

## Supporting Information

### Facile Synthesis of Spiro-Pyrazolone-Tetrahydrofurans: *ipso*-Cyclization of arylidene pyrazolones with haloalcohols

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#### Table of Contents

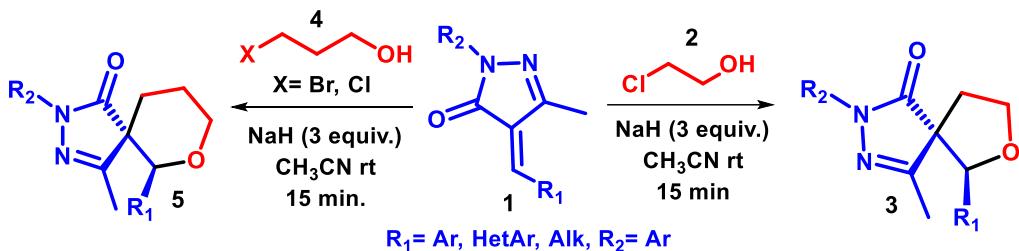
Materials and methodology.....	S2
Experimental Procedure.....	S2
Crystal Data.....	S3
Analytical Data .....	S5
<sup>1</sup> H and <sup>13</sup> C NMR Spectra .....	S12

## Material and Methods General Information

All reactions were carried out in oven-dried glassware and the compounds synthesized were fully characterized by spectroscopic data. The NMR spectra were recorded on JEOL - 400 spectrometers, (<sup>1</sup>H-NMR 400 MHz, <sup>13</sup>C-NMR 100 MHz) and were referenced to the residual peaks of CDCl<sub>3</sub> at 7.26 ppm (<sup>1</sup>H-NMR) and CDCl<sub>3</sub> at 77.23 ppm (<sup>13</sup>C-NMR). Chemical shifts ( $\delta$ ) are expressed in ppm, and  $J$  values are given in Hz. Data are reported as follows: Chemical shift in ppm ( $\delta$ ), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet), coupling constant (Hz), and integration. The reactions were monitored by thin layer chromatography (TLC) using silica gel GF254. The melting points (m.p.) were determined on the digital melting point apparatus and are uncorrected. Micromass Q-TOF mass spectrometer was used to record high-resolution mass spectra 60-70 eV in ESI mode. Materials unless otherwise indicated, all reagents were obtained from commercial suppliers used without further purification.

All the Arylidene pyrazolone was synthesized using the procedure given in the literature.<sup>1</sup>

### General Procedure for the preparation of Spiro-Pyrazolone-Tetrahydrofurans/Pyrans



To a 25 mL reaction flask, was added Arylidene pyrazolone **1** (100 mg, 1 equiv., 0.381 mmol) 2-chloro ethanol **2** (61 mg, 2 equiv. 0.763 mmol) or 3-Bromo propanol **4** (105 mg, 2 equiv. 0.763 mmol), Sodium hydride (45 mg, 3.0 equiv., 1.145mmol) and Acetonitrile (3 mL). The reaction mixture was stirred at room temperature for 15 minutes. The progress of the reaction was monitored by TLC. After the completion of the reaction, the mixture was quenched with water and extracted with ethyl acetate. The combined organic layers were dried over sodium sulfate, concentrated under reduced pressure and purified by column chromatography to afford product **3** or **5** as white solid.

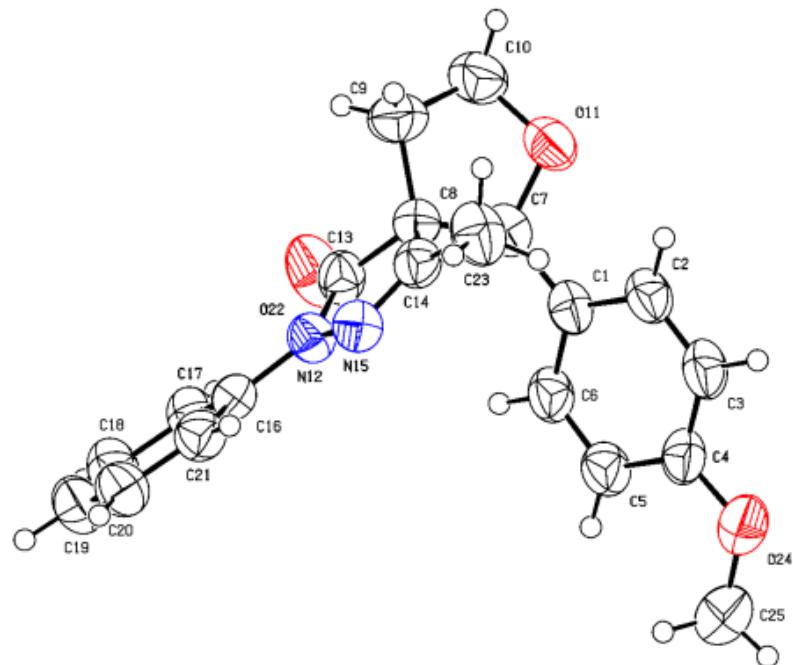
### References

- 1 R. Maity, C. Gharui, AK Sil, S.C. Pan, Organocatalytic asymmetric Michael/hemiketalization/retro-aldol reaction of  $\alpha$ -nitroketones with unsaturated pyrazolones: Synthesis of 3-acyloxy pyrazoles *Org. Lett.*, 2017, **19**, 3, 665.

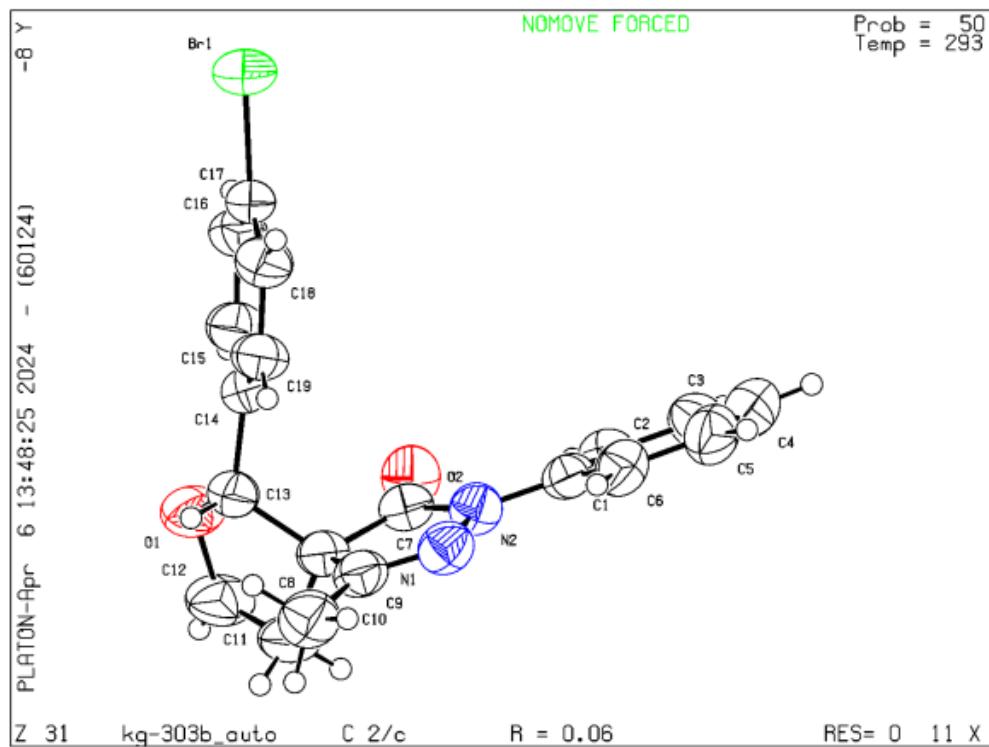
**Table 1: Structures of both major(3c) and minor(3l) diastereomers were confirmed by single crystal X-ray analysis. Crystal structure details are given below.**

Parameters	3c	3l
CCDC Number	2325753	2346737
Empirical formula	C <sub>20</sub> H <sub>20</sub> N <sub>2</sub> O <sub>3</sub>	C <sub>19</sub> H <sub>16</sub> BrN <sub>2</sub> O <sub>2</sub>
Formula weight	336.38	384.24
Crystal system	Orthorhombic	Monoclinic
Space group	P-21	C 2/c
Temperature (K)	293 K	293 K
Unit cell dimensions	a = 7.7915 (1) Å b = 12.8038 (1) Å c = 17.2663 (2) Å α = 90 β = 90 γ = 90	a=21.8407(5) Å b=6.7167(1) Å c=24.6680(7) Å α = 90 β = 109.105 (3) γ = 90
volume (Å <sup>3</sup> )	1722.50(3)	3419.41(15)
Z	4	8
Radiation type (Cu-Kα)/Å	1.54184	1.54184
No. measured reflections	17933	2733
Calculated density (mg/m <sup>3</sup> )	1.297	1.493
Absorption coefficient (mm <sup>-1</sup> )	0.713	3.386
F(000)	712	1560.0
θ range for data collection	4.299 to 72.062°	0.996 to 72.166°
Limiting indices	-9 ≤ h ≤ 9 -15 ≤ h ≤ 15 -21 ≤ h ≤ 20	26 ≤ h ≤ 26 -6 ≤ k ≤ 8 -30 ≤ l ≤ 30
Refinement method	Full-matrix least squares on F <sup>2</sup>	Full-matrix least squares on F <sup>2</sup>
Data / restraints / parameter	3395/0/228	3369/0/218
Final R Indices[I > 2σ(I)]	R1 = 0.0349 wR2 = 0.0908	R1 = 0.0676, wR2 = 0.1780
R indices (all data)	R1 = 0.0385 wR2 = 0.0942	R1 = 0.0582, wR2 = 0.1700
Goodness of fit on F <sup>2</sup>	1.060	1.064
Largest diff. peak and hole (eÅ <sup>-3</sup> )	0.095 to -0.152	0.76/-0.47
Reflections collected / unique	17933/3395 [R(int)=0.0295]	18443/3369 [R <sub>int</sub> = 0.0482, R <sub>sigma</sub> = 0.0288]

**Sample preparation for crystal growth:** Compound **3c&3l** was dissolved in ethanol, while slow evaporation of solvent at room temperature needle type crystals were grown.



**Figure 1:** ORTEP diagram of the compound of **3c (major isomer)** with 50% ellipsoid probability.

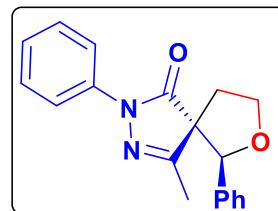


**Figure 2:** ORTEP diagram of the compound of **3l (minor isomer)** with 50% ellipsoid probability.

## Analytical Data

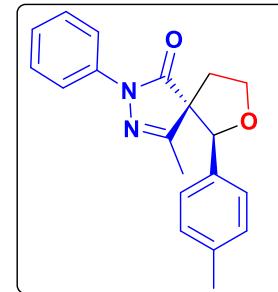
**(5S,6S)-4-methyl-2,6-diphenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3a):**

White solid; m.p. 145 - 147 °C; Yield – 76% (88 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.83 (s, 3H), 2.29 - 2.38 (m, 1H), 2.58 – 2.67 (m, 1H), 4.24 – 4.34 (m, 1H), 4.34 – 4.42 (m , 1H), 5.17 (s, 1H), 7.15 – 7.27 (m, 6H), 7.35 – 7.42 (m, 2H), 7.83 – 7.87 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.18, 34.58, 64.46, 67.39, 87.55, 118.89, 124.18, 125.12, 128.02, 128.32, 128.77, 125.65, 127.83, 161.73, 173.22; HRMS (ESI): m/z calcd for C<sub>19</sub>H<sub>18</sub>N<sub>2</sub>O<sub>2</sub> [M+1] 329.1257 found 329.1260.



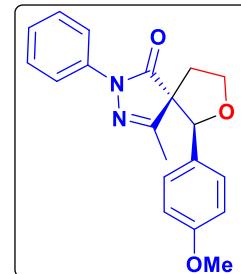
**(5S,6S)-4-methyl-2-phenyl-6-(p-tolyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3b):**

White solid; m.p. 129 - 131 °C; Yield – 78% (90 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.85 (s, 3H), 2.27 (s, 3H), 2.31 – 2.40 (m, 1H), 2.60 – 2.68 (m, 1H), 4.25 – 4.33 (m, 1H), 4.37 – 4.43 (m, 1H), 5.14 (s, 1H), 7.02 – 7.10 (m, 4H), 7.16 – 7.22 (m, 1H), 7.36 – 7.43 (m, 2H), 7.82 – 7.87 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.34, 21.09, 34.64, 64.57, 67.42, 87.73, 118.97, 124.14, 125.16, 128.85, 129.07, 132.63, 137.75, 137.92, 161.97, 173.35; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>20</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 344.1448 found 344.1450.



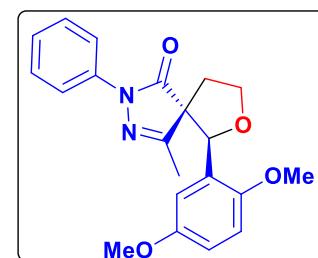
**(5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3c) :**

White solid; m.p. 134 - 136 °C; Yield – 72% (82 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.88 (s, 3H), 2.31 – 2.40 (m, 1H), 2.60 – 2.68 (m, 1H), 3.74 (s, 3H), 4.24 – 4.32 (m, 1H), 4.35 – 4.42 (m, 1H), 5.12 (s, 1H), 6.75 – 6.79 (m, 2H), 7.10 – 7.22 (m, 3H), 7.36 – 7.42 (m, 2H), 7.82 – 7.87 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.36, 34.51, 55.12, 64.60, 67.39, 87.66, 113.75, 118.92, 125.14, 125.46, 127.61, 128.84, 137.89, 159.26, 161.98, 173.30; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>20</sub>N<sub>2</sub>O<sub>3</sub> [M+Na] 359.1361 found 359.1366.



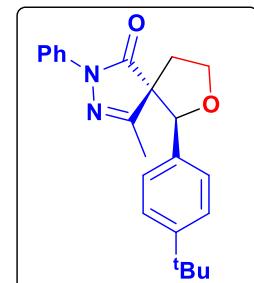
**(5S,6S)-6-(2,5-dimethoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3d) :**

White solid; m.p. 144 - 146 °C; Yield – 75% (85 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.59 (s, 3H), 2.22 - 2.32 (m, 1H), 2.43 – 2.51 (m, 1H), 3.33 (s, 3H), 3.8 (s, 3H), 4.16 – 4.24 (m, 1H), 4.35 – 4.42 (m , 1H), 5.28 (s, 1H), 6.60 – 6.64 (m, 1H), 6.72 – 6.77 (m, 1H), 7.21 – 7.24 (m, 1H), 7.36 – 7.42 (m, 2H), 7.12 – 7.18 (m, 1H), 7.94 - 7.99 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 14.74, 36.82, 55.05, 55.87, 63.11, 67.73, 83.45, 110.17, 112.47, 113.28, 118.01, 124.39, 126.65, 128.81, 138.56, 149.98, 153.38, 161.48, 175.58; HRMS (ESI): m/z calcd for C<sub>21</sub>H<sub>22</sub>N<sub>2</sub>O<sub>4</sub> [M+1] 361.1620 found 361.1623.



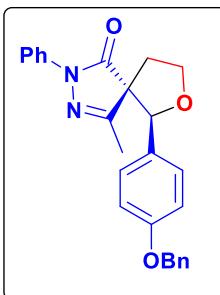
**(5S,6S)-6-(4-(tert-butyl)phenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3e) White**

solid; m.p. 152 - 154 °C; Yield – 87% (99 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.25 (s, 9H), 1.85 (s, 3H), 2.32 – 2.41 (m, 1H), 2.60 – 2.68 (m, 1H), 4.25 – 4.33 (m, 1H), 4.36 – 4.43 (m, 1H), 5.15 (s, 1H), 7.00 – 7.12 (m, 2H), 7.17 – 7.27 (m, 3H), 7.37 – 7.44 (m, 2H), 7.82 – 7.87 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.34, 31.24, 34.50, 34.84, 64.43, 67.40, 87.56, 119.04, 123.99, 125.21, 125.29, 128.88, 132.58, 137.90, 150.96, 162.13, 173.41; HRMS (ESI): m/z calcd for C<sub>23</sub>H<sub>26</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 385.1720 found 385.1725.



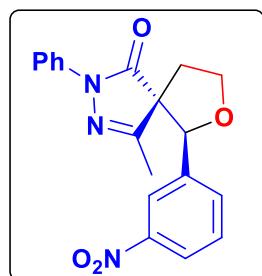
**(5S,6S)-6-(4-(benzyloxy)phenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3f) :**

White solid; m.p. 147 - 149 °C; Yield – 74% (82 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.81 (s, 3H), 2.26 – 2.35 (m, 1H), 2.53 – 2.62 (m, 1H), 4.18 – 4.27 (m, 1H), 4.30 – 4.36 (m, 1H), 4.92 (s, 2H), 5.05 (s, 1H), 6.75 – 6.81 (m, 2H), 7.04 – 7.16 (m, 3H), 7.21 – 7.55 (m, 7H), 7.75 – 7.79 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.41, 34.52, 64.62, 67.44, 69.94, 87.66, 114.70, 118.98, 125.20, 125.52, 127.52, 127.92, 127.98, 128.55, 128.88, 136.73, 137.88, 158.42, 162.02, 173.22; HRMS (ESI): m/z calcd for C<sub>26</sub>H<sub>24</sub>N<sub>2</sub>O<sub>3</sub> [M+Na] 435.1682 found 435.1679.



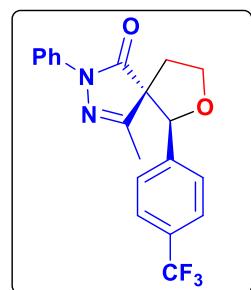
**(5S,6S)-4-methyl-6-(3-nitrophenyl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3g) :**

White solid; m.p. 141 - 143 °C; Yield – 92% (105 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.85 (s, 3H), 2.37 – 2.46 (m, 1H), 2.66 – 2.75 (m, 1H), 4.31 – 4.39 (m, 1H), 4.41 – 4.49 (m, 1H), 5.19 (s, 1H), 7.18 – 7.24 (m, 1H), 7.34 – 7.42 (m, 4H), 8.08 – 8.13 (m, 1H), 8.23 – 8.25 (m, 1H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.40, 34.49, 64.38, 67.73, 86.41, 119.05, 119.69, 123.21, 125.60, 128.97, 129.60, ; HRMS (ESI): m/z calcd for C<sub>19</sub>H<sub>17</sub>N<sub>3</sub>O<sub>4</sub> [M+Na] 374.1126 found 374.1128.



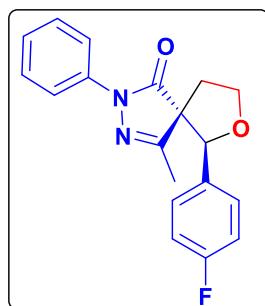
**(5S,6S)-4-methyl-2-phenyl-6-(4-(trifluoromethyl)phenyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3h) :**

White solid; m.p. 140 - 142 °C; Yield – 90% (102 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.83 (s, 3H), 2.33 – 2.42 (m, 1H), 2.63 – 2.72 (m, 1H), 4.27 – 4.35 (m, 1H), 4.37 – 4.45 (m, 1H), 5.17 (s, 1H), 7.17 – 7.23 (m, 1H), 7.30 – 7.33 (m, 2H), 7.37 – 7.43 (m, 2H), 7.48 – 7.52 (m, 2H), 7.81 – 7.86 (M, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.26, 34.73, 64.39, 67.61, 86.79, 118.89, 122.50, 124.73, 125.42, 128.95, 130.48, 137.70, 139.81, 161.30, 172.87; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>17</sub>F<sub>3</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 397.1132 found 397.1134.



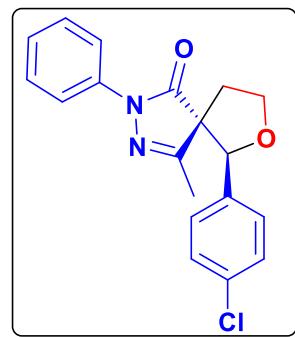
**(5S,6S)-6-(4-fluorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3i) :**

White solid; m.p. 151 - 153 °C; Yield – 52% (60 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.86 (s, 3H), 2.33 – 2.42 (m, 1H), 2.61 – 2.69 (m, 1H), 4.26 – 4.35 (m, 1H), 4.36 – 4.44 (m, 1H), 5.13 (s, 1H), 6.90 – 7.98 (m, 2H), 7.15 – 7.21 (m, 3H), 7.37 – 7.43 (m, 2H), 7.82 – 7.86 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.36, 34.51, 64.40, 67.52, 87.17, 115.32, 115.53, 118.91, 125.33, 125.93, 126.05, 128.92, 131.40, 161.72, 173.06; HRMS (ESI): m/z calcd for C<sub>19</sub>H<sub>17</sub>FN<sub>2</sub>O<sub>2</sub> [M+Na] 347.1326 found 347.1329.



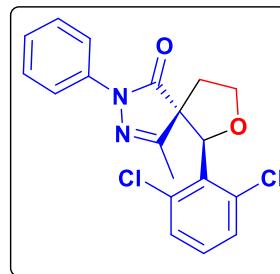
**(5S,6S)-6-(4-chlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3j) :**

White solid; m.p. 137 - 139 °C; Yield – 55% (63 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.86 (s, 3H), 2.33 – 2.42 (m, 1H), 2.62 – 2.71 (m, 1H), 4.26 – 4.35 (m, 1H), 4.36 – 4.44 (m, 1H), 5.12 (s, 1H), 7.11 – 7.16 (m, 2H), 7.18 – 7.25 (m, 3H), 7.37 – 7.42 (m, 2H), 7.82 – 7.86 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.36, 34.59, 64.47, 67.55, 87.01, 118.91, 125.36, 125.70, 128.66, 128.93, 133.90, 134.23, 137.75, 161.54, 172.99; HRMS (ESI): m/z calcd for C<sub>19</sub>H<sub>17</sub>ClN<sub>2</sub>O<sub>2</sub> [M+Na] 363.0864 found 363.0866.



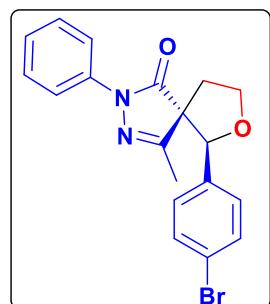
**(5S,6R)-6-(2,6-dichlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3k) :**

White solid; m.p. 136 - 138 °C; Yield – 69% (78 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.56 (s, 3H), 2.21 – 2.27 (m, 1H), 2.47 – 2.56 (m, 1H), 4.32 – 4.47 (m, 2H), 5.85 (s, 1H), 7.07 – 7.16 (m, 2H), 7.17 – 7.22 (m, 2H), 7.31 – 7.37 (m, 2H), 7.78 – 7.82 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 14.14, 36.61, 64.40, 68.32, 83.92, 118.84, 125.16, 128.87, 129.52, 129.75, 132.95, 134.71, 137.76, 158.91, 175.83; HRMS (ESI): m/z calcd for C<sub>19</sub>H<sub>16</sub>Cl<sub>2</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 397.0490 found 390.0494.



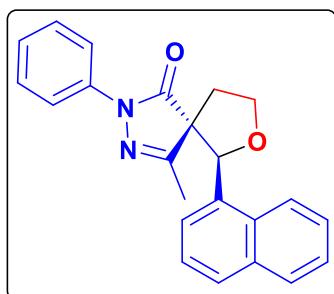
**(5S,6S)-6-(4-bromophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3l) :**

White solid; m.p. 158 - 160 °C; Yield – 81% (91 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.84 (s, 3H), 2.30 – 2.39 (m, 1H), 2.60 – 2.68 (m, 1H), 4.23 – 4.41 (m, 2H), 5.09 (s, 1H), 7.04 – 7.09 (m, 2H), 7.16 – 7.22 (m, 1H), 7.34 – 7.43 (m, 4H), 7.82 – 7.87 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.25, 34.54, 64.33, 6.47, 86.94, 118.82, 121.98, 125.26, 125.91, 128.84, 131.50, 134.77, 137.72, 161.39, 172.90; HRMS (ESI): m/z calcd for C<sub>19</sub>H<sub>17</sub>BrN<sub>2</sub>O<sub>2</sub> [M+Na] 407.0361 found 407.0366.



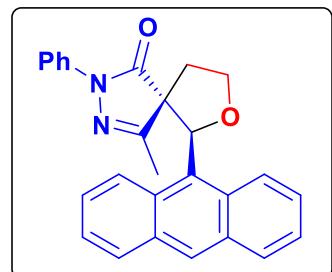
**(5S,6S)-4-methyl-6-(naphthalen-1-yl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3m) :**

White solid; m.p. 142 - 144 °C; Yield – 70% (79 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.54 (s, 3H), 2.36 – 2.46 (m, 1H), 2.56 – 2.64 (m, 1H), 4.35 – 4.43 (m, 1H), 4.50 – 4.56 (m, 1H), 5.90 (s, 1H), 7.13 – 7.21 (m, 2H), 7.30 – 7.38 (m, 3H), 7.43 – 7.49 (m, 1H), 7.56 – 7.59 (m, 1H), 7.65 – 7.69 (m, 2H), 7.76 – 7.80 (m, 2H), 7.87 – 7.91 (m, 1H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.01, 36.31, 64.19, 67.95, 85.32, 119.11, 122.57, 123.31, 124.73, 125.21, 125.81, 126.14, 128.71, 128.82, 129.92, 132.40, 133.46, 13.74, 161.43, 174.98; HRMS (ESI): m/z calcd for C<sub>23</sub>H<sub>20</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 379.1424 found 380.1427.



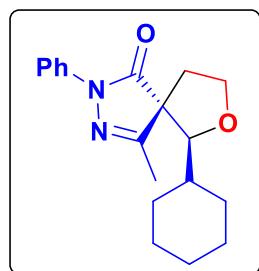
**(5S,6S)-6-(anthracen-9-yl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3n) :**

White solid; m.p. 139 - 141 °C; Yield – 67% (75 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.18 (s, 3H), 2.50 – 2.56 (m, 1H), 2.60 – 2.69 (m, 1H), 4.43 – 4.51 (m, 1H), 4.72 – 4.76 (m, 1H), 6.70 (s, 1H), 7.15 – 7.24 (m, 3H), 7.34 – 7.41 (m, 6H), 7.69 – 7.72 (m, 2H), 7.93 – 7.98 (m, 2H), 8.42 (s, 3H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 14.99, 29.68, 36.92, 65.55, 68.26, 88.15, 119.11, 124.83, 125.25, 126.06, 126.58, 128.77, 129.02, 129.34, 129.49, 130.05, 130.13, 131.33, 135.93, 136.00, 137.77, 148.33, 150.48, 161.16, 176.27; HRMS (ESI): m/z calcd for C<sub>27</sub>H<sub>22</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 429.1579 found 429.1575.



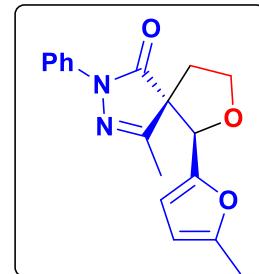
**(5S,6S)-6-cyclohexyl-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3o) :**

White solid; m.p. 123 - 125 °C; Yield – 62% (68 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 0.84 – 1.69 (m, 9H), 2.19 – 2.52 (m, 6H), 2.45 – 2.52 (m, 1H), 3.68 – 3.72 (m, 1H), 4.03 – 4.15 (m, 2H), 7.15 – 7.21 (m, 1H), 7.38 – 7.42 (m, 2H), 7.84 – 7.89 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.78, 25.93, 27.62, 31.28, 36.35, 39.50, 61.72, 66.29, 91.07, 118.82, 125.06, 128.88, 138.04, 162.52, 173.50; HRMS (ESI): m/z calcd for C<sub>18</sub>H<sub>22</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 321.1884 found 321.1886.



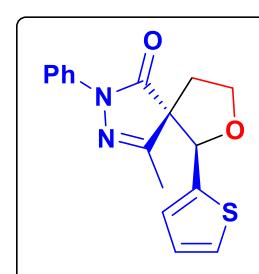
**(5S,6R)-4-methyl-6-(5-methylfuran-2-yl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3p) :**

White solid; m.p. 146 - 148 °C; Yield – 82% (95 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 2.14(s, 3H), 2.15 (s, 3H), 2.29 – 2.40 (m, 1H), 2.58 – 2.67 (m, 1H), 4.24 – 4.38 (m, 2H), 4.36 – 4.43 (m, 1H), 5.02 (s, 1H), 5.82 – 5.85 (m, 1H), 6.16 (d, J = 2.8 Hz, 1H), 7.15 – 7.21 (m, 1H), 7.35 – 7.42 (m, 2H), 7.82 – 7.87 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 13.3, 15.34, 34.17, 63.11, 67.51, 82.49, 106.11, 108.95, 118.96, 125.12, 128.79, 137.88, 146.18, 152.74, 161.89, 172.27; HRMS (ESI): m/z calcd for C<sub>18</sub>H<sub>18</sub>N<sub>2</sub>O<sub>3</sub> [M+Na] 333.1227 found 333.1230.



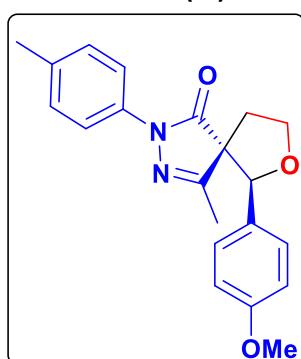
**(5S,6R)-4-methyl-2-phenyl-6-(thiophen-2-yl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3q) :**

White solid; m.p. 149 - 151 °C; Yield – 77% (89 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 2.01 (s, 3H), 2.36 – 2.45 (m, 1H), 2.63 – 2.72 (m, 1H), 4.29 – 4.43 (m, 2H), 5.34 (s, 1H), 6.77 – 6.80 (m, 1H), 6.88 – 6.91 (m, 1H), 7.18 – 7.23 (m, 2H), 7.37 – 7.43 (m, 2H), 7.84 – 7.89 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.58, 34.34, 64.60, 67.70, 85.20, 118.96, 123.29, 124.63, 125.26, 127.05, 128.89, 137.68, 137.84, 161.52, 172.31; HRMS (ESI): m/z calcd for C<sub>17</sub>H<sub>16</sub>N<sub>2</sub>O<sub>2</sub>S [M+Na] 335.0976 found 335.0977.



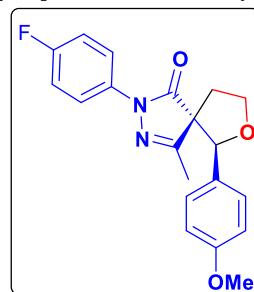
**(5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-(p-tolyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3r) :**

White solid; m.p. 153 - 155 °C; Yield – 63% (72 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.86 (s, 3H), 2.30 – 2.39 (m, 4H), 2.58 – 2.67 (m, 1H), 3.73 (s, 3H), 4.24 – 4.32 (m, 1H), 4.35 – 4.41 (m, 1H), 5.10 (s, 1H), 6.73 – 6.79 (m, 2H), 7.07 – 7.21 (m, 2H), 7.76 – 7.74 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.33, 20.91, 34.45, 55.11, 64.53, 67.39, 87.64, 113.75, 119.00, 125.48, 127.69, 129.34, 134.86, 135.51, 159.26, 161.82, 173.08; HRMS (ESI): m/z calcd for C<sub>21</sub>H<sub>22</sub>N<sub>2</sub>O<sub>3</sub> [M+Na] 343.1403 found 343.1407.



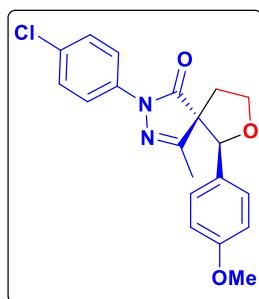
**(5S,6S)-2-(4-fluorophenyl)-6-(4-methoxyphenyl)-4-methyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3s) :**

White solid; m.p. 155 - 157 °C; Yield – 65% (74 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.88 (s, 3H), 2.32 – 2.40 (m, 1H), 2.60 – 2.68 (m, 1H), 3.75 (s, 3H), 4.25 – 4.33 (m, 1H), 4.35 – 4.43 (m, 1H), 5.11 (s, 1H), 6.75 – 6.80 (m, 2H), 7.05 – 7.13 (m, 4H), 7.78 – 7.85 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.35, 34.45, 55.15, 64.61, 67.14, 87.74, 113.79, 115.43, 115.66, 120.62, 120.69, 125.48, 127.56, 134.08, 159.35, 162.15, 173.12; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>19</sub>FN<sub>2</sub>O<sub>3</sub> [M+Na] 377.1246 found 377.1248.



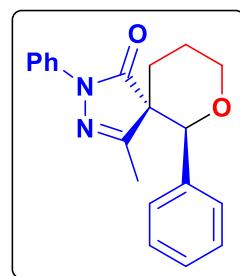
**(5S,6S)-2-(4-chlorophenyl)-6-(4-methoxyphenyl)-4-methyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3t)**

White solid; m.p. 133 - 135 °C; Yield – 61% (69 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.88 (s, 3H), 2.31 – 2.34 (m, 1H), 2.60 – 2.68 (m, 1H), 3.74 (s, 1H), 4.26 – 4.33 (m, 1H), 4.36 – 4.43 (m, 1H), 5.10 (s, 1H), 6.74 – 6.79 (m, 2H), 7.07 – 7.11 (m, 2H), 7.32 – 7.38 (m, 2H), 7.80 – 7.86 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 15.38, 34.49, 55.16, 64.72, 67.43, 87.80, 113.82, 119.94, 125.46, 127.49, 128.91, 130.22, 136.51, 159.37, 162.31, 173.30; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>19</sub>CIN<sub>2</sub>O<sub>2</sub> [M+Na] 393.0976 found 393.0976.



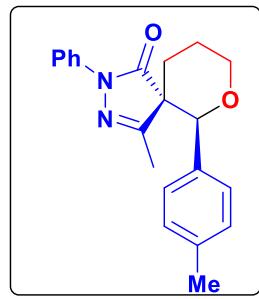
**(5S,6S)-4-methyl-2,6-diphenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5a) :**

White solid; m.p. 166 - 168 °C; Yield – 74% (90 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.72 – 1.79 (m, 1H), 1.92 – 1.99 (m, 1H), 2.07 – 2.19 (m, 1H), 2.32 – 2.42 (m, 4H), 3.80 – 3.88 (m, 1H), 4.33 – 4.39 (m, 1H), 4.74 (s, 1H), 7.08 – 7.23 (m, 6H), 7.26 – 7.33 (m, 2H), 7.55 – 7.60 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.70, 20.91, 28.73, 59.07, 68.77, 82.80, 119.33, 125.18, 125.31, 128.03, 128.09, 128.65, 137.05, 137.41, 161.98, 173.54; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>20</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 343.1526 found 343.1528.



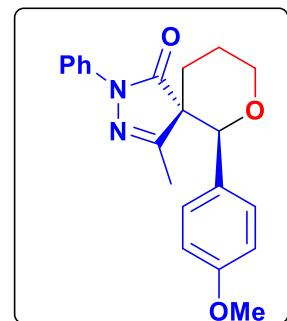
**(5S,6S)-4-methyl-2-phenyl-6-(p-tolyl)-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5b) :**

White solid; m.p. 175 - 177 °C; Yield – 72% (87 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.73 – 1.78 (m, 1H), 1.92 – 1.99 (m, 1H), 2.05 – 2.23 (m, 4H), 2.30 – 2.42 (m, 4H), 3.80 – 3.88 (m, 1H), 4.33 – 4.37 (m, 1H), 4.74 (s, 1H), 6.96 – 6.99 (m, 2H), 7.11 – 7.17 (m, 3H), 7.30 – 7.36 (m, 2H), 7.61 – 7.66 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.63, 20.89, 20.97, 28.78, 59.08, 68.70, 82.63, 119.24, 125.05, 125.12, 128.587, 128.66, 134.08, 137.45, 137.58, 162.07, 173.59; HRMS (ESI): m/z calcd for C<sub>21</sub>H<sub>22</sub>N<sub>2</sub>O<sub>2</sub> [M+Na] 357.1776 found 357.1779.



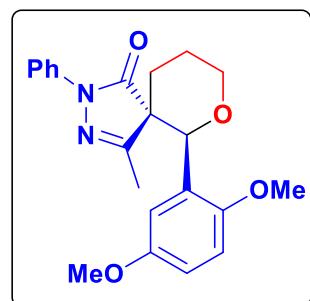
**(5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5c) :**

White solid; m.p. 168 - 170 °C; Yield – 74% (88 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.73 – 1.80 (m, 1H), 1.92 – 1.99 (m, 1H), 2.06 – 2.21 (m, 1H), 2.31 – 2.41 (m, 4H), 3.69 (s, 3H), 3.80 – 3.88 (m, 1H), 4.33 – 4.39 (m, 1H), 4.70 (s, 1H), 6.67 – 6.73 (m, 2H), 7.10 – 7.18 (m, 3H), 7.28 – 7.35 (m, 2H), 7.58 – 7.63 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.75, 20.97, 28.72, 55.10, 59.23, 68.89, 82.65, 113.41, 119.34, 125.16, 126.60, 128.67, 129.34, 137.41, 159.03, 162.19, 173.72; HRMS (ESI): m/z calcd for C<sub>21</sub>H<sub>22</sub>N<sub>2</sub>O<sub>3</sub> [M+Na] 373.1652 found 373.1654.



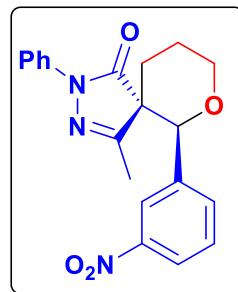
**(5S,6S)-6-(2,5-dimethoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5d) :**

White solid; m.p. 179 - 181 °C; Yield – 69% (81 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.75 – 1.82 (m, 1H), 1.90 – 1.96 (m, 1H), 2.04 – 2.20 (m, 1H), 2.35 – 2.43 (m, 1H), 3.48 (s, 1H), 3.70 – 3.88 (m, 4H), 4.27 – 4.33 (m, 1H), 5.11 (s, 1H), 6.52 – 6.57 (m, 1H), 6.64 – 6.69 (m, 1H), 6.95 – 6.98 (m, 1H), 7.05 – 7.09 (m, 1H), 7.25 – 7.30 (m, 2H), 7.62 – 7.66 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.84, 20.86, 28.57, 55.41, 55.67, 58.12, 68.66, 110.96, 113.12, 114.10, 118.62, 124.38, 124.56, 126.48, 128.56, 137.96, 150.04, 153.61, 161.92, 173.07; HRMS (ESI): m/z calcd for C<sub>22</sub>H<sub>24</sub>N<sub>2</sub>O<sub>4</sub> [M+Na] 403.1776 found 403.1777.



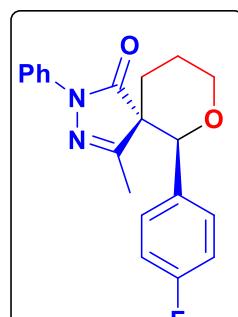
**(5S,6S)-4-methyl-6-(3-nitrophenyl)-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5e) :**

White solid; m.p. 169 - 171 °C; Yield – 89% (105 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.79 – 1.85 (m, 1H), 1.97 – 2.04 (m, 1H), 2.11 – 2.23 (m, 1H), 2.32 – 2.45 (m, 4H), 3.83 – 3.92 (m, 1H), 4.39 – 4.45 (m, 1H), 4.84 (s, 1H), 7.12 – 7.18 (m, 1H), 7.29 – 7.35 (m, 3H), 7.47 – 7.52 (m, 1H), 7.59 – 7.64 (m, 2H), 8.01 – 8.06 (m, 1H), 8.23 – 8.26 (m, 1H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 14.19, 16.24, 24.08, 54.38, 64.34, 77.00, 114.62, 116.07, 118.66, 121.04, 124.35, 124.54, 127.13, 132.62, 134.88, 143.54, 156.99, 168.60; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>19</sub>N<sub>3</sub>O<sub>4</sub> [M+Na] 388.1488 found 388.1490.



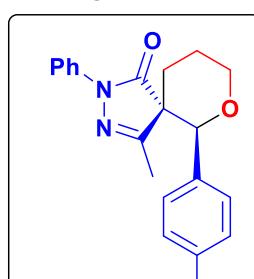
**(5S,6S)-6-(4-fluorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5f) :**

White solid; m.p. 181 - 183 °C; Yield – 56% (67 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.74 – 1.79 (m, 1H), 1.93 – 1.99 (m, 1H), 2.06 – 2.19 (m, 1H), 2.32 – 2.41 (m, 4H), 3.80 – 3.88 (m, 1H), 4.33 – 4.39 (m, 1H), 4.73 (s, 1H), 6.83 – 6.91 (m, 2H), 7.12 – 7.17 (m, 1H), 7.20 – 7.27 (m, 2H), 7.29 – 7.36 (m, 2H), 7.60 – 7.64 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.65, 20.80, 28.57, 59.04, 82.19, 114.81, 115.02, 119.15, 125.24, 127.06, 127.14, 128.69, 132.92, 137.31, 161.02, 161.76, 163.47, 163.47, 173.40; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>19</sub>FN<sub>2</sub>O<sub>2</sub> [M+Na] 361.1423 found 361.1424.



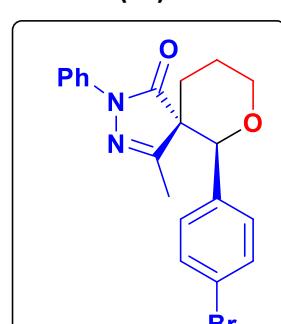
**(5S,6S)-6-(4-chlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5g) :**

White solid; m.p. 186 - 188 °C; Yield – 58% (69 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.74 – 1.79 (m, 1H), 1.93 – 1.99 (m, 1H), 2.05 – 2.19 (m, 1H), 2.30 – 2.41 (m, 4H), 3.80 – 3.87 (m, 1H), 4.33 – 4.39 (m, 1H), 4.73 (s, 1H), 7.13 – 7.21 (m, 5H), 7.31 – 7.36 (m, 2H), 7.61 – 7.65 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.60, 20.79, 28.73, 58.93, 68.73, 81.93, 119.16, 125.29, 126.71, 128.20, 128.72, 133.77, 135.70, 137.30, 161.72, 173.35; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>19</sub>ClN<sub>2</sub>O<sub>2</sub> [M+Na] 377.0256 found 377.0258.



**(5S,6S)-6-(4-bromophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5h) :**

White solid; m.p. 173 - 175 °C; Yield – 78% (138 mg); <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>); δ = 1.66 – 1.72 (m, 1H), 1.85 – 1.92 (m, 1H), 1.97 – 2.11 (m, 1H), 2.23 – 2.33 (m, 1H), 4.63 (s, 1H), 7.02 – 7.11 (m, 3H), 7.17 – 7.30 (m, 4H), 7.53 – 7.58 (m, 2H); <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>); δ = 18.60, 20.80, 28.77, 58.86, 68.71, 81.91, 119.17, 122.02, 125.30, 127.02, 128.73, 131.14, 136.24, 137.30, 161.71, 173.35; HRMS (ESI): m/z calcd for C<sub>20</sub>H<sub>19</sub>BrN<sub>2</sub>O<sub>2</sub> [M+Na] 321.1866 found 321.1869.



**Spectral data:**

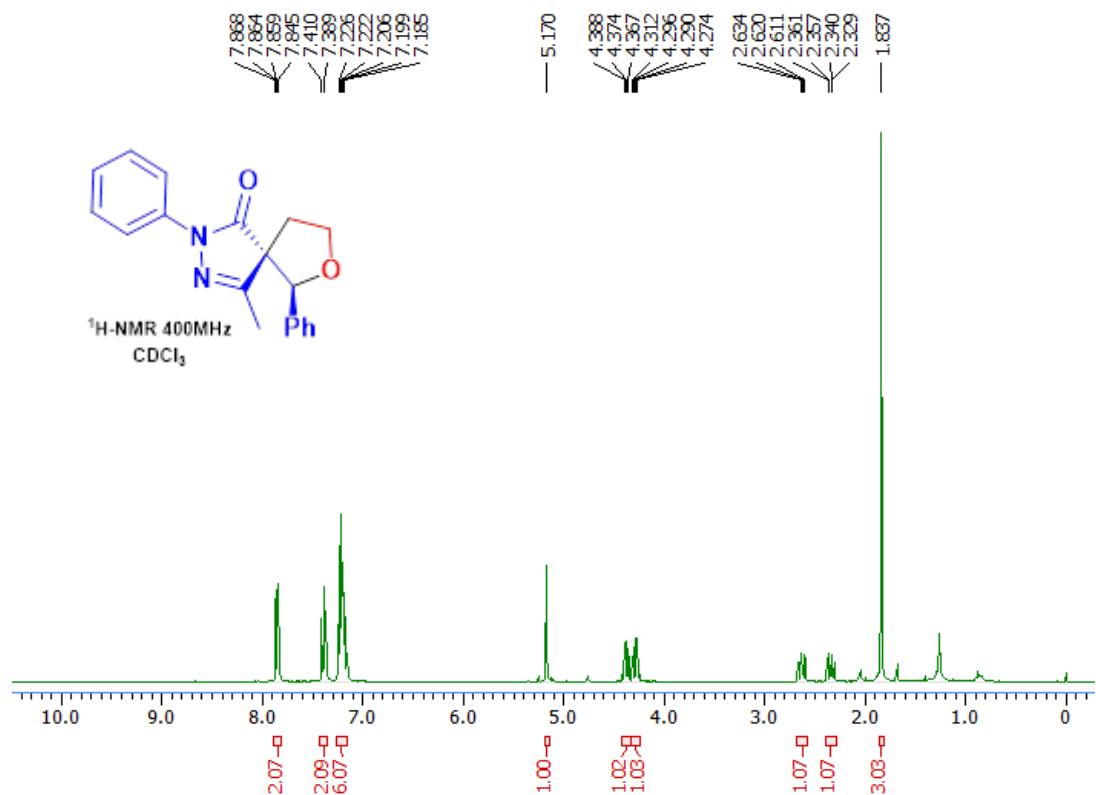


Fig. 3: <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-2,6-diphenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3a)

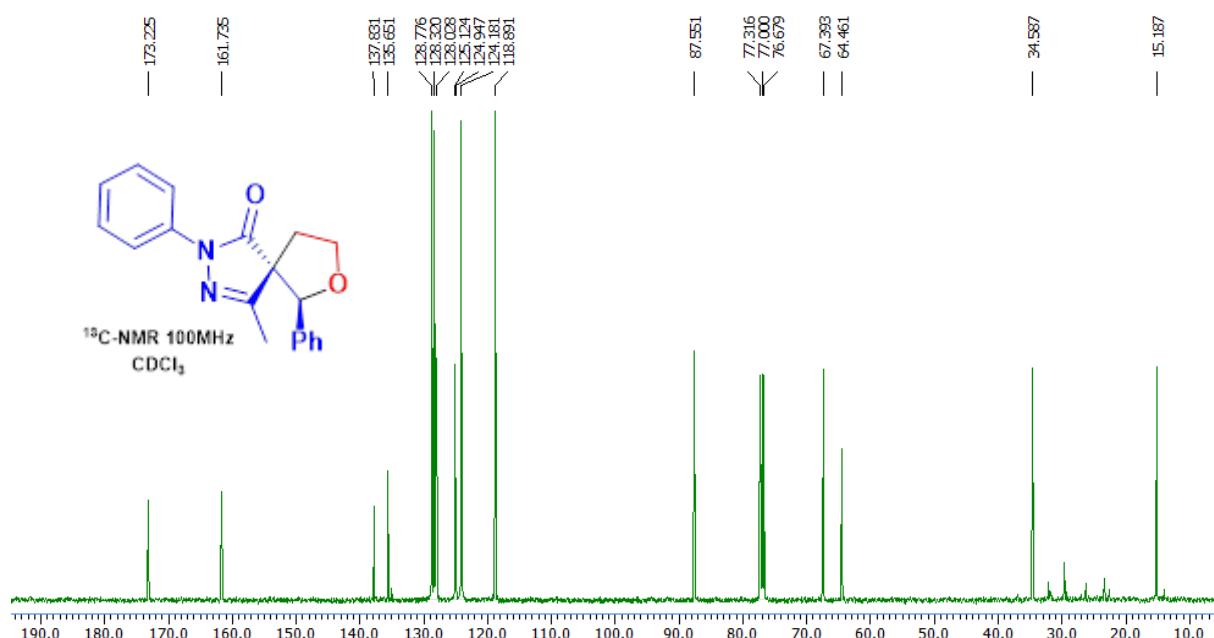
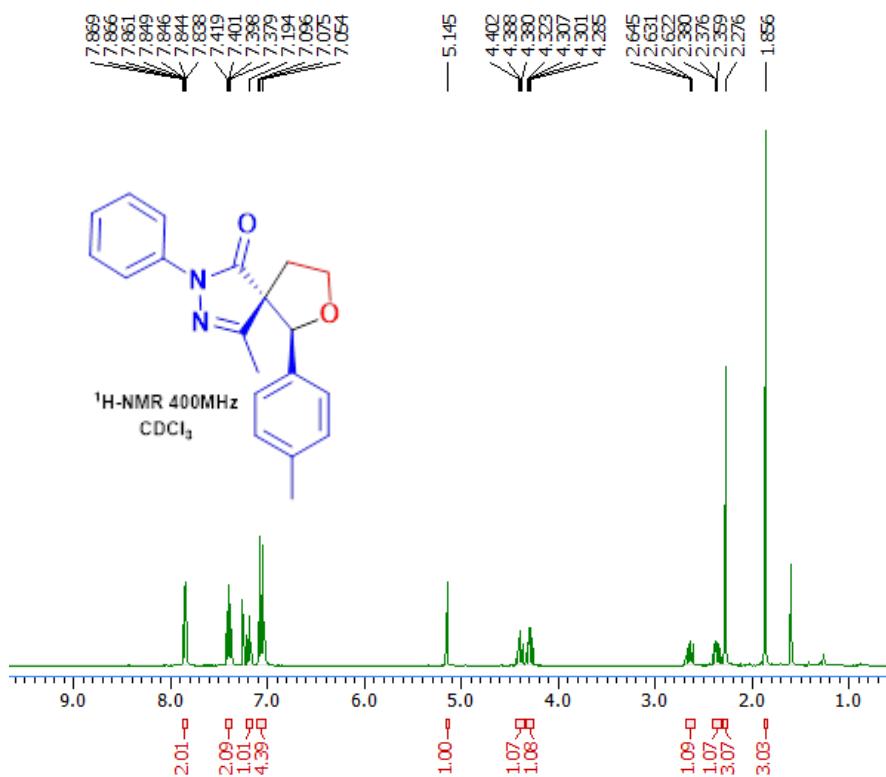
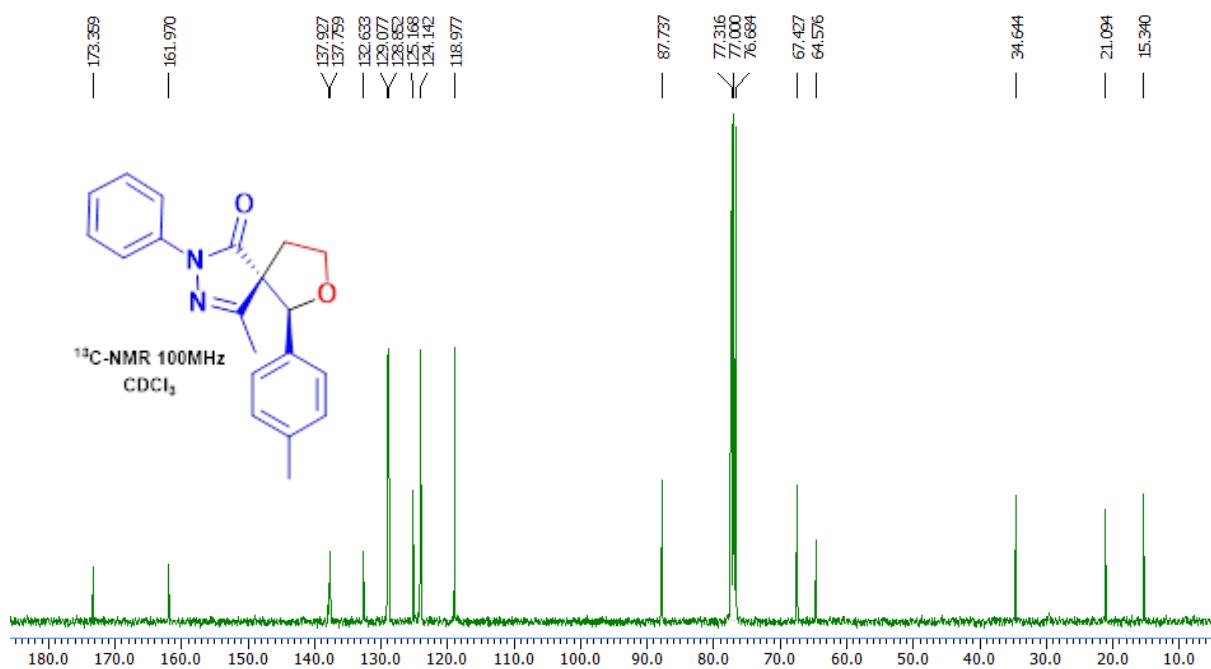


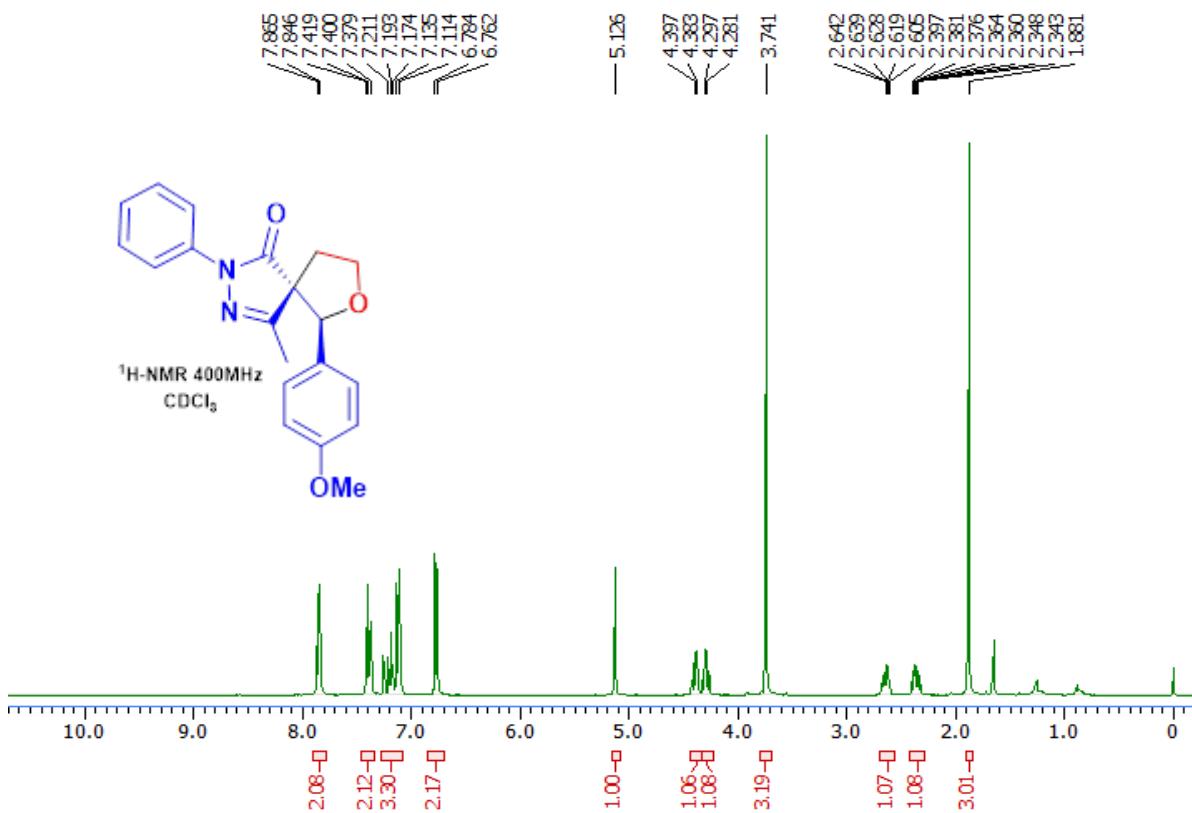
Fig. 4: <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-2,6-diphenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3a)



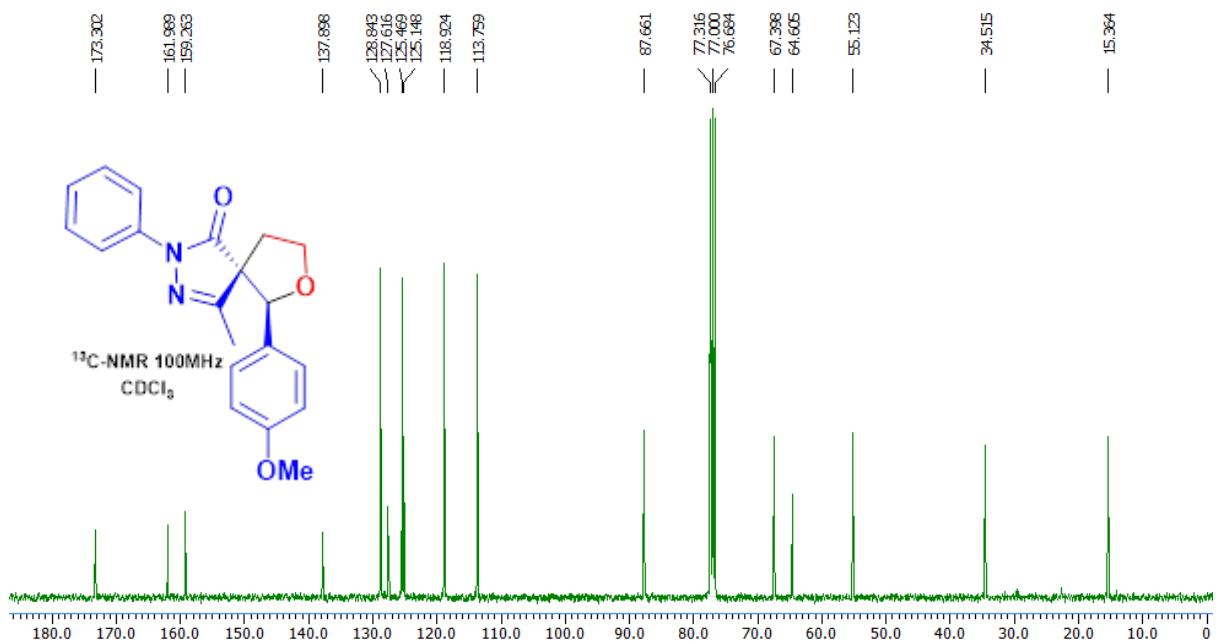
**Fig. 5:** <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-2-phenyl-6-(p-tolyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3b)



**Fig. 6:** <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-2-phenyl-6-(p-tolyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3b)



**Fig. 7:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3c)



**Fig. 8:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3c)

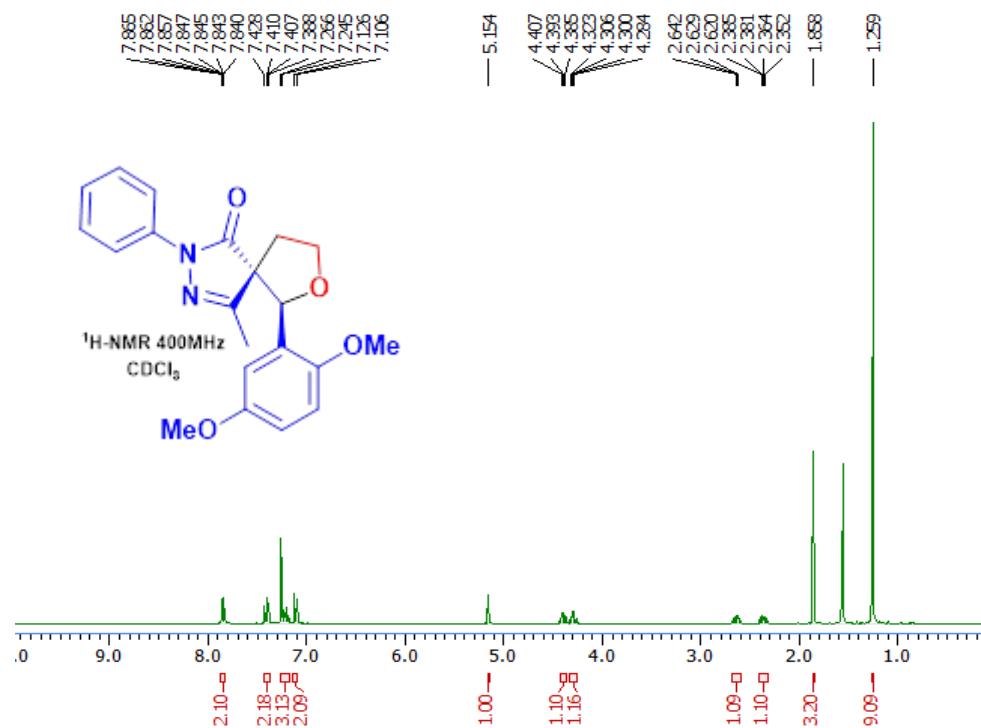
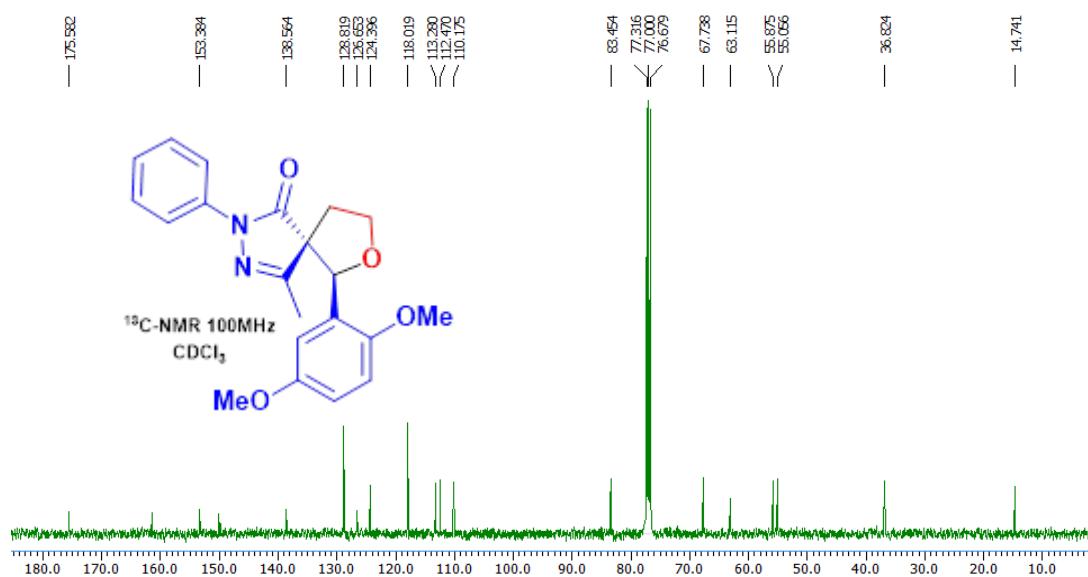
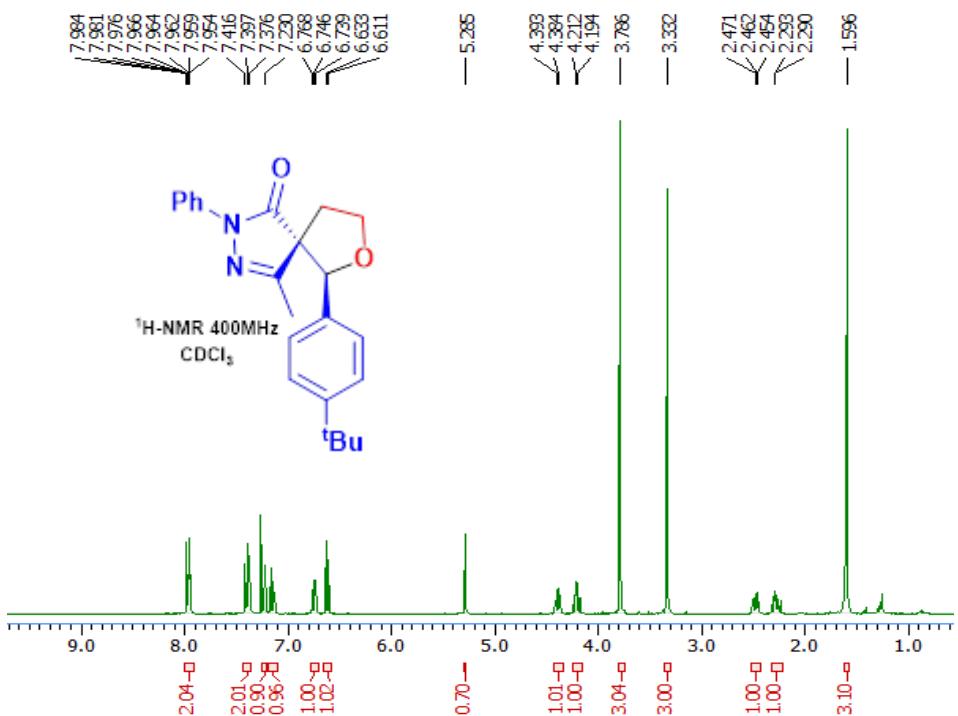


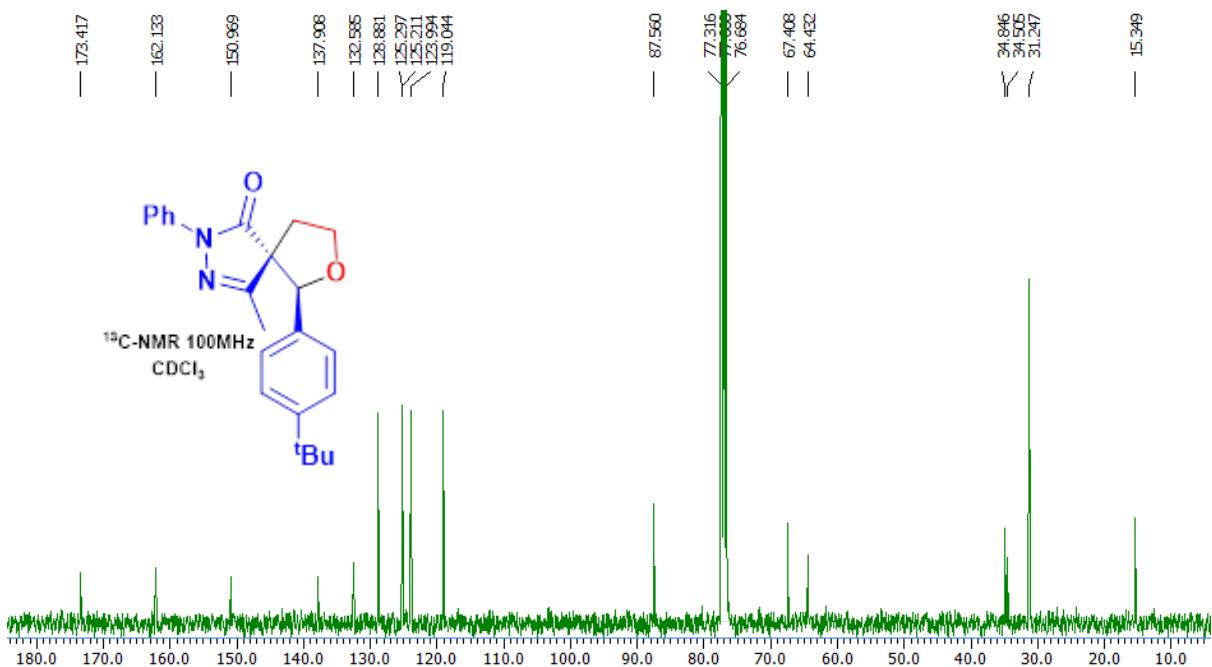
Fig. 9:  $^1\text{H-NMR}$  spectrum of (5*S*,6*S*)-6-(2,5-dimethoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3d)



**Fig. 10:**  $^{13}\text{C}$ -NMR spectrum of (5S,6S)-6-(2,5-dimethoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3d)



**Fig. 11:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(4-(tert-butyl)phenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3e)



**Fig. 12:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(4-(tert-butyl)phenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3e)

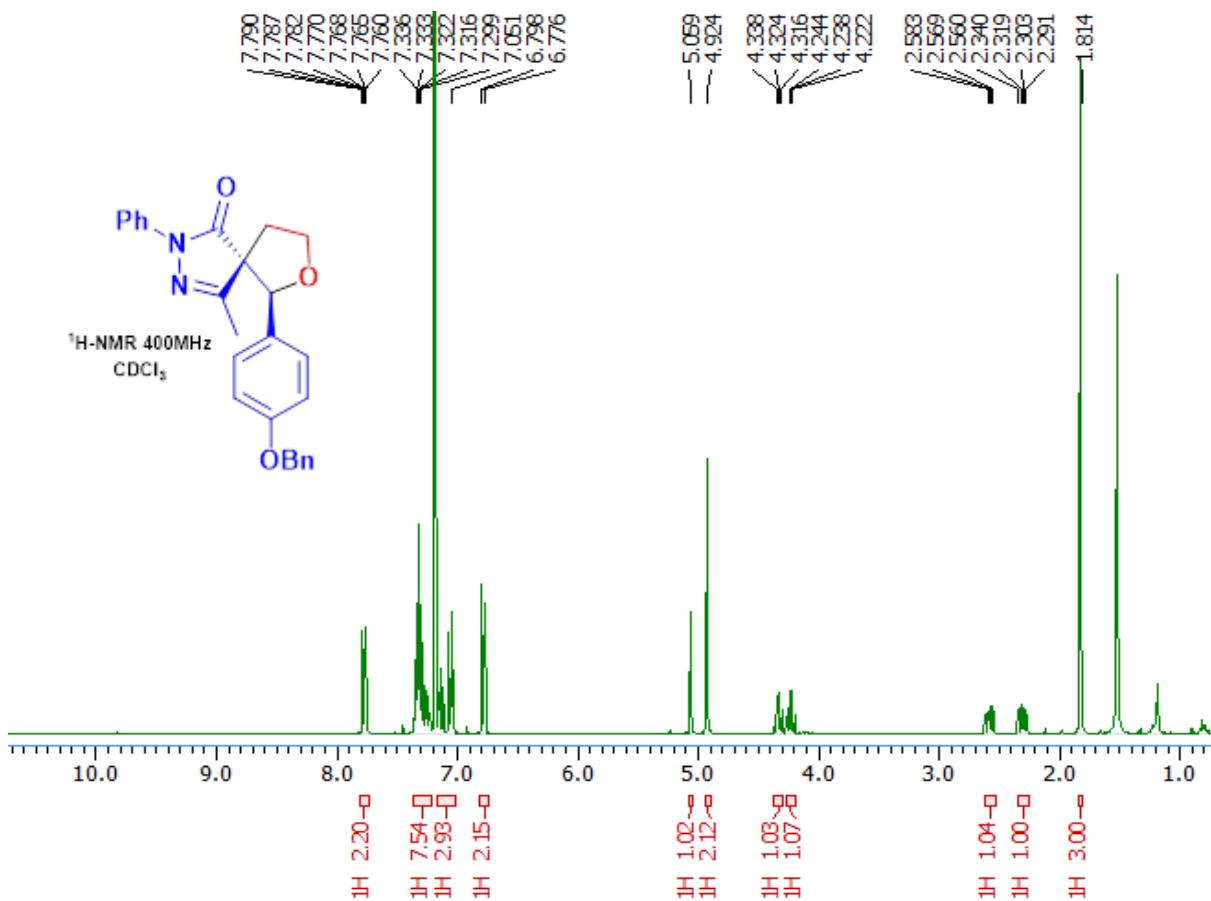


Fig. 13: <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(4-(benzyloxy)phenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3f)

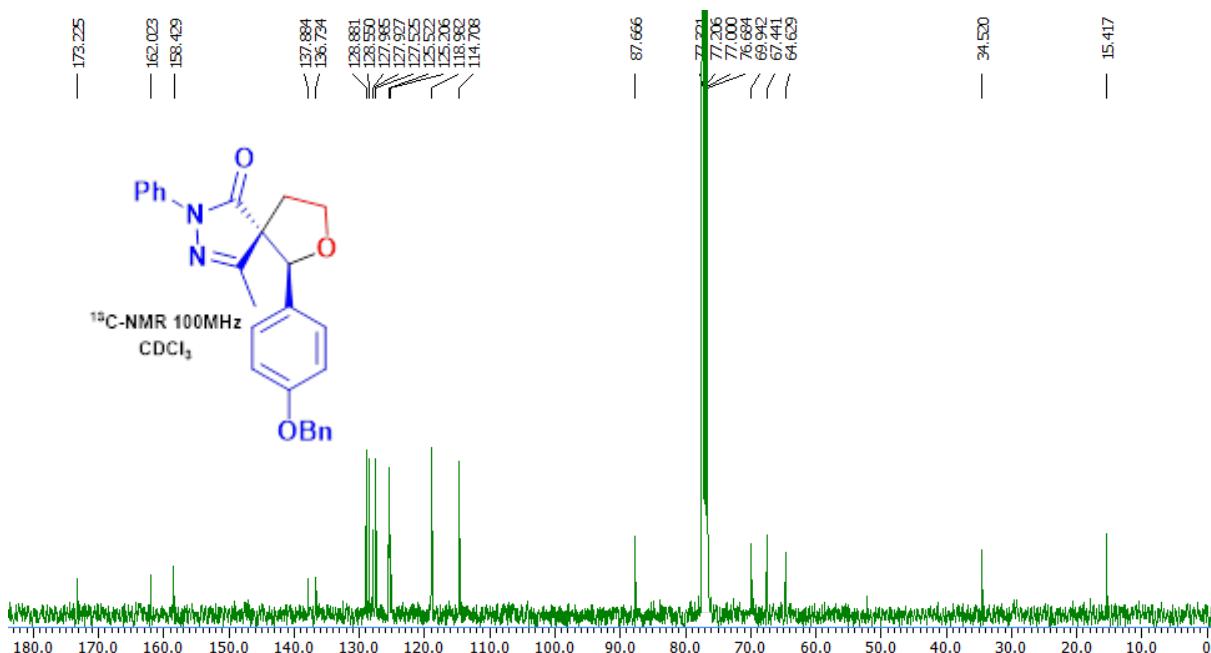


Fig. 14: <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(4-(benzyloxy)phenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3f)

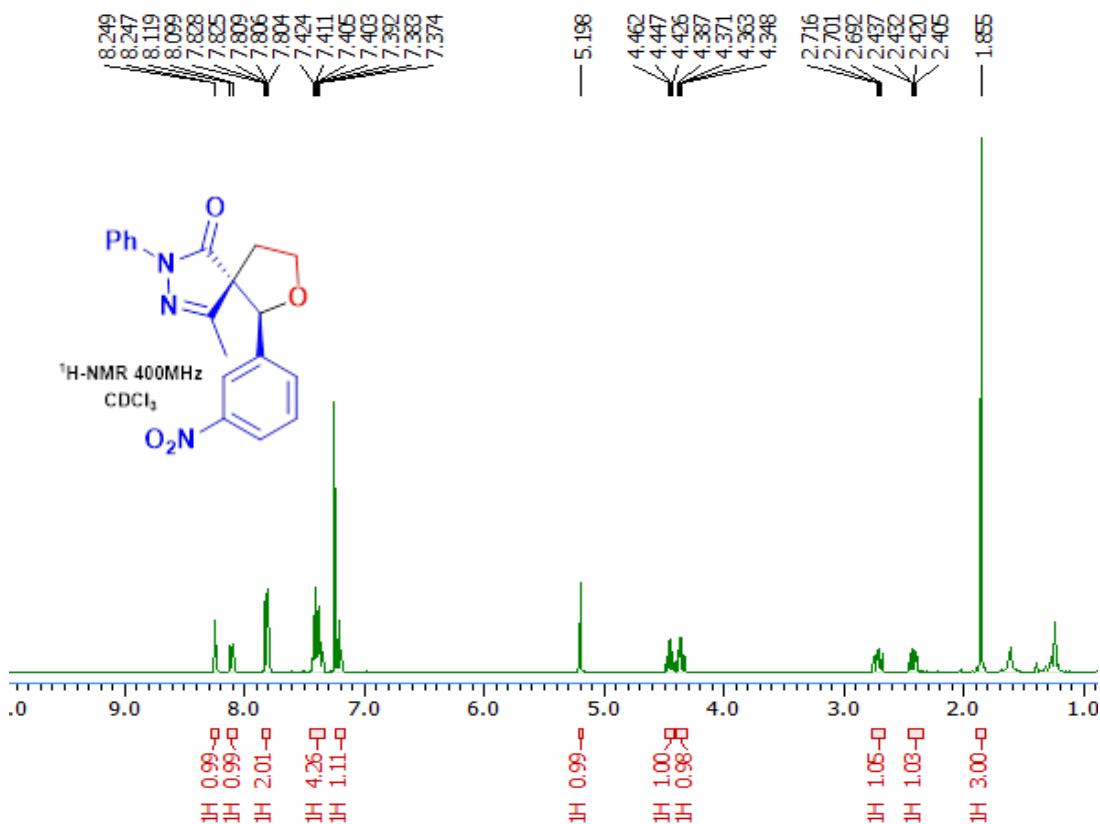


Fig. 15: <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-6-(3-nitrophenyl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3g)

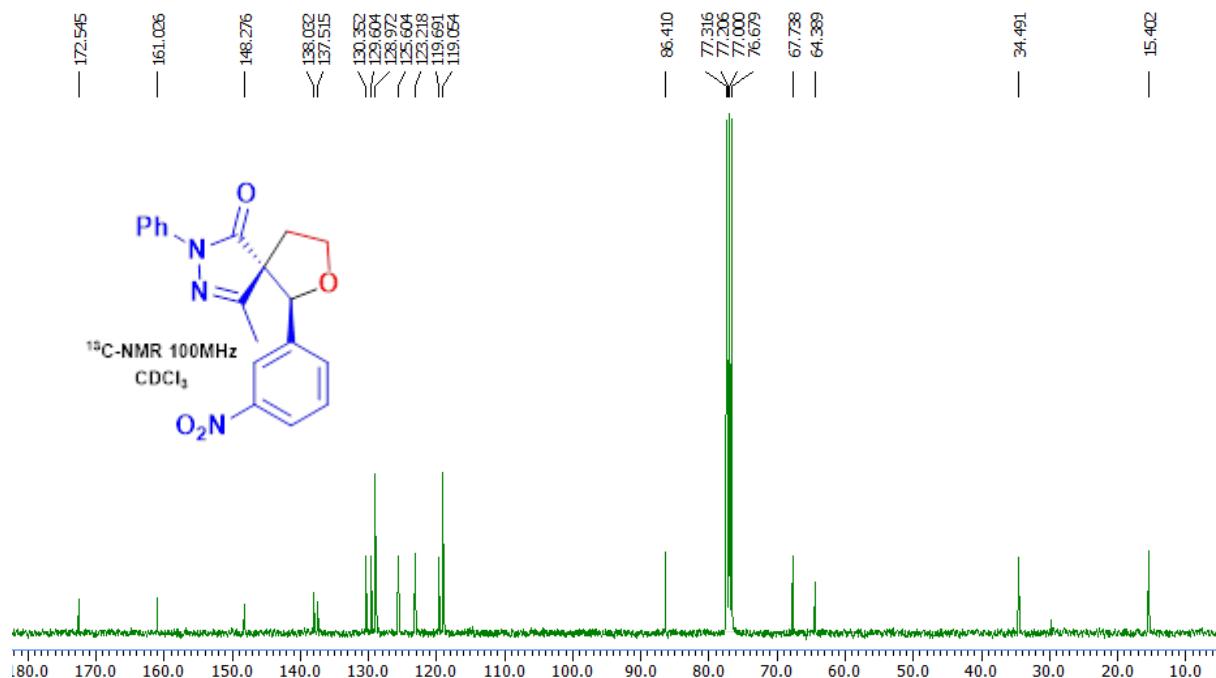
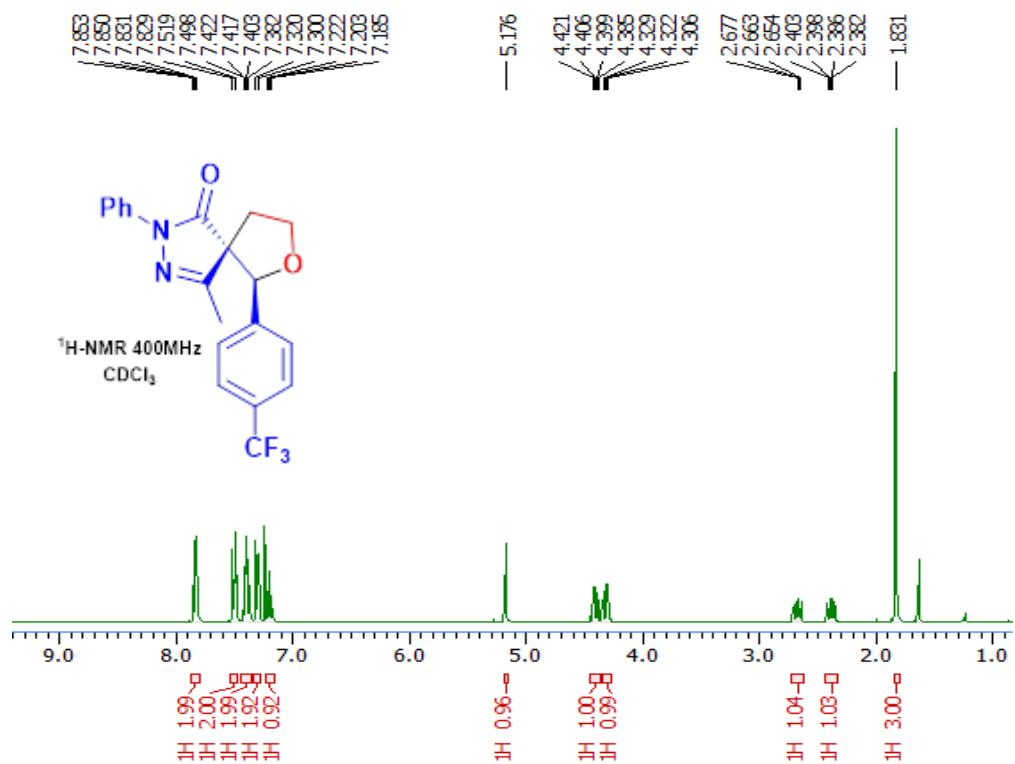
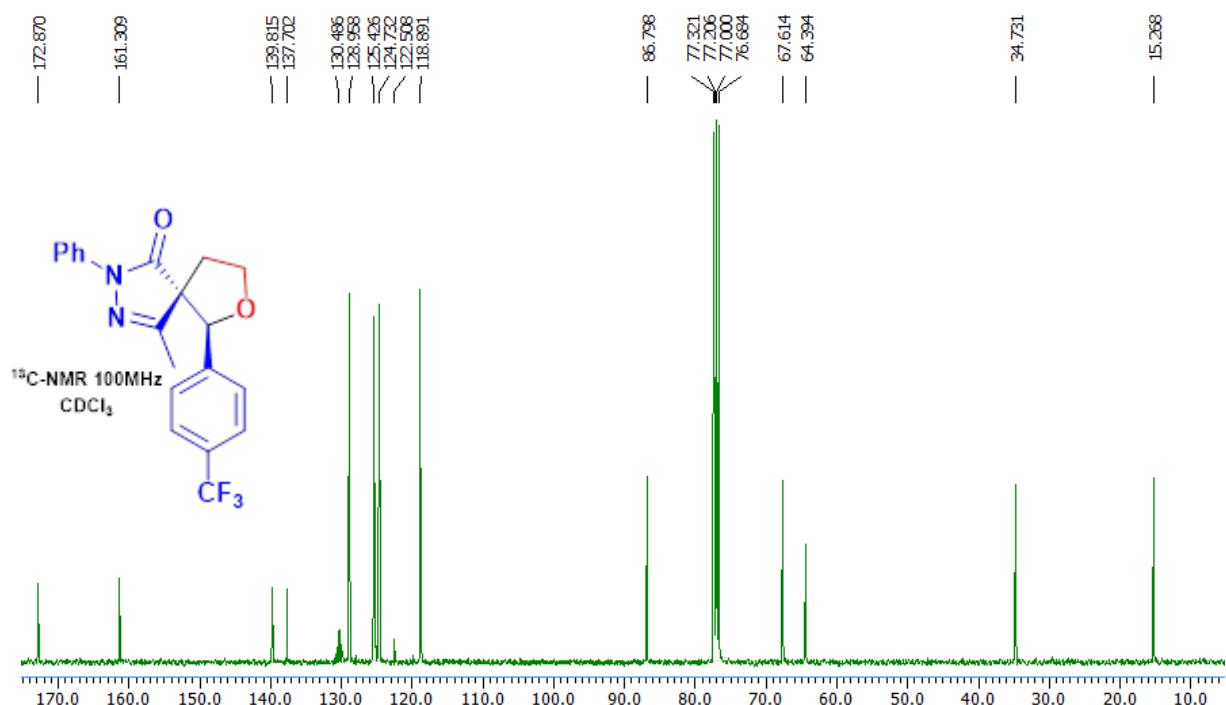


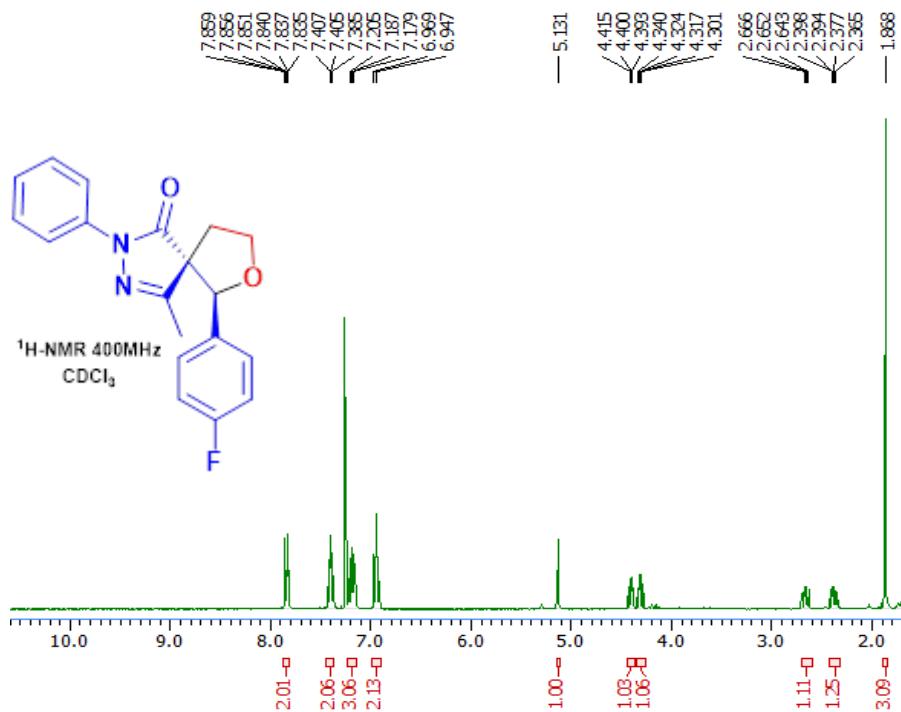
Fig. 16: <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-6-(3-nitrophenyl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3g)



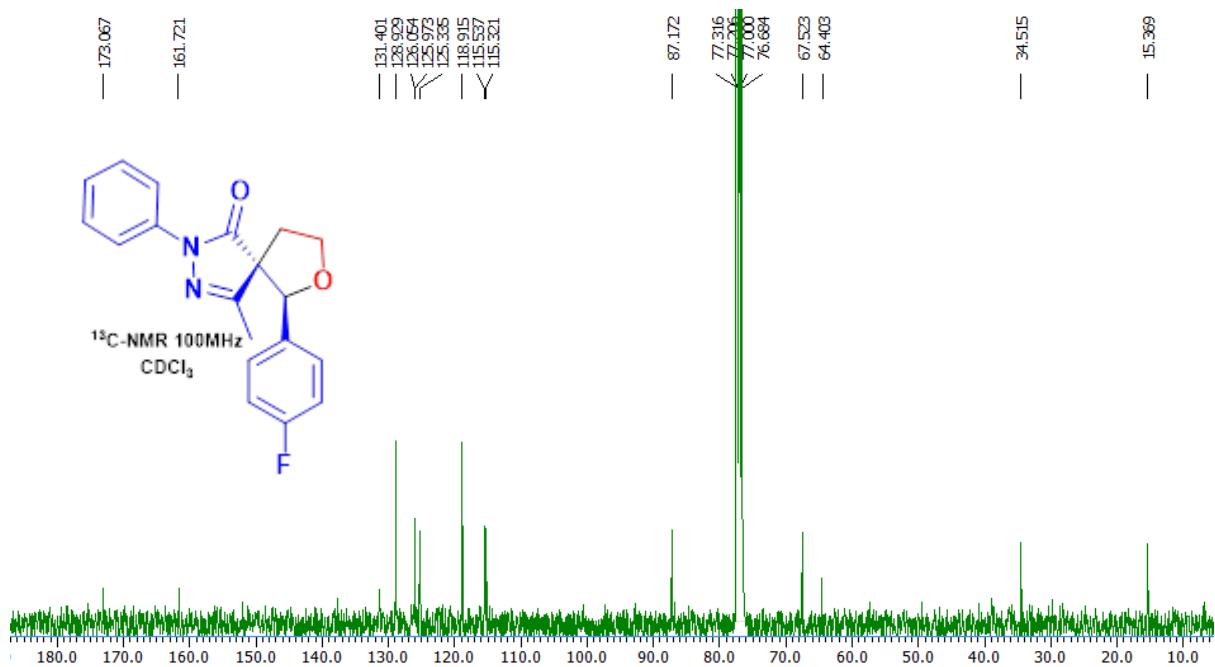
**Fig. 17:** <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-2-phenyl-6-(4-(trifluoromethyl)phenyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3h)



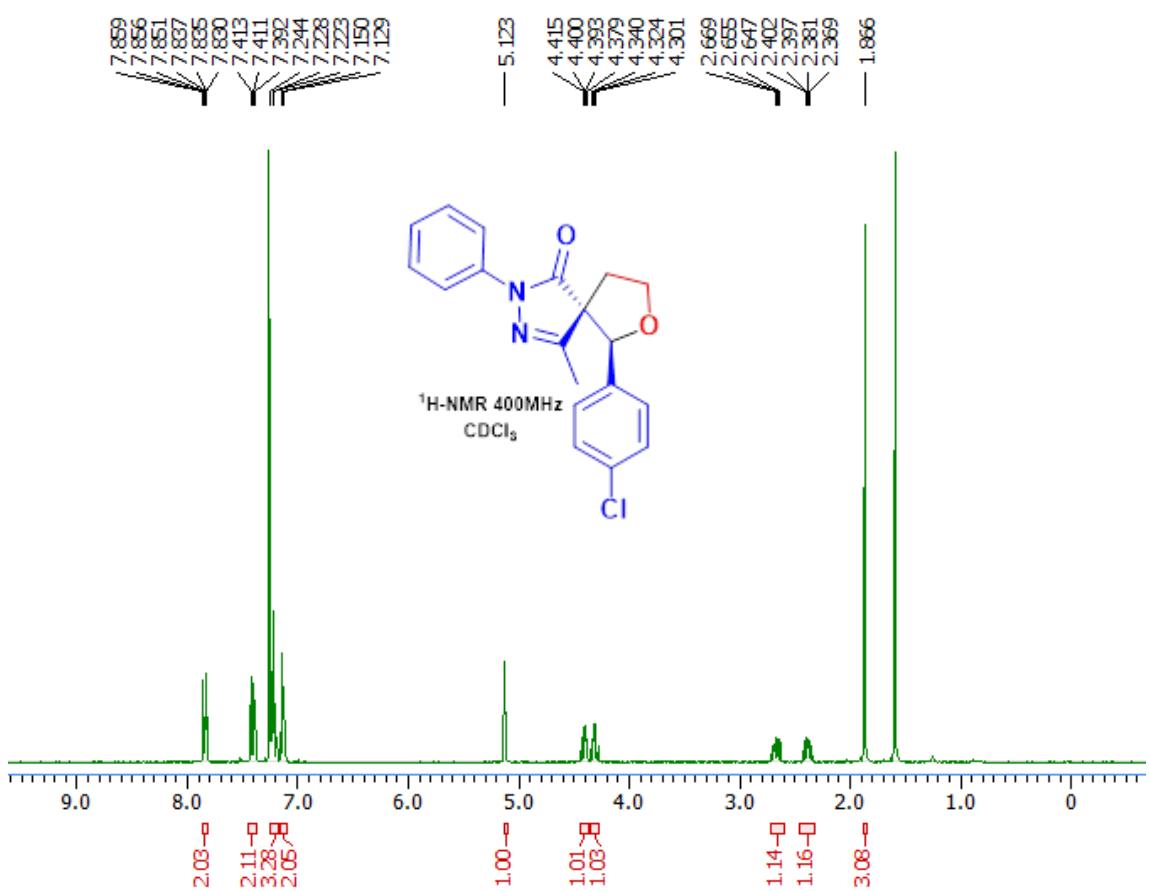
**Fig. 18:** <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-2-phenyl-6-(4-(trifluoromethyl)phenyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3h)



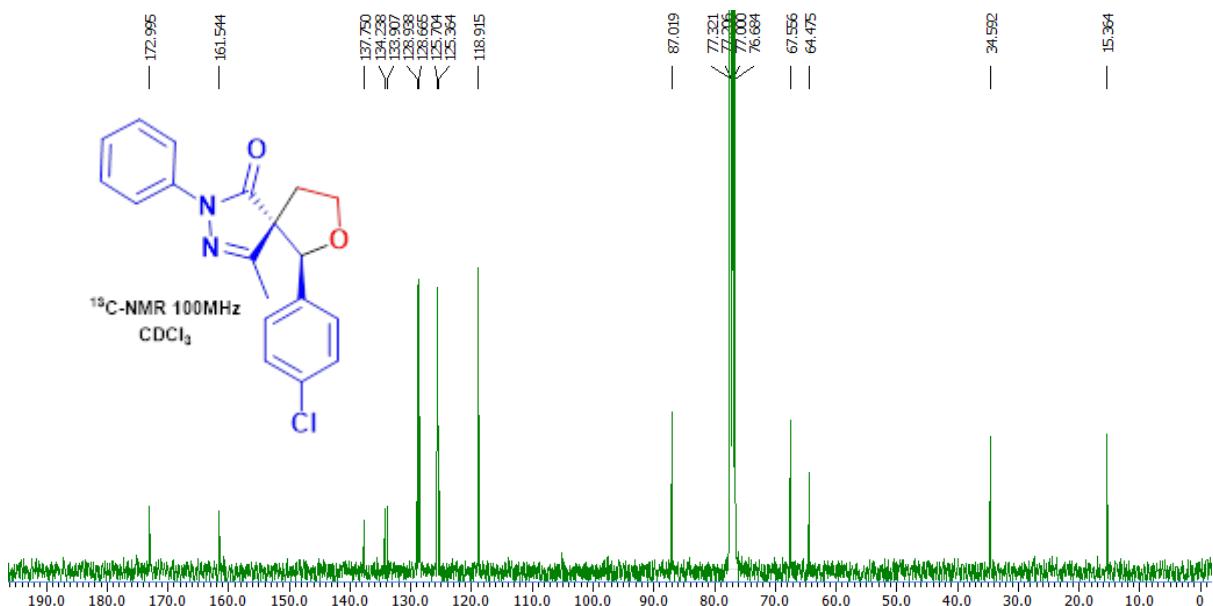
**Fig. 19:**  $^1\text{H-NMR}$  spectrum of (5S,6S)-6-(4-fluorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one(3i)



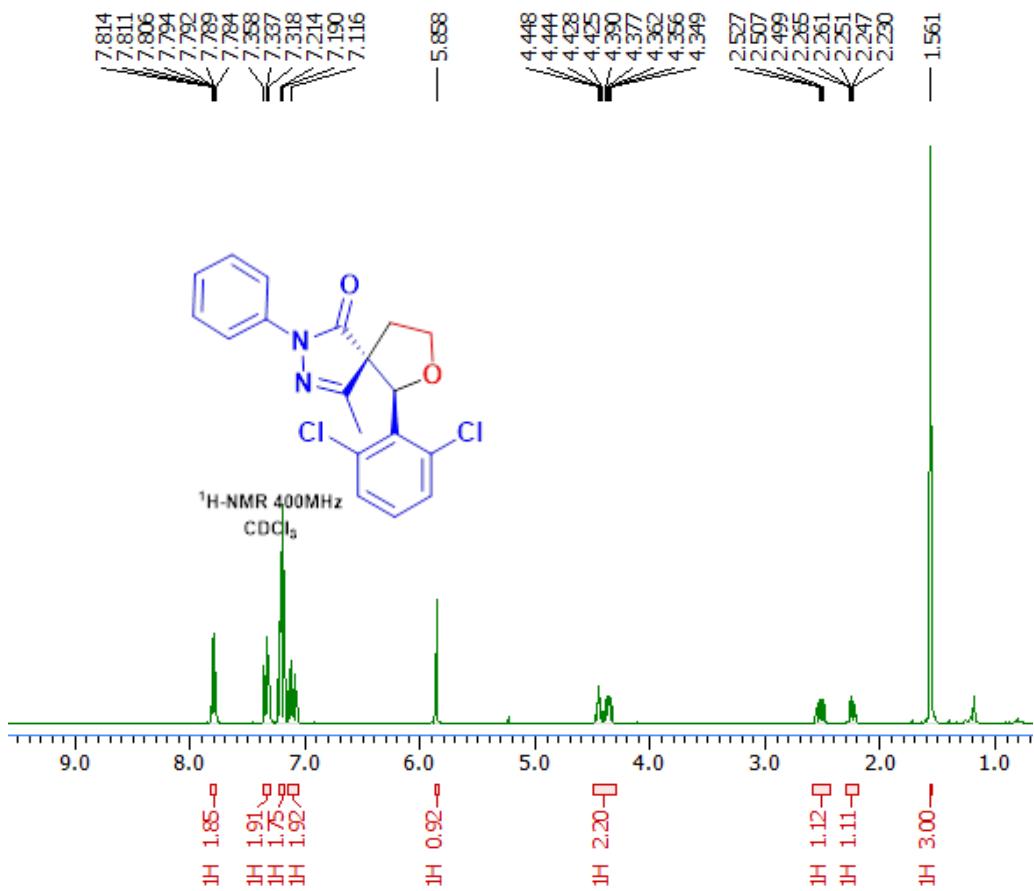
**Fig. 20:**  $^{13}\text{C}$ -NMR spectrum of (*S,S*)-6-(4-fluorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3i)



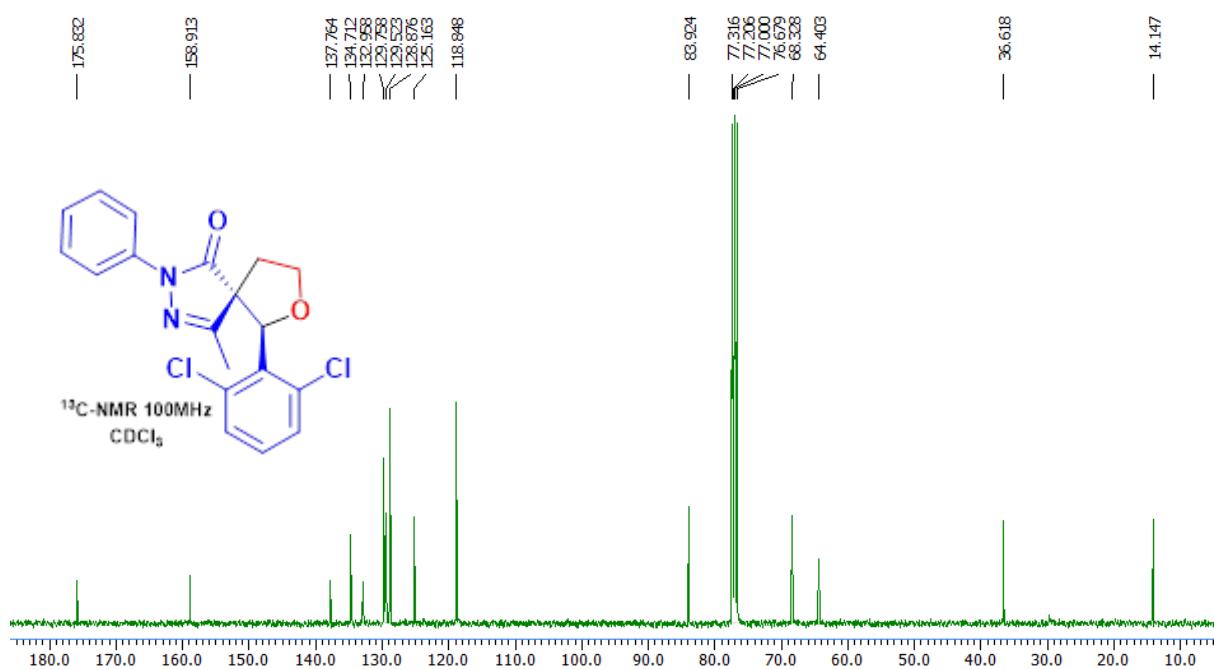
**Fig. 21:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(4-chlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one(3j)



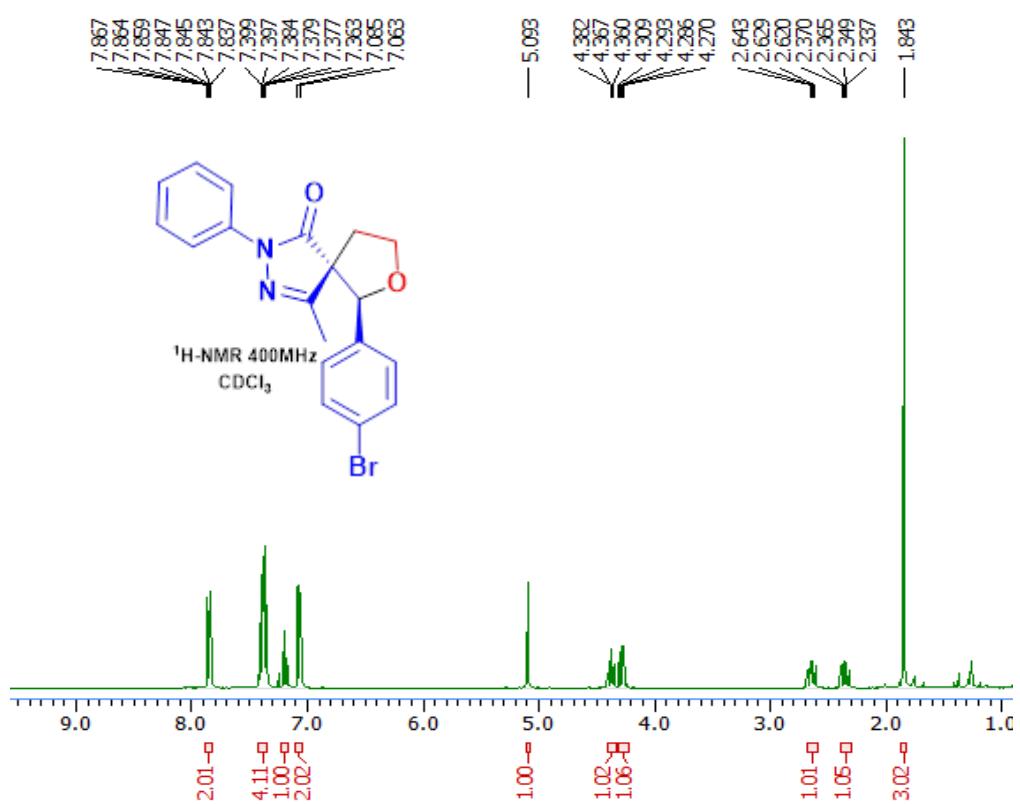
**Fig. 22:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(4-chlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one(3j)



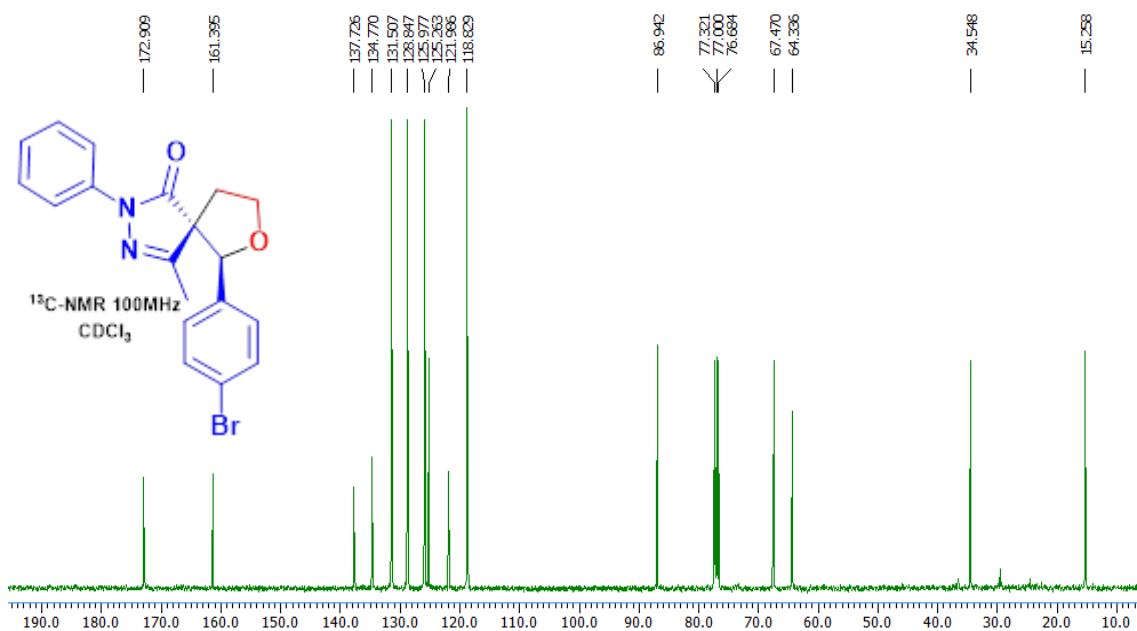
**Fig. 23:** <sup>1</sup>H-NMR spectrum of (5S,6R)-6-(2,6-dichlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3k)



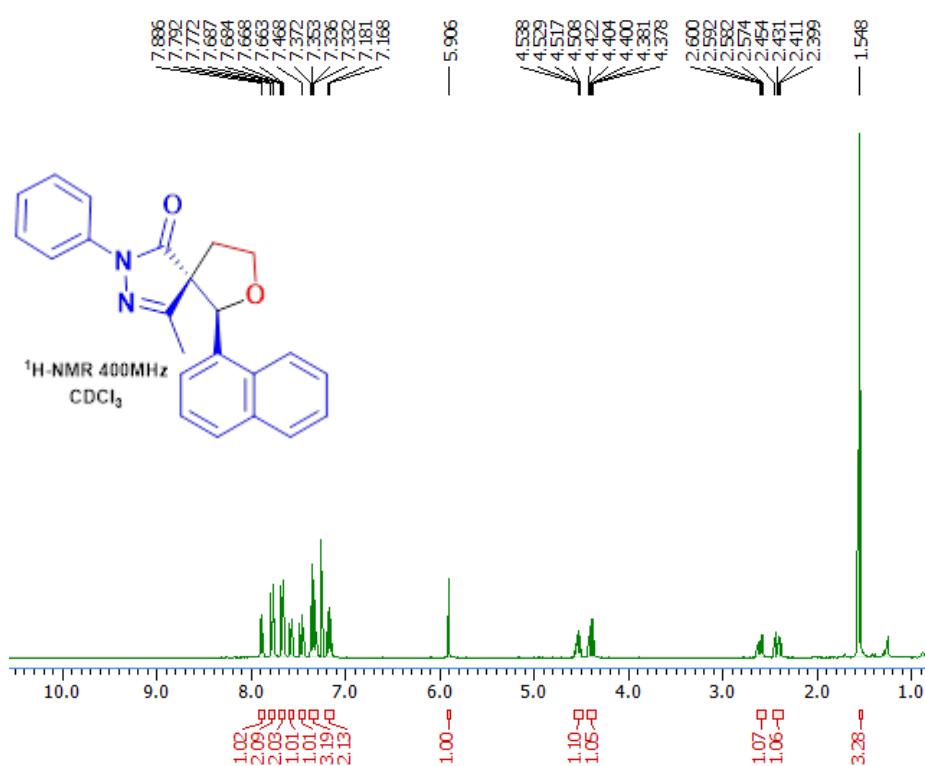
**Fig. 24:** <sup>13</sup>C-NMR spectrum of (5S,6R)-6-(2,6-dichlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3k)



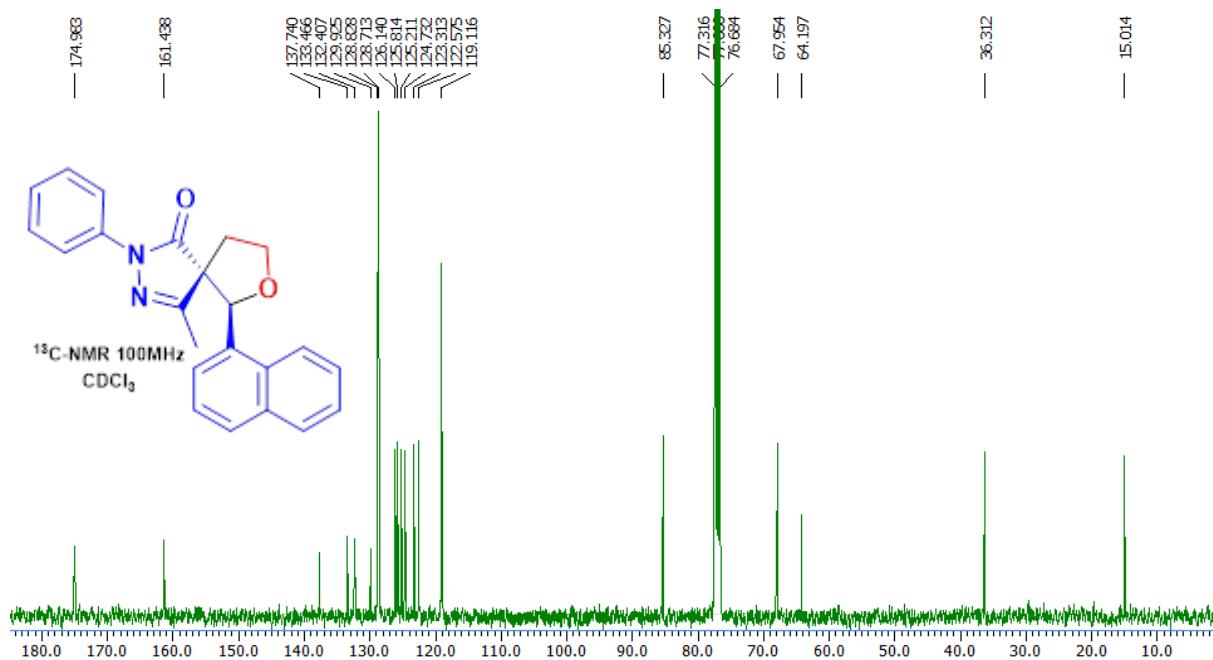
**Fig. 25:**  $^1\text{H}$ -NMR spectrum of (5*S*,6*S*)-6-(4-bromophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one(3l)



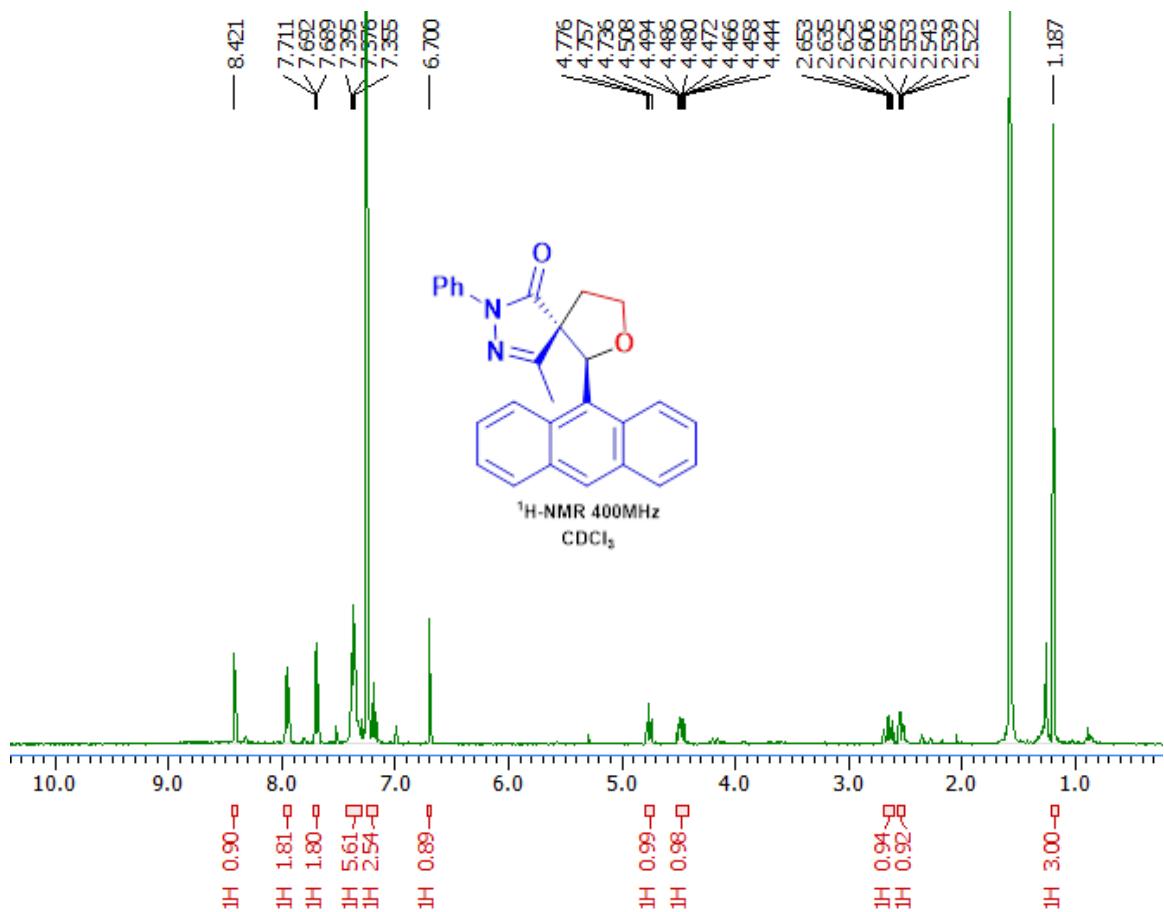
**Fig. 26:**  $^{13}\text{C}$ -NMR spectrum of (5*S*,6*S*)-6-(4-bromophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3l)



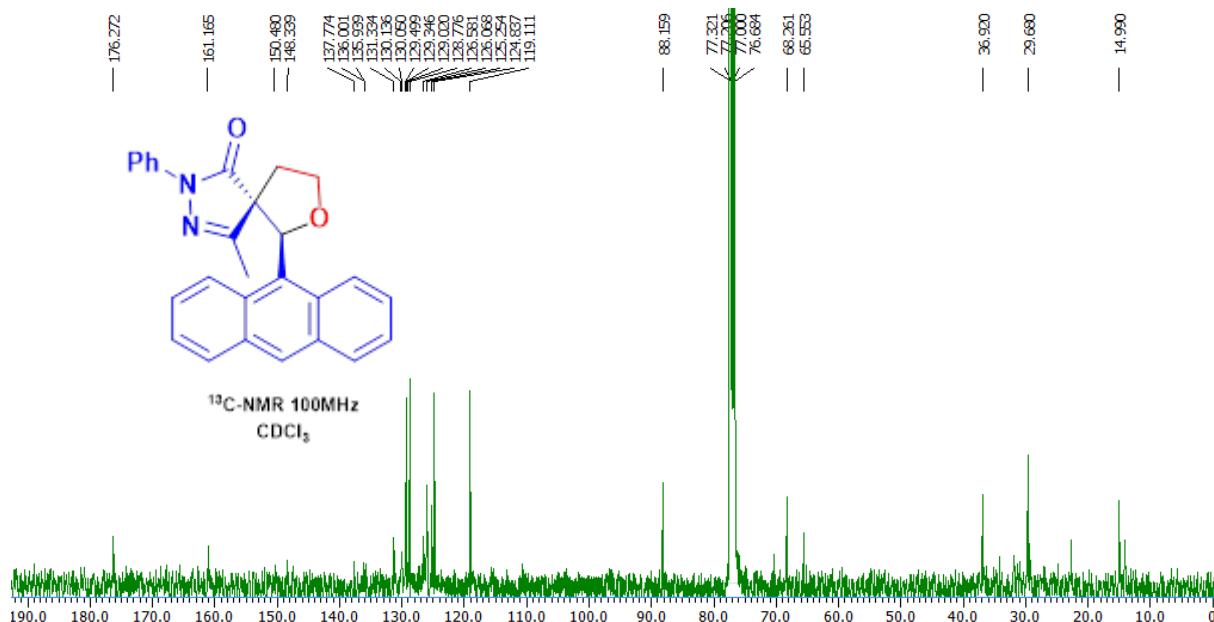
**Fig. 27:** <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-6-(naphthalen-1-yl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3m)



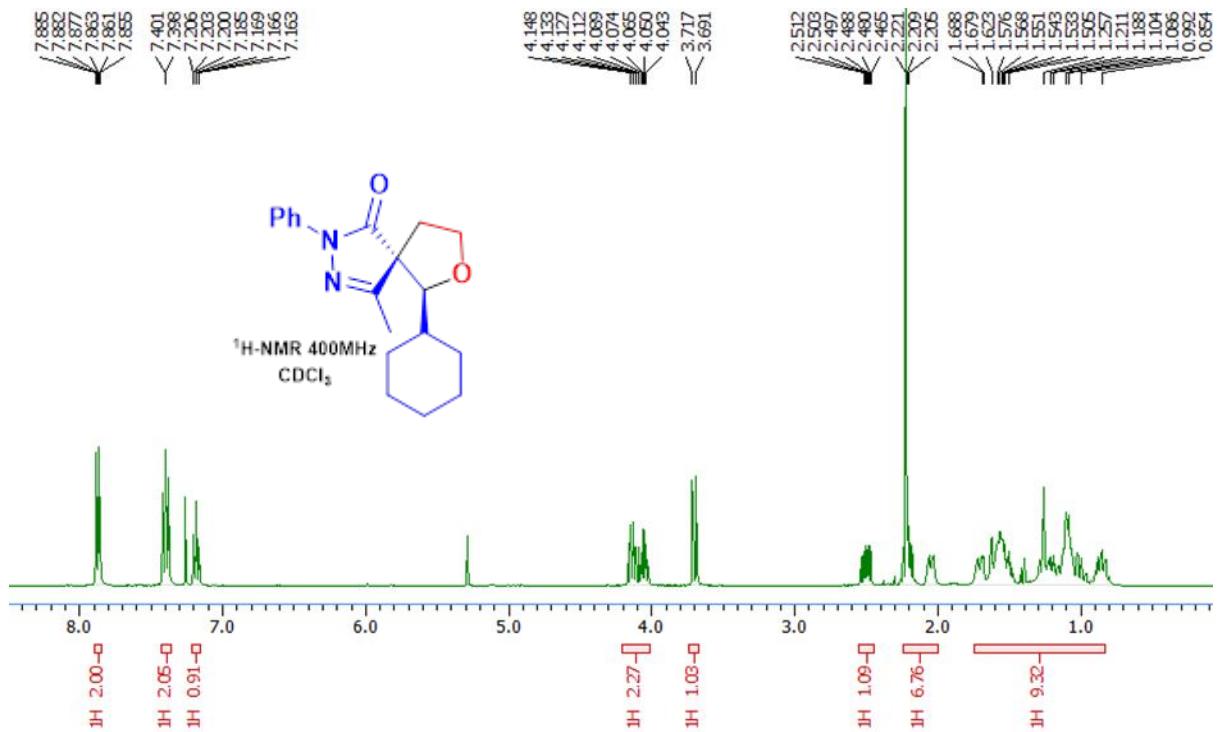
**Fig. 28:** <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-6-(naphthalen-1-yl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3m)



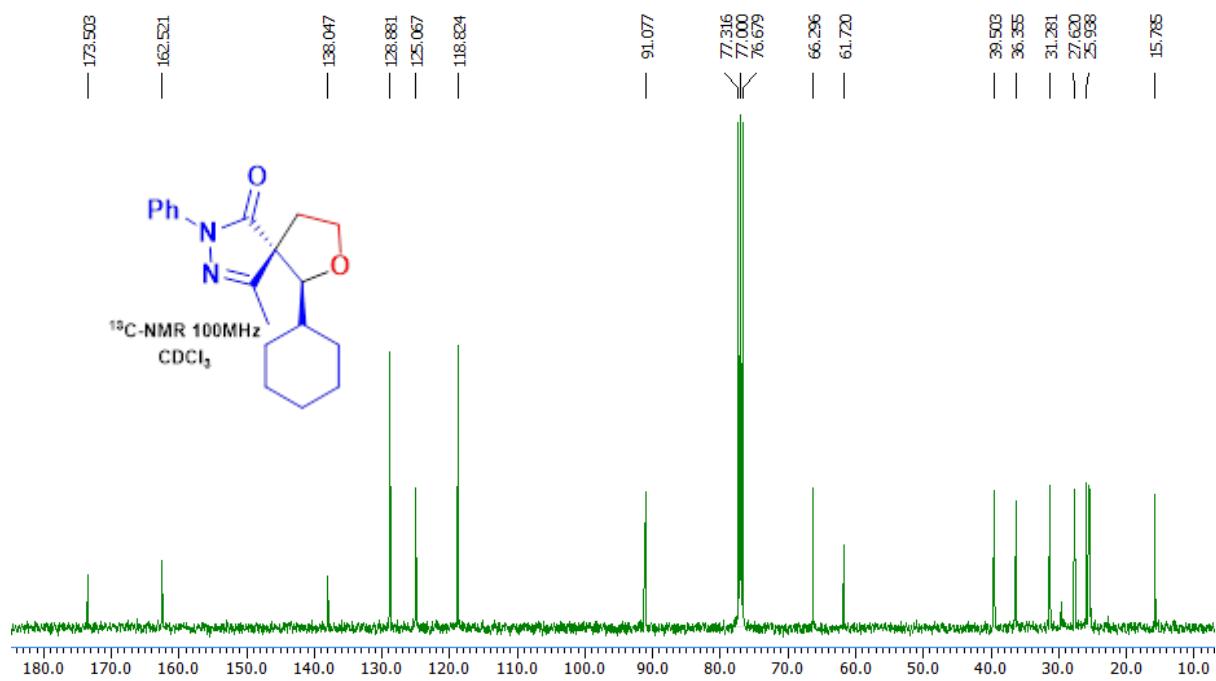
**Fig. 29:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(anthracen-9-yl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3n)



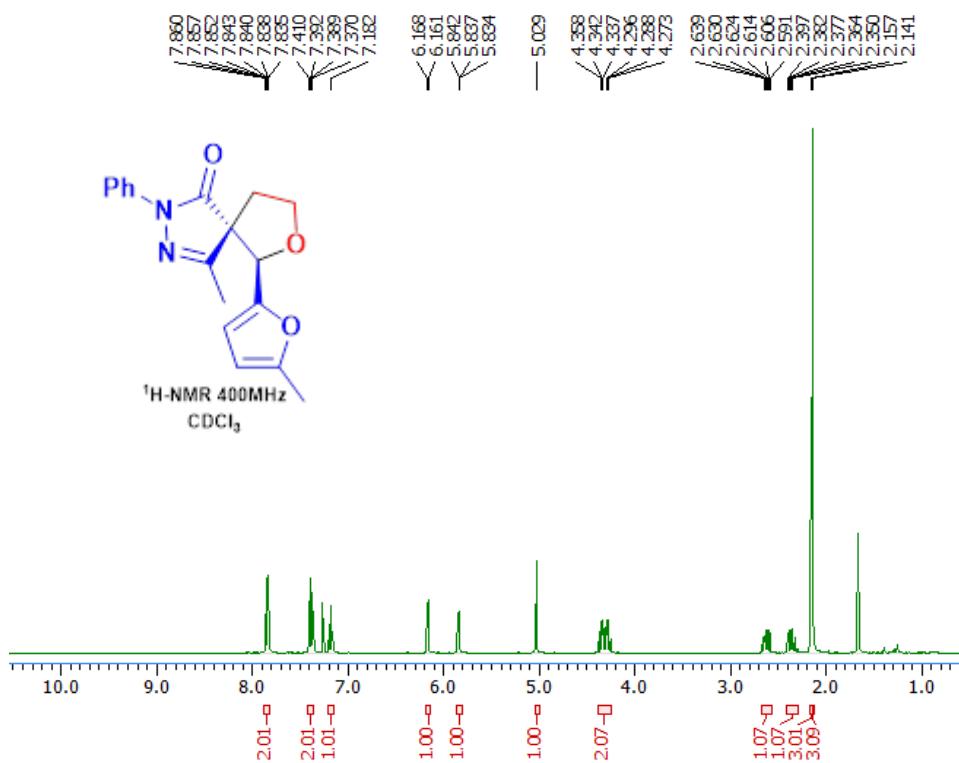
**Fig. 30:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(anthracen-9-yl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3n)



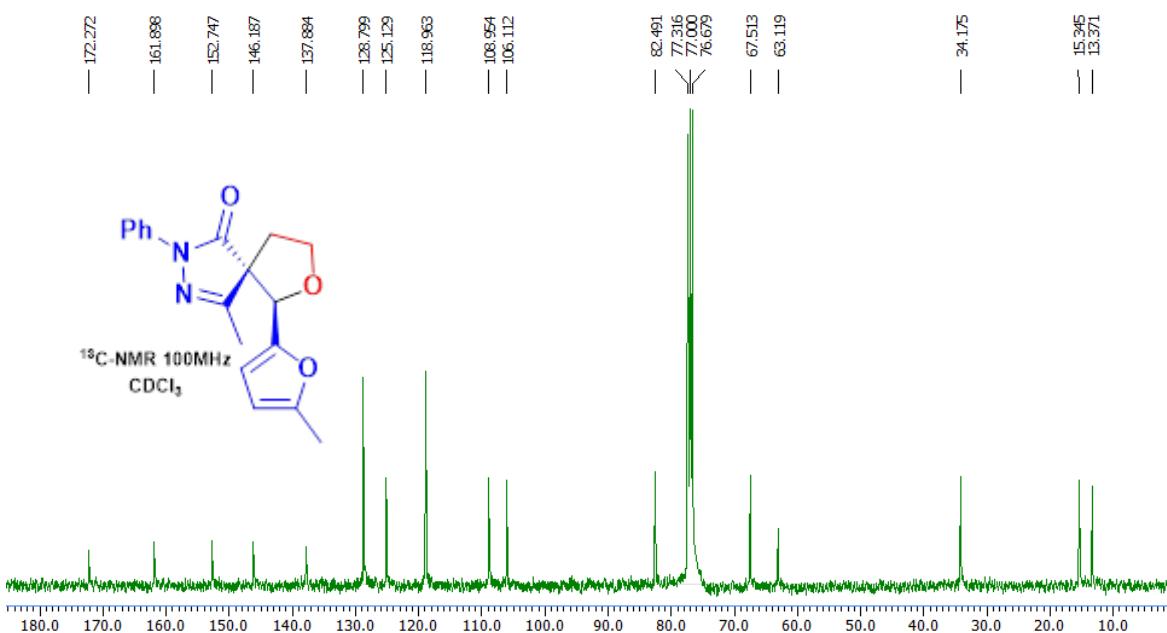
**Fig. 31:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-cyclohexyl-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3o)



**Fig. 32:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-cyclohexyl-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3o)



**Fig. 33:** <sup>1</sup>H-NMR spectrum of (5S,6R)-4-methyl-6-(5-methylfuran-2-yl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3p)



**Fig. 34:** <sup>13</sup>C-NMR spectrum of (5S,6R)-4-methyl-6-(5-methylfuran-2-yl)-2-phenyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3p)

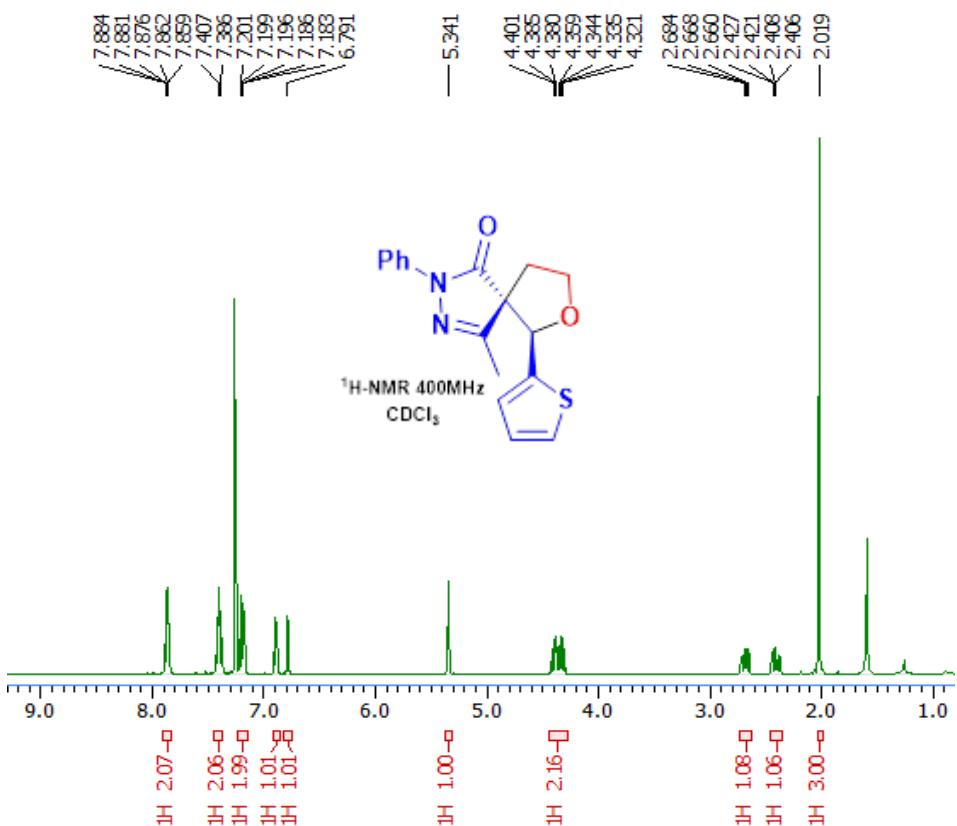


Fig. 35: <sup>1</sup>H-NMR spectrum of (5S,6R)-4-methyl-2-phenyl-6-(thiophen-2-yl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3q)

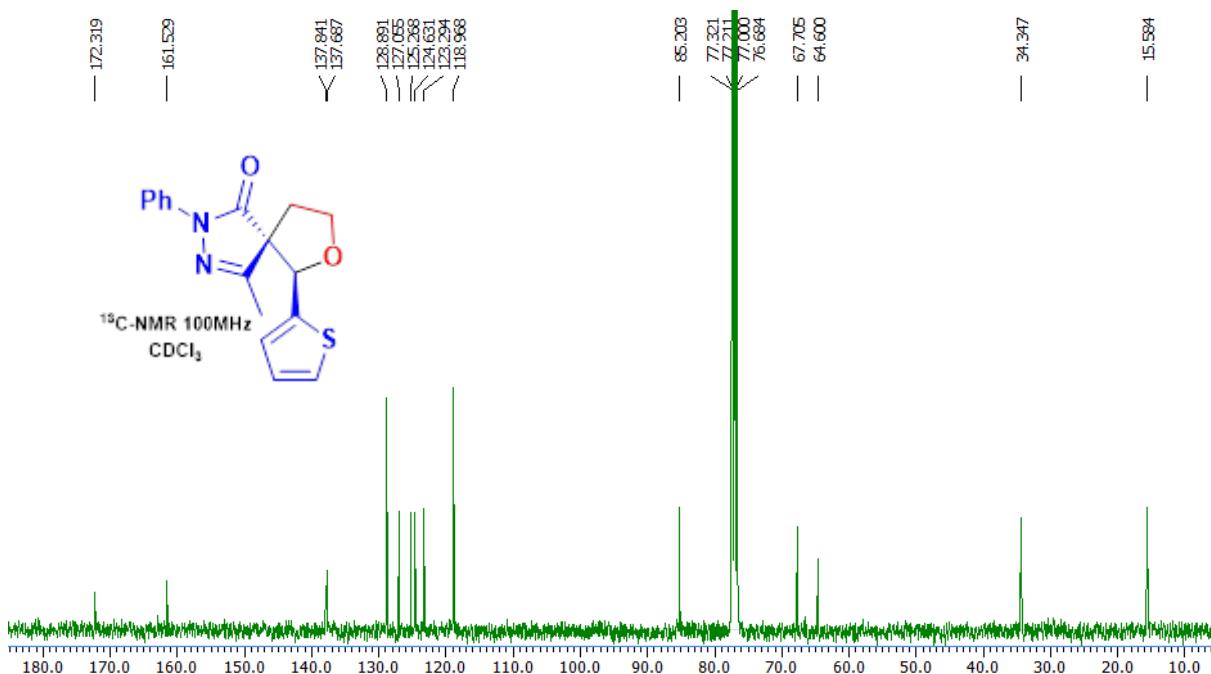
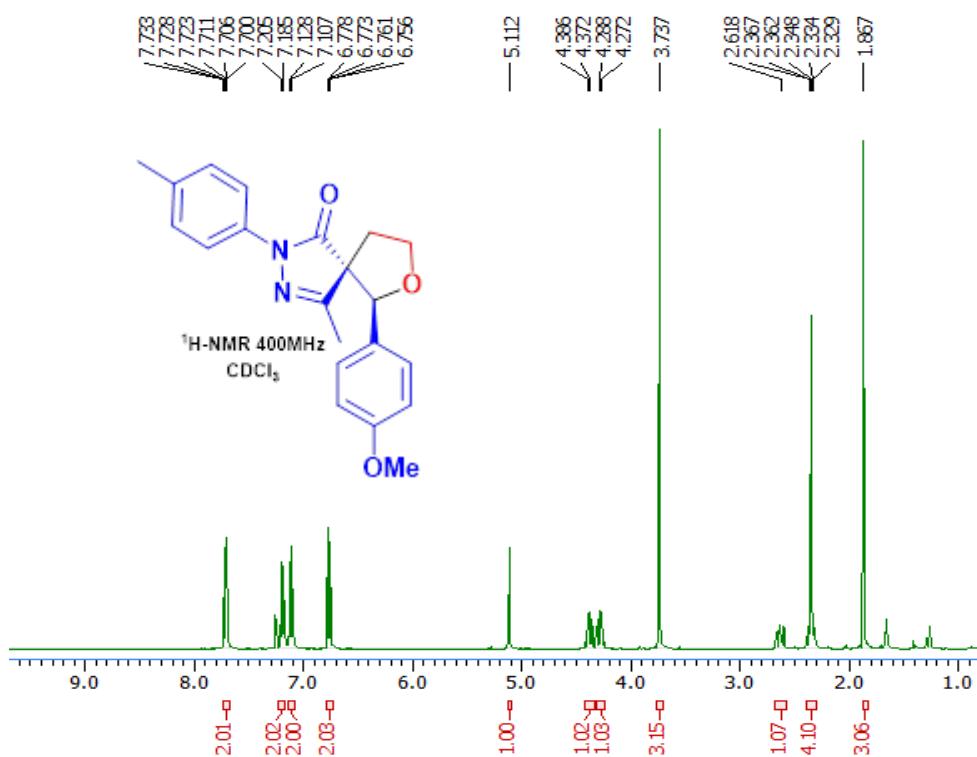
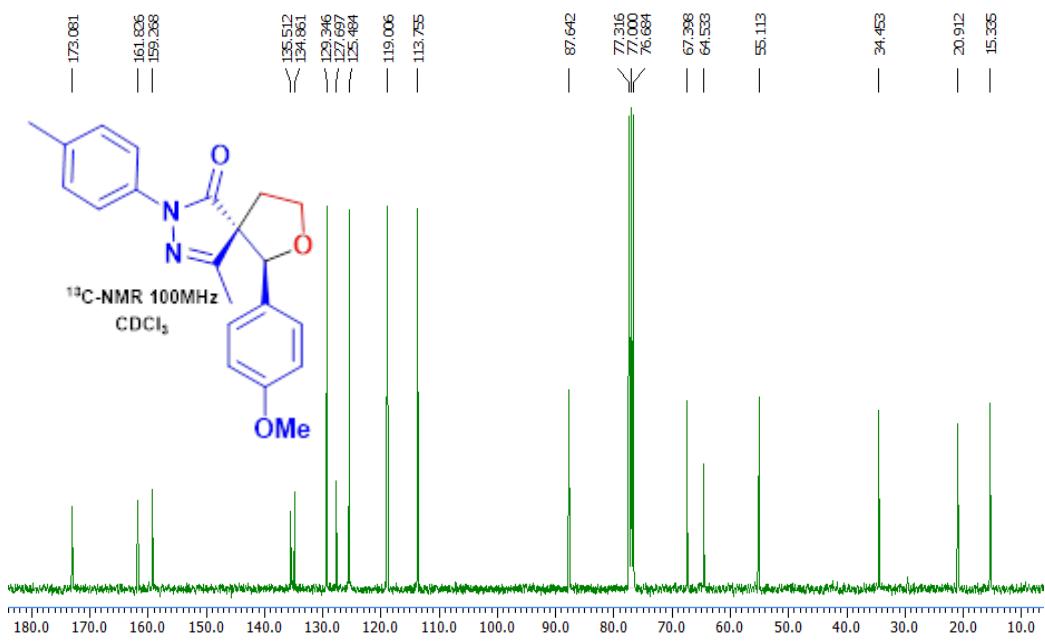


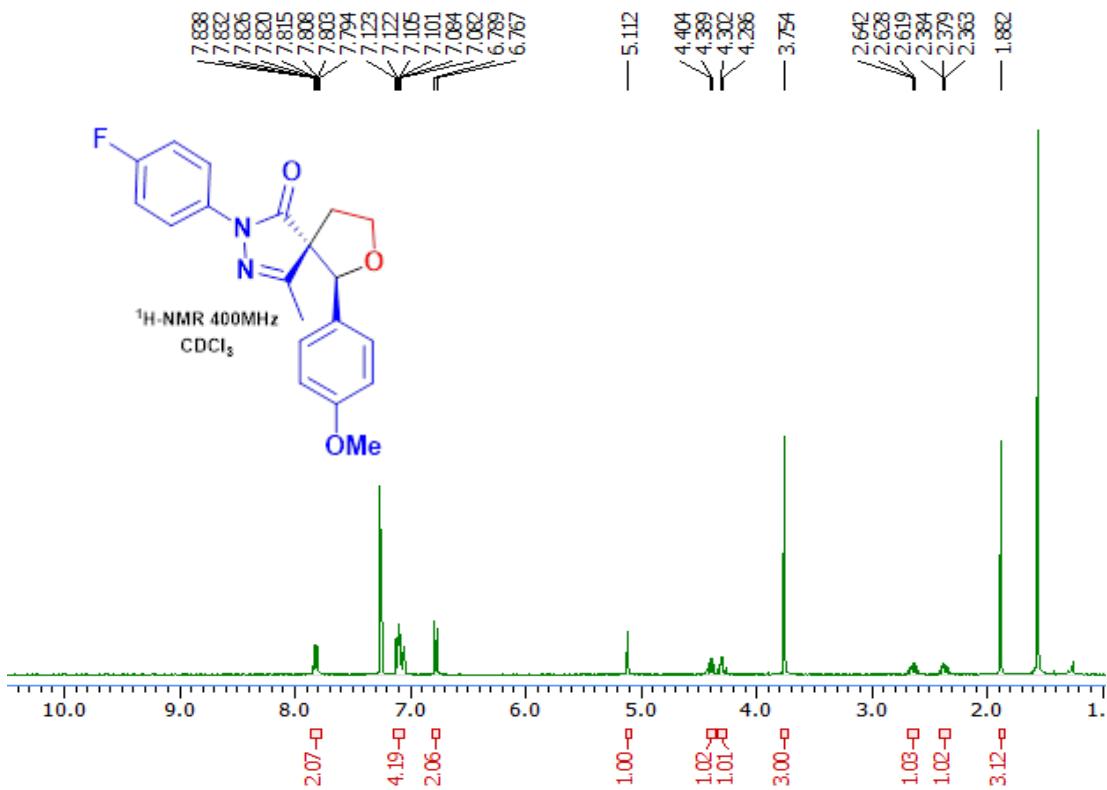
Fig. 36: <sup>13</sup>C-NMR spectrum of (5S,6R)-4-methyl-2-phenyl-6-(thiophen-2-yl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3q)



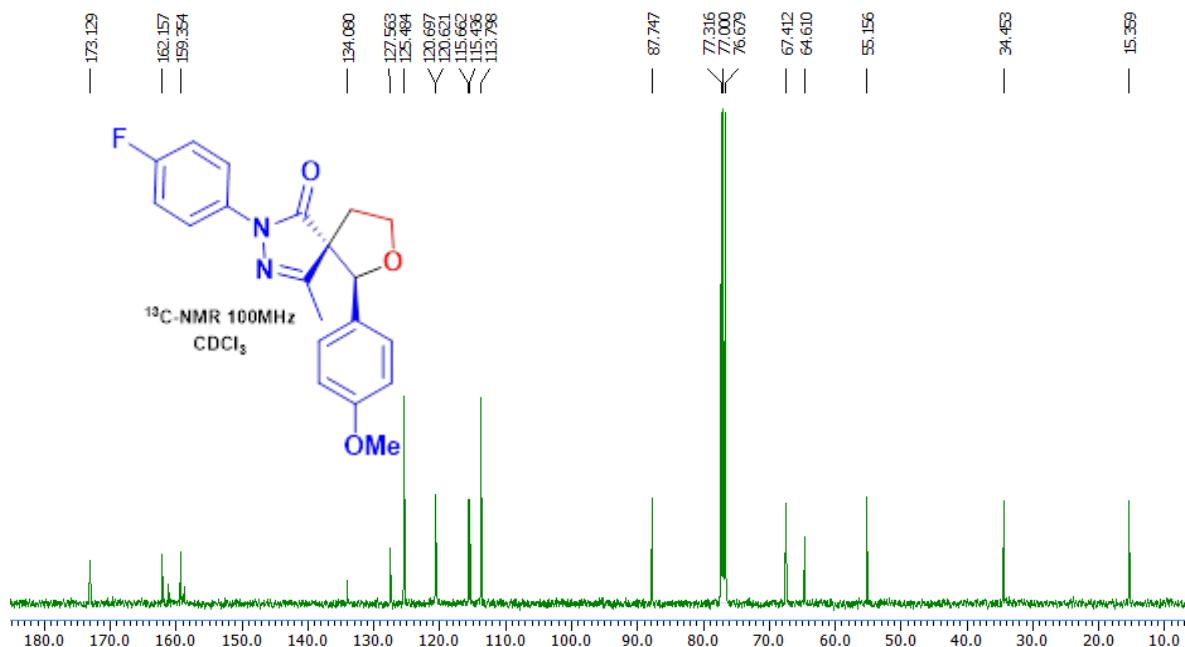
**Fig. 37:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-(p-tolyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one]non-3-en-1-one(3r)



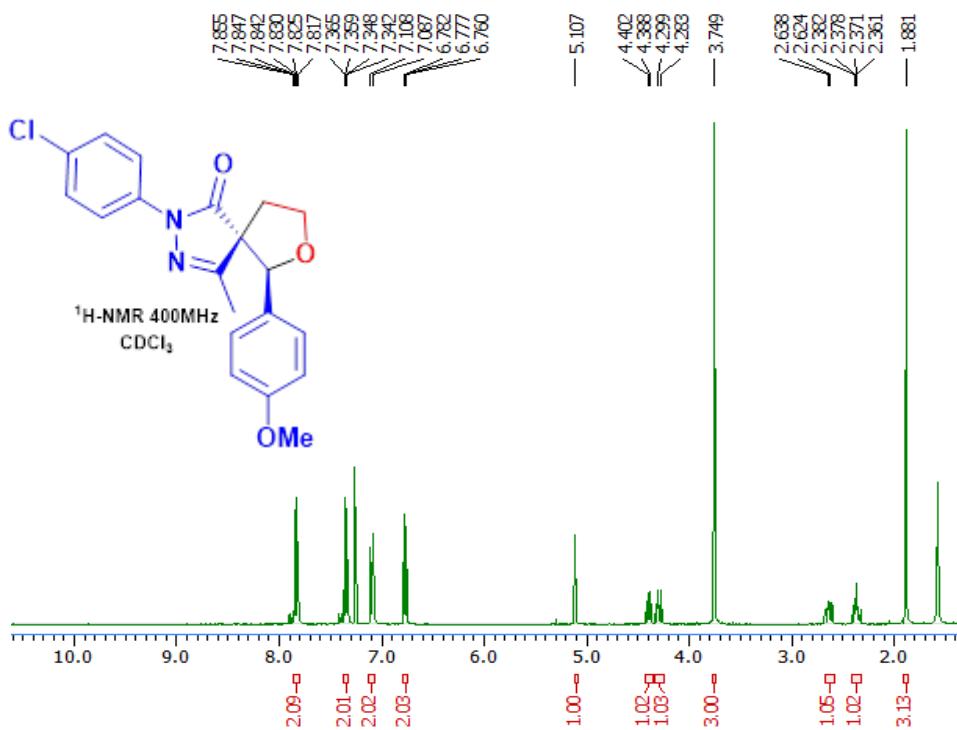
**Fig. 38:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(4-methoxyphenyl)-4-methyl-2-(p-tolyl)-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one]non-3-en-1-one(3r)



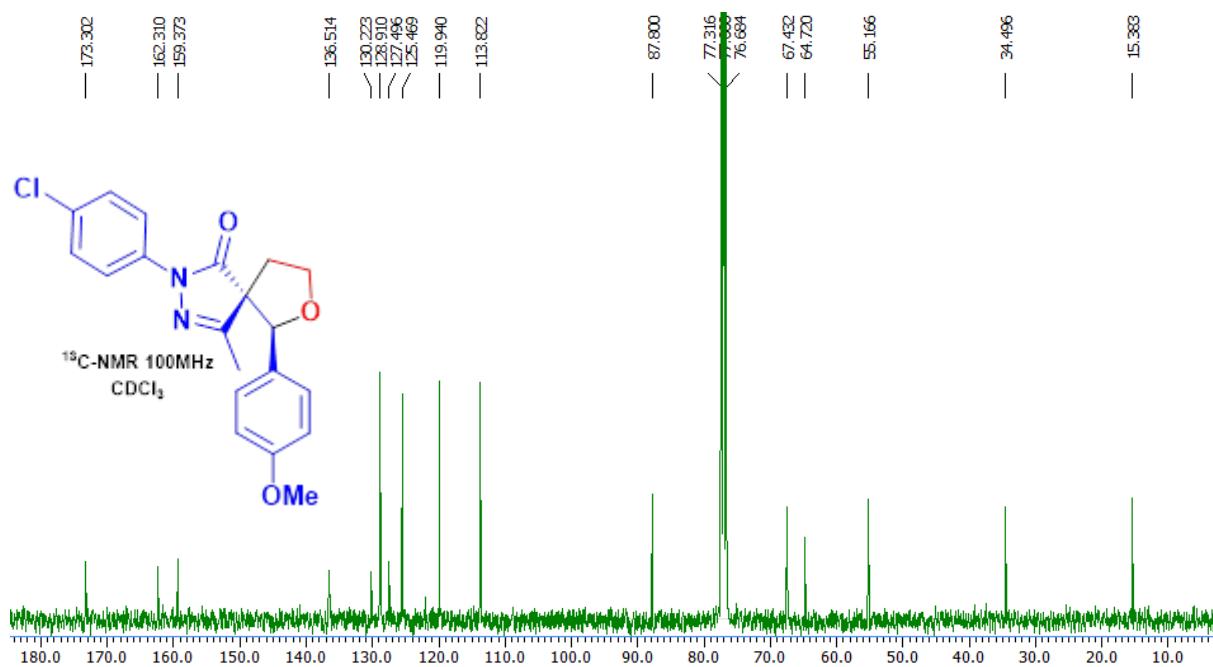
**Fig. 39:** <sup>1</sup>H-NMR spectrum of (5S,6S)-2-(4-fluorophenyl)-6-(4-methoxyphenyl)-4-methyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one(3s)



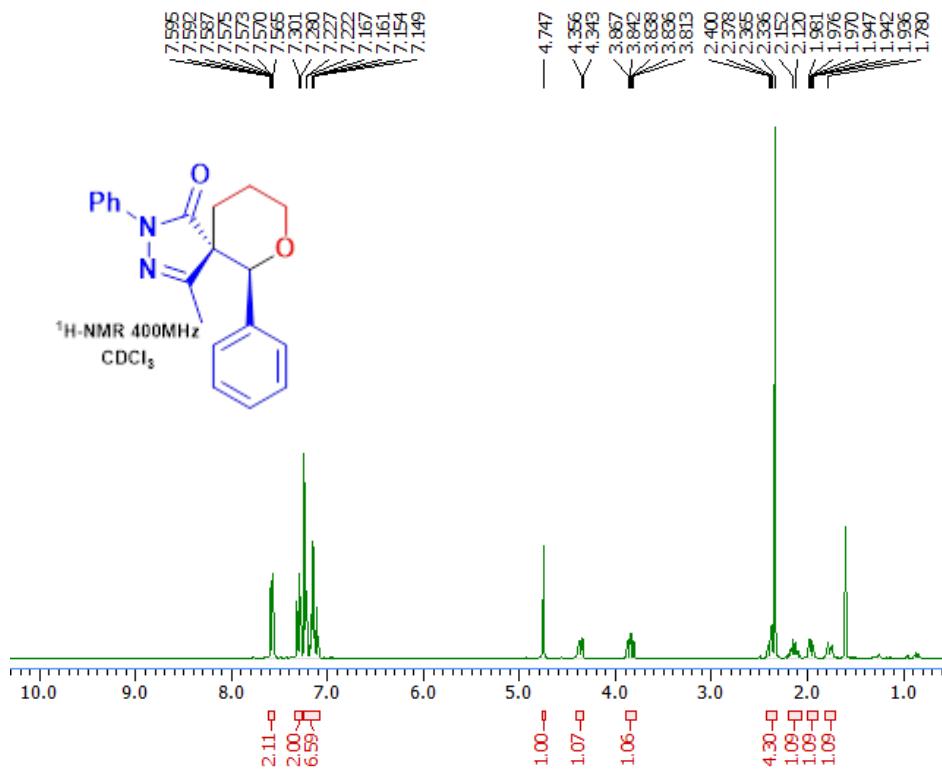
**Fig. 40:** <sup>13</sup>C-NMR spectrum of (5S,6S)-2-(4-fluorophenyl)-6-(4-methoxyphenyl)-4-methyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3s)



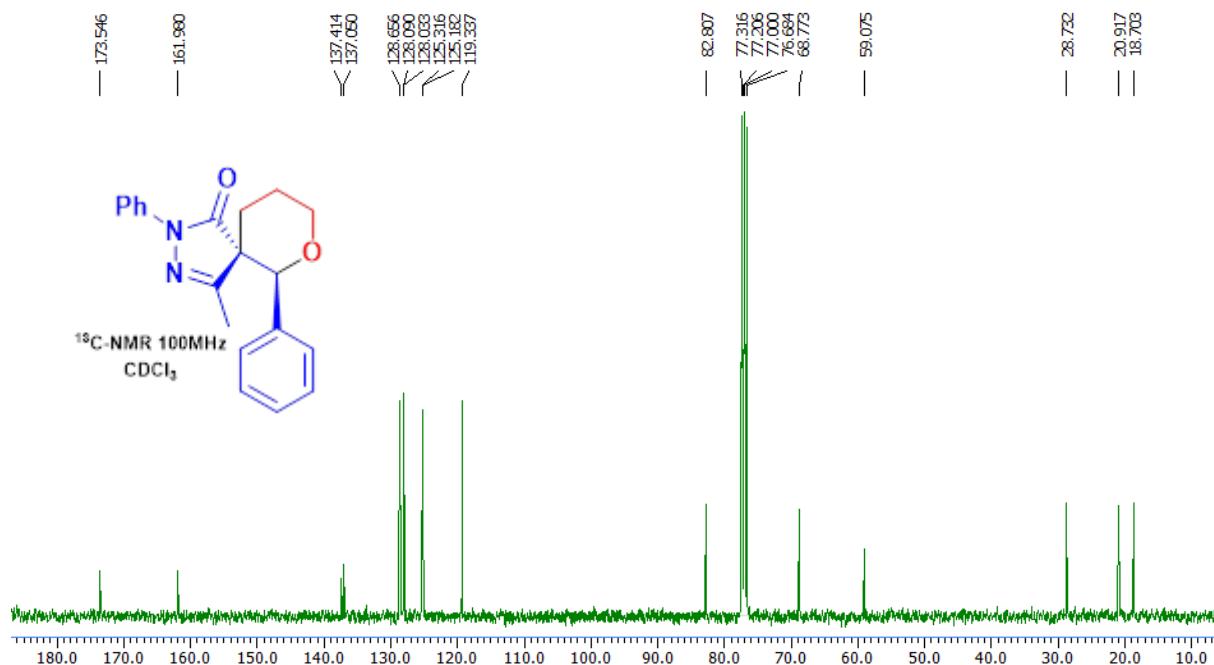
**Fig. 41:** <sup>1</sup>H-NMR spectrum of (5S,6S)-2-(4-chlorophenyl)-6-(4-methoxyphenyl)-4-methyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one(3t)



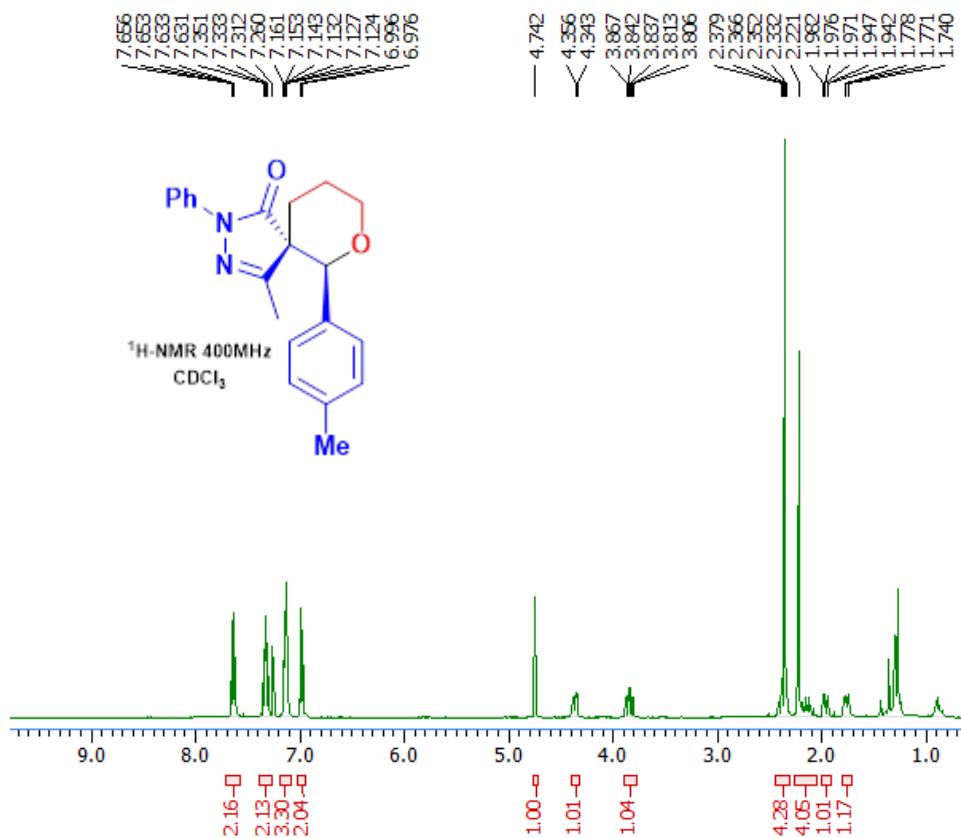
**Fig. 42:** <sup>13</sup>C-NMR spectrum of (5S,6S)-2-(4-chlorophenyl)-6-(4-methoxyphenyl)-4-methyl-7-oxa-2,3-diazaspiro[4.4]non-3-en-1-one (3t)



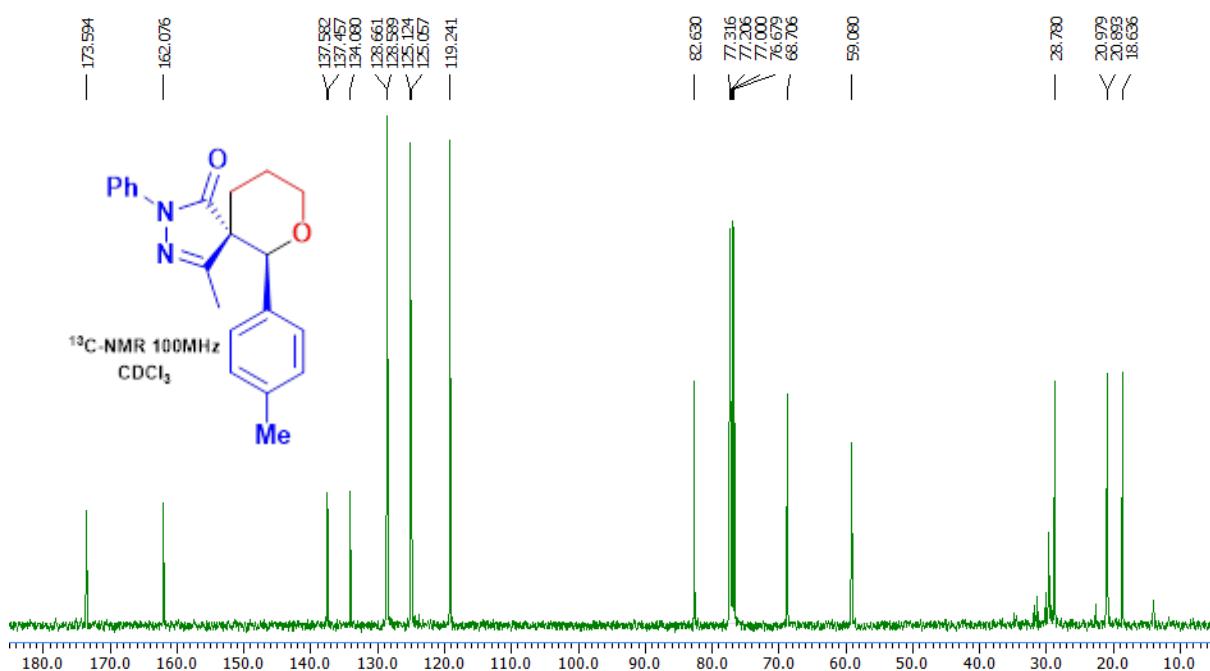
**Fig. 43:** <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-2,6-diphenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5a)



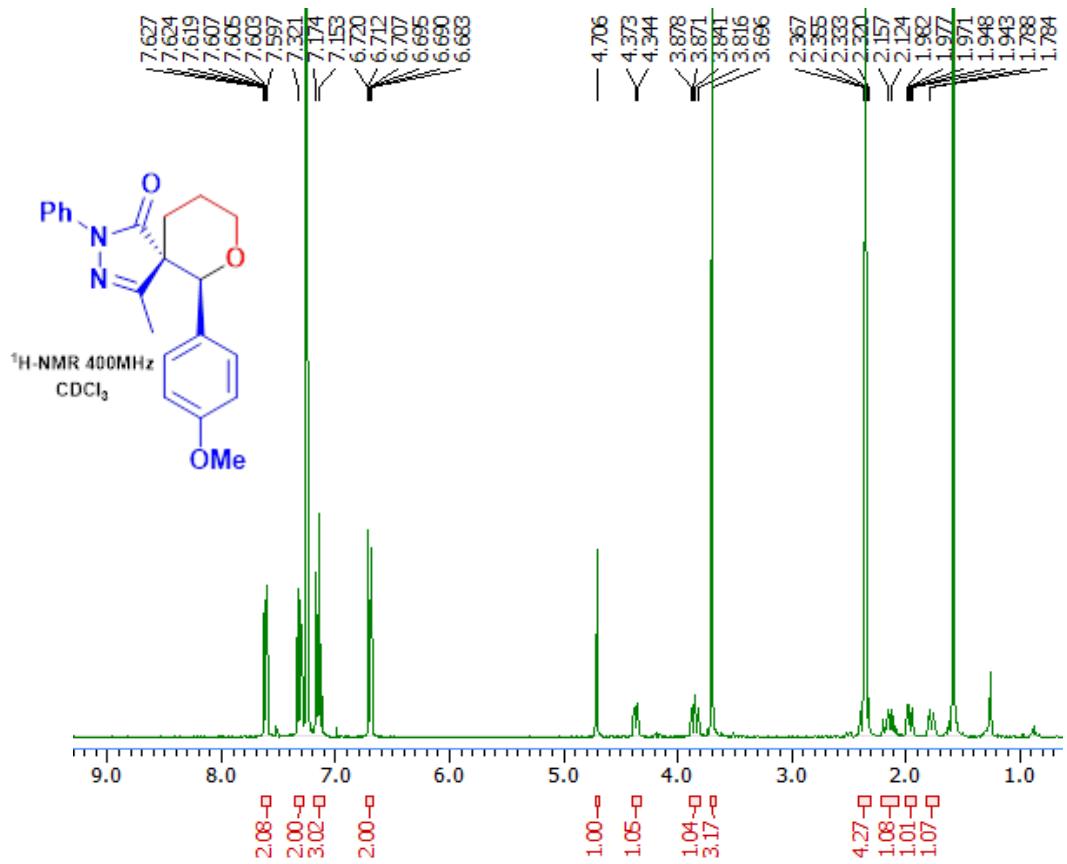
**Fig. 44:** <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-2,6-diphenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5a)



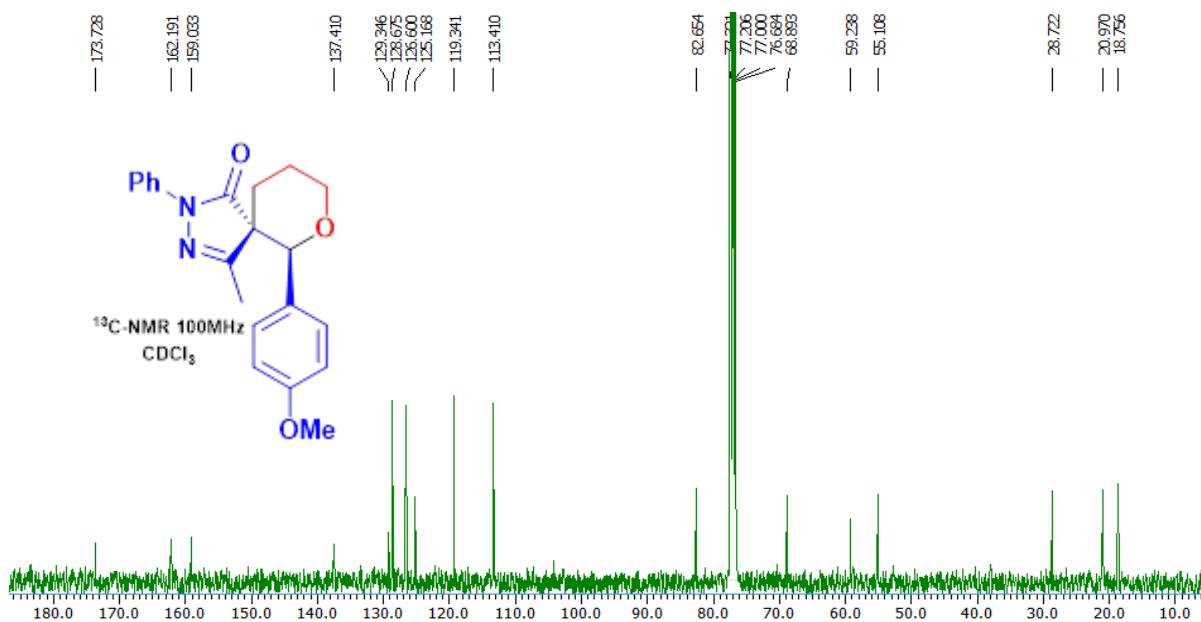
**Fig. 45:** <sup>1</sup>H-NMR spectrum of (5S,6S)-4-methyl-2-phenyl-6-(p-tolyl)-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5b)



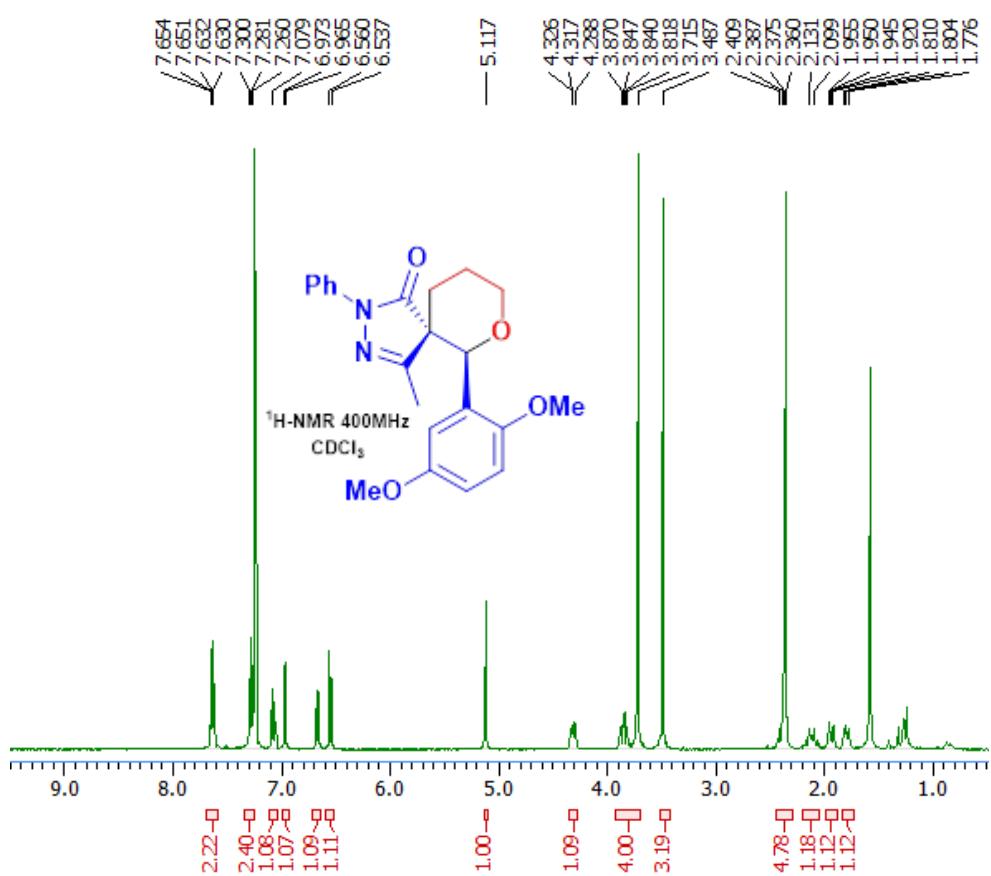
**Fig. 46:** <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-2-phenyl-6-(p-tolyl)-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5b)



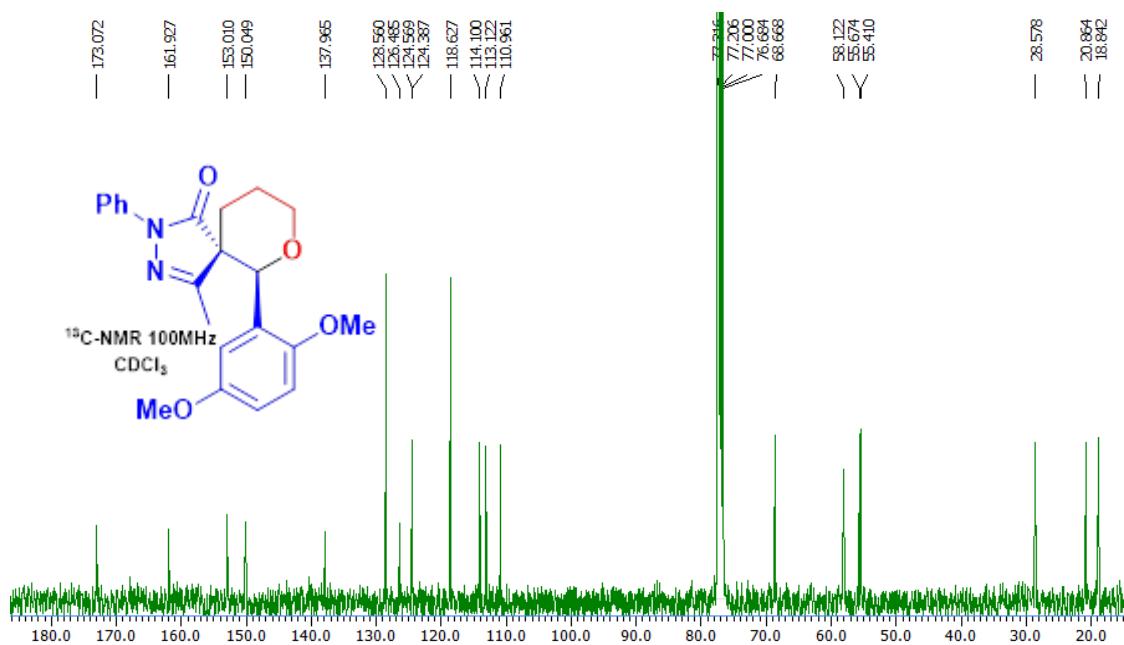
**Fig. 47:** <sup>1</sup>H-NMR spectrum of (5*S*,6*S*)-6-(4-methoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5c)



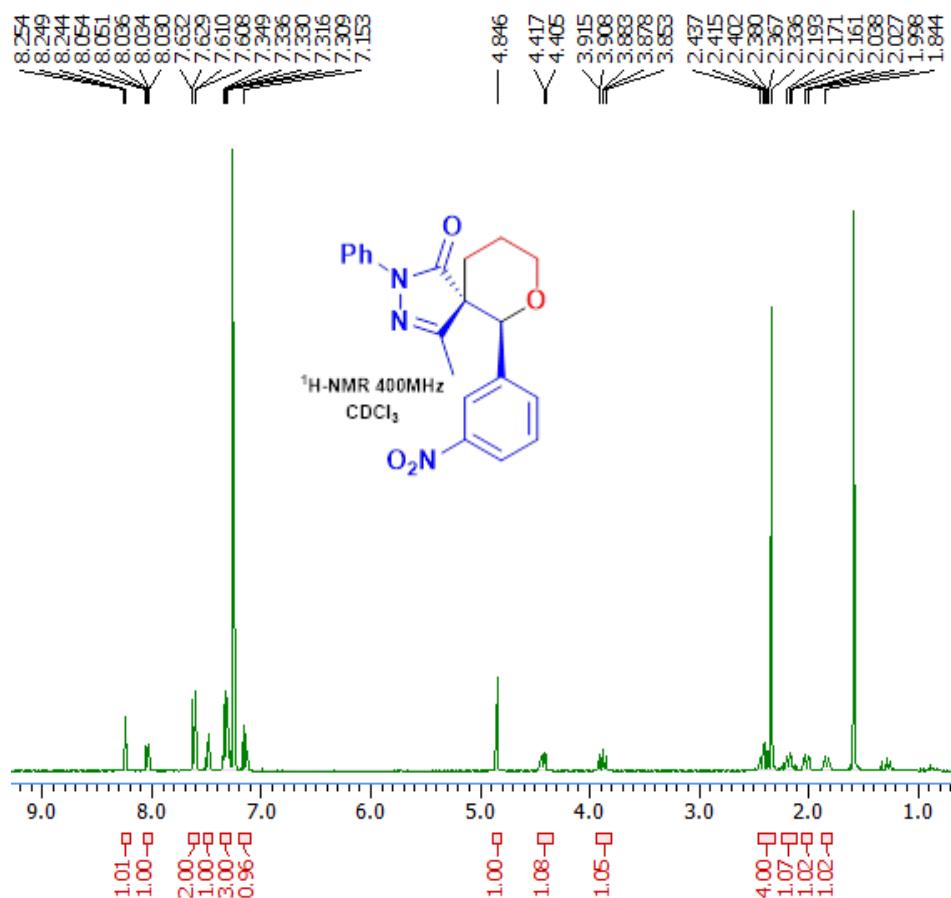
**Fig. 48:** <sup>13</sup>C-NMR spectrum of (5*S*,6*S*)-6-(4-methoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5c)



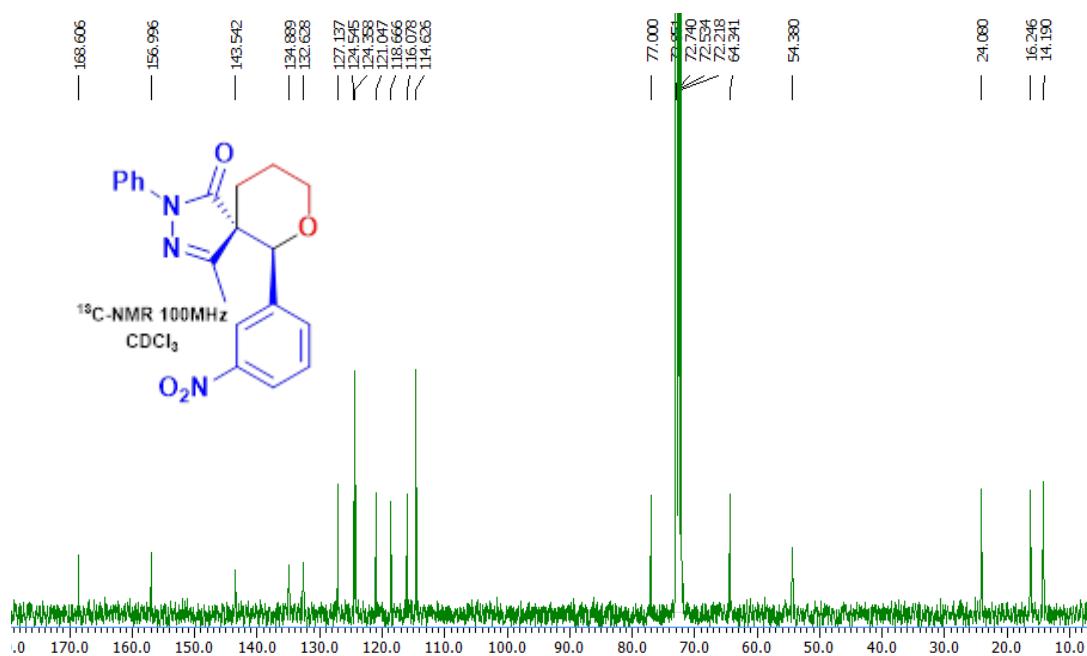
**Fig. 49:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(2,5-dimethoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one(5d)



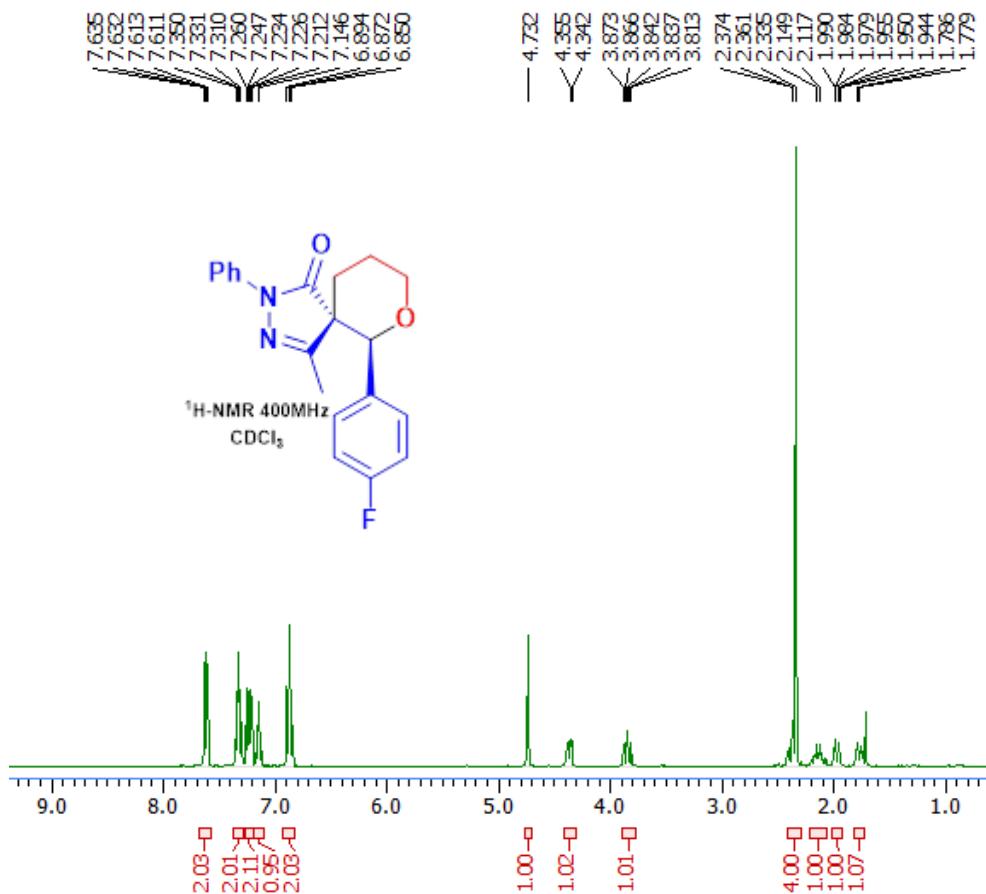
**Fig. 50:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(2,5-dimethoxyphenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one(5d)



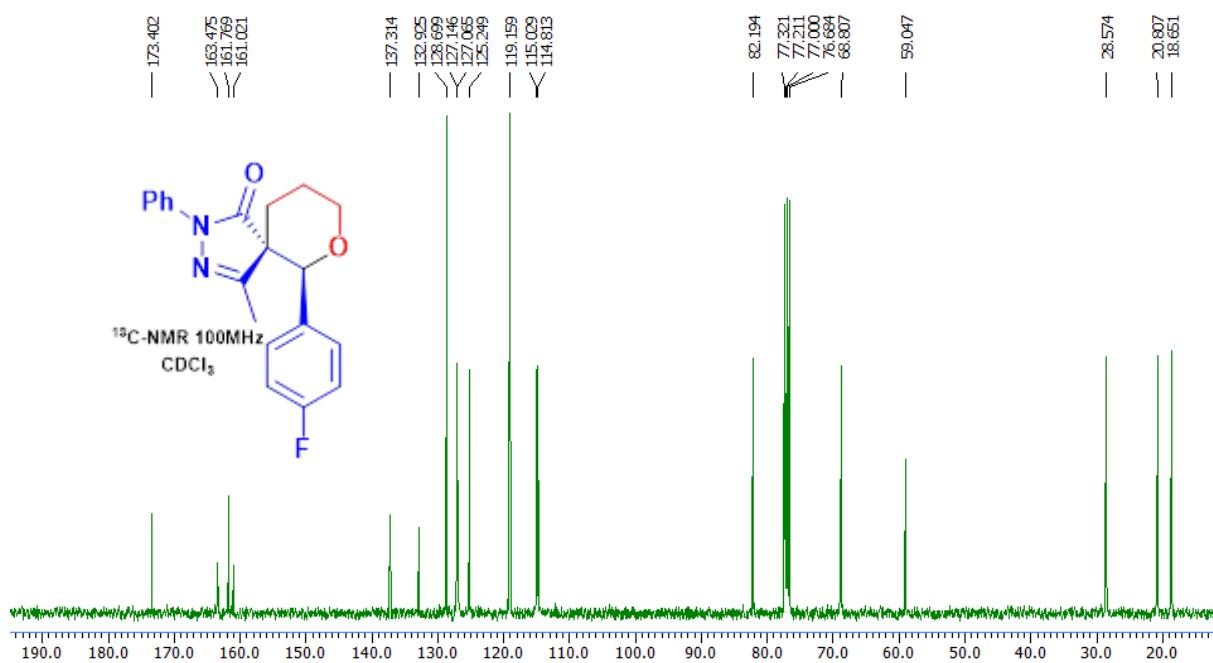
**Fig. 51:** <sup>1</sup>H-NMR spectrum (5S,6S)-4-methyl-6-(3-nitrophenyl)-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5e)



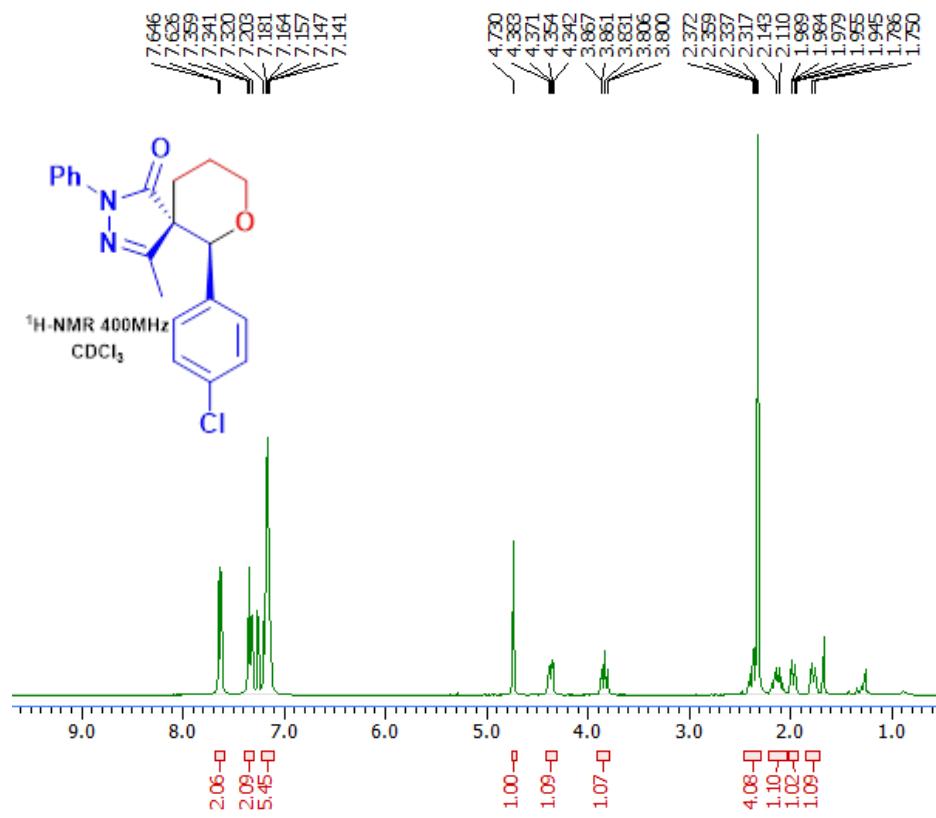
**Fig. 52:** <sup>13</sup>C-NMR spectrum of (5S,6S)-4-methyl-6-(3-nitrophenyl)-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5e)



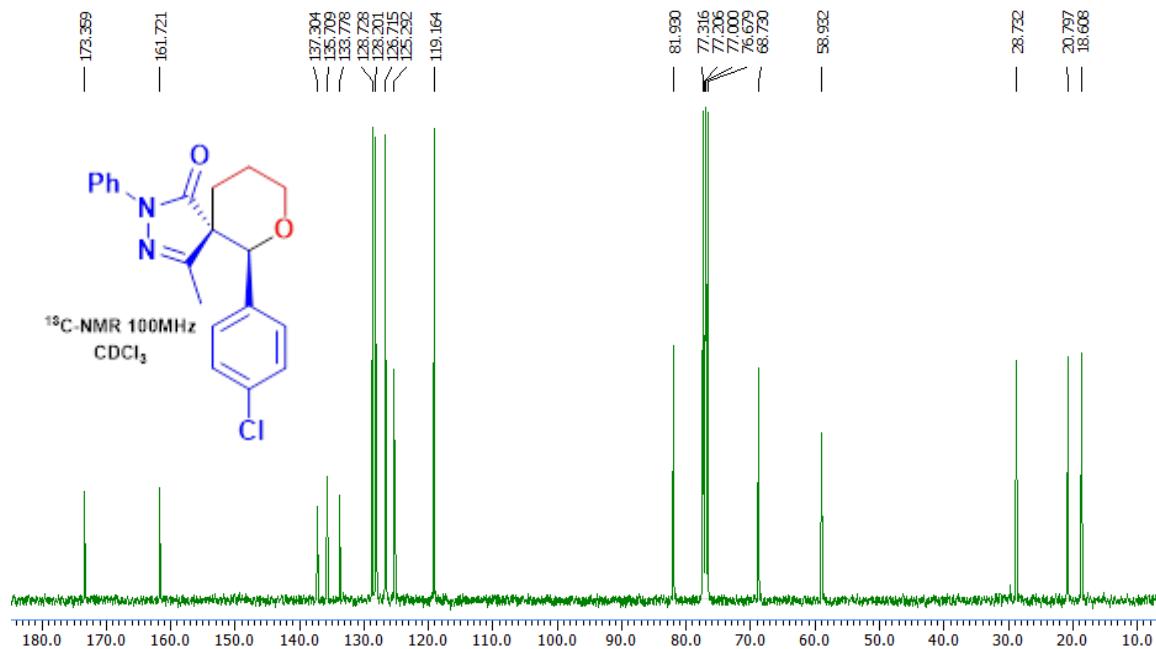
**Fig. 53:** <sup>1</sup>H-NMR spectrum of (5S,6S)-6-(4-fluorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5f)



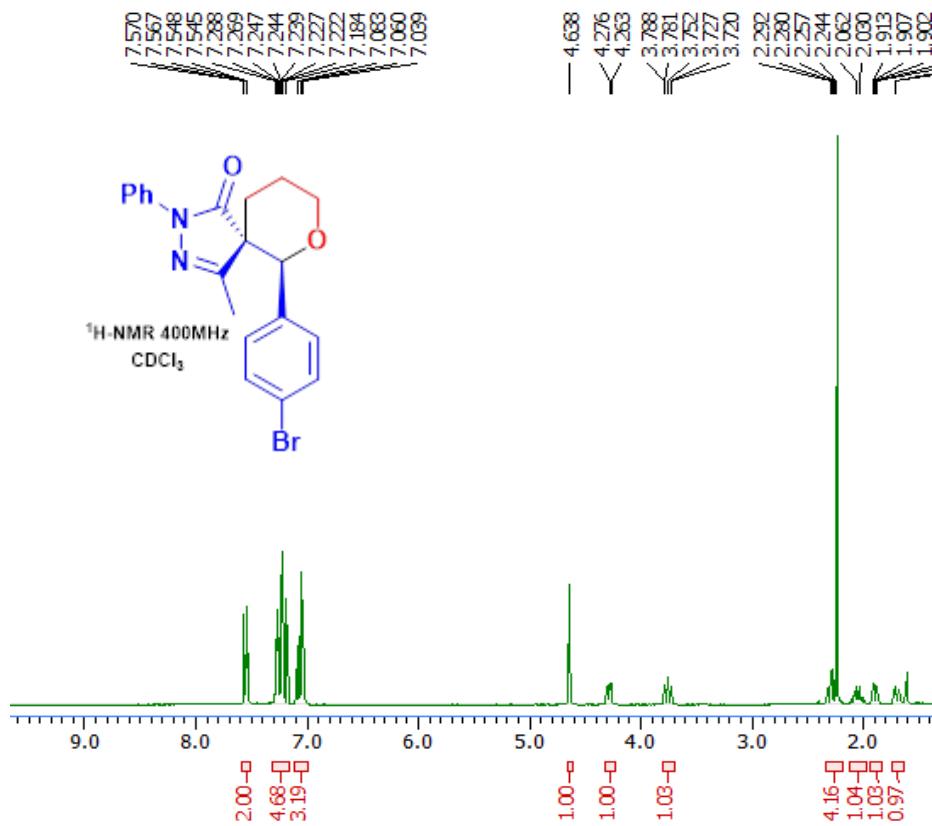
**Fig. 54:** <sup>13</sup>C-NMR spectrum of (5S,6S)-6-(4-fluorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5f)



**Fig. 55:**  $^1\text{H}$ -NMR spectrum of (5*S*,6*S*)-6-(4-chlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5g)



**Fig. 56:**  $^{13}\text{C}$ -NMR spectrum of (5*S*,6*S*)-6-(4-chlorophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5g)



**Fig. 57:**  $^1\text{H-NMR}$  spectrum of (5*S*,6*S*)-6-(4-bromophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5h)

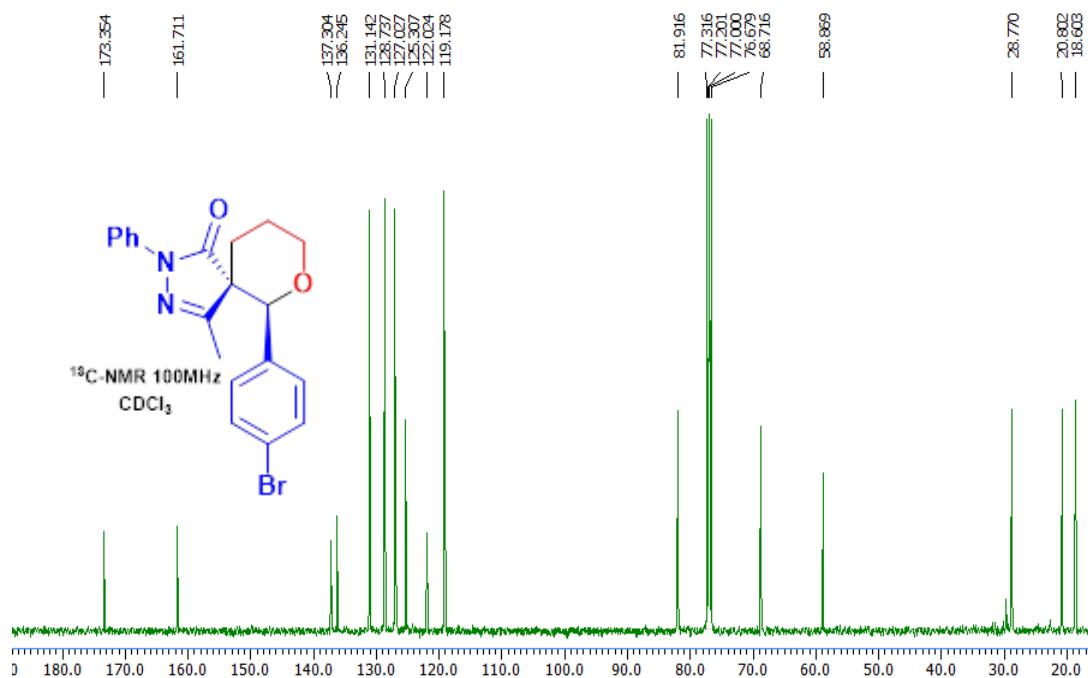


Fig. 58:  $^{13}\text{C}$ -NMR spectrum of (5S,6S)-6-(4-bromophenyl)-4-methyl-2-phenyl-7-oxa-2,3-diazaspiro[4.5]dec-3-en-1-one (5h)