert-butyl)-2-(5'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (24up)

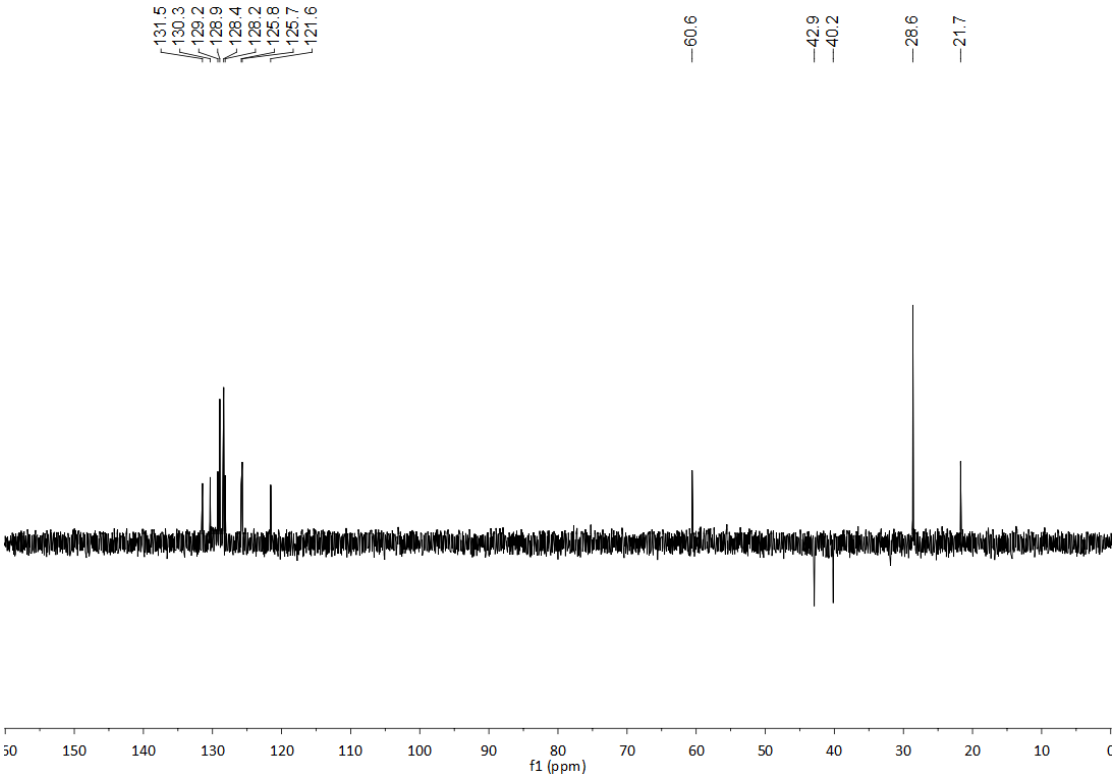
^{1}H NMR (400 MHz, $CDCl_3$)：



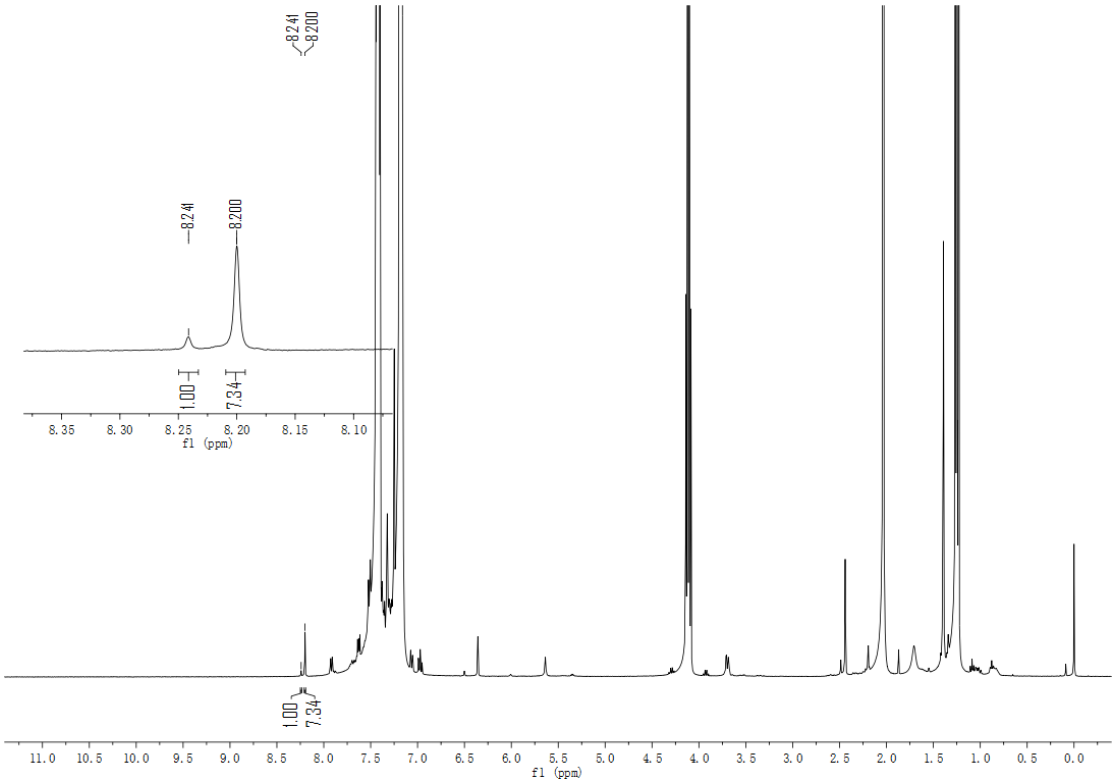
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

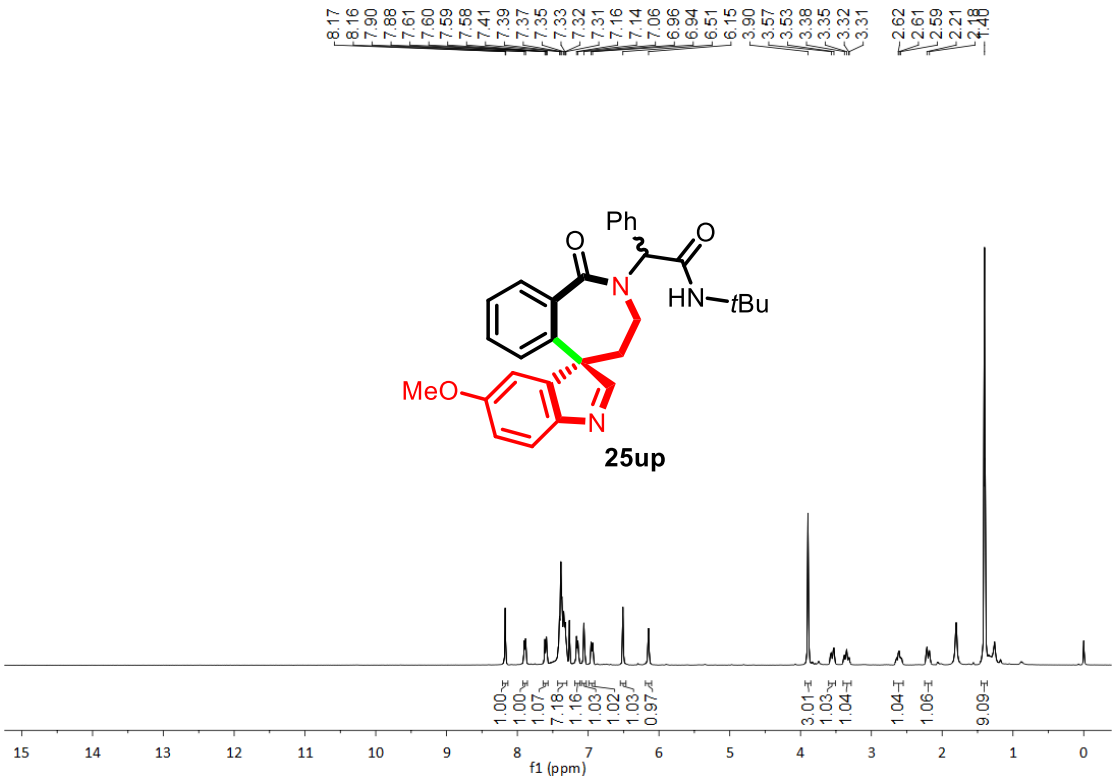


24 crude ^{1}H NMR

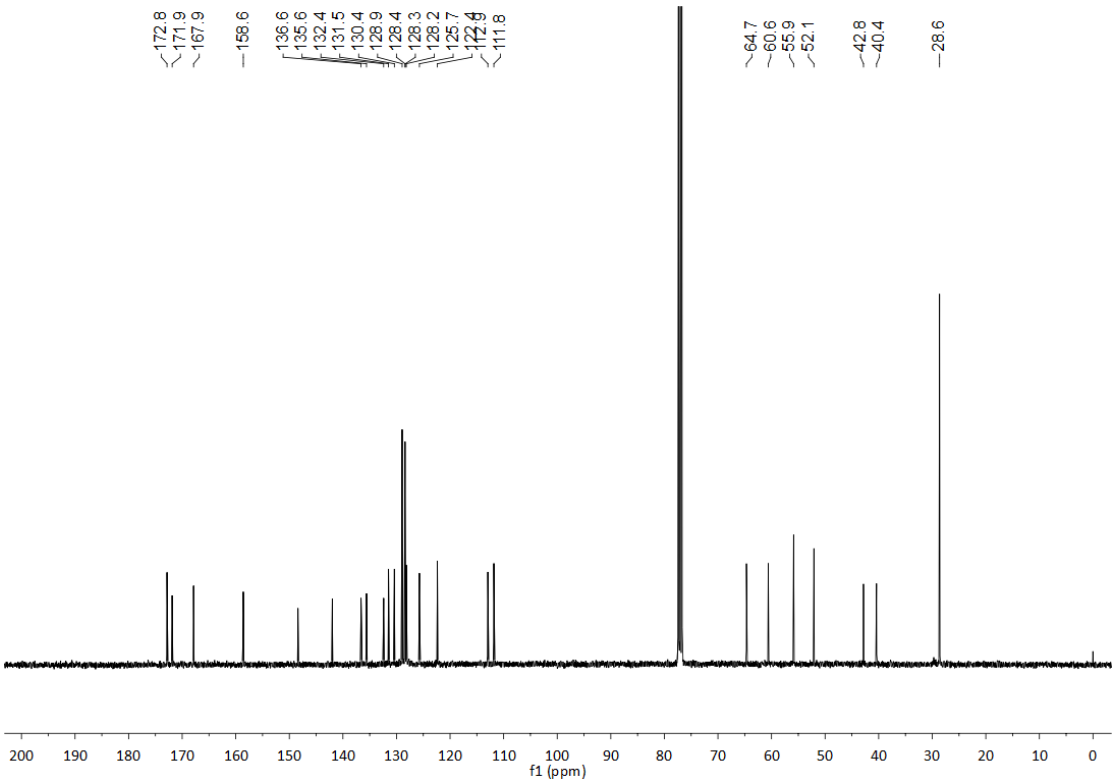


N-(tert-butyl)-2-(5'-methoxy-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (25up)

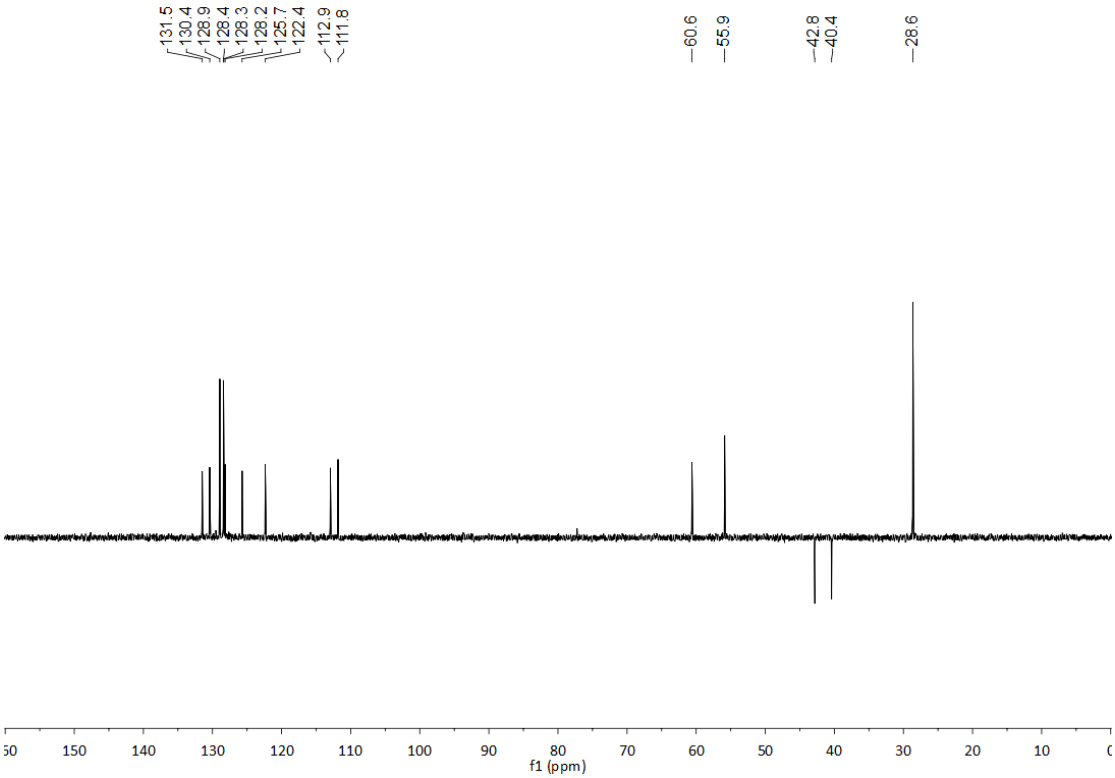
^{1}H NMR (400 MHz, $CDCl_3$):



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

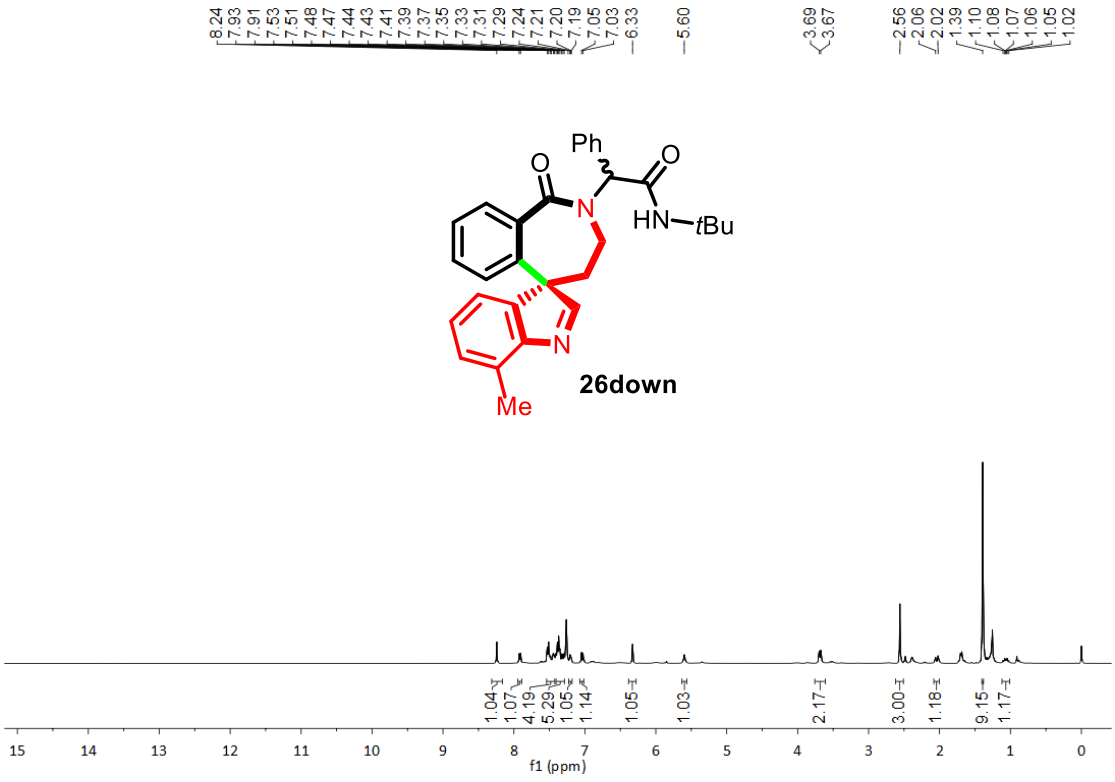


DEPT

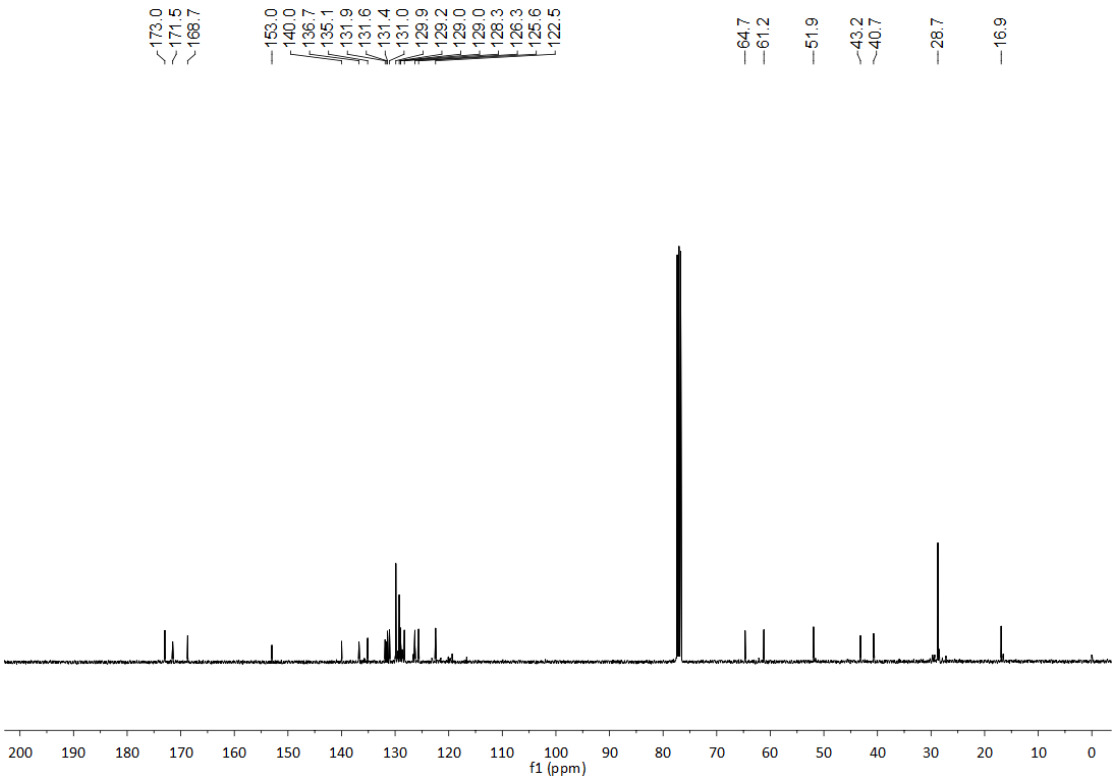


N-(tert-butyl)-2-(7'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (26down)

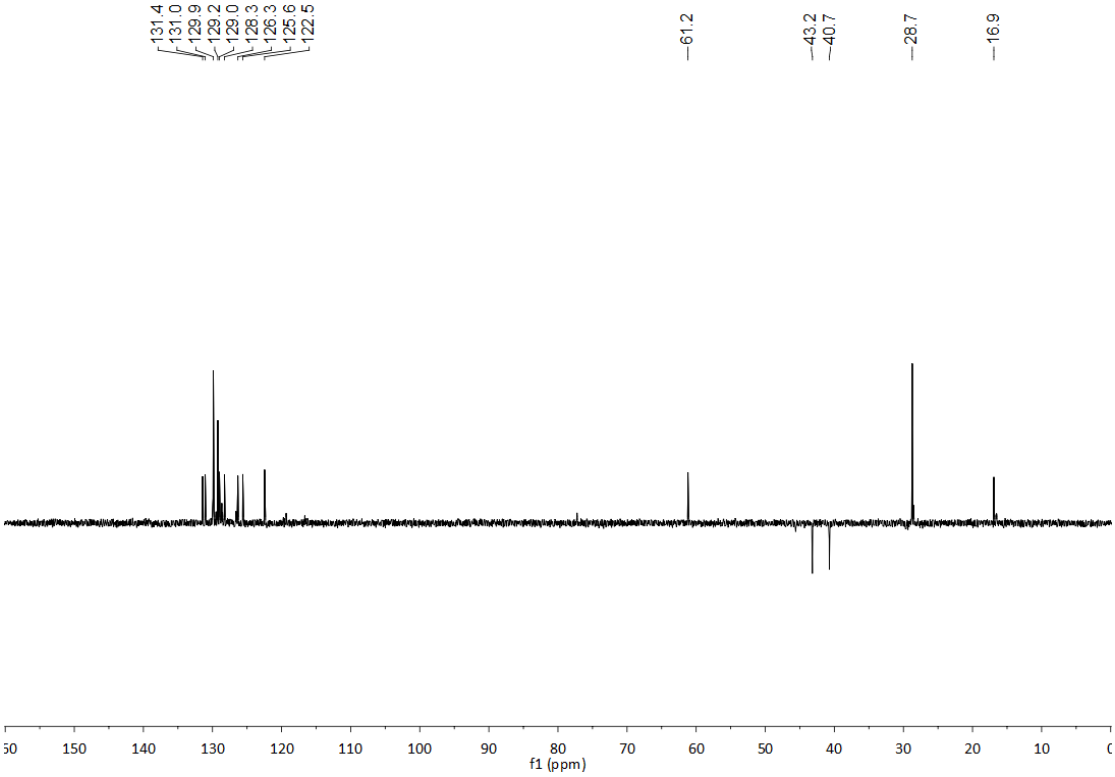
^{1}H NMR (400 MHz, $CDCl_3$):



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

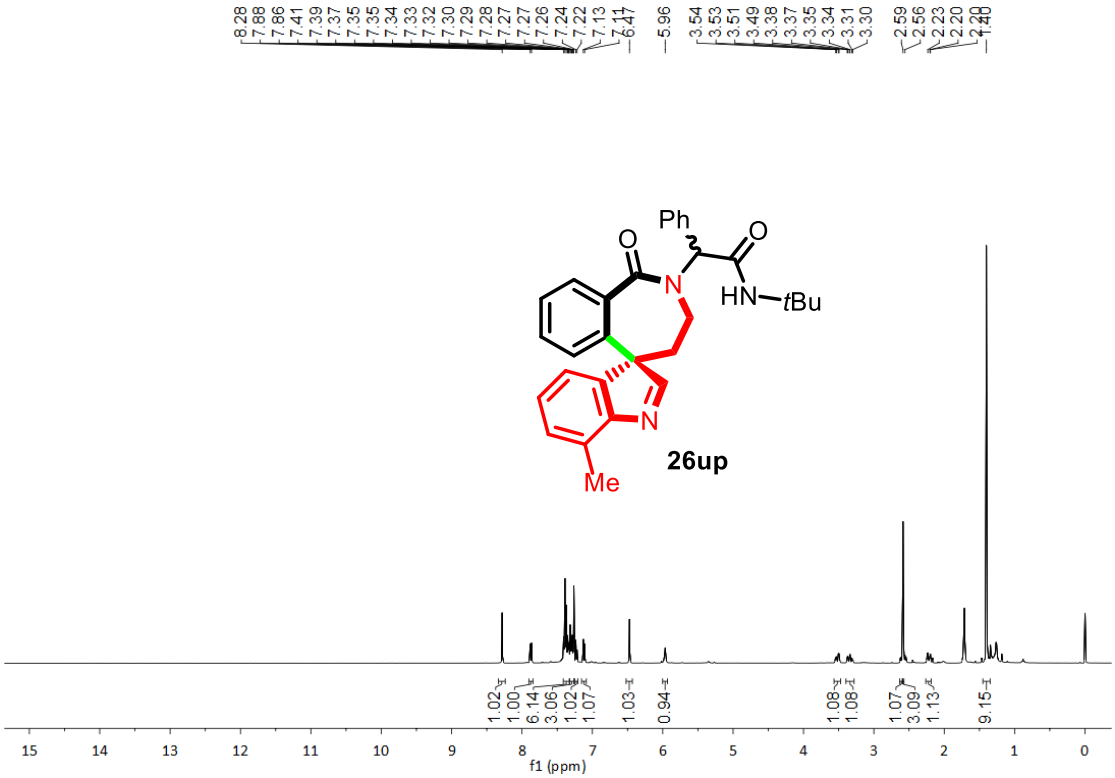


DEPT

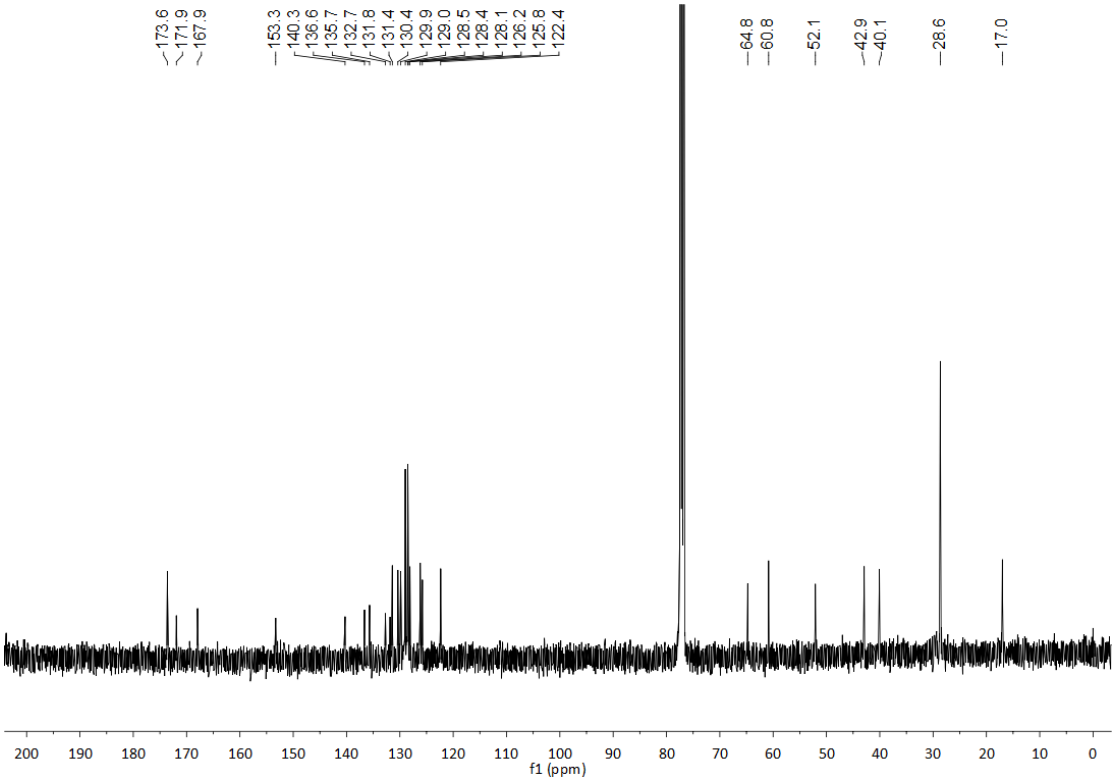


N-(tert-butyl)-2-(7'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (26up)

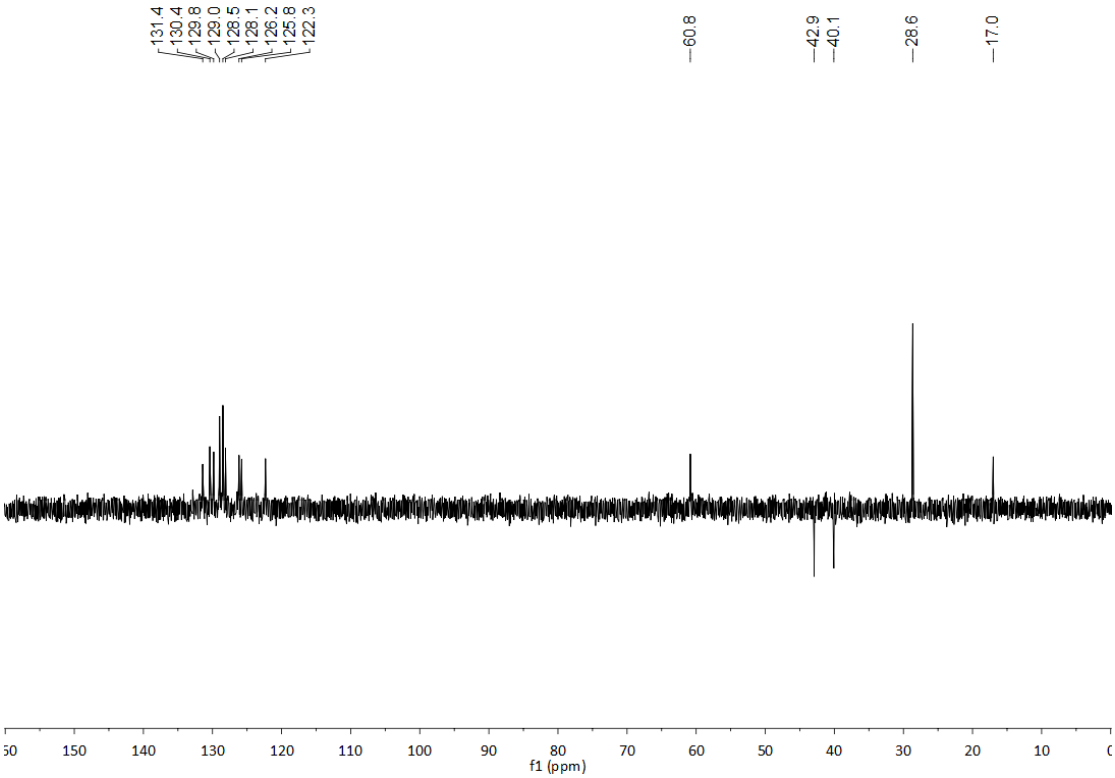
^{1}H NMR (400 MHz, $CDCl_3$)：



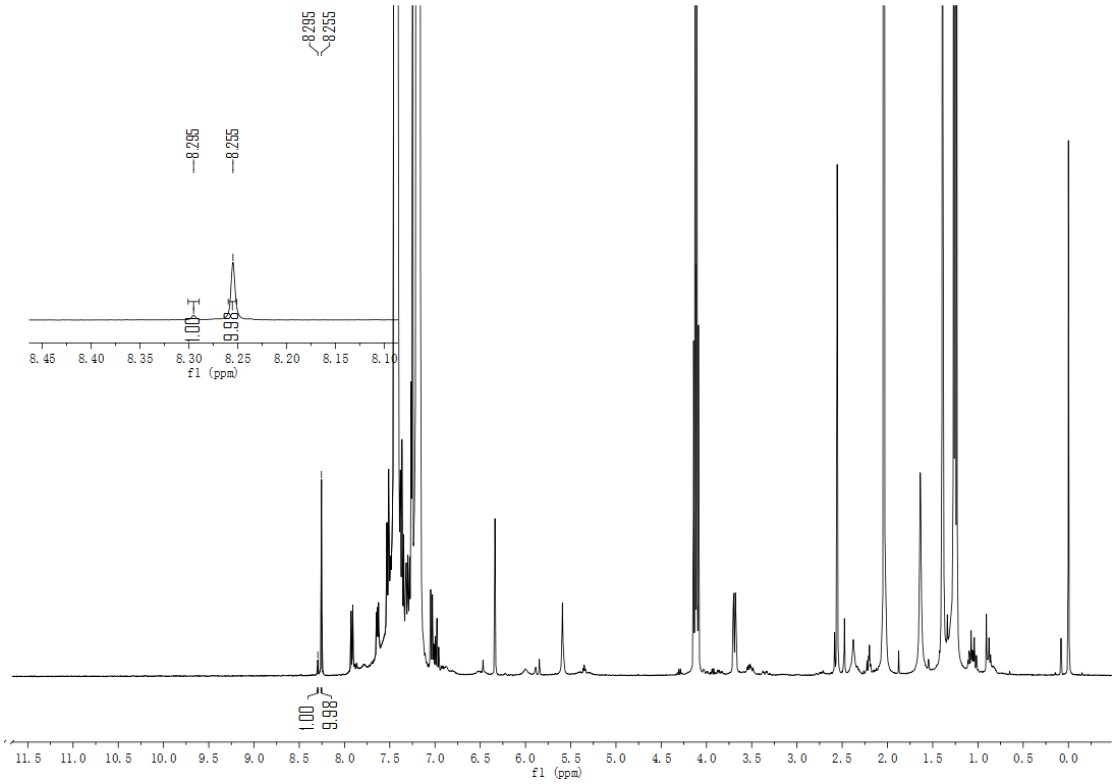
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

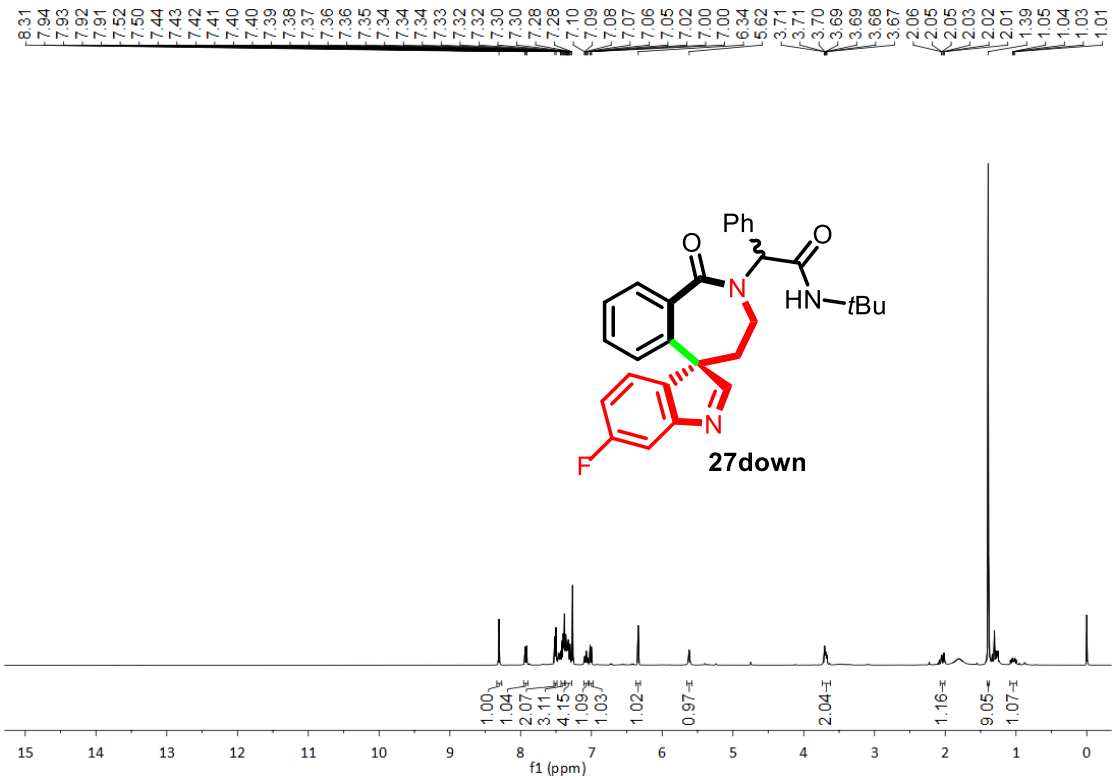


26 crude ^{1}H NMR

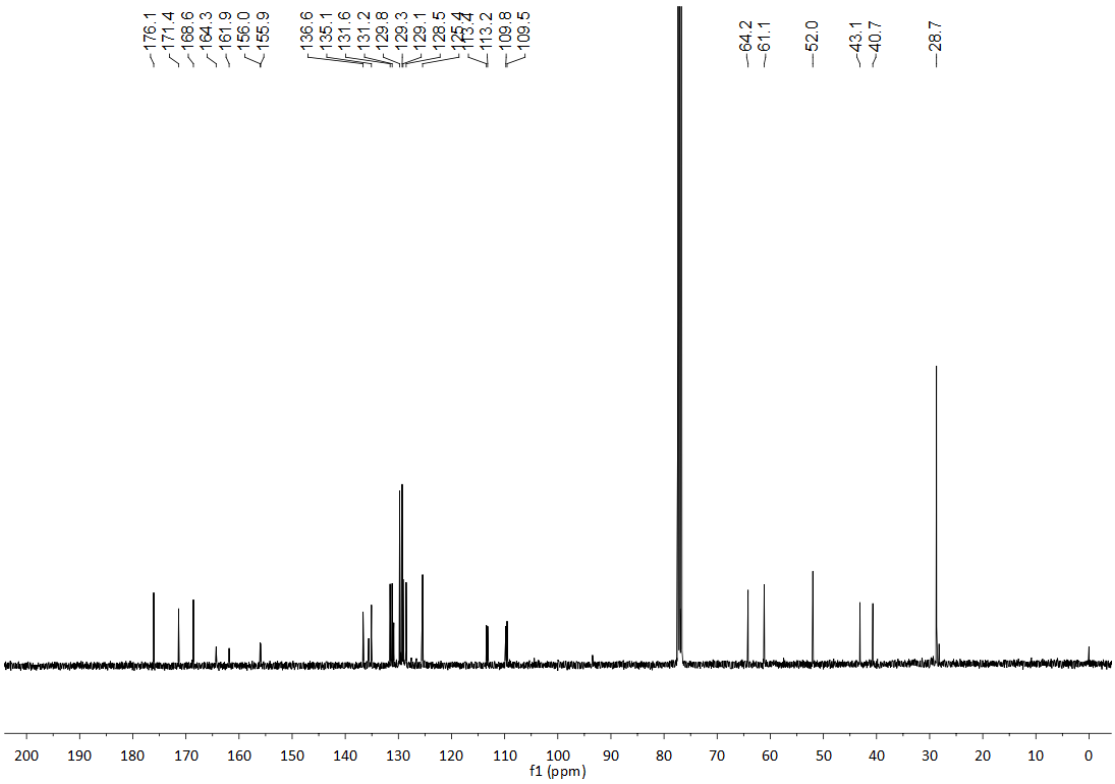


N-(tert-butyl)-2-(6'-fluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide (27down)

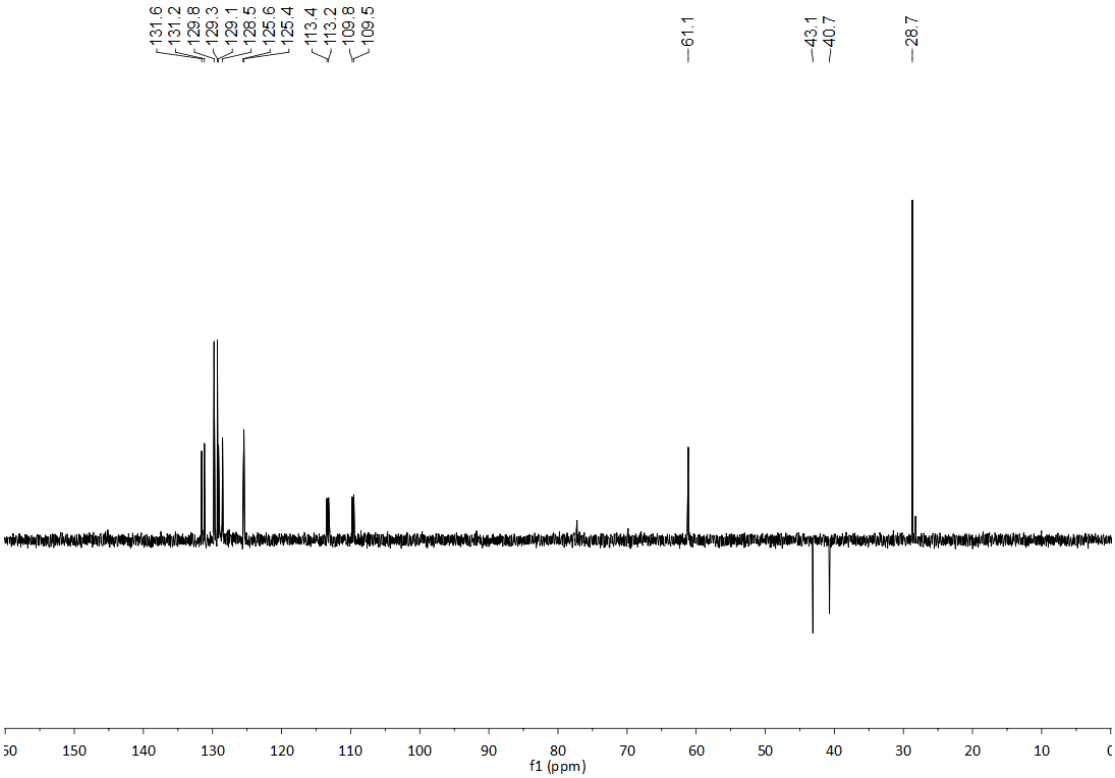
^{1}H NMR (400 MHz, $CDCl_3$)：



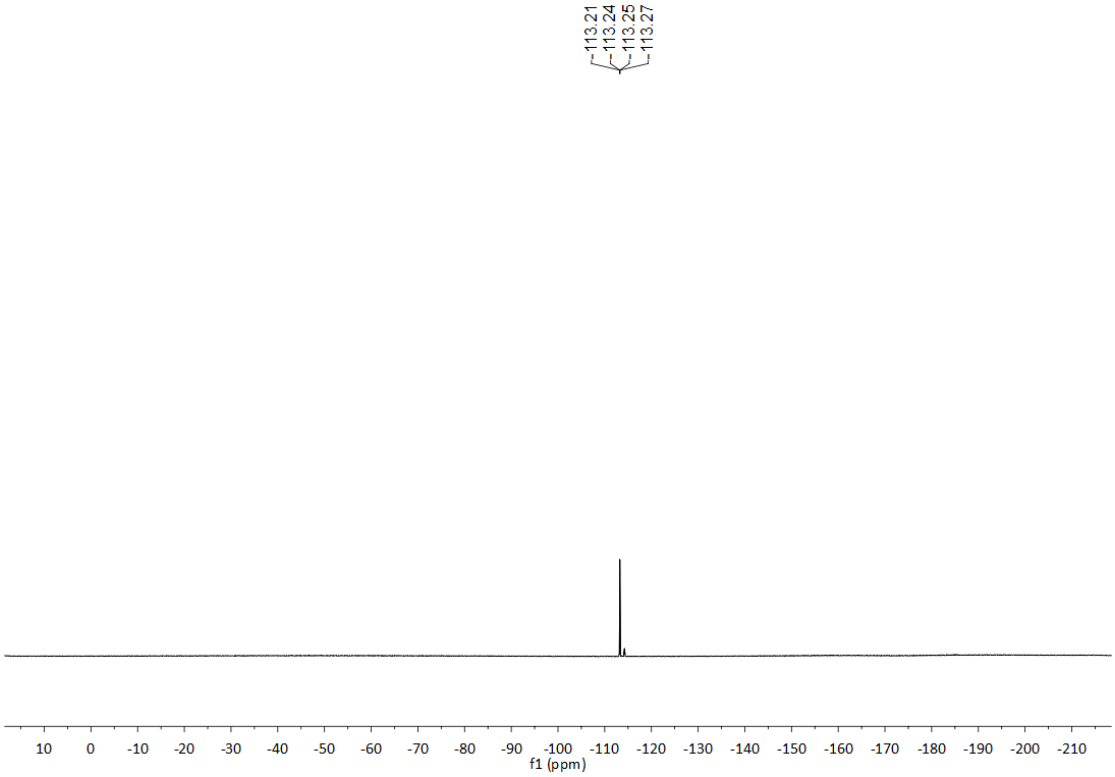
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

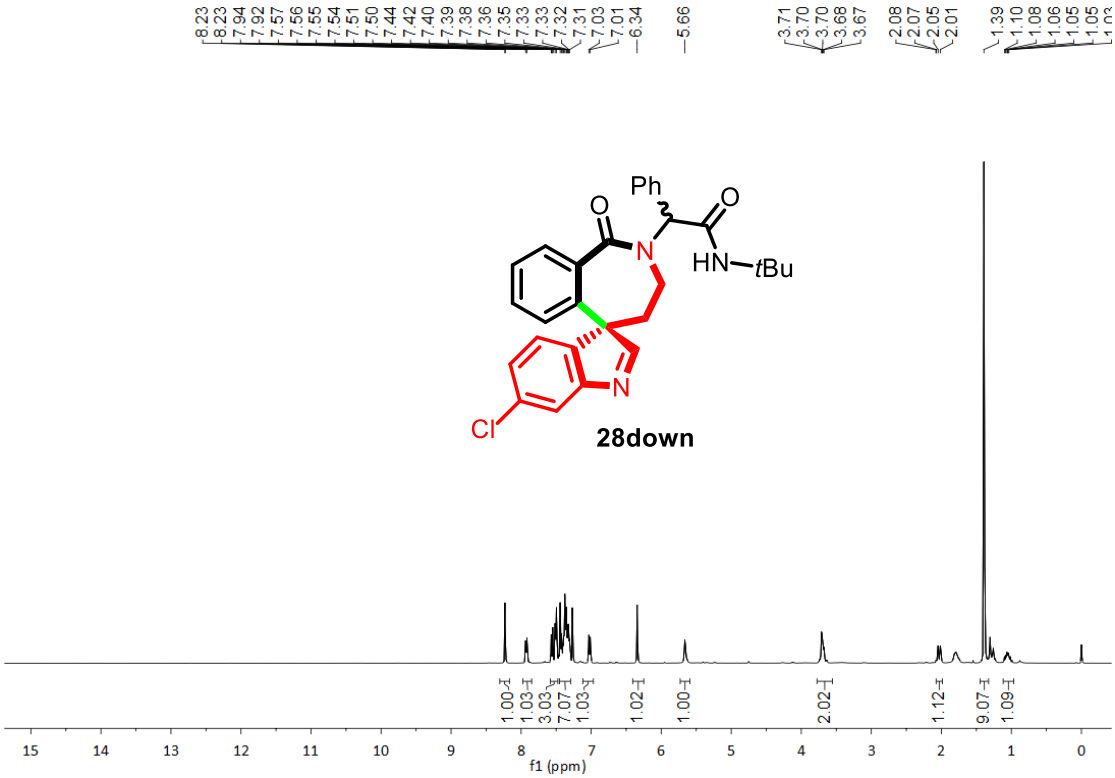


^{19}F NMR (376MHz, $CDCl_3$)

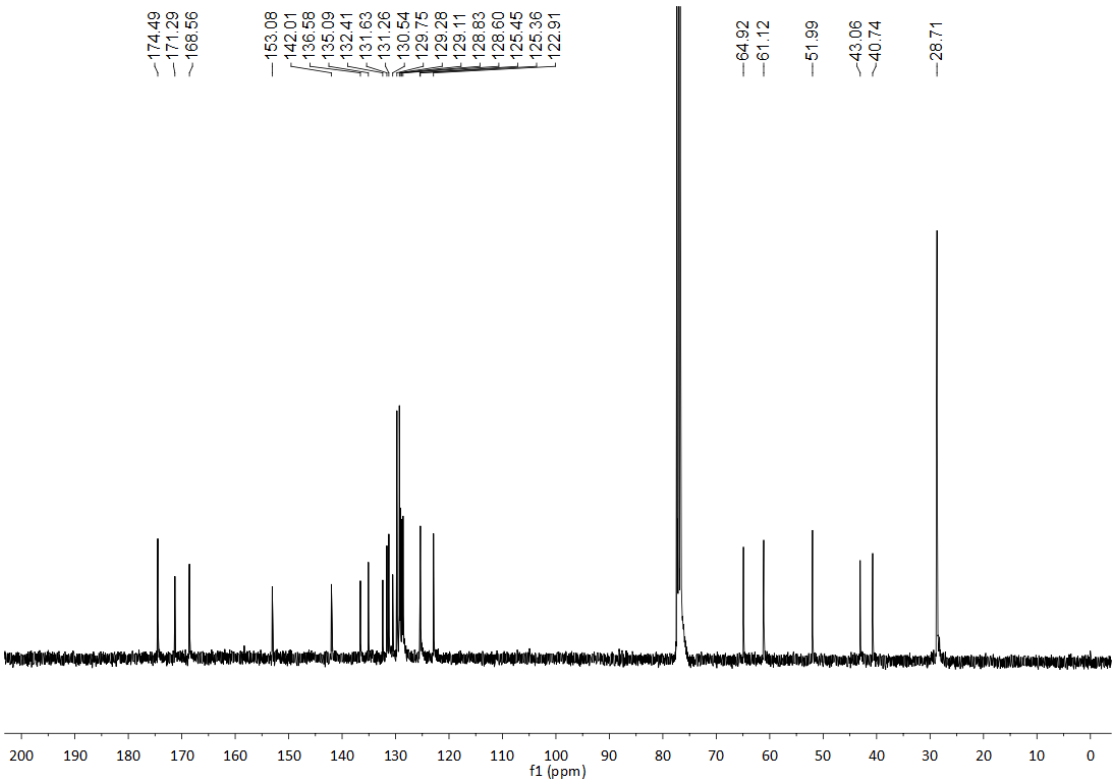


N-(tert-butyl)-2-(6'-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide (28down)

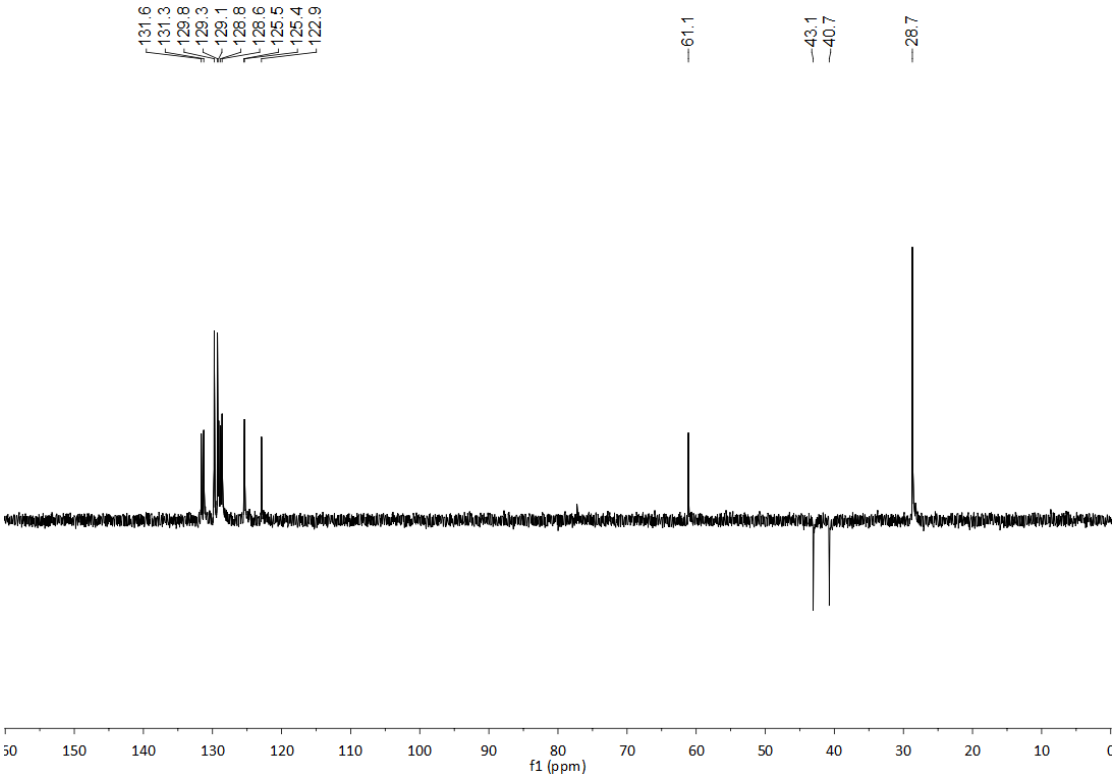
^{1}H NMR (400 MHz, $CDCl_3$)：



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

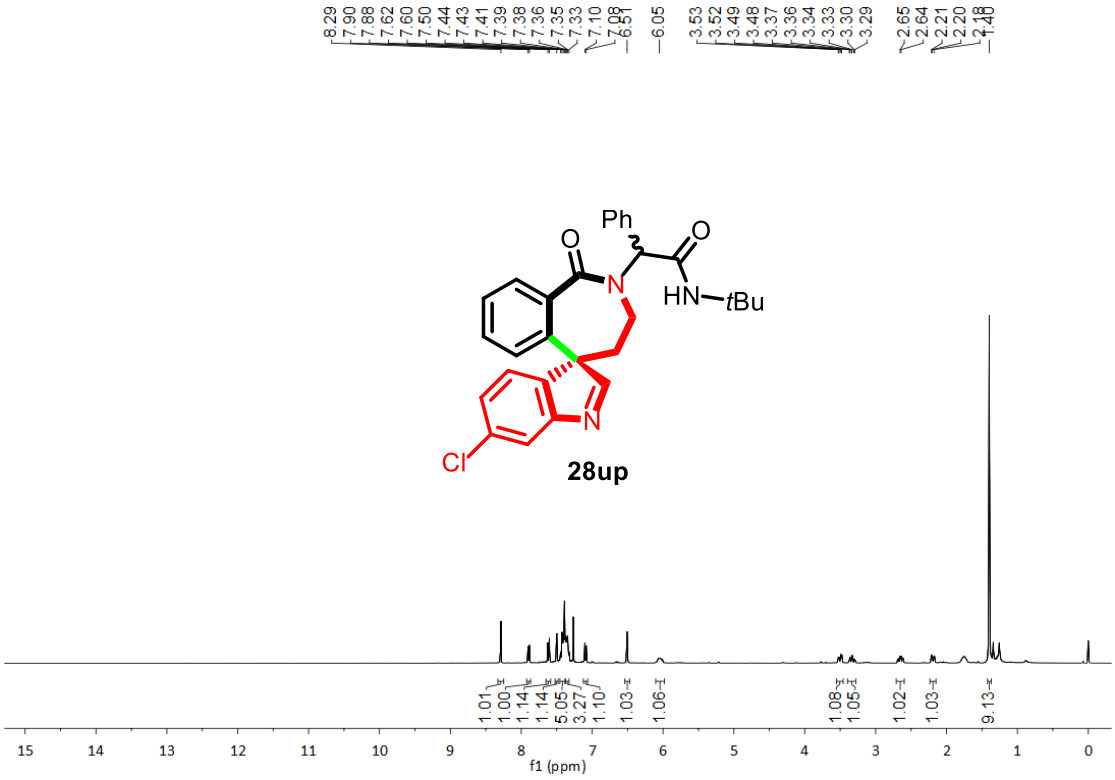


DEPT

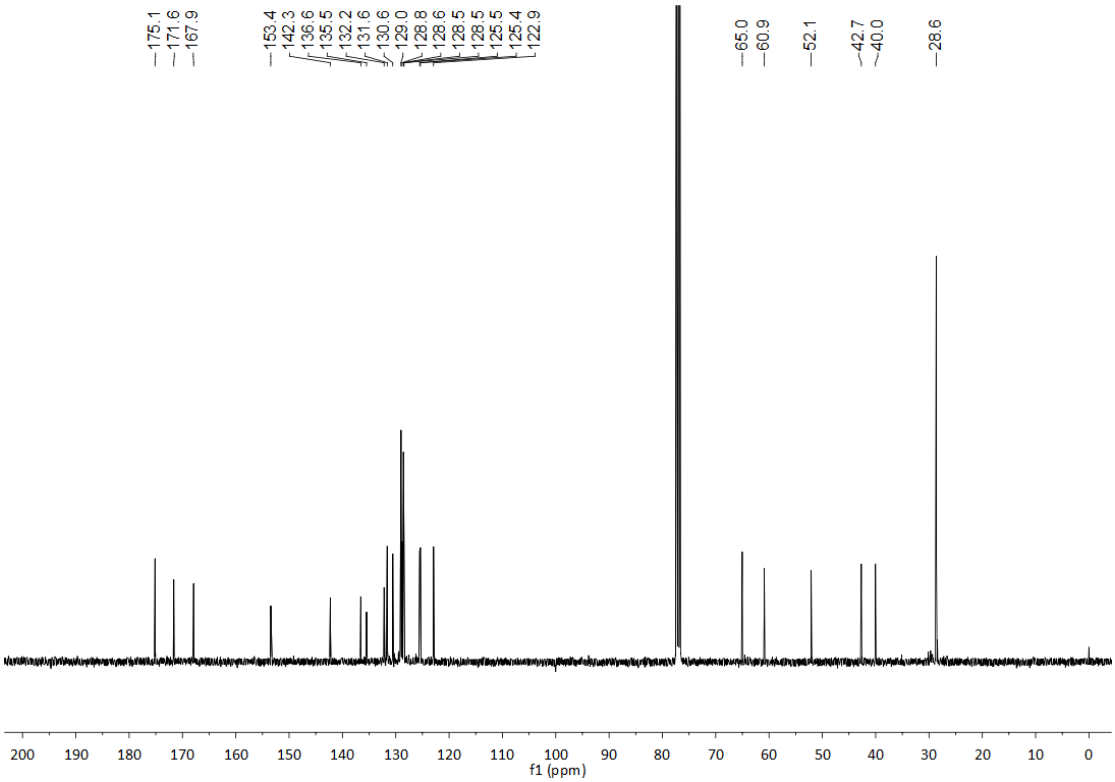


N-(tert-butyl)-2-(6'-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl acetamide (28up)

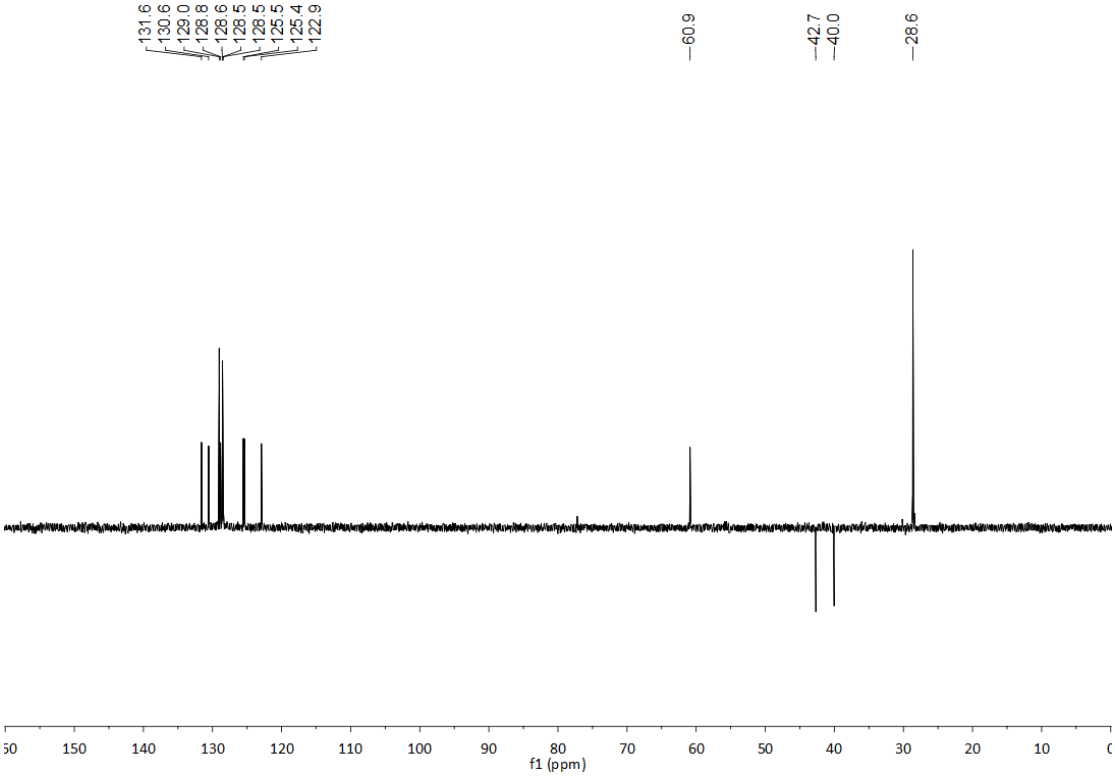
^{1}H NMR (400 MHz, $CDCl_3$):



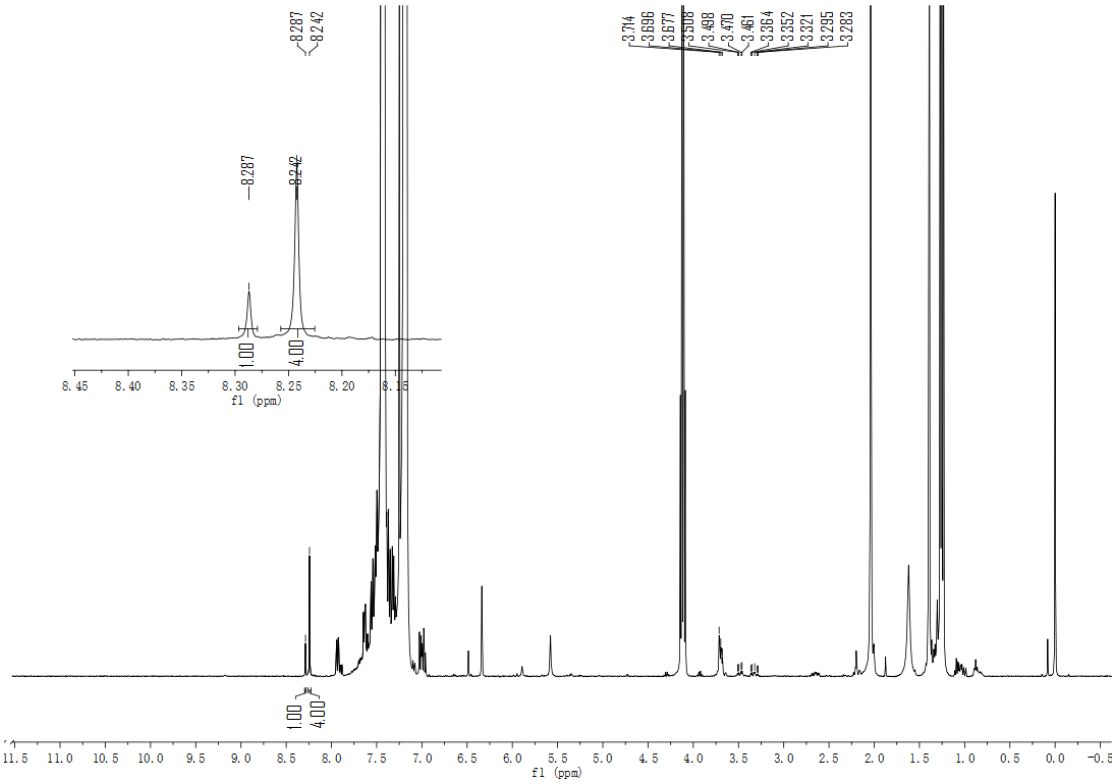
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

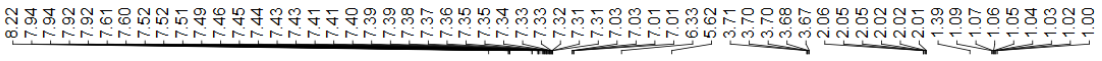


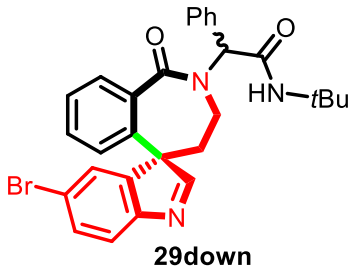
28 crude ^{1}H NMR



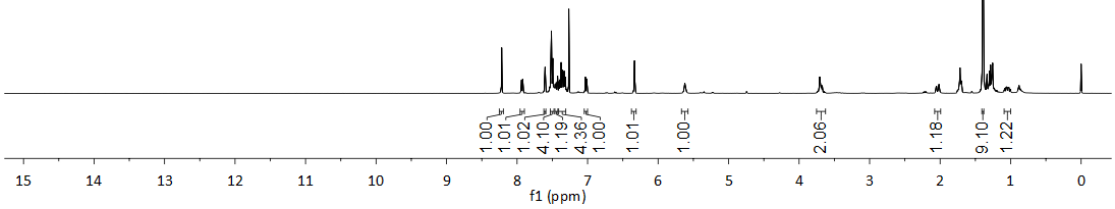
2-(5'-bromo-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-N-(tert-butyl)-2-phenyl acetamide (29down)

^{1}H NMR (400 MHz, $CDCl_3$):

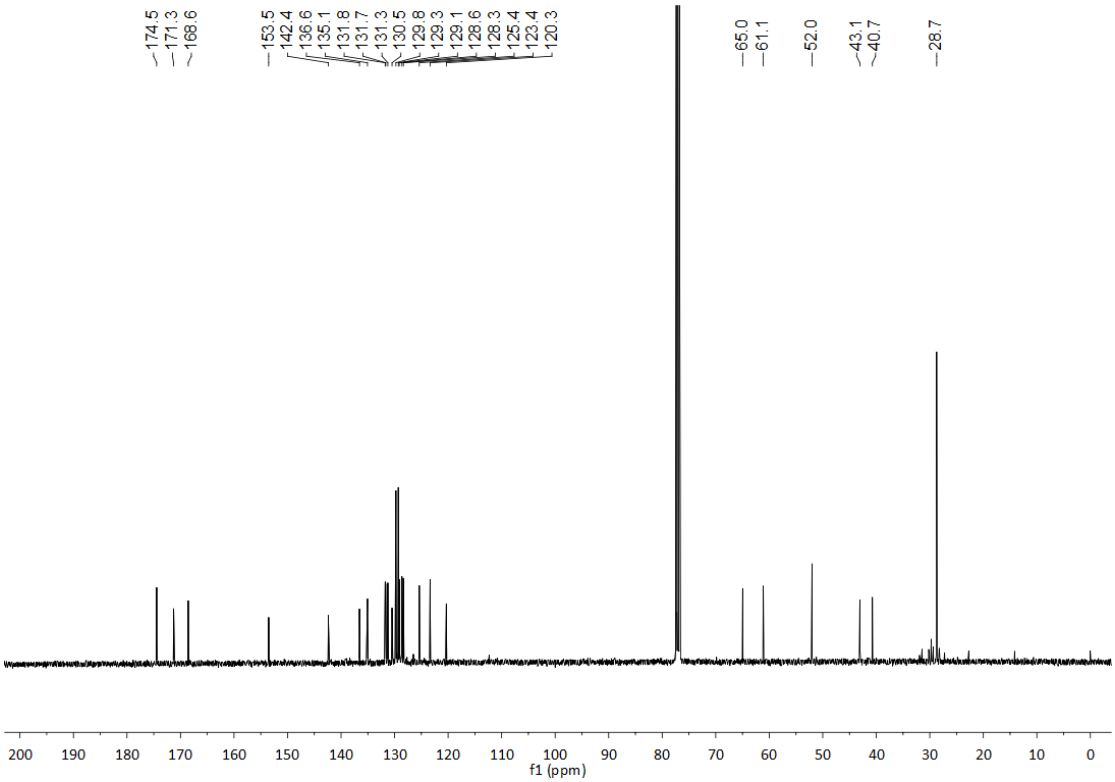




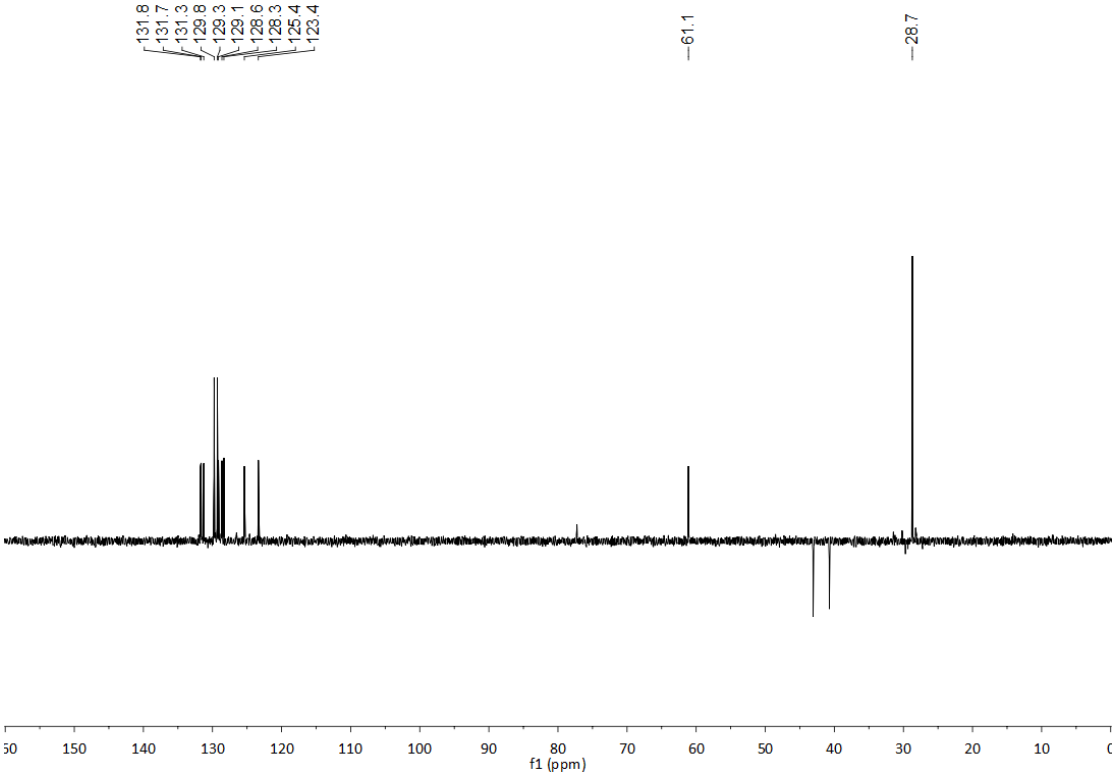
29down



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

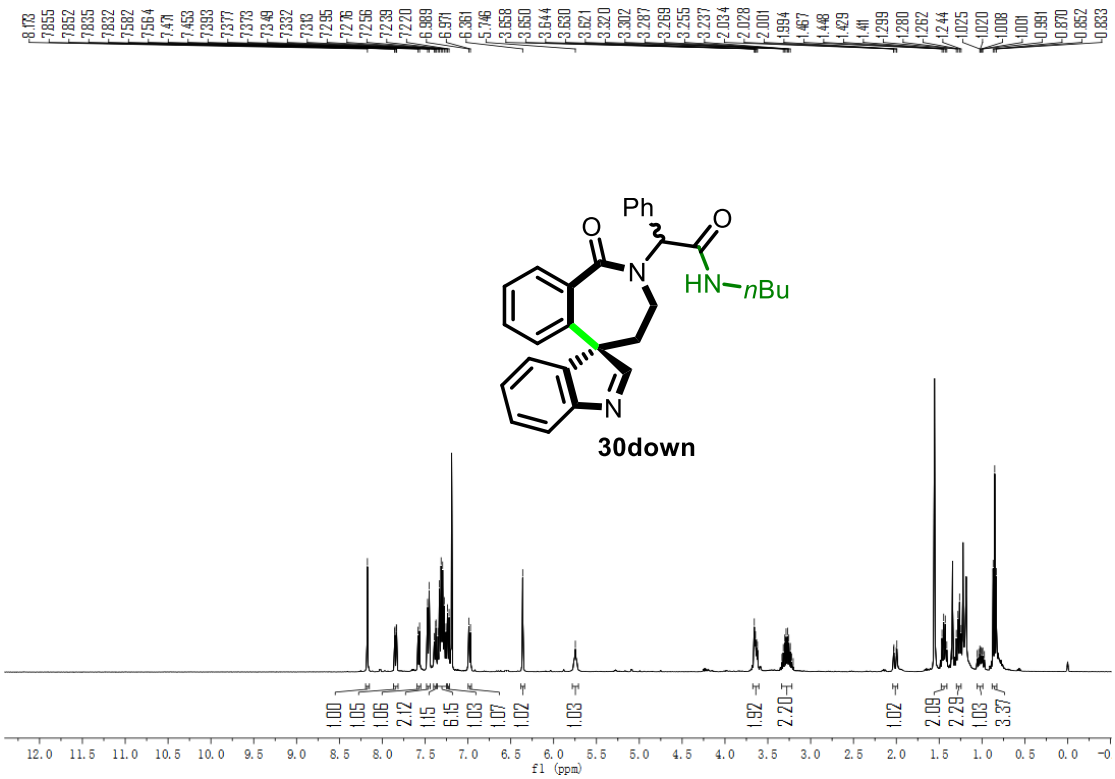


DEPT

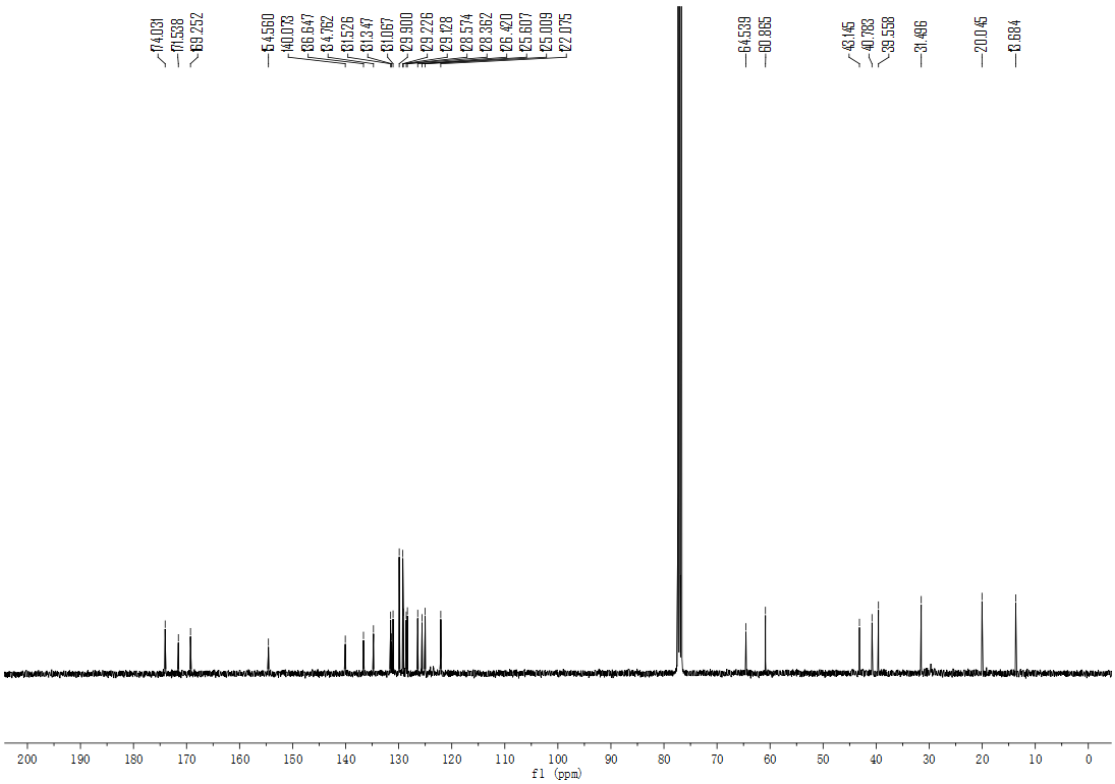


N-butyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (30down)

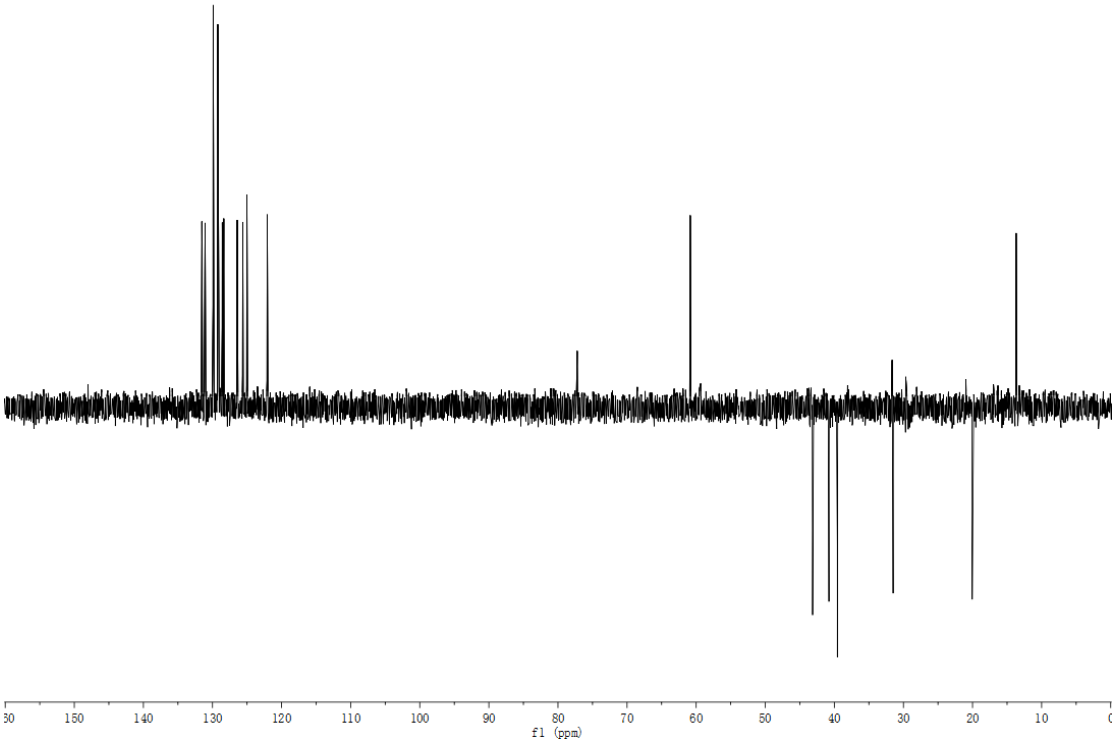
^{1}H NMR (400 MHz, $CDCl_3$)：



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

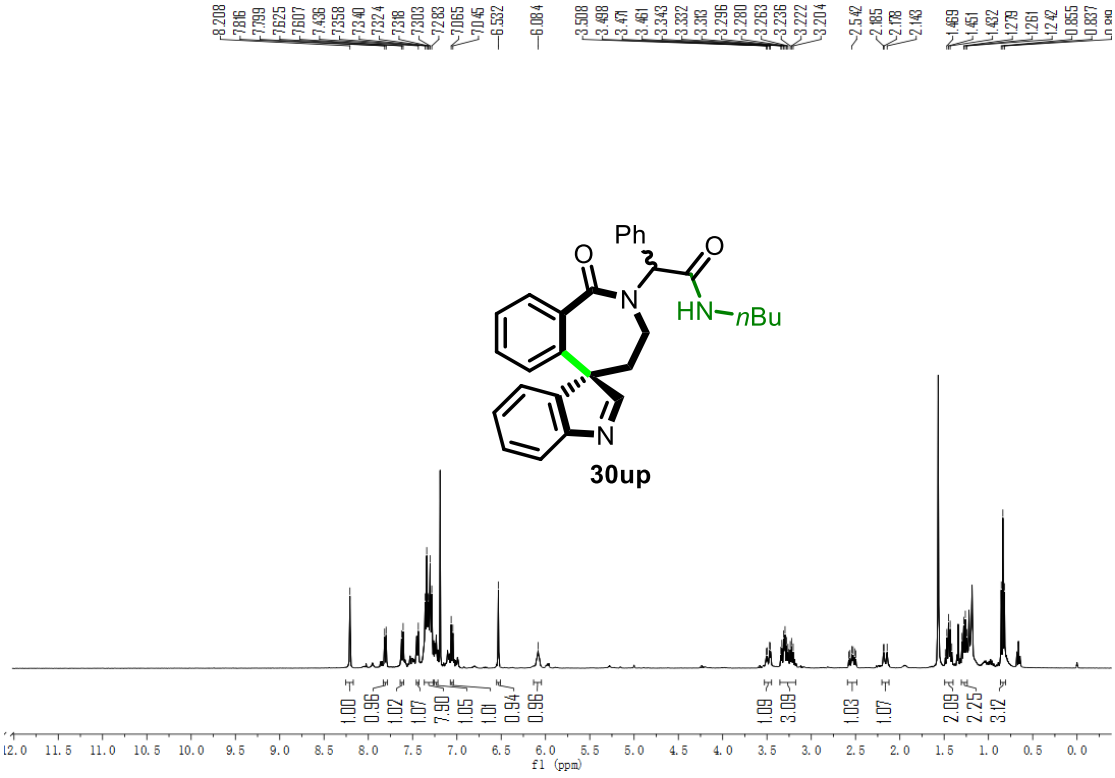


DEPT

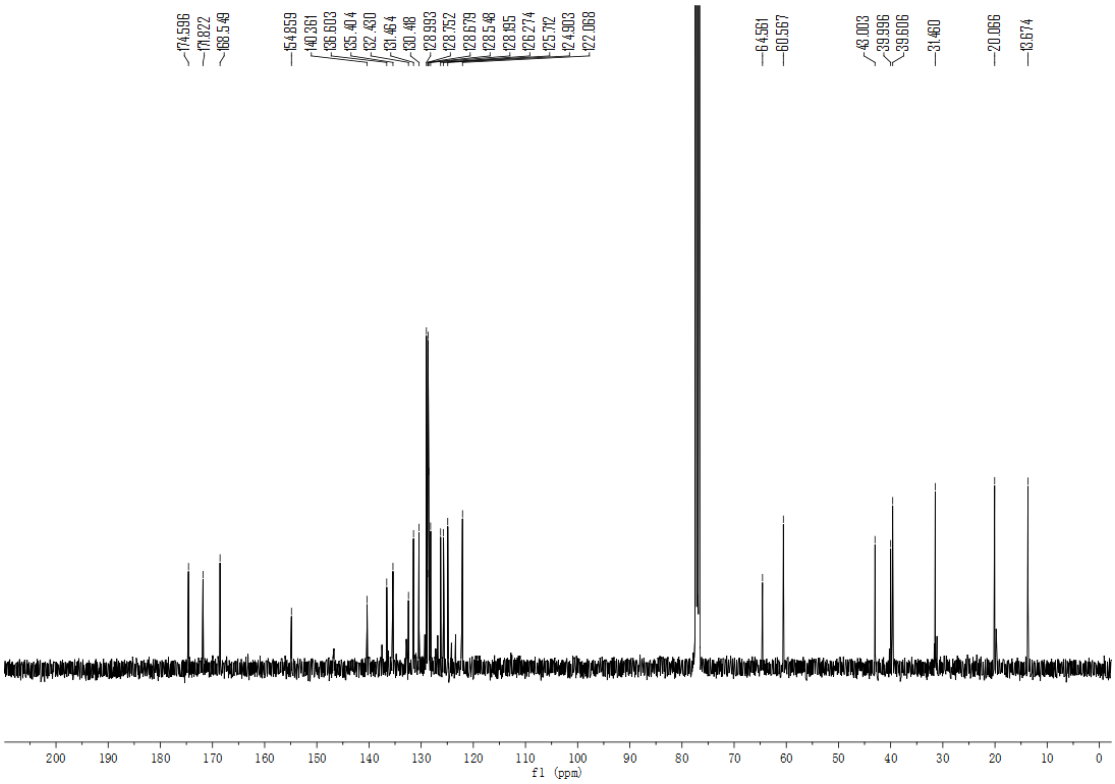


N-butyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (30up)

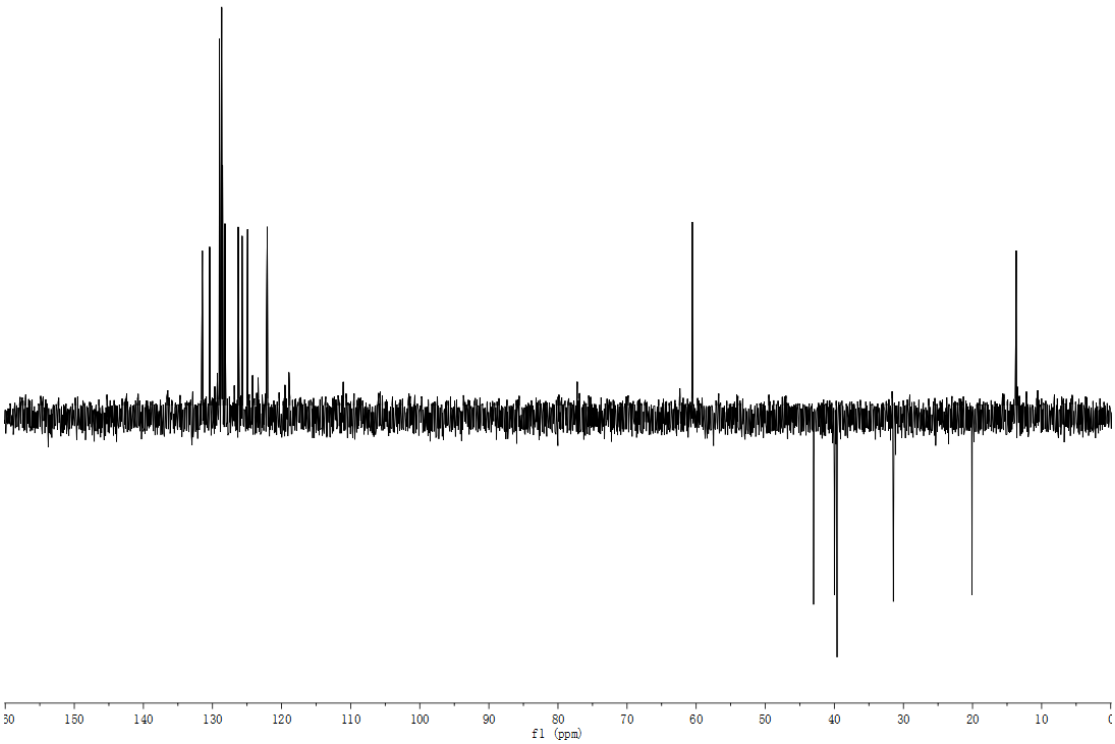
^{1}H NMR (400 MHz, $CDCl_3$):



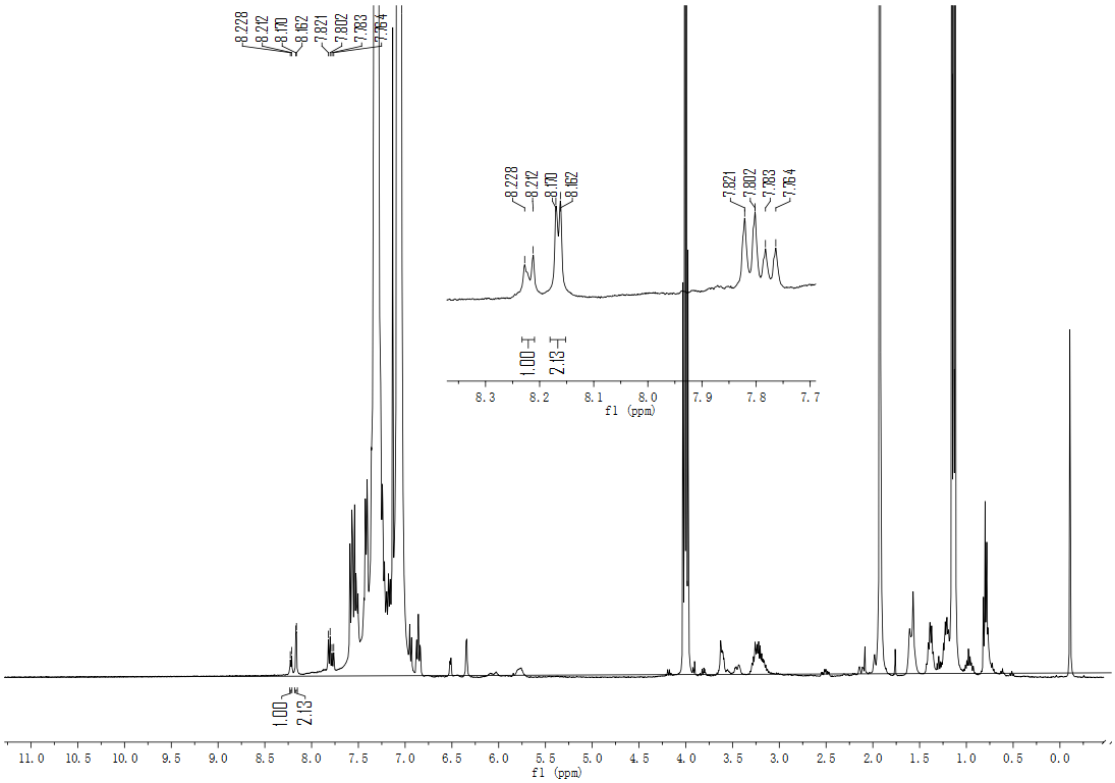
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

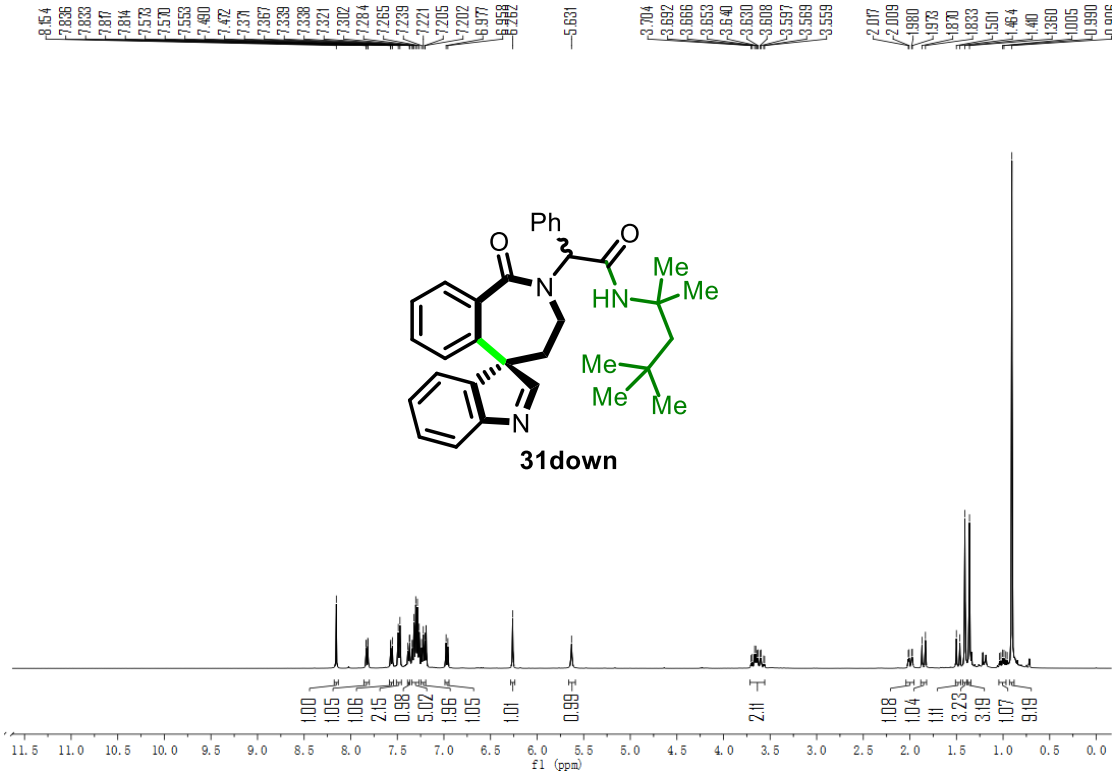


30 crude ^{1}H NMR

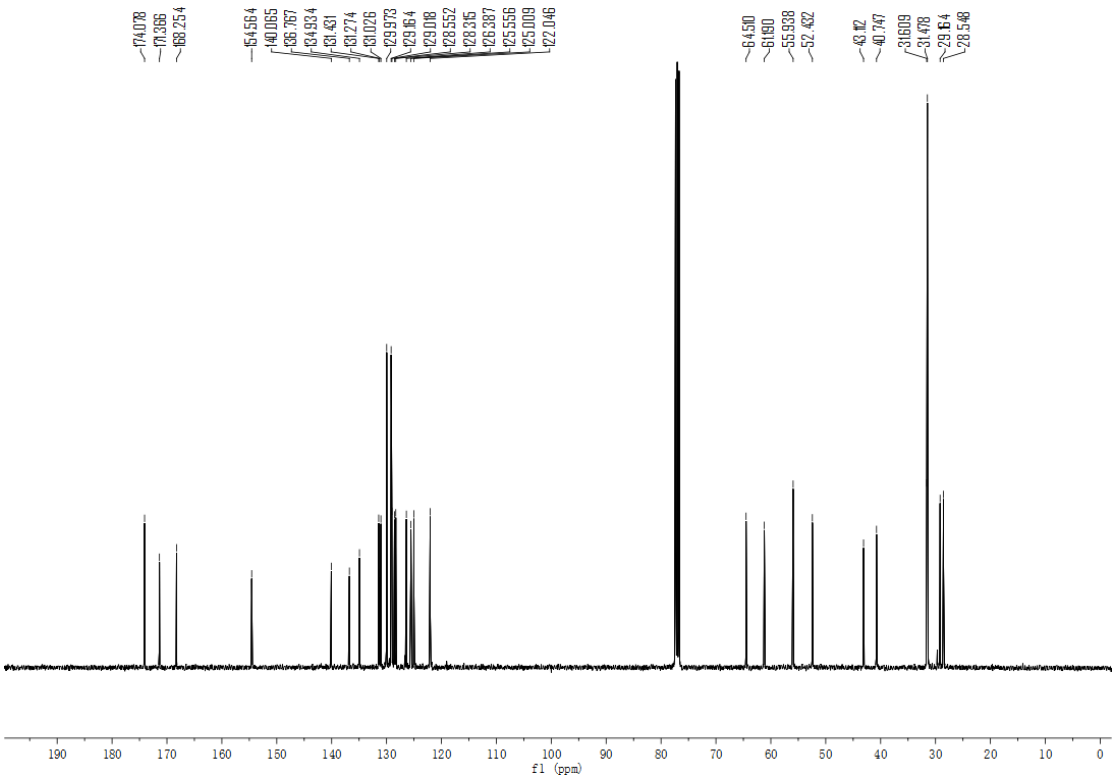


2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl-N-(2,4,4-trimethylpentan-2-yl)acetamide (31down)

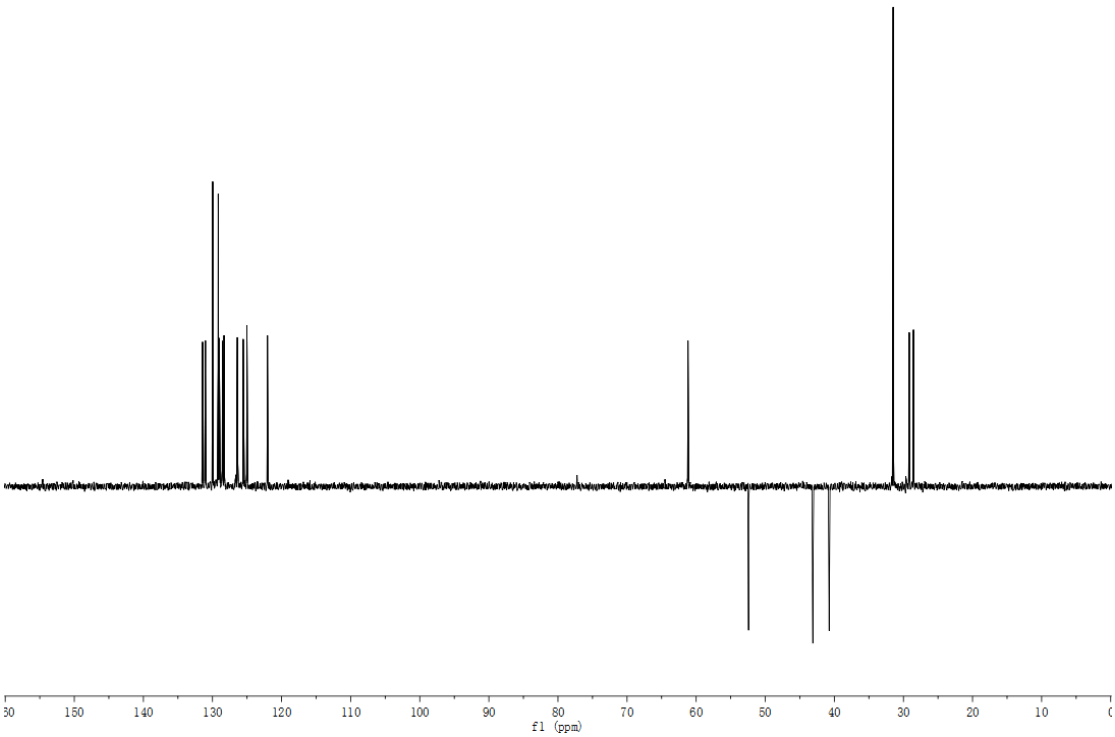
^{1}H NMR (400 MHz, $CDCl_3$):



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

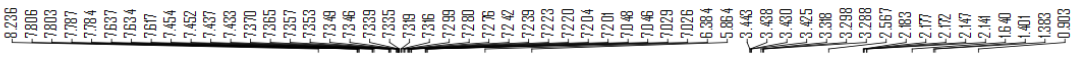


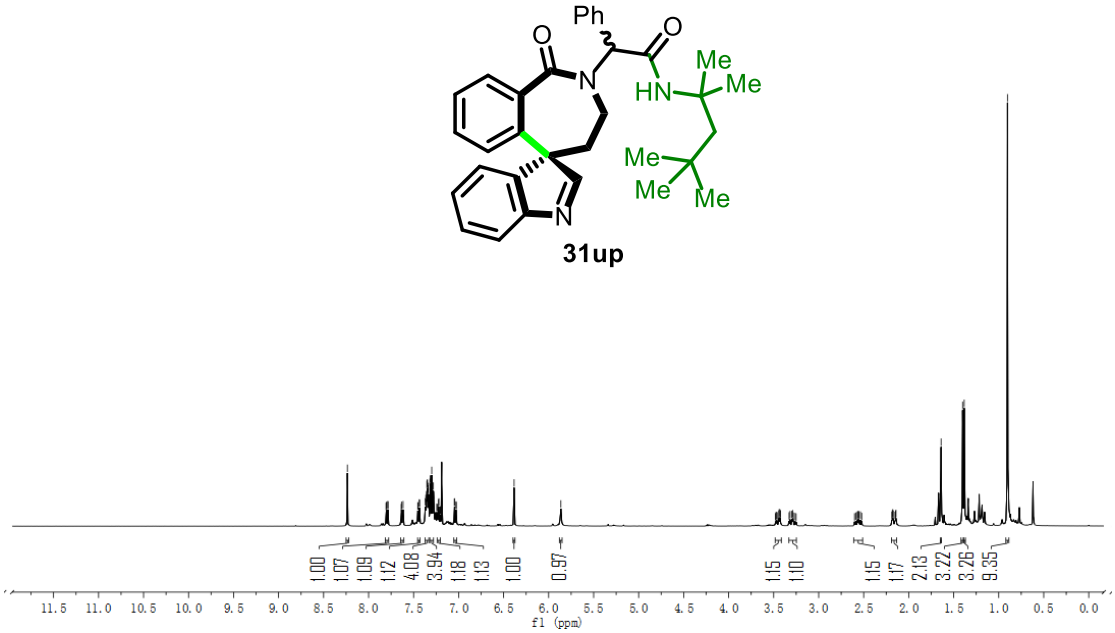
DEPT



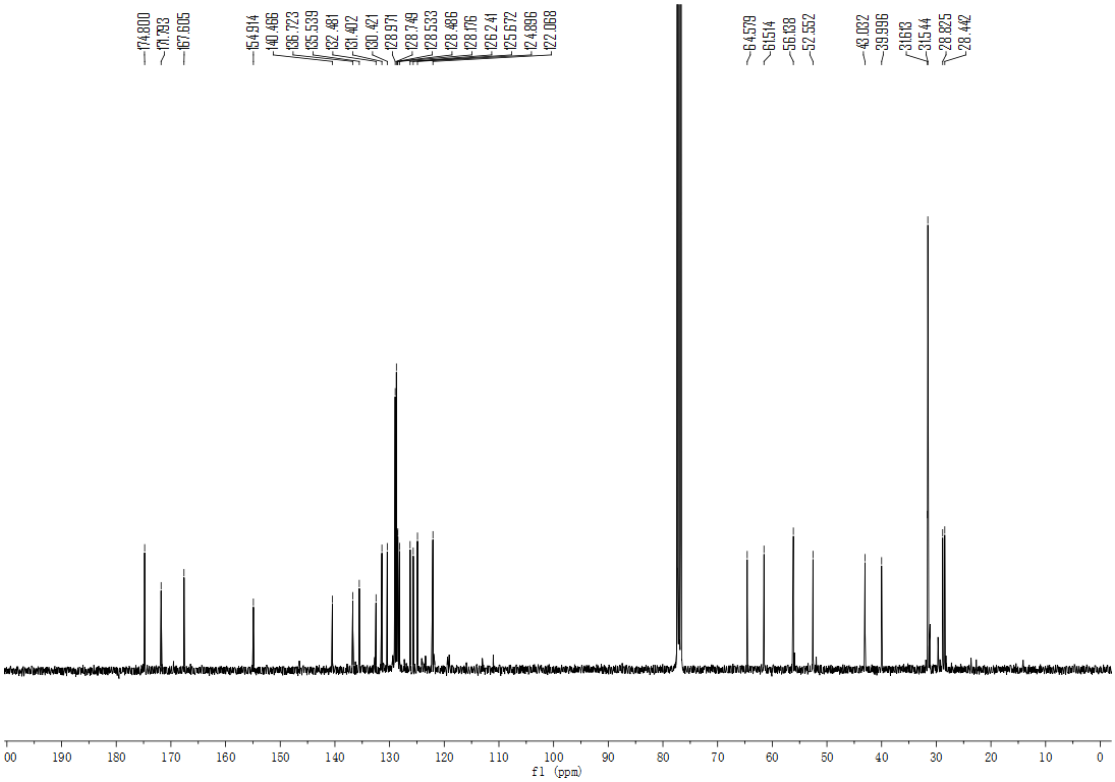
2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenyl-N-(2,4,4-trimethylpentan-2-yl)acetamide (31up)

^{1}H NMR (400 MHz, $CDCl_3$)：

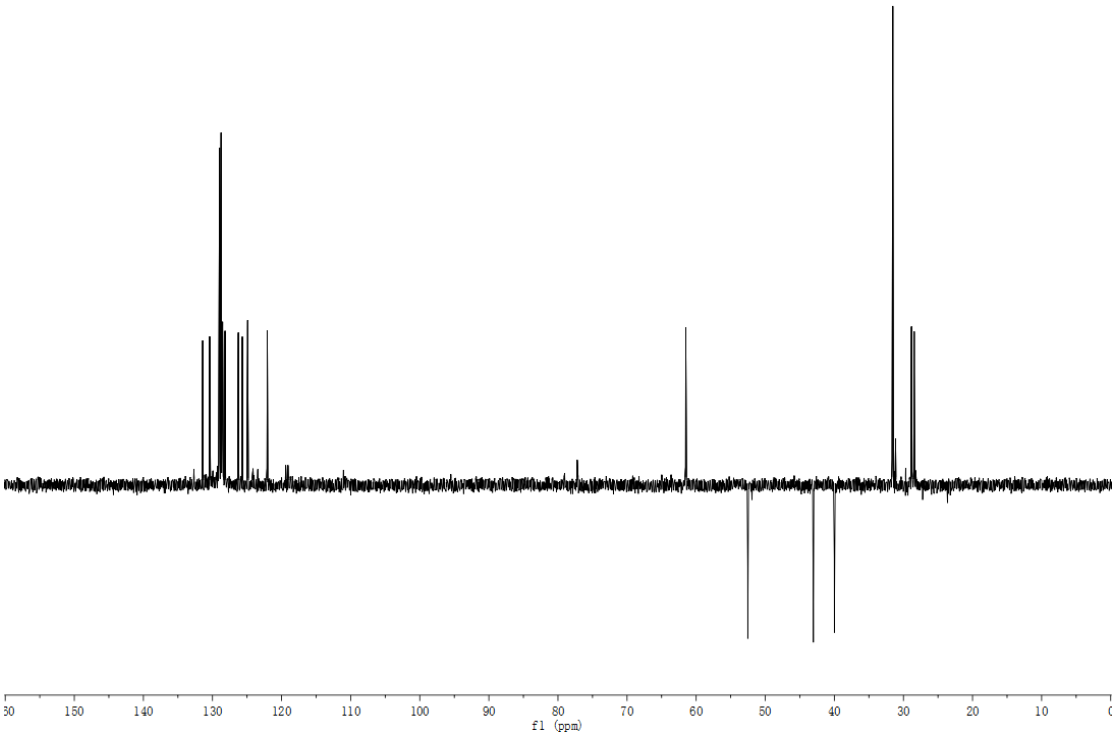




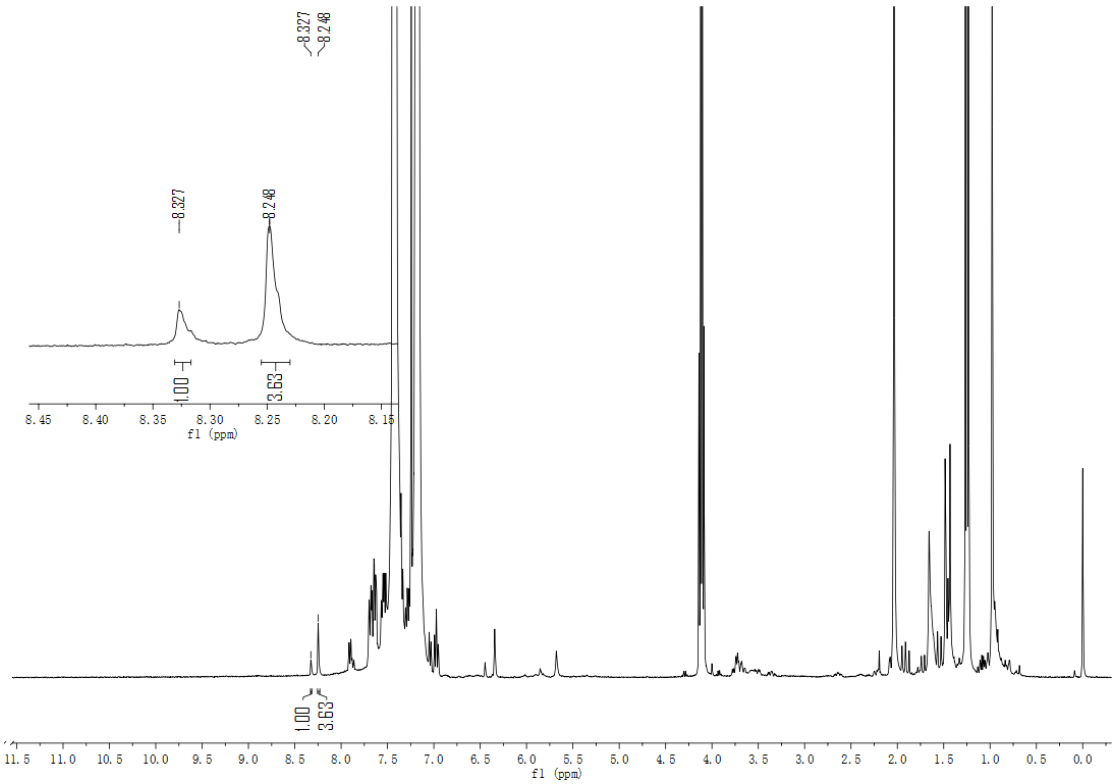
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

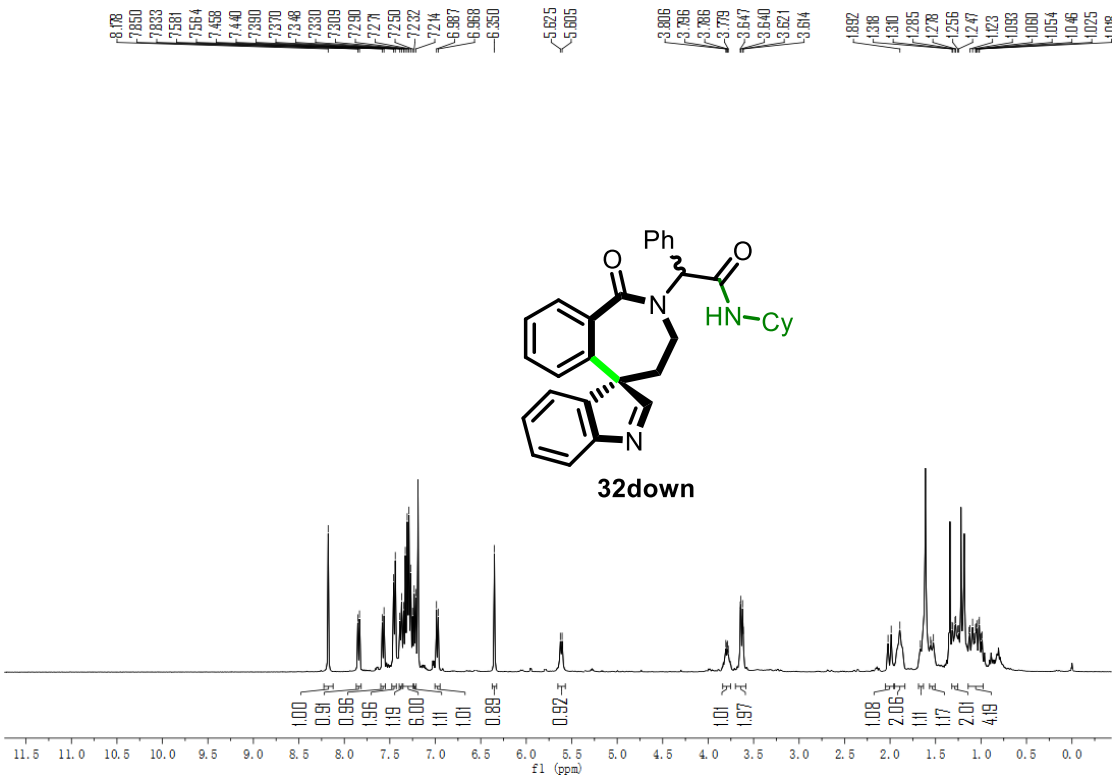


31 crude ^{1}H NMR

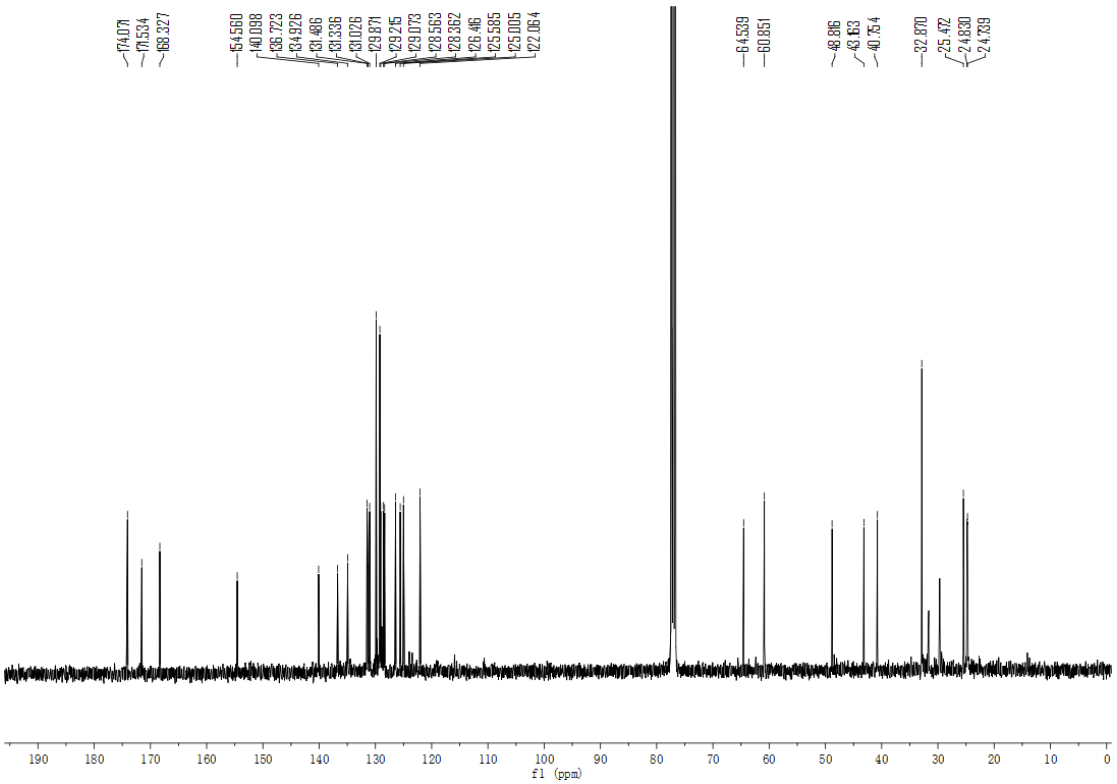


N-cyclohexyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (32down)

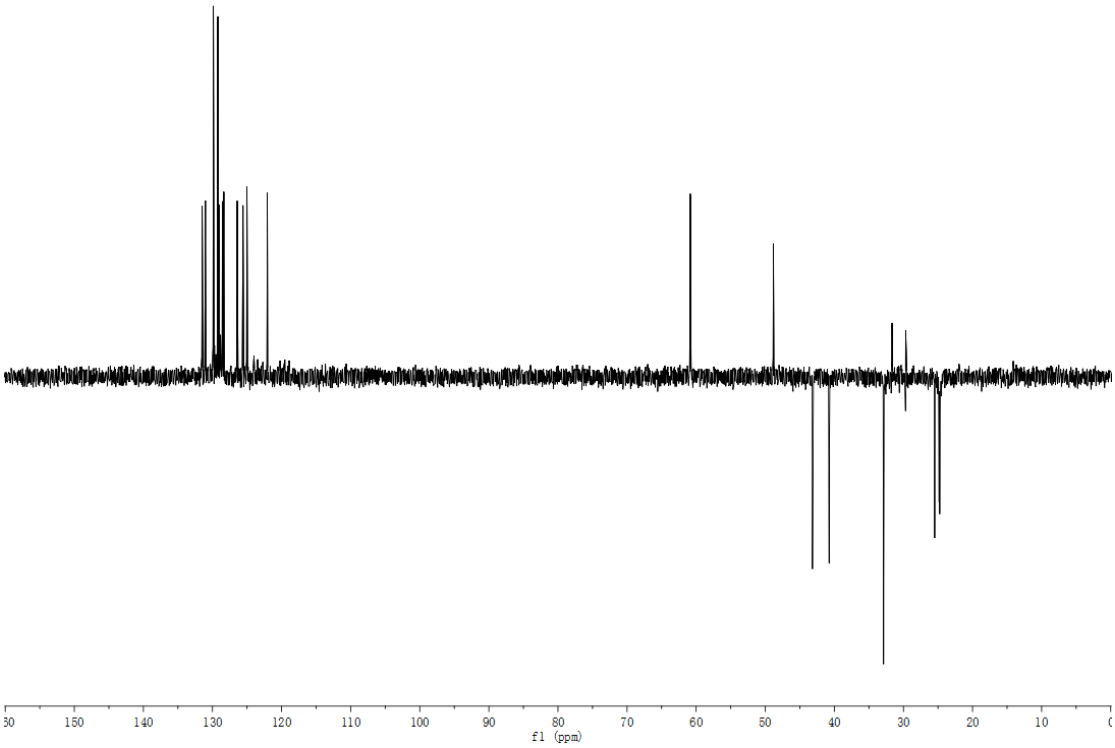
^{1}H NMR (400 MHz, $CDCl_3$)：



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

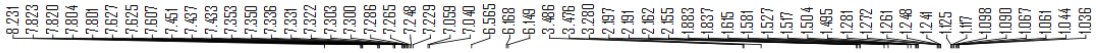


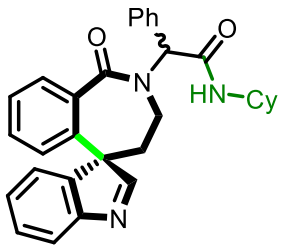
DEPT



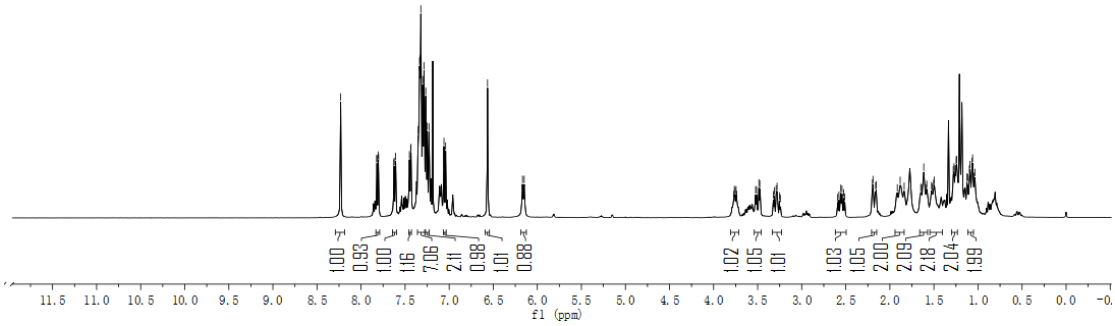
N-cyclohexyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (32up)

^{1}H NMR (400 MHz, $CDCl_3$):

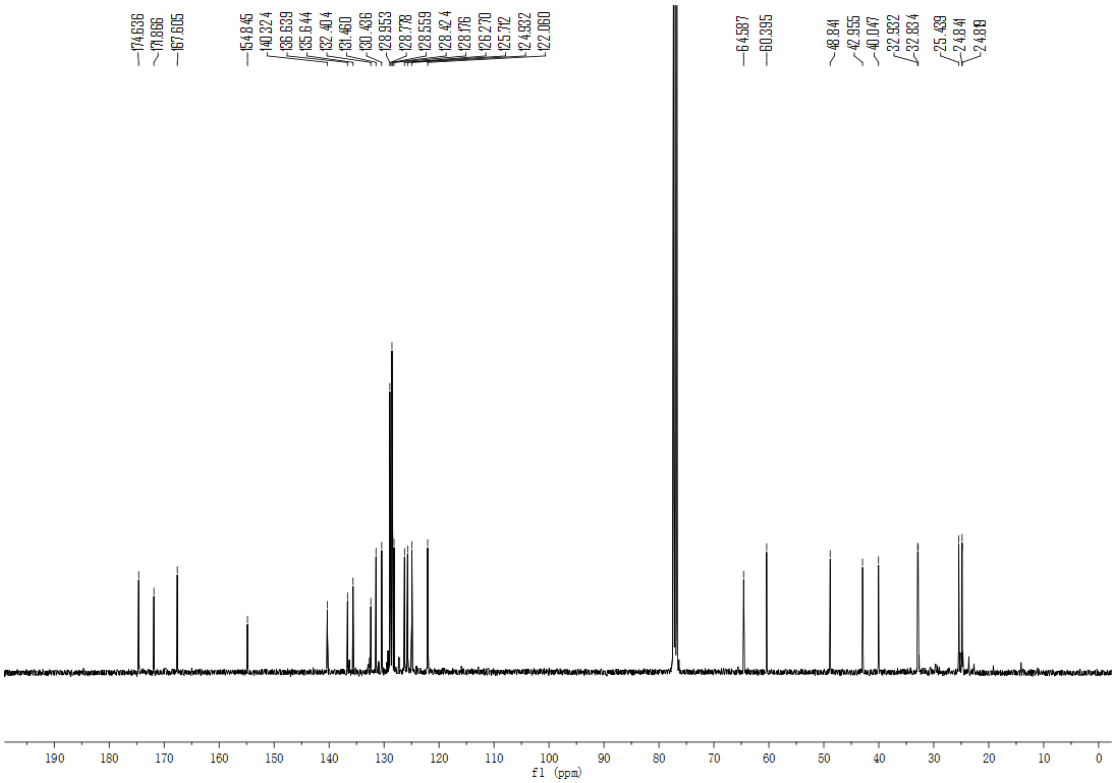




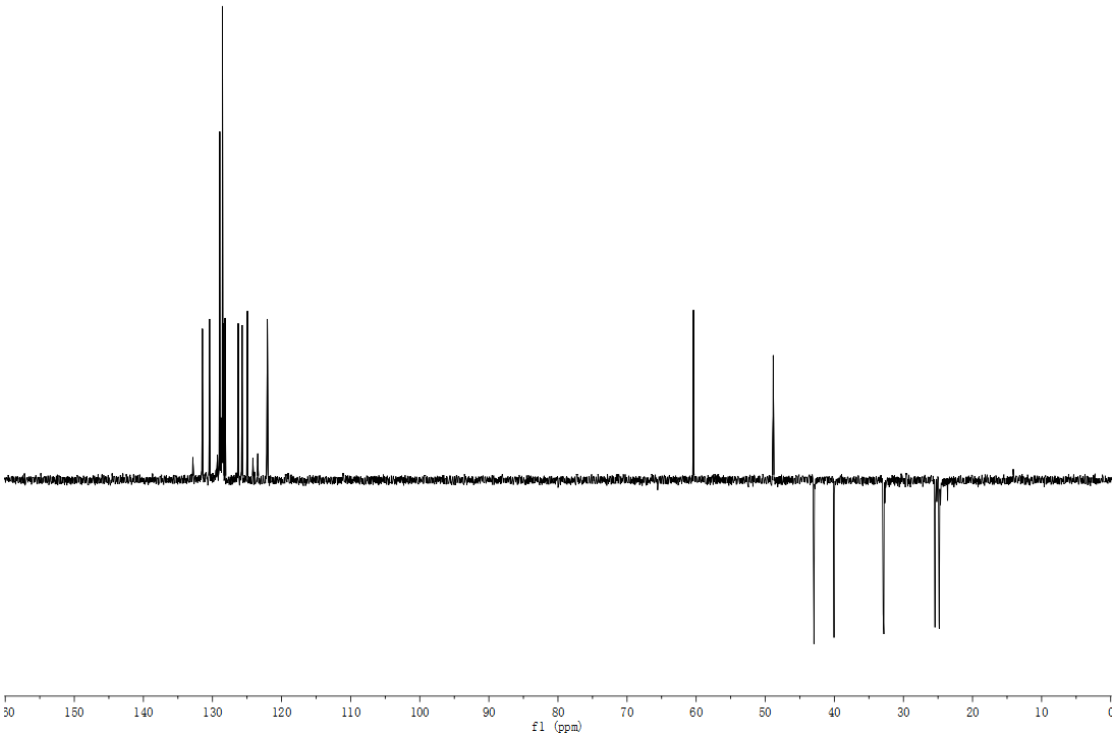
32up



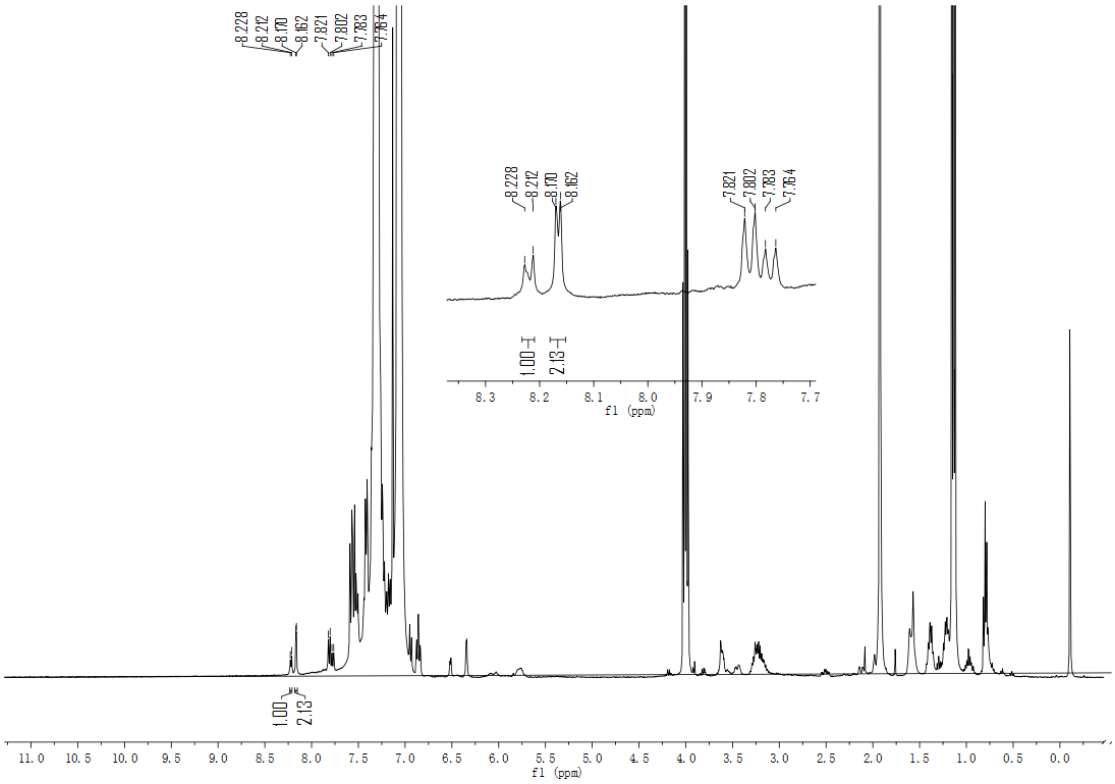
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

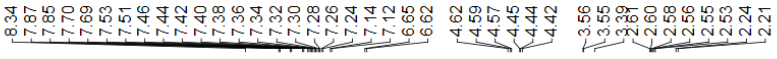


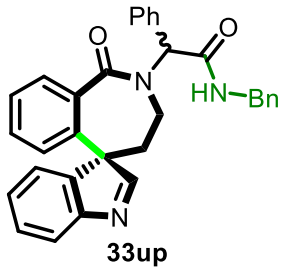
32 crude ^{1}H NMR



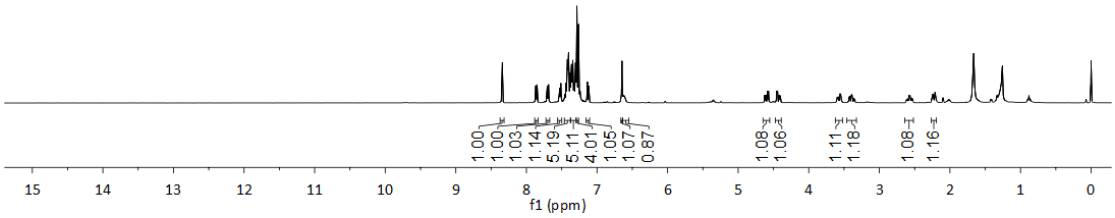
N-benzyl-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (33up)

^{1}H NMR (400 MHz, $CDCl_3$):

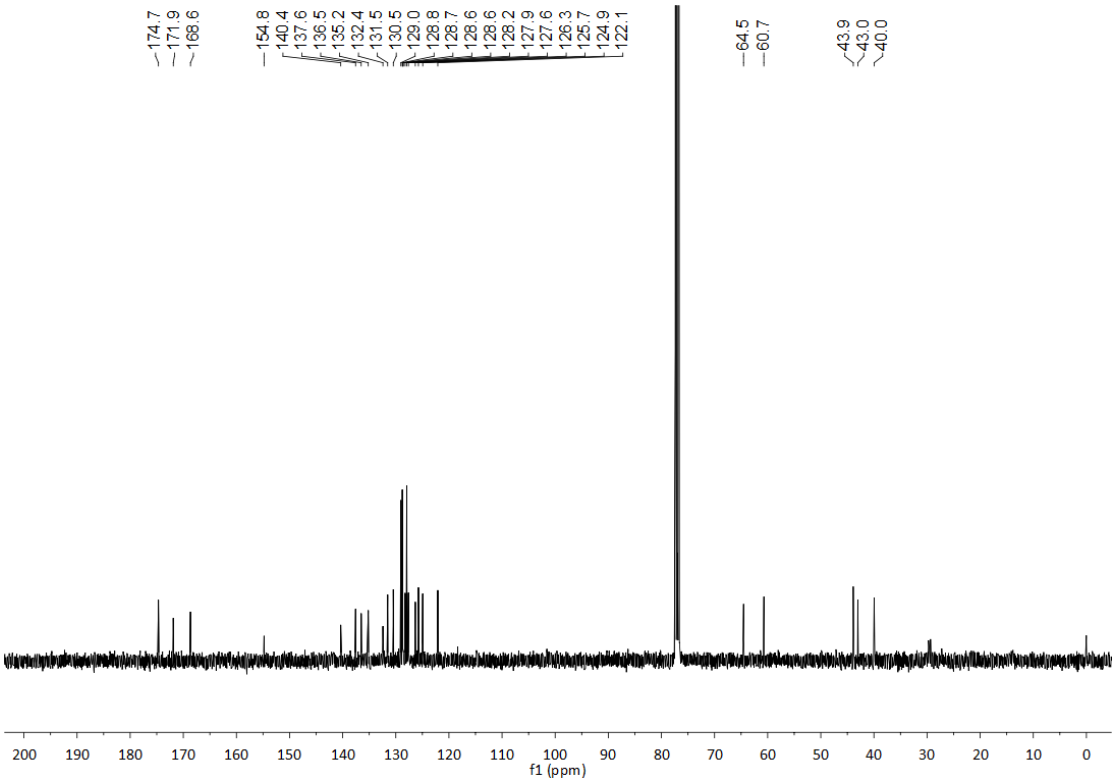




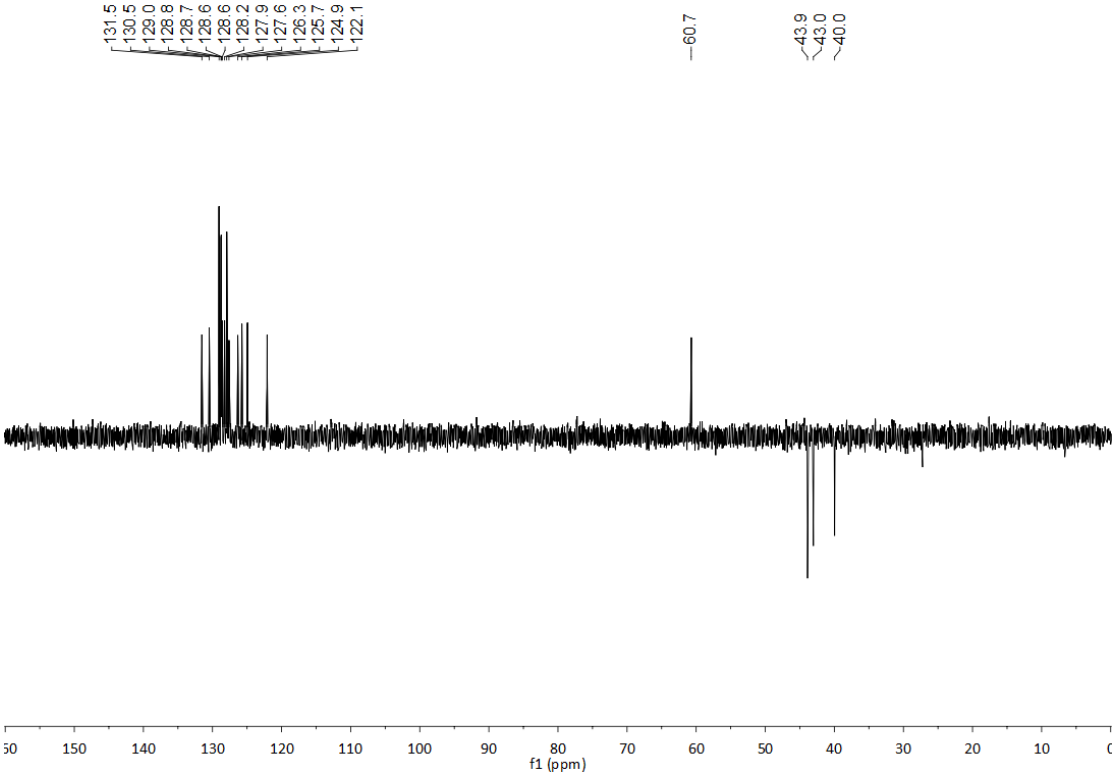
33up



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

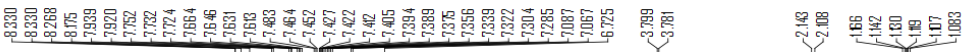


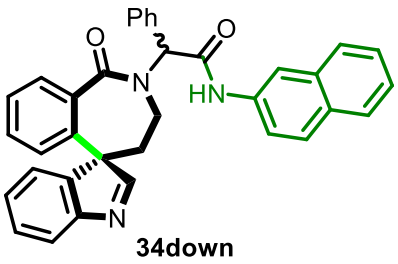
DEPT



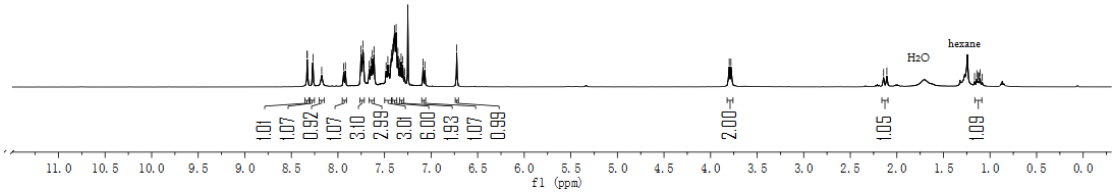
N-(naphthalen-2-yl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (34down)

^{1}H NMR (400 MHz, $CDCl_3$)：

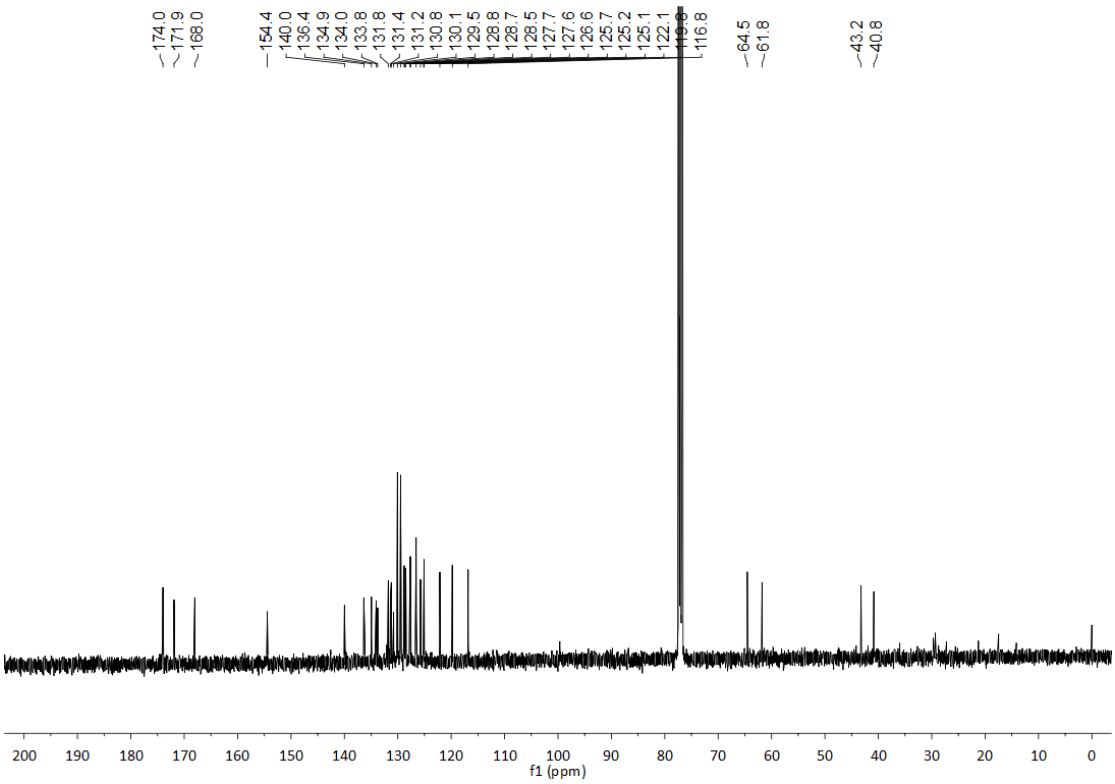




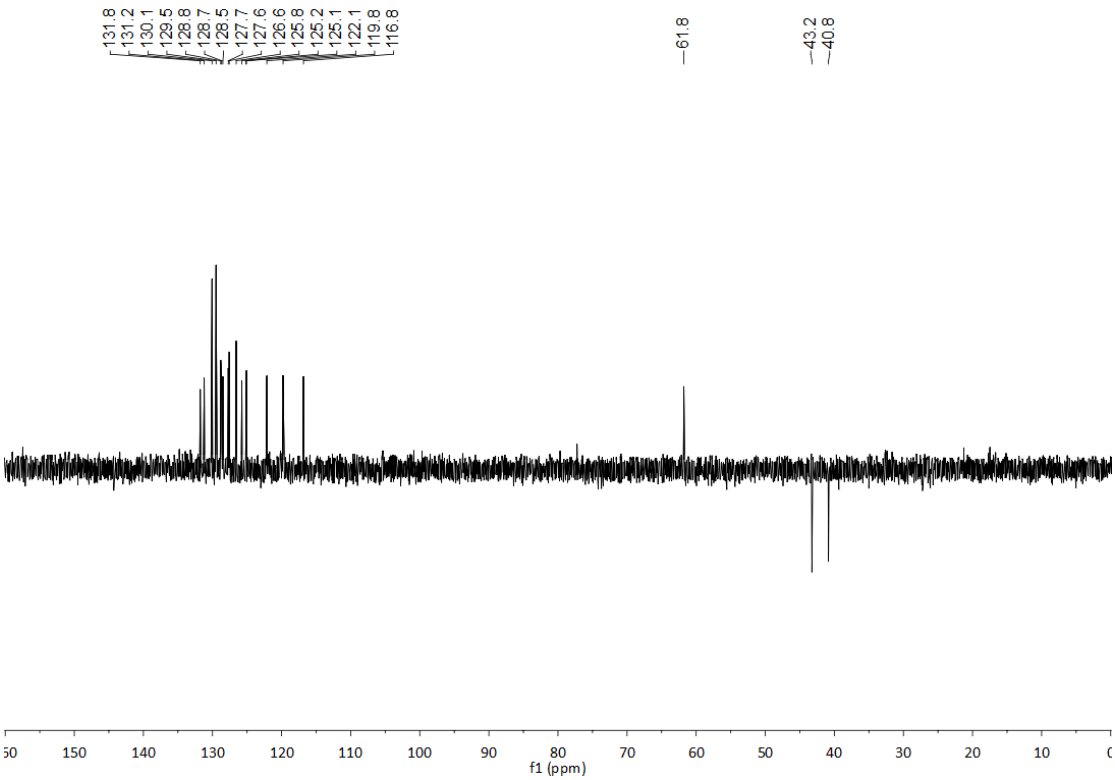
34down



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

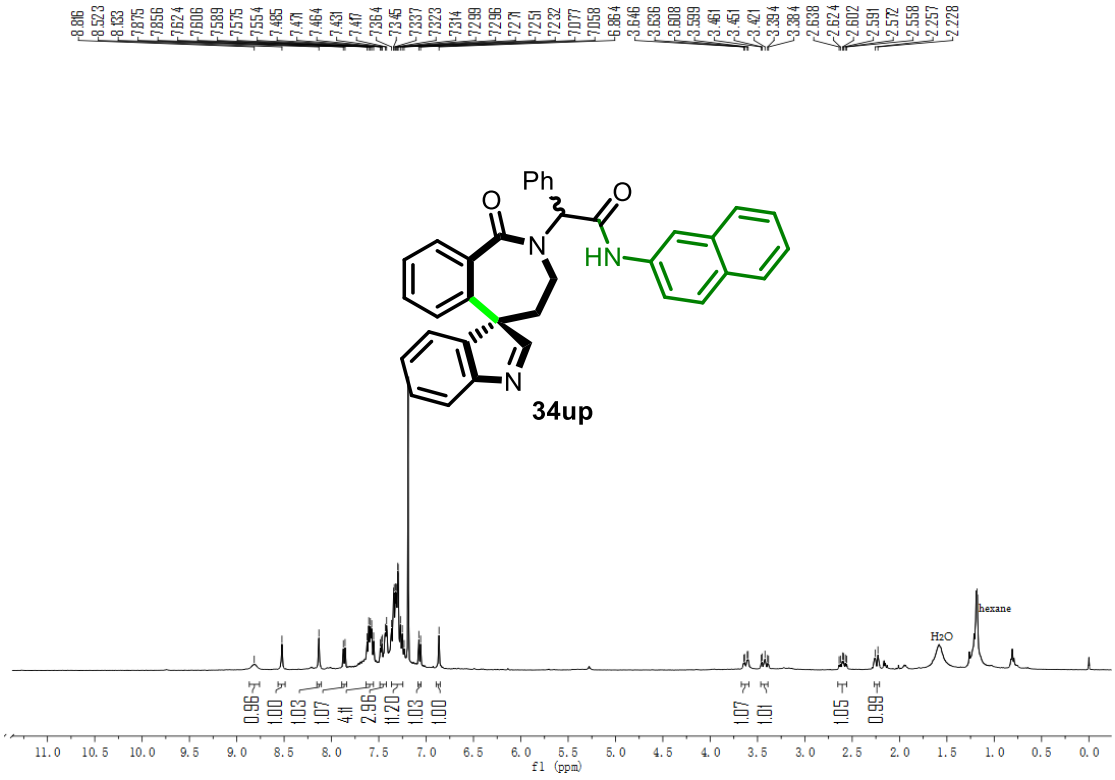


DEPT

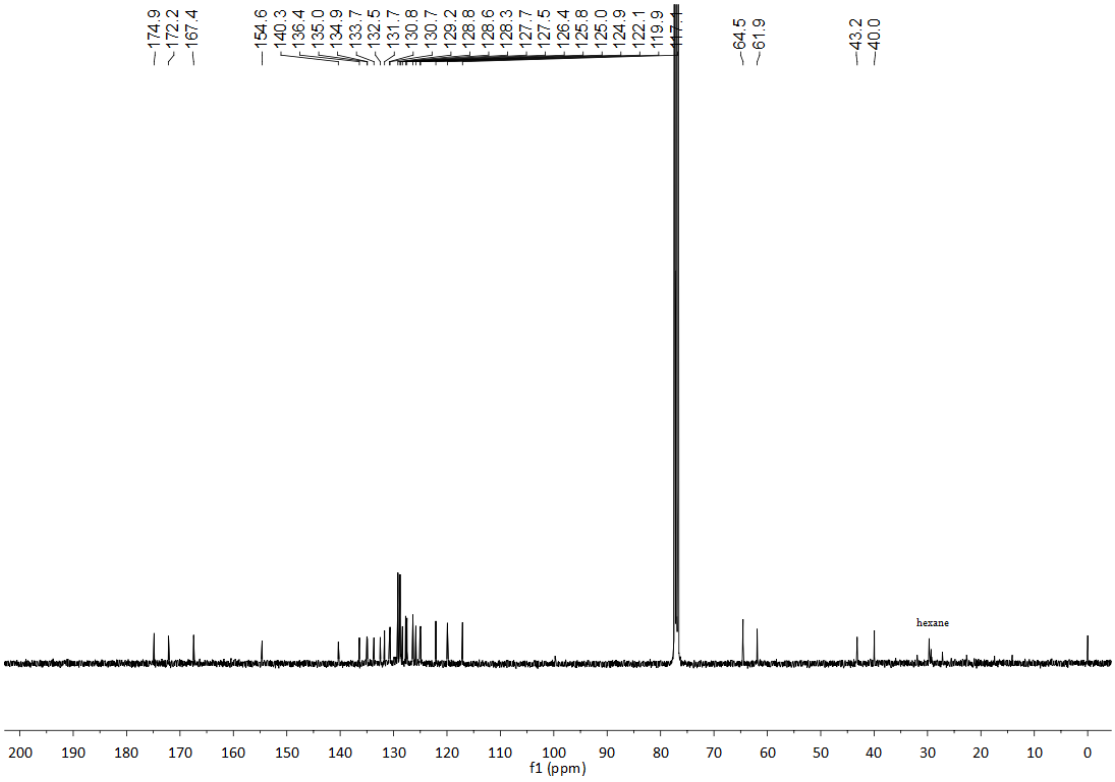


N-(naphthalen-2-yl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indol]-2(1H)-yl)-2-phenylacetamide (34up)

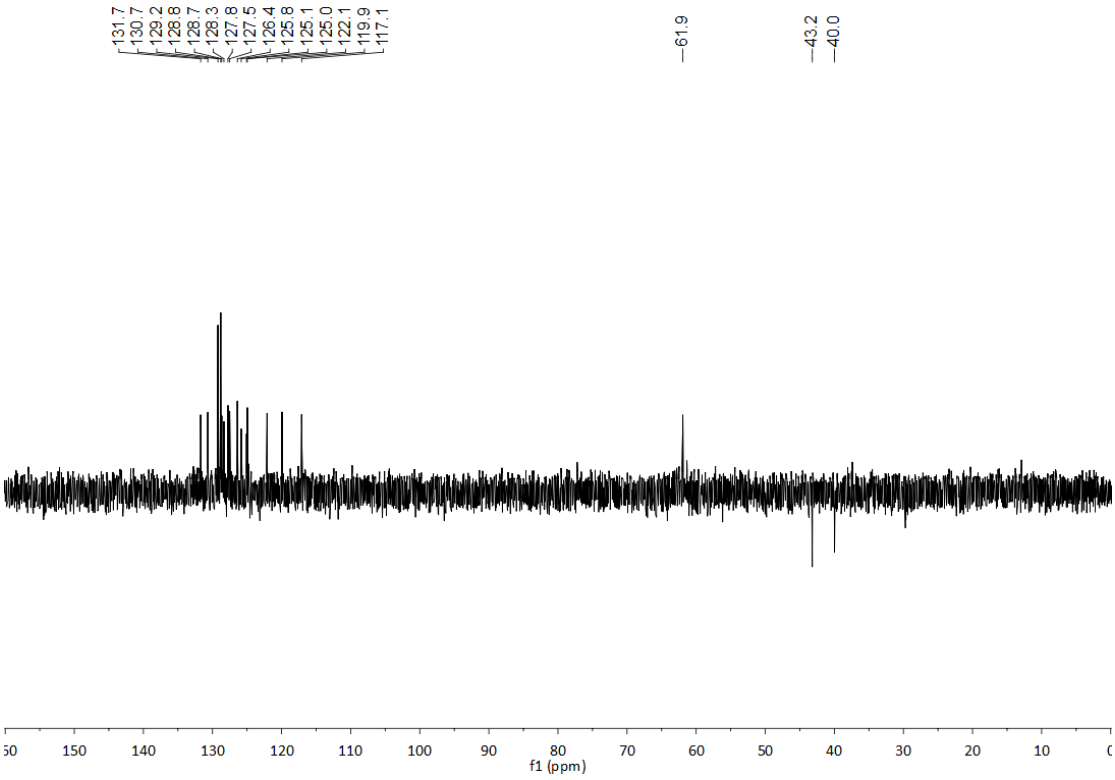
^{1}H NMR (400 MHz, $CDCl_3$):



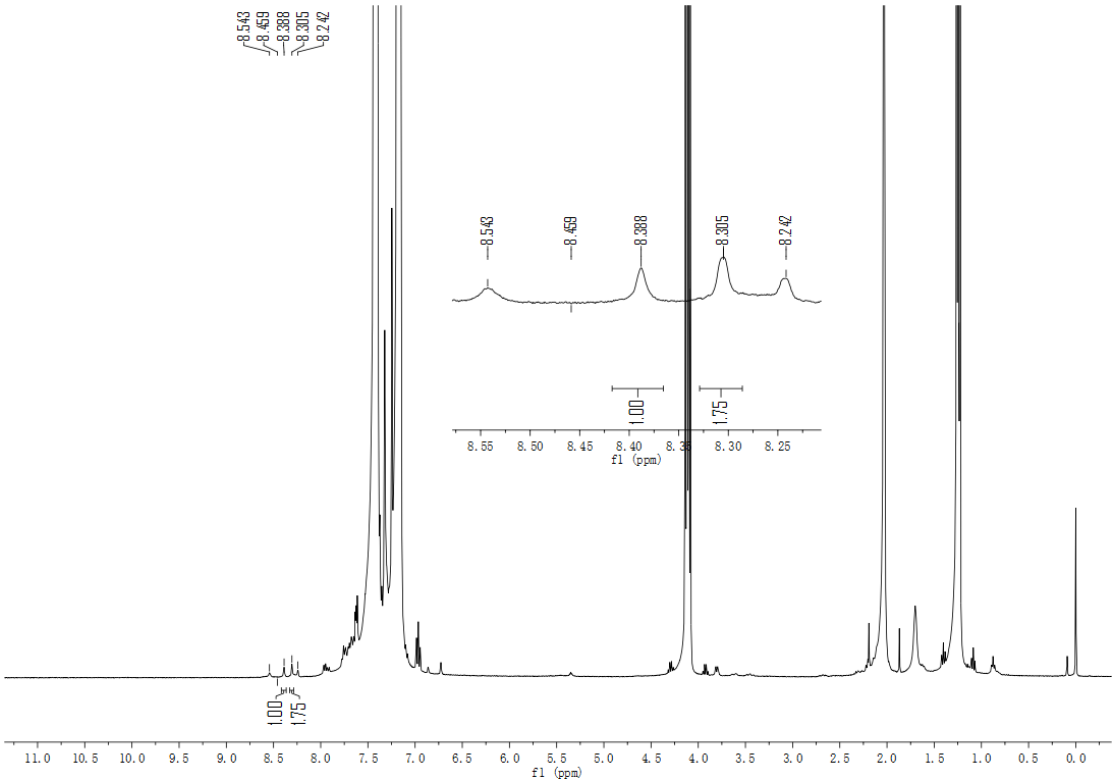
^{13}C NMR (100 MHz, $CDCl_3$):



DEPT

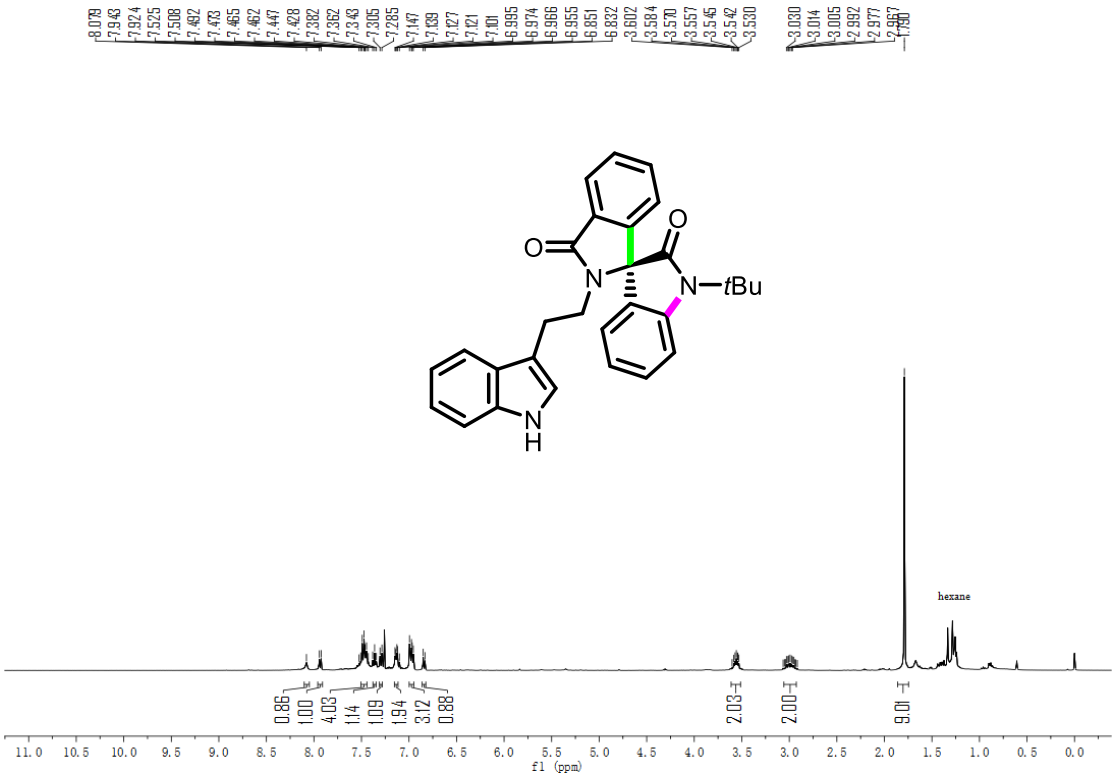


34 crude ^{1}H NMR

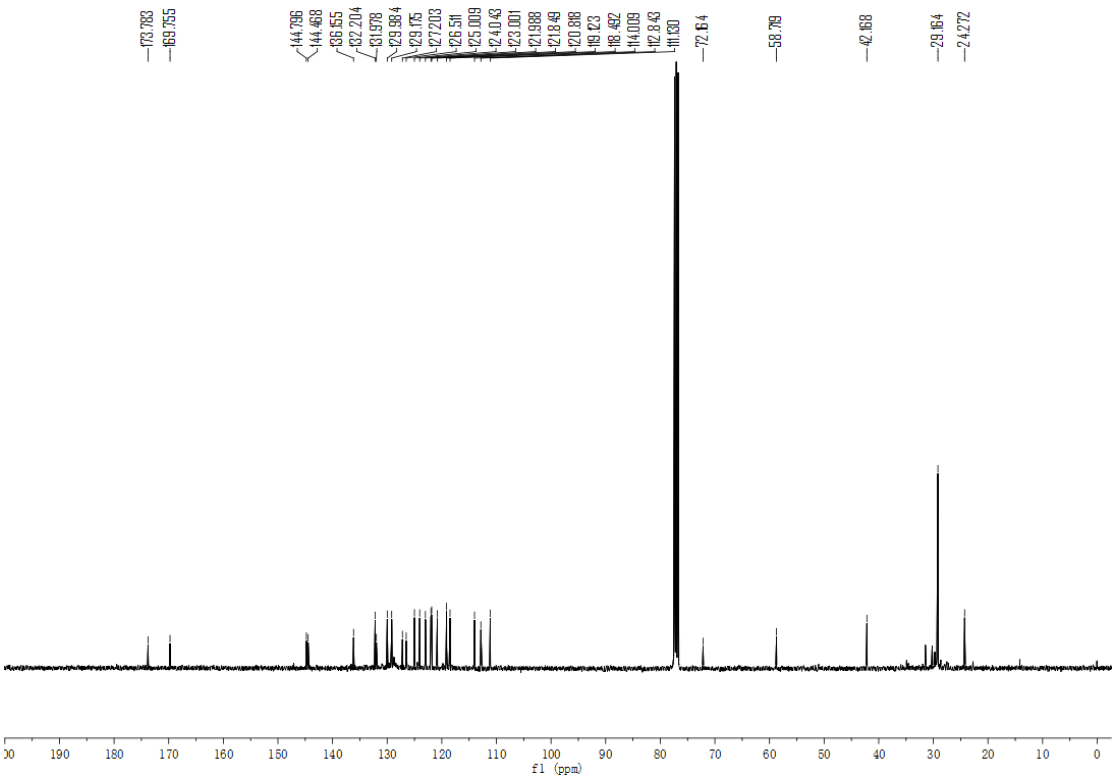


***2'-(2-(1H-indol-3-yl)ethyl)-1-(tert-butyl)spiro[indoline-3,1'-isoindoline]-2,3'-dione* (36)**

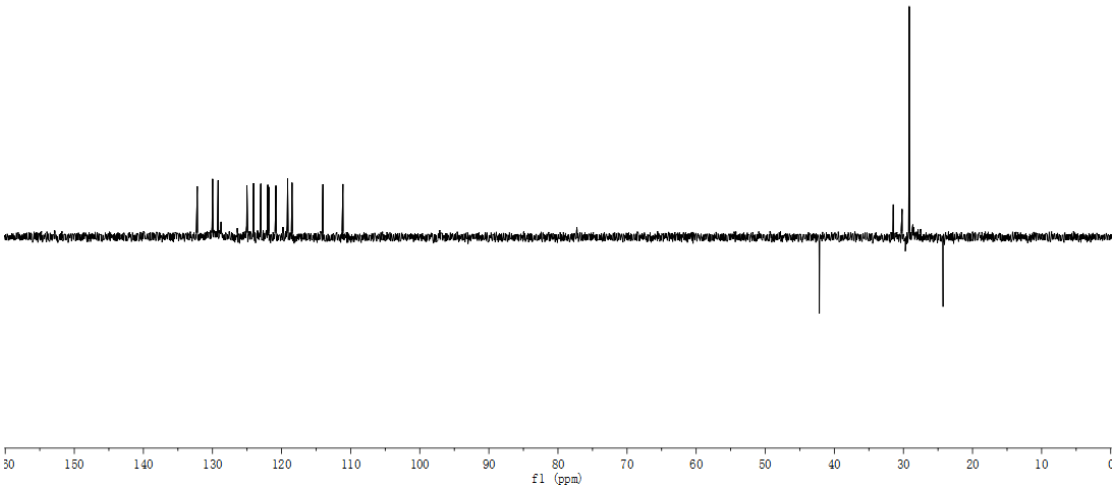
^{1}H NMR (400 MHz, $CDCl_3$):



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

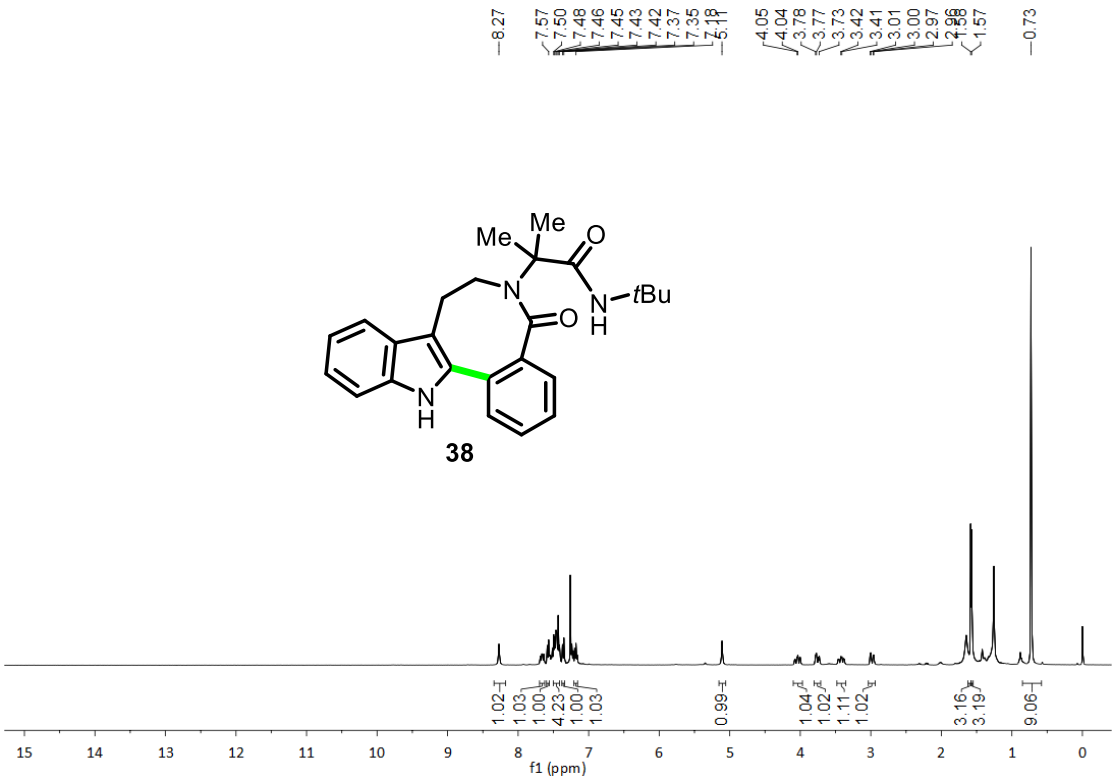


DEPT

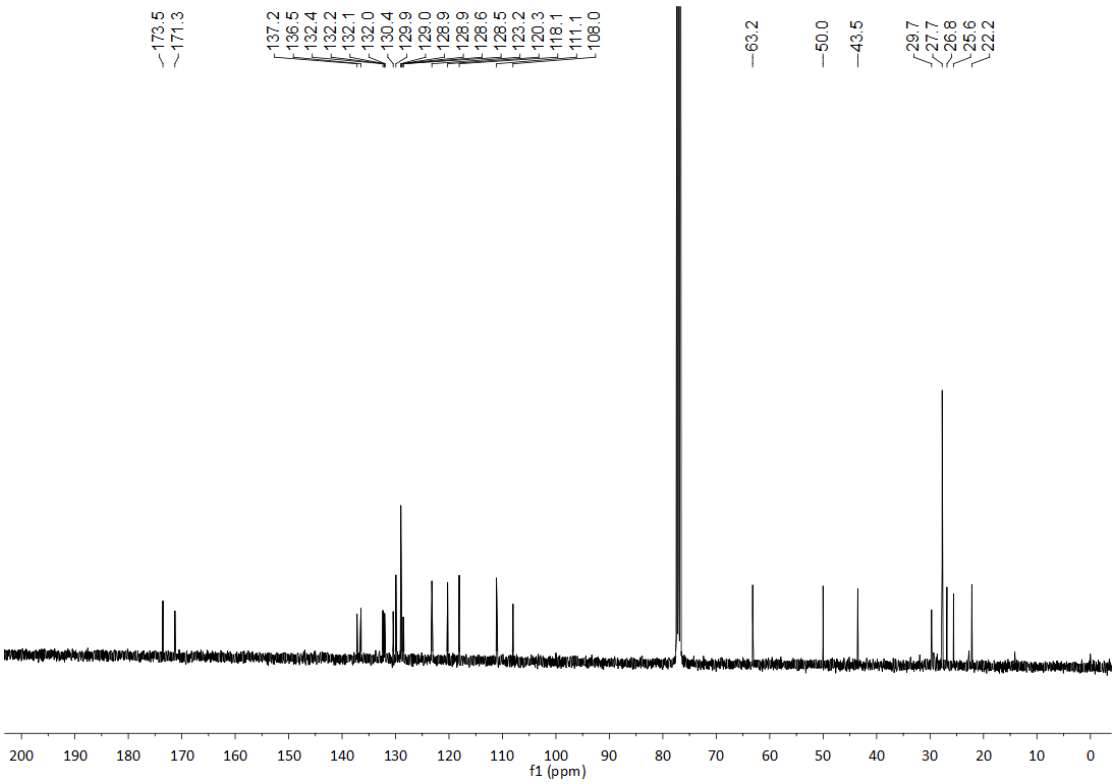


N-(tert-butyl)-2-methyl-2-(5-oxo-5,7,8,13-tetrahydro-6H-benzo[6,7]azocino[5,4-b]indol-6-yl)propanamide (38)

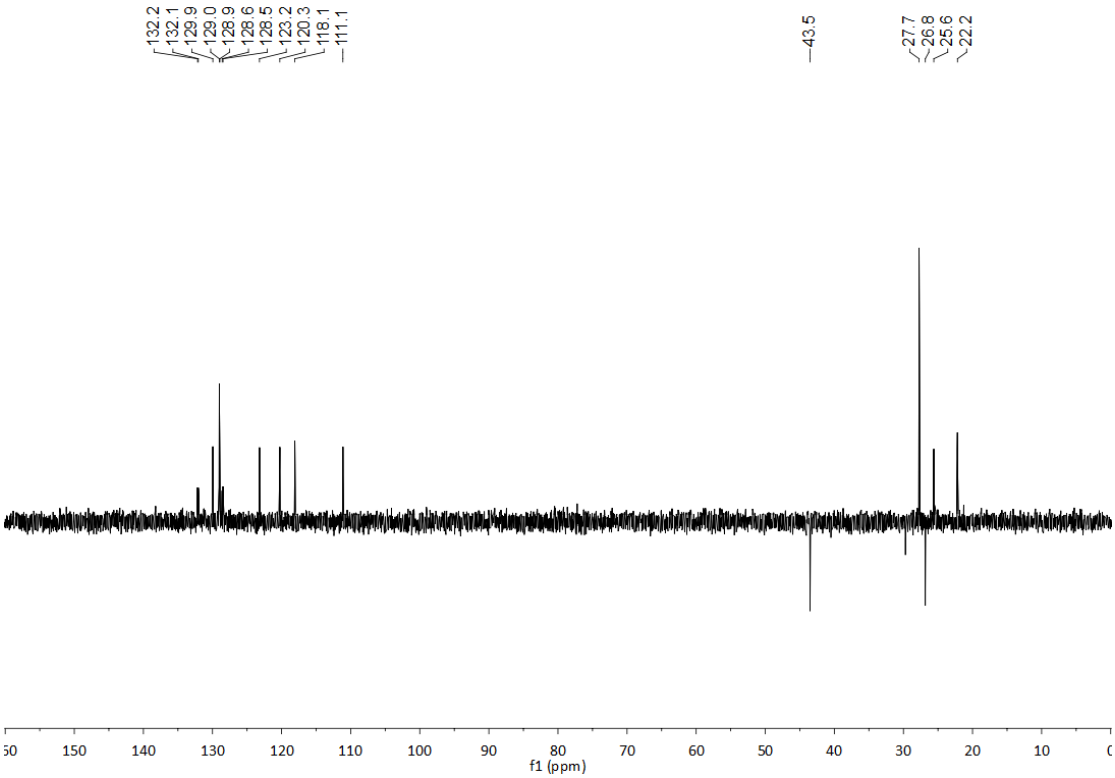
^{1}H NMR (400 MHz, $CDCl_3$)：



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

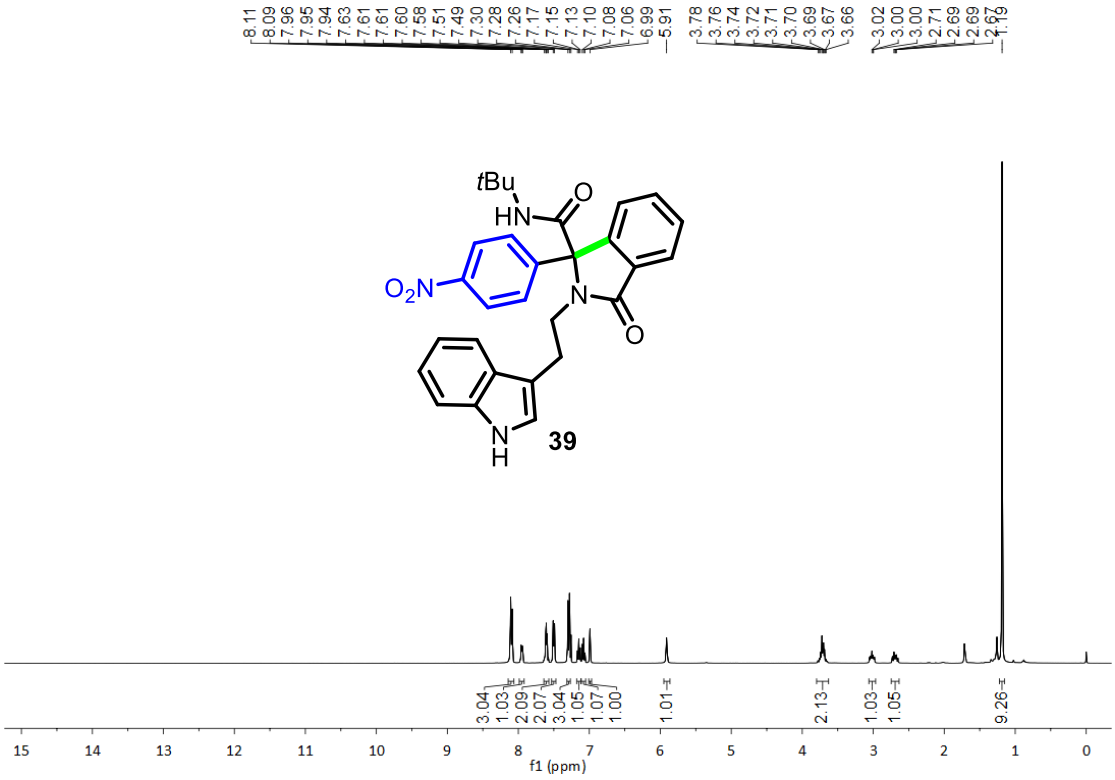


DEPT

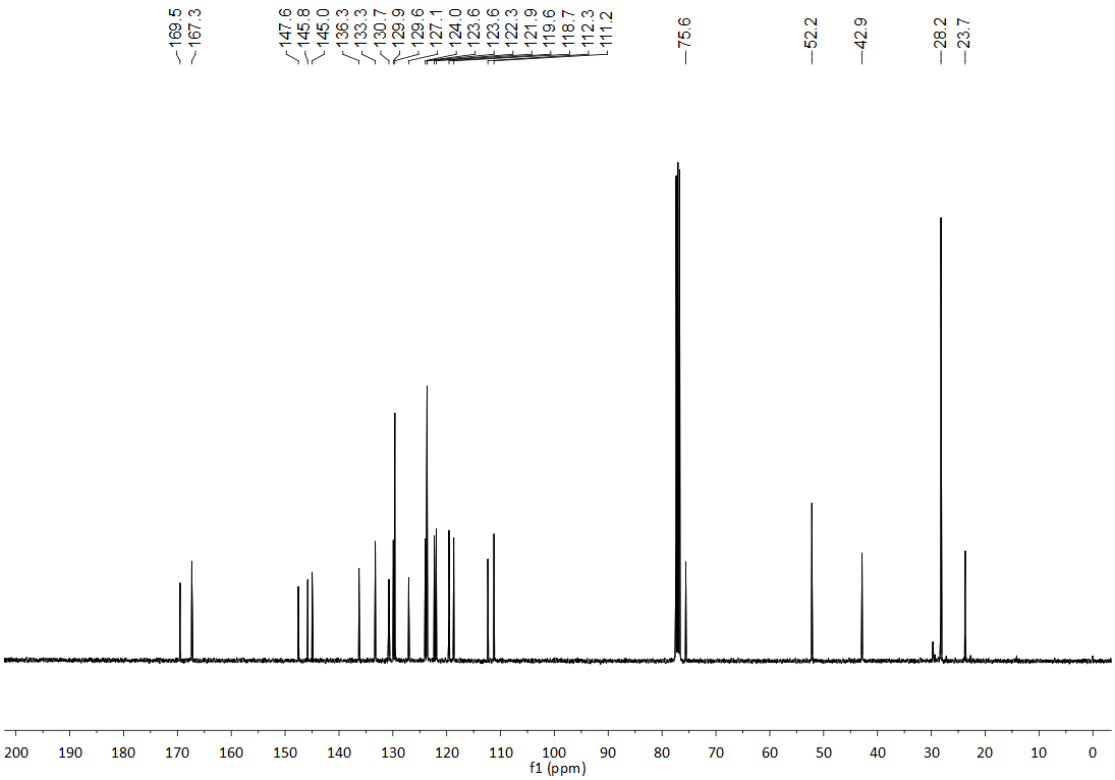


2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-1-(4-nitrophenyl)-3-oxoisoindoline-1-carboxamide (39)

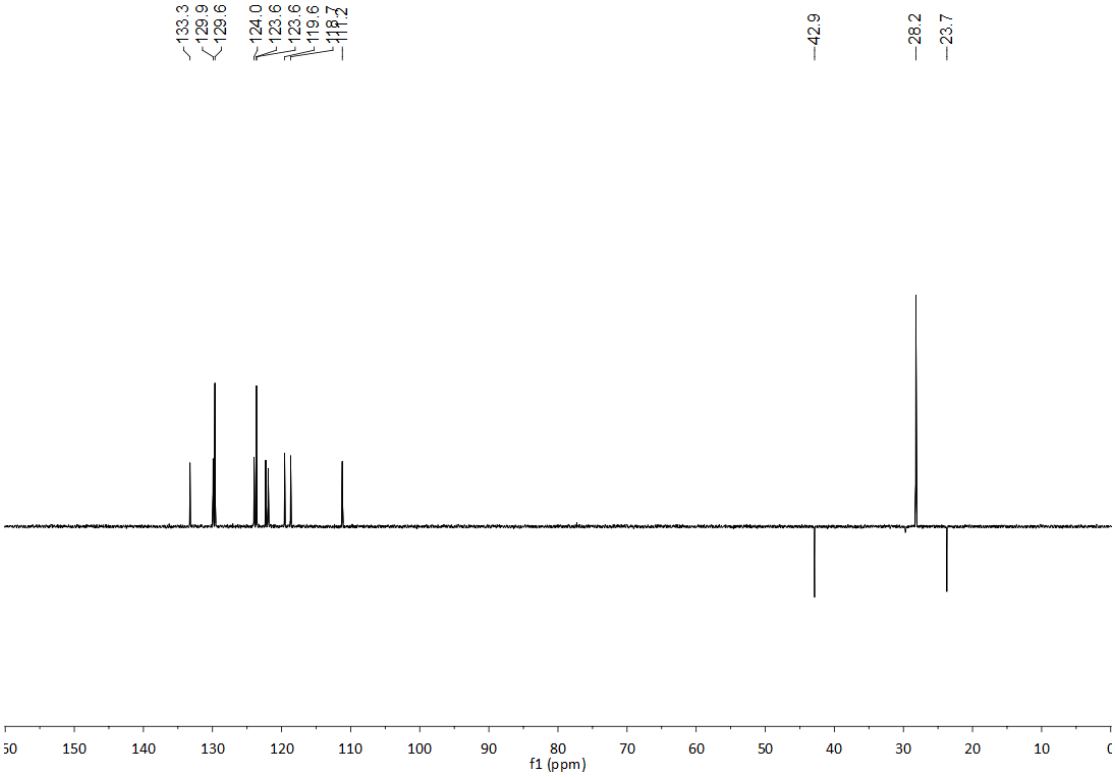
^{1}H NMR (400 MHz, $CDCl_3$):



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

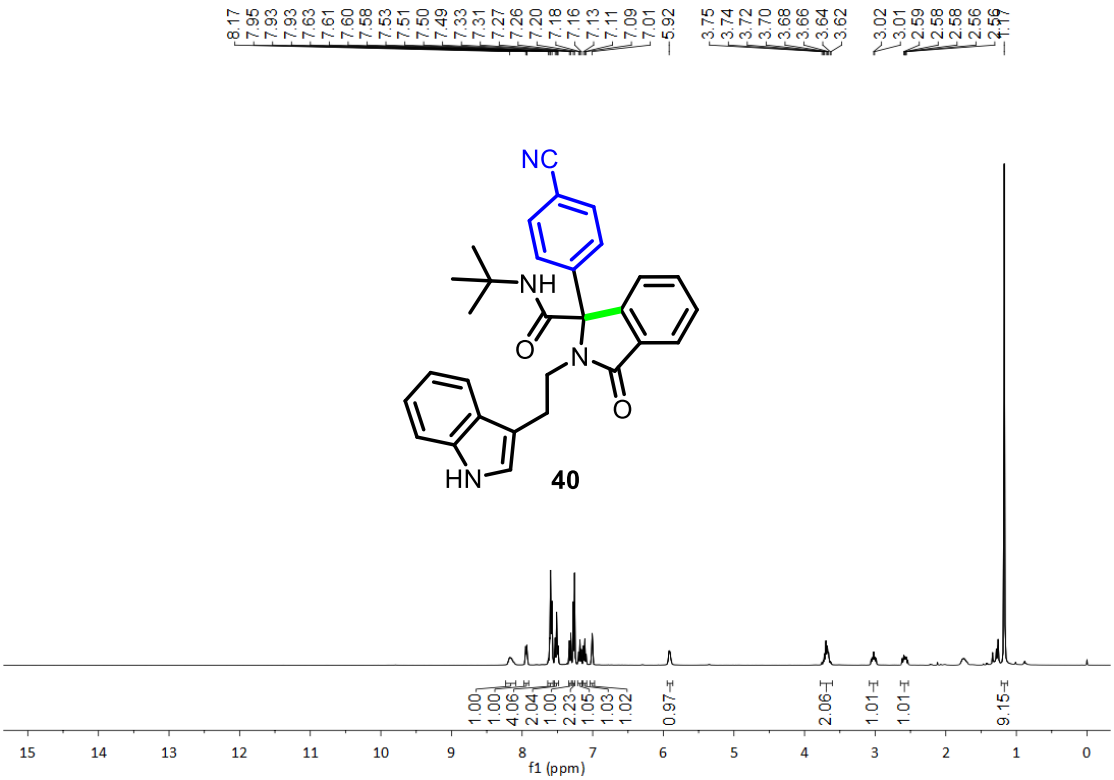


DEPT

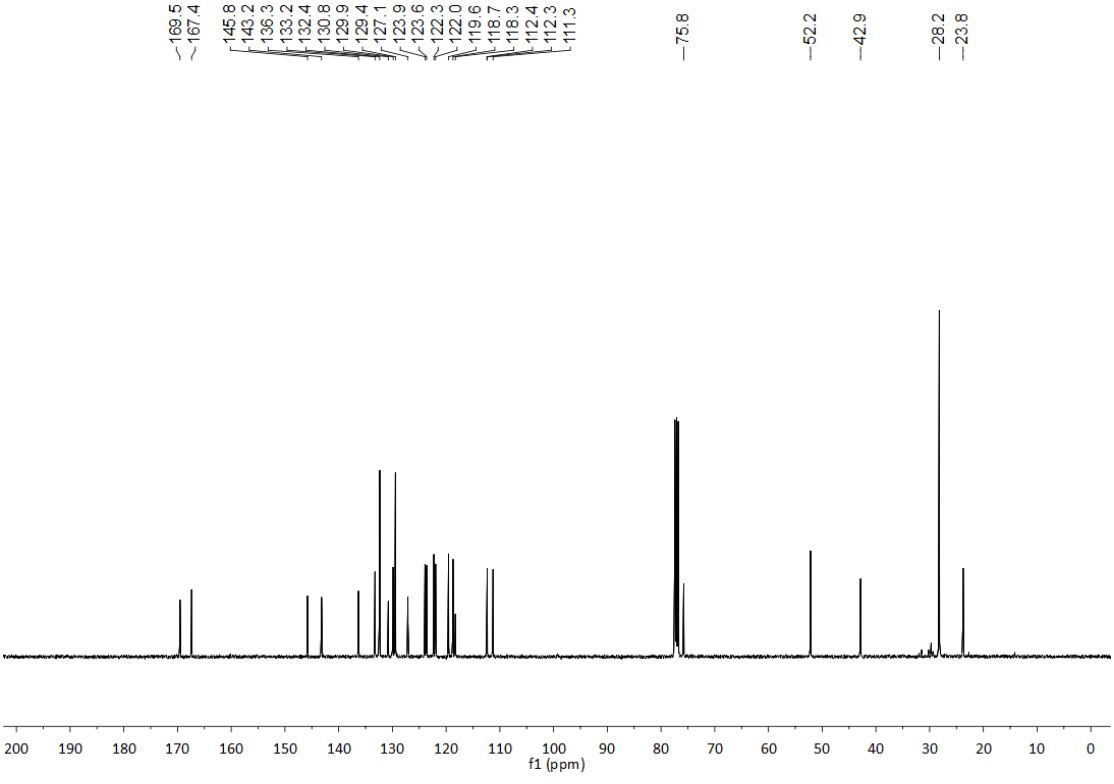


2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-1-(4-cyanophenyl)-3-oxoisoindoline-1-carboxamide (40)

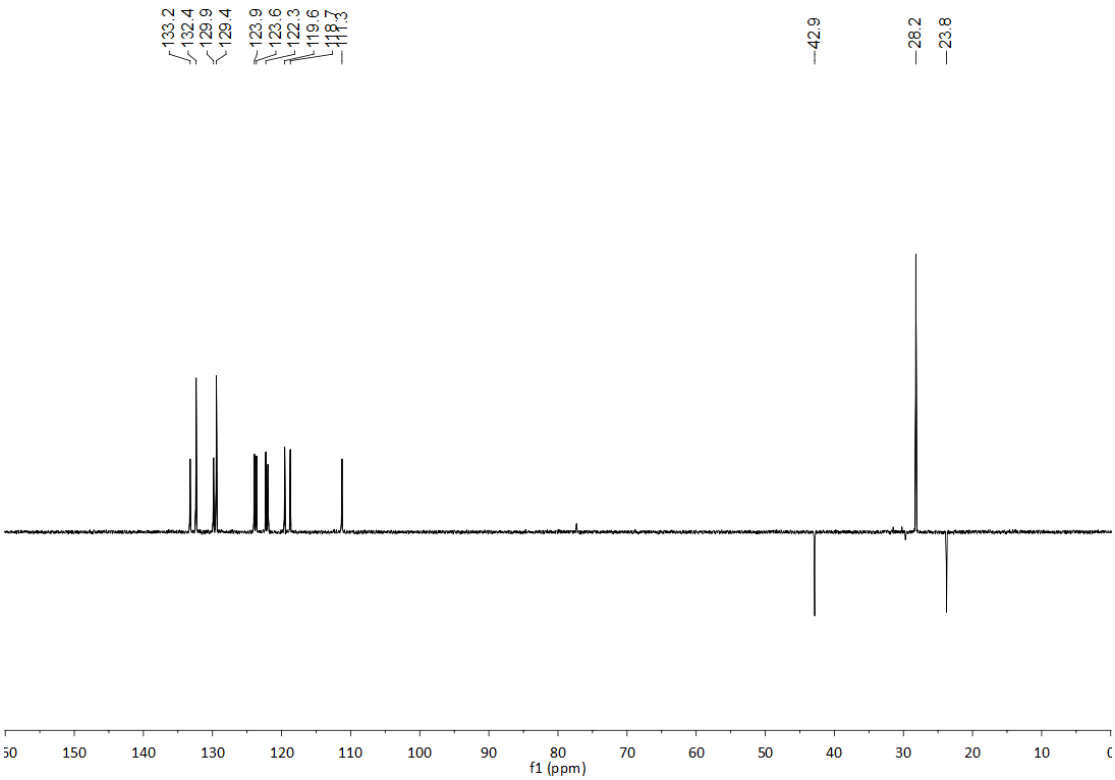
^{1}H NMR (400 MHz, $CDCl_3$)：



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

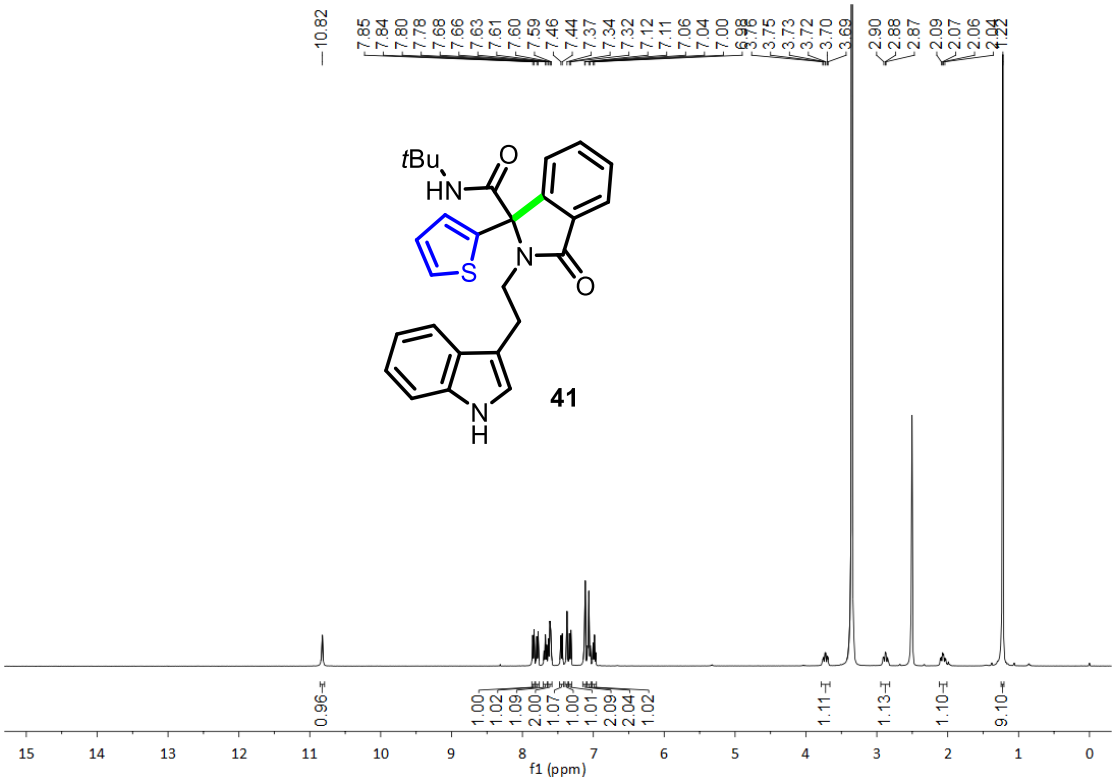


DEPT

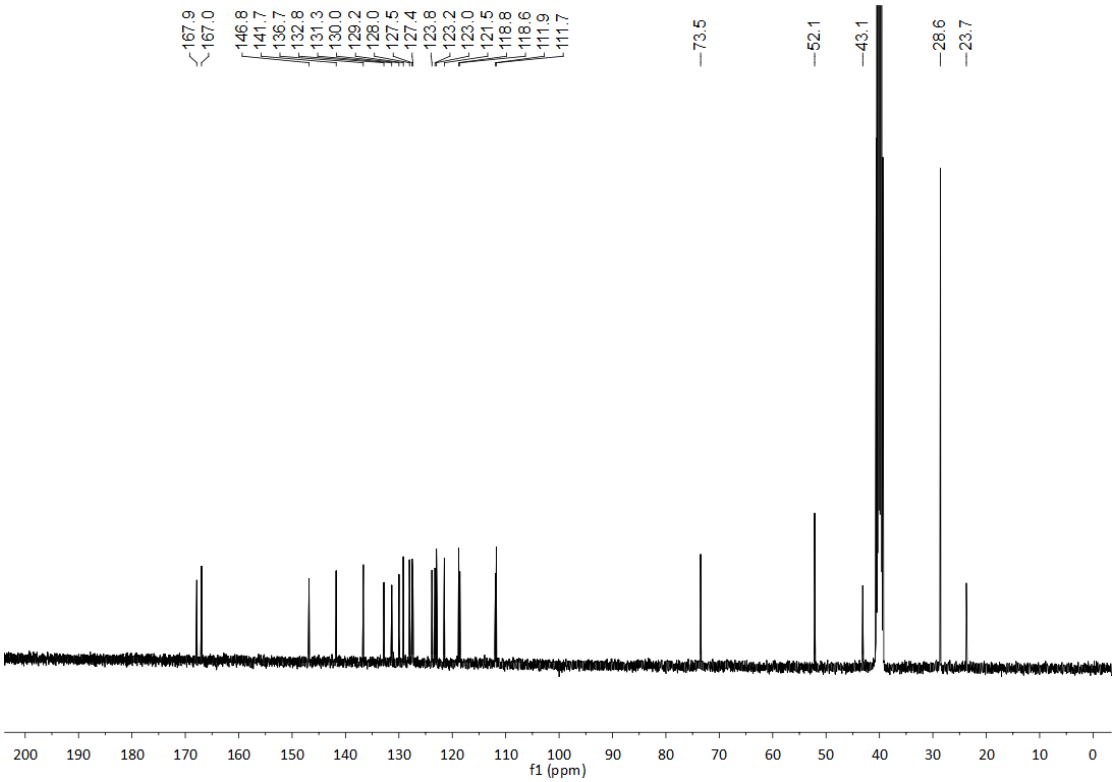


2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-3-oxo-1-(thiophen-2-yl)isoindoline-1-carboxamide (41)

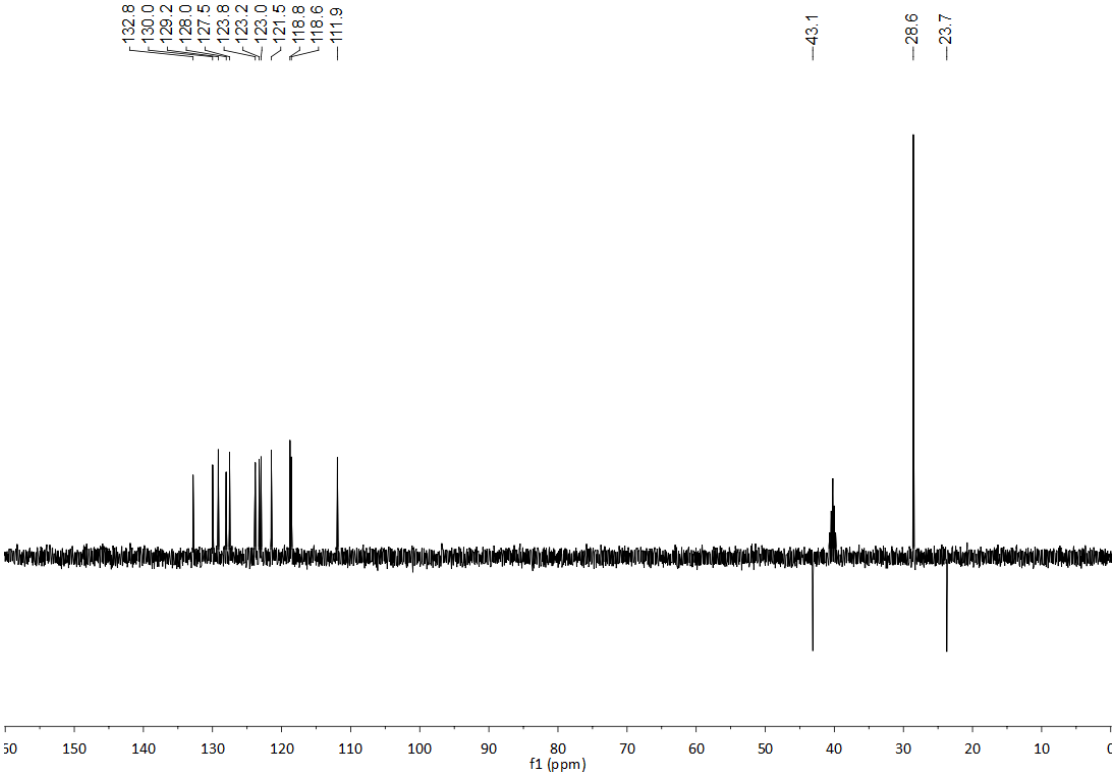
^{1}H NMR (400 MHz, DMSO-D$_6$):



^{13}C NMR (100 MHz, DMSO-D$_6$):

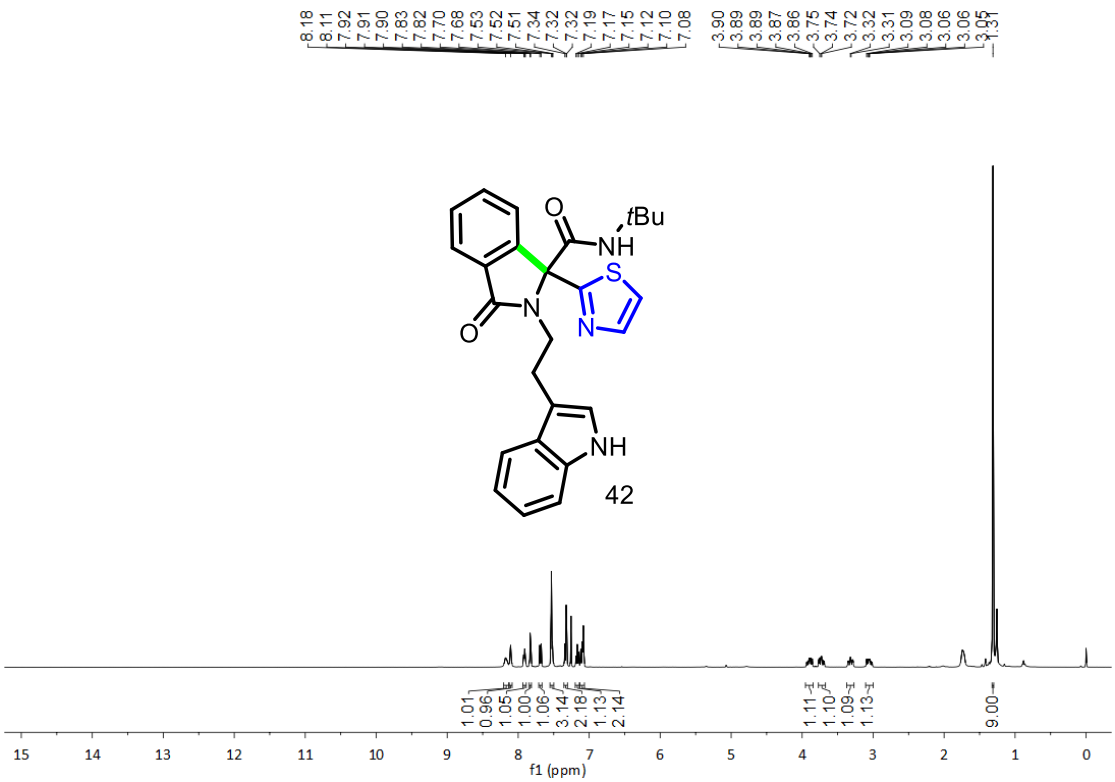


DEPT

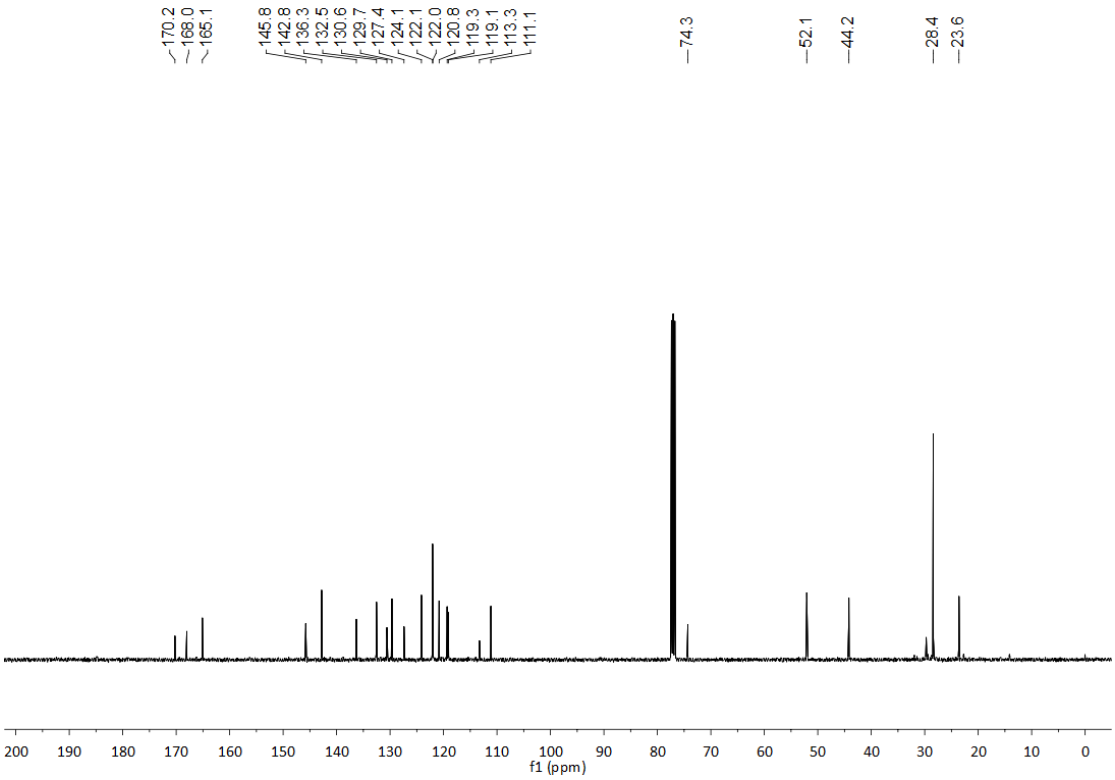


2-(2-(1H-indol-3-yl)ethyl)-N-(tert-butyl)-3-oxo-1-(thiazol-2-yl)isoindoline-1-carboxamide (42)

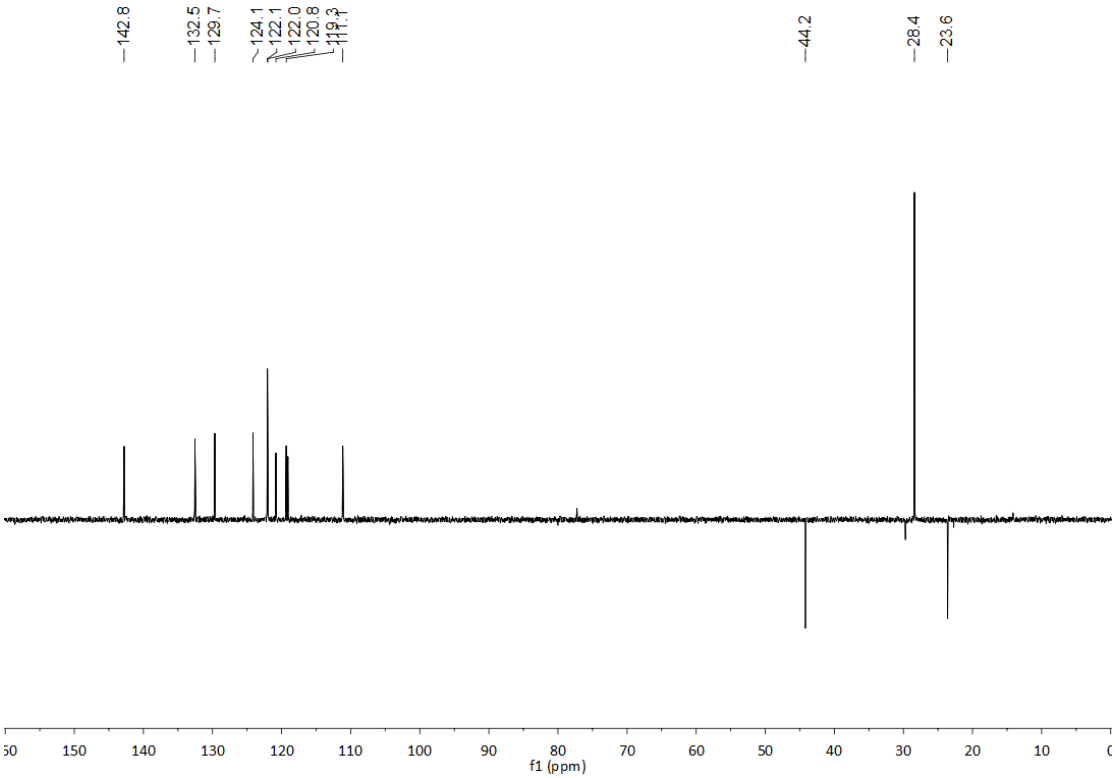
^{1}H NMR (400 MHz, $CDCl_3$)：



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

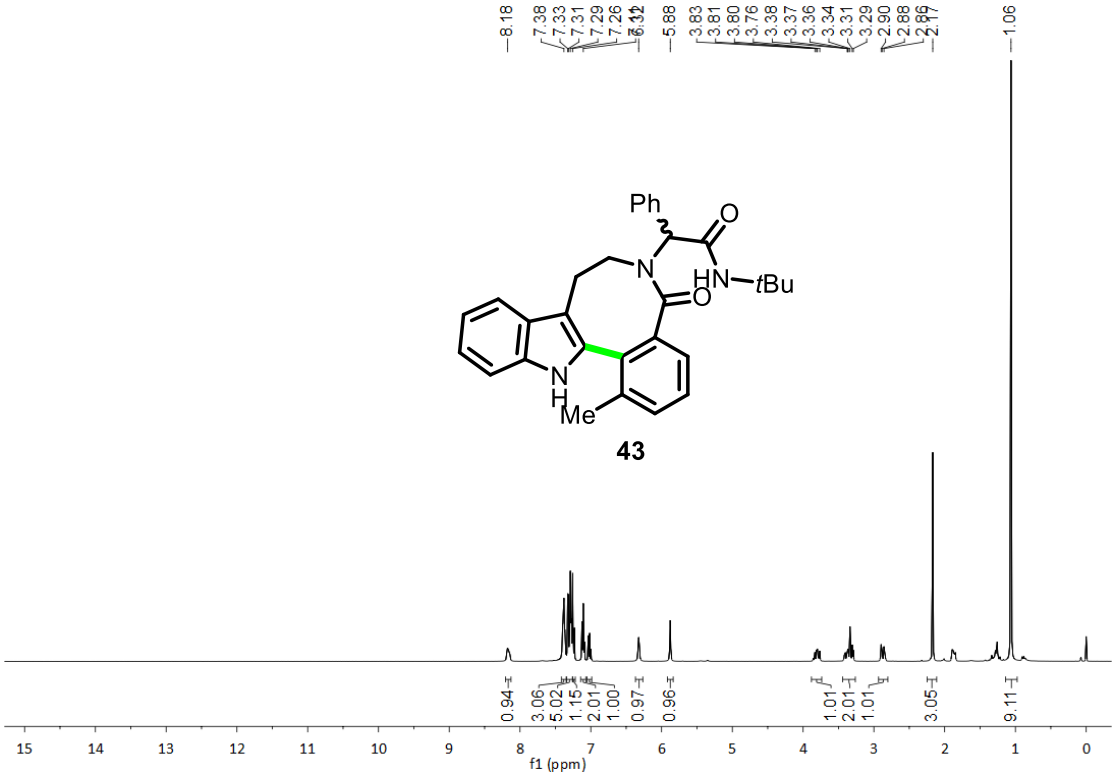


DEPT

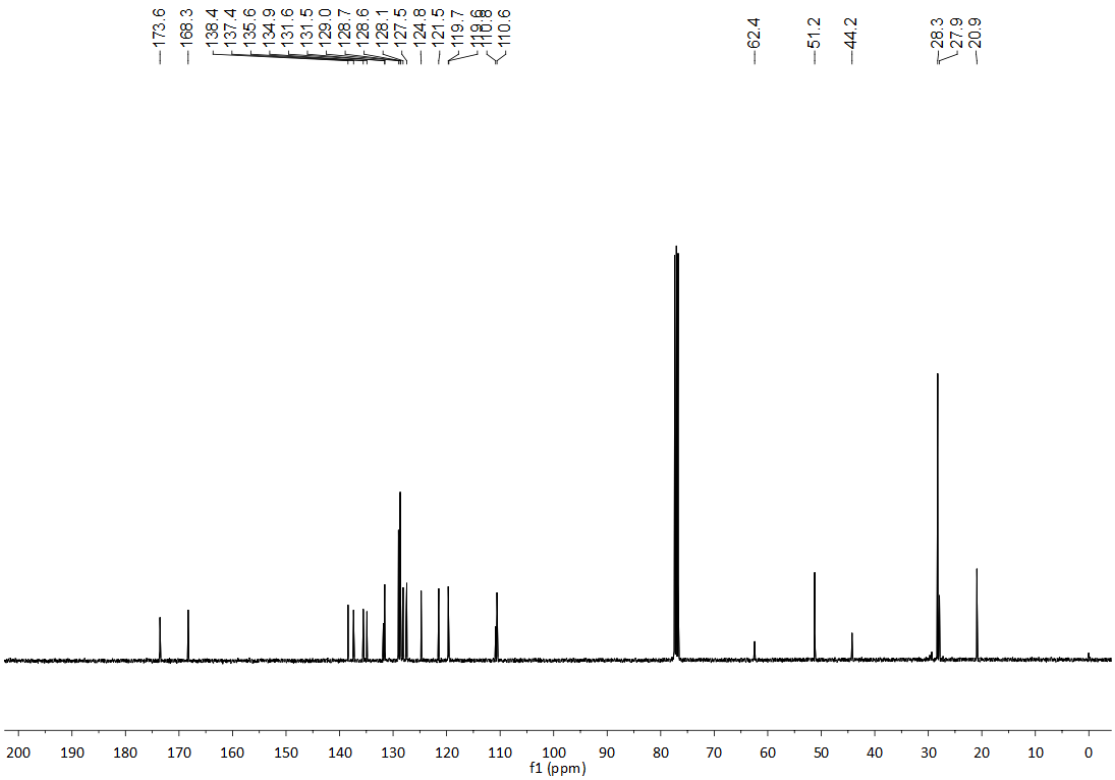


N-(tert-butyl)-2-(1-methyl-5-oxo-5,7,8,13-tetrahydro-6H-benzo[6,7]azocino[5,4-b]indol-6-yl)-2-phenylacetamide (43)

^{1}H NMR (400 MHz, $CDCl_3$):



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



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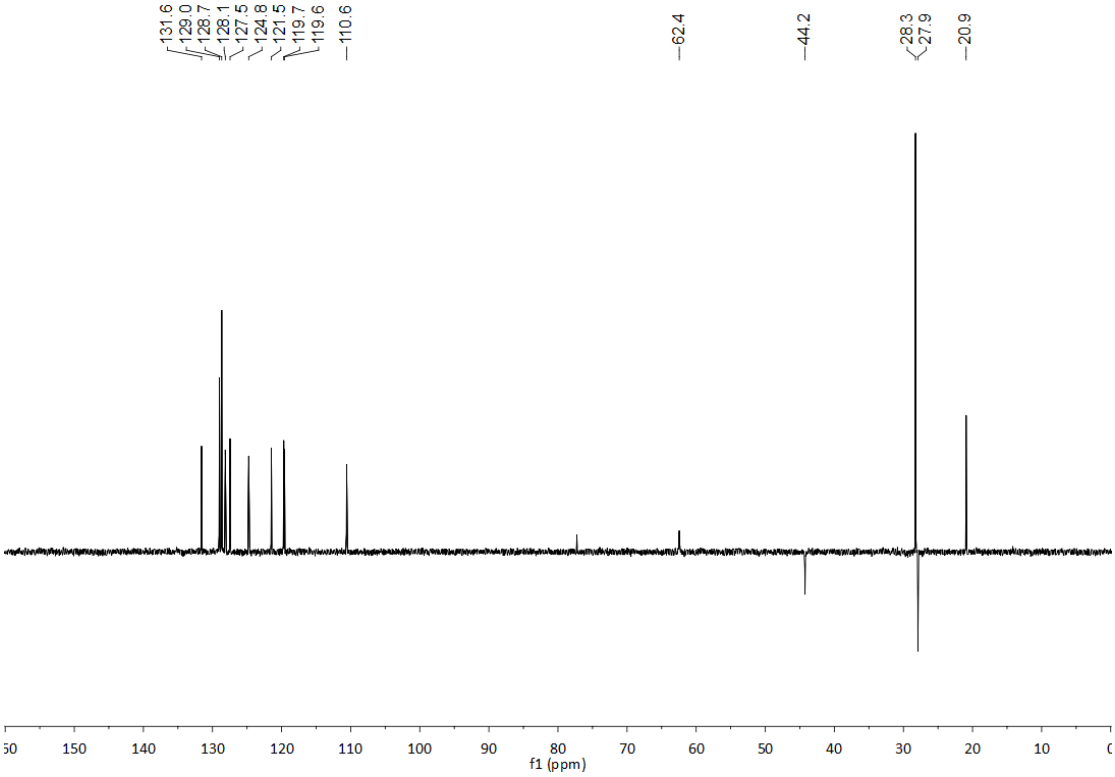
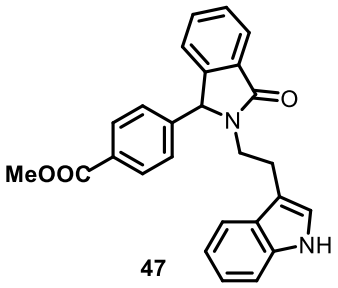
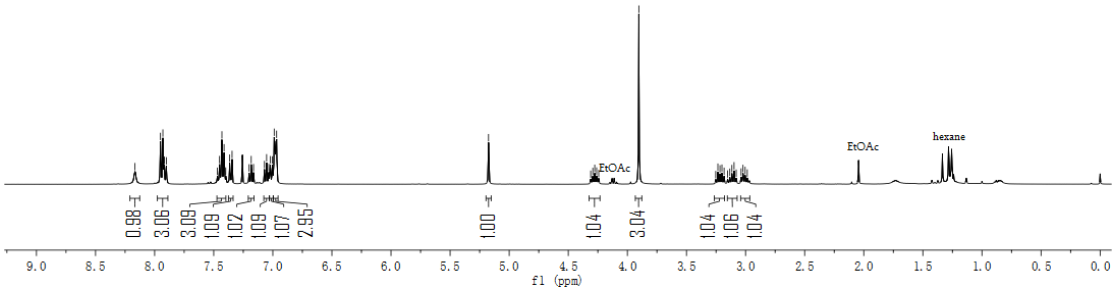


methyl 4-(2-(2-(1H-indol-3-yl)ethyl)-3-oxoisoindolin-1-yl)benzoate (47)

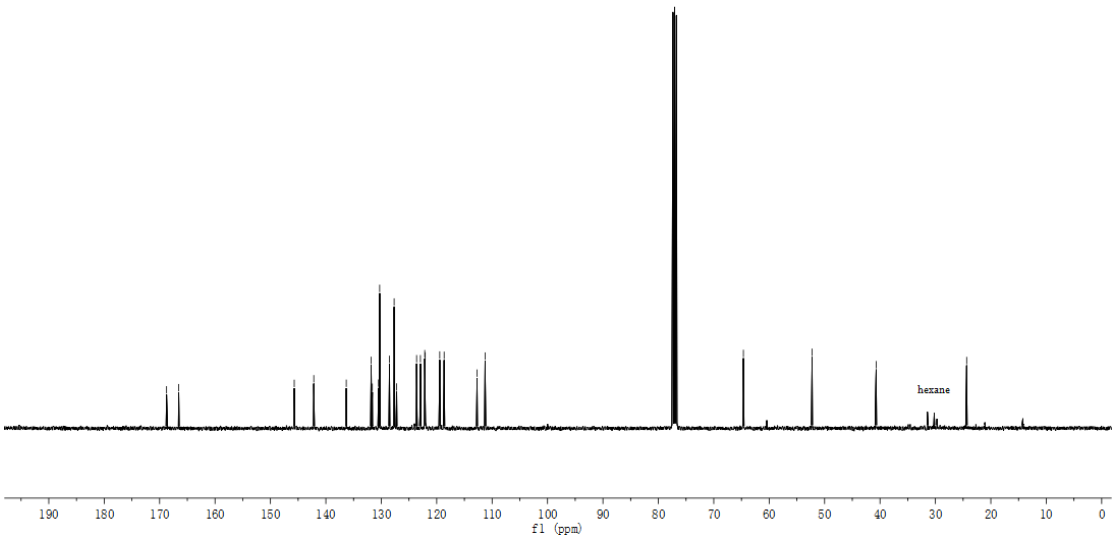
^{1}H NMR (400 MHz, $CDCl_3$)：



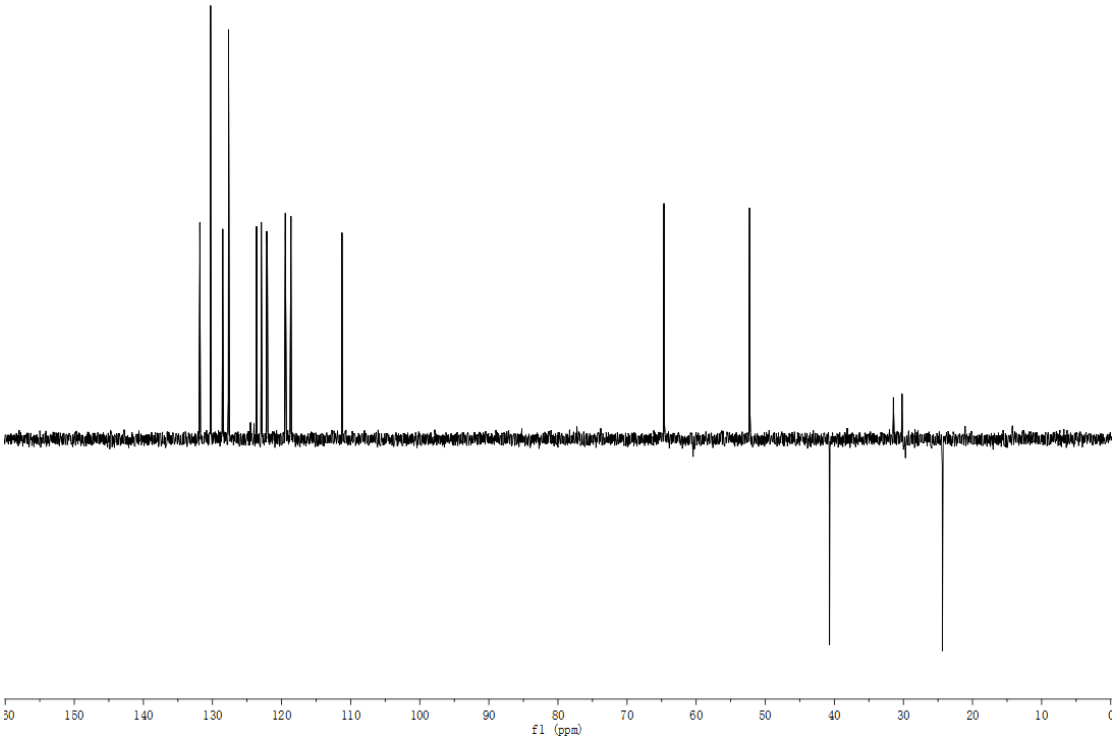
47



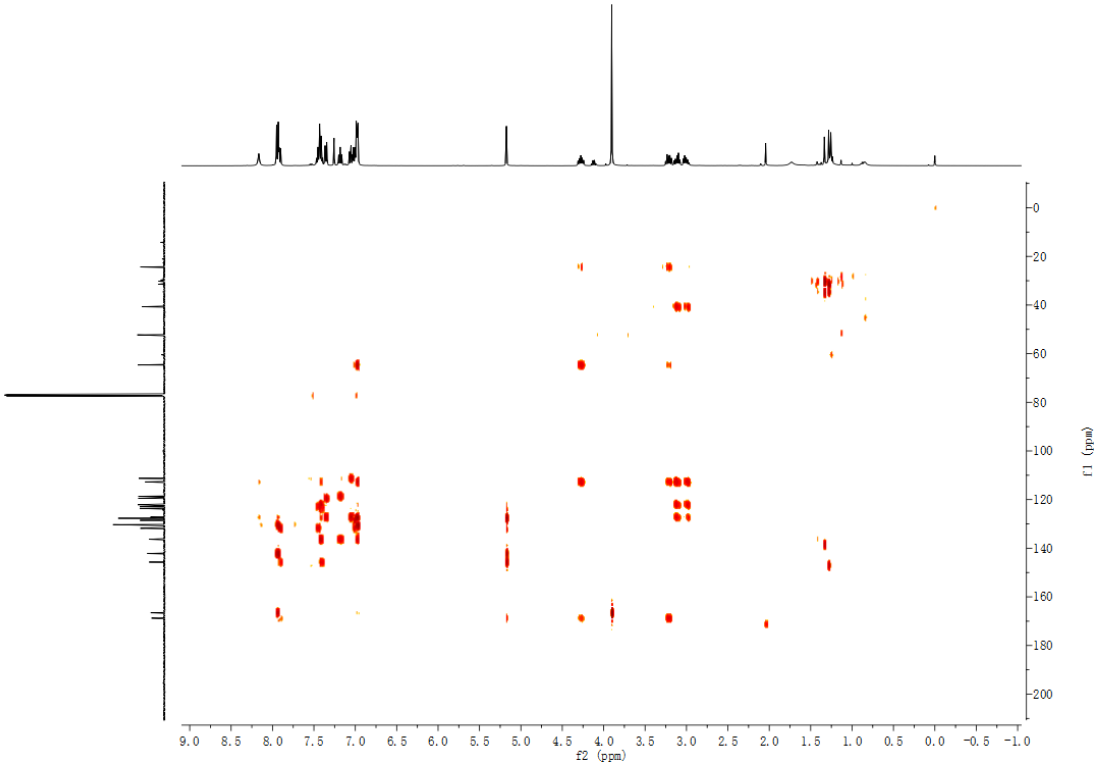
^{13}C NMR (100 MHz, $CDCl_3$):



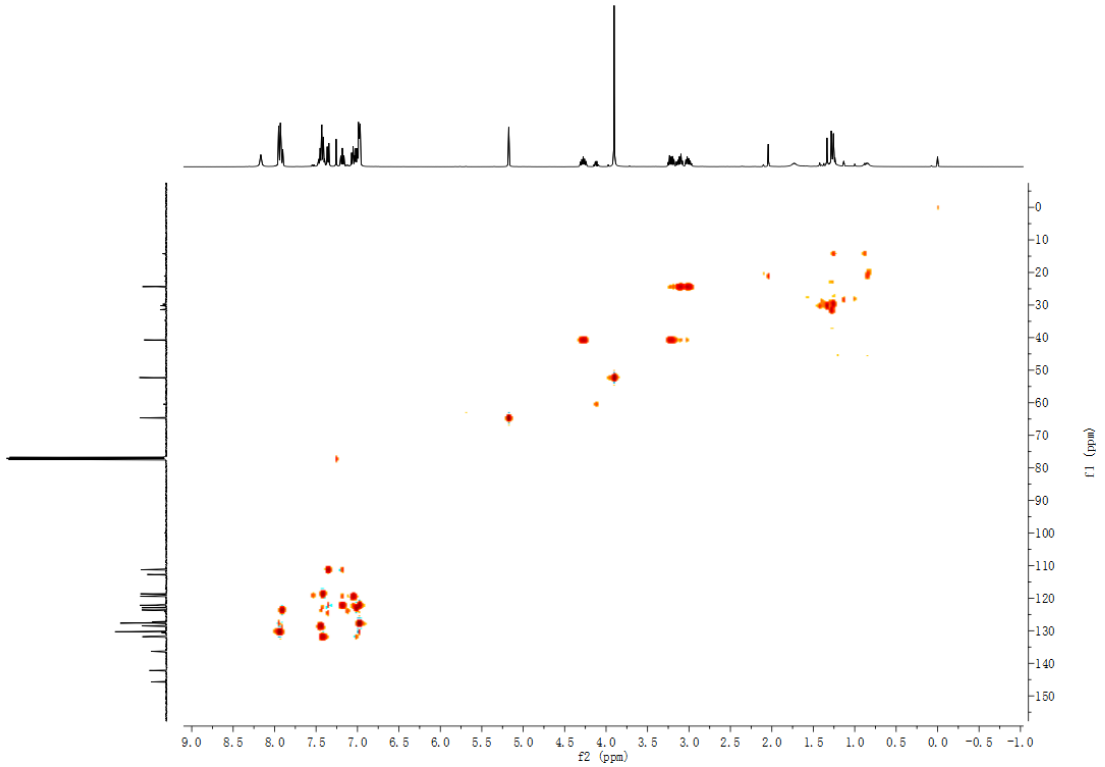
DEPT



HMBC

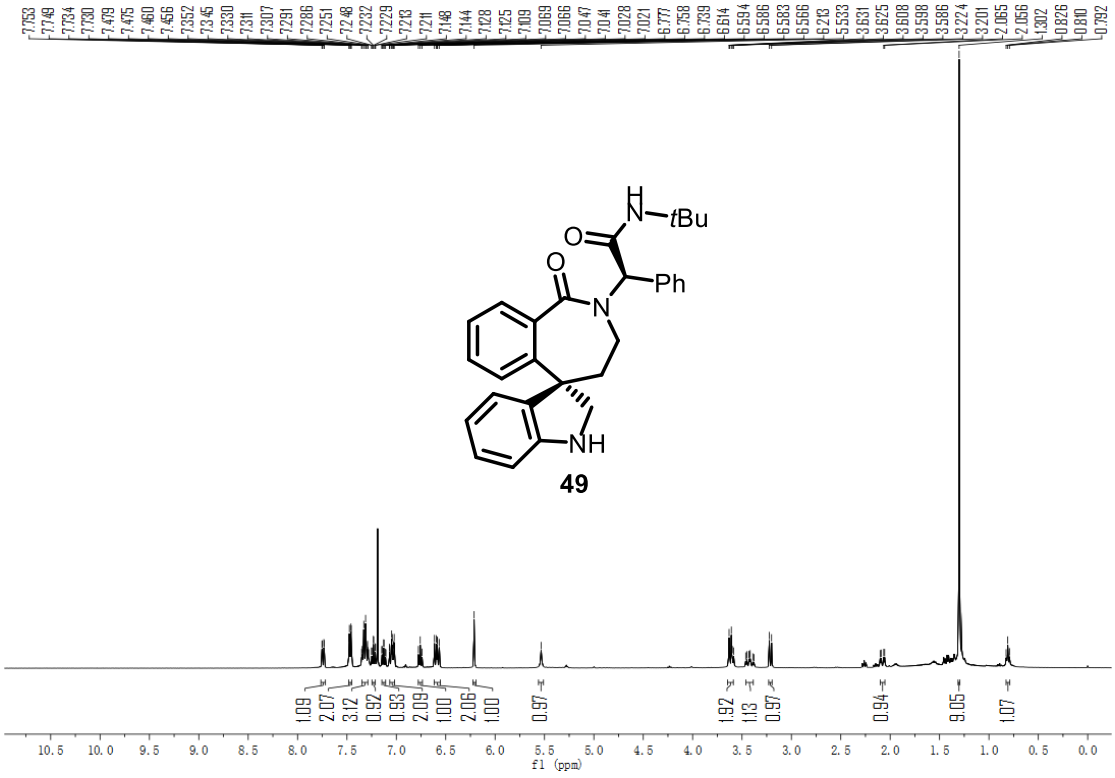


HSQC

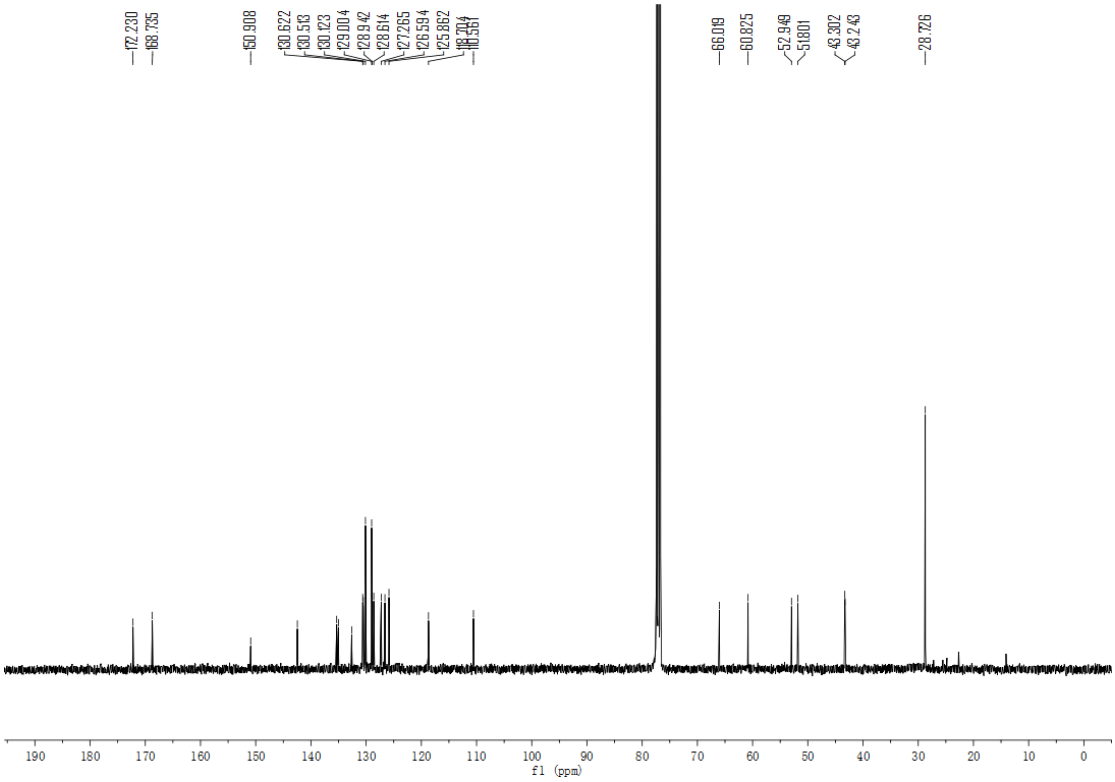


***N*-(tert-butyl)-2-(1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (49)**

^{1}H NMR (400 MHz, $CDCl_3$):



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



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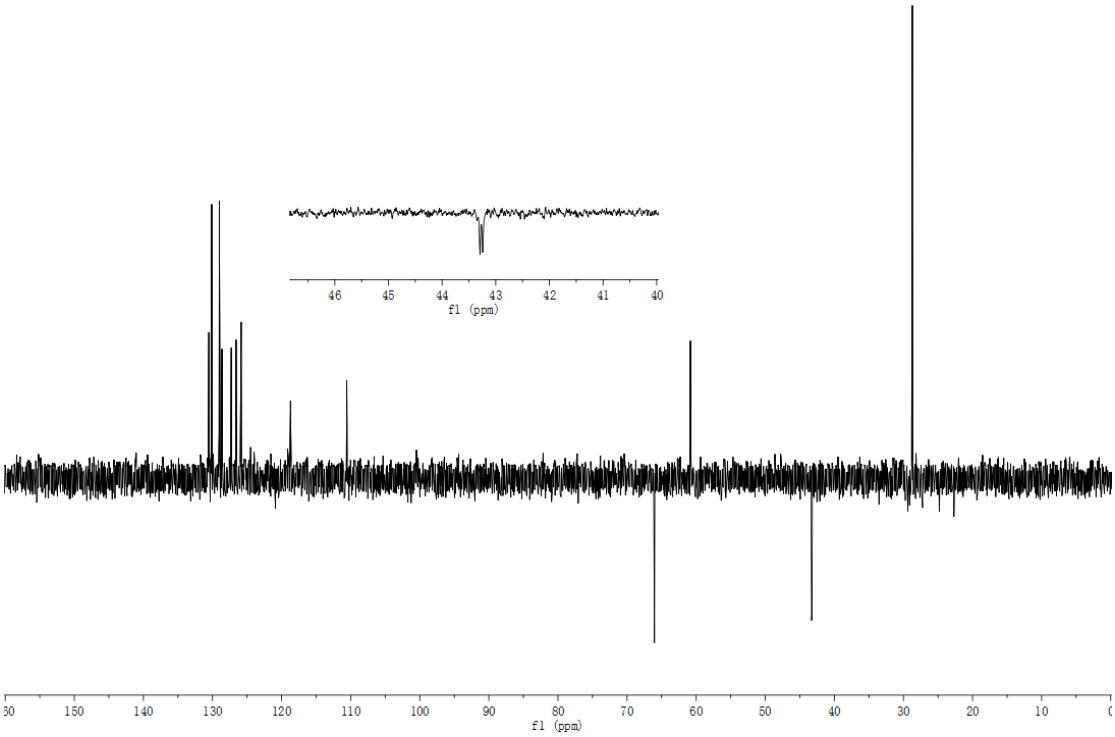
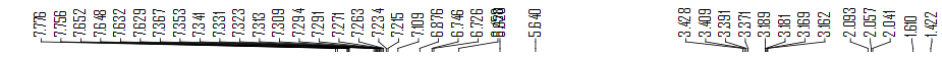
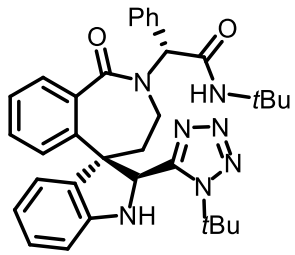


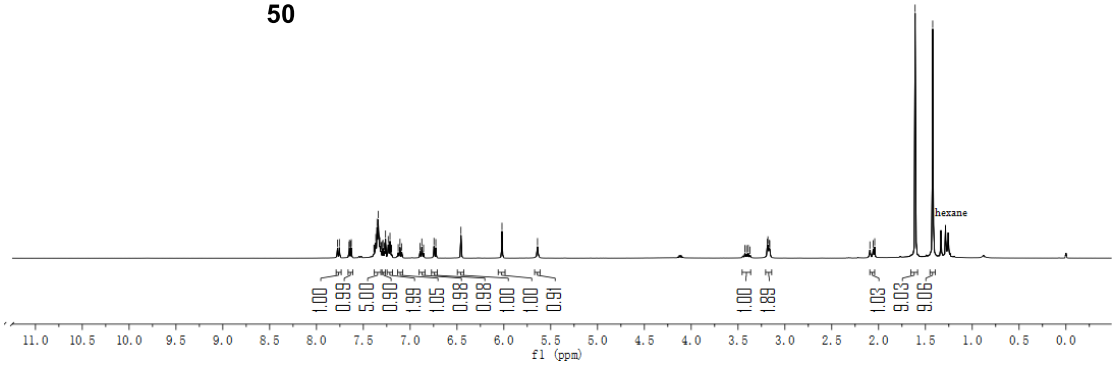
***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (50)**

^{1}H NMR (400 MHz, $CDCl_3$)：

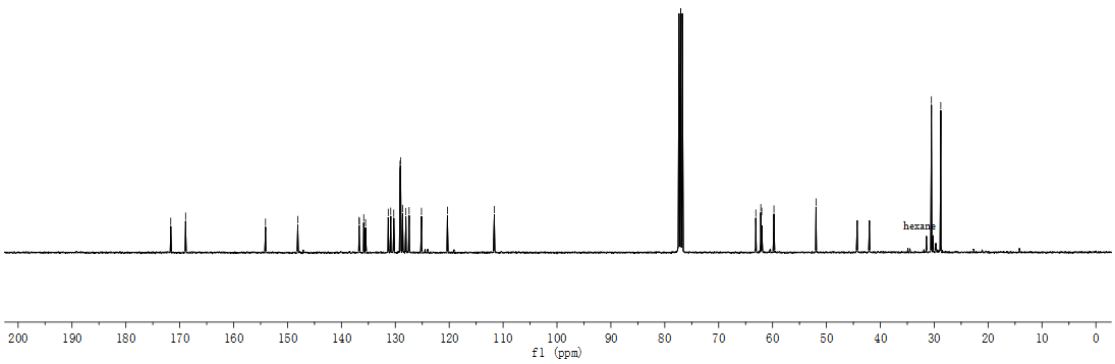




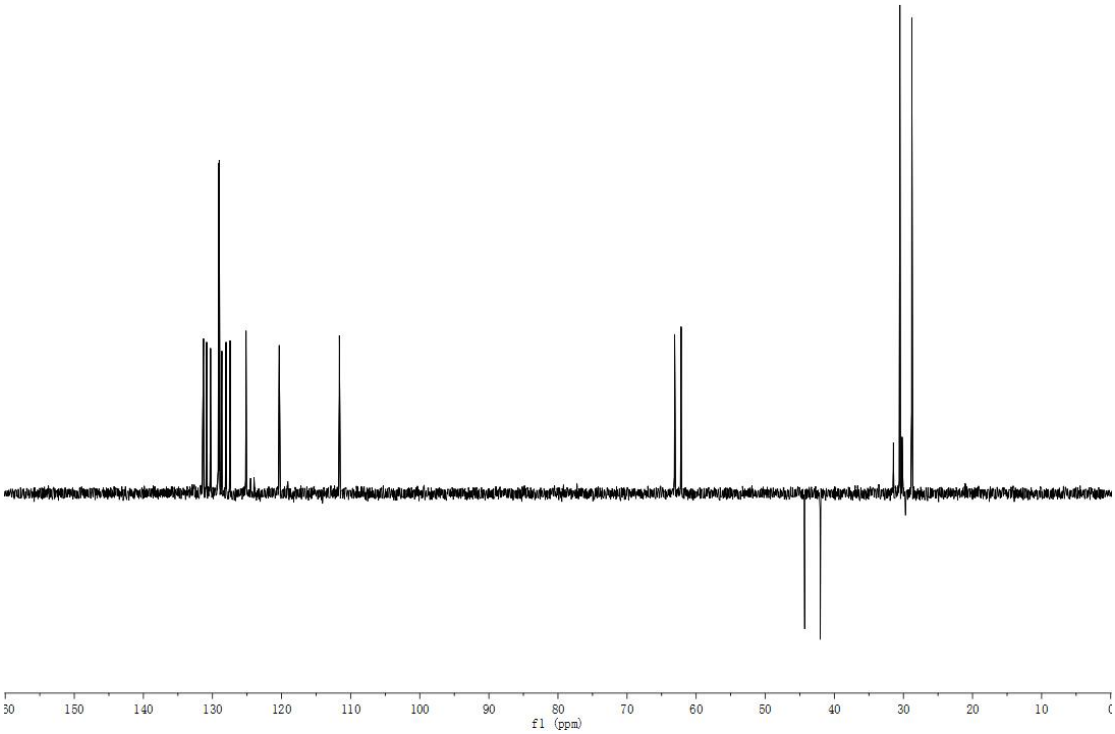
50



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

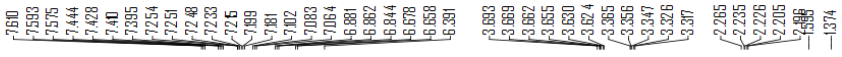


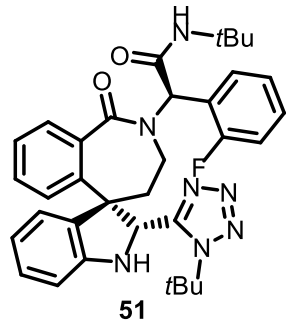
DEPT



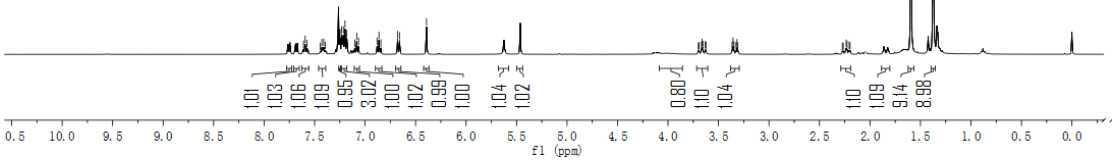
***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-(2-fluorophenyl)acetamide (51)**

^{1}H NMR (400 MHz, $CDCl_3$):

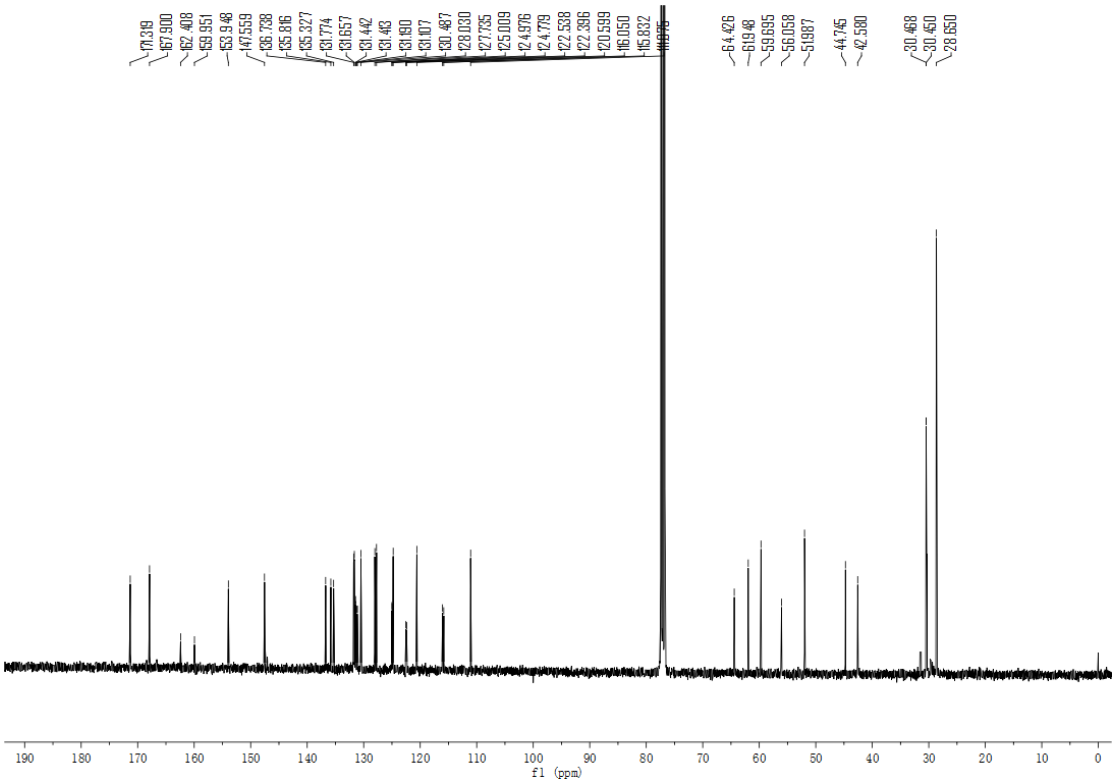




51



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



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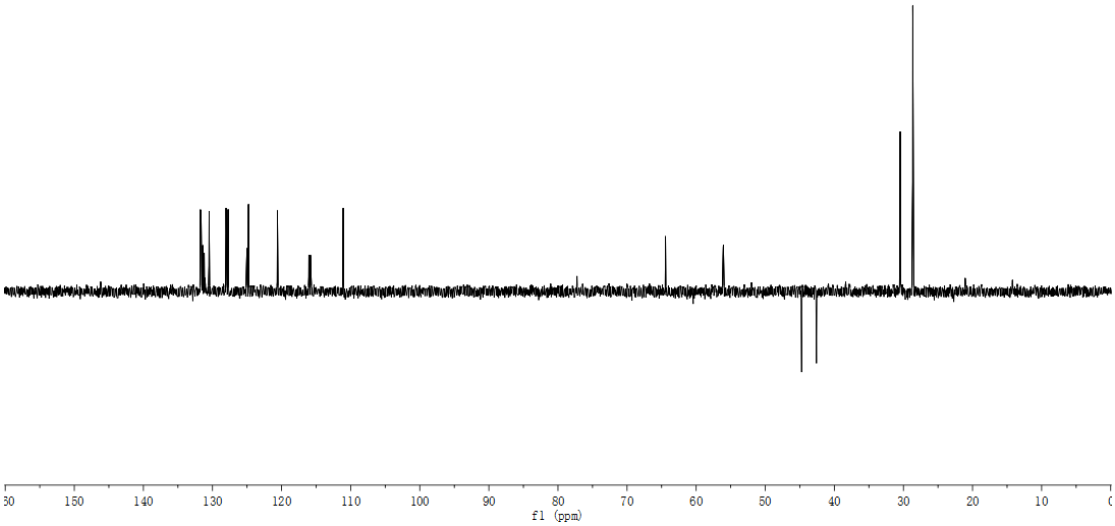
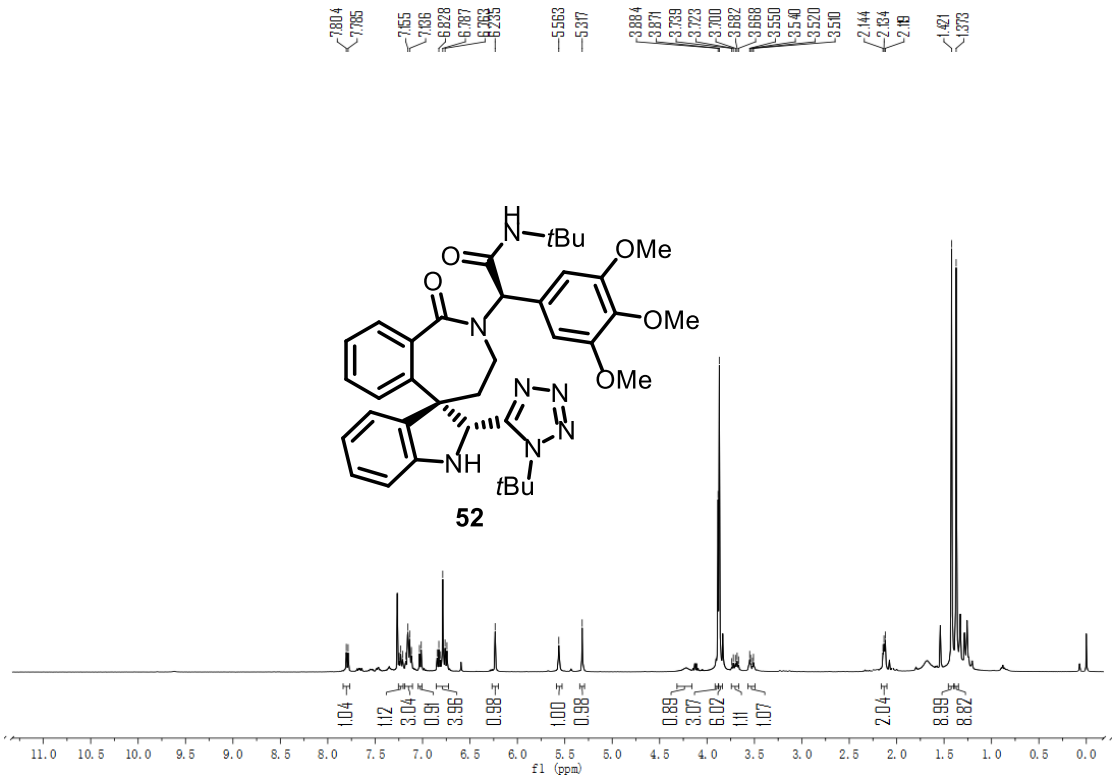
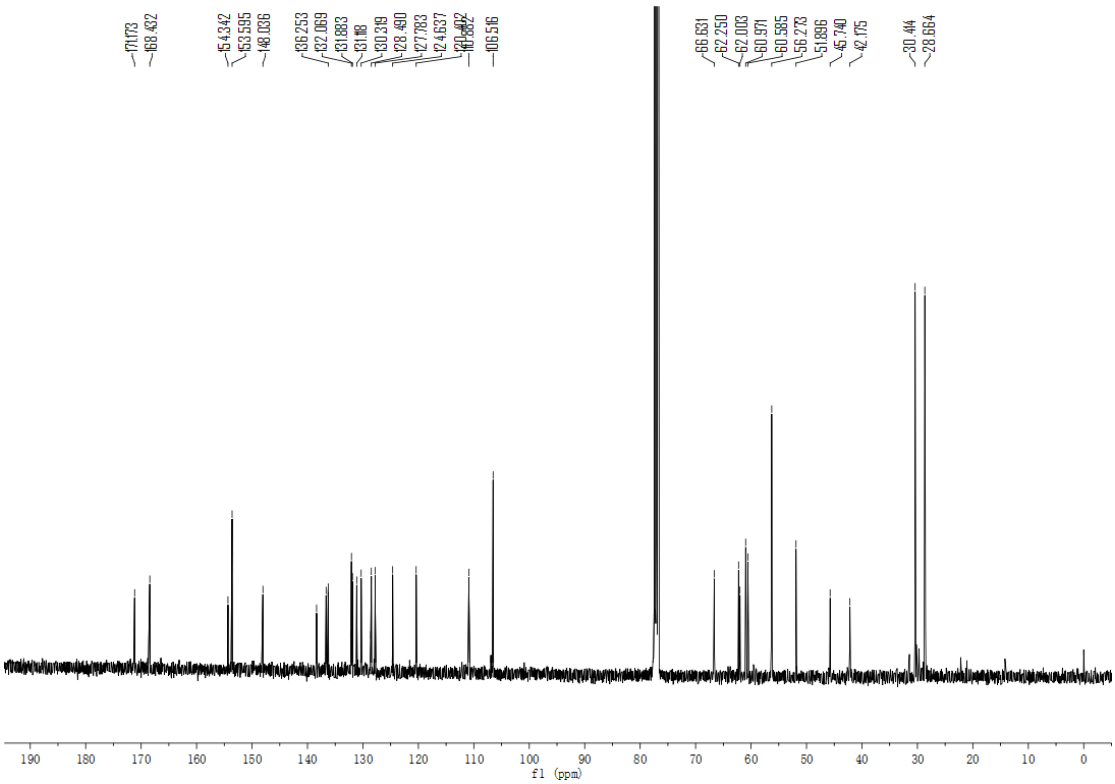


***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-(3,4,5-trimethoxyphenyl)acetamide (52)**

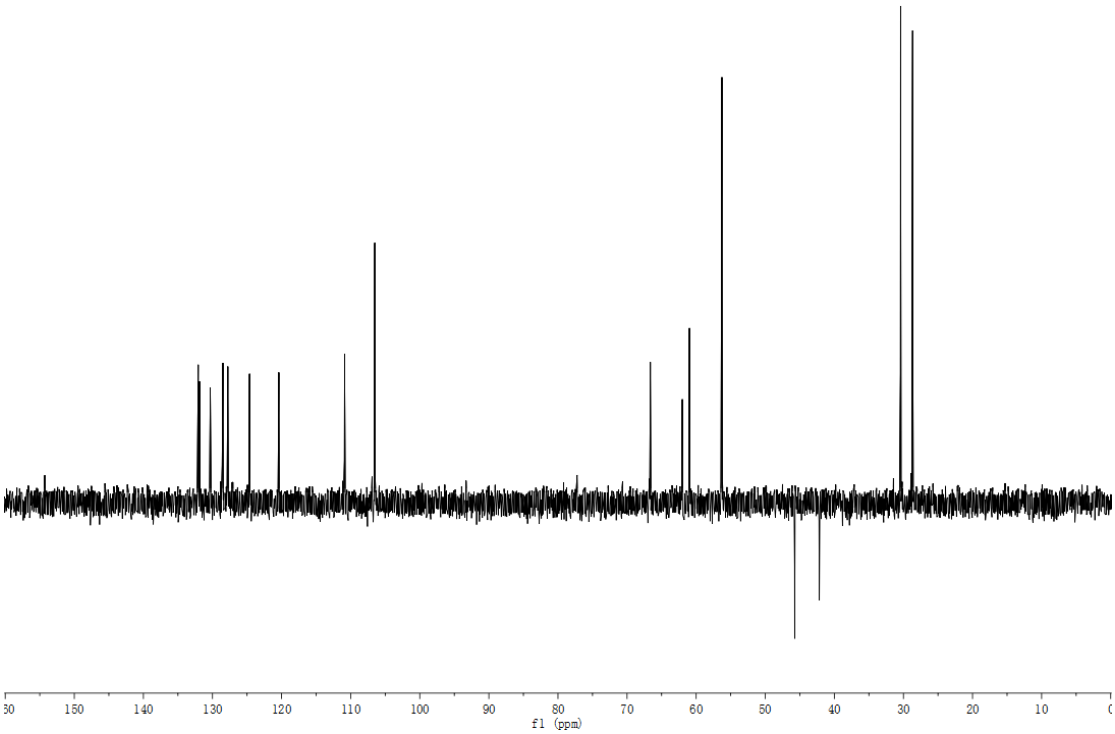
^{1}H NMR (400 MHz, $CDCl_3$)：



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

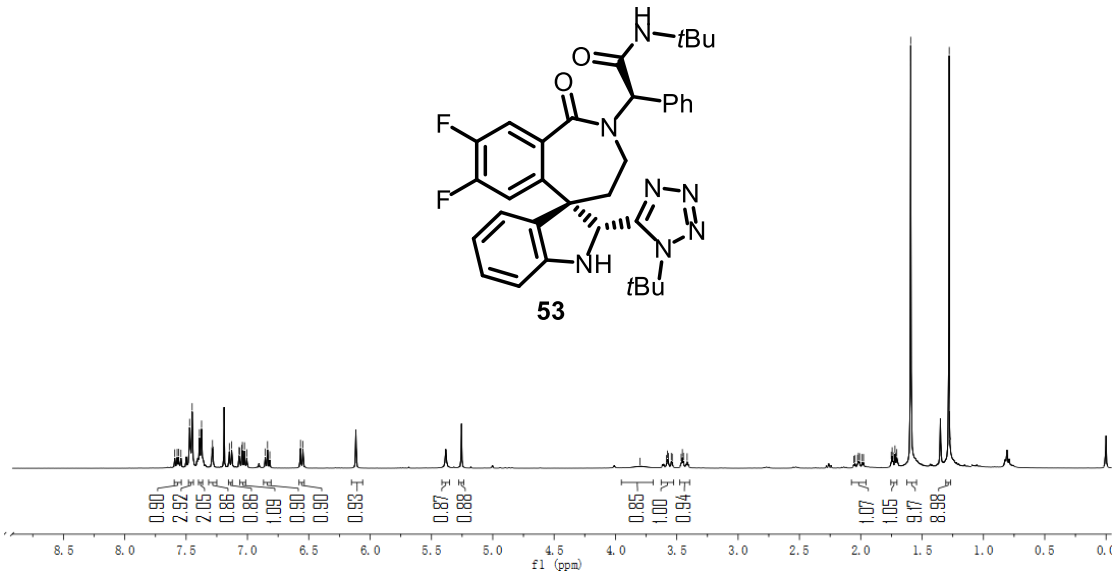


DEPT



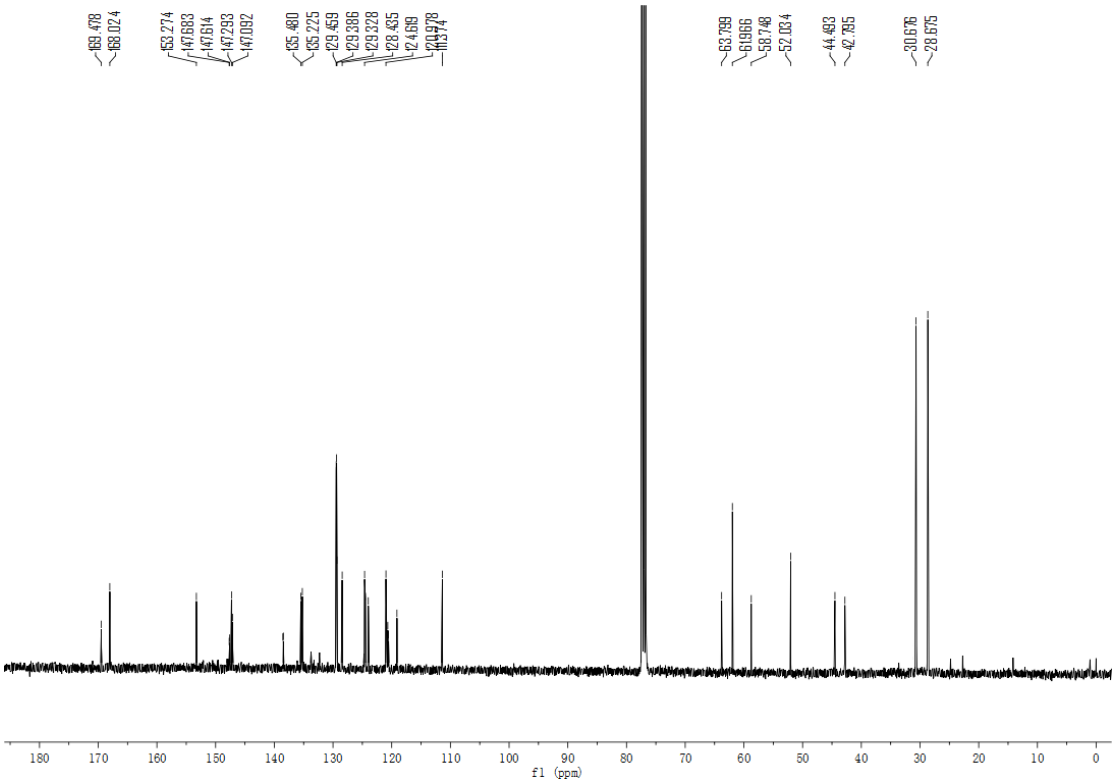
***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-7,8-difluoro-1-oxo-3,4-dihydrospiro[benzo[c] azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (53)**

^{1}H NMR (400 MHz, $CDCl_3$):

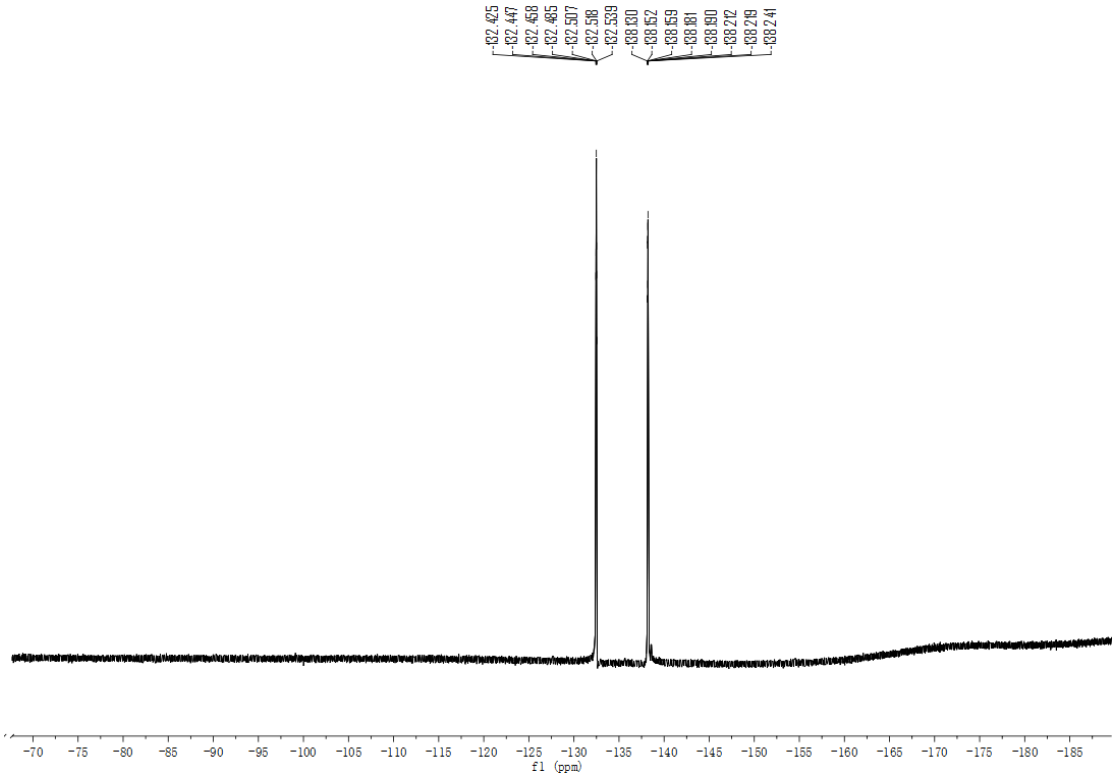


53

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

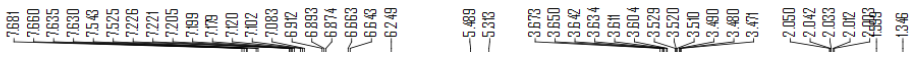


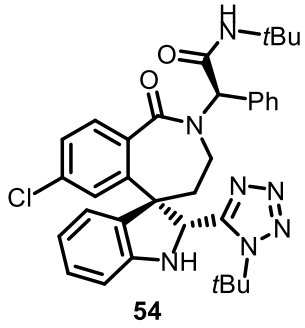
F^{19} NMR



N-**(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-7-chloro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (54)**

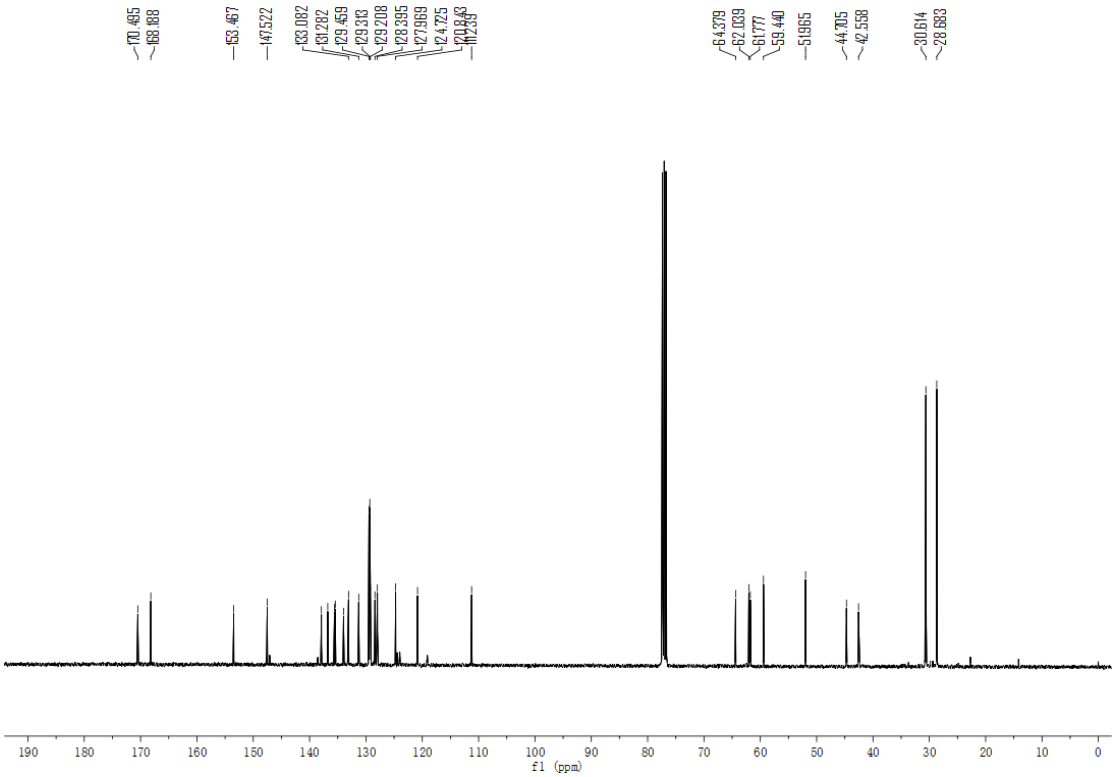
^{1}H NMR (400 MHz, $CDCl_3$)：



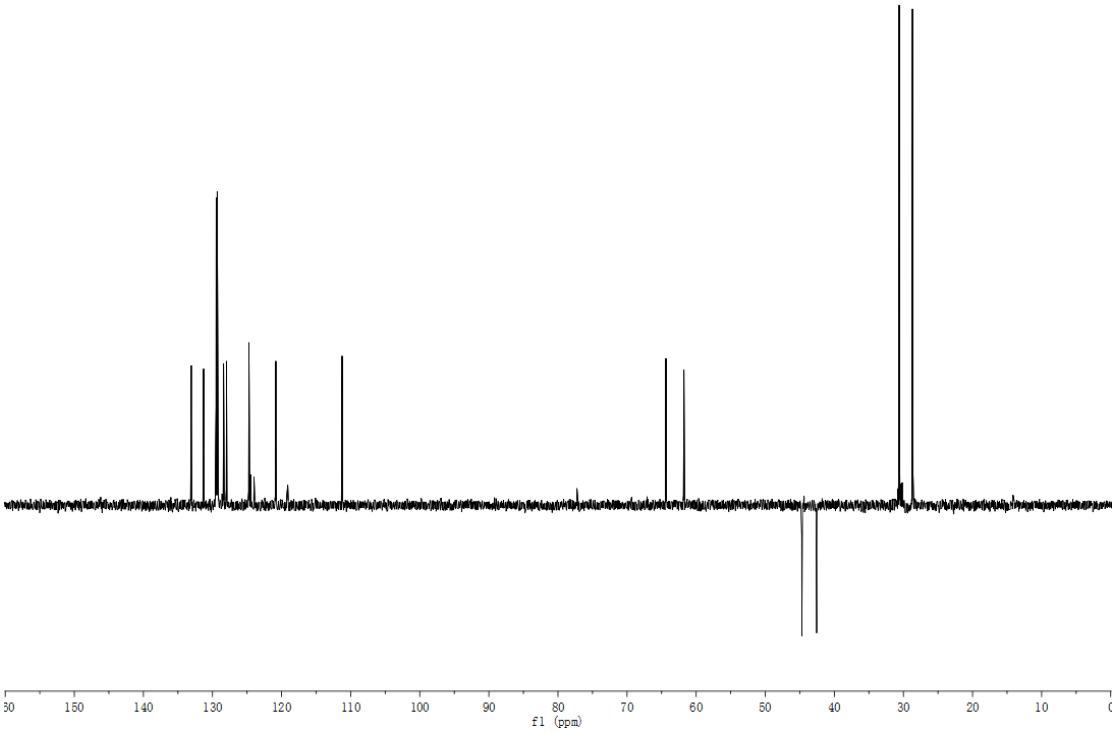


54

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

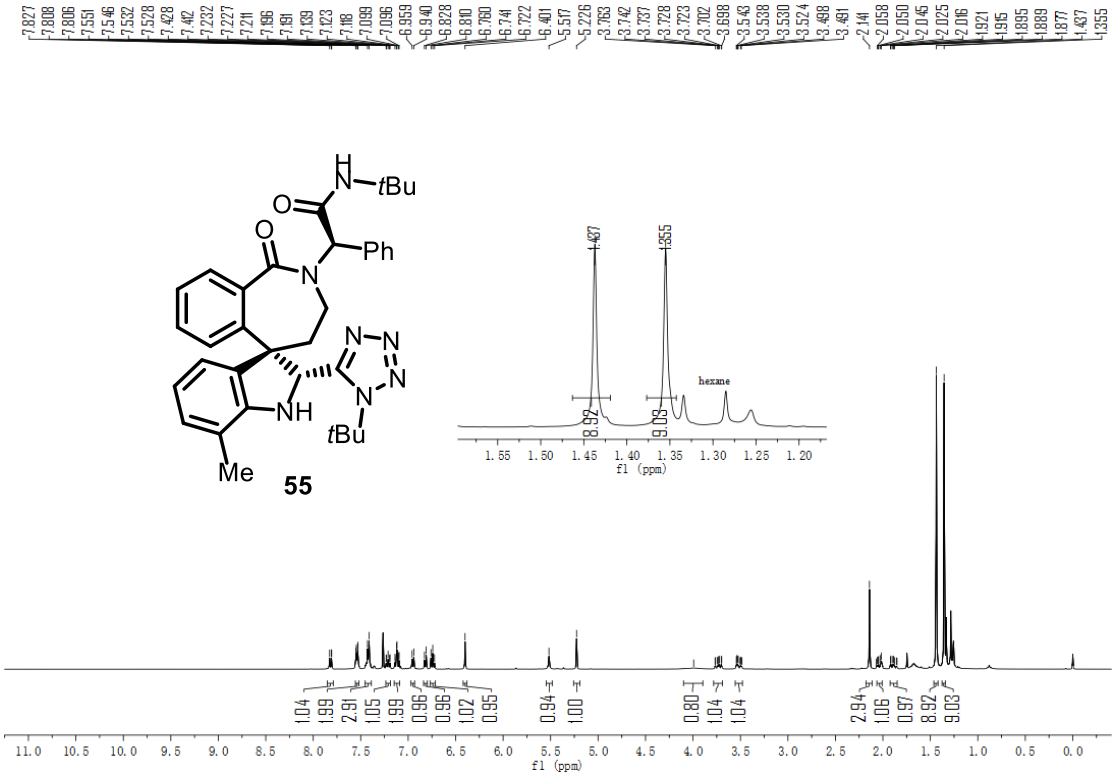


DEPT

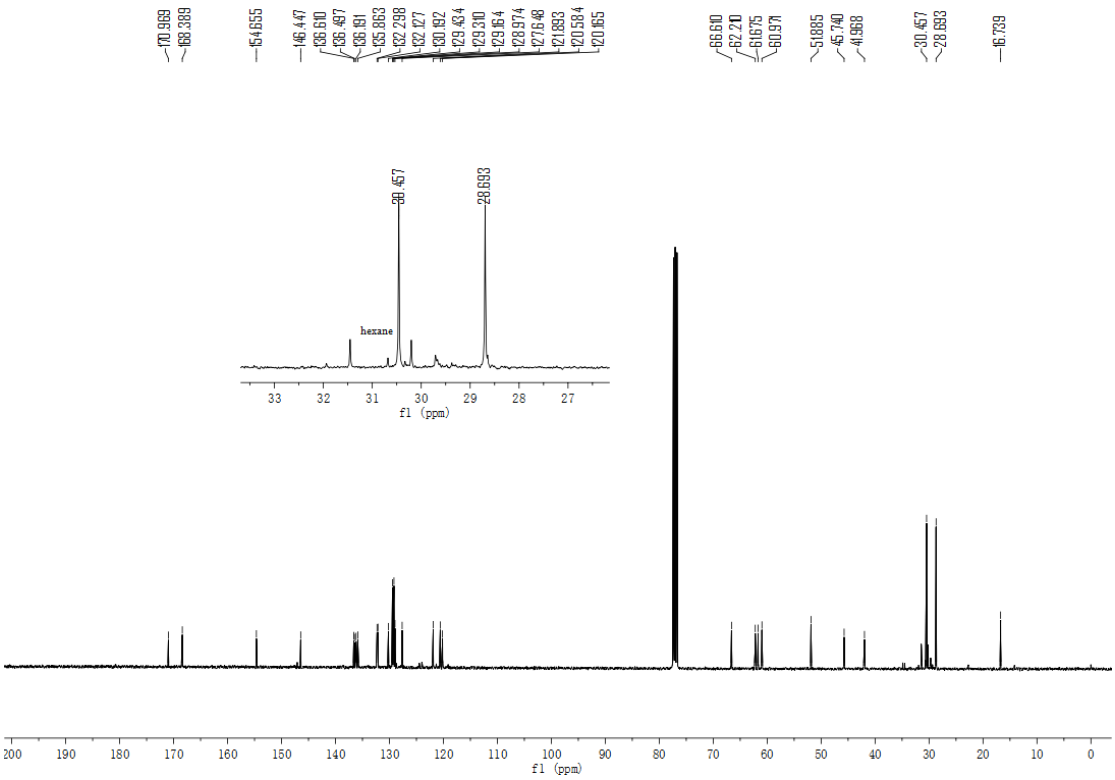


***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-7'-methyl-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (55)**

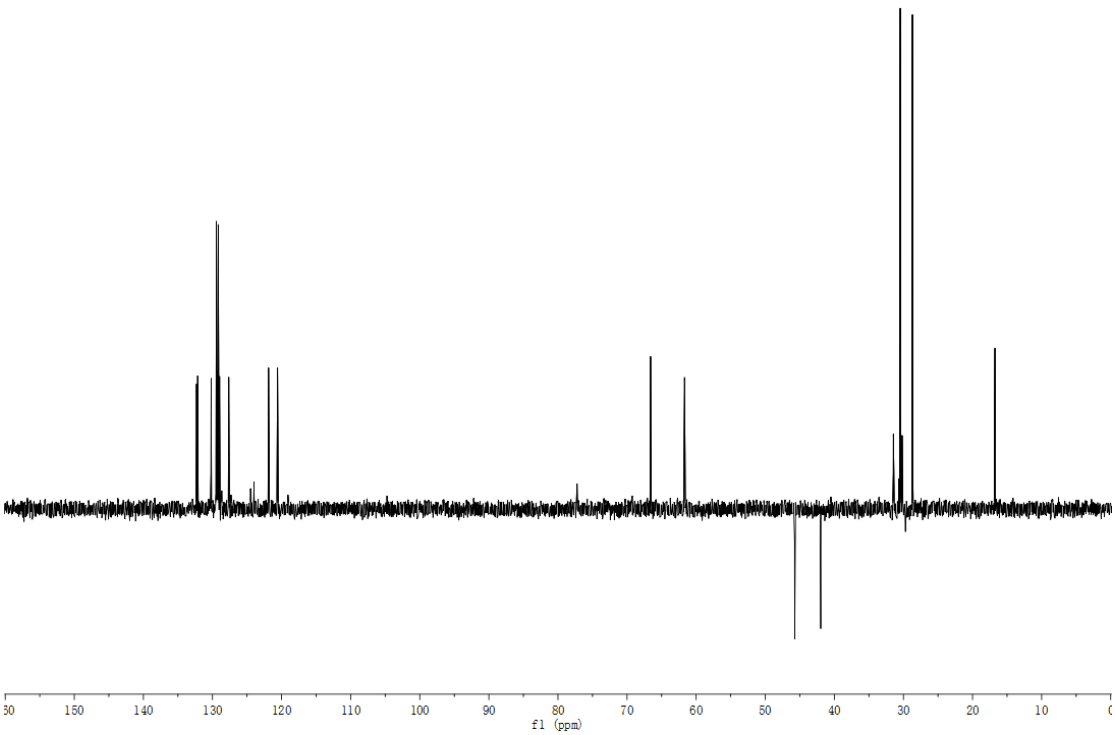
^{1}H NMR (400 MHz, $CDCl_3$)：



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

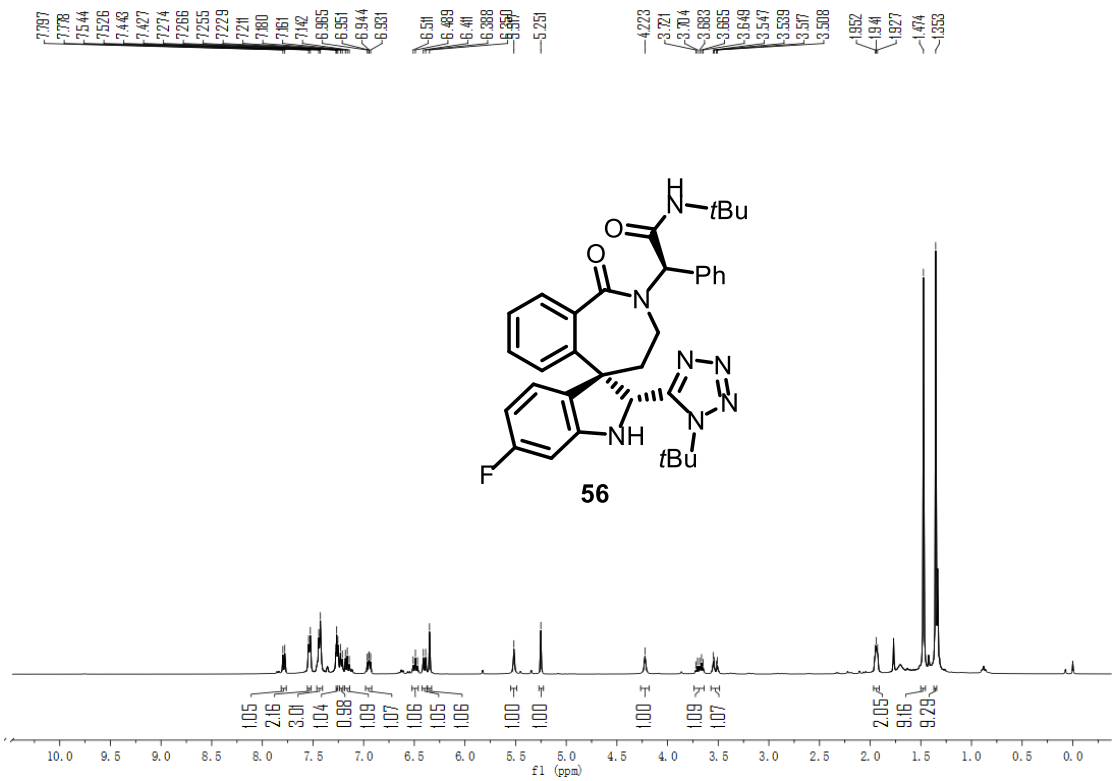


DEPT

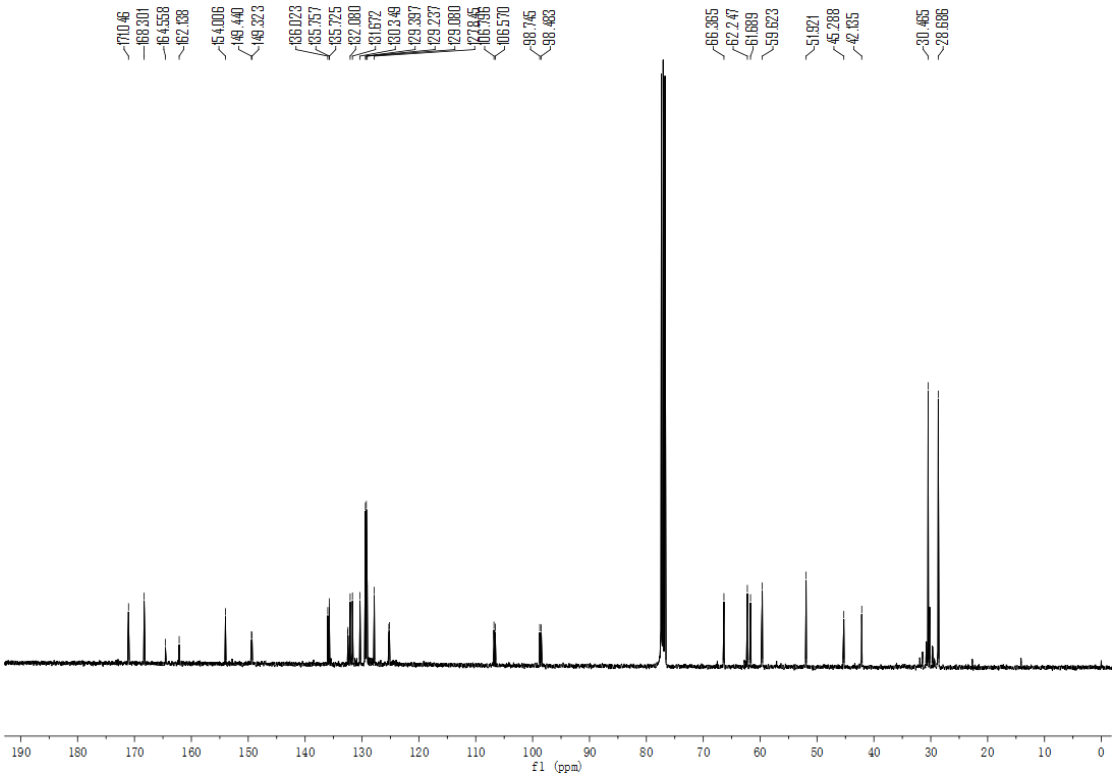


***N*-(tert-butyl)-2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-6'-fluoro-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenylacetamide (56)**

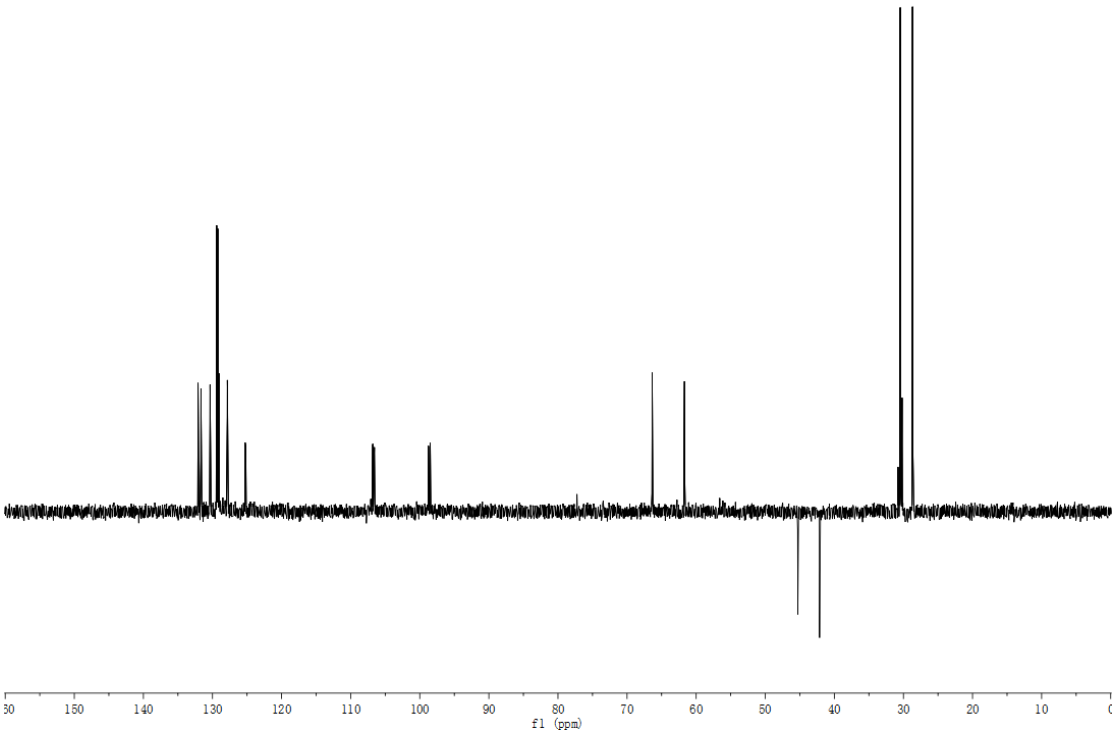
^{1}H NMR (400 MHz, $CDCl_3$):



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

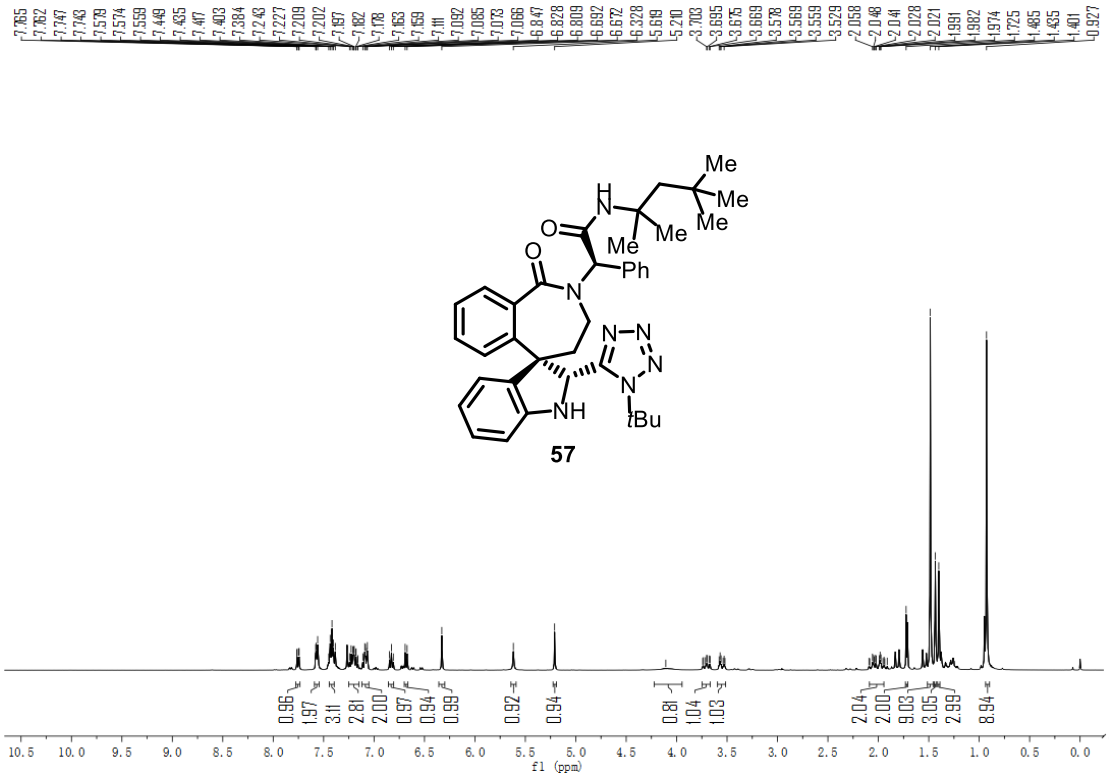


DEPT



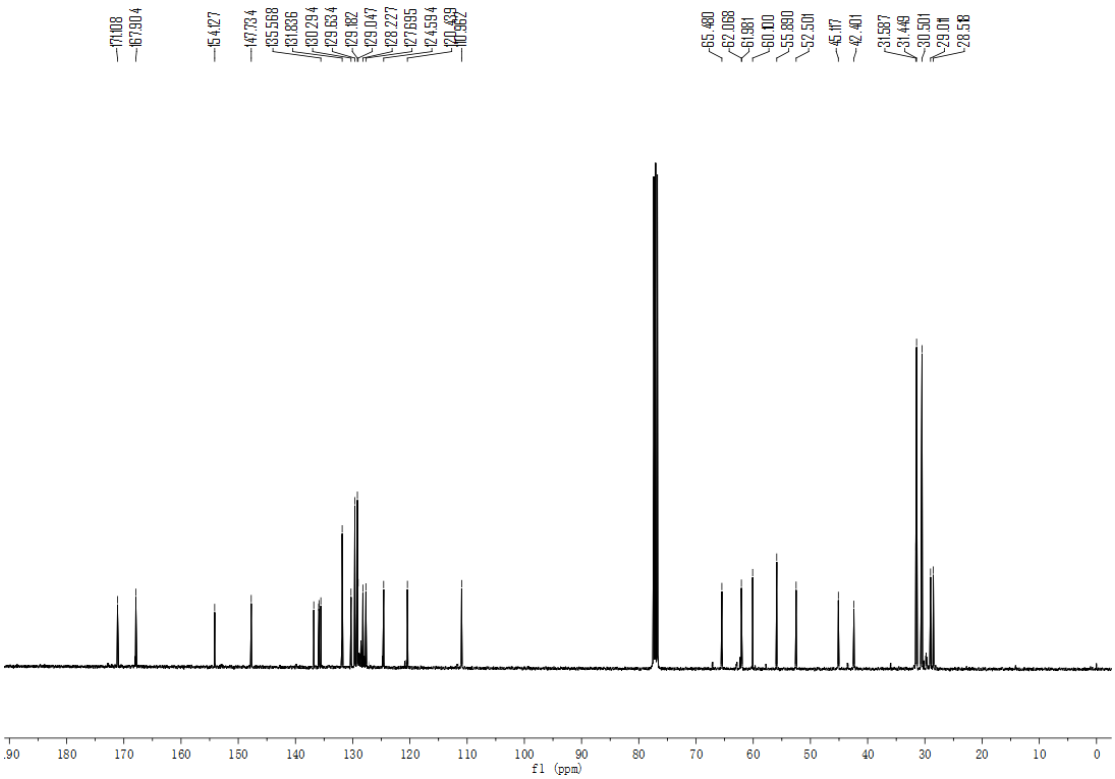
2-(2'-(1-(tert-butyl)-1H-tetrazol-5-yl)-1-oxo-3,4-dihydrospiro[benzo[c]azepine-5,3'-indolin]-2(1H)-yl)-2-phenyl-*N*-(2,4,4-trimethylpentan-2-yl)acetamide (57)

^{1}H NMR (400 MHz, $CDCl_3$):

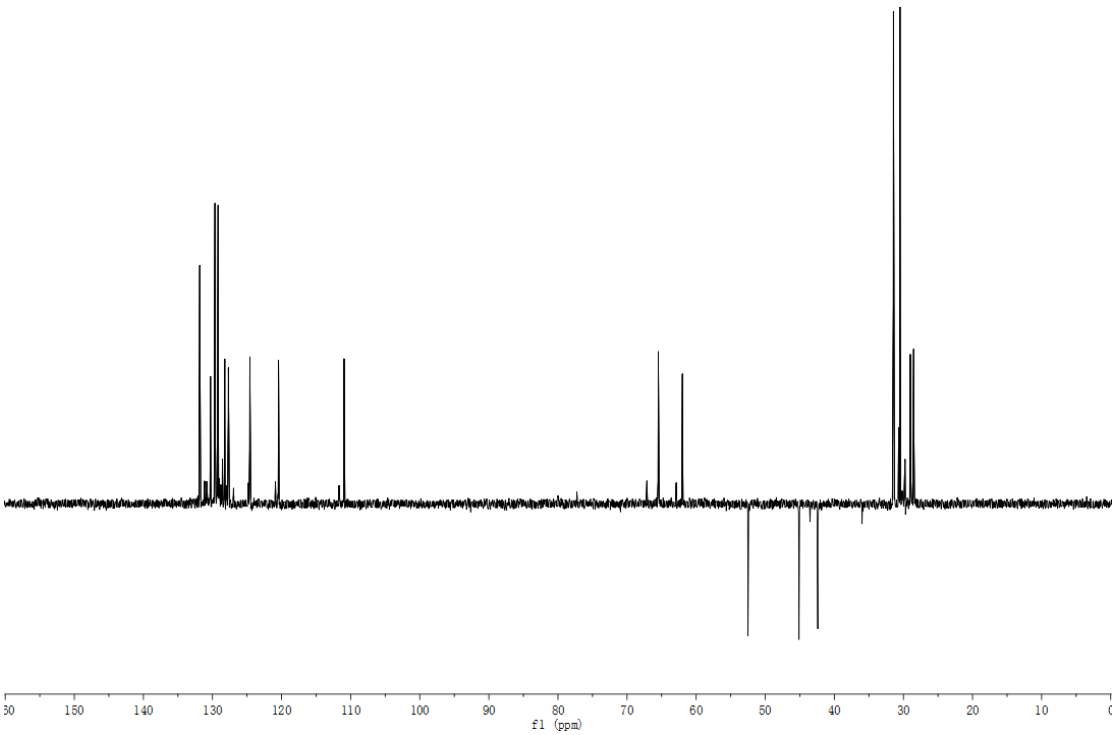


57

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


171.008
167.904
154.427
147.734
135.568
131.836
130.294
129.634
129.482
129.047
128.227
127.695
124.594
120.489
107.952
65.480
62.068
61.981
60.100
55.880
52.501
45.117
42.401
31.587
31.449
30.501
29.011
28.518
f1 (ppm)

DEPT


f1 (ppm)