

**Multicomponent Reaction for Diastereoselective Synthesis of  
Spiro[carbazole-3,4'-pyrazoles] and spiro[carbazole-3,4'-thiazoles]**

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**Supporting Information**

<b>Figures of the Single crystal structures</b>	<b>s2-s4</b>
<b>Single crystal data</b>	<b>s5-s7</b>
<b><math>^1\text{H}</math> and <math>^{13}\text{C}\{1\text{H}\}</math> NMR spectra of all compounds</b>	<b>s8-s64</b>

Single crystals were grown by slow evaporation of concentrated solution in CHCl<sub>3</sub> / DCM / EtOH (compounds **1b**, **1b'**, **1f**, **2b**, **3c** and **3e'**) in glass vials, which were then sealed by plugs with needles on them.

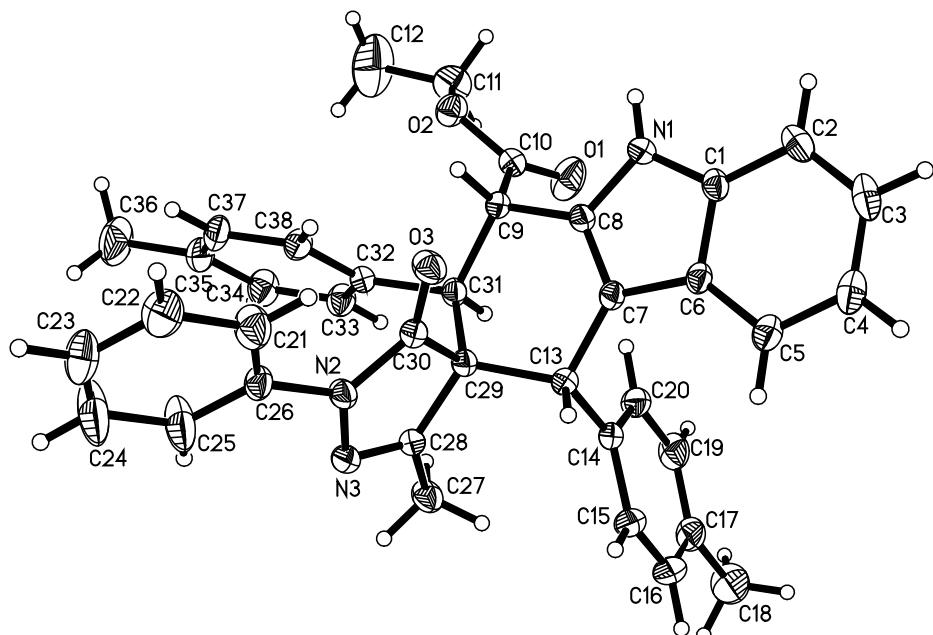


Fig. S1 ORTEP drawing (30%) of the crystal structure of **1b**

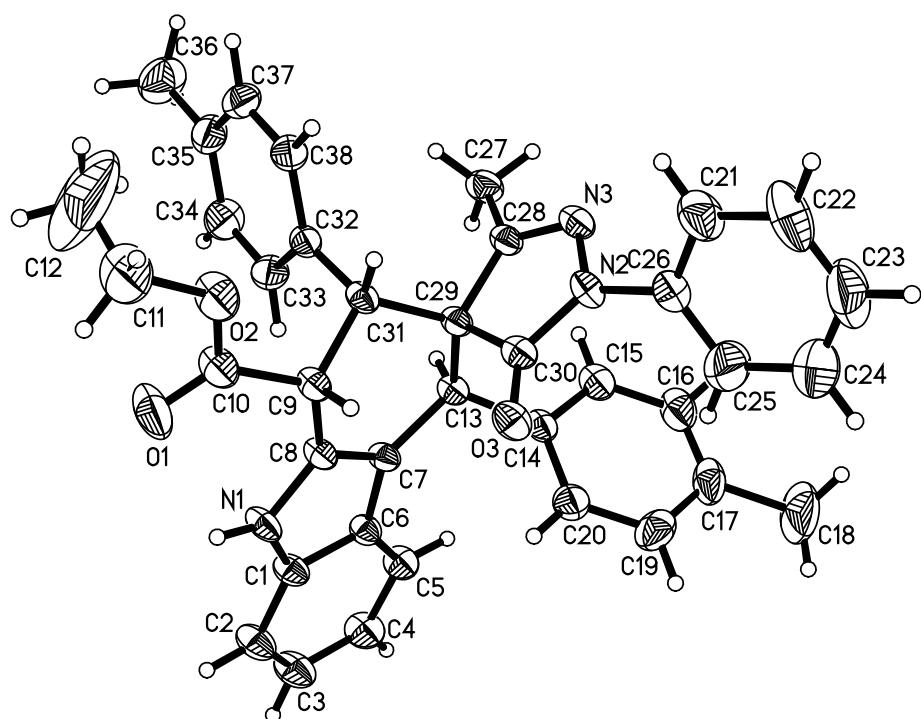


Fig. S2 ORTEP drawing (30%) of the crystal structure of **1b'**

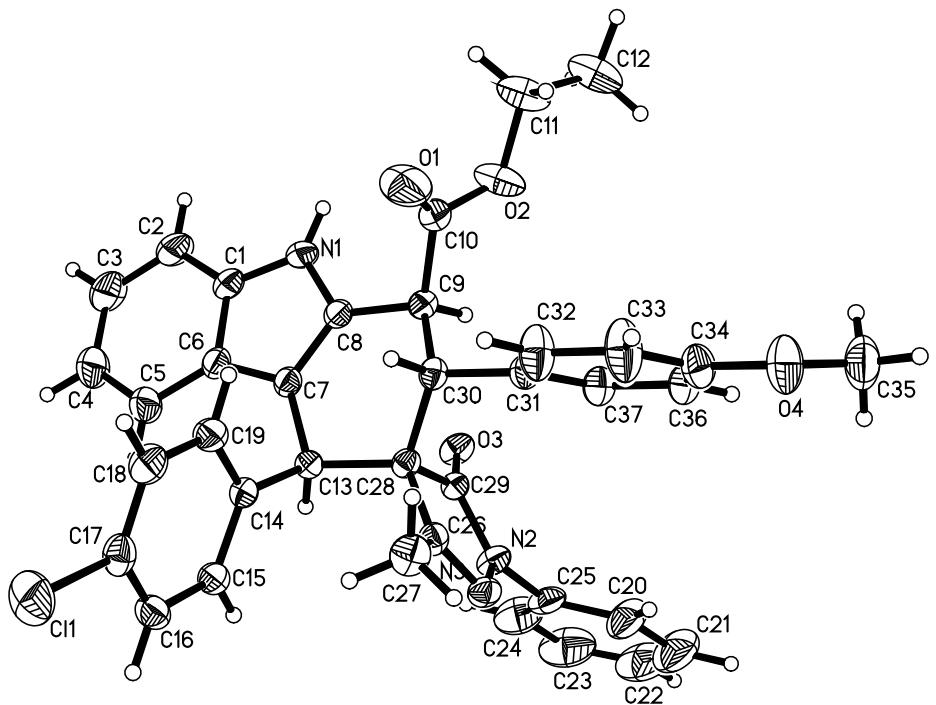


Fig. S3 ORTEP drawing (30%) of the crystal structure of **1f**

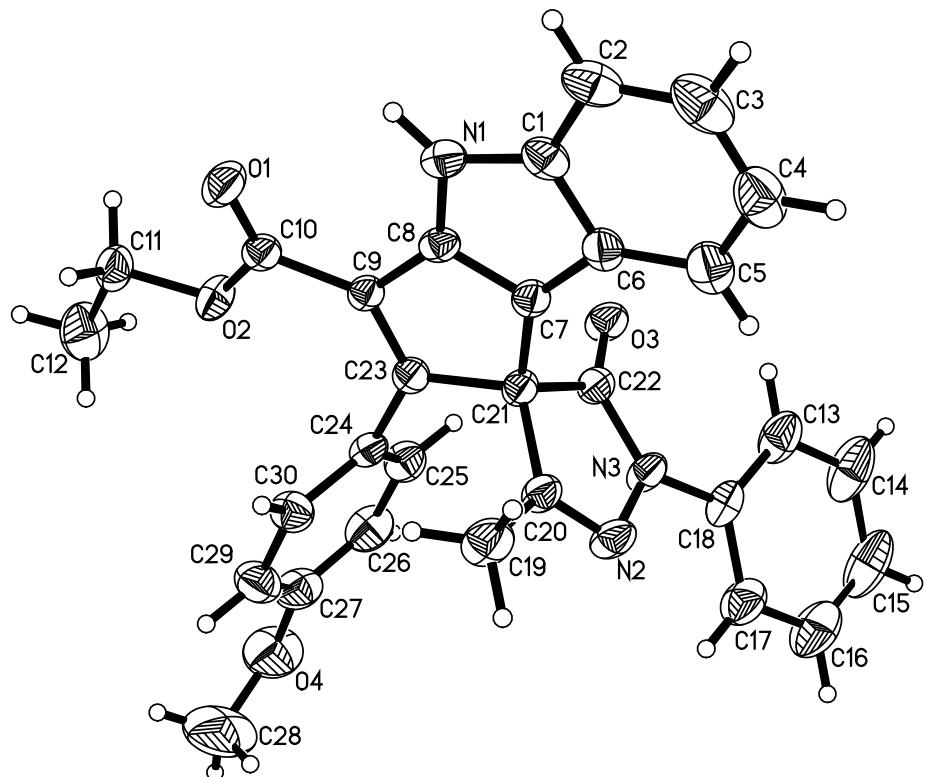


Fig. S4 ORTEP drawing (30%) of the crystal structure of **2b**

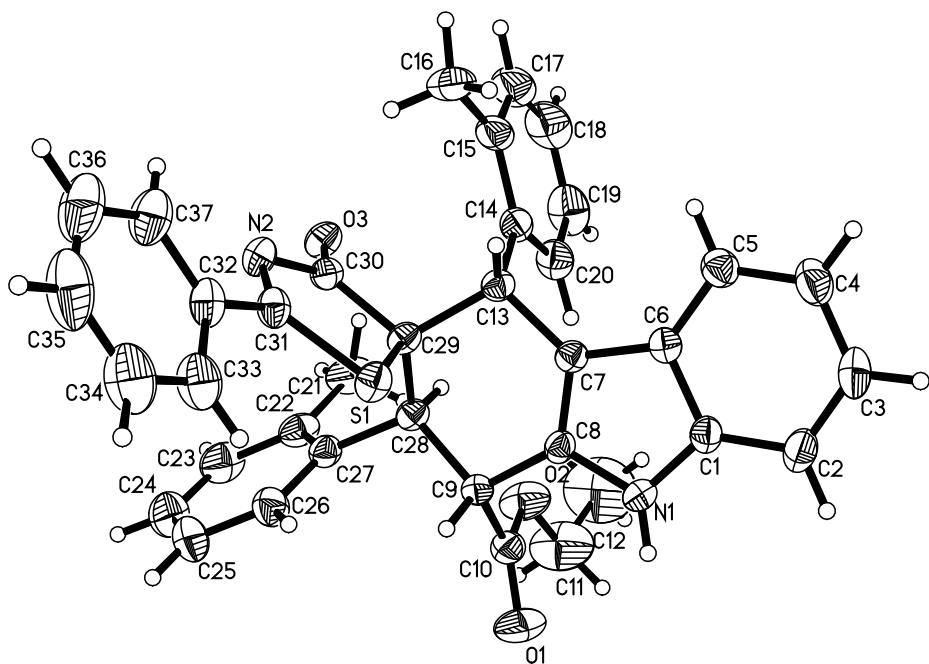


Fig. S5 ORTEP drawing (30%) of the crystal structure of **3c**

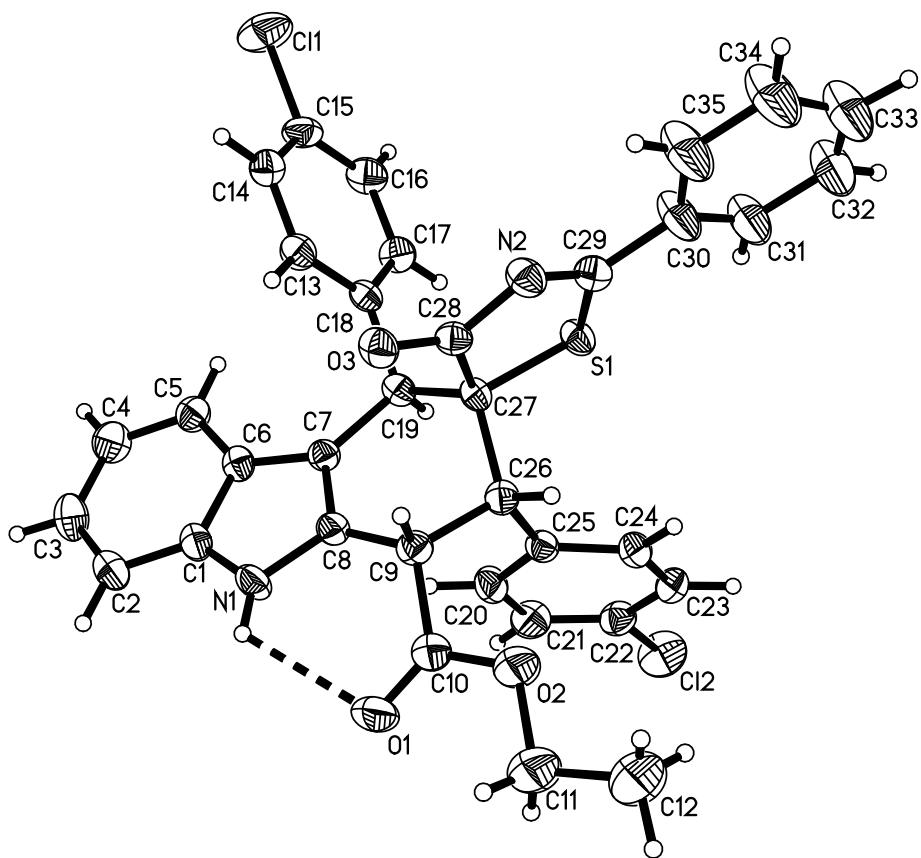


Fig.S6 ORTEP drawing (30%) of the crystal structure of **3e'**

**Table S1**The single crystal date of compounds **1b**, **1b'**

Phase	<b>1b</b>	<b>1b'</b>
Empirical formula	C <sub>38</sub> H <sub>35</sub> N <sub>3</sub> O <sub>3</sub>	C <sub>38</sub> H <sub>35</sub> N <sub>3</sub> O <sub>3</sub>
Formula weight	581.69	581.69
Temperature/K	296(2) K	296(2) K
Wavelength/ Å	0.71073	0.71073
Crystal system	Monoclinic	Triclinic
Space group	P2(1)/c	P2(1)/c
<i>a</i> /Å	9.4410(5)	10.6935(8)
<i>b</i> / Å	14.7057(7)	13.4382(9)
<i>c</i> / Å	23.5552(14)	25.2041(19)
$\alpha$ (°)	90	94.166
$\beta$ (°)	95.6278(19)	93.719 (2)
$\gamma$ (°)	90	106.600
<i>V</i> (Å <sup>3</sup> )	3254.6(3)	3447.8(4)
<i>Z</i>	4	4
Calculated density (g·cm <sup>-3</sup> )	1.187	1.121
Absorption coefficient(mm <sup>-1</sup> )	0.076	0.071
<i>F</i> (000)	1232	1232
$\theta$ range / (°)	2.642 to 26.000 deg.	2.158 to 26.000
Limiting indices	-10<=h<=11, -17<=k<=18, -29<=l<=25	-13<=h<=13, -16<=k<=16, -31<=l<=31
Reflections collected/unique	24061 / 6383 [R(int) = 0.0600]	47750 / 13398 [R(int) = 0.0701]
Completeness to theta	99.7 %	99.0 %
Max. and min. transmission	0.7456 and 0.6827	0.7456 and 0.6677
Refinement method	Full-matrix least-squares on F <sup>2</sup>	Full-matrix least-squares on F <sup>2</sup>
Data/restraints/parameters	6383 / 0 / 402	13398 / 6 / 801
Goodness-of-fit on <i>F</i> <sup>2</sup>	1.016	1.022
Final <i>R</i> indices[I>2sigma(I)]	R1 = 0.0585, wR2 = 0.1316	R1 = 0.0677, wR2 = 0.1582
<i>R</i> indices (all data)	R1 = 0.1197, wR2 = 0.1567	R1 = 0.1627, wR2 = 0.1984
Largest diff. peak and hole (e · Å <sup>-3</sup> )	0.214 and -0.215	0.314 and -0.259

**Table S2**The single crystal date of compounds **1f**, **2b**

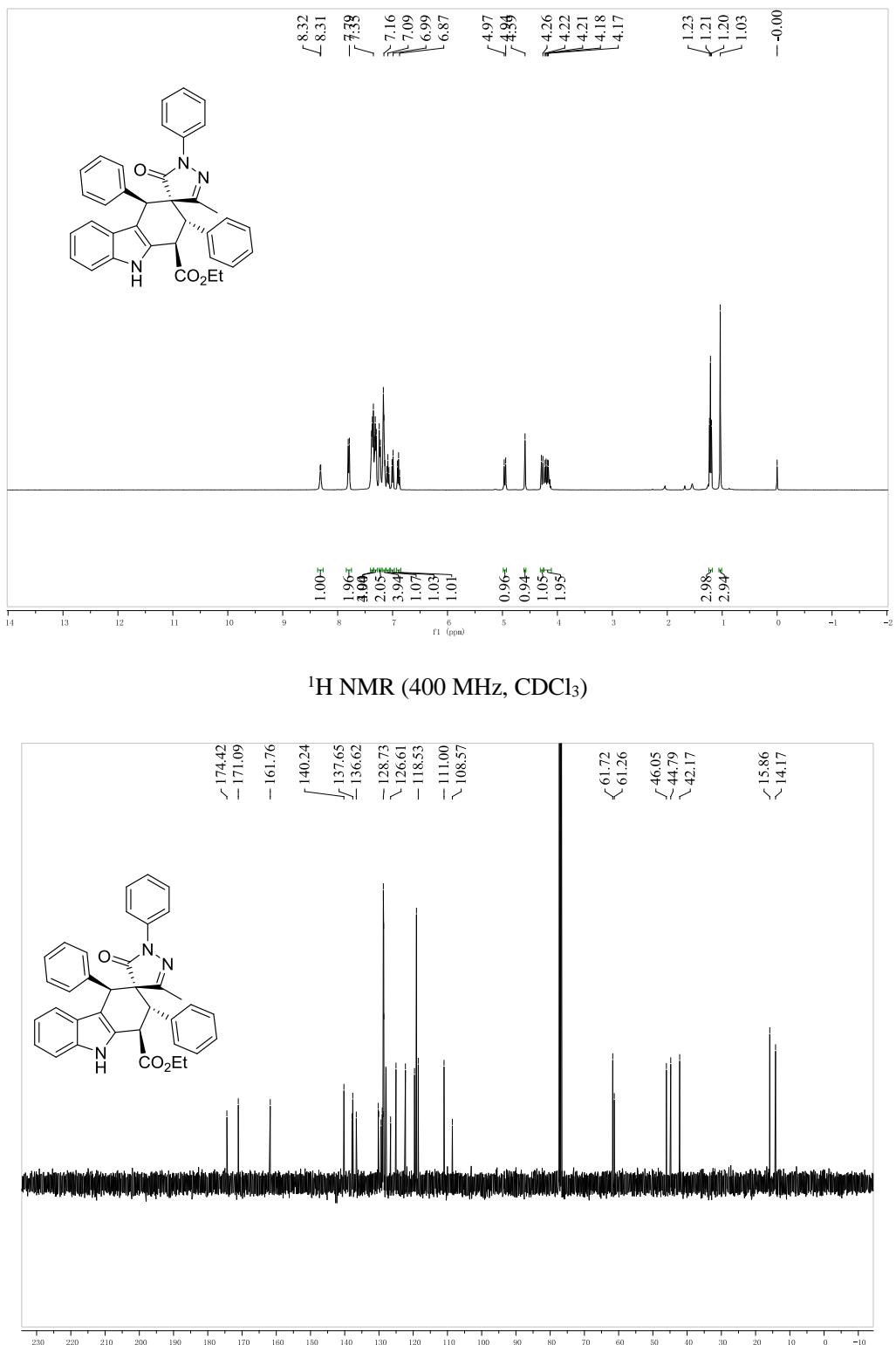
Phase	<b>1f</b>	<b>2b</b>
Empirical formula	C <sub>37</sub> H <sub>32</sub> ClN <sub>3</sub> O <sub>4</sub>	C <sub>30</sub> H <sub>25</sub> N <sub>3</sub> O <sub>4</sub>
Formula weight	618.10	491.53
Temperature/K	296(2) K	273(2) K
Wavelength/ Å	0.71073	0.71073
Crystal system	Monoclinic	Triclinic
Space group	P2(1)/n	P-1
<i>a</i> /Å	9.3586(8)	8.2874(13)
<i>b</i> /Å	19.1548(14)	11.4748(17)
<i>c</i> /Å	17.7838(15)	14.745(2)
$\alpha$ (°)	90	77.506(4)
$\beta$ (°)	94.269(3)	76.692(4)
$\gamma$ (°)	90	73.119(4)
<i>V</i> (Å <sup>3</sup> )	3179.1(4)	1288.8(3)
<i>Z</i>	4	2
Calculated density (g·cm <sup>-3</sup> )	1.291	1.267
Absorption coefficient(mm <sup>-1</sup> )	0.165	0.085
<i>F</i> (000)	1296	516
$\theta$ range / (°)	2.126 to 26.000	2.543 to 26.000
Limiting indices	-11<=h<=11, -23<=k<=23, -21<=l<=21	-10<=h<=10, -14<=k<=13, -18<=l<=18
Reflections collected/unique	29511 / 6242	16820 / 5038
Completeness to theta	[R(int) = 0.0640]	[R(int) = 0.0601]
Max. and min. transmission	99.8 %	99.5 %
Refinement method	Full-matrix least-squares on F <sup>2</sup>	Full-matrix least-squares on F <sup>2</sup>
Data/restraints/parameters	6242 / 120 / 438	5038 / 0 / 337
Goodness-of-fit on <i>F</i> <sup>2</sup>	1.031	1.013
Final <i>R</i> indices[I>2sigma(I)]	R1 = 0.0642, wR2 = 0.1340	R1 = 0.0592, wR2 = 0.1037
<i>R</i> indices (all data)	R1 = 0.1261, wR2 = 0.1590	R1 = 0.1509, wR2 = 0.1303
Largest diff. peak and hole (e · Å <sup>-3</sup> )	0.262 and -0.303	0.139 and -0.146

**Table S3**The single crystal date of compounds **3c**, **3e'**

Phase	<b>3c</b>	<b>3e'</b>
Empirical formula	C <sub>37</sub> H <sub>32</sub> N <sub>2</sub> O <sub>3</sub> S	C <sub>36</sub> H <sub>28</sub> Cl <sub>4</sub> N <sub>2</sub> O <sub>3</sub> S
Formula weight	584.70	710.46
Temperature/K	296(2) K	296(2) K
Wavelength/ Å	0.71073	0.71073
Crystal system	Monoclinic	Monoclinic
Space group	P-1	P2(1)/c
<i>a</i> /Å	12.4625(17)	11.4258(8)
<i>b</i> /Å	13.7498(17)	18.2354(12)
<i>c</i> /Å	18.480(3)	16.3859(11)
$\alpha$ (°)	90	90
$\beta$ (°)	92.758(5)	91.810(2)
$\gamma$ (°)	90	90
<i>V</i> (Å <sup>3</sup> )	3163.1(8)	3412.4(4)
<i>Z</i>	4	4
Calculated density (g·cm <sup>-3</sup> )	1.228	1.383
Absorption coefficient(mm <sup>-1</sup> )	0.141	0.447
<i>F</i> (000)	1232	1464
$\theta$ range / (°)	2.207 to 25.999	2.104 to 25.999
Limiting indices	-15<=h<=14, -16<=k<=16, -22<=l<=22	-13<=h<=14, -22<=k<=18, -19<=l<=20
Reflections collected/unique	35117 / 6217	31222 / 6692
	[R(int) = 0.0860]	[R(int) = 0.0888]
Completeness to theta	99.9 %	99.7 %
Max. and min. transmission	0.7456 and 0.6951	0.7456 and 0.6499
Refinement method	Full-matrix least-squares on F <sup>2</sup>	Full-matrix least-squares on F <sup>2</sup>
Data/restraints/parameters	6217 / 0 / 391	6692 / 79 / 427
Goodness-of-fit on <i>F</i> <sup>2</sup>	1.016	1.022
Final <i>R</i> indices[I>2sigma(I)]	R1 = 0.0586, wR2 = 0.1102	R1 = 0.0911, wR2 = 0.2224
<i>R</i> indices (all data)	R1 = 0.1431, wR2 = 0.1374	R1 = 0.1955, wR2 = 0.2812
Largest diff. peak and hole (e · Å <sup>-3</sup> )	0.263 and -0.237	0.682 and -0.815

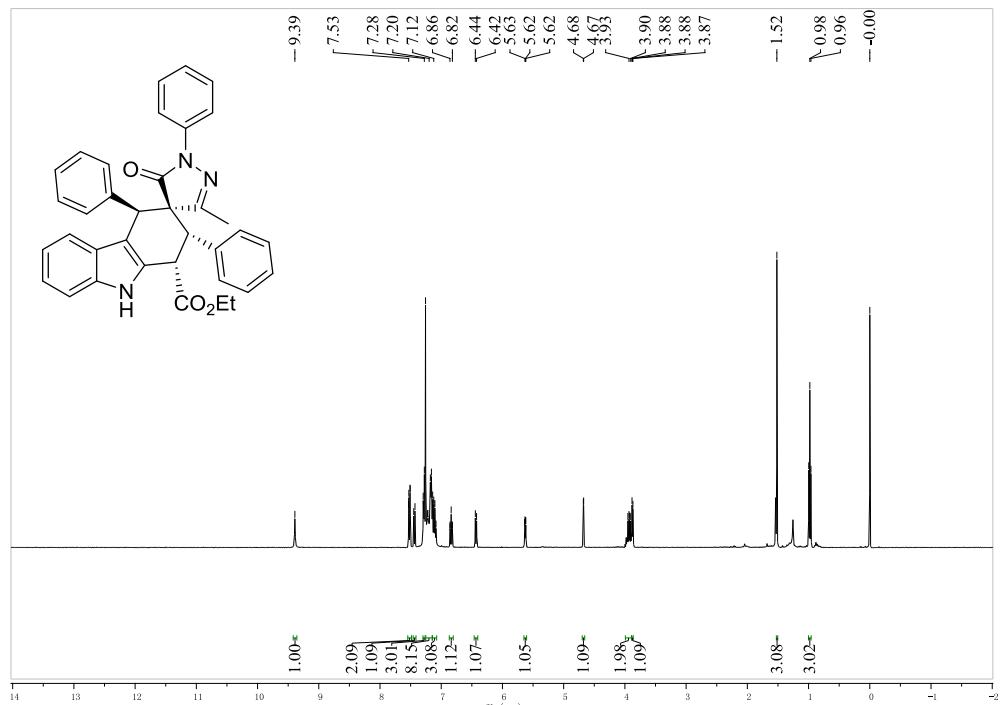
**Ethyl**

***rel*-(1*R*,2*S*,3*R*,4*R*)-3'-methyl-5'-oxo-1',2,4-triphenyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1a) :**

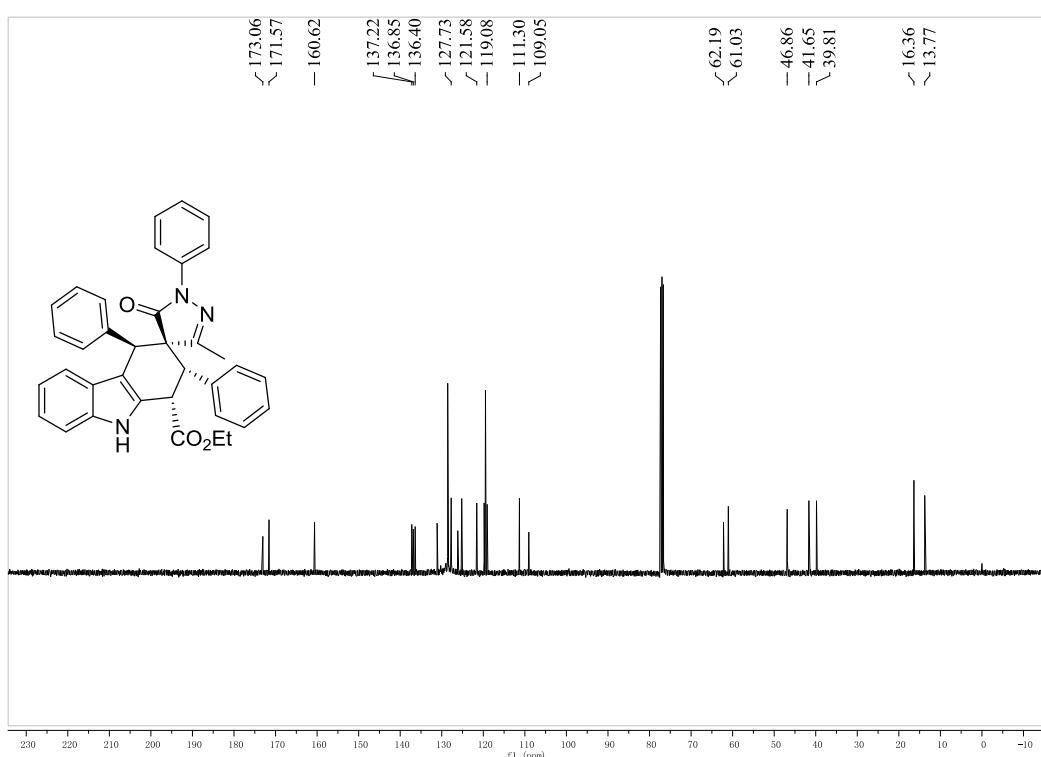


**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-3'-methyl-5'-oxo-1',2,4-triphenyl-1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1a'**) :



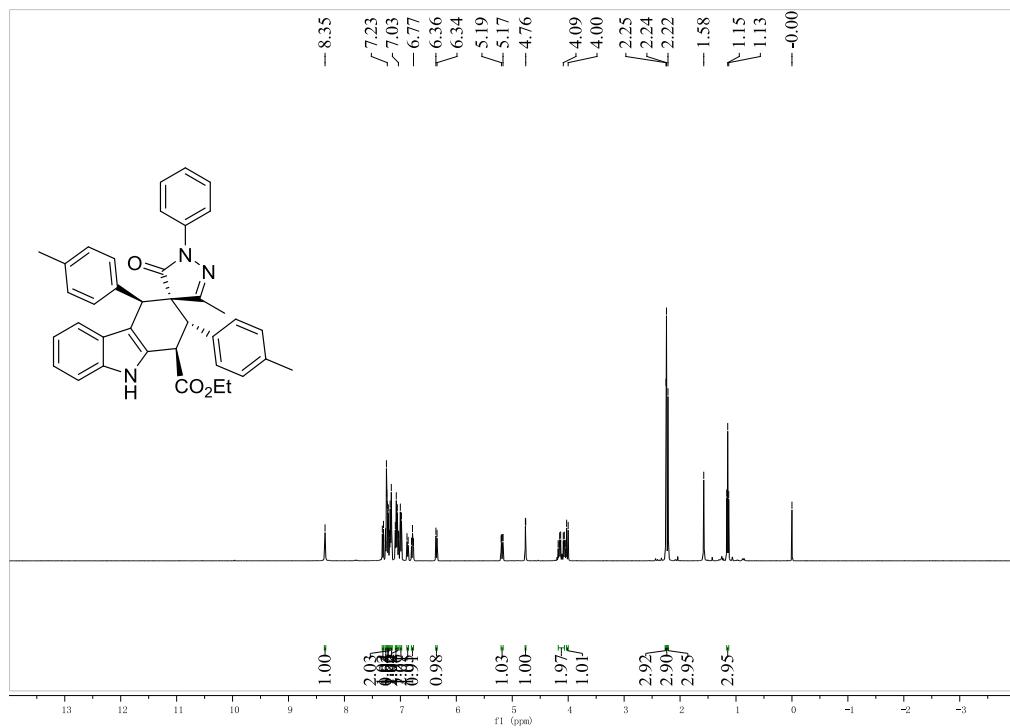
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



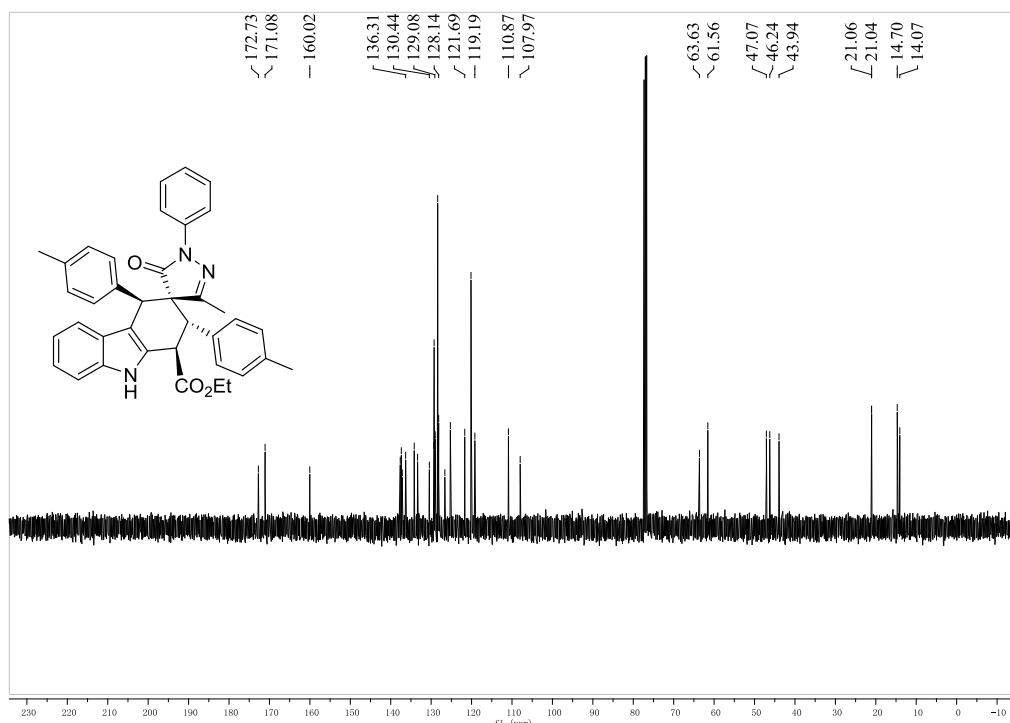
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-3'-methyl-5'-oxo-1'-phenyl-2,4-di-p-tolyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1b**) :



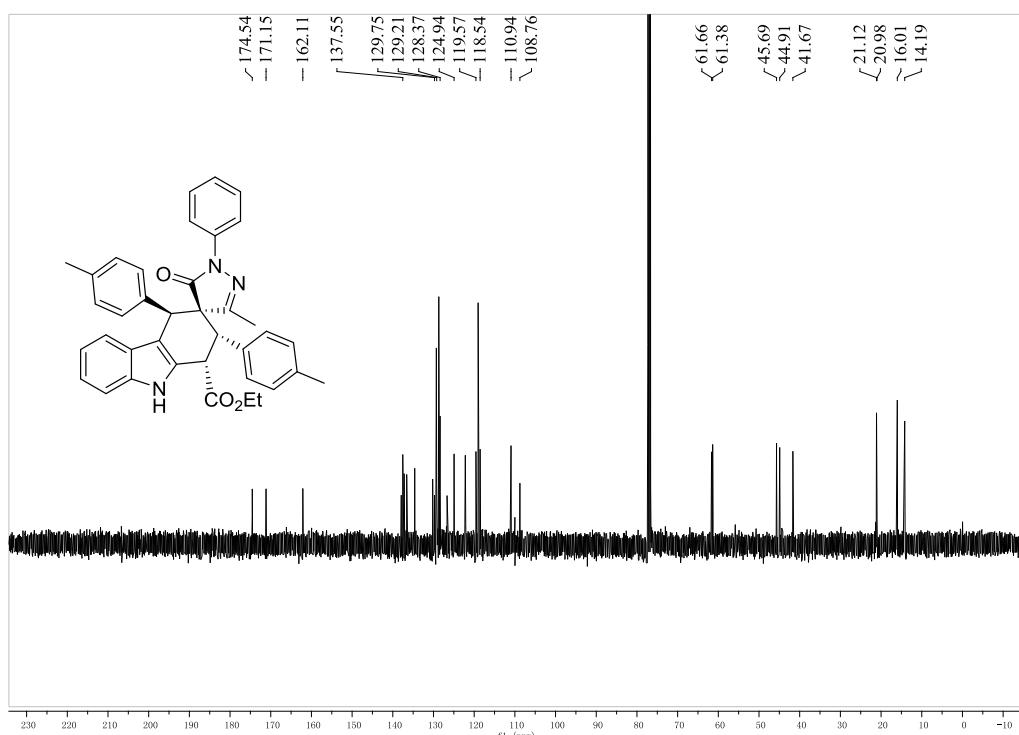
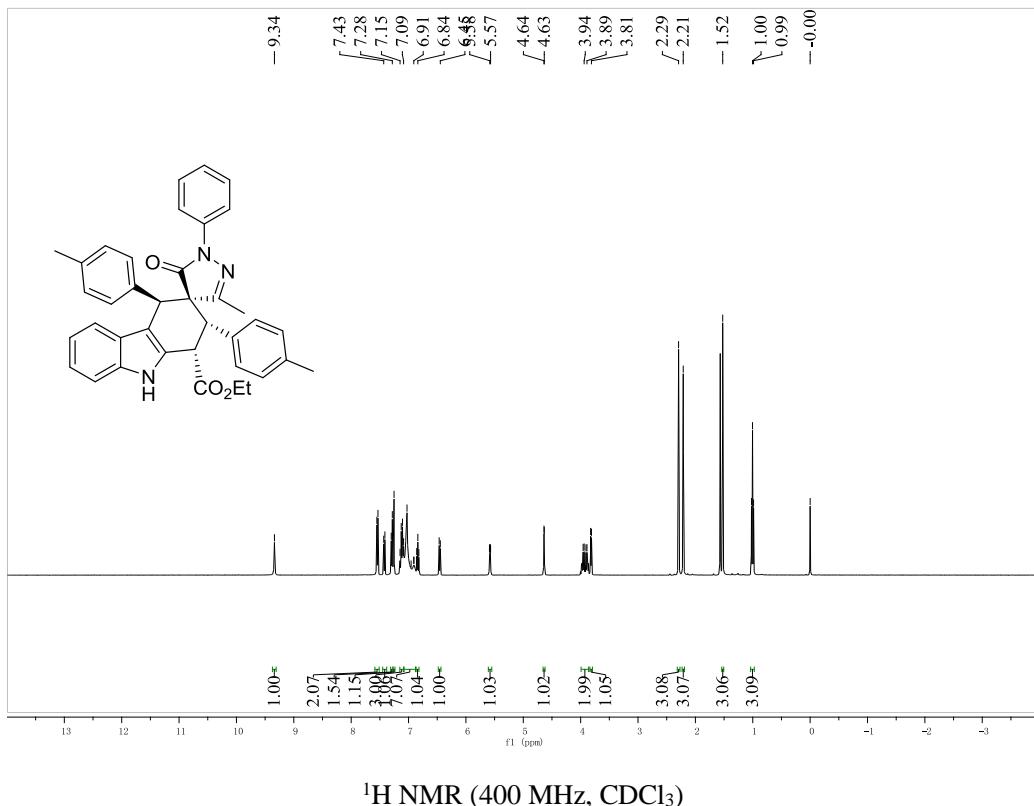
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

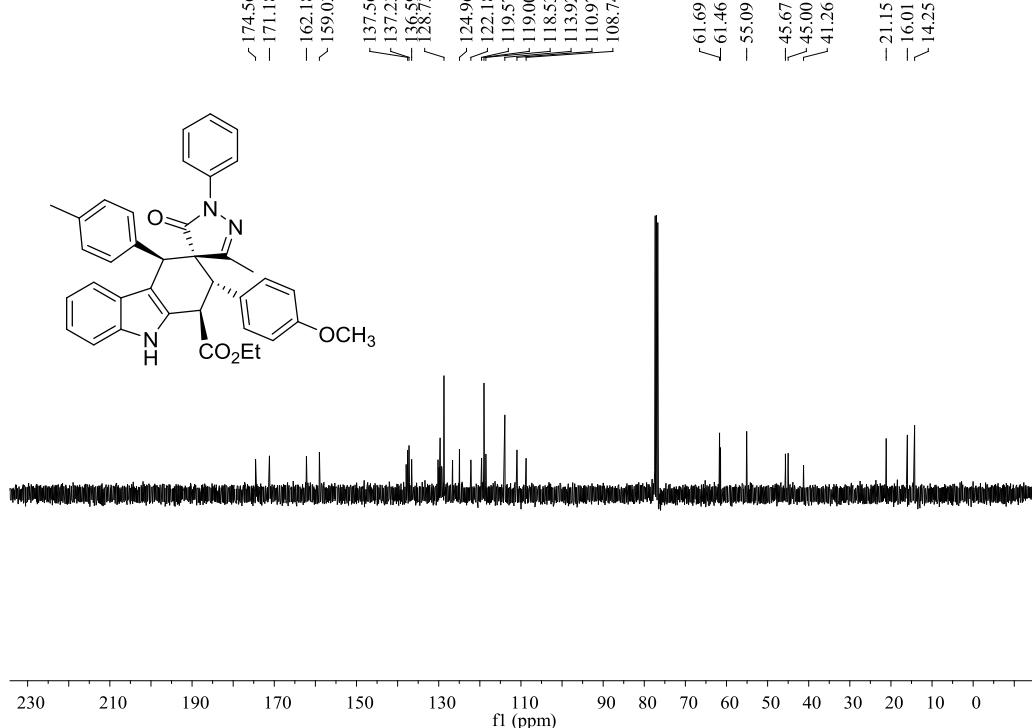
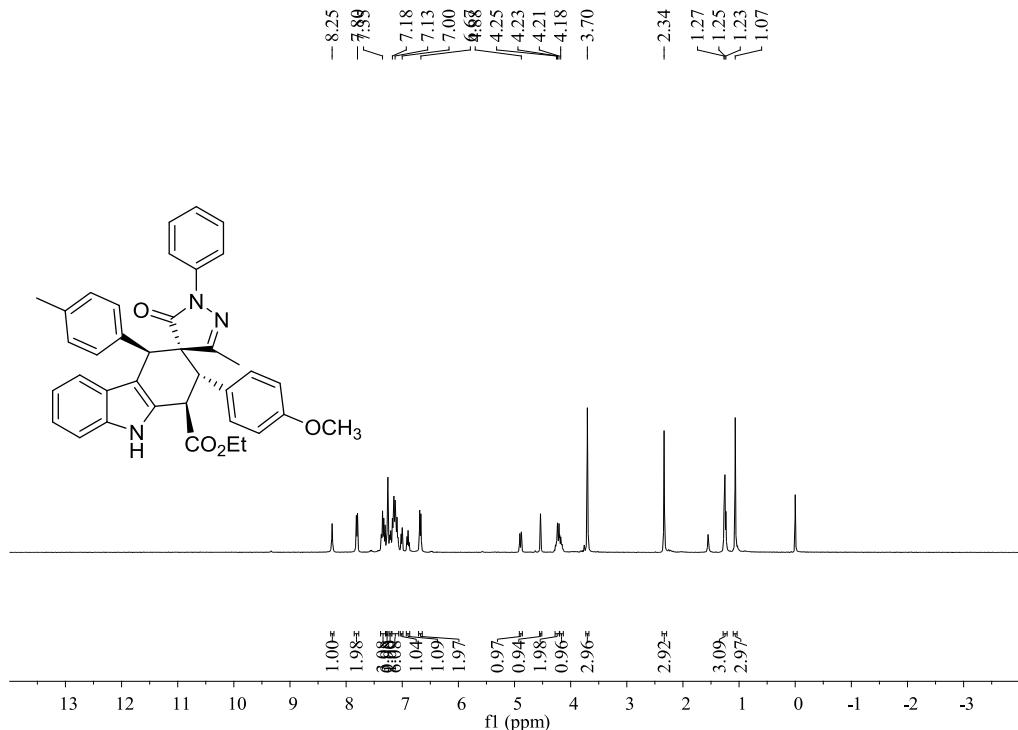
***rel*-(1*S*,2*S*,3*S*,4*R*)-3'-methyl-5'-oxo-1'-phenyl-2,4-di-p-tolyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1b') :**



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

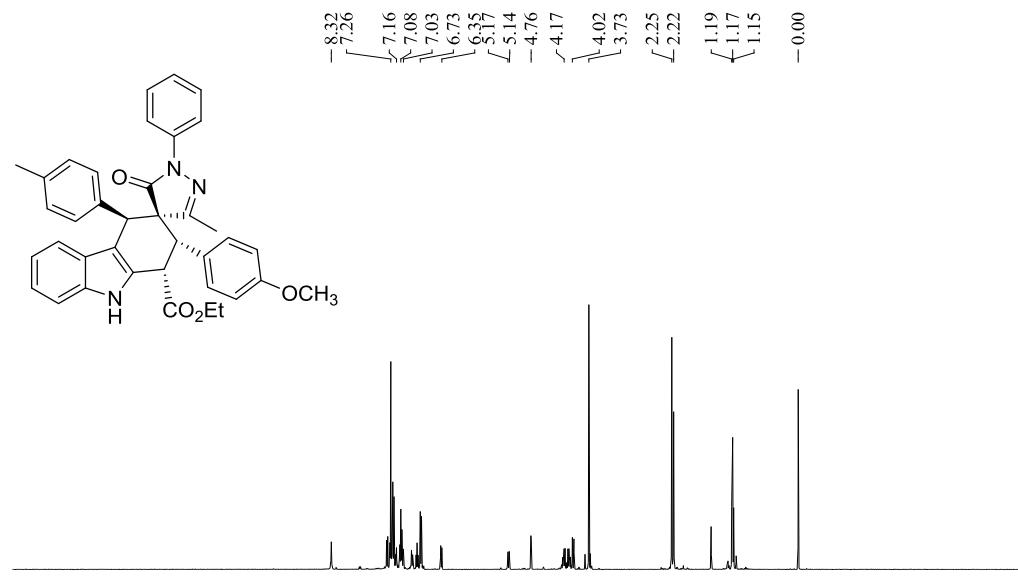
**Ethy**

*rel*-(1*R*,2*S*,3*R*,4*R*)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-4-(p-tolyl)-1,1',2,4,5',9-he  
xahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1c**) :

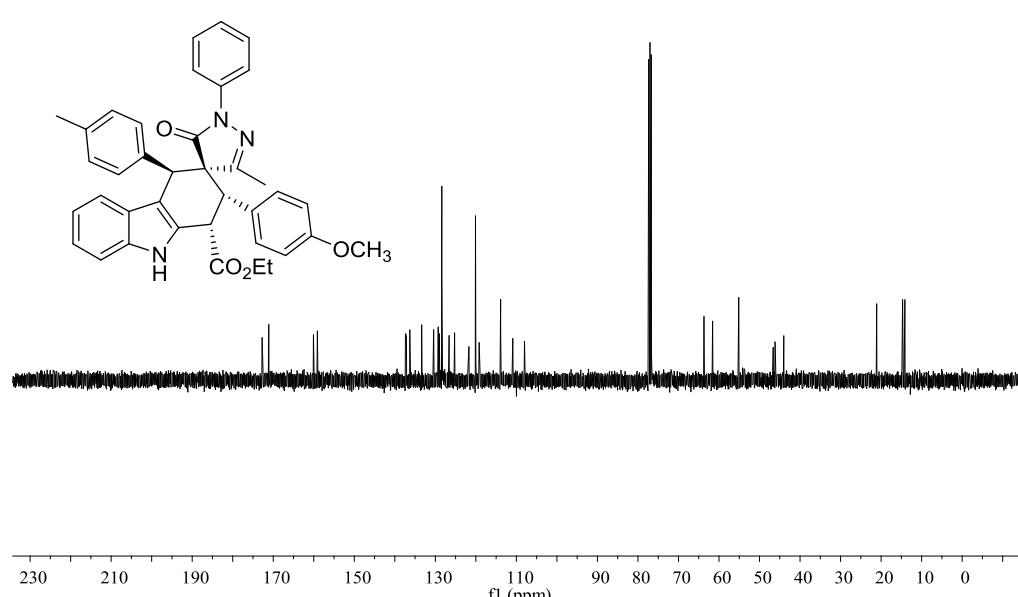
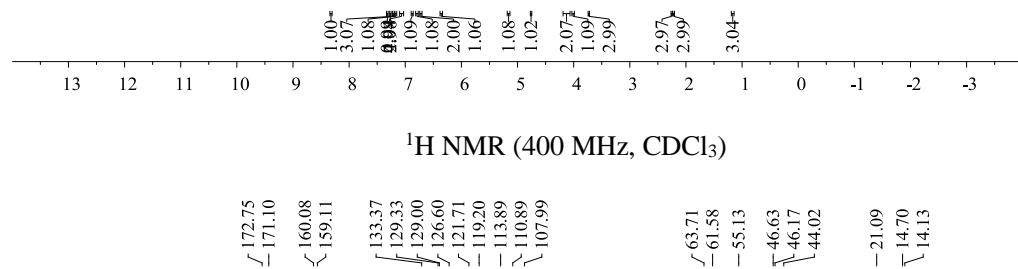


**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-4-(p-tolyl)-1,1',2,4,5',9-he  
xahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1c'**) :



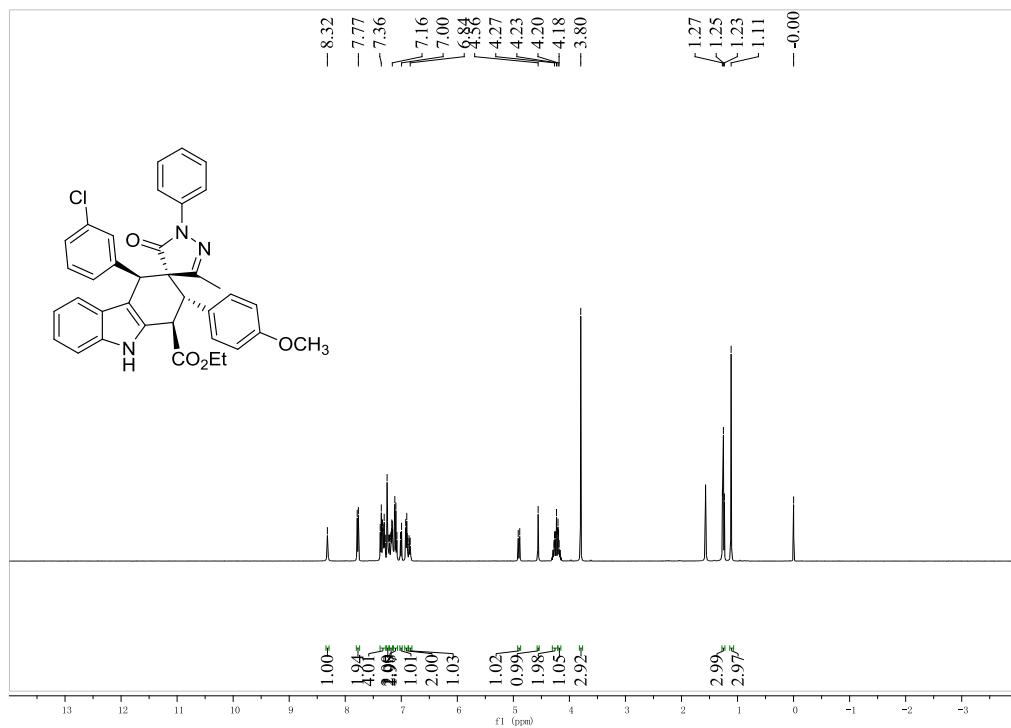
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



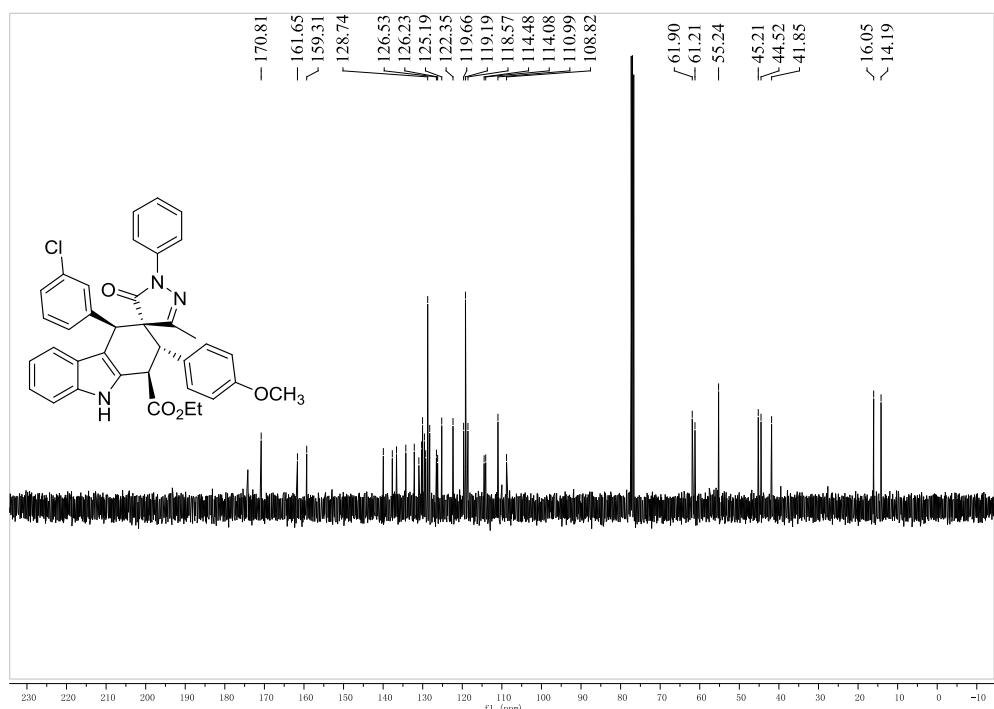
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-4-(3-chlorophenyl)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2',4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1d**) :



<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)

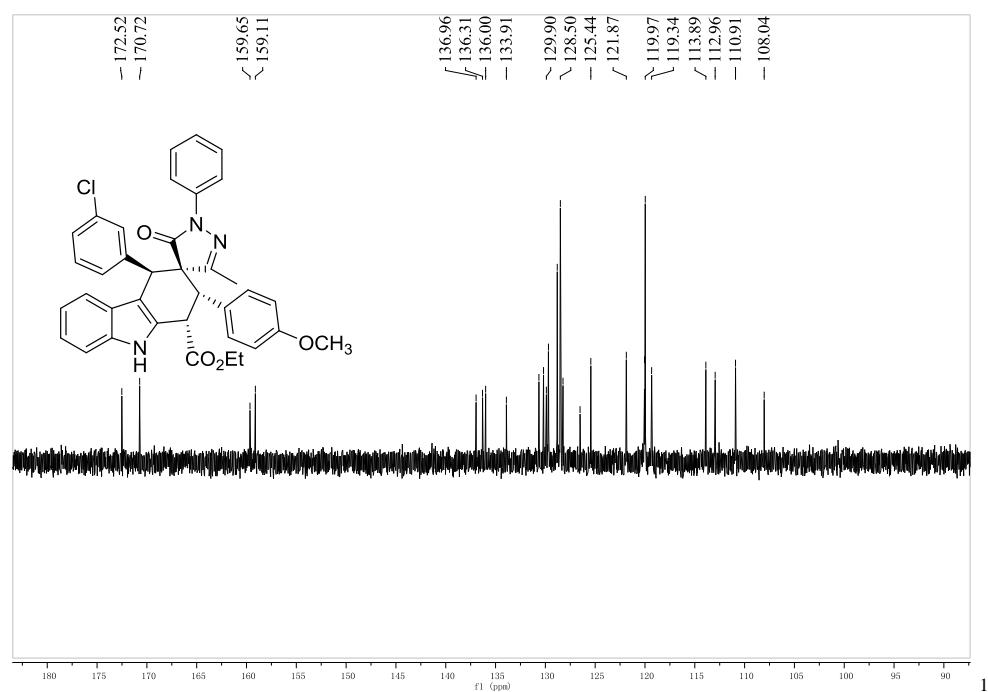
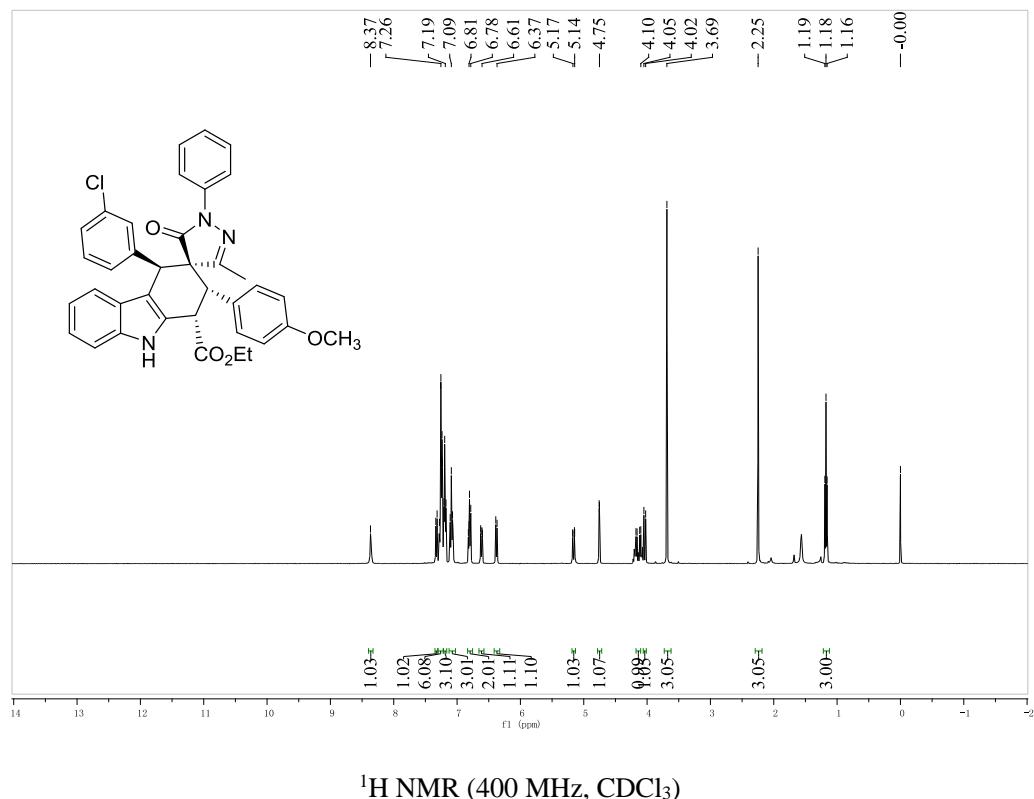


<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

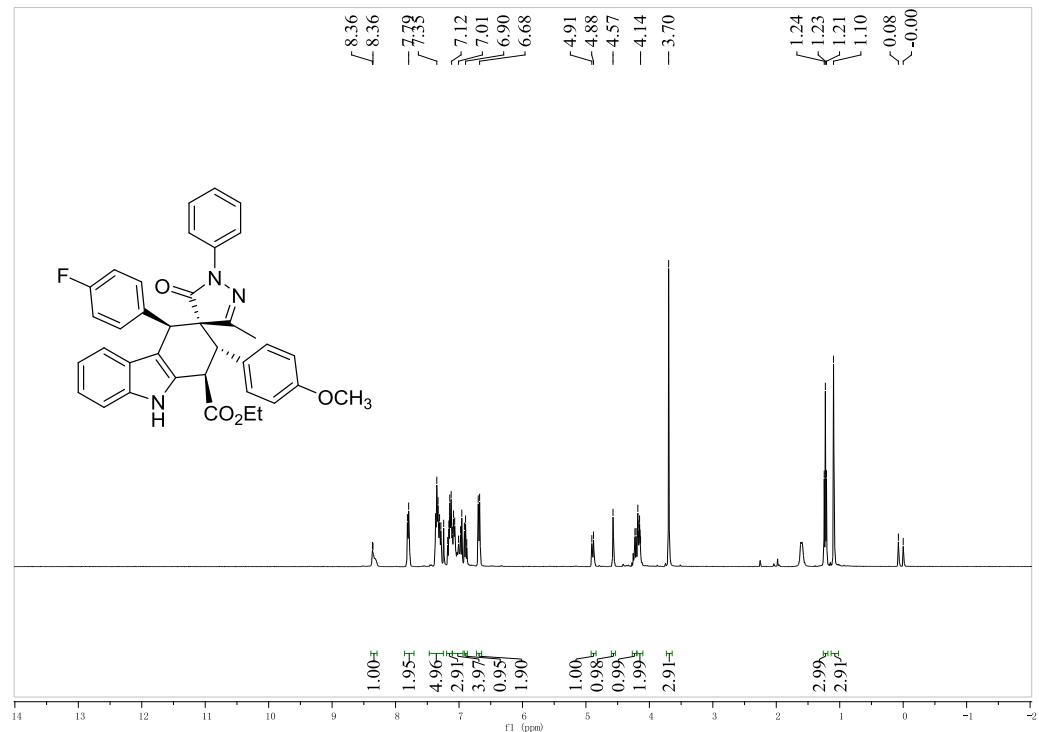
*rel*-(1*S*,2*S*,3*S*,4*R*)-4-(3-chlorophenyl)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,

4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1d'**) :

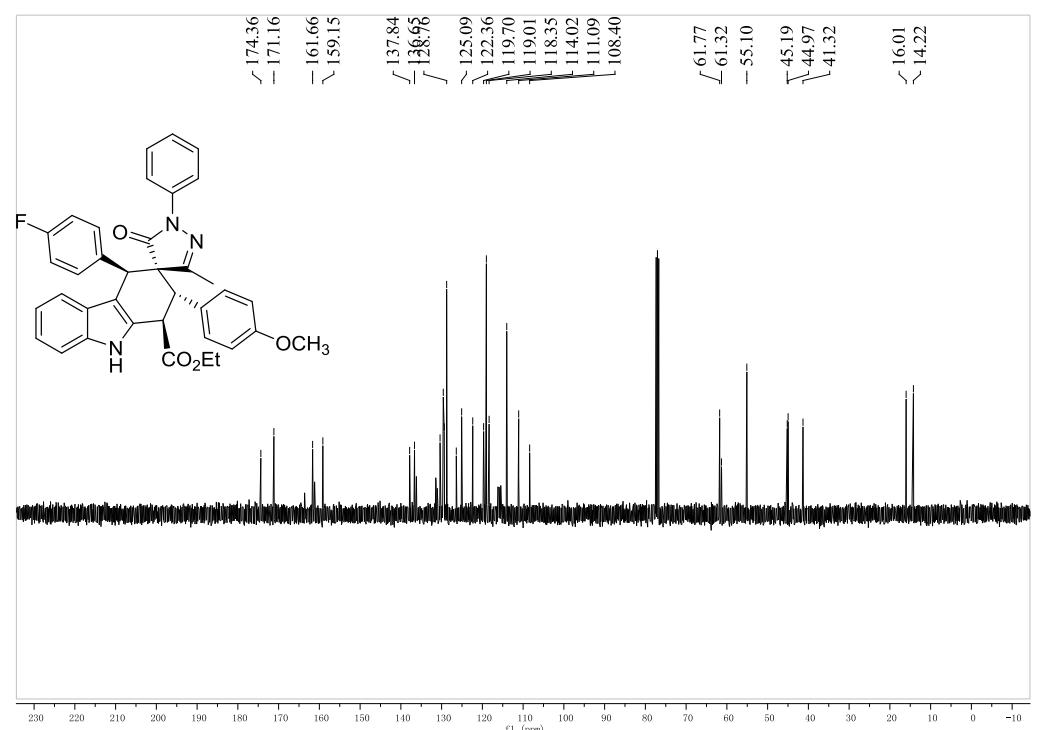


**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-4-(4-fluorophenyl)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1e**) :



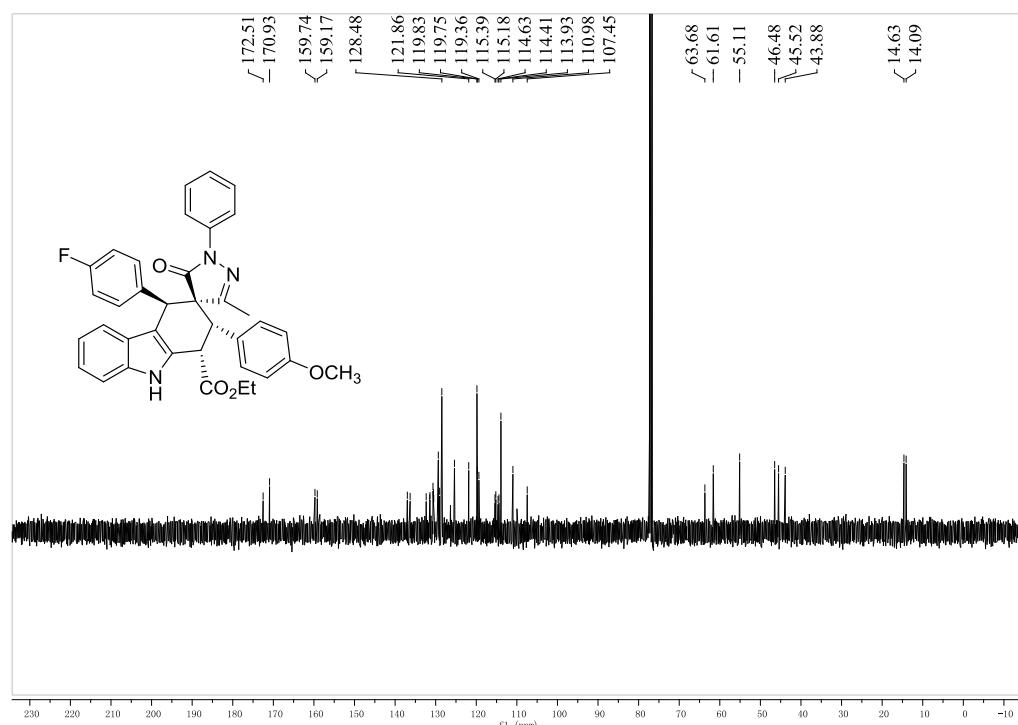
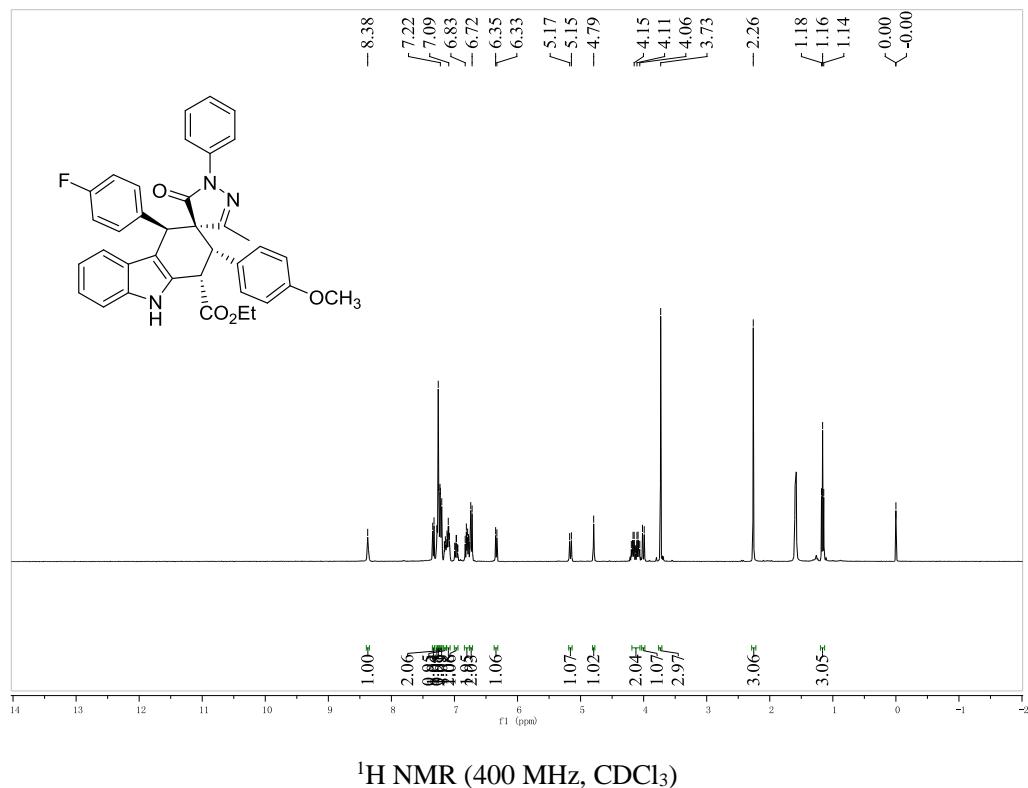
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

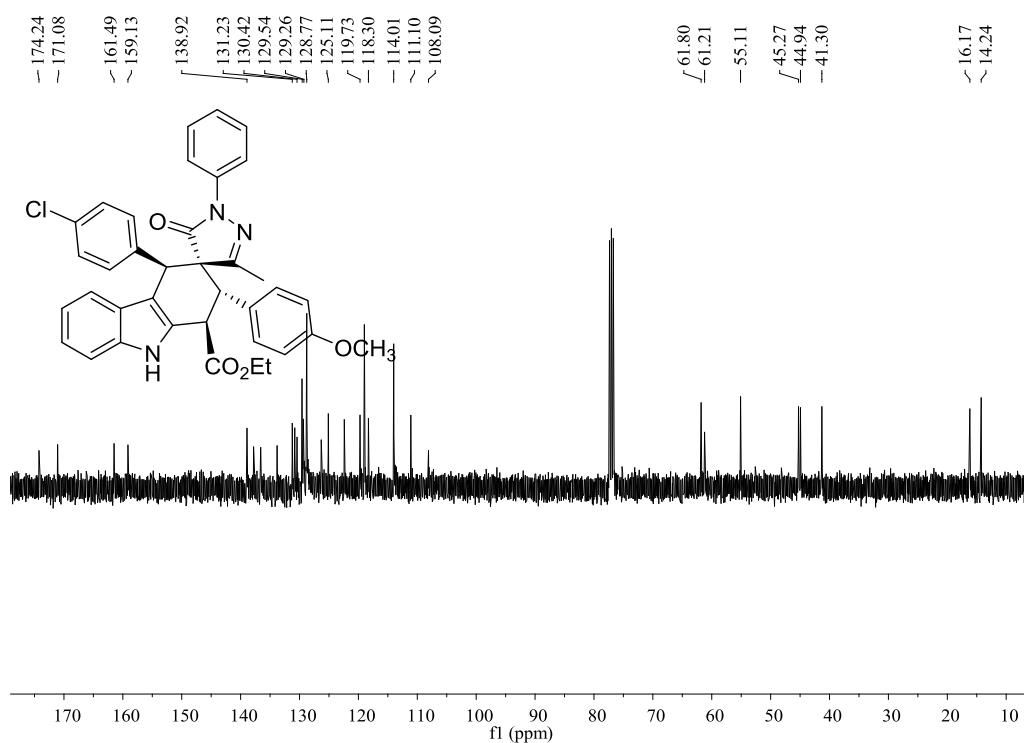
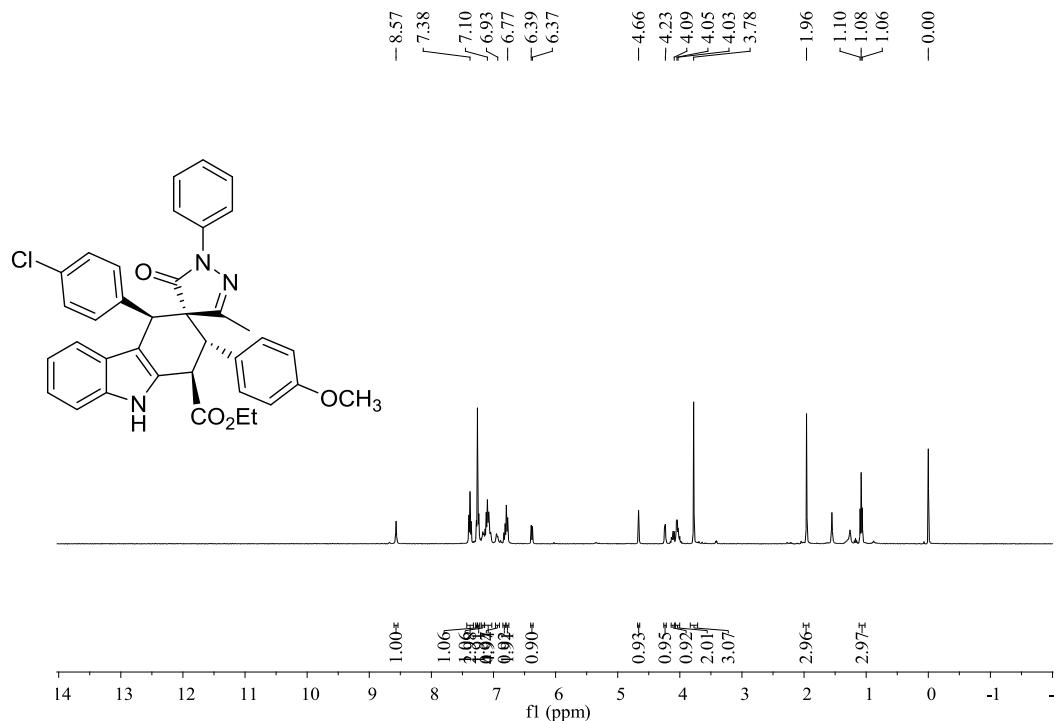
*rel*-(1*S*,2*S*,3*S*,4*R*)-4-(4-fluorophenyl)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1e'**) :



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

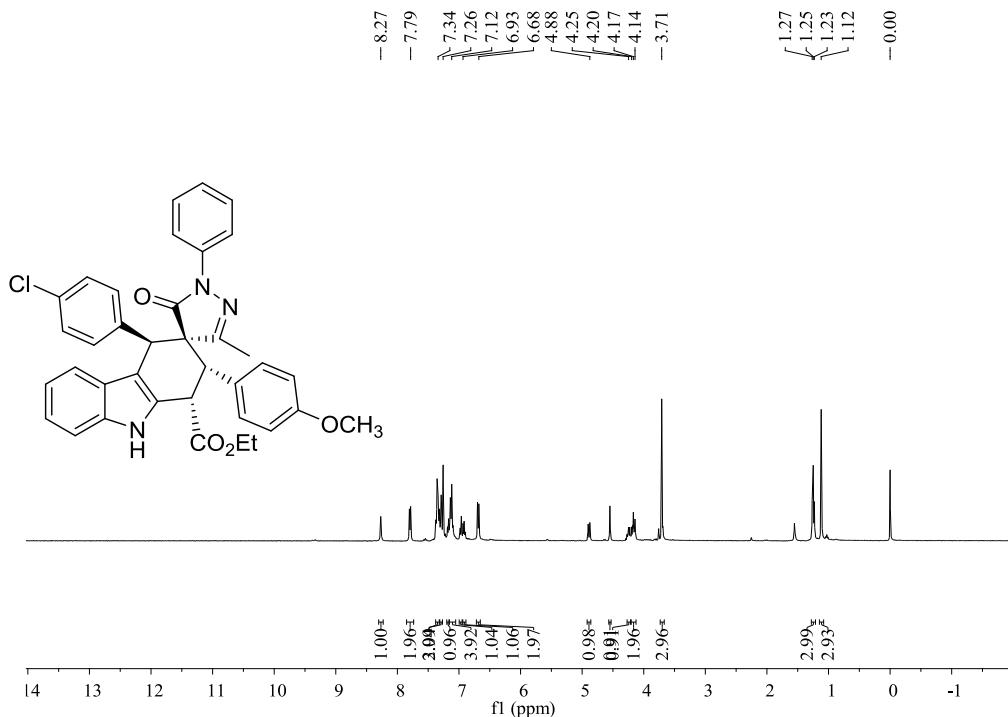
**Ethyl**

**rel-(1R,2S,3R,4R)-4-(4-chlorophenyl)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2',4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1f) :**

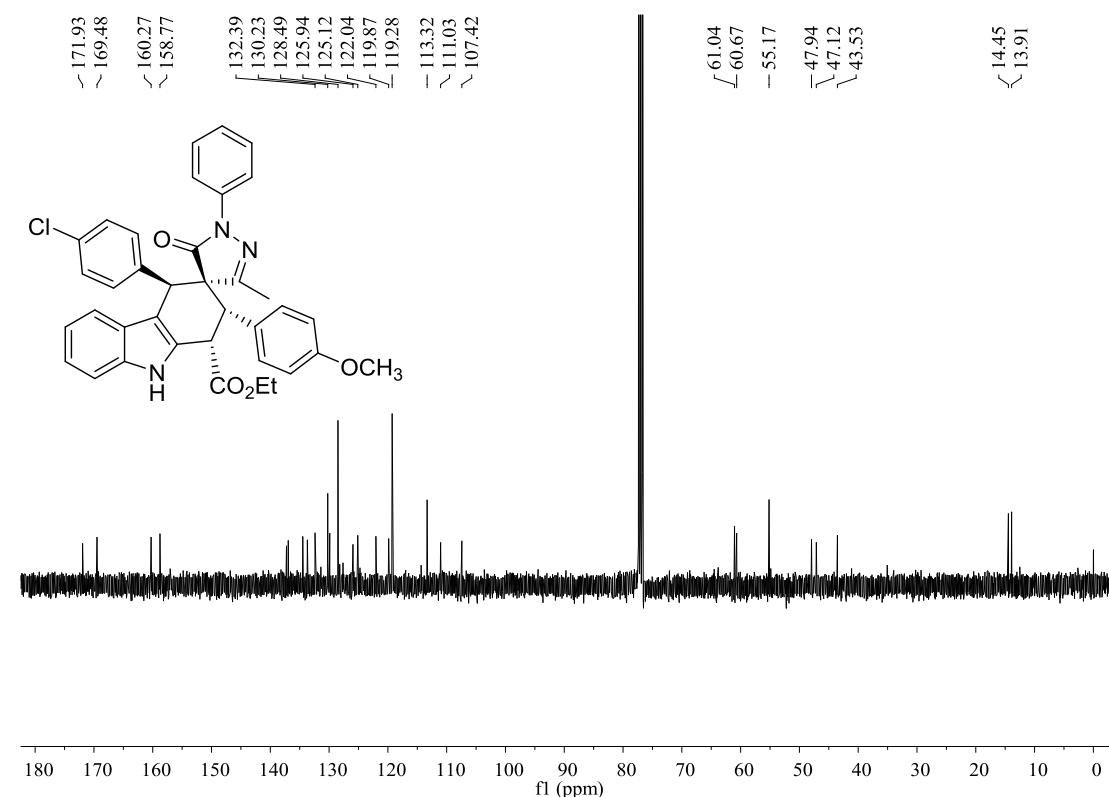


**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-4-(p-tolyl)-1,1',2,4,5',9-he  
xahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1f'**) :



<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)

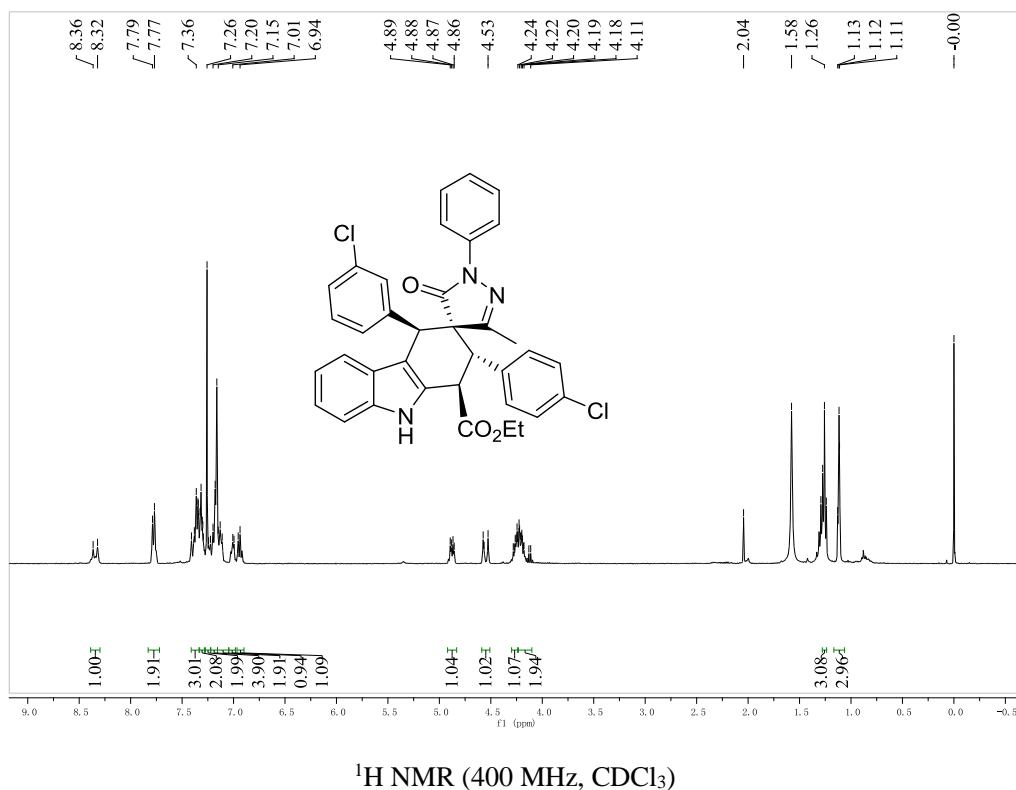


<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

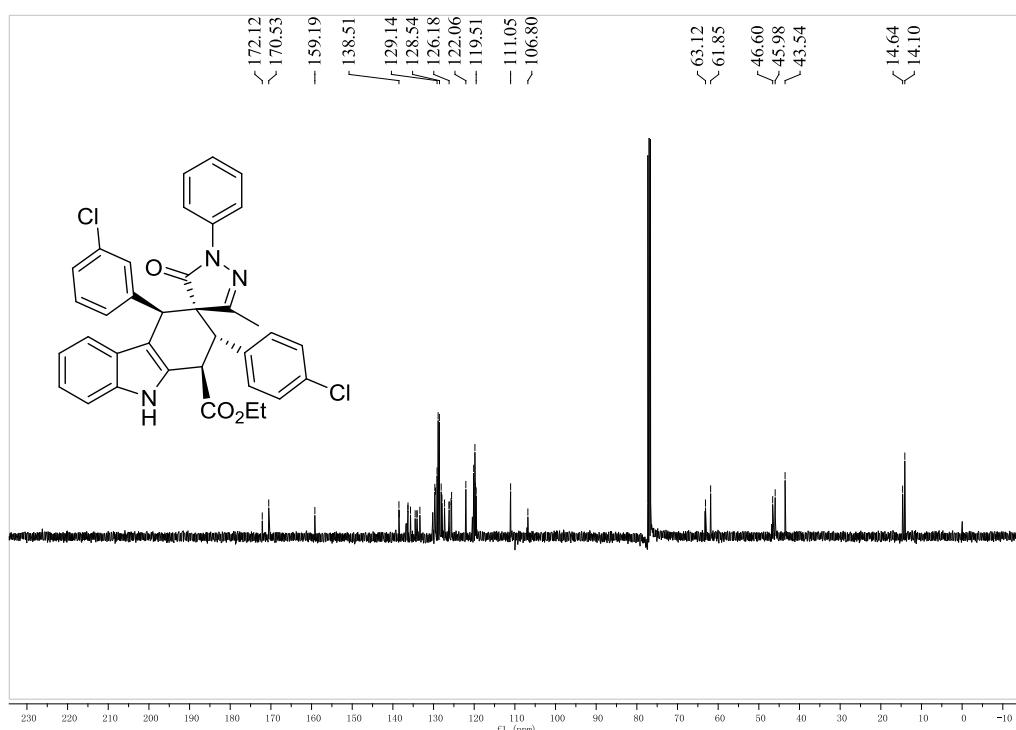
**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-4-(3-chlorophenyl)-2-(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,

5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1g**) :



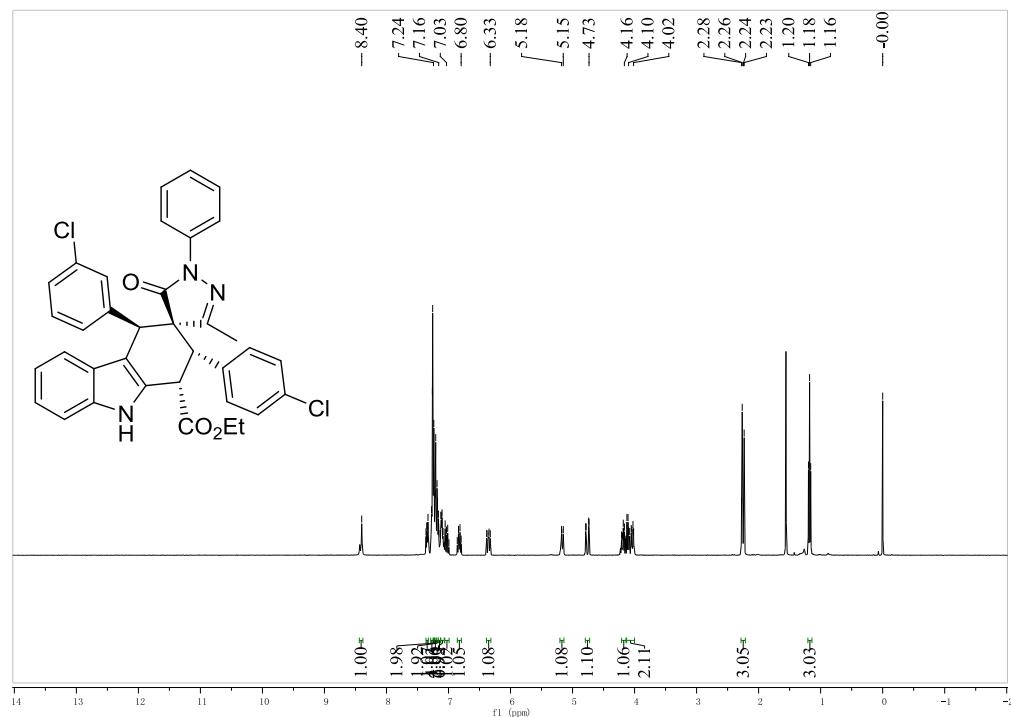
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



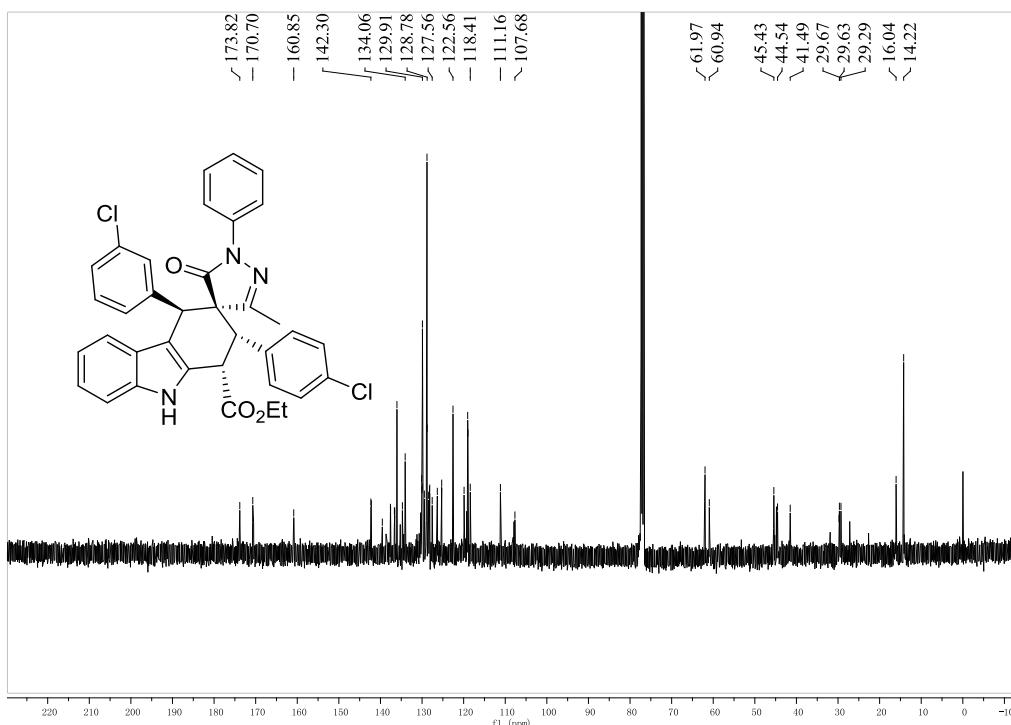
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethy**

**rel-(1S,2S,3S,4R)-4-(3-chlorophenyl)-2-(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1g')** :



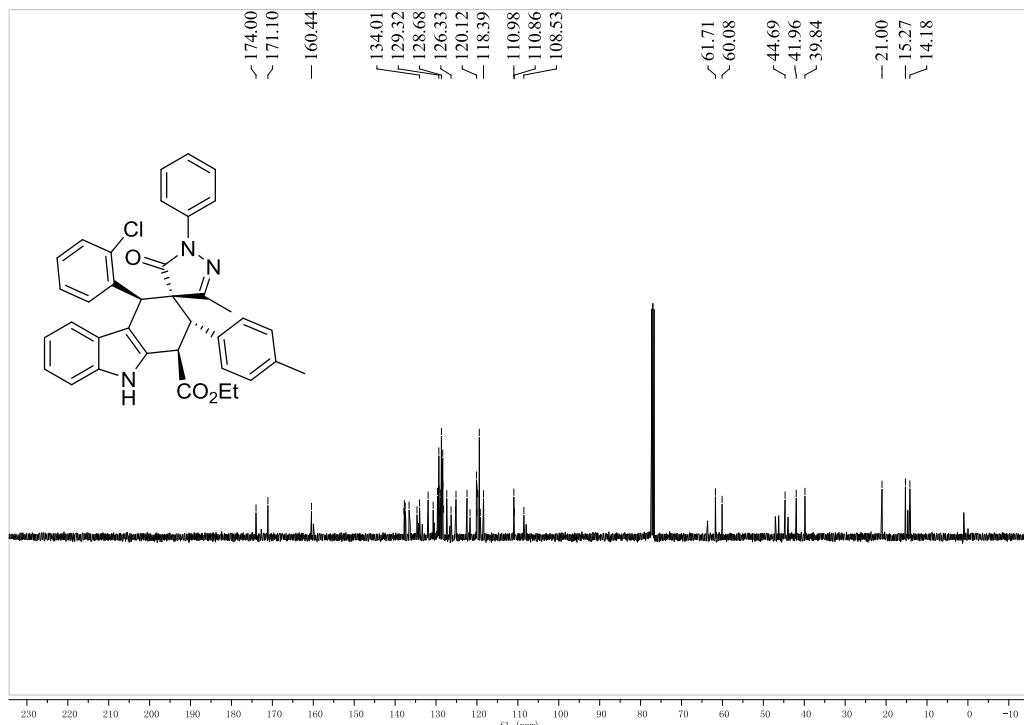
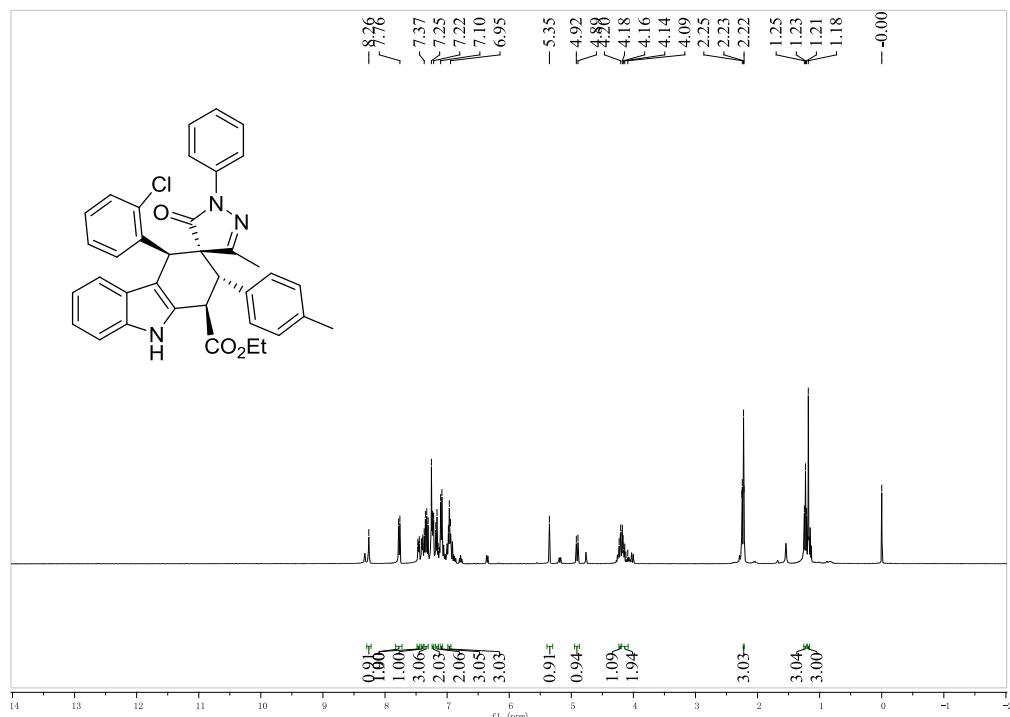
<sup>1</sup>H NMR (400 MHz,  $\text{CDCl}_3$ )



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz,  $\text{CDCl}_3$ )

**Ethyl**

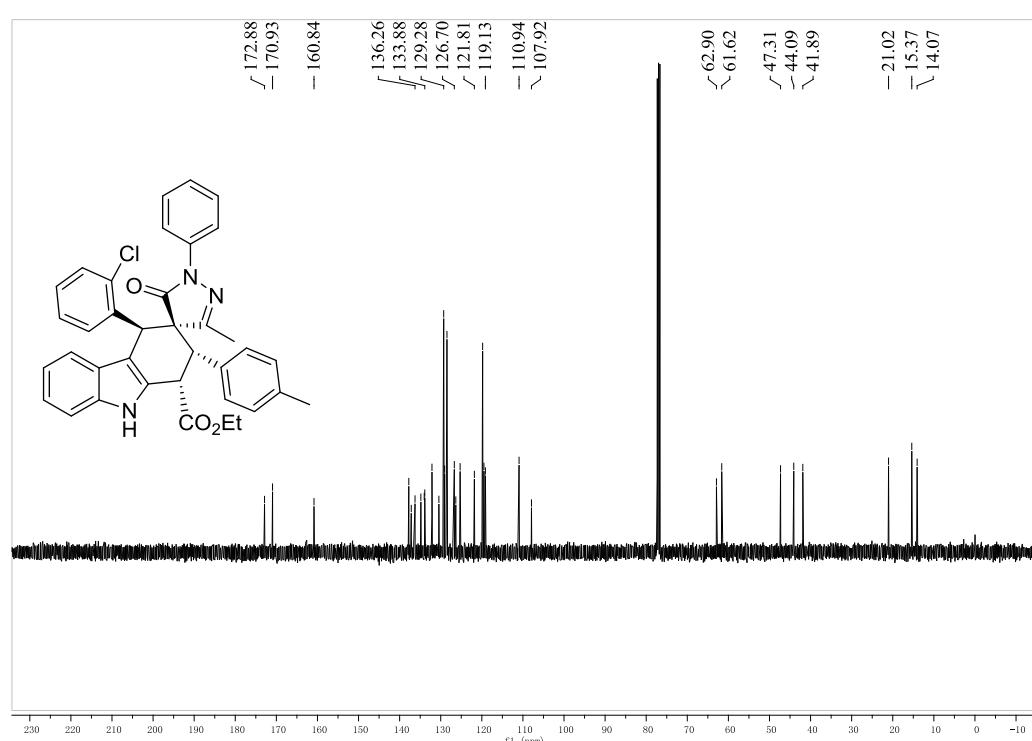
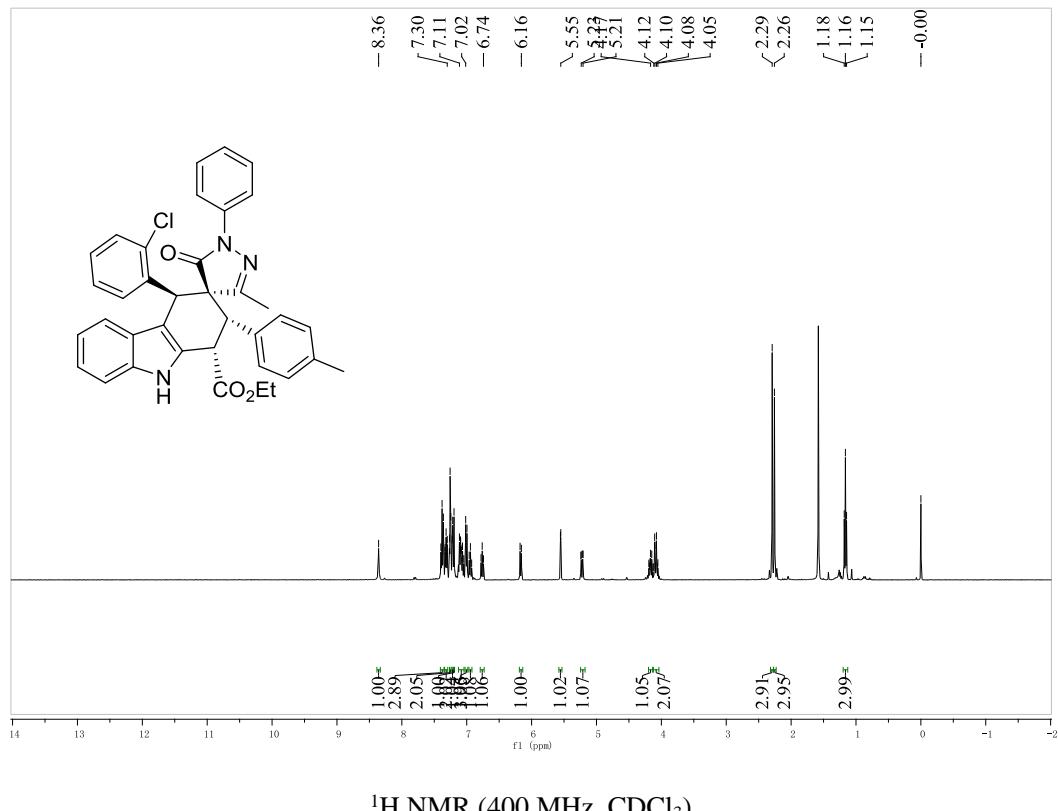
*rel*-(1*R*,2*S*,3*R*,4*R*)-4-(2-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-2-(p-tolyl)-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1h**) :



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

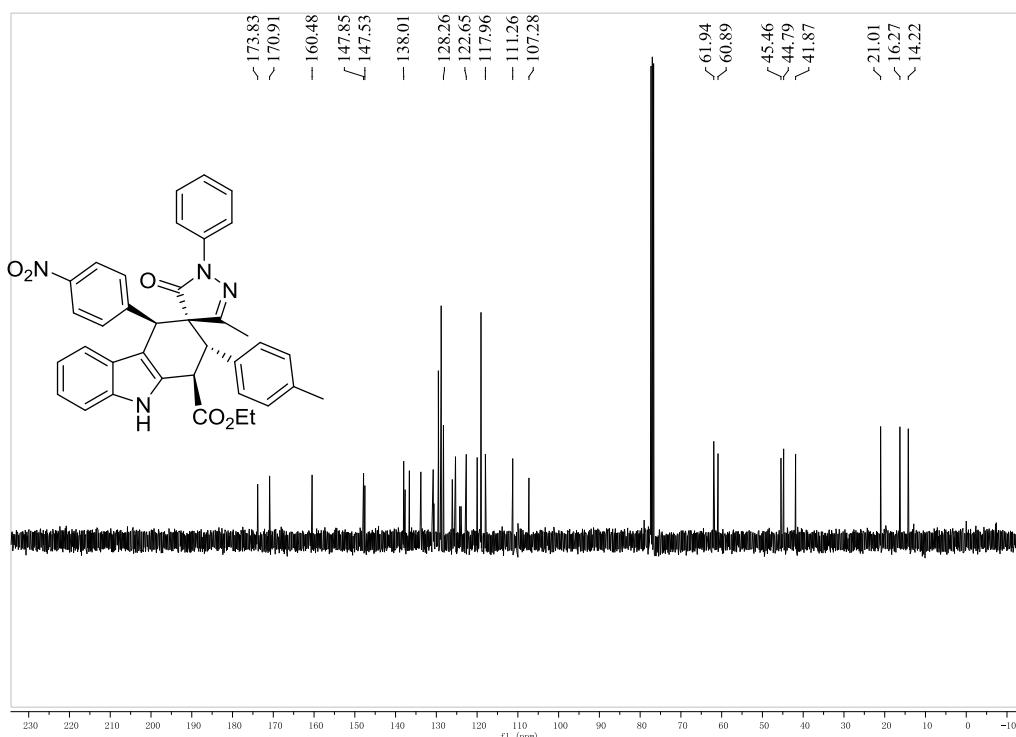
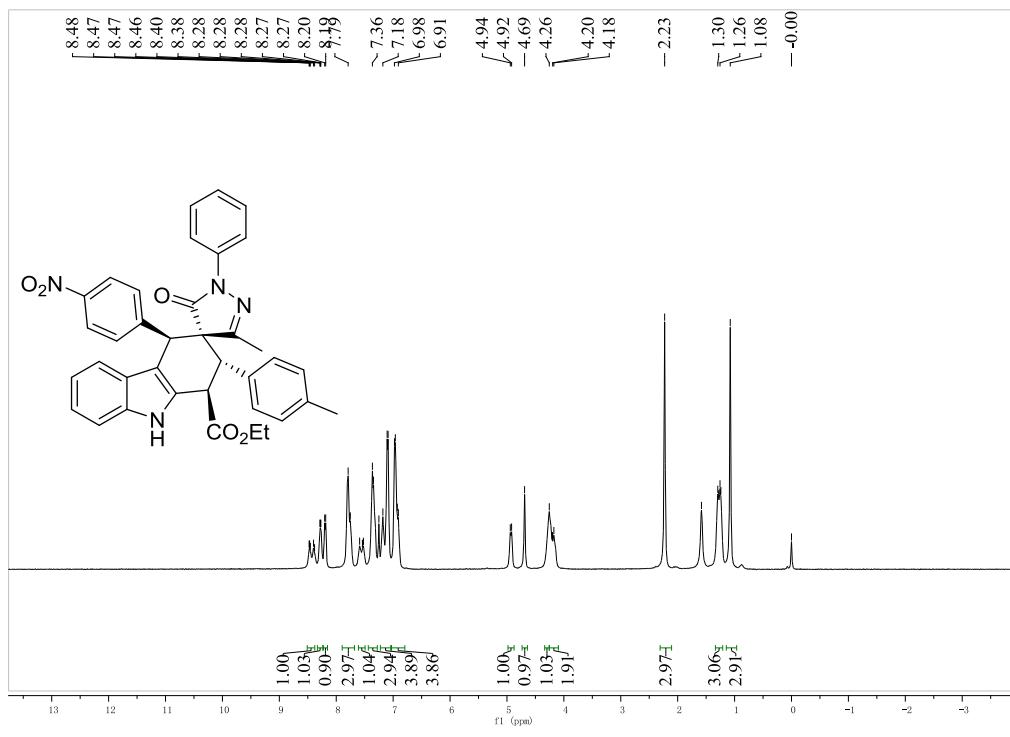
*rel*-(1*S*,2*S*,3*S*,4*R*)-4-(2-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-2-(p-tolyl)-1,1',2,4,5',9-hexa hydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1h'**) :



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

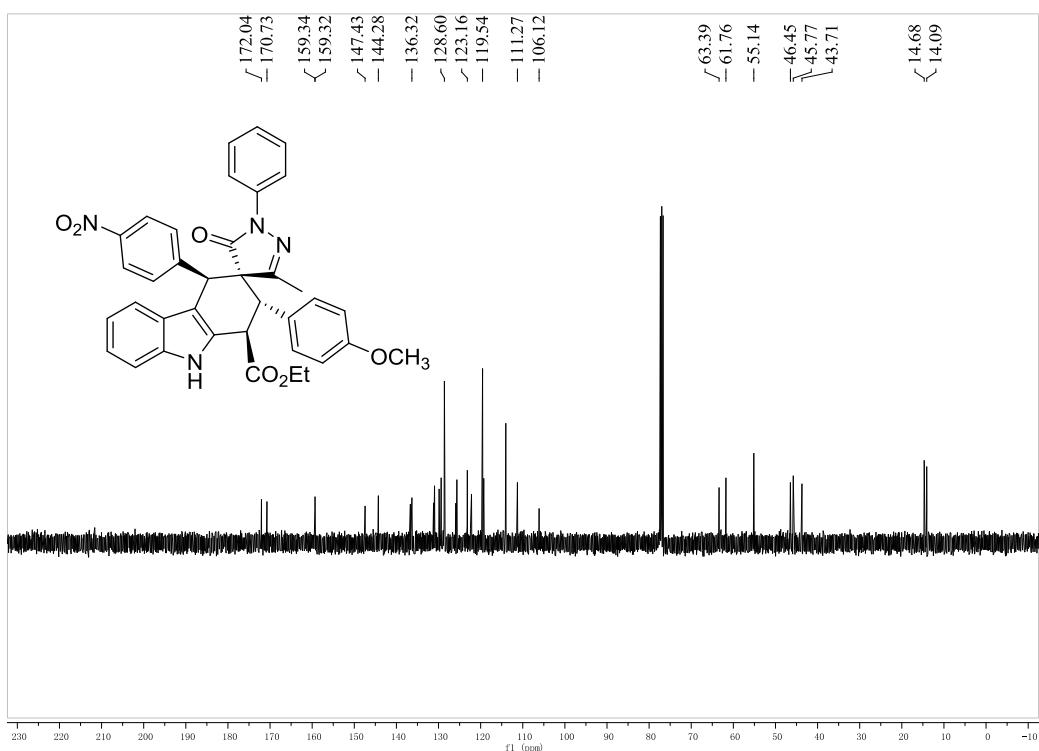
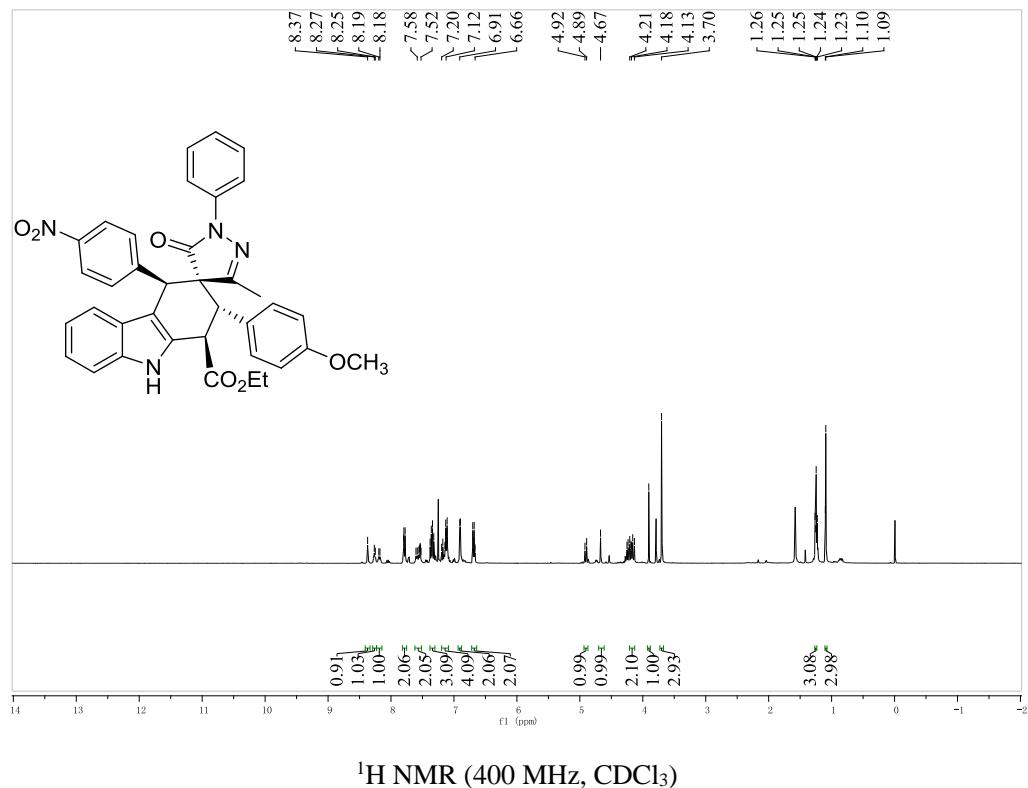
**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-3'-methyl-4-(4-nitrophenyl)-5'-oxo-1'-phenyl-2-(p-tolyl)-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1i**) :



**Ethyl**

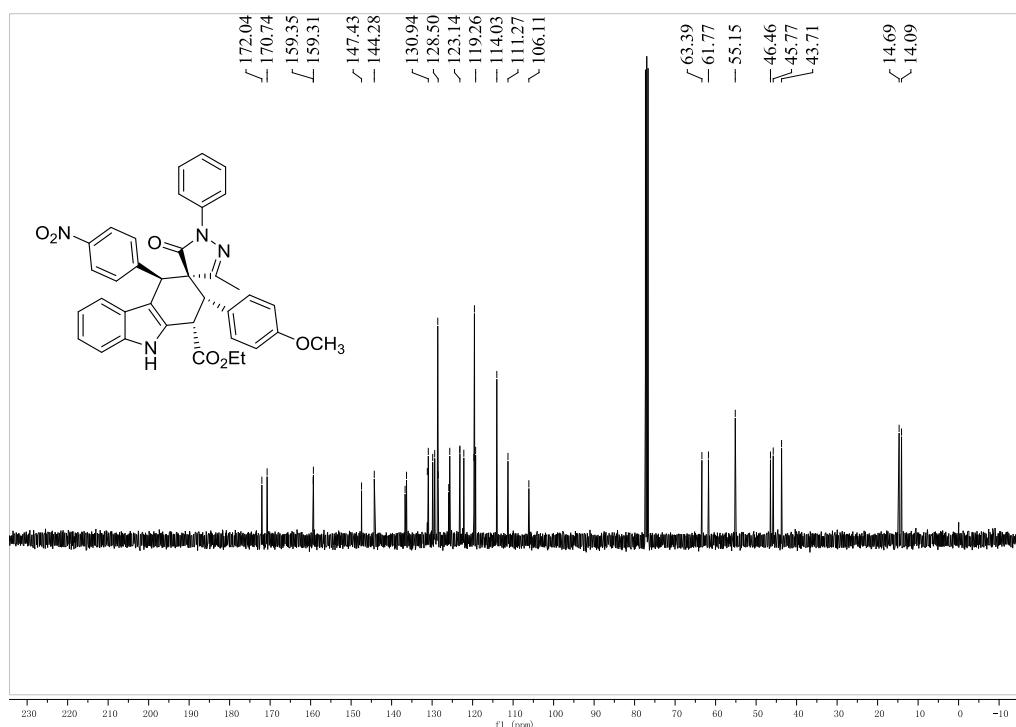
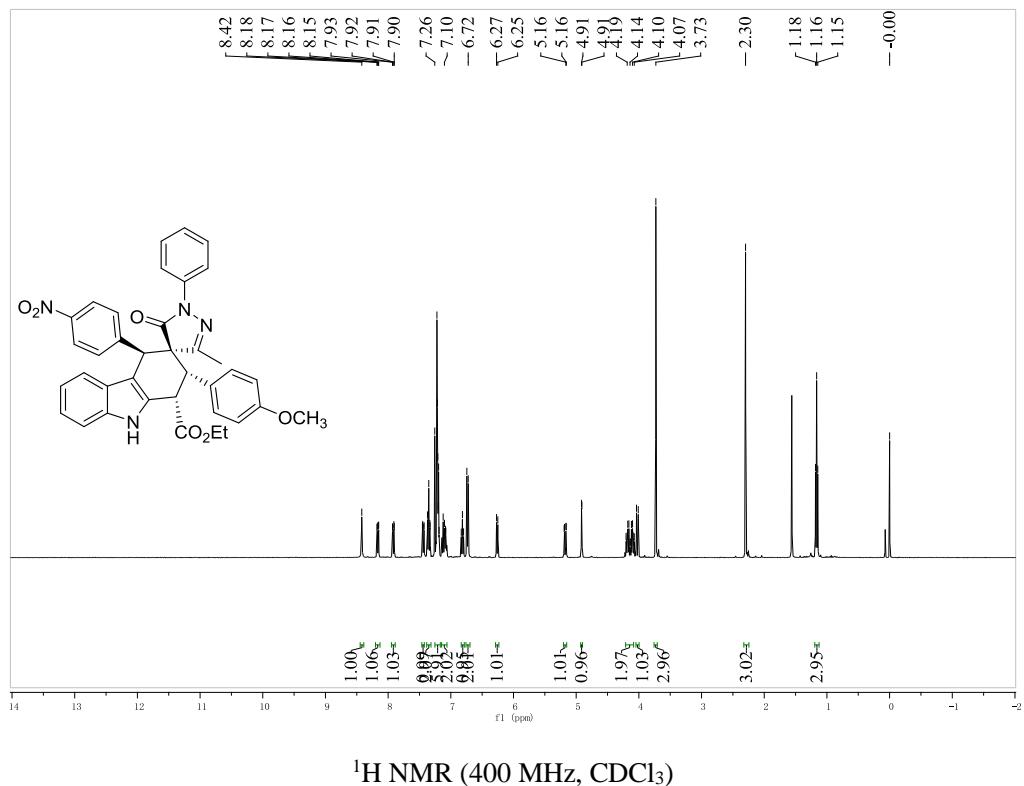
*rel*-(1*R*,2*S*,3*R*,4*R*)-2-(4-methoxyphenyl)-3'-methyl-4-(4-nitrophenyl)-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1j**) :



**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2-(4-methoxyphenyl)-3'-methyl-4-(4-nitrophenyl)-5'-oxo-1'-phenyl-1,1',2,4,

5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1j'**) :

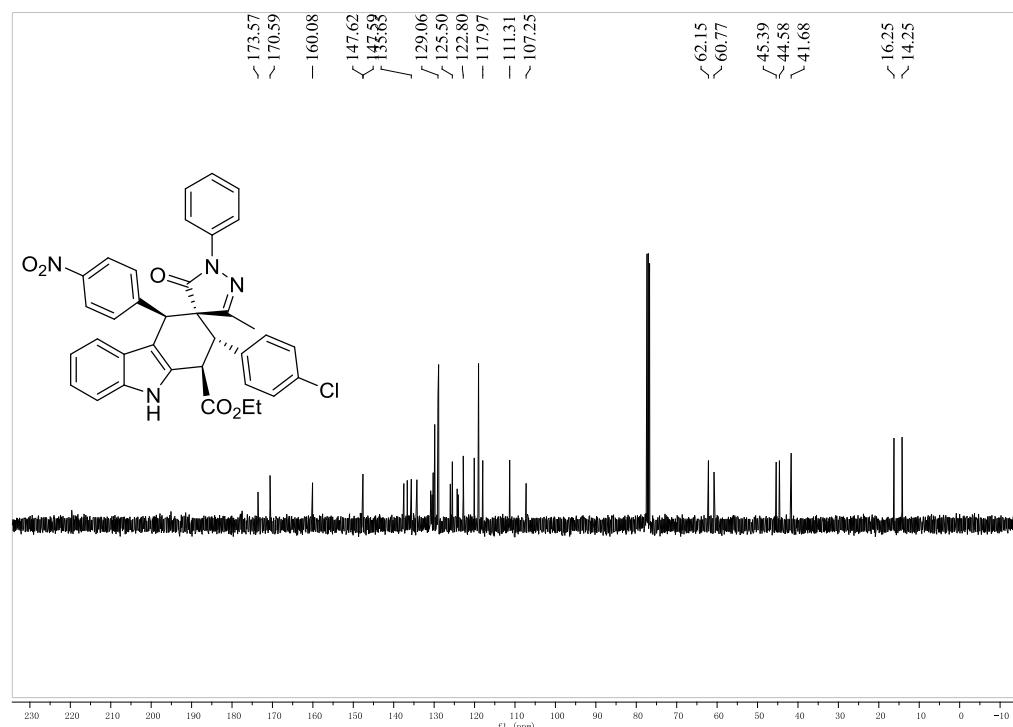
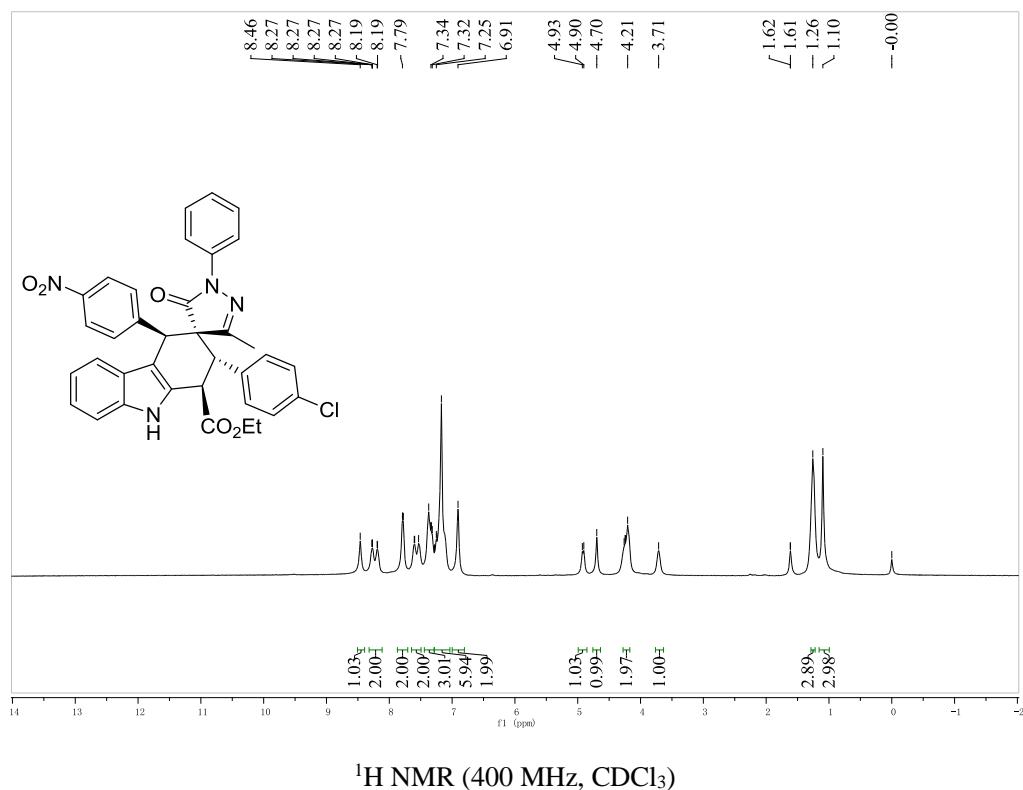


<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

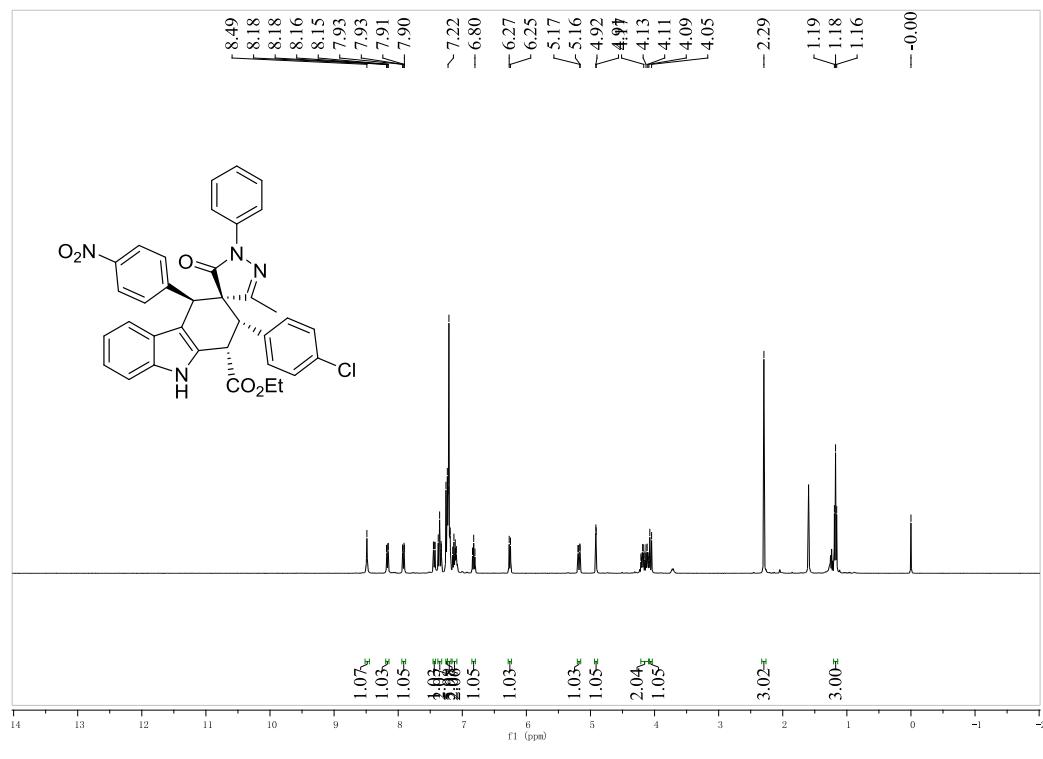
*rel*-(1*R*,2*S*,3*R*,4*R*)-2-(4-chlorophenyl)-3'-methyl-4-(4-nitrophenyl)-5'-oxo-1'-phenyl-1,1',2,4,5'

,9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1k**) :

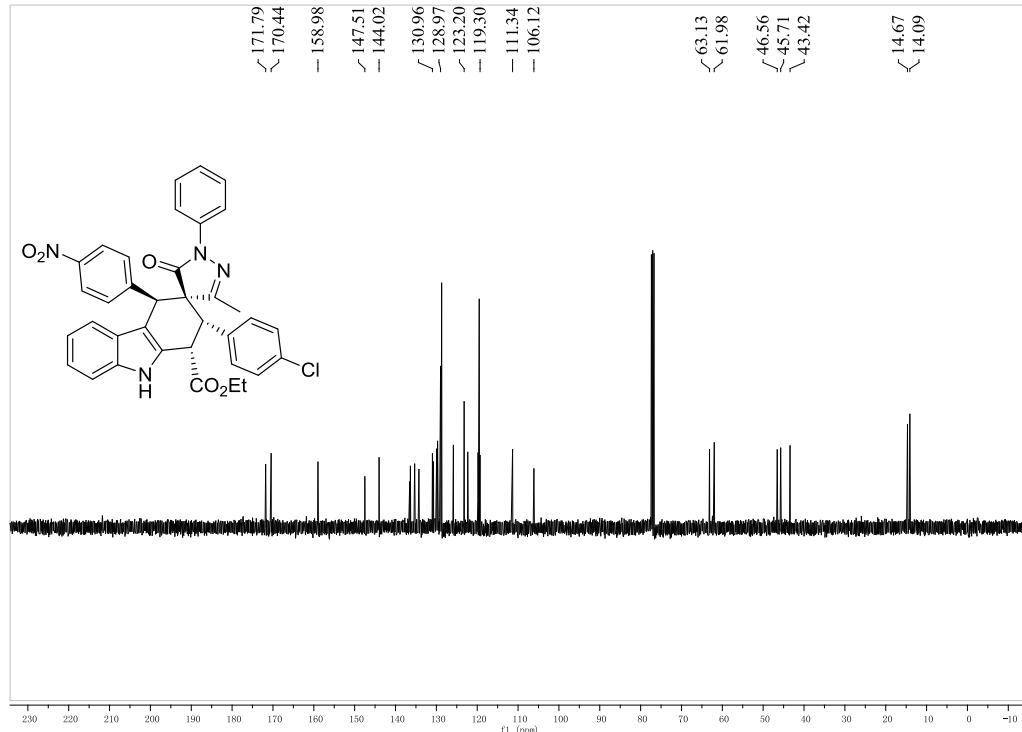


**Ethyl**

**rel-(1S,2S,3S,4R)-2-(4-chlorophenyl)-3'-methyl-4-(4-nitrophenyl)-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1k')** :



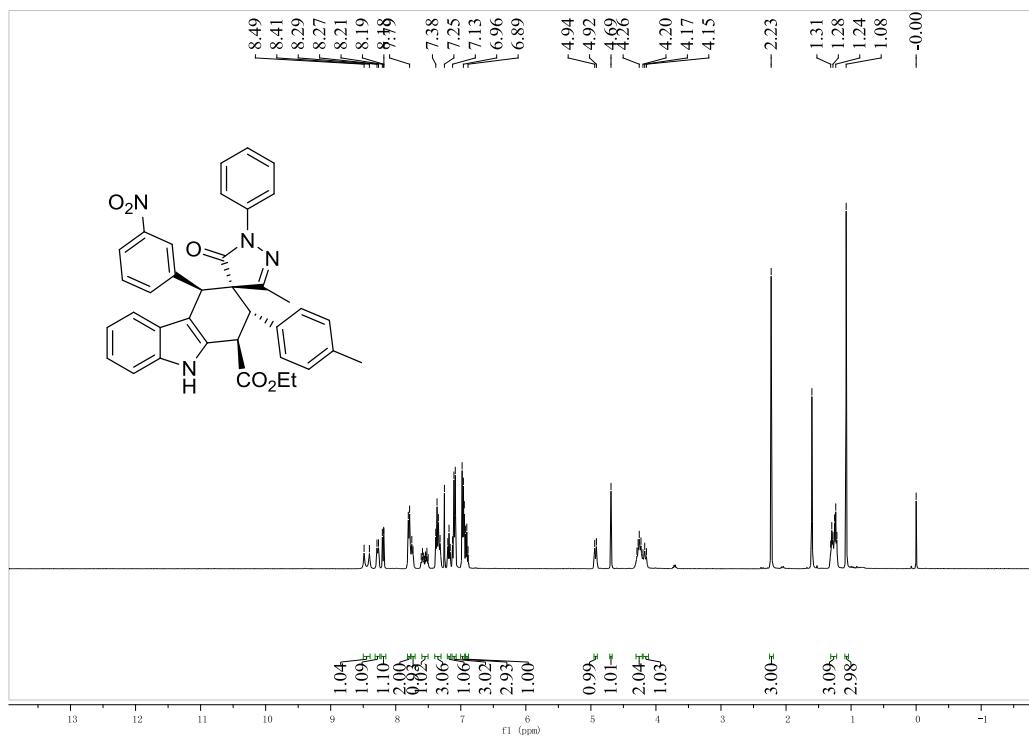
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



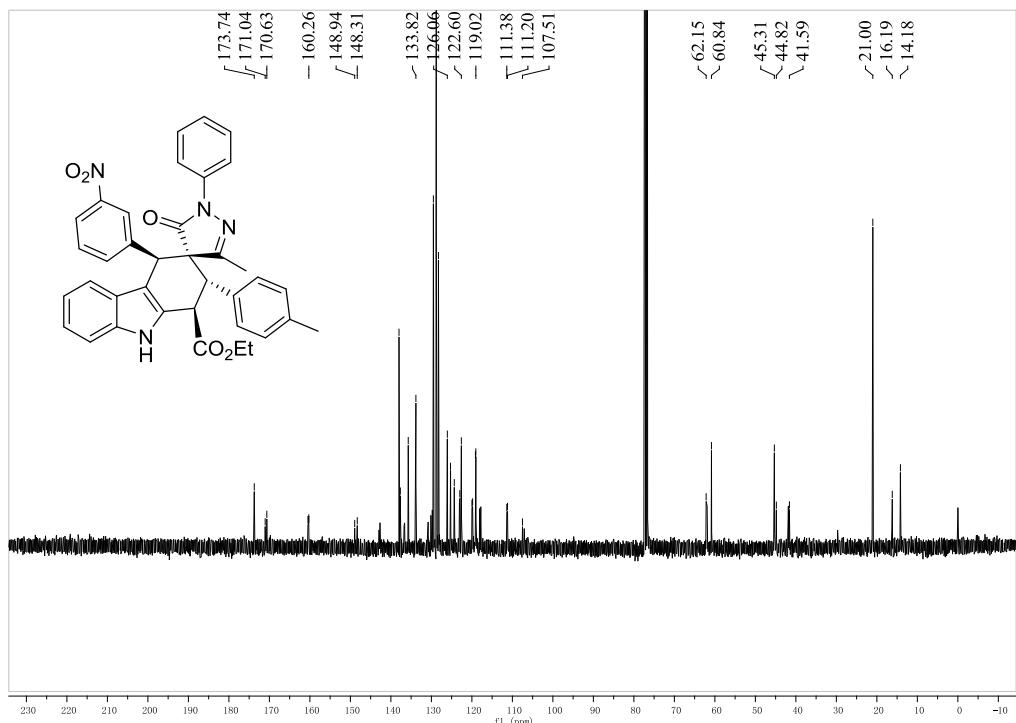
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-3'-methyl-4-(3-nitrophenyl)-5'-oxo-1'-phenyl-2-(p-tolyl)-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1l**) :



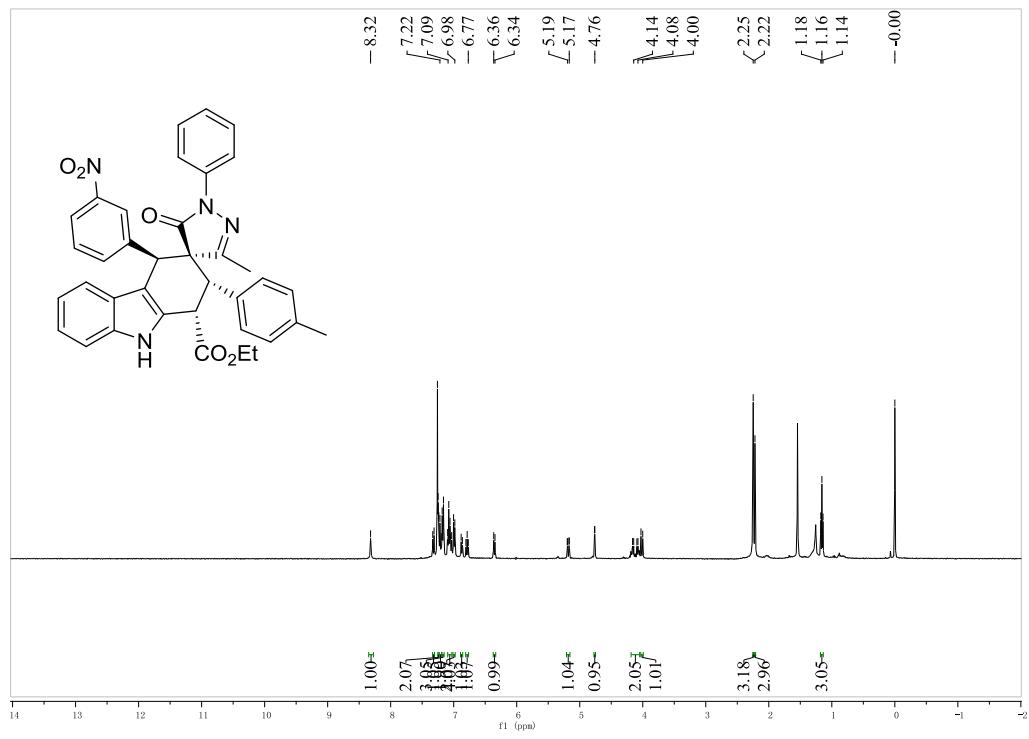
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



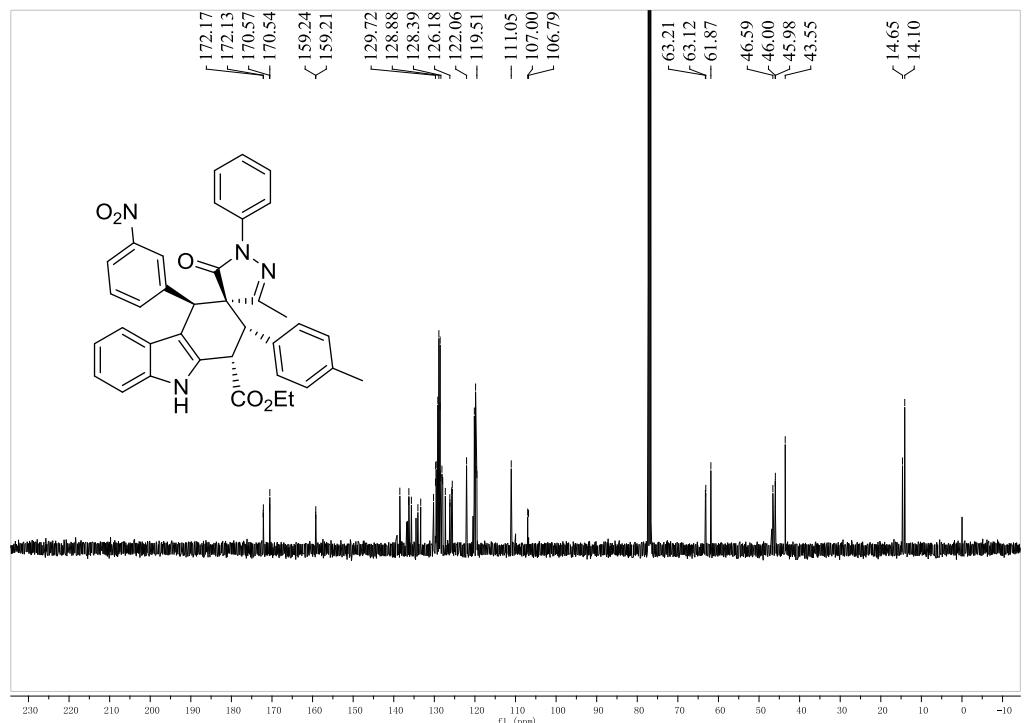
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-3'-methyl-4-(3-nitrophenyl)-5'-oxo-1'-phenyl-2-(p-tolyl)-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1l') :



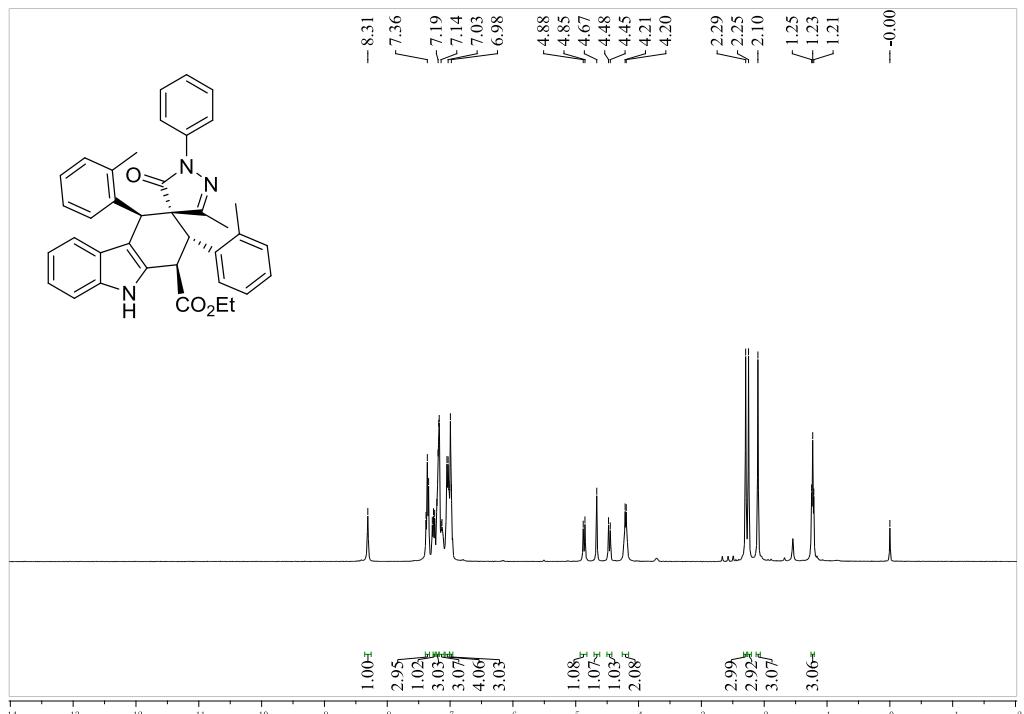
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



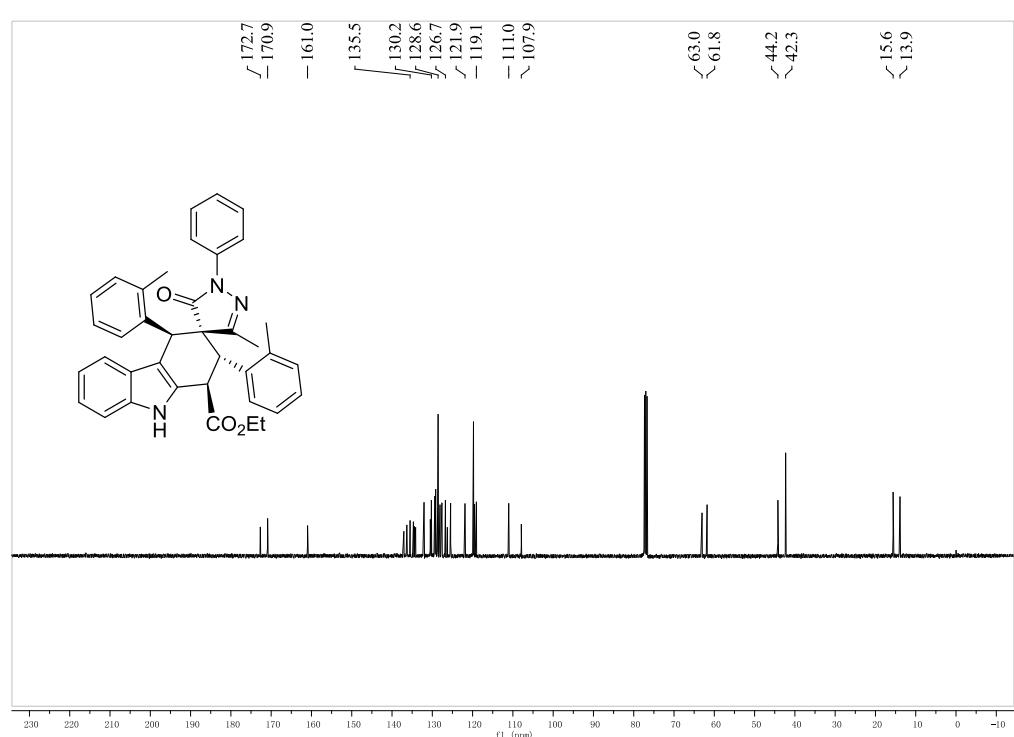
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

***rel*-(1*R*,2*S*,3*R*,4*R*)-3'-methyl-5'-oxo-1'-phenyl-2,4-di-*o*-tolyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1m) :**



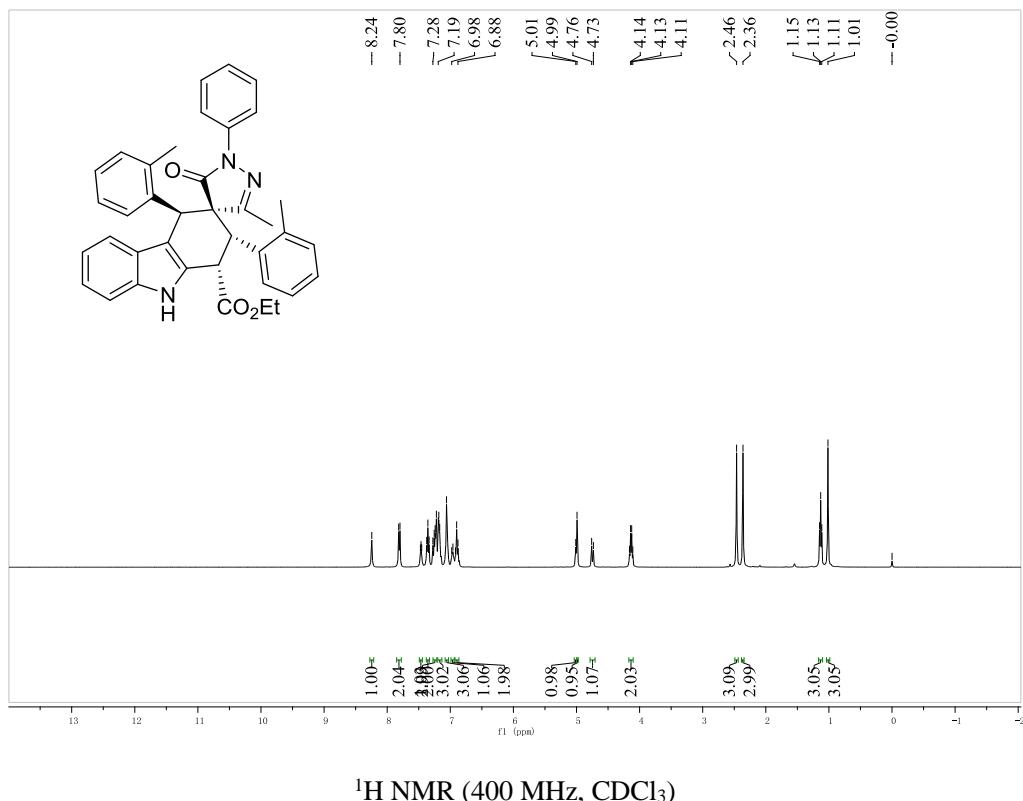
<sup>1</sup>H NMR (400 MHz,  $\text{CDCl}_3$ )



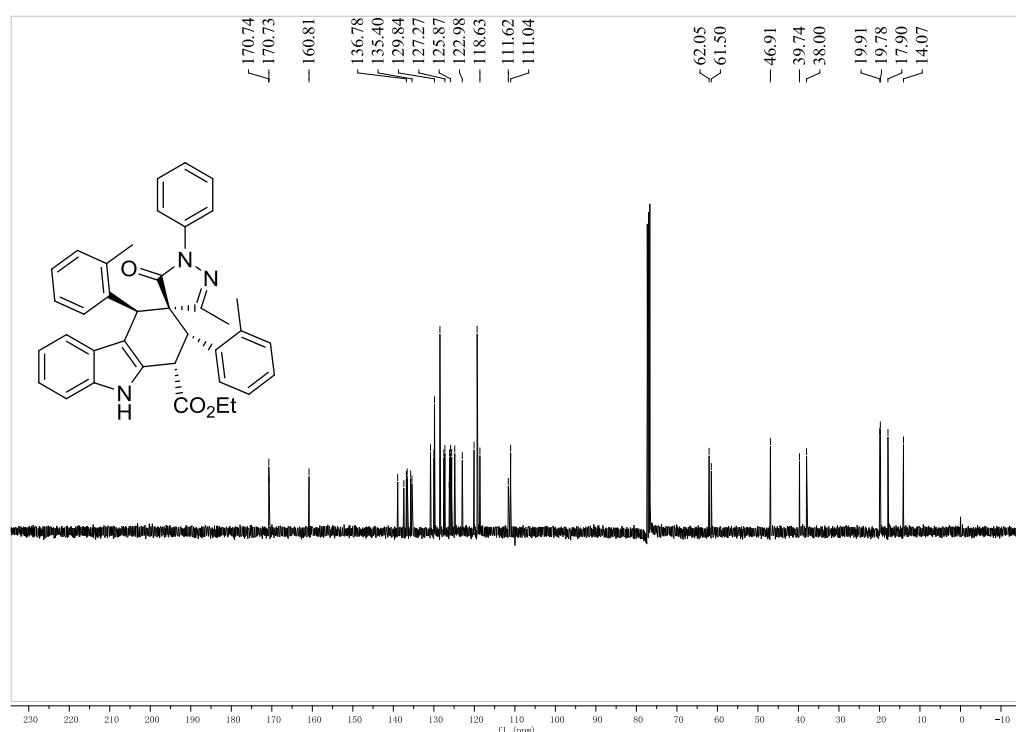
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz,  $\text{CDCl}_3$ )

**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-3'-methyl-5'-oxo-1'-phenyl-2,4-di-*o*-tolyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1m'**) :



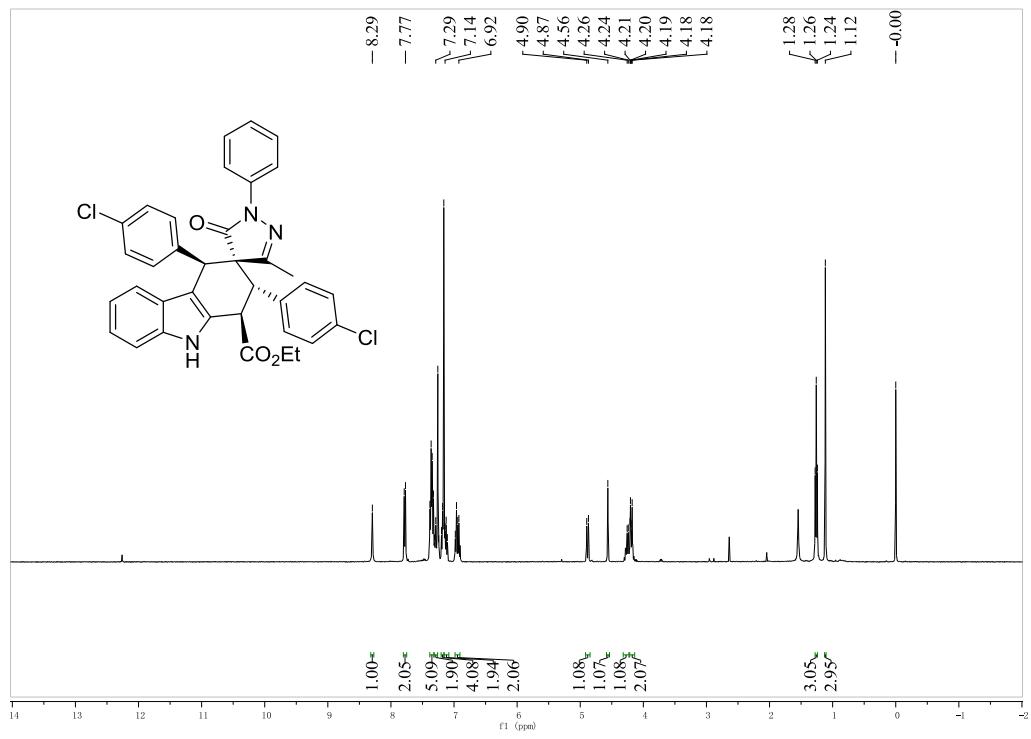
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



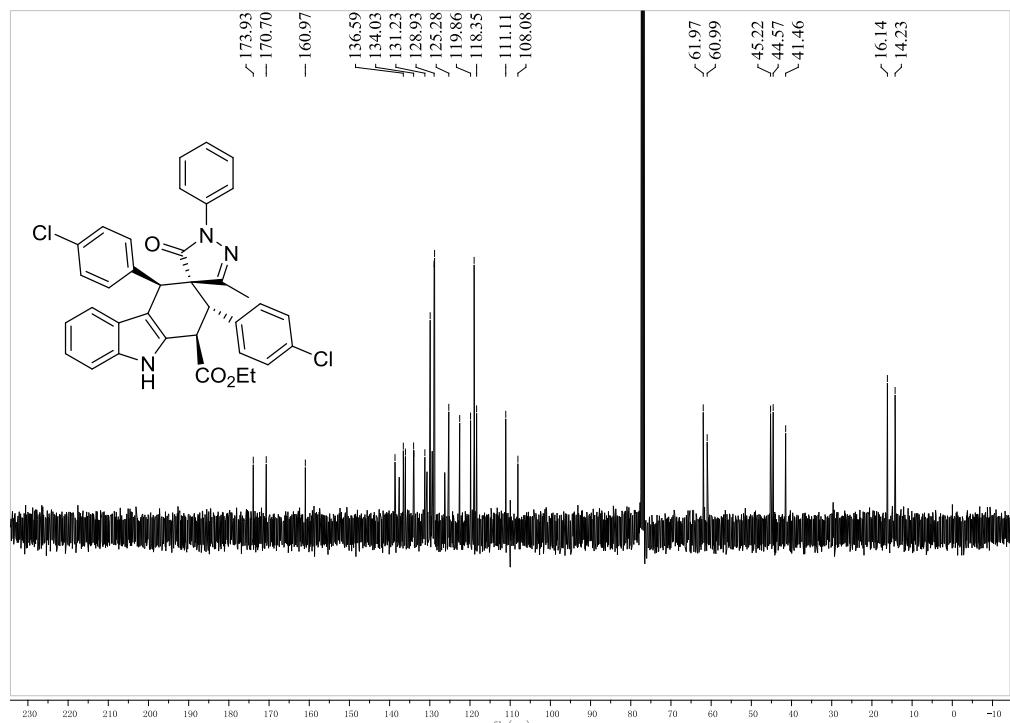
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-2,4-bis(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydro spiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1n**) :



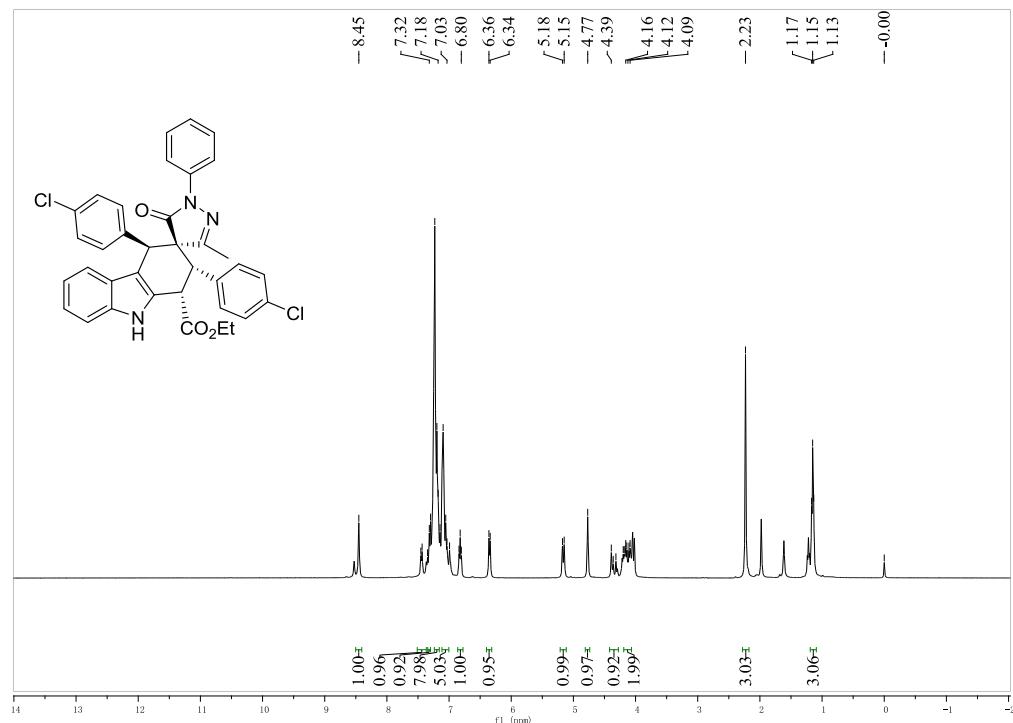
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



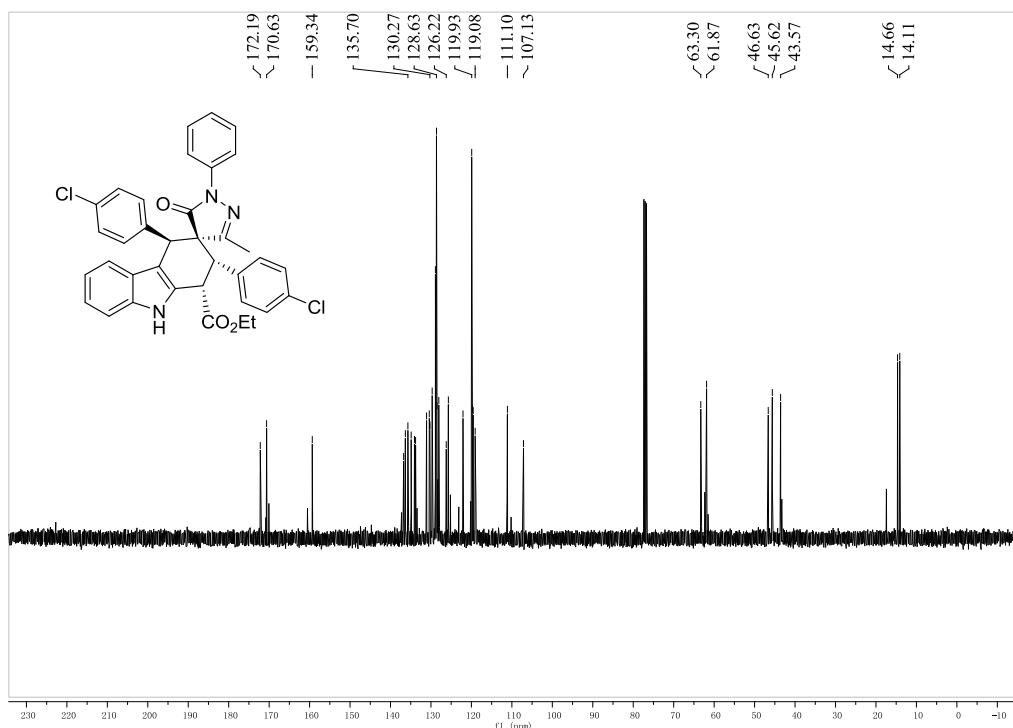
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2,4-bis(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydros  
piro[carbazole-3,4'-pyrazole]-1-carboxylate (**1n'**) :



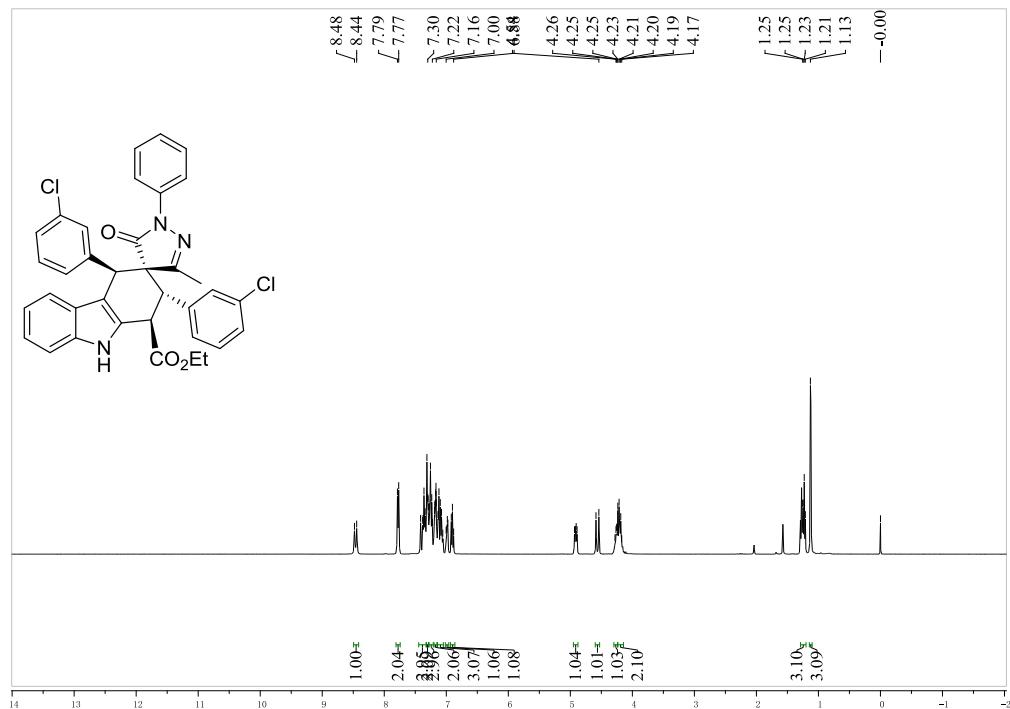
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



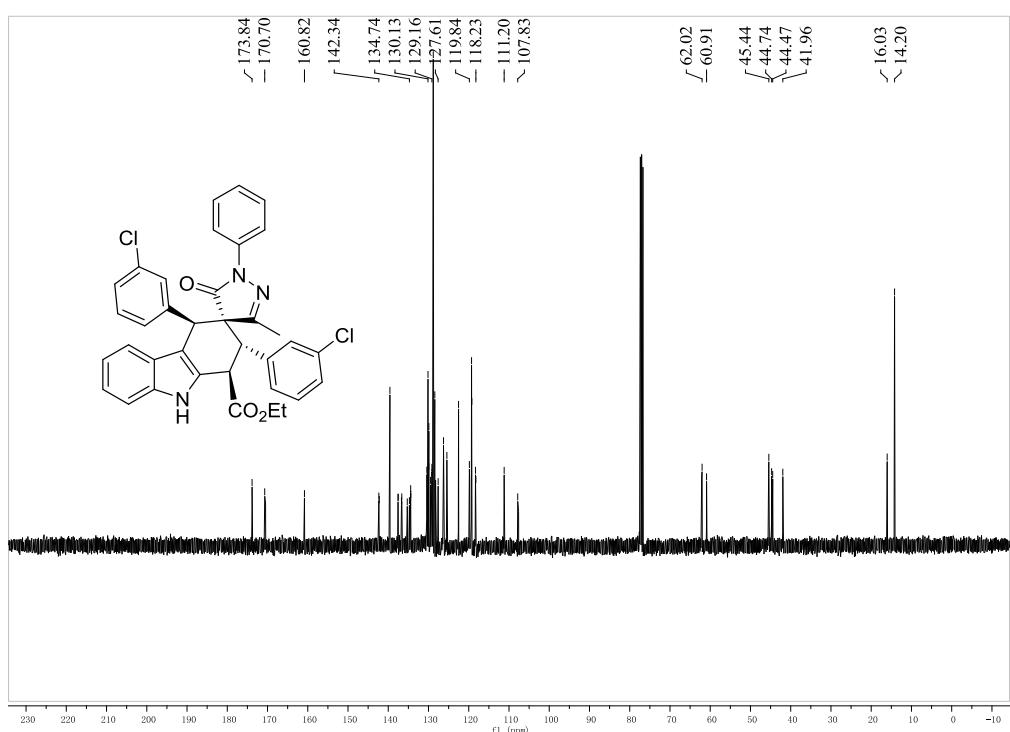
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-2,4-bis(3-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydro spiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1o**) :



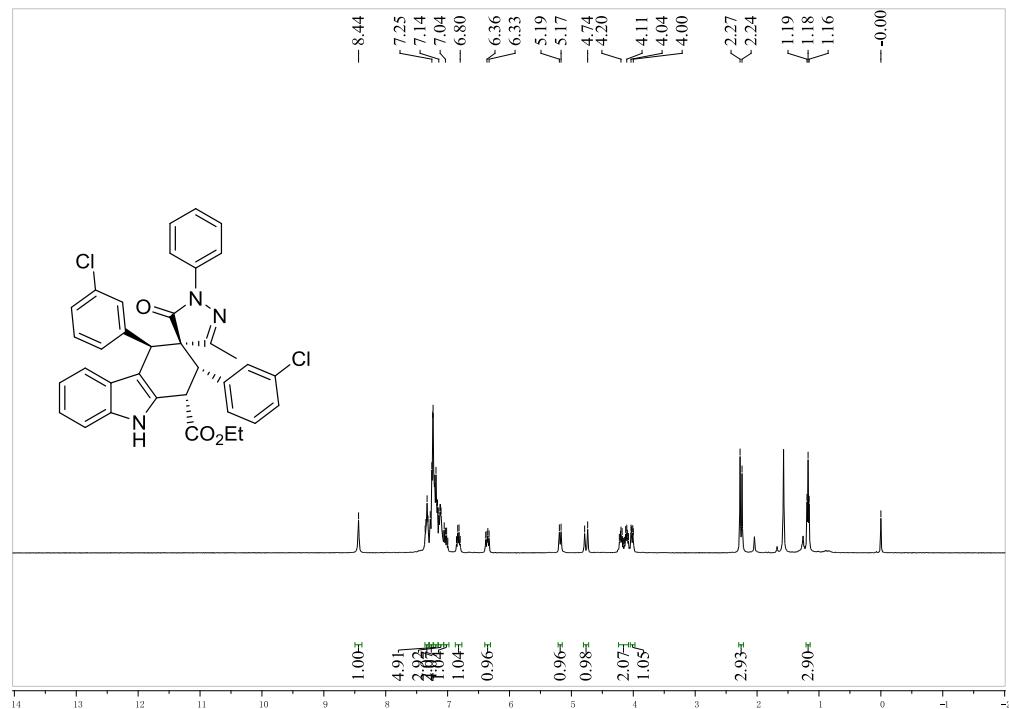
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



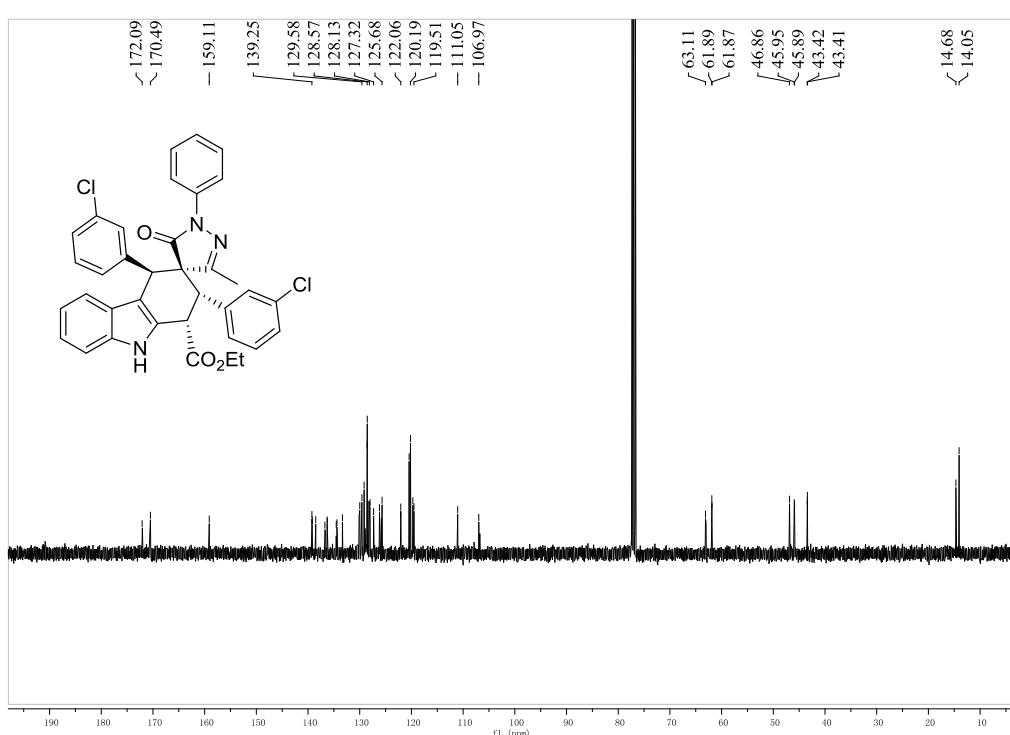
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2,4-bis(3-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydros  
piro[carbazole-3,4'-pyrazole]-1-carboxylate (**1o'**) :



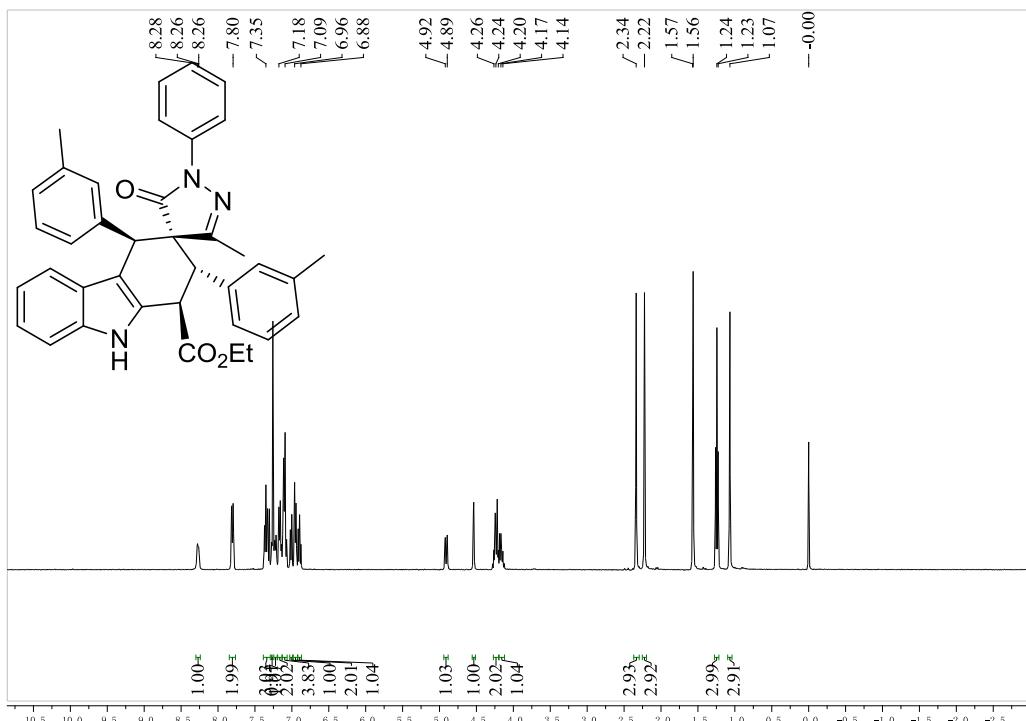
<sup>1</sup>H NMR (400 MHz,  $\text{CDCl}_3$ )



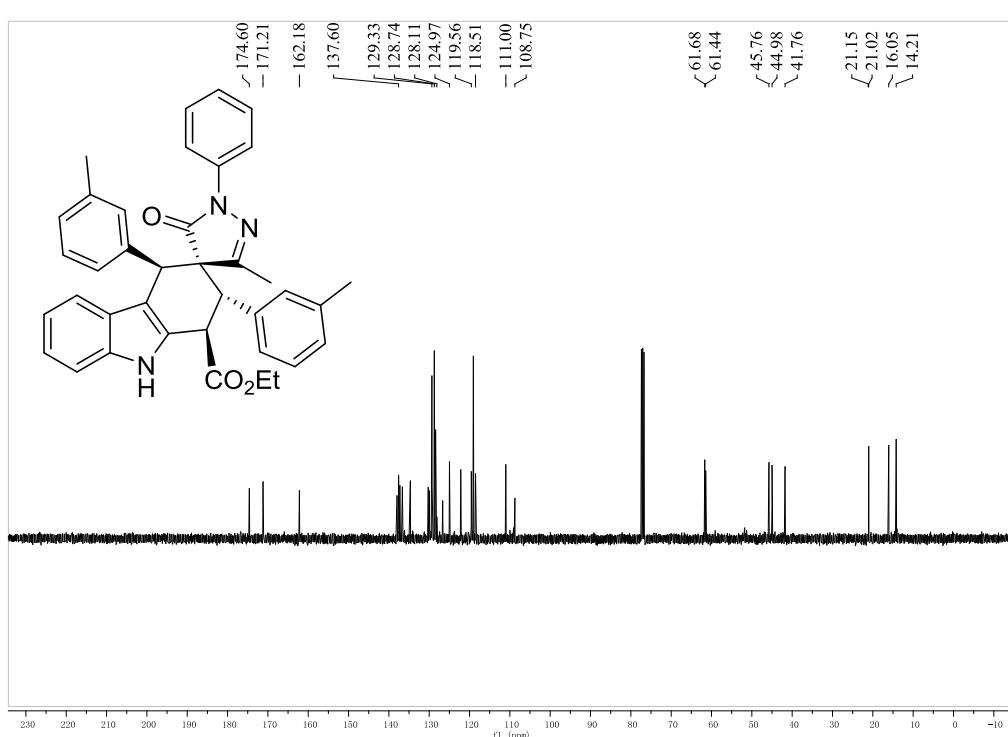
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz,  $\text{CDCl}_3$ )

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-3'-methyl-5'-oxo-1'-phenyl-2,4-di-*m*-tolyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1p**) :



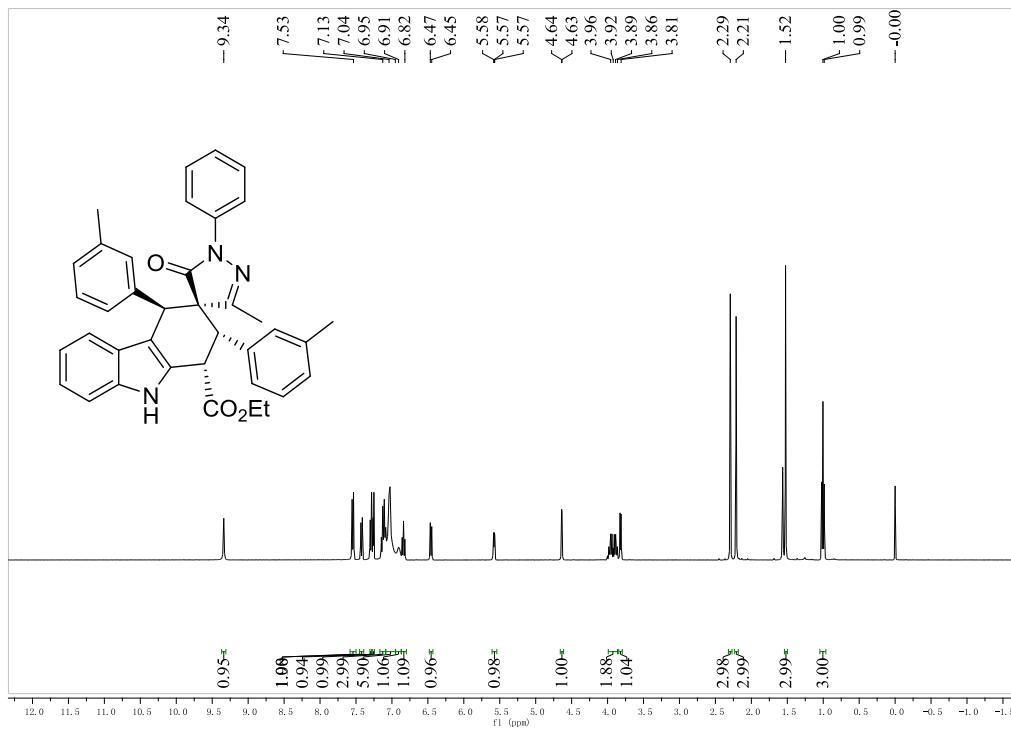
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



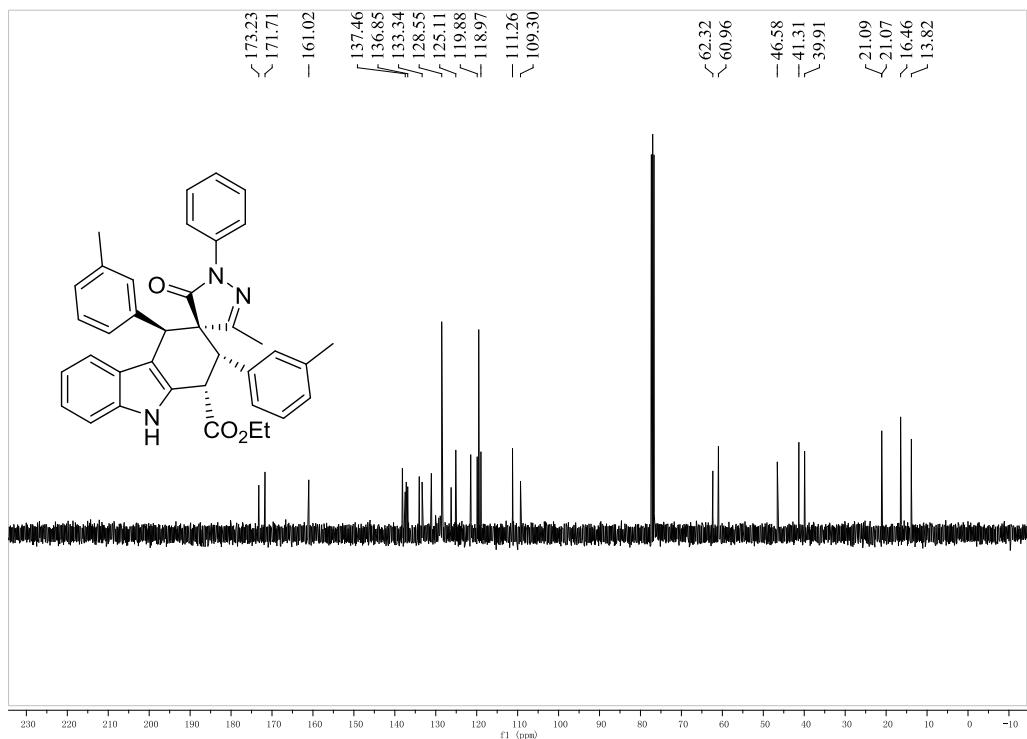
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-3'-methyl-5'-oxo-1'-phenyl-2,4-di-m-tolyl-1,1',2,4,5',9-hexahydrospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1p'**) :



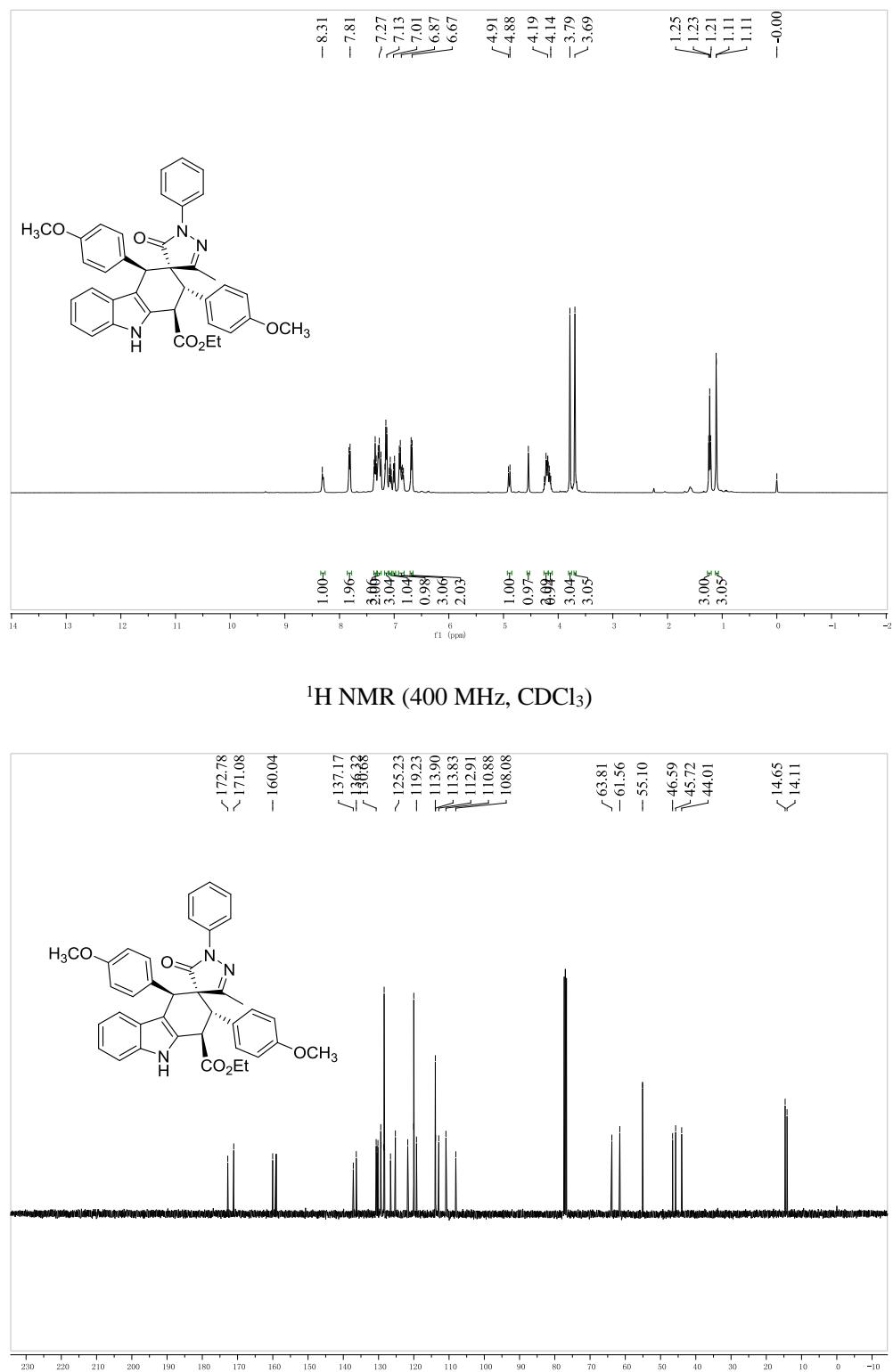
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

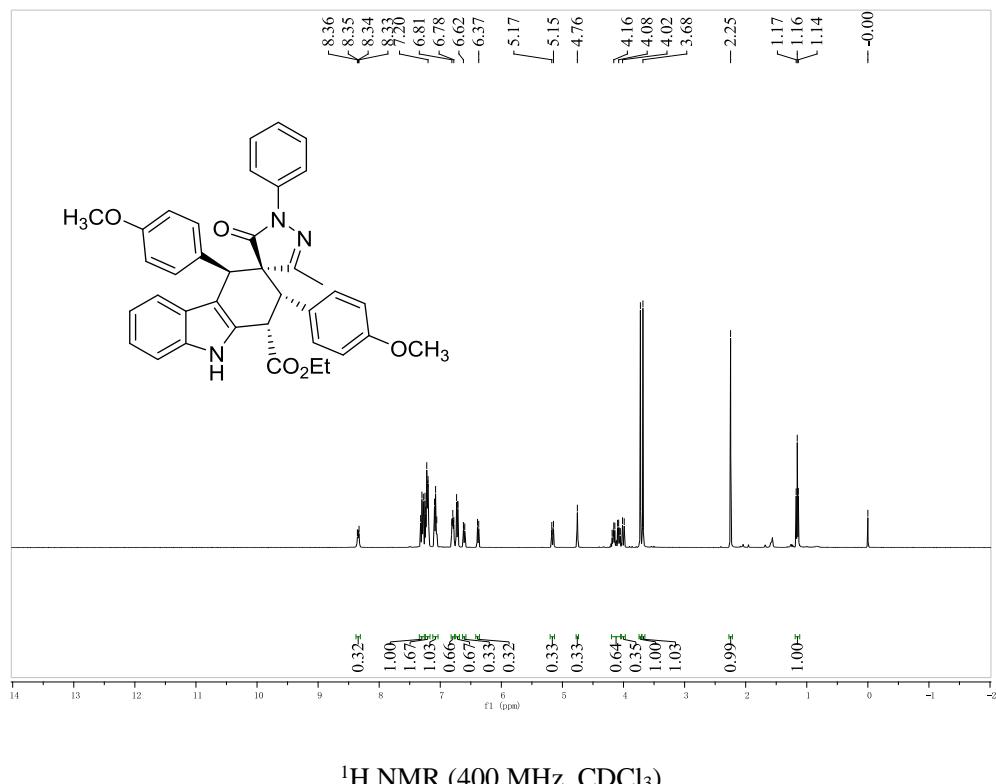
**Ethyl**

**rel-(1R,2S,3R,4R)-2,4-bis(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydro  
rospiro[carbazole-3,4'-pyrazole]-1-carboxylate (1q) :**

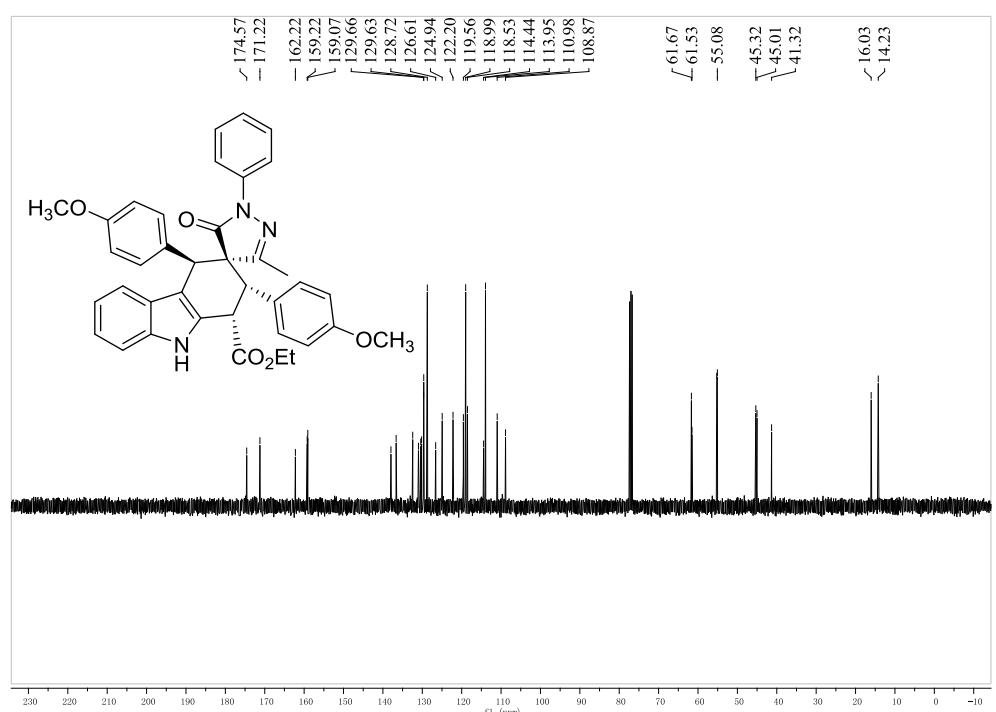


**Ethy**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2,4-bis(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahyd  
rospiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1q'**) :



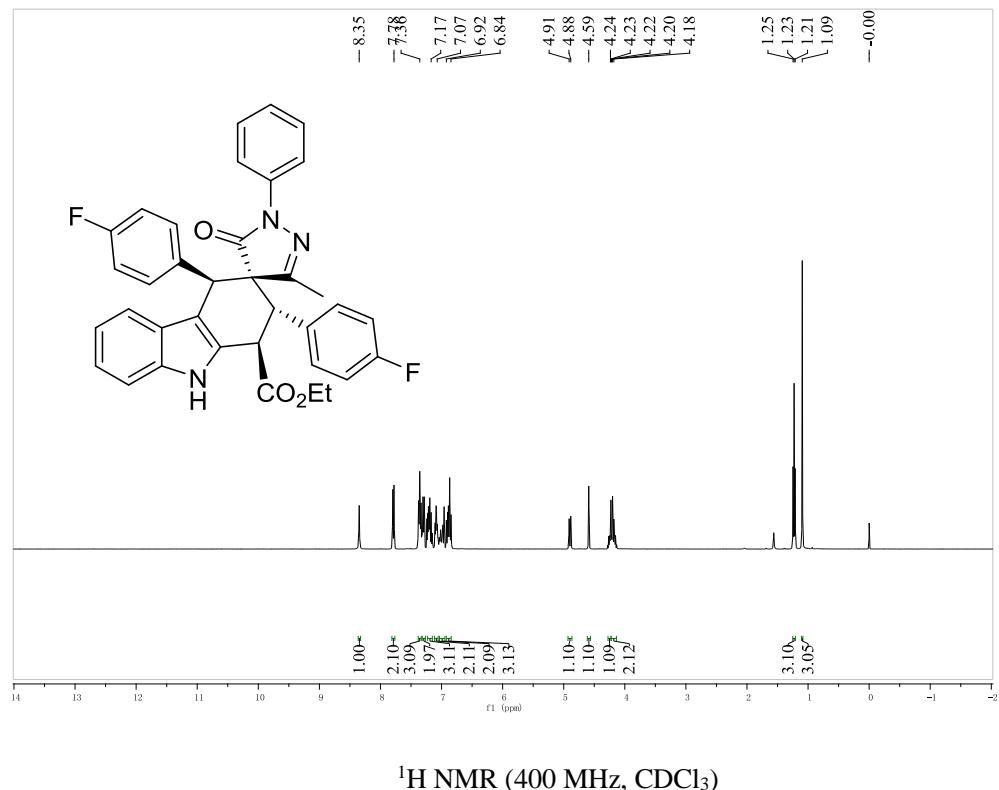
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



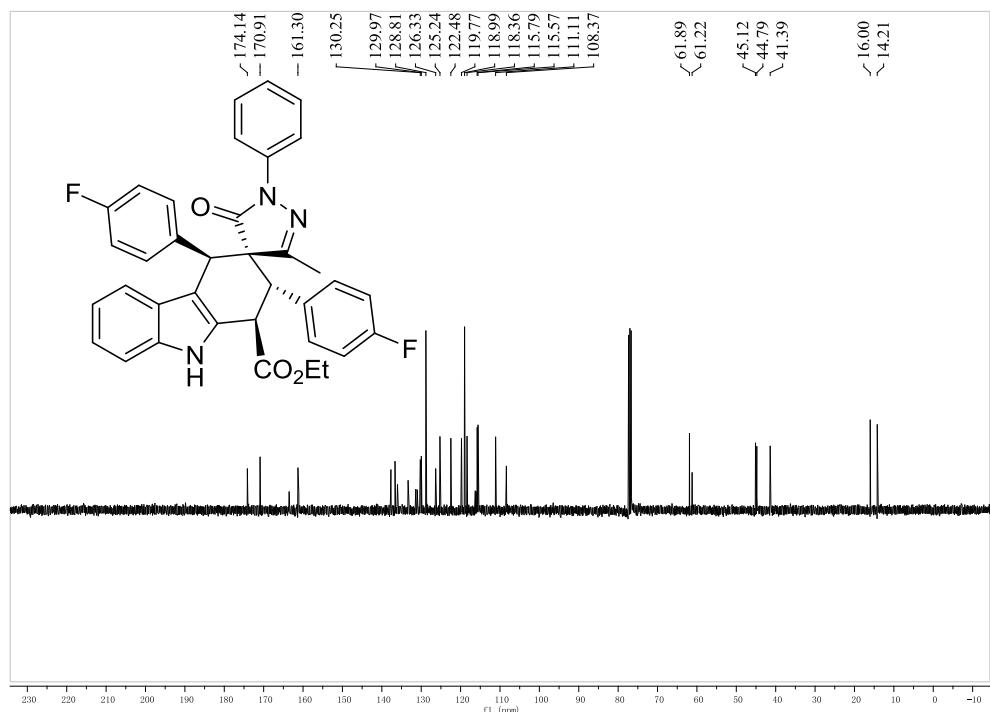
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*R*,2*S*,3*R*,4*R*)-2,4-bis(4-fluorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydro  
spiro[carbazole-3,4'-pyrazole]-1-carboxylate (**1r**) :



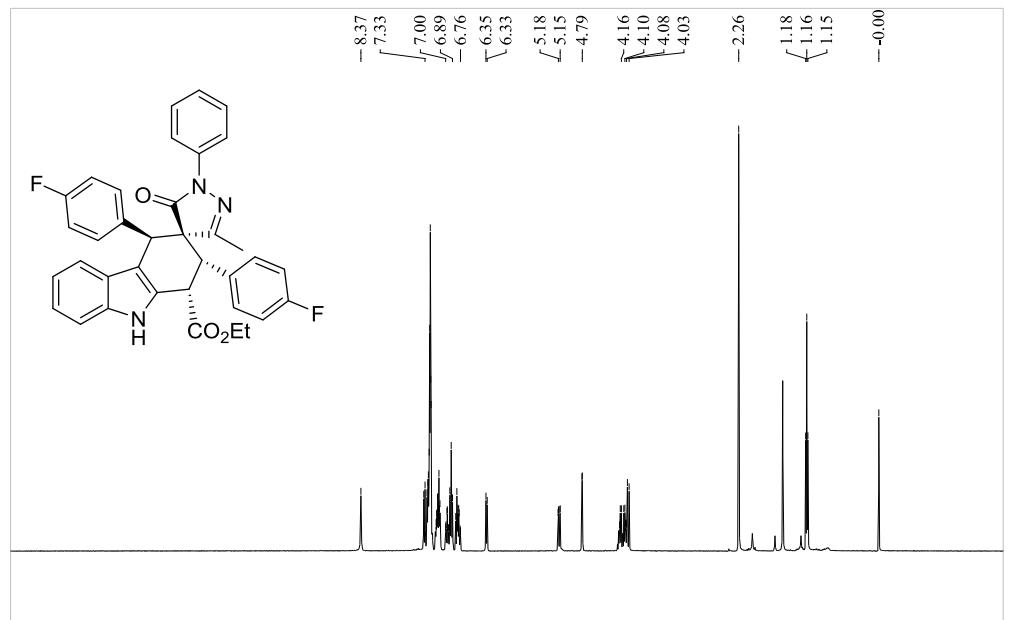
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



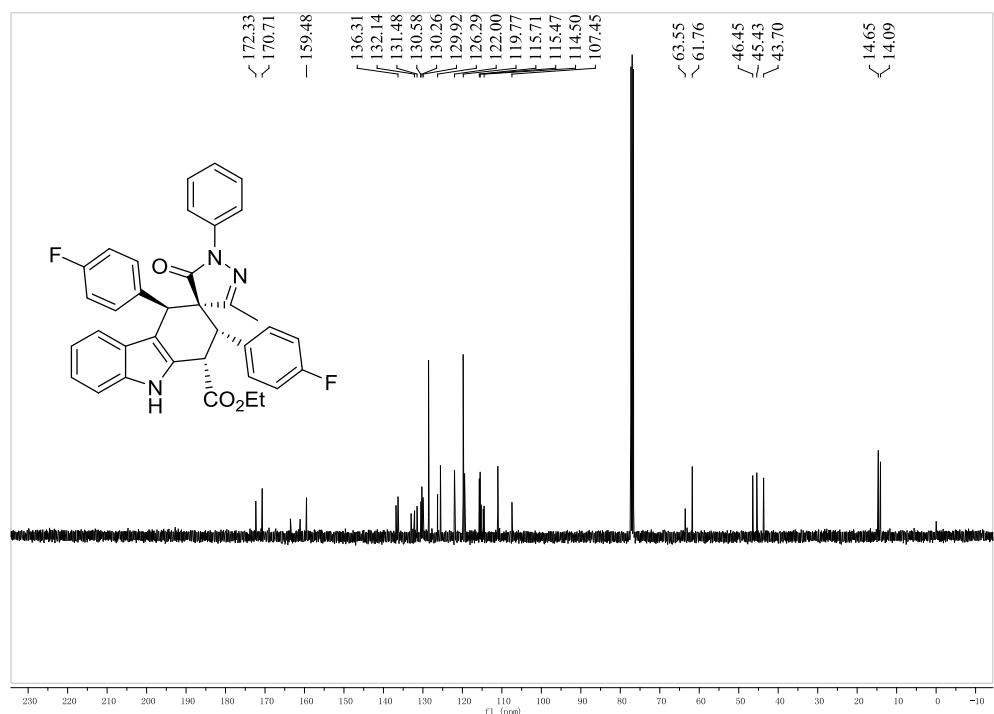
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*S*,4*R*)-2,4-bis(4-fluorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1,1',2,4,5',9-hexahydros  
piro[carbazole-3,4'-pyrazole]-1-carboxylate (**1r'**) :

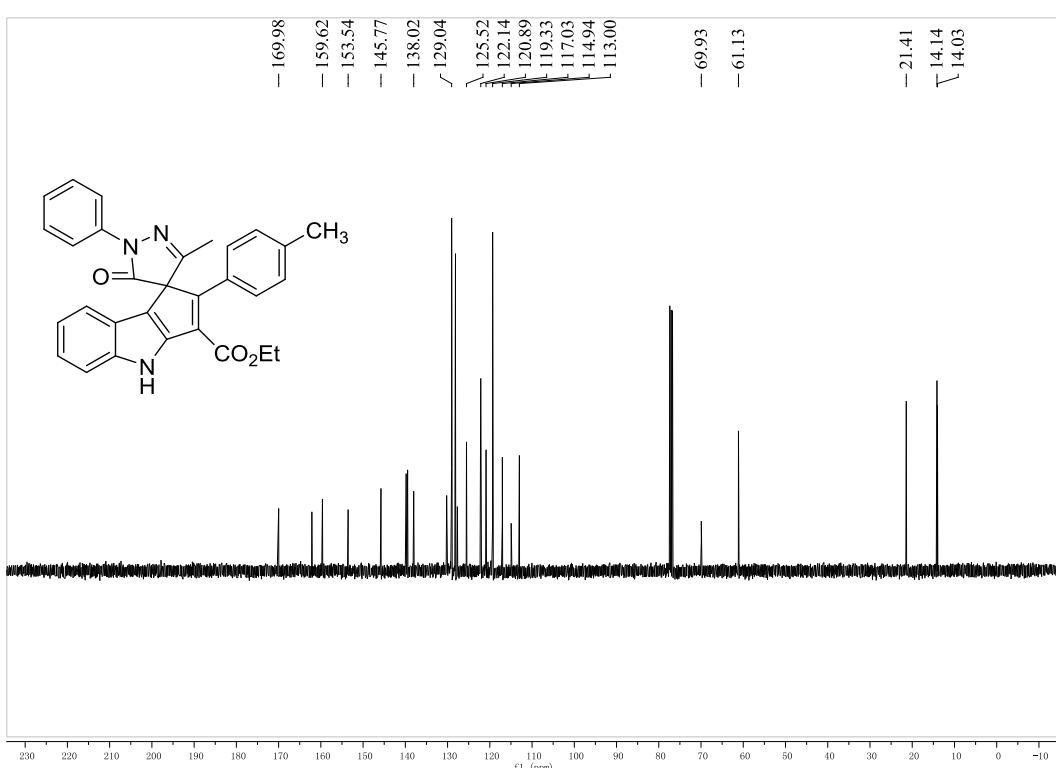
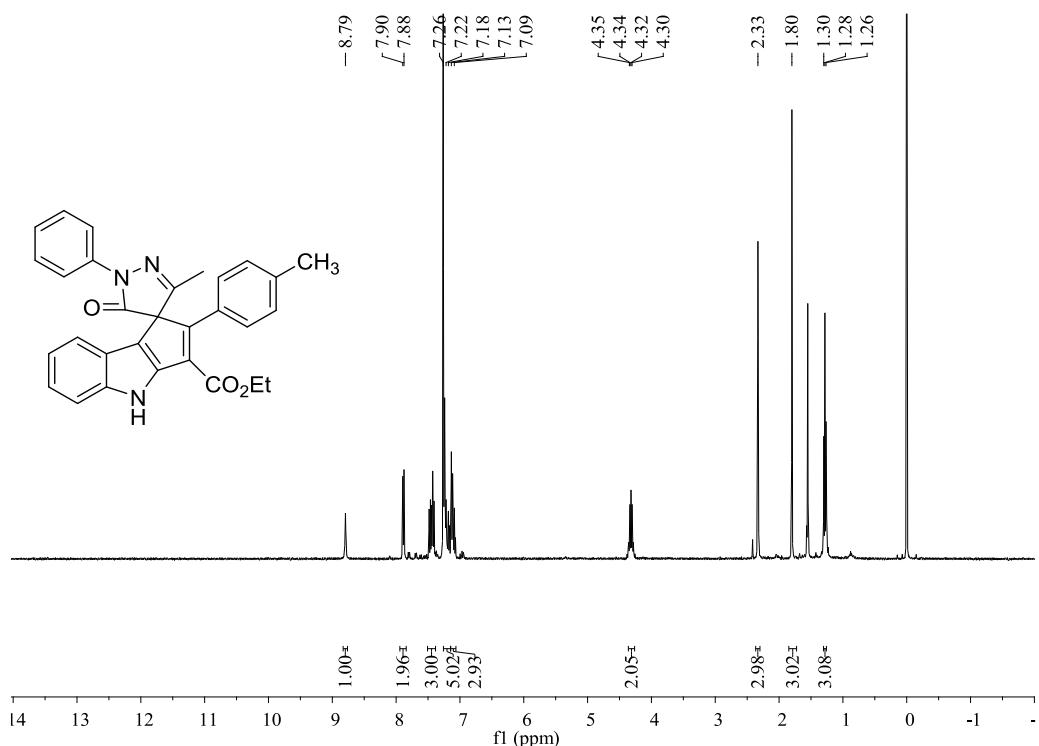


<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)

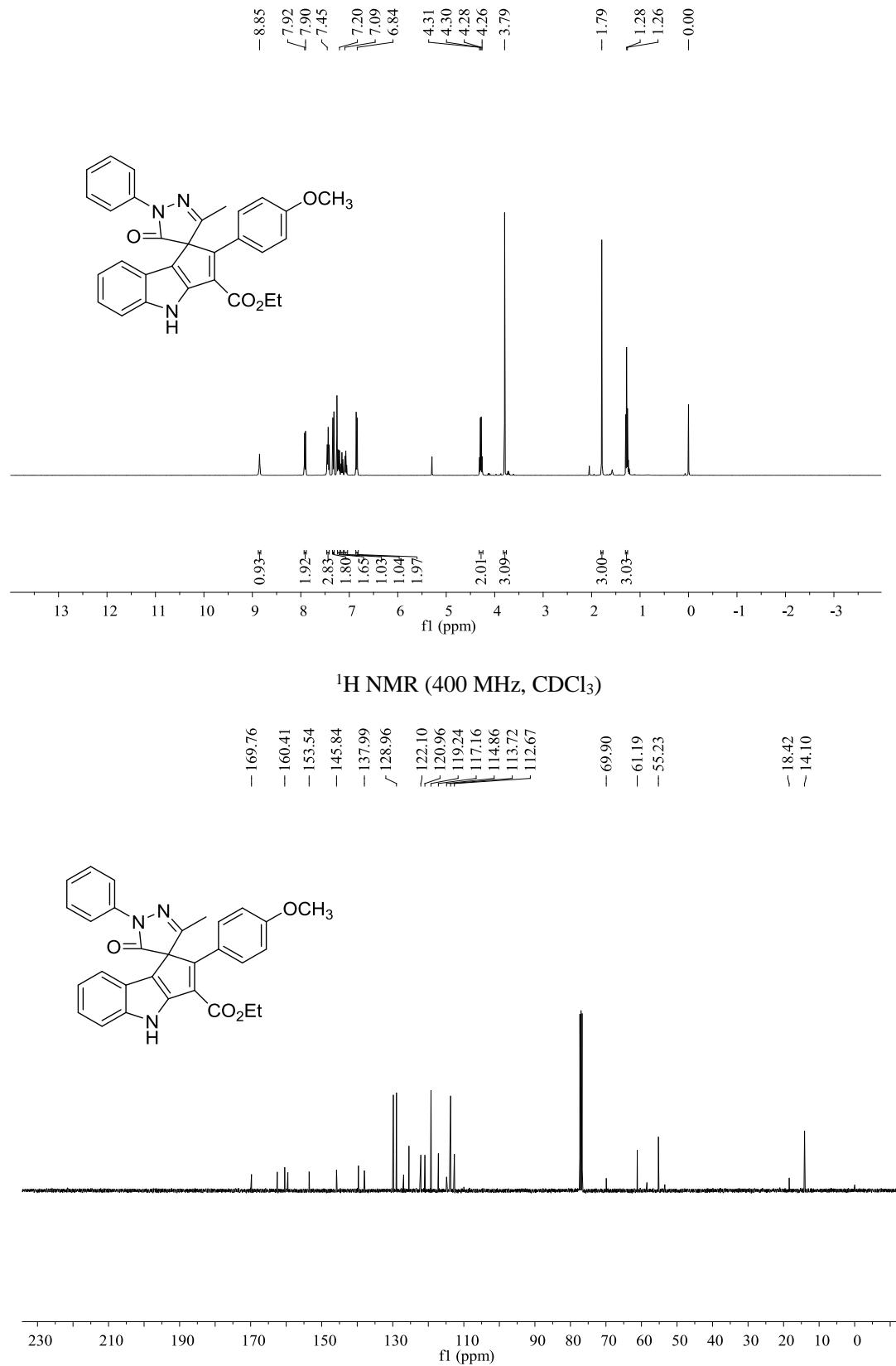


<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl3'-methyl-5'-oxo-1'-phenyl-2-(p-tolyl)-1',5'-dihydro-4H-spiro[cyclopenta[b]indole-1,4'-pyrazole]-3-carboxylate (2a) :**

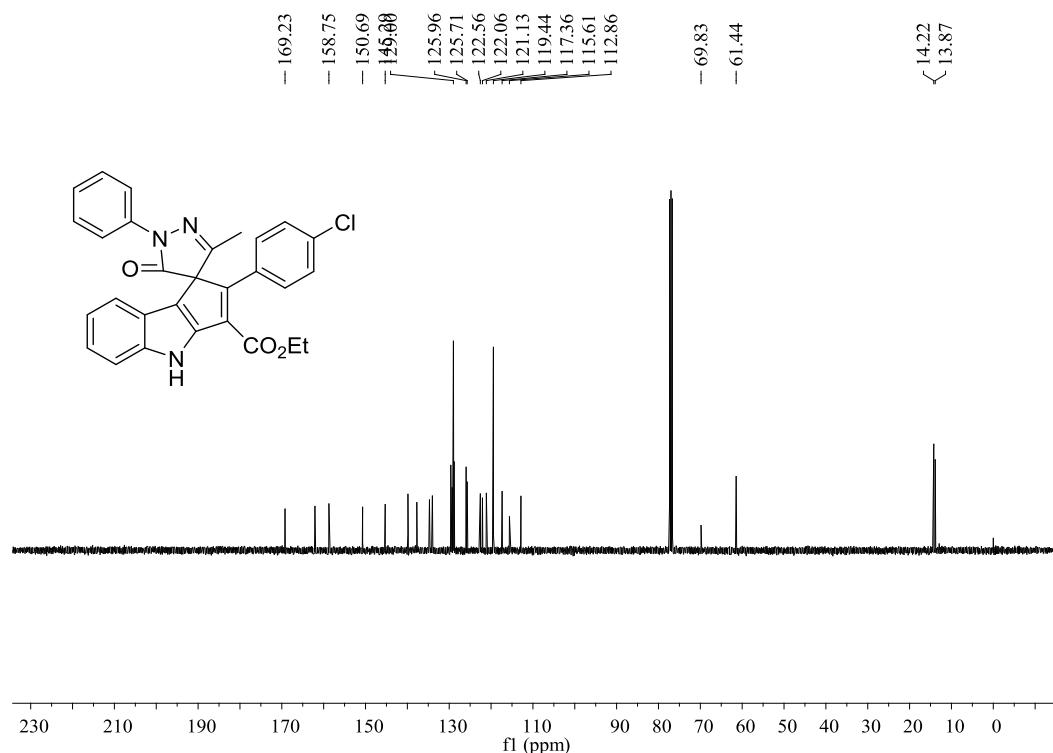
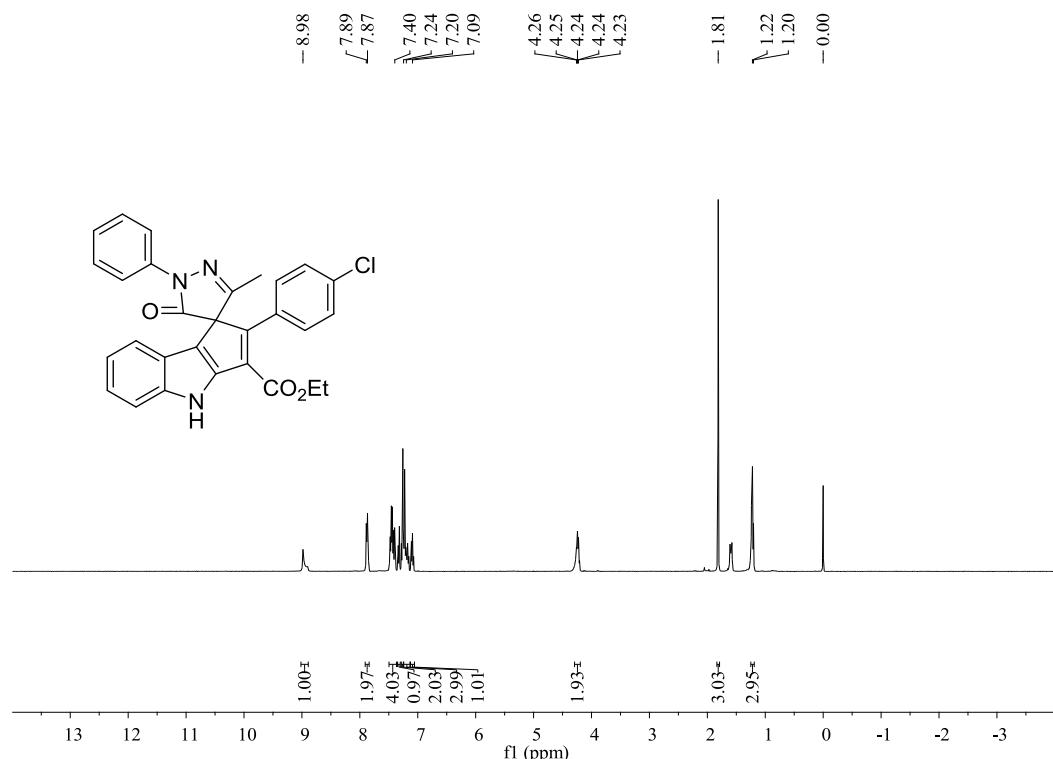


**Ethyl2-(4-methoxyphenyl)-3'-methyl-5'-oxo-1'-phenyl-1',5'-dihydro-4H-spiro[cyclopenta[b]indole-1,4'-pyrazole]-3-carboxylate (2b) :**

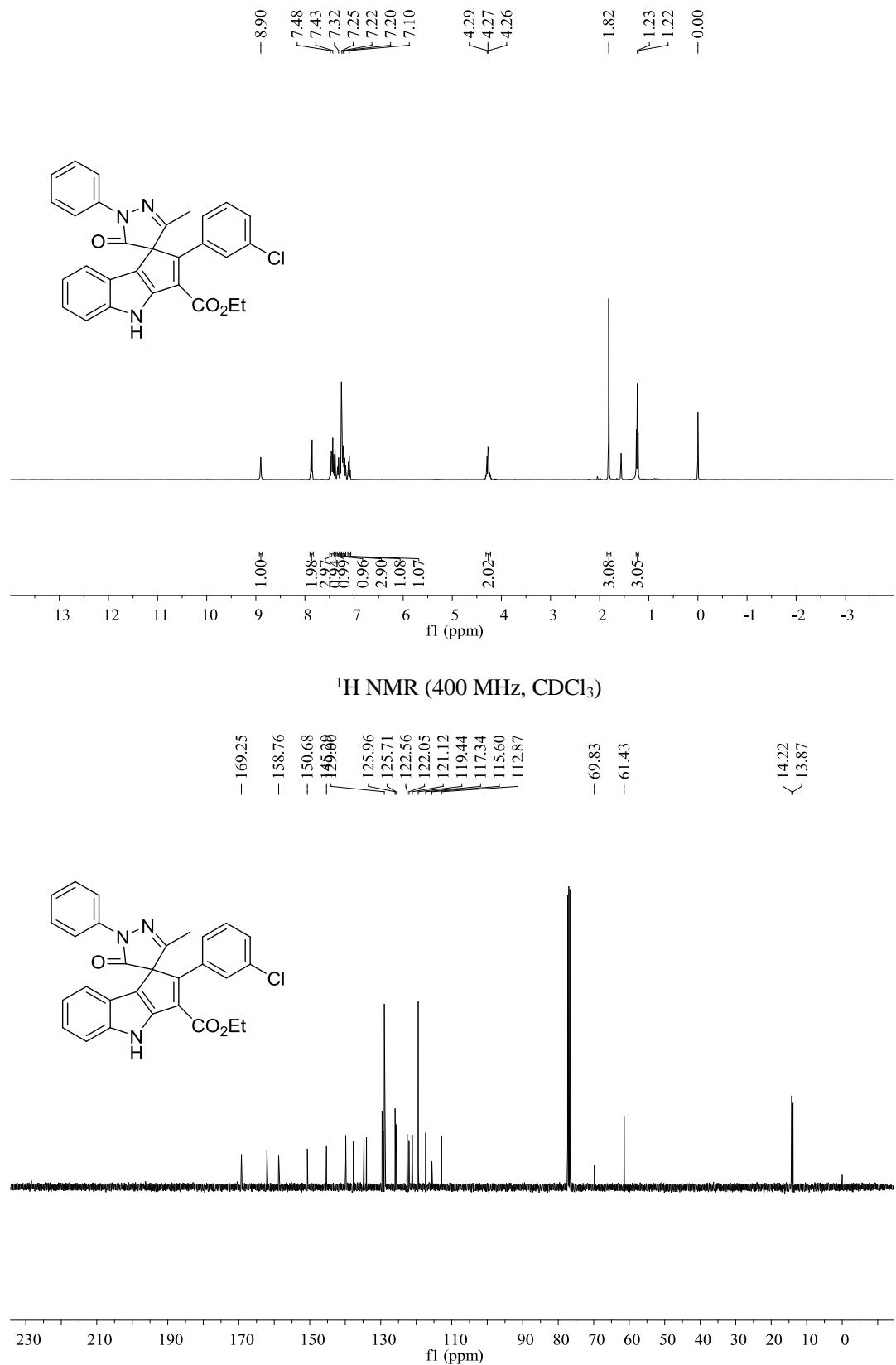


$^{13}\text{C}\{^1\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )

**Ethyl2-(4-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1',5'-dihydro-4H-spiro[cyclopenta[b]indole-1,4'-pyrazole]-3-carboxylate (2c) :**

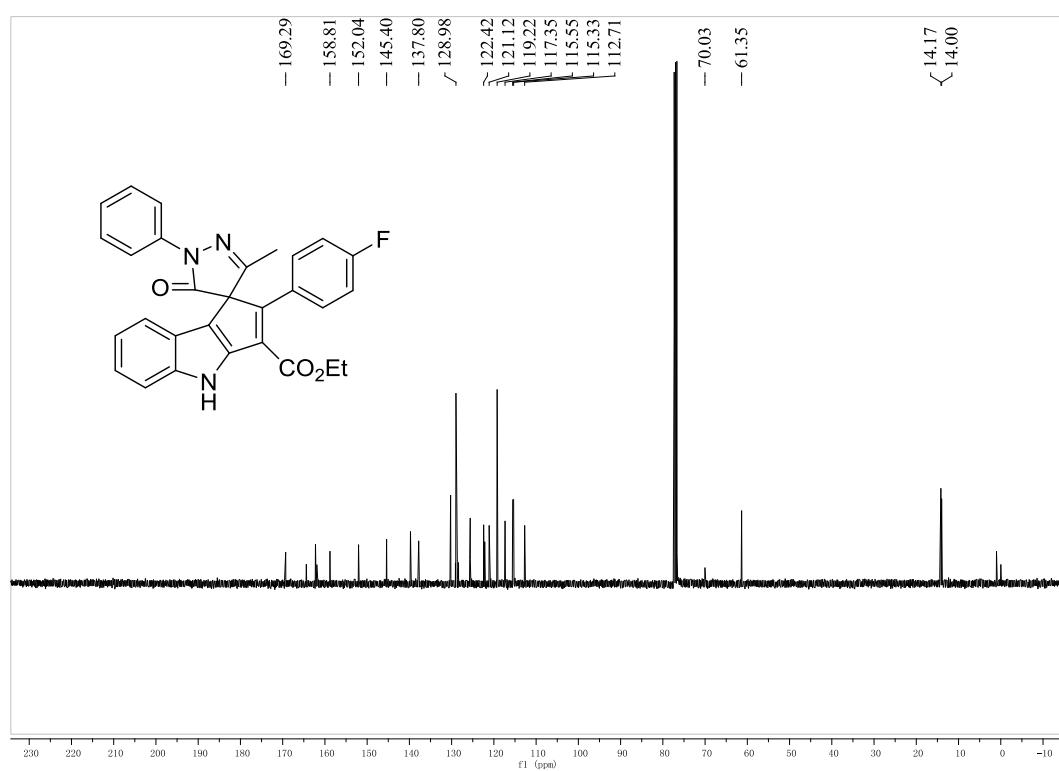
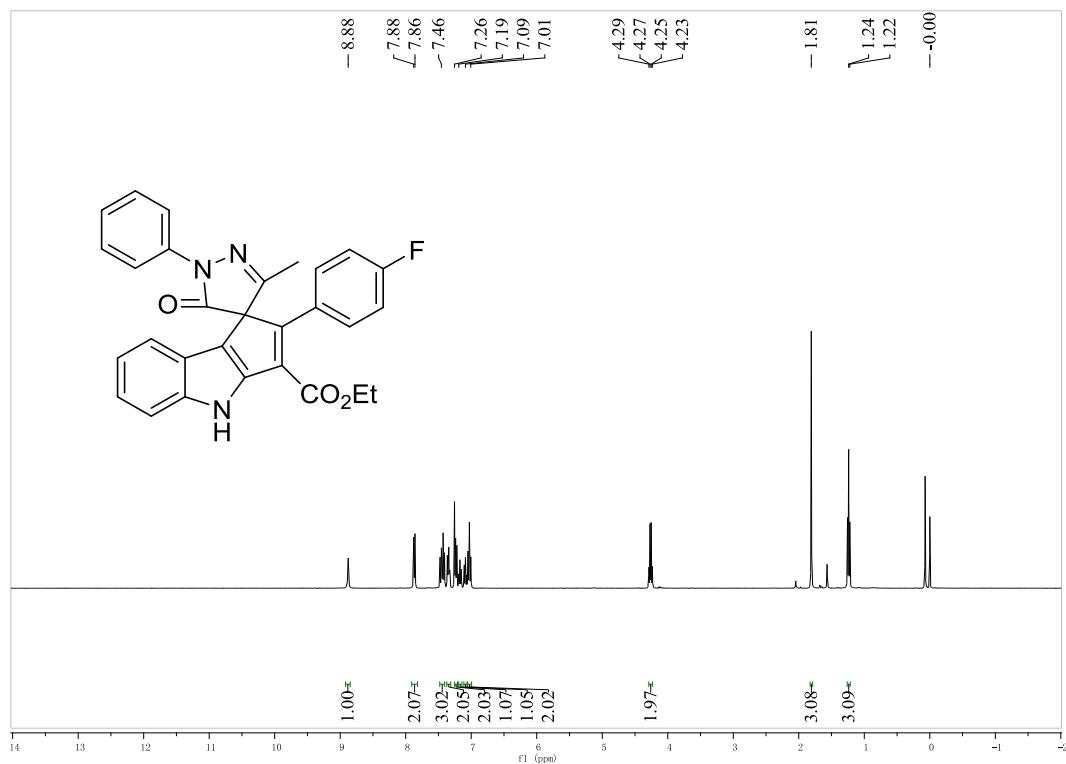


**Ethyl2-(3-chlorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1',5'-dihydro-4H-spiro[cyclopenta[b]indole-1,4'-pyrazole]-3-carboxylate (2d) :**



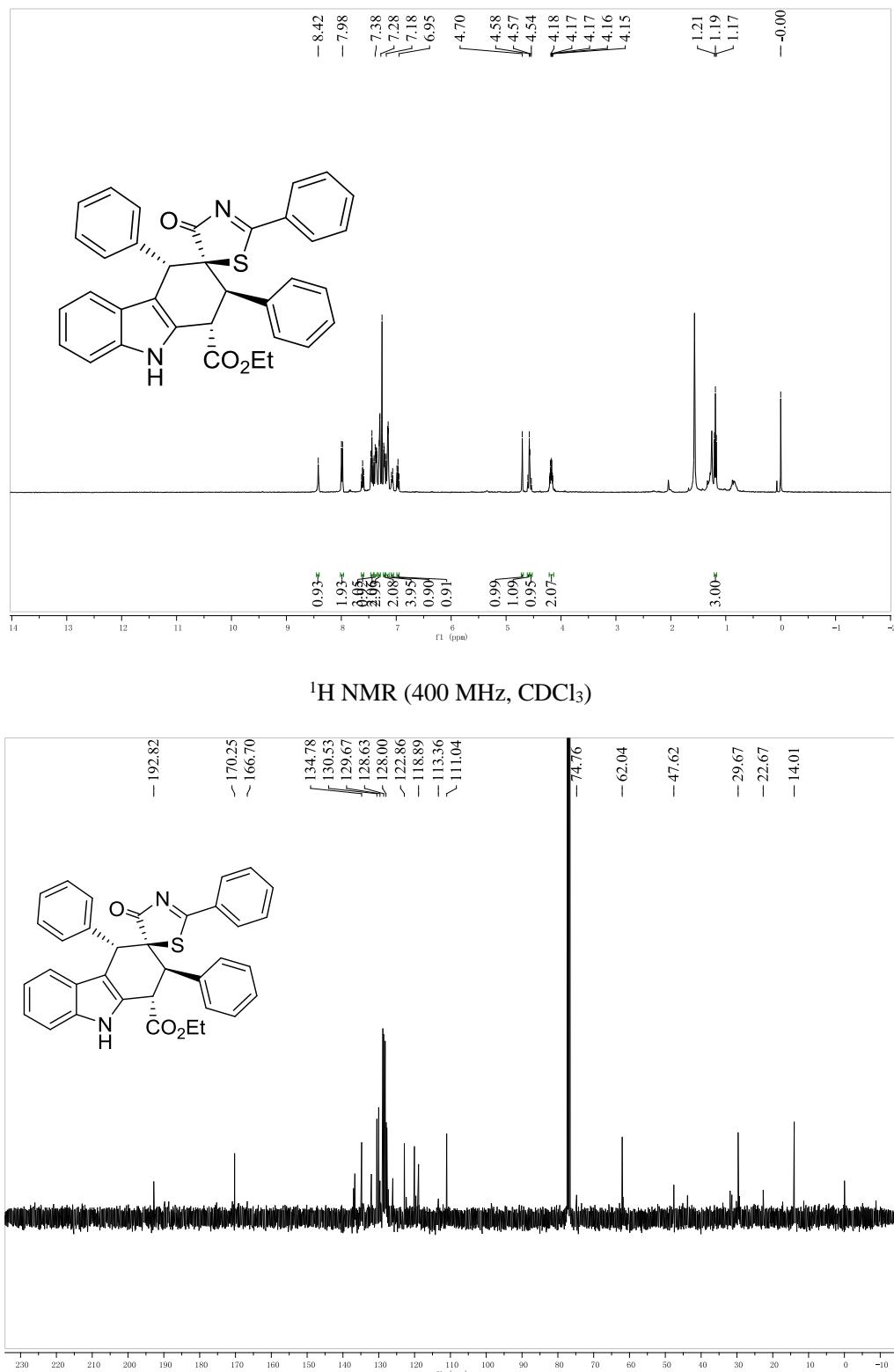
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl2-(4-fluorophenyl)-3'-methyl-5'-oxo-1'-phenyl-1',5'-dihydro-4H-spiro[cyclopenta[b]indole-1,4'-pyrazole]-3-carboxylate (2e) :**



**Ethyl**

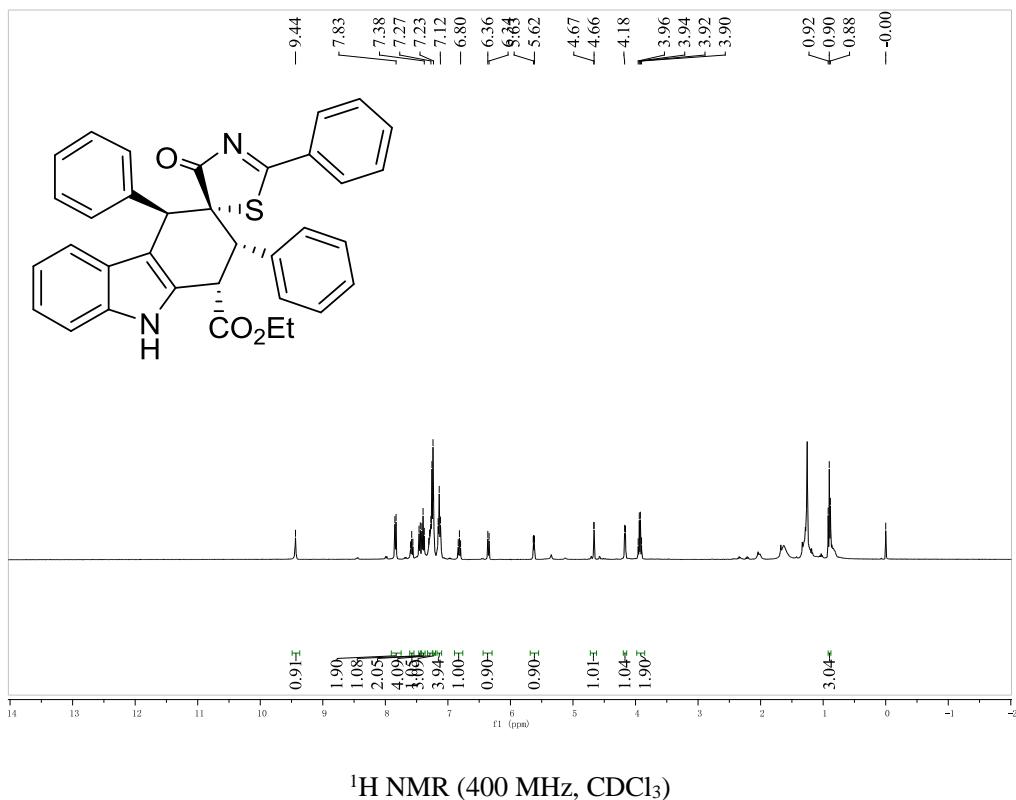
**rel-(1S,2R,3S,4S)-4'-oxo-2,2',4-triphenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole  
]-1-carboxylate (3a) :**



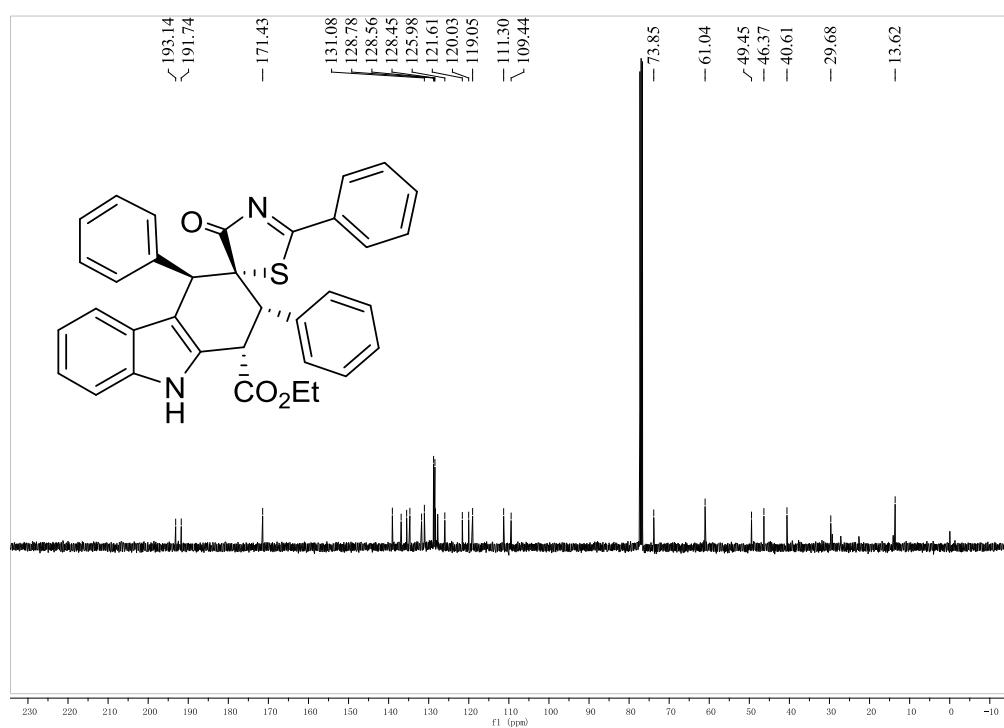
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethy**

*rel*-(1*S*,2*S*,3*R*,4*R*)-4'-oxo-2,2',4-triphenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole-1-carboxylate (3a') :



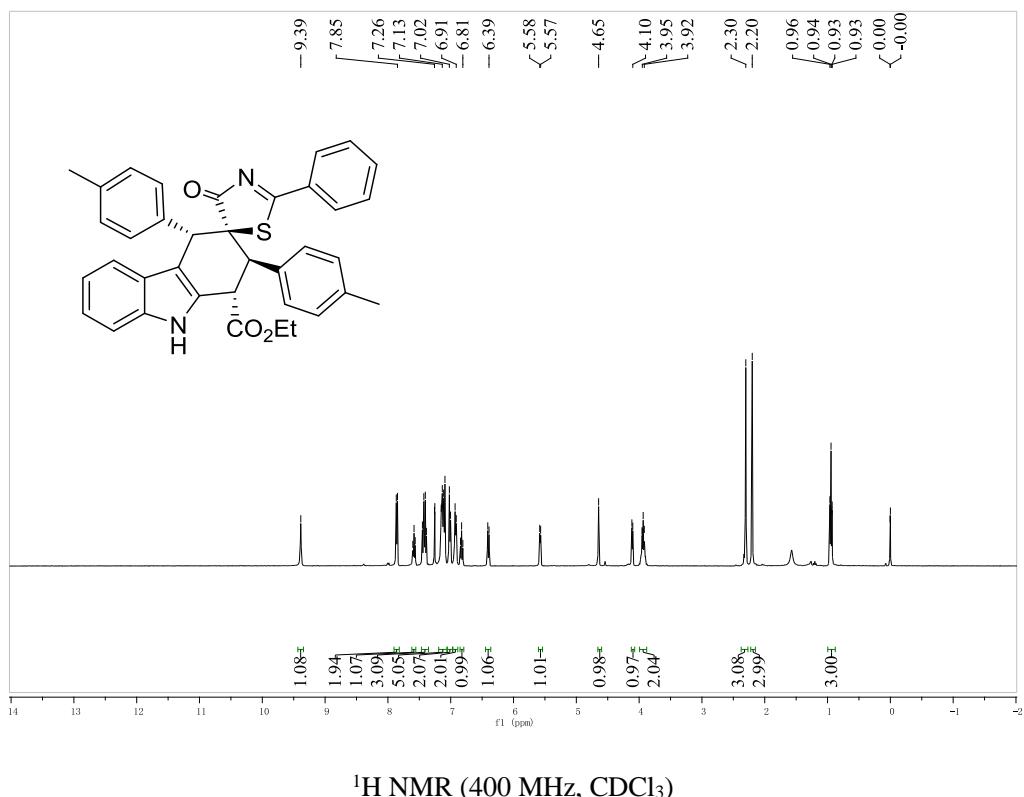
<sup>1</sup>H NMR (400 MHz,  $\text{CDCl}_3$ )



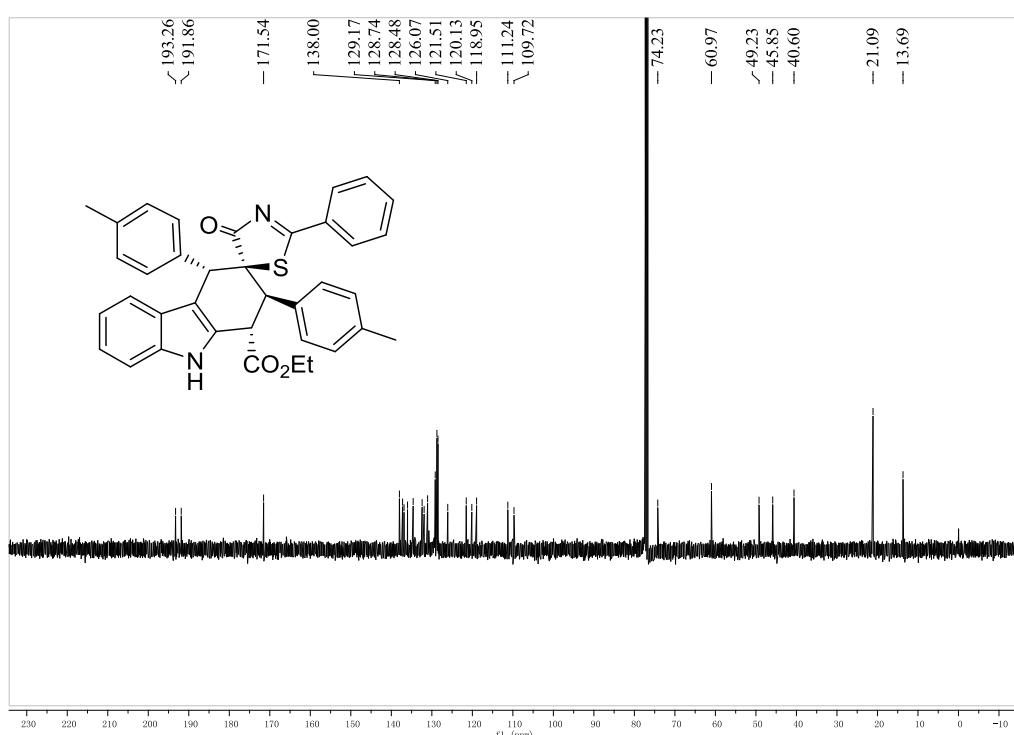
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz,  $\text{CDCl}_3$ )

**Ethyl**

***rel*-(1*S*,2*R*,3*S*,4*S*)-4'-oxo-2'-phenyl-2,4-di-p-tolyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (3b) :**



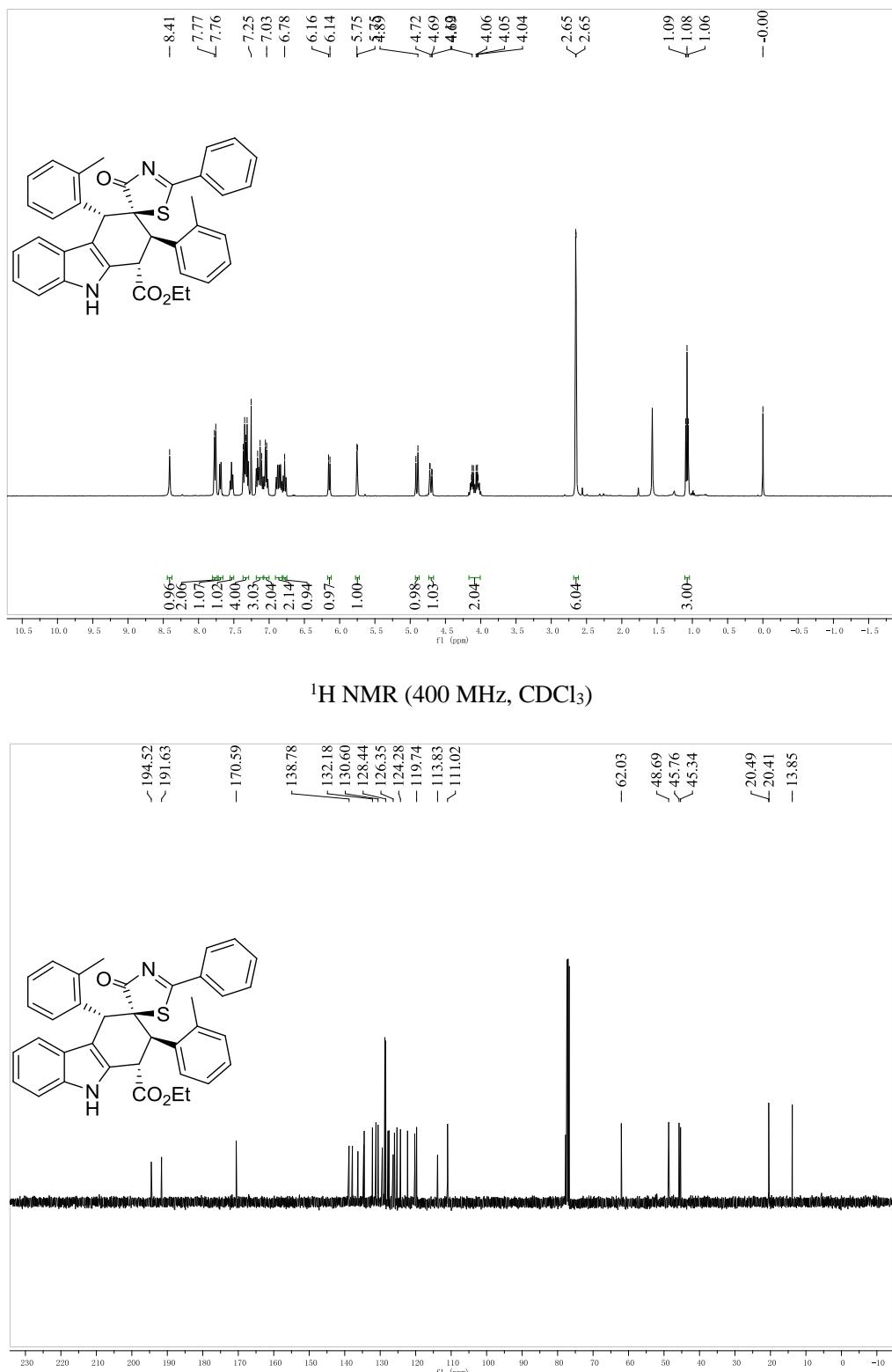
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)  
s50

**Ethyl**

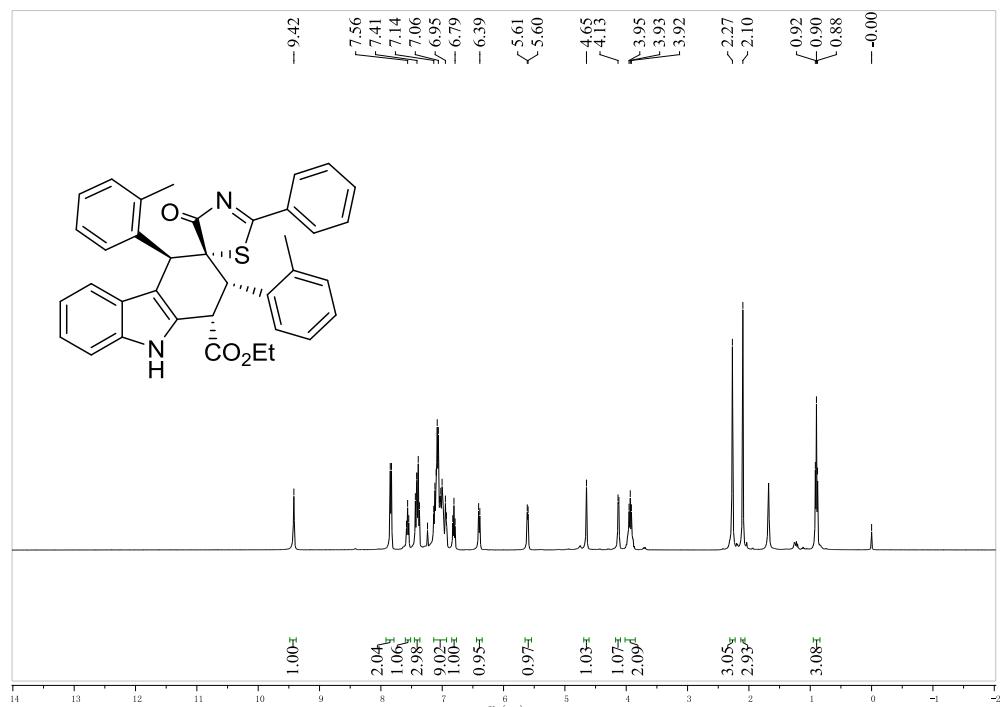
*rel*-(1*S*,2*R*,3*S*,4*S*)-4'-oxo-2'-phenyl-2,4-di-*o*-tolyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3c**) :



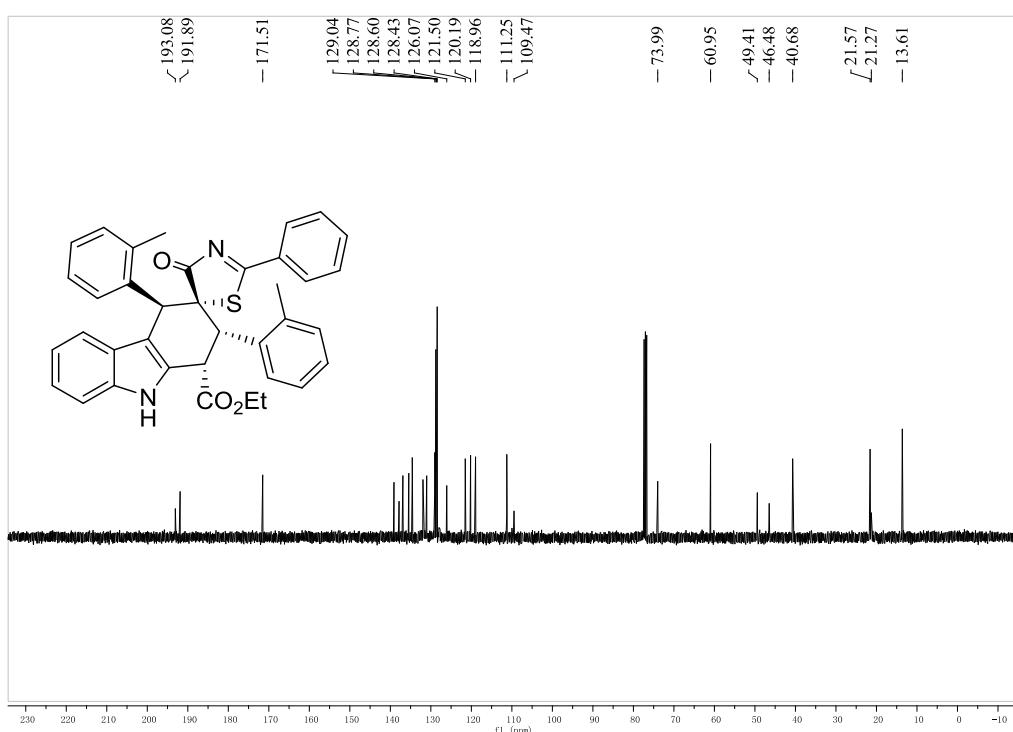
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*R*,4*R*)-4'-oxo-2'-phenyl-2,4-di-p-tolyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3c'**) :



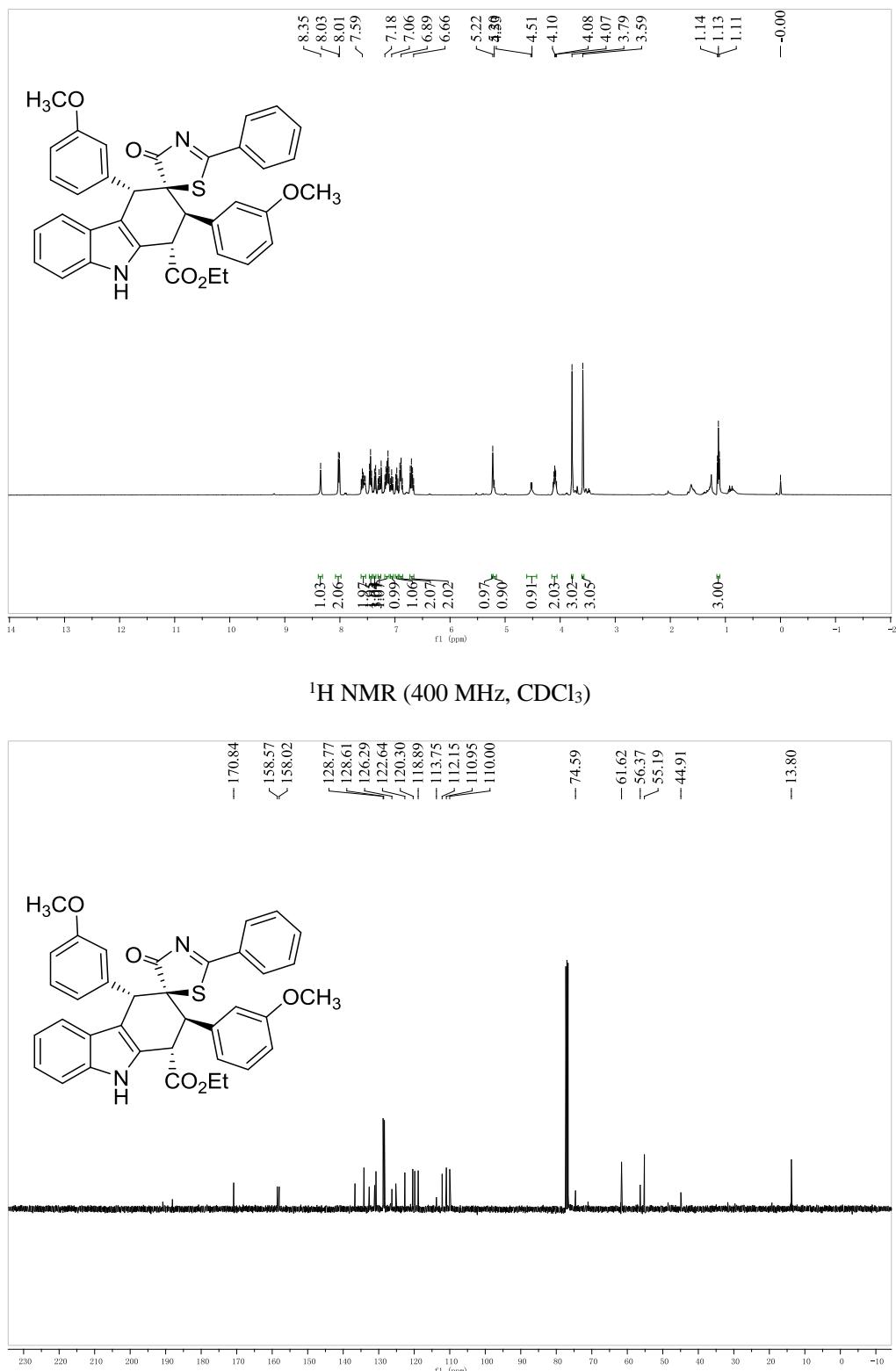
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

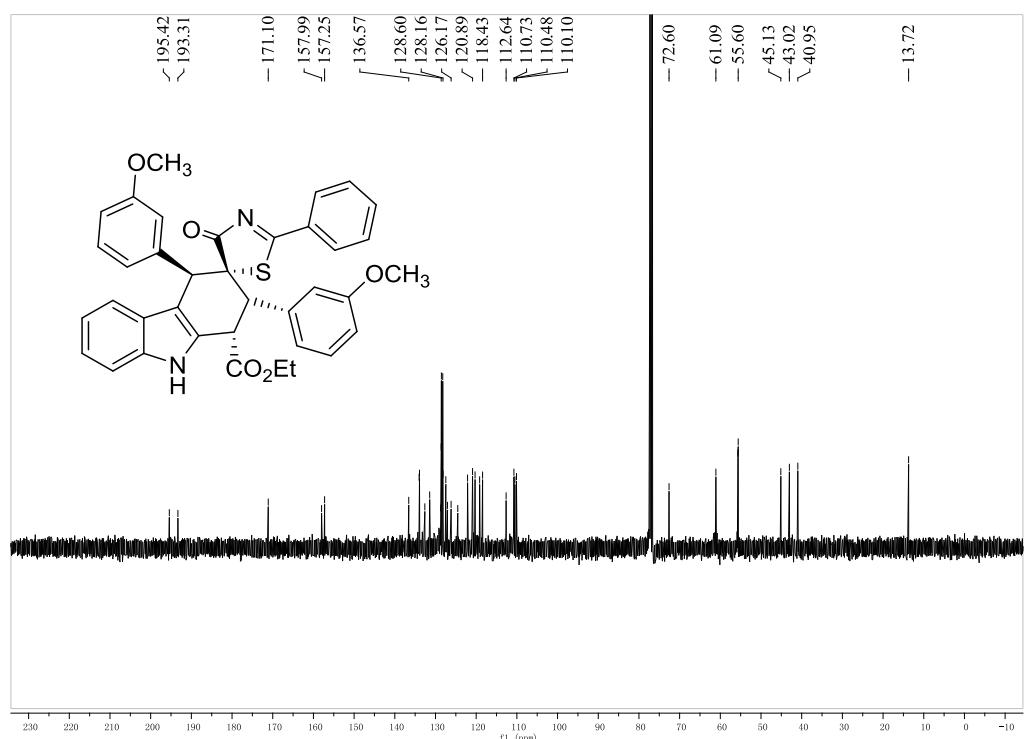
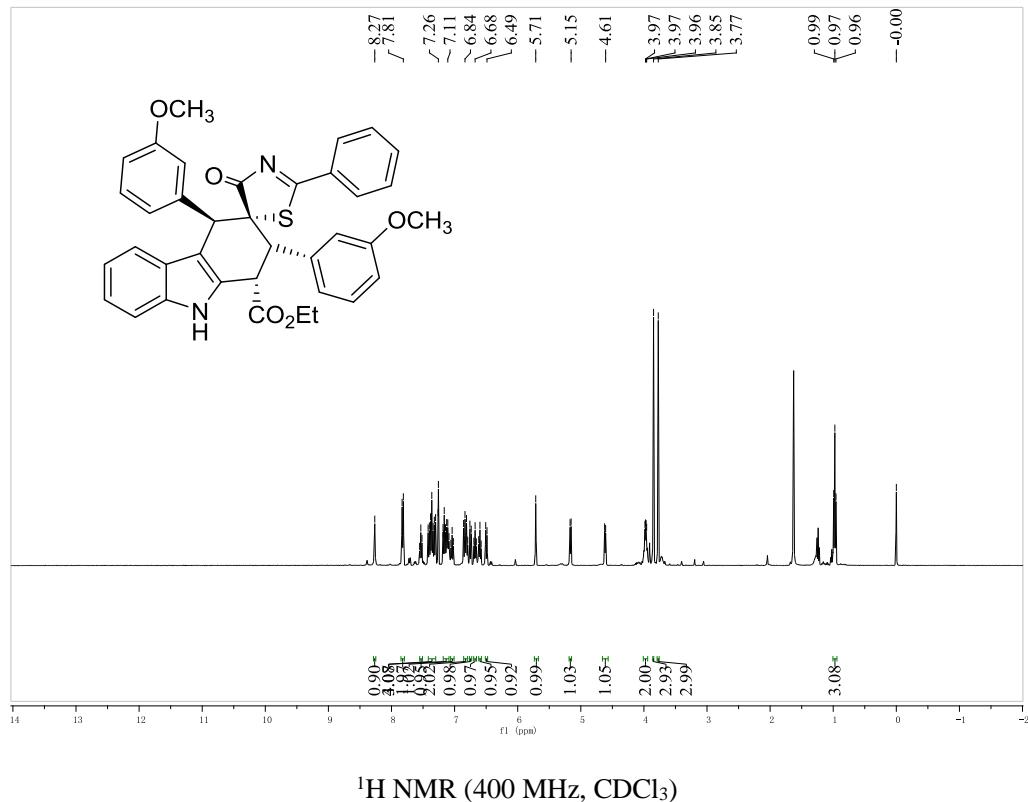
**Ethyl**

*rel*-(1*S*,2*R*,3*S*,4*S*)-2,4-bis(3-methoxyphenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3d**) :



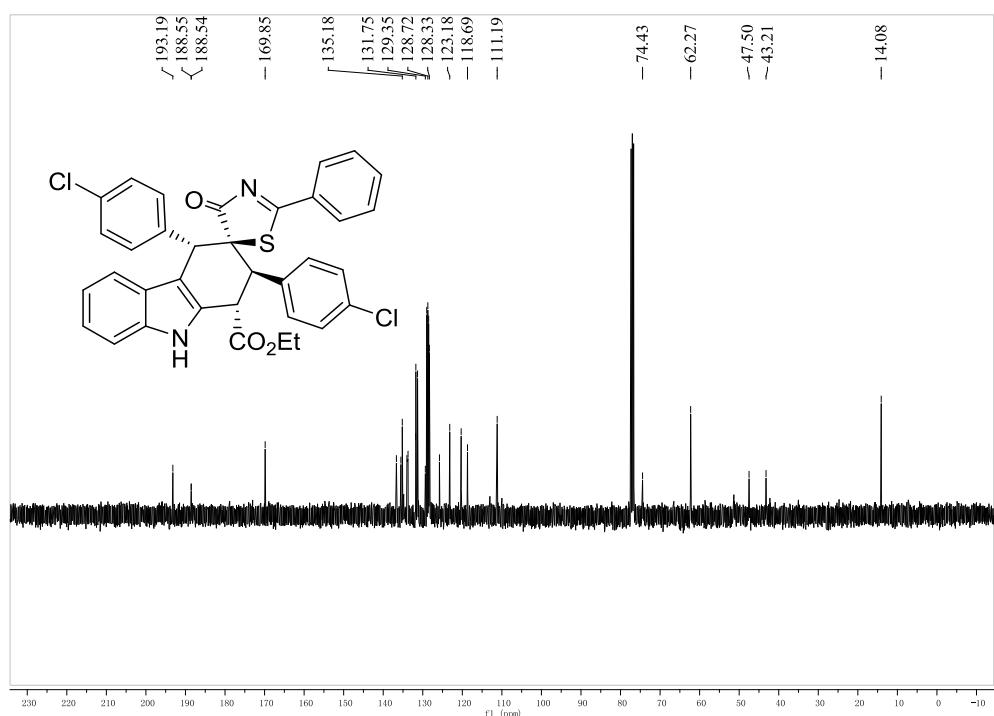
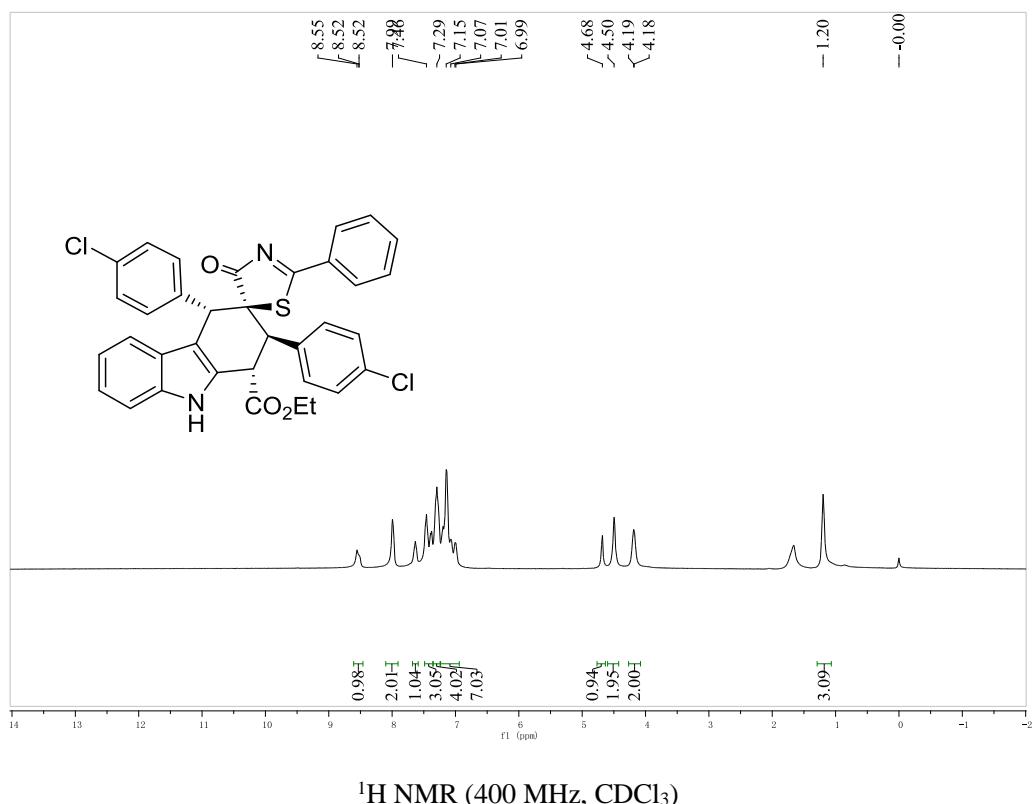
**Ethyl**

*rel*-(1*S*,2*S*,3*R*,4*R*)-2,4-bis(3-methoxyphenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[ca  
rbazole-3,5'-thiazole]-1-carboxylate (**3d'**) :



**Ethyl**

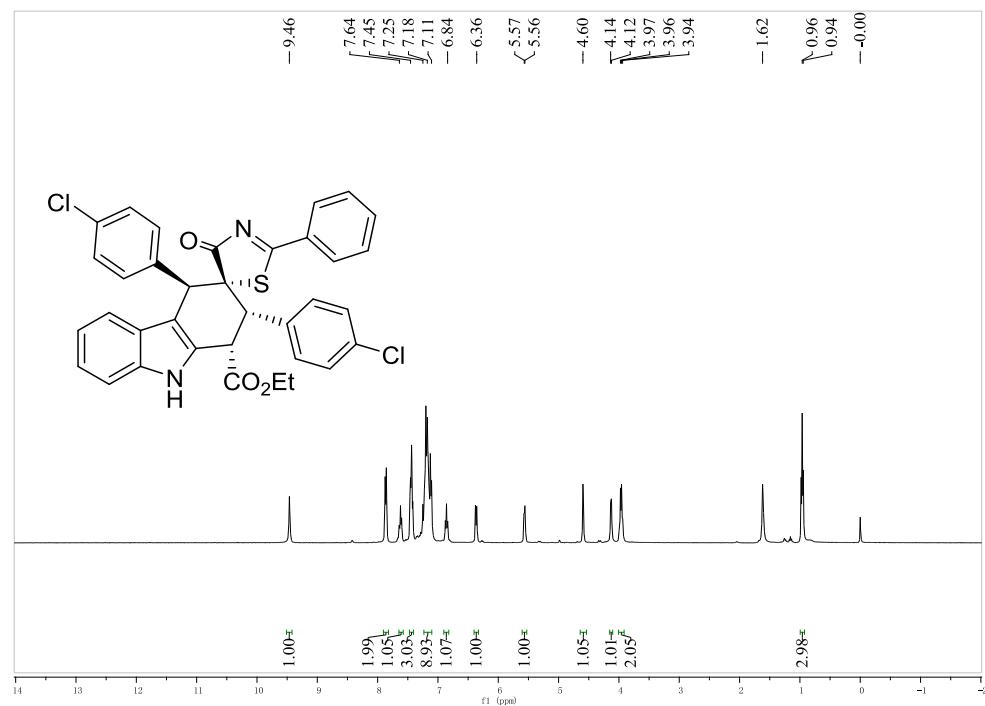
*rel*-(1*S*,2*R*,3*S*,4*S*)-2,4-bis(4-chlorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3e**) :



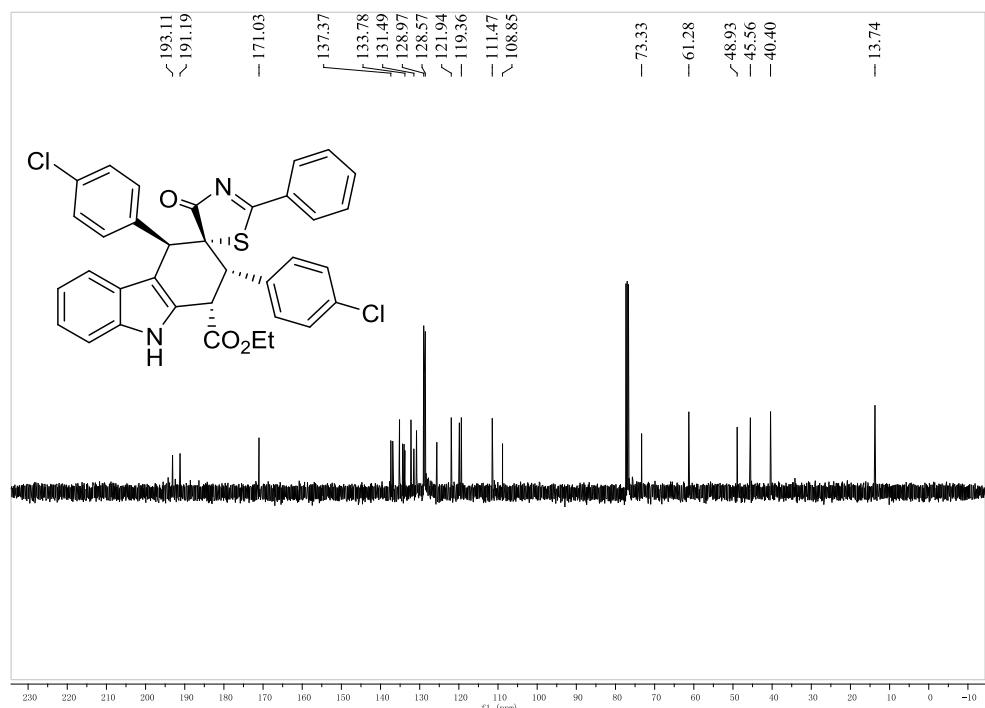
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)  
s55

**Ethyl**

***rel*-(1*S*,2*S*,3*R*,4*R*)-2,4-bis(4-chlorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (3e')**:



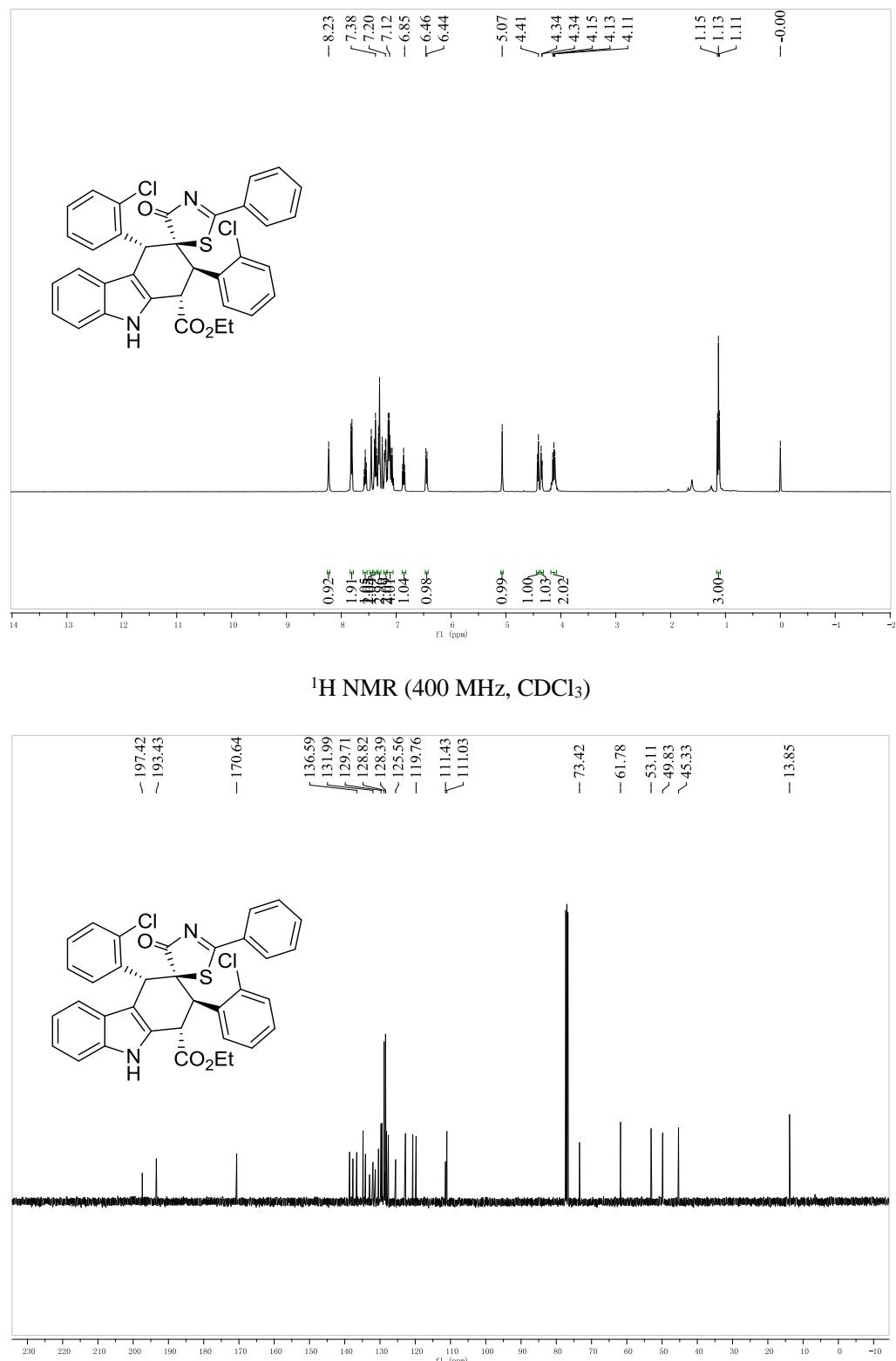
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

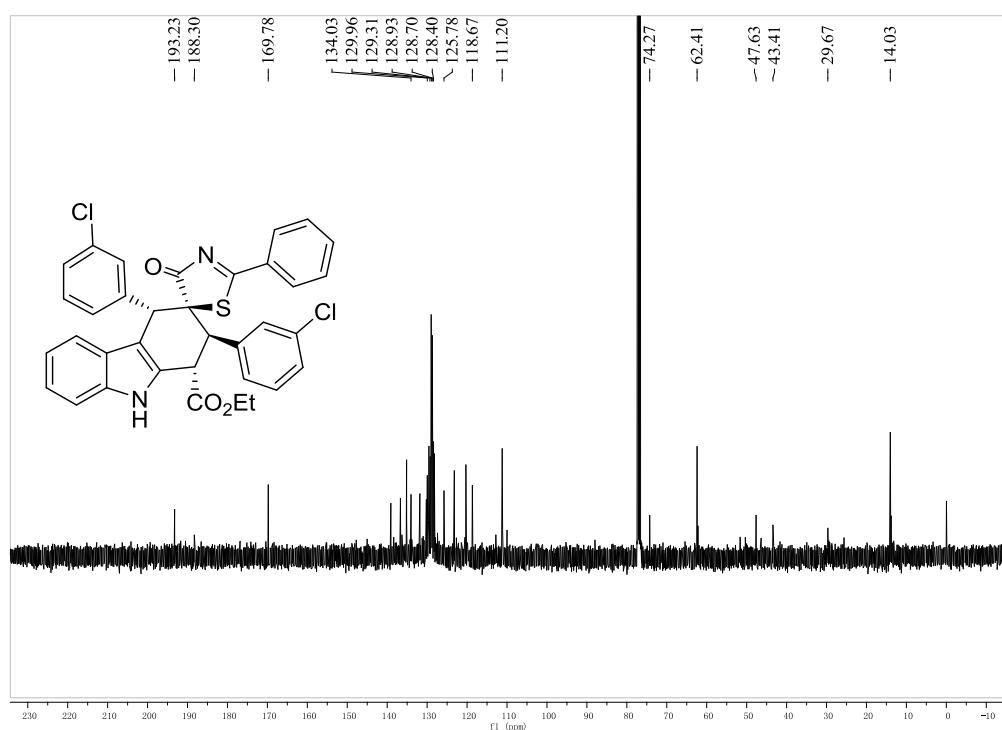
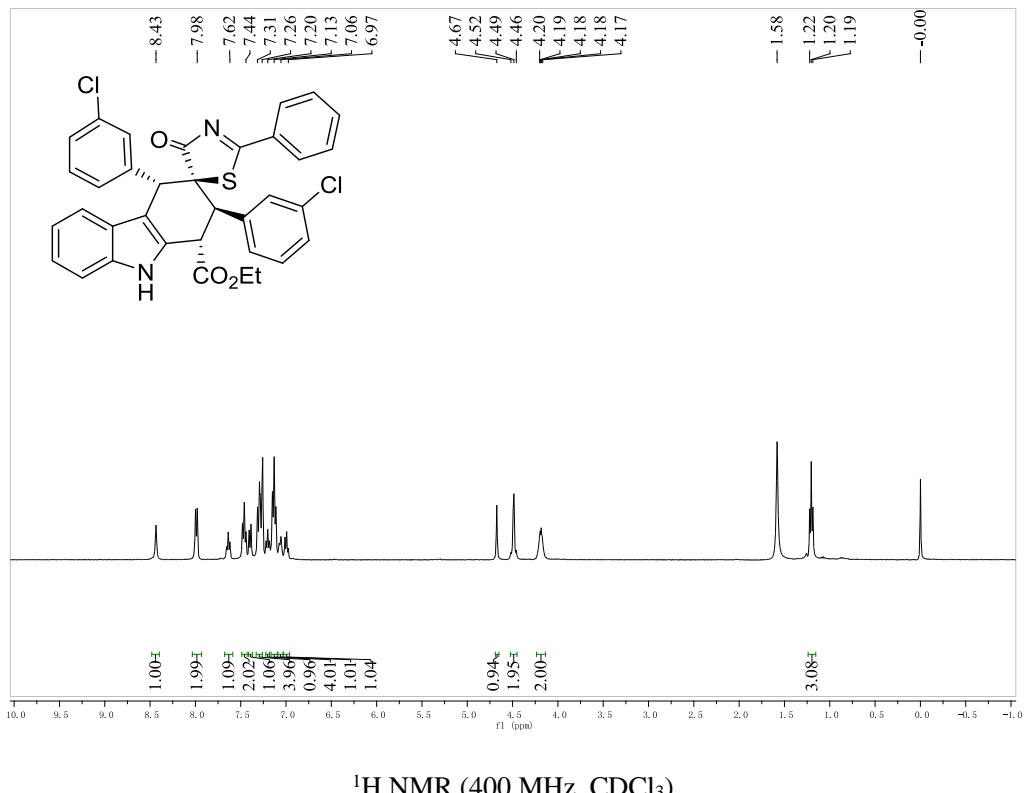
*rel*-(1*S*,2*R*,3*S*,4*S*)-2,4-bis(2-chlorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3f**):



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

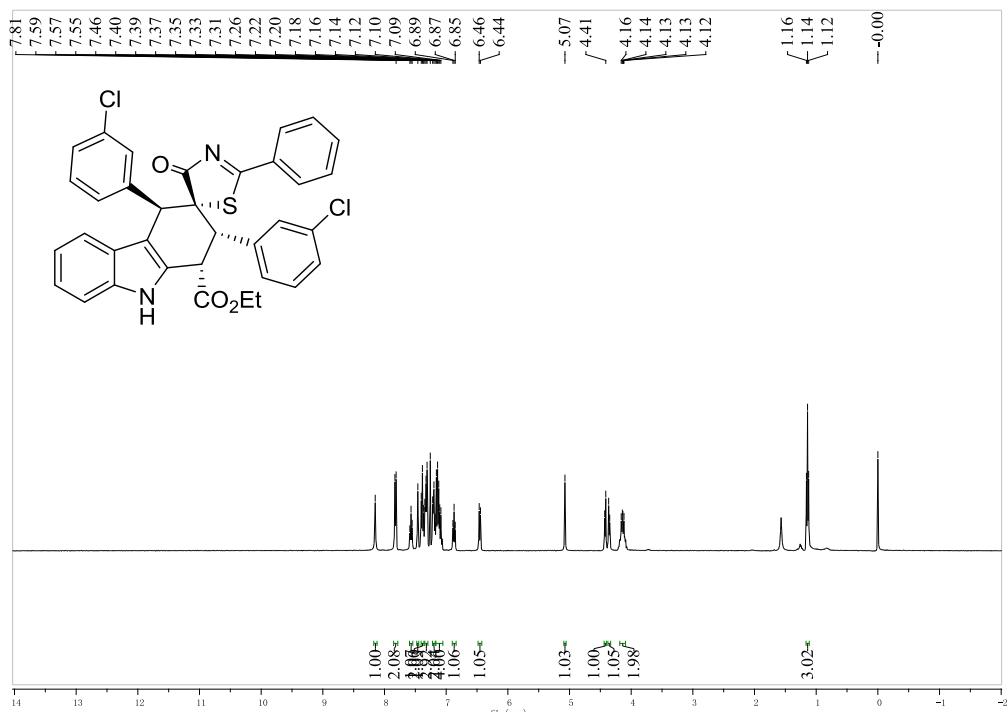
*rel*-(1*S*,2*R*,3*S*,4*S*)-2,4-bis(3-chlorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3g**) :



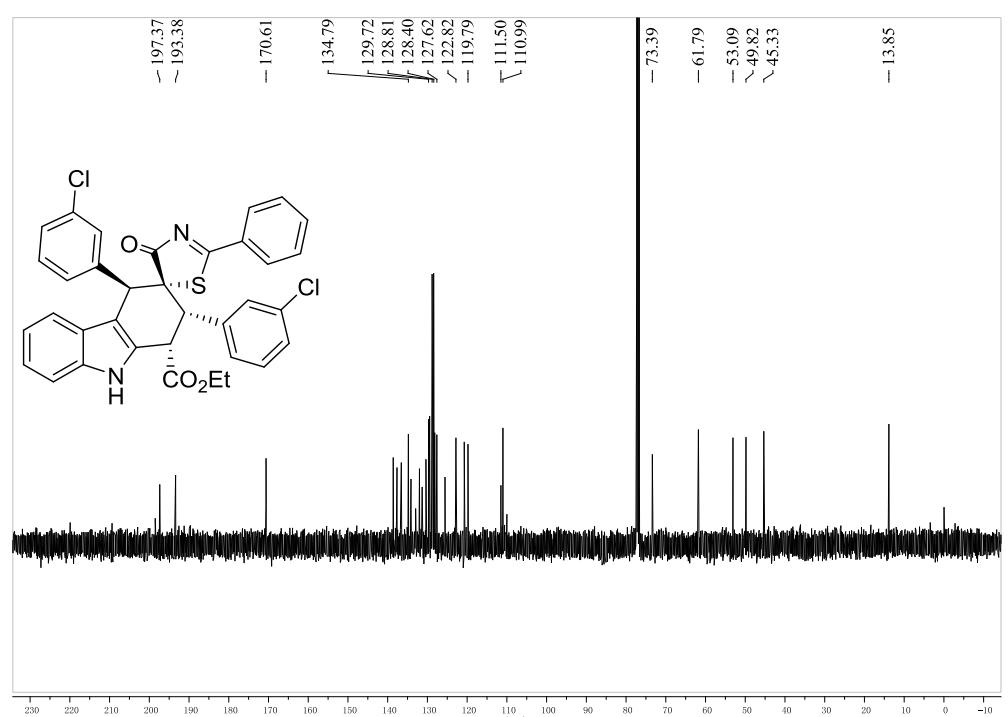
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethyl**

*rel*-(1*S*,2*S*,3*R*,4*R*)-2,4-bis(3-chlorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3g'**) :



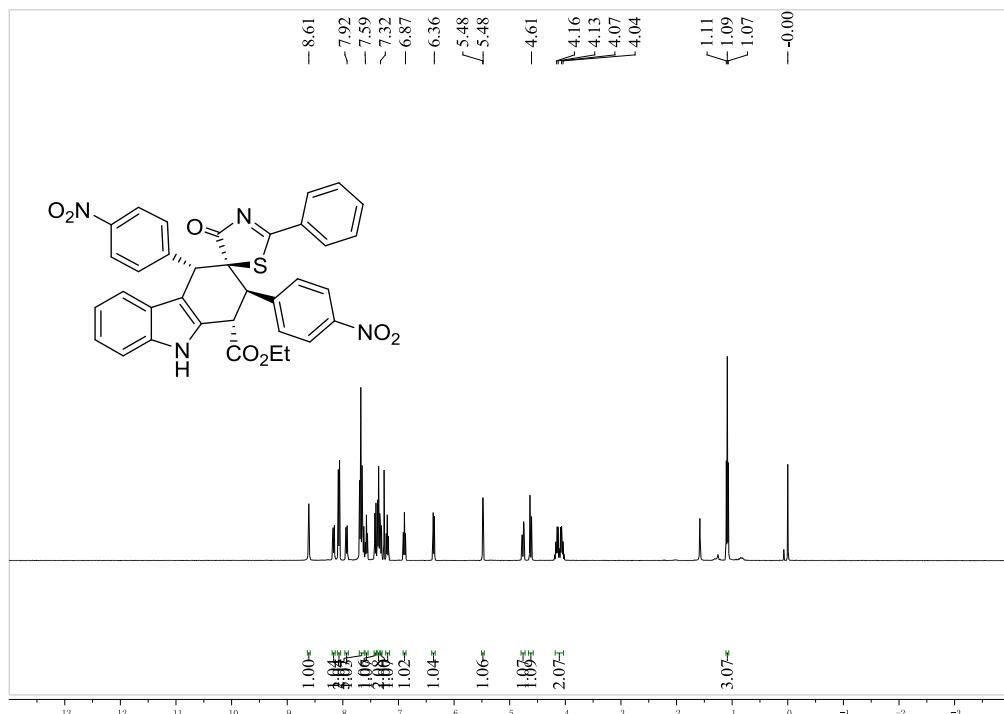
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



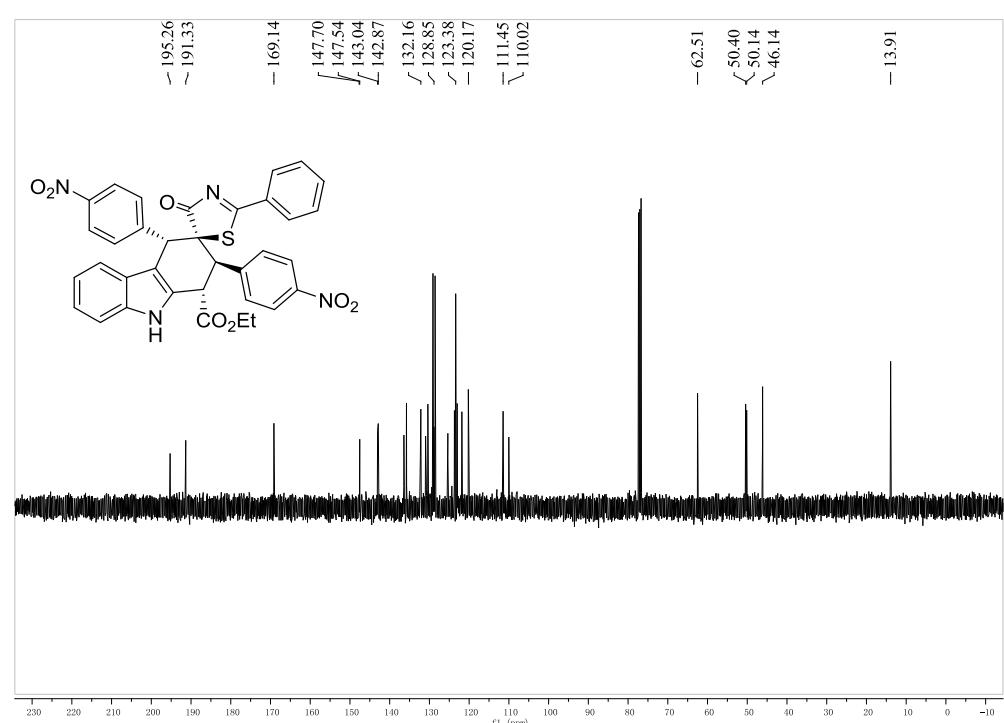
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

**Ethy**

*rel*-(1*S*,2*R*,3*S*,4*S*)-2,4-bis(4-nitrophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carba  
zole-3,5'-thiazole]-1-carboxylate (**3h**) :



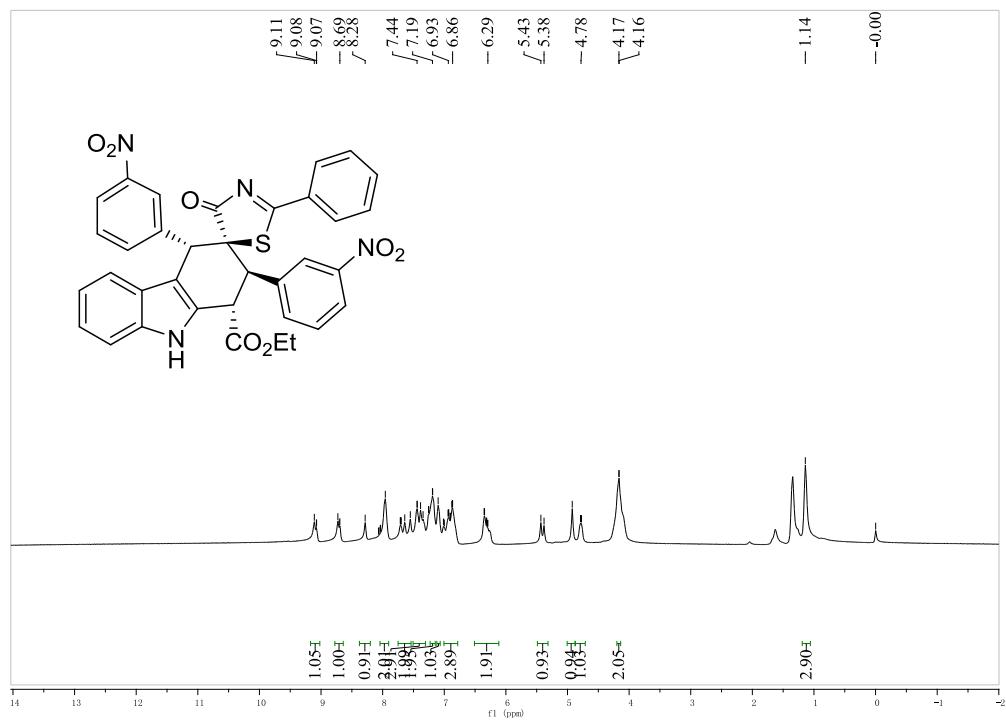
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



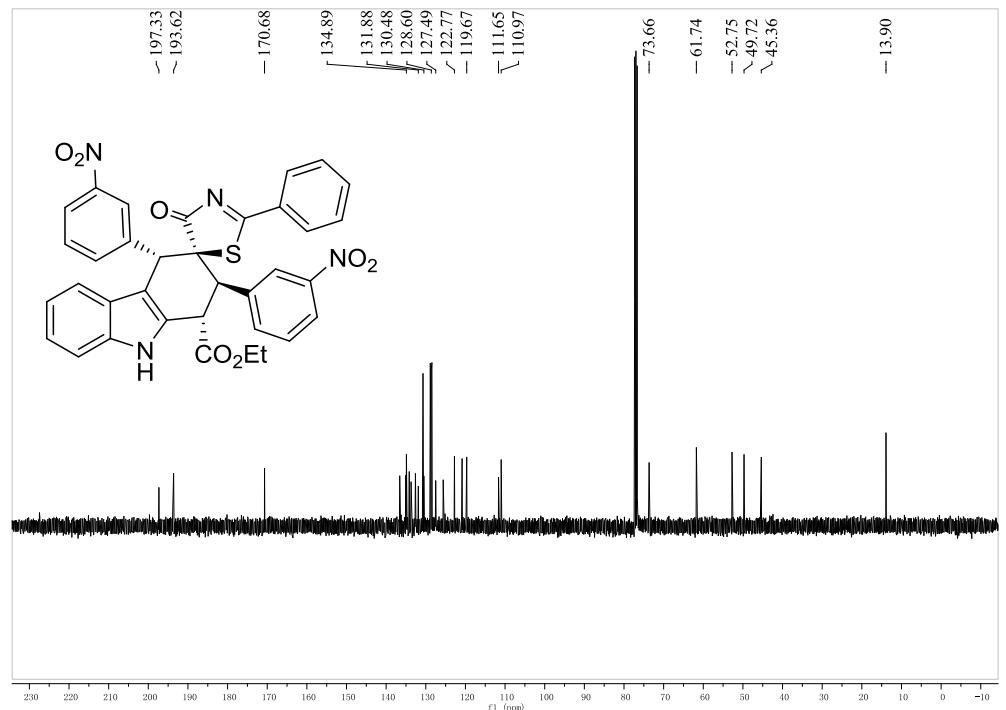
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)  
s60

**Ethy**

*rel*-(1*S*,2*R*,3*S*,4*S*)-2,4-bis(3-nitrophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carba  
zole-3,5'-thiazole]-1-carboxylate (**3i**) :



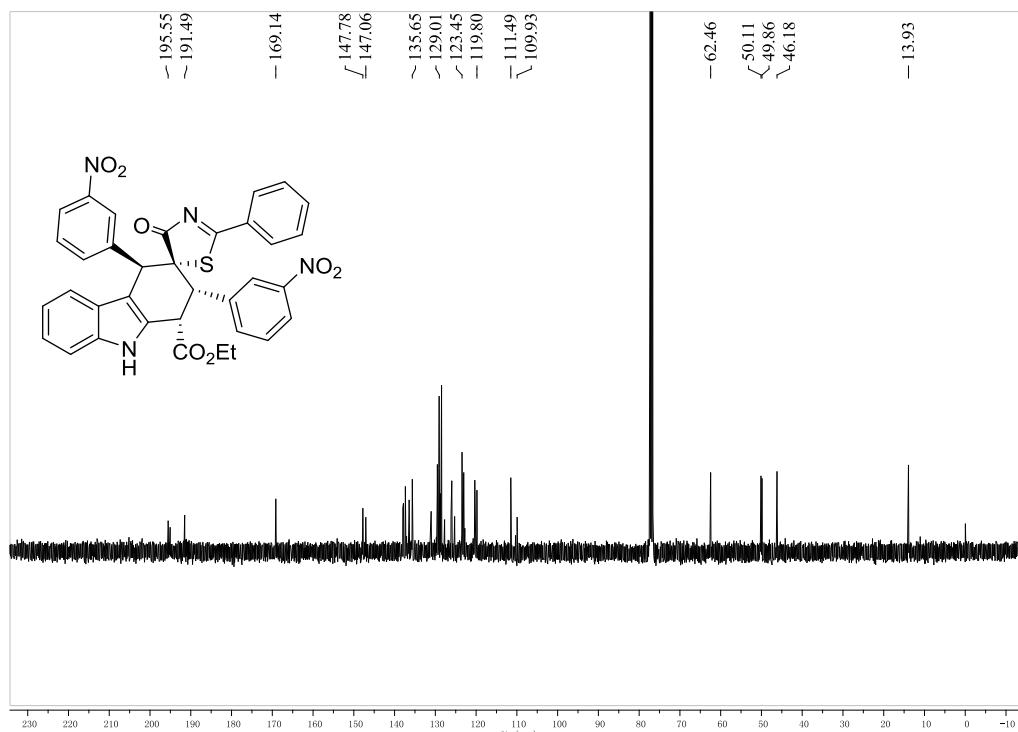
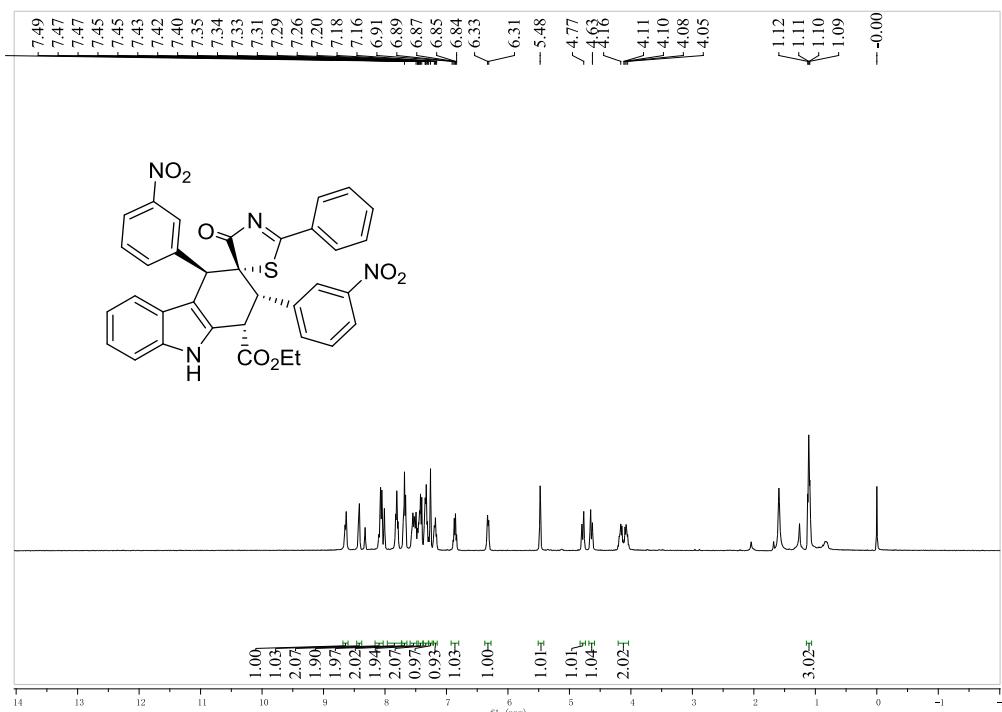
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)

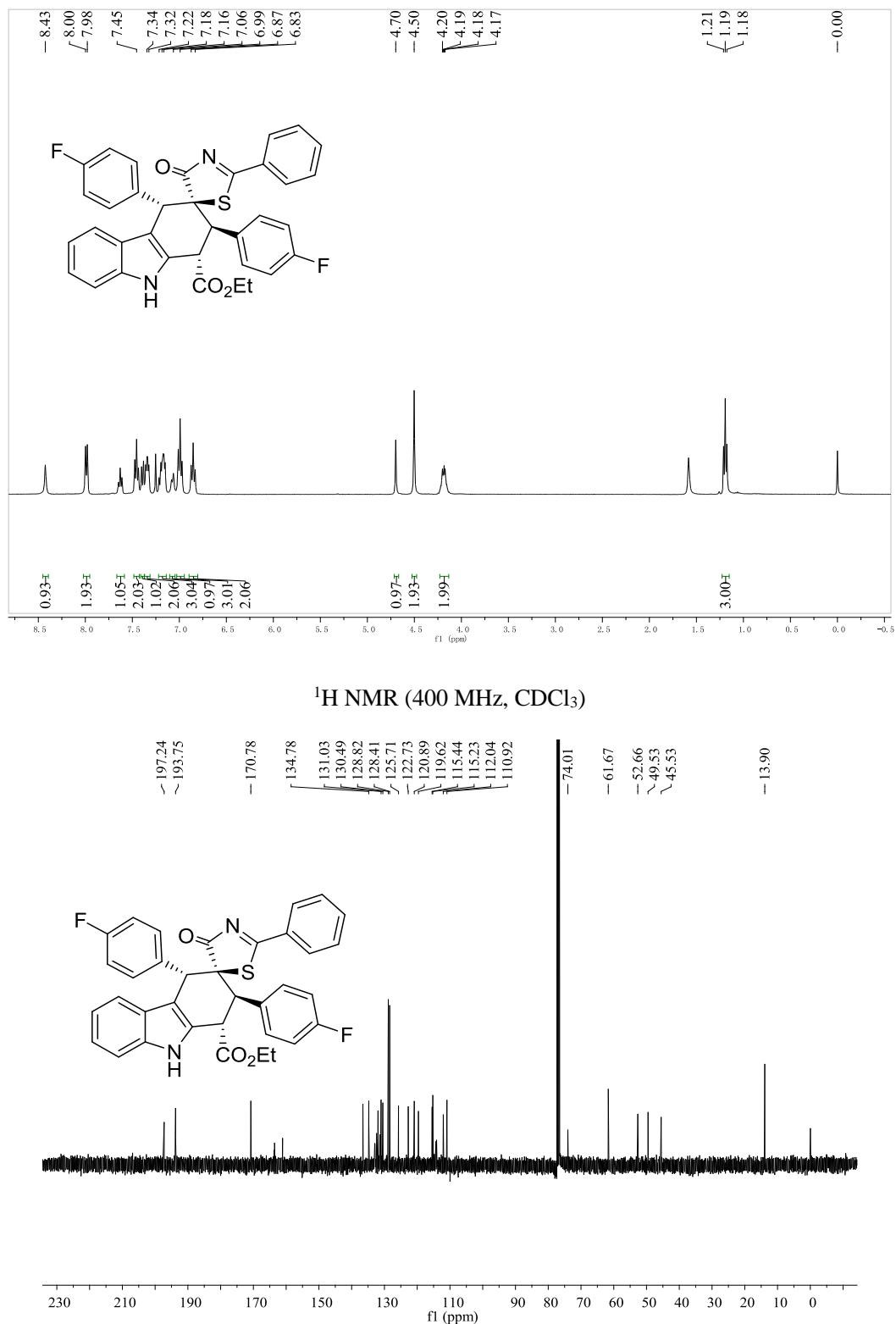
**Ethyl**

*rel*-(1*S*,2*S*,3*R*,4*R*)-2,4-bis(3-nitrophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carba  
zole-3,5'-thiazole]-1-carboxylate (**3i'**) :



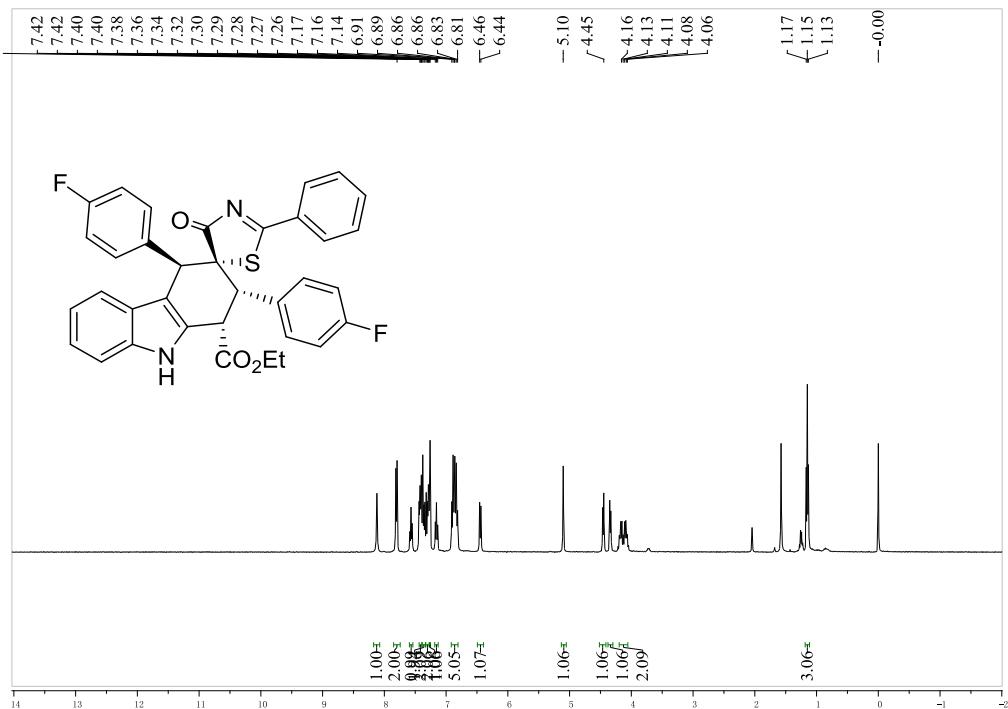
**Ethyl**

**rel-(1S,2R,3S,4S)-2,4-bis(4-fluorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (3j) :**

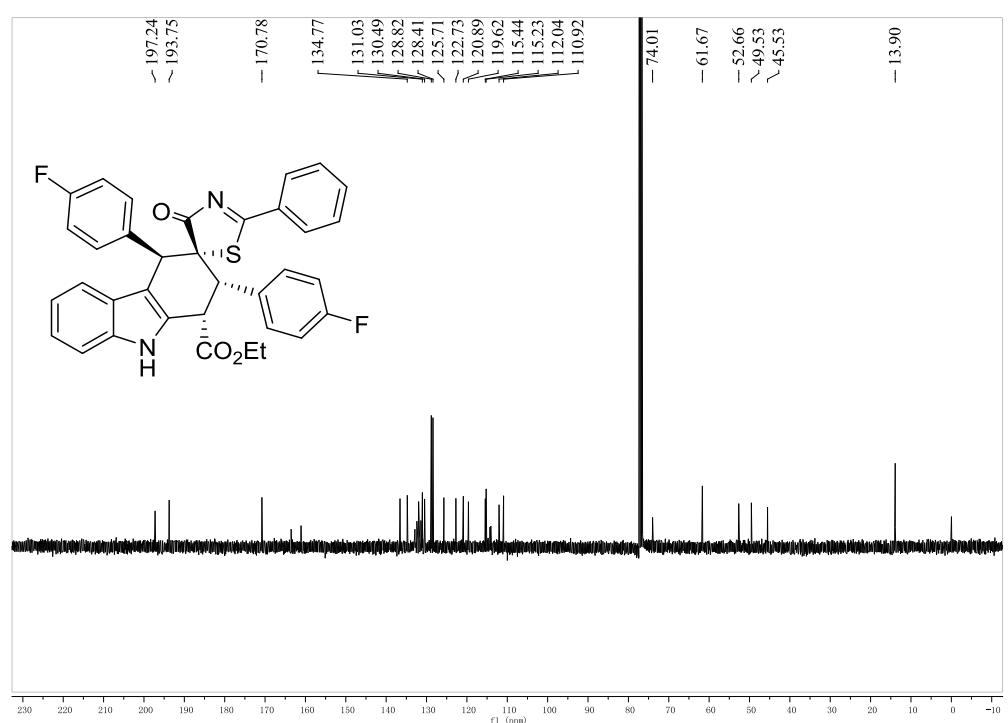


**Ethyl**

*rel*-(1*S*,2*S*,3*R*,4*R*)-2,4-bis(4-fluorophenyl)-4'-oxo-2'-phenyl-1,2,4,9-tetrahydro-4'H-spiro[carbazole-3,5'-thiazole]-1-carboxylate (**3j'**) :



<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)



<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>)